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S. HRG. 115–491

POTENTIAL DEVELOPMENT IN THE NON-WILDERNESS "1002 AREA," OR COASTAL PLAIN, IN THE ARCTIC NATIONAL WILDLIFE REFUGE

HEARING

BEFORE THE

COMMITTEE ON ENERGY AND NATURAL RESOURCES UNITED STATES SENATE

ONE HUNDRED FIFTEENTH CONGRESS

FIRST SESSION

TO

RECEIVE TESTIMONY ON THE POTENTIAL FOR OIL AND GAS EXPLORATION AND DEVELOPMENT IN THE NON-WILDERNESS PORTION OF THE ARCTIC NATIONAL WILDLIFE REFUGE, KNOWN AS THE "1002 AREA," OR COASTAL PLAIN, TO RAISE SUFFICIENT REVENUE PURSUANT TO THE SENATE RECONCILIATION INSTRUCTIONS INCLUDED IN H. CON. RES. 71.

NOVEMBER 2, 2017

Printed for the use of the
Committee on Energy and Natural Resources

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POTENTIAL DEVELOPMENT IN THE NON-WILDERNESS "1002 AREA," OR COASTAL PLAIN, IN THE ARCTIC NATIONAL WILDLIFE REFUGE

THURSDAY, NOVEMBER 2, 2017

U.S. SENATE,
COMMITTEE ON ENERGY AND NATURAL RESOURCES,
Washington, DC.

The Committee met, pursuant to notice, at 9:30 a.m. in Room SD–366, Dirksen Senate Office Building, Hon. Lisa Murkowski, Chairman of the Committee, presiding.

OPENING STATEMENT OF HON. LISA MURKOWSKI, U.S. SENATOR FROM ALASKA

The CHAIRMAN. Good morning, everyone. The Committee will come to order.

We are meeting this morning to consider opening a very small portion of Alaska's 1002 Area to responsible energy development to meet the $1 billion budget reconciliation instruction that our Committee received last week.

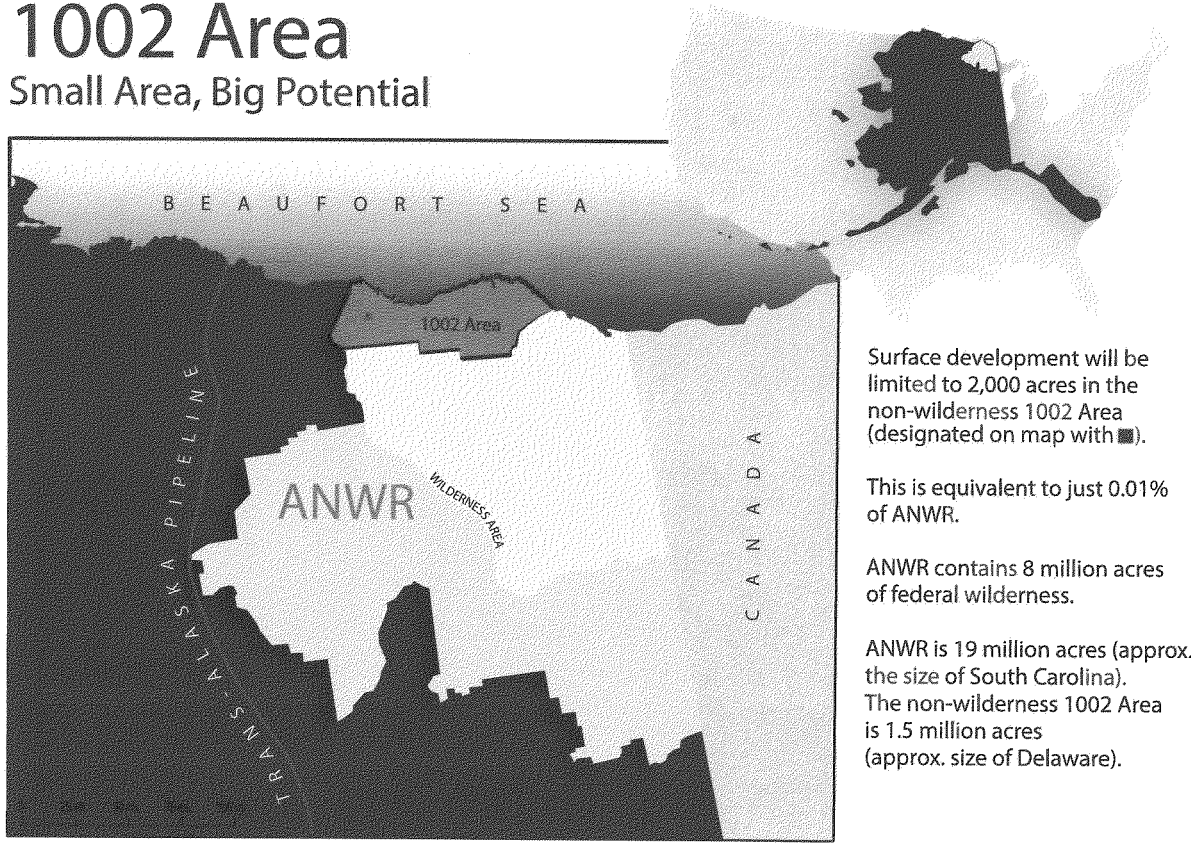
The 1002 Area covers 1.57 million acres of land in northeast Alaska within the non-wilderness portion—will you bring it over here, Sean?—of the Arctic National Wildlife Refuge (ANWR), and I think it is important to put this in context in terms of the areas that we are talking about.

ANWR itself is 19 million acres—approximately the size of South Carolina. The non-wilderness area, this 1002 Area, is 1.5 million acres—approximately the size of Delaware. The area here is designated as wilderness, federal wilderness, 8 million acres there.

[The information referred to follows:]

1002 Area

Small Area, Big Potential



Surface development will be limited to 2,000 acres in the non-wilderness 1002 Area (designated on map with ■).

This is equivalent to just 0.01% of ANWR.

ANWR contains 8 million acres of federal wilderness.

ANWR is 19 million acres (approx. the size of South Carolina). The non-wilderness 1002 Area is 1.5 million acres (approx. size of Delaware).

The CHAIRMAN. So when we are talking about ANWR itself, I think it is important to recognize that there are parts of ANWR that are designated as wilderness, and there are parts of ANWR, the 1002 Area, that have been specifically designated for consideration for oil and gas exploration.

So again, I want to be clear—the 1002 Area is not federal wilderness. Congress recognized the value of ANWR when it designated more than seven million acres as the Mollie Beattie Wilderness—this area here. That is an area that is protected and will not, and cannot, be touched.

The Coastal Plain, again, is separate from the wilderness in ANWR. It is about the size of Delaware, again, in a refuge the size of the State of South Carolina.

So again, the areas that we are talking about are significant, and what Alaskans are asking for is to develop just 2,000 federal acres within it, about one ten-thousandth of ANWR.

We should also understand that if we open the 1002 Area, the economic benefits will be substantial, our national security will be strengthened, and the environmental impacts will be minimal.

For starters, we will create thousands of new jobs and those jobs will pay the types of wages that support families and put our kids through colleges. We will also generate substantial revenue for every level of government, tens of billions of dollars over the life of the fields.

Now there has been some discussion out there as to whether or not we can meet our $1 billion instruction. The answer to that is a simple yes. And I would remind the Committee that the first 10 years are just the start. This is the smallest part here, of a 40-year period where responsible production raises billions of dollars in revenues for our country every year.

The Congressional Research Service has estimated that the Federal treasury could, depending on oil prices and the amount of resources that are ultimately produced—and we all put that in a caveat there—but it could raise anywhere from $48.3 billion on the low end to $296.8 billion over 30 years.

And bear in mind, that is new wealth and prosperity. New wealth. It will not be created, not redirected or repurposed like so much of what we deal with. Those revenues will directly reduce our debt, while simultaneously creating the growth conditions needed to reduce it on a greater scale.

Opening the 1002 Area will help to keep energy affordable. Here in the Lower 48 we have somewhat forgotten what it feels like to pay $4.00 for a gallon of gasoline. Prices are moderate right now, we recognize that, but we also know they do not necessarily stay that way. So we need to be taking steps to plan for the long-term and we need to do that now, not in 10 years, to keep energy prices affordable.

A number of experts are already pointing to the warning signs. The International Energy Agency (IEA) found that, "Global oil supply could struggle to keep pace with demand after 2020, risking a sharp increase in prices, unless new projects are approved soon."

Now some are going to argue that we are doing just fine, we are producing more, we are even exporting some, so we can turn our attention to other matters. But I think that that is a mistake.

We are projected to remain a significant net importer well into the future. And setting aside some of the shorter-term concerns that I have just mentioned, even the more cautious forecast from the EIA, the Energy Information Administration, projects that oil prices will be back above $100 per barrel by the year 2040.

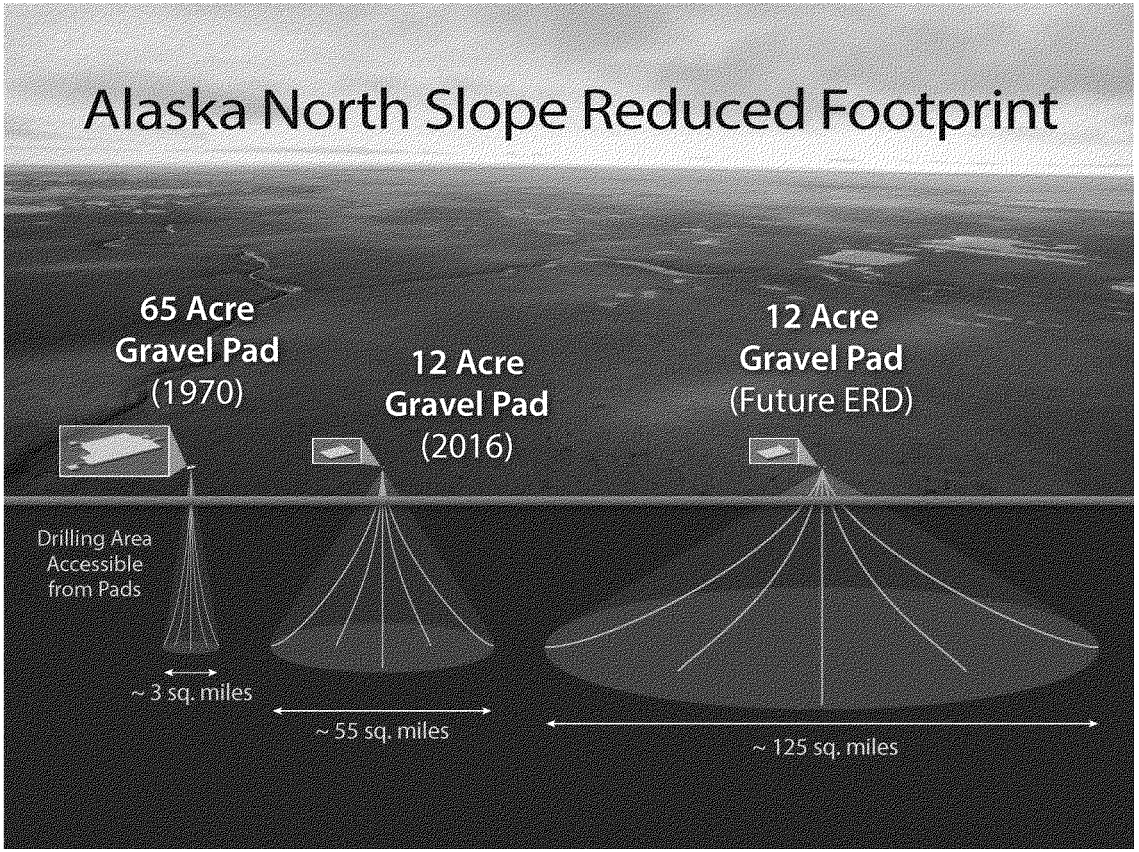
I think it is also misleading to suggest that all of the benefits of opening the 1002 Area will happen all at once or all in the near-term. We know that is not true. We will see the benefit for decades, not just over the ten-year budget window.

We talk a lot about where we were back in 1995, when the Congress had passed ANWR and President Clinton at that time vetoed the effort to open the 1002 Area. 1995. Think about where we would have been had that action not taken place. We would not have seen as dramatic a run-up in oil prices in the mid–2000s. States like California would not be importing so much of their oil from abroad, but that is exactly what has happened as supply from Alaska has declined.

There is no question that opening the 1002 Area is important for our state and our national economy. And we can be just as confident that the new technologies that are in place and are still coming online will ensure that responsible development does not harm the environment.

Between the 1970s and today, the surface footprint of Arctic development has decreased by about 80 percent and several of our witnesses this morning will speak directly to that. But put in context, what was once a 65-acre pad now takes about 12 acres or less.

[The information referred to follows:]


Alaska North Slope Reduced Footprint
65 Acre
Gravel Pad
(1970)
12 Acre
Gravel Pad
(2016)
12 Acre
Gravel Pad
(Future ERD)
Drilling Area
Accessible
from Pads
~ 3 sq. miles
~ 55 sq. miles
~ 125 sq. miles

The CHAIRMAN. Then, below ground, the extended reach drilling from a single pad will grow to an area of 125 square miles by 2020. So just in a few years here, and again, we will have Mr. Schutt speak to that, but that is an increase of more than 4,000 percent since we began oil exploration and production in the 1970s.

Now development in the Arctic has always raised concerns about wildlife and the environment, and appropriately so. But I would remind everyone here this morning, because Alaskans have been so careful with development, fears of impacts to our wildlife and our land have repeatedly been proven wrong. Most of our roads are now built from ice and melt in the summertime, leaving no impact on the tundra. Developers follow thousands of regulatory requirements, best practices, and mitigation measures. We inventory and we assess wildlife and we study their habitat so that we avoid any sensitive places.

We always talk about the caribou. The Central Arctic Caribou herd, which lives year-round in and around Prudhoe Bay, increased from 3,000 animals in 1969, just prior to development, to 5,000 when development began in earnest in 1974 and was at about 22,000 animals just this last year. It is now more than seven times larger than when development began.

Now it also may surprise some to learn that we are developing energy just outside of ANWR, at Point Thomson, a point that my colleague Senator Sullivan knows very, very well, but this is located on state land just two miles from the border of the 1002 Area. That project at Point Thomson is being carried out responsibly. It is not harming the wildlife that cross the invisible western boundary of that Refuge, again, defying the claims we hear about possible harm.

For over 40 years now Alaskans have repeatedly proven that we can develop safely and responsibly and development in the 1002 Area will be no different. We will not harm the caribou who move through the area; we will not harm the polar bears, whose dens can be protected; the snow geese, whose nesting areas can be safeguarded; or, any of the other birds and wildlife that visit the Coastal Plain in the summer. We are sensitive to the habitat in the region and care for it, and Alaskans understand this. This is why more than 70 percent of us have supported opening the 1002 Area to responsible development.

We are also acutely aware that our state needs this, and we will hear this from our Governor. Right now we have the highest unemployment rate in the country, we have massive budget deficits that are projected to last for quite a while, and our Trans-Alaska Pipeline System, the economic backbone of our state, is just one-quarter full.

We know full well that opening the 1002 Area is not an immediate cure. But we also know that it is something that we have to do today, because the benefits of development will take time to be fully realized. It is like the old saying, we say it a lot around here, "The best time to plant a tree was 20 years ago. The second-best time is now." We need to take that first step today so that we can realize the benefits going forward.

I was born in Alaska. My husband and I have raised our boys there and I hope that they lead long and healthy lives in a place

that is so beautiful and so gorgeous that it sometimes takes your breath away.

What I know is that no one cares more for Alaska than those of us who live and work and raise our families there. We love our state. We respect the land. We would never risk its future for the sake of development. But we also realize that is not the case here.

The 1002 Area was created by a Congressional compromise. We always knew its future would require another one, and today Alaskans are offering just that. We are not asking to develop all of the 1002 Area, but instead we are asking for 2,000 acres, or about one ten-thousandth of the Refuge. We have waited nearly 40 years for the right technologies to come along so that the footprint of development is small enough to ensure that the environment continues to be respected and will not be harmed.

This is not a choice between energy and the environment. We are past that. What we have today is a great lineup of witnesses to help our Committee understand that.

We have our entire Alaska delegation with us, our Governor, our Congressman, our Senator, we have our Lieutenant Governor, and we have a number of Alaskans who actually live up on the North Slope.

I thank all of our witnesses for being here this morning. I look forward to an excellent and informative hearing.

Senator Cantwell, I turn to you and welcome your remarks.

STATEMENT OF HON. MARIA CANTWELL,
U.S. SENATOR FROM WASHINGTON

Senator CANTWELL. Thank you, Madam Chair, and I welcome the Governor and our colleagues to today's discussion.

But I should start this by saying this hearing is a great departure from the strong, working relationship that Senator Murkowski and I have set to work together on an energy agenda that will move our country forward.

It is too bad that we are not using our resources this morning to force our House colleagues to reconsider the very important bill that included over 100 different priorities to move our country forward on everything from cybersecurity to energy efficiency.

I also do not support the makeup of today's panels and the fact that our two colleagues who do not support opening up the Arctic Wildlife Refuge, who have carried the bill this legislative session and last legislative session, Senator Markey and Senator Bennet, were not allowed to be part of this panel.

I also believe that we should have had more witnesses from Indian Country that represent not just the Alaska Native Claims Settlement Act Corporations. Yes, corporations are charged with economic development, but individual tribal members as we have seen throughout Alaska and throughout the United States of America do not support this kind of development because they believe in the wildlife nature that God has given us, and that we are stewards of Mother Earth. So I thank them for that. I thank them for their strong spiritual beliefs—thank you.

We are here today because someone has come up with a ludicrous idea that we can pass a tax reform bill that raises the deficit, increases our taxes, and that we will take a sliver out of a wildlife

refuge to do it. I almost want to call this "Caribou for Millionaires" because it is the most ridiculous idea I have ever heard as it relates to meeting the tax reform agenda.

So no, I do not like the setup of these three panels. I am always glad to hear from the Governor and I am always glad to hear from our colleagues, but our other colleagues should have had their voices heard and Indian Country should have been better represented.

We have no bill before us today. We have no bill and there is a proposed markup for next Wednesday. When will we see that language? When will we have any idea about this process?

I am disturbed and I could go in a direction of saying that we don't have to worry because some of the press reports are, from Bloomberg News and others, that "The Coastal Arctic Refuge does not have any promising oil-bearing rock formations," a former BP petroleum analyst said, "There is not great interest in developing the Arctic Wildlife Refuge," and "There are safer bets." So one could have the attitude that there are, particularly with the Trump Administration's desire—I am not sure where in the United States of America they do not want to drill. But with their 1.7 billion acres they want on the Outer Continental Shelf and many other places in America, I find it hard to believe that there will be the economic incentive to drill in the Arctic Wildlife Refuge. But why put a big X on top of something that has been so unique to the United States of America?

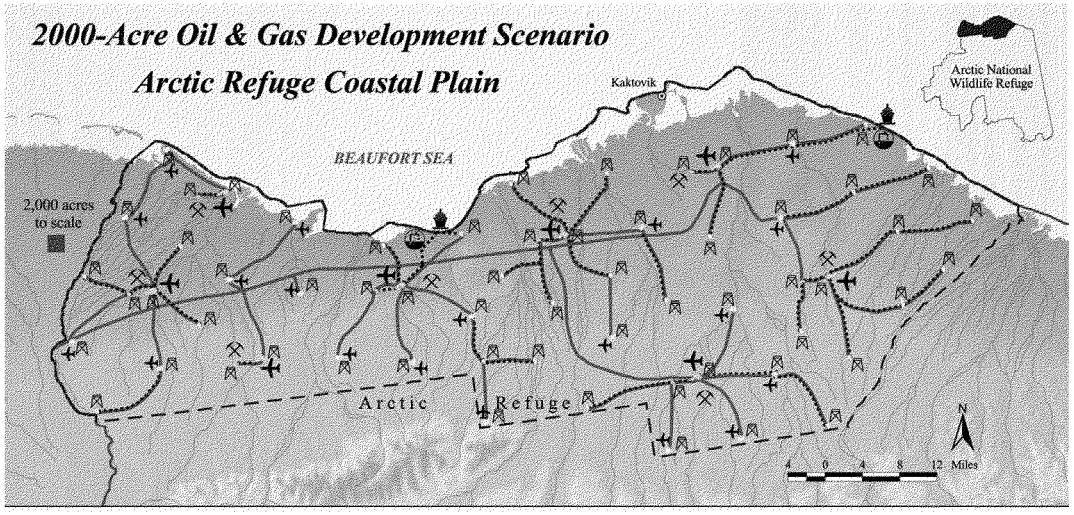
When I recently researched why we got to this point and heard some of the first people that made their case to the Eisenhower Administration, quoting from their reports, "We all knew that it must be preserved as an original fragment of our past. The last opportunity to protect part of this continent as it once was." Why? Because as other people said, "It was a spiritual place, an Arctic Wildlife Refuge." The fact that they also said it was an area that had been left undisturbed by man, that it was the last laboratory in which plants, animals and where they live, as they have always lived, is preserved. So this is why we got to this point, and this is what is unique about it, and this is why, from the Eisenhower Administration to today, we have fought to protect it.

Is Alaska's economy a great concern to us as a nation? Yes. Do we in the Pacific Northwest—I think one of the first things I said to the Chairwoman when we started a discussion is, let's talk about why the natural gas pipeline in Alaska hasn't been built because it has a bigger economic impact than this.

So there are issues in which we need to be mindful about the energy economy moving forward, but this idea is not new and it is not better. There is nothing that has changed here. There is no new science that says we do not have to worry about this wildlife and there is no new science that says that the oil development will take up a smaller footprint.

This map that we will get to everyone basically shows that the development will take up a significant portion of the Refuge, the 800-mile-long Trans-Alaska Pipeline, 219 miles of power transmission lines and so on and so forth.

[The information referred to follows:]



This speculative development scenario is based on the 2,000-acre "limitation" in the House Energy Bill (H.R. 6).

It makes these assumptions:
Industry has 4-mile directional drilling reach from Drill Sites

Facilities included in the 2,000-acre maximum:

- 8 Alpine-type fields @ 82 acres each (Central Processing Pad with housing, storage, drilling; second Drill Site; airstrip)
- 19 Satellite fields like proposed Alpine satellite, Fiord @ 37 acres each (Drill Site, airstrip or storage pad)
- 26 Satellite fields like proposed Alpine satellite, Nanuk @ 11 acres each (Drill Site)
- 2 Docks @ 5 acres each (1,100 foot long solid-fill gravel causeway like Badami)
- 2 Seawater treatment Plants @ 100 acres each

Facilities not subject to the 2,000-acre limitation:

- Roads (in-field roads; main roads to docks, etc.)
- Pipelines (main trunk and sales lines, feeder lines; except negligible amount for support posts (VSM's))
- 8 Gravel Mines @ 150 acres each

Facilities and activities not subject to the 2,000-acre limitation that are not mapped:

- Seismic exploration trails
- Exploration and delineation wells
- Water reservoir excavations, Water withdrawal sites
- Ice roads

- Arctic Refuge Coastal Plain (1002 Area)
- Arctic National Wildlife Refuge

Senator CANTWELL. So the notion that wildlife can exist in this unique environment in the same way with this development is just wrong.

I look forward to hearing from Secretary Perry on this, because I sent him a letter yesterday asking him how they can exist together. We will look forward to seeing how he answers that.

I also point out that the uniqueness of this area has led to an international agreement. The caribou population is so unique, so specific, and so special that we have entered into an agreement with Canada on it. That is because they want to protect this population of caribou as well.

The notion that we should move forward on a wrongheaded idea because all of a sudden people want some revenue for a tax bill and move forward today on something when we don't even know what we are moving forward on in language, is just not the way I think we should be proceeding.

I hope that we will have a chance, our colleagues, to ask our witnesses questions about this, but be assured that even though we do not agree with this process or the process of trying to get 51 votes to change the Arctic National Wildlife Refuge, we are never stopping. We are never stopping in trying to protect the Arctic National Wildlife Refuge and its uniqueness and working with the indigenous people who also support that idea.

Thank you.

The CHAIRMAN. Thank you, Senator Cantwell.

We have several panels this morning and I appreciate not only our delegation being here but all the Alaskans and the visitors that have joined us this morning.

A very distinguished panel will be led off by our colleague here, Senator Sullivan. He will be followed by the Congressman for all Alaska, Congressman Young, who has represented us in the House of Representatives for 45 years, going on 46. And the panel will be rounded out by our Governor. Governor Walker has been in office now for three years, is a life-long resident and has great leadership. I appreciate you being here as well, Governor.

Senator King.

Senator KING. And an Independent, Senator.

The CHAIRMAN. That is true. He is an Independent. Okay, we do not talk about the political affiliations here of anybody——

[Laughter.]

——but that is noted for the record.

Senator Sullivan, if you would like to lead off with the welcome, please.

STATEMENT OF HON. DAN SULLIVAN, U.S. SENATOR FROM ALASKA

Senator SULLIVAN. Well, thank you, Chairman Murkowski, Ranking Member Cantwell, all of my colleagues, for the opportunity to say a few words on this very important issue for our country.

Now many in this room have claimed to be protectors of Alaska's environment. But with all due respect to my colleagues here today, there are three people in Congress who care more about Alaska's

environment than anyone else in the entire body: Senator Murkowski, Congressman Young, and myself.

The fundamental disconnect in the discussion of the 1002 Area is that the debate has not kept up with Alaska's high standards, the highest in the world, and I'll talk about that and advancements in technology. So with all due respect to the Ranking Member, a lot has changed, a lot has changed.

Responsibly developing the 1002 Area is truly a win-win-win for our country: it will create jobs, it will help grow the economy, increase energy security for Americans and, very importantly, it will help protect the global environment and strengthen our national security. It is these last two points I would like to emphasize in my remarks this morning.

Madam Chair, as you know, Alaska has the highest environmental standards regarding responsible Arctic resource development of any place in the world. I was in charge of these standards as Alaska's Commissioner of the Department of Natural Resources, and I can tell you, whether it is what we call "no impact" exploration or specific requirements related to our incredible species like the polar bear or caribou, or mandating use of the best available technology, we have a 50-year record of responsible resource development in our state.

Let me just give you one example of "no impact" exploration. As the Chair noted, on the North Slope of Alaska we only allow for exploration activities during the winter months. Companies are required to build ice roads across the tundra, ice pads where they put their equipment and drill rigs, and you can see examples in some of the slides I've provided, and they have to leave before the winter ends.

[The information referred to follows:]

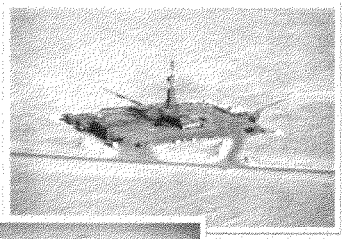
Responsible Resource Development

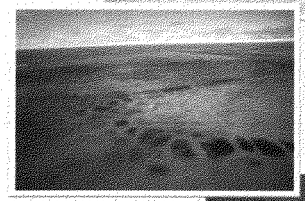
- ALASKA AS A GLOBAL LEADER -

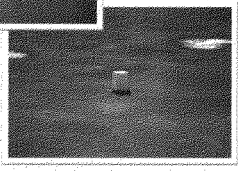
There are few if any places in the world where oil and gas development and infrastructure in the Arctic is as understood, tightly regulated and the impacts as minimal as on the North Slope of Alaska.

For example, Alaska conducts "no impact" exploration on the North Slope by using ice roads and ice pads.

Our experience, knowledge and stringent environmental standards make Alaska a global leader in responsible resource development.







Exploration in winter and spring. The 8x8 foot well house is the only thing that remains for future development.

DAN SULLIVAN

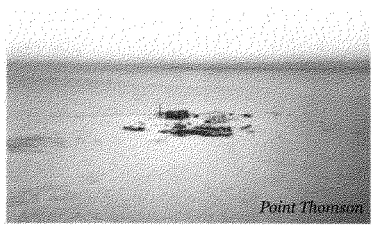
Responsible Resource Development

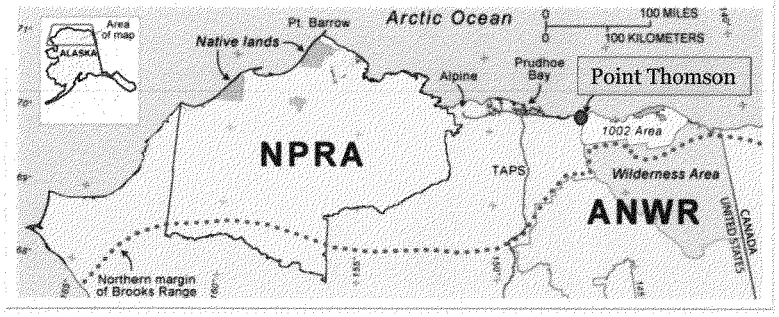
- POINT THOMSON -

The Eastern Boundary of the Point Thomson unit is 1.5 miles to 3 miles from the 1002 area.

Within the last 3 years, the coastal plain has already been explored and is in development.

Point Thomson is within the same ecosystem as the 1002 area, with minimal impact on the environment and to wildlife.





Energy Independence & Foreign Relations

Reducing our dependence on foreign sources of hydrocarbons would significantly benefit U.S. foreign policy interests.

We have the opportunity to provide our allies and important economic partners with increased supplies of energy from the U.S.

We have seen how energy can be used as a tool for good and productive diplomacy, but also for troublesome power-grabs. For example, we have recently witnessed Russia using its oil and natural gas resources to bully and pressure countries within its sphere and project its power into Eastern Europe and Asia.

The New York Times

NYT: Russia Uses Its Oil Giant, Rosneft, as a Foreign Policy Tool (10/29/17)

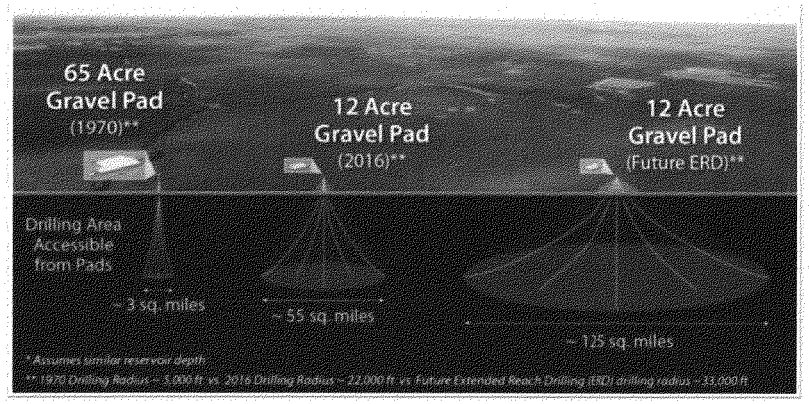
"Russia is increasingly wielding oil as a geopolitical tool, spreading its influence around the world and challenging the interests of the United States."

DAN SULLIVAN
UNITED STATES SENATOR for ALASKA

Responsible Resource Development

- NEW TECHNOLOGY-

Alaska North Slope Reduced Footprint *



DAN SULLIVAN
UNITED STATES SENATOR for ALASKA

Senator SULLIVAN. The ice pads and roads literally melt and have zero impact on the tundra. The only thing left is a small capped well and that is just one example of Alaska's very high, mandated standards.

As the Chair pointed out, we have used these standards, very recently, in the past four years on the Coastal Plain in the same ecosystem of the 1002 Area that is being debated right now with the development of the Point Thomson project. There is a slide that you can take a look at. See how close that is to the 1002 Area. There was literally minimal impact or no impact on the environment and wildlife. The footprint, as you can see from the slides, is very, very small and it is producing energy right now.

Madam Chair, here is the big issue that those in Congress who want to shut down resource development in Alaska never acknowledge. When you disallow investment in Alaska, the place with the highest standards on the environment in the world, you do not end up protecting the global environment. What you do is you end up driving capital and investment to jurisdictions with much less environmental standards or, in some cases, no environmental standards—countries like Nigeria and Venezuela and Iran and Russia, many of which are also our geo-political foes.

This brings me to my second point, producing more energy responsibly—oil, natural gas, renewables—and making the United States, again, the world's energy superpower will dramatically strengthen our national security.

As some of you know, I served in the Marine Corps for 24 years. I have also served as a U.S. Assistant Secretary of State, whose portfolio included energy security issues, global energy security issues, and I have seen how energy can be used as a tool for good, productive diplomacy but also can be used for troublesome power grabs by our nation's foes.

We do not have to import energy. When we do not have to import energy from countries that do not like us or, better yet, when we can export American energy to our allies like Japan or Korea or even to countries like China, this helps our national security and foreign policy.

I sit on the Armed Services Committee, and we have heard from military and civilian leaders from our country, Democrats and Republicans, from Secretary Ash Carter to Secretary Mattis, consistently state that producing more energy strengthens our national security. And I know my friends, Senator King and Senator Hirono, have heard these comments consistently on the Armed Services Committee as well. But it is not just American officials who recognize this, the Russians know this as well.

Madam Chair, I would like to submit for the record a recent New York Times article, just from a few days ago, October 29, titled, "Russia Uses Its Oil Giant, Rosneft, as a Foreign Policy Tool."

The CHAIRMAN. We will include that as part of the record.

[The information referred to follows:]

The New York Times https://nyti.ms/2yWPMYI

Russia Uses Its Oil Giant, Rosneft, as a Foreign Policy Tool

By Clifford Krauss

Oct. 29, 2017

Russia is increasingly wielding oil as a geopolitical tool, spreading its influence around the world and challenging the interests of the United States.

But Moscow risks running into trouble, as it lends money and makes deals in turbulent economies and shaky political climates.

The strategy faces a crucial test this week in Venezuela, a Russian ally that must come up with a billion dollars to avert defaults on its debts.

Russia has been making a flurry of loans and deals all centered on the Venezuelan oil business, money that could make the difference between the government's collapse and its survival. In return, Moscow is getting a strategic advantage in Washington's backyard.

President Nicolás Maduro of Venezuela was all smiles this month on a visit to Moscow seeking fresh financial backing, thanking Vladimir V. Putin "for your support, both political and diplomatic."

Moscow, through the state oil giant Rosneft, is trying to build influence in places where the United States has stumbled or power is up for grabs. Its efforts are also driven out of necessity, as American and European sanctions have forced Rosneft to find new partners and investments elsewhere.

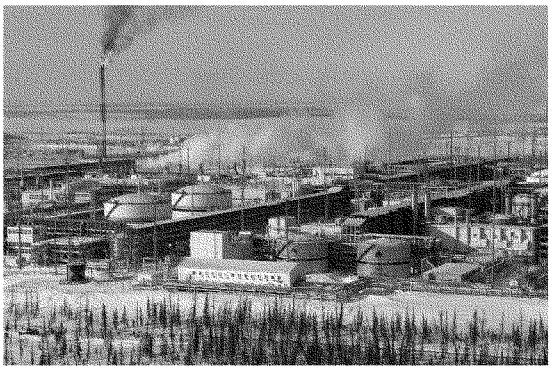
The company, which Russia has long relied on to finance its government and social programs, has been pushing deeply into politically sensitive countries like Cuba, China, Egypt and Vietnam, as well as tumultuous places where American interests are at stake.

Rosneft is looking for deals around the eastern Mediterranean and Africa, areas of tactical importance beyond the energy picture. It is wielding economic and political sway in northern Iraq, by making big oil and natural-gas deals in Kurdish territory. And it is angling to bid for control of Iranian oil fields as tensions between Tehran and Washington escalate.

Rosneft is "trying to create opportunities that can be extremely valuable in geopolitical ways," said Amy Myers Jaffe, an energy security expert at the Council on Foreign Relations. "They really give the Russian government unbelievable leverage on questions of importance to the United States."

The new push by Rosneft follows a clampdown on Russia.

Rosneft, which is 50 percent owned by the Russian state, is led by Igor I. Sechin, a former deputy prime minister and a close Putin ally. After the Russian invasion of Crimea three years ago, the United States and Europe hit Mr. Sechin with sanctions.



A Siberian oil field controlled by Rosneft, the Russian state-owned oil company. Rosneft has long been a source of money for the Russian government. Sergei Karpukhin/Reuters

Since then, Exxon Mobil and other Western oil companies have been prevented from using their technological expertise to help Rosneft develop deepwater, shale and Arctic oil and gas fields. That has forced Rosneft to go far and wide to find new oil fields to replace its reserves.

Rosneft's biggest bet so far is Venezuela. Over the past three years, Russia and Rosneft have provided Caracas with $10 billion in financial assistance, helping Venezuela stave off default at least twice under the weight of as much as $150 billion in debt.

Russia is effectively taking China's place as Venezuela's principal banker. While President Hugo Chávez was in power, China lent Venezuela tens of billions of dollars for projects to be paid for with oil. But China quietly stopped making new loans, leaving Russia to fill the void.

Last year, Rosneft took a 49.9 percent stake in Citgo, the Venezuelan state oil company's refining subsidiary in the United States, as collateral for a $1.5 billion loan to the Venezuelan company. The state oil company, Petróleos de Venezuela, or Pdvsa, used the money to pay its bills and keep its oil fields producing.

The deal was sharply criticized by members of Congress, who warned that an eventual Russian takeover of Citgo would threaten national security. Citgo operates about 4 percent of American refining capacity and has a sprawling network of pipelines and gas stations. And Caracas remains highly dependent on the American market, since few refineries outside the United States can process large quantities of low-quality Venezuela crude.

In April, Rosneft went further, providing a $1 billion advance payment for crude oil produced by the state oil company, crucial aid for it to make nearly $3 billion in payments to bondholders.

But Russia's investments are not without risk. Venezuela's oil fields are aging and in disrepair. Oil service companies have been withdrawing after years of partial payments for their work. And fresh American sanctions have largely prohibited long-term loan transactions with Pdvsa or investments in other new government debt, making Venezuela's financial straits even more acute.

"Russia is the only country that can give Venezuela a lifeline to survive through the rest of the year," said Francisco J. Monaldi, an energy policy analyst at Rice University. "China has the capacity but not the willingness to do it, and that's why Venezuela is so desperate to get the Russian support. There is no other way out."

Venezuela is now Rosneft's second-largest source of crude, after Russia itself. The Russian company resells about 225,000 barrels a day of Venezuelan oil, equivalent to 13 percent of Venezuela's exports.

More Venezuelan oil could soon flow to Russia. Rosneft is negotiating with the Venezuelan state oil company to trade its collateral in Citgo for stakes in oil fields, as a way to gain more reserves at bargain basement prices and avert any sanctions or other legal issues with Washington.

"There is absolutely a geopolitical element to these deals," said Helima Croft, global head of commodity strategy at RBC Capital Markets. "Rosneft acquires cheap acreage in Venezuela, but does it also expand Vladimir Putin's influence in our backyard? Yes."

Rosneft's Venezuela model is also finding traction in the Middle East, where Russia is looking for ways to support the government of Bashar al-Assad in Syria, make friends in Iran and help drive a wedge between Turkey and the West.

In the Kurdish region of northern Iraq, Moscow is seeking influence with competing sides. It follows a Kurdish referendum favoring independence from Baghdad that both the United States and Turkey fear will bring more instability to the region.

Russia also formally opposes Kurdish independence. But that did not stop Rosneft from signing a $400 million deal with the Kurdistan regional government this month for oil field drilling rights.

Russia had already invested more than $4 billion over the past year in the Kurdistan oil fields. And Rosneft became the largest buyer of Kurdish oil as Western oil companies reduced their investments.

"For Russia to be able to play in and have influence over Kurdish politics is useful in Syria, and it's useful as a counterpressure on Turkey as well," said David L. Goldwyn, who was the State Department's top energy diplomat in the first Obama administration.

Now, Rosneft is angling for stakes in coming Iranian oil field auctions even while Mr. Putin seeks energy and other deals with Saudi Arabia, Iran's archrival.

All the wheeling and dealing appears to be at its most aggressive in Venezuela, where Moscow's engagement is more risky.

The Venezuelan government says it has more than $9 billion in currency reserves, though much of that is gold that must be sent abroad to liquidate, a transaction that can take time.

The next major debt payment comes due on Thursday, for $1.2 billion, on a Pdvsa bond that is maturing. Flirting with default, the company scrambled to pay most but not all of a $1 billion bond due on Friday, while the country still owes $350 million more in payments that were due this month.

The American sanctions against Venezuela, declining production and recurring pipeline and port disruptions have prompted several refiners to turn to other Latin American countries for supplies.

Should there be a default and the Maduro government collapses, Russia and Rosneft could be left holding bad loans that a new government might not want to pay.

"Will Russia continue to fund Venezuela?" asked Siobhan Morden, Nomura Holdings' head of Latin America fixed income strategy. "That is still a question. I don't know."

Senator SULLIVAN. The first sentence of that story reads, "Russia is increasingly wielding oil as a geopolitical tool spreading its influence around the world and challenging the interests of the United States."

Let me end with an anecdote of a meeting I was just in last year at the Halifax International Security Forum with Senator McCain. We were meeting with a senior level, Russian dissident and we asked him at the end of the meeting, "What more can we do as a country to push back against the Putin regime?" He looked at us and said, "The number one thing you can do, the number one thing you can do, is produce more American energy."

Opening the 1002 Area using the highest environmental standards in the world and the most advanced technology will produce more American energy for the betterment of our country.

Thank you, Madam Chair.

The CHAIRMAN. Thank you, Senator Sullivan.

Congressman Young, you have been through a few ANWR debates. We welcome your comments this morning.

STATEMENT OF HON. DON YOUNG,
U.S. CONGRESSMAN FROM ALASKA

Representative YOUNG. Are you sure of that?

Madam Chair, thank you for having this hearing, and Ranking Member Cantwell and the rest of the members of the Senate, I don't feel too comfortable on the Senate side. I need a flashlight most of the time because sometimes it's pretty dark over here.

I am one of the few people, there's only one left in the Congress, that went through this battle 45 years ago, actually 42 years ago. Now this 1002 Area, I have to go through the history of it, was created by Senator Jackson, Senator Magnuson, and Senator Stevens when the Senators were really knowledgeable about what goes on. We recognized this area at that time and about the valuable oil and why we had the 1002 Area.

As you mentioned, I believe the ANWR is about 19 million acres of land. The 1002 footprint will probably be—I can't really say what size it is. But I represent Alaska. [Inks a dot on his nose.] You see anything different with my nose right now? This is—I am Alaska—one tenth of one tenth a percent that we're talking about disturbance.

The map that the Ranking Member showed was actually drawn up by the Sierra Club. That bothers me. That's old information.

This little dot on my nose, I weigh 225 pounds, and this little dot is what we're talking about, the 1002 Area. It has the potential of probably around—early estimates were 10 billion barrels, now the estimates are probably around 20 billion barrels of oil.

Senator Sullivan brought it up, this is an issue of national security, national security. It is the one weapon Russia is wielding. We can have the security for the nation as a whole.

And I was interested to hear about the caribou. You're going to hear a lot of nonsense stories later on in the day.

Interested in Canada? The Ambassador sent out a letter about it opposing ANWR. Did we say anything when they drilled 270 wells right in the area for the caribou? Two hundred seventy wells were drilled in this caribou herd's area where they cross every

year. They built a 400-mile road right across the caribou area too. Did we say anything then?

This is not about—it's not about the environment or the caribou, it's about economics.

I'm ashamed of Canada right now because they're wielding an emotional issue that most people don't know what they're talking about nor have they been there, nor seen it, or understand the caribou herd.

That's one thing that bothers me probably the most of all about the legislative process. What used to be, as I mentioned, Warren Magnuson and Senator Jackson worked together, when the states were affected we didn't get involved in the shipyards and certain members' districts about how they were mis-manufacturing a ship. We didn't do that. But we have people going and saying this is a great environmental area. Maybe I'll find out how many of you have gone up there from the Senate side.

But let's think about national security. I run every two years—I'm not one of you guys, every six years—and I've supported this and fought for it 13 times. Thirteen times I've moved it out of the House and it has died on the Senate side, all but once, and President Clinton vetoed it because he said it wouldn't relieve the embargo we had that quickly.

But think about that a moment. If we are to be energy sufficient, to control the international incidences that can be faced, we need ANWR. The Congress recognized it when we passed the Alaska National Interest Lands Conservation Act (ANILCA). Scoop Jackson, Warren Magnuson, Mo Udall, and John Seiberling all agreed to this provision because they knew the value of that oil and the value to this nation.

Now we're fighting the same battle again because of the ignorance and misinformation from those that wouldst not have any resources developed at all, not only in Alaska, we're easy to pick on because of the three-person delegation, but the nation as a whole to make us less strong, to make us a second-rate nation. That's what a lot of you wish to do.

Now, as a House member, I'm going to pass this again and I hope you have the courage to do what's right for this nation—what's good for Alaska, what's good for the nation, and good for all the people in the future.

Madam Chairman, I do thank you for having this hearing. And I will remember and remind you, look at that little blue dot on my nose. That is the 1002 Area.

I don't think it changed my appearance very much because the Coastal Plain is not that pristine area you see in the propaganda that's purveyed by all the environmental groups. It's a flat terrain that, in fact, was set aside by this Congress and the Washington Senators for the development, not the preservation.

I yield.

The CHAIRMAN. Thank you, Congressman. Thank you for being here.

Governor Walker, welcome.

STATEMENT OF HON. BILL WALKER, GOVERNOR, STATE OF ALASKA

Governor WALKER. Good morning, Chairman Murkowski, Ranking Member Cantwell. Thank you for this opportunity to speak today.

I am the Governor of Alaska. I am non-partisan. I am—I have a goal as the Governor that future generations will be able to have the same benefits growing up in Alaska that I had growing up in Alaska. Born in the territory—Lieutenant Governor Mallott, also born in the territory—we've seen many changes in our state and many for the good.

Alaska is different. Resource development is in our DNA. We've done that long before statehood. We'll continue to do that. That's how we earn—it was 90 percent of our income—now 70 percent of our income from resource development. We've done it for a long time. We do it right. We're careful in what we do. We're very vigilant of the environment.

I remember well when we became a state. It was a day we celebrated. We made a—the deal we made was the Statehood Compact that said that Alaska, we cannot sell the resources in the ground. We have to live off of them. We have to live off the royalties of them. That's how we fund our state. That was the deal then. We accepted that deal. But what we didn't understand and didn't realize is that we may not be able to have access to resources responsibly developed, to live off those resources. That was the deal. All I'm asking for is that we get the deal that we made in 1959 under the Statehood Compact.

The great compromise that was made under ANILCA was that the 1002 was set aside for future development. That's what the deal was. All we're asking for is the benefit of the deal that was made long ago.

This has become something that I have lived with as an Alaskan resident all my life, and now I'm dealing with it as the Governor of Alaska in many ways which I'll get to.

The Trans-Alaska oil pipeline. The only thing wrong with the oil pipeline is it's three-quarters empty. Three-quarters empty sitting next to, miles away, from the most prolific area of hydrocarbons you can imagine, ten billion barrels.

You know, this is not about money. This is not about who gets what money in Alaska. This is about a future. This is about an economy. This is about the young people that want a decent education.

I want to thank the Committee members that came into a field hearing in Bethel and went on to a location in Oscarville. You saw a part of Alaska that many have not seen, and I thank you very much for doing that. I'm a big believer in seeing first-hand what Alaska looks like.

We are a vast state, as we all know. We have, we own, as the State of Alaska, 242 airports. The reason we do that is because 80 percent of our communities do not have roads. When we talk about infrastructure, upgrading infrastructure, we don't have enough infrastructure to upgrade.

You know, I sat in a listening circle in Utqiaġvik a few years back and one of the elders said to me, he said—I was not Gov-

ernor—he said, "Mr. Walker, my goal as a grandfather is to see one of my grandchildren flush a toilet in their village."

The infrastructure that we need needs to be paid for out of the, with the resources. That was the deal we made with Congress when we became a state. We need the benefits of that bargain, and we need it now.

As I came into office it was a $1.6 billion deficit that quickly drew to $3.7 billion deficit per year. I've had to do things I hope no future Governor ever has to do. We've had to make some very, very difficult decisions. I've had to say no to some very good requests for help for funding. We have had to close facilities across the state, lay off thousands of people. We have reduced the budget by $1.7 billion. That's a tough thing to do in a couple years. That hurts.

Public safety. Alaskans don't feel safe right now, because we've gone too far in that direction. We're having a special session, right now as we speak, to bring that safety back.

I signed recently, earlier this week, a climate change administrative order. We have stood up a climate change team. You know, we address both in Alaska. We are looking at climate change. Climate change has impacted Alaska. There's no question about it. We're looking at having to relocate as many as 12 of our villages. I've been to Kivalina. I've seen that island becoming a smaller island, but we cannot do it without the resources, the financial resources to do it. I don't see it coming from Washington to relocate 12 villages. So we need to look at how can we bring in the revenue. The only way we can do it is to live off our resources.

Alaska is unique that the beauty above ground is unparalleled. The beauty below the ground is unparalleled as well. The beauty below the ground is our resources that we need to develop responsibly.

As a Governor, I can tell you that the support in the Alaska legislature has been 90 percent. Last year was the last resolution passed, 90 percent in support of this. Please, please, let us develop our resources responsibly so we can fund our state. We can make Alaskans feel safe. We can fund our education, fund our health services. Our health services are the highest in the nation by multiples. Please let us have the benefit of the bargain that we made in 1959 with this body.

Thank you very much for your time today.

[The prepared statement of Governor Walker follows:]

Statement of
Governor Bill Walker
State of Alaska

Before the
U.S. Senate Committee on Energy and Natural Resources

Regarding
The Potential for Oil and Gas Exploration and Development in the Non-Wilderness Portion of the Arctic National Wildlife Refuge, known as the "1002 Area" or Coastal Plain

Thursday, November 2, 2017

Good morning Chairman Murkowski, Ranking Member Cantwell, and members of the Committee. My name is Bill Walker and I am blessed to be the Governor of the Great State of Alaska. I appreciate the opportunity to make this statement today on the incredible potential for safe, low impact development on the North Slope of Alaska and the benefits it can bring to the nation and to the people of Alaska that I have been elected to represent. I have submitted a copy of these comments for the record.

I. Personal Background

Before going to the issue at the heart of today's hearing, I wanted to provide a brief overview of my history and experience in Alaska. I was born in Alaska before statehood. My mother and father were pioneers in Alaska – serving in World War II; helping build the Alaska-Canada, or ALCAN, highway; and owning and operating small businesses in the Territory of Alaska. After the devastation of the 1964 earthquake in my hometown of Valdez, my parents and I took just about every job we could to keep our family businesses afloat until the discovery of oil and construction of the Trans-Alaska Pipeline opened up a new era of prosperity and opportunity in Alaska. I was able to work my way through college and then law school as a carpenter, teamster, and laborer on the pipeline, and then to return to Alaska to build a life, family, and career in the state I love. One of my foremost goals as Governor is to preserve and promote the same opportunities I enjoyed so that new generations of Alaskans can build their lives in the Last Frontier like I was able to.

II. Introduction and Outline of Statement

As the largest state in the union by far, Alaska is home to 50% of the country's coastline, the world's largest sockeye salmon fishery, one of North America's most prolific oil fields, the tallest mountain in North America, and the list goes on. The sheer size of our state and its incredible endowment of natural resources means we Alaskans have the great responsibility to maintain, conserve, and responsibly develop these resources for the benefit of the country as a whole. We see this balance – of enjoyment, conservation, and use – as a fundamental element of our state. We believe we strike this balance better than anywhere else in the world.

We are confident minimal impact, small footprint development in the 1002 Area of ANWR can occur while protecting the environment and conserving the wildlife. That is because just across the border

from ANWR, on the highly prolific state lands just to the west, we have seen almost 18 billion barrels of oil shipped to market in the context of a safe and healthy environment where wildlife thrives and the local communities have economic opportunity and can continue their subsistence way of life.

Today, I will describe the unique foundation of resource ownership and development in the Alaska Statehood Compact and Alaska Constitution, and how the 1002 Area particularly is a key part of this promise. I will also describe the successes and improvements that the state has seen from safely developing its oil and gas over the last 50 years. As Governor of Alaska, I am also uniquely able to describe significant this opportunity is for the people of Alaska, and how badly needed it is in our current fiscal circumstances. The revenue from development will have real impact on the lives of Alaskans, and I will summarize some of the essential services that will be supported. Finally, I will close by confirming that Alaska is uniquely positioned to understand the prospectivity of the 1002 Area, and we strongly urge the members of this Committee to recognize and act on this potential.

III. The Natural Resource Foundation of the State of Alaska – the Statehood Compact and Constitution

Alaska is different. Resource development is in Alaska's DNA. Long before Statehood, Alaska Natives have lived in harmony with the land for more than 10,000 years. Because of the State's harsh climate and extreme terrain, the Alaska Native people have perfected the art of subsistence and responsible management of the land and its resources. They know when herds are becoming too thin, or when fish stocks need time to recover. The wisdom and insight of this traditional knowledge stays with us today as we work to utilize the wealth and value of our natural resources to set our state on a sustainable path to the future.

Planning for Alaska's future must be rooted in our past – and the unique agreement and vision that was ratified when our State was admitted to the United States. Alaska has been, since its founding, a natural resource and resource development state. From our salmon fisheries and beautifully scenic viewscapes to our immense oil, gas, and mineral potential and everything in between, we are a place where the natural environment and its resources underpin Alaskans' lives and livelihoods. The founding documents of Alaska – the Statehood Compact and the Alaska Constitution – make this abundantly clear. I can confirm that when I was a young man these ideas were on everyone's lips and in everyone's heads leading up to 1959 when we became the 49th state.

The fight for Alaska statehood revolved almost exclusively around the question of whether Alaska could do just that – manage the bountiful natural resources contained within her massive borders to make a future for Alaskans. The potential of the State to sustain its economy through resource development was boosted by the significant oil discoveries on the Kenai Peninsula at Swanson River in the late 1950s that pushed Alaska towards achieving statehood in 1959. The Statehood Compact squarely addressed Alaska's resource potential and the need for it to be both developed and protected to sustain the new state. It endowed Alaska and Alaskans with ample land ownership to build an independent, reliable economy and granted the state authority to manage and perpetuate the fish and game stocks that had suffered under federal management. Furthermore, it vested the rights and thus revenue associated with this land with the people of Alaska, allowing the public to benefit from the prodigious natural resources of Alaska for the long term. To increase state and federal alignment, even portions of the revenue from development on federal land were dedicated to support the State and its people.

Alaska is the only State in the Union that cannot sell its mineral rights in the ground. That restriction is set forth in the Statehood Act and has a reversion clause that if Alaska did ever sell resources in the ground, that land would revert back to the Federal government. This restriction ensures that Alaskans can live for generations from the royalty revenues from the responsible development of those in-ground resources rather than one time purchase payments. That was the offer at statehood and Alaska accepted that offer. What we never anticipated was that we would be denied access to those life sustaining resources on federal lands for responsible development.

The government of Alaska, in turn, was built on the premise that sustainable, long-term development would be the basis of our independent economy. The same direction to maintain ownership but utilize the resources of Alaska for Alaskans was written directly into our Constitution. Lax federal policy in the Territory of Alaska, and the view that many western states had suffered from their resources being sold off and exploited for short term returns marked Alaskans' decision to enshrine one of the most important, and singularly unique, provisions in the Alaska Constitution: that the natural resources of the state should be developed and managed for the maximum benefit of the people. When, nearly a decade later North America's largest oil field at Prudhoe Bay on the North Slope was discovered in 1967, the resource development foundation laid in these documents allowed the State to flourish and thrive.

Alaska's delegate to the U.S. Congress, Bob Bartlett, devoted his keynote speech at the Alaska constitutional convention to the role of resource development in Alaska's future: ". . . fifty years from now, the people of Alaska may very well judge the product of this Convention not by the decisions taken upon issues like local government, apportionment, and the structure and powers of the three branches of government, but rather by the decision taken upon the vital issue of resources policy." I am proud to say that the 50 years Delegate Bartlett envisioned saw both success for our state and many lessons learned, and it is necessary that I, as elected leader of Alaska, look towards the next 50 years of successful resource development policy.

IV. Development in the 1002 Area – the Longstanding Priority and Promise for Alaska

The Arctic National Wildlife Range was withdrawn by President Dwight Eisenhower shortly before statehood, formally created in 1960, and enlarged into the Arctic National Wildlife Refuge (ANWR) we know today during the development of the Alaska National Interests Lands Conservation Act (ANILCA) in 1980. In the 1970s as Congress deliberated this "grand compromise" legislation, the immense productivity of the state lands on the North Slope – containing the Prudhoe Bay field and the billions and billions of barrels of oil that have now been produced – was starting to be understood. In light of the potential for some of the lands just to the east of Prudhoe Bay to contain similar petroleum reserves, Congress made a specific compromise in ANILCA for a small portion of the Refuge close to these areas – the Coastal Plain, comprising only 8% of the total refuge – would be scientifically studied for its petroleum potential, environmental qualities, and the possibility of conducting safe development. These provisions are found in Section 1002 of ANILCA, giving rise to the use of the term "1002 Area" to describe the Coastal Plain.

When the Department of the Interior conducted the initial studies required by ANILCA, it recommended Congress adopt a full oil and gas leasing program for the 1002 Area. Since that time the foot print of development has dramatically shrunk, the environmental standards to prevent spills and protect wildlife have improved, and new technology allows wells to reach further than ever underground. Today, after 50 years of successful and safe development on the state lands to the West, and decades of

advancement in both oil and gas technology and environmental mitigation measures, it is time that the Congress act to honor the longstanding promise in these areas available for the benefit of Alaska, the country, and the world.

Of the almost 20,000,000-acre Refuge, the Coastal Plain contains 1,500,000 acres. A full field development on par with current projects happening to the west of the 1002 Area on state lands would see only a few thousand acres of surface footprint for development at most. This would be approximately .1% of the Coastal Plain, and .01% of the overall area of the Refuge. For reference, ANWR is roughly the size of South Carolina, the Coastal Plain is roughly the size of Delaware, and the likely development footprint is the same order of magnitude as a University campus such as the University of Delaware.

It is this small area of the refuge that must be explored and developed for the benefit of our state and country. Using the currently available exploration technology that leaves almost no lasting impact of any kind, a limited development could be designed that provides billions of dollars to the American people, creates jobs across the country, and significantly improves our national security and international influence while fully protecting the wildlife and environment of the Coastal Plain.

V. The Significant State and National Interests at Stake

I must emphasize for the committee how much is at stake for the State of Alaska in these discussions. I believe many listening today have heard about the federal issues at play: The huge potential for federal revenues to offset our national deficit, both in the near term and over the life of the fields. The chance to push our country from energy independence to energy dominance, where our energy exports strengthen our allies and intimidate our international foes and competitors. The chance to strengthen our Arctic infrastructure at a time when the Arctic will be a new international theater for transportation, commerce, and national security. While I will not address these topics at length, I believe the Committee can act to support all these interests by authorizing limited oil and gas leasing in the 1002 Area. As a proud American I urge you to.

What I do want to detail is how prospective and significant the State of Alaska believes the opportunity of the 1002 Area to be, and how critical seizing this opportunity is to the Alaskan people.

The State of Alaska has perhaps never had such significant fiscal needs, and we need to tap into every source of economic activity and potential state revenue that we are able to. My administration is doing everything it can to find a fiscal solution that charts a sustainable and stable path for our State, but a critical part of this is doing what we have done successfully for decades: safely overseeing oil and gas exploration and development.

Alaska's government, funded by Alaska's resources, provides many services in uniquely Alaskan ways – and will likely be called upon to do even more in the years ahead. We have many Alaska Native villages that are being affected by climate change and coastal erosion, and the State will be called upon to help in relocation, mitigation, and adaptation efforts to support these communities. The State currently owns and manages over 240 mostly small and rural airports that are critical supply and resource hubs for our rural residents. We fund education in a state where we have less than 150,000 students spread out over more than 600,000 square miles. We fund Alaska State Troopers that patrol and protect the hundreds of miles between population centers in the interior and southcentral parts of our state, and

Village Public Safety Offices for areas entirely off the "road-system" – where sometimes the only means of reaching the community is a small state-owned airport mentioned above. Over 80% of our communities do not have road access. We fund the State's healthcare obligations in a place where our cost of care can be orders of magnitude higher than the already challenging costs many Americans face.

I am the Governor of Alaska during challenging fiscal times, when all these challenges seem harder than ever. For the three years of my Administration to date, I have had to take a budget to the Alaska Legislature to cut spending, eliminate services, and shrink our workforce. Today, our unemployment rate is the highest in the country.

When I hear public discourse about how the competitive international market for oil and gas investment means that Alaska and America should sit on the sidelines, I could not disagree more. I cannot sit on the sidelines when Alaska, where I was able to work my way through college, has more people out of work than anywhere in the country. From a national perspective, how can we sit on the sidelines when the national infrastructure asset of the Trans Alaska Oil Pipeline System (TAPS) sits at approximately 25% capacity?

We also frequently hear of the challenges of the changing climate, and how we should cease all development now in response. As Governor I must face these issues, and just this week I signed an Administrative Order to reconvene Alaska's efforts to develop a framework to provide Alaskan solutions to the Alaskan impacts of climate change – but I cannot hobble my state and deprive it of the resources and revenue it needs now as we plan for the future.

From my perspective as an advocate of the people of Alaska, it is more important than ever before to seize these opportunities. I cannot understand having a potentially huge resource sit undeveloped and space in our pipeline sit unutilized when the State is challenged to fund core services like education, healthcare, and public safety – with potentially more cuts on the horizon. When we consider the billions of dollars in federal revenue that will be generated at a time when the federal government runs a significant deficit and the national debt is growing every year, I must believe federal leaders are faced with a similar analysis. Paralysis and inaction is not the answer.

These interests at stake are significant over the long term as well. Using the Energy Information Administration's projections for the price of oil and USGS's resource estimate for ANWR, the Alaska Department of Natural Resources (DNR) estimates that oil production from federal lands in the 1002 Area will generate $175 billion dollars in royalty and tax revenues for Alaska over the potential 40-plus year life of the basin. In addition, oil development in nearshore State waters that are adjacent to the 1002 Area are expected to generate tens of billions of dollars in additional royalties and tax revenues, especially when their economics are improved with additional infrastructure. This money will be used to build roads and bridges and schools, fund healthcare, and educate the next generation of enterprising souls who call Alaska home. This same magnitude of benefits will accrue to our nation due to federal royalty and federal income tax revenues, at a time when federal needs are just as great. While we understand that budget processes looks at a limited time frame to calculate the value of this proposal, the Committee should look beyond to the perpetual national asset and over $100 billion federal income stream development in the 1002 Area could create.

It is difficult to project jobs numbers without knowing what projects are under consideration, but studies in Alaska show that one out of every three Alaskan jobs can be traced back to the oil and gas

sector, and for each person employed by the oil and gas industry in Alaska there are 22 additional jobs generated throughout the state economy. When you look at the significant economic opportunity provided to Alaskans by projects like the Point Thomson development or ConocoPhillips recent exploration programs to the West, ANWR's national employment benefits, which will draw workers and equipment from across the country, are quite clear.

VI. The Significant Interest In 1002 Area Development

We also have also heard public discourse that oil prices hurt the demand for leases in the 1002 Area and limit the economic returns to the State and federal government, and thus we should again sit on the sidelines. Again, I completely disagree.

In 2002, when oil prices sat in the low $30 range in inflation adjusted 2017 dollars, a report by Alaska-based McDowell Group estimated that Alaska would see between 10,000 and 20,000 jobs added in the decade after oil from ANWR started to be transported to TAPS. Today, when we see oil prices significantly off the highs of a few years ago, we have still had very successful state and federal lease sales – in areas that have seen significant prior leasing. In this same environment, ConocoPhillips and others are embarking on major exploration programs to confirm discoveries and search for additional prospects as new technology and new geologic understandings continue to find more oil across the North Slope. For ANWR, where promise and potential may mirror or even exceed these areas, we would expect industry to be very eager to establish a position and generate significant bonus bids and rental revenue for the State and federal government in the near term.

The resource potential of the 1002 Area has only been studied a few times, and has never seen modern, minimal impact exploration techniques used to assess its resources. The most recent public data, gathered in the 1980s using equipment that has advanced in the same way fax machines and computers filling rooms have shrunk into the telephones we carry in our pockets, showed great potential and estimated 3.2 billion barrels of recoverable oil resources. Since then, the US Geological Survey's most recent comprehensive assessment of the undiscovered resources published in 1999 found a mean of 10.4 billion technically recoverable barrels of oil in the 1002 Area and the surrounding Alaska Native Corporation and near-offshore State-owned lands.

Additionally, a 2005 economic update to the resource potential study used a model to incorporate $30 per barrel pricing with full cycle cost assumptions to determine that "73 to 82 percent of the technically recoverable oil in the study area could be economically discovered, developed, produced, and transported to market." At $55 per barrel, which is in line with current assumptions, that percentage increased to 92%. Based on the mean economically available oil of 7.1 billion barrels, that brings economically recoverable resource potential to 6.5 billion barrels. Today, with the continued development at Point Thomson just miles away from the coastal plain, infrastructure is available to transport the resource from the point of production and barriers to tapping into this potential are even lower.

As we are seeing billions of dollars of investment on nearby State and National Petroleum Reserve-Alaska lands to assess fields with hundreds of millions of barrels of oil, we have the potential to see even more still if there are fields in the 1002 Area that could hold a billion barrels or more.

VII. Conclusion

Thank you for the opportunity to provide this statement as a life-long Alaskan and Governor of my great state. Alaska is uniquely founded on resource use and development, and the 1002 Area was a critical piece of the compromises that formed our State. As we look forward to the immense benefits that could accrue to Alaska and the Nation from this opportunity, I ask the Committee to survey the full factual record and see the success Alaska has had, the continued vitality of our wildlife and environment, and the technological progress that our high standards have driven in the oil and gas industry. Building on all this knowledge, I am confident that opening the 1002 Area would promote decades of additional economic activity in Alaska and support the same opportunities I was able to enjoy in the Last Frontier.

The CHAIRMAN. Governor, Senator, Congressman, thank you for, not only your testimony here this morning, but putting it into perspective from a historical perspective, from a defense perspective, from a resource perspective. It adds great value to the conversation, and we certainly appreciate it.

I know, Congressman, it is a long way over to the House side, so we will let you get back as we move to our second panel, but I want to thank each of you.

Senator CANTWELL. Madam Chair, could I——

Representative YOUNG. Thank you, Madam Chair, but I'm glad to see so many of my colleagues up there on this side, all served with me.

The CHAIRMAN. It is not so bad on the Senate side.

Representative YOUNG. Everybody but Abraham Lincoln served with me——

[Laughter.]

Thank you, Madam Chair.

Senator CANTWELL. Madam Chair, could I ask the Governor a quick question?

The CHAIRMAN. We were not prepared to do questions, but if it is very quick, I think we can get to it.

Senator CANTWELL. We don't get a chance to talk to him that often and certainly appreciate chances that we do.

The CHAIRMAN. Certainly.

Senator CANTWELL. Part of this idea is traveling with a package of legislation moving through the House that gets rid of our local sales deductions. Washington and Alaska are unique in that we don't have an income tax and we get to deduct.

Are you supportive of that concept? In addition, there are some who thought that they would package this legislation up with another try at health care where they would go back to block granting Medicaid. Are you supportive of those concepts as part of a package just to get ANWR opened up?

Governor WALKER. Senator Cantwell, I have certainly looked at the package and I will evaluate the package in its entirety. I've not been through it as thorough as I'd like to because I've been getting ready for this hearing today, obviously.

You know, we look at that as us, as a part of that, part of the solution on the deficit, revenues from Alaska because the royalties will be shared equally between the Federal Government and the State of Alaska. So we see that, certainly, as if there's interest in reducing the federal deficit, I'm certainly interested in reducing the state deficit. That's what my focus is today.

Senator CANTWELL. Well, I would—we will get you information, but our analysis is that Alaskans will pay about a $1,100 to $1,400 tax increase and individuals a $900 increase under that sales tax deduction idea.

I think it is a bad idea for our state and your state and, certainly, I hope no one around here takes the bait on block granting Medicaid just to open up ANWR.

Thank you for being here, Governor.

Governor WALKER. We will do all we can to open up ANWR. Thank you.

Senator CASSIDY. Madam Chair, just for point of fact.

The CHAIRMAN. Senator Cassidy.

Senator CASSIDY. Health care reform is not part of this. Block granting Medicaid is not part of this. It can be a disinformation campaign put out there to obscure the truth. We will come back to health care reform, but that should not be spoken of here as if it is germane to the argument. That is misleading to the American people.

The CHAIRMAN. We do have somewhat limited jurisdiction here in the Energy Committee. Our instruction is to find $1 billion, and as we mentioned repeatedly, we have that opportunity within the 1002 Area of Alaska.

Governor, Senator, Congressman, thank you for being here this morning.

Let's call up the second panel, please. As you are getting seated, I will provide brief introductions.

We have heard from our Governor, Governor Walker. His Lieutenant Governor and partner is our Lieutenant Governor, Byron Mallott. The Lieutenant Governor is a leader of great renown in our state, an Alaskan Native leader hailing from Yakutat, and has had an opportunity to appear before our Committee on numerous occasions. We welcome him back.

His testimony will be followed by Mr. Greg Sheehan. Greg is the Principal Deputy Director for the Fish and Wildlife Service at the Department of the Interior. It is good to have you before the Committee.

Mr. Samuel Alexander has joined us, and we welcome him as a Tribal Member from the Gwich'in Tribal Government. Thank you for being here this morning and traveling such a long distance.

Mr. Matthew Rexford is the Tribal Administrator in the Native Village of Kaktovik, the one community, the one village within the 1002 Area. It is good to have you here, Matthew.

Lieutenant Governor, if you would like to lead off this morning.

We have asked you to try to limit your comments to about five minutes. Your full statements will be incorporated as part of the record. After the conclusion of your testimony, we will have an opportunity to ask specific questions of each of you.

Lieutenant Governor, thank you again for traveling the long distance and, again, for being before the Committee. Welcome.

STATEMENT OF HON. BYRON MALLOTT, LIEUTENANT GOVERNOR, STATE OF ALASKA

Lieutenant Governor MALLOTT. Thank you, Madam Chairman, Ranking Member Cantwell, members of the Committee.

The statement of Governor Walker in the record details the reasons, clearly, that the State of Alaska supports the issue before the Committee: that the need for development is clear, that the need for the revenue is clear, that the availability of revenue should development take place, will be real.

I want to focus my remarks, briefly, on the history of, as also has been spoken to, the ANWR issue.

I was here as a young staffer during the development of the Alaska Native Claims Settlement Act (ANCSA), ANILCA, and ultimately the federal classifications in Alaska flowed from ANCSA.

In section (d)(2) of that Act there were bargains made that were made very clear to Alaska which from time to time I had the opportunity to help develop and which, in practice, I saw go away. In my home village of Yakutat, I saw preserve areas created in the St. Elias National Park in which we were promised, as Native residents, as Native subsistence users, as folks who lived in that area for centuries, were promised that we could use that area into the future. They were carved out for that purpose. And I saw camps that my family owned and others in our community used for generations, burned down by the National Park Service, regardless of what had been promised to us by this Congress.

I see in ANWR, the 1002 Area being an area in which the Congress made a promise to Alaska and to our country that we would develop those resources should they be able to be done safely, should they meet the market tests, should they be able to be brought to market.

We see a complete infrastructure on the North Slope of our state with a pipeline to market. As the Governor said, that is now at only 25 percent of capacity. We see Point Thomson literally on the border of the 1002 Area with the infrastructure to allow the minimal impact in the 1002 Area for exploration and even development made possible without any further significant impact on the environment.

We see the ability to deal with our national security requirements which Alaska is very concerned about as we look to certain neighbors of our state, our unique global national security location.

We see the need for our people. Alaska is the one state that makes use of our fish and game and plant resources as the highest priority for food security among all the uses of our resources. It's called subsistence. It is our highest public policy use.

And as resources become scarce, as they cycle through the life cycles of resources, we make sure that our people who depend on those resources for their livelihood, for their life ways, for food security, are the ones that have the ultimate access to those resources. No other state does that.

My wife, my children are Athabascan. They're Koyukon, not Gwich'in, but I came to this office largely on the basis that I have fought for my entire life, the life ways, the desire, the aspirations of Alaska's native peoples and I will continue to do so with every breath that I have.

Thank you.

[The prepared statement of Mr. Mallott follows:]

Testimony of
Lieutenant Governor Byron Mallott
State of Alaska

Before the
U.S. Senate Committee on Energy and Natural Resources

Regarding
The Potential for Oil and Gas Exploration and Development in the Non-Wilderness Portion of the Arctic National Wildlife Refuge, known as the "1002 Area" or Coastal Plain

Given in Person
Thursday, November 2, 2017

Good morning Chairman Murkowski, Ranking Cantwell and members of the Senate Committee on Energy and Natural Resources. My name is Byron Mallott and I serve as the Lt. Governor of the Great State of Alaska. I have appreciated hearing from my Governor and friend, Bill Walker, this morning, as well as my fellow Alaskan leaders Senator Dan Sullivan and Congressman Don Young. I appreciate this opportunity to testify on this panel as part of this Committee's important work on the longstanding issue of the Coastal Plain, or 1002 Area, of the Arctic National Wildlife Refuge (ANWR).

In particular, I thank you for the opportunity to emphasize to this Committee and to the rest of your colleagues in the U.S. Congress the priority that the State of Alaska places on the environment and wildlife, and the success we have had with responsible resource development on the Arctic North Slope of Alaska.

I. Personal Background

For those of you I am just meeting, I'm an Alaska Native and clan leader of the Tlingit Raven Kwaash Kee Kwaan Clan. I entered public service just a few years ago at the age of 22 as mayor of Yakutat, where I first began to work on many of the issues still important to Alaska and Alaskans today. I have been able to serve every Alaska Governor since statehood in some capacity, and to represent the Alaska Native people as past-president of the Alaska Federation of Natives and founding-president of the First Alaskans Institute. I have served my Alaska Native Corporation, Sealaska, as CEO and chairman; the State of Alaska as chairman of the board of the Alaska Permanent Fund Corporation; and the United States as a member of the Board of the Federal Reserve Bank of San Francisco – in addition to roles as chair of the Nature Conservancy of Alaska and on the board of Alaska Airlines. I and many of those I have been privileged to work with over the years have grown up with the State of Alaska, and I have been proud to see my children and grandchildren build their lives in our great state.

II. Introduction and Outline of Testimony

Many of the great Alaskan leaders I have learned from and worked with are both pro-conservation and pro-development, and view these interests as part of the balance that continues to make our Alaskan way of life possible in our changing world. I believe we have reached the point where it is time to honor

the federal obligation inherent in ANCSA and ANILCA for safe, limited footprint development in the Coastal Plain of ANWR to perpetuate this balance for a new generation of Alaskans. Advancing technology shows we can do this with minimal impact, and the State's long record with successful development on its lands shows we can do it safely. Our current circumstances demand that we must pursue every opportunity. It is also why Alaska must continue to reinvest future returns from natural resource development into energy efficiency and renewable power in the State's long-term interests. While I speak as an Alaskan leader, I believe the federal interests at stake here, and the potential for balanced and safe federal revenues that can be used to underwrite our national future, places the State and the country in full alignment.

III. The Balance Struck by Alaska's Landmark Federal Legislation – ANCSA and ANILCA

As a younger man, I observed the deliberations and discussions about statehood, finally leading up to our entrance to the United States in 1959. These state-wide debates then shifted to a topic I am personally invested in and that I have worked on my whole life – the rights of the Alaska Native people and our claims to the land of Alaska that is the foundation of our traditional way of life. Like Statehood, there were many things to take into consideration, many different perspectives across our state, and many issues competing to be resolved as the U.S. Congress took up and passed the Alaska Native Claims Settlement Act (ANCSA) in 1971.

This law established frameworks that continue to shape Alaska, such as the subsistence and access rights to our land that many Native Alaskans depend on to continue their traditional way of life. I have lived and fished in my hometown of Yakutat every chance I am able, as generations of my family before me have done. ANCSA also established the Alaska Native Regional Corporations (ANCs), such as Sealaska for my region in Southeast Alaska that I was able to serve in a leadership capacity, and smaller village corporations within the different regions to advance the economic and social interests of Native Alaskans. These corporations are owned by Alaska Native shareholders, and the shares are passed to our descendants and families rather than being bought and sold on the open market. These ANCs were provided with endowments of land and financial resources to begin their operations, with the expectation that they would develop their own resources, engage with the state and federal government to develop all of the resources of Alaska, and enter into general lines of business to advance the interests of their Alaska Native shareholders and generate returns to support the Alaska Native way of life.

However, through the 1970s, debate about Alaska's formative issues across our state continued to grow as the State worked to reconcile the promise and opportunity of Statehood, the newly created ANCs, the beginning of Alaska's oil and natural gas boom, and the role of federal ownership and management in our sovereign state. These debates – and I can tell you at times "debates" was a polite term for them – led to yet another piece of landmark compromise legislation – the Alaska National Interest Lands Conservation Act (ANILCA). This legislation served to finalize the allocation of lands in Alaska to be federally managed for conservation, while guaranteeing the residents of Alaska a suite of rights to access and use the land for hunting, fishing, recreation, and natural resource development. It is clear what the national conservation interests received from ANILCA – the legislation doubled the size of the United States' National Park system, doubled the size of the National Refuge system, and tripled the amount of land designated as federal "Wilderness." We must not forget that the legislation also protected the right of Alaska and Alaskans to promote our economy through the use and safe development of natural resources.

Part of ANILCA's compromise focused on what is now the Arctic National Wildlife Refuge. To support the conservation interest, ANILCA vastly supplemented what was then the Arctic National Wildlife Range by adding nearly 9 million acres of federal land and identifying approximately 8 million acres within the original Range to be designated as federally protected Wilderness. After extensive debate, the state and national interest in resource development was also advanced by identifying the highly prospective Coastal Plain, or 1002 Area, as an area for study and assessment of hydrocarbon potential. If these studies showed balance and mitigation could be achieved in the Coastal Plain, it was expected that Congress would then authorize oil and gas leasing and development.

We have achieved this balance. It is time to permit the exploration and development. The State has demonstrated that wildlife and environmental protection can be achieved through 50 years of development and progress on the North Slope. This would stimulate my State at a time when it is sorely needed, and would unlock the resources that my fellow Alaska Natives in Kaktovik and on the North Slope secured through the promises of ANCSA but have been unable to utilize for decades. It will allow us to invest in climate change adaptation and modification and promote an energy transition for the Alaskan people.

IV. Alaska's Standards and the Drive to Decrease Impacts and Footprints of Development

Companies operating in Alaska must meet stringent standards that minimize impacts when conducting exploration or development activities. In Alaska, our onshore exploration activities are almost always conducted in winter with the construction of ice roads and pads so that permanent roads do not need to be built on the tundra. An ice pad that hosts a drilling rig, 100-person camp, and ice airstrip will be processed down and melt away in the spring without lasting impact. But for protective casings and markings on wells, and a small cabin-like structure to maintain the well head, it would be hard to tell any of the exploration had even occurred. Winter operations are also carefully designed to have almost no impact to wildlife – while polar bears move offshore and many birds and caribou have moved south, every effort is made to avoid disturbing any arctic animals that remain. Trucks can be modified with rubber track kits to spread the weight of the vehicles on the ground, and heavier loads are carried on "roligons," which are special trucks with huge, soft tires – and even these vehicles are only permitted to traverse the tundra when snowpack has confirmed to be fully in place.

When areas move into production, every element of the design of a development pad is scrutinized. Its gravel fill areas and gravel sources are analyzed by state and federal agencies; its location, road access, and size are adjusted to accommodate both wildlife and the local residents who subsist on them. We have seen anything but the catastrophic predictions of those who thought the original developments at Prudhoe Bay would decimate caribou herds, threaten polar bears, and drive away fish, waterfowl, and other wildlife – and today, footprints are only a fraction of those original pads that have been coexisting with wildlife for decades.

Most pertinently, drill siting and spacing; pad design; and extended reach drilling techniques have all advanced tremendously in recent years. Today, on a pad that is 10 or 15 acres in size it is feasible to site over 50 wells that can reach down-hole locations more than six miles from their centerline and tap reservoirs across an area of over 100 square miles or more. This allows not only smaller pads, but less of them to reach resources across a large area.

To describe with examples in operation today in Alaska, the first drill sites in the Prudhoe Bay field, built in the 1970s, covered 65 acres of land to accommodate the size of the drilling rigs of the day. The less

than 100 wells drilled on this large pad could only reach approximately one-mile from their centerline. The Alpine field that was first brought online in the 2000s in the Colville River Delta, in contrast, represents some of the significant advancements in drilling development. From a drill site of only 13 acres, 54 wells have been drilled at a spacing of just 10 feet. The extended reach of these wells can intercept an area eight miles across and penetrate 50 square miles of the field. In just 30 years, surface footprint requirements have been reduced from over two acres per well at Prudhoe Bay to below a quarter of an acre per well at Alpine – and are continuing to go down.

Since the 1002 Area is less than 60 miles from TAPS and in close proximity to the newly developed infrastructure at Point Thomson that is safely operating along its invisible western border, its development is the quickest, most environmentally sound way to increase oil production in Alaska on the scale necessary to ensure the Trans Alaska Pipeline System will continue to operate well into the future.

V. Our History of Safety and Environmental Success

Alaska holds development on its North Slope to some of the highest standards in the world, and we have the record of success to show for it. As discussed above, oil and gas exploration occurs with almost no long-term footprint in Alaska, and areas that are brought into production occupy smaller and smaller spaces with more and more resource accessed. In areas from spill response to wildlife protection, we continue to advance our standards, and expect more from operators to keep Alaska pristine. After almost 50 years of activity at Prudhoe Bay – the nation's largest oil field – we can say we have established a record of success we can proudly carry forward.

As I alluded to, we heard this would not be the case. We heard that the oil fields and the construction of the Trans Alaska Pipeline System would devastate the arctic environment beyond repair. For the Central Arctic Caribou Herd that numbered a few thousand animals when first identified in 1970, we have seen growth to a high of 70,000 in 2010 – during the time of intensive North Slope development. This herd has declined to about 25,000 animals today, which our biologists tell us is a normal fluctuation and may be due in part to some caribou migrating to the Porcupine Caribou Herd. That herd, numbered in the 170,000 range when first reliably surveyed in the 1980s, slowly declined to approximately 120,000 animals in 2000, but has since reached an all-time population high in excess of 200,000. State Biologists do not link the fluctuations in either herd with particular or general impacts of development. Bowhead whale numbers in the Arctic waters off the coasts of the North Slope continue to grow, and Polar Bear population numbers are stable and healthy as they adapt to the changing climate. Contrary to being devastated, all this information shows healthy wildlife coexisting with North Slope development over decades.

We understand that our neighbors in Canada also have interests in the vitality and success of these herds and that the environment extends beyond territorial borders. We believe this is a key reason to locate development and investment in Alaska where the standards are extremely high and we have a record of successful protection. In the event caribou impacts are identified in Canadian herds or in the herds that cross the border due to activity, we must work together to mitigate and, if possible, eliminate those impacts. However, avoiding all development and the significant public benefits we know it would bring because of the potential of impacts that are different than we currently observe is not consistent with the balance we must strike.

We have seen this same successful record in oil spill prevention and response, where Alaska has taken the role of global leader in Arctic spill prevention. Releases for both any regulated material and for crude oil have, on average, been declining for almost 20 years. Studies show the volumes released during these spills are small and can be cleaned without environmental damage – but the State continues to review and strengthen our regulations to continue this decline. We are responsive when we see we need to improve. In the late 2000s, when our Alaska Department of Environmental Conservation learned that corrosion may impact some lines in Alaska in unprecedented ways due to the Arctic environment, we instituted new standards, required new monitoring, and guided the replacement of many affected lines. Just this week, when our Alaska Oil and Gas Conservation Commission determined that permafrost changes may affect certain kinds of well designs, it ordered these wells closed and monitored so that solutions can be designed to address these issues. We will continue this vigilance.

As I have said, Alaskans are aware of the need for balanced development because it is so important to our economy, but they are also supportive because they are aware of the success we have had. Many of our families and friends have worked in the oil fields, and see firsthand the lengths companies go to comply with our standards that protect human health, avoid impacting wildlife, and protect the environment. Our Alaska Native friends on the North Slope continue to hunt caribou, participate in traditional whaling harvests, and catch subsistence fish in the Arctic waters while also encouraging a balance of careful development to strengthen the state and create opportunity for their residents. In Alaska, this bipartisan, collective support extends to the 1002 Area – knowing that all that has been learned from the state lands, and all the technological advances that have been achieved, will be put to use to protect its environment as well.

VI. Our Critical Need for these Resources

The Governor addressed these same issues in his statement, but I must echo them because they are so critical to the current circumstances and future of our State. Today Alaska is facing a fiscal crisis, and we need dramatic solutions. We have instituted cuts, reforms, and our Administration is pursuing both a broad-based tax and changes to our Permanent Fund to help fund the essential services that are being pressured today. While we have been very fortunate to see new geologic potential and new discoveries on the North Slope, our primary legacy fields are predicted to continue their geologic decline. We need to do everything we can to open new potential in Alaska and to fully utilize the resources across the North Slope.

The 1002 Area is a critical cornerstone of this potential. While we understand that the Committee is working within the constructs and timelines of the budget process, the state return from this activity – both from immediate economic stimulus and over the long-term life of the field, could be immense. Based on the Energy Information Administration's projections for the price of oil and the USGS's current resource estimates for ANWR, the State alone could realize $175 billion over the life of the fields to fund roads, schools, healthcare, and public safety. This is direct state revenue – not considering the massive indirect economic benefits of the activity or the comparably large federal revenues generated in Alaska. When these areas are available to the market, based on the currently available USGS estimates, the State believes that ANWR could draw interest orders of magnitude above the significant demand we have seen in recent major state and federal lease sales on the west of the North Slope and the billions of dollars of recent investment in new exploration.

VII. Alaska Reinvests its Resource Revenue in Energy Efficiency for its People

Alaska has some of the highest energy costs in the nation. Despite our abundance of natural resources, too many Alaskans struggle to pay for heat in the winter, electricity for light, and transportation to travel to and from their homes for basic health and quality of life purposes – because of the remoteness of many of our communities and the extremes of Alaska's environment. To counteract this, our state has reinvested significant resources in promoting energy innovation. As we meet the new challenges of climate change and support another generation of Alaskans building their lives in the Last Frontier, we as a State must wisely use the revenue from responsibility developing resources in the 1002 Area to continue this reinvestment.

As the Governor discussed, Alaska has many demands on our resource wealth – remote and rural schools, high healthcare costs, and uniquely challenged arctic infrastructure to name a few – but we have particularly focused it in areas of energy innovation. We know that the lowest cost and lowest emission energy is energy you conserve through efficiency, and that the energy supply of our future must draw heavily on hydro, wind, geothermal, biomass, and natural gas to transition away from the costly fuel oil many areas have relied on.

Earlier this week Governor Walker signed an Administrative Order on climate change establishing a vision, goals and a statewide leadership structure with a mandate for action. As the Arctic frontier of the United States, Alaska is currently seeing the changing of the waters and land on which we live and base our lives like other high-altitude regions around the World. I and the Governor can confirm Alaska will be vigorous in adapting, initiating change, and meeting our responsibility to our children and to the planet they and theirs will inherit. However, we must have resources and revenue today to support this work for our future.

While Alaska's oil and gas resources will continue to be our economic engine in the years ahead, among our most important long-term considerations decades from now is the transition from an economy and society dependent upon carbon-based energy to one of renewables. Alaska is fully aware of the need to create a clear path to a renewable energy future for our citizens and is doing so as a high priority. Natural Resource development has built the State into what it is today, and fiscal resources from petroleum in the Alaska economy for decades to come will be vital to the investment required to support this transition. There is no question petroleum resource development in Alaska and the United States remains vital to our national security, economic livelihoods, and energy independence as we prepare to head into a challenging new decade. However, as markets, technology, policy, and innovation accelerates the renewable energy deployment that Alaska has supported to date, we must have a strong and secure revenue base from our oil and gas to continue to play a critical role in addressing the local impacts of this global issue.

The State has dedicated significant resources to entities like the Alaska Energy Authority (AEA) which has been working for decades to support infrastructure and innovation that lowers the cost of energy in Alaska. AEA has upgraded the micro grids that power many of our villages and small communities across the State that are far from any connection point to a conventional power grid. It funds technical education to increase environmental compliance and prevent accidents, and help communities integrate clean, sustainable, and renewable power such as distributed wind generation and micro-hydro projects.

Over the last decade, the State has devoted significant financial resources to these efforts. Our renewable energy fund, which uses state resources to leverage federal and private sector investment to maximize the deployment, has seen over $250 million in state appropriations. We have invested another $300 million in weatherization programs to protect our infrastructure and improve our energy efficiency. Yet another $200 million has gone towards home energy rebates to encourage Alaskans to co-invest in improving our housing stock and decreasing our demand. As our state has faced immense fiscal challenge and uncertainty, continued support for these programs has been challenged and appropriations have tapered off. However, I can guarantee you, and I know many fellow Alaskan leaders agree, that we absolutely must continue to reinvest in ourselves and secure low-cost, low-emission, sustainable energy for the future every way we can.

Through the actions the Committee is considering today it can set the federal government on a path to benefit from the substantial resources it has warehoused and secure our geopolitical strength, and allow the State to fund investment in further efficiency and energy progress to power Alaska.

VIII. Conclusion

Thank you again for the opportunity to provide this testimony. I am encouraged that this Committee has convened these panels to gather all of this input and, as I described in my introduction, weigh it together to strike a balance for our state and our country as a whole going forward. From my perspective – our state and national economic needs for the development are clear, and the potential to use this revenue to promote long-term sustainability is significant. As Congress originally considered in ANCSA and ANILCA, it must be determined whether these economic benefits can be pursued in a safe manner that protects the wildlife of the Alaska North Slope. I believe the State's longstanding success shows that it definitively can, and thus should, be done.

The CHAIRMAN. Thank you, Lieutenant Governor.
Mr. Sheehan, welcome to the Committee.

STATEMENT OF GREG SHEEHAN, PRINCIPAL DEPUTY DIRECTOR, U.S. FISH & WILDLIFE SERVICE, U.S. DEPARTMENT OF THE INTERIOR

Mr. SHEEHAN. Thank you.
Thank you, Chairman Murkowski, Ranking Member Cantwell, and members of the Committee, for the opportunity to present the Department of the Interior's testimony on resource development in Alaska's 1002 Area. The 1002 Area is contained within the Arctic National Wildlife Refuge.
I am Greg Sheehan, Principal Deputy Director of the U.S. Fish and Wildlife Service. I've spoken to many people about this issue including our dedicated and highly professional staff in Alaska. I appreciate the passion that surrounds every aspect of this issue.
The debate before us is a significant policy question that Congress anticipated decades ago and one we are addressing today. The roots of this hearing date back to 1980 when the Alaska National Interest Lands Conservation Act, or ANILCA, was signed into law. That law expanded the existing Arctic National Wildlife Range to 19.3 million acres and renamed it the Arctic National Wildlife Refuge.
ANILCA made great strides to enhance long-term conservation of fish and wildlife resources in the Refuge. The law also set aside a part of the Refuge, the 1002 Area, for potential development of oil and gas reserves.
ANILCA designated eight million acres of the original range as wilderness requiring the area to be managed in accordance with the Wilderness Act.
ANILCA also added the Refuge purposes including conservation of fish and wildlife populations, fulfilment of international agreements, providing for continued subsistence uses by rural residents, and ensuring water quality and quantity within the Refuge, as well as defining the 1002 Area within the Refuge.
Section 1002 of ANILCA provides for the continuing assessment of the fish and wildlife resources of the Coastal Plain of the Arctic Refuge. It also provides for the analysis of the impacts of oil and gas exploration, development and production and authorizes exploratory activity within the Coastal Plain. Research, observation, and exploratory activities have been occurring on an ongoing basis since the passage of ANILCA.
In section 1003 of ANILCA, Congress statutorily deferred a decision regarding future management of the 1.5 million area Coastal Plain in recognition of the area's natural resource potential. Specifically, section 1003 states, ". . . no leasing or other development leading to production of oil and gas . . . shall be undertaken until authorized by an Act of Congress."
Since the passage of ANILCA, a number of key steps were taken by the Department related to the 1002 Area's unique status. In an assessment completed and sent to Congress in 1987, the Secretary of the Interior recommended that Congress consider leasing the 1002 Area for oil and gas. Since 1987, the U.S. Geological Survey has conducted a number of assessments of the resources in the

1002 Area. Their most recent economic analysis, published in 2009, determined that there is a mean estimate of 10.3 billion barrels of recoverable oil with 80 to 90 percent of that volume being economically recoverable at $42 per barrel. Consistent with ANILCA, the services continued to inventory, monitor, and assess the fish, wildlife, and natural resources within the 1002 Area so that current data is available to inform future activity.

In 1988, the Arctic Refuge's initial Comprehensive Conservation Plan recognized the Coastal Plain as a critical calving area for the Porcupine Caribou herd which is an important subsistence use for Alaska Native peoples. Other important wildlife species including polar bear, migratory birds, and several fish species, inhabit the 1002 Area. At the Fish and Wildlife Service we're committed to ensuring the health of all species as Congress provides direction on future uses of this area.

Last spring, Secretary Zinke visited the North Slope with Chairman Murkowski and a bipartisan Senate delegation. He signed a Secretarial Order that requires the U.S. Geological Survey to update its resource assessment for the 1002 Area. This includes collection and consideration of new geological and geophysical data as well as the potential for reprocessing existing data. The Secretarial Order does not modify any environmental or regulatory requirements for energy development. This evaluation is consistent with the scope and intent of ANILCA and will provide the Department's understanding of resources within the 1002 Area.

The Administration's FY'18 budget proposes oil and gas leasing in the 1002 Area, and we support Congress' effort to open the area for production. If leasing is authorized by Congress, the Administration believes it will bolster our nation's energy independence and national security, provide economic opportunity for Alaskans, and provide much needed revenue to both the State of Alaska and the Federal Government. Should that authorization be enacted, the Department will follow applicable environmental review requirements in the law to ensure that development of the area is conducted responsibly.

Chairman Murkowski, I appreciate the opportunity to testify on behalf of the Department on this issue and look forward to answering any questions you and the members of the Committee may have. Thank you.

[The prepared statement of Mr. Sheehan follows:]

STATEMENT OF GREG SHEEHAN

PRINCIPAL DEPUTY DIRECTOR

U.S. FISH AND WILDLIFE SERVICE

BEFORE THE

SENATE ENERGY AND NATURAL RESOURCES COMMITTEE

ON OIL AND GAS EXPLORATION AND DEVELOPMENT IN THE ARCTIC

COASTAL PLAIN

November 2, 2017

Chairman Murkowski, Ranking Member Cantwell and Members of the Committee, thank you for the opportunity to appear before you today to testify on behalf of the Department of Interior (Department) regarding resource development in the 1002 area of the coastal plain of Alaska's North Slope. I am Greg Sheehan, Principal Deputy Director of the U.S. Fish and Wildlife Service.

The Arctic National Wildlife Refuge

The original 8.9 million acre Arctic National Wildlife Range was established on December 6, 1960 to protect the wildlife, wilderness, and recreational values of the range. It was later expanded through the Alaska National Interest Lands Conservation Act (ANILCA) on December 2, 1980 to 19.3 million acres and renamed the Arctic National Wildlife Refuge. ANILCA also designated 8 million acres of the original Range as Wilderness, requiring this area to be managed in accordance with the Wilderness Act, and added new Refuge purposes. These purposes include conservation of fish and wildlife populations; fulfillment of international treaty obligations of the United States with respect to fish and wildlife and their habitats; providing the opportunity for continued subsistence uses by rural residents; and ensuring water quality and quantity within the refuge.

The 1002 Area

In section 1002 of ANILCA, Congress and President Carter deferred a decision regarding future management of the 1.5-million-acre coastal plain – now referred to as the 1002 area – in recognition of the area's natural resource potential. Section 1002 of ANILCA provides for the comprehensive and continuing inventory and assessment of the fish and wildlife resources of the coastal plain of the Arctic Refuge; an analysis of the impacts of oil and gas exploration, development, and production, and authorization of exploratory activity within the coastal plain in a manner that avoids significant adverse effects on the fish and wildlife and other resources.

Due to its unique purpose and potential, Congress did not include the 1002 area in the refuge's designated wilderness when ANILCA was enacted in 1980. Since then, no Congress has designated the 1002 area as wilderness.

The 1002 area is currently managed as a Minimal Management Area in the National Wildlife Refuge System. As such, Service activities are directed at maintaining the existing conditions of areas that have high fish and wildlife values or other resource values. Opportunities for public use and access are available for subsistence purposes and for a variety of recreational activities, including hunting, fishing, trapping, backpacking, and camping. Traditional motorized access via aircraft and motorboats is allowed. The Service focuses its efforts in the 1002 area primarily on conducting studies and survey/inventory programs.

Section 1003 stipulates that production of oil and gas from the Arctic Refuge is prohibited and no leasing or other development leading to production of oil and gas shall be undertaken until authorized by an Act of Congress.

In an assessment completed and sent to Congress in 1987, the Secretary recommended that Congress consider leasing the 1002 area for oil and gas. In 1988, the Arctic Refuge's initial Comprehensive Conservation Plan (CCP) recognized the coastal plain as a critical calving area for the Porcupine caribou herd, which is an important subsistence resource for Alaska Native people. In 2009, the U.S. Geological Survey determined in its most recent economic analysis the area had a mean estimate of 10.35 billion barrels of recoverable oil, with 80 to 90 percent of that volume being economically recoverable at $42 per barrel.

Since the 1987 assessment was completed, the Service has continued to inventory, monitor, and assess the fish and wildlife resources within the 1002 area so that current data is available to inform future activity.

Last spring, Secretary Zinke visited the North Slope with Chairman Murkowski and a bipartisan Senate delegation. After seeing it first hand, he signed a secretarial order in Anchorage that requires the USGS to update its resource assessments for the 1002 area. The plan includes consideration of new geological and geophysical data, as well as potential for reprocessing existing geological and geophysical data. The secretarial order does not reduce, eliminate, or modify any environmental or regulatory requirements for energy development. This evaluation is consistent with the intent of ANILCA and will improve the Department's understanding of the 1002 area.

Administration Support

The Administration's Fiscal Year 2018 budget proposes oil and gas leasing in the 1002 area. If production is authorized by Congress, the Administration believes this will bolster our nation's energy independence and national security, provide economic opportunity for Alaskans and

provide much-needed revenue to both the State of Alaska and Federal government. With passage of the budget reconciliation provisions in H. Con. Res. 71, and its revenue-raising instructions to your Committee, the Department stands ready to assist Congress as it considers legislation, consistent with ANILCA, to authorize the potential development of the resources contained in this area.

Chairman Murkowski, I appreciate the opportunity to testify on behalf of the Department on this issue and look forward to answering any questions you might have. Thank you.

The CHAIRMAN. Thank you, Mr. Sheehan, for being here on behalf of the Department.

Mr. Alexander, welcome to the Committee.

STATEMENT OF SAM ALEXANDER, TRIBAL MEMBER, GWICHYAA ZHEE GWICH'IN TRIBAL GOVERNMENT

Mr. ALEXANDER. Vanh gwinzii, Shoozhri' Sam Alexander oozhii, Gwichyaa Zhee gwats'an ihłįį, gaa Tanan gwihch'ii. Shiyeghan naįį Clarence ts'a' Ginny Alexander gaavoozhri', Gwichyaa Zhee gwats'an ginlįį.

Good morning, my name is Sam Alexander. I am from Fort Yukon, Alaska, but I live in Fairbanks. My parents are Clarence and Ginny Alexander from Fort Yukon.

Chairman Murkowski, Ranking Member Cantwell, and fellow members of the Committee, thank you for the opportunity to speak with you about the Arctic National Wildlife Refuge.

Today I am here to talk with you about why my people, the Gwich'in Nation, adamantly oppose the opening of the Arctic National Wildlife Refuge. As a graduate of West Point and as a prior U.S. Army Special Forces Officer, my people have asked me to speak because I have walked in two worlds: your world and the Gwich'in world.

So why do we oppose the opening of the Refuge to drilling? At the heart of the issue is freedom. The freedom for us to continue to exist as indigenous people, to exist as Gwich'in.

What does it mean to be Gwich'in? The word Gwich'in means people of a place and for tens of thousands of years our place has been the land now known as Northeastern Alaska and Western Canada. To be Gwich'in is to be connected to the land. To be Gwich'in is to believe that the land and the animals on it are owed our deepest respect. In that regard, it is our duty as Gwich'in to protect the land and animals. We as Gwich'in see the desire to open up the Refuge as an attack on us and on the Porcupine Caribou herd on which we depend.

Like many Gwich'in, I served in the U.S. military. As a Green Beret, I deployed to Iraq to "free the oppressed." Little did I realize that I'd come home to find my own people's freedom under attack.

When we advocate for our traditional ways, we are sometimes viewed with derision, as if we were trying to fight the unstoppable advance of "progress." But we take the long view and we embrace our traditional ways because they have served us well for millennia.

Even people down here have started to embrace our ways. You see it in renewed interest in diets free of processed food, what we would call our traditional diet.

Science now tells us that walking amongst the natural world is good for your brain. You don't have to tell a Gwich'in person that. In fact, when someone is looking unhealthy, we say "Nanakat gwats'i'hindii." Go to your land. We say that because we know that the land will heal you.

The land is essential to our way of life; it provides us sustenance and we view it as sacred. The caribou come from a place we call "Izhik Gwats'an Gwandaii Goodlit," the sacred place where life begins, and these very grounds are being threatened by oil develop-

ment. A study by the National Research Council outlines how drilling on the North Slope has already disrupted the migration and behavior of caribou.

This brings us to the issue of food security. What is food security? According to the United States Department of Agriculture, food security means access by all people at all times to enough food for an active, healthy life. Food insecurity is defined as a household-level economic and social condition of limited or uncertain access to adequate food. What is adequate food? For Gwich'in, the only real adequate food is food that comes from the land—caribou, moose, salmon. We have a hard time eating your "health food." As a cadet at West Point, I tried following a "healthy diet" full of fruits and vegetables and it was disastrous. I found out years later that I couldn't eat tomatoes, apples, and a whole host of other "healthy foods." Over the thousands of years of calling the Arctic home, we had adapted to a largely animal-based diet. It wasn't until I started eating more traditional Gwich'in food did I start to feel healthy again.

The opening of the Refuge to oil development and subsequent decline of the Porcupine Caribou herd will limit our access to traditional, healthy food and push us from food security into the realm of food insecurity. No amount of money can replicate our healthy traditional diet. No amount of money can replicate our ways. Tell me how replacing caribou with highly processed foods is going to be better for us. It will not. If we had to rely on our stores for food, we'd be looking at a steady diet of SPAM, macaroni and cheese and other shelf-stable delicacies, often at four or five times the price of what you find in the Lower 48.

And to what end are you opening up the Refuge? To what end will you destroy our way of life? You aren't addressing climate change, which has been stressing our other food sources as well as stressing the caribou. You aren't addressing our nation's growing deficit; in fact, opening the Refuge represents a drop in the bucket of our budget ills. You aren't even addressing energy security. As a former Special Forces Officer, I fail to see how opening the Refuge at a time when we are already a net exporter of energy provides us any geopolitical advantage. We are hard-pressed to understand your reasoning behind opening the Refuge.

So I will leave you this. The late Traditional Chief Moses Sam of Arctic Village once said when describing his upbringing on the land, "I was never hungry, it was a rich life." We Gwich'in live a rich life. We live a rich life because of our connection to the land and to the Porcupine Caribou herd.

Money can't buy our wealth, but the reckless pursuit of money can take it away. And for that, we will never stop fighting to protect the Porcupine Caribou herd and our way of life.

Thank you for your time.

Mahsì' choo.

[The prepared statement of Mr. Alexander follows:]

Testimony before the Senate Energy and Natural Resources Committee, 11/2/17
Prepared by Sam Alexander on behalf of the Gwich'in Nation

Vanh gwinzii, Shoozhri' Sam Alexander oozhii, Gwichyaa Zhee gwats'an ihłįį, gaa Tanan gwihch'ii. Shiyeghan naįį Clarence ts'a' Ginny Alexander gaavoozhri', Gwichyaa Zhee gwats'an ginlįį.

Good morning, my name is Sam Alexander, I am from Fort Yukon, Alaska, but I live in Fairbanks, Alaska. My parents are Clarence and Ginny Alexander from Fort Yukon.

Today I am here to talk with you about why my people, the Gwich'in Nation, adamantly oppose the opening of the Arctic National Wildlife refuge. As a graduate of West Point and as a prior US Army Special Forces Officer, my people have asked me to speak because I have walked in two worlds: Your world, and the Gwich'in world.

So, who are we? The Gwich'in are the northernmost Indian Nation, living in fifteen small villages scattered across an area extending from northeast Alaska in the United States into the northern Yukon and Northwest Territories in Canada. These communities include Arctic Village, Venetie, Fort Yukon, Beaver, Chalkyitsik, Birch Creek, Stevens Village, Circle, and Eagle Village in Alaska, and Old Crow, Fort McPherson, Tsiigehtchic, Aklavik, and Inuvik in Canada. The home of the Gwich'in People follows the migratory route of the Porcupine Caribou Herd, which sustains our way of life.[1]

The Gwich'in are the caribou people. The Gwich'in have lived in this area and relied on the Porcupine Caribou Herd since time immemorial. Caribou are how we survive and are integral to who we are and how we define ourselves. Caribou are our stories, our soul, the food on our table, our clothes, and our tools.

In 1988 our elders called together the chiefs of all the Gwich'in villages in Alaska and Canada for a traditional gathering because of their concern about proposals to drill for oil in the Coastal Plain of the Refuge. The Gwich'in are so connected to the health of the Porcupine Caribou Herd that it caused our entire nation to come together for the first time in decades. Our elders recognized that oil development in the Porcupine Caribou Herd's calving grounds was a threat to our people. At that gathering, we unanimously decided to speak with one voice against oil and gas development in the birthing and nursing grounds of the Porcupine Caribou Herd. Our unified voice is expressed in a formal resolution, Gwich'in Niintsyaa.[2] This resolution calls on the United States to recognize the rights of the Gwich'in People to

[1] Gwich'in Steering Committee (2012). Primary Habitat of the Porcupine Caribou Herd. http://ourarcticrefuge.org/wp-content/uploads/2012/10/mappch.pdf.
[2] Gwich'in Steering Committee(1988). Gwich'in Niintsyaa Resolution. http://www.gwichinsteeringcommittee.org/gwichinniintsyaa.html.

continue their way of life and to permanently protect the Coastal Plain of the Refuge as Wilderness. The villages of the Gwich'in Nation unite every two years to reaffirm that resolution. The 1988 gathering also led to the formation of the Gwich'in Steering Committee, which works on behalf of the Gwich'in Nation to permanently protect the calving and nursing grounds of the Porcupine Caribou Herd from development.

So, why do we oppose the opening of the Refuge to drilling?

At the heart of the issue is freedom. The freedom for us to continue to exist as an indigenous people. To exist as Gwich'in.

What does it mean to be Gwich'in? The word *Gwich'in* means people of a place. And for tens of thousands of years our place has been the land now known as North Eastern Alaska and Western Canada. To be Gwich'in is to be connected to the land. To be Gwich'in is to believe that the land and the animals on it are owed our deepest respect. In that regard, it is our duty as Gwich'in to protect the land and the animals. We as Gwich'in see the desire to open up the Refuge as an attack on us, and on the Porcupine Caribou herd on which we depend.

Like many Gwich'in, I served in the US Military. As a Green Beret I deployed to Iraq to "free the oppressed." Little did I realize that I would come home to find my own people's freedom under attack. When we advocate for our traditional ways, we are sometimes viewed with derision, as if we were trying to fight the unstoppable advance of "progress." But we take the long view and we embrace our traditional ways because they have served us well for millennia.

Even people down here have started to embrace our ways. You see it in renewed interest in diets free of processed food, what we would call our traditional diet. Science now tells us that walking amongst the natural world is good for your brain.[3] You don't have to tell a Gwich'in person that. In fact, when someone is looking unhealthy, we say *Nanakat gwats'i'hindii*...Go out to your land. We say that because we know that the land will heal you. The land is essential to our way of life; it provides us sustenance, and we view it as sacred. The Caribou come from a place we call *Izhik Gwats'an Gwandaii Goodlit*, the sacred place where life begins. And these very grounds are being threatened by oil development. A study by the National Research Council outlines how drilling on the North Slope has disrupted the migration and behavior of Caribou.[4]

This brings us to the issue of food security. What is food security? According to the United States Department of Agriculture, food security means access by all people at

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[3] Reynolds, Gretchen (2015). How Walking in Nature Changes the Brain. New York Times. July 22, 2015.
[4] Committee on Cumulative Environmental Effects of Oil and Gas Activities on Alaska's North Slope, Board on Environmental Studies and Toxicology, Polar Research Board, Division on Earth and Life Studies, National Research Council of the National Academies. (2003). Cumulative environmental effects of oil and gas activities on Alaska's North Slope. Washington, D.C. :National Academies Press.

all times to enough food for an active, healthy life. Food insecurity is defined as a household-level economic and social condition of limited or uncertain access to adequate food.

What is adequate food? For Gwich'in, the only real adequate food is food that comes from the land— caribou, moose, salmon. We have a hard time eating your "health food." As a cadet at West Point, I tried following a "healthy diet" full of fruits and vegetables and it was disastrous. I found out years later that I couldn't eat tomatoes, apples, and a whole host of other "healthy foods." Over the thousands of years of calling the Arctic home, we had adapted to a largely animal-based diet. [5] It wasn't until I started eating more traditional Gwich'in food did I start to feel healthy again.

The opening of the Refuge to oil development and subsequent decline of the Porcupine Caribou herd will limit our access to healthy traditional food and push us from food security into the realm of food insecurity. No amount of money can replicate our healthy traditional diet. Tell me how replacing Caribou with highly processed foods is going to be better for us. It will not. If we had to rely on our stores for food, we'd be looking at a steady diet of SPAM, macaroni and cheese, and other shelf-stable delicacies, often at 4 or 5 times the price of what you find in the Lower 48.

And to what end are you opening up the Refuge? To what end will you destroy our way of life? You aren't addressing climate change, which has been stressing our other food sources as well as stressing the caribou. You aren't addressing our nation's growing deficit; in fact, opening the Refuge represents a drop in the bucket of our budget ills. You aren't even addressing energy security; As a former Special Forces Officer I fail to see how opening the Refuge at a time when we are already a net exporter of energy provides us any geopolitical advantage. We are hard pressed to understand your reasoning behind opening the Refuge.

So, I will leave you this. The late Traditional Chief Moses Sam of Arctic Village once said when describing his upbringing on the land, "I was never hungry, it was ... a rich life." We Gwich'in live a rich life. We live a rich life because of our connection to the land and to the Porcupine Caribou Herd. Money can't buy our wealth, but the reckless pursuit of money can take it away. And for that, we will never stop fighting to protect the Porcupine Caribou Herd and our way of life. Thank you for your time, Mahsi' choo.

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[5] Fumagalli et al (2015). Greenlandic Inuit show genetic signatures of diet and climate adaptation. Science. 349(6254):1343-7. doi: 10.1126/science.aab2319.

The CHAIRMAN. Mahsì' choo. Thank you, Mr. Alexander.
Mr. Rexford, welcome to the Committee.

STATEMENT OF MATTHEW REXFORD, TRIBAL ADMINISTRATOR, NATIVE VILLAGE OF KAKTOVIK, ALASKA

Mr. REXFORD. Chairman Murkowski, Ranking Member Cantwell, members of the Committee, thank you for the invitation to speak to you today.

My name is Matthew Rexford, and I serve as the Tribal Administrator for the Native Village of Kaktovik (NVK). I am also the President of the Kaktovik Iñupiat Corporation (KIC). Both NVK and KIC serve as members of the Voice of the Arctic Iñupiat (VOICE) along with 18 other North Slope communities and entities.

I was raised and live in Kaktovik, Alaska, located inside the 1002 Area of ANWR. All of the organizations I previously mentioned—NVK, KIC, and VOICE—support oil and gas development there.

Approximately 92,000 acres of surface lands in and around the community are owned by the Kaktovik Iñupiat Corporation, our Village Corporation. These lands are within and are then surrounded by ANWR. We are an island in the middle of the largest wildlife refuge in America.

Much of that land is also the ancestral home of the Iñupiat. Our people are the indigenous inhabitants of the region and have used the resources it has blessed us with for more than 10,000 years. While many refer to the controversial section of ANWR as the 1002 Area, this is the home of the Kaktovikmuit, the people of Kaktovik.

The bowhead whale, caribou, Dall sheep, musk oxen and the fish of the region are a vital food source to the Kaktovikmuit. Another of those natural resources is oil and gas and lots of it. We rely on the bounty of the land and find sustenance within ANWR.

Since the mid–1980s, our people have fought unsuccessfully to open our homelands to responsible exploration and development. At the same time, Lower 48 lawmakers and special interest groups in the country have waged war on the idea, citing the disruption of wildlife and the pristine Arctic environment.

The Kaktovikmuit and the Arctic Iñupiat will not become conservation refugees. We do not approve of efforts to turn our homeland into one giant national park, which literally guarantees us a fate with no economy, no jobs, reduced subsistence and no hope for the future of our people. We are already being impacted by restrictions of access to the federal lands for subsistence purposes.

As ANWR debates occur, the views of the Kaktovikmuit are often left out. In fact, that is precisely why the leadership of the Arctic Slope region created VOICE in 2015. We were tired of outsiders living thousands of miles away, speaking on our behalf and driving Arctic policy decisions that directly affect us and our communities.

My fellow Iñupiat and I firmly believe in a social license to operate, and perhaps no other potential project in the history of America has called for such a blessing from local indigenous peoples more than this one. We Iñupiat have the benefit of decades of experience working with the oil and gas industry to implement stringent regulations to protect the lands through best management

practices and the industry consistently has lived up to our standards. We know development in ANWR can be done safely because it's already being done safely, all over the Arctic. We think that now is the time to open ANWR to measured exploration and development for the benefit of our community, all of Alaska, and the nation.

Thank you.

[The prepared statement of Mr. Rexford follows:]

Testimony of Matthew Rexford
Tribal Administrator, Native Village of Kaktovik
November 2, 2017

Before the
Committee on Energy and Natural Resources
United States Senate

Chairman Murkowski, Members of the Committee, thank you for the invitation to speak to you today.

My name is Matthew Rexford and I serve as Tribal Administrator for the Native Village of Kaktovik (NVK), I am also President of Kaktovik Iñupiat Corporation (KIC). Both NVK and KIC serve as members of the Voice of the Arctic Iñupiat (VOICE) along with 18 other North Slope entities.

I was raised and live in Kaktovik, Alaska, located inside the 1002 area of ANWR. All of the organizations I previously mentioned – NVK, KIC and VOICE – support oil and gas development there.

Kaktovik is located 280 miles southeast of Utqiaġvik (formerly Barrow) and 90 miles west of the Canadian border. Our village borders the Beaufort Sea and is situated on the coast of the Arctic National Wildlife Refuge (ANWR).

Approximately 92,000 acres of surface lands in and around the community are owned by the Kaktovik Iñupiat Corporation - our Village Corporation, established pursuant to the Alaska Native Claims Settlement Act of 1971. These lands are within and are then surrounded by ANWR – so we are an island in the middle of the largest wildlife refuge in America. Spanning more than 19 million acres, ANWR's lands cover an area larger than 10 U.S. states.

This vast expanse is home to caribou, fox, bears and other species. **Much of that land is also home to the Iñupiat, and our people have used the resources it has blessed us with for more than 10,000 years.** One of those natural resources lies beneath this great land — oil and gas, and lots of it.

The residents of Kaktovik and their ancestors are the indigenous inhabitants of the region. They rely on the bounty of the land and find sustenance within ANWR. The bowhead whale, caribou, Dall sheep, muskoxen and the fish of the region are a vital food source to the Kaktovikmiut.

The debate over opening ANWR to drilling gained national attention in 1980, when the Congress set aside less than 8 percent of the refuge for potential oil and gas development. This section of ANWR became known as the 1002 area, after Section 1002 of the Alaska National Interest Lands Conservation Act. This is the home of the Kaktovikmiut.

Since then, we have fought unsuccessfully to open the 1002 area to drilling, which literally requires an act of Congress. At the same time, some Lower 48 lawmakers and special interest groups across the country have waged war on the idea, citing the disruption of wildlife and the pristine Arctic environment.

The Arctic Iñupiat will not become conservation refugees. We do not approve of efforts to turn our homeland into one giant national park, which literally guarantees us a fate with no economy, no jobs, reduced subsistence and no hope for the future of our people. We are already being impacted by restrictions of access to the federal lands for subsistence purposes – this is really disturbing to us since we have lived here long before there ever was a refuge designated.

As ANWR debates occur, the views of the Iñupiat who call the area home are oftentimes left out. The wishes of the people who live in and around the refuge's coastal plain frequently are drowned out. In fact, that was why VOICE was established in 2015 because our people were tired of others – **outsiders who live thousands of miles away – speaking on our behalf** and driving Arctic policy decisions that directly affect us and our communities. **ANWR is a perfect example.**

My fellow Iñupiat and I firmly believe in a social license to operate, and perhaps no other potential project in the history of America has called for

such a blessing from local indigenous peoples more than this one. Attempts to permanently block development in the 1002 – an area intentionally **NOT** designated as wilderness because of its oil and gas potential – **is a slap in the face to our region and its people. It's exactly the same as saying "it's okay for everyone else in this country to have a THRIVING economy, but you can't have one at all.**

Have you ever heard of Prudhoe Bay? When oil was first discovered on our land in 1969, the Iñupiat were worried of industry activities and fought hard for self-determination to protect our subsistence resources. So we fully understand the trepidation from outsiders: the fear that the presence of industry on the coastal plain of ANWR could disrupt wildlife and **affect America's manufactured perspective of our land and culture**.

We Iñupiat have the benefit of decades of experience working with the oil and gas industry to implement stringent regulations to protect our lands through best management practices and the industry consistently has lived up to our standards. We know development in ANWR can be done safely, because it's already being done safely all over the Arctic. Sixty miles away is the largest oil field on the continent, and the wildlife, including caribou, have successfully cohabitated with industry for forty years.

The oil and gas industry supports our communities by providing jobs, business opportunities and infrastructure investments, has built our schools, hospitals, **and has moved our people away from third-world living conditions – we refuse to go backward in time**. It has provided other basic services most Americans may take for granted. Our region recognizes its importance to our local and state economy, and we believe that development can be done responsibly in a portion of the 1002 area. We are not alone.

As Iñupiat, we stand to be unarguably the most affected by oil and gas activity in the Arctic. Therefore, we have the greatest stake in seeing that any and all development keeps our land and subsistence resources safe. We know it can be done, because it's being done.

We think that now is the time to open ANWR to **MEASURED** exploration and development for the benefit of our community and all of Alaska.

THANK YOU.

The CHAIRMAN. Mr. Rexford, thank you, and thank you to each of you on the panel here this morning.

We will now begin with a round of questions, five minutes to each member here.

Mr. Rexford, I want to begin with you, if I may, and I do so because I believe that you are right in your statement that so often the voice of the people who actually live within the 1002 Area, the area that we are speaking about today, are often either not heard or just overwhelmed by outside voices.

I think people are often surprised when they realize that there is a village within the 1002 Area, that there are people who live there, that the community of Kaktovik, you fly into and there is an airstrip there, that you have a school for your children. You have a community hall. You have a store where, I think, most who go in are shocked and horrified by the prices. But you live and work and raise your families within the 1002 Area.

I think oftentimes I go back to the map that I showed initially. This is an area the size of, ANWR is an area the size of the State of South Carolina. The 1002 Area is an area the size of Delaware. But there is one village in Delaware and that village of Kaktovik is home to you and your family and to others.

Can you provide for the Committee a little bit of the expectation that the people of Kaktovik might have from the development of the 1002 Area? Again, we are talking about a small, small piece. You have seen development at Point Thomson, which is just 45 miles from the village of Kaktovik. If you could put it in context, I would appreciate it.

Mr. REXFORD. Thank you, Chairman Murkowski.

Yes, the benefits to the community of Kaktovik will be a lot because the North Slope Borough has a tax base and that is our regional municipal borough who taxes industry and that provides the infrastructure that has provided so much to our communities. It provided us roads, houses, schools, clinics, and to be able to flush our toilets.

And so, yes, the benefits, we've seen the benefits and we do not want to go backward. We do not want to hinder the economy of the North Slope Borough.

The CHAIRMAN. Thank you, Matthew.

I remind people that your kids, what you are hoping for for your children is no different than mine or anybody else. You want them to be well educated. You want them to have a good future.

Lieutenant Governor, I would like to ask you a question. You have spoken very passionately here, as you have in other forums, about subsistence and the identity that it is to our Alaska Native people throughout our state, whether you are up north in the 1002 Area or down in Yakutat in your home community. Many will say that a subsistence lifestyle and an opportunity to access the 1002 Area are not consistent, that there is an inconsistency here, that it cannot be done. Why do you believe that ANWR development within the 1002 Area can occur without negatively impacting the Porcupine Caribou herd or the Native subsistence way of life?

Mr. MALLOTT. In the some 40 years of development of the Arctic for oil and gas production, the resources have been most stable and have grown and waned as their biological cycles determine, particu-

larly the caribou resource has grown. It has moved, generally, as it always has in that region.

The impact of development has been carefully managed and constrained. The management by Alaska of both the petroleum resource and the renewable natural resources, particularly fish and game, has been, as Senator Sullivan, a former Commissioner of Natural Resources of our state and Attorney General of our state has emphasized, has been of the highest order. The priority for subsistence use of our fish and game resources is the highest statutory priority in our state.

As I indicated, it is something that I personally have fought for my entire life. And whether it is the Gwich'in, the Inuit, the Tlingit, or any other rural user group of our natural resources, the State of Alaska has that management and that responsibility as its highest priority and we will continue to fight for it.

The CHAIRMAN. Thank you.

Senator Cantwell.

Senator CANTWELL. Mr. Alexander, thank you for your service to our country and thank you for articulating what I think so many people know, or a lot of people know intuitively, that our great outdoors provide great relief. It is one of the reasons why our veterans have been so outspoken against this Administration's wrongheaded policies, whether it is tacking on park fees or trying to run over the Antiquities Act, whatever it is. I so appreciate our veterans being so supportive of making sure we have a place to fish and hunt and recreate. So thank you for that.

I just would point out for the record, I think there have been something like 640 oil spills in Alaska's North Slope since 1995, including 13 spills of over 10,000 gallons. Since 2009, thousands of gallons of oil have spilled in the North Slope as a result of those operations, including, in 2000 when British Petroleum was ordered to pay $22 million in civil and criminal penalties because they had illegally disposed of hazardous waste containing benzene and other toxic chemicals. And in 2011, BP Exploration Alaska was ordered to pay $25 million in civil penalties for spilling an estimated 213,000 gallons of crude oil from its pipelines onto the North Slope.

So we know what happens. We know what happens. The notion that people think that this is commensurate is, I think, not supported by the science, but we will find out what the Secretary says.

On the Gwich'in and the caribou population, you talked about the migration impacts and I know that we have seen some changes in that caribou population. What is the biggest concern here in the development? That the migration will move out of the reach of subsistence for the Gwich'in people, or could you explain what it is that we are so concerned about?

Mr. ALEXANDER. You know, it's interesting when you're down here in the states and you want to go get some food, you go to the store and you grab you some beef and it costs you maybe $4.00 a pound or something like that. You want to get something organic, nice and tasty and healthy for you, it's going to cost you about $10, $15 a pound.

As Gwich'in we recognize that we already have that tasty organic caribou running around up there. It plays a big part of our diet. And so, what we're concerned with is that, you know, we call this

place, "lizhik Gwats'an Gwandaii Goodlit," a sacred place where life begins. This is where the Porcupine Caribou herd calve. This is it, folks. This is the only spot that they have their calving. And we're concerned that you have any type of disruption in that calving ground, it's not that they're going to move elsewhere, it's that they're not going to exist.

If you take a look at the boundaries of the Gwich'in Nation it follows the path of the caribou. So when people talk about, you know, us being not in the 1002 Area, that's, you know, true, in one sense, but in the other sense, we speak for the caribou. That's why we're here. We're their voice.

And they live in that 1002 Area. That's where their babies are born, alright? That's where their children come from. And it's our responsibility to ensure that they have a safe place to do that, to calve. And it's our responsibility to future generations of Gwich'in people to ensure that we maintain our livelihood which is tied to the caribou. So very important for us.

Senator CANTWELL. And have we seen changes in that population closer to the area to where drilling has happened?

Mr. ALEXANDER. You know, people always bring the Central herd and they talk about how the numbers have grown. They said, there's more caribou there.

Well, more of something doesn't mean healthier of something, alright? Let's keep that in mind. There's Americans, we're a lot more now, aren't we? It doesn't mean we're a lot healthier. So, let's keep that in mind.

In terms of the impact, though. We do see an impact. The caribou, they are scared of the development. They run away from that stuff. They don't want to be out there.

In fact, when we go hunting, you might not know this, but caribou actually have scouts. They have scouts that go up in the front. And when the scouts come into trouble, the rest of the herd moves. Alright? So we always tell our people, you leave those scouts alone. You let them go ahead and you let the main herd go by. So the impact that it's going to have is a real impact.

And we also haven't addressed the impact of climate change and that's impacting the caribou's land as well as there's more brush than there has ever been in the past. They've had to change where they go, alright?

This climate change is real. I just left Fairbanks and there's no snow on the ground. When I was a kid, it'd be 30 below by the time it's Halloween. It was 30 degrees when I left. And that has a real impact on the caribou as well. When it ices over they have a harder time getting to their food. So I'm hoping to see that this body recognizes that.

Senator CANTWELL. Thank you, Mr. Alexander.

Thank you.

The CHAIRMAN. Thank you.

Senator Lee.

Senator LEE. Thank you very much, Madam Chair.

I want to add my support for the opening up of the Coastal Plain region of ANWR to responsible energy development. This proposal makes sense on a number of levels.

From an economic perspective, opening up this small, remote area will provide potentially billions of dollars in federal revenues alone over the next few decades which could be used to chip away at our staggering budget deficits that we are facing. And new development will be a boon, certainly, for Alaska, a state that is struggling with high unemployment and with its own budget shortfalls.

Opening up the Coastal Plain also makes sense from an environmental perspective. Energy development in the United States meets some of the most rigorous environmental standards in the entire world. This is especially true in Alaska where responsible energy production has occurred for decades without undue harm to the surrounding environment, including polar bear and caribou habitats.

Much of the credit for this environmental record of responsibility should go to recent technological innovations. For example, thanks to modern drilling methods developers can access hundreds of miles of oil, of subsurface oil, while occupying just a few acres of surface land. As companies continue to innovate, the environmental and financial cost of energy development will fall even further.

But perhaps the biggest, single reason why I support the opening of the Coastal Plain is because it is widely supported by the people of Alaska, and particularly the Iñupiat, who actually live in that part of the Refuge. I am a strong believer that local input should play an outsized role in land management issues. People living in, on, and near the land in question should have the most significant say in it. The people closest to the land deserve to have their voices heard and deserve to have their wishes respected.

Coming from the State of Utah where the Federal Government owns nearly two-thirds of the land, I fully understand the frustrations of Alaskans whose lives and whose livelihoods are subject, almost constantly, to the whims and wishes of well-connected interest groups, regulators, and politicians in Washington, DC, thousands of miles from where the people connected to the land, themselves, live.

Mr. Rexford, in your testimony you articulated these frustrations very clearly, very passionately, and eloquently. Can you talk about the importance that we should take into account, the importance of incorporating local knowledge and input in major land decisions, including decisions like the ones that we are discussing today?

Mr. REXFORD. Yes, thank you, Senator Lee.

So, we—I am sorry, can you repeat that question?

Senator LEE. Yes.

Can you just talk to us a little bit about the importance of taking into account local knowledge, input, local sentiment, the sentiment of people immediately affected by the land on making decisions like these?

Mr. REXFORD. Yes, thank you.

I would have to say that also the, what brought about the technological advances was the participation of the local government on the North Slope and their stringent rules and conditions and stipulations that they put in place to ensure that this is done right.

And living in the Arctic National Wildlife Refuge is troublesome in the sense that we have limited access to our lands, to the mountains, during the summer season. We cannot travel over the tundra without disturbing or harming the tundra because it is wetland. But throughout most of the year, it's frozen and we use snow machines to go to the areas where we need to find what we are looking for.

Senator LEE. So you experience the land differently. You have a deeper familiarity with it than say, somebody in Washington, DC, would have and that has an impact on the way you view it and on the way it should be managed?

Mr. REXFORD. Yes, very much so.

And we care deeply about the caribou, about the polar bear, about the whales, more than anything else because that is what gives us our livelihoods. We are a strong, subsistence community and much of what is caught, if we have an overabundance it's traditional knowledge to share that abundance with first the elders and those who cannot provide for themselves.

Senator LEE. Thank you.

Thank you, Madam Chair.

The CHAIRMAN. Thank you, Senator Lee.

Senator Heinrich.

Senator HEINRICH. Mr. Alexander, I want to thank you for being with us here today. I had a chance to visit the North Slope, places like Deadhorse, to see a number of the developments that have occurred there in the Prudhoe Bay area, and to visit the Refuge as well and to go to places like Arctic Village.

I was struck by the connection, the language and the cultural connections with the Navajo people in the Southwest. That really surprised me.

And in listening to everyone here today, what really struck me was the way you talked about this place and how different it was from the way my colleagues talked about this place or the way the gentlemen from the Department of the Interior talked about this place.

They talked about the 1002 Area. They talked about ANWR. ANWR, to me, sounds like a Middle Eastern country covered in sand where we should just develop lots of oil and gas. They don't talk about a Refuge.

You said this is the sacred place where life begins. Can you talk a little bit more about how your people talk about this place?

Mr. ALEXANDER. Thank you, Senator.

Our people think of this place as the heart, you know. We think of "lizhik Gwats'an Gwandaii Goodlit" as the heart of the Refuge. Okay? This is the heart of the Refuge.

And you know, it was interesting earlier our Congressman talked about how it was just a little dot on his nose. And I thought that was funny because, you know, if I were to say to you, you want to do something about that dot on your nose, let's go ahead and have open heart surgery. You'd probably think, well, that's not a good idea. Right? That's not a good idea.

And so, when we talk about the Refuge, we talk about the land. It is tied to our language and our understanding of the world. And

you know, the "vadzaih," the caribou, we are connected to them and we recognize that.

You know, we talk about, I hear this talk about development all the time. We need to develop this, we need to develop that. What I think we need is a little bit of understanding of the sustainability of the life that we live as Gwich'in, alright?

We're not asking. We're not sitting here asking for anything. We're not saying we need hospitals. We need schools. We need all these things. We're not saying give us money. What we're saying is let us live as Gwich'in because we already recognize the wealth that we have as people. And there's nothing that you can give us. But we recognize it's something that can be taken away from us. And so, when we talk about the land, when we talk about the caribou, it's in reverence to them.

And you know, I keep hearing well, the locals, let's hear what the locals have to say about the 1002 Area. You know who the locals are? They're caribou. Those are the locals that don't have a voice and that's why we're here as Gwich'in.

Senator HEINRICH. One of the things that really struck me about that geography was how the Arctic Plain, where the caribou calve, is the flat place. To the West is, frankly, an industrial zone. You can say how—you can say birds nest on every drilling rig, but it doesn't look like that when you are there.

Then to the South and to the East are mountains, and this is the place where the caribou flow like a river. And this is the spring. And if you lose the spring, you lose the whole river, don't you?

Mr. ALEXANDER. Absolutely because, you know, I think there's this idea that with development, you know, you're only going to maybe harm part of the herd or maybe they'll just move over a little bit. There's not that option for them. There's not that option.

And so, we're talking about the destruction of the herd and irreparable damage to our culture, to people that have been living there for tens of thousands of years. And when I say, tens of thousands of years, I'm not just making up numbers. There's a place called Bluefish Cave in the Yukon Territory. It's the oldest known human campsite in North America, and that's Gwich'in territory.

Senator HEINRICH. Thank you, Madam Chair.

Thank you, Senator Heinrich.

Senator Cassidy.

Senator CASSIDY. Thank you.

Thank you all for being here.

I am from Louisiana and, believe it or not, even though your average temperature in July is probably colder than my average temperature in December, there are a lot of similarities between the states.

We obviously have a lot of oil and gas development. One of the reasons that I think this is such a positive thing is that there are so many folks in our state who did not go to college, good people who make good incomes because they are able to work in the oil and gas industry and actually make a product which the rest of the world wants and which is economically beneficial for that family. It is about economic opportunity for these folks.

But I can also apply what we do in Louisiana to some of the stuff that we see here. Everybody discusses responsible oil and gas de-

velopment with a limited footprint and I can say that in the Gulf of Mexico that technology has progressed so that you can dynamically drill going from a central point far out and then tying back, therefore limiting the pad, if you will, so the subsea is tiebacks or similar to what is here.

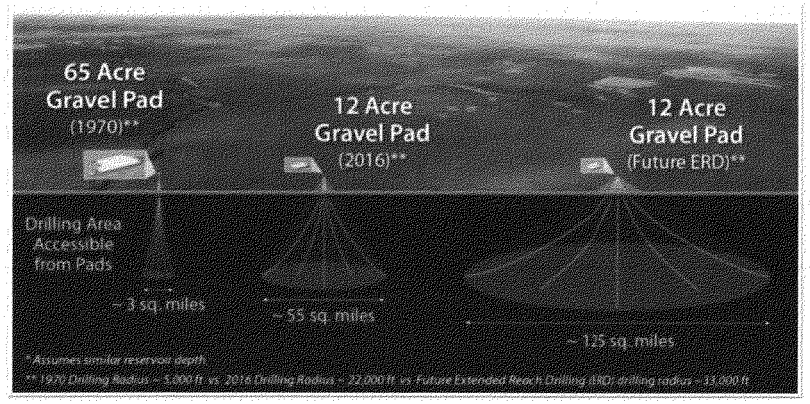
And I look at that because if you look at what Senator Sullivan gave us: it took a 65-acre gravel pad in 1970 to do three square miles of drilling; a 12-acre gravel pad in 2016 to do 55 square miles; and now, for future extended-reach drilling, it will take a 12-acre gravel pad to do 125 square miles.

[The information referred to follows:]

Responsible Resource Development

- NEW TECHNOLOGY-

Alaska North Slope Reduced Footprint *



DAN SULLIVAN
UNITED STATES SENATOR for ALASKA

That is very similar to what we are currently doing in the Gulf of Mexico where once you have the rig, you go far out and then tie back in a way which minimizes impact. So I will say that.

I understand there is currently a project in Alaska that has an extended drilling well of 35,000 feet, again, that can reach 125 square miles. So it is not just the Gulf of Mexico, it is also in Alaska.

Mr. Lieutenant Governor, we actually have empiric evidence though of everything we are discussing. Since the drilling has begun in Prudhoe Bay, not far from the 1002 Area, how has development affected the area and how have these technological advances that we have spoken of, if you will, modified that impact?

Mr. MALLOTT. The technological capacity, as you've just described, is working on the North Slope. The ability to reduce the footprint, the ability to reach out is taking place as we speak. There has been no impact on the 1002 Area simply because that is the issue before us today, to allow that potential to be tapped.

There have been comments about spills and other negative consequences of a massive, decades-long development on the North Slope producing billions of barrels of oil. And what I can say to that is that technology has, again, allowed us to be aggressively responsive, that the regulatory regime has changed, will continue to evolve and the technology has grown. Our ability to respond to difficulty has grown. The ability to maintain the habitat, literally the ecosystems, has been aggressively managed and issues responded to.

And that is, of course, part of the emphasis of our testimony today is to say that we can deal both with the need for the development, the production of the petroleum resource, to manage the future of the renewable resources——

Senator CASSIDY. Let me just mention, because I am about to run out of seconds.

Just to reiterate your point or to emphasize your point from the picture about your way to do responsible drilling—Senator Sullivan gave this out——

[The information referred to follows:]

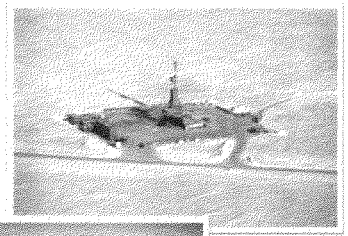
Responsible Resource Development

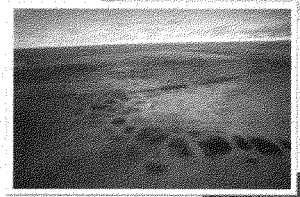
- ALASKA AS A GLOBAL LEADER -

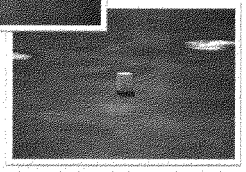
There are few if any places in the world where oil and gas development and infrastructure in the Arctic is as understood, tightly regulated and the impacts as minimal as on the North Slope of Alaska.

For example, Alaska conducts "no impact" exploration on the North Slope by using ice roads and ice pads.

Our experience, knowledge and stringent environmental standards make Alaska a global leader in responsible resource development.







Exploration in winter and spring. The 8x8 foot well house is the only thing that remains for future development.

DAN SULLIVAN

Senator CASSIDY. ——and it shows ice pads being used for this rig and when it thaws you see no roads, you see no pads because they are ice pads and ice roads and they all melt away. And the only thing left is an 8x8-foot well house that remains for future development, but nothing else is seen. So you all have done a very nice job of preserving the ecosystem without trace, except for an 8x8-foot well house.

Mr. MALLOTT. That is exactly right.

Senator CASSIDY. I am out of time. I yield back. Thank you.

The CHAIRMAN. Thank you, Senator Cassidy.

Senator Cortez Masto.

Senator CORTEZ MASTO. Thank you, Madam Chair.

Thank you, gentlemen, for the conversation today.

I would like to start with Mr. Sheehan.

Mr. Sheehan, you have an extensive background in conservation and 25 years in Utah. Nevada appreciates it. It is our neighbor to the east, and I have spent a lot of time in southern Utah, beautiful country. I know you have been there for 25 years with the Utah Division of Wildlife Resources, that is correct? And the Director at some point in time in the last five years?

Mr. SHEEHAN. I was the Director for the past five years, yes.

Senator CORTEZ MASTO. That is great.

Can I ask you this? My understanding of the 1980 law and the purpose of the Refuge states four things: to conserve fish and wildlife populations and habitats in their natural diversity; to fulfill the international treaty obligations of the United States with respect to fish and wildlife and their habitats; to provide, in a manner consistent with purposes one and two, the opportunity for continued subsistence uses by local residents; and to ensure water quality and necessary water quantity within the Refuge. Are those purposes still true today?

Mr. SHEEHAN. Excuse me, yes, absolutely. Those are still being fulfilled.

Senator CORTEZ MASTO. Okay.

Then can you explain to me how, if we are to open it up to oil and gas drilling, that is compatible with those purposes?

Mr. SHEEHAN. Well, thank you, Senator.

As part of the 1980 ANILCA law that you referenced, it certainly established criteria to manage the Refuge area by and that's still being fulfilled.

But when you talk about compatibility in the 1997 Wildlife Refuge Act, it says, "Each refuge shall be managed to fulfill the mission of the system as well as the specific purpose for which that refuge was established." And at the time that that refuge was established, sections 1002 and 1003 of ANILCA created an avenue for the discussion of exploratory work and potentially drilling down in the future, under section 1003. So at this point the Department of the Interior and the President and Secretary are committed to honoring the desires of the state, honoring the desires of the need for energy independence and still fulfilling the law of ANILCA which provided opportunity under that very law, that you mentioned, to perform these types of activities.

Senator CORTEZ MASTO. So there is no compatibility standard that you have to look at? You feel it is in the law that you have

the authority to come in and listen to the locals. This is what they want, so this is what you are going to do. Is that correct?

Mr. SHEEHAN. Certainly we strive to make every action compatible, as best we can within that area.

As has been mentioned multiple times today, that's a 19.5-million-acre area within the boundaries of the Refuge, about 1.5 million of that are in the 1002 Area. If this body of Congress elects to allow for the development of oil and gas resources in that area, we'll work to ensure compatibility of that use with other existing uses——

Senator CORTEZ MASTO. So is your position today that you, the U.S. Fish and Wildlife Service, does not have a position? You are just going to really do whatever we in Congress say you should be doing? So you are not here advocating one way or the other?

Mr. SHEEHAN. No, Senator. I'm saying that the compatibility of that Refuge will be determined, as I mentioned, with the specific purposes for which that Refuge was established.

Senator CORTEZ MASTO. Is it different than what I just identified previously?

Mr. SHEEHAN. It is those four elements you mentioned.

Senator CORTEZ MASTO. Okay.

Mr. SHEEHAN. But it's certainly also the potential exploration and development of other uses as we've heard from multiple members here today.

Senator CORTEZ MASTO. Okay, thank you.

Let me just turn to Lieutenant Governor Mallott. Thank you so much for joining us today.

We have been instructed to raise $1 billion in this Committee as part of Fiscal Year '18 budget in order to pay for $1.5 trillion in tax cuts for the wealthy. I do not see how opening the Refuge to oil and gas leasing will come close to raising that $1 billion, but I am here to understand the numbers and understand why many think it can. Can you explain that math to me or do you have an understanding of that at all?

Mr. MALLOTT. I have a general understanding. I've seen the materials. I've seen the analysis. It seems very clear that with the prospective development and the already existing analysis of the size of the reserve or reserves that very significant revenue can accrue to both the federal and the state governments.

Senator CORTEZ MASTO. Do you think it is going to be $1 billion to the Federal Government to cover that?

Mr. MALLOTT. It will. I believe it will be many multiples of that number, yes.

Senator CORTEZ MASTO. Based on the numbers that you have seen?

Mr. MALLOTT. Yes.

Senator CORTEZ MASTO. Okay. I appreciate that.

I notice my time is up. Thank you, Madam Chair.

The CHAIRMAN. Thank you, Senator.

Senator Barrasso.

Senator BARRASSO. Thank you very much, Madam Chairman.

Lieutenant Governor, it is a pleasure to see you. When Governor Walker testified a little earlier, he mentioned a bipartisan group of us who have been to Bethel and then to Oscarville. I had a chance

to do that. And then I was with Senator Murkowski again this spring and had an opportunity to visit Pump Station 1 of the Trans-Alaska Pipeline System in Deadhorse. It is my understanding that the throughput on the pipeline peaked in the late '80s, which is what the Governor had talked about, and since then it has declined to about 25 percent of the pipeline capacity.

Could you explain the importance of the pipeline to Alaska's economy and why it is so important to maximize the throughput on that pipeline?

Mr. MALLOTT. The pipeline is at 25 percent of its capacity. The need to continue to utilize it and its full capacity is clear when we look at the national security interests of our nation, when we look at the revenue needs of our state, when we look at the revenue needs of our nation and the impact on the economy of our state, the impact on the economy of our nation, are each very clear.

The opportunity to allow our nation and our state to have revenue, not just to meet the full range of existing budgetary needs, but to be responsive to a changing climate, particularly in our state, is very real and must be addressed and if not by our nation, then by our state, which we are fully prepared to do. But it requires resources, fiscal resources, in order to do so.

I want to emphasize once again, that our national security interest is critical, that we, in Alaska, sometimes feel fairly vulnerable. We are in a geopolitical area where modest capacity of destructive force that we can be a target.

We know that a changing Arctic is changing the security interests of each of the nations involved. Those are open questions as we speak. And the need for our nation and our state to have security is very significant.

We also support and believe that with that kind of national security interest being responded to, that the full range of interest that allow us to live reasonable, responsible, good lives, create a society for our state, are significantly tied in with the pipeline and its ability to deliver petroleum to our nation and to our world.

Senator BARRASSO. I agree. That is essentially the same assessment that I had, having been to the locations and obviously being from an energy state in Wyoming, the similar concerns and similar needs that we have for a nation, in terms of energy security, energy independence, and now as President Trump says, energy dominance, in terms of the geopolitical threats that we face from around the world, as you so appropriately stated.

I have one other follow-up question. Given the close proximity of the Coastal Plain area to the Trans-Alaska Pipeline System and other development in Prudhoe Bay, do you believe that there are some opportunities to conduct some coordinated mitigation projects that could, in fact, actually improve existing wildlife habitat?

Mr. MALLOTT. I believe so, yes.

Senator BARRASSO. Okay.

Mr. MALLOTT. The North Slope Borough has a very robust resource management program. The State of Alaska and our Fish and Wildlife Management and our Natural Resource Department and our Department of Environmental Conservation will work as hard as we can in order to both maintain and, where opportunities

present, to grow the full range of fish and wildlife and other natural resources on those lands.

Senator BARRASSO. Yes.

Mr. Sheehan, do you have anything that you might want to add to that in terms of opportunities to conduct some of these mitigation projects and, in fact, improve existing wildlife habitat?

Mr. SHEEHAN. Well, thank you, Senator.

Certainly, I think there's work that is going on throughout those areas now for mitigation, but there's also a lot of research going on up there.

Our U.S. Geological Survey is doing work and we're trying to learn, not just simply about how to mitigate, but how to use best practices to avoid conflicts, to avoid challenges that could exist from the introduction of oil and gas so that if we do have this type of work done down the road, that it's done responsibly and as best it can be with the wildlife resources.

Senator BARRASSO. Thank you.

Thank you very much, Madam Chairman.

The CHAIRMAN. Thank you, Senator Barrasso.

Senator King.

Senator KING. Thank you, Madam Chair.

I have a series of somewhat technical questions that I think are important in evaluating this. I do not see any witnesses that can strictly address them. I am afraid, Mr. Sheehan, you are the nearest I have so you are going to get the questions.

Mr. SHEEHAN. Okay, I'll give it a try.

Senator KING. Hopefully, eventually, we will be able to get this.

The first question is, as I understand this proposed legislation which we have not seen yet, that the House bill talks about a 2,000-acre limitation and I have heard that mentioned. Senator Sullivan has mentioned that. Is that a contiguous 2,000 acres within this 1.5 million acres or is that 12 acres here and 10 acres over there? Do you know what that 2,000 acres means?

Mr. SHEEHAN. Thank you, Senator.

I'm going to have to defer that question because I've not seen any language so I can't respond to that. I don't know——

Senator KING. Well, I think that is an important question because it was presented to me as the size of Dulles airport, which is fine if it's just one place, but I think what it means is it is scattered all over the place and if you add it all together it is 2,000 acres.

Second question. Do you know how many wells are contemplated in this development?

Mr. SHEEHAN. Again, I think that depends on what's passed by the body of this Congress if, in fact, an action is passed because that could stipulate which area of this could be developed, potentially all of it, potentially some part of it.

So I think until we have a better sense of that I can't really respond to how many wells might be——

Senator KING. Again, if we are being told that there are ten billion barrels here, then we have to do—if that is what people are representing is what we are after, it seems to me we have to do some calculations about what that implies.

My back-of-the-envelope, and it is always dangerous to turn me loose with a calculator, is we are talking several thousand wells to produce ten billion barrels over ten years. Again, I think it is an important question to assess the impact. Are we talking ten wells, a hundred wells, or a thousand wells?

Third question. Any idea how this oil is going to get out from all these wells? How does it get anywhere?

Mr. SHEEHAN. Well, again, I suspect that the most likely method of moving that would be via pipelines, but that's how most of that oil is moved now——

Senator KING. We are not only talking about these 12 acre pads, but now we are talking about pipelines and, presumably, roads to get to these various places.

Any ideas on the cost of extraction in this region? What we are talking about is whether this is $50 barrel oil or $40 or $60?

Mr. SHEEHAN. Well, the analysis done by the U.S. Geological Survey said it's economically recoverable at $42 a barrel. And when they define economically recoverable they say that there would be a 12 percent profitability factor, if you will, or 12 percent margin on that. So that's the price point that was done in analysis in 2009. And certainly, oil prices, a little higher than that today, but it's hard to say what they could be in many years.

Senator KING. Well, I understand that you are a resource guy and you are from the Department of the Interior, not an oil and gas guy, but it does bother me that you are representing the Administration today telling us that this is an okay deal without knowing the answers to my questions.

I do not see how you can say this looks fine unless you know how many wells, how many miles of pipeline, or where they will be located. I mean, we are being asked to make an assessment here of essentially economic benefit versus environmental risk, but I do not see how you can make that evaluation without knowing the answers to those questions that I have raised.

Mr. SHEEHAN. Well, thank you again, Senator.

You know, without having a full set of legislation, knowing what that direction is to us, it would be hard for myself or even an oil and gas expert to answer all of those questions, but what I will say is that, you know, there are difficult choices to make here——

Senator KING. I agree with that, but I want to know what choices I am making. I don't want to make choices where I don't understand what the impacts are going to be. That is all I am suggesting.

Mr. SHEEHAN. Well, and what I would say today is that we support responsible development in whatever form or fashion that that best occurs in and we know more about what that footprint of that area looks like and what technologies are best available, if and when this effort takes place, which could be many years from now before drilling took place. I expect that there will be evolving technologies between now and then just as we've seen many in the last eight or nine years.

Senator KING. Thank you.

Madam Chair, I hope that if we are talking about marking up legislation, that we will have the materials and the data necessary to answer the questions that I have raised.

I do not see how we can possibly make this decision without answering the fundamental question of how many wells are we talking about? How many miles of pipeline? We just cannot make that trade-off without having that data. I respectfully request that we have an opportunity to explore that data before we are asked to mark up a bill.

The CHAIRMAN. Senator King, I do hope that you are going to be able to stick around for the second panel because I think that we will have an opportunity to get into some more of the specifics, but again, recognizing——

Senator KING. Yes.

The CHAIRMAN. ——recognizing that in terms of what may actually be produced, again, depends on a lot of variables that we are going to make assumptions on, but again, I think you will get more of the specifics with some of the folks that we——

Senator KING. I hope so. I looked down the list and did not see anyone that I thought would be responsive to those particular questions.

Senator CANTWELL. I think, Madam Chair, too, my colleagues and I feel very strongly that we want to see something and understand it before we vote on it. So it is hard to believe that that would take place by next Wednesday.

The CHAIRMAN. We are certainly not going to be voting on anything that we do not have in front of us. This is an opportunity for us to——

Senator CANTWELL. And to understand the impact on the Interior Department. That is the issue. My colleague is saying he wants to understand from experts what that impact is.

The CHAIRMAN. Today's hearing is an opportunity for us to hear about the 1002 Area, something that this Committee has not had an opportunity to do in about seven years now.

Let's go to Senator Daines.

Senator DAINES. Thank you, Madam Chair, Ranking Member Cantwell.

I know it is a long flight from Alaska to Washington, DC. Thank you for making that journey.

I must tell you as a Montanan, somebody who respects the voice of the states and the voice of the people who live in those states, I am struck, deeply struck, by the fact we have had both U.S. Senators from the State of Alaska, their lone Congressman, the Governor, the Lieutenant Governor, 90 percent of the Alaska legislature and 70 percent of Alaskans when polled on this issue support moving forward, as we are proposing to do with drilling in the 1002.

I just think it is a bit arrogant for Washington, DC, folks who are long ways away from Alaska to be in some way dictating the future of what Alaskans want to do and being contrary, some here in this body, and your voice should count in this city. And to this Senator, it does. Thank you for making the journey.

In my home state, like Alaskans and those from Colorado, we have a blend of protecting the environment as well as responsibly developing our natural resources. This is a Senator who spent August backpacking 70 miles in the wilderness with my wife, over two

weekends. A credit to my wife for carrying all that weight too. She is tough.

But I cherish those kind of outdoor experiences. I cherish the ability to fly fish, to hunt, to backpack, to climb mountains. This is in no way an either/or kind of proposition. This is truly a both/and situation.

I saw that same blend, that passion for the outdoors, for the incredible landscapes in Alaska when I had the opportunity to see the North Slope in May, in fact, with the Chairman of this Committee. And I am just struck. Alaska is an amazing place, truly beautiful. But I know the frustrations of Alaskans that say, we want to be able to define our future and not have Washington, DC, do it for us.

Mr. Sheehan, as I stated earlier, protecting the environment is a value that both Montanans and Alaskans share. As an outdoorsman, I am particularly interested in caribou. I have never hunted caribou, but it would be on my bucket list. As the agency that manages our wildlife, the agency that manages our wildlife, Mr. Sheehan, do you believe that production in the 1002 Area can have minimal impact on the local caribou herds?

Mr. SHEEHAN. Thank you, Senator Daines.

You know, I guess I'd harken back to my time, was brought up by the good Senator from Nevada, about serving as the State Director in Utah where we, too, there built great populations of large ungulates, deer, elk, moose and commercially had energy development within many of those same areas. You've seen that both in Colorado and Montana, as has been pointed out.

These efforts to go into these fragile landscapes can be done. They can be done successfully. Yes. Do our employees have concerns about doing this in a very careful manner? Certainly, they do. But we have wildlife challenges throughout America that we're challenged with every day, not only the federal U.S. Fish and Wildlife Service, who I'm honored to serve among the great employees there, but all of the states.

And as we look at all of the challenges that exist in America, whether that's oil and gas development, wind energy, solar and all the other opportunities that are there for developing energy, all of those have impacts of wildlife resources and fishery resources.

But I'll say this, if this Congress directs us that way we use the best science, the best technologies and other strategies such as timing that we've heard much about today and reduced footprint, to make sure that that has the least amount of impact on the native wildlife species.

Senator DAINES. I want to talk to Lieutenant Governor Mallott.

We have a vibrant outdoor economy like Alaska does. We have millions of acres of public lands, of wilderness. Alaska has, I understand, over 56 million acres of wilderness, about 15 percent of the total acres, and hundreds of millions of additional acres of federal lands, totaling around 60 percent. Some is suitable for hiking, some for snowmobiling, some should be left as wilderness. But some is suitable for timber production, others for mining, oil, or gas exploration.

Do you believe that we are taking a balanced approach by opening up the 1002 Area to production allowing Alaska and all Ameri-

cans to benefit from the revenue and security generated from this land?

Mr. MALLOTT. Thank you, Senator.

I will just emphasize once again that I was with the Alaska Federation of Natives when ANILCA was being developed. I was with the Native community as a leader in the development of ANCSA which is the precedent act to ANILCA.

The effort at balance was among the most important considerations in the development of the Alaska National Interest Lands Conservation Act, ANILCA, which ultimately gained the approval of such giants of conservation as Congressman Mo Udall, the Secretary of the Interior at the time from Idaho, the range of conservation interests and other interests across our nation and within Alaska. It was a grand bargain that was dealing with immense millions of acres, 160 million acres of land in our state went into the federal classifications in our state.

Within those classifications there were——

Senator DAINES. I do not have a lot of time, I will insert myself here.

Mr. MALLOTT. Right.

Senator DAINES. Do you think we are taking a balanced approach?

Mr. MALLOTT. Absolutely.

Senator DAINES. Okay, thank you.

Thank you, Madam Chair.

The CHAIRMAN. Thank you.

Mr. MALLOTT. You mean when I'm responding I'm using your time? Wow, I didn't know that, sorry.

[Laughter.]

Senator DAINES. It was probably better that I interrupt you than the Chairman from your state, so . . .

The CHAIRMAN. I appreciate that.

Lieutenant Governor, thank you.

Senator Stabenow.

Senator STABENOW. Well, thank you, Madam Chair.

I am very, very concerned about the direction of where this is going, and one of the reasons I did not support the budget resolution was because of the provision that would assume $1 billion coming from opening ANWR. I appreciate the Ranking Member's opening comments and other colleagues that have expressed concerns. But when we talk about listening to people from Alaska, we certainly want to do that. I wish we had more diversity here in terms of viewpoints from Alaska. That would be more helpful.

I remember in 2010 I traveled with Senator Begich to Alaska to attend a field hearing on the impact of climate change on Alaska, and we saw what was happening in terms of the snow melting, really quite astounding to see the impacts of climate change on our Arctic. On that trip, I had an opportunity to visit the Tutusix Bay and to meet with the Native Americans there in the far Southwest part of Alaska which has become a center of alternative energy investments. I was so impressed with the very tall large wind turbines, and was particularly happy to find out that some of the component parts were actually manufactured in Michigan. So I felt an immediate connection with what the tribe was doing and how the

vision of moving to types of energy that would actually be so much better for Alaska in terms of what is happening because of the changing climate.

And then I had the opportunity to meet with the tribal elders of Newtok to discuss what was happening for them, the importance of preserving local language and culture and the fact that they are going to have to be evacuated. I don't know if that has fully happened yet, Lieutenant Governor, but I know at the time we were walking on boards. Water was seeping up. The whole community, the whole village was going to have to be moved because of the water that was coming in and going to engulf the community as a result of the permafrost melting. And we saw directly what was happening.

This is deeply concerning to me that we are not embracing what I saw in terms of new opportunities with types of alternative fuel that would actually, it would seem to me, benefit the quality of life of people in Alaska.

But as we sit here today to discuss opening ANWR to oil drilling, even with no evidence that drilling in these areas will increase U.S. energy security and real questions about whether allowing drilling will help the federal budget at all, it feels very much like a political exercise as opposed to looking to the future and what is needed for the people of Alaska, as well as preserving this pristine area.

Mr. Alexander, I know you have spoken a little bit about this, but could you help me better understand real world consequences of allowing drilling in ANWR and talk a little bit more about important cultural and tribal perspectives about what it would mean, from your standpoint, to allow for new drilling in these pristine lands?

Mr. ALEXANDER. Thank you, Senator.

You know, when we think about the real-world consequences of drilling it goes back to the protection, you know, of our way of life as Gwich'in people.

There's a story about how, you know, long ago we had to rely on the caribou and the closeness of our relationship is such that we even say that there's a little bit of caribou heart in us and a little bit of human heart in the caribou.

And so, this impact is a real impact. And it's funny to me because I don't quite understand. We kept talking about economic development and I hear this a lot as an excuse to be going in and drilling.

Economic development. Economic development. What does that actually mean? I think that's not a recognition that the subsistence economy is a real thing. It's not a recognition that, you know, I find it hard to understand, like, why would somebody, why would a Gwich'in person want to work a 40 hour a week job making money so they could turn around and go buy organic food? How does that make sense to anybody? Why would you do that? So I'm going to go work harder so then I could buy food of lower quality, like, how does that make sense? That doesn't make sense to me. That's why we're just perplexed as to what you say when you're talking about progress. Is progress like eating Spam? Is that progress? I don't think so.

You know, here down in the states when you want to talk status, people talk about going to, you know, talking about going to Whole Foods and eating organic food. That's status. Alright? You're saying oh, it's important because it's important for our health to eat this healthy food.

So what is all this drilling for? So that we can have money to do what? To live like Gwich'in? We already live like Gwich'in. We're not trying to change anything in that regard. I think you could learn a lot by seeing how we live. You could learn a lot because we're not chasing our tails up there.

And so, you know, going back to the tribal perspective. The tribal perspective is that it is our responsibility and our duty to take care of the land and take care of the animals because they've taken care of us for thousands of years, thousands of years.

And you know, you're going to hear Alaska Native Corporations representatives coming up here and talk about responsible development too. And I just want to make it clear while I have the time to do such. The Alaska Native Corporations are not tribes. They are not tribes. They do not have a traditional language. Their purpose is profit.

Our purpose as Gwich'in is to protect our traditional way of life and to live that traditional way of life in an honorable way. And so, our elders told us when you go up there you do it in a good way. You do it in a good way. And that good way is to be respectful.

I have a peer over here. You know he's from the North Slope. And we respect their food security. Whenever there's any issue of drilling in the Arctic Ocean, we know that the Iñupiat don't want drilling in the Arctic Ocean because it will impact the whales. It will impact the sea life and they know that and they're worried about that. So they don't want it. And we stand beside them and we say we recognize your right to exist as indigenous people and we recognize that you have a right to food security. And we stand beside you when you do such.

Senator STABENOW. Thank you. I realize my time is up. I have further questions, but I will submit them for the record.

Thank you, Madam Chair.

The CHAIRMAN. Thank you, Senator Stabenow.

Senator Gardner.

Senator GARDNER. Thank you, Madam Chair, and thank you to the witnesses for being here today. I realize and recognize, as Senator Daines did, this is a long ways to travel. So thank you very much for being here.

Mr. Sheehan, a couple questions for you that came up, I think, during some of the other questions.

When Congress moves forward, as we are today, if there is a lease plan developed for the 1002 Area, environmental laws do not change, they are not waived. They remain the same as they are today. Is that correct?

Mr. SHEEHAN. Yes, that's correct, Senator.

Senator GARDNER. And there would be a leasing plan that would be developed with public input. Is that correct?

Mr. SHEEHAN. Absolutely. There'd be full environmental impact reviews.

Senator GARDNER. And there are environmental reviews? Is that correct?

Mr. SHEEHAN. Absolutely.

Senator GARDNER. And there is an analysis of how this would impact the environment. Is that correct?

Mr. SHEEHAN. Yes.

Senator GARDNER. Does that change as a result of the 1002 process?

Mr. SHEEHAN. No, there's nothing in that process that would allow for changing any of those environmental considerations or rules.

Senator GARDNER. Will this area be going into production the day after Congress passes legislation?

Mr. SHEEHAN. We would expect that probably lease sales, perhaps two, would occur four to five years from now with drilling being potentially as far out as seven to ten years.

Senator GARDNER. So seven to ten years.

Litigation? Do you get sued or does this waive lawsuits?

Mr. SHEEHAN. This doesn't waive lawsuits, but certainly we don't like lawsuits any more than anyone else does.

Senator GARDNER. So there is going to be—yes.

I guess what I am saying is that the process of environmental protection, environmental reviews, environmental analysis does not change one iota. Correct?

Mr. SHEEHAN. That's true. Yes.

Senator GARDNER. Thank you.

Lieutenant Governor, the Governor's opening statement and your extensive written testimony lay out some of the history of the founding of Alaska, the laws that led us to the current situation, and your experience working with the oil and gas industry. I have a couple questions for you.

Alaska was brought into the Union as a state with the understanding that it would be allowed to responsibly develop the resources available to it. Is that correct, yes or no?

Mr. MALLOTT. Yes.

Senator GARDNER. When the compromise legislation, the Alaska National Interest Lands Conservation Act, was passed in 1980, it expanded what was then known as the Arctic National Wildlife Refuge, by almost nine million acres to create what we now know as the Arctic National Wildlife Refuge, excuse me, previous, the Range, now the Refuge. Is that correct?

Mr. MALLOTT. Yes.

Senator GARDNER. That bill doubled the size of the National Park System, doubled the size of the National Refuge System and tripled the amount of federal land designated as wilderness. Is that correct?

Mr. MALLOTT. Yes.

Senator GARDNER. That same bill, which massively expanded conservation protections for many areas of the state, also specifically set aside the Coastal Plain, or 1002 lands, for the scientific evaluation of its petroleum development, potential environmental qualities, and the possibility of safe development. Is that correct?

Mr. MALLOTT. Yes.

Senator GARDNER. And the studies conducted by the Department of the Interior led them to recommend Congress adopt a full oil and gas leasing program for the 1002 Area. Is that correct?

Mr. MALLOTT. Yes.

Senator GARDNER. Does the United States consume more oil today than it produces?

Mr. MALLOTT. It does. Yes.

Senator GARDNER. So we still import oil today. I think that has been talked about.

Is it fair to say that not all of the countries we import oil from share the same values as the United States?

Mr. MALLOTT. Absolutely.

Senator GARDNER. And I think production of domestic energy allows us greater leverage over those nations that we import oil from.

Does it make any sense that we would tie the hands of the State of Alaska, the hands of her people, when we have the opportunity to responsibly and sustainably develop a resource that will increase national security of the United States and the prosperity of your state? Does it make any sense to tie your hands?

Mr. MALLOTT. It does not.

Senator GARDNER. And so, based on your experience, I think, and these answers, this is not a situation where there is something new being proposed by Congress. It is actually something that Congress set forward to allow.

Mr. Sheehan, it was mentioned, your experience in the State of Utah, in the wildlife work, in particular. I think 25 years in Utah, is that correct, as a conservation specialist?

Mr. SHEEHAN. Yes.

Senator GARDNER. And the last five years, prior to your appointment, you were running the State of Utah's Division of Wildlife Resources. You oversaw a significant increase in mule deer production. Is that correct?

Mr. SHEEHAN. That's true.

Senator GARDNER. Utah has a heck of a lot of energy production, is that right?

Mr. SHEEHAN. In certain areas of the state, yes.

Senator GARDNER. How do you balance that? How did you actually grow a population when you have that development? How do you balance that?

Mr. SHEEHAN. Well, I think the key to balancing any of that work is to try to avoid and minimize footprints the best we can.

Our biologists and team members there work with those development companies to look at siting locations and have tried to develop those areas in the most responsible way they can to minimize impact to wildlife numbers and I think we've seen some good success with those efforts.

Senator GARDNER. Based on your professional experience then, can we responsibly develop the resources that Congress has put in agreement with the State of Alaska and minimize impact to wildlife and other parts of the ecosystem?

Mr. SHEEHAN. Certainly I believe that if that's developed there can be similar efforts to minimize the impacts to wildlife in that 1002 Area.

Senator GARDNER. Thank you.

My time is expired, Madam Chair.

The CHAIRMAN. Thank you, Senator Gardner.

We will next go to Senator Franken.

Senator FRANKEN. Thank you, Madam Chair.

One argument that we often hear from my friends across the aisle is that we need to open more federal land to drilling, and in Alaska, but if you look at the facts it is simply not true that the big oil companies like access to public lands, especially in Alaska.

Of the more than one million acres of federal land under lease for oil and gas drilling in Alaska, only about 17,000 are actually being drilled on by the end of Fiscal Year 2016, 17,000 out of one million. Maybe that is why the pipeline is only operating at 25 percent of capacity. And the Trump Administration just announced that it would lease another ten million acres of the National Petroleum Reserve in Alaska. They announced this in December. Simply put, there is no shortage of federal oil and gas leases in Alaska. It is not even close.

I don't know why it is necessary to open a pristine natural area like this Refuge. Why the Refuge?

And speaking to Senator King's questions that Mr. Sheehan could not answer, I just think that if my colleagues across the aisle think that drilling in this Refuge is such a good idea, we should have hearings. We should do this as regular order and not do this on the quick and cheap because of a tax plan.

Mr. Alexander, I would like to read you a quote from my good friend, the late Senator Paul Wellstone, and get your response.

Senator Wellstone fought for more than a decade to preserve the Arctic National Wildlife Reserve and for the rights of the Gwich'in people. Sorry if I pronounced it wrong. He said of your people, and I quote, "They are fighting for their most fundamental right to exist as an indigenous people who are an integral part of the landscape of the unique ecology of this region. We cannot condemn the Gwich'in as a people. We must respect their right for survival."

You have spoken eloquently to this. I do have some other questions, but doesn't it seem strange to all of us, to me it does anyway, that we are talking about you as—and by the way, thank you for your service in our military. But we are talking about changing the habitat and the way of life for these indigenous peoples to get $1 billion worth of resources, a lot of which is to address climate change. Can you just talk to the irony here or your feelings on it?

Mr. ALEXANDER. That's absolutely correct, Senator, and thank you for your words.

It is absolutely astounding that we want to—you know, when I was in the Army we used to call it a self-licking ice cream cone. And this is really what this has become where we are trying to drill more oil, pump out more pollutants, to address climate change and the impact that it has. And that is just insanity to me. And that's insanity to the Gwich'in people. We don't understand that. And so, you know, perhaps my colleagues here can explain it, but I can't understand it.

Senator FRANKEN. Lieutenant Governor, you know that the impact of climate change on your state, that your state is warming twice as fast as the rest of the country.

Mr. MALLOTT. Yes.

Senator FRANKEN. And this means coastal erosion and loss of sea ice and melting permafrost. I hear that part of the reason for drilling in this area, when there is going to be over 11 million other acres available to drill, is to address mitigation for climate change. Drilling for oil in the last pristine Arctic ecosystem on the continent while climate change is having a disproportionate impact on the region seems, to me, kind of ironic.

As you have made clear, Lieutenant Governor, climate change has deeply impacted your constituents. I think we need to curb emissions and provide support to communities to help them adapt to climate change, but not by drilling in the habitat of the food source for an indigenous people. Do you disagree that there is some irony here?

The CHAIRMAN. Lieutenant Governor, the Senator's time is expired, but I will allow you an opportunity to answer the question because it is an important one.

Mr. MALLOTT. I disagree. We need to continue to evolve our petroleum-based economy as we also seek to be responsive to our climate change reality. Nobody knows that better than we do. We live with it every single day.

It will take decades for us to withdraw from reliance on a petroleum-based economy. And for us, in the meantime, to rely on sources other than our own raises national security issues. It raises economic issues. It raises issues that impact us in Alaska very directly.

The resources that the development of the Coastal Plain can bring to Alaska will allow us to have fiscal resources to meet rapidly changing climate circumstances. Otherwise, we have no real ability to respond. The national government must ultimately also respond.

I do not believe there is an irony when the ecosystem that we are discussing is already in place to allow the most minimal, going forward, impact on the Arctic Coastal Plain of any oil development. I do not think it is ironic——

Senator CANTWELL. Madam Chair? Madam Chair?

I think we are going to have a vote, two votes at noon, and there are several of our colleagues who have been here. I would like them—I know our Lieutenant Governor here has been over time. I hope that we can get a short summation here——

The CHAIRMAN. We——

Senator CANTWELL. ——so that we can move on.

Mr. MALLOTT. Sure.

I disagree that it is ironic. I think it is a national interest. It is in Alaska's interest. It is in the world's interest that we allow this kind of development to take place, that it has the most minimal impact that we can see and that it allows us to be responsive to a climate change future that we must address.

The CHAIRMAN. Thank you, Lieutenant Governor.

Senator Hirono.

Senator HIRONO. Thank you, Madam Chair.

This hearing is in the context of the Republican tax and budget plan singling out this Committee to come up with $1 billion of revenue savings over the next decade.

The Committee has until November 13th to come up with this amount. So this hearing is all a piece to support the Republican budget and tax proposal that cuts $1.5 trillion from Medicare and Medicaid and imposes massive reductions in funds for education and affordable housing, among other things, all to benefit huge corporations and the wealthy. So we therefore should resist the urge to compartmentalize what we are doing in this Committee as disconnected from a larger picture. The larger picture being the Republican tax and budget plan.

So here we are. The decades-long debate over the Arctic National Wildlife Refuge is a highly controversial issue that has come to represent a fight between protecting pristine ecosystems and continuing our reliance on fossil fuels. And we should not be considering whether to exploit national treasures like the Arctic Refuge to pay for tax cuts for the rich.

Instead, we should be discussing how to raise royalties from companies already drilling and mining on public lands so that taxpayers get a fair deal, reduce overly generous revenue sharing payments from offshore oil drilling and limit the ability of companies to flare natural gas so that resources from public lands are not wasted.

I want to ask Mr. Sheehan a question. Does the Trump Administration support drilling in ANWR?

Mr. SHEEHAN. Yes, they do.

Senator HIRONO. Okay.

Is that why there is an August 11 memo from U.S. Fish and Wildlife Acting Director James Kurth instructing the agency's Alaska Regional Director to update a rule that had to do with exploratory drilling between 1984 and 1986 and lifting these calendar constraints so that more applications can be submitted to approve drilling? That is where we are heading, right? In spite of the fact that it is Congress that gets to make the ultimate decision as to whether or not drilling is appropriate in ANWR.

Mr. SHEEHAN. Thank you, Senator.

First of all, the document you referred to and those surrounding documents were not any part of a rule that's been publicly released yet, but I will say this. If in fact this body of Congress wants to contemplate the development of oil and gas in the 1002 Area of the Arctic National Wildlife Refuge, it should be done with the best science, the most current science available and that involves probably the most current level of exploration using the most modern technologies.

That original research that was done, was done in the early 1980s and that was——

Senator HIRONO. Mr. Sheehan, do you think this Committee can come up with all of that by November 13th?

Mr. SHEEHAN. I don't believe that, in my opinion, this Committee has asked to have all that research work done. I believe that should the body of Congress pass it, we want to make a best-informed decision to our public of what and where and when that could look like and to industry who may be interested in pursuing bidding on that one.

Senator HIRONO. We agree with that. That is why I am really glad that Senator King raised some very specific questions to you which you could not answer.

It really has to do with—you know what, Mr. Lieutenant Governor, you said that we should proceed in a way that has the most minimal impact. And, of course, that is the crux of the debate as to what kind of impact drilling in ANWR will have. There are people on one side of the debate that say this is going to have a terribly detrimental impact on the environment and, as so eloquently put by Mr. Alexander, that it would impact their way of life.

By the way, Mr. Alexander, I'm really glad that you came and testified because I believe that as Native peoples you share certain common perspectives as the Native Hawaiians do and that is a very strong, spiritual, economic, if you want to economize it, connection to the land. I think it is really important to the Gwich'in Tribe, which covers a very large part of the area that we are talking about, as well in Canada. I am really grateful for your testimony.

That is why the debate has continued because there has been a huge discussion as to how minimal the impact of drilling would be, and there are those who believe that it will not, indeed, be minimal.

Thank you, Madam Chair.

The CHAIRMAN. Thank you, Senator Hirono.

Senator Sanders.

Senator SANDERS. Thank you very much, Madam Chair.

Madam Chair, my guess is that historians in years to come will look back at hearings like this and they will ask, what were they thinking about? What world were they living in? Why didn't they see what was going on all around them?

All over this planet today we are seeing nations, including our own, ravaged by the impact of climate change. And meanwhile, while climate change is doing horrendous damage to peoples all over the world, we have hearings like this that talk about more oil exploration, more dependency on fossil fuels when the evidence is overwhelming that this country should lead the world in transforming our energy system away from fossil fuel to energy efficiency and sustainable energies.

And it is especially surprising that in a beautiful state like Alaska, which has been hit so hard by climate change, that you are not leading the world, leading this country in telling us the damage that has been done and the need to move away from fossil fuel.

Right now, according to NASA, the first six months of 2017 were almost a full degree hotter than any year since records started being kept in 1880. This is unbelievable. The duration and strength of hurricanes—and I just came back from Puerto Rico—have increased by 50 percent. 2017 is already one of the worst wildfire seasons on record.

The Intergovernmental Panel on Climate Change tells us that the average global sea levels have already risen by about three millimeters annually since the early 1990s and coastal cities all over our country and the world are in danger of being flooded. And here we are talking about more dependency on fossil fuels. More de-

struction of the planet. What world are we living in? What are you going to say to your children and your grandchildren?

Meanwhile, there is a revolution taking place in sustainable energy. We are seeing the price of solar and wind plummeting. We are seeing massive corporate investments, not in oil, not in gas, by the way, but in sustainable energy. The solar sector today employs more people than Apple, Google and Facebook combined.

So I have a simple question. I do understand, Mr. Sheehan, that your boss, the President, told us during the campaign that climate change was a hoax. Right? It was a hoax. Briefly, Mr. Sheehan, is climate change a hoax or is it real?

Mr. SHEEHAN. No, Senator Sanders, certainly I believe that climate change is real. I believe we can see it from areas from Alaska to many other areas.

But what I do believe is that as we look at these alternative forms of energy that are coming online, and you don't have to look far around this country to see new wind energy and solar operations popping up all over the place, but they still represent a very small part of the energy in this country.

Senator SANDERS. That is right. That is right.

But my question to you is why is the Trump Administration not recognizing that reality, investing heavily in trying to move us in that direction rather than encouraging more oil and gas exploration?

Mr. SHEEHAN. I think they are encouraging those other energy sources but I think that they're also trying to be forward looking to say, what do we need ten years from now for oil in this country?

Senator SANDERS. You think that the Trump Administration is encouraging, is investing, is urging us forward in wind and solar? Is that what you are saying for the record?

Mr. SHEEHAN. I haven't seen a back-stepping in those particular sorts of energy mechanisms, so——

Senator SANDERS. Really?

Well then, I think you should examine what your Administration is doing.

Let me ask the Lieutenant Governor, very briefly, that at a time when your state, perhaps—and it's a beautiful state. My God, it is the last natural wilderness that we have. Don't you think that Alaska should be leading our country in terms of transforming our energy system away from the products that have caused the problems that are impacting your state?

Mr. MALLOTT. Absolutely. We feel it every single day. We know it.

We have investment in alternative energy. We need to continue to do so. There were references to wind power. If you look at wind power and other alternative forms of energy, we are making those investments. We need to make more, but we also know that we cannot flip a switch, and that's not a pun, and turn off our reliance on——

Senator SANDERS. But we will never flip that switch as long we continue investing in oil and gas.

Let me ask one last question, Madam Chair, if I may?

Let me ask Mr. Alexander——

The CHAIRMAN. Senator Sanders, you are out of time. We do have one more panel, and we do have votes coming up at noon.

Senator CANTWELL. Let him just finish. We went three minutes over on two of our colleagues over here. Let him just ask the question.

The CHAIRMAN. If it is a quick question.

Senator SANDERS. It is a quick question.

The CHAIRMAN. Quick question.

Senator SANDERS. I have just one, Mr. Alexander, to summarize briefly the impact that this drilling will have on his people's way of life.

Mr. ALEXANDER. Senator Sanders, we believe that drilling in "lizhik Gwats'an Gwandaii Goodlit" will devastate us as a people. And it will absolutely devastate us as a people because you're talking about 80 percent of the diet of the Gwich'in people being vadzaih, that Porcupine Caribou herd.

And so, our connection to that is so strong that you're talking about just an absolute change in the way we live as people and, you know, what about the next generation? Will they ever even have the opportunity to learn how to hunt caribou and to respect it? I don't know. And I'm hoping that you here today will protect that.

Senator SANDERS. Good. Thank you very much.

The CHAIRMAN. Thank you, Senator Sanders.

Senator Manchin.

Senator MANCHIN. Madam Chairman, thank you.

I want to thank all of you for being here and you can see this is quite divisive, if you will, but the bottom line is we live in the real world. We do not live in a fantasy world and we cannot pick and choose what we would rather have. Really, we are a country that depends on almost 20 billion barrels of oil a day. Those are the facts. And we imported oil from 70 countries last year. That is a fact.

I come from the State of West Virginia and it is a state that believes, really, in an all-in energy policy. It never hesitated once when this country needed the coal that made the steel that built the guns and ships that did everything for this country. You know, our people work and work hard. They will continue to.

Governor Walker, I thank you for being here. Lieutenant Governor Mallott, I want you to know you are not the only Democrat here that believes in an all-in energy policy and supports ANWR and doing it in a responsible way.

I also know that I voted against the budget because I thought the budget was just a gimmick to get to a budget reconciliation which took all of us out of the process. Democrats cannot participate, have not participated in the budget process right now for overall tax reform which the country needs.

But with that being said, I also realize that there is going to be more fossil used in the world than ever before. All we can do is find different technologies and different abilities to use it until we find a technology or a new industry that will provide a cleaner energy, if it is going to be fusion or some other form, in the near future.

But right now, the world is using more coal and we are using more oil. I look at the dependency that we have, and when you

start looking at the security of our nation, the less dependent that we are on foreign oil, the better we are strategically and the stronger we are as a nation.

I also noticed that Point Thomson, for the last three years, the Coastal Plain has already been exporting and is in development. I think that is being done in an environmentally sound way, a balance between the environment and the economy up there. It is within the same ecosystem as 1002.

I understand, Mr. Alexander, and everyone, depending on what side you are on, there has to be a balance here. I don't know why we cannot find that balance, why it is always either one side or the other, why we are divided as a nation, why we are divided as a people. It always comes down to what side are you on? I have had people ask me, so, what are your politics? I said, you ought to ask what is my purpose of being in the process, the political process. You should care less whether we are Democrats or Republicans.

I want a country that is strong, and a country can only be strong if we are energy independent. That is a fact of life. And if you want to set the technology standards of the rest of the world, you better develop them right here.

For the last eight years under the previous Administration, we never developed or basically spent anything on research trying to find better ways of using coal and oil and natural gas in a much cleaner way. With that being said, people say they want all renewables. I said, fine. Tell me what five hours of the day you want your energy. Tell me what five hours of the day you want your refrigerator or your heat or your air conditioner to work because that is really what you are going to get. And I think, Mr. Sheehan, you related to that.

But if you could briefly, Mr. Mallott, speak on—do you believe there is a balance, I mean, I don't think that you all will be representing the great State of Alaska thinking you are encroaching and changing the lives of your citizens there. Or have you just basically thrown caution to the wind?

Mr. MALLOTT. We need balance.

First let me say very quickly, I'm a Tlingit Indian. And when people ask me to be brief, I'm doing my damnedest.

[Laughter.]

But we need balance. We need to build a future in which renewable energy sustains our children. It is an absolute high priority that Alaska recognizes its responsibility for and will, at every juncture possible, take——

Senator MANCHIN. Is Alaska developing clean energy with renewables the way you all are——

Mr. MALLOTT. Yes.

Senator MANCHIN. ——the way you are extracting——

Mr. MALLOTT. Yes.

Senator MANCHIN. ——basically, the resources of——

Mr. MALLOTT. We have a long way to go.

Senator MANCHIN. Okay.

Mr. MALLOTT. We have invested and continue to invest in alternative energy as a high priority.

Senator MANCHIN. Mr. Alexander, is there a balance to be found here where we can preserve the way of life of your wonderful peo-

ple but also have energy independence, if we can, and use the resources that we have? Do you think that is possible?

Mr. ALEXANDER. Thank you, Senator.

Senator MANCHIN. Have you made overtures toward that, that you are trying to find the balance and it has been rejected?

Mr. ALEXANDER. Senator, what I would say is this, is why is the balance being put on the back of my people?

Senator MANCHIN. Okay. I am just saying——

Mr. ALEXANDER. And I'm answering your question, Senator——

Senator MANCHIN. Sure.

Mr. ALEXANDER. ——why is the balance being put on the back of my people? Because if you take a look at the North Slope there is plenty of other places to drill as has been mentioned earlier, plenty of other places. So that's the balance. You have NPR-A you can drill in. We don't need to drill in the Arctic National Wildlife Refuge.

Senator MANCHIN. Can I ask a real quick question then, for the Lieutenant Governor there? Have you all looked at different areas to support trying to find that balance but protecting their rights?

Mr. MALLOTT. Absolutely.

And with a pipeline, the reality being three-quarters empty with all of the existing areas of exploration and development and more coming on with recent discoveries, we still are a long way from being responsive to current national energy needs and we need to continue to find the ability to achieve national security, safety in energy, and we need the access to the 1002 Coastal Plain in order to achieve that.

Senator MANCHIN. Let me just say that my time is up and thank you, Madam Chairman.

Those of us who come from extraction states have done the heavy lifting. West Virginia has been heavy lifting for a long, long time and we continue. Our way of life, also, has been infringed upon. We think we can do things better but also find a balance. And all we are asking for is some tolerance here. We try to find alternatives so that we can respect your people and your way of life and also balance the energy that we need to keep this country strong. I think that is a responsibility.

There is nobody in West Virginia that wants to drink dirty water or breathe dirty air, the same as Alaska.

So if anyone thinks from the public leaders, and all of you are supporting doing more, as far as an energy resource, energy production in the most scientific way or the most advanced way that you possibly can.

I know the footprints as far as horizontal drilling. We have reduced the footprint in West Virginia. We have been blessed with a lot of shale gas, and it is unbelievable. We know we can do it much better, much cleaner, much more environmentally friendly.

I would urge all of you to try to find that pathway forward, try to find that balance.

Thank you, Madam Chairman.

The CHAIRMAN. Senator Manchin, thank you.

I appreciate the focus on balance. That is what we try to do around here.

I spent a lot of time last night reading everyone's written testimony, and I was struck by a comment that you had included, Lieutenant Governor, in saying just these words: "We have achieved this balance. It is time to permit the exploration and development. The state has demonstrated that wildlife and environmental protection can be achieved through 50 years of development and progress on the North Slope."

I think it is important to remember that what we are seeking to do in the 1002 is not something that has not been done in the North Slope. We have 40 years plus of a track record up there, 40 years of ensuring that the caribou continue to move through, that the polar bear are protected, that the snow geese are protected, that the mitigation that we talk about has been addressed.

At the same time we have been leading, not only the country but the world, when it comes to our innovation and our pioneering with microgrids. I talk about it a lot here in this Committee.

So much to be proud of there from Alaska's perspective, and I know that each of you, as you have provided testimony here today, have contributed to this conversation in a very important and a substantive way.

Our votes have started. We have two of them.

It would be my intention to thank this panel. Thank you for your time. This is a long time to be sitting and fielding questions, so we appreciate that.

We will take a recess, and it is my intention that we will resume the hearing at 12:30 with the second panel.

Again, thank you to each of you.

The rest can all take a stretch break, and we will be back at 12:30.

[RECESS]

The CHAIRMAN. Welcome back, everyone. I am sorry for the extra ten-minute delay, but we have finished at least this tranche of voting and hopefully we will have an opportunity to get through this last panel with an opportunity for questions and conclude the hearing before we have another round of votes. That is the hope here.

This second panel is perhaps more of our technical panel. We have several witnesses present to help answer questions about modern development on the North Slope and what it might look like in the future.

Joining us today is Mr. Aaron Schutt. Aaron is the President and CEO of Doyon, Limited. Thank you for being here. You also brought your son with you which is a great educational opportunity for him, and we appreciate you both being here.

Lois Epstein is with us. Lois has been before the Committee before. We welcome her back. She is the Arctic Program Director for the Wilderness Society.

Following Ms. Epstein, we will have Mr. Richard Glenn, also a frequent flyer here to the Energy Committee. He is the Executive Vice President for Land and Natural Resources with the Arctic Slope Regional Corporation. It is good to have you back, Richard.

Pat Pourchot is known to many Alaskans and many here in Washington, DC. He is the former Special Assistant for Alaska Affairs at the Department of the Interior during the previous Administration. Welcome back, Pat.

Last on our panel is Dr. Matthew Cronin. He is a biologist. He is a former research professor at the University of Alaska, Fairbanks. Some of us know him as "the caribou man," but certainly one that is well-versed in the biology of many of these issues that we have been discussing.

So thank you all for traveling the distance to be here today. Thank you, not only for your contributions for the hearing, but also for the good work that you do in your respective areas.

Aaron, if you would like to lead the panel off with your comments. Again, please try to stick to five minutes if you can. Your full statements will be incorporated as part of the record, and then we will have an opportunity for questions.

Welcome.

STATEMENT OF AARON SCHUTT, PRESIDENT AND CHIEF EXECUTIVE OFFICER, DOYON, LIMITED

Mr. SCHUTT. Thank you, Madam Chairwoman, members of the Committee. Do'eent'aa? It's a very great opportunity to be here to testify today.

I am the President and Chief Executive Officer of Doyon, Limited. I am Koyukon Athabascan, a Tanana Tribal Member, and a Doyon shareholder.

Doyon is one of the 13 Native Regional Corporations established by Congress under the terms of the Alaska Native Claims Settlement Act and the southern portion of the Arctic National Wildlife Refuge lies within our region. Doyon supports the opening of the ANWR Coastal Plain to oil and gas development if it can be shown to be consistent with the protection of the Porcupine Caribou herd.

The Gwich'in people, many of whom are Doyon shareholders, some here today, rely on that herd for subsistence and cultural survival. And we encourage the United States Government to offer the Gwich'in a role in co-management of the Porcupine Caribou herd, whether or not it opens ANWR to oil and gas development.

Today, I want to focus my testimony on one of our wholly owned subsidiaries that operates in the oil and gas industry, it's Doyon Drilling. We operate on the North Slope with eight of the most unique and advanced rigs in the industry, and they're designed especially for the Arctic. Doyon Drilling has led the industry in innovation and adoption of new technology over its 40 years of existence. We're proud of that leadership role as it fits within our corporate value of a commitment to employee safety and sound environmental practices.

When Congress last debated opening ANWR to oil and gas development in 2005, supporters made many arguments about the use of new technology and how it would minimize the impact on ANWR. Since then, a lot of these claims have borne out in the industry, and we're going to share some of them today.

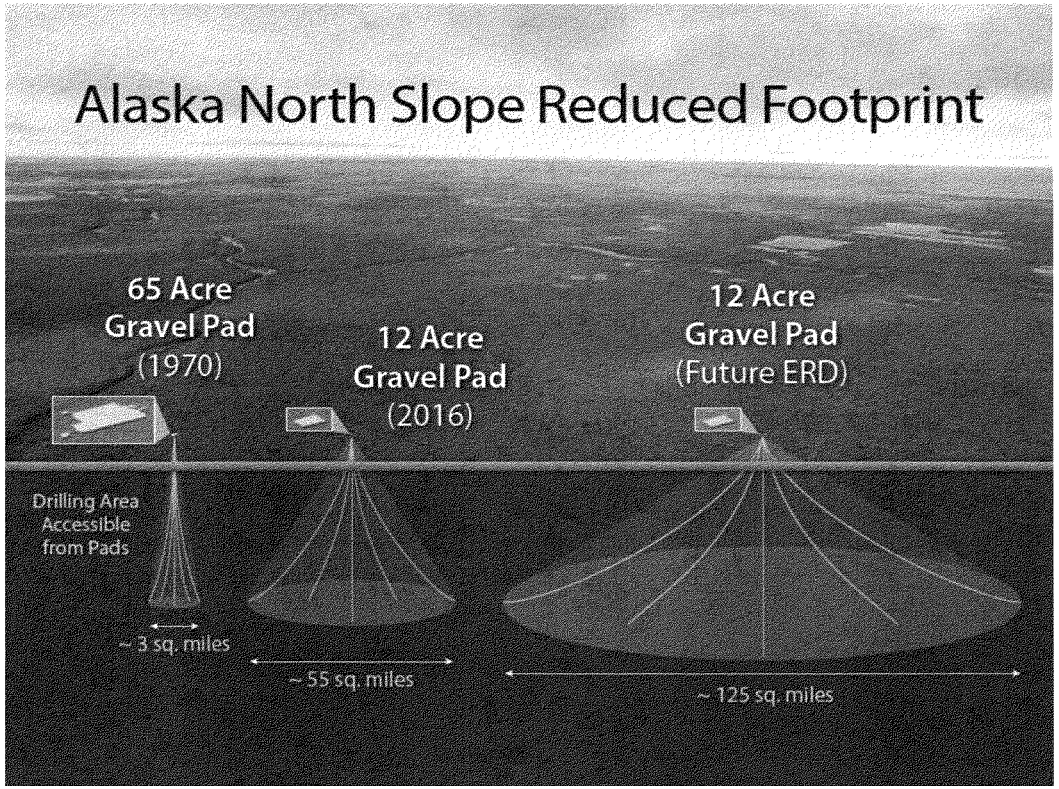
A couple are directional, extended reach, multi-lateral drilling techniques that have been developed and perfected in that timeframe. Those techniques allow wells to be drilled in all directions from a well pad, kind of like spokes on a bicycle wheel.

Directional drilling has been around since the 1970s but at that time it did not allow the reach that we can now. And so, you could

drill a couple square miles around a pad. And I've got a figure here that's been shown before in the hearing today.

[The information referred to follows:]

Figure 1. Minimizing Footprint Through Technology.

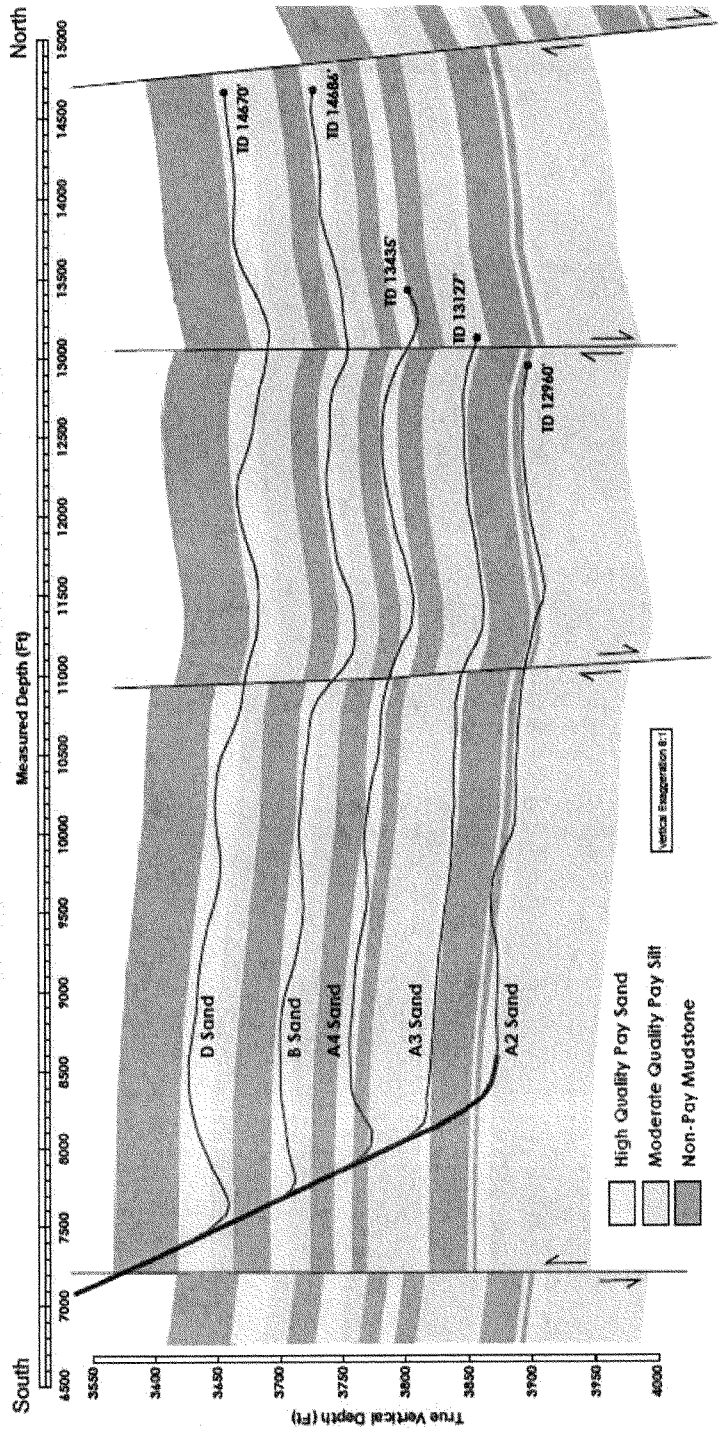


You can see a couple, three square miles using technology from the 1970s. And fast forward to the one on the far right, a 12-acre pad where a drill rig can reach out and cover 125 square miles. That means that you can space pads in modern development up to 10 miles apart and that there's little to no surface impact between those pads. That's a fairly dramatic shift in technology in that time period.

And I'd like to say that the impact of those technological changes are not theoretical. I've got another graphic coming up here.

[The information referred to follows:]

Figure 2. Penta-Lateral Well Drilled by Doyon Rig 142.



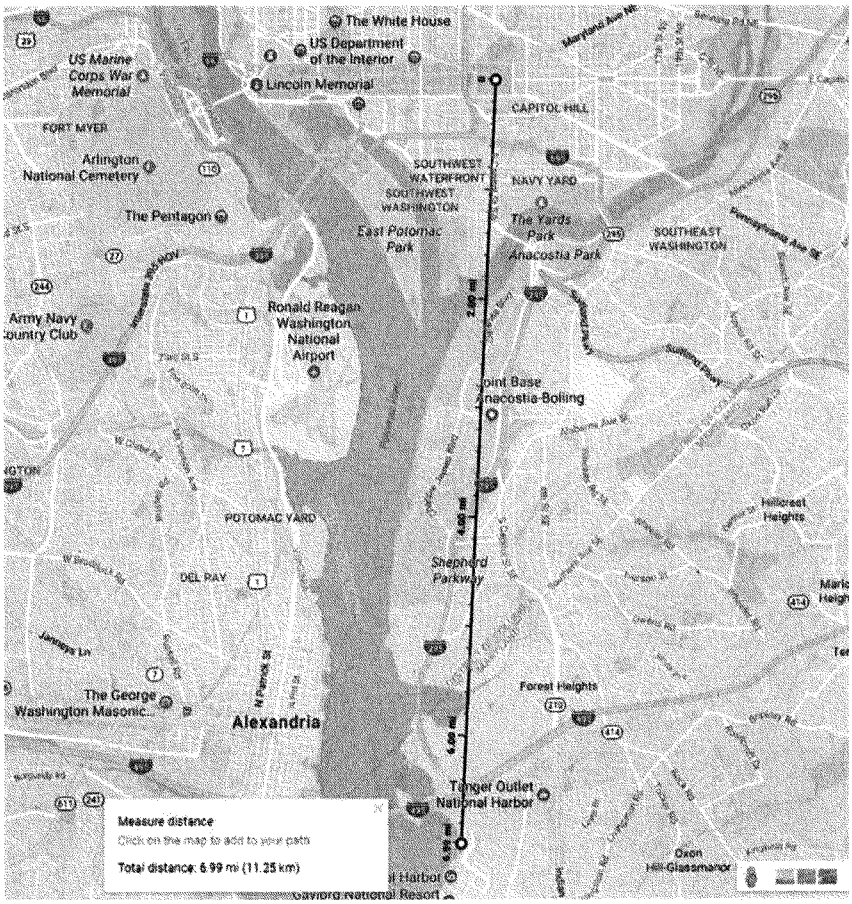
Doyon's Rig 142 just recently completed a penta-lateral well in the Kuparuk field on Alaska's North Slope. That's five production wells drilled from a single surface wellbore. Each of those penta-lateral wells is now producing from different reservoir sands through three different fault blocks. The total drill length of the five wells is over 39,000 feet; 28,000 feet of that, I understand, is in the production zone.

If Doyon's client had developed these same resources 20 years ago, it likely would have required probably three drill pads and multiple wells on each of those pads to access the same resources we were able to access from a single surface location.

Doyon is currently building an extended reach drilling rig—also referenced earlier in the hearing, it's Rig 26—that will be able to reach out even further. That's the 35,000 horizontal feet that was mentioned by several people earlier today. And that's the capability that allows us to reach out for the full 125 square miles from a single surface well pad.

[The information referred to follows:]

Figure 3. Doyon Rig 26 Horizontal Reach



For perspective of those here in the room, Rig 26 will be able to drill from here on Capitol Hill and hit a target the size of certainly this room at the National Harbor Resort and Convention Center on the Potomac River that's six and a half miles away.

Rig 26 is being developed to allow our client to develop known, but currently untapped, oil resources from existing surface infrastructure. In other words, our client won't have to build new pads, roads, or pipelines on the surface to produce known oil reserves.

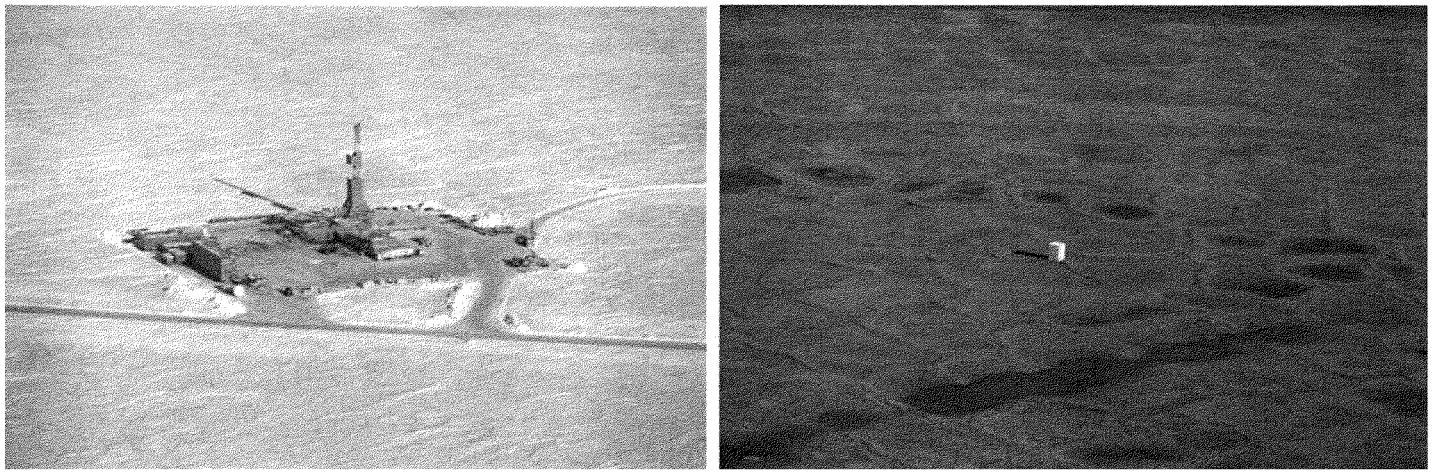
And the changes in the technology have allowed smaller well pads on the North Slope and they're up to 70 percent smaller and there are 70 to 80 percent fewer pads since Prudhoe Bay was developed in the 1970s.

And so, what that looks like is a 19,000-acre footprint goes down to just a few hundred acres to develop the Alpine Field on the Western side.

Finally, this has also been referenced. The impact of exploration on the environment is very minimal. The difference between exploration and production, you can see here, a location in the NPR-A with our Rig 141. And then we've got the summer version of the same location. Senator Sullivan mentioned this before where there's almost no lasting surface impact from exploration.

[The information referred to follows:]

Figure 4. Doyon Rig 141 Exploration in NPRA



I wanted to close my testimony here by saying how important oil and gas is to the economy of the state and to our company. We obviously have a large presence in the Alaska oil and gas economy. It was developed because it was the available economy to us as an ANCSA corporation in the 1970s with the development of Prudhoe Bay.

We're very proud that we employ hundreds of our Alaska Native shareholders and we do it in an environmentally safe way and the protection of our employees is paramount, but to also provide income to our shareholders. A single drill rig, for example, could have a salary impact of $4 million for our Alaska Native shareholders per year on those rigs. Those numbers are not theoretical either. That's the reality we've had for many years times the number of rigs we have working.

So in short, Madam Chairwoman, we're very proud to be here today. We're supportive of opening ANWR, but only if we can assure ourselves of the protection of the Porcupine Caribou herd, as I mentioned earlier in my testimony.

Thank you.

[The prepared statement of Mr. Schutt follows:]

Testimony of

Aaron Schutt
President and Chief Executive Officer
Doyon, Limited
November 2nd, 2017
Energy and Natural Resources Committee
Hearing on Reconciliation Instructions for
H. Con. Res. 71

Madam and Ranking Chairwomen and Members of the Committee, thank you for the opportunity to testify on the potential for oil and gas exploration and development in the non-wilderness portion of the Arctic National Wildlife Refuge, known as the "1002 Area" or Coastal Plain, to raise sufficient revenue pursuant to the Senate reconciliation instructions included in H. Con. Res. 71. I would especially like to thank my home state Senators Lisa Murkowski and Dan Sullivan. Chair Murkowski invited me here to testify today. My name is Aaron Schutt. I am President and Chief Executive Officer of Doyon, Limited. I am Koyukon Athabascan, a shareholder of Doyon, and a tribal member of the Native Village of Tanana.

Doyon, Limited (Doyon) is one of the thirteen Native regional corporations established by Congress under the terms of the Alaska Native Claims Settlement Act (ANCSA) of 1971. Headquartered in Fairbanks, Doyon has more than 19,700 Alaska Native shareholders. Doyon is the largest private landowner in Alaska, with a land entitlement under ANCSA of more than 12.5 million acres. Doyon's lands extend from the Brooks Range in the north to the Alaska Range in the south. The Alaska-Canada border forms the eastern border and the western portion almost reaches the Bering Sea. The southern portion of the Arctic National Wildlife Refuge (ANWR) lies within the Doyon region.

Doyon's mission is to promote the economic and social well-being of our shareholders and future shareholders, to strengthen our Native way of life, and to protect and enhance our land and resources. Doyon, Limited operates a diverse family of companies in industries including oil and gas service contracting, natural resource development, government contracting and tourism, among others.

Doyon supports the opening of the ANWR Coastal Plain to oil and gas development if it can be shown to be consistent with protection of the Porcupine Caribou Herd. The Gwich'in people, many of whom are Doyon shareholders, rely on that herd for subsistence and cultural survival. We encourage the United States government to offer the Gwich'in a role in co-management of the Porcupine Herd should it open ANWR to oil and gas exploration and development.

Today, I will focus my testimony on one of our wholly owned subsidiaries in the oil and gas service industry, Doyon Drilling, Inc. (DDI). DDI operates on the North Slope of Alaska with eight oil and gas land drilling rigs specially designed to drill oil wells in extreme conditions. DDI also has one more rig, Rig 26, an extended reach rig, under construction. Doyon and Nugget

Alaska, Inc. formed DDI in 1982 as a joint venture. DDI became a wholly owned subsidiary of Doyon in 1993.

DDI currently has over 300 employees with its main office located in Anchorage, Alaska. We have demonstrated our commitment to remain competitive in the industry by continually reinvesting in our employees and rigs. Investment and innovation in our fleet has helped to make our rigs more efficient and protective of the environment.

DDI has proudly celebrated a number of "firsts" in the industry. Our Rig 9, now Rig 19, was the first self-propelled, wheel-mounted rig developed for the North Slope. We later applied that same moving system to Rigs 14, 15 and 16. We were also the first drilling company on the North Slope to use highline power and dual fuel turbines.

The balance of my testimony will focus on the use of new technology to minimize the footprint of oil and gas development in the Arctic. DDI has played a significant role and led its industry in innovation and the adoption of new technology.

New Technology Reduces Footprint/Impacts of Development

When Congress last debated opening the ANWR to oil and gas exploration and development in 2005, supporters of development argued that using new technology and advanced engineering designs would allow oil companies to develop ANWR safely while protecting the environment. Since 2005, oil companies and drilling contractors have continued to incorporate new technology into Alaska's oil field and those advances have borne out the claims made in 2005.

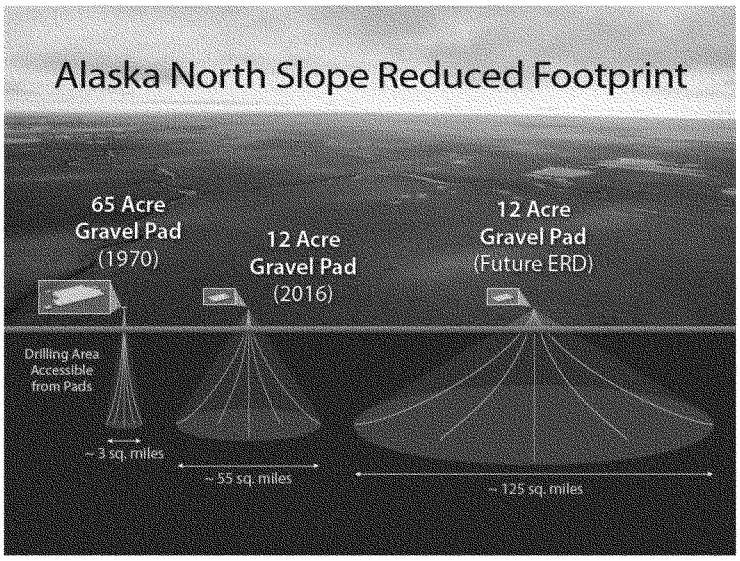
When oil companies developed Alaska's Prudhoe Bay oil field in the early 1970s through the 1980s, they had to drill wells straight down and the spacing of the wells on the surface was usually about 120 feet. The roughly 3,000 wells sunk at Prudhoe Bay and their spacing caused the surface development there to affect about 19,000 acres.

Technological advances made since the Prudhoe Bay oil field's development in the 1970s have resulted in increased oil recovery rates from fewer oil wells with far smaller surface impacts as a result of fewer and smaller drill pads. The technology has resulted in dramatically less overall surface disturbance, meaning far less impact on the habitat for wildlife.

Several critically important developments in drilling are the use of directional, extended reach, and multi-lateral drilling. Those techniques allow wells to be drilled in all directions from a well pad, like spokes on a bicycle wheel.

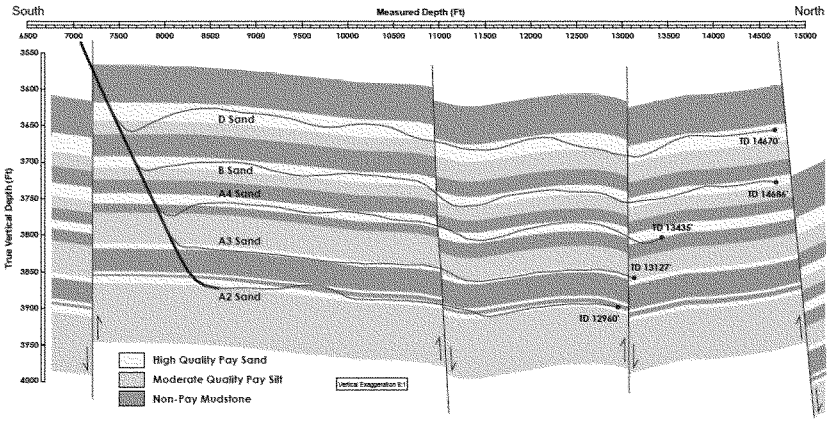
Directional drilling in the 1970s permitted oil companies to produce oil from only about 16 square miles surrounding a single well pad. Today's drilling rigs can easily drill wells from a single pad that can access over 100 square miles. That means that pads can be spaced up to ten miles apart and the habitat between pads can be protected with little or no surface disturbance. Figure 1 shows the dramatic change in surface footprint made possible by modern drilling technology.

Figure 1. Minimizing Footprint Through Technology.



The impact of technological changes are not theoretical. Doyon's Rig 142 recently drilled a penta-lateral well in the Kuparuk field on Alaska's North Slope. Figure 2, below, is a schematic of that well. It shows five production wells drilled from a single surface well bore. Doyon directionally drilled each of the legs of the penta-lateral well. Our client is now producing from different reservoir sands at varying depths below the surface through three fault blocks. The total drilled length of the five wells is over 39,000 feet. If Doyon's client had developed these same resources twenty years ago, it would have required several well pads on the surface and multiple wells on each of those pads.

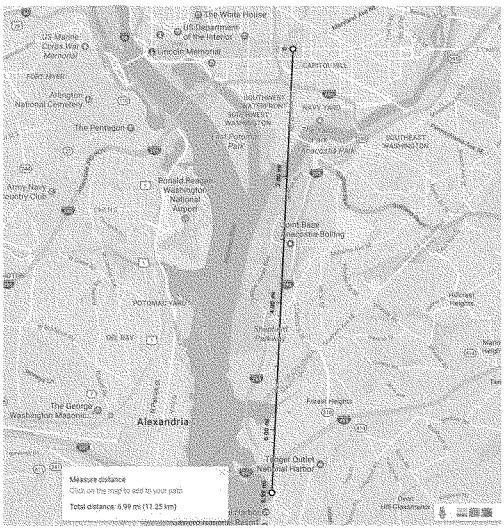
Figure 2. Penta-Lateral Well Drilled by Doyon Rig 142.



Doyon is currently building an extended reach drilling rig (ERD rig), Rig 26, that will be able to reach out even further. DDI, our client, and our rig builder have designed Rig 26 to drill up to 35,000 feet horizontally. That capability will allow the rig to drill wells covering 125 square miles from a single surface well pad as depicted in Figure 1. For perspective, that means that Rig 26 will be able to drill horizontally from Capitol Hill in Washington, D.C. and hit a target the size of a small room at the National Harbor Resort and Convention Center on the Potomac River, six and a half miles away.

Doyon's Rig 26 will join our fleet in the winter of 2019-2020. It will allow our client to develop known but currently untapped oil resources from existing surface infrastructure. In other words, our client will not need to build any new pads, roads or pipelines to produce known oil reserves.

Figure 3. Doyon Rig 26 Horizontal Reach



The changes in drilling technology and well design have also resulted in smaller well pads on Alaska's North Slope. Today's well pads are now 70 to 88 percent smaller in acreage than three decades ago. As noted above, the number of pads needed to access a field has fallen by up to 70 percent.

In East Texas in the early 1900s, the surface footprint of oil development was 140,000 acres to produce 5.2 billion barrels of oil from 30,340 wells. By 1969 at the original Prudhoe Bay field in Alaska, 19,000 acres were required to produce 11.9 billion barrels from 3,000 wells. By the time industry developed the Alpine field in Alaska in 2000, only 97 acres were required to produce 450 million barrels of oil from 116 wells – the footprint being less than 0.5 percent of the productive area.

The Tarn oil field at Prudhoe Bay was finished in 1998 and required a gravel pad of just 6.7 acres. The newest development at Oooguruk at the Kuparuk River Unit consists of a 6-acre drill site holding 50 wells and just a 1.5-acre onshore facility to help transport oil back to the main Prudhoe Bay pipelines.

Recent development by Eni at Spy Island, the Nikaitchuq deposit, has allowed 52 wells with related oil processing facilities, to be drilled from a pad about 11 acres in size. Doyon's Rig 15 has drilled all of those wells. It has been on Spy Island since 2009. DDI is currently modifying

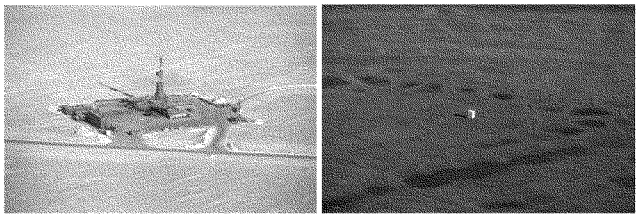
Rig 15 to allow it to drill up to 35,000 feet horizontally to further extend the reach of wells drilled from Spy Island.

New Technology Reduces Footprint/Impacts of Exploration

Oil development today also causes far less impact to wildlife and the environment during exploration. Three-dimensional seismic testing allows oil to be located more accurately reducing the need for exploratory well drilling. This results in fewer "dry holes" and less physical disturbance on the surface.

Modern oil and gas exploration in Alaska leaves almost no permanent trace until development for production. The oil industry in Alaska uses ice roads and ice pads to support winter-only exploration drilling programs. The surface land is largely unaffected and it is difficult to know a few months later that a large drilling rig and all of the supporting equipment has even been there. Figure 4 shows Doyon Rig 141 drilling an exploration well in the National Petroleum Reserve Alaska and the same location the following summer.

Figure 4. Doyon Rig 141 Exploration in NPRA



The official environmental impact statement for ANWR development from the U.S. Department of the Interior, now three decades old, showed that ANWR's total potential oil reserves could be developed while only affecting about 2,000 acres of the surface of the coastal plain. The technology available to oil and gas companies today supports that assessment. Development will not physically touch 99.99 percent of the refuge, and it would leave untouched all of the refuge's current 7.16 million acres of formal wilderness.

Benefits of Natural Resource Development to Doyon

Alaska's oil and gas industry is important to Doyon. We have built a healthy and sustainable business that employs hundreds of our Alaska Native shareholders and gives them career opportunities. Many of our positions are well-paying blue collar jobs, something that seems increasingly rare these days. It has also been a profitable business that allows us to fund scholarships and training opportunities for our shareholders and to pay dividends.

In Doyon's fiscal year 2016, we employed 574 Doyon shareholders and 121 shareholders of other Alaska Native corporations. DDI employed 215 of the Doyon shareholders.

Responsible development of ANWR would likely result in additional opportunities for Doyon. A single rig contract creates job opportunities for up to 80 employees. At current levels, more than forty of those employees would be Doyon shareholders. DDI would pay salaries to those Doyon shareholders of about $4 million per year.

In fiscal year 2016, Doyon contributed $2.5 million to our affiliated education foundation, the Doyon Foundation. That total included contributions to the endowment, operating expenses and scholarships, and for the language revitalization program run by the Foundation. The contribution is possible, in large measure, because of our oil and gas contracting business.

In our fiscal year 2016, we paid a dividend to our Alaska Native shareholders that totaled $9.7 million dollars. Doyon will distribute a dividend to its shareholders on December 5, 2017, that will be approximately $12.0 million. Much of the profit Doyon makes and that supports our dividend is from our oil and gas contracting business.

Doyon's shareholders are not the only Alaska Natives that would benefit from development in ANWR. Subsidiaries of a number of other Alaska Native corporations provide services to the industry on the North Slope. The State as a whole benefits from new development. Each new development results in new jobs for Alaskans, tax revenue for the State, and potential profits for Alaska Native corporations and other companies in the industry. This results in continued services for our shareholders and Alaska citizens.

The CHAIRMAN. Mr. Schutt, thank you very much, and we appreciate the visuals as well.

Let's next go to Ms. Epstein. Welcome.

STATEMENT OF LOIS N. EPSTEIN, ENGINEER AND ARCTIC PROGRAM DIRECTOR, THE WILDERNESS SOCIETY

Ms. EPSTEIN. Thank you very much, Chairman Murkowski and also, though she's not here, to Ranking Member Cantwell, Senator King and other members of the Committee, for inviting me to testify at this important hearing on a critical, national public lands issue.

My name is Lois Epstein, and I am the Arctic Program Director for The Wilderness Society and my home is in Anchorage. Our organization's scientists began working in this region of the Arctic in the 1930s and, as an Alaska-licensed engineer, I am proud to be part of that legacy.

The Arctic National Wildlife Refuge is a vast wilderness landscape of tundra plains, boreal forests, dramatic mountain peaks, and coastal lagoons along the nation's wildest northern edge. There is no other place like it in America.

For thousands of years the area has been home to Gwich'in and Iñupiat communities and has sustained them. It provides vital habitat for more than 45 species of mammals including one of Alaska's largest caribou herds, polar and grizzly bears, wolves, Dall sheep and over 160 species of birds who migrate from the Refuge to breed there from all 50 states.

The Arctic Refuge is the crown jewel of our nation's National Wildlife Refuge System. The 1.5-million-acre Coastal Plain is widely recognized as the biological heart of the Refuge. The Coastal Plain is as important to our nation's natural heritage as Yellowstone and the Grand Canyon where we don't choose to drill.

Now, contrast this pristine wild place with oil and gas exploration and production which is complicated and messy and a lot has not changed over the years to make it less so. Even the most well-financed operators have blowouts and spills.

Just this year BP had a production well blowout due to thawing permafrost, and international well kill specialists had to fly in to prevent a safety disaster. This week the state is looking at all wells with similar designs because they are concerned for the potential for additional blowouts.

In 2012, Rexall had an exploratory well blowout on the North Slope that spewed roughly 42,000 gallons of drilling muds. It took a month to plug that well because frigid temperatures prevented work on many days.

According to the state's spill database which I looked at this week, there have been 121 crude oil spills on the North Slope during the past five years, or approximately two per month. A 2010 state study showed almost five spills each year on the North Slope over a thousand gallons, and I think it's important to recognize they're not all small spills.

Oil development infrastructure would sprawl over vast parts of the Coastal Plain and not be confined to 2,000 acres, as some have said. The 2,000-acre calculation does not include roads, gravel

mines or pipelines, except for the limited places where their support posts touch the ground.

There also would be year-round air pollution and noise from generators, trucks, aircraft and processing facilities, long-distance pipelines and gravel roads that could deter some caribou from crossing and cost them energy and wastes from drilling operations and living quarters that require disposal.

Directional or extended reach drilling, which is not a new technology, will have these same impacts. Directional drilling reduces only one concern and that is pad size. Roads and airstrips are still needed, pipelines are still required and pollution, industrial noise, and toxic spills are still inevitable.

Because of higher costs due to longer wells, directional drilling may or may not be used by industry for exploratory drilling. As discussed at the May 10, 2011, hearing in this Committee, oil companies actually prefer not to use directional drilling for exploratory wells because doing so provides less technical information about subsurface conditions.

Directional drilling rhetoric is, in some respects, a Trojan horse for access to the entire Arctic Refuge Coastal Plain for oil production. Neither the 2,000-acre provision nor directional drilling would prevent the entire Coastal Plain from becoming industrialized.

And Arctic Refuge drilling is not needed. Trans-Alaska oil pipeline flow is up six percent during the past three years and the Alaska Department of Natural Resources expects the pipeline's throughput to continue increasing through the late 2020s. And I have a figure—Figure 2 in my testimony shows that.

Significant new discoveries not on federally-protected lands, including in the National Petroleum Reserve, will increase production and this new technology that we've heard about is also very useful in existing oil fields to increase production.

Notably, drilling in the Arctic Refuge is not necessary to ensure that the Trans-Alaska oil pipeline remains viable for decades.

The most recent CBO report on Arctic Refuge leasing was issued with limited documentation in February 2012. The report estimates $5 billion in bonus bids for Coastal Plain leases split between the state and federal governments. Crude oil prices were approximately twice as high in 2012 as they are now, making Arctic Refuge drilling significantly less attractive today and for the foreseeable future. It is highly unlikely revenue and bonus bids on Arctic Refuge Coastal Plain leases will come anywhere close to CBO's or other's estimates. Since 2000, the average North Slope onshore bid has been just $34 an acre.

In summary, conclusion of Arctic—inclusion of the Arctic Refuge in the budget is less about meeting revenue targets and more about approving a controversial, problematic measure to open the Arctic Refuge Coastal Plain to oil development without the possibility of a filibuster. It would be a black mark for Alaska and this Congress with future generations to industrialize and essentially destroy such a unique place.

Thank you for this opportunity to discuss this unique and important region. I am happy to answer your questions.

[The prepared statement of Ms. Epstein follows:]

Testimony of Lois N. Epstein, P.E.
Engineer and Arctic Program Director
The Wilderness Society
Anchorage, Alaska
lois_epstein@tws.org

Before the U.S. Senate Committee on Energy and Natural Resources

Hearing on "Potential for Oil and Gas Exploration in the 1002 Area of the Arctic National Wildlife Refuge"

November 2, 2017

Good morning and thank you for inviting me to testify at this very important hearing on a critical Arctic land use issue. My name is Lois Epstein and I am an Alaska-licensed engineer and the Arctic Program Director for The Wilderness Society. The Wilderness Society (TWS) is a national public interest conservation organization with more than 700,000 members and supporters. TWS' mission is to protect wilderness and inspire Americans to care for our wild places. Our organization's scientists began working in the Arctic in the 1930s.

I have worked on oil and gas technical and policy issues since 1983, approximately half that time in Washington, DC and half in Alaska. I served on the U.S. Department of Transportation's advisory committee on oil pipelines for 12 years, on the Ocean Energy Safety Advisory Committee formed by Interior after the BP *Deepwater Horizon* tragedy, and I currently serve on a second National Academy of Sciences oil and gas-related committee. I have worked for three private consulting organizations which included assisting industrial clients, as well as for national and regional conservation organizations.

I have visited North Slope oil production and pipeline facilities, as well as numerous oil and gas production operations in the Cook Inlet region. I also visited the Arctic National Wildlife Refuge for two weeks on a recreational trip unrelated to work, and I have been to Kaktovik for a public meeting on Hilcorp's offshore Liberty project.

I will begin with a brief discussion about why the Arctic National Wildlife Refuge coastal plain is so important ecologically and as a key element of our country's natural heritage, touching briefly on how it sustains the Gwich'in and other subsistence users' way of life. Following this section is an extensively footnoted discussion developed by TWS' landscape ecologist, Dr. Tim Fullman, on the importance of the Arctic Refuge coastal plain to both caribou and polar bears.

After these sections on the coastal plain's unique and important characteristics, I will paint a picture of the adverse impacts oil development will have on the coastal plain year-round, and I will refute the 2000 acre myth.

Next, just as I did when I testified before this committee on May 10, 2011, I will describe the limitations of directional drilling.

I then will provide data on current and projected future increases in Trans-Alaska Pipeline System (TAPS) flow from oil production on state and federal lands available for oil production at this time.

Finally, I will address the likely revenue implications of Arctic Refuge coastal plain oil development.

Overall Importance of the Arctic National Wildlife Refuge and its Coastal Plain

The Arctic National Wildlife Refuge is a vast, wilderness landscape of tundra plains, boreal forests, dramatic mountain peaks, and coastal lagoons situated in the nation's wildest, most northern edge. It is like no other place in America. At 19.3 million acres, it is approximately the

size of South Carolina and contains approximately 7 million acres of Congressionally designated wilderness under the Alaska National Interest Lands Conservation Act.

The Arctic Refuge has no roads, marked trails or campgrounds. Wilderness opportunities abound, from wildlife watching to hiking, rafting and hunting. Its wild, unspoiled nature is central to the refuge's rugged appeal as one of the last truly pristine areas on Earth. For thousands of years the area has been the homeland to Native Gwich'in and Inupiat communities and has sustained them culturally. It provides vital habitat for more than 45 species of mammals including: one of Alaska's largest caribou herds, the Porcupine Caribou Herd, threatened polar bears, wolves, Dall sheep, grizzly bears, and over 160 species of birds. The Arctic Refuge is the crown jewel and largest refuge of our nation's National Wildlife Refuge System and an important part of our nation's heritage. The 1.4 million acre coastal plain of the Arctic Refuge is widely recognized as the biological heart of this 19.3 million-acre refuge.

In 2015, the Obama administration revised the Comprehensive Conservation Plan – the overall management plan - for the Arctic Refuge, after conducting a multi-year, full scientific and policy analysis and a robust public process. The US Fish and Wildlife Service received hundreds of thousands of comments from members of the public, the vast majority of which supported wilderness protection for the coastal plain of the refuge. The 2015 final management plan for the Arctic Refuge included a wilderness recommendation for 12.28 million acres of the refuge – virtually all of the lands not currently designated as wilderness. This decision underscores the significant values of the refuge, including the critical role the refuge plays for sustaining Native cultures, the important benefits the refuge provides to all Americans and its vital habitat for wildlife species, including for adaptation in our changing Arctic climate. The final wilderness recommendation was transmitted to Congress, emphasizing the need for legislative action to protect the refuge, and not develop it for oil and gas. The unparalleled intrinsic values of the Arctic Refuge far outweigh any short-term gains from oil and gas development within its boundary.

The Arctic Refuge's coastal plain region is, for all intents and purposes, one of the wildest and among the most beautiful landscapes in the country (Figure 1). It is as important to our nation's natural heritage as Yellowstone and the Grand Canyon.

Opening the Arctic Refuge coastal plain to oil leasing, exploration, and production unacceptably threatens the Arctic Refuge's globally significant wilderness and wildlife values. Allowing oil development in this region should not be a budget issue, but instead is a complex policy issue that should be decided by Congress through "regular order."

Oil exploration and production activities – even with directional drilling as one component – would substantially undermine the Arctic Refuge's fundamental purposes: to protect wilderness, wildlife, and subsistence, and thus these activities are unacceptable.

Figure 1
Arctic Refuge Coastal Plain

Photo by Lois Epstein, P.E.

Background on the Arctic Refuge Coastal Plain's Importance to Caribou and Polar Bears[1]

The Arctic National Wildlife Refuge is used, with varying frequency, by three of the four herds that calve on the North Slope. The most consistent use of the refuge is by the Porcupine Caribou Herd, which inhabits the refuge throughout the year, including using the coastal plain for calving, insect relief, and other summer habitat.[2] It is critical that calving grounds and other sensitive habitat be protected from anything that may disturb or disrupt caribou use.

Studies of the Central Arctic Caribou Herd provide a cautionary tale about possible effects of energy development on caribou calving and migration within the Arctic Refuge. As development expanded from Prudhoe Bay, caribou using the western calving grounds where new development

[1] Section authored by Dr. Timothy Fullman, Senior Ecologist, The Wilderness Society (Anchorage, Alaska).
[2] Caikoski, J. R. 2015. Units 25A, 25B, 25D, and 26C caribou. Chapter 15, pages 15-1 through 15-24 [In] P. Harper and L. A. McCarthy, editors. Caribou management report of survey and inventory activities 1 July 2012–30 June 2014. Alaska Department of Fish and Game, Species Management Report ADF&G/DWC/SMR-2015-4, Juneau.

occurred, shifted south,[3, 4, 5, 6] while those in the east outside of main development areas did not shift.[3] Food availability was lower for development-exposed caribou[3, 7] which exhibited lower calf body mass[8] and birth rate.[4, 9] A review by the United States Geological Survey concluded there was no clear biological explanation for the shift in concentrated calving in the west, implicating petroleum development as its likely cause.[7] In addition to changes in distribution, research has shown that industrial roads can alter caribou migratory movements[10] and that females about to give birth or with very young calves tend to avoid or are less likely to cross roads and pipelines during the calving season.[7]

It is likely that the responses to development observed in the Central Arctic Caribou Herd will similarly apply to the Porcupine Caribou Herd. In fact, the United States Geological Survey points out a number of reasons why responses may be greater in the Porcupine Caribou Herd compared to the Central Arctic Herd.[7] One major factor is that the coastal plain is narrower within the Arctic Refuge compared to the main Central Arctic Herd range, leaving less room for shifts in space use. Another is that the expansion of development and the shift in Central Arctic Herd calving occurred during a period of relatively favorable environmental conditions. Future environmental changes, due to natural fluctuations or climate change, may reduce the ability of caribou to accommodate range shifts.

Over ¾ of the Arctic Refuge's coastal plain is designated as Critical Habitat for polar bears, which are listed as "threatened" under the Endangered Species Act.[11] The Southern Beaufort Sea polar bear subpopulation, which uses the coastal plain and barrier islands of the Arctic Refuge, is currently in decline, decreasing from just over 1500 bears in 2006 to about 900 in 2010.[12, 13]

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[3] Wolfe, S.A. 2000. Habitat selection by calving caribou of the Central Arctic Herd, 1980-95. MS Thesis, University of Alaska Fairbanks, Fairbanks, Alaska, USA.

[4] Cameron, R.D., Smith, W.T., White, R.G., Griffith, B. 2005. Central Arctic caribou and petroleum development: distributional, nutritional, and reproductive implications. Arctic 58, 1-9.

[5] Joly, K., Nellemann, C., Vistnes, I. 2006. A Reevaluation of caribou distribution near an oilfield road on Alaska's North Slope. Wildlife Society Bulletin 34, 866-869.

[6] Lenart, E.A. 2015. Units 26B and 26C caribou. Chapter 18, pages 18–1 through 18–38 [In] P. Harper and L. A. McCarthy, editors. Caribou management report of survey and inventory activities 1 July 2012–30 June 2014. Alaska Department of Fish and Game, Species Management Report ADF&G/DWC/SMR-2015-4, Juneau.

[7] Griffith, B., Douglas, D.C., Walsh, N.E., Young, D.D., McCabe, T.R., Russell, D.E., White, R.G., Cameron, R.D., Whitten, K.R. 2002. The Porcupine caribou herd. Pages 8-37 [In] Douglas, D.C., Reynolds, P.E., Rhode, E.B., editors. Arctic Refuge coastal plain terrestrial wildlife research summaries. U.S. Geological Survey, Biological Resources Division, Biological Science Report USGS/BRD/BSR-2002-0001.

[8] Arthur, S.M., Del Vecchio, P.A. 2009. Effects of oil field development on calf production and survival in the Central Arctic herd. Alaska Department of Fish and Game. Federal Aid in Wildlife Restoration. Final Research Technical Report. Grants W-27-5 and W-33-1 through W-33-4. Project 3.46. Juneau, AK, USA.

[9] National Research Council. 2003. Cumulative environmental effects of oil and gas activities on Alaska's North Slope. National Academies Press, Washington D.C., USA.

[10] Wilson, R.R., Parrett, L.S., Joly, K., Dau, J.R. 2016. Effects of roads on individual caribou movements during migration. Biological Conservation 195, 2-8.

[11] United States Fish and Wildlife Service. 2017, June. Marine Mammal Management, Endangered Species Act Listing: Polar Bear, https://www.fws.gov/alaska/fisheries/mmm/polarbear/esa.htm.

[12] Regehr, E. V., S. C. Amstrup, and I. Stirling. 2006. Polar bear population status in the southern Beaufort Sea. U.S. Geological Survey Open-File Report 2006-1337.

[13] Bromaghin, J. F., T. L. McDonald, I. Stirling, A. E. Derocher, E. S. Richardson, E. V. Regehr, D. C. Douglas, G. M. Durner, T. Atwood, and S. C. Amstrup. 2015. Polar bear population dynamics in the southern Beaufort

Recent research has found that decreasing sea ice due to climate change has increased the use of terrestrial habitats by these polar bears.[14] Greater time on land reduces availability of the polar bears' main seal prey and can lead to poorer body condition and lower cub survival rates.[15]

In light of these declines and the increasing stresses of climate change on polar bears, there are great concerns about the cumulative impacts that potential development on the Arctic Refuge coastal plain would place on polar bear populations. Oil development activities have disturbed polar bears from maternity dens[16] and any development within the Arctic Refuge will increase the potential that onshore bears will be disturbed by human activities, as well as increasing the potential for human-polar bear conflict.[17]

What Oil Development Means for the Arctic Refuge Coastal Plain

Oil and gas drilling and production is an inherently complicated and messy business. Even the best and most well-financed operators cannot ensure they will not have crude oil, hazardous materials or produced water spills. Nor can operators prevent all blowouts because they may encounter unexpected or changing conditions that have not been adequately addressed. Additionally, there is always a tension for oil companies between reducing costs while still maintaining regulatory compliance, safety and environmental protection.

This year, BP had a production well blowout due to thawing permafrost on the North Slope, which could have been much more serious had the gas ignited. International well kill specialists Boots & Coots came to Alaska to shut down this well. This week, the Alaska Oil and Gas Conservation Commission (which oversees all oil and gas wells in the state) ordered a review of every North Slope well to determine if they have designs that have the potential for dangerous and environmentally damaging blowouts.[18]

During the winter of 2012, Repsol had an exploratory well blowout on the North Slope that spewed approximately 42,000 gallons of drilling muds; it took a month to plug that well because frigid temperatures slowed down or prevented work during that period.

BP's March 2006 spill of over 200,000 gallons was the largest crude oil spill to occur in the North Slope oil fields and it brought national attention to the chronic nature of such spills. Another pipeline spill in August 2006 resulted in shutdown of BP's production in Prudhoe Bay and brought to light major concerns about systemic neglect of key infrastructure. Lack of adequate preventive maintenance is not a new issue, however, as corrosion problems in Prudhoe

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[14] Atwood TC, Peacock E, McKinney MA, Lillie K, Wilson R, Douglas DC, et al. 2016. Rapid Environmental Change Drives Increased Land Use by an Arctic Marine Predator. PLoS ONE 11(6): e0155932. doi:10.1371/journal.pone.0155932

[15] Rode, K. D., S. C. Amstrup, and E. V. Regehr. 2010a. Reduced body size and cub recruitment in polar bears associated with sea ice decline. Ecological Applications 20:768-782.

[16] National Research Council. 2003. Cumulative environmental effects of oil and gas activities on Alaska's North Slope. National Academies Press, Washington D.C., USA. p. 157.

[17] Amstrup, S.C. 1993. Human Disturbances of Denning Polar Bears in Alaska. Arctic 46(3), 246-250.

[18] Demarban, A., State regulators launch wide review of North Slope oil fields following BP leak, *Alaska Dispatch News*, retrieved November 1, 2017 from https://www.adn.com/business-economy/energy/2017/10/30/state-regulators-launch-wide-review-of-north-slope-oil-fields-following-bp-leak/ (October 30, 2017).

Bay's and other oil field pipelines have been raised previously by regulators and others, including as early as 1999 by the Alaska Department of Environmental Conservation.[19]

The State of Alaska completed a report in November 2010[20] which reviewed over 6,000 North Slope spills from 1995-2009. This report showed that there were 44 loss-of-integrity spills each year[21] with 4.8 of those each year greater than 1,000 gallons,[22] meaning that there is a spill of 1,000 gallons or more nearly every two months.

In 2009, TWS issued a report on North Slope spills entitled *Broken Promises*[23] which should be used in conjunction with the state's North Slope spill report. The TWS report shows a spill frequency on the North Slope of 450 spills each year during 1996-2008, with the difference being that the state included only "production-related" spills in its analysis and excluded North Slope toxic chemical (e.g., antifreeze) and refined product (e.g., diesel) spills - many of which are related to oil development - as well as spills indirectly related to oil production infrastructure, such as those from drilling or workover operations and from vehicles.

According to the Alaska Department of Environmental Conservation's database,[24] there have been 121 reported crude oil spills on the North Slope during the five years from October 30, 2012 until October 30, 2017 or approximately two crude oil spills per month. Additionally, there have been 1,647 reported spills of all types on the North Slope during this period, which is nearly one spill per day.

In addition to spills, oil development infrastructure would sprawl over vast parts of the coastal plain and not be confined to 2000 acres as some have said. In several introduced bills, the 2,000 acre limitation has not included all infrastructure necessary for oil and gas exploration and development. For example, it has not included roads, gravel mines, and even pipelines, except for the limited places where their support posts touch the ground. Additionally, the bills do not contain meaningful requirements to consolidate operations or avoid duplicative infrastructure.

Beyond spills and the direct footprint of well pads, there would be air pollution and noise from generators, trucks, aircraft, and processing facilities; long-distance pipelines and, potentially, gravel roads that could individually and in combination deter some caribou from crossing; waste streams and wastewaters from drilling operations and living quarters that would require disposal; and the use of substantial quantities of water from fish-bearing lakes for ice roads. These sprawling industrial activities also would severely restrict access for subsistence and recreation.

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[19] Charter for the Development of the Alaskan North Slope, December 2, 1999, (BP ARCO Merger Agreement), http://www.dec.state.ak.us/spar/ipp/docs/Charter%20Agreement.pdf.

[20] Nuka Research & Planning Group, LLC, North Slope Spills Analysis: Final Report on North Slope Spills Analysis and Expert Panel Recommendations on Mitigation Measures, for the Alaska Department of Environmental Conservation, 244 pp., retrieved November 1, 2017 from http://dec.alaska.gov/spar/PPR/ara/documents/101123NSSAReportvSCREENwMAPS.pdf (November 2010) .

[21] *Ibid.*, p. 21.

[22] *Ibid.*, p. 23.

[23] The Wilderness Society, Broken Promises: The Reality of Oil Development in America's Arctic (2nd Edition), (2009).

[24] See the Alaska Department of Environmental Conservation Spills Database Search website: http://dec.alaska.gov/Applications/SPAR/PublicMVC/PERP/SpillSearch.

Realistically Assessing Directional Drilling

Directional or extended reach drilling for oil, which is not a new technology and which means drilling at an angle, has the same impacts as vertical well drilling with one exception – smaller well pads. Directional drilling requires surface occupancy for drill rigs, well pads, pipelines, roads and human infrastructure, though at locations near but not immediately above oil and gas reservoirs. Permanent gravel roads and airstrips are still needed, pipelines are still required, and pollution and toxic spills are still inevitable. Additionally, oil and gas operations on the North Slope have proven impacts to subsistence.[25]

Those familiar with directional drilling know that, for technical reasons, directional drilling only has a range of a few miles. The maximum horizontal distance drilled to date on the North Slope is approximately five miles. Even the new, costly "state-of-the-art" drilling rig Doyon is building which is expected to be operational in 2020 will only be able to drill wells 6.25 miles. Moreover, that distance would be the exception, not the rule.

Because of higher costs due to longer wells, directional drilling may or may not be used by industry for exploratory drilling. As discussed by Mr. Kevin Banks of the Alaska Department of Natural Resources during the May 10, 2011 Senate Energy and Natural Resources Committee hearing, oil companies actually prefer not to use directional drilling for exploratory wells because doing so would provide less technical information about subsurface conditions.

As a result of its short range and it not being cost-effective or technically optimal for exploratory drilling, any bill proposing to require directional drilling to access the Arctic Refuge's coastal plain:

1. Misleads decision-makers by ignoring the need for surface use across extensive areas for seismic exploration, including 3-D surveys, and exploratory and reserve delineation drilling. In the Arctic, seismic exploration typically involves heavy vehicles driving across the tundra in a grid pattern, compressing sensitive soil and plants. Tundra recovery from seismic activities can take decades.[26] and
2. Misleads decisionmakers and the public by implying that oil production would be forever limited to the distance accessible via directional drilling, and that directional drilling somehow eliminates or minimizes impacts. Should oil production proceed, there will be calls to expand drilling to reach portions of reservoirs not accessible via directional drilling.

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[25] For example, in 2015 the Bureau of Land Management approved ConocoPhillips' drilling permit for the sixth development pad extending out from Alpine, at Greater Mooses Tooth 1 (GMT1). In approving the development, BLM recognized that there would potentially be significant impacts related to subsistence, sociocultural systems, environmental justice, and other values from GMT1, and that future developments in the region that could not be adequately mitigated by existing mitigation measures.

[26] Seismic trails made from the 2-D seismic surveys in the refuge in the 1980s remain visible to this day. Newer 3-D seismic surveys on the North Slope deploy even more vehicles than older 2-D seismic surveys and make a grid profile with line spacing of only a few hundred yards — ten times closer than older 2-D seismic convoys. These intrusive surface exploration activities — which are typically employed year after year throughout the life of an oil field — would cause severe and long-lasting damage to the Arctic Refuge.

Directional drilling rhetoric is a Trojan Horse for access to the entire Arctic Refuge coastal plain for oil production.

The bottom line with directional drilling is that eventually the entire 1.5 million acre coastal plain will be industrialized if there is sufficient oil to be found there. Wildlife using federally-protected areas do not recognize political boundaries and will encounter directional drilling-related well pads, roads, pipelines and spills. Moreover, wildlife movements are not always predictable from year to year, particularly with the advent of climate change. There's no question that conducting directional drilling activities immediately adjacent to federally-protected areas like the Arctic Refuge would have significant, harmful ecological impacts.

Trans-Alaska Pipeline Throughput is Increasing

Because of increased production from existing operations and recent oil discoveries on state and federal lands currently open to oil development, TAPS' throughput, or flow, has been increasing since 2015. According to the Alaska Department of Revenue, throughput this fiscal year is projected to be 533,000 barrels per day, up from 501,000 barrels a day from three years ago, an increase of over six percent. [27]

Perhaps even more importantly, the Alaska Department of Natural Resources expects TAPS throughput to continue increasing through the late 2020s due to significant new discoveries that are now in pre-operational phases (Figure 2). These discoveries, which are not on federally-protected lands, include Armstrong's Pikka Nanushuk project on state lands and the ConocoPhillips' Willow and Greater Mooses Tooth projects in parts of the National Petroleum Reserve – Alaska currently open to development.

Alaska's North Slope oil producers and, indeed, all Alaskans have a financial interest in keeping operating. There are several ways to ensure that TAPS continues to operate even if there is declining flow over the long-term including technical upgrades to the pipeline such as adding heat; TAPS' operator, Alyeska, is employing those measures. Notably, although TAPS currently is operating at less than at its peak, pipelines are always designed and operated to carry less than peak flow.

Despite in-state and DC-based rhetoric, drilling on currently protected federal lands or waters is <u>not</u> necessary to ensure that TAPS remains viable for decades to come.[28]

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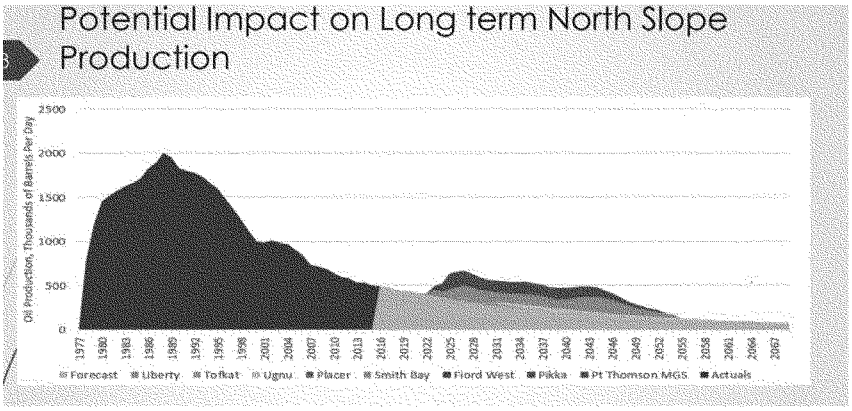
[27] Demarban, A., After a long decline, Alaska expects third straight year of increased oil production, *Alaska Dispatch News*, retrieved from https://www.adn.com/business-economy/energy/2017/10/25/after-a-long-decline-alaska-expects-third-straight-year-of-increased-oil-production/ (October 25, 2017).

[28] See Epstein, L., Trans-Alaska Oil Pipeline Flow: Doing Just Fine After Forty Years, 11 pp. https://wilderness.org/sites/default/files/Alaska%20Pipeline%20Report.pdf (June 2017).

Figure 2
Alaska Department of Natural Resources Projections of TAPS Throughput[29]



CBO's 2012 Estimate of Arctic Refuge Coastal Plain Revenues Does Not Reflect Current Market Conditions

The most recent Congressional Budget Office (CBO) report on Arctic Refuge coastal plain leasing was issued on February 7, 2012.[30] This five year old report – with just four pages and limited documentation – estimates there would be $5 billion in bonus bids for those leases split between the state and federal governments. Crude oil prices were far higher in 2012, however, making Arctic drilling significantly more attractive than today. According to the Energy Information Administration (EIA), "On February 2, Brent settled at $112.07 per barrel, unchanged from its closing price on January 3, and West Texas Intermediate (WTI) settled at $96.36 per barrel…There have been several developments related to the crude oil market over the last month but none have provided new direction to prices."[31] Thus, worldwide crude oil prices were over $100 per barrel at the time of the 2012 CBO report.

EIA's latest crude oil price analysis states that "North Sea Brent crude oil spot prices averaged $56 per barrel (b) in September, an increase of $4/b from the average in August. EIA forecasts Brent spot prices to average $52/b in 2017 and $54/b in 2018, which is $1/b higher in 2017 and

[29] Umekwe, P., Alaska's 10-year Oil Production Outlook And Potential Future Developments Report, Alaska Department of Natural Resources, presented to the Alaska Support Industry Alliance, retrieved October 30, 2017 from http://alaskaalliance.com/wp-content/uploads/2013/10/Pascal-Umekwe-AK-10-Year-Oil-Production-Outlook.pdf (April 27, 2017). Perhaps mistakenly, although ConocoPhillips' Willow project is far along and included in this presentation, its estimated 40,000-100,000 barrels per day of oil production is not included in this figure.

[30] Congressional Budget Office, Cost Estimate: H.R. 3407, Alaskan Energy for American Jobs Act, (February 7, 2012).

[31] Energy Information Administration, Short-Term Energy Outlook; Market Prices and Uncertainty Report, retrieved October 30, 2017 from https://www.eia.gov/outlooks/steo/uncertainty/pdf/feb12_uncertainty.pdf (February 7, 2012).

$2/b higher in 2018 compared with last month's forecast. West Texas Intermediate (WTI) average crude oil prices are forecast to be $3.50/b lower than Brent prices in 2018."[32] Thus, worldwide crude oil prices are only just over $50 per barrel today, approximately half of what they were at the time of the 2012 CBO report.

With today's crude oil prices and unlikely price increases in the near to medium term, it is highly unlikely revenue and bonus bids on Arctic Refuge coastal plain leases will come anywhere close to CBO's or others' estimates.[33, 34] Billion or more dollar estimates are out of touch with the realities of leasing on the North Slope. Since 2000, the average North Slope onshore bid has been just $34 an acre. A recent report from the Center for American Progress estimated that leasing in the Arctic Refuge coastal plain is not likely to yield more than $37.5 million for the U.S. Treasury over 10 years — nowhere close to the estimates.[35]

CBO in 2012 acknowledged its bonus bid estimates are "uncertain"[36] since "oil companies have other domestic and overseas investment options that they would evaluate and compare with a potential investment in [the Arctic National Wildlife Refuge]."[37] To include highly speculative revenues from coastal plain leasing as an offset for the current budget reconciliation process when those revenues are likely to be both minimal and extremely unlikely to reach the reconciliation bill's instructions with known market conditions is, many believe, an abuse of the legislative process.

Inclusion of the Arctic Refuge in the budget is less about meeting revenue targets and more about approving a controversial measure to open the Arctic Refuge coastal plain to oil development without the possibility of a filibuster.

Conclusion

TWS greatly appreciates the opportunity to provide the committee, the Senate, and others with this important information on a unique and important portion of our country's natural heritage, the Arctic Refuge's coastal plain.

Thank you very much for your attention to these important issues. I look forward to answering your questions.

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[32] Energy Information Administration, Short-Term Energy Outlook; Market Prices and Uncertainty Report, retrieved October 30, 2017 from https://www.eia.gov/outlooks/steo/report/prices.cfm (October 11, 2017).
[33] Dlouhy, J. and Nussbaum, A., Low Oil Prices Dim GOP Bid for Budget Bonanza in Arctic, *Bloomberg*, retrieved November 1, 2017 from https://www.bloomberg.com/news/articles/2017-10-31/arctic-refuge-oil-bonanza-more-likely-to-be-bust-for-gop-budget (October 31, 2017).
[34] Some revenue estimates assume every coastal plain acre would be leased and at an extraordinarily high rate not typically found for other onshore Alaska least tracts, making such revenue estimates highly unlikely if not impossible to realize.
[35] Center for American Progress, Arctic National Wildlife Refuge 101, https://www.americanprogress.org/issues/green/news/2017/10/10/440559/arctic-national-wildlife-refuge-101/ (Oct. 10, 2017).
[36] Congressional Budget Office, *op. cit.*, p. 2.
[37] *Ibid.*, p. 3.

The CHAIRMAN. Thank you, Ms. Epstein.
Mr. Glenn, welcome.

STATEMENT OF RICHARD K. GLENN, EXECUTIVE VICE PRESIDENT FOR LANDS AND NATURAL RESOURCES, ARCTIC SLOPE REGIONAL CORPORATION

Mr. GLENN. Thank you, Madam Chairman, Committee members. I'm happy to see that the other half of the Arctic Coalition of America is here. So thank you for staying for the hearing, Senator King.

My name is Richard Glenn. I'm the Vice President of Lands for the Arctic Slope Regional Corporation (ASRC). It's an Alaska Native Corporation created by Congress in 1971. It's headquartered on the North Slope and it includes villages such that extend from the west to the east in the Arctic region of Alaska from Point Hope, Point Lay, Wainwright, Atqasuk, Utqiaġvik, Nuiqsut, Kaktovik, and Anaktuvuk Pass. North Slope village residents there have always depended upon subsistence resources from the land, the rivers, and the ocean.

I'm a tribal member. Mr. Schutt is a tribal member. Matthew Rexford who spoke before me is a tribal member. Our Lieutenant Governor is a tribal member, and I was particularly stung by the Ranking Member's comments that said she didn't see tribal members. Maybe she just didn't find enough tribal members that agree with her position. I hope that you hear from all of the tribal members of the State of Alaska, the majority of whom support safe, responsible exploration and development in ANWR.

I'm also not here to debate the sacredness of the land on either side of the Brooks Range, the north or the south. For us, all the lands are sacred. They contain the bones of our ancestors. And I'm not talking about ancient people. I'm talking about people in living memory. We didn't start burying our dead until around the 1920s. So my great grandparents were the first generation of folks who were buried right after the flu epidemics swept through the region. Before those days the tradition was to leave the residence, however temporary it was, where the person died. So ancient sod houses, up until the early 1900s carry the bones of our people. And some of my ancestors' bones, my grandmother's, my grandfather's grandmother, are in Prudhoe Bay. Others are scattered along the Coastal Plain from the Canadian border to Point Hope.

Our people are named after the places. The places are named after the people. Some of it is state land, some of it is federal land, some of it is native-owned land, but it's all equally sacred.

Yet, we depend on that land for development. We depend upon that land for food. And I don't wish to trivialize anyone's dependence on the resources because ours is equally as important.

ASRC, as a corporation, owns a piece of this heritage, 92,000 acres of land on the Coastal Plain of ANWR, along with Matthew Rexford's Village Corporation, the Kaktovik Iñupiat Corporation. These lands hold resource potential for oil and gas development.

I'm a geologist by training. I help drill and develop natural resources on the North Slope. I know the practices related to drilling, and I've seen the evolution over the past 50 years and 30 or so years of my own professional life from really simple drilling, cementing, and production to the ornate and efficient diagrams that

you've seen here on the posters that Mr. Schutt presented so effectively. The reduced footprint is real. Hundreds of square miles drained by tens of acres of development.

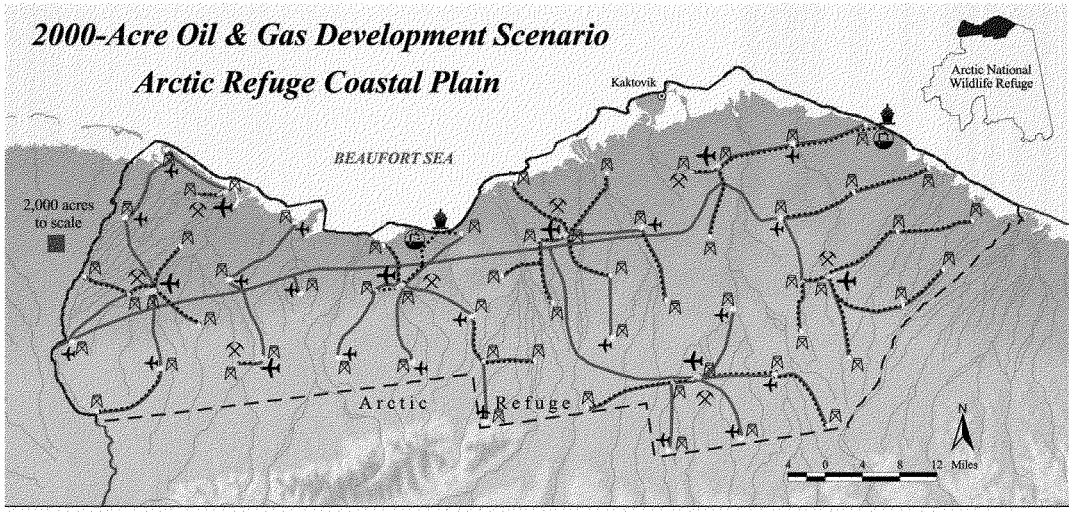
Senator King asked how many wells are we talking about? How much surface impact? We have real world answers to those questions. They're here at the table. They're here in the audience.

In the west end of today's exploration on the Colville River Delta and just to the west, where the Native folks from another village 100 miles from Kaktovik also own some resource potential. Five hundred wells have been drilled down to depths around 8–9,000 feet and radiating outward as far as five or six miles.

On these 500 wells, production wells, injector wells, they're done from four basic, central facilities for drilling, covering maybe 300 acres of land. So now we're talking real world examples, real world numbers of wells for at its peak hundreds of thousands of barrels per day in production. That's the kind of development that we envision moving into the Coastal Plain of ANWR.

This is a cartoon. This diagram shows dramatic exaggerations. If you'd follow the scale of this map, the dots themselves are two miles across each. The well symbols themselves are three miles high. The pipelines, if they're shown, as they've shown on this map, that pipeline, it would be a quarter mile wide. This is not realistic. If you want to see realistic development, look at realistic numbers, go to the areas of modern exploration and development.

[The information referred to follows:]



This speculative development scenario is based on the 2,000-acre "limitation" in the House Energy Bill (H.R. 6).

It makes these assumptions:
Industry has 4-mile directional drilling reach from Drill Sites

Facilities included in the 2,000-acre maximum:

- 8 Alpine-type fields @ 82 acres each (Central Processing Pad with housing, storage, drilling; second Drill Site; airstrip)
- 19 Satellite fields like proposed Alpine satellite, Fiord @ 37 acres each (Drill Site, airstrip or storage pad)
- 26 Satellite fields like proposed Alpine satellite, Nanuk @ 11 acres each (Drill Site)
- 2 Docks @ 5 acres each (1,100 foot long solid-fill gravel causeway like Badami)
- 2 Seawater treatment Plants @ 100 acres each

Facilities not subject to the 2,000-acre limitation:

- Roads (in-field roads; main roads to docks, etc.)
- Pipelines (main trunk and sales lines, feeder lines; except negligible amount for support posts (VSM's))
- 8 Gravel Mines @ 150 acres each

Facilities and activities not subject to the 2,000-acre limitation that are not mapped:

- Seismic exploration trails
- Exploration and delineation wells
- Water reservoir excavations, Water withdrawal sites
- Ice roads

- Arctic Refuge Coastal Plain (1002 Area)
- Arctic National Wildlife Refuge

And yet, one thing we learned in production is production declines. It starts at a peak and begins a decline. And the lion in the room on Alaska production is Prudhoe Bay. The Prudhoe Bay and Kuparuk River oil fields were super giant oil fields and we're on the shoulders of their decline and the new discoveries, as significant as they are and as thankful as I am that they have been discovered, they can't match the slope of the decline. They only change its slope. It's still a decline.

Meanwhile, 92,000 acres and the million or so acres of the Coastal Plain of ANWR, set aside just for its energy potential, lies fallow and we can't even test their potential unless Congress acts.

We think that the Alaska Native landowners of Kaktovik and the folks from the Arctic Slope region cannot realize their right to economic self-determination if Congress fails to lift the prohibition on safe and responsible exploration and development of the Coastal Plain. So Congress needs to act.

My organization was an agreement made between Congress and the tribes of Alaska. We didn't ask for it. In fact, we fought against it, but we're living with the results. And so, in our region we have a braided relationship of municipalities, tribes, and ANCSA corporations. We're all welded together, braided together, like a rope. So you can't separate tribe from corporation and you can't separate our mother's languages from the language of discourse we're using here today. I could speak in the language of my mother and it would be gibberish to you and, frankly, disrespectful to everybody.

The only indigenous people that should be listened to the loudest are the folks from Kaktovik. And today's hearing to me shows there's a lack of attention paid to them. Listen to what they're saying. They need an economy. They need development in their area. They want to have the freedom to do what the rest of the country seemingly takes for granted. We're talking about reliable power and water and schools and the ability to use sanitation that keeps their kids healthy. I strongly recommend that the Committee look at the testimony of the folks from the village of Kaktovik.

If you look at the tribal folks from throughout Alaska, we don't agree 100 percent, but the majority do agree. We believe that wildlife and development can coexist. They already do today. In fact, we're collaring caribou that are calving in the area of current development around Prudhoe Bay and the Kuparuk River. This is the Central Arctic Caribou herd.

The Alaska Fish and Game, U.S. BLM, and North Slope Borough Wildlife biologists are collaring caribou that are calving in the area of infrastructure and then migrating South to Arctic Village to be hunted by our Gwich'in neighbors to the south. So we already are hunting caribou who are calving in areas of development. I've had the honor of taking some of you on tours of North Slope development. We see caribou there underneath pipelines, sometimes underneath facilities like man camps and hotels. And when they're trying to get away from summer mosquitos, caribou will go anywhere. They'll be laying down right on the tundra next to the buses that are taking the codels through the area. The caribou aren't afraid.

The CHAIRMAN. Richard, we are going to have to ask you to wrap up.

Mr. GLENN. The caribou aren't afraid because they're not being hunted. They're not being hunted there. So the wildlife and infrastructure can coexist.

We speak in favor of a safe and expeditious opening of the 1002 Area. It will be good for our region, our state, and our country.

Thank you.

[The prepared statement of Mr. Glenn follows:]

The Potential for Oil and Gas Exploration and Development in ANWR's 1002 Area

Written Testimony
of
Richard K. Glenn
Executive Vice President for Lands and Natural Resources
Arctic Slope Regional Corporation

November 2, 2017

Before the
United States Senate Committee on Energy and Natural Resources

Chairman Murkowski, Ranking Member Cantwell, and Members of the Committee:

My name is Richard Glenn and I am a resident of Alaska. I am a geologist by training and serve as Executive Vice President for Lands and Natural Resources of Arctic Slope Regional Corporation (ASRC), which is headquartered in Utqiaġvik (formerly Barrow), on Alaska's North Slope. The North Slope region of Alaska includes the villages of Point Hope, Point Lay, Wainwright, Atqasuk, Utqiaġvik, Nuiqsut, Kaktovik, and Anaktuvuk Pass. The residents of the villages that I have named are also citizens of the North Slope Borough, a home-rule municipality. They are largely Iñupiat (North Alaskan "Eskimos"); and they comprise many of the shareholder owners of ASRC. North Slope village residents depend on subsistence resources from the land, rivers and ocean, as they have for millennia.

ABOUT ASRC

Arctic Slope Regional Corporation is one of twelve land-owning Alaska Native regional corporations created at the direction of Congress under the terms of the Alaska Native Claims Settlement Act of 1971 (ANCSA). ASRC's region is the North Slope of Alaska and encompasses 55 million acres (the informal names "North Slope" and "Arctic Slope" are geographically identical and are alternately used when one or the other has become more associated with a given usage or is a part of a formal name).

THE ISSUE

ASRC and Kaktovik Iñupiat Corporation (KIC) own more than 92,000 acres, surface and subsurface in the ANWR Coastal Plain. These lands hold significant potential for onshore oil and gas development. However, as a result of Section 1003 of the Alaska

National Interest Lands Conservation Act (ANILCA), these important resources remain off limits to ASRC and KIC.

To not allow the safe and responsible exploration and development of the Coastal Plain of ANWR, lands set aside specifically for their resource potential, is to deny the Kaktovik residents and Native landowners there a right to economic self-determination on their own lands.

As a representative of the landowners of Alaska's North Slope who has long debated the merits of exploration in our region, I would like to address another issue: When considering whether to open the Coastal Plain of ANWR, opponents will say that "we already have the NPR-A". Yet when trying to develop NPR-A, I have heard opponents will say "just because it is called NPR-A, it should not be treated as a gigantic fuel container". When the Arctic OCS is considered for exploration and development, opponents will say "explore on land, in the NPR-A, and in ANWR first". It is a constant game of *Hide the Ball*, conducted by people who in reality want no development anywhere.

THE FOOTPRINT

The presence of the oil and gas industry in our region is the economic base responsible for improvements to our cities and towns from formerly hardscrabble conditions. Our community is and has been empowered by oil and gas development; it is the only viable industry in our region today.

The lands of Alaska's North Slope contain some of the nation's most promising energy resource potential. The supergiant Prudhoe Bay (initial production in the 1970's) and Kuparuk River (1980's) fields were discovered and developed on State-owned North Slope lands.

As production from the supergiant fields declined over time the industry expanded their development efforts onto adjacent state-, federal- and Native-owned lands.

Senator Murkowski, the North Slope exploration and development industry has during this period of time, nearly five decades, gone through an amazing evolution. Production decline of giant fields spurred new and safer seismic exploration. Wildlife populations on land and in our rivers and estuaries were unaffected. The isolated location, absence of roads, and overall respect for the environment triggered seemingly light-years of technological advancements: extended reach horizontal and directional drilling, innovative completion techniques, sweeping of formation fluids with arrays of injectors and producers, and others. Collectively, these advancements

have resulted in the dramatic reduction of the surface acreage, or "footprint" necessary to efficiently and safely produce a large (and growing) subsurface area.

The statistics are impressive. Seismic exploration is done in winter with techniques that cause no harm and leave virtually no trace when the snow and ice melt in the springtime. Drilling conducted from ice pads is impossible to detect a few short months later. Production of a huge subsurface area can be done without permanent roads and with minimal surface footprint. To illustrate, let's use real industry numbers and the Washington DC area as an example. With surface production and processing facilities whose footprint is as large as the US Capitol Building and surrounding grounds, using the drilling and production techniques described above, today's practices can efficiently and safely produce from an area greater than the entire District of Columbia. With extended reach drilling reaching safe distances as far as six miles in a given direction, wells sited at the Capitol can tap the resources under Hyattsville, Maryland to the northeast and Alexandria, Virginia to the southwest. A well sited under FedEx Stadium could drain the area beneath Andrews Air Force Base.

I know this because I have seen production of this magnitude on our lands. The technologic innovations have been tried and proven on Native-owned lands belonging to another village in our region a hundred miles away from ANWR's 1002 Area.

HUMAN RIGHTS VS. ANIMAL RIGHTS

For too long the human rights issue in this debate has been ignored, even hijacked by the opposition. The simple fact of the matter is that there is but one indigenous population that resides within the Coastal Plain. In fact, there is but one indigenous people within the entire 19.6 million acres of the ANWR and they are the Iñupiat from Kaktovik (Kaktovikmiut).

The opposition, specifically the environmental lobby, should not be the voice for the future sustainability of Kaktovik; it should be the local people and land owners.

Throughout the life of this issue, the big and powerful environmental lobby have gone into Native communities with promises of trips around the world and per diem to individuals who are willing to be the Native face of this opposition. Giving them a platform so large it has turned this into an emotional movement filled with half-truths which generate large donations to the environmental lobby's so called "non-profit" organizations. In the meantime it squelches the voices of the Iñupiat in the process.

Rather than debating the merits of responsible development, sadly, the environmental lobby has successfully pitted the Gwich'in Indians from Interior Alaska against the North Slope Iñupiat.

Unfortunately, we feel that we have more in common with them and have sought an amicable solution for years. We have invited them north to see our communities and visit with our people. Those invitations have been extended at least a dozen times to no avail.

The opposition will tell you that this place is sacred to the Gwich'in because it is the calving ground of the Porcupine caribou, and they are caribou people. The residents of Kaktovik, too, are dependent upon caribou for survival- because it fills the freezer and puts food on the table. The calving grounds are in the backyard of the Kaktovikmiut. It is in the best interest of Kaktovik to also sustain this herd so that it may migrate through Canada's oil rich Eagle Plain Basin and back into the Gwich'in territory of Alaska.

ASRC is not here to debate this issue on the merits of "sacredness". To us, all of our lands are sacred. All across the North Slope, including the Coastal Plain, these lands contain sod-house ruins and graves of our ancestors. These sites can be trace from thousands of years to the memory of people alive today.

It is unfortunate that the environmental lobby continues to promote half-truths or allow for the misrepresentation of history. History shows that the Iñupiat opposed development when oil was first discovered in Alaska, but then realized that our people needed a seat at the table to protect our subsistence lifestyle and practices. The Iñupiat were proactive and formed the North Slope Borough, our county form of government, to ensure that seat at the table had authority. We have worked alongside the industry to ensure development takes place on our terms, with the appropriate protections incorporated into development projects so as to perpetuate sustainable wildlife populations, including the caribou. Conversely, history will also show that when the Gwich'in leased their lands for oil and gas exploration and development in the 1980's, **no protections** for the caribou were incorporated into their lease agreements. Further, while the Gwich'in chose to serve as the face of the environmental lobby, residents of their communities have worked in our companies for decades. These are companies that work in ***our*** backyard and service Alaska's oil industry.

History will show that it has been our desire for over two decades to work with the Gwich'in, and that invitation remains open today.

ASRC strongly recommends the Committee look at the human rights aspect of this issue from the lens of the Kaktovikmiut. As the aboriginal environmental stewards of their backyard, there is no better perspective.

CONCLUSION

On the North Slope, we believe that exploration and production can be conducted safely. The reality is that the survival of our region and the development of our communities today depend on continued exploration and production. Without this economic driver, our communities will need access to greater government subsidies and programs in order to be sustained. We speak in favor of a safe and expeditious opening of the 1002 Area. It will be good for our region, our state and our country. Thank you for the opportunity to provide comments today.

The CHAIRMAN. Thank you, and hopefully we will have an opportunity to ask more so that you can continue.

Pat—Mr. Pourchot, welcome.

STATEMENT OF PAT POURCHOT, FORMER SPECIAL ASSISTANT TO THE SECRETARY OF THE INTERIOR FOR ALASKA AFFAIRS, ANCHORAGE

Mr. POURCHOT. Chairman Murkowski, Members of the Committee, thank you for the privilege to testify today on the Arctic National Wildlife Refuge.

Today I am testifying as a retired public servant and a private citizen. My past "lives" over 45 years in Alaska have included serving in the Alaska State Legislature, as Commissioner of the Alaska Department of Natural Resources, work for the Alaska Federation of Natives and Audubon Alaska, and most recently, Special Assistant to the Secretary of the Interior for Alaska Affairs. I would confess from the onset that I have worked for politicians and organizations that have favored drilling in the Arctic Refuge and for those that have opposed exploration and development. Since my participation as a Congressional staffer in the passage of the Alaska National Interest Lands Conservation Act, or ANILCA, 40 years ago, I have witnessed the decades of debate on the issue of permitting oil and gas leasing and development in the Refuge.

As an Alaskan, I appreciate the economic benefits that might accrue from oil development in the Refuge. But I have come to the conclusion that the last piece of America's Arctic is more appropriately left as wilderness as a far more valuable legacy for future generations.

I have had the opportunity to hike the mountains and float wild rivers in the Refuge, to observe herds of caribou on the Coastal Plain, witness dozens of polar bear on the Beaufort Sea coast and fly over thousands of snow geese gathering on the Coastal Plain of the Refuge. There can be no denying that the Arctic Refuge is one of the most special and spectacular places on the planet.

America's Arctic Coastal Plain stretches over 600 miles from the Canadian border westward to the Chukchi Sea. Most of this area is available for oil and gas development. In the Central Arctic, oil development on state lands surrounding Prudhoe Bay sprawls for over 100 miles along the Beaufort Sea coast. Further west, leasing and development are proceeding in the 23-million-acre National Petroleum Reserve–Alaska. And now it is proposed to explore and develop the last remaining part of the Arctic Coastal Plain, our national heritage.

Some argue that the 1.5 million acres of Coastal Plain proposed for development in the Refuge represents only a small fraction of the Refuge and development would not significantly impact the overall Refuge, but the narrow Coastal Plain is the biological and ecological "heart" of the Refuge. The Coastal Plain is an integral component of the Refuge's ecosystem and provides key habitat for calving and migrating caribou, waterfowl, nesting shorebirds, and denning sites for polar bear.

The resources report called for in section 1002 of ANILCA, issued in 1987, found that the "1002 Area is the most biologically produc-

tive part of the Arctic Refuge for wildlife and is the center of wildlife activity."

And why are we proposing to develop the last remaining part of the Arctic Coastal Plain? Are we at war and need more oil for our nation's security? Have we run out of oil, gas, and gasoline for our homes and cars? Do we really think that leasing revenues will significantly help our federal and state budgets? The answer is clearly no, to all these questions. And the answer should be no to the question of allowing oil and gas development in the Refuge.

I was greatly moved by the documentary, "The National Parks: America's Best Idea." In the late 1950s a dedicated group of Fairbanks residents, including the Fairbanks Garden Club, had a "best idea" to protect wild public lands spanning the Brooks Range in the northeast corner of Alaska. In 1960 the nine-million-acre Arctic National Wildlife Range was created under a land order by Secretary of the Interior Seaton for the purpose of "preserving unique wildlife, wilderness, and recreational values." This "great idea" was renewed in 1980 with the passage of ANILCA in which the Range was expanded and renamed the Arctic National Wildlife Refuge. Its purposes were laid out in statute "to conserve fish and wildlife populations and habitats in their natural diversity."

Ken Burns' documentary vividly demonstrates how the heroes of our nation's history are those who had the foresight to protect and defend America's cultural and natural treasures for the benefit and enjoyment of future generations. Those folks of Fairbanks helped protect something of preeminent value to the nation, a generation ago, for those of us today. Conversely, history and our children will not honor those that would deface one of America's most treasured landscapes. The Arctic Refuge should be the very last place we allow oil development.

Thank you.

[The prepared statement of Mr. Pourchot follows:]

Testimony of Pat Pourchot
Senate Committee on Energy and Natural Resources
Potential for oil and gas exploration and development in the Arctic National Wildlife Refuge, Alaska
November 2, 2017

Madam Chairman, Members of the Committee:

Thank you for the privilege of allowing me to testify today on the Arctic National Wildlife Refuge. Although I have served in several roles in the past with direct involvement in oil and gas issues in Alaska, today I am testifying as a retired public servant and private citizen.

My past "lives" over 45 years in Alaska have included serving as a senator and representative in the Alaska State Legislature, Commissioner of the Alaska State Department of Natural Resources, Land Manager for the Alaska Federation of Natives, Senior Policy Representative with Audubon Alaska, and most recently, Special Assistant to the Secretary of the Interior for Alaska Affairs. These positions have obviously provided me varying viewpoints and experiences with land management and oil and gas issues in Alaska. In fact, I would confess from the onset that I have worked for politicians and organizations that have favored drilling in the Arctic Refuge and for those that have opposed exploration and development.

Since my participation as a congressional staffer in the passage of the Alaska National Interest Lands Conservation Act (ANILCA) 40 years ago to more recent trips and meetings in the Arctic with DOI Secretaries Salazar and Jewell, I have witnessed the decades of debate on the issue of permitting oil and gas leasing and development in the Refuge. As an Alaskan I fully understand and appreciate the economic benefits that might accrue from oil development in the Refuge.

But, I have come to the conclusion that the last piece of America's Arctic is more appropriately left as wilderness as a far more valuable legacy for future generations.

I have had the opportunity to hike the mountains and float wilderness rivers in the Refuge, to observe herds of caribou on the Coastal Plain, witness dozens of polar bear on the Beaufort Sea coast, and fly over thousands of snow geese gathering on the coastal plain of the Refuge in early fall. There can be no denying that the Arctic Refuge is one the most special and spectacular places on the planet.

There are many in Alaska who support development in the Refuge that could bring jobs, income to Native corporations and tax dollars to the North Slope Borough. Similarly, Alaska state officials see revenues coming to the state--particularly attractive in these times of huge state budget deficits. But, most of these benefits are short-term, and I think that the Governor and Lt.

Governor would readily agree that more significant actions are now needed to address an annual $2-2.5 billion shortfall in the state's budget.

America's Arctic of coastal plain and Brooks Range foothills stretch over 600 miles from the Canadian border westward to the Chukchi Sea. Most of this area is available for oil and gas development. In the Central Arctic, oil development on state lands surrounding Prudhoe Bay sprawls for over a hundred miles along the Beaufort Sea coast and inland. Further west, development is proceeding in the 23-million-acre National Petroleum Reserve-Alaska. This December the Department of the Interior will hold a lease sale for all currently available acreage in the Reserve—12 million acres, about the size of the entire states of New Hampshire and Vermont combined. The Secretary has also recently announced his intent to review and possibly revise the current plan for the Reserve to potentially make most, if not all, the Reserve available to leasing. West of NPR-A, state and Native-owned lands, available for resource development, abut the Chukchi Sea.

And now, it is proposed to explore and develop that last remaining part of the Arctic coastal plain, our national heritage. There are those that argue that the 1.5 million acres of coastal plain proposed for development in the Refuge represent only a small fraction of the total acreage of the Refuge and would not significantly impact the overall Refuge. But this belies the known biological values of the Refuge. The narrow coastal plain is the biological and ecological "heart" of the Refuge. This region provides key habitat with the highest productivity for calving and migrating caribou, waterfowl, nesting shorebirds, and a host of other wildlife, including terrestrial denning sites for polar bear. The report called for in Section 1002 of ANILCA, issued in 1987, found that "The Arctic Refuge is the only conservation system unit that protects, in an undisturbed condition, a complete spectrum of the Arctic ecosystems in North America." It further found that "[t]he 1002 area is the most biologically productive part of the Arctic Refuge for wildlife and is the center of wildlife activity."

From 2010 to early 2015 the previous Administration undertook an update of the 1988 Comprehensive Conservation Plan (CCP) for the Refuge to ensure that the purposes of the Refuge were being met, to establish management objectives, to incorporate new scientific information on Refuge resources, and other objectives. The plan update involved numerous public meetings and tribal consultations in Alaska, including villages surrounding the Refuge. The draft CCP and environmental statement received over 600,000 comments, most in support of protecting wilderness and wildlife values of the Refuge. The new plan recommended that Congress designate the Coastal Plain as wilderness and that the "1002 Area" continue to be managed as wilderness.

The CCP Record of Decision concluded that these recommendations best met the legislative purposes of the Refuge and the implementation of the Refuge's mission statement:

This untamed arctic landscape continues to sustain the ecological diversity and special values that inspired the Refuge's establishment. Natural processes continue and traditional cultures thrive with the seasons and changing times; physical and mental challenges test our bodies, minds, and spirit; and we honor the land, the wildlife and the native people with respect and restraint. Through responsible stewardship this vast wilderness is passed on, undiminished, to future generations.

And why are we proposing to develop that last remaining part of the Arctic coastal plain? Are we at war and strategically need more oil for our nation's security? Are we suffering lines at the gas pumps and desperately need more domestic oil? Is the price of oil and gasoline so high that we need to increase our supplies? Do we really think that lease revenues will somehow significantly help our federal or state budgets? The answer is clearly "no" to all these questions. And the answer should be "no" to the question of allowing oil and gas development in the Arctic Refuge.

I was greatly moved by the Ken Burns documentary *THE NATIONAL PARKS: AMERICA'S BEST IDEA*. In the late 1950's a dedicated group of Fairbanks residents, including the Fairbanks Garden Club, had a "best idea" for the portion of public land spanning the Brooks Range in the Northeast corner of Alaska. They urged the Department of the Interior to withdraw the area for protection of its wilderness and wildlife values. In 1960 the nine million-acre Arctic National Wildlife Range was created under a land order by Secretary of the Interior Seaton in the Eisenhower Administration for the "purpose of preserving unique wildlife, wilderness and recreational values.

This "great idea" was renewed in 1980 with the passage of ANILCA in which the Range was expanded and renamed the Arctic National Wildlife Refuge. Its purposes were laid out in statute "to conserve fish and wildlife populations and habitats in their natural diversity including, but not limited to, the Porcupine caribou herd… polar bears, grizzly bears, muskox, Dall sheep, wolves, wolverines, snow geese, peregrine falcons and other migratory birds and Arctic char and grayling; to fulfill the international treaty obligations of the United States with respect to fish and wildlife and their habitats; to provide… for continued subsistence uses by local residents, and to ensure…water quality and necessary water quantity within the refuge."

It is noteworthy that simultaneous to designating the Arctic Range, the national conservation community quietly withdrew its opposition to the Secretary's revocation of a prior land order which had blocked the State from land selections in Arctic Alaska. The lifting of this land order enabled the State to select and develop lands beyond the Range's western boundary, including what became the Prudhoe Bay oil field.

Ken Burns' documentary vividly demonstrates how the heroes of our nation's history are those who had the foresight to act to protect and defend our America's cultural and natural treasures

for the benefit and enjoyment of future generations. Those folks of Fairbanks helped protect something of preeminent value to the nation a generation ago for those of us today. Conversely, history and our children will not honor those that would deface one of our nation's most treasured landscapes. The Arctic Refuge should be the very last place we allow oil development.

The CHAIRMAN. Thank you, Pat.
Dr. Cronin, welcome to the Committee.

STATEMENT OF DR. MATTHEW A. CRONIN, BIOLOGIST AND FORMER RESEARCH PROFESSOR, ANIMAL GENETICS, UNIVERSITY OF ALASKA FAIRBANKS

Dr. CRONIN. Thank you, Senator Murkowski, Senator King and Committee for allowing me to testify. I'm Matt Cronin, and I'm a biologist. And today I'll speak mostly about caribou and oil fields and the science.

The science is large. The literature on the science is very large, and I'll provide a brief summary here orally and in my written testimony there's many citations to scientific papers.

This summer I was lucky enough to watch Senator King at the symposium on the impacts of an ice diminishing Arctic. I watched it online. Senator Murkowski, you gave comments at the symposium. And Senator King said something very insightful to me as a scientist. He said, "We can't make good policy without good data." And then he said, "Give us the science in a way we can understand it and absorb," and that nothing could be more important. So I understand that as non-scientists you need scientists to tell you things in a way you can understand. There's two problems. One is the science. The literature is very large. And the other is separating the actual data and science from interpretation. And that's our job as scientists is to clearly differentiate those.

I feel it's my duty to inform all of Congress and all the American people of the science and then policy will come from that. Science doesn't make policy, it informs policy. And that was a major point of Senator King's comments at that symposium that I really appreciated.

With regard to caribou in the oil fields, there's many references in my written testimony and within the references, many references.

I'll hit on a few key points. First, there is impacts to individuals and then there's impacts to populations, an important concept with regard to the North Slope caribou herds. Herds are not the same as populations, as we typically speak about them in biology. Herds you define by calving areas. The population, all four North Slope herds, to some extent, are the same population. There's immigration between them. There's overlap on winter ranges. So the herd censuses are good in terms of quantifying the numbers of animals calving in the area, but the population is much more dynamic and affected by many factors.

The studies have shown some level of displacement of calving cows from roads, but it's not unequivocal. In the case of those studies, 44 percent of the calves observed were within the first four kilometers of the roads which was the area claimed to be displacement. And then a replicate study showed most of the calves, the higher density, was within the first kilometer. The point is the literature is not clear cut. Calves don't always avoid oil field infrastructure, the cows having the calves. In the summer, the caribou use the oil fields quite extensively, as Mr. Glenn said. They go up on the pads and under pipelines for insect relief. The caribou herds themselves are quite dynamic. If you look at the charts in my writ-

ten testimony which are the graphs of the populations, the Central Arctic, the Porcupine, Teshekpuk, and Western Arctic herds, you'll see dramatic variation over time. And natural populations in general, and caribou in particular, have very large population fluctuations naturally due to many things, winter conditions, predation, and immigration and emigration, as I mentioned.

So the biology is complex and the literature is large. The Alaska Department of Fish and Game stated in a newsletter last year, "The impact of oil infrastructure on the Central Arctic herd is also being considered in a recent decline, but is not thought to be contributing to the decline since the herd grew substantially during peak oil development."

Several of the papers that I co-authored address this point up through the early 2000s and it's important to look at the original literature and the references therein.

I believe that the status of caribou in the North Slope oil fields has been good. They continue to use the oil field areas as habitat. The herd has grown substantially since the oil fields were developed.

As the oil fields were developed, new technologies and insights resulted in the much smaller area of development and mitigation measures such as elevating pipelines, separating pipelines from roads, have been implemented that have helped a lot with passage through the oil fields.

I think oil and gas development in the 1002 Area can be done with limited impacts by using proven mitigation measures. I believe it can be done with minimum impacts to caribou as long as mitigation measures are implemented.

One, of course, because calving is a main concern, is very simple. You simply limit activities during the calving period. You limit traffic. You limit aircraft. You limit noise and you get local knowledge to help you manage in the local area.

I've also done research on polar bears and other Arctic animals that I'd be happy to provide information if anyone is interested. And feel free to ask questions.

Thank you.

[The prepared statement of Dr. Cronin follows:]

Written Testimony of Matthew A. Cronin for the U.S. Senate Energy and Natural Resources Committee, 2 November 2017.

I am Matthew A. Cronin, and provide the U.S. Senate Energy and Natural Resource Committee this testimony regarding oil and gas development in the 1002 Area of the Arctic National Wildlife Refuge (ANWR). I will focus my comments on the on the issue of potential impacts to caribou, with some brief comments on polar bears. Included in my testimony are several papers (PDF files) that I cite in this testimony.

I first acknowledge my colleagues with whom I published several papers on the topic, especially Warren Ballard, Heather Whitlaw, Shawn Haskell, Lynn Noel, Steve Johnson, Bobbi Pierson, Jay McKendrick, John Patton, Keith Parker, and Robert Pollard. These biologists have done good research and published results in peer-reviewed scientific journals. I also acknowledge the working men and women of the oil industry who make our modern society possible.

1. **Introductory comments on science and policy**.

Senator Angus King (ME), at the Seventh Symposium on the Impacts of an Ice-Diminishing on Naval and Maritime Operations, July 2017 (https://www.youtube.com/watch?v=zgmP8U9tJ6w), stated:

> "We can't make good policy without good data.... Give us data in a form we can understand....If you can develop a shared understanding of the facts the policy prescription is pretty easy. It almost becomes self-evident if everybody understands the facts...What you're doing in terms of the science and understanding what's happening and demonstrating it to us in a way that we can understand and absorb could not be more important...Give us the data in ways that we can understand and use."

Senator King's comments reveal a critical point: science does not dictate policy, but science informs policy. I will discuss this idea further below. Senator King's comments also indicate the need for science to be presented in an understandable manner. I will attempt to do so in this testimony. Of course, the published literature that I cite should be consulted for detailed information.

2. **Caribou and North Slope oil fields.**

I will describe the relationships of caribou and the Alaska North Slope oil fields. There has been considerable controversy over the issue of oil field impacts on caribou (e.g., Cronin 2001) so I recommend thorough reading and consideration of all of the literature cited for a complete understanding of this topic. I do not cite all of the available literature in this testimony, and the references within the sources that I cite should be consulted for additional information.

Calving-Caribou calving (i.e., cows giving birth to calves) in the Alaska North Slope oil fields has been studied extensively. On the North Slope, caribou cows give birth to calves in late May and the first two or three weeks of June. Some studies reported statistically significant lower density of calving caribou within 1 kilometer (km) of oilfield roads and facilities than in areas farther from the roads and facilities (Cameron et al. 1992). Non-statistically significant lower densities of calving caribou were also observed within 4 km of roads and facilities (Dau and Cameron 1986, Cameron et al. 1992). These observations were interpreted as displacement from, and avoidance of, oil field roads and facilities. However, these studies showed that some calving occurs within 1 km and within 4 km of roads and facilities. That is, there was not complete absence of calving caribou within 1 km or within 4 km of the oilfield roads and facilities. In the study reporting displacement and avoidance of the area within 4 km of an oil field road, 44.4% of the calves occurred from 0 to 4 km of the road, and 55.6% occurred from 4 km to 6 km of the road, so there was not complete avoidance of the areas within 4 km of the roads and facilities (Cameron et al. 1992, Noel et al. 2004). A replicate study actually found higher densities of calves within 1 km of the roads than farther away from the roads (Noel et al. 2004).

These studies indicate that lower calf density sometimes occurs, and sometimes does not occur, within 1 km of roads and facilities. Factors including habitat (e.g., types of vegetation), timing of snow melt in the spring (persistent snow influences how far north caribou move as they migrate from their winter ranges that are south of the oil fields), and perhaps most importantly, habituation (caribou learn over time that vehicles, roads, and buildings are not a threat) influence where caribou calve (Haskell and Ballard 2008, Haskell et al. 2006).

General calving areas also shift over time. This has been reported for caribou herds with no oil development within their ranges and is a natural occurrence (Noel et al. 2006a and references therein). A shift of calving concentration to the south of the North Slope oil fields has been attributed to oil field expansion on the North Slope (Joly et al. 2006 and references therein). However, this is not definitive because the same factors affecting individual caribou responses to roads and facilities (e.g., timing of spring snowmelt, habitat, habituation, predators and human hunting) also affect the general areas in which caribou calve (Haskell and Ballard 2008, Haskell et al. 2006).

Summer-After the calving period, caribou do not avoid the oil fields and travel through them regularly (Pollard et al. 1996a, Cronin et al. 1998a, Noel et al. 1998, 2006b). Pipelines and roads can block or deflect caribou movements, but elevating pipelines above the ground, separating pipelines and roads, and other measures minimize this impact. There is intense mosquito and fly harassment of caribou during the summer, and caribou will travel to the coast where there is more wind, and also often congregate on the oil field roads and gravel pads and in the shade of buildings and pipelines to escape the insects (Pollard et al. 1996b, Noel et al. 1998). There is no hunting allowed in the oil fields, which gives caribou protection. Proper design and operation of oil fields has actually enhanced caribou habitat in important ways.

Impacts to calf production and numbers of caribou in herds-It has been hypothesized that the oil fields have negatively affected caribou reproduction and recruitment (i.e., calf birth and

survival) and the number of animals in the Central Arctic herd (NRC 2003 and references therein). In particular, a decline of the Central Arctic herd of 5,344 animals between 1992 and 1995 (Table 1 and Figure 1) was partially attributed to oilfield impacts (NRC 2003 and references therein). Several lines of data do not support this hypothesis (Cronin et al. 1997, 1998b, 2000, Haskell and Ballard 2004, Noel et al. 2006a). First, note that the decline in the Central Arctic herd was small relative to the overall changes in the four Arctic Alaska herd numbers over time (Tables 1-4, Figures 1-4). Increases or decreases of the magnitude seen in the Central Arctic herd between 1992 and 1995 are well within the natural variation of herd numbers. Second, note that the Teshekpuk herd also declined by a similar amount (8,951 animals) in the same time period (between 1993 and 1995) without oil fields in its range (Table 3, Figure 3). Third, consider that the caribou of the Central Arctic herd spend about 10 months of the year in ranges away from the oil fields where many other factors affect their survival and fitness (Cronin et al. 2000). It is becoming apparent from studies of population genetics and population dynamics that inter-herd movements substantially affect the numbers of caribou in each herd, and data do not support the hypothesis that oil field impacts have caused a population decline (Cronin et al. 1997, 1998b 2000, 2003, 2005, ADFG 2016).

The Central Arctic caribou herd has grown since the oil fields and Trans Alaska Pipeline were developed. There have been fluctuations in numbers (Table 1, Figure 1), but neither the increases nor decreases can be attributed to impacts of the oil fields as noted by the Alaska Department of Fish and Game:

> "The impact of oil infrastructure on CAH (Central Arctic herd) has also been considered, but *is not thought to be contributing to the decline* since the herd grew substantially during peak oil development." (ADFG 2016, my italics).

In contrast, there is empirical evidence that emigration contributed to a decline in the numbers of caribou in the Central Arctic herd between 2013 and 2016:

> "From 2013 to 2015, extensive mixing occurred between the CAH (Central Arctic herd), Porcupine, and Teshekpuk herds after calving and during the winter. Several thousand caribou left CAH and joined other herds." (ADFG 2016).

This is seen in the herd numbers (Table 1). The number of caribou in the Central Arctic herd census in 2013 was actually about 70,000 but there were animals from the Porcupine caribou herd present, so the herd estimate was adjusted downward to 50,753 (Parrett et al. 2014, Lenart 2015). The decline between 2013 and 2016 was likely due in part to high female mortality and emigration (Bohrer 2017, Cotten 2016).

The numbers of caribou in the Central Arctic herd reflect habitat, winter severity, inter-herd emigration and immigration, population density, and other factors described in the published literature. The hypothesis that changes in herd numbers are due to oil field impacts has not been supported considering all of the available data.

3. Oil development in ANWR

The status of caribou in the North Slope oil fields has been good. Caribou continue to use the oil field areas as habitat, and the herd has grown substantially since the oil fields were developed. As the oil fields developed, new technology and insights resulted in a much smaller area of development (e.g., with directional drilling) and better mitigation of impacts with elevated pipelines, separation of roads and pipelines, and other measures.

I think that oil and gas development in the 1002 Area of ANWR can be done with limited impacts on caribou by using proven mitigation measures. First, the Porcupine caribou herd does not calve in the 1002 area every year. Second, because the primary concern is impacts during the calving period, simple adjustment of timing of oil field activity can greatly mitigate possible disturbance to caribou during this time. Restrictions on vehicle and aircraft traffic and loud drilling activities during the calving period can be implemented. Likewise, burying or elevating pipelines and separating pipelines and roads can minimize obstruction of movements. By identifying a clear management objective of minimizing disturbance and loss of habitat to caribou, I believe that oil exploration and development can be done in the 1002 Area of ANWR with minimum impacts to caribou.

4. Insights on Science and Management

As Senator King's quote above indicates, science and policy (and management) are not the same. Science can inform policy and management, but does not dictate it. For example, here are four potential management objectives for the 1002 Area of ANWR:

1. All of ANWR, including the 1002 Area be designated as wilderness. No oil or other development allowed.
2. Oil leasing and development in accordance with past leasing practices, with mitigation to minimize impacts on wildlife (i.e., multiple-use management).
3. Exploration to document what resources are present for potential development later (e.g., Senator Sullivan's 2013 exploration plan, developed when he was Commissioner of the Alaska Department of Natural Resources).
4. Develop oil and gas resources in the 1002 Area of ANWR immediately to provide funding for the Department of Defense (DoD). I developed this proposal in 2013 when DoD was under severe budget constraints due to sequestration (Cronin 2013).

Each of these management objectives is favored by some people and opposed by others. Science has nothing to do with whether one favors one objective or another. Science can be used to implement any of them (except the first which entails no actual management). Claims that science somehow supports a particular objective are simply not correct. People choose management objectives, science can be used to achieve them.

Science is often invoked by anti-development advocates as the so-called "precautionary principle" which states that if an action or policy has a suspected risk of causing harm (to the environment), in the absence of scientific consensus (that the action or policy is not harmful), the burden of proof that it is *not* harmful falls on those taking that action. This is simply a way for anti-development advocates to present their management objective as a "principle", when it is really just what they want. One could just as easily create a "precautionary principle" defined by potential harm to the economy or peoples' jobs. It is of primary importance to clearly identify management objectives, and then suggest ways that science can be used to achieve them.

5. Comments on Polar bears

Polar bears can be impacted by onshore oil field development because of conflicts with people, and disturbance to denning female bears (Amstrup 2000). Mitigation measures in the North Slope oil fields have been implemented including control of garbage and other human foods, training of oil field workers about the danger posed to them and to polar bears by interactions, and by avoiding disturbance of dens aided by detection methods such as forward-looking infrared devices (FLIR).

There is also research regarding the overall condition of polar bears as a species, and its predicted extinction and endangered species listing. Cronin and Cronin (2015) stated:

> "The Arctic Ocean is undergoing rapid climatic changes including higher ocean temperatures, reduced sea ice, glacier and Greenland Ice Sheet melting, greater marine productivity, and altered carbon cycling."
>
> "If, as DNA and fossil evidence suggests, polar bears and their primary prey, ringed seals and other prey such as walruses, have existed for at least 125 ka (ka = thousand years) and likely hundreds of thousands of years, then they experienced extreme climate conditions of glacial periods as well as partially or completely summer sea-ice-free interglacial periods (MIS 11, MIS 5 and the early Holocene)."

Diminishing sea ice can have serious impacts to polar bears and marine mammals. However, polar bears and other species associated with sea ice survived previous ice-free periods as described by Cronin and Cronin (2015). These observations may be useful in the current assessments of impacts from recent declines in sea ice.

References (several of the papers cited below are included as part of this testimony as separate PDF files)

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Table 1. Central Arctic caribou herd numbers 1975-2016.

Year	Number of Caribou
1975	5000
1978	5000
1980	5000
1981	8537
1983	12905
1985	15000
1989	18000
1991	19046
1992	23444
1995	18100
1997	18824
2000	29519
2002	34211
2008	66666
2010	68442
2013	50753
2016	22630

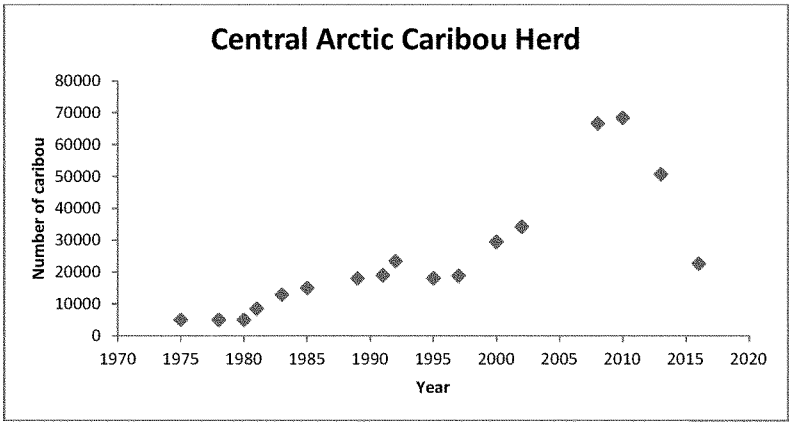

Figure 1. Central Arctic caribou herd numbers of animals from 1975 to 2016.

Table 2. Porcupine caribou herd numbers 1964-2013.

Year	Number of caribou
1964	140000
1972	99959
1977	105000
1979	105683
1982	125174
1983	135284
1984	149000
1985	165000
1986	182500
1987	165000
1989	178000
1992	160000
1994	152000
1998	129000
2001	123000
2010	169000
2013	197000

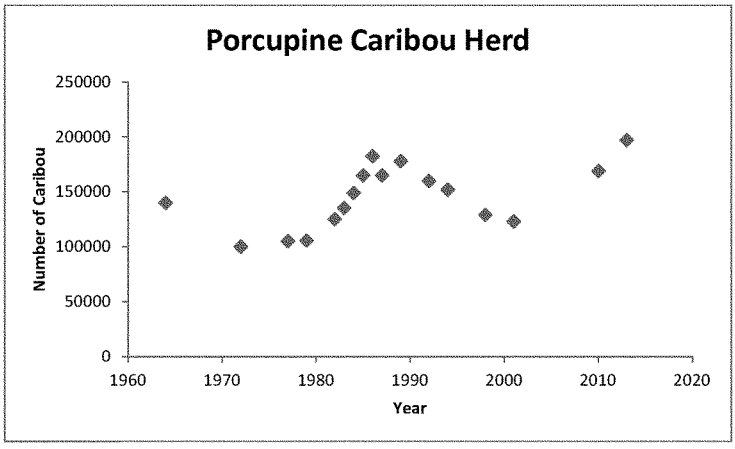

Figure 2. Porcupine caribou herd numbers of animals from 1964 to 2013.

Table 3. Teshekpuk caribou herd numbers 1981-2013.

Year	Number of caribou
1981	3009
1984	18292
1985	13406
1989	19724
1993	41800
1995	32839
1999	28627
2002	51783
2008	68932
2011	55704
2013	39172

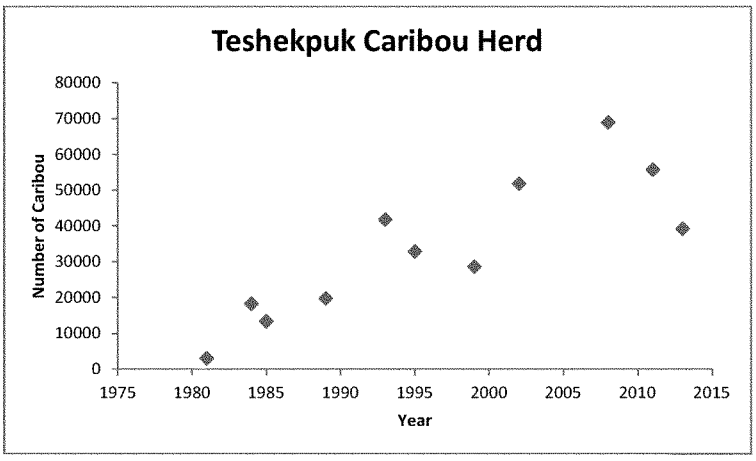

Figure 3. Teshekpuk caribou herd numbers of animals from 1981 to 2013.

Table 4. Western Arctic caribou herd numbers 1961-2013.

Year	Number of caribou
1961	156000
1962	187500
1964	300000
1970	242000
1975	100000
1976	75000
1977	75000
1978	107000
1980	138000
1982	217863
1986	229000
1988	343000
1990	417000
1993	478822
1996	463000
1999	444597
2003	490000
2007	381501
2009	355828
2011	324963
2013	234757

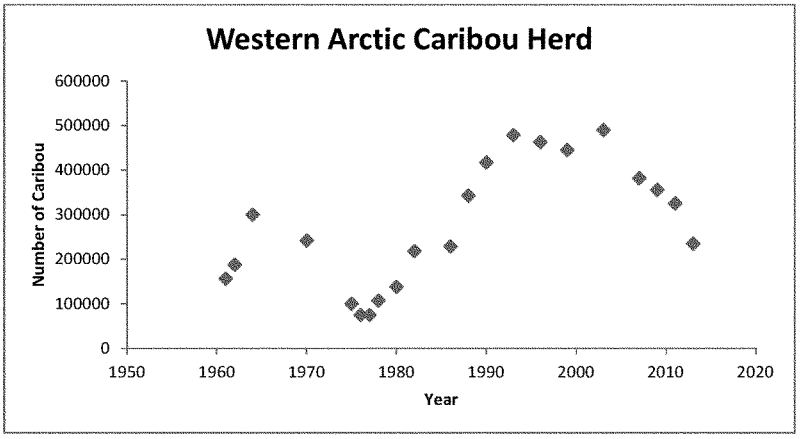

Figure 4. Western Arctic caribou herd numbers of animals 1961 to 2013.

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Caribou Distribution During the Post-Calving Period in Relation to Infrastructure in the Prudhoe Bay Oil Field, Alaska

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ABSTRACT. There is concern that caribou (*Rangifer tarandus*) may avoid roads and facilities (i.e., infrastructure) in the Prudhoe Bay oil field (PBOF) in northern Alaska, and that this avoidance can have negative effects on the animals. We quantified the relationship between caribou distribution and PBOF infrastructure during the post-calving period (mid-June to mid-August) with aerial surveys from 1990 to 1995. We conducted four to eight surveys per year with complete coverage of the PBOF. We identified active oil field infrastructure and used a geographic information system (GIS) to construct ten 1 km wide concentric intervals surrounding the infrastructure. We tested whether caribou distribution is related to distance from infrastructure with a chi-squared habitat utilization–availability analysis and log-linear regression. We considered bulls, calves, and total caribou of all sex/age classes separately. The habitat utilization–availability analysis indicated there was no consistent trend of attraction to or avoidance of infrastructure. Caribou frequently were more abundant than expected in the intervals close to infrastructure, and this trend was more pronounced for bulls and for total caribou of all sex/age classes than for calves. Log-linear regression (with Poisson error structure) of numbers of caribou and distance from infrastructure were also done, with and without combining data into the 1 km distance intervals. The analysis without intervals revealed no relationship between caribou distribution and distance from oil field infrastructure, or between caribou distribution and Julian date, year, or distance from the Beaufort Sea coast. The log-linear regression with caribou combined into distance intervals showed the density of bulls and total caribou of all sex/age classes declined with distance from infrastructure. Our results indicate that during the post-calving period: 1) caribou distribution is largely unrelated to distance from infrastructure; 2) caribou regularly use habitats in the PBOF; 3) caribou often occur close to infrastructure; and 4) caribou do not appear to avoid oil field infrastructure.

Key words: caribou, *Rangifer tarandus*, caribou distribution, oil field infrastructure, petroleum development

RÉSUMÉ. On s'inquiète du fait que le caribou (*Rangifer tarandus*) pourrait éviter les routes et installations (c-à-d. les infrastructures) du champ pétrolifère de Prudhoe Bay dans l'Alaska septentrional et que ce comportement pourrait avoir des répercussions négatives sur les animaux. Des relevés aériens effectués de 1990 à 1995 ont permis de quantifier le rapport entre la distribution du caribou et les infrastructures du champ pétrolifère de Prudhoe Bay au cours de la période suivant immédiatement la mise bas (de mi-juin à mi-août). On a procédé à un nombre de relevés annuels allant de quatre à huit, couvrant toute la superficie du champ. On a identifié les infrastructures du champ pétrolifère qui étaient en activité et utilisé un système d'information géographique (SIG) pour construire dix anneaux concentriques de 1 km de large entourant chaque infrastructure. On a testé l'hypothèse que la distribution du caribou est reliée à l'éloignement de l'infrastructure grâce au test de chi carré entre l'utilisation et la disponibilité de l'habitat, et à la régression log-linéaire. On a tenu compte séparément de la catégorie des mâles, de celle des veaux et de celle de la population totale, sexe et âge confondus. L'analyse de l'utilisation et de la disponibilité de l'habitat révélait qu'il n'y avait pas de schéma cohérent d'attrait ou d'évitement des infrastructures. Les caribous étaient souvent plus abondants que prévu dans les anneaux proches des infrastructures, et cette tendance était plus prononcée pour les mâles adultes et pour l'ensemble des catégories, sexe et âge confondus, que pour les veaux. On a aussi fait la régression log-linéaire (en incluant la structure d'erreur de Poisson) des nombres de caribous et des distances par rapport à l'infrastructure en regroupant et sans regrouper les données à l'intérieur des anneaux de 1 km de largeur. L'analyse sans regroupement montrait qu'il n'existe pas de rapport entre la distribution du caribou et l'éloignement des infrastructures du champ pétrolifère, ou entre la distribution du caribou et la date julienne ou même l'éloignement de la côte de la mer de Beaufort. La regression log-linéaire avec les caribous regroupés dans des anneaux concentriques montrait que la densité des mâles adultes et de l'ensemble de la population, sexe et âge confondus, était plus élevée dans les anneaux jouxtant les infrastructures. Nos résultats indiquent que, durant la période suivant immédiatement

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la mise bas: (1) dans une large mesure, la distribution du caribou n'est pas reliée à l'éloignement des infrastructures; (2) le caribou utilise les habitats au sein du champ pétrolifère de Prudhoe Bay sur une base régulière; (3) le caribou se trouve fréquemment près des infrastructures; et (4) le caribou ne semble pas chercher à éviter les infrastructures du champ pétrolifère.

Mots clés: caribou, *Rangifer tarandus*, distribution du caribou, infrastructures du champ pétrolifère, exploitation pétrolière

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INTRODUCTION

Caribou (*Rangifer tarandus*) of the Central Arctic Herd (CAH) in Alaska occupy summer range on the coastal plain in northern Alaska. This range encompasses the Prudhoe Bay oil field (PBOF) and other adjacent oil fields. There has been concern that the oil fields may negatively affect caribou through habitat loss, disturbance, impedance of movements, and displacement to inferior foraging areas (Dau and Cameron, 1986; Cameron, 1992, 1994; Cameron et al., 1992, 1995; Nellemann and Cameron, 1996).

Impacts of the oil fields can be considered on two levels, impacts on individual animals and impacts on the herd as a whole (Bergerud et al., 1984; Cronin et al., 1994; Ballard and Cronin, 1995; Cronin et al., 1997, 1998). Opinions differ regarding the impacts at the herd level. Some researchers have suggested that herd productivity has been reduced because of oil field impacts (Cameron, 1992, 1994, 1995; Nellemann and Cameron, 1996). Others acknowledge the potential for herd-level impacts, but point out the difficulty of distinguishing human impacts from other environmental factors that affect caribou herds (Bergerud et al., 1984; Maki, 1992; Ballard and Cronin, 1995; Cronin et al., 1997, 1998). These authors note that the CAH has grown steadily, with demographics similar to those of adjacent herds, since the oil fields were developed. This indicates that few or no herd-level impacts have been realized.

Oil field impacts on individual caribou of the CAH have been assessed through studies of distribution and movements in and around the oil fields. In one study, relatively low densities of cow and calf caribou (during the calving season) were observed within 1–2 km of an oil field road (Dau and Cameron, 1986; Cameron et al., 1992). These low densities were attributed to avoidance of the road by parturient cows, which are known to be sensitive to disturbance for a few weeks around calving time. Cameron et al. (1995) also reported fewer observations of caribou in the Prudhoe Bay area than in other areas across the Alaskan arctic coastal plain during the post-calving summer period. In contrast, six years (1990–95) of extensive aerial surveys in and around the PBOF during the post-calving period indicated frequent use of, and movements through, the PBOF (Pollard et al., 1996a).

Because of continued concerns over potential disturbance and displacement of caribou from the PBOF (Cameron, 1995; Cameron et al., 1995; Nellemann and Cameron, 1996), we assessed caribou distribution using the survey data collected between 1990 and 1995. In a previous paper, we described the numbers, distribution, and general movements of caribou during the post-calving period in the PBOF (Pollard et al., 1996a). In the present study, we tested whether the distribution and abundance of calves, bulls, and total caribou of all sex/age classes are influenced by oil field infrastructure. We tested the null hypothesis that the distribution of caribou is unrelated to distance from infrastructure during the post-calving period.

STUDY AREA

The PBOF survey area lies between 147°41′ and 149°00′ west longitude and extends south from the Beaufort Sea coast to 70°05′ north latitude (Fig. 1). Relief ranges from 0 to 23 m above sea level. The terrain has many shallow lakes and drained lake basins, and vegetation dominated by wet and moist tundra (Walker et al., 1980). The PBOF includes 53 producing oil well pads, 31 exploration drilling pads, 8 gathering centers, 2 gravel landing strips for jet aircraft, and 2 base camps, which serve as operation centers and housing for oil field personnel. All facilities are built on gravel pads (approximately 1.5 m in elevation) and are connected by a network of gravel roads (totaling approximately 220 km in length). Above-ground pipelines run adjacent to many of the roads. The PBOF survey area encompasses 1393 km^2, including 179 km^2 of freshwater ponds and lakes. Potential predators of caribou include grizzly bears (*Ursus arctos*), which are abundant in the Prudhoe Bay oil fields, and wolves (*Canis lupus*), which are rare in the area.

METHODS

We counted caribou on 37 surveys from fixed-wing aircraft (Cessna 206 and 207) flying at 130 km/hr and 90 m above ground level with two observers and pilot. Each survey consisted of flights along 29 systematically spaced (1.6 km), fixed-width transects that ran north/south. The pilot used a Global Positioning System (GPS) receiver to navigate the aircraft, and observers searched for caribou within an 800 m wide swath on both sides of the transect centerline. We covered 100% of the study area on 34 of the 37 surveys and 50–95% of the study area on 3 surveys. Our observations consisted of the numbers, classification, and location of groups of caribou. Each observation was entered into a laptop computer that was linked to the GPS receiver in the airplane. The position of a group of caribou was defined as the central point of that group. This point was determined from GPS coordinates and a visual estimate of group position relative to the transect line. The aircraft circled large groups (of more

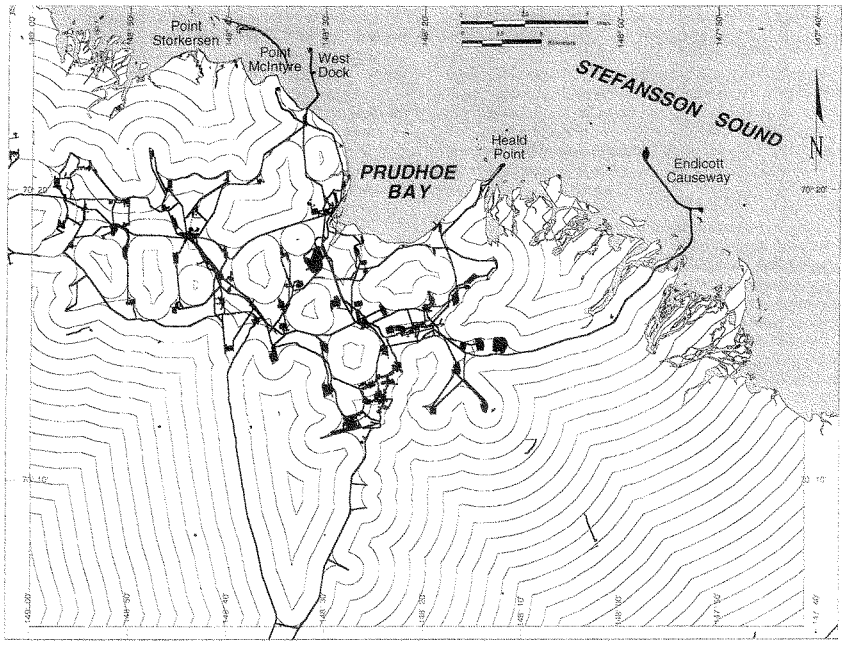

FIG. 1. The study area, showing distance intervals (1 km wide) surrounding active infrastructure (roads, gravel pads, pipelines, facilities) of the Prudhoe Bay oil field, Alaska.

than 100 animals) to facilitate counting and classification. During the surveys, calves and adult bulls were readily identifiable, but cows and young bulls, which are similar in size and appearance, were hard to differentiate. Therefore, we limited data analyses to groups of calves, adult bulls, and total caribou of all sex/age classes. Calf distribution can be considered indicative of the distribution of parturient females. Surveys were conducted between 0800 and 1700 Alaska Daylight Time, depending on weather conditions, from 20 June to 18 August each year. Calving by CAH caribou is usually completed by mid-June (Cameron et al., 1984; Smith and Cameron, 1990), so these survey dates were during the post-calving period.

We used Geographic Information System (GIS) ARC/INFO® software to generate a point coverage of caribou group locations. Distances of caribou groups from active oil field infrastructure were calculated with the NEAR command in ARC/INFO®. Infrastructure was identified as all roads and facilities that were in active use for activities such as construction, drilling, and vehicular or pedestrian traffic. Abandoned gravel pads that had no active operations and were not connected to other infrastructure by roads were not included. We assumed that caribou react similarly to different types of infrastructure (e.g., roads, drilling platforms) to which they might be exposed and did not further differentiate among types of infrastructure. We established concentric distance intervals surrounding oil field infrastructure. The intervals, 1 km wide as in previous studies (Dau and Cameron, 1986; Cameron et al., 1992), were generated with the BUFFER command in ARC/INFO® (Fig. 1). The area (km^2) of each distance interval was calculated, excluding the area of lakes and ponds identified on 1:63 360 scale maps.

Two analyses assessed caribou distribution in relation to oil field infrastructure. First, we compared the expected and observed numbers of caribou in each of the intervals 1–10 km from infrastructure with a habitat utilization–availability analysis using the methods of Neu et al. (1974). We used a Bonferroni Z statistic to calculate 95% confidence intervals around the observed proportion of caribou within each interval. The expected proportion of individuals was calculated by

assuming that the total number of observed caribou was distributed homogeneously relative to the area of each interval (i.e., # observed ÷ area of interval). If the expected proportion was outside the observed 95% confidence interval, then the observed numbers were considered significantly lesser or greater than expected. As in Neu et al.'s (1974) example with moose (*Alces alces*), we did this analysis by combining all surveys into annual totals for each sex/age class. Utilization–availability analyses were performed using SAS (version 6.09, SAS Institute, Inc., Cary, North Carolina).

Second, we evaluated the distribution of caribou with log-linear regression models. Because caribou observations are counts rather than continuous measurements, normal theory regressions or ANOVAs are not appropriate analyses. Linear models can adequately address discrete distributions if counts are consistently large, and if they do not vary greatly among categories (Manly, 1994). Caribou counts, however, were highly variable with regard to distance from infrastructure, and the numbers of calves and bulls varied greatly within and among groups. Preliminary plots of the distributions and numbers of caribou of all classes suggested that assumptions of normality in the patterns of these data could not be justified. Log-linear models correctly handle non-normal count data and can assess effects of interactions among several independent variables (Manly, 1994).

Our models were of the form:

$$Y = e^{(B_0 + B_1X_1 + B_2X_2 + B_3X_3 + \ldots\ldots + B_pX_p)},$$

where Y, the number of caribou observed, is distributed Poisson, e is the base of the natural logarithm, the X values are the independent variables (i.e., the covariates), and B_i are coefficients of the independent variables. We hypothesized that the distribution of caribou could be explained by 1) distance from infrastructure (X_1); 2) distance from the Beaufort Sea coast (which is thought to be important insect-relief habitat, Pollard et al., 1996a, b) (X_2); 3) year of the survey (X_3); 4) Julian date of the survey (X_4); and 5) pairwise interactions among these variables (e.g., $X_5 = X_1 \cdot X_2$, $X_6 = X_1 \cdot X_3$, $X_7 = X_1 \cdot X_4$). Interaction effects were modeled by the simple multiplication of the individual covariates (Manly et al., 1993; Manly, 1994). Log-linear models were built using the "Nonlin" command in SYSTAT V7.0 (SPSS Inc., Chicago, Illinois). The null hypothesis was that the distribution of caribou was unrelated to the covariates. Separate models were built with total caribou, calves, and bulls as the Y (i.e., dependent) variable.

We constructed full models incorporating all of the covariates plus interactions, and used backward stepping (Neter et al., 1990) to progressively eliminate variables in search of the model that best fit the observations. Model fit was evaluated by Akaike's Information Criterion (AIC) (Akaike, 1973). The AIC is defined as "negative 2 times the log-likelihood plus 2 times the model degrees of freedom [$-2 \cdot \ln(L) + 2 \cdot$(model df)]" (Akaike, 1973; LeBreton et al., 1992). Like the adjusted R^2 in normal theory regression, the AIC balances improvement in fit achieved by adding terms to the model against the cost of increasing the model degrees of freedom (LeBreton et al., 1992). Model selection by AIC is functionally equivalent to selection by drop in deviance chi-squared (LeBreton et al., 1992; Manly et al., 1993; Manly, 1994). A large AIC value indicates a large difference between the fitted and the observed values of Y and shows that the covariates (or X variables) in the model do not explain the variation in the data very well. Conversely, a small AIC value suggests that the covariates *do* explain much of the variation in the observed Y values. The models with the lowest AIC values were judged to be those with the best fits (Akaike, 1973). Although our data were distributed in a fashion similar to a Poisson distribution, variances were larger than in a Poisson distribution. Hence, we adjusted for extraneous variance by multiplying the calculated variances by the ratio of the log-likelihood chi-squared values to the error degrees of freedom (Manly, 1994).

We first applied the log-linear models using the numbers and exact location (latitude/longitude) of each observed group of caribou as the Y variables. Because there was extensive variation in numbers of caribou in groups, we also combined caribou observations within the 1 km wide distance intervals used in the habitat utilization–availability analysis. In this approach, we built log-linear models in which Y was the density of caribou (again, separate models were built for each of the three classes of caribou) in each interval, and X was the distance (1–10 km) of each interval from the infrastructure. When data were combined within distance intervals, much of the inherent variation was hidden. This dramatically reduced the AIC values and appeared to improve the model fits. This analysis was limited to caribou density relative to infrastructure, and did not include distance from the coast, Julian date, or year.

Coefficients (B_i) were considered different from zero at the 5% level of significance (i.e., the regression relationship explained a significant proportion of the variation in the observations) if the ratio of B to its standard error (T-ratio) exceeded |2.0| (Manly et al., 1993; Manly, 1994).

RESULTS

Between 1990 and 1995, we conducted 37 surveys of the PBOF during the post-calving period. We saw a total of 77 833 caribou, of which 75 639 were within the first ten 1 km intervals (i.e., within 10 km of infrastructure). The remaining 2194 caribou were more than 10 km from infrastructure. We observed 24 120 bulls, 17 009 calves, and 34 510 caribou of other sex/age classes within 10 km of infrastructure. These numbers of caribou, observed during multiple surveys over six years, probably include many resightings of the same animals, and do not reflect the herd size for any given time. See Cronin et al. (1997, 1998) for population-level analyses of the CAH. The complete data for each aerial survey, including the numbers of caribou, weather conditions, levels of insect activity, and caribou movements are described by Pollard et al. (1996a) and in unpublished reports (Cronin et

TABLE 1. Numbers of caribou (calves, bulls, total caribou) observed during aerial surveys of the Prudhoe Bay oil field 1990–95. Observations are grouped into 1 km distance intervals from oil field structure.

	Distance Interval										Interval Totals		
	1	2	3	4	5	6	7	8	9	10	1–10	11–23	1–23
Area (km²)	385.2	145.9	100.1	78.8	68.1	54.4	47.2	43.0	36.2	33.4	992.4	192.6	1185.0
Calves													
1990	175	16	226	529	9	2101	5	3	1	2	3067	0	3067
1991	1286	21	427	99	15	104	12	14	8	15	2001	139	2140
1992	3019	2263	125	611	220	1082	21	651	42	241	8275	192	8467
1993	1333	86	12	239	10	25	18	0	4	1	1728	1	1729
1994	401	96	31	22	30	146	52	74	119	59	1030	33	1063
1995	272	91	10	10	60	64	110	290	1	0	908	0	908
Subtotal	6486	2573	831	1510	344	3522	218	1032	175	318	17009	365	17374
Bulls													
1990	450	107	327	1039	10	1756	54	13	2	18	3776	20	3796
1991	2104	142	512	213	191	159	88	58	34	26	3527	193	3720
1992	4961	2928	186	396	225	1060	91	558	16	196	10617	257	10874
1993	2343	438	269	496	59	85	115	175	103	2	4085	25	4110
1994	684	238	80	32	53	66	51	30	36	24	1294	25	1319
1995	241	316	6	5	101	7	65	80	0	0	821	0	821
Subtotal	10783	4169	1380	2181	639	3133	464	914	191	266	24120	520	24640
Total Caribou													
1990	1076	158	1043	2511	47	7066	79	27	8	23	12038	34	12072
1991	5844	281	1521	527	432	551	189	150	99	101	9695	1158	10853
1992	14684	9408	586	2004	908	4328	175	2407	128	886	35514	845	36359
1993	7156	775	416	1321	95	163	179	190	128	5	10428	33	10461
1994	1825	801	175	122	149	415	208	225	342	173	4435	119	4554
1995	1299	568	57	67	285	199	336	715	3	0	3529	5	3534
Total	31884	11991	3798	6552	1916	12722	1166	3714	708	1188	75639	2194	77833

al., 1996; Pollard et al., 1992a, b, 1996a, b; Pollard and Ballard, 1993; Pollard and Noel, 1994, 1995, 1996) which are available from the authors.

The area of each 1 km interval decreased with increasing distance from infrastructure (Table 1, Fig. 1). For example, the interval immediately adjacent to infrastructure (interval 1) was 385 km², while the interval farthest from infrastructure (interval 23) was only 0.819 km². In addition to having relatively small areas, the intervals beyond 10 km may be beyond the range where visual and auditory stimuli could be detected or at least beyond the range where important responses might be expected. Hence, we focused our analysis on the first ten 1 km intervals. Previous studies during the calving period (Dau and Cameron, 1986; Cameron et al., 1992) evaluated caribou distribution within the first six 1 km intervals from oil field infrastructure.

To provide a view of the actual data, the numbers of caribou observed each year within each 1 km distance interval are shown in Table 1, and the total numbers for all six years are plotted in Figure 2. Each point in Figure 2 represents an observed group of caribou. Visual examination of Figure 2 suggests that most groups contained fewer than 10 caribou, and that more caribou were observed within the two intervals closest to infrastructure than in the intervals 3–10 km from infrastructure. However, the data show considerable variation, which we assessed with the habitat availability–utilization and log-linear regression analyses.

Habitat Availability–Utilization Analysis

The habitat utilization–availability analysis showed distributions that varied among the six years and three caribou classes (Table 2). Bulls frequently occurred more than expected within the first two intervals: in the first interval in four years, and in the second interval in three years. The other intervals had more bulls than expected in zero, one, or two years. Total caribou of all sex/age classes also occurred more than expected in the first interval in four years, in the sixth interval in three years, and in the other intervals in zero, one, or two years. More calves than expected occurred in the first interval in two years, and in the sixth and eighth intervals in three years. Fewer calves than expected occurred in the first interval in three years, and in the second, third, fifth, and ninth intervals in five years. No consistent trend was found of avoidance of (or attraction to) infrastructure, except that possibly bulls and total caribou prefer locations near infrastructure. Overall, however, the availability–utilization analyses did not suggest rejection of our null hypothesis that distribution is unrelated to distance from infrastructure.

Log-linear Regression Analyses

Log-linear modeling of the distribution of caribou groups (without combining data into distance intervals) showed no significant relationships between the distribution of caribou and distance from infrastructure or other covariates. The AIC values were very large, and the T-ratios were all

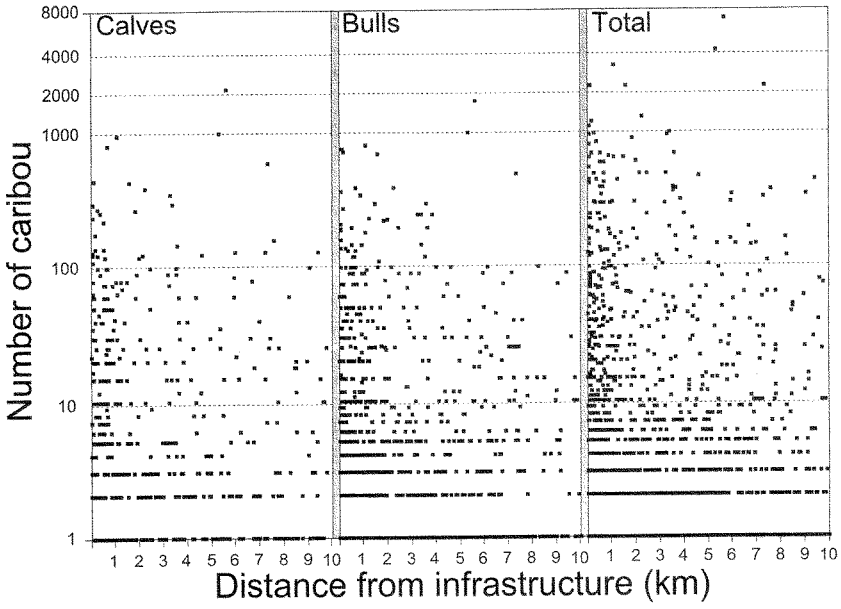

FIG. 2. Numbers of caribou (calves, bulls, and total caribou) plotted (log scale) against distance from Prudhoe Bay oil field infrastructure.

TABLE 2. Results of utilization–availability analysis for caribou distribution in ten 1 km intervals from oil field infrastructure for 6 years, 1990–95. The letters in the body of the table indicate whether the number of caribou observed in a given interval is significantly greater than (G), less than (L), or not significantly different from (N) that expected for a given year.

Interval	Bulls							Calves							Total Caribou of all Sex/age Classes						
	'90	'91	'92	'93	'94	'95	#G	'90	'91	'92	'93	'94	'95	#G	'90	'91	'92	'93	'94	'95	#G
1	L	G	G	G	G	L	4	L	G	L	G	N	L	2	L	G	G	G	G	N	4
2	L	L	G	L	G	G	3	L	L	G	L	L	L	1	L	L	G	L	G	N	2
3	L	G	L	L	L	L	1	L	G	L	L	L	L	1	L	G	L	L	L	L	1
4	G	L	L	G	L	L	2	G	L	N	G	L	L	2	G	L	L	G	L	L	2
5	L	L	L	L	L	G	1	L	L	L	L	L	N	0	L	L	L	L	L	N	0
6	G	N	G	L	N	L	2	G	N	G	L	G	N	3	G	N	G	L	G	N	3
7	L	L	L	L	N	G	1	L	L	L	L	N	G	1	L	L	L	L	N	G	1
8	L	L	G	N	L	G	2	L	L	G	L	G	G	3	L	L	G	L	N	G	2
9	L	L	L	L	N	L	0	L	L	L	L	G	L	1	L	L	L	L	G	L	1
10	L	L	L	L	L	L	0	L	L	N	L	G	L	1	L	L	L	L	N	L	0

nonsignificant (i.e., < 12.0; Table 3). The ranges of AIC values for all of the models (using all or some of the covariates) were 96 386 to 108 065 for calves, 107 425 to 118 846 for bulls, and 358 797 to 399 209 for total caribou. The T-ratios were less than 0.570 for calves, less than 0.390 for bulls, and less than 0.500 for total caribou. That is, none of the log-linear regressions showed a significant relationship between caribou distribution and distance from infrastructure, distance from the coast, Julian date, year, or any pairwise combination of these covariates.

Because the AIC is derived from the log-likelihood chi-squares, which measure the difference between observed values and corresponding fitted values (Akaike, 1973; LeBreton et al., 1992; Manly, et al., 1993; Manly, 1994), small AIC values result when values predicted by the model are close to the values observed in the data. Large AIC values,

TABLE 3. Results of log-linear regression modeling for total caribou, bulls, and calves (Y) with independent variables (X_i): distance from infrastructure; distance from coast; distance from infrastructure and coast; and their interactions.

	X_i	β	SE	T-Ratio	AIC
Y = TOTAL CARIBOU					
Distance from infrastructure	Intercept	3.560	2.209		399 165
	X_1	0.009	0.596	0.015	
Distance from coast	Intercept	4.044	2.127		383 996
	X_1	− 0.072	0.279	− 0.256	
Distance from infrastructure and coast	Intercept	3.735	2.334		380 773
	X_1	0.103	0.578	0.178	
	X_2	− 0.033	0.301	− 0.108	
	$X_{interaction}$	− 0.012	0.076	− 0.156	
Y = BULLS					
Distance from infrastructure	Intercept	2.502	2.083		118 731
	X_1	− 0.027	0.607	− 0.044	
Distance from coast	Intercept	2.797	2.118		116 020
	X_1	− 0.052	0.252	− 0.207	
Distance from infrastructure and coast	Intercept	2.527	2.269		114 763
	X_1	0.085	0.590	0.144	
	X_2	− 0.007	0.270	− 0.026	
	$X_{interaction}$	− 0.015	0.074	− 0.196	
Y = CALVES					
Distance from infrastructure	Intercept	1.975	2.487		107 805
	X_1	0.044	0.624	0.071	
Distance from coast	Intercept	2.656	2.272		102 793
	X_1	− 0.094	0.334	− 0.281	
Distance from infrastructure and coast	Intercept	2.316	2.549		101 855
	X_1	0.117	0.603	0.194	
	X_2	− 0.065	0.362	− 0.178	
	$X_{interaction}$	− 0.008	0.083	− 0.097	

on the other hand, occur when the average difference between the actual and fitted values is large. With 2103 groups observed, the average AIC per observation for total caribou was 171 – 190 (e.g., 358 797/2103 to 399 209/2103). Values this large indicated very poor fits of all of our models. In fact, the variation in AIC values (and hence the log-likelihood chi-squared) among models built for each category of caribou was grossly overshadowed by the magnitude of all of the AIC values. Hence, choosing the best model according to AIC values was meaningless. As would be expected with models that fit so poorly, none of the calculated regression parameters were significantly different from zero. Table 3 summarizes the AIC and regression parameters for the models, including the covariates of primary interest (distance from infrastructure, distance from the coast, and both of these covariates together). The log-linear analysis indicates we cannot reject the null hypothesis that caribou distribution is unrelated to distance from oil field infrastructure.

When we combined caribou observations into 1 km distance intervals, the log-linear regression analyses resulted in better fits of the models to the data than did the analyses with the non-combined data. This better fit is indicated by lower AIC values and higher T-ratios (Table 4). The T-ratios for bulls and total caribou were significant (> 12.0l) and the negative signs indicate that the relationship is decreasing density of caribou with increasing distance from infrastructure. Thus, densities of bulls and total caribou were higher in the distance intervals close to infrastructure, a trend also seen in the availability–utilization analysis. For calves, the slope was in the same direction (i.e., negative), but nonsignificant. The log-linear analysis with data combined into distance intervals allows rejection of the null hypothesis that caribou distribution is unrelated to distance from infrastructure for bulls and total caribou. These groups tend to occur close to infrastructure.

In summary, the log-linear analyses, without combining data into intervals, indicate that caribou distribution in the PBOF is unrelated to the covariates (distance from infrastructure, distance from the coast, Julian data, year). The log-linear analyses of the caribou in distance intervals suggest that caribou prefer habitats near infrastructure to those farther away. Our analyses suggest that caribou, rather than avoiding oil field infrastructure, occur independent of, or close to, infrastructure. Our analyses also indicate that caribou distribution was unrelated to distance from the coast, interactions between the distance from the coast and the distance from infrastructure, Julian date, and year of the survey.

DISCUSSION

Our results indicate that during the post-calving period, caribou are abundant in the PBOF; they often occur close to oil field infrastructure; and their overall distribution is largely unrelated to the distribution of infrastructure. Conversely, Cameron et al. (1995) reported that caribou avoided the general area encompassing the PBOF during the post-calving period. Timing and methodology may account for these differing observations. Cameron et al. (1995) reported data for 141 radio-collared caribou (6-40/year), each of which was relocated at least once per year during the period 25 June to 10 August. Our conclusions are based on over 75 000 caribou

TABLE 4. Results of log-linear regressions of densities of total caribou, bulls, and calves, combined into 1 km intervals with one independent variable, distance from oil field infrastructure.

Y_i	X_i	β_i	SE	T-Ratio	AIC
Total Caribou	Intercept	0.9241	0.0765		
	X_1	−0.0504	0.0131	−3.8406*	2862
Bulls	Intercept	−0.1011	0.1358		
	X_1	−0.0914	0.0246	−3.7207*	715
Calves	Intercept	0.6360	0.1595		
	X_1	−0.0212	0.0264	−0.8025	726

* Significant at the 0.05 level.

observations recorded during 37 aerial surveys of the entire PBOF. Surveys were distributed between 20 June and 18 August for each of six consecutive years. Our frequent surveys with complete coverage of the PBOF detected caribou use of, and movement through, the PBOF that the relatively infrequent radio-tracking surveys of Cameron et al. (1995) may have missed.

The analyses with data combined into distance intervals (log-linear and availability–utilization) suggested that caribou do not avoid oil field infrastructure, but occur close to it during the post-calving period. This result may reflect the frequent use of oil field infrastructure for relief from parasitic insects (Pollard et al., 1996b), but it also could be an artifact of the use of combined data. Combining individual observations into distance intervals is intuitively satisfying because it results in fewer data records, and it is convenient to think of zonal distances from infrastructure. However, combining observations into distance intervals dramatically reduces the variation in the data and could suggest distinct trends when the actual data show highly variable distributions. Indeed, whereas our analyses of the raw data suggested no trends (Table 3), analyses of data combined into distance intervals suggested caribou were attracted to infrastructure (Tables 2 and 4). Both alternatives (i.e., no relationship or attraction to infrastructure) are plausible, but the smoothing effect of combining data into intervals suggests the need for careful interpretation of results based upon combined data (e.g., Tables 2 and 4; Dau and Cameron, 1986; Cameron et al., 1992).

Our long-term monitoring demonstrates that caribou frequently use habitats in the PBOF and do not avoid oil field infrastructure during the post-calving period. Tolerance of oil field activity was also described for elk (*Cervus elaphus*), which simply shifted among areas, but did not abandon the range in which the oil field activity occurred (Van Dyke and Klein, 1996). It appears that with the proper mitigation actions, caribou can coexist with active oil field operations.

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NORTHERN ALASKA OIL FIELDS AND CARIBOU: A COMMENTARY

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Abstract

We discuss the status of caribou, Rangifer tarandus, *herds relative to oil field development in the Prudhoe Bay region of Alaska. The Central Arctic caribou herd, which spends June and July in and around oil fields in the Prudhoe Bay region, has increased since the inception of oil field development and has demographics similar to those of adjacent herds which are not near oil fields. Although oil field development may impact individual caribou through disturbance or impedance of movements, herd-level impacts of the oil fields are not apparent. Caribou populations characteristically fluctuate dramatically, and differentiating human and non-human impacts is difficult or impossible. The herd is the unit of management, and management objectives are being met. The experience in northern Alaska's oil fields indicates resource extraction and wildlife populations can be compatible when managed properly.* © *1998 Published by Elsevier Science Ltd*

Keywords: Alaska oil development, caribou, population-level impacts, *Rangifer*, wildlife management.

INTRODUCTION

Over the last 25 years, oil fields have been developed in the Prudhoe Bay region of Alaska. These include the largest fields in the United States and account for over 25% of U.S. domestic oil production. As oil production in these fields is declining, there will be proposals to explore new areas, including the Arctic National Wildlife Refuge (ANWR; Clough *et al.*, 1987). Assessment of the effects of oil field development in the Prudhoe Bay region will be important for predicting potential effects in other areas in the Arctic. There has been a tremendous amount of research conducted on fish and wildlife of the Prudhoe Bay region because of the concern that oil field development would have detrimental effects. Some studies have predicted negative effects on wildlife (e.g., Walker *et al.*, 1986, 1987, 1989), while others have suggested limited effects or even enhancement of habitat in the oil fields (Robertson, 1989; Gallaway *et al.*, 1991; Maki, 1992; Truett and Kertell, 1992; Amstrup, 1993; Rodrigues, 1994; Amstrup and Gardner, 1994; Martin and Gallaway, 1994; Truett *et al.*, 1994; Bruce *et al.*, 1995; Pollard *et al.*, 1996*a*).

The fact is that most fish and wildlife populations have not declined in the area of the Prudhoe Bay oil fields (Gallaway *et al.*, 1991; Maki, 1992 and references therein). Indeed, populations of many mammals and birds that spend part of the year in the vicinity of the oil field (caribou, *Rangifer tarandus*; musk ox, *Ovibos moschatus*; grizzly bear, *Ursus arctos*; arctic fox, *Alopex lagopus*; polar bears, *U. maritimus*; snow geese, *Chen caerulescens*; Pacific black brant, *Branta bernicla*; and other waterfowl and shorebirds) are either stable or larger now than when the oil field was first developed (Amstrup and DeMaster, 1988; Reynolds, 1992; Johnson, 1994; Rodrigues *et al.*, 1994; R. Shideler, Alaska Department of Fish and Game, unpubl. data). Other species, such as the common eider, *Somateria mollissima*, have colonized man-made structures in the oil field (Johnson *et al.*, 1993). Despite this encouraging scenario, there is still concern about the impacts of oil field development on wildlife (Amstrup *et al.*, 1986; Walker *et al.*, 1987; Klein, 1991; Smith and Cameron, 1991; Wildlife Management Institute [WMI], 1991; Cameron *et al.*, 1992*a*,*b*, 1995; McCabe *et al.*, 1992; Monda *et al.*, 1994; Truett *et al.*, 1994; Nelleman and Cameron, 1996). This concern is justified because of the potential for cumulative habitat loss or disturbance which may negatively affect populations. However, we believe it is important to acknowledge the fact that wildlife populations in the oil field region are either stable or have been expanding over the last two decades in which extensive oil exploration and development have occurred. We also should recognize that extensive research-based mitigation and regulation has apparently

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helped to minimize impacts of the oil fields. Like McPherson and Shaw (1994), we are concerned that natural resource issues are accurately portrayed.

Our objective is to present and interpret information about caribou, a species which has been extensively studied relative to oil field development. Our treatment is not meant to be a comprehensive review, which would take a large volume, but a presentation of facts and ideas which we hope will stimulate constructive discussion. Like many papers on oil field-wildlife issues (e.g., Maki, 1992; Cameron *et al.*, 1992*b*; Rodrigues, 1994), ours will rely heavily on unpublished agency and industry reports. However, the information is relevant to the issues we discuss, and is used in making management decisions (e.g. Clough *et al.*, 1987).

IMPACTS ON INDIVIDUALS

A considerable amount of research has focused on the Central Arctic caribou herd (CAH), which occupies the area in and around the Prudhoe Bay oil field during June and July. The Western Arctic caribou herd (WAH) and the Porcupine caribou herd (PCH) occupy ranges to the west and east of the CAH, respectively (Fig. 1). Females of the PCH calve on the coastal plain of ANWR. The Teshekpuk Lake caribou herd (TCH) occurs near the coast, west of the CAH. These herds are all affected by predation, including human hunting, although hunting of caribou or other species is not permitted in the oil field areas.

Several potential impacts of oil field development on caribou have been identified (Cameron, 1983; Smith and Cameron, 1983, 1990; Bergerud *et al.*, 1984; Whitten and Cameron, 1985; Dau and Cameron, 1986; Klein, 1991). Human activity may disturb caribou and displace them from traditional calving or foraging areas. This may be detrimental to the caribou if displacement is to areas with increased predation or inferior forage (Truett *et al.*, 1989; White *et al.*, 1989; Fancy and Whitten, 1991; Whitten *et al.*, 1992; McCabe *et al.*, 1992; Whitten, 1993*a*; Nelleman and Cameron, 1996). In addition, structures such as pipelines and roads may impede caribou movements through oil fields or during migrations (Klein and Kuzyakin, 1982; Klein, 1991; Cronin *et al.*, 1994 and references therein; Cameron *et al.*, 1995).

Like other ungulates, female caribou are especially sensitive to disturbance for about 2 weeks around parturition and may distance themselves from human activity at this time (Dau and Cameron, 1986; Cameron *et al.*, 1992*b*). There is also some evidence from radio telemetry data of avoidance of oil field areas during the post-calving period (Cameron *et al.*, 1995). However, after calving, especially when mosquito or oestrid fly harassment is severe, many caribou ignore human activity and congregate on and around oil field structures and on gravel roads (Fig. 2; Robertson, 1989; Truett *et*

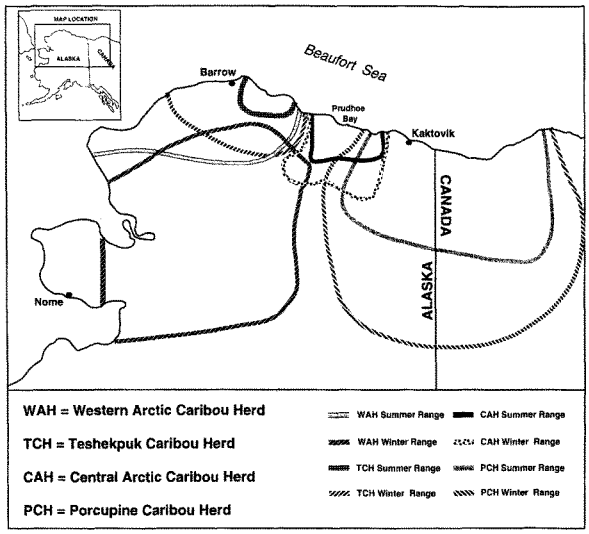


Fig. 1. Summer and winter ranges of four Alaskan arctic caribou herds.

al., 1994; Pollard *et al.*, 1996*b*) Caribou also will cross roads and pipelines more readily when under insect harassment (Child, 1974; Curatolo and Murphy, 1986; Dau and Cameron, 1986; Klein, 1991). Aerial surveys of the Prudhoe Bay oil field and surrounding area during the summers of 1990–1994 have shown large numbers of caribou using habitats within, or moving through, the oil field complex (Cronin *et al.*, in press *a*; Pollard *et al.*, 1996*a* and references therein). It is not uncommon to have vehicular traffic obstructed by groups of caribou milling on gravel roads in the northern Alaska oil fields. It should be noted that the reindeer, the Eurasian form of caribou, is the only member of the deer family that was domesticated by prehistoric man, and the adaptability and tolerance of the species to human activities is considerable (Bergerud *et al.*, 1984; Bergerud, 1988).

Caribou movements during summer appear to be dictated by the need to feed and avoid the swarms of insects which occur primarily in July. On warm days, caribou predictably move to the coast where there are winds which provide some relief from mosquitoes. On cooler days, caribou move inland to feed, often within the oil field complex (Cameron, 1983; Dau and Cameron, 1986). They congregate on gravel pads (used for drilling and other oil field activity) where mosquitoes and parasitic oestrid flies (warble flies, *Hypoderma taradi* and bot flies, *Cephenemyia trompe*, Diptera) are significantly less abundant than on adjacent tundra (Pollard *et al.*, 1996*b*). This presumably is due to the higher wind velocity, lower ambient temperature, and lack of vegetation on gravel pads. During investigations at Prudhoe Bay, oestrids were collected only in sunlit areas and not in the shade (Pollard and Noel, 1994). In July, when oestrid flies are present, some caribou seek the shade of buildings or elevated pipelines (the oil fields in northern Alaska are north of the tree line). Espmark (1968) also noted that reindeer may stand in shade to avoid oestrid flies.

Movement through the oil fields is important for caribou as they feed and try to avoid insects. Several studies have shown that elevating pipelines five feet or more above ground can be an effective measure to facilitate passage of caribou (reviewed by Cronin *et al.*, 1994). Movements through the older parts of the oil field may be difficult because of unelevated pipelines (Smith and Cameron, 1983), but development in newer areas has included the elevation of pipelines to at least five feet above the tundra (see Fig. 2), gravel ramps over pipes, and separation of roads and pipes. Future development may include buried pipelines. These measures have facilitated caribou movements through much of the oil field area.

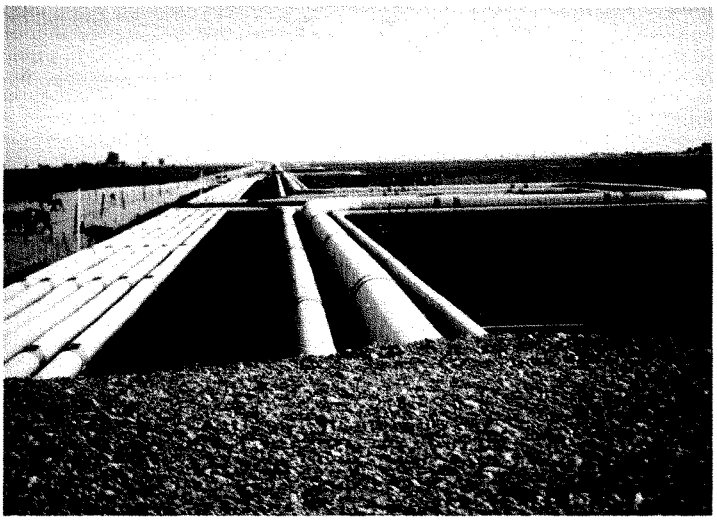
IMPACTS ON HERDS

There undoubtedly are effects of oil field development on individual caribou which can be mitigated to some extent with measures such as elevating pipelines. However, wildlife management usually focuses on populations (Soulé, 1987; Gilbert and Dodds, 1992; Caughley and Sinclair, 1994) or, in the case of caribou, herds. Caribou have been classified into geographically separate herds by management agencies. Skoog (1968) defined caribou herds as units with distinct calving grounds used repeatedly over a period of years. This definition is useful for identifying management units that are most relevant to herd productivity, i.e., recruitment of new calves into the herd. Telemetry studies support the concept of independent calving units because females show high fidelity to calving areas (Cameron *et al.*, 1986; Valkenburg and Davis, 1986). However, herds may not be equivalent to the common concept of populations or subpopulations, i.e., groups of interbreeding individuals having limited contact with other such groups. In many years, caribou of the CAH have mixed with those of the PCH, WAH, or TCH on non-calving ranges. Overlap with the PCH may occur in summer or winter, and overlap with the WAH and TCH in fall or winter (Bergerud *et al.*, 1984; Carruthers *et al.*, 1984; Sopuck and Jakimchuk, 1986; Carruthers *et al.*, 1987; Fancy *et al.*, 1992; Abbott, 1993). Mixing of herds may occur during the breeding period, and there is probably some gene flow among herds (Cronin *et al.*, 1995).

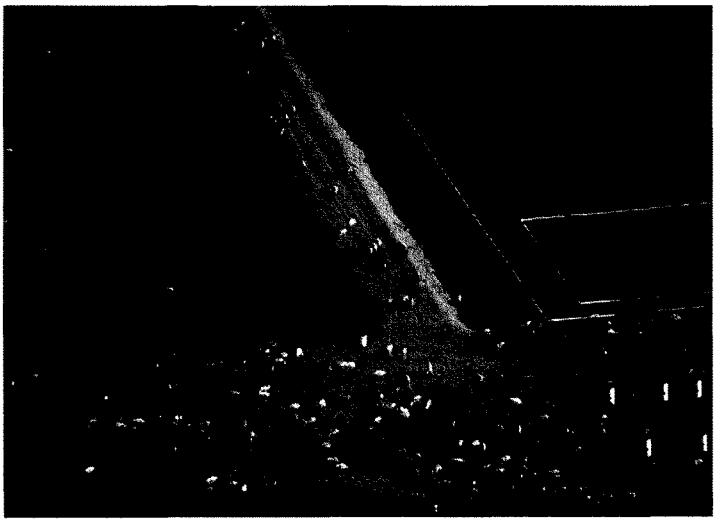
What can be said about oil field development and herd-level impacts? One simple way to assess impacts at the herd level is to compare the demographics of herds that are exposed to oil field development to those that are not exposed. This is similar to the strategy of government agency research, in which the body condition of caribou in contact with the oil fields is being compared with caribou without oil field contact (Cameron *et al.*, 1992*a*; Cameron, 1994).

As mentioned previously and discussed by others, the CAH has steadily increased in numbers over the period of oil field development around Prudhoe Bay (Klein, 1991; Maki, 1992; Cameron *et al.*, 1992*b*, 1995), although the rate of growth has decreased since 1985 (Valkenburg, 1993; Cameron, 1994) and the herd declined from 23 444 to 18 100 between 1992 and 1995. We compared the CAH and the three other northern Alaska herds and found overall positive growth rates and similar calf/cow ratios since the early 1970s (Fig. 3, Table 1). Our analysis used census data from agency reports (reviewed by Ballard and Cronin, 1995, and cited in Table 1). Additional census data prior to those used in our analyses, and the methods of data collection, are given in the Appendix. Although the census methods vary, and estimates of precision are lacking, these data are the best available estimates of caribou numbers.

We used the population estimates of the four arctic herds to assess the growth of the herds with both exponential and logistic growth models (Pielou, 1977; Caughley and Sinclair, 1994). Exponential rates of increase of the individual herds were calculated using



(a)



(b)

Fig. 2. (a) Caribou around a road and elevated pipes in the Prudhoe Bay oil field, Alaska. Photo by Robert Pollard. (b) Caribou congregated on a gravel pad in the Prudhoe Bay oil field, Alaska. Photo by John Warden, courtesy of BP Exploration (Alaska) Inc.

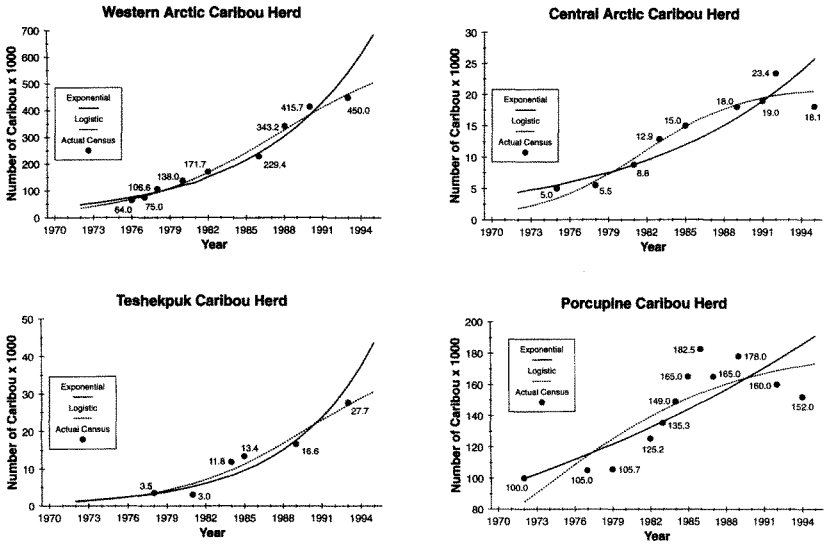


Fig. 3. Numbers of caribou over time and exponential and logistic growth curves for four arctic Alaskan caribou herds from 1970 to 1992. Note the different scales on *Y*-axis.

Table 1. Summary of population estimates, exponential growth rates, and calf:cow ratios from the 1970s through the early 1990s for the four major caribou herds (Western Arctic herd — WAH, Teshekpuk Caribou herd — TCH, Central Arctic herd — CAH, and Porcupine Caribou herd — PCH) occurring in northern Alaska

Parameter	WAH	TCH	CAH	PCH
Range of herd estimates×1000 (years)	64·0–450·0[a] (1976–1993)	3·1–27·7[b] (1978–1993)	5·0–23·4[c] (1975–1995)	105·7–178·0[d] (1972–1994)
Exponential growth rate — r (±95% CI)	0·116 (0·020)	0·152 (0·087)	0·077 (0·026)	0·028 (0·014)
Logistic growth Rate — r	0·182	0·198	0·249	0·131
Logistic carrying capacity (K)	640 433	42 423	21 361	183 115
Summer range areas[e]	197 000 km^2	12 500 km^2	17 000 km^2	121 000 km^2
Summer range density	0·32–2·28/km^2	0·25–2·22/km^2	0·29–1·38/km^2	0·87–1·47/km^2
Winter range areas[e]	375 000 km^2	25 000 km^2	54 000–65 000 km^2	337 000 km^2
Winter range density	0·17–1·20/km^2	0·12–1·11/km^2	0·09–0·36/km^2	0·31–0·53/km^2
Average calves/100 cows	69[a]	75[b]	74[f]	81[g]
(range)	(49–80)	(71–80)	(45–91)	(74–89)
Years	1960–1992	1981–1992	1978–1992	1978–1990

[a]Source: Davis and Valkenburg (1978), Davis *et al.* (1978), Machida (1992, 1993), Hicks (1994), P. Valkenburg, Alaska Dept. of Fish and Game, pers. comm.

[b]Source: Davis and Valkenburg (1979), Reynolds (1982), Carroll (1992, 1993), Hicks (1994), G. Carroll, Alaska Dept. of Fish and Game, pers. comm.

[c]Source: Cameron and Whitten (1979), Whitten and Cameron (1983), Garner and Reynolds (1986), Cameron *et al.* (1989), Valkenburg (1992, 1993), Fancy *et al.* (1992); P. Valkenburg, Alaska Dept. of Fish and Game, pers. comm.

[d]Source: Skoog (1968), LeResche (1972), Bente and Roseneau (1978), Whitten (1984, 1986, 1992, 1993*b*), Whitten and Cameron (1980, 1984), Garner and Reynolds (1986), Fancy *et al.* (1992), P. Valkenburg, Alaska Dept. of Fish and Game, pers. comm.

[e]Source: P. Valkenburg, Alaska Dept. of Fish and Game, pers. comm.

[f]Source: Cameron *et al.* (1981, 1988), Smith and Cameron, (1988, 1990), Valkenburg (1992, 1993), Fancy *et al.* (1992).

[g]Source: Fancy *et al.*, (1992), Whitten (1992).

$\log_e$ transformations of caribou numbers fit by least squares regression to calculate an intrinsic rate increase (r) and 95% confidence intervals around r (using SYSTAT's MGLH; Wilkinson, 1990). Growth rate (r) and carrying capacity (K) were calculated for logistic curves derived with nonlinear regression using the NONLIN program of SYSTAT. The population numbers and r and K estimates are presented in Table 1, and the exponential and logistic growth curves for the four herds are plotted in Fig. 3.

The exponential growth rates of the WAH ($r=0{\cdot}116$) and TCH ($r=0{\cdot}152$) are higher than those for the CAH ($r=0{\cdot}077$) and PCH ($r=0{\cdot}028$). The WAH and TCH have continued to increase as of the latest censuses in 1993. The exponential curve and logistic curve for each of these herds are very similar (Fig. 3). These herds' growth has been exponential without any indication of leveling off at a carrying capacity for the time period considered. The CAH and PCH had relatively lower exponential growth rates and have shown declines in numbers since 1989 (PCH) and 1992 (CAH). The CAH and PCH appear to have stabilized, or begun a decline, indicated by the leveling off of the logistic curves (Fig. 3). A logistic curve seems to better fit the CAH and PCH data than an exponential one, although we cannot predict if the herds will resume growth, stabilize, or decline in the future. The logistic model suggests carrying capacities of about 21 000 for the CAH and 183 000 for the PCH (Table 1).

In addition to herd growth characteristics, we compared calf/cow ratios (which indicate recruitment and herd productivity) and spatial density. Average ratios ranged from 69 to 81 calves/100 cows for the four herds over time. These estimates are from years preceding the recent declines of the PCH and CAH, so they may not reflect the current status of the herds' productivity. Considering the wide range of values for some herds, it appears the ratios are generally similar among the four herds.

As in other species, population density may affect the body condition and productivity of caribou, with slower population growth at higher densities (Valkenburg *et al.*, 1991; Messier, 1991). Using range area estimates provided by the Alaska Department of Fish and Game (P. Valkenburg, pers. comm.), we calculated summer and winter range densities for the four arctic herds by simply dividing the population estimates (Fig. 3) by the range area (Cronin *et al.*, in press*b*). We present summer and winter density estimates for the lowest and highest numbers for each herd (Table 1). For example, when the WAH contained 64 000 animals (lowest number), the summer density was $0{\cdot}32/km^2$; and when it contained 450 000 animals (highest number), the summer density was $2{\cdot}28/km^2$. The density estimates should be considered as approximate, as the ranges used by caribou may vary considerably among years. For example, the winter range of the CAH expanded from $54\,000\,km^2$ to $65\,000\,km^2$ (Table 1) because of a range expansion during the winter of 1990–1991 (Valkenburg, 1993). The George River Herd in Quebec has also expanded its range considerably over the last several decades (Messier *et al.*, 1988; Couturier *et al.*, 1990).

For all four herds, the summer ranges are considerably smaller than the winter ranges, so densities are higher on summer ranges than on winter ranges (Table 1). For example, at the lowest herd size, the summer density of the PCH was $0{\cdot}87/km^2$ and the winter density was $0{\cdot}31/km^2$. At the largest herd size, the summer density was $1{\cdot}47/km^2$, and the winter density was $0{\cdot}53/km^2$. Comparison among the herds at their largest sizes indicates the WAH had the highest summer range density followed by the TCH, the PCH, and the CAH. At the highest herd sizes, the WAH also had the highest winter range density, followed by the TCH, PCH, and CAH. The WAH and the TCH had the highest summer and winter densities, and these herds also had the highest growth rates. The CAH and the PCH, both with lower densities (at the largest herd sizes), had slower rates of growth and have apparently stabilized or begun to decline (Fig. 3). There is no clear trend of slower growth rate with high density, and we actually see the opposite. It could be argued that the slowing of the rate of growth of the CAH is due to oil field effects and not density, which is relatively low. However, at the largest herd size the PCH also had a relatively low density and a slowing of rate of growth, without oil fields within its range. A more detailed analysis of the CAH shows that density varies across the summer range, and dispersal may affect herd size (Cronin *et al.*, in press*b*).

The lack of a clear relationship between population density and growth at this large spatial scale of analysis is not particularly surprising, as our analysis does not consider other important factors. For example, Caughley and Gunn (1993) point out that caribou populations may not be limited by density *per se*, but by weather conditions (e.g. winter snow depth) and availability of forage which may be present but inaccessible because of snow cover. Several other authors have discussed these ideas as well (e.g. Messier *et al.*, 1988; Couturier *et al.*, 1990).

Our assessment shows that the CAH has had demographics similar to adjacent herds during the period of oil field development. The rate of growth, calf/cow ratios, and density of the CAH are not consistently different from those of the other herds which are not exposed to oil fields. Of course, many factors other than exposure to oil fields may affect the herds differently (e.g. predation, summer and winter range conditions), for which in-depth assessments are lacking. Can we draw any conclusions about the impacts of the oil fields on the herd? The answer is that we cannot draw cause and effect conclusions in a strictly scientific sense. As Klein (1991) stated: 'we cannot be conclusive about the cause and effect relationships between oil development and herd population dynamics.' Similarly, Bergerud *et al.* (1984) said: 'In a casual examination of the existing

literature, one may find evidence to support virtually any conclusion regarding the significance of disturbance to large ungulates. This uncertainty is largely the result of the emphasis being placed on individual and group observations which are then extrapolated to the population level....'

In the case of the CAH, there is considerable speculation about the effect of the oil fields on the herd but few unequivocal data. One hypothesis is that the presence of the oil fields has displaced caribou to inferior foraging areas which may result in poor body condition, fecundity, or survival, and ultimately poor herd productivity (WMI, 1991; Cameron *et al.*, 1992*a*; Cameron, 1994; Nelleman and Cameron, 1996). However, for 25 years the herd has grown at a rate within the range of growth rates for adjacent herds not exposed to oil fields. Bergerud *et al.* (1984) point out that caribou and other deer species can withstand periodic and severe disturbance without adverse effects on productivity and survival.

It also has been concluded that CAH caribou have abandoned the Prudhoe Bay oil field as a calving area, although there are few pre-development data to support this conclusion (Whitten and Cameron, 1985; Klein, 1991). A study in the Milne Point oil field west of Prudhoe Bay documented reduced density of calving caribou 1–2 km from an oil field road, but not abandonment of the area. Caribou returned to areas on both side of the road every year for 6 years after the road was constructed (Cameron *et al.*, 1992*b*).

It has been suggested that the CAH has avoided the oil field during the post-calving period, but that there was adequate adjacent habitat available for the herd to grow in spite of development (Cameron, 1983; Whitten and Cameron, 1983, 1985; Cameron *et al.*, 1995). However, surveys have shown that caribou regularly use habitats within the oil field complex throughout the post-calving period, and caribou can habituate to human activity (Bergerud *et al.*, 1984; Pollard and Ballard, 1993; Pollard and Noel, 1994; Cronin *et al.*, 1994; Pollard *et al.*, 1996*a*). In addition, in the early 1970s it was uncommon to see caribou cows with calves in the Prudhoe Bay oil field, but recently they are commonly observed there during the summer (J. D. McKendrick, pers. obs.).

Finally, it is interesting to compare management concerns of different herds in the context of demographics. Predator control and restricted hunting have been used to enhance growth and expansion of the Fortymile caribou herd (Hicks, 1994). In other cases, reduction of caribou numbers to keep herds within range capacity has been suggested (e.g. the George River Herd; Messier *et al.*, 1988; Couturier *et al.*, 1990). In contrast, maintaining herd productivity is still a concern for the CAH, although it may be approaching range capacity (Cameron *et al.*, 1992*a*; Cameron, 1994) (Fig. 3). It seems a multi-faceted approach is needed for management of the CAH, including an appraisal of summer and winter range capacity and animal density (Ballard and Cronin, 1995).

HUMAN IMPACTS AND NATURAL POPULATION FLUCTUATIONS

What are we to make of the equivocal results of oil field impacts on the CAH? As discussed by others (Bergerud *et al.*, 1984; Messier *et al.*, 1988; Couturier *et al.*, 1990; and references therein), we must appreciate the many variables which affect caribou populations (e.g. population density, predation, parasites, habitat condition, weather, snow conditions, human hunting, immigration and emigration, and unknown extrinsic factors). First, consider that with or without human impacts, caribou populations are often characterized by dramatic fluctuations in numbers (Couturier *et al.*, 1990; Caughley and Gunn, 1993; and references therein). For example, the WAH declined from over 250 000 to 64 000 animals in the 1970s, and there were other fluctuations of more than 100 000 animals since 1950 (Fig. 4). The WAH has recovered rapidly from the sharp decline in the 1970s, and is approaching half a million animals. Using historical data, we have graphed herd numbers of the WAH and three additional herds which have fluctuated considerably in number over time (Fig. 4; Caughley and Gunn, 1993).

The George River Herd in Quebec has increased even more dramatically than the WAH, from about 5000 to over 470 000 in 30 years (1954–1984), with an accompanying range expansion (Fig. 4; Messier *et al.*, 1988). This herd has continued to grow since the 1950s despite a deterioration of female body condition owing to poor habitat quality on calving grounds, and increased calf mortality in the late 1970s and early 1980s (Couturier *et al.*, 1990).

The decline of the Kaminuriak Herd of the Canadian Northwest Territories, from the late 1960s through 1980 (Fig. 4), has been blamed on excessive harvest (Gates, 1985), but it also occurred at a time when birth rates and calf survival were low and wolves were abundant (Heard and Calef, 1986). From 1980 to 1985, increased birth rates and calf survival, decreased predator to prey ratios, and a possible large-scale immigration, paralleled a period of high herd growth rate (Gates, 1985; Heard and Calef, 1986). The most recent population estimate in 1994 indicates the herd is continuing to increase (A. Gunn, Northwest Territories Dept. of Renewable Resources, pers. comm.).

The Fortymile Herd of east-central Alaska was estimated at 568 000 animals in the 1920s (Murie, 1935), only to fall to 10–20 000 in the 1930s for unknown reasons (Fig. 4; Skoog, 1956). Subsequent increases began in the 1940s and may have been due in part to implementation of a federal predator control program in 1947 (Gardner, 1993). A decline followed, and the herd reached a low of 5740 animals in 1976 during a period

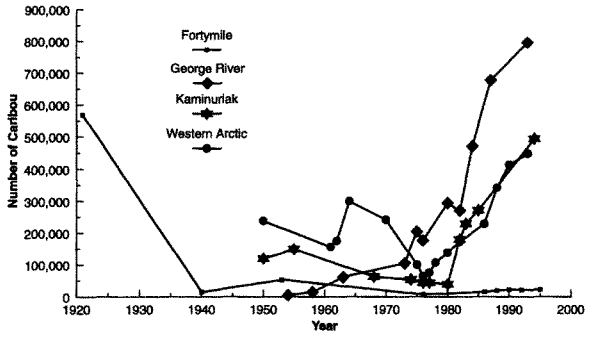


Fig. 4. Population estimates over time of four North American caribou herds. Estimates are from Murie (1935); Skoog (1956); Gardner (1993); and C. Gardner, pers. comm. for the Fortymile herd; Messier *et al.* (1988); Crête *et al.* (1990); and M. Manseau, pers. comm. for the George River herd; Heard and Calef (1986) and Ann Gunn, pers. comm., Dept. of Renewable Resources, Yellowknife, N. W. T. for the Kaminuriak herd; and Davis and Valkenburg (1978); Lent (1966); Skoog (1968); Machida (1993); and Hicks (1994); for the Western Arctic herd.

of excessive harvest (up to one-third of the herd per year), high wolf *Canis lupus* densities, and unfavorable weather conditions (Gardner, 1993; C. Gardner, pers. comm.). The herd is slowly increasing in conjunction with restricted harvests, shortened hunting seasons, and predator control (Gardner, 1993; C. Gardner, pers. comm.), although predation still may be limiting growth (Hicks, 1994).

Dramatic fluctuations of caribou populations are not unique, as it is well known that animal populations in northern latitudes undergo drastic fluctuations, which may be cyclical (e.g. snowshoe hare, *Lepus americanus* and lynx, *Lynx lynx* (Keith and Cary, 1991; Krebs *et al.*, 1995)). Caribou population fluctuations are possibly cyclic, although the length of the cycles may be erratic and on the order of a hundred years (Meldgaard, 1986; Couturier *et al.*, 1990). Caughley and Gunn (1993) suggest caribou numbers may fluctuate, in part, owing to unpredictable weather conditions, and do not have cycles with a regular period. Dramatic population fluctuations which may result in local extinctions and recolonizations have been recognized by population geneticists as frequent and episodic in many species, particularly in areas influenced by glaciations (Sage and Wolff, 1986; Slatkin, 1987; Wade and McCauley, 1988; Cronin, 1992). It is also commonly recognized that natural population fluctuations must be considered when assessing human impacts (Bergerud *et al.*, 1984; Baringa, 1990; Pechmann *et al.*, 1991; Pascual and Adkison, 1994).

It is instructive to note some of the factors which have been considered important in the regulation of caribou herds. The Nelchina caribou herd (NCH) from south-central Alaska has been the focus of long-term study and debate about population regulation. The NCH's range includes several roads and towns, and there is considerable human harvest each year. Most biologists agree that hunter-harvest of adults can have a major effect on herd demographics. In fact, to control the growth of the herd, a hunter-harvest of 10 000 females had been targeted for 1996. Regarding calf survival and, hence, recruitment into the herd, one school holds that wolf, *Canis lupus*, and bear, *Ursus* spp., predation on calves is of primary importance in regulating the NCH (Bergerud and Ballard, 1988, 1989), while others believe winter range and weather (including snow conditions) are more important (Van Ballenberghe, 1985, 1989). Other than hunting, human disturbance has not been a major concern. The George River Herd is thought to be most influenced by deteriorating calving range conditions and energy expenditure during increasingly long migrations which accompanied increases in population density (Messier *et al.*, 1988; Couturier *et al.*, 1990). Winter range, forage, and snow conditions seem most important for the Coats Island, Northwest Territories, herd (Gates *et al.*, 1986). In contrast to these other herds, the focus on the CAH has been potential oil field impacts. This has included study and monitoring primarily on summer ranges, where it spends only 2–3 months of the year.

The coincident increase in sizes of the arctic Alaska caribou herds, and the fact that these herds may overlap on winter ranges, exchange individuals, or undergo large scale changes of range (Whitten and Cameron, 1983; Bergerud *et al.*, 1984; Valkenburg, 1992, 1993), suggest these herds can be considered subpopulations of the same metapopulation (Skoog, 1968; Ballard and Cronin, 1995). Although radio-telemetry data suggest that there is considerable fidelity of female caribou to their natal calving ranges on the time scale of a few years (Whitten and Cameron, 1983; Cameron *et al.*,

1986, 1992*b*), over time, major range changes, immigration, and emigration may be important demographic factors. The CAH is considerably smaller than the adjacent WAH and PCH, and Bergerud *et al.* (1984) believe that the CAH split from the WAH during a population decline in the 1970s. Gavin (1975) also considered the animals in the range of the CAH to be 'offshoots' of the WAH and PCH. Bergerud *et al.* (1984) cautioned that if the CAH abandoned its range, it might be incorrectly attributed to human disturbance rather than the natural spacing shift of a large mobile population. Many other range shifts and mixing of herds are thought to have occurred in Alaska and other areas (Skoog, 1968, Bergerud *et al.*, 1984).

It appears to us that many complex factors must be appreciated when assessing potential human impacts on caribou populations. We agree with others that distinguishing development-induced impacts from natural changes in populations of caribou, or other species, will be very difficult or impossible (Bergerud *et al.*, 1984; Baringa, 1990; Klein, 1991; Pechmann *et al.*, 1991; Pascual and Adkison, 1994; Cameron *et al.*, 1995).

CONCLUSION

The CAH has grown during the period of oil field development. Klein (1991) points out that all of the major caribou herds in Arctic Alaska and Canada have also been increasing during this period, although there is concern that cumulative effects of oil field development may eventually have a detrimental impact on the CAH. Distinguishing natural from human impacts at the herd level will be difficult. Impacts on caribou have been predicted since the beginning of oil field development, but the herd has continued to grow and use the oil field areas.

We do not suggest there have been no impacts on individual animals or groups of caribou from oil field development, as disturbance or local displacement certainly can occur. However, the impacts on the herd may be small compared with non human impacts, or human impacts in other areas where hunting or other activities occur. We also wish to point out that oil fields provide benefits to caribou in the form of insect-relief habitat and protection from hunting. Because this is a resource management issue, and management focuses on the herd, it is perhaps most important to recognize that *management objectives are being met*. These objectives, for the CAH, as defined by the Alaska Department of Fish and Game, include: maintain a minimum population of 10 000 caribou, work with industry to prevent barriers to movement and disturbance, restrict hunting around development, and minimize harvest of females, and maintain a male:female ratio of at least 40:100 (Valkenburg, 1992; Hicks, 1994).

In addition to caribou, other species of wildlife use habitats in and near the Prudhoe Bay oil field on a regular basis and populations have grown concurrently with the caribou population (Maki, 1992; Johnson, 1994). The experience at Prudhoe Bay shows that wildlife populations can be maintained or increase in the presence of oil field development. However, control of human–wildlife interactions (hunting, harassment, or feeding), along with mitigation measures (e.g., elevated pipelines), should be an integral part of development. We choose to view the stable or increasing wildlife populations in the Prudhoe Bay region with optimism. We think that with careful research, planning, monitoring, and cooperation by industry and regulators, resource extraction, including oil production, can be compatible with maintaining wildlife populations.

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APPENDIX

Herd	Year	Season	Herd size	Methods
Western Arctic herd				
	1950	post-calving	238 000	Revision of earlier estimates from aerial observations (Skoog, 1968; Davis & Valkenburg, 1978)
	1961	post-calving	156 000	First attempted photocensus (Lent, 1966)
	1962	post-calving	175–200 000	Aerial photos of the entire herd were not possible, so visual observations using a correction factor from the 1961 estimate was used for this estimate (Lent, 1966)
	1964		300 000	Minimum estimate of adults from extrapolation of harvest numbers (Skoog, 1968)
	1970	post-calving	242 000	APDCE[a] (Davis & Valkenburg, 1978)
	1975	post-calving	100 000	APDCE[a] (Davis & Valkenburg, 1978)
	1976	post-calving	64 000	APDCE[a], this was considered a minimum estimate (Davis & Valkenburg, 1978)
	1977	post-calving	75 000	Calving ground census and APDCE[a], (Davis & Valkenburg, 1978)
	1978	post-calving	106 635	Modified APDCE (MAPDCE[b]; Machida, 1993)
	1980	post-calving	138 000	MAPDCE[b] (Machida, 1993)
	1982	post-calving	171 699	MAPDCE[b] (Machida, 1993)
	1986	post-calving	229 433	MAPDCE[b] (Machida, 1993)
	1988	post-calving	343 167	MAPDCE[b] (Machida, 1993)
	1990	post-calving	415 692	MAPDCE[b] (Machida, 1993)
	1993	post-calving	450 000	MAPDCE[b] (Hicks, 1994)
Teshekpuk Lake herd				
	1978	post-calving	3100–4000	Visual estimate from aerial survey (Carroll, 1993)
	1981	post-calving	3009	Visual estimate from aerial survey (Carroll, 1993)
	1984	post-calving	11 882	MAPDCE[b] (Carroll, 1993)
	1985	post-calving	13 406	Visual estimate from aerial survey (Carroll, 1993)
	1989	post-calving	16 649	MAPDCE[b] (Carroll, 1993)
	1993	post-calving	27 686	MAPDCE[b] (G. Carroll, pers. comm.; Hicks, 1994)
Central Arctic herd				
	1975	post-calving	4000–6000	Six systematic surveys of riparian and coastal habitat between March and November 1975 (Cameron & Whitten, 1979)
	1978	post-calving	5300–5800	Estimate of aggregations from the air followed by direct count from the ground (Whitten & Cameron, 1983)
	1980	post-calving	5000	Not accurately censused, but "undoubtedly exceeds 5000 head" (Cameron & Whitten, 1980)
	1981	post-calving	8537–9000	Direct counts or counts from photographs from aerial surveys and subjective extrapolation (Whitten & Cameron, 1983)
	1983	post-calving	12 900–12 905	MAPDCE[b] (Fancy *et al.*, 1992; Valkenburg, 1993)
	1985	post-calving	15 000	MAPDCE[b] (Garner & Reynolds, 1986:243)
	1989	post-calving	18 000	MAPDCE[b] (Cameron *et al.*, 1989)
	1991	post-calving	19 046	Extrapolation from aerial observations of stratified random quadrants (Valkenburg, 1993)
	1992	post-calving	23 444	MAPDCE[2] (Valkenburg, 1993)
	1995	post-calving	18 100	MAPDCE[2] (P. Valkenburg, pers. comm.)
Porcupine herd				
	1961	calving	110 000–117 000	Aerial census of adults (Skoog, 1968; Garner & Reynolds, 1986:240; Whitten, 1993*b*)
	1964	calving	140 000	Aerial census of adults (Skoog, 1968; Garner & Reynolds, 1986:240)
	1972	post-calving	100 000	APDCE[a], minimum estimate (LeResche, 1975)
			99 959	APDCE[a] (Whitten, 1993*b*)
	1977	post-calving	105 000	APDCE[a] (Whitten & Cameron, 1980; Whitten, 1993*b*)
	1979	post-calving	110 000	MAPDCE[b] (Whitten & Cameron, 1980)
			105 683	MAPDCE[b] (Whitten, 1993*b*)
	1982	post-calving	137 000	MAPDCE[b] (Whitten, 1986)
			125 174	Radio census[c] (Whitten, 1993*b*)
	1983	post-calving	135 284	Radio census[c] (Whitten, 1993*b*)
	1984		149 000	Projection estimate based on recruitment, mortality, and herd composition data obtained during radio-telemetry studies (Whitten, 1986)
	1985		165 000	same as 1984
	1986		182 500	same as 1984
	1987	post-calving	165 000	Radio census[c] (Whitten, 1993*b*)
	1989	post-calving	178 000	Aerial photo census adjusted for mixing with Central Arctic Herd and observer error (Fancy *et al.*, 1992) and radio census[c] (Whitten, 1993)
	1992	post-calving	160 000	Radio census[c] (Whitten, 1993)
	1994	post-calving	152 000	Radio census[c] (P. Valkenburg, pers. comm.)

[a]The aerial photo-direct count-extrapolation (APDCE) is a survey method using photographs of the major aggregations of caribou, counts of all groups incurred incidentally to the aggregations, and extensive reconnaissance of the entire post-calving range followed by an extrapolation to estimate missing bulls and yearlings (Hemming & Glenn, 1968; Davis *et al.*, 1979).

[b]The modified aerial photo-direct count-extrapolation (MAPDCE) is like the APDCE, but without extrapolation for caribou not in aggregations (Davis *et al.*, 1979).

[c]The radio census survey method requires locating radiotelemetry-collared animals at times of aggregation and photographing/counting animals in those groups and any groups are encountered incidentally to radio-collared animals (P. Valkenburg, pers. comm.; Valkenburg *et al.*, 1985).

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Northern Alaska oil fields and caribou

Matthew A. Cronin, Heather A. Whitlaw, and Warren B. Ballard

Abstract Caribou (*Rangifer tarandus*) are a prominent factor in regulating and managing oil and gas exploration and development in Alaska. Concerns that the oil fields in the Prudhoe Bay region of northern Alaska have negatively affected the distribution and productivity of the Central Arctic caribou herd (CAH) have been expressed in scientific literature and management documents such as environmental impact statements. The number of CAH caribou in the western summer range that includes the oil fields declined by more than 50% between 1992 and 1995 but then almost doubled between 1995 and 1997. Numbers of caribou in the eastern portion of the range, without oil fields, showed opposite trends during these time intervals. The changes in numbers of caribou in areas with and without oil fields are probably due to movements between summer ranges rather than oil-field impacts. Although there may be some disturbance of animals in the oil fields, population-level impacts apparently have not occurred. The number of caribou in the CAH has increased from approximately 5,000 to approximately 20,000 since oil-field development began, and the management objectives for the CAH have been met despite development of the largest oil and gas fields in the United States. Managers and regulators should acknowledge that coexistence of caribou with oil and gas development demonstrates the success of mitigation, regulation, and management efforts. These successes should be cited and incorporated in planning efforts for future oil development and in public management documents such as environmental impact statements (EIS). Management documents can be considered as scientific and objective only if all available information is included, regardless of whether the information has negative or positive connotations for developments.

Key words Alaska oil fields, caribou, population management objectives, *Rangifer tarandus*

The oil fields in the Prudhoe Bay region of northern Alaska are the largest in North America and account for about 20% of United States domestic oil production. Caribou (*Rangifer tarandus*) have been a key consideration in managing exploration and development of these oil fields. Extensive research and monitoring of caribou of the Central Arctic Herd (CAH) have been conducted in the Alaska oil fields since the early 1970s (reviewed by Cronin et al. 1998*a*, Ballard et al. 2000, Murphy and Lawhead 2000). Cameron et al. (1992, 1995), Cameron (1994, 1995), and Nellemann and Cameron (1996, 1998) found that female caribou may avoid oil-field infrastructure, especially roads with vehicle traffic during the calving season. They suggested that such avoidance might adversely affect body condition and herd productivity. The potential negative impacts of oil fields on caribou were described in an environmental impact statement (EIS) for future oil and gas leasing in the National Petroleum Reserve Alaska (NPRA) and some areas were excluded from leasing (United States Department of the Interior [USDOI] 1998*a*, *b*).

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However, the CAH has grown since the beginning of oil-field development from an estimated 5,000 animals in 1975 to about 20,000 animals in 1997 (Nowlin 1998; E.A. Lenart, unpublished memo to David James [Management Coordinator], Alaska Department of Fish and Game (ADF&G), Fairbanks, Alaska, 1998; Maki 1992; Cronin et al. 1998*a*; Ballard et al. 2000). This rate of growth is comparable to other caribou herds in undeveloped areas (Cronin et al. 1998*a*). In addition, survey data for 1990–1995 show regular use of habitats in the oil fields and no avoidance of infrastructure (Cronin et al. 1998*b*). After the calving period in early June, caribou move regularly throughout the oil fields and use gravel pads, roads, and shade provided by buildings and pipelines for relief from parasitic insects (Pollard et al. 1996*a*, *b*; Noel et al. 1998). We present census and productivity data collected by the Alaska Department of Fish and Game that suggest that the oil fields have not negatively affected caribou at the population level. State of Alaska management objectives for the CAH (e.g., maintain a minimum population size of 10,000 caribou, Nowlin 1998) have been achieved, reflecting effective mitigation and regulation that should be acknowledged in environmental impact statements, environmental assessments, and planning for new developments.

Central Arctic Herd caribou numbers and productivity 1992–1997

The CAH grew from 5,000 to 23,444 animals between 1975 and 1992 (Cronin et al. 1998*a* and references therein). Its estimated size then declined to 18,093 between 1992 and 1995 (Valkenburg 1993; Woolington 1997; Table 1; Figure 1). Estimated numbers of caribou in the western portion of the herd's summer range (including the oil fields) declined from 14,842 in 1992 to 6,327 in 1995, whereas numbers estimated in the eastern portion of the summer range (without oil fields) increased from 8,602 to 11,766 during the same period (Table 1). The cause of these changes is uncertain, although oil-field impacts and natural factors are possible (ADF&G 1995). Cronin et al. (1997) suggested that the decline in the western range between 1992 and 1995 was probably the result of basic population processes (i.e., population density effects or immigration or emigration between the eastern and western ranges) and was not related to oil fields. A census conducted in 1997 supported this view. First, the estimated total herd size in 1997 increased to 19,730 (E.A. Lenart, unpublished memo to David James [Management Coordinator], Alaska Department of Fish and Game, Fairbanks, Alaska, 1998). Second, and more importantly, the estimated number of caribou in the western range (with the oil fields) approximately doubled to 11,997 in 1997 and the estimated numbers in the eastern range (without oil fields) decreased by about half to 7,733 caribou (Table 1; Figure 1). Hence, trends in caribou numbers in the eastern and western ranges between 1995 and 1997 were the reverse of the trends between 1992 and 1995. We believe this indicates that oil fields did not cause the decline between 1992 and 1995. The increase in the western range between 1995 and 1997 was reported in agency documents (E. A. Lenart, unpublished memo to David James [Management Coordinator], Alaska Department of Fish and Game, Fairbanks, Alaska, 1998), but not in the EIS for NPRA (USDOI 1998*a*).

Table 1. Central Arctic caribou herd (CAH) photo census population estimates for developed (Western Range) and undeveloped (Eastern Range) areas of the central Arctic Slope of Alaska, 1992–1997.

	Caribou numbers in the CAH		
Year	Eastern Range	Western Range	Total
1992[a]	8,602	14,842	23,444
1995[b]	11,766	6,327	18,093
1997[b]	7,733	11,997	19,730

[a] Valkenburg 1993.

[b] E. A. Lenart, unpublished memo to David James [Management Coordinator], Alaska Department of Fish and Game, Fairbanks, Alaska, 1998.

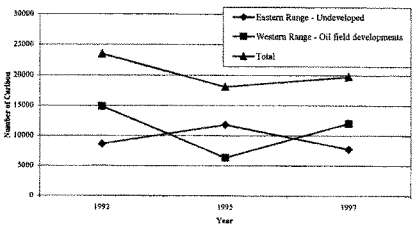

Figure 1. Central Arctic caribou herd (CAH) photo census population estimates for developed (Western Range) and undeveloped (Eastern Range) areas of the central Arctic Slope of Alaska, 1992–1997 (from Valkenburg 1993; E. A. Lenart, unpublished memo to David James [Management Coordinator], Alaska Department of Fish and Game, Fairbanks, Alaska, 1998).

It seems most likely that numbers of caribou in the eastern and western summer ranges of the CAH fluctuate for reasons other than impacts from the oil fields. The western range with oil fields had high numbers in 1992 and 1997 and low numbers in 1995, relative to the eastern range (Table 1, Figure 1). As suggested previously (Cronin et al. 1997), movement of animals may have resulted in the changes in numbers in the eastern and western summer ranges of the CAH. Caribou are very mobile and regularly make major changes in spatial distribution (Bergerud et al. 1984, Cronin et al. 1998*a*, Ferguson and Messier 2000). Most caribou of the CAH spend approximately 10 months each year on autumn, winter, and spring ranges outside the areas with oil fields. Movements among seasonal ranges and herds would not be surprising.

Parturition and recruitment data do not support the hypothesis that oil fields adversely affect caribou productivity. Between 1978 and 1992, the CAH had calf/cow ratios within the range observed for 3 other herds in undeveloped areas (Cronin et al. 1998*a*). Within the CAH, from 1997 to 1999, parturition rates (calves:100 cows in early June) in the western range were greater than or equal to (78%–94%) those in the eastern range (50%–87%). During the same years, early recruitment rates (calves:100 cows in late June) in the western range also were greater than or equal to (79%–93%) those in the eastern range (64%–88%; Lenart 1999).

Management implications

We think it is important to acknowledge that the management objectives for the CAH have been met during the 25-year history of oil development in Arctic Alaska. One current objective is to maintain a minimum population size of 10,000 caribou (Nowlin 1998), and the population in 1997 was estimated to be 19,730 caribou. However, we do not claim that oil development does not affect caribou of the CAH in some manner. For example, displacement of some caribou from oil-field infrastructure can occur during the calving season (Dau and Cameron 1986, Cameron et al. 1992). Nevertheless, these local impacts have not resulted in negative population-level effects and the CAH has grown throughout the period of oil-field development at a rate comparable to other herds in undeveloped areas (Cronin et al. 1998*a*, Ballard et al. 2000). We conclude that the dual objectives of producing oil and maintaining the CAH have been achieved. We encourage managers and regulators to stress succinct management objectives, rather than speculative impact assessments, in management documents such as environmental impact statements (e.g., USDOI 1998*a*). Management documents are scientific and objective only if all available information is included, regardless of whether it has negative or positive connotations.

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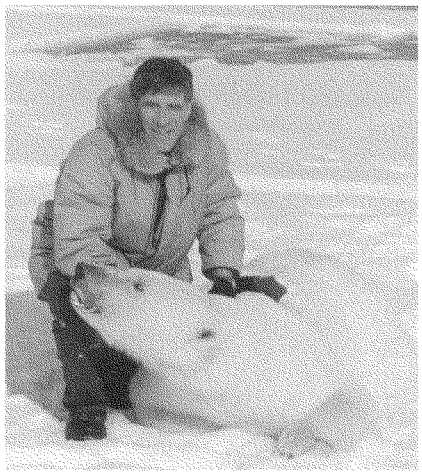

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REVIEW ARTICLE

Biological response to climate change in the Arctic Ocean: the view from the past

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Abstract The Arctic Ocean is undergoing rapid climatic changes including higher ocean temperatures, reduced sea ice, glacier and Greenland Ice Sheet melting, greater marine productivity, and altered carbon cycling. Until recently, the relationship between climate and Arctic biological systems was poorly known, but this has changed substantially as advances in paleoclimatology, micropaleontology, vertebrate paleontology, and molecular genetics show that Arctic ecosystem history reflects global and regional climatic changes over all timescales and climate states (10^3–10^7 years). Arctic climatic extremes include 25 °C hyperthermal periods during the Paleocene-Eocene (56–46 million years ago, Ma), Quaternary glacial periods when thick ice shelves and sea ice cover rendered the Arctic Ocean nearly uninhabitable, seasonally sea-ice-free interglacials and abrupt climate reversals. Climate-driven biological impacts included large changes in species diversity, primary productivity, species' geographic range shifts into and out of the Arctic, community restructuring, and possible hybridization, but evidence is not sufficient to determine whether or when major episodes of extinction occurred.

Keywords Arctic Ocean · Paleoclimate · Marine mammal phylogeny · Arctic ecosystems · Molecular clock

Introduction

Today's Arctic climate is warming faster than most other regions and losing summer sea-ice cover at historically unprecedented rates [27, 186]. This pattern of "Arctic amplification" is due to the changes in albedo [145], heat exchange between the atmosphere and ocean and other processes [146, 172] that are consistent with paleoclimate evidence for elevated polar temperatures during past warm periods [21, 126]. In addition to sea-ice decline, concerns exist about other climate-related processes that affect Arctic Ocean environments, such as submarine methane release [166], glacier melting [70], greater riverine discharge [147], marine ecosystem shifts [75], changes in biological productivity [9, 198], habitat loss and extinction [163], and carbon cycling [5, 180].

Instrumental and observational records are too short to fully evaluate the long-term effects of climate change on Arctic ecosystems, but two disparate fields—paleoclimatology and molecular genetics—now provide a unique context for assessment of climate change in the Arctic. In contrast to model simulations of future climatic and ecosystem change, paleoclimatology and genetics look back in time, using geochronology, physical, geochemical and paleoecological proxy methods, and DNA-based molecular clock analyses. Here we assess marine ecosystem response to past climate changes using an integrated approach based on Arctic sediment records of past intervals

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of warmth, orbital-scale glacial-interglacial cycles, and abrupt climate transitions coupled with DNA-based phylogenetic reconstructions and fossil records of polar vertebrate lineages. Although all parts of Arctic marine ecosystems cannot be studied, our study involves a wide variety of taxonomic groups and several key biological metrics of Arctic ecosystems including biodiversity, primary productivity, biogeography (range expansion and contraction) and hybridization. We address the fundamental question: does climate change cause large-scale loss of biodiversity through species' extinctions (α diversity) or rearrangement of species abundances within local communities, geographic range shifts (β diversity) [52, 65], or ecosystem restructuring [28, 76].

Advances in Arctic paleoclimatology

Most early studies of the Arctic Ocean sedimentary record were based on cores taken from research stations floating on sea ice in the 1960s and 1970s, which provided important discoveries but were geographically limited and lacked sufficient stratigraphic and age control [183]. Since the early 1990s, cruises led by German, Swedish, Canadian, Russian, and US researchers expanded the spatial and temporal coverage of Arctic sediment cores used for paleoceanography [135] (Fig. 1, Supplementary Table 1). In addition, greatly improved age control now allows a more complete reconstruction of Arctic Cenozoic climate history that, with exceptions, allows correlations with paleoclimate records from extra-Arctic regions.

Rapid advances have also come from the development of sediment proxy methods used to reconstruct environmental conditions and biological, chemical and physical processes influenced by climate (Supplementary Table 2). Examples used in the following discussion of Arctic climate and ecosystem evolution include micropaleontological records of benthic and pelagic communities, proxies of sea-ice cover, sediment transport, marine biological productivity, ocean temperature, salinity, dissolved oxygen and circulation, and ice sheet and ice shelf activity.

Cenozoic climate in the Arctic

In 2004, the Arctic Coring Expedition (ACEX), part of the Integrated Ocean Drilling Program (IODP Expedition 302), recovered 428 m of sediment from the central Arctic Lomonosov Ridge dating back to 56 million years (Ma) [10, 129, 182]. For the first time, a unique, though incomplete record of Arctic climatic and faunal evolution can be compared to the Cenozoic greenhouse-to-icehouse climate transition established on the basis of deep-sea foraminiferal $\delta^{18}O$ records of sea level and temperature and ice core records of atmospheric CO_2 concentrations and temperature (Fig. 2). Initial study of ACEX Paleocene-Eocene micropaleontological records Expedition 302 [59] identified numerous diatoms ($\sim$40 taxa), silicoflagellates and ebridians ($\sim$40), palynomorphs ($\sim$58), agglutinated benthic foraminifera ($\sim$40) and, due to poor pre-Miocene preservation of calcareous shells, lesser numbers of calcareous nannoplankton, calcareous benthic and planktic foraminifers, and ostracode taxa.

ACEX researchers also investigated key climatic and ecosystem events including the Paleocene-Eocene Thermal Maximum (PETM), an $\sim$170,000-year long warm period about 56 Ma when sea-surface temperatures in the Arctic (SST) reached 22 °C [174]. In addition, ACEX recovered sediment from two younger hyperthermal periods—the Eocene Thermal Maximum 2 (ETM2) at 53.5 Ma [175] and the *Azolla* horizon $\sim$48.5 Ma [22]. During ETM2 TEX_{86}-derived SST estimates indicate Arctic temperatures reached 25 °C, dinoflagellate cysts document freshwater influx and eutrophication, and palm pollen suggests winter temperatures on adjacent continents exceeded 8 °C. The dominance of the genus *Azolla*, a free-floating, freshwater fern, and associated microfossils, characterized an $\sim$800,000-year long interval of episodic fresh surface water, a stratified ocean, endemism in silicoflagellates and ebridians [134], SSTs of 10–14 °C [22], and intermittent oxygen depletion [181] (Fig. 2d, f). During Paleocene-Eocene hyperthermal events, marine primary productivity in the central Arctic varied greatly with maximum values reaching 50–100 C g m^{-2} $year^{-1}$ [106, 181]. These values are comparable to those from today's highly productive Arctic marginal ice zones [138] and higher than estimates for the central Arctic Ocean over the last 18 Ma, including today (Fig. 2c).

During the interval 48–45 Ma, Arctic SSTs fell by as much as 5–10 °C depending on which proxy method is used [182, 200]. This cooling is coincident with the inception of a winter sea-ice regime seen in ice-rafted debris (IRD) [179] and sea-ice diatom records [184] (Fig. 2a). There is also lithological evidence for ephemeral perennial sea ice at times between 47 and 44 Ma [42] (Fig. 2b). Climate history of the late Eocene, Oligocene and early Miocene is poorly known because one age model calls for a major sedimentary unconformity from 44 to 18 Ma [11], and another for a condensed zone representing the interval from 36 to 12 Ma [149]. This introduces uncertainty in identifying key Cenozoic cooling events, such as the Eocene/Oligocene transition $\sim$34 Ma, and their biological impacts. There is, nonetheless, evidence for stepwise cooling during the last 18 Ma of the Cenozoic greenhouse-icehouse transition. For example, IRD, mineral, and radiogenic proxies record a shift from a mid-Miocene climatic optimum ($\sim$15 Ma) toward a colder climate since about 13 Ma [41, 66, 79, 179].

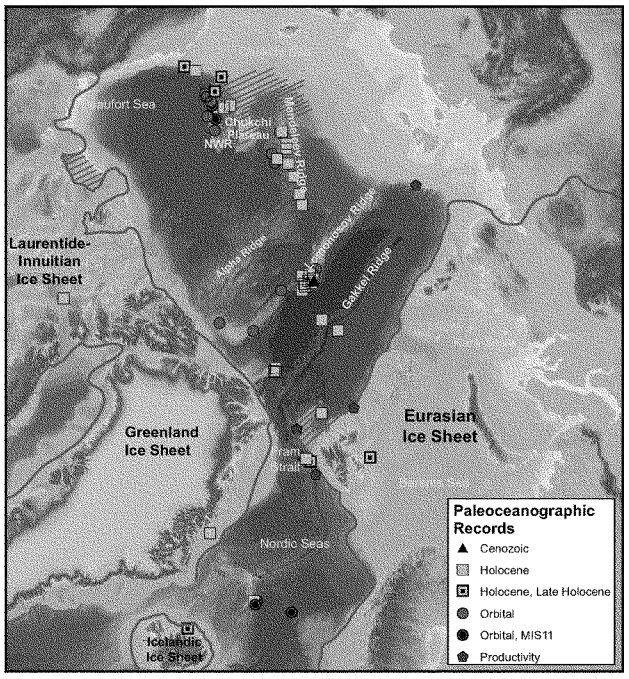
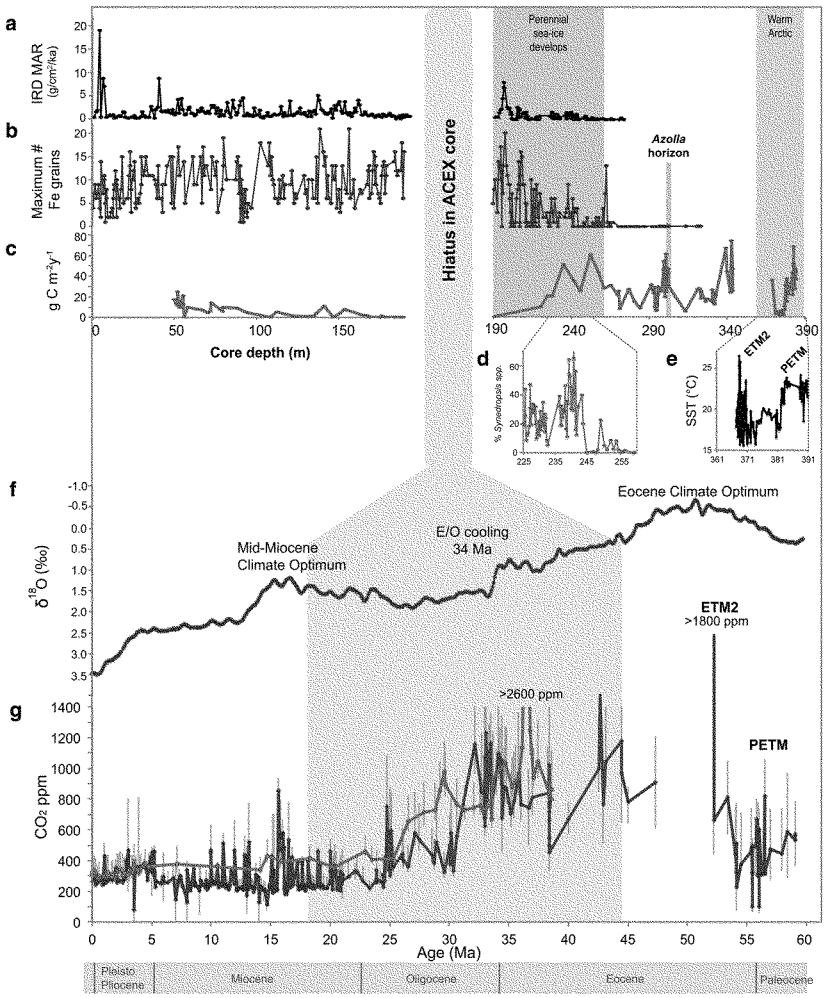


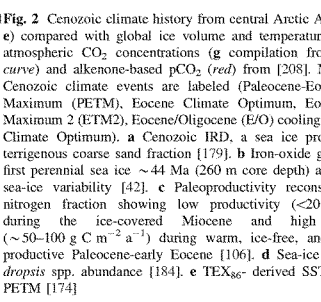
Fig. 1 Map of selected sediment core sites used for paleoceanographic reconstruction. The *key symbols* designate the age of the record. The *black triangle* is the Cenozoic record from IODP ACEX Project [10, 129]. "Orbital" cores record multiple glacial interglacial cycles. "Orbital, MIS 11" cores are orbital records that include warm interglacial Marine Isotope Stage 11 ~400 ka. "Holocene, Late Holocene" cores contain the last 1000–2000 years. Core sites keyed as "Productivity" were used in Arctic productivity studies. *Red lines* show the approximate margins of ice sheets. The Laurentide-Innuitian, Greenland and Eurasian ice sheet margins are maximum extent during the Quaternary [97, 188]. The Iceland ice sheet extent is the LGM [89]. Following [97], *red* crosshatched areas may or may not have been covered by ice sheets. *NWR* Northwind Ridge. Supplementary Table 1 provides information about core sites. Basemap is International Bathymetric Chart of the Arctic Ocean (IBCAO) [96]. See O'Regan [135] and Stein et al. [182] for additional core records

Early- to mid-Pliocene global climate (5–3 Ma) serves as an important benchmark for understanding modern climate because Pliocene atmospheric CO_2 concentrations were near today's level (400 ppmv, [139, 171]), but global mean annual temperature (MAT) was about 2.5–3 °C higher [53] and peak sea level ~22 m higher [127]. Pliocene Arctic Ocean summer SSTs were appreciably warmer than modern and seasonally sea-ice-free conditions existed in some regions [108, 121]. Non-marine proxy records from continental sections also point to a warm Pliocene climate in the high latitudes of the northern hemisphere. At Lake El'gygytgyn (Lake "E") in Siberia summer temperatures were 8 °C warmer than modern [21] and at Ellesmere Island, Canada, summer and MAT were 11.8 and 18.3 °C higher than today [13]. In addition to periods of warmth, the Pliocene saw continued intensification of Northern Hemisphere glaciations and crossing of climate thresholds at 4 and 2.75 Ma as ice sheets reached Arctic coastlines [107]. Such warm Pliocene conditions allowed a major trans-Arctic migration of mollusks [58, 195], ostracodes [37], and other groups ~4.5–3.8 Ma when the Bering Strait opened [71, 194]. The direction of this migration was mainly from Pacific-to-Atlantic and probably led to the evolution of some of today's endemic Arctic species.

Quaternary glacial-interglacial cycles

Climatic cycles driven by changes in earth's orbital geometry (eccentricity, tilt and precession) are known throughout the geological record. Orbital cycles have been recognized in early to mid Eocene Arctic sediments from the ACEX core site [141, 167], but they are much better known from Quaternary sediments deposited during the last 600 ka across the entire Arctic Ocean. Quaternary glacial-interglacial cycles (here we use marine oxygen isotopic stage (MIS) terminology, [115]) signify changes in global ice volume and ocean temperature inferred from


a
IRD MAR (g/cm²/ka)
b
Maximum # Fe grains
c
g C m⁻²yr⁻¹
Core depth (m)
Hiatus in ACEX core
Perennial sea-ice develops
Warm Arctic
Azolla horizon
d
% Synedropsis spp.
e
SST (°C)
ETM2
PETM
f
δ18O (‰)
Eocene Climate Optimum
E/O cooling 34 Ma
Mid-Miocene Climate Optimum
ETM2 >1800 ppm
g
CO2 ppm
>2600 ppm
PETM
Age (Ma)
Pleisto Pliocene
Miocene
Oligocene
Eocene
Paleocene



◀**Fig. 2** Cenozoic climate history from central Arctic ACEX core (**a**–**e**) compared with global ice volume and temperature (**f**, [30] and atmospheric CO_2 concentrations (**g** compilation from [17] (*blue curve*) and alkenone-based pCO_2 (*red*) from [208]. Major steps in Cenozoic climate events are labeled (Paleocene-Eocene Thermal Maximum (PETM), Eocene Climate Optimum, Eocene Thermal Maximum 2 (ETM2), Eocene/Oligocene (E/O) cooling, mid-Miocene Climate Optimum). **a** Cenozoic IRD, a sea ice proxy, based on terrigenous coarse sand fraction [179]. **b** Iron-oxide grain record of first perennial sea ice ~44 Ma (260 m core depth) and subsequent sea-ice variability [42]. **c** Paleoproductivity reconstruction from nitrogen fraction showing low productivity (<20 g C m^{-2} a^{-1}) during the ice-covered Miocene and high productivity (~50–100 g C m^{-2} a^{-1}) during warm, ice-free, and biologically productive Paleocene-early Eocene [106]. **d** Sea-ice diatom *Synedropsis* spp. abundance [184]. **e** TEX_{86}- derived SST showing the PETM [174]

deep-sea foraminiferal oxygen isotopes (Fig. 3a). These are accompanied by changes in atmospheric temperature and CO_2 concentrations known from Antarctic ice cores and other proxy records (Fig. 3b, c). In the Arctic Ocean, glacial-interglacial cycles are seen in a variety of proxies: manganese concentrations [92, 118, 148, 155, 156], sediment physical properties (grain size, bulk density) [136], mineral assemblages and trace elements [61], organic biomarkers [204], and stable isotopes [1, 153, 176] (Fig. 3d–f). Variability in these proxies reflects massive changes in ice cover, river runoff, and ocean circulation during opposing extremes of interglacial warmth with summer sea-ice-free conditions and glacial-age ice cover.

Although not gaining as much attention as past warm periods, glacial periods in the Arctic and adjacent subarctic deserve special attention because they provide a stark environmental contrast with interglacials and concrete evidence for the resiliency of marine ecosystems in the face of large-scale climate oscillations. Records of the Last Glacial Maximum (LGM, MIS 2, ~24–19 ka) and the penultimate glacial MIS 6 (~150 ka) have excellent age control [150], broad spatial sediment core coverage, extensive submarine geophysical surveys, and onshore glacial geological mapping. At these times, the Arctic Ocean was reduced to ~50 % of its current area due to the combined effects of a 125 m fall in global sea level (increased ice-sheet volume), which exposed the vast Arctic continental shelves, and the expansion of ice sheets and ice shelves bordering the Arctic Ocean [43, 90, 91, 93, 94]. During glacial maxima, the cryosphere, including ice sheets, ice shelves, glaciers and sea ice, was substantially more extensive than what we see today (Fig. 1). The Laurentide, Innuitian, Eurasian, Barents Sea-Svalbard, and Icelandic Ice Sheets covered large parts of continental regions adjacent to the Arctic Ocean [56, 188], but perhaps as important, extensive ice shelves as thick as 1 km have been identified from submarine glacial landforms mapped using geophysical methods on the Chukchi margin and Yermak Plateau [97, 98, 131, 196], the Lomonosov Ridge and Chukchi Plateau [151], the Lomonosov Ridge [110], and the Morris Jesup Rise [95]. During peak glacial conditions, sea ice was so thick during glacial maxima that little or no IRD could be transported to the central basin from continental margins leaving a sediment-starved central Arctic Ocean [150, 153]. Although the thickness of glacial-age sea ice is not known precisely, multiyear sea ice, called paleocrystic ice, thicker than today's >40 m-thick ice shelves off Ellesmere Island, may have dominated the glacial Arctic Ocean before the main phase of deglaciation began at 15 ka [20].

At the same time that the LGM Arctic Ocean proper was dominated by thick sea ice and ice shelves, sea ice extended far southward into subarctic regions of the Nordic Seas, the northern North Atlantic and the Bering Sea. Using dinoflagellate cyst assemblages from more than 50 core sites, de Vernal et al. [48] reconstructed spatial patterns of LGM sea ice, SST and sea-surface salinity from mid-to-high latitudes across the Northern Hemisphere. Among their findings were the presence of mid-latitude sea ice, stronger seasonality, nearshore to offshore SST gradients, and reduced surface salinities. Planktic foraminiferal assemblages and stable isotope values [132], and epipelagic ostracodes [38] also indicate southward migration of sea ice into the Nordic Seas and North Atlantic during glacial periods MIS 2, 4, and 6. Similarly, in the southern Bering Sea, LGM sea ice is evident from diatom assemblages [24].

Biological response to glacial-interglacial cycles

Perhaps the most striking biological manifestations of orbital cycles in the Arctic Ocean and surrounding seas are patterns of microfossil density, species diversity, and assemblage composition, which, when combined with physical and geochemical proxies, provide compelling evidence for ecosystem response to climate change. In contrast to the pre-Miocene sediments in the Arctic, which lack calcareous microfossils [see above], commonly preserved microfossil groups in the Quaternary include benthic and planktic [153, 201]) foraminifera, calcareous nannofossils [12], and ostracodes [39]. Along Arctic margins and in the Nordic Seas, diatoms [16], tintinnids (planktic ciliates, [169]), and dinoflagellates [120] also occur. In addition to faunal and floral remains, there are indirect proxies of oscillating biological activity, notably organic biomarkers of sea-ice diatoms and phytoplankton [60] and sediment manganese oxyhydroxide content related to terrestrial input, ice cover, and bioturbation [117, 118].

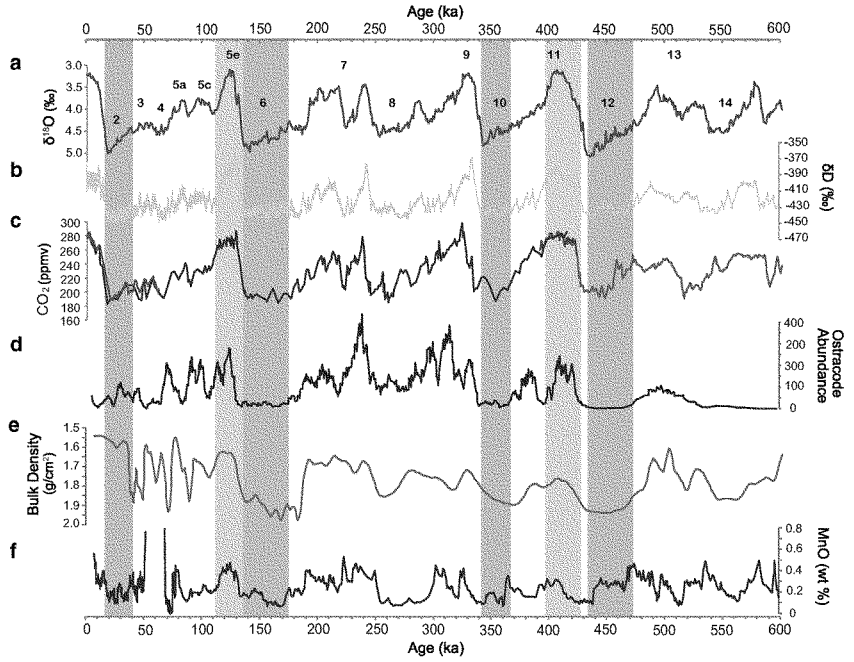


Fig. 3 Quaternary Climate. Global (*top panels* **a**–**c**) and Arctic (*bottom panels* **d**–**f**) climate proxies for the last 600,000 years. **a** Benthic oxygen isotope curve reflects global ice volume and temperature, marine isotope stages are numbered [115], **b** EPICA dome C deuterium, a temperature proxy [99], **c** EPICA dome C CO_2 curves [measured at Bern (*green*), Grenoble (*blue*), Taylor Dome (*gray*) and Vostok (*red*)] [173]. Deuterium and CO_2 values are on EDC3 gas age scale, **d** Arctic ostracode density composite from five western Arctic cores (Cronin et al. 2013), **e** Manganese content in sediments from Oden 96-12 core [Lomonosov Ridge [92], **f** Sediment density (Lomonosov Ridge IODP 302 ACEX core [136]). *Green bars* show periods that, based on Arctic proxies, were likely seasonally sea-ice free. These correspond to particularly warm marine isotope stages 5e and 11. *Gray bars* denote glacial stages with thick Arctic sea ice inferred from proxies corresponding to marine isotope stages 2, 6, 10, and 12

The density of calcareous microfossils in sediments from central Arctic ridges is directly linked to interglacial and glacial climate regimes and changes in sea-ice cover, surface productivity, sedimentation, and post-depositional processes [12, 119]. It is well established that foraminifera (benthic and planktic) and ostracodes are major components of the sand-sized fraction in interglacial sediments in contrast to near absence in glacial-age sediments [1, 80] (Fig. 3d). In addition to density, microfossil biodiversity is extremely variable in the eastern Arctic, where benthic foraminiferal diversity measured by the Fisher α and Shannon Wiener indices varied several-fold during the last glacial cycle [203], and in the western Arctic over the last few glacial-interglacial cycles [154]. Mechanisms driving species diversity patterns within the Arctic include the strength of inflowing warm Atlantic water, ice cover and surface productivity.

Microfossil assemblage composition (e.g. β diversity), measured by the relative abundances of environmentally sensitive species and genera, is also a useful measure of ecosystem dynamics. One striking example of climate-driven migration is the Pacific diatom *Neodenticula seminae*, a species that sediment records show disappeared in the North Atlantic Ocean ~800 ka. It has recently been discovered that this species has migrated back into the North Atlantic and Nordic Seas during the last 2 decades

almost certainly in response to higher ocean temperatures allowing inter-oceanic migration [125, 161]. In Arctic cores, biogeographic range shifts occur frequently due to changes in climate and ocean circulation over various timescales. One widely used benthic foraminifera, *Epistominella exigua*, is a phytodetritus-eating, opportunistic species that dominates modern oceanic frontal zones [73]. Microfossil assemblages with dominant *E. exigua* indicate seasonally sea-ice-free and/or marginal ice zone conditions that characterized the early-mid Quaternary (~1.5 Ma–300 ka) prior to the development of perennial sea ice. This species is common during warm interglacials MIS 5 (125 ka, the Eemian Interglacial) and MIS 11 (400 ka) but absent during glacial periods [154].

As discussed above, ice shelves and thick sea ice covered the glacial Arctic Ocean, and, as a consequence, species were forced to migrate southward into extra-Arctic regions on a large scale. We can track the range expansion and contraction of sea-ice and marginal ice zone species because the ecology of several groups is well known from large, pan-Arctic surface sediment databases. In the case of dinoflagellates, fossil assemblages are used to estimate months of sea ice cover in subarctic seas [48, 49]. The epipelagic ostracode species *Acetabulastoma arcticum*, which today lives as a parasite on sea-ice dwelling species of the amphipod *Gammarus,* is also a useful sea-ice proxy in the Arctic and adjacent seas [38]. As expected from its ecology, this species occurs only in glacial age sediments (MIS 2, 4 and 6) in cores from the Nordic Seas and North Atlantic.

There is also evidence in the Arctic for two well-known global climate transitions involving changes in the pattern of orbital glacial-interglacial cycles—the Mid-Pleistocene Transition between 1.2 Ma and 700 ka [26], and the mid-Brunhes Event ~450–400 ka [205]. Importantly, both climate transitions involved changes in Arctic sea-ice ecosystems. For example, the mid-Pleistocene transition, a shift from 41 to 100-kyr glacial-interglacial cycles, is characterized by faunal turnover (including regional extinctions) in Arctic foraminifera and ostracodes and reduced marine productivity. These signal a change from a seasonally ice-free to mostly perennial sea-ice cover during interglacial periods [154]. Globally, the mid-Brunhes Event coincides with the glacial termination between MIS 12 and MIS 11 (~450–400 ka) after which interglacial periods had smaller continental ice sheets, higher sea level, warmer temperatures, and higher atmospheric CO_2 concentrations. MIS 11 was an exceptionally warm interglacial, notable because, whereas atmospheric CO_2 concentrations (~280 ppmv) and orbital insolation were similar to those of the Holocene interglacial, global sea level was higher than today, perhaps due to the collapse of parts of the Antarctic Ice Sheet [84, 160, 165]. Arctic sediments from the Northwind, Mendeleev, and Lomonosov Ridges show that during MIS 11, there was no summer sea ice and SSTs reached 8–10 °C [39]. Warm Arctic Ocean summers during MIS 11 are also evident in the Nordic seas and the subpolar North Atlantic [15, 100], in Lake "E" sediments [123] and from terrestrial pollen in cores off southern Greenland [50]. Subsequent interglacial and interstadial periods (MIS 9, 7, 5 and 3) also experienced, at least at times, summer sea-ice-free conditions [133, 137].

In sum, the contrast between glacial and interglacial oceanic environmental conditions in the Arctic and subarctic reflects frequent biogeographic marine ecosystem shifts of several thousand kilometers supporting the view that climate change alters β diversity but does not cause the systematic loss of species.

Abrupt, suborbital climate transitions

One pressing question is whether climate has reached a "tipping point" such that we are witnessing an abrupt climate reversal (over a century or less) [25]. The last deglacial period (~19–11.7 ka) included several well-known millennial climate events whose onsets and terminations were abrupt transitions. These include stadial periods called Heinrich Event 1 (H1, 17–15 ka), the Younger Dryas climate reversal (YD, 13–11.7 ka) and interstadials called the Bølling-Allerød (B/A, 14.6–13 ka), and the Preboreal period (PB, 11.7–9 ka) (Fig. 4). Importantly, past abrupt climate reversals had major impacts on Arctic marine ecosystems over timescales much shorter than orbital cycles and they provide a unique context for today's changing Arctic. The last glacial period from 60 to 15 ka included multiple Heinrich Events, identified by ice-rafted sediment and sea-surface cooling in the North Atlantic Ocean, and Dansgaard-Oeschger (DO) cycles identified in Greenland ice core oxygen isotopes and extra-Arctic proxy records.

Changes in the dominant species in benthic foraminifer assemblages occurred on the Yermak Plateau and Barents Sea slope during stadial-interstadial events. These changes suggest a more than twofold change in marine productivity (from 30 to >60 g C m^{-2} $year^{-1}$) (Fig. 4a) [202]. On the Laptev Sea margin, changes in dominant benthic foraminiferal species occur over a century or less at the onset and termination of H1 and the YD. Decreases in planktic foraminiferal stable isotope values during the YD up to 1 per mil are known from the Beaufort and Laptev Seas and the Mendeleev Ridge [6, 157, 177]. Faunal and isotopic proxies signify complex hydrological changes in the surface and subsurface Arctic Ocean caused by freshwater influx probably from multiple catastrophic glacial lake drainage episodes [192] and changes in the strength of inflowing Atlantic water. It is worth noting that other types of catastrophic events disrupted Arctic marine

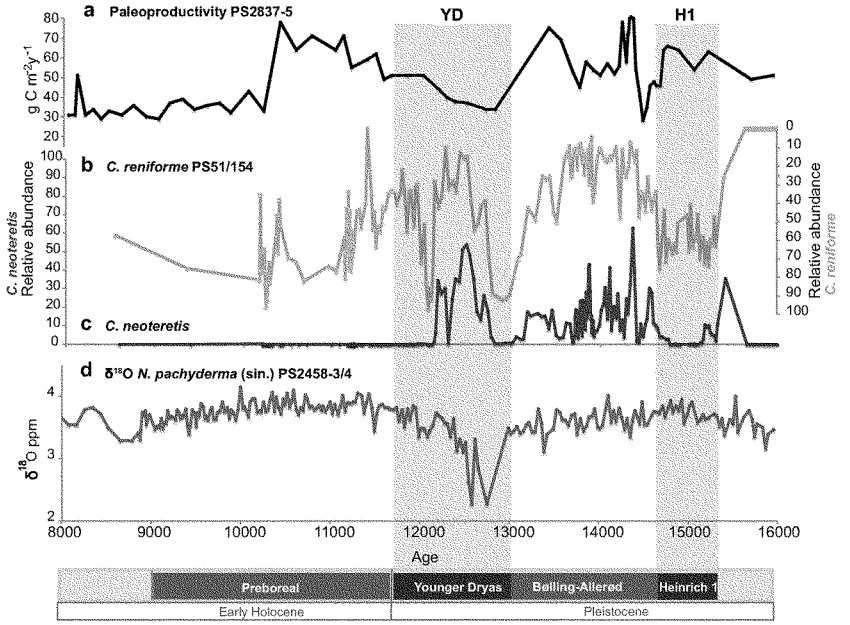


Fig. 4 Abrupt climate change in the Arctic during the last deglacial period including Bølling-Allerød and Preboreal interstadials and Heinrich 1 (H1, 17–15 ka) and Younger Dryas (YD, 13–11.7 ka) stadials. **a** Benthic foraminiferal record of marine productivity from core PS2837-5 (1023 m water depth), Yermak Plateau, showing high interstadial and low stadial (YD) productivity [202]. **b–c**. Two species of benthic foraminifera from core PS51/154 (270 m water depth) highlight ecosystem changes during abrupt stadial-interstadial oscillations [190]. Absence of *C. neoteretis* (*dark blue*) and dominance of *C. reniforme* (*light blue*, *y* axis reversed) at 15 and 13 ka signify ocean circulation changes related to freshwater influx at the end of H1 and the YD. **d** Oxygen isotope values of planktic foraminifer *Neogloboquadrina pachyderma* (sin) in core PS2458 from Laptev Sea continental margin (983 m water depth) show abrupt decline at 13 ka due to fresh water influx during YD [177]. Higher $\delta^{18}O$ values reflect ice sheet retreat during Preboreal and Bølling-Allerød

ecosystems, such as mega-iceberg discharges caused by Eurasian Ice Sheet surge and collapse, which scoured the seafloor in the Kara-Barents Seas [95, 131, 152] and central Arctic as far back as 500,000 ka [110]. Space limits our discussion to the Arctic Ocean proper, but suborbital millennial-scale events also caused frequent marine ecosystem reorganizations in the Nordic Seas during the last glacial-interglacial cycle [14, 78].

Holocene climate oscillations

Although smaller in scale than glacial-interglacial cycles, climate variability during the Holocene interglacial period had significant impacts on polar biological systems. There is extensive evidence for an Early Holocene Thermal Maximum (EHTM) ~11–7 ka with regionally variable seasonally sea-ice-free conditions based on circum-Arctic lake and ice core records [101, 187], glacial geology [122], ocean temperatures [62], IRD [44], dinoflagellate assemblages [112], and sea-ice biomarkers [130]. The EHTM was followed by Neoglacial cooling, which witnessed the development of what we know as the preindustrial, perennial sea-ice-covered Arctic, culminating in the Little Ice Age (LIA, 1400–1900 C.E.). Temporally and spatially variable sea-ice cover throughout the Holocene is among the most notable discoveries of the last decade [170, 193] because it reflects an Arctic Ocean highly sensitive to insolation and unforced climate variability.

Similarly, high-resolution late Holocene records covering the last 1000–2000 years are particularly important because they provide baseline variability to interpret recent trends in sea ice and temperature. Terrestrial [40, 102], marine SST [178], and sea ice [104] proxies show natural climate variability during the late Holocene, including the Medieval Climate Anomaly (600–1400 C.E.) and the LIA, as well as anomalous 20th century patterns.

Arctic Ocean marine mammals

Marine mammals are a major component of modern Arctic sea-ice ecosystems [74, 105] and their molecular genetics and paleontology provide insights about past climate changes in the Arctic. The use of molecular sequences of DNA and proteins to infer species' phylogeny and divergence times (i.e., a molecular clock) is an important aspect of phylogenetics [191]. These analyses, combined with vertebrate fossil evidence, can provide information about the temporal distribution of species, which can be used with paleoclimate data to better understand the Arctic climate-biological relationships, especially for vertebrate lineages (Supplementary Table 3). As we see below, molecular methods are increasingly applied to integrated paleoclimatic-ecosystem studies in the Arctic, so it is important to briefly consider the strengths and limitations.

The molecular approach involves comparison of the amino acid sequences of proteins or nucleic acid sequences (DNA or RNA) in different species [158, 191, 197, 209]. Molecular sequences will diverge by mutation from a common ancestral sequence at some rate, which is the time component of the "clock". If the rate of sequence divergence is constant, then its extent will be a function of time and the phylogenetic relationships and time of divergence of the sequences can be estimated. If the time of divergence of the sequences is assumed to be equal to the time of divergence of the species, then an estimate of species' divergence time is obtained. The assumptions of a constant rate of sequence divergence (depending on mutation rate and population genetic factors of selection, population size, migration) and that a sequence divergence reflects the species divergence are key factors affecting the accuracy of molecular clocks. Single gene sequences often do not reflect the species phylogeny so multiple genes or entire genome sequences are needed for robust analyses (e.g., [142]). DNA from extant animals is typically used to quantify sequence divergence, but ancient DNA (aDNA) from fossil material as old as 0.7 ma can also be used and provide valuable insights [168].

The accuracy of molecular clocks also depends on the accuracy of a fossil calibration date to identify the divergence time for at least one node of the phylogenetic tree of the taxa considered [7, 87, 124, 143]. Divergence time estimates can be controversial because of potential discrepancies of molecular clocks depending on the genes, calibration points, and models of molecular evolution considered [69, 158, 191, 197].

Case studies of vertebrate phylogeny with fossils and DNA sequences

In the case of Arctic climate change, the divergence time of polar bears (*Ursus maritimus*) and its sister species, brown bears (*U. arctos*), is especially relevant because there is concern about reduced summer sea ice habitat, especially for some geographic populations [3, 4, 54, 185]. Polar bears and brown bears are thought to have evolved from a common ancestor during the Pleistocene [111], and a polar bear fossil from the last interglacial (Eemian) period ~125 ka established this age as their minimum time of divergence [2, 88, 114].

Molecular clock estimates of the divergence time of polar bears and brown bears vary widely depending on the genes used. These include divergence times of 2–3 Ma using proteins [72], 110–130 ka with mitochondrial DNA (mtDNA, [8, 19, 46, 57, 109, 114, 189, 206, 207], 0.43–1.12 Ma with Y-chromosome DNA sequences [18] and 0.34–2.0 Ma with nuclear DNA sequences [57, 77, 206]. The most recent analyses of genome sequences estimated the polar bear-brown bear divergence at 340–480 ka [116], 1.2 Ma [23, 36], and 4–5 Ma [128].

Due to the inherent uncertainty of molecular clocks, some authors have refrained from applying them to these species [32, 67, 140, 199]. Cahill et al. [23] note that the molecular divergence times for bear species are relative, not absolute dates because of the uncertainty of the fossil record regarding bear species' divergences. However, it is reasonable to infer the minimum age of *U. maritimus* is about 125 ka and more likely somewhat older, between 300 ka and 2 Ma. As discussed above, major climate transitions including the mid-Pleistocene Transition and mid-Brunhes Event occurred during this time frame.

Given the dynamic nature of climate-driven habitat changes outlined above, it is important to note that speciation may be accompanied by interbreeding between populations until there is permanent reproductive isolation. Extant populations of polar bears and brown bears have separate gene pools with minimal interbreeding [34–36, 77, 144], but future interbreeding (i.e., hybridization) is hypothesized if sea-ice declines and polar bears spend more time on land [103]. Past interbreeding in these species is suggested by paraphyletic mtDNA phylogeny in which polar bears and brown bears from Admiralty, Baranof, and Chichagof islands (ABC) in southeast Alaska have haplotypes in a clade separate from other brown bears [32, 35]. In addition, polar bears and ABC brown bears

share nuclear alleles [77, 116, 128], including <1 % of the autosomal genome and 6.5 % of the X-chromosome loci [23], but none of the Y-chromosome [18]. The pattern of genes shared by polar bears and ABC brown bears—maternally inherited mtDNA > X chromosome > autosomes > Y-chromosomes—is consistent with introgressive hybridization of male brown bears mating with female polar bears. This is hypothesized to have occurred about 12 ka when brown bears replaced polar bears during postglacial colonization of the ABC islands [23].

Pinniped phylogenies also shed light on the development of the Arctic marine ecosystem. The pinnipeds, which include seals (Phocidae), sea lions (Otariidae), and walruses (Odobenidae), live in Arctic and subarctic seas with seasonal or perennial ice. Seals of the subfamily Phocinae (tribe Phocini) include three closely related genera in the northern hemisphere whose divergence has been estimated with fossil and molecular data relevant to our discussion. This includes the ringed seal (*Pusa hispida*), a primary prey of polar bears. The genus *Pusa* has a circumpolar Arctic distribution that in addition to *P. hispida* in the central Arctic includes Caspian seals (*P. caspica*) in the Caspian Sea, and Baikal seals (*P. sibirica*) in (freshwater) Lake Baikal, Siberia. *Phoca* includes the harbor seal (*P. vitulina*) in the temperate and subarctic northern hemisphere, and the spotted seal (*P. largha*) in the subarctic North Pacific Ocean. The gray seal (*Halichoerus grypus*) occurs in the North Atlantic Ocean.

However, seal classification is not definitive because of close relationships among various groups. For example, harbor seals and spotted seals are sometimes considered conspecific, and some taxonomists suggest that *Pusa* and *Halichoerus* could be reclassified as *Phoca* [45, 86]. This is reflected in equivalent mtDNA divergence (mean sequence divergence 3.36 %) of ringed seals, harbor seals, and gray seals, which has been used as a standard to calibrate a molecular clock for other taxa [7].

The fossil record shows that ringed seals occurred in the Arctic region during Quaternary interglacial and interstadial periods, including the eastern Beaufort Sea (~42 ka), Greenland (130 ka), and the Chukchi Sea (130 ka, [81, 162]). *Phoca* (harbor seal or spotted seal) fossils also occur in the Chukchi Sea (115–130 ka, [162]). This indicates that the oldest fossils of ringed seals and spotted/harbor seals in the Arctic are the same age as the oldest polar bear fossil from the Eemian (MIS 5) interglacial. Even though molecular clock estimates suggest a much older origin of polar bears, the fossil data provide a minimum estimate of their origin and that of ringed and harbor/spotted seals. This confirms that the bears and seals co-existed in the Arctic during MIS 5 and persisted until the present.

Molecular genetic data indicate that the Phocini radiated during the last 1–2 Ma. Analysis of 8935 bp of 16 nuclear genes and mtDNA indicates that *Pusa* and *Phoca* split 1.58 Ma; and within *Phoca* harbor seals and spotted seals split 0.4–1.3 Ma, and within *Pusa* ringed, Caspian, and Baikal seals split 0.7–1.8 Ma [68]. Analysis of 26,818 bp of 52 nuclear and mtDNA genes indicate *Pusa* and *Phoca* split 2.1 Ma; and within *Phoca* harbor seals and spotted seals split 1.1 Ma, and within *Pusa* ringed, Baikal, and Caspian seals split 2.0 Ma [86]. The differences in these estimates reflect the different genes and models used, but they also indicate that seal species, including ringed seals, probably existed over much of the Pleistocene and Holocene along with polar bears.

The walrus (*Odobenus rosmarus*) also lives in Arctic and subarctic sea-ice-covered regions. Two subspecies are generally recognized, the Atlantic walrus (*O. r. rosmarus*) in the central Canadian Arctic east to the Kara Sea and the Pacific walrus (*O. r. divergens*) in the Bering and Chukchi Seas. A population in the Laptev Sea is related to the Pacific walrus [63, 113]. The fossil record shows that the Odobenidae evolved in the mid-Miocene ~16–21 Ma [47] and *O. rosmarus* is the only extant species, although up to 14 genera and 20 species lived in the past [47, 81]. *Odobenus rosmarus* is thought to have migrated from the Atlantic to the Pacific about 600 ka [81]; walrus fossils in the Bering and Chukchi Seas date to about 130 ka, on Vancouver Island, British Columbia 70 ka Ma, and as far south as California ~270 ka [82].

Molecular clock estimates suggest the walrus family diverged from the sea lion family (Otariidae) about 15.1–18 Ma [68, 86]. There are no extant taxa for molecular clock comparison of walruses with other Odobenidae, but an estimate of divergence of the Atlantic and Pacific walrus can be made considering their mtDNA divergence of 1–1.6 % [33] and a rate of pinniped mtDNA evolution of 1.2 %/Ma [7]. These data suggest the Atlantic and Pacific subspecies split sometime between 83 and 133 ka, although there may have been gene flow between the oceans over this time considering the changes in sea-ice conditions described above.

Vertebrate range expansion and contraction during climate changes

Vertebrate paleontology often combined with paleoclimatic and/or molecular genetics provides key information about Arctic mammalian response to climate change. For example, Cooper et al. [29] recently analyzed genetic (13 events) and paleontological (18 events) megafaunal "transition events" for terrestrial taxa within the context of abrupt climate transitions including Dansgaard-Oeschger events identified in Greenland ice cores and Cariaco Basin sediments. They defined faunal transitions as geographically widespread or global extinctions, or invasions, of species or major clades.

The bulk of the evidence indicated terrestrial vertebrates are affected by abrupt climate transitions.

In addition, there have been several studies in which polar bear evolution has been assessed in the context of orbital paleoclimate cycles over the past few million years [23, 46, 57, 77, 128]. If, as DNA and fossil evidence suggests, polar bears and their primary prey, ringed seals and other prey such as walruses, have existed for at least 125 ka and likely hundreds of thousands of years, then they experienced extreme climate conditions of glacial periods as well as partially or completely summer sea-ice-free interglacial periods (MIS 11, MIS 5 and the early Holocene). Microfossil proxy evidence for southward expansion of sea ice during glacial periods implies that vertebrate species that are dependent on sea ice habitat might have also migrated southward into the Nordic and Bering Sea-North Pacific regions.

Several lines of evidence support this idea of frequent geographically extensive range shifts, not only in terrestrial vertebrates [29], but sea ice based marine mammals as well. First, the close genetic relationships among bear species and among seal species discussed above, including evidence for hybridization, suggests dynamic population shifts. Moreover, large-scale range expansion during glacial periods is evident in the fossil record of vertebrates in extra-Arctic regions [81]. For example, the post-glacial Champlain Sea (13–9 ka, [159]) of New York, Vermont, and Canada has well-studied Arctic vertebrate faunas that include whales, walruses, brown bears and seals [64, 83]. Likewise, in coastal regions around Alaska, fossil records [31, 85] support molecular genetic data [23] showing that during the LGM, polar bears and ringed seals ranged as far south as the Gulf of Alaska, considerably south of their current Arctic ranges. In the case of summer sea-ice-free interglacial periods, the presence of winter sea ice habitat, polar bears' ability to fast during summer [164], seals ability to use land areas in the absence of sea ice, and the availability of new prey species shifting ranges into the Arctic may have allowed survival during warm periods. Walrus also have an extensive glacial and post-glacial fossil record [55] including specimens from the paleo-Hudson River Valley on the New York and New Jersey continental shelf dated at ~ 10.6–11.2 ka [51].

Discussion

The Cenozoic ecosystem changes in the Arctic described above are summarized in Figs. 5 and 6 within the context of climate changes over different timescales. Several conclusions can be made. First, a seasonally ice-free marginal and central Arctic Ocean was common not only during Greenhouse worlds of PETM and Early Eocene, but also during the Pliocene, the early Quaternary before the Mid-Pleistocene Transition, during MIS 11, MIS 5 and regionally during the early Holocene. During orbital climatic cycles of the last few hundred thousand years, interglacial periods were characterized by perennial and at times seasonal sea ice cover and inhabited by marine ecosystems similar to those of the pre-industrial Holocene. Some species thought to be dependent on summer sea ice (e.g., polar bears) survived through these periods. In contrast, during glacial periods the much smaller Arctic Ocean and much of the adjacent continents were covered with massive ice sheets, thick ice shelves, and sea ice making large regions virtually uninhabitable to most species that inhabit today's Arctic. Despite the scale, frequency and

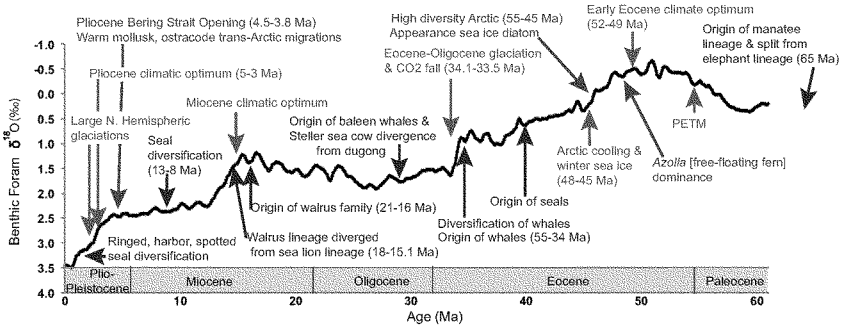


Fig. 5 Summary of Arctic Ocean biological and climatic events during the Cenozoic. *Blue letters* are marine mammal events, *red* are climatic events, *green* are biological events. See text and Supplementary Tables 1–3 and Supplementary references for sources

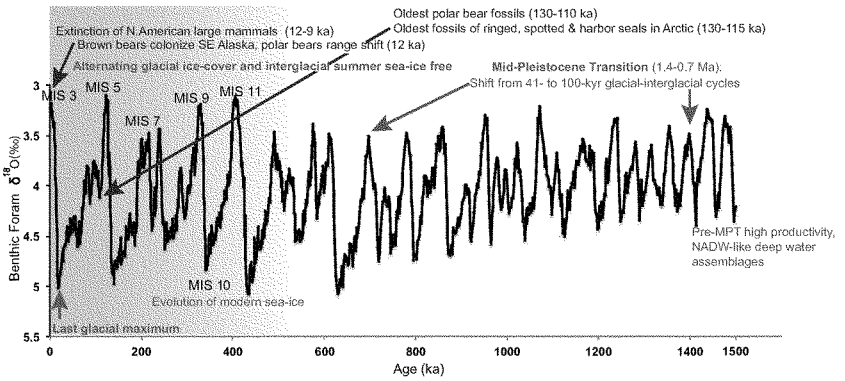


Fig. 6 Summary of Arctic Ocean biological and climatic events during mid-to-late Quaternary orbital glacial-interglacial cycles. *Blue letters* are marine mammal events, *red* are climatic events, *green* are biological events. See text and Supplementary Tables 1–3 and Supplementary references for sources

rapidity of Quaternary climate changes, Arctic marine ecosystems associated with sea-ice habitats were extremely resilient, adapting through geographic range expansion into the Arctic during warm periods, and south into extra-Arctic regions during glacial periods. The stratigraphic record of the last 1.5 Ma indicates that no marine species' extinction events occurred despite major climate oscillations. The Cenozoic sedimentary record is too incomplete to conclude that large climate transitions caused extinction of Arctic species, but hopefully future IODP coring will recover more complete records [182]. More generally, future cross-discipline studies of Arctic species and ecosystems combining molecular methods and paleoclimate reconstructions will result in a better understanding of how biological systems respond to climate changes.

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Dynamic Responses of Calving Caribou to Oilfields in Northern Alaska

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ABSTRACT. Past research has suggested that during the calving period, caribou (*Rangifer tarandus*) in Arctic Alaska generally avoid areas within 1 km of oilfield roads with traffic. However, avoidance is not absolute, and caribou may habituate to infrastructure (e.g., buildings, roads, well pads) and human activity. We conducted road-based surveys of caribou in oilfields on Alaska's Arctic Coastal Plain during the late calving and post-calving periods of June in 2000–02. We recorded location, composition, and behavior of caribou groups located less than 1 km from active gravel roads and production pads. Caribou groups with calves were on average distributed farther from oilfield infrastructure than were groups without calves, but habituation to oilfield activities, indicated by decreased avoidance, occurred at similar rates for groups with and without calves. During the calving period, sighting rates were greater in areas of low human activity, and calf percentages tended to be greater at night when oilfield activity was reduced. Caribou groups were on average closer to infrastructure during the post-calving periods than during the calving periods in 2000 and 2001, but not in 2002. In 2002, when snow melted early, caribou groups were closer to infrastructure during the calving period than in 2000 and 2001, when snow melted later, emphasizing the importance of examining environmental variables when investigating the dynamic interactions of caribou and oilfields. Overall, caribou appeared to habituate to active oilfield infrastructure after the calving period in 2000, late in the calving period in 2001, and likely before our sampling period in 2002. The timing of annual rehabituation was positively correlated with timing of spring snowmelt. Land and wildlife managers can use information from this study to develop calving period-specific mitigation measures that are more effective and flexible.

Key words: Alaska, avoidance, calving caribou, distribution, habituation, oilfields, *Rangifer tarandus*, road surveys, snowmelt

RÉSUMÉ. Selon des recherches antérieures, pendant sa période de vêlage, le caribou (*Rangifer tarandus*) de l'Alaska arctique évite généralement les régions se trouvant à l'intérieur d'un kilomètre des routes où circulent des véhicules menant aux chantiers pétroliers. Cependant, cet évitement n'est pas absolu, et le caribou peut s'accoutumer aux infrastructures (comme les bâtiments, les routes et les chantiers) et à l'activité humaine. Nous avons effectué le dénombrement des caribous près des routes des champs de pétrole de la plaine côtière arctique de l'Alaska vers la fin de la période de vêlage et après la période de vêlage de juin 2000 à 2002. Nous avons consigné l'emplacement, la composition et le comportement des groupes de caribous se trouvant à moins d'un kilomètre des routes de gravier et des chantiers de production en activité. En moyenne, les caribous qui avaient des petits se tenaient plus loin des infrastructures pétrolières que les groupes de caribous qui n'avaient pas de petits. Cela dit, l'accoutumance aux activités pétrolières, dénotée par un moins grand évitement, survenait à des taux semblables pour les groupes qui avaient des petits et les groupes qui n'en avaient pas. Pendant la période de vêlage, les taux d'observation de caribous étaient plus élevés dans les régions où il y avait peu d'activité humaine, et les pourcentages de petits avaient tendance à être plus élevés la nuit, lorsqu'il y avait peu de va-et-vient aux chantiers. En moyenne, les groupes de caribous s'approchaient plus des infrastructures pendant les périodes suivant le vêlage des années 2000 et 2001, mais pas en 2002. En 2002, quand la neige a fondu plus tôt que d'habitude, les groupes de caribous s'approchaient plus des infrastructures pendant la période de vêlage qu'en 2000 et 2001, lorsque la neige a fondu plus tard. Cela fait ressortir l'importance de tenir compte des variables environnementales lorsque nous faisons des enquêtes sur les interactions dynamiques entre les caribous et les champs de pétrole. Dans l'ensemble, les caribous semblaient s'accoutumer aux infrastructures pétrolières en activité après la période de vêlage en 2000, puis vers la fin de la période de vêlage en 2001, et vraisemblablement avant notre période d'échantillonnage en 2002. Le moment de l'accoutumance annuelle coïncidait positivement avec le moment de la fonte des neiges au printemps. Les gestionnaires des terres et de la faune peuvent se servir de l'information émanant de cette étude pour élaborer des mesures d'atténuation tenant compte de la période de vêlage, mesures qui sont plus efficaces et qui présentent plus de souplesse.

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Mots clés : Alaska, évitement, vêlage, caribou, répartition, accoutumance, champs de pétrole, *Rangifer tarandus*, dénombrements près des routes, fonte des neiges

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INTRODUCTION

The effects of Alaska's North Slope oilfields on caribou of the Central Arctic Herd (CAH) have been the subject of extensive research and monitoring over the last 30 years (Shideler, 1986; Maki, 1992; NRC, 2003). Some authors have suggested that oilfield development has prompted shifts in distribution and displacement of calving caribou from areas within several kilometers of roads (Dau and Cameron, 1986a, b), potentially decreasing nutritional status and reproductive performance (Cameron et al., 1992, 2002, 2005; Cameron, 1995; Nellemann and Cameron, 1996, 1998; NRC, 2003). However, impacts to individuals may or may not translate to population-level impacts. The CAH has increased in numbers since oilfield development began on the North Slope (from ~5000 in 1975 to ~32 000 in 2002; Cameron and Whitten, 1979; Lenart, 2003), and the herd regularly uses habitats in the oilfields (Pollard et al., 1996a; Cronin et al., 1998a; Noel et al., 1998). The variability of the herd's recent high rates of net productivity (Cronin et al., 1998b; Ballard et al., 2000; Lenart, 2003) has been shown to be strongly correlated with environmental factors related to snow cover, and not to presence or absence of oilfields (Haskell, 2003; Haskell and Ballard, 2004). Furthermore, to achieve a suitable body weight for net-productive conceptions (i.e., those resulting in a healthy calf), *Rangifer* females may exhibit a time-minimizing foraging strategy that emphasizes the importance of forage availability during the fall pre-rut period, when CAH caribou are typically located away from the oilfields (Haskell and Ballard, 2004).

Since 1978, systematic aerial surveys have been conducted during the calving and post-calving periods in the Milne Point Unit (MPU), Kuparuk Unit (KRU), and Prudhoe Bay Unit (PBU) of the oilfields and in undeveloped areas (Cameron et al., 1992; Jensen and Noel, 2002; Lawhead and Prichard, 2002). The results of these surveys have been used to describe the number and distribution of caribou within major portions of the CAH's summer range following a northward spring migration from wintering areas (Gavin, 1975). The CAH has two general calving areas: 1) the Kuparuk-Milne Point area, between the Colville and Kuparuk rivers west of Prudhoe Bay, and 2) the Bullen-Staines area, between the Shaviovik and Canning rivers east of Prudhoe Bay (Whitten and Cameron, 1985; Wolfe, 2000). In recent years, the majority of CAH calving west of Prudhoe Bay has occurred approximately 7–27 km south of the coastal KRU, whereas, from 1978 to 1986, the majority of calving typically occurred closer to the coast (Whitten and Cameron, 1985; Murphy and Lawhead, 2000; Wolfe, 2000). After construction of the MPU and KRU in 1982, densities of calving caribou in the new oilfields increased markedly for three years and then dropped in 1986, a year with late spring snowmelt (Cameron et al., 1992; Haskell, 2003). As the herd continued to grow through 2001, the number of caribou using habitats within the oilfields during the calving period did not increase (Noel et al., 2004). It has been suggested that this relative shift in calving density may have been prompted by oilfield development (Nellemann and Cameron, 1998; Cameron et al., 2002, 2005; Griffith et al., 2002). Interactions over time of other biotic factors such as caribou, predator, and parasite densities—for example, herd history as it relates to predator control and social learning among caribou—may also cause changes in calving distributions (Folstad et al., 1991; Barten et al., 2001; Gunn and D'Hont, 2002; Gunn and Irvine, 2003). Also, with plant phenology following the south-to-north snowmelt progression (Lent, 1980; Whitten and Cameron, 1980), higher densities of desirable forage plants in better-drained habitats south of the coastal area (Walker et al., 1980; Walker, 1985; Smith, 1996), and the absence there of significant predation by wolves (*Canis lupus*; Murphy and Lawhead, 2000; Shideler, 2000), the area south of the KRU may provide more suitable habitat during the spring calving period in most years. However, no cause-effect relationship can be determined to explain the relative shift in calving density exhibited by the CAH over the past 20 years (Murphy and Lawhead, 2000).

When considering human disturbance effects on wildlife, it may be useful to examine environmental variables that influence habitat availability and selection, as well as implications of evolutionary theory regarding innate and learned animal behavior (Bergerud, 1974; Frid and Dill, 2002). When selecting an appropriate calving area, parous caribou often face a tradeoff between availability of nutritious spring forage and reduced risk of predation on neonates (Bergerud, 2000; Barten et al., 2001). This may explain why the majority of non-parous CAH caribou lag behind during northward spring migrations: they may prefer the same foraging habitats, but no such tradeoff exists (Cameron et al., 1992). In the MPU oilfield, density of caribou and calves during the calving period has been positively correlated with distance from roads (Dau and Cameron, 1986a; Cameron et al., 1992), but interacting factors that include local habitat selection, snow cover, and intraspecific competition may also affect caribou distributions (Haskell, 2003). Calving distribution relative to oilfield infrastructure is variable; calves are frequently seen within 1–4 km of roads (Lawhead and Prichard, 2002; Noel et al., 2004); displacement effects may wane over the years (Noel et al., 2004); and caribou

have recently been documented calving within 500 m of active oilfield roads and production pads (S. Haskell, pers. obs.). Like other deer (Cervidae), caribou may be capable of adapting to human activities (Haskell, 2003).

Caribou surveys from roads in the MPU and KRU oilfields were conducted through the 1980s, during early construction and operation, to assess the effects of the altered habitat and human activities on caribou distribution, group composition, and movement (Dau and Cameron, 1986b; Smith et al., 1994). From sighting rates and percentages of calves within 1 km of roads, Smith et al. (1994) concluded that during calving, occupancy of areas near roads by cow-calf pairs had progressively decreased, and habituation of maternal cows to the road system had not occurred.

We believe that spatial technologies made available to wildlife researchers within the past decade and the greater accuracy and precision of data that new methods produce should increase the scope and reliability of inferences made from such data (Taylor and Knight, 2003). The objectives of our study were to quantify distribution, behavior, numbers, and age and sex composition of caribou within 1 km of active gravel roads and pads in the MPU, KRU, and western PBU oilfields during the late calving and post-calving periods of 2000–02. We were also interested in examining environmental variables that might help to explain patterns of caribou distributions and behavior by inference. We predicted that maternal caribou groups would be distributed farther from active oilfield roads and production pads than non-maternal groups, and that displacement effects would be reduced after the calving period. We refer to results from aerial surveys concurrent to our road surveys to help develop and support our conclusions (Noel et al., 2004). Predicting impacts is part of the environmental review process, and understanding gross processes of habituation by caribou may aid in land management decisions and development of effective mitigation measures for industry and wildlife management agencies.

STUDY AREA

The study area is located on the northern edge of Alaska's Arctic Coastal Plain, between latitudes 70°10′ N and 70°30′ N and longitudes 149°10′ W and 150°20′ W, within the MPU, KRU, and western PBU oilfields. The PBU and KRU oilfields are the first and second largest producers of oil in North America, respectively (BP Exploration [Alaska] Inc., 2001). Terrain ranges from sea level to 25 m ASL. The area is characterized by low relief, many shallow lakes and drained lake basins, and a variety of habitats dominated by wet and moist graminoid tundra communities (Walker et al., 1980). Large mammals of the area, other than caribou, include grizzly bears (*Ursus arctos*), muskoxen (*Ovibos moschatus*), and occasionally moose (*Alces alces*; Gavin, 1980).

There are three major roads in our study area. The Spine Road, the main road through the oilfields, is oriented east-west approximately 20 km south of the Beaufort Sea coast, while the Milne Point and Oliktok Roads lead from the Spine Road north to the coast (Fig. 1). There are 32 secondary roads leading to production pads or mine sites. All roads and pads are gravel. There are about 222 km of all roads combined within 692.9 km^2 (road density = 0.32 km/km^2), calculated from a minimum convex polygon of external points along the roads surveyed during the 2000–02 road surveys (excluding the Tarn Road, which was surveyed only once during each calving period).

Smith et al. (1994) provided the following sequence of oilfield development. By spring 1978, the Spine Road was extended to about 3 km west of KRU CPF-1. The Kuparuk airstrip and operations center were constructed in winter 1979–80, and the pipeline to Prudhoe Bay was constructed in winter 1980–81. The Milne Point Road was constructed during winter 1981–82, and a corresponding pipeline, in 1984. The road system was extended west in spring 1982 to include the Oliktok Road and Kuparuk River Unit CPFs 2 and 3 (Fig. 1). Most existing facilities have been operational since 1986.

METHODS

Calving of the CAH typically occurs at the end of May, peaks during the first week of June, and is mostly complete by 15 June (Shideler, 1986). Calving has been documented as late as 24 June (S. Haskell, unpubl. data). In previous studies, calving and post-calving periods have been treated separately, and 20 June has been considered the date separating these periods (Dau and Cameron, 1986b; Pollard et al., 1992; Smith et al., 1994). We continue to use this date as the transition from the calving to the post-calving period.

We conducted road-based surveys of caribou from a pickup truck during late calving and post-calving periods in the Milne Point and Kuparuk oilfields and along the Spine Road from the Milne Point Road east to Prudhoe Bay Unit Z-Pad (Fig. 1) during 15–29 June 2000, 12–28 June 2001, and 11–18 and 21–26 June 2002. Depending on weather and caribou numbers, it took three or four 8-hour periods (1.5–2 days with two surveys per day) to complete coverage of the entire study area. We surveyed the study area in a general east-to-west direction, using standardized routes, to minimize potential biases from sampling varying habitats and areas of intensive human activity disproportionately to their relative abundance. Our systematic surveys are easily repeated, and we consistently maximized the time between surveys of an area (and consequently, the temporal independence of observations). Calving caribou from an adjacent herd traveled 2–3 km/day (Prichard et al., 2001).

We used caribou groups, not individuals, as sampling units to minimize dependence of observations of this

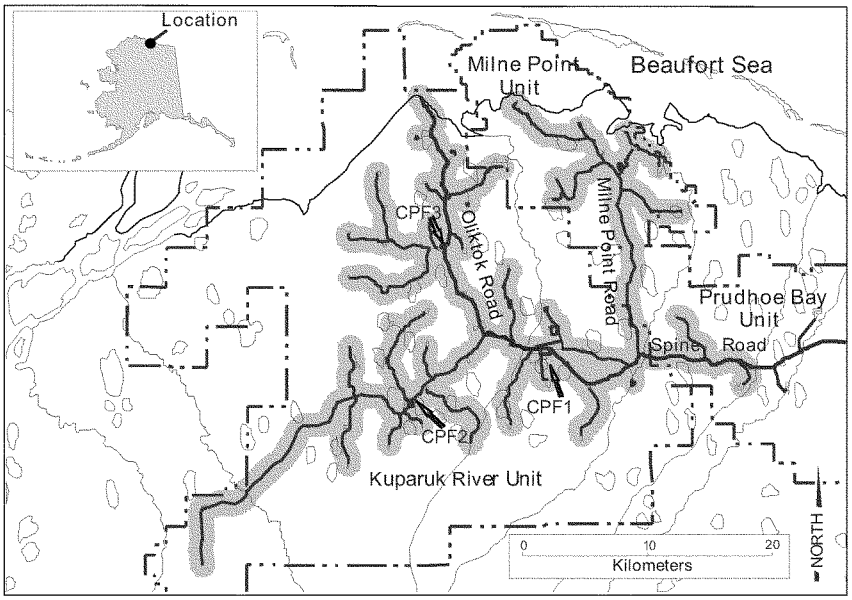

FIG. 1. Area surveyed for caribou within 1 km of gravel roads and pads (shaded) in the Milne Point, Kuparuk, and Prudhoe Bay oilfields, Alaska, June 2000–02. Oilfields are delineated by dashed lines, and black dots on the road system are production pads. CPF indicates major central processing facilities. The map represents the extent of development in June 2000.

gregarious species. Groups with calves were on average larger than groups without calves, but within group type, group size was independent of distance from infrastructure (Haskell, 2003). Groups were generally well dispersed and beyond visible range of one another. Because of the flat topography and the observers' elevated position, sightability of caribou groups was consistent throughout the study area. However, prone calves in particular can become more difficult to locate as distance increases. We used a global positioning system, laser range-finder, and compass to determine caribou group locations. Group center was subjectively based on individual caribou dispersion within a group (i.e., a weighted centroid). We used a geographic information system to measure the distance from the group center to the nearest active oilfield infrastructure (i.e., gravel road or production pad), and this distance served as a response variable in regression analyses. We obtained annual snow cover data collected at the Kuparuk, Alaska weather station from the National Climatic Data Center, National Oceanic and Atmospheric Administration (Asheville, North Carolina, USA). We used net-sweep methods described by Pollard et al. (1996b) to document parasitic insect activity at the beginning and end of each survey in 2001 and 2002, but relied on field notes to determine insect activity in 2000.

For comparisons of observed sighting rates (number of caribou per km surveyed) and calf percentages (calves as percent of total caribou observed), we classified observations for each group according to human activity level at the observation site (high or low) and time of observation (day or night). High-low area designations were based on general traffic rates and adapted from Johnson and Lawhead (1989). Human activity level was greater in the oilfields during the day than at night, so the standard work-shift change times of 0600 h and 1800 h were used as diel separators. Daylight was continuous, but usually dimmer at night.

Data Analyses

To assess factors influencing caribou group distance from infrastructure, we used a regression analysis with the response variable bound between 0 and 1 km. Responses were not normally distributed, having a heavy right-hand

TABLE 1. Spring snowmelt index, sighting rates (no. caribou/km surveyed), calf percentages, and total numbers of caribou individuals and groups observed during road surveys of the Milne Point, Kuparuk, and western Prudhoe Bay oilfields, Alaska, during the calving and post-calving periods of 2000–02.

		Calving				Post-calving			
Year	FDZSD[1]	Sighting Rate	% Calves	No. Caribou	No. Groups	Sighting Rate	% Calves	No. Caribou	No. Groups
2000	15 Jun	0.91	23.5	260	49	13.98	13.5	12844	407
2001	10 Jun	0.53	19.3	605	142	3.06	24.7	2517	264
2002	18 May	3.31	27.2	2547	318	8.14	27.1	5485	214

[1] First day of zero snow depth recorded at the Kuparuk weather station, Alaska. Data from the National Climatic Data Center, National Oceanic and Atmospheric Administration.

tail, so we transformed distances to ensure that error terms in the final model would be approximately normally distributed with near-constant error variances. We used an empirical logit transformation on distance from infrastructure to obtain a new response variable that was more normally distributed. The empirical logit transformation used was:

$$Y_i' = \ln\left(\frac{Y_i + 0.001}{1 - Y_i - 0.001}\right),$$

where Y_i was the observed distance (km) of caribou group i from infrastructure. We used SAS proc glm (SAS Institute, 2000) to estimate the coefficients and standard errors of the model:

$$E[Y_i'] = \beta_0 + \beta_1 X_{1i} + \ldots + \beta_p X_{pi},$$

where β_j were unknown coefficients, and X_{ji} were values of the *j-th* explanatory variable measured on the *i-th* observation. The model was fit using the method of maximum likelihood (Neter et al., 1996).

The normal theory regression modeling process began with the full model containing all three main effects of *period*, *calf presence*, and *year* and all possible interactions. Type III F tests were employed to test for significant terms in the model ($\alpha = 0.1$), and non-significant terms were removed, one at a time, until a final model was reached. For reporting purposes, Wald T statistics were computed for all parameters in the final model. Reference levels were changed, if necessary, to estimate means and standard errors for all levels of categorical variables in the final model.

To check that neither spatial nor temporal autocorrelation was present in the model residuals and adversely affecting significance levels of terms in the final model, we assessed deviance residuals (McCullagh and Nelder, 1989) from the final model for spatial and temporal autocorrelation, using Moran's I statistic (Moran, 1948; Cressie, 1993). Spatial correlation was assessed between locations less than 5 km apart. We tested for temporal autocorrelation within each of the three years and between observations less than five days apart. If high correlation (temporal or spatial) was found in the residuals, generalized mixed model estimation procedures were employed that specifically allowed for the correlation.

We present data distributions of caribou groups within 200 m distance intervals from 0–1000 m for clarity and support of interpretations (i.e., evidence of no bimodal effect on means) and additional information found beyond the first and second (μ and σ^2) moment statistics. We performed goodness-of-fit analyses using Pearson's chi-square (χ^2) procedures (Zar, 1999), assuming equal areas per interval and an expected uniform distribution of caribou among intervals. Yates' correction for continuity was applied to χ^2 analyses when appropriate. We compared proportions with a normal approximation of the χ^2 test using angular transformations (Zar, 1999).

We used simple linear regressions to determine relationships within years between distance from infrastructure and distribution of maternal groups through the calving period. Maternal caribou during the calving period are the prominent issue regarding oilfield impacts, and this specific relationship could not be addressed in the larger distance analyses without loss of information. Using inferential evidence and linear regression, we suggest a relationship between the timing of spring snowmelt and mean distance from infrastructure of caribou groups during the calving period. Except for tests on the effect of period and calf presence on mean group distance from infrastructure, all analyses were a posteriori.

RESULTS

Calving period surveys covered the entire study area 1.3 times (5 surveys) in 2000, 4.8 times (15 surveys) in 2001, and 3.7 times (14 surveys) in 2002. Post-calving surveys covered the entire area 5.5 times (17 surveys) in 2000, 3.5 times (13 surveys) in 2001, and 3.3 times (11 surveys) in 2002. Although we have no data to confirm this, individual caribou were likely observed more than once within and between years, but not within a survey. Sighting rate calculated during the calving period was greatest in 2002, when the snow melted earliest (Table 1). Sighting rate during the post-calving period was greatest in 2000 (Table 1). Insect harassment caused large aggregations (up to 2000 individuals) of caribou to form and move rapidly

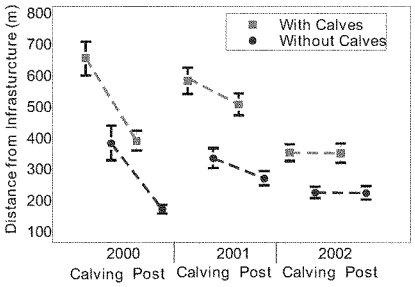

FIG. 2. Estimated mean distance from infrastructure for caribou groups, based on the final regression model. Error bars represent ± 1 SE. Data are from road surveys conducted in North Alaskan oilfields in June 2000–02.

through our study area towards the coast during this period. During the post-calving period, we observed insect harassment of 64 caribou groups in 2000 and 12 groups in 2002. Insect harassment was not evident during the calving periods of any year or the post-calving period of 2001. We therefore assume it had no direct effect on calving period relationships or others specific to 2001.

Distance from Infrastructure

The full model was first reduced to contain only main effects and two-way interaction terms between all three predictor variables (F-statistic on three-way interaction = 0.19; df = 2, 1382; $p = 0.83$). This model was then further reduced by dropping the period • calf presence interaction ($F = 0.149$; df = 1, 1384; $p = 0.22$). Inspection of model residuals indicated that the residuals were approximately normally distributed and that variance of the residuals was fairly constant across predicted values of the transformed response. Because spatial and temporal correlation detected in residuals from the final model was small ($-0.01 \leq$ Moran's $I \leq 0.01$ in all years), we found that the use of mixed model procedures was unnecessary.

During the calving period, caribou groups with and without calves were closer to infrastructure in 2002 than in 2000 or 2001 (Fig. 2, Table 2). There were no significant differences between calving periods of 2000 and 2001 (Table 2). During the post-calving period, groups tended to be closer to infrastructure in 2000 than in other years, except that groups with calves were at similar distances in both 2000 and 2002 ($p = 0.365$, Table 2). In 2000, greater insect harassment may have been responsible for the shorter distances during the post-calving period, when some caribou groups traveled along north-south roads to coastal habitats (including gravel production pads) that provided relief from insects (for prior documentation see Pollard et al., 1996b; Noel et al., 1998).

Groups with calves were distributed farther from infrastructure than groups without calves during all three years ($p < 0.0001$ for all; Fig. 2, Table 3). Caribou groups were farther from infrastructure during the calving period than during the post-calving period in 2000 and 2001 ($p < 0.0001$, $p = 0.06$, respectively), but not in 2002 ($p = 0.960$; Fig. 2, Table 3).

Groups with calves were farther from infrastructure than expected in the calving period of 2000, but closer than expected during both calving and post-calving periods in 2002 (Table 4). Groups without calves were found closer than expected in both periods of all years except the

TABLE 2. Wald T tests comparing distance to infrastructure between years, in calving and post-calving periods, with or without calves in group (n = number of groups). For each comparison in the "Parameter" column, the second year was set as the reference level in the analysis. A positive estimate indicates that observations during the reference year were closer to infrastructure. Data from road surveys conducted in North Alaskan oilfields in June of 2000–02.

Parameter	Coefficient Estimate	Standard Error	Wald T Statistic	*p*-Value
Calving Period with Calf Present:				
Year 2000 (22) vs. Year 2002 (140)	1.257	0.268	4.69	< 0.0001
Year 2001 (44) vs. Year 2002	0.944	0.210	4.5	< 0.0001
Year 2000 vs. Year 2001	0.313	0.297	1.05	0.293
Calving Period with No Calf Present:				
Year 2000 (27) vs. Year 2002 (178)	0.757	0.259	2.92	0.004
Year 2001 (98) vs. Year 2002	0.549	0.178	3.09	0.002
Year 2000 vs. Year 2001	0.208	0.275	0.76	0.450
Post-Calving Period with Calf Present:				
Year 2000 (132) vs. Year 2002 (90)	0.170	0.188	0.91	0.365
Year 2001 (100) vs. Year 2002	0.645	0.194	3.32	0.001
Year 2000 vs. Year 2001	-0.474	0.193	-2.46	0.014
Post-Calving Period with No Calf Present:				
Year 2000 (275) vs. Year 2002 (124)	-0.330	0.154	-2.14	0.032
Year 2001 (164) vs. Year 2002	0.250	0.168	1.49	0.138
Year 2000 vs. Year 2001	-0.579	0.148	-3.91	< 0.0001

TABLE 3. Wald T tests comparing mean distance from infrastructure of caribou groups, by period and by calf-presence, within each survey year. A positive estimate indicates that groups in the second classification being compared were closer to infrastructure. Data from road surveys conducted in North Alaskan oilfields, June 2000–02.

Year	Parameter	Coefficient Estimate	Standard Error	Wald T Statistic	*p*-Value
2000	Calving vs. Post-Calving Periods	1.094	0.239	4.57	< 0.0001
	Calf Present vs. No Calf Present	1.127	0.157	7.20	< 0.0001
2001	Calving vs. Post-Calving Periods	0.306	0.164	1.86	0.060
	Calf Present vs. No Calf Present	1.023	0.164	0.16	< 0.0001
2002	Calving vs. Post-Calving Periods	0.007	0.139	0.05	0.960
	Calf Present vs. No Calf Present	0.628	0.138	4.55	< 0.0001

TABLE 4. Pearson's goodness-of-fit analyses, assuming uniform distributions of caribou groups with and without calves within 200 m intervals from infrastructure. Caribou observations are from road surveys in North Alaskan oilfields during the calving and post-calving periods, June 2000–02.

			No. of Groups Observed by Interval[1]						H_o: P1 = P2... = P5	
Year	Period	Group Type	0–199	200–399	400–599	600–799	800–999	Expected Values	χ^2	*p*
2000	Calving	With Calf	0 -	5	2	5	10 +	4.4	13.00	0.011
		No Calf	6	6	7	4	4	5.4	1.33	0.856
	Post	With Calf	35	33	22	24	18	26.4	8.08	0.089
		No Calf	151 +	66	25 -	22 -	11 -	55	241.13	< 0.001
2001	Calving	With Calf	3	10	10	9	12	8.8	5.32	0.256
		No Calf	29 +	23	19	17	10 -	19.6	10.16	0.038
	Post	With Calf	12	27	29 +	17	15	20	11.40	0.022
		No Calf	63 +	41	38	8 -	14 -	32.8	60.21	< 0.001
2002	Calving	With Calf	43 +	38 +	22	19	18 -	28	19.36	0.001
		No Calf	82 +	51 +	24 -	15 -	6 -	35.6	110.76	< 0.001
	Post	With Calf	29 +	20	25	10 -	6 -	18	21.22	< 0.001
		No Calf	56 +	29	22	13 -	4 -	24.8	63.34	< 0.001

[1] Number of groups observed > ("+") or < ("-") expected ($\alpha = 0.05$).

calving period of 2000 (Table 4). No maternal groups were initially observed within 200 m of infrastructure during the calving period of 2000 (Table 4).

Mean distance from infrastructure during the calving period, for groups with and without calves, was positively correlated with the timing of spring snowmelt (Fig. 3). When complete snowmelt occurred relatively early, caribou groups were on average distributed closer to roads and production pads than they were when snow melted later (Fig. 3). Persisting snow hinders the northward spring migration of the CAH (Gavin, 1975) and probably reduced the exposure time of caribou to oilfields during our sampling period.

For groups with calves, distance from oilfield infrastructure (as plotted along an hourly continuum) did not change measurably during the late calving period in 2000 and 2002 ($p > 0.550$, Fig. 4). In 2001, however, groups with calves were seen closer to infrastructure as the calving period progressed ($p = 0.037$, Fig. 4). These results, along with mean comparisons between periods within and among years and calving-period frequency distributions (Tables 2, 3, and 4; Fig. 2), suggest that maternal groups reduced avoidance, or habituated, after the putative end of the calving period (20 June) in 2000, late during the calving period in 2001, and likely sometime before our sampling began in 2002.

Avoidance of Human Activity

Sighting rates were lower in areas of high human activity in all years during the calving period, but not during the post-calving period (Table 5). Calf percentages (% calves of caribou observed) were significantly greater at night than in the day during the calving periods of 2001 and 2002 and the post-calving periods of 2000 and 2001 (Table 6). During the calving period of 2000 and the post-calving period of 2002, there was no significant difference in calf percentages between day and night (Table 6).

DISCUSSION

Results from studies using aerial survey techniques indicated that displacement effects for caribou and calves

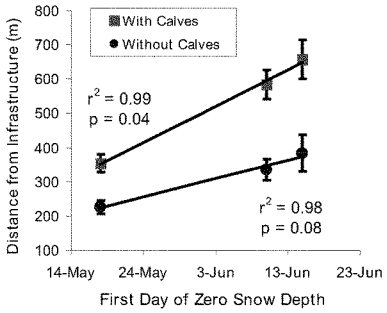

FIG. 3. Mean predicted distance from infrastructure (in meters, ± 1 SE) of caribou groups with and without calves during the calving period, in relation to the first day of zero snow depth recorded by the NOAA weather station at Kuparuk, Alaska, in 2000–02.

during the late calving period were measurable at the 1 km interval nearest the Milne Point Road after construction (Dau and Cameron, 1986a; Cameron et al., 1992). We examined caribou response at a finer scale (< 1 km) and can make inferences beyond our study area only with caution. However, results from more recent aerial surveys centered on the Milne Point Road, some of them concurrent with our own road surveys, indicated no displacement effects at the 1 km spatial resolution (Noel et al., 2004). Thus, the extent of displacement described in this study may be the true extent at present for the latter part of the calving period. It could be argued that our results do not apply to the entire western segment of CAH calving caribou because we have documented displacement effects only for a sample of caribou with a predisposition for oilfield tolerance. We believe this to be possible but unlikely, for reasons given in the introduction and the discussion below.

Our data quantitatively supported previous observations of heightened sensitivity in maternal caribou after parturition (de Vos, 1960; Skoog, 1968; Bergerud, 1974). Maternal caribou groups avoided infrastructure more than non-maternal groups, but exhibited a waning avoidance response, or habituation, at a similar rate between periods (i.e., insignificant calf presence•period interaction in distance regression analysis; see Fig. 2). Although calf age may affect avoidance behavior of maternal cows, particularly during the first few days of neonate development, we conducted our surveys during the latter half of the calving period, when calves were generally highly mobile and capable of evading real or perceived predatory threats (i.e., grizzly bears or human activity; review by Frid and Dill, 2002). The fact that groups with and without calves similarly reduced avoidance behavior from the calving period to the post-calving period indicated that calf

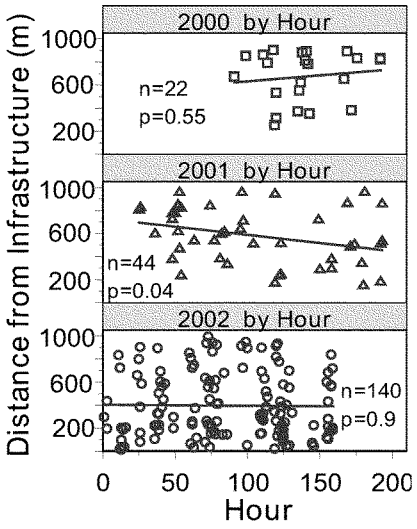

FIG. 4. Distance (m) from active oilfield infrastructure of caribou groups with calves observed during the late calving period in 2000–02 and plotted along an hourly continuum consistent among years (11 June 2200 h to 19 June 2300 h).

presence was not the underlying cause and justified the term "habituation" to describe the waning over time of the avoidance response.

Disturbance that triggers an avoidance response is necessary before habituation to that disturbance can occur. Avoidance of human activity during the calving periods was measurable in both space and time. Displacement effects during the calving period that may have reached beyond our study area were more likely to have occurred in localized areas of high human activity unless caribou were displaced within the study area from areas with high activity to areas with low activity (Table 5). Our diel analyses were useful in that the confounding factor of habitat quality as it relates to animal use was mostly circumvented by ensuring that similar numbers of surveys were conducted during the day and at night in each section of the study area. Parous caribou tended to be more represented in the population of caribou within 1 km of active oilfield infrastructure at night, when human activity levels were lower (Table 6). Reasons why day and night calf percentages were similar during the 2000 calving period may include small sample sizes, or a late spring thaw that may have attracted parous caribou to dust shadows near roads (Walker and Everett, 1987; Smith et al., 1994) or other snow-free habitats, particularly within low-activity areas. The insect-free post-calving data for 2002 indicated

TABLE 5. Comparison of sighting rates (no. caribou/km surveyed) and distance surveyed between areas of low and high human activity in North Alaskan oilfields during the late calving and insect-free post-calving periods of 2000–02. Ratio data are not amenable to significance testing.

Activity Area		2000		2001		2002	
		Calving	Post	Calving	Post	Calving	Post
Low	Sighting rate	1.90	7.93	0.83	4.29	4.85	4.84
	No. km	120	397	544	387	384	308
High	Sighting rate	0.29	7.35	0.39	2.98	2.34	8.41
	No. km	109	448	392	286	293	257

TABLE 6. Calf percentage (% calves of total caribou) and number of caribou observed day and night during the late calving and insect-free post-calving periods 2000–02. Results of two-sample tests for equality of proportions with continuity corrections are shown testing differences in calf % between diel periods.

Diel Period		2000		2001		2002	
		Calving	Post	Calving	Post	Calving	Post
Day	Calf %	27.5	12.9	10.3	17.0	25.6	21.0
	No. caribou	69	1668	243	654	1616	2898
Night	Calf %	22.0	20.2	25.4	27.4	29.9	21.4
	No. caribou	191	4773	362	1863	931	752
Significance between calf %:		$p = 0.444$	$p < 0.001$	$p < 0.001$	$p < 0.001$	$p = 0.023$	$p = 0.836$

no diel difference in calf percentages, apparently because habituation of caribou had already occurred. Discrepancies between calf percentages and sighting rates as indicators of an avoidance response may be explained by the absolute difference in avoidance between caribou groups with and without calves, and possibly also a diel response of maternal groups observed in areas of high human activity.

Group distributional trends within 1 km of infrastructure during calving mainly describe an annual pattern of habituation for the portion of CAH caribou that calve in the oilfields. However, a later influx of large maternal groups from the south will mean that these new arrivals also have to habituate, somewhat confounding our overall results. When we began surveys in 2002 on 11 June, relatively large maternal groups, presumably from a calving concentration area to the south (Murphy and Lawhead, 2000), were observed moving into areas of low human activity at the southern periphery of the oilfields. In the previous two years, when snow melted later, this influx did not occur until the very end of the calving period, around 20 June. This occurrence may explain why sighting rates were higher in areas of low human activity and a diel difference in calf percentage was noted during the calving period of 2002 (Tables 5 and 6) while overall, more groups with calves than expected were observed near infrastructure (Table 4). The influx of these groups from the south appeared to have little effect on overall group distance means and frequency distributions. It may be that the innate hypersensitivity of maternal caribou deteriorates after the neonatal period, allowing these animals to experience cultural and social learning and habituate more rapidly to human disturbance stimuli than the "resident" calving-period caribou that reared neonates in the oilfields upon arrival.

Our results indicated that caribou habituation to oilfields, determined by a measured decrease in overall avoidance of roads, reoccurred annually. The timing of this annual rehabituation was positively correlated with the timing of spring snowmelt (Fig. 3), and accordingly, occurred either before or after the putative end of calving (20 June) in each year (Figs. 2 and 4). This was likely a function of the group's exposure time to oilfields, as the northward spring migration was hindered by persisting snow (Gavin, 1975). Although our results are limited to three years of study, yearly differences in data distribution during the calving period (Table 4), differences in mean group distances from calving to post-calving period within a year (Fig. 2, Table 3), and distribution of maternal groups through all three calving periods (Fig. 4) all support the hypothesis of a snowmelt-dependent timing of annual rehabituation. Available road and aerial survey data through the 1980s have been used to further extrapolate, apply, and support the hypothesis of a snowmelt-dependent timing and extent of annual rehabituation (Haskell, 2003).

According to our hypothesis of annual rehabituation, caribou should have been most sensitive to oilfield activities during the calving period in 2000, when snowmelt was later than in other years. Except during the calving period of 2000, groups without calves were observed near infrastructure more often than expected (Table 4). This pattern was also apparent for groups with calves during the calving and post-calving periods of 2002. We believe that the right-tailed distribution of caribou relative to oilfield

infrastructure indicated that the spatial threshold between habituation and avoidance responses (review by Whittaker and Knight, 1998) was generally reduced to less than 200 m from active roads and pads (Table 4). Caribou become less sensitive to disturbance as they move and eventually approach roads, but they may hesitate to move across them as freely as they might on open tundra. In itself, this hesitation does not imply negative energetic effects, but it could affect potential exposure to abomasal parasites and alter optimal foraging strategies if local caribou densities were consistently high (Gunn and Irvine, 2003). Similarly, Noel et al. (2004) found during the late calving period that caribou densities within 6 km from the Milne Point Road were highest in the 1 km interval nearest the road, perhaps documenting the same phenomenon at a greater spatial extent.

The distributional differences between groups with and without calves were statistically significant, meaning that they reflect real behavioral differences. It is unknown whether differences at this small spatial extent have nutritional effects, but given the low densities of caribou and short duration of displacement, such effects are probably negligible. Although mean distances from infrastructure differed between the 2001 and 2002 calving periods, group activity behaviors were consistent: in both years, groups with calves fed more than non-maternal groups (Haskell, 2003). Behavioral data were not collected in 2000.

MANAGEMENT IMPLICATIONS

Previous studies have assessed the effectiveness of mitigation measures implemented in the Prudhoe Bay region to reduce negative impacts of oilfields on CAH caribou (reviews by Cronin et al., 1994; Murphy and Lawhead, 2000). Caribou aversion for infrastructure is likely a conditioned response, whereas vehicular movement may evoke an unconditioned response to perceived predation risk (Bergerud, 1974; Frid and Dill, 2002). Minimizing traffic, especially within calving areas during the calving period when snow melts late, would reduce the potential for negative synergistic impacts on caribou. However, data from this study and concurrent aerial surveys (Noel et al., 2004) indicate that displacement was measurable only within the first kilometer from infrastructure and may not be as far-reaching as has often been reported (e.g., Dau and Cameron, 1986a; Cameron et al., 1992, 2002, 2005; NRC, 2003). Immediately after arriving in oilfields, maternal caribou rearing neonates may cross roads in haste, not lingering to forage nearby, and thus experience functional displacement from areas within 200 m of roads (see 2000 in Table 4 and 2001 in Fig. 4). Nutritional effects from displacement remain unknown, but are probably negligible. The necessity of calving period-specific mitigation measures (e.g., convoys and mass transit) should be considered on a case-by-case basis. If such measures are deemed justifiable given costs, they should be revaluated regularly, particularly in areas of new development, considering the potential for caribou learning and tolerance (Haskell, 2003). To maximize efficacy without overregulation, calving period-specific mitigation measures in established oilfields may be terminated prior to or extended beyond 20 June, depending on the timing of spring snowmelt. Our 2001 data (Fig. 4) seemed to approximate well the date of complete snowmelt (10 June) that would translate, in terms of caribou behaviour, into an actual 20 June transition from the calving to post-calving period. More data are needed to fully describe the annual timing of a behavioural transition between discrete calving and post-calving periods, and harassment by parasitic insects as an overriding stimulus may also need to be considered in some years.

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Annual re-habituation of calving caribou to oilfields in northern Alaska: implications for expanding development

Shawn P. Haskell and Warren B. Ballard

Abstract: Previous research led to hypotheses that calving caribou (*Rangifer tarandus granti* J.A. Allen, 1902) in north Alaskan oilfields habituated to human activities: (*i*) across years and (*ii*) annually after spring migration (i.e., re-habituation). We used predictor variables of year and a spring snowmelt index to evaluate weight of evidence for these competing hypotheses. Response variables were calf percentage and sighting rate of calving caribou along a high-traffic road system from 1982 to 1990 and 2000 to 2002. We also considered local calf percentage and caribou density, determined by aerial surveys, for respective response variables. We found no evidence of habituation across years. We found two more lines of evidence (one strong and one weaker) for re-habituation within years during calving periods. Post hoc models suggested a further tolerance response exhibited by caribou; more data are needed. Even when snow melted early and calving caribou were most habituated among years, caribou and calves were under-represented near the road system. Investigation of a traffic-rate effect seems warranted. However, habitat selection and forage availability should be considered when interpreting avoidance behaviour at a larger spatial extent. We contend that the behavioural adaptability of calving caribou exhibited in existing oilfields was contingent on the no-hunt policy.

Résumé : Des études antérieures ont mené à la formulation d'hypothèses selon lesquelles les caribous (*Rangifer tarandus granti* J.A. Allen, 1902) avec petits dans les champs pétroliers du nord de l'Alaska s'habituent aux activités humaines (*i*) au cours des années et (*ii*) au cours d'une même année après la migration du printemps (c'est-à-dire une nouvelle habituation). Nous utilisons des variables prédictives des années et un indice de fonte des neiges au printemps pour évaluer les données qui appuient ces hypothèses de rechange. Les variables dépendantes sont le pourcentage de petits et le taux de signalisation de caribous avec petits le long d'un système routier à forte circulation en 1982–1990 et en 2000–2002. Nous utilisons aussi le pourcentage local de petits et la densité de caribous, déterminés lors d'inventaires aériens, comme variables dépendantes respectives. Il n'y a aucune indication d'une habituation au cours des années. Nous trouvons deux séries d'indications (l'une forte et l'autre plus faible) de l'existence d'une nouvelle habituation chaque année durant la période de mise bas. Des modèles post hoc indiquent l'existence d'une réaction additionnelle de tolérance chez les caribous, mais il est nécessaire d'obtenir plus de données. Même lorsque la neige fond tôt et que les caribous avec petits sont le plus habitués au cours des ans, il y a une sous-représentation des caribous et de leurs petits près du système routier. Il semble donc nécessaire d'étudier l'effet du taux de circulation. Il faudrait, cependant, tenir compte de la sélection de l'habitat et de la disponibilité de fourrage pour interpréter l'évitement à une échelle spatiale élargie. Nous croyons que l'adaptabilité comportementale des caribous avec petits qui se manifeste dans les champs pétroliers actuels dépendant de la politique d'interdiction de la chasse.

[Traduit par la Rédaction]

Introduction

Understanding animal behaviour has practical management implications when mitigation of negative human impacts is desired (Geist and Walther 1974; Taylor and Knight 2003). Proximate factors affecting risk-aversion behaviour of ungulates include physiological requirements and processes, past experience, existing predators, and social contexts (Bergerud and Page 1987; Aastrup 2000; Millspaugh et al. 2000; Barten et al. 2001; Borkowski 2001). Studies of prey animal behaviour in response to human disturbance should be constructed under the framework of ultimate evolutionary explanations, particularly predation risk (Bergerud 1974; Geist 1998; Gavin and Komers 2006), thus facilitating a priori hypothesis formation, model building, and rapid strong inference (Platt 1964; Frid and Dill 2002).

Animal behaviour can be observed directly or inferred from patterns in spatial data (Bergerud and Luttich 2003; Gavin and Komers 2006; Haskell et al. 2006; Preisler et al. 2006). Ecologists may also wish to investigate proximate physiological explanations of behaviour and stress responses (Romero 2004). These proximate links to behaviour, survival, and reproduction may be useful to managers assessing and predicting individual and population-level impacts of human disturbance if studies are designed and interpreted

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carefully (Millspaugh and Washburn 2004). Animal behaviour and stress responses must be considered in both short- and long-term contexts (Romero 2004; Stankowich and Blumstein 2005). Learning processes of social animals may expedite measurable trends in disturbance response (Davis et al. 1986; Shettleworth 2001; Dukas 2004), and individual or group responses may or may not translate to population-level impacts (Cronin et al. 1998; Mallord et al. 2007).

Animal behaviour is often used to guide policy for industrial developments on public lands in the United States through the National Environmental Policy Act review process. As an example, we present data on caribou (*Rangifer tarandus granti* J.A. Allen, 1902) interactions with oilfields in northern Alaska during the calving period, but the theoretical concepts and logic that we apply are probably applicable for most cervids and development scenarios (Whittaker and Knight 1998; Frid and Dill 2002). The US Department of Interior's Bureau of Land Management (BLM) has recently considered and approved expanding petroleum development westward from existing North Slope oilfields onto pristine public lands of the National Petroleum Reserve – Alaska (BLM 2004, 2005, 2006). These operations are likely to have an impact on calving caribou of the Teshekpuk Lake Herd (TLH), which has not been formerly exposed to oilfields (Noel and George 2003; Carroll et al. 2005). Consequently, the BLM stipulated a number of mitigating procedures that included spatial restrictions on placement of infrastructure and various temporal restrictions on construction, vehicle speeds, and traffic rates; also, hunting and trapping would be prohibited for nonlocal oilfield personnel (BLM 2005, 2006). There were no restrictions for hunting by local residents who may have access to oilfield roads, as well as waterways, into the future oilfields and areas within the range of overland off-road vehicles (BLM 2004, 2005, 2006).

Verifying a behavioural disturbance response pattern from field data may be useful for management while also leading to formation of testable research hypotheses. Results from aerial surveys in the Milne Point oilfield before and after road construction suggested some spatial displacement of calving Central Arctic Herd (CAH) caribou at least 1 km from the road (Cameron et al. 1992). Results from more recent and precise surveys indicated no such displacement from the Milne Point Road in this CAH calving area (Noel et al. 2004). One possible explanation for this discrepancy is that calving caribou habituated to human activities across years from the former study to the latter. Habituation is a waning of disturbance response to repeated neutral stimuli (Whittaker and Knight 1998).

Another recent study (Haskell et al. 2006), concurrent with Noel et al. (2004), provided evidence that CAH caribou re-habituated to oilfield activities every year. Maternal caribou avoided the area within 200 m of oilfield roads when complete snowmelt occurred late in the calving period, but during the calving period in a year when snow melted early, there were more maternal caribou than expected <200 m from the same roads (Haskell et al. 2006). Similarly, mean distance from roads (within 1 km) during calving for groups with and without calves was positively correlated with the date of complete snowmelt. Haskell et al. (2006) interpreted this snowmelt index as a proxy variable for the amount of time caribou were present in oilfields, and therefore exposed to neutral stimuli (i.e., road traffic) prior to road surveys, because persistent snow delays the northward spring migration into the oilfields for calving (Gavin 1975; Lenart 2003). Thus, after considering alternate explanations, Haskell et al. (2006) forwarded the hypothesis of annual re-habituation of calving caribou to oilfields in northern Alaska, dependent on the timing of complete snowmelt.

Our objective was to use caribou spatial and composition data along with an environmental variable to evaluate competing (not exclusive) hypotheses regarding the behavioural response of calving caribou to human activities in existing oilfields. We compared a priori models to weigh evidence among hypotheses of habituation across years (year), re-habituation within years (snowmelt index), and no evidence of habituation (intercept-only model). We used two common response variables from road survey observations along a relatively high-traffic road system from 1982 to 1990 (Smith et al. 1994) and 2000 to 2002 (Haskell 2003). The response variables were biologically independent, and for each we considered a potential nuisance explanatory variable. The available data were few, so our results may benefit from further verification or falsification. We discuss post hoc models as hypotheses to advance the science of animal disturbance behaviour. These analyses pertain only to those CAH caribou that were present in oilfields during the calving periods. Caribou of the CAH (and other Arctic Alaskan caribou herds) were also present elsewhere during spring calving periods at higher elevations where emerging vegetation was more abundant (Albon and Langvatn 1992; Thomas et al. 2006; discussed by Haskell et al. 2006). Despite the observational nature of our study, we believe that our hypothetico-deductive approach coupled with prior information should help answer important questions in road ecology (Roedenbeck et al. 2007), thus facilitating responsible management.

Materials and methods

Study area

A thorough description of the biotic and abiotic environments along with the history of human development on Alaska's North Slope was provided by Truett and Johnson (2000). We provide some of the more important points regarding context of this analysis and case study. The oilfields were located on the Arctic coastal plain. Predator densities (e.g., gray wolves, *Canis lupus* L., 1758) tended to be higher in the mountains and foothills south of the Arctic coastal plain, but a wolf reduction campaign in the mid-1900s and establishment of a nearby community with hunters using snowmobiles in the early 1970s probably contributed to low predator abundance in the foothills south of the oilfields (Rearden 1998; BLM 2005).

As a behaviour common among migratory caribou herds (Bergerud 2000), parous caribou of the CAH reduce predation risk for neonates by migrating north from mountainous wintering grounds for spring calving in and near the Kuparuk and Milne Point oilfields (Gavin 1975; Lenart 2003). Calving typically peaks during the second week of June. Caribou of the CAH use coastal habitats, including oilfield infrastructure, to gain relief from parasitic insects dur-

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ing the summer (Noel et al. 1998; Ballard et al. 2000). However, snow and late-spring weather keep mosquitoes (genus *Aedes* Meigen, 1818) from emerging on the Arctic coastal plain until the postcalving period in late June or early July (Ballard et al. 2000). Data presented in this study were collected during the June calving periods before 20 June, so insect harassment should not have been a factor. In fact, the earliest date of complete snowmelt considered in this study was 18 May 2002, and Haskell (2003) reported no insect activity affecting caribou behaviour until 25 June that year — 1 week after collection of calving data was complete.

The discovery of major petroleum deposits near Prudhoe Bay was announced in 1968, and industrial development of the area ensued shortly thereafter (Truett and Johnson 2000). By spring 1978, the Spine Road was extended west from the Prudhoe Bay Unit to about 3 km west of Kuparuk River Unit CPF-1 (see Fig. 1 in Haskell et al. 2006). The Kuparuk oilfield was outfitted with an airstrip and operations center in winter 1979–1980 and a pipeline to Prudhoe Bay the following year. The Milne Point Road was constructed during winter 1981–1982 with a corresponding pipeline in 1984. The road system was extended west in spring 1982 to include the Oliktok Road and Kuparuk River Unit CPFs 2 and 3. Most existing facilities have been operational since 1986, and hunting has not occurred in the oilfields (Smith et al. 1994; Truett and Johnson 2000).

Data and models

Caribou surveys during the calving period were conducted along the relatively busy Spine and Oliktok roads from 1982 to 1990 (Smith et al. 1994) and 2000 to 2002 (Haskell 2003; Haskell et al. 2006) prior to 20 June. Traffic rates varied from 4 to 22 vehicles/h (Cameron and Whitten 1979; Cameron et al. 1983). Counts of caribou within 1 km of the road were recorded, as well as demographics (i.e., male, female, or calf) and total length of roads surveyed (as a measure of effort). Available data from Smith et al. (1994) were not decomposable into multiple independent surveys within years. With new technologies (i.e., laser rangefinder, GPS, and GIS), Haskell et al. (2006) examined mean distance of caribou groups from roads in response to the snowmelt index among years. Earlier data from Smith et al. (1994) were measured with less precision. Therefore, for regression analyses we identified common potential response variables between the two studies to be calf percentage (relative to total caribou sighted) and sighting rate (caribou per kilometre of road surveyed). Smith et al. (1994) examined calf percentages and sighting rates qualitatively to conclude that habituation during calving periods had not occurred across years. Similarly, Haskell et al. (2006) determined that during calving periods within years, calf percentages tended to be higher at night (with continuous light) when human activities were lower than during the day, and sighting rates of caribou tended to be higher in areas of low human activity. Thus, these two measures were promising response variables, indicative of caribou disturbance behaviour, that were common between studies.

To assess competing hypotheses of (*i*) habituation across years, (*ii*) annual re-habituation within years, or (*iii*) no evidence of habituation, we used the predictor variables of "year", "first day of zero snow depth (FDZSD)", and "intercept-only", respectively. Late snowmelt should be indicative of less time for habituation behaviour to develop in caribou exposed to oilfield disturbance stimuli prior to calving surveys. Thus, we predicted negative correlations between response variables and the snowmelt index to suggest within-year re-habituation. Conversely, we predicted that positive correlations between response variables and "year" would suggest habituation across years. We considered "local calf percentage" and "local caribou density", determined by aerial surveys, as potential nuisance variables because caribou composition and counts near roads may simply reflect those within the larger oilfield spatial extent at that time.

FDZSD was recorded at the Kuparuk Weather Station (1983–2002), located at CPF1 (see Fig. 1 in Haskell et al. 2006), and made available by the National Oceanic and Atmospheric Administration National Climatic Data Center. Data for 1982 were recorded at a weather station in Umiat, obtained from the Western Regional Climate Center, and standardized to the Kuparuk data by overlapping years (n = 18); on average, snow melted 10.5 days earlier at Umiat than at Kuparuk. Caribou composition and density in the local oilfield region were estimated by aerial surveys (1982–1986, Fig. 2 in Cameron et al. 1992; 1987–1990, Nellemann and Cameron 1998; 2000–2002, Lawhead and Prichard 2003[3]).

We failed to justify models with multiplicative combinations of predictor variables a priori, and the data were too few to support concluding inferences from multiplicative models. We included a post hoc model in our analysis sets in a way that did not interfere with a priori model comparisons but did allow post hoc hypothesis formation.

Data analysis

Log-linear Poisson models of annual caribou count data from road surveys were greatly overdispersed, so we modeled the processes with a negative binomial generalized linear model (GLM) using maximum likelihood to estimate the dispersion parameter and partial coefficients (White and Bennetts 1996; Lindsey 1999*a*; Newbold and Eadie 2004). For road survey calf percentage and sighting rate models, we used the logarithms of total caribou and distance surveyed, respectively, as offset terms for calf and caribou counts. We used the ratio of the generalized Pearson χ^2 statistic to its degrees of freedom (df) to calculate model overdispersion for small data sets (McCullagh and Nelder 1989). We used Pearson residuals for diagnostics to be consistent with estimates of overdispersion and because they appeared unskewed.

We used information–theoretic weight of evidence as the primary tool to determine preferred models (Burnham and Anderson 2002). We applied the second-order bias correction to calculate Akaike's information criterion statistics for small samples (AIC_c) to achieve parsimonious model selec-

[3] B.E. Lawhead and A.K. Prichard, 2003. Surveys of caribou and muskoxen in the Kuparuk–Colville Region, Alaska, 2002. Unpublished report by ABR, Inc. – Environmental Research and Services, Fairbanks, Alaska.

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Table 1. Data used to assess behavioural responses of calving caribou (*Rangifer tarandus granti*) to human activities in north Alaskan oilfields from 1982 to 1990 and 2000 to 2002, including the snowmelt index (first day of zero snow depth, FDZSD), local calf percentage (no. of calves/total no. of caribou × 100) and local caribou density (no. of caribou/km^2) in the oilfields determined by aerial surveys, counts of total numbers of caribou and calves within 1 km of the Spine and Oliktok roads, distance surveyed (km) along roads as a measure of effort, calf percentage of total caribou observed during surveys from roads, and sighting rate of caribou from roads (caribou count/distance surveyed).

Year	FDZSD	Local calf percentage	Local density	Caribou count	Calf count	Distance surveyed	Calf percentage	Sighting rate
1982	12 June	35.1	1.05	409	26	619	6.4	0.66
1983	31 May	43.1	2.06	526	30	1067	5.7	0.49
1984	27 May	42.8	2.96	1170	49	897	4.2	1.30
1985	21 May	41.9	2.24	1045	149	896	14.3	1.17
1986	14 June	35.2	0.91	741	15	1026	2.0	0.83
1987	8 June	30	0.80	55	0	170	0.0	0.33
1988	18 June	42	2.01	816	17	504	2.1	1.62
1989	17 June	37	1.10	527	4	729	0.8	0.72
1990	24 May	36	0.93	1960	139	673	7.1	2.91
2000	15 June	38.6	0.36	4	0	57	0.0	0.07
2001	10 June	40.9	0.60	25	0	227	0.0	0.11
2002	18 May	39.3	0.86	291	51	164	17.5	1.77

tion (Burnham and Anderson 2002). With our sample size (n = 12), n/K ratios were small (K is the number of estimated parameters), and asymptotic theory for applied statistics was questionable (Burnham and Anderson 2002). Therefore, we chose to examine other useful statistics (Lindsey 1999*b*; Stephens et al. 2005; Murray et al. 2006). We examined estimated significance of partial parameters along with coefficient estimates and standard errors derived from the Hessian matrix as additional diagnostics to aid in model discrimination for these few data (Stephens et al. 2005). We estimated a likelihood ratio-based R^2 goodness-of-fit statistic (R^2_{LR}; Magee 1990). We did not estimate QAIC for overdispersed count data because use of the negative binomial distribution rather than the Poisson reduced overdispersion to acceptable levels in the preferred models (Lindsey 1999*a*). We performed a randomized power analysis to assess the validity of basing inference only on AIC statistics for these few data. We used SAS® version 9.1 (SAS Institute Inc., Cary, North Carolina, USA) for GLM analyses, Matlab® version 6.5 (The MathWorks, Natick, Massachusetts, USA) for randomized techniques, and S-Plus® version 7.0 (Insightful Corp., Seattle, Washington, USA) for data plots.

Results

We analyzed 12 years of CAH survey data collected during calving periods (Table 1). The snowmelt index explained most of the variability in calf percentage but left much more unexplained variation when sighting rate was considered the response variable (Tables 2, 3; Fig. 1). Based on partial p values and AIC statistics, the snowmelt model demonstrated a significant negative effect as the only plausible model describing calf percentages estimated from the road system (Table 2), thus supporting the within-year re-habituation hypothesis. When considered additively with the other two variables of year and local calf percentage, the snowmelt index maintained its significance as a partial parameter, while the other two variables appeared to add very little to the models (Table 2, nos. 2 and 3). Comparable coefficients and standard errors for the snowmelt variable among simple and additive models suggested negligible effects of multicollinearity (Neter et al. 1996). The post hoc quadratic snowmelt model was not supported by the calf percentage data (Table 2, no. 8; Fig. 1).

Based on information explained (i.e., R^2_{LR}) and p values of parameter estimates with standard errors, the variables of year and local caribou density by themselves appeared to have little or no value for predicting caribou sighting rate (Table 3, nos. 3 and 4). Alone, the snowmelt index improved model fit and appeared to exhibit a moderately significant negative correlation with sighting rate (R^2_{LR} = 0.21, p = 0.081; Table 3, no. 2). The a priori within-year re-habituation model (Table 3, no. 2; w_2 = 0.28) had four times more support than the among-year habituation model (Table 3, no. 4; w_4 = 0.07) and nearly three times more support than the density-dependent model (Table 3, no. 3; w_3 = 0.10). Again, the comparative statistics (e.g., R^2_{LR}, partial p values, and log-likelihoods) among the univariate and additive combinations of predictor variables supported the re-habituation hypothesis, dependent on timing of snowmelt, over the among-year habituation hypothesis and nuisance variable (Table 3, nos. 2–7).

Because of the low n/K ratios (range = 3–6) and consequent second-order AIC bias correction, we must interpret these data with caution. The fully reduced intercept-only model had the lowest AIC_c value by 0.9 in the sighting rate model set, suggesting that all other models were inferior, yet other models appeared to capture valuable information from sighting rates (Table 3; Fig. 1). With such small n/K ratios, the tendency seemed to be selection for underfitted models (Fig. 2), thus minimizing model variance but increasing bias. Even with these few data, the post hoc quadratic snowmelt effect was significant at p = 0.065, while nearly doubling the R^2_{LR} over the linear snowmelt model (Table 3, nos. 2 and 8). Sighting rate of caribou along the main oilfield road system appeared to initially decrease as snow

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Table 2. Calf percentage of caribou (*Rangifer tarandus granti*) within 1 km of the Spine and Oliktok roads in north Alaskan oilfields during the calving periods of 1982–1990 and 2000–2002 explained by year, local calf percentage, and the snowmelt index (first day of zero snow depth, FDZSD) treated as a negative binomial generalized linear model with calf count within years (n = 12) as the response variable and total caribou count as an offset.

				Respective parameters											
No.	Variables	χ^2/df	R^2_{LR}	Estimate	SE	Pr >χ^2	Estimate	SE	Pr >χ^2	Log(L)	K	AIC	AIC$_c$	Δ_i	w_i
1	FDZSD	1.37	0.66	–0.066	0.013	<0.001				7.81	3	–209.62	–206.62	0.00	0.82
2	Year, FDZSD	1.44	0.66	–0.012	0.026	0.638	–0.069	0.015	<0.001	7.92	4	–207.85	–202.13	4.48	0.09
3	Local calf percentage, FDZSD	1.51	0.66	–0.004	0.046	0.926	–0.067	0.014	<0.001	7.81	4	–207.63	–201.91	4.71	0.08
4	Intercept	1.03	0.00	–2.865	0.279	<0.001				1.38	2	–198.76	–197.43	9.19	0.01
5	Local calf percentage	1.11	0.11	0.101	0.086	0.240				2.06	3	–198.11	–195.11	11.51	0.00
6	Year	1.02	0.04	0.026	0.037	0.473				1.64	3	–197.27	–194.27	12.35	0.00
7	Year, local calf percentage	1.09	0.15	0.028	0.035	0.421	0.095	0.078	0.218	2.37	4	–196.75	–191.03	15.59	0.00
8	FDZSD, FDZSD^2	1.65	0.67	–0.105	0.057	0.066	0.001	0.002	0.486	8.04	4	–208.09	–202.37	4.25	

Note: Statistics are for model overdispersion (χ^2/df), information explained (R^2_{LR}), partial parameter estimates with standard errors (SE) and p values, log-likelihood (Log(L)), number of estimated parameters (K), and Akaike's information criterion model selection (AIC, AIC$_c$, Δ_i, w_i). Log(L) and AIC values are truncated. Relative AIC$_c$ model weights (w_i) are calculated for a priori models only.

Table 3. Sighting rate of caribou (*Rangifer tarandus granti*) within 1 km of the Spine and Oliktok roads in north Alaskan oilfields during the calving periods of 1982–1990 and 2000–2002 explained by year, local caribou density, and the snowmelt index (first day of zero snow depth, FDZSD) treated as a negative binomial generalized linear model with caribou count within years (n = 12) as the response variable and distance surveyed (km) as an offset.

				Respective parameters											
No.	Variables	χ^2/df	R^2_{LR}	Estimate	SE	Pr >χ^2	Estimate	SE	Pr >χ^2	Log(L)	K	AIC	AIC$_c$	Δ_i	w_i
1	Intercept	0.93	0.00	–0.008	0.248	0.973				2.57	2	–21.13	–19.80	0.00	0.44
2	FDZSD	1.07	0.21	–0.033	0.019	0.081				3.95	3	–21.90	–18.90	0.90	0.28
3	Local caribou density	1.33	0.06	0.292	0.362	0.419				2.91	3	–19.82	–16.82	2.98	0.10
4	Year	1.07	0.00	–0.009	0.040	0.828				2.59	3	–19.18	–16.18	3.62	0.07
5	Local caribou density, FDZSD	1.25	0.28	0.358	0.345	0.299	–0.034	0.018	0.059	4.51	4	–21.03	–15.31	4.49	0.05
6	Year, FDZSD	1.43	0.27	–0.043	0.041	0.289	–0.041	0.020	0.037	4.47	4	–20.94	–15.23	4.57	0.05
7	Year, local caribou density	1.45	0.06	0.013	0.046	0.774	0.355	0.421	0.399	2.95	4	–17.90	–12.19	7.61	0.01
8	FDZSD, FDZSD^2	1.09	0.39	–0.215	0.101	0.034	0.005	0.003	0.065	5.53	4	–23.07	–17.36	2.44	

Note: Statistics are for model overdispersion (χ^2/df), information explained (R^2_{LR}), partial parameter estimates with standard errors (SE) and p values, log-likelihood (Log(L)), number of estimated parameters (K), and Akaike's information criterion model selection (AIC, AICc, Δ_i, w_i). Log(L) and AIC values are truncated. Relative AIC$_c$ model weights (w_i) are calculated for a priori models only.

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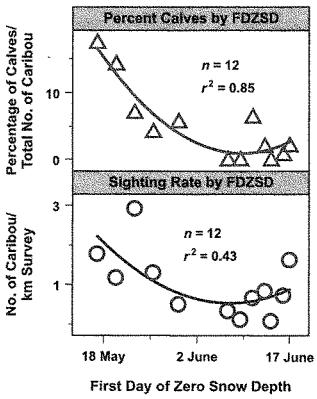
Fig. 1. Calf percentage and sighting rate of caribou (*Rangifer tarandus granti*) observed within 1 km of the Spine and Oliktok roads during calving periods of 1982–1990 and 2000–2002 explained by the snowmelt index, i.e., first day of zero snow depth (FDZSD). Measures of fit from ordinary least squares regression of quadratic model.



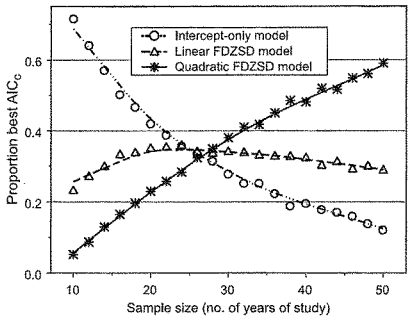
melted later from May into June but then increase as snow melted progressively later in June (Fig. 1). We interpret this apparent phenomenon as a tolerance response of caribou feeding on emergent vegetation near roads during a period when they would prefer not to be there.

Discussion

We found a lack of evidence for a habituation response across years (Table 2, no. 6; Table 3, no. 4). An alternate hypothesis to explain the discrepancy between results from Cameron et al. (1992) and Noel et al. (2004) could be that, with 2–5 km location errors (e.g., Cameron et al. 1995), data collected without GPS technology in the earlier study were too crude to make inferences at the 1 km spatial precision. Also, traffic rates may have been greater during the earlier study. Local calf percentage and caribou density alone appeared to have little effect on the response variables estimated along the main oilfield roads (Table 2, no. 5; Table 3, no. 3). We did find confirmatory evidence for re-habituation within years during the calving period predictable by the timing of the spring snowmelt (Table 2, no. 1; Table 3, no. 2). We also found exploratory evidence for a tolerance response (Table 3, no. 8; Figs. 1, 3), defined as an apparent habituation but with a trade-off that may not be overt (Herrero et al. 2005).

This study provided two more lines of evidence that the snowmelt index can be used to predict the pattern and timing of annual re-habituation of calving caribou to existing oilfields in northern Alaska. Our method was observational but hypothetico-deductive (Platt 1964; Romesburg 1981), stemming from previous observations by Haskell et al. (2006). However, data were few for these current analyses, so we encourage further investigation of the annual re-habituation response. There has been no formal examination of the influence of variable traffic rates on disturbance behaviour of caribou in oilfields. We believe that traffic rates added unexplained variability to our models and should be considered further as a path to mitigating potential negative impacts of development.

Fig. 2. Information–theoretic model selection Monte Carlo power analysis (i.e., 3000 iterations per sample size) given random data generated from the quadratic snowmelt model (Table 3, no. 8 with intercept = 1.361 and dispersion parameter = 0.471). Log-likelihoods estimated by negative binomial regression analysis in each iteration for 3 models: (1) fully reduced intercept-only model, (2) linear FDZSD (first day of zero snow depth) effect, and (3) the "true" quadratic FDZSD effect. Trend lines are Loess-smoothed.



We presume that calving caribou arriving in the oilfields are initially disturbed by human activity perceived as predation risk (Bergerud 1974; Frid and Dill 2002), but evolution in an open environment has resulted in a gregarious species with adaptive and adaptable antipredator behaviour (Bergerud 1974, 2000; Gustine et al. 2006). The mere sight of a predator does not necessarily induce flight, but instead, caribou generally wait until the predator approaches closely and intentions to attack become clear (Kelsall 1968; Bergerud 1974; Geist 1998). Evolved antipredator behaviour and the gregarious nature of caribou may facilitate horizontal social and vertical cultural learning that allows habituation to neutral human activities and perhaps even a tolerance response induced by a trade-off with foraging stress.

Post hoc tolerance model

A tolerance response may have been evident in the quadratic predictive models (Tables 2, 3, no 8; Fig. 1), which we forward as a testable hypothesis for future study. Similarly, the effect of late snowmelt may depend on local caribou density (Fig. 3). Riparian corridors are well drained in this permafrost tundra environment and are characterized by fine-scale topographic relief that can result in early snow melt (Truett and Johnson 2000); consequently, caribou may at times prefer such riparian areas for foraging in spring (Nellemann and Thomsen 1994). Halfway between the

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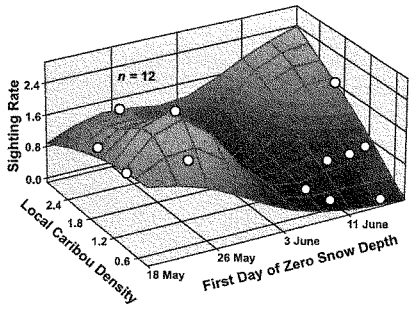
Fig. 3. Spline-interpolated scatterplot of sighting rate of caribou (*Rangifer tarandus granti*; no. of caribou/km surveyed) observed within 1 km of the Spine and Oliktok roads in north Alaskan oilfields during calving periods of 1982–1990 and 2000–2002 as affected by the snowmelt index (first day of zero snow depth) and local caribou densities (no. of caribou/km^2).



Milne Point and Oliktok roads was a well-drained riparian corridor about 4–5 km away from these major roads (Muller et al. 1999). This riparian area was probably a natural attraction for calving caribou when they first arrived in the spring for its physiographic properties and for its location away from roads allowing caribou to locally space away from the perceived predation risk (Bergerud 1974, 2000). However, when local densities of caribou are relatively high in the oilfields and snow melts progressively later, caribou may experience intraspecific forage competition at preferred sites away from roads. This may result in attraction to areas near roads where the dust shadow causes vegetation to emerge early (Walker and Everett 1987) even though they would rather not be there based solely on their innate antipredator behaviour (Haskell et al. 2006; Figs. 1, 3). Field observations by Smith et al. (1994) corroborated this phenomenon in 1988.

Why the quadratic response to the snowmelt index appeared to exhibit greater effect for sighting rate than calf percentage and why there was more unexplained variation for sighting rate (Fig. 1) may be explained by the difference in avoidance behaviour between groups with and without calves. Groups with calves were, on average, located farther from active oilfield infrastructure than groups without calves even after re-habituation had occurred within years (Haskell et al. 2006). Caribou without calves would likely be the first to exhibit the described tolerance response.

The fact that both response variables initially declined as snow melted later indicates that spatial avoidance effects did at times extend beyond 1 km along this relatively high-traffic road system. The relatively low caribou densities and calf percentages <1 km from this main road system compared with the oilfield region as a whole suggest the same (Table 1). However, habitat characteristics should be considered in a resource selection model at this larger spatial extent (e.g., Sawyer et al. 2006). The hypothetical tolerance response emphasizes the importance of interpreting disturbance behaviour in light of constraints on animals — trading predation risk for more limited resources does not have to mean that resources become limiting (Barten et al. 2001; Gustine et al. 2006).

The obvious weakness of the tolerance model is the overall paucity of data (n = 12), and it could take several years of similar data to support such a model (Fig. 2). As the CAH continues to grow in size (Lenart 2003), there may be increased likelihood of observing similar phenomena to confirm or refute the hypothetical tolerance response. We recommend repeated independent road surveys within years while accounting for variability in traffic rates and local caribou composition and density. High-resolution location data from individual animals may also be useful to quantify disturbance effects (Preisler et al. 2006; Sawyer et al. 2006). Invasive and noninvasive studies of glucocorticoid steroid hormones promise various ways to test hypotheses of stress responses in caribou, but studies must be designed and results interpreted with considerable caution (Millspaugh and Washburn 2004; Romero 2004; Reeder and Kramer 2005). Noninvasive observation of behaviour patterns may also be useful (Alados et al. 1996). Linking human-caused stress response or resource limitation to demographic vital rates such as adult survival, reproduction, and recruitment may be important (Bergerud et al. 1984; Haskell and Ballard 2004, 2007; Mallord et al. 2007).

Behavioural and historic considerations for the CAH case history

It should not be surprising that calving CAH caribou have proven adaptable to human disturbance. Evolution of New World deer in ecologically disturbed seasonal environments resulted in phenotypically plastic species with large brains, and *R. tarandus* is the only extant deer species to have been domesticated (Geist 1998).

About four generations of caribou were exposed to human activities and industry infrastructure prior to development of the Kuparuk and Milne Point oilfields in their calving grounds. Caribou of the CAH did not have cause to identify human activities in the oilfields as real predation risk because hunting was not allowed. In fact, oilfield infrastructure provided insect-relief habitat and was an attractant at times during summer (Ballard et al. 2000). Therefore, it is reasonable to believe that most CAH caribou had been previously exposed to the Prudhoe Bay oilfield before development in the calving area. Social and cultural transmission of learned behaviour in caribou is not well understood but is a process observed in other animals that should be considered (Davis et al. 1986; Thurber et al. 1994; Sargeant et al. 2005; Vilhunen et al. 2005; Ferrari and Chivers 2006). Furthermore, transmission of a learned behavioural response to human disturbance could be synergistic, as there is evidence that exposure to moderate stressors as a neonate reduces the lifelong physiological stress response in mammals (Romero 2004). There has been an additional eight generations of CAH caribou exposed to the existing oilfields in their calving grounds. The fact that some CAH continue to space away from real predation risk by migrating north into the oilfields for calving suggests that even in an interannual temporal context these caribou can distinguish between real and innately perceived predation risk. If industry is to en-

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croach into caribou calving grounds, then incremental development reaching closer to the calving grounds over time may be an effective approach for mitigating adverse disturbance impacts.

Acclimation was described as a reduced physiological stress response resulting from repeated exposure to some stressor (Romero 2004); this physiological response may be directly linked to the outward behavioural response of habituation (Whittaker and Knight 1998). An interesting phenomenon that may be associated with acclimation is facilitation. Facilitation is an enhanced response to some stressor after acclimation to a different form of stressor has occurred (Romero 2004), perhaps correlating to behavioural sensitization (Whittaker and Knight 1998). This phenomenon emphasizes the importance of keeping stimuli consistent when wildlife habituation is a management objective (Nisbet 2000; Miller et al. 2001; Papouchis et al. 2001).

Some biologists have recommended regular and predictable disturbance stimuli as a prescription to habituate wildlife if humans are to be present during sensitive life-history stages (Cowan 1974; Geist 1978; Nisbet 2000). By moderating traffic patterns in new oilfields during calving as required by BLM (2005, 2006), the effect may be to prevent rapid habituation to neutral traffic stimuli initially perceived as predation risk. There was no widespread traffic control in areas where data presented in this study or by Haskell et al. (2006) were collected, yet it is clear that annual re-habituation of caribou has occurred in these areas during the predefined calving period. After re-habituation has occurred, caribou frequently feed next to main roads and use them as insect-relief habitat and travel corridors (Ballard et al. 2000; Haskell 2003).

Caribou did not contend with wolves in the oilfields. Early petroleum exploration apparently displaced resident wolves from the current Kuparuk calving grounds prior to discovery of the CAH (Gavin 1980[4]; J. Helmericks, North Slope resident and naturalist, personal communication (2001)); none have returned. In fact, evidence from early surveys suggests that the CAH did not exist in its current stable state prior to displacement of wolves from the coastal oilfield region (Olson 1959; Skoog 1961; Sage 1970; Gavin 1971[5], 1975). Hunting by residents of a local village, established in 1973, has likely contributed to low wolf densities in calving ranges of the CAH and TLH outside of the existing oilfields (BLM 2005).

Disturbance by wolves and human hunters near the oilfields could explain the observed re-habituation pattern each spring. However, summer movements of the CAH bring them into contact with hunters on one day and oilfield infrastructure and activities the next, and there appears to be no similar behavioural transition period, although attraction to insect-relief habitat should be considered in summer (Noel et al. 1998; Ballard et al. 2000). Innate behaviour to space away from predators during the calving season seems to be the most likely explanation of the initial disturbance response prior to annual re-habituation each spring (Bergerud 1974, 2000).

The hunting hypothesis

Until this point, all discussion has been contingent on the no-hunting policy in existing oilfields where data were collected. We believe that the no-hunting policy has allowed calving CAH caribou to discriminate between innately perceived and environmentally real (or lack thereof) predation risk associated with human activities in the existing oilfields, resulting in the documented re-habituation patterns during and after the calving period (Haskell et al. 2006; this study). Ungulates seem to learn when and where they are hunted by humans (Millspaugh et al. 2000; Conner et al. 2001; Kilpatrick et al. 2002; de Boer et al. 2004; Donadio and Buskirk 2006). This may be why even semi-domesticated *Rangifer* appear to avoid human activity and infrastructure when hunted (Nelleman et al. 2000; Vistnes and Nelleman 2001), whereas wild *Rangifer* do not when protected from hunting (Burson et al. 2000; Yost and Wright 2001).

Current petroleum development on Alaska's Arctic coastal plain is expanding west into the calving grounds of the TLH. Hunting is prohibited for nonlocal oilfield personnel. However, local resident hunters have access into the planned oilfields by waterways and roads; they are also permitted the use of off-road vehicles over tundra (BLM 2005, 2006). Caribou use space to control predation risk and moderate the stress response, and this psychological context may be important to consider (Bergerud 1974, 2000; Romero 2004). Exposing caribou to real predation risk from humans across the landscape could increase the stress response synergistically, causing abandonment of neonates or preferred calving range owing to herding and escape instincts. Disturbance from human recreational activities has been shown to be greater off established travel corridors for a variety of species (Schultz and Bailey 1978; MacArthur et al. 1982; Taylor and Knight 2003). We predict that TLH caribou will not exhibit the habituation behaviour evident by calving caribou of the CAH if hunting occurs within the new oilfields. Generally stated, caribou will not coexist with hunted oilfields as they have with oilfields as a refuge.

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Caribou distribution near an oilfield road on Alaska's North Slope, 1978–2001

Lynn E. Noel, Keith R. Parker, and Matthew A. Cronin

Abstract Previous research in the Milne Point oilfield in northern Alaska showed that the density of caribou (*Rangifer tarandus*) in the calving period within 1 km of a road was significantly lower after construction than before construction of the road. This was interpreted as displacement from the road and a functional loss of habitat and has been extensively cited as a documented effect of oilfield development on caribou. We continued this study with additional aerial surveys flown during 1991–2001 and compared caribou numbers and density in 6 1-km intervals from the road over 3 time periods: pre-road construction (1978–1981), early post-road construction (1982–1987), and recent post-road construction (1991–2001). During the recent post-road period, the densities of calves and of all caribou were not significantly lower within 1 km of the road than the densities in the pre-road period. In addition, calf density was higher in the interval within 1 km of the road than in the intervals 1–6 km from the road during the recent post-road construction period. The total number of calving caribou observed in the study area has declined since pre-road construction and early post-road periods, but we found no evidence that caribou using the area during calving avoided areas near the road during the recent post-road period. Numbers of caribou in the study area during the post-calving period (after 20 June) during 1991–2001 were highly variable, but generally were higher than during calving. Analyses of relationships between calving and post-calving caribou densities and distance intervals from Milne Point Road suggested that distributions of calves and adult caribou were not strongly influenced by presence of the road.

Key words calving period, caribou, displacement, habitat use–availability, post-calving period, *Rangifer tarandus*

The range of the Central Arctic Caribou (*Rangifer tarandus*) Herd includes the oilfield complex in the Prudhoe Bay region in northern Alaska (Ballard et al. 2000, Murphy and Lawhead 2000). An important issue regarding oil development in this region is the potential for displacement and disturbance of caribou during the calving period. Pre- and post-road construction data in the Milne Point oilfield suggested that cow caribou with calves were displaced from roads with traffic during the calving period (Dau and Cameron 1986, Cameron et al. 1992). In addition, shifting of the entire calving area to the southwest away from the Milne Point and Kuparuk oilfields and negative impacts on the nutritional status of cow caribou leading to reduced calf production have been suggested (Cameron et al. 2002, National Research Council 2003 and references therein). Displacement of caribou from the oilfields during the post-calving period also has been suggested (Cameron et al. 1995), although the Prudhoe Bay oilfield habitats are used extensively by caribou and

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aerial surveys showed no apparent displacement from infrastructure during 1990–1995 (Pollard et al. 1996, Noel et al. 1998, Cronin et al. 1998*a*).

The previous assessment of displacement of caribou from oilfield infrastructure during calving (Dau and Cameron 1986, Cameron et al. 1992) compared distribution before (1978–1981) and after (1982–1987) development of the Milne Point access road. Caribou distribution was documented with 1 aerial (helicopter) survey per year (Dau and Cameron 1986, Cameron et al. 1992). They assessed caribou distribution in successive 1-km intervals from a road to the then-new Milne Point oilfield (Figure 1) and found a significantly lower caribou density in the interval closest to the road after the road was built. They also concluded that densities of calves and total caribou after road construction decreased within 2 km and increased beyond 4 km from the road system. They suggested this change in distribution resulted from displacement of cow caribou with calves, during the calving period, from the new, heavily traveled road.

To evaluate the longer-term influence of the road, we studied caribou distribution in the same Milne Point study area during calving periods for 7 years between 1991 and 2001 (Figure 1). In this paper we compare these recent distributions with the distributions reported from 1978–1987 (Dau and Cameron 1986, Cameron et al. 1992). Our objective was to quantify and compare distribution of caribou during the calving period in relation to Milne Point access road, over 3 time periods: pre-road construction (1978–1981), early post-road construction (1982–1987), and recent post-road construction (1991–2001). Our analyses focused on comparison among the time periods as well as among distance intervals within time periods. We also describe post-calving caribou distribution during the recent post-road construction period.

Methods

Fieldwork

We conducted aerial surveys of caribou distribution in the Milne Point area during the calving period (13–20 June) and post-calving period (21 June–8 August) in 1991, 1994, 1996, 1998, 1999, 2000, and 2001. We also conducted post-calving surveys in 1997. We included all of the Milne Point study area surveyed during 1978–1987 (Dau and Cameron 1986; Cameron et al. 1992; J. Dau, Alaska

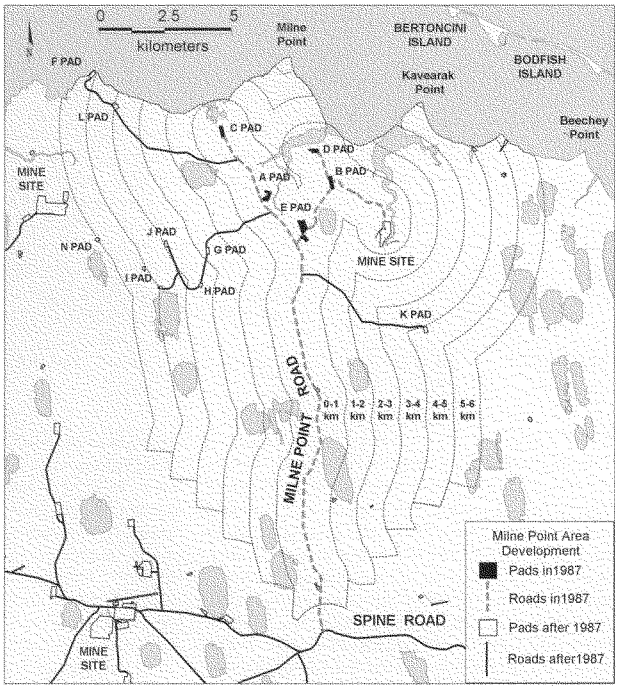

Figure 1. Distance intervals from the Milne Point Road, North Slope, Alaska, based on roads and pads used for interval calculations in Cameron et al. (1992; J. Dau, Alaska Department of Fish and Game, personal communication) and used to calculate density and number of calves and total caribou for aerial survey data from 1991–2001.

Department of Fish and Game, personal communication) in our 1991–2001 surveys. We flew systematic strip-transect surveys (Caughley 1977) in a Cessna 206 or 207 (Cessna Aircraft Company, Wichita, Kans.) fixed-wing airplane, with 2 observers. Transect centerlines were spaced at 1.6-km intervals, oriented north–south and centered on township and section lines. Two observers, each searching an 800-m swath on one side of the transect centerline, provided for 100% transect coverage. Aircraft wing struts were marked to enable visual control of transect-strip width (Pennycuick and Western 1972). Observers verified transect width using inclinometers. We used Global Positioning System (GPS) receivers (Garmin International Inc., Olathe, Kans.;Trimble Navigation Limited, Sunnyvale, Calif.) to navigate the aircraft along transects and to record the location of the aircraft when animals were observed. The observer's GPS receiver was linked to a notebook computer via Geolink® software (Baker GeoResearch, Inc., Billings, Mont.). Sighting data, including a visual estimate of distance and direction from the aircraft, group size, and sex and age composition, were entered by a third crewmember or by 1 of the 2 observers. We then calculated coordinates for sightings using the visual estimates of distance and direction from the aircraft to offset the GPS aircraft positions.

Dau and Cameron (1986) and Cameron et al. (1992) assessed caribou distribution before (1978–1981) and after (1982–1987) construction of Milne Point Road. They divided the study area into a series of successive 1-km intervals on each side of the road and reported the density of caribou seen in each zone during one helicopter survey each year of their study (Dau and Cameron 1986, Cameron et al. 1992). We evaluated our new data from 1991–2001 and that of Cameron et al. (1992, as reported in Cronin et al. 1994; Appendix A–D) from 1978–1987. This approach allowed assessment of caribou distribution for 23 years in the vicinity of the Milne Point Road. There was 1 survey per year for the pre-road and early post-road periods. In our recent post-road period, there was >1 survey per year in 1991, 1994, 1998, and 2001 and 1 survey per year in 1996, 1999, and 2000 (Appendix A, B). For years with >1 survey, we used the survey with the largest number of caribou observed.

Data analysis

We divided the surveys into 3 periods: pre-road construction (1978–1981), early post-road construction (1982–1987), and recent post-road construction (1991–2001). The pre-road construction and early post-road construction periods were the subjects of the earlier comparisons (Dau and Cameron 1986, Cameron et al. 1992). Our recent post-road surveys serve as another post-road construction period.

For each year we calculated numbers and density of total caribou (calves, yearlings, and adults) and calves only in 6 1-km intervals from Milne Point Road, as in the original study (Figure 1; Cameron et al. 1992; J. Dau, Alaska Department of Fish and Game, personal communication). We did not include new roads and production pads built after 1987 and replicated the original study by considering only Milne Point Road (Figure 1). Milne Point Road was the primary access road for Milne Point oilfield and had higher traffic levels than the production-pad access roads constructed after 1987.

Calving period. We evaluated the 23-year time series of data for the study area for trends in caribou density using simple linear regression for years with early and late (after 5 June) snowmelt. Snowmelt was either as reported in Cameron et al. (1992) or the first day with 0 cm snow depth at the National Oceanic and Atmospheric Administration's Kuparuk River Station (National Climatic Data Center, Asheville, N.C.).

We assessed the potential effect of Milne Point Road on caribou distribution during the calving period in 3 ways. First, like Cameron et al. (1992), we used Student's *t*-test with Satterthwaite corrected degrees of freedom to compare densities for each of the 6 distance intervals (0–1 km, 1–2 km, 2–3 km, 3–4 km, 4–5 km, and 5–6 km) between pre-road and recent post-road periods. Differences were considered significant at $\alpha = 0.05$.

Second, we evaluated changes in caribou density over time periods in the 6 distance intervals. We used Poisson regression (McCullagh and Nelder 1989, Parker et al. 1999) to simultaneously test for a relationship between sampling period and distance interval on caribou density. We modeled caribou density as a function of time (period) and distance interval from Milne Point Road (distance),

$$\text{count} = \exp(\mu + \text{period} + \text{distance} + \text{period-by-distance} + \text{error}), \quad (1)$$

where count was number of caribou per interval, μ was the grand mean for caribou over distance and period, and period-by-distance measured interac-

tion between period and distance. Count was offset by area of distance intervals. If change in caribou density over sampling periods differed among distance intervals (i.e., if changes in density were not parallel), the period-by-distance interaction will be statistically significant. Interactions were considered significant at $\alpha = 0.05$.

Third, we compared expected and observed numbers of caribou in each of the intervals from 0–6 km using a habitat use–availability test including the nonparametric Bonferroni Z statistic (Neu et al. 1974, Manly et al. 1993, Cronin et al. 1998*a*) to calculate a 95% simultaneous confidence limit for each interval. We calculated the expected proportion of caribou by assuming that the total number of observed caribou was distributed homogeneously relative to the area of each interval (i.e., number observed ÷ area of interval). If the expected proportion was outside the observed 95% confidence interval, then we considered the observed numbers significantly lesser or greater than expected, depending upon the side of the confidence interval in which they occurred. Proportions inside the 95% confidence interval were considered not different than expected. We completed these habitat use–availability tests for each year and for the combined years of each period (pre-road, early post-road, and recent post-road).

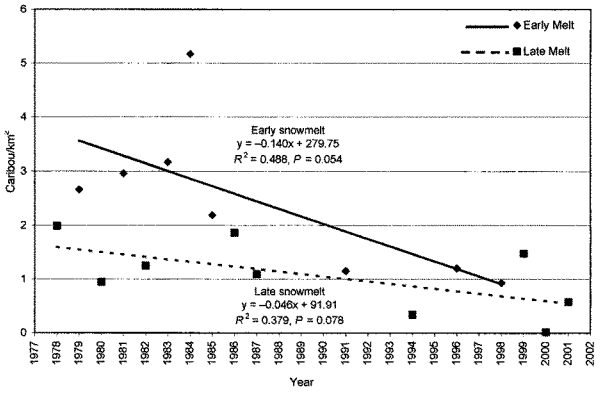

Figure 2. Trends in caribou density (caribou/km^2) during the calving period within 6 km of Milne Point oilfield access road, North Slope Alaska, 1978–2001. Early (<6 June) and late (>5 June) snowmelt years (Cameron et al. 1992 [1978–1982 snowmelt data]; National Oceanic and Atmospheric Administration, Kuparuk River Station (National Climatic Data Center, Asheville, North Carolina [1983–2001 first day with 0 cm snow depth]) are identified and fitted to separate linear regressions.

Post-calving period. Post-calving-period systematic aerial survey data were not available prior to 1991. Therefore, we compared post-calving distributions among intervals only during the recent post-road period. Because the Poisson regression failed to converge, we compared caribou densities among distance intervals using regression following the form:

$$\text{count} = (\mu + \text{distance} + \text{error}). \quad (2)$$

Count was offset by area of distance intervals. We also compared the numbers of total caribou and calves in each distance interval using the habitat use–availability test.

Results

The numbers of caribou observed in aerial surveys during the calving period varied from 0–559 calves, and 5–1,259 total caribou, between 1978–2001 (Appendix A, B). During the post-calving period, numbers varied from 0–1,164 calves and 2–4,767 total caribou between 1991–2001 (Appendix C, D). During the calving period, there was general decline in number of caribou for all distance intervals during 1978–2001, where the mean number of calves observed per survey decreased from 216 to 61 and the mean number of total caribou decreased from 521 to 192 (Figure 2, Table 1). The declining trend in numbers of caribou in this area was significant for all years (slope = –0.09, $P = 0.015$, $n = 17$) but was more pronounced for years with early snowmelt (before 5 June, slope = –0.140, $P = 0.054$, $n = 8$) than for years with late snowmelt (Figure 2, Appendix A, B, slope = –0.046, $P = 0.078$, $n = 9$).

Numbers of post-calving caribou observed in the study area during the recent post-road period were highly variable both within and among years (2–4,767 per survey, Appendix C). During 10 of 32 surveys over 7 years, total number of caribou in the

Table 1. Mean density (caribou/km^2) and 95% confidence interval (CI) of calves and total caribou for 6 1-km distance intervals from Milne Point oilfield access road, North Slope Alaska, during the calving period 1978–2001. Also shown are mean caribou numbers for each period and *t*-tests results for pair-wise comparisons among time periods.

	Distance interval						
	0–1 km	1–2 km	2–3 km	3–4 km	4–5 km	5–6 km	Number
Time period	$\bar{x}$ 95% CI	$\bar{x}$ 95% CI	$\bar{x}$ 95% CI	$\bar{x}$ 95% CI	$\bar{x}$ 95% CI	$\bar{x}$ 95% CI	$\bar{x}$ 95% CI
Calves							
Pre-road (1978–1981)[a]	0.60 (0.518)	0.76 (0.722)	1.31 (1.940)	1.60 (1.910)	0.57 (1.220)	0.56 (0.630)	216 (178)
Early post-road (1982–1987)[a]	0.04 (0.059)	0.34 (0.456)	1.01 (0.897)	1.45 (1.351)	2.49 (2.682)	2.03 (1.383)	250 (180)
Recent post-road (1991–2001)	0.34 (0.316)	0.17 (0.273)	0.24 (0.223)	0.25 (0.217)	0.29 (0.347)	0.23 (0.298)	61 (36)
P: Pre-road vs. early post-road[b]	0.04	0.19	0.68	0.85	0.13	0.04	
P: Pre-road vs recent post-road	0.26	0.07	0.18	0.11	0.53	0.21	
Total caribou							
Pre-road (1978–1981)[a]	1.41 (1.115)	1.93 (1.568)	3.08 (4.003)	3.82 (3.546)	1.39 (2.606)	1.41 (1.273)	521 (344)
Early post-road (1982–1987)[a]	0.31 (0.334)	1.10 (1.028)	2.48 (1.879)	3.34 (2.847)	5.49 (5.456)	4.53 (2.999)	598 (389)
Recent post-road (1991–2001)	0.93 (0.842)	0.67 (0.860)	0.77 (0.763)	0.74 (0.466)	1.05 (1.129)	0.73 (0.750)	192 (113)
P: Pre-road vs early post-road[b]	0.05	0.24	0.70	0.77	0.12	0.04	
P: Pre-road vs recent post-road	0.36	0.08	0.17	0.07	0.73	0.22	

[a] R. D. Cameron, Alaska Department of Fish and Game, unpublished data (Cronin et al. 1994).
[b] Cameron et al. (1992).

study area during the post-calving period exceeded the maximum number observed during the calving-period surveys (1,259 caribou in 1984; Appendix A–D).

Calving period

Calf and total caribou densities in the interval closest to the road (0–1 km) were not significantly different during the pre-road and recent post-road periods (P=0.26 for calves, P=0.36 for total caribou; Table 1). This was in contrast to the significantly higher (P=0.04 for calves, P=0.05 for total caribou) density in the 0–1-km interval in the pre-road period than in the early post-road period reported by Cameron et al. (1992) and shown in Table 1. In fact, during the recent post-road period, the highest density of calves (0.34 calves/km^2) and second highest density of total caribou (0.93 caribou/km^2) occurred in the 0–1-km interval (Table 1).

Calf and total caribou densities in the 5–6-km distance interval were not significantly different during the pre-road and recent post-road periods (P= 0.21 for calves, P=0.22 for total caribou; Table 1). This is in contrast to the significantly lower (P= 0.04 for calves and total caribou) density in this interval in the pre-road period than in the early post-road period reported by Cameron et al. (1992) and shown in Table 1. Densities in the 1–2-km, 2–3-km, 3–4-km, and 4–5-km intervals were not significantly different between the pre-road and early post-road or between the pre-road and recent post-road periods for either calves or total caribou (Table 1).

Poisson regression. Trends in mean density over the 3 time periods were not parallel among distance intervals for either calves or total caribou as shown by significant period-by-distance interactions (P<0.001 for both calves and total caribou, Table 2). These nonparallel trends in mean density among distance intervals are shown for both calves and total caribou (Figure 3). Density of calves and total caribou in the 0–1-km interval decreased from the pre-road to the early post-road period and then increased in the recent post-road period. Densities of calves and total caribou in the 1–2-km, 2–3-km, and 3–4-km intervals show general declines from the pre-road to the recent post-road period. Densities of calves and total caribou in the 4–5-km and 5–6-km intervals increased from the pre-road to the early post-road period, and then decreased during the recent post-road period (Figure 3).

Habitat use-availability tests. During all 6 years of the early post-road period, there were lower than expected numbers of calves and total caribou in the 0–1-km interval. This analysis showed that calf and total caribou numbers during the pre-road period also were lower than expected in the 0–1-km interval for 2 of 4 years and for combined data (Table 3). There were lower than expected or not different from expected numbers of calves and

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Table 2. Coefficients, standard errors (SE) and *t*-values from Poisson regressions on density of calves and total caribou for distance intervals from Milne Point oilfield access road, North Slope Alaska, during the calving period 1978–2001. Distance intervals were 1-km distances from the Milne Point Road, and periods were between pre- and early post-road construction, and early post-road and recent post-road construction.

	Calves			Caribou		
Coefficients	Value	SE	*t*-value	Value	SE	*t*-value
Intercept	−37.13	0.03	−1,373.24	−36.08	0.01	−2,500.89
Distance 1	5.09	0.06	88.49	5.02	0.03	189.36
Distance 2	4.32	0.03	168.15	4.23	0.01	314.57
Distance 3	3.34	0.02	201.68	3.29	0.01	352.50
Distance 4	2.66	0.01	196.87	2.64	0.01	341.38
Distance 5	2.26	0.01	186.75	2.24	0.01	315.92
Period 1	−0.09	0.03	−2.96	0.01	0.02	0.61
Period 2	0.07	0.02	3.28	0.13	0.01	11.51
Distance 1 by Period 1	0.47	0.08	6.17	0.24	0.03	7.02
Distance 2 by Period 1	0.25	0.03	8.26	0.14	0.02	9.02
Distance 3 by Period 1	0.14	0.02	8.36	0.08	0.01	8.32
Distance 4 by Period 1	0.24	0.01	16.34	0.20	0.01	22.11
Distance 5 by Period 1	0.15	0.01	11.53	0.11	0.01	14.73
Distance 1 by Period 2	−0.30	0.04	−8.17	−0.17	0.02	−9.58
Distance 2 by Period 2	−0.30	0.02	−15.66	−0.26	0.01	−25.10
Distance 3 by Period 2	−0.20	0.01	−15.42	−0.19	0.01	−25.03
Distance 4 by Period 2	−0.06	0.01	−6.21	−0.04	0.01	−7.23
Distance 5 by Period 2	−0.11	0.01	−11.87	−0.11	0.01	−19.27

total caribou in the 5-6-km interval during the pre-road period. There were greater than expected numbers of calves and total caribou in the 5-6-km interval in the early post-road period (Table 3). The use-availability analysis indicated there were greater than expected numbers of caribou in the 3-4-km interval during both the pre-road and early post-road periods (Table 3). In general, during the pre-road period, the 2-3-km and 3-4-km distance intervals had greater than expected numbers of calves and total caribou and the more distant intervals had fewer than expected. During the early post-road period, there were fewer than expected caribou in the closer intervals and more than expected in the more distant intervals (Table 3).

Habitat use-availability tests for the recent post-road period indicated that numbers of calves and total caribou were greater than expected or not different from expected in the interval closest to the road (0-1-km interval) in 4 of 6 years and more than expected for the 7 years combined (Table 3). In the interval most distant from the road (5-6 km), the numbers of calves and total caribou were greater than expected or not different than expected in 3 of 6 years. The data combined for all 7 years indicated that numbers of calves and total caribou were not different from expected in the 5-6-km interval. Numbers of calves and total caribou in the other intervals (1-2 km, 2-3 km, 3-4 km, and 4-5 km) were variable among years. The combined data for all 7 years for the 1-2-km, 2-3-km, and 3-4-km intervals indicated less than expected or not different from expected numbers of calves or total caribou. In general, during the recent post-road period, the 0-1-km interval had more caribou than expected, while the more distant intervals had either no difference than expected or more animals than expected (Table 3).

Post-calving period

Regression. Mean densities of calves and total caribou were not significantly different among distance intervals during the post-calving period ($P=0.51$ calves and $P=0.31$ total caribou). There was no relationship in densities of calves or total caribou over distance intervals from the road (left to right in Figures 4 and 5) that suggested avoidance of or attraction to Milne Point Road. There was broad overlap of caribou density among intervals. Lowest density occurred in the 4-5-km distance interval and highest density in the 1-2-km distance interval (Figures 4 and 5).

Habitat use-availability tests. During 4 of 8 years (for total caribou) and 3 of 8 years (for calves), there were greater than expected numbers of caribou in the 0-1-km interval during the post-calving period (Table 4). In 4 of 8 years, and in the combined data for all years, there were fewer than expected calves and total caribou in the 0-1-km interval. The 1-2-km and 2-3-km intervals showed greater than expected numbers of calves and the 1-2-km interval showed greater than expected numbers of total caribou. The other intervals (3-4 km, 4-5 km, and 5-6 km) had lower than expected or not different from expected numbers of calves and total caribou for the data combined for all 8 years (Table 4).

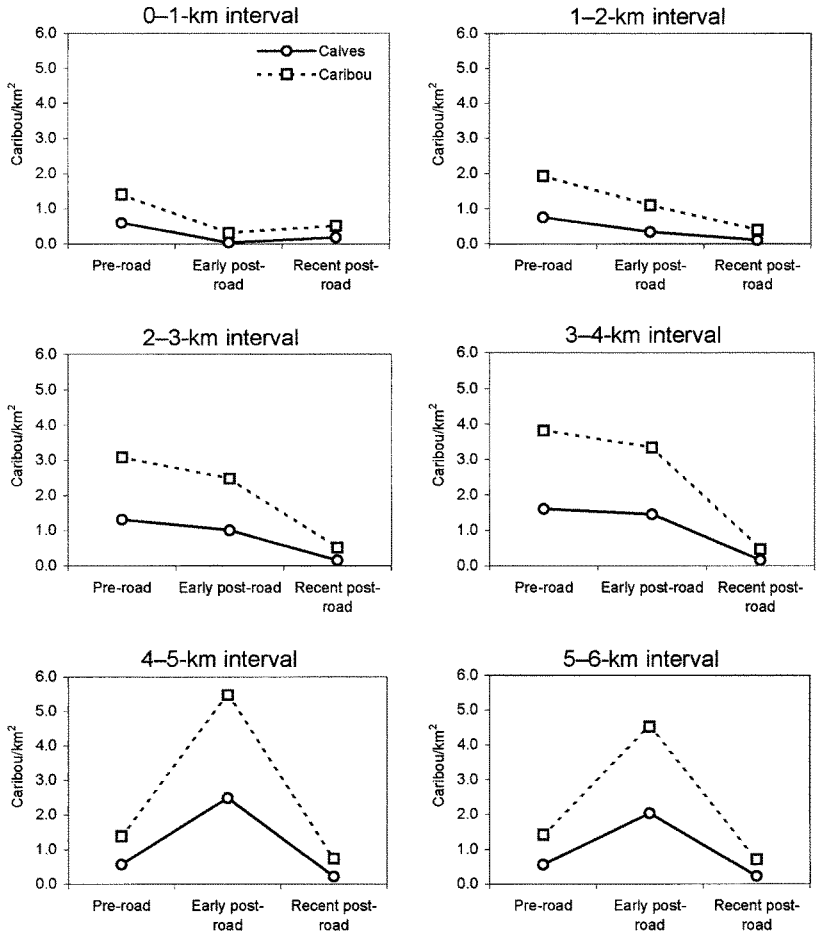

Figure 3. Mean calf and total caribou density (caribou/km^2) for 6 1-km distance intervals from the Milne Point Road, North Slope, Alaska, during the pre-road construction (Pre-road [1978–1981]), early post-road construction (Early post-road [1982–1987]), and recent post-road construction (Recent post-road [1991–2001]) periods.

Table 3. Relative caribou use of habitat adjacent to Milne Point oilfield access road during the calving period 1978–2001, North Slope, Alaska. For each year and distance interval (measured from the road), "L" indicates that, at $\alpha = 0.05$, fewer caribou than expected were sighted relative to sightings in the whole area; "N" indicates number of caribou seen did not differ from expected, and "G" indicates more caribou were seen than expected.

Distance	Pre-road (1978–1981[a])					Early post-road (1982–1987[a])							Recent post-road (1991–2001[b])							
interval	1978	1979	1980	1981	Combined	1982	1983	1984	1985	1986	1987	Combined	1991	1994	1996	1998	1999	2000[c]	2001	Combined
Calves																				
0–1 km	N	L	N	L	L	L	L	L	L	L	L	L	N	L	G	G	N	—	L	G
1–2 km	G	L	N	L	N	L	N	L	L	L	L	L	L	N	G	L	L	—	L	L
2–3 km	L	G	N	G	G	N	N	L	G	N	L	N	L	L	L	N	N	—	G	N
3–4 km	G	G	N	G	G	G	N	G	L	G	N	G	N	G	L	N	N	—	L	N
4–5 km	N	N	L	L	L	N	G	G	G	N	G	G	N	N	L	N	G	—	N	N
5–6 km	L	N	N	N	L	G	G	G	N	G	G	G	G	N	L	L	L	—	G	N
Total caribou																				
0–1 km	N	L	N	L	L	L	L	L	L	L	L	L	N	L	G	G	N	—	L	G
1–2 km	G	L	N	L	N	L	N	L	L	L	L	L	N	N	G	L	L	—	L	L
2–3 km	L	G	N	G	G	N	N	L	G	N	L	N	L	L	L	N	G	—	G	N
3–4 km	G	G	N	G	G	G	G	G	L	G	N	G	N	G	L	N	N	—	L	N
4–5 km	N	G	L	L	L	N	G	G	G	N	G	G	N	N	L	N	G	—	G	G
5–6 km	L	L	N	L	L	G	G	G	N	G	G	G	G	N	L	L	L	—	G	N

[a] Survey dates 10–14 June (Cameron et al. 1992).

[b] Survey dates 12–20 June; individual surveys used in analyses are identified in Appendix A and Appendix B.

[c] Too few observations to complete test.

Table 4. Relative caribou use of habitat adjacent to Milne Point oilfield access road during the during the post-calving period after 20 June 1991–2001[a], North Slope, Alaska. For each year and distance interval (measured from the road), "L" indicates that, at $\alpha = 0.05$, fewer caribou than expected were sighted relative to sightings in the whole area; "N" indicates number of caribou seen did not differ from expected, and "G" indicates more caribou were seen than expected.

Distance	Recent post-road: calves									Recent post-road: total caribou								
interval	1991	1994	1996	1997	1998	1999	2000	2001	Combined	1991	1994	1996	1997	1998	1999	2000	2001	Combined
0–1 km	G	L	G	L	L	G	N	L	L	G	L	G	L	L	G	G	L	L
1–2 km	L	N	N	G	G	N	G	L	G	L	G	N	G	G	N	G	L	G
2–3 km	N	N	N	N	N	L	G	G	G	G	N	N	L	L	L	N	G	L
3–4 km	N	N	L	L	G	G	L	L	N	L	N	L	L	G	G	L	L	N
4–5 km	L	G	L	N	L	L	L	N	L	L	G	L	L	L	L	L	L	L
5–6 km	N	G	L	L	L	L	L	L	N	G	G	L	L	N	L	L	L	L

[a] Survey dates 21 June–15 August; individual surveys used in analyses are identified in Appendix C and Appendix D.

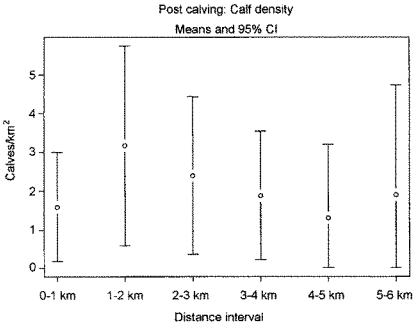

Figure 4. Means and 95% confidence intervals for calf density (calves/km^2) in 6 1-km distance intervals from Milne Point Road, North Slope, Alaska, during the recent post-road construction period, after 20 June 1991–2001. Lower confidence intervals are truncated at 0 for the 4–5 and 5–6-km intervals.

Discussion

Our analysis was not an exact replication of the 1978–1987 analyses (Dau and Cameron 1986, Cameron et al. 1992) because new oilfield roads and production facilities have been built within the study area (Figure 1), and the caribou herd has increased in size. Aerial survey methodologies also were different. Dau and Cameron (1986) flew surveys in a helicopter using a 3.2-km transect spacing and plotting sightings on paper maps. We used fixed-wing aircraft, 1.6-km transect spacing, and GPS-integrated methods to plot sightings. Because visibility was usually better from a helicopter than from a fixed-wing aircraft, we might have missed observations of more animals in our counts than did Dau and Cameron (1986). Our transect spacing may have mitigated this difference, however, and our locations were plotted more accurately. Nonetheless, we see no reason these differences should compromise comparing our data with the data from the earlier study.

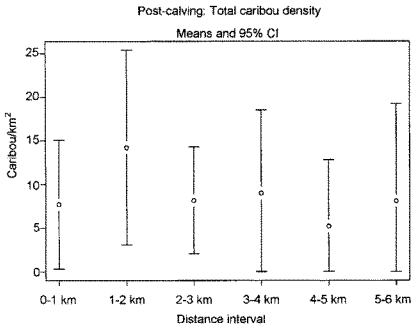

Figure 5. Means and 95% confidence intervals for total caribou density (caribou/km^2) in 6 1-km distance intervals from the Milne Point Road, North Slope, Alaska, during the recent post-road construction period, after 20 June 1991–2001. Lower confidence intervals are truncated at 0 for the 3–4-km, 4–5-km, and 5–6-km intervals.

The primary result of our analysis was that there was no significant difference in caribou density in the interval closest to the road (0–1 km) between the pre-road period and the recent post-road period. The 0–1-km interval actually had the highest density of calves, second highest density of total caribou, and greater than expected numbers of calves and total caribou during the recent post-road period. This was in contrast to the previous study in which caribou density in the 0–1-km interval was significantly lower in the early post-road period than in the pre-road period (Dau and Cameron 1986, Cameron et al. 1992).

If low density in the early post-road period resulted from caribou avoidance of the road, higher density in the recent post-road period may reflect habituation of calving caribou to the road and associated human activity (Cronin et al. 1994, Murphy and Lawhead 2000, Haskell 2003). However, it also was possible that the apparent displacement during the early post-road period reflected naturally variable distribution of caribou, not active avoidance of the Milne Point Road. In this regard, it is important to note that distributions during the pre-road period were not consistent. During the pre-road period, when there would be no displacement, there were fewer than expected caribou in the 0–1-km interval in 2 of the 4 years and for the combined 4 years of surveys (Table 3). That is, even before the road was built, fewer than expected caribou (assuming a homogeneous distribution) sometimes occurred in the 0–1-km interval. The high degree of variability in these distributions suggest that cause–effect inference is risky at best. A conclusion that caribou were displaced in the early post-road period would logically be followed by a conclusion that caribou were attracted to the road in the recent post-road period. We reject these inferences because there is too much variability in the distributions and many unknown variables affecting caribou distribution and behavior (Cronin et al. 1997).

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Caribou cows and calves feed near road in Milne Point Field, 14 June 2002.

Natural variation in caribou distribution also may be reflected in our post-calving-period data. Caribou are more sensitive to disturbance during the calving period than during the post-calving period (Murphy and Lawhead 2000). Although avoidance of oilfields during post-calving has been reported (Cameron et al. 1995), extensive use of oilfield habitats during the post-calving period has been documented (Pollard et al. 1996, Noel et al. 1998, Cronin et al. 1998*a*). Our post-calving data for the Milne Point area show nonsignificant differences among the distance intervals using regression analysis but lower than expected numbers in the 0–1-km interval using habitat use–availability analysis (Table 4).

Another observation from our data is that numbers observed in surveys of the study area declined from a mean of 216 to 61 calves and from 521 to 192 total caribou between the pre-road and recent post-road periods (Table 1). This is consistent with other observations of decreased use of the area during the calving period (Murphy and Lawhead 2000, Cameron et al. 2002, National Research Council 2003). Potential causes for lower numbers in the area during the calving period include a range shift away from the oilfields (Murphy and Lawhead 2000, Cameron et al. 2002, National Research Council 2003) or natural factors such as snowmelt timing (Haskell 2003) and rotational grazing to reduce parasite transmission (Gunn and Irvine 2003). Numbers of caribou in the study area generally have been lower in years of late snowmelt, and the declining trend in the number of caribou in the study area is more apparent in years with early snowmelt (i.e., before 5 June) than for years with late snowmelt (Figure 2).

Regardless of one's interpretation of the distribution data, there is little support for the speculation that displacement during the calving and post-calving periods has contributed to negative impacts on calf production and herd growth as suggested by Cameron et al. (2002) and the National Research Council (2003). The Central Arctic herd has grown from approximately 5,000 to 32,000 animals since the beginning of oilfield development. The numbers of animals in the western part of the calving range with oilfields increased along with the entire herd, and the calf–cow ratios generally have been as high as or higher than in undeveloped areas (Cronin et al. 1998*b*, 2000, 2001).

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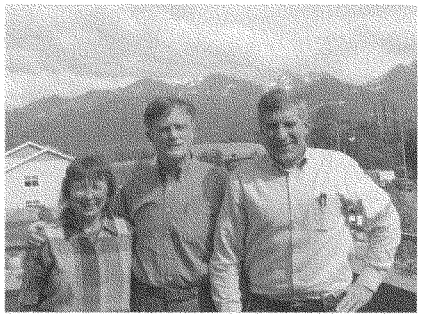

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See Appendices beginning next page.

Appendix A. Density (caribou/km^2) and number of total caribou within each of 6 1-km distance intervals from Milne Point Road oilfield access road, North Slope Alaska, during the calving period 1978–2001[a].

		Distance interval												
		0–1 km		1–2 km		2–3 km		3–4 km		4–5 km		5–6 km		
Survey date	Year[b]	Density	No. caribou	Density	No. caribou	Density	No. caribou	Density	No. caribou	Density	No. caribou	Density	No. caribou	Total caribou
10–14 Jun	1978	1.94	113	3.37	163	0.67	27	3.11	111	1.80	58	0.45	13	485
10–14 Jun	1979	0.81	47	1.70	82	4.26	172	4.96	177	3.53	114	1.94	56	648
10–14 Jun	1980	0.79	46	1.16	56	1.34	54	1.06	38	0.22	7	1.08	31	232
10–14 Jun	1981	2.08	121	1.49	72	6.04	244	6.16	220	0.00	0	2.19	63	720
10–14 Jun	1982	0.24	14	0.37	18	1.46	59	2.30	82	1.24	40	3.19	92	305
10–14 Jun	1983	0.34	20	3.04	147	2.55	103	4.17	149	5.57	180	5.97	172	771
10–14 Jun	1984	0.91	53	0.60	29	2.90	117	8.18	292	15.54	502	9.24	266	1,259
10–14 Jun	1985	0.28	16	1.01	49	5.74	232	0.45	16	5.23	169	1.74	50	532
10–14 Jun	1986	0.00	0	0.93	45	1.53	62	3.39	121	2.51	81	5.07	146	455
10–14 Jun	1987	0.10	6	0.64	31	0.67	27	1.54	55	2.82	91	1.94	56	266
5 Jun	1991	0.02	1	0.00	0	0.13	5	0.63	22	1.93	60	0.17	5	93
11 Jun	1991	0.00	0	0.00	0	0.18	7	0.00	0	0.03	1	0.00	0	8
18 Jun	**1991**	**1.11**	**62**	**1.07**	**49**	**0.61**	**24**	**0.94**	**33**	**1.29**	**40**	**2.23**	**64**	**272**
1 Jun	1994	0.00	0	0.00	0	0.05	2	0.00	0	0.00	0	0.10	3	5
6 Jun	1994	0.00	0	0.00	0	0.03	1	0.03	1	0.32	10	0.00	0	12
16 Jun	**1994**	**0.02**	**1**	**0.33**	**15**	**0.05**	**2**	**1.26**	**44**	**0.26**	**8**	**0.35**	**10**	**80**
13 Jun	**1996**	**2.05**	**114**	**2.60**	**119**	**0.20**	**8**	**0.69**	**24**	**0.00**	**0**	**0.63**	**18**	**283**
8 Jun	1998	0.18	10	0.44	20	0.84	33	0.17	6	0.10	3	3.83	110	182
16 Jun	**1998**	**1.46**	**81**	**0.57**	**26**	**0.97**	**38**	**0.92**	**32**	**0.87**	**27**	**0.52**	**15**	**219**
16 Jun	**1999**	**1.85**	**103**	**0.09**	**4**	**2.29**	**90**	**1.23**	**43**	**3.47**	**108**	**0.00**	**0**	**348**
12 Jun	**2000**	**0.00**	**0**	**0.02**	**1**	**0.00**	**0**	**0.11**	**4**	**0.00**	**0**	**0.00**	**0**	**5**
10 Jun	2001	0.05	3	0.04	2	0.05	2	0.06	2	0.00	0	0.00	0	9
20 Jun	**2001**	**0.00**	**0**	**0.02**	**1**	**1.30**	**51**	**0.00**	**0**	**1.45**	**45**	**1.39**	**40**	**137**
Interval area (km^2)[c]		58.05 (55.66)		48.26 (45.79)		40.44 (39.30)		35.65 (34.94)		32.31 (31.11)		28.76 (28.73)		

[a] Data for 1978–1987 (R. D. Cameron, Alaska Department of Fish and Game, unpublished data; in Cronin et al. 1994).

[b] 1978–1981 = pre-road period, 1982–1987 = early post-road period, 1991–2001 = recent post-road period (bold indicates surveys used for analyses, 0 = measured values).

[c] First area value for interval (R. D. Cameron, Alaska Department of Fish and Game, unpublished data; in Cronin et al. 1994); second area value for interval (in parentheses) calculated from interval areas shown in Figure 1.

Appendix B. Density (caribou/km^2) and number of caribou calves within each of 6 1-km distance intervals from the Milne Point oilfield access road, North Slope Alaska, during the calving period 1978–2001[a].

		Distance interval												
		0–1 km		1–2 km		2–3 km		3–4 km		4–5 km		5–6 km		
Survey date	Year[b]	Density	No. calves	Density	No. calves	Density	No. calves	Density	No. calves	Density	No. calves	Density	No. calves	Total calves
10–14 Jun	1978	0.84	49	1.41	68	0.10	4	1.20	43	0.62	20	0.10	3	187
10–14 Jun	1979	0.38	22	0.66	32	1.83	74	2.16	77	1.64	53	0.80	23	281
10–14 Jun	1980	0.26	15	0.37	18	0.54	22	0.14	5	0.03	1	0.38	11	72
10–14 Jun	1981	0.91	53	0.58	28	2.77	112	2.91	104	0.00	0	0.97	28	325
10–14 Jun	1982	0.07	4	0.04	2	0.47	19	1.01	36	0.50	16	1.22	35	112
10–14 Jun	1983	0.00	0	1.20	58	1.04	42	1.88	67	2.48	80	2.81	81	328
10–14 Jun	1984	0.14	8	0.17	8	1.14	46	3.81	136	7.46	241	4.17	120	559
10–14 Jun	1985	0.03	2	0.31	15	2.60	105	0.14	5	2.29	74	0.80	23	224
10–14 Jun	1986	0.00	0	0.06	3	0.57	23	1.12	40	0.90	29	2.26	65	160
10–14 Jun	1987	0.00	0	0.25	12	0.22	9	0.73	26	1.30	42	0.90	26	115
5 Jun	1991	0.00	0	0.00	0	0.03	1	0.14	5	0.74	23	0.00	0	29
11 Jun	1991	0.00	0	0.00	0	0.05	2	0.00	0	0.00	0	0.00	0	2
18 Jun	**1991**	**0.36**	**20**	**0.13**	**6**	**0.15**	**6**	**0.17**	**6**	**0.55**	**17**	**0.84**	**24**	**79**
1 Jun	1994	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0
6 Jun	1994	0.00	0	0.00	0	0.00	0	0.00	0	0.13	4	0.00	0	4
16 Jun	**1994**	**0.00**	**0**	**0.11**	**5**	**0.03**	**1**	**0.60**	**21**	**0.10**	**3**	**0.10**	**3**	**33**
13 Jun	**1996**	**0.75**	**42**	**0.83**	**38**	**0.10**	**4**	**0.14**	**5**	**0.00**	**0**	**0.07**	**2**	**91**
8 Jun	1998	0.00	0	0.20	9	0.18	7	0.09	3	0.00	0	1.43	41	60
16 Jun	**1998**	**0.59**	**33**	**0.11**	**5**	**0.38**	**15**	**0.40**	**14**	**0.26**	**8**	**0.07**	**2**	**77**
16 Jun	**1999**	**0.68**	**38**	**0.02**	**1**	**0.66**	**26**	**0.46**	**16**	**1.03**	**32**	**0.00**	**0**	**113**
12 Jun	**2000**	**0.00**	**0**	**0.00**	**0**	**0.00**	**0**	**0.00**	**0**	**0.00**	**0**	**0.00**	**0**	**0**
10 Jun	2001	0.00	0	0.00	0	0.00	0	0.03	1	0.00	0	0.00	0	1
20 Jun	**2001**	**0.00**	**0**	**0.00**	**0**	**0.38**	**15**	**0.00**	**0**	**0.13**	**4**	**0.52**	**15**	**34**
Interval area (km^2)[c]		58.05 (55.66)		48.26 (45.79)		40.44 (39.30)		35.65 (34.94)		32.31 (31.11)		28.76 (28.73)		

[a] Data for 1978–1987 (R. D. Cameron, Alaska Department of Fish and Game, unpublished data; in Cronin et al. 1994).

[b] 1978–1981 = pre-road period, 1982–1987 = early post-road period, 1991–2001 = recent post-road period (bold indicates surveys used for analyses, 0 = measured values).

[c] First area value for interval (R. D. Cameron, Alaska Department of Fish and Game, unpublished data; in Cronin et al. 1994); second area value for interval (in parentheses) calculated from interval areas shown in Figure 1.

Appendix C. Density (caribou/km^2) and number of total caribou within each of 6 1-km distance intervals from the Milne Point oilfield access road, North Slope Alaska, after 20 June 1991–2001.

		Distance interval												
		0–1 km		1–2 km		2–3 km		3–4 km		4–5 km		5–6 km		
Survey date	Year[a]	Density	No. caribou	Density	No. caribou	Density	No. caribou	Density	No. caribou	Density	No. caribou	Density	No. caribou	Total caribou
25 Jun	1991	0.43	24	0.83	38	0.56	22	0.86	30	1.70	53	0.17	5	172
2 Jul	**1991**	**12.97**	**722**	**7.58**	**347**	**13.61**	**535**	**7.73**	**270**	**5.05**	**157**	**13.85**	**398**	**2,429**
9 Jul	1991	1.72	96	3.04	139	1.17	46	0.57	20	0.87	27	0.42	12	340
17 Jul	1991	0.02	1	0.00	0	0.00	0	0.00	0	0.00	0	0.07	2	3
24 Jul	1991	0.07	4	0.15	7	0.03	1	0.11	4	0.00	0	0.00	0	16
6 Jul	**1994**	**5.12**	**285**	**22.93**	**1,050**	**19.41**	**763**	**20.84**	**728**	**26.94**	**838**	**38.39**	**1,103**	**4,767**
12 Jul	1994	1.99	111	3.82	175	9.62	378	21.69	758	6.49	202	10.44	300	1,924
20 Jul	1994	0.00	0	0.00	0	0.00	0	0.06	2	0.00	0	0.00	0	2
25 Jul	1994	0.07	4	0.02	1	0.00	0	0.03	1	0.00	0	0.00	0	6
28 Jul	1994	10.35	576	0.92	42	2.16	85	3.29	115	19.96	621	25.27	726	2,165
1 Aug	1994	0.41	23	0.17	8	0.13	5	0.49	17	0.29	9	0.38	11	73
8 Aug	1994	0.36	20	0.04	2	0.20	8	0.17	6	0.03	1	0.07	2	39
4 Jul	**1996**	**1.35**	**75**	**0.87**	**40**	**0.61**	**24**	**0.14**	**5**	**0.13**	**4**	**0.03**	**1**	**149**
1 Jul	1997	0.02	1	0.20	9	0.08	3	0.29	10	0.00	0	0.03	1	24
4 Jul	**1997**	**0.07**	**4**	**24.02**	**1,100**	**3.31**	**130**	**0.17**	**6**	**3.02**	**94**	**0.00**	**0**	**1,334**
23 Jul	1997	0.05	3	0.11	5	0.03	1	3.03	106	0.06	2	0.07	2	119
1 Aug	1997	0.05	3	0.04	2	0.00	0	0.00	0	0.00	0	0.07	2	7
1 Jul	**1998**	**4.56**	**254**	**9.17**	**420**	**5.19**	**204**	**10.19**	**356**	**2.83**	**88**	**6.61**	**190**	**1,512**
15 Jul	1998	1.22	68	0.00	0	0.76	30	0.14	5	0.03	1	0.03	1	105
28 Jun	1999	2.52	140	0.76	35	0.79	31	1.80	63	0.35	11	0.14	4	284
7 Jul	1999	0.00	0	0.00	0	0.00	0	3.15	110	0.00	0	0.80	23	133
10 Jul	**1999**	**12.32**	**686**	**10.66**	**488**	**3.72**	**146**	**30.37**	**1,061**	**0.10**	**3**	**4.21**	**121**	**2,505**
16 Jul	1999	0.13	7	0.00	0	2.93	115	0.00	0	15.11	470	26.91	773	1,365
26 Jun	**2000**	**25.15**	**1,400**	**38.33**	**1,755**	**16.59**	**652**	**2.58**	**90**	**3.25**	**101**	**1.50**	**43**	**4,041**
3 Jul	2000	5.77	321	21.80	998	8.91	350	2.23	78	1.13	35	0.49	14	1,796
15 Jul	2000	0.72	40	0.02	1	0.05	2	0.03	1	0.10	3	0.73	21	68
23 Jul	2000	2.01	112	0.02	1	0.00	0	0.03	1	0.03	1	0.03	1	116
4 Aug	2000	0.13	7	0.04	2	0.08	3	0.14	5	0.16	5	0.31	9	31
25 Jun	**2001**	**0.04**	**2**	**0.17**	**8**	**2.88**	**113**	**0.03**	**1**	**0.29**	**9**	**0.10**	**3**	**136**
7 Jul	2001	0.07	4	0.22	10	0.00	0	0.57	20	0.16	5	0.21	6	45
15 Jul	2001	0.00	0	0.00	0	0.00	0	0.14	5	0.00	0	0.90	26	31
25 Jul	2001	0.02	1	0.09	4	0.05	2	0.06	2	0.13	4	0.03	1	14
Interval area (km^2)[b]		55.66		45.79		39.30		34.94		31.11		28.73		253.53

[a] 1991–2001 = recent post-road period (bold indicates surveys used for analyses, 0 = measured values).

[b] Value for interval calculated from interval areas shown in Figure 1.

Appendix D. Density (calves/km^2) and number of caribou calves within each of 6 1-km distance intervals from the Milne Point oilfield access road, North Slope Alaska, after 20 June 1991–2001.

		Distance interval												
		0–1 km		1–2 km		2–3 km		3–4 km		4–5 km		5–6 km		
Survey date	Year[a]	Density	No. calves	Density	No. calves	Density	No. calves	Density	No. calves	Density	No. calves	Density	No. calves	Total calves
25 Jun	1991	0.14	8	0.33	15	0.23	9	0.31	11	0.74	23	0.07	2	68
2 Jul	**1991**	**3.67**	**204**	**1.92**	**88**	**3.41**	**134**	**3.15**	**110**	**1.77**	**55**	**3.79**	**109**	**700**
9 Jul	1991	0.36	20	0.83	38	0.38	15	0.06	2	0.16	5	0.07	2	82
17 Jul	1991	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0
24 Jul	1991	0.00	0	0.02	1	0.00	0	0.03	1	0.00	0	0.00	0	2
6 Jul	**1994**	**1.17**	**65**	**5.63**	**258**	**4.83**	**190**	**4.89**	**171**	**6.62**	**206**	**9.54**	**274**	**1,164**
12 Jul	1994	0.72	40	1.40	64	3.72	146	7.58	265	2.03	63	3.06	88	666
20 Jul	1994	0.00	0	0.00	0	0.00	0	0.03	1	0.00	0	0.00	0	1
25 Jul	1994	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0
28 Jul	1994	3.05	170	0.35	16	0.64	25	1.06	37	6.46	201	6.79	195	644
1 Aug	1994	0.14	8	0.07	3	0.03	1	0.09	3	0.00	0	0.14	4	19
8 Aug	1994	0.04	2	0.00	0	0.00	0	0.06	2	0.00	0	0.03	1	5
4 Jul	**1996**	**0.45**	**25**	**0.22**	**10**	**0.18**	**7**	**0.06**	**2**	**0.03**	**1**	**0.00**	**0**	**45**
1 Jul	1997	0.00	0	0.00	0	0.00	0	0.06	2	0.00	0	0.00	0	2
4 Jul	**1997**	**0.02**	**1**	**4.37**	**200**	**1.27**	**50**	**0.06**	**2**	**0.96**	**30**	**0.00**	**0**	**283**
23 Jul	1997	0.00	0	0.04	2	0.00	0	1.14	40	0.00	0	0.00	0	42
1 Aug	1997	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.03	1	1
1 Jul	**1998**	**0.88**	**49**	**2.93**	**134**	**1.25**	**49**	**2.15**	**75**	**0.19**	**6**	**0.45**	**13**	**326**
15 Jul	1998	0.32	18	0.00	0	0.13	5	0.06	2	0.00	0	0.00	0	25
28 Jun	1999	0.86	48	0.28	13	0.28	11	0.40	14	0.13	4	0.03	1	91
7 Jul	1999	0.00	0	0.00	0	0.00	0	0.57	20	0.00	0	0.07	2	22
10 Jul	**1999**	**2.07**	**115**	**1.31**	**60**	**0.38**	**15**	**4.01**	**140**	**0.03**	**1**	**1.04**	**30**	**361**
16 Jul	1999	0.02	1	0.00	0	0.13	5	0.00	0	3.21	100	0.94	27	133
26 Jun	**2000**	**4.42**	**246**	**8.98**	**411**	**6.84**	**269**	**0.72**	**25**	**0.74**	**23**	**0.38**	**11**	**985**
3 Jul	2000	1.04	58	6.66	305	1.27	50	0.09	3	0.13	4	0.03	1	421
15 Jul	2000	0.04	2	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	2
23 Jul	2000	0.20	11	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	11
4 Aug	2000	0.00	0	0.00	0	0.00	0	0.00	0	0.03	1	0.03	1	2
25 Jun	**2001**	**0.02**	**1**	**0.02**	**1**	**1.02**	**40**	**0.00**	**0**	**0.10**	**3**	**0.03**	**1**	**46**
7 Jul	2001	0.00	0	0.00	0	0.00	0	0.03	1	0.00	0	0.00	0	1
15 Jul	2001	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.17	5	5
25 Jul	2001	0.00	0	0.02	1	0.00	0	0.03	1	0.06	2	0.00	0	4
Interval area (km^2)[b]		55.66		45.79		39.30		34.94		31.11		28.73		235.53

[a] 1991–2001 = recent post-road period (bold indicates surveys used for analyses, 0 = measured values).

[b] Value for interval calculated from interval areas shown in Figure 1.

Thursday, November 15, 2001 B-7

ice of the Times
A CONSERVATIVE VOICE FOR ALASKANS

WILLIAM J. TOBIN
Senior editor

Did federal agency set up Norton?

By MATTHEW A. CRONIN

In the Washington Post (Oct. 19) and Anchorage Daily News (Oct. 20) Secretary of the Interior Gale Norton was criticized by anonymous employees of the U.S. Fish and Wildlife Service (FWS) and Public Employees for Environmental Responsibility.

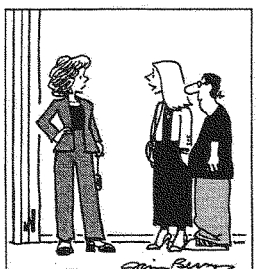
The criticism focused on Secretary Norton's omission of information provided by the FWS in a letter, and her reference to a scientific paper in the "Wildlife Society Bulletin" in her response to Sen. Frank Murkowski's questions about oil development in the Arctic National Wildlife Refuge. In the Post article, the FWS claimed it was careful to send Secretary Norton a complete and balanced portrait of the science in a letter. As I describe below, the FWS did not provide a balanced view, ignored relevant published papers, and gave speculative cause-effect appraisals of oil field impacts.

I am the senior author of the WSB article referenced by Secretary Norton, in which data on caribou in the oil field areas were presented. The data, originally reported by the Alaska Department of Fish and Game, were updated in a 2001 issue of the WSB. The numbers of animals in the oil field areas declined between 1992-1995 and then increased between 1995-2000.

Secretary Norton's critics claim that by omitting some of the FWS information, she was not using the best available information. In fact, she did a more thorough review of the issue than the FWS. The FWS ignored scientific papers on caribou and oil fields, while Secretary Norton used the FWS information and other published science. I will point out shortcomings of the FWS letter, focusing on one specific question:

What has been the impact of development in Prudhoe Bay on the Central Arctic Caribou Herd?

The FWS letter was selective and did not reference several papers on caribou and Alaskan oil fields in scientific journals. Omission of relevant peer-reviewed literature is a serious flaw, and reflects incompetence, ignorance or a deliberate attempt to mislead the secretary. I will provide these papers to readers (M. Cronin, LGL Alaska Research Associates, 1101 E. 76th, Anchorage, AK 99518).



"Of course, he's a nerd — and he's my nerd."

The information in the FWS letter was speculative regarding two primary impacts on caribou: displacement during calving and obstruction of movements, and nutritional/reproductive impacts.

Regarding displacement and obstruction, the FWS letter states that calving "essentially ceased" after 1977 in the industrial complex near Prudhoe Bay and Deadhorse. However, the extent of calving before development is not well known, and may have been uncommon. The quality and quantity of data supporting the premise that calving ceased is poor, but the FWS presented it without qualification.

The FWS letter also states that mid-summer movement of caribou along the coast was blocked by roads, pipes, and facilities. The FWS did not reference three published papers documenting extensive use of, and movements through, the oil fields. Thus, the FWS letter selectively presented information.

The FWS letter also states that cows with young calves were displaced from developed areas by four or more kilometers. In fact, in the study cited, displacement was from only one road at Milne Point, and was statistically significant only within one kilometer of the road. The FWS letter is inaccurate regarding calving distributions and development.

Regarding nutrition and reproductive impacts, the FWS letter refers to data in an abstract and unpublished reports and suggests that under some combinations of weather and animal density the oil fields impacted calf production, and under other conditions, they did not. This is possible, but speculative and not the only interpretation.

Colleagues and I addressed these issues in the Journal of Wildlife Research in 1997 and the WSB articles noted above. First, the numbers of caribou in the oil fields were high in 1992, declined between 1992 and 1995, and increased from 1995-2001. Attributing the decline in 1995 to oil fields is a limited interpretation.

First, movements between the developed and undeveloped ranges can be as high as 18 percent and account for the changes in numbers.

Second, the density of animals in the developed ranges was higher than in the undeveloped ranges in some years so density or oil fields may have contributed to low calf production.

Third, I am not aware of any published analysis of impacts of weather in the early 1990s. The potential for the oil fields to impact calf production is a legitimate hypothesis, but the FWS gave a speculative cause-effect interpretation and ignored published alternatives.

A final point, not included in the FWS letter, is that dual management objectives of producing oil and maintaining the caribou herd have been met during the period of oil field development. These points were emphasized in a paper by colleagues and I in "Biological Conservation" in 1998.

In summary, I believe the FWS gave Secretary Norton incomplete and biased information for her presentation to Congress. The Secretary used additional information for which she should be commended. Rather than considering Secretary Norton as unethical as she was accused, I submit that the FWS acted at best incompetently, and at worst unethically, in this case.

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Peer Edited: Head-to-Head

Response to Joly et al. (2006), A Reevaluation of Caribou Distribution Near an Oilfield Road on Alaska's North Slope

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Abstract

*Joly et al. (2006) critically reviewed our paper (Noel et al. 2004) describing caribou (*Rangifer tarandus*) distribution data in relation to an oilfield road in Alaska, USA. Their review focused on 4 primary points: 1) we concluded there were no adverse impacts to caribou distribution, 2) we failed to discuss data that revealed caribou abandoned the study area following additional development of gravel roads and pads, 3) we failed to consider expanding infrastructure and some surveys, and 4) our conclusions contradict others' findings. We did not draw conclusions, but rather presented our data and analyses and discussed possible explanations for our observations. We presented all of the original data showing a decline in caribou use of the area during calving and discussed potential influential factors. We discussed our method and rationale for the focus of our analysis on displacement from the Milne Point Road in order to replicate methods used in an earlier study. The fourth point reflects that we simply had different results from those of other studies.* (WILDLIFE SOCIETY BULLETIN 34(3):870–873; 2006)

Key words

Alaska, caribou, North Slope, Rangifer tarandus.

We appreciate Joly et al.'s (2006) reading our paper (Noel et al. 2004) and reevaluating it. We value informed scientific discourse, recognition of the uncertainty of scientific research, and providing sound information to resource managers. In this response we first provide a brief background of the research related to the issue of caribou and Alaska, USA, oilfields to give the reader perspective. We then respond to specific comments by Joly et al. (2006).

Summary of Relevant Alaska Oilfield–Caribou Research

Dau and Cameron (1986) and Cameron et al. (1992) compared density of calving caribou before and after construction of an oilfield road near Prudhoe Bay, Alaska, USA. They showed statistically significant lower density of calving caribou within 0–1 km and significantly higher density of calving caribou 5–6 km from the Milne Point oilfield road after its construction in 1981–1982. These authors interpreted these densities as the result of displacement caused by the road.

As development progressed in the 1980s to 1990s, the number of caribou calving in the oilfield areas, including our study area at Milne Point, declined (Murphy and Lawhead 2000, Wolfe 2000, Cameron et al. 2002, 2005, National Research Council [NRC] 2003). Some authors interpreted this decline as a calving-range shift attributable to oilfield disturbance and loss of habitat (Wolfe 2000, Cameron et al. 2002, 2005, NRC 2003). Although oilfield effects cannot be ruled out in the Milne Point area, other authors have documented shifts in calving ranges where no disturbance or habitat loss was implicated (Gunn and Irvine 2003, Hinkes et al. 2005).

The research reported in our paper involved repeating the study of Cameron et al. (1992) in the same study area during 1991–2001 (Noel et al. 2004). We compared caribou densities and numbers in 6 1-km-distance intervals from the Milne Point Road over 3 time periods: the 2 time periods used by Cameron et al. (1992) that were designated "pre-road" and "early post-road" periods, and the 1991–2001 period designated as the "recent post-road period." We evaluated these data using 3 analytical techniques: Student's *t*-test of densities as completed by Cameron et al. (1992), Poisson regression of densities, and habitat use–availability of counts. Our results suggested that there was no consistent influence of the road on caribou distribution within the study area during the calving or post-calving periods. The data set illustrates the dynamic nature of caribou distributions during the calving and post-calving periods, as well as an overall decline over time in numbers of caribou during calving in the study area.

From the start of oilfield development and operation in the mid-1970s to 2002, the Central Arctic caribou herd (CAH), which uses ranges in and around the oil fields, grew from approximately 5,000 to 32,000 animals. This increase has been documented during photographic censuses and has been cited as evidence of successful achievement of the dual management objectives of oil production and maintenance of a wildlife population (Cronin et al. 1997, 1998*a*,*b*, 2000, 2001). Others have concluded that this increase cannot be interpreted as a lack of negative impacts of the oilfields on the caribou herd in light of fluctuations in herd numbers, body condition, and parturition data (e.g., Cameron et al. 2002, 2005, NRC 2003).

Response to Joly et al. (2006)

The review by Joly et al. (2006) focused on 4 primary points: Noel et al. (2004) 1) claimed there were no adverse impacts to caribou distribution, 2) failed to discuss data that revealed caribou abandoned the study area following additional development of

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gravel roads and pads, 3) failed to consider expanding infrastructure and some surveys, and 4) had conclusions that contradict others' findings.

The first 2 points are inaccurate. We intentionally did not draw conclusions or claim there were no adverse impacts. Caribou were documented within the study area during calving and postcalving, and we presented the original data and discussed changes in the numbers of animals in the study area over time. The third point relates to our replication of the methods used in an earlier study, and the fourth point reflects that we simply had different results from those of other studies. We discuss these points below.

Point 1: Noel et al. (2004) Claims No Adverse Impacts to Caribou Distribution

Joly et al. (2006:866) state that "Noel et al. (2004) claimed that oil development on Alaska's North Slope has not adversely affected caribou (*Rangifer tarandus*) distribution." They go on to say, "The primary conclusion reached by Noel et al. (2004:757) was that 'distributions of calves and adult caribou were not strongly influenced by presence of the road'" (Joly et al. 2006:866). Our paper did not claim that oil development has not adversely affected caribou distribution, nor did we draw any conclusions. We were careful to state our empirical result with a reasonable interpretation and not as a conclusion: "Analyses of relationships between calving and postcalving caribou densities and distance intervals from Milne Point Road *suggested* that distributions of calves and adult caribou were not strongly influenced by the presence of the road" (Noel et al. 2004:757; emphasis added).

With regard to the statistical analysis in our paper, Joly et al. (2006:866) "... argue that, in this case, a lack of statistical significance is not the same as lack of impact. Noel et al. (2004) used their finding of no statistically significant difference in density of caribou within 1 km of the road between pre-road (1978–1981) and recent post-road surveys (1991–2001) to support a conclusion that oilfield roads do not strongly influence the distribution of calves and adult caribou." Furthermore, "although the central tenet of Noel et al. (2004) was that there are no statistically significant differences between caribou distribution in relation to the Milne Point Road prior to its construction and recent post-road surveys, we contend they failed to accurately discuss what their data actually did portray" (Joly et al. 2006:866). On the contrary, our paper does not make a general claim about whether or not oilfields displace caribou. Our purpose was to present the data and compare it with the original study. As a result, we presented data and analyses with reasonable interpretations after replicating a previous study (Cameron et al. 1992) of caribou distribution relative to this road.

Joly et al. (2006:866) claim that we "further imply that this new analysis refutes the Cameron et al. (1992) claim that oilfield development displaces caribou." In our paper, we discussed the fact that our results may have differed from those of Cameron et al. (1992) because of habituation or other factors, and illustrated, with habitat use–availability analyses, that caribou distributions within this area were variable prior to and after construction of the Milne Point Road. Rather than refute the findings of Cameron et al. (1992), we added new data to complement the original study.

Point 2: Noel et al. (2004) Failed to Discuss Data that Revealed Caribou Largely Abandoned the Study Area Following this Development

In several places, Joly et al. (2006) misrepresent our paper: "our primary criticisms of that article are that the authors failed to ... discuss data that revealed caribou largely abandoned their study area following this development" (Joly et al. 2006:866); and "we believe that the Noel et al. (2004) conclusion represents a potentially serious misinterpretation because they failed to ... discuss the bulk of their results revealing an abandonment of the study area" (Joly et al. 2006:866). However, we presented, acknowledged, cited, and discussed the fact that our data were consistent with other studies showing the decrease in caribou numbers during calving in the Milne Point area over time. The Abstract states "the total number of calving caribou observed in the study area has declined since pre-road construction and early post-road periods..." (Noel et al. 2004:757). The Discussion points out that "another observation from our data is that numbers observed in surveys of the study area declined from a mean of 216 to 61 calves and from 521 to 192 total caribou between the pre-road and recent post-road periods. This is consistent with other observations of decreased use of the area during the calving period (Murphy and Lawhead 2000, Cameron et al. 2002, NRC 2003)" (Noel et al. 2004:766).

Joly et al. (2006) point out that our primary focus should have been on the changes in overall numbers of caribou in the study area during the calving period. "We believe it is possible that progressive development, which left areas more than 4 km from development in small, isolated fragments, may have contributed to caribou abandoning the study area" (Joly et al. 2006:866). "Our analysis of the Noel et al. data shows an overall gradual abandonment of the oilfield during calving and a drop in abundance of calving caribou" (Joly et al. 2006:866). However, our research objective, as well as that of Cameron et al. (1992), was to measure displacement of calving caribou and postcalving caribou away from the Milne Point Road.

In their comments, Joly et al. (2006) discuss a shift of calving to the south: "The major concentration of calving shifted to south of the oilfield, whereas such shifts in calving did not occur in the eastern portion of the Central Arctic Herd that was less affected by development" (Joly et al. 2006:866); and "... after 1987, there was a southward shift of the calving ground away from the oilfield study area" (Joly et al. 2006:868). However, we were not able to address the potential southward shift of the calving ground because we did not collect data outside of the Milne Point study area We noted in our discussion that the decrease in numbers of caribou in the study area over time could be due to oilfield impacts. We also stated that there may be other influential factors and illustrated that timing of snowmelt may influence numbers of caribou during calving within this study area (Noel et al. 2004:760, fig. 2). Range shifts by caribou during calving without oilfields in their ranges have been documented (Hinkes et al. 2005 and references therein), as has timing of snowmelt (Whitten and Cameron 1985, Haskell 2003).

Point 3: Noel et al. (2004) Failed to Consider Expanding Infrastructure and Some Surveys

This point is made several times: "these new developments within the study area, though ignored by Noel et al. (2004), have changed

traffic patterns in the area and substantially increased the area affected by roads and pipelines" (Joly et al. 2006:866); and "we believe the Noel et al. (2004) failure to incorporate growing oil infrastructure in their analyses compromised the utility of their conclusions" (Joly et al. 2006:868). Although not described in Noel et al. (2004), we had previously evaluated caribou distributions in relation to new infrastructure in the Milne Point area during calving and postcalving. We chose not to include new infrastructure in the data analyses presented in Noel et al. (2004) because our intent was to replicate a previous study that included analysis of caribou distribution relative to the Milne Point Road. This road is the primary access road for the Milne Point oilfield and has more vehicle traffic than the access roads to the oil production pads. We cover this point in the text and in a figure (Noel et al. 2004:758, fig. 1). Our previous analyses, including new roads and pads, included areas beyond the boundaries presented in fig. 1 of Noel et al. (2004:758). These analyses indicated that caribou calving and postcalving distributions were highly variable within and among years and showed no consistent trend in decreased use of areas near new and old infrastructure nor increased use of areas away from infrastructure.

With regard to the 6 of 13 surveys not used in our analysis, "we believe that the Noel et al. omission of 46% (6 of 13) of their survey results conceals more substantial declines in caribou numbers in the area" (Joly et al. 2006:868), these data were presented in appendices (Noel et al. 2004:768–771). Although not explicitly stated, fig. 3 of Noel et al. (2004:763) shows the mean value by interval for all recent post-road construction surveys ($n = 13$). We used one survey per year in our analyses because the previous study (Cameron et al. 1992) that we replicated did so. Our objective was to assess the distribution of caribou, and for each year we chose the survey with the largest number of animals (i.e., the largest sample size). Four of the 6 surveys not used in analyses but presented in appendices were completed prior to the 10–14 June period used in Cameron et al. (1992; Noel et al. 2004:768–769). Rather than considering that the data for more than one survey per year provided the valuable insight that caribou distribution changes daily and annually within this study area, Joly et al. (2006) consider that the additional survey data further supported their analysis that caribou use of the area during calving has declined beyond that reported by Noel et al. (2004). Additional surveys with fewer animals do not negate the presence of caribou in the surveys that were used in the analyses. Joly et al (2006:867 and fig. 2) consistently dismiss variability and statistical significance in distributions even as presented in Cameron et al. (1992) and Noel et al. (2004): "... but caribou abundance within 1–4 km of the road declined significantly and increased 4–6 km from the road (Fig. 2)." However, there were significant differences in caribou densities from pre-road to early post-road periods only for the 0–1-km and 5–6-km intervals (Cameron et al. 1992, Noel et al. 2004).

Point 4: Noel et al.'s (2004) Conclusions Contradict Others' Findings

Joly et al. (2006) argue "that the Noel et al. (2004) conclusion contradicts a large series of investigations, most recently summarized in the reports from the National Research Council (NRC 2003), Cameron et al. (2005), and more importantly, their own data" (Joly et al. 2006:866). It is important to realize that our data differed from those of other studies and we gave possible explanations why. We believe scientists and land managers should consider and evaluate all data, even those that may be inconsistent with other studies.

Discussion

Joly et al. (2006) place primary importance on the decline over time in overall numbers in the study area during calving. However, this does not invalidate our objective to replicate the previous study focused on displacement away from the Milne Point Road. Joly et al. (2006) focused on the issue of changes in the numbers of animals in the area, but given the variability inherent in this relationship, attributing this decline in numbers of caribou solely to the single variable, gravel oilfield roads and pads, should be interpreted with caution. As noted above, we presented the decline in numbers in this area during the calving period and discussed potential causes. "Potential causes for lower numbers in the area during the calving period include a range shift away from the oilfields ... or natural factors such as snowmelt timing ... and rotational grazing to reduce parasite transmission" (Noel et al. 2004:766).

Acknowledgments

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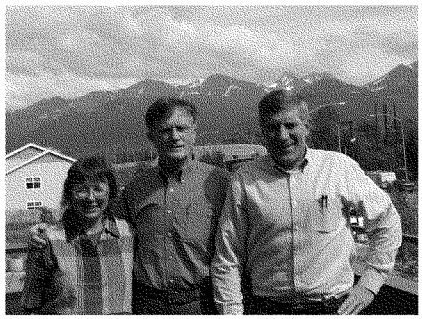

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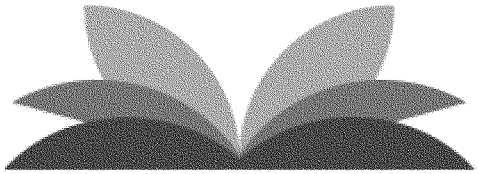

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Summer Distribution of Caribou, *Rangifer tarandus granti*, in the Area of the Prudhoe Bay Oil Field, Alaska, 1990-1994

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Aerial surveys were conducted within the Prudhoe Bay oil field area in northern Alaska during 1990-1994 to document summer distribution of Caribou (*Rangifer tarandus granti*). Numbers of Caribou observed per survey ranged from 34 to 13058. When insect activity was moderate to high, more Caribou were observed within the oil field than when insect activity was low. Severe mosquito (*Aedes* spp.) harassment often resulted in large post-calving aggregations of Caribou in coastal areas. When mosquito harassment subsided, aggregations often moved inland through the oil field or laterally along the coast. On several occasions, large groups of Caribou (2000-4000 individuals) were observed feeding or bedded down in the central portion of the oil field. Caribou were observed on, and used, oil field gravel pads and roads as insect relief habitat during the mosquito season in late June through mid-July, and also used the shade of oil field structures when oestrid flies (*Hypoderma tarandi* and *Cephenomyia trompe*) were abundant from mid-July to early August. Five years of observations document that Caribou use habitat within and travel through oil fields during summer during periods of high insect activity.

Key Words: Caribou, *Rangifer tarandus granti*, Prudhoe Bay, Alaska, insect harassment, oestrid flies, mosquitoes, post-calving, oil field, aerial survey.

The potential impacts of oil field development on Caribou (*Rangifer tarandus granti*) of the Central Arctic Herd (CAH) has been the focus of intensive research in Alaska's North Slope oil fields since the early 1970s (Clough et al. 1987). Effects of oil fields on movements and habitat-use patterns have been of particular concern (Cameron and Whitten 1976*, 1980; Klein 1980; Curatolo and Murphy 1986; Cameron et al. 1992). The CAH has grown from about 5000 animals in 1975 (Cameron and Whitten 1979*) to 23444 animals in 1992 (Cameron 1993*) and numbered 18093 in 1995 (P. Valkenburg, Alaska Department of Fish and Game, personal communication). The CAH generally winters in the northern foothills of the Brooks Range and migrates each spring to calving grounds and summer range on the Arctic Coastal Plain between the Itkillik and Colville rivers (151°00' W longitude) on the west to the Sadlerochit River (145°00' W longitude) on the east (Clough et al. 1987). The Prudhoe Bay oil field (PBOF) is located within the summer range of the CAH.

During the calving period, the CAH segregates into segments east and west of the Sagavanirktok River (Cameron and Whitten 1977*; Lawhead 1988). The western segment uses the area in and around the Kuparuk oil field during the post-calving period. The eastern segment uses areas to the east of the PBOF. A 1992 photocensus of the CAH estimated 8602 animals in the eastern segment and 14 842 animals in the western segment (Valkenburg 1993*). The most recent photocensus in 1995 indicated 11 634 animals in the eastern segment and 6459 in the western segment (P. Valkenburg, Alaska Department of Fish and Game, personal communication).

During the calving period female Caribou with calves may distance themselves from oil field facilities such as roads (Whitten and Cameron 1985; Dau and Cameron 1986; Klein 1991; Cameron et al. 1992). However, the Kuparuk and Milne Point oil field areas west of the PBOF have not been abandoned, as calving has continued in these areas concurrent with expanding oil field development (Cameron et al. 1992). There is little information on use of the PBOF for calving prior to oil field development in 1970, but it is believed that it was not a concentrated calving area (Child 1973*; Gavin 1983*; Whitten and Cameron 1985; Klein 1991). Furthermore, Whitten and Cameron (1985) suggested that the generally wet conditions in the PBOF area (between the Kuparuk and Sagavanirktok rivers) provides suboptimal calving habitat. CAH Caribou use snow-covered lowlands or well-drained uplands over river valleys or deltas for calving (Carruthers et al. 1987).

*Unpublished, see Documents Cited section following Acknowledgments. All other dates are to published references given in Literature Cited.

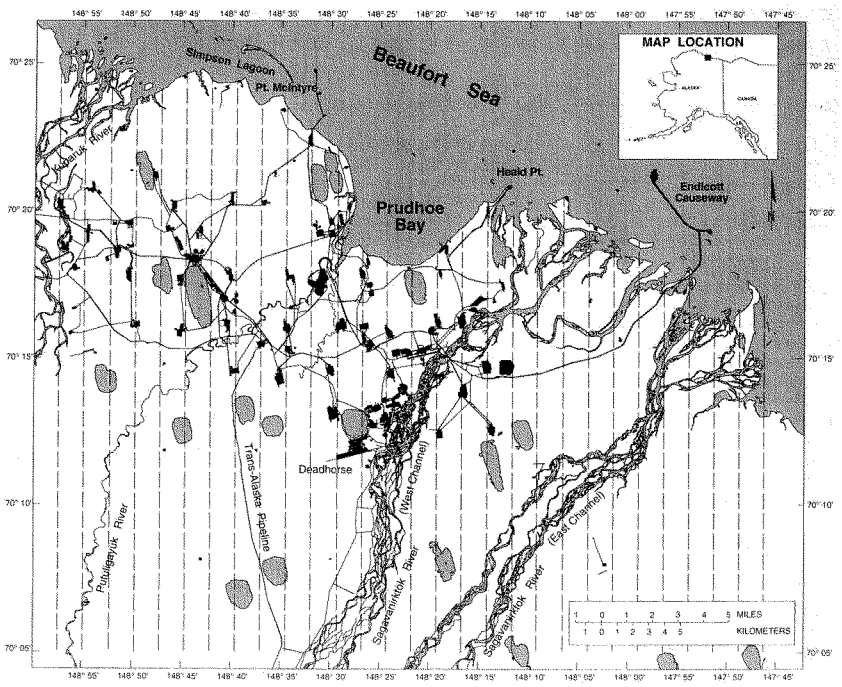


FIGURE 1. Location of strip-transect centerlines for aerial surveys conducted between 26 June and 8 August, 1990-1994, Prudhoe Bay oil field, Alaska. Solid lines are roads or pipelines and rectangles are gravel pads which support oil field facilities.

In contrast to the calving period, the PBOF may have been used frequently by Caribou during the post-calving period (late June through early August) prior to oil field development (Child 1973*; Whitten and Cameron 1983*a*). Child (1973*:7) identified extensive "traditional trail systems of Caribou" in the area that is now the PBOF. Whitten and Cameron (1985) and Johnson and Lawhead (1989*) suggested that, since the mid-1970s, movements by large post-calving aggregations through the PBOF have become rare or ceased entirely. However, harassment by mosquitoes and oestrid flies (warble flies, *Hypoderma tarandi* and nose bot flies, *Cephenomyia trompe*) have a large influence on Caribou post-calving distribution and movements (White et al. 1975; Curatolo et al. 1982*; Lawhead 1988), and there is evidence that the oil field areas may provide relief habitat from insects (Pollard et al. 1996).

There is interest in expanding oil field development in arctic Alaska, including areas within the Arctic National Wildlife Refuge used as calving and post-calving habitat by the Porcupine Caribou Herd (Clough et al. 1987). Because impact assessments at existing oil fields will be used to infer potential impacts at new developments, it is important to document accurately the extent of post-calving use of the PBOF. The objectives of this study were to quantify the post-calving distribution and number of Caribou in the area of the PBOF over five years and relate caribou distribution and numbers to insect activity.

Study Area

The study was conducted on the northern edge of the Arctic Coastal Plain of Alaska north of 70°05′N latitude between the Kuparuk and Sagavanirktok rivers (Figure 1). The 1394 km^2 study area contains the PBOF and is characterized by little elevational relief, many shallow lakes and drained lake basins, and a variety of vegetation types dominated by wet and moist tundra (Walker et al. 1980).

The PBOF includes 53 producing well pads, 31 exploration pads, 8 gathering centers, 2 gravel land-

TABLE 1. Estimated numbers and sex/age composition of Caribou in relation to relative insect activity observed during aerial surveys conducted in the Prudhoe Bay study area, Alaska, during the post-calving period, 1990-1994.

Year Date	Bulls	Cows	Calves	Yearlings	Unclassified	Total	Relative Insect Activity[a]
1990							
4,5 July	3151	4203	2947	563	3	10867	high
12 July	60	14	4	2	2	82	low
19 July	253	372	179	58	66	928	low
26 July	44	35	9	1	20	109	low
1 August	77	45	12	1	24	159	low
1991							
26 June	137	27	23	29	51	267	low
3 July	259	25	25	8	53	370	low-moderate
10 July	268	156	121	6	230	781	low
16 July	2151	1801	1797	0	1330	7079	moderate
25 July	522	108	96	7	732	1465	low
31 July	35	12	7	2	76	132	low
1992							
9 July	2535	2746	2641	427	1982	10331	high
10 July	4074	3242	3186	346	2210	13058	moderate
13, 14 July	72	24	23	9	19	147	low
19 July	2503	1579	1572	452	1538	7644	high
23 July	566	428	405	91	446	1936	high
25 July	826	541	530	78	528	2503	high
28 July	254	96	92	10	141	593	moderate
31 July	44	23	18	2	60	147	low
1993							
1 July	1315	434	209	171	113	2242	low
6 July	60	10	3	2	0	75	low
10 July	438	727	713	0	1210	3088	high
17 July	190	454	252	52	215	1163	moderate
19 July	2055	625	542	145	430	3797	high
26 July	52	31	10	0	3	96	low
1994							
5 July	129	55	40	11	41	276	[b]
11 July	804	922	562	54	257	2599	[b]
19 July	138	97	64	6	44	349	[b]
26 July	18	12	2	0	2	34	[b]
31 July	198	496	386	18	119	1217	[b]
7,8 August	32	36	9	1	1	79	[b]

[a]Quantified in detail by Pollard et al. (1996).
[b]Insect activity not monitored.

ing strips for jet aircraft, and 2 base camps. Other service facilities are present both in the oil field and the nearby community of Deadhorse. All facilities are supported by elevated gravel pads (approximately 1.5 m) and are connected by a network of gravel roads (totaling approximately 220 km in length) and above-ground pipelines.

Our study area included the entire PBOF complex, and also considerable area surrounding the oil field (Figure 1). For example, the southeast, southwest, and northwest portions of the study area have large areas which are distant from oil field infrastructure. A detailed assessment of Caribou distribution in relation to infrastructure is beyond the scope of this report, and will be described elsewhere. The results of that analysis show no evidence of avoidance of infrastructure by Caribou. Here we are concerned with the numbers, distribution, and movements of caribou relative to the PBOF as a whole. For this paper, we will loosely define the PBOF as the area within 10 km of roads and oil field infrastructure.

Methods

During 1990-1994 between 26 June and 8 August, we conducted a series of aerial surveys of the study area from fixed-wing aircraft (Cessna 206) with two

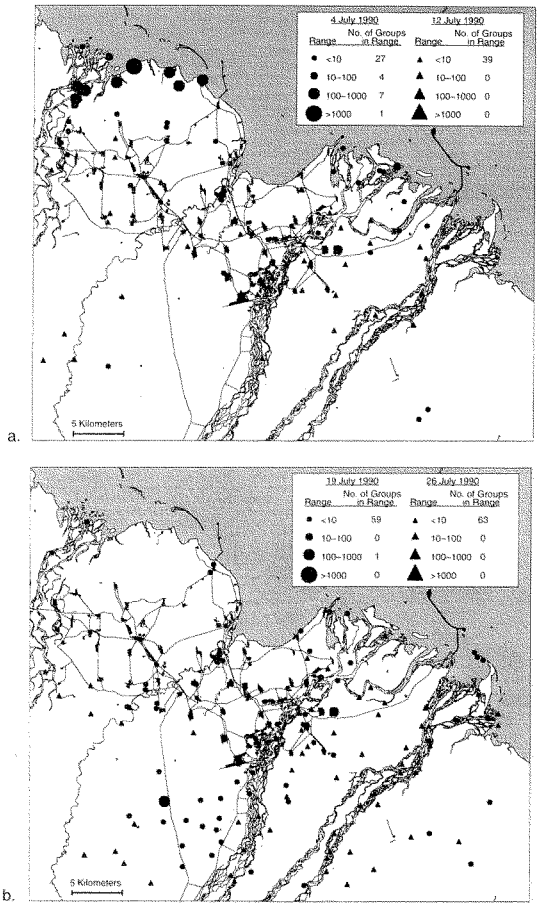
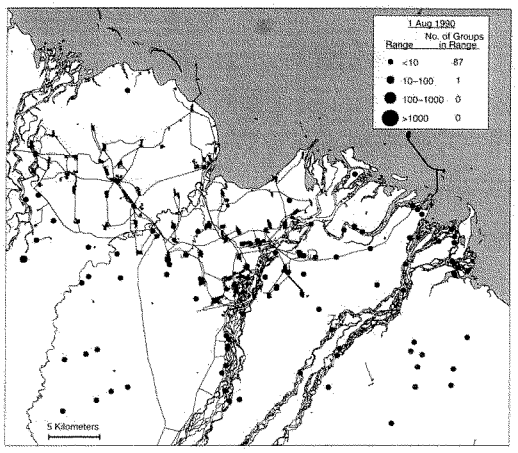


FIGURE 2 *a-b*. Distribution of Caribou observed in the study area during five aerial surveys conducted during 4 July – 1 August 1990. Solid lines are roads or pipelines and rectangles are gravel pads which support oil field facilities.

observers and pilot flying at 130 km/h and 90 m above ground level. Each survey consisted of flights along 29 systematically spaced, fixed-width strip transects (Caughley 1977). Transects were oriented north-south and centered on longitudinal section and township lines mapped on 1:63 360-scale U.S. Geological Survey (USGS) topographic maps. Survey transects were 1.6 km wide and spaced 1.6 km apart. During surveys, each observer was responsible for searching an 800 m-wide swath on one side of the transect centerline. Aluminum rods attached to the aircraft wing struts enabled visual control of transect strip-width. Surveys were conducted between 0800-1700 Alaska Daylight Time.

During surveys, when Caribou were sighted, we slowed the survey aircraft, circled each group, and estimated total number and sex/age classes (i.e., bulls, cows, calves, yearlings, and unclassified



c.

FIGURE 2 *c*. See caption on facing page.

adults). Data were entered into a laptop computer linked to the GPS receiver in the airplane. Locations of Caribou groups were determined by using GPS coordinates recorded on the transect line corrected with the visual estimation of their distances from the transect line. Caribou data were combined with digital base-map data in MapInfo® (MapInfo Corp., 200 Broadway, Troy, New York 12180) and mapped for each survey. For mapping purposes Caribou group size was categorized into four size classes: < 10, 10-100, 101-1000, and > 1000 individuals.

During 1992 and 1993, we systematically monitored weather patterns and insect activity on a daily basis (Pollard et al. 1996). Weather variables were measured using automated weather stations and handheld instruments (Pollard et al. 1996). Insect abundance was measured using sweep nets, insect traps, and ground observations of Caribou. Insect activity during 1990 and 1991 was subjectively estimated based on ground observation before and after surveys, and by interviews with field technicians located on the ground during aerial surveys. We classified relative insect activity as relatively low, moderate, or high. Insect activity was not measured during 1994.

Results

Distribution and abundance of Caribou within the study area was highly variable within and among years (Table 1). Numbers of Caribou observed on any survey ranged from 34 to 13 058. Movement of Caribou through the oil field appeared to be directly related to insect activity. In general, when insect activity was low, most Caribou moved inland away from the coast and insect-relief habitat within the oil field. However, when insect activity was moderate or high, Caribou either were present within or were moving through the oil field to reach insect-relief habitats along the coast or on sandbars within major river systems (Table 1, Figures 2-6). When Caribou moved through or were present within the oil field, it was necessary for them to cross pipelines, roads, and associated infrastructure. We describe Caribou distribution and abundance for each year of study below. More detailed descriptions of each survey are given in unpublished reports available from the authors (Pollard et al. 1992*a**, *b**; Pollard and Ballard 1993*; Pollard and Noel 1994*, 1995*).

1990. — The 4-5 July survey revealed large groups of Caribou in the coastal region of Simpson Lagoon and the Kuparuk River Delta (Figure 2*a*). These groups comprised most of the 10 867 Caribou in the study area. Insect activity was high during this survey (Table 1). Smaller groups were distributed throughout the central portion of the PBOF within 18 km of the coast. On 12 July, insect activity was low and the coastal aggregations of Caribou had dispersed (Figure 2a). Most Caribou had left the study area and only 82 individuals were observed in small groups spread throughout the PBOF.

On 19 July, insect activity was again low and most Caribou were in small groups distributed along 30 km between the west channel of the Sagavanirktok River and the Putuligayuk River, and within the PBOF (Figure 2*b*). One large group of 400 individuals was observed near the Trans-Alaska Pipeline, about 11 km south of the central portion of the PBOF.

On 26 July, insect activity was still low and 109 individuals were distributed in small groups along the

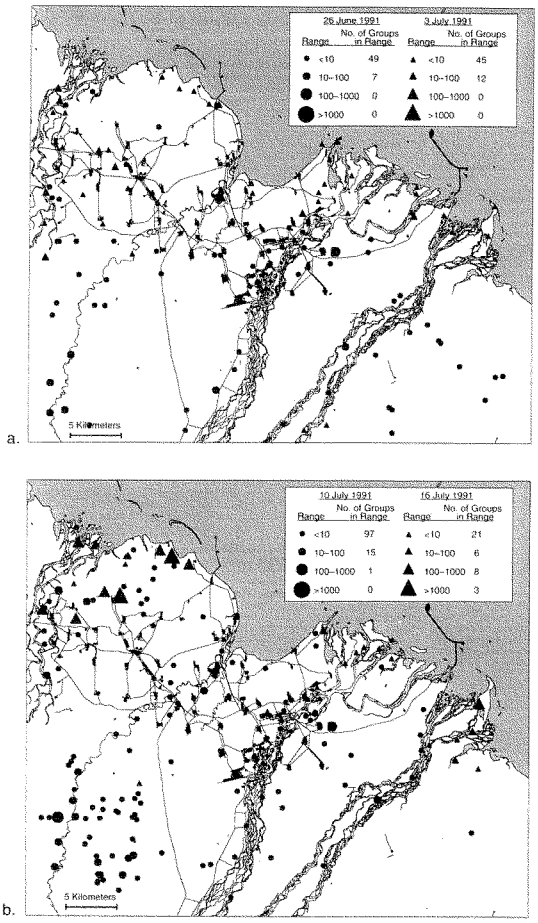


FIGURE 3 *a-b*. Distribution of Caribou observed in the study area during six aerial surveys conducted during 26 June–31 July 1991. Solid lines are roads or pipelines and rectangles are gravel pads which support oil field facilities.

Sagavanirktok River and along the southern limit of the study area (Figure 2*b*). Some of these groups were close to roads and infrastructure. The 1 August survey was also during low insect activity and revealed small groups of Caribou scattered along the southern portion of the study area and throughout the PBOF (Figure 2*c*).

1991. — During the 26 June survey, insect activity was low and a total of 267 Caribou were observed along the Kuparuk, Putuligayuk, and Sagavanirktok river channels and in the PBOF (Figure 3*a*). Twelve small groups were observed southeast of the eastern channel of the Sagavanirktok River. On 3 July, insect activity was classified as low to moderate and 370 individuals were observed within 16-18 km of the coast. Small groups were found across the study area, including areas along the Sagavanirktok and Kuparuk rivers and in the PBOF (Figure 3*a*).

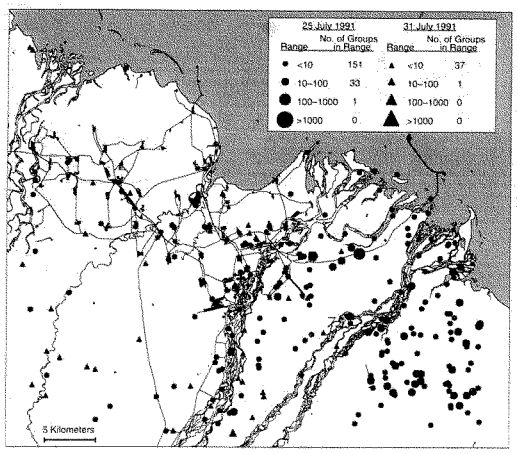


FIGURE 3 *c*. See caption on facing page.

Over twice as many Caribou (n = 781) were observed during the 10 July survey as on 3 July, although insect activity was again low (Table 1). Small groups were scattered throughout the study area, including the PBOF, and there was a large concentration inland, south of the PBOF and west of the Trans-Alaska Pipeline (Figure 3*b*). Relatively high winds and low temperatures suppressed insect activity on 10 July (Pollard et al. 1996).

The 16 July survey indicated a large influx of Caribou into the study area as we observed 7079 individuals (Table 1). Most were located along the Kuparuk River and near the coast in the western portion of the PBOF (Figure 3b). Smaller groups were observed along the coast in the Sagavanirktok River Delta. Mosquitoes were moderately active during the early part of the day, but activity diminished in the afternoon as winds increased (Pollard et al. 1996). Ground-based observations conducted at 1700 hours, after the aerial survey, revealed that many of the large groups observed during the aerial survey had combined and were moving south through the center of the oil field. A group of approximately 4000 Caribou moved clockwise through the entire PBOF and was observed finally on the floodplain of the Kuparuk River. To make these movements, this group crossed at least six roads and ten pipelines.

On 25 July, with low insect activity, there were 1465 Caribou in the study area. Most were distributed east of the west channel of the Sagavanirktok River, and there were small groups in the PBOF (Figure 3*c*). The 31 July survey, also with low insect activity, indicated that even fewer Caribou were in the study area; only 132 Caribou were sighted. Most of these individuals were inland in the southwestern portion of the study area, with some small groups in the PBOF (Figure 3*c*).

1992. — During the aerial survey on 9 July, 10 331 Caribou were observed in the study area (Table 1). Mosquito activity was high on this date. An influx of Caribou from the west resulted in high concentrations in coastal areas between the Kuparuk River and the western shore of Prudhoe Bay (Figure 4*a*). Ground observations conducted on the evening of 9 July, after the aerial survey, suggested that mosquito activity had decreased and several large groups had combined and traveled south through the oil field. This is the same pattern observed on 16 July 1991 with moderate mosquito activity. By 2200 hours on 9 July, a group of approximately 4000 Caribou was observed bedded down in the central portion of the oil field.

On 10 July, 13 058 Caribou were observed in the study area. Mixed-sex Caribou groups were widely distributed across the oil field (Figure 4a). Approximately 3000 Caribou were observed on gravel drilling pads and roads, probably seeking relief from mosquitoes which were moderately active. We observed several groups from the ground which encountered roads with high levels of vehicular traffic. The animals were delayed in crossing until traffic subsided, and then crossed or walked along the roads.

The 13-14 July survey was completed over a two-day period due to mechanical problems with the aircraft. Only 147 Caribou were observed in the

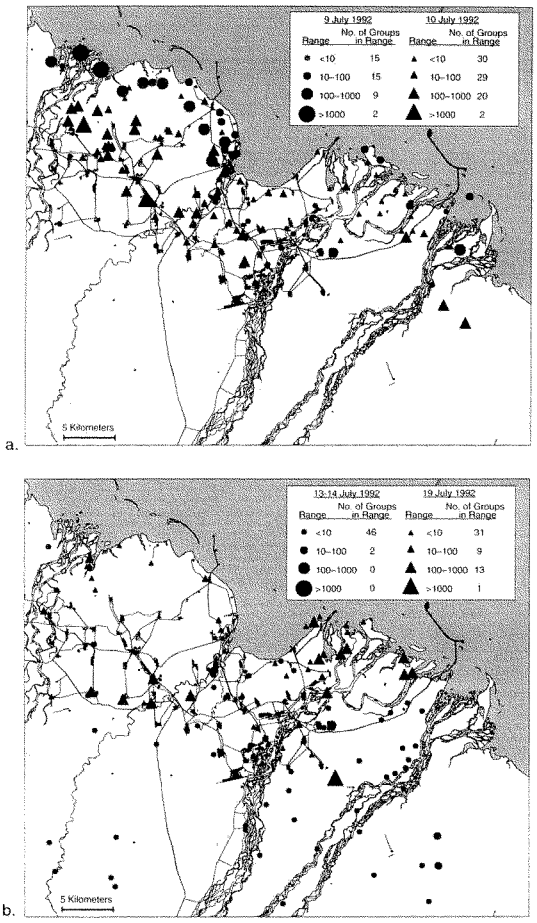


FIGURE 4 *a-b*. Distribution of Caribou observed in the study area during eight aerial surveys conducted during 9 July–31 July 1992. Solid lines are roads or pipelines and rectangles are gravel pads which support oil field facilities.

study area during the survey, most of which were in small groups south of the PBOF near the Sagavanirktok River (Figure 4*b*) and scattered throughout the PBOF. Insect activity was low during this survey.

During the 19 July survey, 7644 Caribou were observed in the study area (Table 1). Observations from this survey, and ground-based observations conducted during 20-22 July, indicated large groups of Caribou moved through the PBOF on these dates. Insect activity (mosquitoes and oestrid flies) was moderate to high on 19-22 July. Many Caribou were on gravel roads and pads, or in the shade of buildings and pipelines. These Caribou displayed signs of insect harassment (e.g., shaking their heads, bodies, and twitching their tails, and kicking) (Pruitt 1960; Espmark 1968; Kelsall 1968; Skoog 1968; Curatolo 1975; Dau 1986). Caribou remained on the gravel

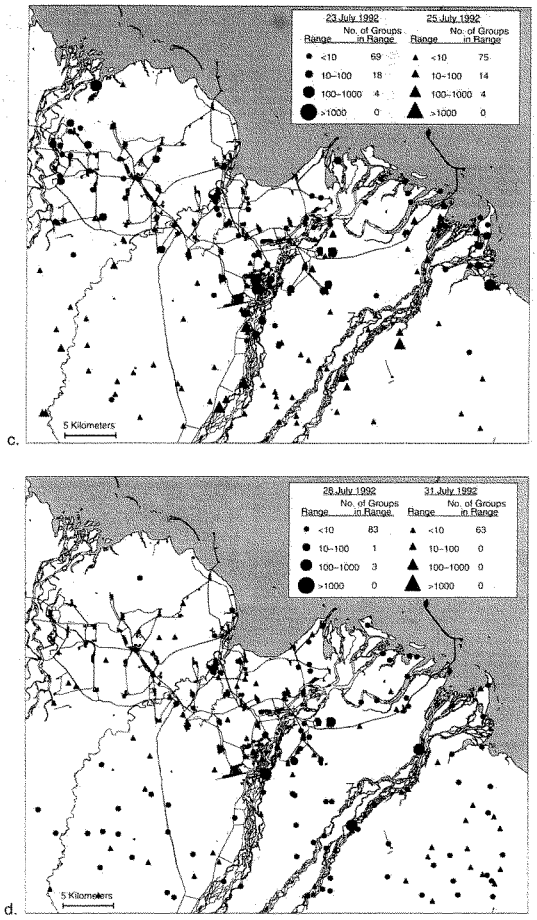


FIGURE 4 *c-d.* See caption on facing page.

structures from several minutes to >2 hours. Many large Caribou groups were observed in the Sagavanirktok River delta, or on barren mud flats and gravel river bars, probably seeking insect relief from coastal winds (Figure 4b). Several groups of 100-1000 animals were in the center of the PBOF.

On 23 July, 1936 Caribou were observed in the study area (Table 1). Mosquito abundance was low, but oestrid activity remained high. Approximately 27% of the Caribou observed were on gravel pads, roads, or under buildings seeking relief from insects. The highest concentrations of Caribou occurred in the Kuparuk and Sagavanirktok river channels and deltas (Figure 4c). Many small groups were scattered throughout the PBOF.

A total of 2503 Caribou were observed on 25 July within the study area (Table 1). A majority were in large groups on gravel bars in the Sagavanirktok River. Many smaller groups were widely distributed across the southern half of the study area. Cooler temperatures, fog, and moderate winds from the northeast suppressed mosquito

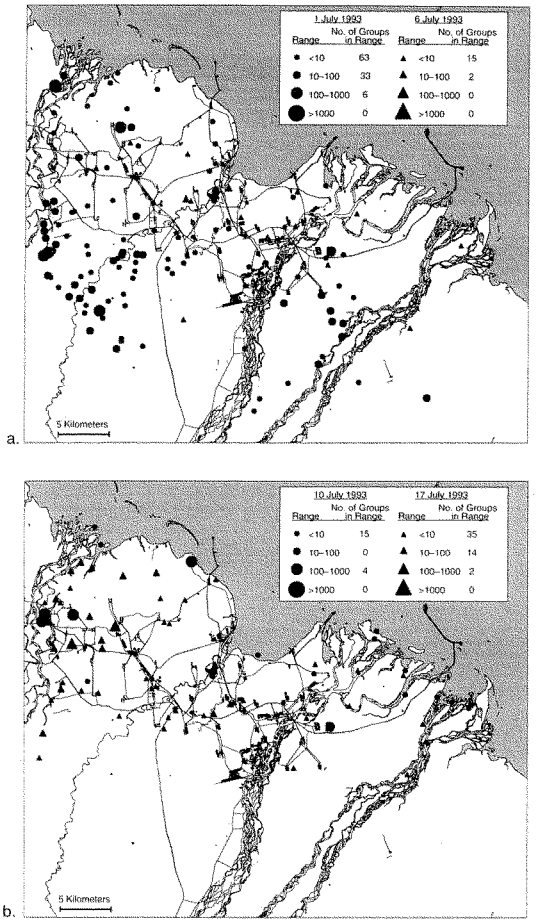


FIGURE 5 *a-c*. Distribution of Caribou observed in the study area during six aerial surveys conducted during 1 July – 26 July 1993. Solid lines are roads or pipelines and rectangles are gravel pads which support oil field facilities

activity but not oestrid fly activity on this day (Pollard et al. 1996).

During the 28 July survey, 593 Caribou were observed in the study area (Table 1). The majority were located in small groups in the southern half of the study area. There were a few large groups along the Sagavanirktok River (Figure 4*d*). A similar distribution was observed on 31 July for 147 Caribou, except several small groups were in the PBOF (Figure 4*d*). Insect activity was moderate on 28 July and low on 31 July, and many Caribou exhibited behavior characteristic of animals experiencing oestrid fly harassment.

1993. — During the 1 July survey, insect activity was low, and 2242 Caribou were observed (Table 1).

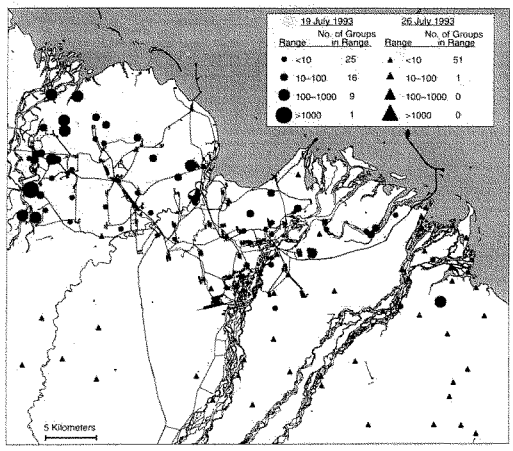


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FIGURE 5 *c*. See caption on facing page.

The majority of these were in the western portion of the study area (Figure 5*a*). Most of the larger groups were along the Kuparuk River. Many moderately sized groups were observed in the drainages of the Kuparuk, Putuligayuk, and Sagavanirktok rivers and in the PBOF (Figure 5*a*). We observed only 75 Caribou on the 6 July survey. Most of these animals were in small groups widely dispersed in the central portion of the PBOF (Figure 5*a*). Few mosquitoes were active on either 1 July or 6 July (Pollard et al. 1996).

On 10 July, insect activity was high, and 3088 Caribou were observed. The majority of Caribou were in four large groups, three of which were in or adjacent to the Kuparuk River (Figure 5*b*). The fourth large group was located on the coast in the northwest portion of the study area. There were a few small groups in the PBOF.

On 17 July, 1163 Caribou were observed (Table 1). The majority were scattered across the northern half of the study area, primarily in the northwest portion. Most Caribou occurred in small groups, several of which were observed on gravel pads and roads in the PBOF. The two largest groups (140 and 300 animals) were moving northeast through the PBOF. Observations of Caribou behavior and quantitative measures of insect abundance suggested that oestrid flies were moderately active and mosquito activity was low (Pollard et al. 1996).

The number of Caribou (n =3797) observed on 19 July had more than tripled since 17 July, probably as a result of an influx of Caribou from the Kuparuk oil field to the west, as insect activity increased over those two days. As on 17 July, the majority of Caribou were located in the northwest section of the study area (Figure 5*c*). Sixty-two percent of the animals were in four large groups that were moving north along the Kuparuk River. Other groups of 10-1000 were scattered throughout the PBOF. Oestrid fly activity was high on 19 July, but mosquito activity was low. On 26 July, only 96 Caribou were observed (Table 1). These animals were widely scattered across the study area in small groups primarily south of the PBOF (Figure 5*c*). Insect activity was low on 26 July.

1994. — During the 5 July survey, 276 Caribou were observed (Table 1, Figure 6*a*). Sixty-two percent of the animals were located in the northwest section of the study area. The remainder were in small groups scattered throughout the PBOF and near the Sagavanirktok River. On 11 July, we observed the largest number of Caribou (i.e., 2599) for any survey of 1994. Ninety-four percent of the Caribou were within four groups. Three of these groups were in the south and west side of the PBOF, and one was on the coast near the mouth of the Kuparuk River.

Relatively small numbers of Caribou occurred in the study area on 19 and 26 July (Figure 6*b*). On the 31 July survey, 1217 Caribou were observed in the study area (Table 1). Caribou were widely-scattered across the study area, including the PBOF. Eighty-two percent of the Caribou were located in the southwest corner of the study area (Figure 6*c*). In the 7-8 August survey, only 79 Caribou were observed widely scattered throughout the PBOF.

Discussion

It was suggested that large post-calving aggregations stopped moving through the PBOF as a

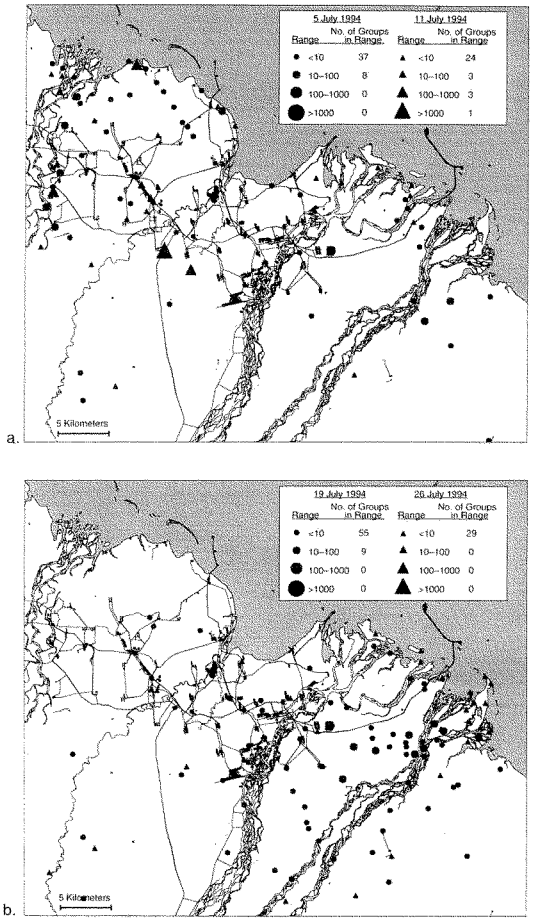

FIGURE 6 *a-b.* Distribution of Caribou observed in the study area during six aerial surveys conducted during 5 July – 8 August 1994. Solid lines are roads or pipelines and rectangles are gravel pads which support oil field facilities.

result of oil field development (Whitten and Cameron 1985; Johnson and Lawhead 1989*). However, from 1975-1989, post-calving surveys of the PBOF were limited in intensity and number (Cameron and Whitten 1976*; Whitten and Cameron 1983*b*; Cameron et al. 1986; Carruthers and Jakimchuk 1986; Carruthers et al. 1987). Because Caribou frequently move into and out of the PBOF in response to changing environmental conditions, infrequent, non-systematic, and/or low-intensity aerial surveys may be of limited value for examining Caribou distribution in relation to oil field infrastructure. Perhaps, more importantly, the relatively small numbers of Caribou observed in the PBOF in the mid-1970s to mid-1980s (Whitten and Cameron 1985; Lawhead 1988; Johnson and Lawhead 1989*), and the large numbers we observed in the 1990s (Table 1), may be related to

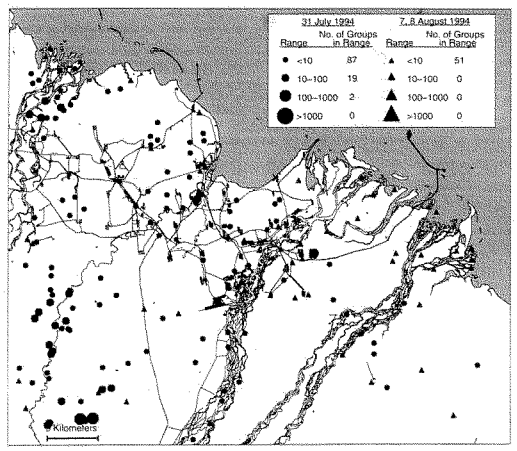

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FIGURE 6 *c*. See captions on facing page.

the increasing number of Caribou within the CAH. The CAH grew from 5000 to 23 000 animals between 1975 and 1992 (Whitten and Cameron 1983*b*; Valkenburg 1992*; Cameron 1993). It is also possible that Caribou have habituated to the oil fields over the last two decades. There is no hunting or deliberate harassment of animals in the PBOF, so this is a likely possibility.

Weather conditions are generally cooler and windier, and there is less vegetation near the Beaufort Sea coast than inland in the PBOF area (Dau 1986; Linkswiler and Curatolo 1984*; White et al. 1975). These factors are probably responsible for fewer mosquitoes on the coast than inland. Caribou often use the coast as mosquito-relief habitat on warm days, and move inland with cooler evening temperatures (Roby 1978). This occurred on 16 July 1991 and 9 July 1992. Caribou are not always on the coast when mosquitoes are active, however. On 10 July 1992, mosquito activity was moderate, and few Caribou were on the coast. Most Caribou were widely distributed across the PBOF, and about 3000 were on gravel pads and roads, probably seeking relief from mosquitoes. Lawhead and Curatolo (1984*) suggested that, under moderate levels of insect harassment, Caribou will move only as far toward the coast as needed to reach ameliorating temperatures or wind. In the Kuparuk oil field to the west of the PBOF, Dau (1986) suggested forage was of higher quality inland compared to that near the coast, and that Caribou sought such forage after expending large amounts of energy avoiding insects.

When only oestrid flies are present (from late July through mid-August), coastal areas apparently offer limited relief to Caribou (Lawhead and Smith 1990*). Unvegetated sites, such as gravel bars and mud flats, and elevated sites, such as pingos and sand dunes, are used as oestrid fly-relief habitat (White et al. 1975; Fancy 1983; Kuropat and Curatolo 1983*; Murphy and Curatolo 1987; Pollard et al. 1996). We observed Caribou using oil field gravel pads and roads as well as gravel bars in the Sagavanirktok and Kuparuk rivers when oestrid flies were active. The influence of oestrid flies can override any tendency to avoid oil field structures or activities (White et al. 1975; Curatolo et al. 1982*; Dau 1986; Murphy and Curatolo 1987). Indeed, gravel pads and roads appear to provide insect-relief habitat similar to sparsely vegetated gravel bars (Murphy and Curatolo 1987; Pollard et al. 1996). Caribou often are observed lying, standing, or traveling on gravel pads and roads or in the shade of buildings and pipelines (Roby 1978; Fancy 1983; Murphy and Curatolo 1987; Johnson and Lawhead 1989; Pollard and Noel 1994*). During our survey on 19 July 1992, 2400 of the 7644 Caribou observed were on gravel pads and roads in the PBOF, and the rest were on mud flats and gravel bars in river deltas.

Bergerud et al. (1984: 7) examined the impacts of human disturbances on Caribou and concluded that, "Caribou apparently have a high degree of resilience to human disturbance, and seasonal movement patterns and extent of range occupancy appear to be a function of population size rather than of extrinsic disturbance." Our study of post-calving use of the PBOF from 1990-1994 also indicates that Caribou distribution and movements are influenced by weather and insects more than human disturbance.

Our observations are similar to those reported 20 years ago, prior to extensive oil field development. White et al. (1975) found that insect-harassed Caribou moved into the Prudhoe Bay area, across the Kuparuk River Delta, or down the drainages of the Sagavanirktok River to gain access to coastal insect relief habitat. When insect levels diminished, Caribou dispersed inland, moving in a southwesterly direction through the area now occupied by the PBOF.

Recently, Cameron et al. (1995) examined the distribution and movements of 6 to 40 radio-collared Caribou annually during 1980-1993 in relation to a quadrant surrounding the PBOF complex. They relocated each Caribou at least once during the period 25 June through 10 August. They concluded that few Caribou were in the general area of the PBOF complex. Our data suggest that Caribou distribution and use of the PBOF area may be high or low, and is highly variable and can change within hours. Our periodic daily surveys may even have under-represented the occurrence of Caribou in the PBOF. Daily surveys and/or relocation of radio-collared Caribou every 3 to 4 hours would better document the use of the PBOF by Caribou.

Our observations show that Caribou can and do traverse oil field areas during periods of insect harassment. Others have also shown that Caribou cross under elevated pipelines and over roads to access insect-relief habitat (Curatolo and Murphy 1986; Lawhead 1988). Roads, pipelines, and human activity may block, delay, or deflect Caribou as they move through the PBOF, but movements of large groups do occur.

In summary, our observations show the use of, and movement through, the PBOF and surrounding area by Caribou in small and large groups. Caribou occurrence is variable, and depends on weather and insect conditions.

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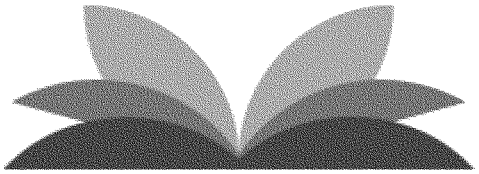

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Parasitic Insect Abundance and Microclimate of Gravel Pads and Tundra Within the Prudhoe Bay Oil Field, Alaska, in Relation to Use by Caribou, *Rangifer tarandus granti*

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During the post-calving period (late June-early August), Caribou (*Rangifer tarandus granti*) movements, distribution, and behavior are significantly influenced by harassment from parasitic insects such as mosquitoes (*Aedes* spp.) and oestrids (Warble Fly [*Hypoderma tarandi*] and Nose Bot Fly [*Cephenomyia trompe*]). A number of studies have mentioned that Caribou use oil field infrastructure features such as gravel pads and roadbeds during insect harassment but there has been no effort to quantify factors contributing to this behavior. During 1992 and 1993 parasitic insect abundance and several weather parameters were measured on active and inactive gravel drilling pads, and undisturbed adjacent tundra in the Prudhoe Bay oil field, Alaska, in an effort to explain use of these man-made structures by Caribou. Ambient air temperatures were lower on gravel pads than adjacent tundra at inactive pads but not at active pad sites. Wind velocities were higher on inactive and active pads than on adjacent tundra. Mosquitos were more abundant on tundra than gravel pads at both active and inactive sites. Mosquito abundance was positively correlated with temperature and negatively correlated with wind velocity and relative humidity at both inactive and active gravel pads. During periods of high insect harassment Caribou were observed using both active and inactive gravel pads.

Key Words: Caribou, *Rangifer tarandus granti*, insect, harassment, microclimate, *Aedes* spp., *Hypoderma tarandi*, *Cephenomyia trompe*, Alaska.

Movements, distribution and behavior of Central Arctic Herd (CAH) Caribou (*Rangifer tarandus*) during post–calving and dispersal periods are influenced by insect harassment (White et al. 1975; Curatolo et al. 1982*[1]; Lawhead 1988). Caribou are harassed by mosquitoes (*Aedes* spp.) during late June or early July through late July and then by oestrid flies (Warble Fly [*Hypoderma tarandi*] and Nose Bot Fly [*Cephenomyia trompe*]) which emerge 2–3 weeks after mosquito emergence and remain active through August (Dau 1986). Oestrid harassment is most severe after mosquito harassment has abated in late July (Kuropat and Curatolo 1983*; Murphy and Curatolo 1987).

Insect harassment can be costly to Caribou health in terms of blood loss, infestation by oestrid fly larvae, and movements to coastal insect-relief habitat or other habitats which may not be in optimal foraging areas (Roby 1978; Dau 1986; Downes et al. 1986). When insect harassment ceases, Caribou return inland to preferred feeding habitat. Such movements are thought to reduce overall energy expenditure by increasing feeding and nursing opportunities, thereby maximizing energy retention (Cameron et al. 1989*).

Insect activity on the Arctic Coastal Plain is influenced by weather conditions. Dau (1986) reported that insect activity on CAH summer range was correlated with ambient-air temperature. Insects were most active during periods of high temperature, low wind velocity, low humidity, and low cloud cover. Caribou move to the Beaufort Sea because it is cooler, windier, and more humid than inland areas (White et al. 1975; Dau 1986). Mosquito activity increases with distance from the coast, whereas oestrid fly activity does not (Dau 1986). Others have also evaluated the effects of weather on mosquito activity in Alaska and northern Canada (Hocking et al. 1950; Gjullin et al. 1961).

A variety of terrain features provide insect–relief habitat for Caribou. When oestrid flies alone harass Caribou, coastal areas apparently offer little or no relief to Caribou (Dau 1986; Lawhead and Smith 1990*). Promontories, pingos, river deltas, gravel bars, sand dunes, and mud flats are frequently used for insect relief (Roby 1978; Dau 1986; Pollard et al. 1990*). Gravel pads within Alaska's North Slope oil fields may mimic naturally occurring elevated insect-relief sites such as pingos. Gravel pads and roads provide insect-relief habitat similar to sparsely vegetated gravel bars and are widely used during the insect season (White et al. 1975; Roby 1978;

[1]References marked with asterisk(*) are listed in separate Documents Cited section following Acknowledgments, all others are in Literature Cited.

Curatolo et al. 1982*; Fancy 1983; Kuropat and Curatolo 1983*; Murphy and Curatolo 1987; Lawhead and Smith 1990*).

In spite of numerous accounts of Caribou using roads and gravel pads for insect-relief, there has been no effort to quantify reasons for apparent differences in insect abundance between gravel pads and adjacent undisturbed areas. The purpose of this study was to quantify insect abundance on gravel pads and adjacent tundra, and attempt to determine factors which influence the use of gravel pads. Our objectives were to quantify mosquito and oestrid fly abundance on gravel pads and adjacent undisturbed tundra; to determine microclimate effects of ambient temperature, wind direction and velocity, and relative humidity on gravel pads and adjacent undisturbed tundra; and to relate mosquito and oestrid fly abundance to differential microclimate conditions on gravel pads and adjacent undisturbed tundra.

Study Area

The study area (Figure 1) is on the northern edge of Alaska's Arctic Coastal Plain (within 147°50′–149°10′ N longitude and 70°25′–70°10′ W latitude) and is characterized by low relief, many shallow lakes and drained lake basins, and a variety of vegetation types of which wet and moist tundra are dominant (Walker et al. 1980). Summers are short and cool. Summer temperatures are consistently lower along the coast than inland up to 20 km and are influenced by the prevailing east to east–northeast winds (Brown and Hogen 1975; Walker et al. 1980).

Our study area encompassed the Prudhoe Bay Oil Field (PBOF) which is characterized by oil production facilities and supporting infrastructure. Oil Field facilities and roads are built on a gravel base up to 1.6 m thick which insulates the underlying permafrost, thus preventing thawing and subsidence. Among the facilities within the PBOF are 53 producing well pads, 31 non–producing well pads, eight gathering centers, two gravel landing strips for jet aircraft, and two base camps. All facilities are connected by a network of primary and secondary gravel roads totaling approximately 220 km in length.

In 1992, five study sites in the PBOF were selected from exploratory gravel well pads, hereafter called inactive pad sites, (Figure 1): Term Well C, Able State 1, Storage Pad, Lake State 1, and Delta State 2. Gravel pads varied in thickness from approximately 0.3 to 1.6 m, amount of plant colonization (0 to > 50% cover), and proximity to the coast (from 2.4–11.0 km). Only single capped well heads or steel posts marking the site of plugged wells were on the pads. In 1993, in addition to the five inactive pad sites, we selected five active gravel well pad sites: A Pad, D Pad, K Pad, M Pad, and Y Pad (Figure 1). Gravel pads at these sites are generally much larger and thicker (1.6 m on average) than pads at inactive sites. Structures on active pads consisted of numerous well houses enclosing active well heads, pipelines, reserve pits, and large elevated production facilities (modules). All active pads were essentially devoid of vegetation and were from 5.6 to 14.1 km from the coast.

Methods

We measured mosquito and oestrid fly abundance and weather parameters at the five inactive pad sites daily from 26 June to 4 August 1992. During 1993, weather variables and insect abundance were measured at the same five inactive pads examined during 1992 and an additional five active pad sites from 27 June to 31 July 1993. Each site was visited once daily between the hours of 1000–1730 Alaska Daylight Time (ADT), and contained two sampling stations; one located on the gravel pad (20 m from the edge of the pad) and one located on the tundra (50 m north or northeast of the pad). Because the prevailing winds in summer are from the east–northeast, the sampling station alignment was designed to minimize effects of the gravel pad on the tundra site.

During 1992, ambient air temperatures were recorded every 5 min using Omnidata Datapod® (Logan, Utah) and Dryden R2® (Anchorage, Alaska) electronic data loggers located at each sampling station. Temperature probes (accuracy ±0.25°C), housed in radiation shields, were located at 1.0 m above ground. In 1993, ambient air temperatures were recorded at each sampling station using a hand-held thermometer, equilibrated 15 minutes during each sampling visit.

Wind velocity and direction were recorded daily at 1.0 m above ground using a Davis Turbometer® (Hayward, California) wind speed indicator (accuracy ±0.04 m/s) and a hand–held compass for each sampling station. Velocity was averaged over a 1 min period. Wind direction was recorded as degrees from true north to the nearest 45 degrees. Relative humidity was recorded daily at each sampling station using a sling psychrometer (Forestry Suppliers, Inc., Jackson, Mississippi).

At Lake State 1 site, weather parameters were continuously monitored on the gravel pad and adjacent tundra in 1992 and 1993 with an Omnidata Easylogger® (Logan, Utah) data logging system which recorded and stored data from the following instruments: (1) an RM Young® (Traverse City, Michigan) wind microvane and anemometer which recorded wind velocity (m/s) and wind direction (degrees from true north); and (2) temperature probes which recorded ambient temperatures. Instruments were placed 1.0 m above the gravel pad and tundra surfaces. All temperature and relative humidity probes were housed in plastic radiation shields which allowed for adequate ventilation yet

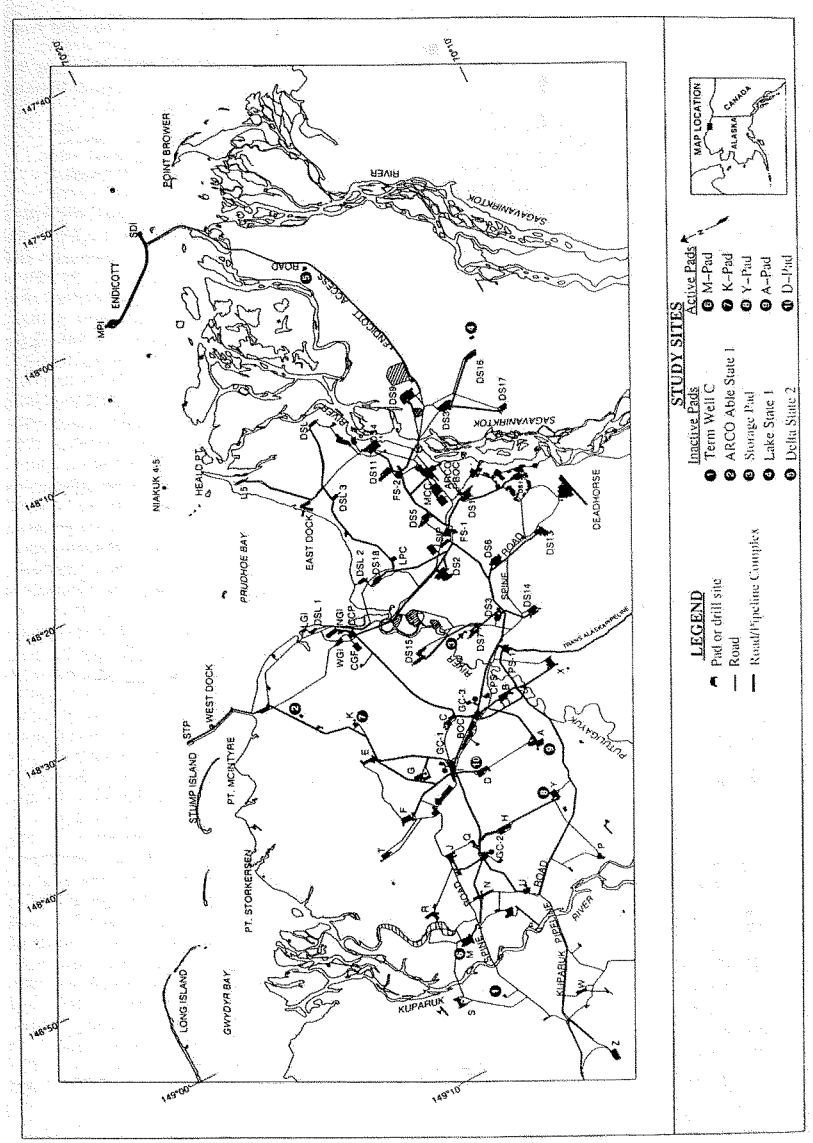

FIGURE 1. Location of study sites in the Prudhoe Bay Oil Field, Alaska.

protected equipment from direct solar radiation and inclement weather.

Insects were sampled daily at each site using sweep nets. Sweeps were conducted at gravel stations first to minimize the chances of insects following researchers to the gravel pad stations. The sweep net consisted of a 0.5 m diameter net bag attached to a 1.5 m aluminum handle. Each sample consisted of 100 sweeps made in a figure–eight motion at approximately one sweep per second; sweeps spanned approximately 0.5 to 2.0 m above ground. The 100 sweeps were composed of 25 sweeps made while walking away from the sampling stations on gravel or tundra in each of the four cardinal compass directions. Mosquitoes and oestrid flies were identified by gross anatomical characteristics, placed in plastic bags and counted daily.

Oestrid fly abundance was also continuously sampled from 16–30 July 1993 using four sticky traps. Each trap consisted of a dried Reindeer hide, coated with Tangle–trap® adhesive, and draped over a wooden sawhorse. At Term Well C (an inactive pad site), one sticky trap was placed near each sampling station on the gravel pad and adjacent tundra. At S Pad (an active pad site), one sticky trap was placed near the sampling station on the pad, and one sticky trap was placed underneath a large module located on the pad. These traps were checked daily and all captured oestrid flies were removed and counted.

Daily temperature, wind velocity, and relative humidity measurements between tundra and gravel pad stations for combined inactive pad sites and combined active pad sites were compared using paired *t*–tests (Snedecor and Cochran 1980). For 1992 data, we used the average temperature over a three-hour period encompassing each sampling visit, recorded by the elctronic data loggers. For 1993, we used the point-in-time temperature measurements recorded during each sampling visit.

Data collected during 1992 and 1993 were analyzed seperately and, where appropriate, pooled. We conducted a single paired *t*–test (for each weather parameter measured) that included data from all inactive pad sites to compensate for variation among inactive pad sites. We also conducted a single paired *t*–test that included data from all active pad sites to compensate for variation among active pad sites. Due to the distinct physical differences between inactive pad sites and active pad sites, these data were not combined. Spearman rank correlations were used to determine correlations among weather parameters, mosquito abundance, and distance to coastline. Wilcoxon paired–sample tests were used to determine differences in mosquito and oestrid fly abundance at gravel pad versus tundra stations. Two–sample chi–square tests (Zar 1984: 145) were used to evaluate differences in median wind direction between gravel pad and tundra stations for each site. Raw insect and weather data are contained in Pollard and Ballard (1983) and Pollard and Noel (1984).

All statistical analyses were conducted using the software packages SYSTAT® (Evanston, Illinois) and STATISTIX® (St. Paul, Minnesota).

Results

Weather Variables – Gravel Pads vs. Tundra

Inactive Pad Sites

Ambient air temperatures were higher ($P < 0.001$) on tundra than on gravel pads in 1992 ($\bar{x} = 6.6$°C, SE = 0.3 and $\bar{x} = 6.4$°C, SE = 0.32, respectively) and 1993 ($\bar{x} = 11.4$°C, SE = 0.4 and $\bar{x} = 11.2$°C, SE = 0.3, respectively). Similar results were obtained ($P < 0.001$) when data from both years were pooled. Daily mean temperatures recorded by the data logger at the Lake State 1 study site in 1993 were also higher ($P = 0.008$) on tundra ($\bar{x} = 9.3$°C, SE = 0.6) than on the gravel pad ($\bar{x} = 9.2$°C, SE = 0.5). The range of daily temperature differences between gravel pads and tundra at any one site was 0.0–1.6°C in 1992 and 0.0–6.8°C in 1993. Overall and at individual sites, relative humidity was higher on gravel pads ($\bar{x} = 78.3\%$, SE = 0.9) than on tundra ($\bar{x} = 77.7\%$, SE = 0.9) in 1992, but this difference was not significant ($P = 0.059$). In 1993, daily relative humidity measurements were not different ($P = 0.54$) between gravel pads ($\bar{x} = 82.4\%$, SE = 1.0) and tundra ($\bar{x} = 82.1\%$, SE = 1.0).

Wind velocities were higher ($P < 0.001$) on gravel pads than on tundra in 1992 ($\bar{x} = 3.7$ m/s, SE = 0.13 and $\bar{x} = 3.2$ m/s, SE = 0.1, respectively) and 1993 ($\bar{x} = 3.6$ m/s, SE = 0.1 and $\bar{x} = 3.2$ m/s, SE = 0.1, respectively). This was also true ($P < 0.001$) for pooled data and for wind velocity data recorded by weather stations on gravel and tundra at Lake State 1 in 1992 ($\bar{x} = 3.8$ m/s, SE = 0.3 and $\bar{x} = 3.2$ m/s, SE = 0.3, respectively) and 1993 ($\bar{x} = 3.4$ m/s, SE = 0.2 and $\bar{x} = 2.9$ m/s, SE = 0.2, respectively). The range of wind velocity differences between gravel pads and tundra at any one site ranged from 0.0 to 2.8 m/s in 1992 and from 0.0 to 8.6 m/s in 1993. There was no significant difference ($P > 0.05$) in median wind direction between gravel pads and tundra for any of the five sites in both years of study.

Temperature and relative humidity were negatively correlated on gravel pads ($r = -0.6$, $P < 0.05$) and tundra ($r = -0.6$, $P < 0.05$) but wind velocity and relative humidity were not. Temperature and wind velocity were negatively correlated ($r = -0.2$, $P < 0.05$) on gravel pads, but not on tundra in 1992 and for neither of the sites in 1993.

Active Pad Sites – 1993

Temperatures were similar ($P = 0.920$) on tundra ($\bar{x} = 11.8$°C, SE = 0.4) and gravel pads ($\bar{x} = 11.8$°C, SE = 0.4). Temperature measurements ranged from 2.3 to 22.9°C, and differences between temperatures

TABLE 1. Comparison of sweep net counts of mosquitoes between tundra and gravel sites at five inactive pad sites in the Prudhoe Bay Oil Field, during 1992 and 1993.

	Number (%) of mosquitoes				
	1992		1993		
Site	Tundra	Gravel	Tundra	Gravel	Total
Able State	148(13)	29(5)	385(8)	39(2)	601(7)
Storage Pad	70(6)	54(9)	709(15)	461(20)	1294(15)
Term Well C	227(21)	171(29)	821(17)	138(6)	1348(15)
Delta State	333(30)	79(13)	1411(29)	526(22)	2349(26)
Lake State 1	329(30)	253(43)	1557(32)	1190(51)	3329(37)
Total	1107	586	4874	2354	8921

at gravel and tundra stations ranged from 0.0 to 4.1°C.

Wind velocities were significantly higher (P = 0.005) on gravel pads ($\bar{x}$ = 3.1 m/s, SE = 0.1) than on tundra ($\bar{x}$ = 2.9 m/s, SE = 0.1). Velocity measurements ranged from 0.0 to 9.3 m/s, and differences between wind velocity on gravel pads and tundra ranged from 0.0 to 6.3 m/s. There were no significant differences ($P > 0.05$) in median wind direction between gravel pads and tundra for any of the five active pad sites. Median wind direction, all sites combined, was northeast (45°) for active pad sites.

Daily relative humidity measurements were similar (P = 0.478) on gravel pads ($\bar{x}$ = 82.2%, SE = 1.0) and tundra ($\bar{x}$ = 82.5%, SE = 0.1). Relative humidity ranged from 36 to 100%, and differences in humidity between gravel pads and tundra ranged from 0 to 2%.

Temperature and relative humidity were negatively correlated on tundra (r = -0.8, $P < 0.05$) and gravel pads (r = -0.8, $P < 0.05$) but there were no significant correlations between temperature and wind velocity or relative humidity and wind velocity.

Insect Abundance and Relationships with Weather

Inactive Pad Sites

Mosquito abundance was low (i.e., 0-4 mosquitoes per day [mpd]) from 26 June through 7 July 1992. On 8 July mosquito abundance peaked (840 mpd). A second peak (268 mpd) occurred on 19 July. Other than these two peaks, mosquitoes were moderately active on 9–11 July (57–169 mpd), 18 July (79 mpd), and 20–23 July (24–100 mpd). After 23 July, mosquito levels were relatively low at all study sites. Mosquitoes were more abundant ($P <$ 0.001) on tundra ($\bar{x}$ = 31.4, SE = 14.3) than on gravel pads ($\bar{x}$ = 16.9, SE = 9.7). Sweep net counts of mosquitoes were higher on tundra than on gravel 21 of 25 days (84%) on which mosquitoes were caught. High winds on 4–6 July precluded sweep net sampling of insects.

In 1993, mosquito abundance was moderate–to–high on 28–29 June (384 and 451 mpd, respectively), 3–4 July (78 and 260 mpd, respectively), 7–9 July (197 and 436 mpd, respectively), 11–12 July (476 and 467 mpd, repectively), and 14 July (194 mpd), with abundance peaking on 5 July (3048 mpd) and 10 July (651 mpd). After 15 July, mosquito levels were relatively low at all study sites. Sweep net counts of mosquitoes were higher on tundra than gravel pads 22 of 29 days (76%) when mosquitoes were caught. Mosquitoes were more abundant (P = 0.002) on tundra ($\bar{x}$ = 139.3 mpd, SE = 60.6) than on gravel pads ($\bar{x}$ = 67.3 mpd, SE = 29.5).

There was considerable variation among sites relative to total numbers of mosquitoes captured (Table 1). The highest number of mosquitoes occurred at the Lake State 1 site (37%) followed by Delta State 2 (26%) and Storage Pad and Term Well C (15% each). Able State 1 had the lowest number of mosquitoes overall (7%).

Mosquito activity was positively correlated with air temperature (tundra - r = 0.6, $P < 0.05$; pads - r = 0.5, $P < 0.05$) and negatively correlated with relative humidity (tundra - r = -0.3, $P < 0.05$; pads - r = -0.3,

TABLE 2. Minimum and maximum weather variable values at which mosquitoes were caught at inactive pad sites in the Prudhoe Bay Oil Field, Alaska, during 1992 and 1993.

	1992			1993		
Weather Variable	Min	Max	n	Min	Max	*n*
Temperature (°C)*	3.5	25.4	89	4.6	21.9	159
Wind Velocity (m/s)	0	5.3	100	0.2	6.8	159
Relative Humidity (%)	29	97	99	45	100	152

*averaged over a 3-hour period encompassing sampling visits in 1992.

$P < 0.05$) and wind velocity (tundra - $r = -0.2$, $P < 0.05$; pads $r = -0.3$, $P < 0.05$). Similar results were obtained for individual years. Periods of maximum mosquito activity coincided with periods of high ambient temperature, low wind velocity and low relative humidity.

The minimum temperature at which mosquitoes were caught at any one site in 1992 was 3.5°C and the maximum was 25.4°C (Table 2). Mosquitoes were active with totally calm conditions (0.0 m/s) up to a maximum wind velocity of 5.3 m/s. Minimum relative humidity at which mosquitoes were caught was 29% and the maximum was 97%. The minimum temperature at which mosquitoes were caught at any inactive pad site in 1993 was 4.6°C, and the maximum was 21.9°C. Mosquitoes were active at wind velocities of 0.2–6.8 m/s, and relative humidities of 45–100% (Table 2).

During1992, no oestrid flies were caught during sweep net sampling. In 1993, no oestrid flies were caught on inactive pad sites at gravel pad stations during sweep net sampling, and only three Warble Flies were caught in sweep nets on tundra stations adjacent to the pads. In contrast, sticky traps at the Term Well C site were more effective in capturing oestrids. Warble Flies were captured on 13 of 15 days (87%), and Bot Flies were captured on 8 of 15 days (53%). Peaks in catches occurred on 16 July (38 oestids), 19 July (52 oestrids), and 21 July (30 oestrids). On all other days, between 0-19 oestrid per day were captured. More ($P = 0.002$) oestrids were captured on the tundra sticky trap (total = 152, $\bar{x}$ = 10.1, SE = 2.9) than on the gravel pad sticky trap (n = 54, $\bar{x}$ =3.6, SE = 1.4).

Active Pads Sites-1993

Mosquito abundance was low on 27 June, 1–2 July, 6 July, 13 July, and 15–31 July (0–49 mpd). Moderate–to–high levels ($\bar{x}$ =182 mpd) occurred 28–30 June, 3–4 July, 7–10 July, 12 July, and 14 July, with peak abundance on 5 July (852 mpd) and 11 July (652 mpd). After 15 July, mosquito levels were relatively low at all study sites (0–25 mpd). Sweep net counts of mosquitoes were higher ($P < 0.001$) on tundra ($\bar{x}$ = 96.2 mpd, SE = 29.8) than on gravel pads ($\bar{x}$ = 9.7 mpd, SE = 3.1) on all days (n = 27) when mosquitoes were caught.

Mosquito activity was positively correlated with air temperature (tundra - $r = 0.6$, $P < 0.05$; pads - $r = 0.4$, $P < 0.05$) and negatively correlated with wind velocity (tundra - $r = -0.2$, $P < 0.05$; pads - $r = -0.3$, $P < 0.05$) and relative humidity (tundra - $r = -0.5$, $P < 0.05$; pads - $r = -0.4$, $P < 0.05$). The minimum temperature at which mosquitoes were caught at any active pad site was 5.4°C, and the maximum was 22.9°C. Mosquitoes were active at wind velocities of 0.0–6.7 m/s, and relative humidities of 47–100%.

Only two Warble Flies were collected in sweep nets, one on the gravel pad station at A Pad and one on the tundra station at M Pad on 21 July and 11 July, respectively. Oestrid flies were collected from 16–30 July on sticky traps set at the gravel pad station and under the module at S Pad. No Warble or Bot Flies were caught on the sticky trap set in the shade of the module. Warble Flies were caught on the gravel pad 5 of 15 days (33%) and Bot Flies were caught 3 of 15 days (20%). Peaks in oestrid catches occurred on 19 July (11 oestrids) and 20 July (5 oestrids).

Weather/Insect Relationships Relative to Distance from Coast

Mosquito abundance and weather variables on five tundra stations in 1992 and ten tundra stations in 1993 were evaluated in terms of proximity to the Beaufort Sea coast. Tundra stations at inactive pad sites ranged from 2.4–11.7 km from the coast while tundra stations at active pad sites ranged from 5.6–14.1 km from the coast. In 1992, wind velocity and relative humidity were negatively correlated (r = -0.9, $P < 0.04$) with distance from the coast but there was no correlation between mosquito abundance and distance from coast, or temperature and distance from the coast. In 1993, relative humidity was negatively correlated ($r = -0.7$, $P = 0.03$) and temperature was positively correlated ($r = 0.79$, $P = 0.006$) with distance from the coast. There was no significant correlation between wind velocity and distance from coast or mosquito abundance and distance from coast.

Discussion

Insect Abundance and Climatic Conditions

Several physical differences between inactive and active pads may have effected our results. These included: active gravel pads were higher than inactive pads due to a thicker gravel layer; and oil production structures, including well houses and production modules, are common on active pads but absent on inactive pads. Structures on active pads provide shade and block winds, both of which probably influence microclimate.

For inactive gravel pad sites, ambient air temperature was higher and wind velocity was lower on tundra than on gravel pads. Differences in temperature may be rel ted to the reflectance characteristics of the two mediums. Gravel pads are well-drained and are composed of a mixture of various sizes of gravel and sand. These materials exhibit a characteristically higher reflectance of incoming solar radiation and a lower emissivity than green vegetation at tundra sites (Lillesand and Kiefer 1979). Emissivity is a measure of an object's ability to radiate energy and is a function of temperature. For active pad sites, there was no difference in ambient air temperatures between

gravel and tundra, possibly due to the influence of structures (well houses, pipelines, and modules) on wind velocities at the pads, even though wind velocities were higher on gravel pads than on tundra. Higher wind velocities on gravel pads were likely due to a "gradient" effect. Wind velocity increases with elevation (Snow 1976) and gravel pads are higher than adjacent tundra. During both years, there were no differences in wind direction or relative humidity between gravel pads and tundra stations at inactive pad sites. This was also true for active pad sites.

Relative humidity was negatively correlated with temperature, but not with wind velocity. Identical findings were reported by Dau (1986) and Nixon (1990). In 1992, temperature was negatively correlated with wind velocity on gravel pads but not on tundra. However, for both gravel pads and tundra, no correlation was found between these two variables in 1993 or when data were pooled. Dau (1986) and Nixon (1990) also did not find correlations between temperature and wind velocity.

During 1993, temperature increased with distance from the Beaufort Sea coast, while relative humidity decreased with distance from the coast for tundra stations at inactive and active pad sites combined. Dau (1986) reported correlations between temperature and humidity with distance from the coast. During 1992 wind velocity and relative humidity decreased with distance from the coast, while temperature was not correlated. Dau (1986) and Searby and Hunter (1971) also reported a negative correlation between wind velocity and distance to coast. In contrast, there was no correlation between wind velocity and distance during 1993.

Dau (1986) reported that mosquito activity increased with distance from the Beaufort Sea coast (for five sites in roughly north–south alignment). We found no significant relationship between mean number of mosquitoes in sweep nets and distance from the Beaufort Sea coast for either 1992 or 1993. Other site attributes, such as proximity to waterbodies or distance to the coast measured with regard to prevailing wind direction, may be more relevant.

Insect activity in arctic areas is a function of at least two weather variables, i.e., temperature and wind (Curatolo 1975*; White et al. 1975; Roby 1978; Dau 1986). Mosquito abundance was correlated with temperature, wind velocity, and relative humidity for both inactive and active pad sites. Temperature and mosquito abundance had the highest correlation coefficient for both 1992 and 1993, similar to Dau's (1986) findings. Nixon (1990) reported that the average mosquito catch was more strongly correlated with wind velocity than temperature. But Nixon (1990) also found a highly significant quadratic regression ($r^2 = 0.92$) for the proportion of samples containing mosquitoes with the temperature. Peaks in mosquito abundance appear to correspond with periods of high ambient air temperature, low wind velocity, and low relative humidity in both 1992 and 1993.

The minimum air temperature (4.6°C) at which mosquitoes were caught in 1993 was similar to the 4.4°C minimum reported by Gjullin et al. (1961) but higher than the minimum recorded in 1992 (3.5°C). Other studies have suggested that mosquitoes are more active at temperatures above 6-7°C (White et al. 1975; Roby 1978; Nixon 1990). The maximum air temperature (21.9°C) at which mosquitoes were caught in 1993 was slightly lower than that recorded in 1992 (25.4°C) and both maximums were lower than the 26°C upper threshold identified by Dau (1986). The maximum wind speed at which mosquitoes were caught was slightly higher in 1993 (6.8 m/s) than in 1992 (5.3 m/s) and higher than the 4.5 m/s maximum reported by Gjullin et al. (1961). However, it is similar to the 6 to 7 m/s range reported by Roby (1987), Dau (1986), and Nixon (1990).

Mosquito abundance was higher on tundra than on inactive gravel pad stations during both years of study. Active pad sites also had higher mosquito abundance at tundra stations in 1993. Reduced mosquito abundance on gravel pads was probably due to higher wind velocities, lower ambient temperatures, and poor insect cover habitat on gravel pads. Although plant colonization has occurred on some inactive pads, there were no sizable (i.e., > 5 m^2) contiguous stands of vegetation on the gravel pads at any of our study sites except Lake State 1, which was part of an earlier restoration project (Jorgenson 1988*). Interestingly, proportionately more mosquitoes were captured at this site than at any of the other four sites. Vegetation provides resting habitat and escape cover for mosquitos during periods of inclement weather (White et al. 1975; Linkswiler and Curatolo 1984*; Dau 1986).

Dau (1986) reported annual variation in the proportion of days mosquitoes were active. For example, in 1982 he caught mosquitoes on 64% of sampling days and in 1983 on 85% of sampling days. In our study, mosquitoes in any number were captured on 68% of sampling days in 1992 and on 86% of sampling days in 1993. MacLean (1975) suggested that annual variability in mosquito abundance may be related to difference in air temperatures as much as actual differences in abundance. Indeed, daily mean temperatures, on both gravel pads and tundra and over the entire sampling period, were 4.8°C higher, on average, in 1993 than in 1992.

Active pad sites generally had fewer mosquitoes than inactive pad sites. Site specific differences in amount of available larval habitat; i.e., temporary marsh pools (dry four to five weeks after spring break up) and semipermanent pools (dry for at least a short period during July or August) (Gjullin et al.

1961), may account for some of the differences. Perhaps road dust created by vehicular traffic at active pad sites may also influence mosquito abundance by reducing adult resting and cover habitat quality (vegetation dusting) or by coating pool surfaces and inhibiting larval respiration.

Several reasons exist for our low success rate for capturing oestrid flies using sweep nets. In arctic environments oestrids have a clumped distribution, occur in low densities, and are much less ubiquitous than mosquitoes (Dau 1986; Curatolo 1975*). Dau (1986) also did not catch oestrids using sweep nets and caught only low numbers in sticky traps relative to mosquito catches. Nixon (1990) was unsuccessful in capturing oestrids using Malaise traps even when using CO_2 as an attractant.

In our study, as with Dau's (1986), sticky traps were more successful in capturing oestrids. Oestrids were significantly more numerous on the tundra station sticky trap than on the adjacent gravel pad. No oestrids were collected on the sticky trap placed in the shade of the module at S Pad, but oestrids were collected on the sticky trap placed on the gravel pad nearby. There is some evidence that oestrids are shade–intolerant. Espmark (1968), in fact, noted that Reindeer may stand under the shade of a thick–branched tree to avoid oestrid flies. Dau (1986) suggested oestrid fly distribution was influenced by Caribou distribution. Oestrids locate hosts more efficiently than mosquitoes because they use olfaction and warm convection currents associated with warm–blooded animals to locate Caribou (Roby 1978). Our S Pad sticky trap data appear to support Dau's conclusions. On four of the five days oestrids were caught on the sticky trap at S Pad, Caribou were sighted on or near S Pad during road surveys (Pollard and Noel 1994, unpublished data). On one occasion, a group of Caribou that was observed running from a tundra area up onto the pad, aggregated under the module where our sticky trap was located. Interestingly, the cloud of oestrid flies that had apparently elicited this behavior, stopped short of the module and would not fly under this structure. The highest number of oestrids were caught on the day (19 July 1993) when the most Caribou were observed on the pad.

During insect–free periods, movements of Caribou are related to gaining access to preferred forage (White et al. 1975). Caribou disperse inland during oestrid harassment (Lawhead and Curatolo 1984*; Lawhead 1988; Dau 1986) and may expend large amounts of energy avoiding insects (Dau 1986). If insect harassment is particularly severe, energy deficits, resulting from increased running and less time feeding, may affect the survival of animals during winter and calves during summer (Curatolo 1975*). Availability of man–made insect–relief habitats (i.e., gravel pads and roads) may allow Caribou to remain in preferred foraging habitat, thereby lessening the energy demands imposed on Caribou during the insect season.

Dau (1986) indicated that natural insect–relief habitat is limited to within 3 km of the Beaufort Sea coast, and that the area within 1 km is probably of highest value to Caribou. Apparently, coastal areas do not afford much relief from oestrid harassment (Lawhead and Smith 1990*) and naturally occurring oestrid–relief terrain (e.g., gravel bars, pingos) is limited on the Arctic Coastal Plain (Dau 1986). Furthermore, the quantity and quality of forage may be substantially lower along the coast than inland (White et al. 1975; Dau 1986).

Use of oil field facilities by Caribou to ameliorate oestrid harassment is well documented (White et al. 1975; Curatolo et al. 1982*; Fancy 1983; Curatolo and Murphy 1986; Dau 1986; Johnson and Lawhead 1989*; Lawhead and Smith 1990*). During insect harassment Caribou are less sensitive to oil field facilities and activities than at other times (White et al. 1975; Curatolo et al. 1982*; Dau 1986; Murphy and Curatolo 1987). Indeed, the dominating influence of oestrids often overrides any tendency to avoid development related structures and/or activities (Pollard et al. 1992*). Reduced mosquito and oestrid abundance on gravel pads, and absence of oestrids in the shade of a module, indicate that gravel pads and structures on pads offer insect-relief habitat because these sites are windier, drier, and have less vegetative cover.

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Summer Distribution of Caribou, *Rangifer tarandus granti*, in the Area of the Prudhoe Bay Oil Field, Alaska, 1990-1994

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Aerial surveys were conducted within the Prudhoe Bay oil field area in northern Alaska during 1990-1994 to document summer distribution of Caribou (*Rangifer tarandus granti*). Numbers of Caribou observed per survey ranged from 34 to 13058. When insect activity was moderate to high, more Caribou were observed within the oil field than when insect activity was low. Severe mosquito (*Aedes* spp.) harassment often resulted in large post-calving aggregations of Caribou in coastal areas. When mosquito harassment subsided, aggregations often moved inland through the oil field or laterally along the coast. On several occasions, large groups of Caribou (2000-4000 individuals) were observed feeding or bedded down in the central portion of the oil field. Caribou were observed on, and used, oil field gravel pads and roads as insect relief habitat during the mosquito season in late June through mid-July, and also used the shade of oil field structures when oestrid flies (*Hypoderma tarandi* and *Cephenomyia trompe*) were abundant from mid-July to early August. Five years of observations document that Caribou use habitat within and travel through oil fields during summer during periods of high insect activity.

Key Words: Caribou, *Rangifer tarandus granti*, Prudhoe Bay, Alaska, insect harassment, oestrid flies, mosquitoes, post-calving, oil field, aerial survey.

The potential impacts of oil field development on Caribou (*Rangifer tarandus granti*) of the Central Arctic Herd (CAH) has been the focus of intensive research in Alaska's North Slope oil fields since the early 1970s (Clough et al. 1987). Effects of oil fields on movements and habitat-use patterns have been of particular concern (Cameron and Whitten 1976*, 1980; Klein 1980; Curatolo and Murphy 1986; Cameron et al. 1992). The CAH has grown from about 5000 animals in 1975 (Cameron and Whitten 1979*) to 23444 animals in 1992 (Cameron 1993*) and numbered 18093 in 1995 (P. Valkenburg, Alaska Department of Fish and Game, personal communication). The CAH generally winters in the northern foothills of the Brooks Range and migrates each spring to calving grounds and summer range on the Arctic Coastal Plain between the Itkillik and Colville rivers (151°00' W longitude) on the west to the Sadlerochit River (145°00' W longitude) on the east (Clough et al. 1987). The Prudhoe Bay oil field (PBOF) is located within the summer range of the CAH.

During the calving period, the CAH segregates into segments east and west of the Sagavanirktok River (Cameron and Whitten 1977*; Lawhead 1988). The western segment uses the area in and around the Kuparuk oil field during the post-calving period. The eastern segment uses areas to the east of the PBOF. A 1992 photocensus of the CAH estimated 8602 animals in the eastern segment and 14 842 animals in the western segment (Valkenburg 1993*). The most recent photocensus in 1995 indicated 11 634 animals in the eastern segment and 6459 in the western segment (P. Valkenburg, Alaska Department of Fish and Game, personal communication).

During the calving period female Caribou with calves may distance themselves from oil field facilities such as roads (Whitten and Cameron 1985; Dau and Cameron 1986; Klein 1991; Cameron et al. 1992). However, the Kuparuk and Milne Point oil field areas west of the PBOF have not been abandoned, as calving has continued in these areas concurrent with expanding oil field development (Cameron et al. 1992). There is little information on use of the PBOF for calving prior to oil field development in 1970, but it is believed that it was not a concentrated calving area (Child 1973*; Gavin 1983*; Whitten and Cameron 1985; Klein 1991). Furthermore, Whitten and Cameron (1985) suggested that the generally wet conditions in the PBOF area (between the Kuparuk and Sagavanirktok rivers) provides suboptimal calving habitat. CAH Caribou use snow-covered lowlands or well-drained uplands over river valleys or deltas for calving (Carruthers et al. 1987).

*Unpublished, see Documents Cited section following Acknowledgments. All other dates are to published references given in Literature Cited.

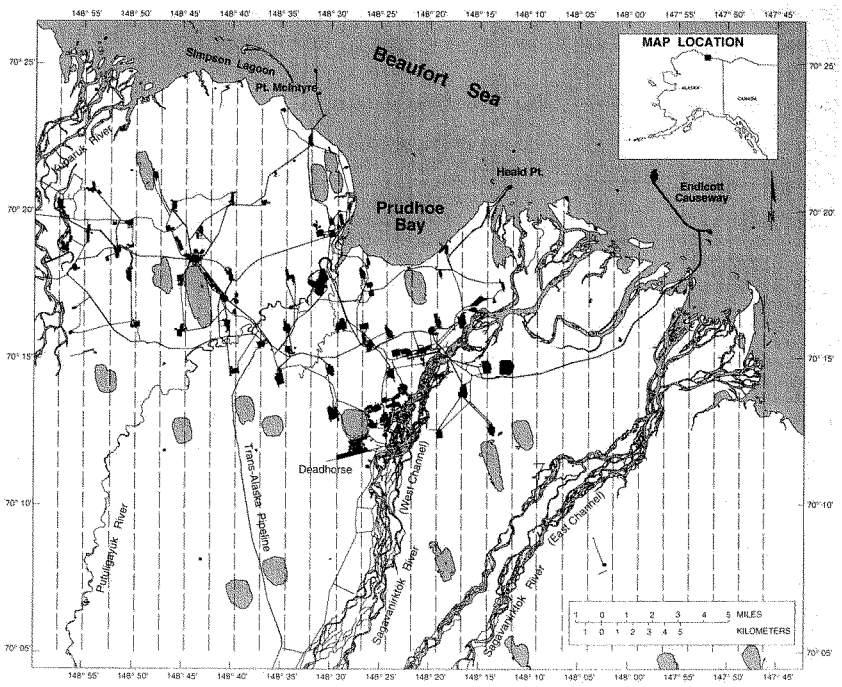


FIGURE 1. Location of strip-transect centerlines for aerial surveys conducted between 26 June and 8 August, 1990-1994, Prudhoe Bay oil field, Alaska. Solid lines are roads or pipelines and rectangles are gravel pads which support oil field facilities.

In contrast to the calving period, the PBOF may have been used frequently by Caribou during the post-calving period (late June through early August) prior to oil field development (Child 1973*; Whitten and Cameron 1983*a*). Child (1973*:7) identified extensive "traditional trail systems of Caribou" in the area that is now the PBOF. Whitten and Cameron (1985) and Johnson and Lawhead (1989*) suggested that, since the mid-1970s, movements by large post-calving aggregations through the PBOF have become rare or ceased entirely. However, harassment by mosquitoes and oestrid flies (warble flies, *Hypoderma tarandi* and nose bot flies, *Cephenomyia trompe*) have a large influence on Caribou post-calving distribution and movements (White et al. 1975; Curatolo et al. 1982*; Lawhead 1988), and there is evidence that the oil field areas may provide relief habitat from insects (Pollard et al. 1996).

There is interest in expanding oil field development in arctic Alaska, including areas within the Arctic National Wildlife Refuge used as calving and post-calving habitat by the Porcupine Caribou Herd (Clough et al. 1987). Because impact assessments at existing oil fields will be used to infer potential impacts at new developments, it is important to document accurately the extent of post-calving use of the PBOF. The objectives of this study were to quantify the post-calving distribution and number of Caribou in the area of the PBOF over five years and relate caribou distribution and numbers to insect activity.

Study Area

The study was conducted on the northern edge of the Arctic Coastal Plain of Alaska north of 70°05′N latitude between the Kuparuk and Sagavanirktok rivers (Figure 1). The 1394 km^2 study area contains the PBOF and is characterized by little elevational relief, many shallow lakes and drained lake basins, and a variety of vegetation types dominated by wet and moist tundra (Walker et al. 1980).

The PBOF includes 53 producing well pads, 31 exploration pads, 8 gathering centers, 2 gravel land-

TABLE 1. Estimated numbers and sex/age composition of Caribou in relation to relative insect activity observed during aerial surveys conducted in the Prudhoe Bay study area, Alaska, during the post-calving period, 1990-1994.

Year Date	Bulls	Cows	Calves	Yearlings	Unclassified	Total	Relative Insect Activity[a]
1990							
4,5 July	3151	4203	2947	563	3	10867	high
12 July	60	14	4	2	2	82	low
19 July	253	372	179	58	66	928	low
26 July	44	35	9	1	20	109	low
1 August	77	45	12	1	24	159	low
1991							
26 June	137	27	23	29	51	267	low
3 July	259	25	25	8	53	370	low-moderate
10 July	268	156	121	6	230	781	low
16 July	2151	1801	1797	0	1330	7079	moderate
25 July	522	108	96	7	732	1465	low
31 July	35	12	7	2	76	132	low
1992							
9 July	2535	2746	2641	427	1982	10331	high
10 July	4074	3242	3186	346	2210	13058	moderate
13, 14 July	72	24	23	9	19	147	low
19 July	2503	1579	1572	452	1538	7644	high
23 July	566	428	405	91	446	1936	high
25 July	826	541	530	78	528	2503	high
28 July	254	96	92	10	141	593	moderate
31 July	44	23	18	2	60	147	low
1993							
1 July	1315	434	209	171	113	2242	low
6 July	60	10	3	2	0	75	low
10 July	438	727	713	0	1210	3088	high
17 July	190	454	252	52	215	1163	moderate
19 July	2055	625	542	145	430	3797	high
26 July	52	31	10	0	3	96	low
1994							
5 July	129	55	40	11	41	276	[b]
11 July	804	922	562	54	257	2599	[b]
19 July	138	97	64	6	44	349	[b]
26 July	18	12	2	0	2	34	[b]
31 July	198	496	386	18	119	1217	[b]
7,8 August	32	36	9	1	1	79	[b]

[a]Quantified in detail by Pollard et al. (1996).
[b]Insect activity not monitored.

ing strips for jet aircraft, and 2 base camps. Other service facilities are present both in the oil field and the nearby community of Deadhorse. All facilities are supported by elevated gravel pads (approximately 1.5 m) and are connected by a network of gravel roads (totaling approximately 220 km in length) and above-ground pipelines.

Our study area included the entire PBOF complex, and also considerable area surrounding the oil field (Figure 1). For example, the southeast, southwest, and northwest portions of the study area have large areas which are distant from oil field infrastructure. A detailed assessment of Caribou distribution in relation to infrastructure is beyond the scope of this report, and will be described elsewhere. The results of that analysis show no evidence of avoidance of infrastructure by Caribou. Here we are concerned with the numbers, distribution, and movements of caribou relative to the PBOF as a whole. For this paper, we will loosely define the PBOF as the area within 10 km of roads and oil field infrastructure.

Methods

During 1990-1994 between 26 June and 8 August, we conducted a series of aerial surveys of the study area from fixed-wing aircraft (Cessna 206) with two

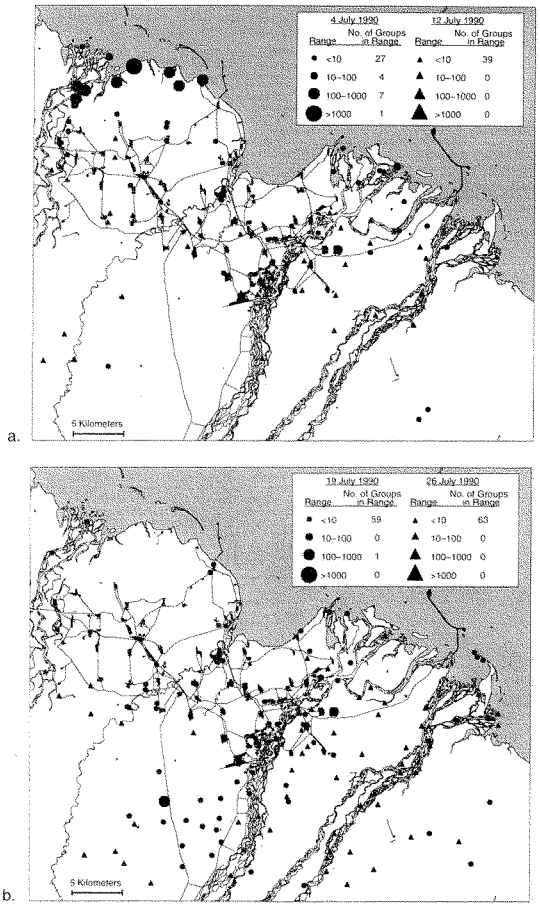
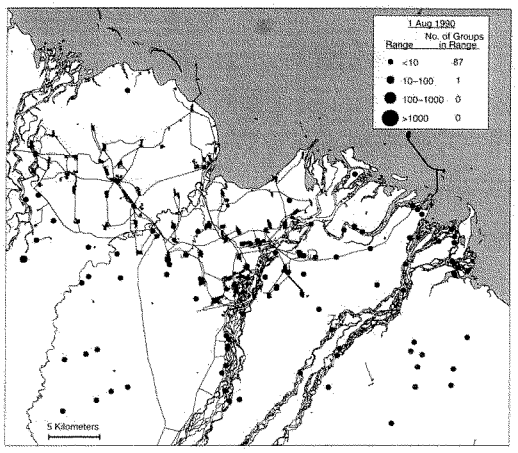


FIGURE 2 *a-b*. Distribution of Caribou observed in the study area during five aerial surveys conducted during 4 July – 1 August 1990. Solid lines are roads or pipelines and rectangles are gravel pads which support oil field facilities.

observers and pilot flying at 130 km/h and 90 m above ground level. Each survey consisted of flights along 29 systematically spaced, fixed-width strip transects (Caughley 1977). Transects were oriented north-south and centered on longitudinal section and township lines mapped on 1:63 360-scale U.S. Geological Survey (USGS) topographic maps. Survey transects were 1.6 km wide and spaced 1.6 km apart. During surveys, each observer was responsible for searching an 800 m-wide swath on one side of the transect centerline. Aluminum rods attached to the aircraft wing struts enabled visual control of transect strip-width. Surveys were conducted between 0800-1700 Alaska Daylight Time.

During surveys, when Caribou were sighted, we slowed the survey aircraft, circled each group, and estimated total number and sex/age classes (i.e., bulls, cows, calves, yearlings, and unclassified



c.

FIGURE 2 *c*. See caption on facing page.

adults). Data were entered into a laptop computer linked to the GPS receiver in the airplane. Locations of Caribou groups were determined by using GPS coordinates recorded on the transect line corrected with the visual estimation of their distances from the transect line. Caribou data were combined with digital base-map data in MapInfo® (MapInfo Corp., 200 Broadway, Troy, New York 12180) and mapped for each survey. For mapping purposes Caribou group size was categorized into four size classes: < 10, 10-100, 101-1000, and > 1000 individuals.

During 1992 and 1993, we systematically monitored weather patterns and insect activity on a daily basis (Pollard et al. 1996). Weather variables were measured using automated weather stations and handheld instruments (Pollard et al. 1996). Insect abundance was measured using sweep nets, insect traps, and ground observations of Caribou. Insect activity during 1990 and 1991 was subjectively estimated based on ground observation before and after surveys, and by interviews with field technicians located on the ground during aerial surveys. We classified relative insect activity as relatively low, moderate, or high. Insect activity was not measured during 1994.

Results

Distribution and abundance of Caribou within the study area was highly variable within and among years (Table 1). Numbers of Caribou observed on any survey ranged from 34 to 13 058. Movement of Caribou through the oil field appeared to be directly related to insect activity. In general, when insect activity was low, most Caribou moved inland away from the coast and insect-relief habitat within the oil field. However, when insect activity was moderate or high, Caribou either were present within or were moving through the oil field to reach insect-relief habitats along the coast or on sandbars within major river systems (Table 1, Figures 2-6). When Caribou moved through or were present within the oil field, it was necessary for them to cross pipelines, roads, and associated infrastructure. We describe Caribou distribution and abundance for each year of study below. More detailed descriptions of each survey are given in unpublished reports available from the authors (Pollard et al. 1992*a**, *b**; Pollard and Ballard 1993*; Pollard and Noel 1994*, 1995*).

1990. — The 4-5 July survey revealed large groups of Caribou in the coastal region of Simpson Lagoon and the Kuparuk River Delta (Figure 2*a*). These groups comprised most of the 10 867 Caribou in the study area. Insect activity was high during this survey (Table 1). Smaller groups were distributed throughout the central portion of the PBOF within 18 km of the coast. On 12 July, insect activity was low and the coastal aggregations of Caribou had dispersed (Figure 2a). Most Caribou had left the study area and only 82 individuals were observed in small groups spread throughout the PBOF.

On 19 July, insect activity was again low and most Caribou were in small groups distributed along 30 km between the west channel of the Sagavanirktok River and the Putuligayuk River, and within the PBOF (Figure 2*b*). One large group of 400 individuals was observed near the Trans-Alaska Pipeline, about 11 km south of the central portion of the PBOF.

On 26 July, insect activity was still low and 109 individuals were distributed in small groups along the

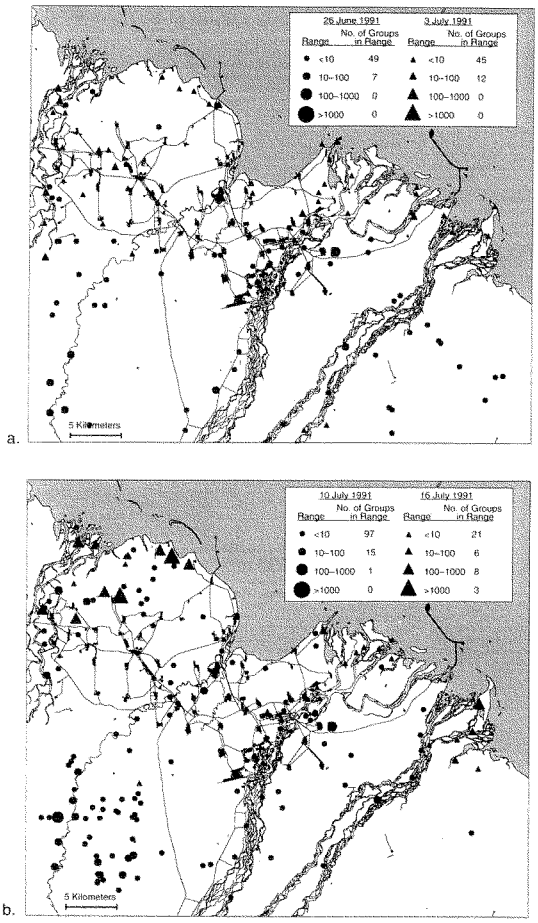


FIGURE 3 *a-b*. Distribution of Caribou observed in the study area during six aerial surveys conducted during 26 June–31 July 1991. Solid lines are roads or pipelines and rectangles are gravel pads which support oil field facilities.

Sagavanirktok River and along the southern limit of the study area (Figure 2*b*). Some of these groups were close to roads and infrastructure. The 1 August survey was also during low insect activity and revealed small groups of Caribou scattered along the southern portion of the study area and throughout the PBOF (Figure 2*c*).

1991. — During the 26 June survey, insect activity was low and a total of 267 Caribou were observed along the Kuparuk, Putuligayuk, and Sagavanirktok river channels and in the PBOF (Figure 3*a*). Twelve small groups were observed southeast of the eastern channel of the Sagavanirktok River. On 3 July, insect activity was classified as low to moderate and 370 individuals were observed within 16-18 km of the coast. Small groups were found across the study area, including areas along the Sagavanirktok and Kuparuk rivers and in the PBOF (Figure 3*a*).

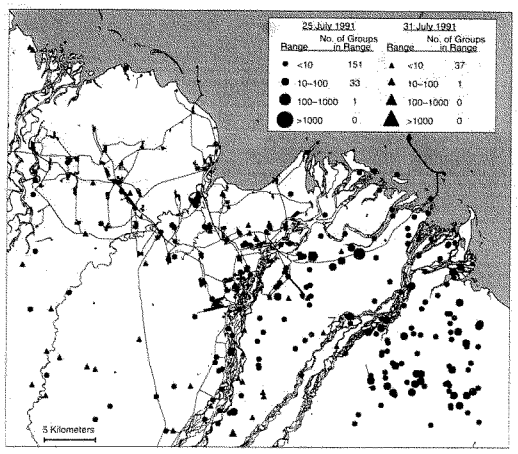


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FIGURE 3 *c*. See caption on facing page.

Over twice as many Caribou (n = 781) were observed during the 10 July survey as on 3 July, although insect activity was again low (Table 1). Small groups were scattered throughout the study area, including the PBOF, and there was a large concentration inland, south of the PBOF and west of the Trans-Alaska Pipeline (Figure 3*b*). Relatively high winds and low temperatures suppressed insect activity on 10 July (Pollard et al. 1996).

The 16 July survey indicated a large influx of Caribou into the study area as we observed 7079 individuals (Table 1). Most were located along the Kuparuk River and near the coast in the western portion of the PBOF (Figure 3b). Smaller groups were observed along the coast in the Sagavanirktok River Delta. Mosquitoes were moderately active during the early part of the day, but activity diminished in the afternoon as winds increased (Pollard et al. 1996). Ground-based observations conducted at 1700 hours, after the aerial survey, revealed that many of the large groups observed during the aerial survey had combined and were moving south through the center of the oil field. A group of approximately 4000 Caribou moved clockwise through the entire PBOF and was observed finally on the floodplain of the Kuparuk River. To make these movements, this group crossed at least six roads and ten pipelines.

On 25 July, with low insect activity, there were 1465 Caribou in the study area. Most were distributed east of the west channel of the Sagavanirktok River, and there were small groups in the PBOF (Figure 3*c*). The 31 July survey, also with low insect activity, indicated that even fewer Caribou were in the study area; only 132 Caribou were sighted. Most of these individuals were inland in the southwestern portion of the study area, with some small groups in the PBOF (Figure 3*c*).

1992. — During the aerial survey on 9 July, 10 331 Caribou were observed in the study area (Table 1). Mosquito activity was high on this date. An influx of Caribou from the west resulted in high concentrations in coastal areas between the Kuparuk River and the western shore of Prudhoe Bay (Figure 4*a*). Ground observations conducted on the evening of 9 July, after the aerial survey, suggested that mosquito activity had decreased and several large groups had combined and traveled south through the oil field. This is the same pattern observed on 16 July 1991 with moderate mosquito activity. By 2200 hours on 9 July, a group of approximately 4000 Caribou was observed bedded down in the central portion of the oil field.

On 10 July, 13 058 Caribou were observed in the study area. Mixed-sex Caribou groups were widely distributed across the oil field (Figure 4a). Approximately 3000 Caribou were observed on gravel drilling pads and roads, probably seeking relief from mosquitoes which were moderately active. We observed several groups from the ground which encountered roads with high levels of vehicular traffic. The animals were delayed in crossing until traffic subsided, and then crossed or walked along the roads.

The 13-14 July survey was completed over a two-day period due to mechanical problems with the aircraft. Only 147 Caribou were observed in the

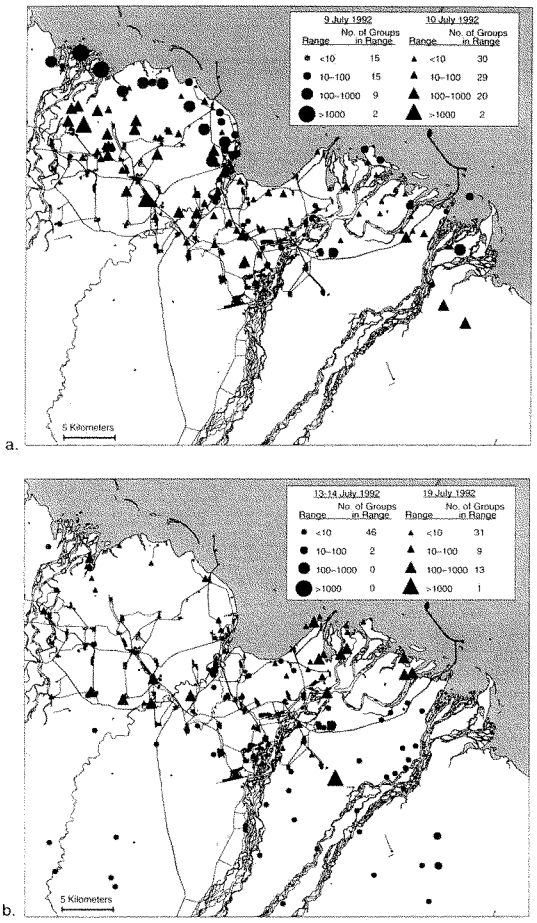

FIGURE 4 *a-b*. Distribution of Caribou observed in the study area during eight aerial surveys conducted during 9 July–31 July 1992. Solid lines are roads or pipelines and rectangles are gravel pads which support oil field facilities.

study area during the survey, most of which were in small groups south of the PBOF near the Sagavanirktok River (Figure 4*b*) and scattered throughout the PBOF. Insect activity was low during this survey.

During the 19 July survey, 7644 Caribou were observed in the study area (Table 1). Observations from this survey, and ground-based observations conducted during 20-22 July, indicated large groups of Caribou moved through the PBOF on these dates. Insect activity (mosquitoes and oestrid flies) was moderate to high on 19-22 July. Many Caribou were on gravel roads and pads, or in the shade of buildings and pipelines. These Caribou displayed signs of insect harassment (e.g., shaking their heads, bodies, and twitching their tails, and kicking) (Pruitt 1960; Espmark 1968; Kelsall 1968; Skoog 1968; Curatolo 1975; Dau 1986). Caribou remained on the gravel

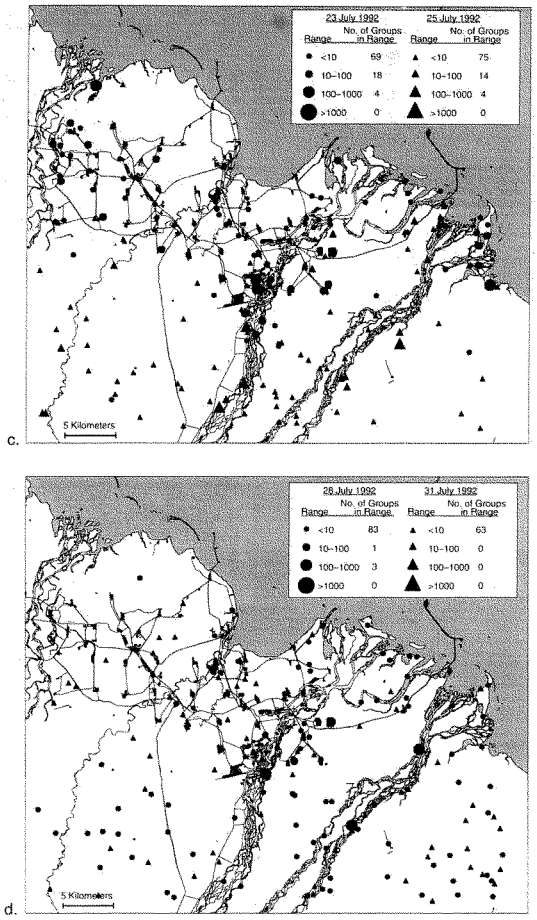

FIGURE 4 *c-d.* See caption on facing page.

structures from several minutes to >2 hours. Many large Caribou groups were observed in the Sagavanirktok River delta, or on barren mud flats and gravel river bars, probably seeking insect relief from coastal winds (Figure 4b). Several groups of 100-1000 animals were in the center of the PBOF.

On 23 July, 1936 Caribou were observed in the study area (Table 1). Mosquito abundance was low, but oestrid activity remained high. Approximately 27% of the Caribou observed were on gravel pads, roads, or under buildings seeking relief from insects. The highest concentrations of Caribou occurred in the Kuparuk and Sagavanirktok river channels and deltas (Figure 4c). Many small groups were scattered throughout the PBOF.

A total of 2503 Caribou were observed on 25 July within the study area (Table 1). A majority were in large groups on gravel bars in the Sagavanirktok River. Many smaller groups were widely distributed across the southern half of the study area. Cooler temperatures, fog, and moderate winds from the northeast suppressed mosquito

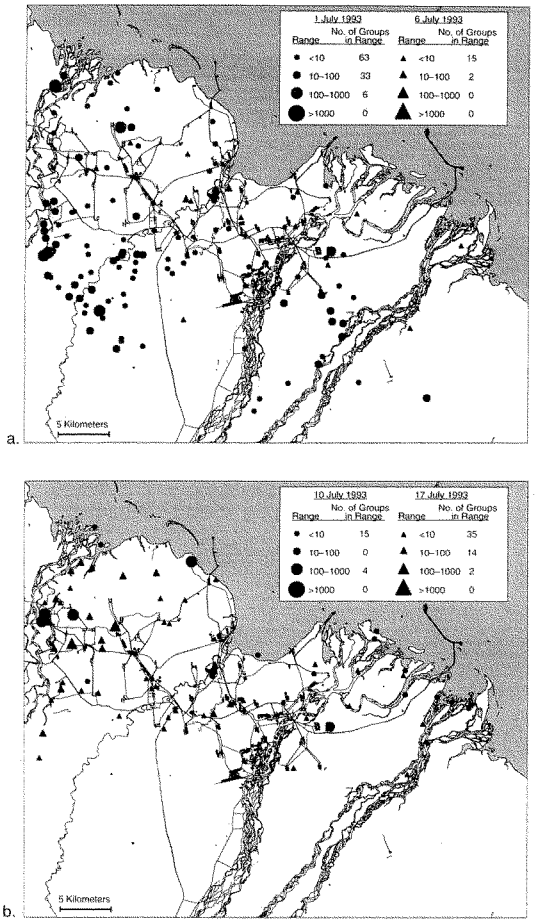

FIGURE 5 *a-c*. Distribution of Caribou observed in the study area during six aerial surveys conducted during 1 July – 26 July 1993. Solid lines are roads or pipelines and rectangles are gravel pads which support oil field facilities

activity but not oestrid fly activity on this day (Pollard et al. 1996).

During the 28 July survey, 593 Caribou were observed in the study area (Table 1). The majority were located in small groups in the southern half of the study area. There were a few large groups along the Sagavanirktok River (Figure 4*d*). A similar distribution was observed on 31 July for 147 Caribou, except several small groups were in the PBOF (Figure 4*d*). Insect activity was moderate on 28 July and low on 31 July, and many Caribou exhibited behavior characteristic of animals experiencing oestrid fly harassment.

1993. — During the 1 July survey, insect activity was low, and 2242 Caribou were observed (Table 1).

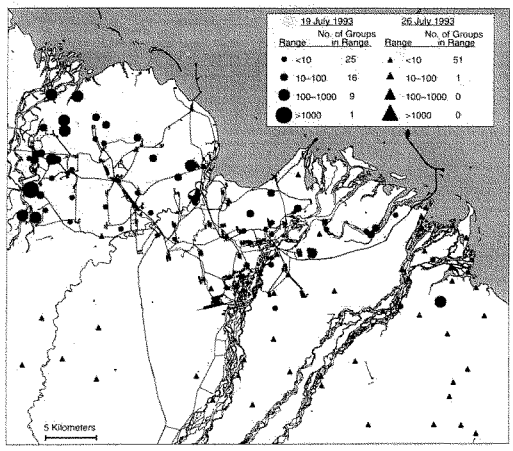

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FIGURE 5 *c*. See caption on facing page.

The majority of these were in the western portion of the study area (Figure 5*a*). Most of the larger groups were along the Kuparuk River. Many moderately sized groups were observed in the drainages of the Kuparuk, Putuligayuk, and Sagavanirktok rivers and in the PBOF (Figure 5*a*). We observed only 75 Caribou on the 6 July survey. Most of these animals were in small groups widely dispersed in the central portion of the PBOF (Figure 5*a*). Few mosquitoes were active on either 1 July or 6 July (Pollard et al. 1996).

On 10 July, insect activity was high, and 3088 Caribou were observed. The majority of Caribou were in four large groups, three of which were in or adjacent to the Kuparuk River (Figure 5*b*). The fourth large group was located on the coast in the northwest portion of the study area. There were a few small groups in the PBOF.

On 17 July, 1163 Caribou were observed (Table 1). The majority were scattered across the northern half of the study area, primarily in the northwest portion. Most Caribou occurred in small groups, several of which were observed on gravel pads and roads in the PBOF. The two largest groups (140 and 300 animals) were moving northeast through the PBOF. Observations of Caribou behavior and quantitative measures of insect abundance suggested that oestrid flies were moderately active and mosquito activity was low (Pollard et al. 1996).

The number of Caribou (n =3797) observed on 19 July had more than tripled since 17 July, probably as a result of an influx of Caribou from the Kuparuk oil field to the west, as insect activity increased over those two days. As on 17 July, the majority of Caribou were located in the northwest section of the study area (Figure 5*c*). Sixty-two percent of the animals were in four large groups that were moving north along the Kuparuk River. Other groups of 10-1000 were scattered throughout the PBOF. Oestrid fly activity was high on 19 July, but mosquito activity was low. On 26 July, only 96 Caribou were observed (Table 1). These animals were widely scattered across the study area in small groups primarily south of the PBOF (Figure 5*c*). Insect activity was low on 26 July.

1994. — During the 5 July survey, 276 Caribou were observed (Table 1, Figure 6*a*). Sixty-two percent of the animals were located in the northwest section of the study area. The remainder were in small groups scattered throughout the PBOF and near the Sagavanirktok River. On 11 July, we observed the largest number of Caribou (i.e., 2599) for any survey of 1994. Ninety-four percent of the Caribou were within four groups. Three of these groups were in the south and west side of the PBOF, and one was on the coast near the mouth of the Kuparuk River.

Relatively small numbers of Caribou occurred in the study area on 19 and 26 July (Figure 6*b*). On the 31 July survey, 1217 Caribou were observed in the study area (Table 1). Caribou were widely-scattered across the study area, including the PBOF. Eighty-two percent of the Caribou were located in the southwest corner of the study area (Figure 6*c*). In the 7-8 August survey, only 79 Caribou were observed widely scattered throughout the PBOF.

Discussion

It was suggested that large post-calving aggregations stopped moving through the PBOF as a

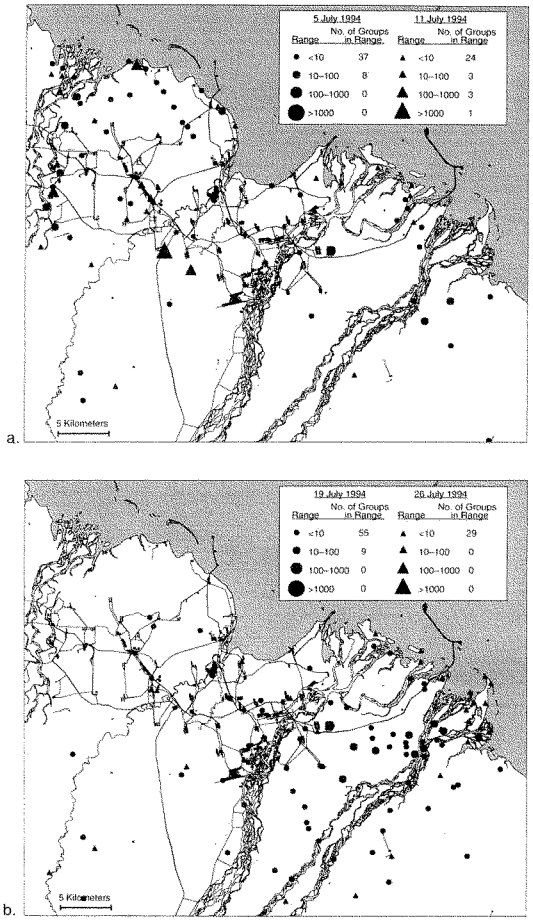

FIGURE 6 *a-b.* Distribution of Caribou observed in the study area during six aerial surveys conducted during 5 July – 8 August 1994. Solid lines are roads or pipelines and rectangles are gravel pads which support oil field facilities.

result of oil field development (Whitten and Cameron 1985; Johnson and Lawhead 1989*). However, from 1975-1989, post-calving surveys of the PBOF were limited in intensity and number (Cameron and Whitten 1976*; Whitten and Cameron 1983*b*; Cameron et al. 1986; Carruthers and Jakimchuk 1986; Carruthers et al. 1987). Because Caribou frequently move into and out of the PBOF in response to changing environmental conditions, infrequent, non-systematic, and/or low-intensity aerial surveys may be of limited value for examining Caribou distribution in relation to oil field infrastructure. Perhaps, more importantly, the relatively small numbers of Caribou observed in the PBOF in the mid-1970s to mid-1980s (Whitten and Cameron 1985; Lawhead 1988; Johnson and Lawhead 1989*), and the large numbers we observed in the 1990s (Table 1), may be related to

CARIBOU POPULATION DENSITY IN THE PRUDHOE BAY REGION OF ALASKA

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Abstract: The west segment of the Central Arctic caribou (*Rangifer tarandus*) herd (CAH) occupies ranges encompassing the oil fields of the Prudhoe Bay region in northern Alaska, while the east segment is in an undeveloped area. It has been suggest that the oil fields may negatively impact the west segment through reduced calf production. We assessed animal density as another factor influencing the CAH. East segment densities were assessed in areas east of the Prudhoe Bay oil fields (ESA), and west segment densities were assessed in the Prudhoe Bay oil field (PSA) and Kuparuk oil field (KSA). There was no difference in caribou density among years (1990–1995) for either the PSA or the ESA. Caribou densities were significantly lower in the ESA than in the PSA in 1990, 1993, and for all six years combined. The KSA was surveyed only in 1991, and caribou density was significantly higher in the KSA that year than in either the PSA or the ESA. The trends in animal density in our study were consistent with those for the CAH as a whole, and the west and east segments individually as indicated by agency census data. Cause and effect relationships can not be established, but factors affecting a decline in the west segment of the CAH between 1992–1995 could include oil field impacts on calf production, inter-segment or inter-herd movements, or relatively high density in the west segment of the CAH. The segments are not independent of each other, as there is some movement of animals between them during the summer, and the segments mix during winter. Inter-segment movements, perhaps in response to high summer densities within the west segment, may have contributed to the concurrent decline in the west segment and increase in the east segment.

Key words: caribou, condition indices, herd productivity, oil field infrastructure, petroleum development, *Rangifer tarandus*.

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INTRODUCTION

Caribou (*Rangifer tarandus*) of the Central Arctic Herd (CAH) have been the subject of intensive study and monitoring for >20 years. The summer range of the CAH includes the oil field complexes at Prudhoe Bay and surrounding areas. There is concern that oil field development may negatively affect caribou through habitat loss, disruption of movements, and displacement of caribou to inferior foraging areas (Dau and Cameron 1986, Cameron et al. 1992, Nellemann and Cameron 1996). It is thought that this may result in poor body condition, reduced fecundity or survival, and ultimately poor herd productivity (Cameron et al. 1989, Wildlife Management Institute 1991). Although these studies suggest some reduction in calf production may occur, effects on herd demographics are questionable. The CAH has grown at rates comparable to adjacent herds (Ballard and Cronin 1995, Cronin et al., in press) and uses habitat within, and traverses through, the oil fields during the post calving period (Pollard et al. 1996 a,b, Cronin et al., submitted). In addition, other factors such as winter range, population density, and weather effects, which are known to affect caribou, have not been thoroughly assessed for the CAH.

The range of the west segment of the CAH includes the oil field areas and the range of the east segment does not. The segments have separate calving ranges and generally remain on the east or west side of the Sagavanirktok River (the proposed boundary between the herd segments) during the summer (Cameron 1995). Cameron (1992, 1994, 1995) suggested that the oil field contributed to a reduced plane of summer nutrition and decline in body condition, resulting in less frequent conception or calf production in the west segment of the CAH. It also was speculated in the news media that the recent decline of the CAH, from 23,444 in 1992 to 18,100 in 1995, was due to these effects because the west segment declined during this period while the

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Table 1. Area surveyed, numbers, and density of caribou within the Prudhoe Study Area (PSA), the East Study Area (ESA), and Kuparuk Study Area (KSA) during the post-calving period, 1990–1995.

Caribou herds	1990	1991	1992	1993	1994	1995	1990–95
PRUDHOE STUDY AREA							
Survey area (km^2)	984	984	984	984	984	984	984
Number of surveys	6	7	8	6	5	4	36
Total caribou recorded	11,980	9,602	33,867	10,275	3,152	3,519	72,395
Date	June 21–Aug. 1	June 26–Aug. 13	July 9–31	July 1–26	July 5–Aug. 8	July 5–26	June 21–Aug.13
No. of caribou per survey (x± SD) and data range	1,997±4,344 (74–10,858)	1,372±2,426 (132–6,847)	4,233±4,930 (112–12,350)	1,713±1,530 (60–3,671)	630±1,102 (21–3,152)	880±997 (16–1,826)	2,011±3,281 (16–12,350)
Caribou/km^2 per survey(x± SD) and data range	2.03±4.41 (0.07–11.04)	1.39±2.46 (0.13–6.96)	4.30±5.01 (0.11–12.55)	1.74±1.55 (0.06–3.73)	0.64±1.12 (0.02–2.63)	0.89±1.01 (0.02–1.86)	2.04±3.33 (0.02–12.55)
EAST STUDY AREA							
Survey area (km^2)	230	230	230	922	578	943	230–943
Number of surveys	6	7	8	6	7	2	36
Total caribou recorded	92	1,235	2,492	1,114	3,659	2,421	11,013
Date	June 21–Aug. 1	June 26–Aug. 13	July 9–31	June 22–Aug.18	July 5–Aug. 8	July 10–20	June 21–Aug. 18
No. of caribou per survey (x± SD) and data range	15±13 (2–38)	176±330 (0–902)	312±314 (0–708)	186±247 (0–582)	523±1,225 (9–3,294)	1,213±1,708 (5–2,426)	306±682 (0.00–2,426)
Caribou per km^2 (x± SD) and data range	0.07±0.06 (0.01–0.16)	0.77±1.44 (0.00–3.92)	1.35±1.36 (0.00–3.08)	0.20±0.27 (0.00–0.63)	0.90±2.12 (0.04–5.70)	1.30±1.83 (0.01–2.59)	0.74±1.36 (0.00–5.70)
KUPARUK STUDY AREA							
Survey area (km^2)	—	1,126	—	—	—	—	1,126
Number of surveys	—	5	—	—	—	—	5
Total caribou recorded	—	22,983	—	—	—	—	22,983
Date	—	June 25–July 24	—	—	—	—	June 25–July 24
No. of caribou per survey (x± SD) and data range	— —	4,597± 3,759 (1,856–11,025)	— —	— —	— —	— —	4,597± 3,759 (1,856–11,025)
Caribou per km^2 (x± SD) and data range	— —	4.08± 3.34 (1.65–9.79)	— —	— —	— —	— —	4.08± 3.34 (1.65–9.79)

east segment did not (Rinehart 1995). Verifying oil-field effects on the west segment on the CAH depends on several assumptions. First, the east and west segments must be independent units. That is, for the effects of the oil field to be manifested in one group and not the other, the same animals must use only the east or west summer range areas within and among years. Second, for oil field effects to be clearly identified, the east and west segments of the CAH should also have essentially identical environments and population characteristics. For example, the density of animals, levels of parasite infestation and insect harassment, and the quality of habitat all can affect fecundity, body condition, and survival. Ballard and Cronin (1995) and Cronin et al. (in press) discuss these issues in the context of comparisons among the CAH and three other arctic Alaska

Table 2. Mean densities of caribou in three study areas (ESA, PSA, KSA), 1990–1995. For inter-study area comparisons, probability (p) values for both t test/Mann-Whitney U tests are given.

Study area	Density (caribou/km^2)												Among year ANOVA comparison	Six year mean	
	1990		1991		1992		1993		1994		1995				
	Mean	*SD*	Mean	*SD*	Mean	*SD*	Mean	*SD*	Mean	*SD*	Mean	*SD*		Mean	*SD*
PSA	2.029	4.415	1.394	2.465	4.302	5.010	1.740	1.555	0.641	1.120	0.894	1.013	p=0.437	2.044	3.335
ESA	0.067	0.057	0.767	1.436	1.354	1.366	0.201	0.268	0.904	2.119	1.299	1.829	p=0.436	0.743	1.357
KSA	ND	ND	4.082	3.338	ND	ND	ND	ND	ND	ND	ND	ND		ND	ND
ESA vs PSA	p=0.21/0.05*		p=0.51/0.20		p=0.16/0.25		p=0.04*/0.05*		p=0.64/0.87		p=0.84/1.00			p=0.02*/0.003*	
KSA vs PSA			p=0.04*/0.03*												
KSA vs ESA			p=0.009*/0.03*												

*Significant α=0.05 level; ND — surveys not done.

caribou herds. In this paper, we used data from 6 consecutive years of aerial surveys (Pollard et al. 1996 a) of the Prudhoe Bay region to assess caribou density as a potential factor affecting demography.

It is well known that animal density is an important factor affecting population dynamics in cervids (e.g., Clutton-Brock et al. 1982, Skogland 1985). The number of animals in a given area may affect the amount of resources, including food, which is available to individuals. It is obvious that, as animal numbers and density increase, resources may become limited. This may impose nutritional constraints which, in extreme cases, may result in starvation (e.g., Klein 1968, Gates et al. 1986). In other cases, nutritional constraints may be manifested in smaller body size, poor body condition, and lower fecundity or survival. For example, it is well-documented that, in wild and domestic animals, low food availability is associated with reduced milk yields in lactating females and reduced growth in calves (Allden 1970, Grubb 1974, Clutton-Brock et al. 1982).

It is not easy to differentiate the relative effects of animal density, weather, or other factors (e.g., oil field impacts) on free-ranging animals. In a classic study of an island population of red deer, (*Cervus elaphus*) Clutton-Brock et al. (1982) investigated the relative effects of density and weather conditions on animal condition, fecundity, and survival. They found that calf birth weight was primarily affected by weather conditions, but that population density also had an effect. They also found that conception date was delayed, fecundity decreased, calf/female ratios decreased, and calf mortality in winter increased as population size and density increased. The results of the red deer study are not directly comparable to Alaskan caribou populations for several reasons; the study was conducted on an island population with limited opportunity for dispersal, the red deer did not migrate among seasonal ranges, and there were no predators. However, the general effects of density and weather on herd productivity likely occur in caribou as well (e.g., Skogland 1985, 1990, Thing et al. 1986, Messier et al. 1988, Couturier et al. 1990, Messier 1991, Leader-Williams 1988, Valkenburg et al. 1991, Crete and Huot 1993, Bowyer and Roby 1995). It is important to note that effects of various factors on caribou populations are complex, and often inter-dependent (Klein 1991). For example, wolf (*Canis lupus*) predation may have a greater effect on caribou herd growth at low herd densities (Haber and Walters 1980), while extreme weather conditions may affect herds differently, depending on density (Heard and Ouellet 1994). It is also possible that dispersal or range changes among caribou herds occur at high population densities (Skoog 1968, Haber and Walters 1980, Tyler and Oristland 1995). Because of the concerns over the potential effects of northern Alaska oil fields on caribou, we felt it was important to consider animal density as another factor which may affect herd productivity. This was especially true for the east and west segments of the CAH. Our objectives were to quantify and compare densities of caribou during the post-calving period in the east and west segments of the CAH from 1990–1995, and compare densities for the two segments with densities for the CAH as a whole.

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METHODS

To determine caribou distributions, we conducted aerial surveys of the area around the Prudhoe Bay oil field (1990–1995), the Kuparuk oil field (1991), and undeveloped areas to the east of the Prudhoe Bay oil field (1990–1995) (Fig. 1, Pollard et al. 1996 a, LGL, 1994, 1995; BPXA 1995). The surveys included a contiguous area along the Beaufort Sea coast from the Colville River on the west, to the Staines River on the east. This area was divided into three study areas: the Kuparuk

Table 3. Summary of population estimates, and density, from the 1970s through the early 1990s for the four major caribou herds occuring in northern Alaska (modified from Cronin et al., in press).

Caribou herds	Years	Range of herd (thousands) estimated	Summer range areas [5] (km^2)	Summer range population density (n/km^2)
Western Arctic Herd	1976–1993	64.0–450.0[1]	197,000	0.32–2.28
Teshekpuk Caribou Herd	1978–1993	3.1–27.7[2]	12,500	0.25–2.22
Central Arctic Herd	1975–1995	5.0–23.4[3]	17,000	0.29–1.38
Porcupine Caribou Herd	1979–1994	105.7–178.0[4]	121,000	0.87–1.47

[1]Source: Davis and Valkenburg 1978, Davis et al. 1978, Machida 1992, 1993, P. Valkenburg, Alaska Dept. of Fish and Game, pers. comm.; [2]Source: Davis and Valkenburg 1979, Reynolds 1982, Carroll 1992, 1993, G. Carroll, Alaska Dept. of Fish and Game, pers. comm. [3]Source: Cameron and Whitten 1979, Whitten and Cameron 1983a, Garner and Reynolds 1986, Cameron et al. 1989, Valkenburg 1992, 1993, Fancy et al. 1992; [4]Source: Skoog 1968, LeResche 1972, Bente and Roseneau 1978, Whitten 1984, 1986, 1992, 1993, Whitten and Cameron 1984, Garner and Reynolds 1986, Fancy et al. 1992, P. Valkenburg, Alaska Dept. of Fish and Game, pers. comm.; [5]Source: P. Valkenburg, Alaska Dept. of Fish and Game, pers comm.

study area (KSA), the Prudhoe study area (PSA), and the eastern study area (ESA) (Fig. 1). The KSA contains newer and less concentrated oil field infrastructure than the PSA and was only surveyed in 1991. The PSA was surveyed annually from 1990–1995, and contains the Prudhoe Bay oil field. The eastern boundary of the PSA was designated as the eastern channel of the Sagavanirktok River because this has been identified as the boundary between the east and west segments of the CAH (Cameron and Whitten 1977, Cameron et al. 1983, Lawhead and Curatolo 1984, Lawhead 1988, Lawhead and Murphy 1988, Lawhead and Smith 1990). The ESA was designated as the area surveyed east of the Sagavanirktok River. The KSA and PSA are within the area used by the west segment of the CAH, and the ESA is within the area used by the east segment of the CAH.

The areas surveyed (km^2) were the same for all years for the PSA, and varied annually for the ESA. The KSA was surveyed only in 1991. For analysis of the post-calving period, only surveys conducted between 20 June and 18 August were used. Calving is usually completed by mid-June (Gavin 1980, Cameron et al. 1984, Smith and Cameron 1990) and most caribou have left the study areas by mid-August. Surveys consisted of low-level flights with complete coverage of the study areas. Caribou were classified as bull, cow, yearling, calf, or unclassified. Because calves are readily identified by their small size, unclassified animals were most likely adults or yearlings. A complete description of survey methods and data for all surveys were provided by Pollard et al. (1996 a).

We calculated the area of each study area using the 1:63 360 Beechey Point Quadrangle topographic digital base maps using both ARCINFO™ and MAPINFO™ geographic information systems (GIS). Areas of lakes and ponds which were large enough to be identified on 1: 63 360 scale maps were subtracted from the study areas. Caribou density was calculated by dividing numbers of animals by the study area. For an annual measure of density, the mean density for all surveys for each year was calculated and graphed for each year. We chose this instead of total density (total animals for all surveys/area) because there were unequal numbers of surveys among years and study areas, and the number of animals would be biased upward in the areas and years with more surveys. We compared density for ESA, KSA, and PSA with one-way factorial analyses of variance (ANOVA) (Zar 1984). We also compared densities between study areas for each year with both parametric (*t* test) and non-parametric (Mann-Whitney U test) methods. Summer range densities for the entire CAH and other herds were obtained from the literature (Cronin et al., in press, P. Valkenburg, Alaska Department of Fish and Game [ADF&G], pers comm.) for comparison with densities in our study areas.

RESULTS

Annual mean numbers of caribou in the PSA ranged from a low of 630 in 1994 to a high of 4,233 in 1992, with an overall 6-year mean of 2,011 caribou per year (Table 1). The variability in numbers among surveys was large, with a high 12,350 on the 10 July 1992 survey, and a low of 16 on the 19 July 1995 survey (Pollard et al. 1996 a). Overall numbers were relatively high in 1992, moderate in 1990, 1991, and 1993, and low in 1994 and 1995 (Table 1). The area of the PSA was the same in all six years (984 km^2), so the relative trends in densities mirrored those for total numbers of caribou. Mean densities were highest in 1992 (4.3 caribou/km^2), 1993 (1.7/km^2), 1991 (1.4/km^2), 1995 (0.9/km^2), and 1994 (0.6/km^2)(Fig. 2, Table 2). The six-year mean density was 2.0/km^2. There were no significant differences in density among years within the PSA (p=0.437).

The KSA was only surveyed in 1991. Numbers of caribou were high on all surveys (range = 1,856–11,025), relative to the PSA that year (Table 1). Mean density for the KSA in 1991 was 4.1/km^2 (Fig. 2, Table 2). This was considerably higher than the PSA 1991 density, and similar to the highest PSA density (4.3/km^2) which occurred in 1992.

The area surveyed in the ESA varied from 230 km^2 in 1990–1992, 578 km^2 in 1994, 922 km^2 in 1993, and 934 km^2 in 1995 (Fig. 1, Table 1). As might be expected, there were relatively few caribou observed with the relatively small areas surveyed in 1990-1992. Numbers of caribou observed on individual surveys in these years ranged from 0–902, with means of 15, 176, and 312 for 1990, 1991, and 1992, respectively. More caribou were observed in the relatively large areas surve-

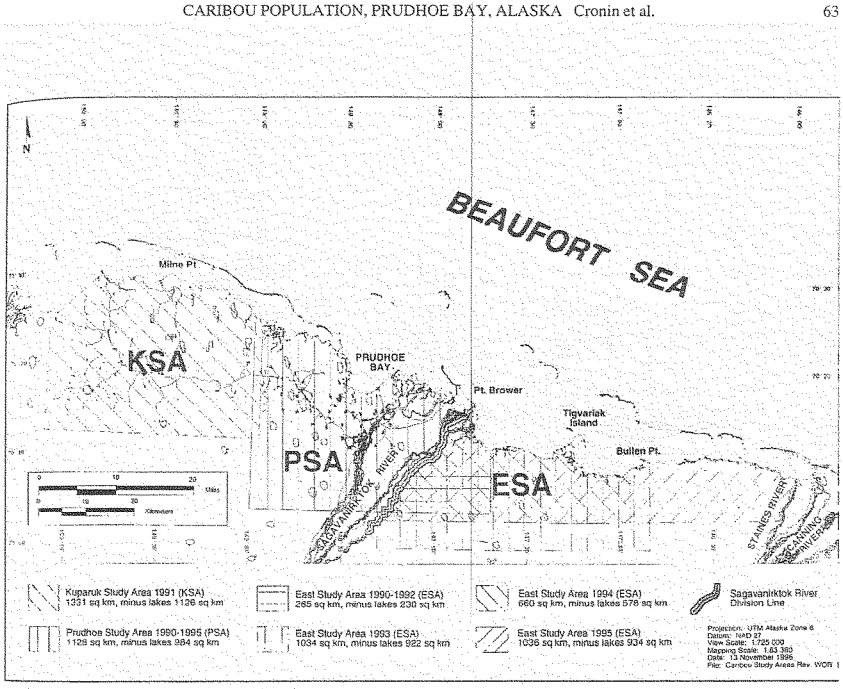

Fig.1. Caribou aerial survey study areas 1990 to 1995 around Prudhoe Bay, Alaska

yed in 1993 and 1995. Fewer caribou were observed in 1993 (range 0–582, mean 186) than in 1995 (range 5–2,426, mean 1,213)(Table 1). Densities in the ESA did not vary directly with numbers observed because of the different areas surveyed among years. Mean density was highest in 1992 (1.4/ km^2), followed by 1995 (1.3/km^2), 1994 (0.9/km^2), 1991 (0.8/km^2), 1993 (0.2/km^2), and 1990 (0.07/km^2)(Fig. 2, Table 2). The six-year mean density was 0.74/km^2. There were no significant differences in density among years in the ESA (p=0.436).

Caribou are highly mobile and move in response to weather and insect conditions (Pollard et al., 1996 a.b), so density was quite variable over the course of the post-calving period. Density was particular high in the KSA on 2 July 1991, with a lower peak between 17–24 July in the one year that surveys were done. Density in the PSA and ESA peaked during the week of 4–10 July.

Comparison of the annual mean densities for the three study areas suggested that caribou densities within the KSA were significantly higher (p<0.05) than those in the PSA and the ESA in 1991 (Table 2). Densities were significantly higher in the PSA than in the ESA in 1990 and 1993. Density in the PSA was particularly high in 1992, though the difference from the ESA was not significant. In 1994 and 1995 densities were higher in the ESA than in the PSA, but again differences were not significant (Table 2). Over the 6 year period, the overall mean density was significantly higher in the PSA than the ESA (Table 2, Fig. 2).

We also compared densities in our study areas with those for summer ranges for the CAH as a whole, and other herds (Table 3). Summer range densities for each herd varied as population sized changed. Densities of the entire CAH are available for some of the years of our study in which herd censuses were conducted (i.e., 1991, 1992, 1995). The highest density for the entire CAH (1.4/km^2) was in 1992 when the population peaked at 23,400 animals (Table 3). Densities in the PSA and ESA were also highest in 1992. The density in the PSA in 1992 was higher than, and in the ESA equal to, that for the CAH as a whole (4.3/km^2 for the PSA and 1.4/km^2 for the ESA)(Table 2).

Between 1991 and 1992, the density of the entire CAH increased from 1.1/km^2 to 1.4/km^2 (Valkenburg 1992, 1993), a trend also observed in our surveys of the PSA and ESA (Table 2). Our surveys revealed higher densities in 1991 and 1992 for the PSA and KSA than the entire CAH, and lower (1991) or equal (1992) densities for the ESA than the entire CAH.

In 1995, the density of the entire CAH was 1.1/km^2, as the herd declined to 18,100 animals. In this year the earlier trends were reversed, as the ESA had a higher density (1.3/km^2) and the PSA had a lower density (0.9/km^2) than the CAH as a whole. These results are consistent with observations that the west segment of the CAH declined, and the east segment of the CAH increased between 1992 and 1995 (Rinehart 1995; P. Valkenburg, ADF&G, pers. comm.).

DISCUSSION

The results of our analyses, and Alaska Department of Fish and Game census data (Table 4), are consistent in demonstrating a reduction in number and density of caribou in the west segment, and an increase in number and density in the east segment of the CAH between 1992 and 1995. However, determining the cause for these changes may be impossible based on existing data. As indicated earlier, loss of habitat, displacement to inferior foraging areas, or disruption of movements caused by the oil fields may result in reduced productivity in the west segment. However, the existence or extent of these effects is not definitive. In considering other potential causes it is instructive to consider the numbers in the east and west segments (Table 4). The west segment declined by 8,383 caribou, or 56%, between 1992 and 1995 (Table 4). Over the same time period, the east segment increased by 3,032 caribou, or 35%, and the CAH as a whole decreased by 5,351 caribou, or 23%. Assigning causes for the decline in the west and increase in the east segments is highly speculative, but several potential explanations exist.

First, higher mortality within the west segment could be one explanation for differences between east and west segments. Mortality may be from human hunting, predation, or winter weather conditions. We have no data to assess these factors in the east and west segments of the CAH. The segments are thought to mix after the post-calving period for the remainder of the year, so presumably winter conditions and subsequent predation would be the same for both segments. Numerous grizzly bears (*Ursus arctos*) occur in the PSA (R. Shideler, pers. comm.), so there is considerable potential for summer predation at least in the west segment. However, we have no data on summer predation on the west or east segments of the CAH.

A second cause for the decline of the west segment may be reduced calf production. As mentioned previously, there is some evidence of reduced reproduction in female caribou in the west segment of the CAH. This may be due to negative effects of the oil fields, but population density or habitat quality differences between the east and west segments are other possibilities (Ballard and Cronin 1995, Cameron 1995). Density in the west segment (in the KSA and PSA) was relatively high from 1990–1993. The differences in density compared to the ESA were statistically significant in 1990 and 1993. In 1992, 12,350 animals were observed within the Prudhoe Bay oil field on one day, 10 July (Pollard et al. 1996 a). This was 83% of the entire west segment for that year. Density in the PSA was lower than that in the ESA during 1994 and 1995, though differences were not significant. It would be highly speculative to suggest that the high density between 1990–1993 was responsible for the decline of the west segment. However, other herds have exhibited lower growth rates at high densities (e.g., Messier et al. 1988, Couturier et al. 1990), and June calf survival has been correlated with calving density in the adjacent Porcupine caribou herd (Russell and Griffith 1995). Habitat differences between the east and west segments may also have influenced calf production, but this has not been investigated.

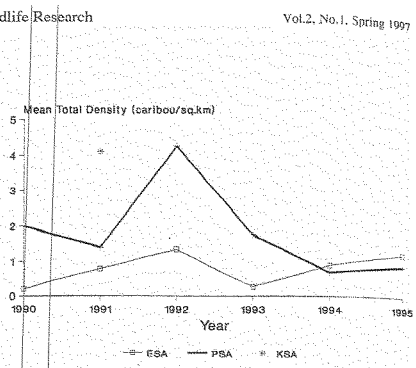

Fig. 2. Mean annual density of caribou within the PSA (Prudhoe Study Area), The ESA (East Study Area, and the KSA (Kuparuk Study Area) during the post-calving period.

A third possible cause for the decline of the west segment of the CAH could be intersegment movement of animals from the west to the east segment, either before or after the calving period. Several authors have referred to east and west segments of the CAH, separated by the Sagavanirktok River during summer (e.g., Cameron and Whitten 1977, Cameron et al. 1983, Lawhead and Curatolo 1984, Lawhead 1988, Lawhead and Murphy 1988, Lawhead and Smith 1990). This claim originally was based on low frequency of east-west crossings of the

Table 4. Numbers of carbou in the east and west segments of the CAH, 1992 and 1995.

Year	Source	East segment	West segment	Total CAH
1992	Valkenburg 1993	8,602	14,842	23,444
1995	Valkenburg, pers.comm.	11,634	6,459	18,093
	Change	+3,032 (35%)	−8,383 (56%)	−5,351 (23%)

Sagavanirktok River and Trans-Alaska Pipeline corridor by caribou (Cameron and Whitten 1977). More recently, the two-segment hypothesis has been based on the locations of two calving areas, one on each side of the river and on observations of post-calving movements and distributions (Lawhead and Curatolo 1984).

The best data for understanding the relationship between the two segments are from radio-collared caribou. Studies of radio-collared caribou by Lawhead and Curatolo (1984) and Cameron and Smith (1988) indicated that there is a tendency for CAH caribou to remain on one side of the Sagavanirktok River or the other (i.e., within the same segment) throughout a summer, although interchange does occur. Telemetry studies have shown one of seven yearlings spent the summer in a different segment than its dam in 1983, and three of 27 cows calved in one segment and summered in the other that same year (Lawhead and Curatolo 1984). Caribou of the CAH also tend to return to the same segment each year, but inter-year fidelity is apparently weaker than intra-year fidelity. Seven of 27 radio-collared caribou spent summer 1983 in a different segment than they did in summer 1982 (Lawhead and Curatolo 1984).

Considering the aforementioned observations the following calculations can be made. Movements between the east and west segments were recorded for a total of 4 of 34 (11.8%) animals in summer, 1983. Inter-year movements between the east and west segments were recorded for 7 of 27 (25.9%) animals between 1982–1983. Using the mean herd size for the CAH between 1992 and 1995 (20,769) estimates of the potential emigres between the segments for the three year period would be as follows:

A. intra-summer,

0.118 X 20,769 = 2,451 animals per year X 3 years = 7,352 animals

B. inter-year,

0.259 X 20,769 = 5,379 animals per year X 3 years = 16,137 animals

If we consider that over the 3 years the net loss for the west segment was 8,383 animals and the net gain for the east segment was 3,032, these calculations suggest that inter-segment movements could have contributed substantially to the changes in numbers in each segment. This would require primarily west-east movement as the east segment increased and the west segment decreased. Again, it would be highly speculative to suggest that the high densities in the PSA in 1992 and 1993 were responsible for such one-way movements, although others have reported range changes or expansion of caribou in response to density increases (Messier et al. 1988, Couturier et al. 1990). For example, in the Kaminuriak Herd in Canada, Heard and Calef (1986) reported that immigration probably resulted in an increase of breeding females in the herd from 13,000 in 1980 to 41,000 in 1982, and an increase in the overall herd size from 39,000 in 1980 to 180,000 in 1982.

It is also possible that inter-herd movements contributed to the changes in numbers of the segments of the CAH. Emigration and immigration can potentially influence caribou herd demographics, although there is not a consensus of their importance (Skoog 1968, Haber and Walters 1980, Whitten and Cameron 1983, Klein 1991). The CAH may mix in the winter with the WAH and PCH (Cameron et al. 1986), and exchange of animals is possible. In addition, the east segment of the CAH may mix with the PCH during the post-calving period. Indeed, no census was successfully conducted on the CAH between 1984–1990 because the east segment of the CAH mixed with the PCH in July (R. Cameron, pers. comm. in Pollard et al. 1992). In addition, in July 1988 radio-collared animals of the PCH and CAH overlapped by more than 140 km (Fancy et al. 1989). This herd overlap does not necessarily result in exchange of animals between herds, but it is possible. Data for radio-collared caribou of the CAH and PCH suggest inter-herd movements of perhaps 1% to 9% (Whitten and Cameron 1983b, Cameron et al. 1986, Whitten et al. 1992). This degree of herd interchange, and genetic data (Cronin et al. 1995), suggest that over many generations there is considerable gene flow among Alaska caribou herds, which may constitute a single breeding population (Skoog 1968, Whitten and Cameron 1983b).

These observations indicate that there is considerable potential for immigration and emigration between the east and west segments of the CAH, and between the CAH and other herds. This suggests that studies which compare characteristics of individuals within and between the segments may be dealing with non-independent groups. In addition, such movements could account for the changes in numbers of the CAH. A thorough herd-level assessment of movements between the east and west segments would be desirable to address this issue.

Considering the preceding discussion, it is important to note that effects of various factors on caribou populations are complex, and often inter-dependent (Klein 1991). For example, winter weather, oil field disturbances, inter-segment or inter-herd movements, and insect harassment may all be exacerbated at high herd densities. Wolf predation may have a greater effect on caribou herd growth at low densities than at high densities (Haber and Walters 1980), while extreme weather conditions may affect herds differently, depending on density (Heard and Ouellet 1994). It is also possible that dispersal or range changes among caribou herds occur at high population densities (Skoog 1968, Haber and Walters 1980, Tyler and Oristland 1995). It follows that factors affecting the west segment of the CAH may also vary with population density. Although the oil fields may affect the productivity of the CAH, there are many other factors which must be considered. We suggest that the concept of "oil field impacts" be put in the context of all relevant population characteristics, and single factor cause-effect explanations be avoided.

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The CHAIRMAN. Thank you, Dr. Cronin.

Thank you to each of you for your testimony here this afternoon. We will now have an opportunity for some questions.

It was stated by my Ranking Member at the outset of the Committee that in her view things have not changed, not much has changed. And you know, I think some of the arguments against ANWR, that is true. Those arguments are still the same that many of us recall from a long time ago.

But what I have heard today is a recognition that we really have seen change in the seven years since this Committee has last considered the prospect for the 1002 Area. The technology, as Mr. Schutt outlined, has changed considerably.

But I also think that the data, the science, the research that has been collected over the 40-some-odd years that we have been operating up North can better inform us. And you mentioned mitigation, Dr. Cronin, you mentioned those technologies. Mr. Glenn, you speak of the caribou and the fact that the caribou are around the camps. They are on the roads. They are not deterred by manmade activities. Now we recognize that that is not while they are calving. That is clearly a more sensitive time.

But I would like a little more discussion here, just in terms of how we are utilizing the science that we have collected to be better stewards of the wildlife, the infrared that is being used to detect polar bears in a den and how we are avoiding contact or disturbance and again, some of the other mitigation measures.

The proposal was made that perhaps there might be some form of co-management of caribou if we are to move forward with the 1002 Area. I would like to open up that discussion, if I may. Let's start off with you, Richard.

Mr. GLENN. Thank you for the question, Senator Murkowski.

As Dr. Cronin stated, the issue of timing comes out strongest and the exploration, of course, of the Coastal Plain, would happen in the winter which is not a calving season. And so, there's already——

The CHAIRMAN. Before you move on, I think it is important for colleagues to understand when we talk about exploration in Alaska in the wintertime, it is not because we like to be out in the cold and the dark.

Mr. GLENN. Right.

The CHAIRMAN. It is because we are required to do exploration during this period. If you might address that as well.

Mr. GLENN. The Navy began exploring for oil and gas on the North Slope in the 1940s and they discovered very quickly that the summertime which is when a lot of exploration happens in warmer climates, is not the time to try to move about on the tundra because everything you do that needs heavy equipment gouges itself into the thawed-out surface.

And so, over a few short years of learning the hard way, the industry tailored its practices to operate in the winter when the ground is frozen so that even if there was no snow cover and no ice road, for example, the tundra kind of protects itself by being in a frozen state. That's just the general paradigm of exploration the way that it exists today.

Flash forward to today. In addition to those hard lessons learned, they developed ways to explore with seismic and drilling on ice roads and ice pads that further insulate the surface from the harmful effects of summertime disturbance of the tundra. So the calendar already dictates that the machinery is going to be around when the animals are less likely to be there.

Now my upbringing is from the central part of the Arctic Slope where sometimes caribou are around year-round. I've hunted—in fact, those of us who live from Fairbanks northward, we're caribou connoisseurs. We know when the marrow changes flavor. We know when the fur is the best. We can tell the difference between pregnant and non-pregnant cows, for example. And calving is a special time. And if you're a caribou hunter you know that a mother caribou that's already carrying a calf inside her, she wants to lay down. And she'll lay down anywhere as long as she's not being threatened by something. And it's the pregnant caribou that shows the least, I don't know. Dr. Cronin might know better than me, but I've hunted a lot of caribou and when they run away from you, the pregnant cows are the ones that still stay laying on the ground or for some reason run away and come back. And so, the nature of a caribou carrying her calf is different than regular caribou behavior. All of that is this May/June timeframe when all of the exploration tools should be out of the theater.

Once development happens, if development happens, the facilities and the pipelines are constructed to minimize their effects. The pipelines are elevated so caribou can walk unimpeded underneath the pipelines. And the facilities are concentrated under small, focused pads. There's a lot of stuff happening on one piece of gravel, and the caribou are free to do whatever they need to do on the undisturbed tundra that surrounds the pads.

The CHAIRMAN. Thank you. I am over my time.

Let's go to Senator King.

Senator KING. Thank you.

Dr. Cronin, it is intimidating that you cite my own words. Literally, scores of people watched that presentation online.

[Laughter.]

So let me go back to some of the questions that I asked before and, Mr. Schutt, maybe you can answer this. I think I have discerned the answer. It is not 2,000 contiguous acres, is that correct? It is 2,000 acres made up of lots of little pieces.

Mr. SCHUTT. It would certainly not be 2,000 contiguous acres.

Senator KING. So, the drilling is not limited to one 2,000-acre square in this large area?

Mr. SCHUTT. I have to say I've never seen the geology. It's not publicly available to people like me. But the size of oil fields is many thousands of acres or hundreds of thousands of acres, if you're talking about billions of barrels of potential oil and to recovery that there would certainly be several small pads, maybe one or two medium-sized pads. We're talking 10-acre drill sites or 12-acre drill sites and maybe a few central drill pads that are a couple hundred acres that have the——

Senator KING. But there would have to be, I presume, to get the oil out, there would have to be pipelines, right, from each pad, each drill site?

Mr. SCHUTT. For sure you have to have a way to transport from the drill sites to some central location.

Senator KING. And the way to transport is a pipeline.

Mr. SCHUTT. Yes, sir.

Senator KING. That would be easier to say than a way to transport.

So we are talking about a pipeline. In terms of the 2,000 acres we are only talking about the feed of the pipeline. Is that correct, not the shadow of the pipeline that is above the ground?

Mr. SCHUTT. I don't know that part, but I heard that for the first time today.

Senator KING. And how many wells would you be talking about in an area like this? Someone mentioned 500 wells. Is that—what are we talking about here?

My calculation was a couple thousand to get out ten billion barrels over ten years.

Any——

Mr. SCHUTT. I'm not the right person to answer that.

Senator KING. Do you know what the production is of that, of your well, 1H-102, the one you had the chart on?

Mr. SCHUTT. That well was finished in the last month, so I don't have production data. It's not my well either, it's our client's well. We drilled it for them.

Senator KING. So give me a production for a typical well that you have in service.

Mr. SCHUTT. Again, we drill a lot of wells for our clients, and I'm not the one to ask. There's a huge range. Some of the wells we drill are not production wells. They're injectors or other types of wells.

Senator KING. Well, you see what I am trying to get at here is how many wells are we talking about in this space? Is it 10, 100, 1,000, 2,000?

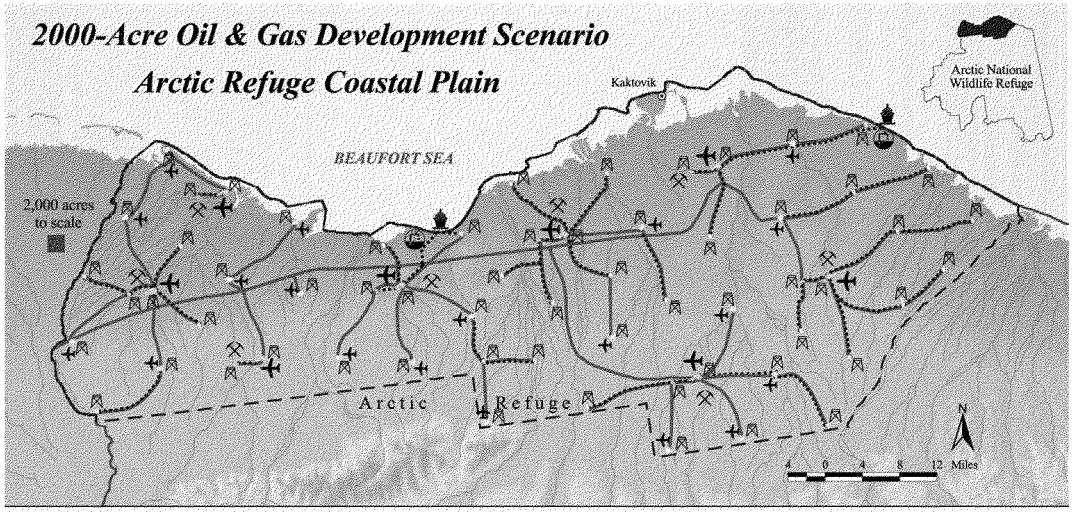
Mr. SCHUTT. It would be hundreds over time to develop a billion-barrel field, if that's what's there. If it's much smaller, it could be 50 wells.

Senator KING. Okay.

I would point out, Mr. Glenn, you characterized this as a cartoon. This shows 50 wells, and I don't take much from the size of the little well thing, but that only shows 50 wells.

If we are talking about 100 or 500, you are talking about a lot more dots on this map. Is that correct?

[The information referred to follows:]



This speculative development scenario is based on the 2,000-acre "limitation" in the House Energy Bill (H.R. 6).

It makes these assumptions:
Industry has 4-mile directional drilling reach from Drill Sites

Facilities included in the 2,000-acre maximum:

- 8 Alpine-type fields @ 82 acres each (Central Processing Pad with housing, storage, drilling; second Drill Site; airstrip)
- 19 Satellite fields like proposed Alpine satellite, Fiord @ 37 acres each (Drill Site, airstrip or storage pad)
- 26 Satellite fields like proposed Alpine satellite, Nanuk @ 11 acres each (Drill Site)
- 2 Docks @ 5 acres each (1,100 foot long solid-fill gravel causeway like Badami)
- 2 Seawater treatment Plants @ 100 acres each

Facilities not subject to the 2,000-acre limitation:

- Roads (in-field roads; main roads to docks, etc.)
- Pipelines (main trunk and sales lines, feeder lines; except negligible amount for support posts (VSM's))
- 8 Gravel Mines @ 150 acres each

Facilities and activities not subject to the 2,000-acre limitation that are not mapped:

- Seismic exploration trails
- Exploration and delineation wells
- Water reservoir excavations, Water withdrawal sites
- Ice roads

- Arctic Refuge Coastal Plain (1002 Area)
- Arctic National Wildlife Refuge

Mr. SCHUTT. Senator King, we can drill 50 wells from a 10-acre drill pad.

Senator KING. Okay, so you are considering a multiple, the chart, that you are calling those separate wells? Is that correct?

Mr. SCHUTT. I'm not——

Senator KING. You are saying each line is a separate well, that those—I am just trying to understand this.

Mr. SCHUTT. Which chart?

Senator KING. You have one drill pad. The picture you put up of the—you said you can do ten laterals.

Mr. SCHUTT. That was a penta-lateral well.

Senator KING. Right, which is five.

Mr. SCHUTT. Which means there are five production wellbores off of one single surface location.

Senator KING. Right.

Mr. SCHUTT. Each single well off of the surface.

Senator KING. So each one of those you would call a well even though there is only one surface?

Mr. SCHUTT. That's correct.

Senator KING. Five.

Mr. SCHUTT. Technically for those in the industry, those are five wells. Yes, sir.

Senator KING. Well, I think it is important as we work through this to try to understand if we are talking about ten billion barrels over some period of time, what is the period of time and what does that imply in terms of the number of wells and how many penta-laterals are there? I am trying to determine what we are really talking about here on the face of the Earth. And that is what I am searching for. I think you answered my question. The calving period is the spring or the summer?

Dr. CRONIN. Yes, sir. The end of May and first few weeks of June.

Senator KING. Another question, I guess Mr. Schutt, you are the guy to try to answer this.

Is there anything special about this 1002 Area in terms of oil and gas? There is this—I looked on the map that Senator Sullivan gave us and there is this huge area that is set aside for oil and gas drilling, much larger than this area. Do we have indications that this is an extraordinarily rich area that we are talking about, this part of ANWR?

Mr. SCHUTT. Senator, I'm probably not the expert you need on that question. Although, certainly the outcrops of the sandstone reservoirs that are producing at Prudhoe Bay and the source rocks that caused the oil to be at Prudhoe Bay are similar or the same.

Senator KING. What I am getting at is we are talking about a special area here that has been set aside for a long time, and we are saying we need to drill here. And what I am trying to determine is, is this area particularly productive or could we not drill in some of the other areas that are literally called the oil and gas drilling area?

Mr. SCHUTT. I'm going to start with a slight aside, Senator.

Senator KING. Yes.

Mr. SCHUTT. I've heard people refer to a special area which I do not want to minimize at all, but many areas of Alaska are special.

Those of us who grew up in different parts of Alaska call our own section of Alaska, God's Country, without minimizing the fact that all of Alaska is God's Country.

Senator KING. You are incorrect on that. My town in Maine is truly God's Country.

[Laughter.]

I know exactly—I take your point though, thank you.

Mr. SCHUTT. With regard to the question about oil prospectivity, there is a difference between what the USGS says about the NPR-A and the likely fields you might find there through exploration and the scale of what might be available in the 1002 Area and they're orders of magnitude different.

Senator KING. I think that is important for us to know. Thank you.

Dr. CRONIN. Yeah, Senator King, I was just going to add that I think USGS would be a good source for very specific information on the resources that they predict either in the 1002 or the NPR-A.

Senator KING. Thank you.

Thank you, Madam Chair.

The CHAIRMAN. Senator Cantwell.

Senator CANTWELL. I am going to defer to my colleague who has been here waiting.

The CHAIRMAN. Okay. Alright.

Senator CANTWELL. Thank you.

The CHAIRMAN. We will next turn to Senator Cortez Masto.

Senator CORTEZ MASTO. Thank you. I appreciate that.

Let me just follow up on the line of questioning from Senator King, because I am now getting a little confused.

So if I understand this correctly, section 1002 we are looking at is opening up the Coastal Plain for drilling and that is 1.57 million acres. Is that true? So I am—and that is yes? Your understanding? Yes. So I am confused as to where the 2,000 acre limitation comes from. I think this is referring to a House Energy bill, H.R. 6, which is not before us, and so I am not sure what all of that means. But I do want to get a better understanding if we are talking about drilling in 1.57 million acres, which is the Coastal Plain. I do want to get a better understanding of how many pads we are talking about. How many drill pads?

And I think, from my perspective, it would help to have a better understanding in the NPR-A. How many drill pads are there right now and how many more potentially can you—how much more drilling can occur there at the NPR-A and why isn't that occurring instead of opening up the Coastal Plain? And I will open that up to whomever we want to start with, please.

Ms. EPSTEIN. Thank you for the question, Senator.

I work both on the NPR-A as well as the Arctic Refuge. And in the NPR-A, historically, there have been both high numbers in terms of how much likely oil and lower numbers more recently.

But now there is a reassessment going on and there have been some new discoveries. That's why I made the point that, in fact, the slope of the oil going through the Trans-Alaska pipeline is going up. There are new discoveries and there are new ways of getting into existing reserves that are increasing, which is good. It's

good for Alaska. I'm an Alaskan. I think that's good. Drill in less sensitive areas as you both are referring to.

USGS is looking at the NPR-A right now, and there's a lot of activity around that in terms of coming up with a new estimate which may actually show quite a bit. There's not much data for the Arctic Refuge right now.

Senator CORTEZ MASTO. Okay.

There is potential still to—we are waiting for the data for the NPR-A to make that determination.

How many drill pads are there now?

Ms. EPSTEIN. There's the CD–5 one and there—Conoco Phillips is working on Greater Mooses Tooth, a new project and then they have a new discovery that's just beginning the permitting process in the Willow Area, but it could be quite large. They're trying to delineate that.

And one more very quick point. We had quite a bit of discussion about balance on the last panel and the fact that the North Slope is a large landscape and the points you're making about drilling in the NPR-A, we think that really does represent balance. That's where some areas are open for development. Some areas are not because they are quite sensitive. Certainly, there's a lot going on in the state lands right now and that's also considered by us and others, less sensitive. And that's fully appropriate.

Senator CORTEZ MASTO. Okay.

And then just to get a better understanding—and thank you for the graphs because that helps really, kind of, put it in perspective, what we are talking about.

If I understood correctly, each pad has the potential of having more than one drill hole or whatever you want to call it, right? And then from that drill hole comes the various wells and there could be more, four to five or six wells from just one borehole. Is that correct?

Mr. SCHUTT. You're asking very technical questions, and I don't have any technical——

Senator CORTEZ MASTO. I am just going off your graphs. So that is what it looked like to me.

Mr. SCHUTT. That's one.

Senator CORTEZ MASTO. Okay.

And so, each drill pad—and so, you talk about the size of your drill pads and over the course of time with new technology, they decreased in their footprint. And it looks like from 65 acres now to potentially 12 acres.

So how many of those boreholes could potentially come from a 12-acre pad? And if you don't—you may not technically be able to answer that, and I will figure out another way to get that answered. I am just curious if you know.

Mr. SCHUTT. I sound like a lawyer here, but it depends, but you can assume from a 12-acre pad that dozens of surface boreholes can be drilled and then, if appropriate, multi-laterals out of those that would count as additional wells.

So, you know, somewhere between 10 and 100, depending on the appropriateness of the design, just as a rough ballpark.

Senator CORTEZ MASTO. Okay.

Please go ahead if you have any comments.

Mr. GLENN. Thank you. You gave half of the answer that I was going to give, but also it probably helps to put in perspective the order of events.

If the Coastal Plain is open to exploration, seismic exploration starts and it comes and it goes away. And then targets are established. And then exploration drilling occurs on ice pads, and the rules about drilling exploration wells are to plug and abandon it when you're done, cut the casing below the surface so it disappears when you're done with exploration.

In the event of discovery, then you move into the paradigm that you're talking about with pads on the ground and radiating outward from the reservoir as discussed by Aaron.

So there's things that have to happen. Exploration should occur everywhere and then we should make reasonable decisions about development when it happens. So there are two different aspects to drilling, exploration then development.

Senator CORTEZ MASTO. Thank you.

Thank you very much. I notice my time is up, I appreciate that, Madam Chair.

The CHAIRMAN. Thank you.

Senator Heinrich.

Senator HEINRICH. Thank you, Madam Chair.

I am going to go back to this chart again because while it may be just, you know, effectively it is just an illustration. But having some experience with development in the Permian Basin and the San Juan Basin, and having seen the development around Prudhoe Bay, I would just note for my colleagues that with, at least the ungulates that I am familiar with, like mule deer and antelope, it is not the well pads that typically are the substantial part of the disturbance and which can impede the movement of wildlife. It is everything that comes with those well pads: it's the roads, it's the gravel mines, it's the electrical transmission, it's the pipelines. And the more linear barriers you put in the face of any sort of migration, the less likely that migration is to occur.

So rather than look at an illustration, I would just suggest, maybe, all of us or our staff can do a little search on Google Earth and go look at what Prudhoe Bay looks like, having flown over that because, you know, it is not the well pads that got my attention. It is all those other linear obstacles to migration.

I have a question for Ms. Epstein. One of my frustrations with this process is that we are doing this through budget reconciliation and in the context of a budget bill, rather than a regular legislative process. I assume we are doing that because it would be difficult, if not impossible, to pass this as stand-alone legislation and get 60 votes for it.

But one of the requirements of that budget process is that we produce $1 billion of new revenue over the next two years. A new report out this week casts some serious doubt on whether that is realistic.

Can you walk us through some numbers and talk about what would be necessary, in particular, in terms of reasonable bonus bids because that is the most likely income to come in, in the first ten years, and whether or not we could hit that target or not, or what a realistic estimate might be?

Ms. EPSTEIN. Thank you, Senator Heinrich.

I would say that I share your frustration about the speed of this process and the inability to get all the information that decision-makers need, the Senate needs, to make a responsible decision.

Just as an example, I have—my colleague, a senior ecologist, has quite a number of responses to Dr. Cronin's testimony that I think would be very beneficial and we will submit that to the Committee. And that would be important so that you would have a full picture of the actual nature of the caribou development and relationship, as well as polar bears.

Senator HEINRICH. You have to add that to the record.

Ms. EPSTEIN. Yes, thank you. In terms of directly answering your question, I can partly answer.

With the price of oil being what it is now, in the $50 a barrel range, Alaska is not terribly attractive in new areas to oil companies and, at the same time, we have lots of shale oil development in the Lower 48 that is more inexpensive. So the idea that they would pay extra and go for bonus bids to be sure they had a piece of this very controversial area that a lot of companies would actually even shy away from is unlikely.

I just participated in a National Academy of Sciences oil-related committee on Thursday and Friday and I talked to some of my industry colleagues about the Arctic Refuge. And one comment I heard was that if this was likely to be as productive, you know, there would have been a lot more activity, more wells previously.

Senator HEINRICH. My calculations are that it would have to be a little over $1,300 an acre in terms of bonus bids which is about six times that historical average.

Ms. EPSTEIN. Right.

Senator HEINRICH. I don't have a ton of time left. I guess I will just end with this.

I guess we have to come up with $1 billion, but we produce a lot of oil and gas in the State of New Mexico. There are some places we will never, ever drill: the Valle Vidal or the Bosque del Apache National Wildlife Refuge. I think we need to be careful about what doors we are opening today because we will not be able to undo this once a substantial reserve is found.

And to find that $1 billion, I would never advocate mining for uranium in the Grand Canyon or doing geothermal resources in Yellowstone, and having been to the Refuge, it is a wildlife refuge. That is why it is called the Arctic National Wildlife Refuge. It is not a petroleum reserve and we should remember that.

The CHAIRMAN. Thank you, Senator.

Senator Duckworth.

Senator DUCKWORTH. Thank you, Chairwoman Murkowski and Ranking Member Cantwell, for convening this very important conversation.

I also want to thank our witnesses who traveled far to join us for today's hearing.

One of my priorities in the Senate is working to expand economic opportunity for working families in Illinois and across the nation. I know that every state faces unique challenges when it comes to supporting existing industries and creating new jobs, and I recog-

nize how important the oil industry has been to the Chairwoman's home State of Alaska.

However, when it comes to dramatically expanding oil extraction operations in areas like the Arctic National Wildlife Refuge, I have serious questions concerning the potential for catastrophic incidents that could inflict irreparable harm. If the tragedy of Deepwater Horizon should teach us anything, it is that difficult and tough questions must be addressed before approving any massive expansion of drilling operations. For when we are discussing oil extraction at the scale and vision in this Republican budget, it is not a matter of if an oil spill will occur, but rather a matter of when and how bad will it be.

We have heard a lot about advances in directionally drilling today. Setting aside the engineering jargon, Ms. Epstein can you explain in plain English if it is more dangerous to drill in the Arctic and why?

Ms. EPSTEIN. Thank you, Senator, for the question.

The Arctic is remote. There aren't a lot of additional resources if there are problems. Those have to be brought in, flown in. That has happened when we've had a blowout. Just this last spring, BP, a well resource company, had something unexpected happen, the permafrost around an old well, so you think that they knew what was going on was fine. And that resulted, not in an enormous oil spill, but quite a serious safety situation which is of concern to operators and their employees. Absolutely.

So we have had situations where it is frigid and cold, and you can't work then. So you need a lot of very specific Arctic expertise. It is, very much, an area where you need to know what you're doing.

Senator DUCKWORTH. Thank you.

I understand that the State of Alaska completed a report in November 2010 which reviewed over 6,000 North Slope spills from 1995 to 2009. Analysis of this report indicates there was an oil spill of 1,000 gallons of oil or more nearly every two months from 1995 to 2009.

Ms. Epstein, when the oil spills and we have to clean it up, again, is the oil spill cleanup more challenging in the Arctic compared with drilling on land elsewhere? And if oil spilled in the area of debate today, what would the effects of that spill be?

Ms. EPSTEIN. Thank you for that question.

It would depend a bit about the time of year. If you had an oil spill in winter and it landed just on frozen tundra you might be able to clean it up quickly. If you had a spill that ended up in a waterway, however, and flowed into the, say the Colville River and onward into the Beaufort Sea—tremendous impacts to the ecosystem. These are fragile areas. The water is only flowing some of the year so that's when all the biology, all the activities take place. It would be quite damaging.

Senator DUCKWORTH. Is there new legislation we could consider that would make drilling in the Arctic safer and less prone to spills?

Ms. EPSTEIN. The best we could do is tweak it.

We're going to have spills. We're going to have—it's a complicated industry, hard to be on top of everything all the time. At

the same time, companies are trying to minimize costs. So it's very tough. We can't prevent spills. There's no evidence that—I don't think you'd find anyone from the industry that said, that can say we will stop all spills.

Senator DUCKWORTH. Thank you.

Mr. Alexander, I just want to start off by saying that the Alaskan First Peoples are some of the—have served our United States military at rates per capita far greater than so many of our other population and with extreme courage and dedication and just want to thank all of the representatives of the First Peoples here today for that.

Mr. Alexander, is your community alone in its concerns or are your fears shared by other tribes? Can you please remind us what the stakes are if your people can no longer depend on caribou and subsistence hunting?

The CHAIRMAN. Senator?

Senator DUCKWORTH. Oh, I am sorry.

The CHAIRMAN. Mr. Alexander was part of the first panel.

Senator DUCKWORTH. Oh, sorry.

The CHAIRMAN. He is not with us. Perhaps you can ask that question of him after the hearing, but I apologize for that.

Senator DUCKWORTH. No worries. Thank you.

With that, I yield back. I only have 16 seconds anyway.

Thank you.

The CHAIRMAN. Let's go to Senator Cantwell.

Senator CANTWELL. I would yield to Senator Franken.

The CHAIRMAN. Senator Franken.

Senator FRANKEN. Thank you to the Ranking Member and the Chair.

Dr. Cronin, in your research looking at caribou populations you found that they were not significantly impacted by the presence of an oil field road, is that correct?

Dr. CRONIN. Yes.

Senator FRANKEN. Thank you.

For this research did you ever receive any funding from oil companies?

Dr. CRONIN. Yes.

Senator FRANKEN. Okay.

Do you think receiving funding from oil companies could bias the outcomes of your research?

Dr. CRONIN. No, sir.

Senator FRANKEN. Did you ever consider that the same oil companies that funded your research would use your work as justification for drilling and that might have been a motivation of theirs?

Dr. CRONIN. Well, first of all, the data we used in—probably the paper you're talking about is a 2004 paper with Noel as the Senior Author. We used the Alaska State Department of Fish and Game data in addition to the data collected by our group.

The oil industry funded studies, sometimes as a requirement for permits or for stipulations for operating after the permits were granted, and they wanted to get pre- and post-development data in some cases or in other words, in other cases, just post-development to, in this case, look at the distribution of caribou.

So whether it was used to justify future drilling, it was always done with the intent of publishing in peer-reviewed scientific literature, which we did, and all the references that I gave in my written testimony are such.

Senator FRANKEN. Okay, well the manuscript says it was developed with support from Exxon Mobil and BP Exploration. Is that right?

Dr. CRONIN. Well, depending which paper, sure.

Senator FRANKEN. Okay.

Thank you.

Ms. Epstein, could you talk about why this Refuge was preserved in the first place? What are the distinguishing factors that make the Arctic Refuge Coastal Plain different from other areas on the Arctic Coastal Plain, and why does that matter?

Ms. EPSTEIN. Yes, thank you, Senator Franken.

One important characteristic is the Coastal Plain there is very narrow compared to further West where the Prudhoe Bay field is and that means that the area that the caribou go to birth their calves is smaller. There aren't alternatives and they go there because they receive insect relief and they also are able to avoid predators. They can see them coming, in other words. Beyond that, it is an intact ecosystem with the full range of species. It's a national treasure in a lot of ways that many refer to as America's Serengeti.

I, myself, was there just once, not related to work. I was there recreationally, and I did see enormous numbers of caribou and really felt that I saw one of the world's great migrations happening that I felt very privileged to see. And there are few special places like that in the world. It was quite beautiful. I included a personal photo in my testimony.

Thank you.

Senator FRANKEN. Well, you are right. The Arctic National Wildlife Refuge is home to many unique plant and animal species, including critical habitat for the polar bear which is listed as threatened under the Endangered Species Act and, of course, for the Porcupine Caribou that is essential, as we heard from the last panel, to the Gwich'in people.

Mr. Pourchot, as climate change continues to affect Alaska, how important will pristine areas like the Arctic Refuge be to wildlife and to indigenous people?

Mr. POURCHOT. Thank you, Senator.

I think we heard from the other panel that climate change is very real and very dramatic in the further you move north, particularly on the North Slope of Alaska.

And I think, again, other panelists have described climate change impacts on many things, of human life and wildlife. And I think that in the areas that Ms. Epstein has described for the Coastal Plain is, for example, a very finite calving area. The effects of climate change on that, you know, could be substantial.

And I think the answer, if there is one to your question, is really, we don't really know. And I think that's one of the issues surrounding this debate is in the absence of knowing things as science or fact or what the impacts may be. I think that argues for a cautionary approach.

Senator FRANKEN. Thank you.

Thank you, Madam Chair.

The CHAIRMAN. Thank you, Senator.

Senator Cantwell.

Senator CANTWELL. Well, Mr. Pourchot, I definitely agree. I find the debate that we have had so far interesting just because when I think of Alaska, I think of its great beauty and, you know, I think of John Muir and his exploration of the glaciers at Glacier Bay that made it popular and what it is today. Yet those glaciers are receding. I don't know if anybody is ready to put up a sign saying cruise ships don't bother anymore because I am pretty sure Alaska still wants them to come, but yet, that is what we are continuing to threaten here by continuing to proceed.

You are undermining not only this wildlife refuge, but you are undermining a very important way of life that is even larger than just the wildlife refuge. To me, I hold that dear but then again, those are very important elements of the northwest economy. Just because I represent the State of Washington I guarantee you, Patty Murray and I do not get to decide what happens at Mount Rainier National Park just because it is in our state. We do not get to decide that. And so, when federal land is designated, yes, we have a lot of discussion with a lot of locals, but no, you do not get to make the decision just because you represent that state.

So I wanted to ask you, there has been so much discussion about whether this wildlife refuge, in its purpose that it was created for, can coexist with oil development on the Refuge. Can it, yes or no?

Mr. POURCHOT. I would answer no and, as I said in my testimony, when you look at the purposes in statute that establish the Refuge that included wildlife in their natural diversity, that references to wilderness. Similar, the Executive Order establishing the range, the predecessor of the Refuge in 1960, talks about those same sorts of values in outstanding resources.

When you look at the 1987 report that was authorized by Congress for the 1002 Area, very emphatic references to wilderness resources, to wildlife resources. Those were also brought out in the more recent Comprehensive Conservation Plan, CCP, that was just completed for the Refuge in 2015 after four years of effort to look at the new science, look at management options, look at the purposes of the Refuge and the Refuge Administration Act and they reiterated again it was very important those natural resources, particularly wildlife and wilderness, that were really exemplified by the Refuge. And that recommendation which, it was interesting that Deputy Director Sheehan did not mention, was for recommendation for wilderness designation for the Coastal Plain of the Refuge.

Senator CANTWELL. Yes, a nice way to say about his testimony was that he was very selective.

But we have sent a letter to the Secretary and this should be clear. We should just get a yes or no answer from him about the purposes.

You gave me one today and the answer is no, and I think that is what any scientist would tell you.

So what I object to, besides the sham process that we have been going through here to hurry this through with 51 votes, is that it just ought to be clear. If people want to open the Arctic Wildlife

Refuge, you should just admit you are going to destroy the wildlife refuge.

You can't sit here and tell our colleagues and try to deny it by stacking a hearing and not giving us information and not having the scientists, that somehow that is not the case, because it is.

So you can decide you don't want the Refuge. I disagree. I think it is one of the most unbelievable things that we have on Planet Earth, not just in the United States, on Planet Earth. It is that intact. And what we are going to learn from it and continue to preserve from our heritage and our past and the wildlife that is there is just unbelievable.

People spend thousands of dollars to go to the Serengeti in Africa to look at it. Did anybody in Alaska ever think that in the near future, as the Arctic ice continues to melt that there wouldn't be people who would want to come up and visit it in a more recreational environment? To me, it is well worth preserving.

So we will see what happens when the Secretary answers our letter, but you can't have both and that is what scientists are going to tell us. And so people should just choose if they want to drill or they want to destroy, drill and destroy.

I would preserve because, as I've said before, I guarantee you we are all going to be gone in the future and it is going to be whether this great pristine place continues to give the next generation such a great, unbelievable look at what has existed on our planet before.

And I agree with the Gwich'in people that it is spiritual. It is spiritual, and we should preserve it.

Thank you, Madam Chair.

The CHAIRMAN. Well, we clearly disagree that this is an either/or proposition. It absolutely is not.

And for those of us who call Alaska home, to suggest that we would despoil our environment for short-term gain, I think, is offensive. As an Alaskan, I am offended by that.

I respect every Alaskan's opinion. I respect the fact that there are those who come from a different homeland than I might, being born down in the southeast, but I respect their views and opinions.

I think we recognize that as Alaskans we have options and our options, I think it would be at the beginning of the day and the end of the day, we all want to get to the same place, that we have an economy that will allow us to stay in the most amazing place. And whether your home is Utqiaġvik or Kaktovik or Ketchikan, we want to be able to remain there, but you have to have the ability to stay there. And when you live in a cold place, you need to be able to have the means to keep warm.

I think about Matthew Rexford's family and the generations that came before him, just one generation prior, it was a life and a lifestyle that was pretty harsh and pretty difficult and literally trying to find firewood that would come down the river to keep the family home warm.

And so, again, as we think about the choices that we have as Alaskans, we have always been in this place. We have always been in a place where we are resource rich with a small population. Our costs are high. But the effort to make sure that we can continue to remain in this amazing place has to be one where we work to

find the balance, where we ensure that we have the level of food security.

If you are from Fort Yukon or Kaktovik, you are going to rely on the caribou or the whale and probably will for generations to come, as long as we care for the land and the waters. And this is our challenge. This is our charge.

I do not think any one of us wishes to be the one that says that we allowed rape, pillage, and ruin on our land for short-term gain. That is not what this is about.

I think people forget that for 40 years now, 40 plus years, we have been exploring. We have been producing. We have been giving revenue and jobs and opportunity to Alaskans and to the country. And we have done so in a way that everybody still wants to come to Alaska. Those cruise ships and people want to come to Alaska. So if we have ignored our environment, that certainly is not apparent.

And so, we do require the highest standards, I believe, in the country; I believe, in the world. And we do that for good reason because when the exploration winter period is over we do not want to see the tracks on the tundra if the winter trail led to a place that was not going to be productive.

We are making sure that we are using our smarts and our intelligence and all that we have to develop the technologies that make some of these questions hard to answer. How can you predict how many pads we are going to need?

Forty years ago, the pad in Prudhoe was pretty significant and remains today; but nobody, nobody is talking about building another Prudhoe because we believe that even with Prudhoe-like resources, our technology will allow us to access this in a way that is more consistent with our respect for the environment. To be able to shrink that footprint, to be able to do so much more with a smaller area and to recognize what that delivers to us. So we do not know how many pads. We are not sure how many wells necessarily because the technology is evolving every single day.

To look, Aaron, at the diagram and to hear your testimony that you have one series of wells that is just in production now, one month ago, but knowing that by 2020, what you will be able to access will be so much more than what you have been, what you have put in place today, this is where the technology is taking us.

We talk about the shale revolution here in the Lower 48 and what that has done to allow us a level of energy independence that we never thought possible. It is not because that resource just materialized overnight in places where it was not, it was always there but we just use our smarts and our technology to allow us to access it better and more efficiently. That is what we are doing. That is what we are proving out in Alaska.

And Senator Heinrich challenged us all. Go to Google Earth and take a look at Prudhoe Bay. Yes, Prudhoe Bay is up there. It is still a 65-acre pad. It is. But that is technology from 40 years ago. That is what it looked like 40 years ago. That is like telling you to stick with the same phone we were using 40 years ago and compare it to what we are using today.

The statement was made that nothing has changed with the ANWR debate, and I disagree so, so, so strongly with that. The

technology has changed. Our ability to access and understand the science and the data and the research that we know and the effort that we are making, led by Alaskans who care to not only protect the environment, but to protect the animals, the wildlife, the waterfowl.

Richard, your family has been up on the North Slope for generations and on your mother's side for hundreds, if not thousands of years. I bet you still feel awe and wonderment when you see those caribou come through, thousands at a time. It is amazing. It is magical, and it is spiritual. And our challenge, our challenge, is to allow that to continue, not only for the benefit of the caribou, but for the people who live there. I just feel like so much of this discussion has taken place in the absence of those who live there.

And so, I was actually going to ask more questions, but I think we have probably taken as much time as was important to lay the record down here today. I do hope that colleagues recognize this is not an effort to do some secret maneuver in a back room. If that were the case, we would not have had a public hearing for five hours, televised, for all the world to see. If that were the case, we would not have an open markup, like we will. None has been scheduled yet, but we will have that. And we will have an opportunity to weigh in as lawmakers on whether or not we should keep that commitment, the commitment that the Governor and the Lieutenant Governor reminded us of, that commitment that when this 1002 Area, when this Area was specifically set aside for the opportunity to pursue exploration and development of our oil and gas potential, provided that certain conditions were met and the Congress approves.

Well, we have gone through this battle many times, as Congressman Young reminded us, 12 times. I believe that we are at that place that the Lieutenant Governor has reminded us, that we are at that place where we have met that balance in that our technology is allowing us to do things that were once just unimaginable. You could not even imagine being able to drill down here at the center of the Capitol and be able to reach an area out by the National Harbor. This is not drilling rhetoric as has been suggested. This is not theoretical. This is actual application. We are making it happen.

I think that is what our colleagues need to appreciate and to recognize is that change has happened for the better allowing us to be able to be more responsible as we access our resources, but to do so in a way that allows not only for the jobs and opportunity for Alaskans but to address the national security issues that Senator Sullivan has raised, to address the environmental concerns, to address our energy security needs, and to do so in a manner that allows us, as the United States, to lead, not only leading with access to a resource that we want, but leading in a way that allows for our innovation, our really pioneering in an area, is recognized.

So I thank those of you who have joined us. I want to acknowledge you, Governor Walker, for remaining through the duration of this hearing. And the Lieutenant Governor, I think, making sure that this conversation is heard loud and heard clearly, enables us, as Alaskans, to speak with even greater voice and greater clarity.

So I thank you for your time.

With that, ladies and gentlemen, we stand adjourned.
[Whereupon, at 2:10 p.m. the hearing was adjourned.]

APPENDIX MATERIAL SUBMITTED

U.S. Senate Committee on Energy and Natural Resources
November 2, 2017 Hearing: *The Potential for Oil and Gas Exploration and Development in the Non-Wilderness Portion of the Arctic National Wildlife Refuge, Known as the "1002 Area" or Coastal Plain, to Raise Sufficient Revenue Pursuant to the Senate Reconciliation Instructions included in H. Con. Res. 71*
Questions for the Record Submitted to the Honorable Byron Mallott

Question from Ranking Member Maria Cantwell

Question: What is the leasing and activity status of the state waters immediately offshore of the Arctic refuge Coastal Plain?

There is currently no exploration or development activities immediately north of ANWR in state waters. As of November 2017, there are 10 existing state leases to the Northwest of ANWR, for 33,116 leased acres.

The State of Alaska currently plans to offer leases for sale in the Beaufort Sea from the Aichilik River to the Canning River. Bids are due in early December.

Leases to be offered Fall 2017: 39
Acres to be offered Fall 2017: 156,000

Total lease sale tracts: 61
Approximate State-owned acres adjacent to ANWR: 255,000 acres

Lease sale tracts not offered Fall 2017: 22 (including 9 currently leased tracts)

The Beaufort Sea lease sale tract map is available at:
http://dog.dnr.alaska.gov/Documents/Leasing/SaleDocuments/BeaufortSea/2017W/BS2017W-TractMap-20171030.pdf

Additional information is available here:
http://dog.dnr.alaska.gov/Services/LeaseSale?scrollTo=CurrentLeaseSales

Questions from Senator Bernard Sanders

Question 1: Do you agree with the vast majority of scientists that climate change is real, it is caused by human activity, and that we must aggressively transition away from fossil fuels toward energy efficiency and sustainable energy like wind, solar, and geothermal?

Yes, climate change is real. Yes, the cause is in significant measure from human activity. Yes, we should expand our opportunities to transition to a renewable energy-based future. Alaska is warming at twice the rate of the rest of the United States. Alaskans are experiencing climate change on the ground in our state and in our communities. Our communities face accelerating rates of erosion, rising sea levels, thawing permafrost, ocean acidification and other impacts that threaten our social and cultural fabric, health, safety, and economic future. These are reasons why the Governor just signed a climate change administrative order to

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organize Alaskan leaders to develop Alaskan solutions and take action in response to the climate change impacts we see now and will experience in the future, and why the State has supported energy efficiency and renewable energy deployment with significant state investments in the past.

In 2010, the Alaska State Legislature passed House Bill 306, which outlined five goals: (1) establish a statewide energy policy; (2) establish a thorough and coordinated approach to supporting energy efficiency and conservation; (3) encourage economic development; (4) support energy research, education, and workforce development; and (5) coordinate government functions to support these actions. The bill set out a goal of increasing energy efficiency by 15% by 2020 and to produce 50% of the state's electricity from renewable resources by 2025. The State is working to achieve these goals, but there's more work to be done – and our recent fiscal challenges have been a big impediment.

Alaska's unique geography presents a number of challenges, but also a number of opportunities for renewable energy development. Alaskans face some of the highest energy costs in the nation, and to address those costs, are innovative in finding new ways to save heat and electricity through energy efficiency and conservation. As of 2016, hydroelectric power supplied approximately 25 percent of the state's electricity in an average water year. Alaska has thousands of miles of coastline, providing potential for tidal and wave energy development. Alaska also has abundant wind resources available, especially in western and coastal portions of the state. The State and its partners continue to look to hydropower, wind, biomass, geothermal, solar, tides, and waves to provide more renewable energy opportunities and to reduce communities' and individual households' dependence on diesel and other fossil fuels.

Question 2: Do you agree with the vast majority of scientists that the combustion of fossil fuels contributes to climate change?

Yes

Question 3: Scientists tell us that we must work keep to keep fossil fuels in the ground if we are to avoid the most dangerous impacts of climate change. The U.S. Geological Survey estimates that more than 10 billion barrels of recoverable oil could be held in the Arctic Refuge. How does extracting this oil from the Arctic Refuge help the U.S. transform its energy system, as quickly as possible, from one based on carbon-intensive fuels to one based on clean, sustainable sources?

Both Alaska and the nation have immense energy and economic needs today, and share the need for a clean energy future. Just as states must invest in essential public services to support the daily lives of our citizens, they must work to directly invest and support private investment in sustainable sources to support a renewable energy based future.

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The more aggressively any transition is to be pursued, the more well-resourced we must be today. The federal and state revenue from developing these resources, in an area with high environmental standards, can and should help support this aggressive transition. In Alaska, we have a renewable energy goal and policy we are striving to fund. Hundreds of millions of dollars have been appropriated in past years to increase energy efficiency and facilitate and deploy renewable energy across our state – but these appropriations have been limited during recent years as fiscal constraints have caused cuts to essential public services like education, health, and safety. If the state and federal government want to allocate billions of dollars to renewable energy investment and transition, we must have billions of dollars in revenue.

Question 4: According to the State of Alaska, there have been over 640 oil spills on Alaska's North Slope since 1995, 13 of which were greater than 10,000 gallons. Since 2009, tens of thousands of gallons of crude oil and drilling fluids have spilled on the North Slope.
In April, a BP oil well leaked crude oil and gas for several days due to damage caused by pressure from thawing permafrost. The Alaska Oil and Gas Conservation Commission issued an emergency order to review all wells on the North Slope of Alaska due to the threat posed by warming permafrost.

Do you agree with the Alaska Oil and Gas Conservation Commission that warming permafrost poses a threat to fossil fuel infrastructure? If not, why not? What specific technology can guarantee no spills in the face of melting permafrost?

Can you provide an example of an oil well on the scale of the $1 billion dollar project proposed in the 1002 area of the Arctic Refuge that has not had a spill?

It should be noted that a vast majority of all spills and materials releases in the North Slope feature less than two barrels of material, and occur either around facilities or on gravel pads that feature protective liners for secondary containment that prevent any industrial material from being transmitted to the environment. These kinds of releases, no matter how small, are required to be reported and remediated because they are a concern to the state, but they result in no long term, measurable impacts to the environment.

For the larger spill incidents, Alaskan regulators take extensive remedial action to address the situation that led to the spill, minimize its likelihood of reoccurring, and fully remove hydrocarbons from the environment to prevent long term harm. Alaska is recognized as a leader and innovator in spill prevention around the world in arctic environments because of the focus on improving our standards and preventing spills both large and small.

While human releases of any industrial materials – hydrocarbons, drilling mud and fluids, produced water, and otherwise – must all be reported and remediated, it should be noted that natural oil seeps and hydrocarbon releases in Alaska on the North Slope may place comparable

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levels of hydrocarbons into the environment as releases from industrial activity and development in some years, but have been doing so for thousands of years or longer.

In direct response to the question, warming permafrost presents an issue that all State of Alaska regulators, including the Alaska Oil and Gas Conservation Commission (AOGCC) and others, are continuing to be aware of, monitor, and, when necessary, respond to.

Finally, there are many different advanced spill prevention techniques in place in Alaska today that have evolved to address issues that have arisen to date. While the number, volume, and frequency of spills of any kind continue to decline, no approach can guarantee a spill won't occur. Many oil wells, facilities, and pipelines, supported by billions of dollars of investment and of significant size and scope, operate safely without release, consistent with the State's focus on prevention. Part of the design parameters for these activities anticipate small releases, and take steps to prepare to protect the environment even when they occur.

Question 5: The Arctic Refuge is home to hundreds of plant and wildlife species, including America's most iconic animals such as polar bears, grizzly bears, musk ox, wolves and caribou.

This area includes more polar bear den sites than any other area on the north coast of Alaska and has been designated as a critical habitat for these threatened animals, which are listed as a threatened species under the Endangered Species Act.

The Arctic Refuge is also the nesting ground for millions of birds, including waterfowl such as Northern Pintail and Tundra Swans, which migrate from all 50 states.

What specific technology can guarantee that the infrastructure and technology used for extraction does not adversely affect this pristine ecosystem?

What specific technology can guarantee that the infrastructure and technology used for extraction does not violate the Endangered Species Act?

Oil and gas development in Alaska features numerous technologies and design elements to limit impacts to wildlife, as well as permitting and management restrictions. These include small development pad sizes with modular facilities that can be placed in specific locations with limited transportation impact, protective liners under pads to prevent transmission of any industrial materials to the environment, arctic engineering and inspection standards for pipelines and wells, and many other protective measures. Exploration can only happen during the winter to prevent any long-term impacts, and full season development that does occur is thoroughly reviewed to relocate, reshape, and shrink footprints to avoid impacts to water, wetlands, wildlife habitat, or other resources.

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For the Endangered Species Act (ESA), "Section 7" consultations with the appropriate federal agencies occur during federal permitting and the extensive public National Environmental Policy Act (NEPA) review associated both with federal land planning and lease management, and with the development of any particular project proposal. Projects must comply with identified mitigation measures to protect any endangered species and their habitats. Adaptive development to protect habitat and wildlife is the norm on the Alaska North Slope.

For polar bears, for example, dens can be located using infrared technology and satellite monitoring. Where denning bears are identified, companies must avoid the area to protect the bears. Polar bears currently den in areas where there is already oil and gas infrastructure and development, and protecting their habitat in this context is an established part of managing development. For reference, polar bear dens on land are most often found in areas that collect snow drifts and are associated with a pronounced landscape feature such as coastal or river banks, rather than flat, open plains areas such the central portions of as the 1002 Area. In addition to the 1002 Area, the Alaska Department of Fish and Game has identified significant bears denning on the broader coastal plain, on the numerous coastal barrier islands along northern Alaska, and offshore.

Question 6: Nearly 200,000 Porcupine Caribou, currently the only healthy caribou herd in North America, birth their calves in the Arctic Refuge. Disrupting these calving grounds could have a significant adverse impact on the herd's continued health.

What specific measures and technology can guarantee that the infrastructure used for extraction does not adversely impact this herd?

The herd is also an essential part of life for the Gwichyaa Zhee Gwich'in Nation. The Nation has survived off the food from the herd for 20,000 years and the land where the herd lives is sacred.

What specific measures and technology can guarantee that the infrastructure and equipment used for extraction does not disrupt the Gwich'in Nation and preserves their relationship with the herd?

It should be noted that Alaska is host to a number of caribou herds that have stable or increasing numbers compared to historical averages and can meet the subsistence needs of Alaskans while maintaining a healthy breeding population. Several of these herds ranges and calving ranges are on the North Slope surrounding the existing development. These herds are regarded as "healthy" by Alaska's caribou biologists. Across the State, in developed and undeveloped areas, there are 32 healthy herds – some seeing increases in population, some decreases, and some steady, but none considered to be in jeopardy by our wildlife managers.

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Also of note, the porcupine caribou herd uses the 1002 Area, including the eastern portion of the 1002 Area, for some calving activities in some years – but also calves in other areas and some years does not calve in the 1002 Area in any significant amount. Recent years have seen a return of some calving in the coastal plain, but for approximately a decade before that there was little to no calving in the 1002 Area. The heard also uses a much broader range throughout the year, including areas in other parts of the Refuge, and areas in Canada that have already seen development.

The measures and technology that would be used to protect the Caribou Herd from development in the 1002 Area include many of the same measures currently used on the North Slope around other healthy herds. Pipelines are elevated to avoid preventing migration and free movement, pads are sited to avoid sensitive areas and key habitat, and disturbances of wildlife by workers and equipment is minimized by conducting much of the construction activities during winter months when most wildlife is not present, including the porcupine herd that winters south of the 1002 Area.

The continued health and availability of the herd will continue to support the Gwich'in Nation's access to caribou as a subsistence resource, along with other animals such as salmon, whitefish, and moose. As I noted during the hearing, Alaska is unique as a State because the subsistence use of game for food security and maintenance of traditional ways of life is our highest priority. Personally, it has been a priority of my life and we will always fight to ensure the Gwich'in have access to caribou from the Porcupine Herd.

Question 7: The average lease sale per acre on the neighboring North Slope is $194 per acre. In order to meet the Senate reconciliation instructions to the Senate Committee of Energy and Natural Resources, every single acre in the Coastal Plain would need to be leased at an average rate of $1,333 per acre. What is the likelihood that every acre in the Coastal Plain would be sold at this rate? Describe the specific modeling and methods used to estimate the revenue that would be generated from leases on the Coastal Plain.

In March 2008, the Chukchi lease sale generated $2.66 billion in bonus bids. There were 487 lease tracts sold. Each lease tract contains 5,760 acres. Average price per acre was $948. These lease tracts were offshore, and 200 miles from infrastructure, and purchased without knowing the technology for producing offshore in the Arctic Ocean. The price of oil at the time was between $100 and $110 per barrel, but there were many factors that would have to be developed and refined to bring resources to market. For comparison, ANWR is also new territory that has not been previously available for leasing, but it is only miles from existing infrastructure and can use existing, well-demonstrated technology to produce resources that are discovered. Based on USGS reports, has a high potential for hydrocarbons – significantly higher than has been estimated for the National Petroleum Reserve – Alaska to the west, which is currently seeing significant leasing interest and investment – including bids for some leases significantly

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exceeding $1,000 per acre. Similarly, 1002 Area resources are located onshore, near the currently operational Point Thomson project and its infrastructure for taking resources to market.

The State believes all of these factors support the analysis by the Congressional Budget Office that finds that the sale will generate the funds called for in the resolution.

In terms of overall revenue, the State has estimated that both the state and federal government would receive billions to hundreds of billions of dollars from development in the 1002 Area over the life of the leases based on the prospectivity of the area and the oil price during the development.

The State understands that the CBO ten-year revenue outlook following authorization for leasing in the 1002 Area includes preliminary development – seismic exploration, lease sales, possibly exploration drilling, and development design and permitting – but not development. Bonus bids and rentals would be generated at this time, providing significant federal revenue – amounting to the $1 billion, and the even more significant federal revenue in tens of billions would follow in ensuing years.

If production is to begin in years eleven, twelve, or later, royalty from production will begin to accrue to the federal government. Assuming a conservative value of $40 per barrel of royalty oil, and a total production rate of 200,000 barrels per day, the royalty that would accumulate to the federal government is approximately a quarter of a billion dollars every year. If development leads to 400,000 barrels per day at $50 per barrel, that would result in well over half a billion dollars of federal revenue every year – not including significant federal corporate and personal income tax receipts associated with the activity. Different estimations of this revenue can be made using models based on different field sizes, total recoverable oil, development costs, oil price, timelines for development, and other factors.

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Questions from Ranking Member Maria Cantwell

Question 1: Your testimony states that the Administration supports oil and gas development in the Arctic National Wildlife Refuge. The Fish and Wildlife Service is charged with managing the Arctic refuge "to protect fish and wildlife and their habitat in their natural diversity."

The Arctic refuge Coastal Plain is a critical calving area for the Porcupine Caribou herd—as your testimony notes—and almost the entire area has been designated as critical habitat for polar bears, which are listed as a threatened species under the Endangered Species Act.

What analysis did the Administration undertake in assessing the impact of oil development on its obligation to protect the Arctic refuge and its wildlife, including a polar bear population that is listed under the Endangered Species Act, before deciding to promote oil development in the refuge?

Response: The Alaska National Interest Lands Conservation Act (ANILCA) reserved the decision to develop oil and gas resources in the 1002 area for Congress. The Administration supports legislation to authorize that development. We will follow all applicable laws, including the Endangered Species Act, the Marine Mammal Protection Act, the National Wildlife Refuge System Administration Act, and the National Environmental Policy Act, to analyze potential effects of developing oil and gas resources in the 1002 area and determine compatibility with established purposes for the refuge. Environmental reviews will identify potential measures to avoid or reduce impacts to wildlife and habitat and ensure that development, if authorized, proceeds in a way that is consistent with all applicable laws. In addition, the Department will use the best practices learned from development within the National Petroleum Reserve Alaska (NPRA), which is very similar to the 1002 area, to make sure we are thorough in our reviews and surveys and that we avoid or reduce impacts to the greatest extent possible.

Question 2: Do you agree that oil development in one of the most pristine and ecologically important national wildlife refuges in the country should be undertaken only if consistent with all environmental laws?

Response: Yes. Only Congress can authorize oil and gas development in the 1002 area. If authorized by Congress, development would only be undertaken in a manner consistent with all applicable environmental laws and Congressional intent.

Question 3: Do you agree that allowing an oil field to be developed inside a national wildlife refuge is a major federal action requiring a full public process and the development

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of an environmental impact statement in accordance with the National Environmental Policy Act?

Response: Yes.

Question 4: The 2015 Comprehensive Conservation Plan (CCP) for the Arctic Refuge was the result of years of scientific work and public input. As part of the plan, the US Fish and Wildlife Service recommended that the Coastal Plain of the Arctic Refuge be designated as wilderness.
In your testimony, you mentioned the original CCP but did not mention the current CCP, which is the Fish and Wildlife Service's most recent scientific review of the Refuge, management policy for the Refuge, and recommendations to Congress.

Is the Arctic Refuge still being managed according to this plan?

Response: Yes, the refuge is managed according to the current Comprehensive Conservation Plan (CCP). If Congress enacts legislation that authorizes oil and gas development in the 1002 area, we will modify the CCP as needed to continue to minimize impacts and remain consistent with Congressional intent.

Question 5: Is current Department of the Interior leadership committed to the scientific analysis behind the 2015 Comprehensive Conservation Plan for the Arctic National Wildlife Refuge?

Response: The 2015 CCP is the current management plan for the Arctic National Wildlife Refuge, and the USFWS continues to administer the refuge consistent with this plan and its underlying science. If Congress enacts legislation that authorizes oil and gas development in the 1002 area, we will modify the 2015 CCP as needed.

Questions from Senator Ron Wyden

Question 1: Mr. Sheehan, in your spoken testimony you referred to research and best practices to avoid complications from drilling. But I am still concerned that drilling could seriously damage the pristine nature of the Refuge. We've heard that using ice pads and ice roads can reduce the environmental footprint of drilling, but the Refuge has a hillier terrain and less standing water than other drill sites on the North Slope. That means it could be harder to use ice drilling techniques in the Refuge.

Given the lack of drilling experience in the uniquely-rugged terrain of the Refuge, how can the Administration be certain that oil exploration and production won't damage the Refuge?

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Response: ANILCA reserved the decision to develop oil and gas resources in the 1002 area for Congress. The Administration supports legislation to authorize that development. We will follow all applicable laws to analyze potential effects; determine compatibility with established purposes for the refuge; recommend measures to avoid or reduce impacts; and ensure that development proceeds in a way that is consistent with all applicable laws. If development of oil and gas resources in the 1002 area is authorized, the environmental review process would identify potential environmental effects as well as opportunities to avoid or reduce adverse impacts to the greatest extent possible by utilizing best practices and lessons learned from development in similar terrain in Alaska.

Question 2: I am also concerned about the potential for oil spills. We've heard that drilling technology has advanced, but oil spills still happen. In fact, since 2009 tens of thousands of gallons of crude oil and drilling fluids have spilled on the North Slope, damaging waters and local wildlife.

Since oil spills have happened in places where there's a longer history of drilling, how could a spill prevention or disaster recovery plan for the Refuge be credible?

How much access would disaster recovery crews have to respond to a spill in the Refuge?

Response: ANILCA reserved the decision to develop oil and gas resources in the coastal plain of the 1002 area for Congress. The Administration supports legislation to authorize that development. We will follow all applicable environmental laws to analyze potential effects and recommend measures to avoid or reduce impacts.

The USFWS and the Bureau of Land Management (BLM) both play important roles in ensuring involved parties are committed to preventing spills and have a credible disaster recovery plan in place. A credible spill prevention or disaster recovery plan will establish best management practices that will include the deployment of recovery crews, which should reduce the potential for spills and reduce the effects of spills.

The BLM is responsible for ensuring that EPA requirements including the EPA's Spill Prevention, Control, and Countermeasure (SPCC) Plan and the Facility Response Plan (FRP) rules are followed. The intent behind the SPCC rule is to prevent a discharge of oil into navigable waters or adjoining shorelines and to control a spill should one occur. The FRP rule requires operators to submit response plans developed to respond to a worst-case oil discharge or threat of a discharge.

In addition, the BLM will utilize lessons learned and best practices from similar areas such as the NPRA to operate and development in the most safe and least intrusive manner possible. As you

mentioned and as was illustrated at the hearing, exploration and development technology has made great progress over the years. The Department is confident that any future development can be done in a safe and mitigated manner that is consistent with the same environmental laws and safeguards that govern every other development and production project. I would also reiterate Secretary Zinke's sentiments from his budget and confirmation hearings that development should happen under reasonable environmental regulations in the United States rather than countries overseas whose regulations are slim to none.

In response to your question on access, if there was an oil pipeline spill in the 1002 area, response personnel would be able to utilize the access roads adjacent to pipelines. If oil and gas development in the 1002 area was authorized by Congress and initiated, roads would be constructed to provide access to the pipeline for routine maintenance, spill prevention, and emergency response. Helicopters can also be used as a reliable source to help determine the initial spill area and quickly bring first responders to the site.

Questions from Senator Bernard Sanders

Question 1: Do you agree with the vast majority of scientists that climate change is real, it is caused by human activity, and that we must aggressively transition away from fossil fuels toward energy efficiency and sustainable energy like wind, solar, and geothermal?

Response: As I stated at the hearing, I believe that climate change is real. I am not an expert or a climate scientist, but I believe it is caused at least in part by human activity. As Principal Deputy Director of the U.S. Fish and Wildlife Service, I am not responsible for developing the Administration's energy policy. However, as I indicated at the hearing, I am aware that the Administration supports securing our energy future by developing an all-of-the above energy strategy.

Question 2: Do you agree with the vast majority of scientists that the combustion of fossil fuels contributes to climate change?

Response: I am not an expert or a climate scientist, but I believe combustion of fossil fuels contributes to climate change.

Question 3: During your testimony, you said that the Trump administration is being "forward looking" with regard to advancing renewable energy technologies. However, the Administration's proposed budget has called for a 70% cut to the Department of Energy Office of Energy Efficiency and Renewable Energy (EERE) and zeroing out of ARPA-E. Additionally, the Administration has announced its intention to leave the Paris Climate

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Accord and proposed to repeal the Clean Power Plan. Can you please explain how such actions are helping advance renewable energy technology? Can you please provide any examples of ways the Trump Administration has increased support for renewable energy since taking office?

Response: While I cannot speak to the Department of Energy's budget request, the America First Energy Plan is an "all-of-the-above" approach that includes oil and gas, coal, hydropower and renewable resources. The FY 2018 Budget requests funds for onshore and offshore renewable energy development at a level that is expected to address current industry demand. The Department is also taking steps to improve its leasing processes, including implementation of BLM's competitive leasing rule. This will support a competitive leasing process for solar and wind energy development. The rulemaking updates and codifies acreage rent and megawatt capacity fees for wind and solar energy projects, establishes a new rate adjustment method that provides greater certainty and fair return for use of the public lands, provides incentives for leases within designated leasing areas, updates project bonding requirements, and incorporates sensible solar and wind energy policies into the right-of-way regulations. In March, 2017, the Secretary announced the completion of the nation's seventh competitive lease sale for renewable wind energy in federal waters. BOEM also this year marked the operational launch of the nation's first commercial offshore wind farm – the five-turbine, 30 megawatt Block Island Wind Facility.

Question 4: **Scientists tell us that we must work to keep fossil fuels in the ground if we are to avoid the most dangerous impacts of climate change. The U.S. Geological Survey estimates that more than 10 billion barrels of recoverable oil could be held in the Arctic Refuge. How does extracting this oil from the Arctic Refuge help the U.S. transform its energy system, as quickly as possible, from one based on carbon-intensive fuels to one based on clean, sustainable sources?**

Response: As Principal Deputy Director of the USFWS, I am not responsible for developing the Administration's energy policy. However, as I stated at the hearing, I am aware that the Administration supports developing energy from all sources, including fossil fuel sources. Fossil fuels serve as a major energy source that remains in high demand to meet immediate and shorter term energy needs.

Question 5: **According to the State of Alaska, there have been over 640 oil spills on Alaska's North Slope since 1995, 13 of which were greater than 10,000 gallons. Since 2009, tens of thousands of gallons of crude oil and drilling fluids have spilled on the North Slope. In April, a BP oil well leaked crude oil and gas for several days due to damage caused by pressure from thawing permafrost. The Alaska Oil and Gas Conservation Commission**

issued an emergency order to review all wells on the North Slope of Alaska due to the threat posed by warming permafrost.

Do you agree with the Alaska Oil and Gas Conservation Commission that warming permafrost poses a threat to fossil fuel infrastructure? If not, why not? What specific technology can guarantee no spills in the face of melting permafrost?

Response: According to BLM, warming permafrost does pose a risk to older production wells, such as the example of the BP well referenced in your question. Modern wells, such as what could be developed in the 1002 area, do not carry the same level of risk because the surface casing extends completely below the permafrost zone. Surface casing is the protective pipe that houses the production strings. The surface casing also provides a heat buffer that prevents thaw while producing warm fluids (they are captured in a separate string contained within the surface casing). In the BP example, the surface casing did not extend through the permafrost zone. With the surface casing being a rigid pipe, melting permafrost will not bend or fracture the casing. It is cemented in place at the surface by specially designed cement specific for permafrost and arctic conditions. Any changes or movement of the pipe will be noticed at the surface where the well integrity can be determined. This issue is alleviated further by having many wellheads contained within a single pad, thus making detection easier as all would be routinely inspected as a group.

All potential impacts on new oil and gas infrastructure—including that from permafrost melt—would be assessed and appropriately addressed by environmental reviews under applicable laws.

Can you provide an example of an oil well on the scale of the $1 billion dollar project proposed in the 1002 area of the Arctic Refuge that has not had a spill?

Response: According to BLM, clarification would need to be provided if the question refers to an incidental spill or a large spill. To prevent spills of any size the operator must maintain a strict inspection and maintenance schedule that meet federal requirements.

<u>Question 6</u>: The Arctic Refuge is home to hundreds of plant and wildlife species, including America's most iconic animals such as polar bears, grizzly bears, musk ox, wolves and caribou.

This area includes more polar bear den sites than any other area on the north coast of Alaska and has been designated as a critical habitat for these threatened animals, which are listed as a threatened species under the Endangered Species Act.

The Arctic Refuge is also the nesting ground for millions of birds, including waterfowl such as Northern Pintail and Tundra Swans, which migrate from all 50 states.

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What specific technology can guarantee that the infrastructure and technology used for extraction does not adversely affect this pristine ecosystem?

Response: If development of oil and gas resources in the 1002 area is authorized, the environmental review process would identify potential environmental effects as well as opportunities to minimize adverse impacts to the greatest extent possible. ANILCA reserved the decision to develop oil and gas resources in the 1002 area for Congress. The Administration supports legislation to authorize that development and will follow all applicable laws to analyze effects, avoid or reduce effects, including through the evaluation of technology to avoid or reduce effects as much as practicable, so that development would be consistent with all applicable laws.

What specific technology can guarantee that the infrastructure and technology used for extraction does not violate the Endangered Species Act?

Response: ANILCA reserved the decision to develop oil and gas resources in the 1002 area for Congress. The Administration supports legislation to authorize that development. We will follow all applicable laws, including the Endangered Species Act (ESA), the Marine Mammal Protection Act, the National Wildlife Refuge System Administration Act, and the National Environmental Policy Act, to analyze potential effects; determine compatibility with established purposes for the refuge; recommend measures to avoid or reduce impacts; and ensure that development proceeds in a way that is consistent with all applicable laws, including Section 7 of the ESA.

Question 7: **Nearly 200,000 Porcupine Caribou, currently the only healthy caribou herd in North America, birth their calves in the Arctic Refuge. Disrupting these calving grounds could have a significant adverse impact on the herd's continued health.**

What specific measures and technology can guarantee that the infrastructure used for extraction does not adversely impact this herd?

Response: ANILCA reserved the decision to develop oil and gas resources in the 1002 area for Congress. The Administration supports legislation to authorize that development. We will follow all applicable laws to analyze potential effects; determine compatibility with established purposes for the refuge; recommend measures to avoid or reduce impacts; and ensure that development proceeds in a way that is consistent with all applicable laws. If Congress enacts legislation to authorize oil and gas development in the 1002 area, environmental review, siting criteria, and recommended measures to avoid or reduce impacts will help avoid or reduce adverse effects to ensure the herd's health. It is worth noting that the caribou herd migrates

through areas where development is currently occurring, particularly the NPRA, and the herd has continued to healthily grow while maintaining its migration patterns.

The herd is also an essential part of life for the Gwichyaa Zhee Gwich'in Nation. The Nation has survived off the food from the herd for 20,000 years and the land where the herd lives is sacred.

What specific measures and technology can guarantee that the infrastructure and equipment used for extraction does not disrupt the Gwich'in Nation and preserves their relationship with the herd?

Response: The USFWS recognizes that Alaska Native people are spiritually, physically, culturally, and historically connected to the land, wildlife, and waters. If Congress enacts legislation to authorize oil and gas development in the 1002 area, we will, through consultation with all affected tribes, identify concerns and establish measures to avoid or reduce impacts to the Porcupine Caribou Herd, along with other impacts of concern to Alaska Natives. Consultation will provide an opportunity to identify and address potential disruptions with respect for the Gwich'in Nation's cultural and spiritual relationship with the coastal plain of the 1002 area and the caribou. This consultation will also include the Iñupiat people who have lived off the land and the wildlife for thousands of years. As I am sure you remember, Mr. Rexford testified on behalf of Kaktovic and the Iñupiat people in support of developing the 1002 area. Should development be authorized, we look forward to a complete and thorough consultation process.

Question 8: **The average lease sale per acre on the neighboring North Slope is $194 per acre. In order to meet the Senate reconciliation instructions to the Senate Committee of Energy and Natural Resources, every single acre in the Coastal Plain would need to be leased at an average rate of $1,333 per acre. What is the likelihood that every acre in the Coastal Plain would be sold at this rate? Describe the specific modeling and methods used to estimate the revenue that would be generated from leases on the Coastal Plain.**

Response: Estimates for how much companies may bid for leases in the 1002 area, should leasing be authorized, involve a number of assumptions, considerations and variables that are inherently uncertain. What we do know is that the 1002 area contains the largest undeveloped oil resources discovered in the United States and state oil and gas lease sales demonstrate industry interest in the region. In its analysis of the Committee's legislation, the Congressional Budget Office concluded that, based on historical information and information from the Department, the Energy Information Administration, and industry, bonus bids alone would result in over $2 billion in Federal revenues over 10 years, with $1 billion in deficit reduction and another $1 billion in revenues that would be shared with the State of Alaska under the bill.

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Questions for the Record Submitted to Mr. Samuel Alexander

Question from Ranking Member Maria Cantwell

Question*: What is your response to those who say the Gwich'in live far from the Coastal Plain and any decisions about whether to allow oil drilling on the Coastal Plain should be left to those who live closest to the area?*

We Gwich'in depend upon the Porcupine Caribou herd for our sustenance and cultural survival. The Porcupine Caribou migrate vast distances every year, covering a range of nearly 100,000 square miles. This covers most of the current-day area inhabited by Gwich'in (see Figure 1). However, the Caribou only calve in the *Iizhik Gwats'an Gwandaii Goodlit* (The Sacred Place Where Life Begins) —the coastal plain 1002 area.

If a river spans the border of two countries, one country is not free to dam the river and divert the flow as it pleases just because the source lies within its borders. Similarly, the Gwich'in must be consulted on developments that threaten the Caribou. The Gwich'in are the Caribou people. The Gwich'in have lived in this area and relied on the Porcupine Caribou Herd since time immemorial. Caribou are how we survive and are integral to who we are and how we can be proud of who we are. Caribou are our stories, the food on our table, our clothes, and our tools. We have a story about the caribou: the caribou is in our heart, and the caribou takes care of us and we take care of the caribou. The Coastal Plain is the life source of the Refuge, and by devastating this sacred area the Caribou and all of the plants and animals within the Refuge will be impacted, including the Gwich'in.

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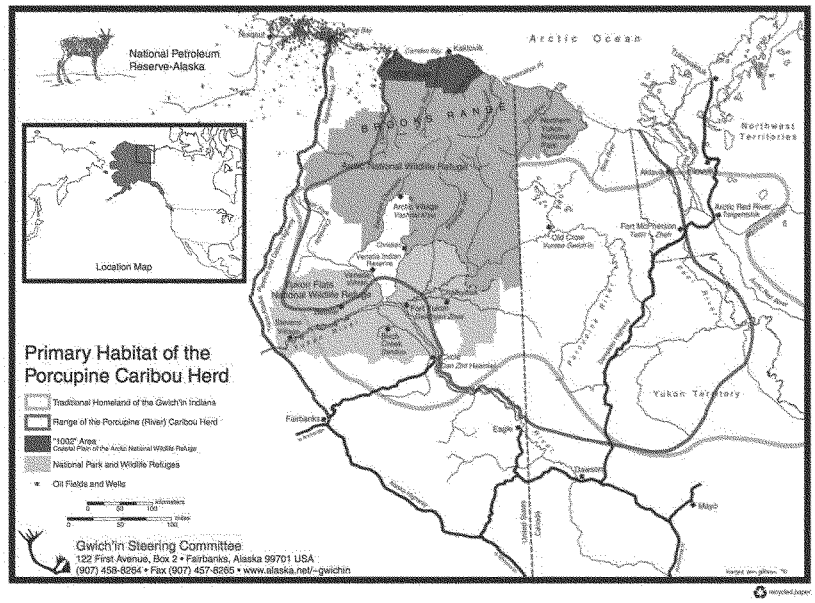

Figure 1: Range of the Porcupine Caribou Herd (source: Gwich'in Steering Committee)

Questions from Senator Bernard Sanders

Question 1: *According to the State of Alaska, there have been over 640 oil spills on Alaska's North Slope since 1995, 13 of which were greater than 10,000 gallons. Since 2009, tens of thousands of gallons of crude oil and drilling fluids have spilled on the North Slope. In April, a BP oil well leaked crude oil and gas for several days due to damage caused by pressure from thawing permafrost. The Alaska Oil and Gas Conservation Commission issued an emergency order to review all wells on the North Slope of Alaska due to the threat posed by warming permafrost.*

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Do you agree with the Alaska Oil and Gas Conservation Commission that warming permafrost poses a threat to fossil fuel infrastructure?

Are you worried about the risk to both wildlife and communities poised by oil spills, especially with the growing effects of climate change?

At a time when existing wells are threatened by warming temperatures due to climate change, does it make sense to build more wells and risk further oil spills in the Arctic Refuge's pristine environment?

As a Gwich'in and an Alaskan, the growing effects of climate change, including the increased risk of oil spills are grave concerns for me. As the only state with substantial Artic and Subarctic climate zones, Alaska is in many ways distinct from the Lower 48.

The Arctic is experiencing warming at a rate of almost twice the global average. According to scientists, this trend is likely to accelerate: As snow and ice melt, the Arctic cannot reflect heat back to space, fueling the cycle of warming.[1] Many Alaskan communities are threatened by rising tides, changing river patterns, and other effects of climate change. Earlier this year, for example, the Yupik village of Newtok, sought a federal disaster declaration for the effects of climate change in order to relocate the entire village.[2]

Most of our land is permafrost; a small active layer of soil sits atop frozen ground. The frozen layer is made up of a significant portion of ice, so as it thaws, that volume disappears as water runs off. This has already resulted in warped roads, cracked foundations, and many other challenges for Alaskan residents.[3] Many of the construction techniques used in the Lower 48 cannot be used here.

As warming continues, the continued disruption to everyday life for many Alaskans will only get worse. The safety impact on oil infrastructure is particularly worrying. The safety and

[1] AMAP, 2017. Snow, Water, Ice and Permafrost in the Arctic (SWIPA) 2017.

[2] Waldholz, Rachel, 2017. Alaskan Village, Citing Climate Change, Seeks Disaster Relief In Order to Relocate. NPR. https://www.npr.org/2017/01/10/509176361/alaskan-village-citing-climate-change-seeks-disaster-relief-in-order-to-relocate

[3] Demer, Lisa, 2017. The Permafrost is Dying: Bethel Sees Increased Shifting of Roads and Buildings. Alaska Dispatch News. https://www.adn.com/alaska-news/rural-alaska/2017/07/07/the-permafrost-is-dying-bethel-sees-increased-shifting-of-roads-and-buildings/

effectiveness of technologies used elsewhere has not been studied on the changing permafrost landscape during a period of increased global warming.

It does not make sense to continue to build oil wells, which pose significant safety hazards and threaten both our land and our livelihood which is reliant upon the sustainable resources of the land such as Caribou and Salmon.

Question 2: *The Arctic Refuge is home to hundreds of plant and wildlife species, including America's most iconic animals such as polar bears, grizzly bears, musk ox, wolves and caribou.*

This area includes more polar bear den sites than any other area on the north coast of Alaska and has been designated as a critical habitat for these threatened animals, which are listed as a threatened species under the Endangered Species Act.

The Arctic Refuge is also the nesting ground for millions of birds, including waterfowl such as Northern Pintail and Tundra Swans, which migrate from all 50 states.

Do you anticipate that the infrastructure and technology used for extraction will adversely affect this pristine ecosystem?

Do you think that the infrastructure and technology used for extraction will violate the Endangered Species Act?

The land in question is pristine and home to a diverse range of plants and animals, including Polar Bears, which are listed as threatened under the Endangered Species Act. As Gwich'in, we have acted as stewards for this land; we have depended upon it for sustenance. We respect the animals and are careful to never hunt for more than we need. There is no question in my mind that the infrastructure and technology used for oil extraction will adversely impact the many animals that call the coastal plain home. While advocates for drilling have focused on the footprint of the wells themselves, little has been said about the aboveground infrastructure needed to support drilling, including roads and pipeline. Nor has the threat of oil spills been adequately addressed.

Question 3: *Nearly 200,000 Porcupine Caribou, currently the only healthy caribou herd in North America, birth their calves in the Arctic Refuge. Disrupting these calving grounds could have a significant adverse impact on the herd's continued health. Do you think that the technology and infrastructure used for extraction will adversely impact this herd?*

Yes, oil development in the place we call *Izhik Gwats'an Gwandaii Goodlit*, the sacred place where life begins, will threaten the Porcupine Caribou herd. A study by the National Research Council outlines how drilling on the North Slope has disrupted the migration and behavior of the

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Central Arctic Caribou.[4] The Porcupine Caribou are likely to behave in a similar way, and may stop calving entirely if their environment is threatened.

Question 4*: Can you describe how the technology and infrastructure used for extraction will disrupt the Gwich'in people and your special relationship with the herd?*

Imagine a silence so quiet that all you can hear is the sound of your own heart. No manmade distractions to pull you away from the barely audible hum of life. No smart phone. No internet. No ads. No voices. Silence. This is the last refuge for our Caribou relatives. The last refuge for natural world. Development will shatter the silence of this land and shatter the protective nature of this sanctuary. To live as Gwich'in is to be on the land. It is to be free to live as our ancestors did, fully recognizing that there is significant value in being a part of the natural world. The land is essential to this way of life; it provides us sustenance, and we view it as sacred. The technology and infrastructure to extract oil without having a negative impact on the Caribou and by extension our way of life doesn't exist. The same people that say it does will never mention the 210,000 gallons of Oil spilled in South Dakota only days ago…That is their best technology and it can't even handle the mild weather of the lower forty eight states. Without Caribou to hunt, what will we do? What will we eat? All the beef steak in the world can't replace the nutritional let alone spiritual needs we have as Gwich'in people. The Caribou call us away from modern life, they remind us of our traditional ways and they make sure that we abide by our traditional values. We say that the Caribou have a little of our heart, and that we have a little of theirs. As go the Caribou, so go the Gwich'in.

[4] Committee on Cumulative Environmental Effects of Oil and Gas Activities on Alaska's North Slope, Board on Environmental Studies and Toxicology, Polar Research Board, Division on Earth and Life Studies, National Research Council of the National Academies. (2003). Cumulative environmental effects of oil and gas activities on Alaska's North Slope. Washington, D.C. :National Academies Press.

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Questions for the Record Submitted to Mr. Aaron Schutt

Introduction

I am providing written responses to questions submitted for the record by Ranking Member Cantwell and Senator Wyden. The Committee should understand that Doyon, Limited (Doyon) is not a current oil and gas leaseholder on Alaska's North Slope nor is it an oil and gas production company. Doyon owns several companies that operate as service providers in the oil and gas market in Alaska. My individual background also does not include work for oil and gas producing companies.

Within the Doyon Family of Companies, the Doyon Oil Field Services pillar participates in oilfield services in Alaska, including Doyon Drilling – which my testimony focused on, but also includes Doyon Associated, Doyon Remote Facilities and Services, and Doyon Anvil. Our employees in these companies participate fully in Alaska's oil and gas industry in engineering and design, project management, construction coordination, pipeline construction, and housing, in addition to drilling.

Regarding pipelines and infrastructure, Doyon formed Doyon Associated, LLC (DAL) in 2006 with Associated Pipe Line Contractors, Inc. DAL specializes in arctic pipeline construction and associated infrastructure. This partnership provides extensive knowledge and collective experiences from multiple projects spanning many years, including expertise on Alaska's North Slope. DAL has a proven track record of successful completion of projects under challenging conditions, while maintaining corporate commitment to quality production, workforce safety, and protection of the environment.

Questions from Ranking Member Maria Cantwell

Question 1: Isn't it true that although directional drilling may reduce the number of well pads required to access an oil deposit, you will still need gravel roads and air strips and water impoundments and causeways and pipelines to develop that deposit, just as is necessary now with conventional drilling?

A new oil discovery and affiliated development would require new surface infrastructure. However, the long-term trend on Alaska's North Slope shows that the amount of necessary new infrastructure continues to decline. As stated in my earlier written testimony, the Alpine field on Alaska's North Slope developed in 2000 required only 97 acres to produce 450 million barrels of oil from 116 wells on five pads. Just as technology has greatly reduced the pad footprint needed to develop a new oil field, so too does it greatly reduce the footprint of the infrastructure needed for production and transportation of the newly developed oil.

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Currently there are no proposed exploration projects in the 1002 area, and answering the question requires a deeper understanding of the steps taken to get from exploration to production, which including leasing, seismic exploration and exploratory drilling prior to the development of a new discovery. Planning and permitting for each of these steps include planning for remote locations, protections of the environment, as well as meeting strict regulatory requirements.

Once an oil company identifies a commercial discovery, a plan of development and an environmental impact statement must be approved. The plan of development takes into consideration many variables, including plans for the location of pads and the number of wells expected to be drilled from each pad (each pad can easily accommodate fifty to seventy wells). Other considerations include identifying the best location for the gathering center, and what are the needs for an airstrip, gravel or ice roads. The plan would also show the plans for affiliated flowlines, which go from the well pad and follow the gravel or ice road to the gathering center.

The assumption that the ANWR would be road-connected to other oil and gas infrastructure is not necessarily a good assumption. Just to the west of ANWR is the relatively recently developed Point Thompson gas field. That large gas field is in production from two pads and currently has no gravel road connection to Prudhoe Bay.

Question 2: Even with directional drilling, is it not true that the same number of seismic tests are still necessary for exploration to determine where to locate the directional drill pads, just as with conventional drilling?

Does seismic testing still result in the same lasting damage to the tundra and wildlife when used for directional drilling as it does for conventional drilling?

Modern oil and gas exploration in Alaska leaves almost no permanent trace until development for production. Seismic testing is completed by companies exploring in order to reduce risks, costs, reduce impact on the environment, and before the sanctioning of an exploration well. On Alaska's North Slope, oil and gas exploration companies perform seismic testing exclusively in the winter months. As mentioned in my testimony, three-dimensional seismic testing allows oil to be located more accurately, reducing the need for exploratory well drilling. Current seismic technology does not result in lasting damage to the tundra and wildlife.

While 3D seismic does not remove all the risks of investing in exploration it greatly improves success and helps to identify the optimal locations for wells.

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Questions from Senator Ron Wyden

Question 1: Mr. Schutt, in your written testimony you mentioned the difference in environmental impact between winter and summer exploration. However, I am concerned that even winter exploration could seriously damage the pristine nature of the Refuge. The Refuge has a hillier terrain and less standing water than other drill sites on the North Slope. That means it could be harder to use ice drilling techniques in the Refuge.

Given the lack of drilling experience in the uniquely-rugged terrain of the Refuge, how can proponents be certain that oil exploration and production won't damage the Refuge?

Oil development today causes far less impact to wildlife and the environment during exploration. Modern oil and gas exploration in Alaska leaves almost no permanent trace until development for production. The oil industry in Alaska uses ice roads and ice pads to support winter-only exploration drilling programs. The surface land is largely unaffected and it is difficult to know a few months later that a large drilling rig and all of the supporting equipment has even been there.

I would encourage the Senate to look closely at impacts on the minimal impacts on the environment from exploration at Smith Bay, and from development at Alpine, Point Thompson, and the National Petroleum Reserve-Alaska. These are areas where there is a history of exploration and development, a similar terrain, and mitigated impacts to the environment.

Question 2: I am also concerned about the potential for oil spills. In your written testimony you alluded to advances that have been made in drilling since the 70's and 80's, but oil spills still happen. In fact, since 2009 tens of thousands of gallons of crude oil and drilling fluids have spilled on the North Slope, damaging waters and local wildlife.

Since oil spills have happened in places where there's a longer history of drilling, how could a spill prevention or disaster recovery plan for the Refuge be credible?

The State of Alaska operates a comprehensive, credible, and strict program to address spill prevention and spill response across Alaska's North Slope, up to the boundaries of the 1002 area.

Doyon and its subsidiary companies care deeply about the environment where we live and work. Our corporate values recognize the importance of the natural environment. Protecting the natural beauty of Alaska and respecting our resources helps to improve the quality of our lives and the communities where we live.

On each drilling project we work on, there is an extensive spill prevention and recovery plan. The appropriate government agencies approve that plan. The same procedures

apply to all drilling in Alaska. The plans ensure that adequate resources are in place to respond to each kind of emergency that might arise. Although ANWR is some distance from existing infrastructure, it is no further from infrastructure than other recent exploration drilling we have safely performed in the National Petroleum Reserve-Alaska.

Doyon Drilling has a strong Health Safety and Environmental Policy, which calls for strict compliance with all applicable governmental agency regulations, industry standards and our client's contractual requirements.

Further questions regarding the credibility of spill prevention or disaster recovery plans should be directed to appropriate government agencies.

How much access would disaster recovery crews have to respond to a spill in the Refuge?

State of Alaska regulations govern the response to spills in the industry. For questions specific to ANWR, guidelines regarding spill prevention and response would be set forth by the appropriate agencies.

The State of Alaska has the Department of Environmental Conservation Spill Prevention and Response Division. This department identifies the statutes in state law and current regulations that operators are required to adhere. The division also has a Prevention preparedness and response program where the intent is to protect public health, safety and the environment (HSE) by preventing and mitigating the effects of oil and hazardous substance releases and ensuring their cleanup.

Specific to DDI HSE policy, DDI is committed to operating as a safe, environmentally sound and cost efficient Oil Well Drilling/Workover Contractor. Our goal in all operations is to eliminate losses due to incidents, accidents and spills that affect personnel, equipment and the environment.

Additionally, all employees are annually trained as first responders. All DDI employees are trained annually for proper spill prevention, proper waste handling, and on DDI HSE policy and procedures. DDI, as a contractor, also adopts and regularly updates a spill prevention controls counter measures (SPCC) plan for each rig; these plans are also reviewed by a state-licensed engineer for the state; and are often audited by both customers and government agencies.

The resources to respond to oil spills are present and are available in even the more remote locations on the North Slope, including at locations like Greater Moose's Tooth, the development in the NPRA furthest west, as well as at Point Thompson, an area far to the east that is not road connected, just outside of Section 1002 area.

Questions for the Record Submitted to Ms. Lois Epstein

Questions from Ranking Member Maria Cantwell

Question 1: What evidence is there that acreage in the Arctic National Wildlife Refuge Coastal Plain will be valued enough by oil companies to receive $1 billion in bonus bids, as has been assumed?

As outlined in a recent Key-Log Economics, LLC report (Attachment A, p. 29), there is no evidence that the coastal plain of the Arctic National Wildlife Refuge would be valued enough by oil companies to receive $2 billion in bonus bids with the federal government receiving half of that amount and the state receiving half under the bill passed by the committee on November 15, 2017. Since 2010, the average price per acre on the North Slope has ranged from $14.81 to $80.59, with a weighted average for the cumulative 2,442,868 acres sold in the past six years equaling $41.59. Undoubtedly, recent North Slope bids are the best indicator of how much federal revenue could be raised from leasing the coastal plain. While the bids per acre could increase, no evidence exists that oil companies would be inclined to pay more for land in the Arctic Refuge coastal plain which has no existing infrastructure or proven reserves.

An October 2017 analysis by the Center for American Progress found that offering oil and gas leases in the Arctic Refuge likely would amount to no more than $37.5 million in federal revenue over 10 years, substantially short of the $1 billion to $1.8 billion that the White House, Congress, and drilling proponents claim could be raised.[1]

Question 2: If oil is located in multiple reservoirs that spread across the Coastal Plain, as has been predicted, would the use of directional drilling eliminate the need to have surface development across the length of the coastal plain?

Answer: The 1.5 million acre Arctic National Wildlife Refuge coastal plain represents over 2,300 square miles of land area. As Mr. Schutt testified before the committee on November 2, 2017, Doyon is developing an extended-reach drill rig[2] that could "drill wells covering 125 square miles from a single surface well pad." (p. 4, Schutt written testimony) If the oil reservoirs are spread across the coastal plain, there would need to be as many as 18 (2,300/125 = 18.4) well pads connected by pipelines and possibly roads throughout the coastal plain to maximize oil production. If fewer than 1.5 million acres are leased, as in the Senate bill regarding the coastal plain that passed the committee on November 15, 2017, there would be fewer well pads however those pads still could be located throughout the entire coastal plain.

The above calculation assumes, problematically, that all rigs used on the coastal plain would access 125 square miles of land surface. The Doyon rig described by Mr. Schutt is under contract for use by ConocoPhillips at its Fiord West field on state lands beginning in 2020,[3] however, and

[1] Lee-Ashley, M. and Rowland, J., Arctic National Wildlife Refuge 101: Protecting America's Last Great Wilderness from Being Sold Out for a Congressional Tax Scam, Center for American Progress (Oct. 10, 2017), [blog post] retrieved from https://www.americanprogress.org/issues/green/news/2017/10/10/440559/arctic-national-wildlife-refuge-101/

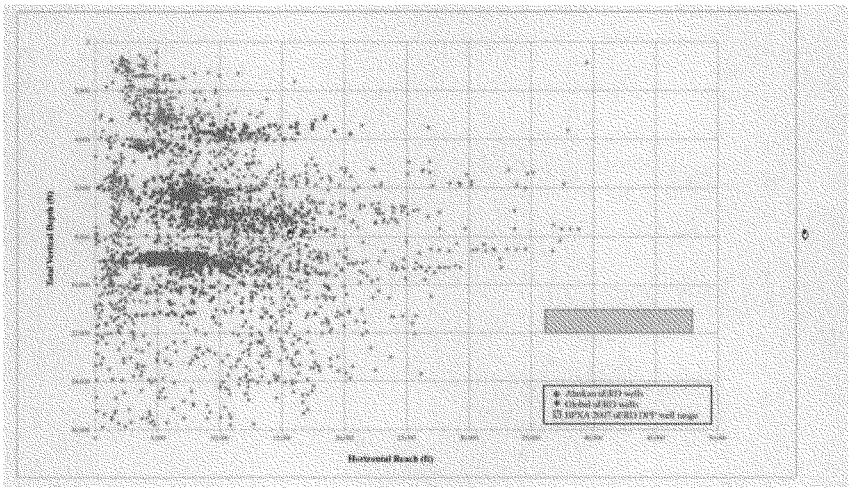
[2] Extended-reach drill rigs are rigs that can directionally drill wells.

[3] Baird, K., Doyon, ConocoPhillips team up to build extended-reach drilling rig, *Fairbanks Daily News-Miner* (Oct. 6, 2016), retrieved from http://www.newsminer.com/business/doyon-conocophillips-team-up-to-build-extended-reach-drilling-rig/article_4cdfa0f4-8c06-11e6-b8fe-bb1c090dfd1d.html

might not be available for drilling on the coastal plain. Additionally, this is the only rig that will be operating on the North Slope with such an extended reach capability for the foreseeable future.

As shown in Figure 1 below, most extended-reach wells drilled on the North Slope have a horizontal distance only of approximately 5,000-15,000 ft. Existing rigs on the North Slope are likely to be used for oil production on the coastal plain to reduce the cost of building new extended-reach rigs and/or transporting such rigs from elsewhere to Alaska. Because the existing rigs on the North Slope cannot drill a horizontal distance of 33,000 ft like the Doyon rig under construction, it is not unreasonable to expect that far more than 18 well pads would be located throughout the coastal plain.

Figure 1
Total Vertical Depth and Horizontal Distance of Ultra-Extended Reach Drilling Wells[4]



Question 3: Would the use of directional drilling eliminate the possibility of oil spills?

Answer: No. Oil and gas drilling and production is an inherently complicated and messy business. Even the best and most well-financed operators cannot ensure they will not have crude oil, hazardous materials or produced water spills from wells, pipelines, storage and transfer facilities, and processing infrastructure. Nor can operators prevent all blowouts because they may encounter unexpected or changing conditions that have not been adequately addressed, as was

[4] Bureau of Ocean Energy Management memorandum, Feasibility of Ultra-Extended-Reach Drilling for Resource Development of the Liberty Prospect, p. 4 (Feb. 1, 2017).

the case for BP with its April 2017 production well blowout[5] later determined to have been caused by thawing permafrost.[6]

Directional well drilling does not eliminate any of the risks of conventional/vertical well drilling. Well-related risks even may be enhanced as directional drilling is a more difficult, complex operation to monitor and control compared to conventional well drilling.

Question 4: Can you please provide data on Trans-Alaska Pipeline System flow in recent years and elaborate on projections for flow in the future?

Answer: As I discussed in my written testimony, because of increased production from existing operations and recent oil discoveries on state and federal lands currently open to oil development, the Trans-Alaska Pipeline System's (TAPS') throughput, or flow, has been increasing since 2015. According to the Alaska Department of Revenue, throughput during the state's fiscal year is projected to be 533,000 barrels per day, up from 501,000 barrels per day from three years ago, an increase of over six percent.[7]

The Alaska Department of Natural Resources expects TAPS throughput to continue increasing through the late 2020s due to significant new discoveries that are now in pre-operational phases (Figure 2). These discoveries, which are not on federally-protected lands like the Arctic Refuge coastal plain, include Armstrong's (now Oil Search) Pikka Nanushuk project on state lands and the ConocoPhillips' Willow and Greater Mooses Tooth projects in parts of the National Petroleum Reserve – Alaska currently open to development. These new discoveries will ensure increases in TAPS flow for many years to come, as shown in Figure 2.

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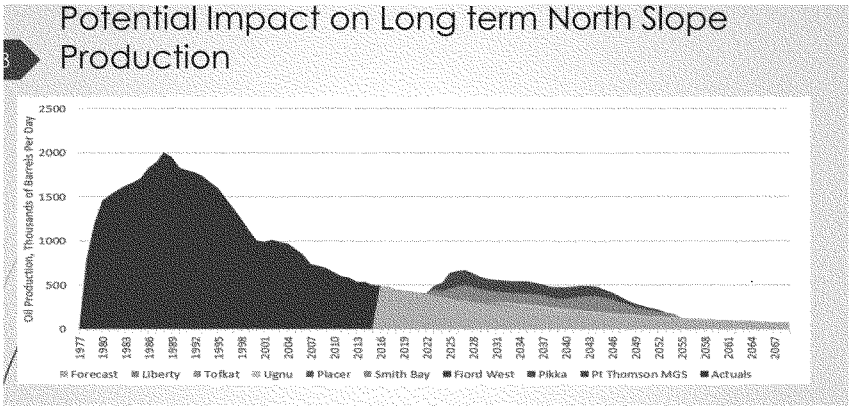
[5] Krauss, C., BP Struggles to Control Damaged Well in Alaskan Arctic, *New York Times* (April 16, 2017), retrieved from https://www.nytimes.com/2017/04/16/business/bp-damaged-oil-well-alaskan-arctic.html?_r=0

[6] BP Exploration (Alaska), October 2017 Update to the DS02-03 Accidental Oil and Gas Release, PowerPoint developed for the Alaska Oil and Gas Conservation Commission.

[7] Demarban, A., After a long decline, Alaska expects third straight year of increased oil production, *Alaska Dispatch News*, retrieved from https://www.adn.com/business-economy/energy/2017/10/25/after-a-long-decline-alaska-expects-third-straight-year-of-increased-oil-production/ (October 25, 2017).

Questions for the Record Submitted to Ms. Lois Epstein

Figure 2
Alaska Department of Natural Resources Projections of TAPS Throughput[8]



Question 5: What do you think is the likely remaining operational timeline of the pipeline if oil is not produced from the Arctic refuge?

Answer: A state court decision in 2011 between the pipeline owners and the State of Alaska involving property taxes determined that TAPS is likely to operate for another 50 years with proven reserves.[9] This estimate does not include any unproven reserves in the Arctic Refuge coastal plain. That court decision was affirmed by the Alaska Supreme Court.[10] The approach used by the state court was affirmed a second time by the Alaska Supreme Court in a similar case in 2015.[11]

Questions from Senator Bernard Sanders

Question 1: According to the State of Alaska, there have been over 640 oil spills on Alaska's North Slope since 1995, 13 of which were greater than 10,000 gallons. Since 2009, tens of thousands of gallons of crude oil and drilling fluids have spilled on the North Slope. In April, a BP oil well leaked crude oil and gas for several days due to damage caused by pressure from thawing permafrost. The Alaska Oil and Gas Conservation Commission issued an

[8] Umekwe, P., Alaska's 10-year Oil Production Outlook And Potential Future Developments Report, Alaska Department of Natural Resources, presented to the Alaska Support Industry Alliance, retrieved October 30, 2017 from http://alaskaalliance.com/wp-content/uploads/2013/10/Pascal-Umekwe-AK-10-Year-Oil-Production-Outlook.pdf (April 27, 2017). Perhaps mistakenly, although ConocoPhillips' Willow project is far along and included in this presentation, its estimated 40,000-100,000 barrels per day of oil production is not included in this figure.

[9] Lisa Demer, *Judge pegs pipeline life at 50 more years,* Anchorage Daily News, January 5, 2012, https://www.adn.com/economy/article/judge-pegs-pipeline-life-50-more-years/2012/01/04/

[10] See *BP Pipelines (Alaska) Inc. v. State, Dep't of Revenue*, 325 P.3d 478 (Alaska 2014).

[11] See *State, Dep't of Revenue v. BP Pipelines (Alaska) Inc.*, 354 P.3d 1053 (Alaska 2015).

emergency order to review all wells on the North Slope of Alaska due to the threat posed by warming permafrost.

Do you agree with the Alaska Oil and Gas Conservation Commission that warming permafrost poses a threat to fossil fuel infrastructure?

Answer: Yes. The BP incident in April was a blowout (i.e., an uncontrolled release of gas and/or oil) from an older, producing well, DS02-03. BP and the Alaska Oil and Gas Conservation Commission (AOGCC) have agreed that thawing permafrost resulted in subsidence affecting this well which, in turn, led to the blowout. It is not clear, however, whether thawing of shallow permafrost or thawing of permafrost from warm well fluids several thousand feet down, or both, caused this serious incident.

Since this incident, BP has:[12]

1. Abandoned the oil reservoir,
2. Secured 14 wells with similar three string casing construction as DS02-03, and
3. Found another well showing substantial subsidence similar to DS02-03.

This type of incident has not occurred previously and shallow permafrost thawing due to climate change-related increases in temperature may be the reason. Though AOGCC's emergency order only is looking at wells of similar design and construction as DS02-03, other well designs also might be affected by thawing permafrost.

Question 2: Are you worried about the risk to both wildlife and communities poised by oil spills, especially with the growing effects of climate change?

Answer: Depending on volume, location, and time of year of occurrence, major oil spills can have significant impacts on wildlife. Summertime releases would have serious impacts on wildlife as migratory birds and calving caribou likely would be utilizing the Arctic Refuge coastal plain. Additionally, the rivers and wetlands of the coastal plain would not be frozen which would allow oil to spread easily and make oil spill response much more difficult. Bringing heavy equipment and personnel to the coastal plain for oil spill response would have significant adverse effects on wildlife as they likely would leave nearby areas to avoid industrial noise and related response activities.

One concern regarding drilling in the Arctic Refuge coastal plain is that it is a relatively narrow strip of land compared to the coastal plain in other parts of the U.S. Arctic. Figure 3 is a map that illustrates this point. Were a spill to occur and heavy equipment and personnel be brought in, wildlife that are already constricted by oil infrastructure would be further restricted and threatened by spills.

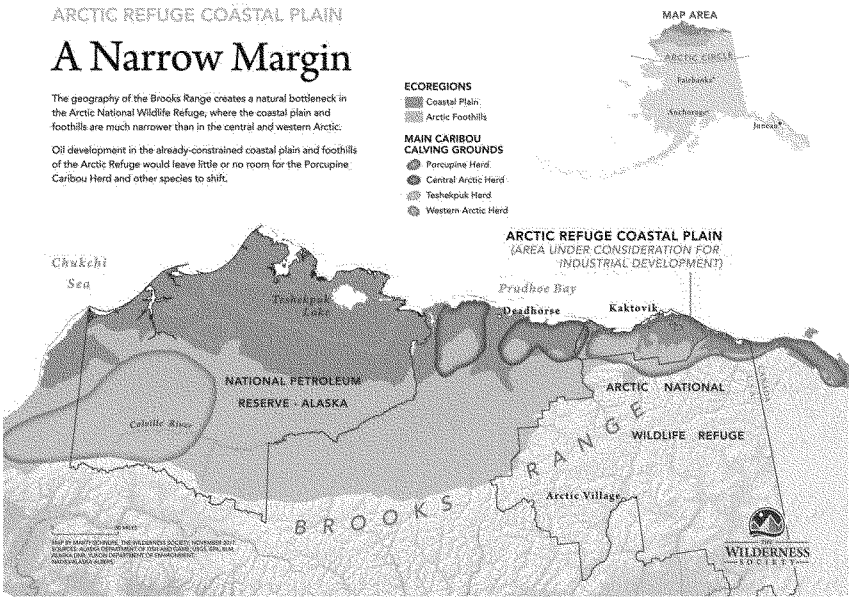
Should habitat conditions be altered due to climate change, wildlife would face additional stresses. Oil development would reduce prime habitat available in the coastal plain and that, in addition to climate change-related stresses, could result in diminished populations. Arctic Village

[12] BP Exploration (Alaska), October 2017 Update, op. cit.

and other communities that rely on caribou and other wildlife that use the coastal plain could be harmed by reduced wildlife populations.

A major oil spill during winter would have different wildlife impacts. At that time of year, polar bears are denning onshore. Because industrial noise and related activities involved in spill cleanup would be significant, female polar bears denning nearby could abandon their dens. At a time when Beaufort Sea populations of polar bears are classified as "threatened" under the Endangered Species Act, the loss of any polar bear cubs would be damaging to the population.

Figure 3
Map Showing the Comparative Narrowness of the Arctic Refuge Coastal Plain



Question 3: At a time when existing wells are threatened by warming temperatures due to climate change, does it make sense to build *more* wells and risk further oil spills in the Arctic Refuge's pristine environment?

Questions for the Record Submitted to Ms. Lois Epstein

Answer: No. It clearly is a conflict to create a major, new oil development in a pristine region at the same time that nations throughout the world, and states like Alaska which support the goals of the Paris [climate change] Agreement,[13] are working to reduce the impacts of climate change.

While wells and major oil spills unquestionably would adversely affect wildlife, it's important to recognize that this pristine environment and the characteristics of the Arctic Refuge coastal plain allow wildlife to thrive. With respect to migratory birds that breed on the coastal plain, this pristine environment ensures thriving bird life for species that migrate to all 50 states. If the relatively narrow coastal plain in the Arctic Refuge were utilized for oil development, Porcupine Caribou Herd calving habitat would be greatly diminished, which would have an enormous impact on the Gwich'in and other people who rely on that herd for food and other essential purposes.

Further, at this time nearly 27 million acres of the U.S. Arctic already are available to the oil and gas industry.[14] Here is how the acreage breaks down:

- 15 million acres are available for leasing on state lands on Alaska's North Slope, including 3.5 million acres already under lease.
- 11.8 million acres are available for leasing in the National Petroleum Reserve-Alaska, including 1.3 million acres already under lease.

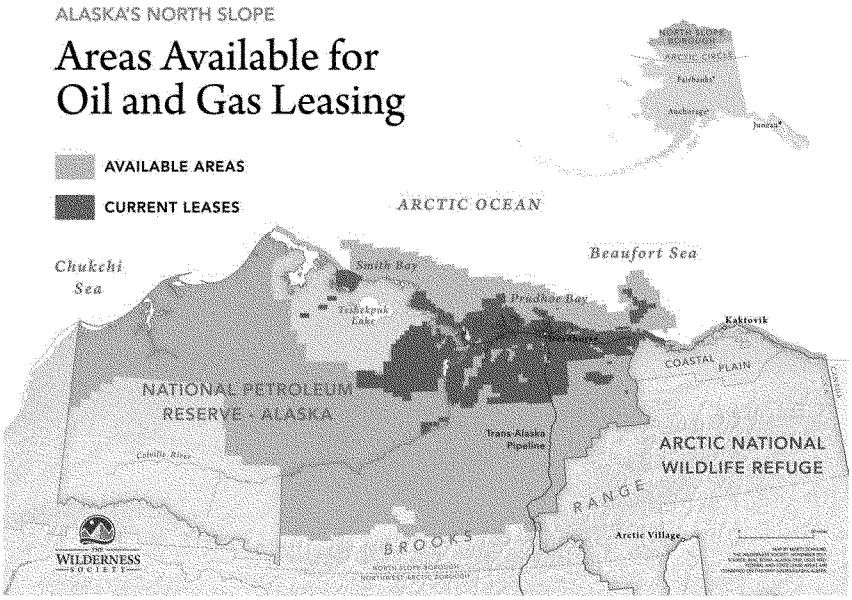
Figure 4 is a map identifying the areas available for oil development:

[13] Governor Walker Signs Administrative Order Establishing Climate Change Strategy for Alaska (Oct. 31, 2017), retrieved from https://gov.alaska.gov/newsroom/2017/10/governor-walker-signs-administrative-order-establishing-climate-change-strategy-for-alaska/

[14] Based on data from the U.S. Department of the Interior, Bureau of Land Management, and the Alaska Department of Natural Resources, Division of Oil and Gas.

Questions for the Record Submitted to Ms. Lois Epstein

Figure 4
Areas Available for Oil and Gas Leasing in the U.S. Arctic



At a time when so much of the U.S. Arctic is available for leasing – and much of this available land is showing good prospects for oil development as discussed in the answer to Question 4 from Senator Cantwell – our nation should be taking steps to protect remaining sensitive ecological areas like the coastal plain of the Arctic Refuge.

Question 4: The Arctic Refuge is home to hundreds of plant and wildlife species, including America's most iconic animals such as polar bears, grizzly bears, musk ox, wolves and caribou. This area includes more polar bear den sites than any other area on the north coast of Alaska and has been designated as a critical habitat for these threatened animals, which are listed as a threatened species under the Endangered Species Act.

The Arctic Refuge is also the nesting ground for millions of birds, including waterfowl such as Northern Pintail and Tundra Swans, which migrate from all 50 states.

Do you anticipate that the infrastructure and technology used for extraction will adversely affect this pristine ecosystem?
Answer: Development would involve construction at many different drill site locations, and these locations would be interconnected with many miles of roads and pipelines. There is no

question that this infrastructure would dramatically impact the natural environment and alter the wilderness characteristics of the Arctic Refugecoastal plain.

Development can be expected to adversely impact wildlife and their habitat. There are a number of studies over the past several decades that have shown negative impacts on wildlife of activities associated with oil and gas development on Alaska's North Slope. A comprehensive study was conducted by the National Research Council's Committee on Cumulative Environmental Effects of Oil and Gas Activities on Alaska's North Slope in 2003.

The sensitivity to oil development of female caribou about to give birth and those with young calves, for example, has been well documented. In addition, multiple studies have demonstrated changes in movement and distribution of caribou following development of the North Slope's Prudhoe Bay oil field and the Kuparuk Development Area. Impacts are predicted to be even greater in the narrow coastal plain of the Arctic Refuge. For details and additional concerns please see the testimony by Dr. Timothy Fullman in Attachment B, submitted for the record to the committee on November 15, 2017.

Question 5: Do you think that the infrastructure and technology used for extraction will violate the Endangered Species Act?

Answer: The bill passed by the committee on November 15, 2017 does not exempt the leasing and development activities in the Arctic Refuge coastal plain from the requirements of the Endangered Species Act (ESA). Because the bill mandates an oil and gas program, however, fulfilling that requirement will take precedence over protection of species even if they are listed under the ESA. One can reasonably expect as a result that there would be impacts to threatened and endangered species including adverse impacts to designated critical habitat for polar bears.

Question 6: How much revenue do you expect would be generated from leases under the proposal to open drilling in the 1002 Area of the Arctic Refuge? Do you believe the federal government's share of leases on the Coastal Plain would be sufficient to offset a $1 billion tax?

Answer: As outlined in the response to Question 1 from Senator Maria Cantwell above and in a Key-Log Economics, LLC report (Attachment A, p. 29), there is no evidence that the coastal plain of the Arctic National Wildlife Refuge would be valued enough by oil companies to receive $2 billion in bonus bids with half of that amount going to the federal government. Since 2010, the average price per acre on the North Slope has ranged from $14.81 to $80.59, with a weighted average for the cumulative 2,442,868 acres sold in the past six years equaling $41.59. Undoubtedly, recent North Slope bids are the best indicator of how much federal revenue could be raised from leasing the coastal plain. While the bids per acre could increase, no evidence exists that oil companies would be inclined to pay more for land in the Arctic Refuge coastal plain which has no existing infrastructure or proven reserves.

An October 2017 analysis by the Center for American Progress found that offering oil and gas leases in the Arctic Refuge likely would amount to no more than $37.5 million in federal revenue

over 10 years, substantially short of the $1 billion to $1.8 billion that the White House, Congress, and drilling proponents claim could be raised.[15]

In summary, with such low North Slope lease sale prices in recent years and with the very low estimate of federal government revenue in the CAP analysis, I believe the amount of revenue to be raised in the next ten years from lease sales in the Arctic Refuge coastal plain is relatively trivial – likely within the statistical noise – with respect to offsetting $1.5 trillion in tax cuts.

Questions from Senator Debbie Stabenow

Question 1: As an engineer, may you elaborate on the surface impacts that result from directional drilling? Also, from your experience, what has been the track record for oil and gas development on the North Slope? Do you believe it has generally been done in an environmentally responsible manner?

I ask this question because I am not convinced that opening the Arctic National Wildlife Refuge to drilling won't sacrifice one of our country's sacred wilderness areas.

Answer: Directional drilling for oil, which is not a new technology, has impacts that are no different than conventional oil drilling except for smaller and potentially fewer well pads. It requires surface occupancy for drill rigs and well pads as well as runways, roads, processing facilities, pipelines and other transportation and supply infrastructure. Noise, air and water pollution, and toxic chemical spills still are inevitable

Regardless of whether directional or conventional drilling is used, there would be extensive adverse impacts from seismic exploration which does occur directly above the subsurface being explored. In the Arctic, seismic exploration typically involves heavy vehicles driving across the tundra in a grid pattern, compressing sensitive soil and plants. Tundra recovery from seismic activities can take decades.

The bottom line with directional drilling is that it allows a region to become industrialized and adversely impacted to essentially the same extent as conventional drilling.

Regarding the track record of oil and gas development on the North Slope, it definitely is mixed and varies based on a number of factors including: company-specific safety and environmental protection culture, new vs. old infrastructure, experience with Arctic operations, financial resources at a given time, etc. As discussed in my written testimony, there is a spill of 1,000 gallons or more nearly every two months on average. This is not a good track record regarding major spills.

It's important to remember that corporate/operator competency is not evaluated during lease acquisition or even looked at thoroughly during permitting. Additionally, if operators choose to

[15] Lee-Ashley, M. and Rowland, J., Arctic National Wildlife Refuge 101: Protecting America's Last Great Wilderness from Being Sold Out for a Congressional Tax Scam, Center for American Progress (Oct. 10, 2017), [blog post] retrieved from https://www.americanprogress.org/issues/green/news/2017/10/10/440559/arctic-national-wildlife-refuge-101/

develop their leases without directional drilling, they would be free to do so and habitat loss would be even greater.

In summary, if the highly sensitive coastal plain is made available for oil development, there is no guarantee there would not be major spills and serious adverse impacts to wildlife through industrialization and loss of habitat. There is a guarantee, however, that this pristine, sacred region would no longer remain one of the world's most treasured and iconic landscapes, as well as a haven for wildlife.

Question 2: The purposes of the Refuge, as stated in the 1980 law establishing it, are:

1. to conserve fish and wildlife populations and habitats in their natural diversity;
2. to fulfill the international treaty obligations with respect to fish and wildlife and their habitats;
3. to provide the opportunity for continued subsistence uses by local residents; and
4. to ensure water quality and necessary water quantity within the refuge.

While we have not yet seen the legislative language that will open ANWR to drilling, bills previously introduced exempt or limit the compliance of production activities with federal environmental statutes.

If we are going to drill in the Refuge, do you think we should at least require these activities to comply with our nation's core environmental statutes?

Answer: Yes. We now have a bill passed by the committee on November 15, 2017 which was before the due date for these responses to November 2, 2017 hearing follow-up questions.

While the bill does not expressly exempt leasing and development from specific environmental laws, it circumvents them by mandating a leasing program, which can reasonably be expected to lead to oil development in the Arctic Refuge coastal plain regardless of other laws. The bill specifically calls for a minimum of two sales within ten years consisting of a minimum offering of 400,000 acres each "with the highest potential for oil." This approach undercuts numerous environmental laws, including the National Environmental Policy Act and the Endangered Species Act by prioritizing oil and gas activities over protection of the fish and wildlife and habitat. Additionally, the bill states that the Secretary "*shall* issue rights-of-way or easements" (emphasis added) necessary for exploration, development and production of oil and gas.

Furthermore, the purposes of the Arctic Refuge outlined in the Alaska National Interest Lands Conservation Act (ANILCA) as you noted would now include an oil and gas program. The bill directs the Bureau of Land Management to administer this oil and gas program on the Arctic Refuge coastal plain, essentially eliminating the U.S. Fish and Wildlife Service's role and the service's ability to protect fish and wildlife resources in the refuge. Tragically, the original purposes of the Arctic Refuge coastal plain would be lost under the bill passed by the committee.

Arctic National Wildlife Refuge: Economics of Potential Oil Development

November 1, 2017

Prepared for:

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Executive Summary

Background

To some, drilling for oil and gas in the Coastal Plain of the Arctic National Wildlife Refuge (Coastal Plain) promises abundant, cheap energy that would displace oil imports, lower domestic gas prices, boost employment, and raise revenue to bring down the deficit. These promises, however, are based on outdated information and rosy assumptions about how much oil the Coastal Plain may hold, the price the oil may fetch, and the speed with which oil and gas could be found, extracted, and brought to market. Given the enormous risk to ecosystems and human welfare that such oil exploration and development would impose, it is essential that promised benefits be closely, carefully, and critically examined.

Estimates of Undiscovered Oil on the Coastal Plain

Oil under the Coastal Plain are unproven reserves, meaning there is no guarantee that oil is there and could one day be produced and sold. Ultimately, the only oil that matters is economically recoverable oil--that portion of technically recoverable oil which can be produced for less than the price of oil in the market—contingent on its discovery (Energy Information Administration, 2014). The U.S. Geological Survey (USGS) in 1998 estimated that there is a 50% chance that the Coastal Plain holds 10.4 billion barrels (BBO) of technically recoverable oil, a 95% chance that it holds up to 5.9 BBO, and a 5% chance that as much as 15.2 BBO are present (Attanasi & Freeman, 2009). Economically recoverable oil would be fraction of these volumes. Given the wide range of these estimates (not to mention the fact that they have not been updated in 20 years), Congress should be cautious about relying on oil from the Coastal plain to solve America's energy, budgetary, or broader economic problems.

Arctic Refuge Production Impact on U.S. and Global Oil Supply

Previous assessments suggest that during its peak year of production, the Coastal Plain could bring 700,000 barrels of oil a day to market (Energy Information Administration, 2008). Globally, any added supply from the Arctic Refuge could be offset by a small reduction from OPEC (Behar & Ritz, 2016). Domestically, the argument that Arctic Refuge oil would displace oil imports is not well substantiated: additional oil shipped from Port of Valdez would go primarily to west coast foreign markets. This would initially reduce the flow of tight oil from the Northern Midwest—but only to a limited extent (DeRosa & Flanagan, 2017). After that, additional Arctic Refuge oil would go into storage rather than further displacing imports. Even if each barrel pumped from the Coastal Plain meant one less barrel imported, imports, as a portion of all U.S. oil consumption would fall by only 4% to 48%, and that is at the projected peak of Coastal Plain production (Fineberg, 2011). Meanwhile, unconventional oil production and advances in energy efficiency are the big reasons for reductions in U.S. oil imports in the past decade. Energy conservation displaces 25 times more crude oil imports than oil taken from the Arctic National Wildlife Refuge ever could (Fineberg, 2011).

National and Global Price Impact

The effect on national oil prices would be brief and minimal at best, largely because prices are determined in the global market in which non-OPEC producers act as price-takers rather than price-makers. According to both the EIA (2008) and USGS (2009), the earliest commercial production could begin is 7 to 10 years after Congressional

approval. Once production begins, any impact on prices at the pump would likely only be felt during a single peak production year approximately 10 years later (Energy Information Administration, 2008).At best, consumers could save 1% on gas 15 years after Congressional approval (Energy Information Administration, 2008; Hahn & Passell, 2008).

Potential Jobs Associated with Refuge Development

Changes in employment associated with potential oil production in the Arctic National Wildlife Refuge depend on factors including the phase of development, the number of wells and rigs, specific geographic location, and the type of project (Wood Mackenzie, 2011). Previous employment estimates of these changes vary widely and sit atop a house of cards, the foundation of which is out-of-date assessments of oil volume and oil prices nearly twice what they are today. While it is certain that extracting oil from the Coastal Plain would support some employment, the gains would be temporary and may simply represent a shift of jobs from other regions. Newer data and better models of net changes in economic well-being—that is, those that consider potential loss of traditional and current economic use of the Arctic Refuge—are needed.

Hypothetical Timeline for Oil Development on the Coastal Plain

Various U.S. government, industry, and other entities have estimated the time lag between Congressional approval of oil and gas development in the Arctic Refuge and actual production; estimates range from 7 to 20 years (Thomas et. al, 2009; Arctic Power, 2001; Attanasi and Freeman, 2009). If approval were to be granted in 2018, development and production could occur between 2025 and 2030 based on U.S. Department of Energy phasing (Thomas et. al, 2009). In this scenario, the first payments to the U.S. Treasury would begin in 2022 for leases, and in 2030 for royalties from production, assuming no delays. Under other plausible government and industry scenarios, production might not commence until 10 years later, or by 2040.

Opening the Refuge: Cost to the American Taxpayer

How much revenue the federal government receives will depend on the number of acres leased, the price per acre leased, and the distribution of revenue between the U.S. Treasury and the state of Alaska (Alaska Oil and Gas Competitive Review Board, 2015). Currently, the Trump Administration claims $1-1.8 billion could be raised by lease sales alone in the next ten years (Office of Management and Budget, 2017). The Center for American Progress, meanwhile, finds no more than $37.5 million in federal revenue could be raised from leases over the same period, or just 2% of the Administration's estimate (Lee-Ashley & Rowland, 2017). Because the White House and Congress are counting on high estimated revenues to fund expenditures, including proposed tax cuts, any shortfall relative to those expectations will increase the deficit.

Challenges of Frontier Exploration

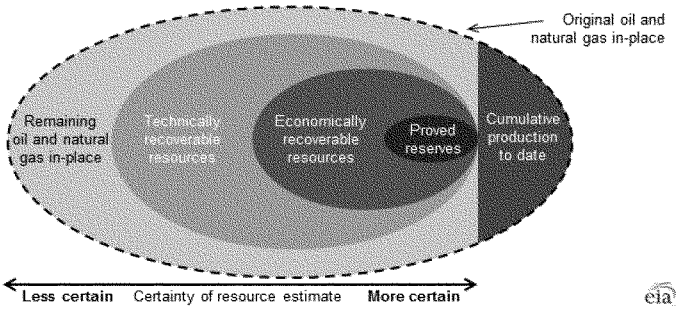
The climate, geography, and isolation of the Arctic present challenges to oil and gas exploration and development. The North Slope of Alaska is remote and sparsely populated with only one road connecting it with the rest of the state. These factors contribute to Arctic development being more expensive, riskier, and lengthier than comparable deposits found elsewhere in the world (Budzik, 2009). In addition to requiring larger

investments than comparable projects elsewhere, the long lead-times required for Arctic projects add risk because economic conditions can change significantly between the time exploration leases are secured and when production begins.

Economically Recoverable Oil Potential in the Arctic Refuge

Estimates of technically recoverable oil on Alaska's Northern Slope continue to fuel the decades-long debate on oil drilling in the Coastal Plain (1002 Area) of the Arctic National Wildlife Refuge.[1] The more important consideration—and one often overlooked by those advocating for drilling—is how much of that oil will be economically recoverable, and to what extent should undiscovered economically recoverable oil inform market and policy decisions? While technically recoverable oil refers to oil that can be produced using current technology and geologic knowledge, economically recoverable oil is the portion of technically recoverable oil that can be produced for less than the price the oil would bring in the market—contingent on its discovery (Figure 1) (Energy Information Administration, 2014).

Figure 1. Visual representation of oil resource categorization (not to scale)
Source: U.S. Energy Information Administration, 2014



In the longer run, changes in technology (which presumably would be adopted only if they make recovery cheaper) would increase economically recoverable reserves. However, if cost-saving technology affects only other reserves elsewhere, the relative cost of North Slope oil will increase and its economically recoverable reserves will fall. Hydraulic fracturing, which has made production from shale and tight sands in the lower 48 states relatively less expensive, is a good example of this dynamic at work. The fracking boom has boosted

[1] The absolute limit to technically recoverable oil is not the total amount of oil available (as shown in Figure 1). Rather, it is the amount that can be extracted at a lower cost *in energy* than the energy content of the extracted oil. The ratio of energy out to energy in is the "energy return on investment" (EROI) and when that ratio falls below one, further effort to produce that energy become thermodynamically nonsensical (Daly & Farley, 2011; Hall, Lambert, & Balogh, 2014). One would not, for example, use 6 million BTUs of energy to pump a barrel of oil that may yield only 5.8 million BTUs (EROI=0.97). Even so, and due either to poor policy or a desire to have energy of a particular type or in a particular form (e.g., liquid fuel), it is possible to produce such oil at an energy loss, so long as other energy is available to make up that gap between energy out and energy in. Moreover, technically recoverable oil can increase over time as energy-saving technology, which increases EROI up, is developed and adopted in the energy industry.

energy supply and driven down prices, which further narrows the gap between the price of non-fracked oil and the cost of producing it (Nicks, 2014).

Clearly, estimates of the portion of oil reserves that is economically recoverable are fluid, and they are not nearly as easy to know at any moment as the volume of oil *in situ*, or even the volume that is technically recoverable. Economically recoverable reserves, however, is the more appropriate measure to use when assessing potential undiscovered resources in the Arctic. Otherwise, taxpayer dollars may be spent to facilitate production, incur environmental and social costs, and otherwise subsidize the production of oil that is not worth recovering.

Government Estimates of Recoverable Oil in the Coastal Plain Area of the Arctic Refuge

Government reports published in the last ten years provide estimates of the total undiscovered technically and economically recoverable oil in the Arctic Refuge. The latest U.S. Geological Survey (USGS) assessment, published in 1998 and updated in 2009, provides an average estimate, or 50% chance, that 10.4 billion barrels (BBO) of technically recoverable oil exist on the Coastal Plain (1002 Area) of the Arctic Refuge. Their estimates give a 5% probability that as much as 15.2 BBO exist on the Coastal Plain, and a 95% probability that at least 5.9 BBO are present (Attanasi & Freeman, 2009). Both the National Energy Technology Laboratory and USGS reported that, of the technically recoverable amount on the Coastal Plain, a mean estimate of 7.7 BBO, or 75% of the total estimate, is located on federal lands, while 25% lies under state and native lands within the Refuge. Considering that the economically recoverable volume is almost always a fraction of the technically recoverable volume, the 7.7 BBO represents an upper threshold mean estimate for how much oil could be produced from the Coastal Plain's federal lands (Thomas, et al., 2009).

The U.S. Energy Information Administration (EIA) (2008) based its estimates oil production potential in the Refuge on the USGS estimate of about 7.7 billion barrels of oil technically recoverable in the federal land portion of the Coastal Plain. The EIA created three scenarios that reflected the low, mean, and high estimate of *technically* recoverable oil provided by the USGS 1998 assessment. They compare these three scenarios to the 2008 Annual Energy Outlook "reference" case, which is a business-as-usual projection of resource supplies and prices contextualized by economic conditions.

In the reference case, with no additional oil from the Arctic Refuge, U.S. production increases from 5.1 MBD (million barrels per day) in 2006 to a peak of 6.3 MBD in 2018, then falls to an average of 5.6 MBD by 2030 (Energy Information Administration, 2008). In this case, Alaskan production increases post-2014 from the discovery and development of new offshore oil fields expected to be found off the North Slope (Energy Information Administration, 2008).

In all three Arctic Refuge oil resource cases, production starts in 2018 (now 2028, because, the analysis was published 10 years ago), and peaks at 510,000, 780,000, and 1,450,000 barrels per day around 2028 (now 2038) in the low, mean, and high-resource-case scenarios respectively. EIA estimates that Cumulative oil production in the twelve years following initial production would be 1.9 BBO, 2.6 BBO, and 4.3 BBO in the low, mean, and high-resource-case respectively (Energy Information Administration, 2008).

Limitations of Government Agency Analyses

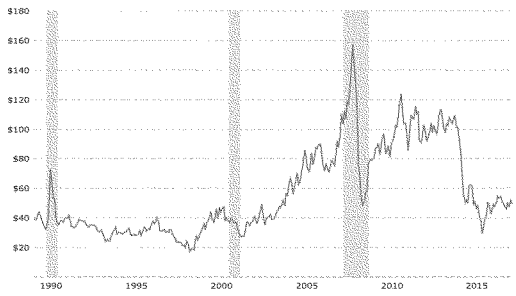
There are a number of reasons to be cautious in using the 2008 EIA and 2009 USGS updated economic analyses as a resource for policy-making. The first and foremost concern with these government analyses is that they are based on outdated information. The last geological assessment was performed two decades ago using financial data and technological assumptions from that time, making it nearly irrelevant as a guide to current energy, budget, or economic policy. In May of 2017, Secretary of Interior Ryan Zinke ordered a plan for updating assessments of undiscovered, technically recoverable oil in the Coastal Plain, which would include consideration of new data as well as a reprocessing of existing data (U.S. Department of the Interior, 2017). Second, and while often noted at the end of these reports, there is a great deal of uncertainty surrounding resource estimates in the Arctic Refuge.

Another concern arises from the comparison of the three EIA *technical* estimates with a reference case embedded in the 2008 (then current) economy rather than economic estimates tied to long-term oil price projections. These factors suggest that the EIA's 2008 report, while one of the most recent analyses of oil production in the Arctic Refuge, is outdated in significant aspects ten years later, and should not be relied on as a source for economically recoverable estimates in the Arctic Refuge.

Price Projections

Price projections for crude oil are essential for determining the volume of undiscovered economically recoverable oil. Both the USGS 1998 assessment and 2009 economic update estimates are based on data from periods in which crude oil prices were fluctuating significantly. Since 2009, however, the global financial crisis as well as increases in supply erased much of the gain in prices (in real, or inflation-adjusted terms) since 2000, and prices are now more in line with historical norms (Figure 2).

Figure 2. Crude Oil Prices 1989-2016
Source: Macrotrends, L.L.C., 2017



A more relevant estimate of economically recoverable reserves available in the Coastal Plain is obtained by re-examining the 2009 USGS scenario in light of today's prices and the longer-term trends. First, we adjust the current price of crude oil, which was $50/BBL in September 2017, for inflation to get its 2007 equivalent of $42/BBL. Assuming all other parameters are unchanged, there would have been 14.9 BBO of economically recoverable oil at that $42/BBL price point in the entire North Slope study area in 2008. Of that total, 9.1 BBO would have been in the 1002 Area of the Arctic Refuge. Finally, since 75% of the technically recoverable oil in the Coastal Plain of the Arctic Refuge is estimated to occur on federal lands, some 6.8 BBO could be economically recoverable at current (September 2017) prices (Attanasi and Freeman, 2009). The purpose of this calculation is not to provide a new estimate for how much oil production to expect from the Coastal Plain, but rather to show how price changes alone can affect the implications of assessments from 10 to 20 years ago.

Economically Recoverable Oil vs. Break-even Prices

The most relevant oil prices are those that may prevail during the time at which Arctic Refuge resources would be extracted. If development were permitted today, it is unlikely that any oil would flow before 2028 (Energy Information Administration, 2008). Therefore, the relevant prices to use *today* to estimate economically recoverable oil would be the prices expected in 2028 and through a production period of up to 30 years. Naturally, predicting future price trends is difficult, and any resulting estimates of economically recoverable oil should be understood to come with a wide margin of error, and to be a measure of *undiscovered oil* (Behar & Ritz, 2017).

The price estimates for undiscovered oil cannot be contextualized with regional break-even prices often reported by market analysts; the economically recoverable price is used to inform industry of potential in a region under particular economic conditions, whereas the break-even prices often inform companies on specific producing regions or projects for which costs are more certain.

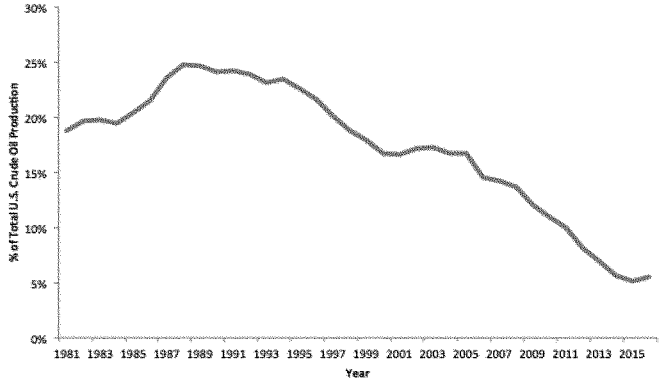
Other Factors Influencing the Cost of Coastal Plain Oil Production

The most important stipulation to projections of economically recoverable oil is that all of the projections described above are based on the estimated private or *internal* (to the oil companies) costs of bringing undiscovered oil to market. They do not consider the *external* costs of development, extraction, transportation, and ultimate consumption of energy derived from the Arctic Refuge crude oil. These costs include climate change, loss of habitat, human health effects of the release of toxins, disaster (spill) preparedness and response and a host of other costs that are largely shouldered by taxpayers. These costs are only imperfectly (at best) reflected in the market price of a barrel of oil, and call into question the notion that oil and gas development in the Arctic Refuge would actually generate revenues to balance the federal treasury. Because these costs could total 100% or more of the market value, the *net* price of oil could be zero or even negative. In that case, obviously, the amount of oil economically recoverable from the Arctic Refuge would be zero (Hall, 2004).

Impact of Arctic Coastal Plain Oil Production on U.S. and Global Supply

Since the debate on drilling in the Arctic National Wildlife Refuge began, proponents have insisted that the added domestic production will reduce U.S. dependence on foreign oil while lowering consumer prices and adding industry jobs in Alaska. Historically, Alaska has been one of the highest producing oil states in the U.S. with more than 738 million barrels of oil produced in its peak year in 1988 (Energy Information Administration, 2016a). In the 1980s and 1990s, Alaska accounted for 20% to 25% of total U.S. production annually, but as of 2016, Alaskan crude oil production made up only 5.5% of total U.S. supply (Figure 3). In the past ten years, mostly increases in tight oil production in the Northern Midwest and Gulf Region have contributed to decreased imports and greater U.S. reserves (Energy Information Administration, 2017b).

Figure 3. Alaska Crude Oil Production as a Portion of Total Annual U.S. Production
Source: Adapted from Energy Information Administration, 2016a



The smaller potential increases in U.S. supply—from even the most optimistic estimates of Refuge production—are projected to have little effect on U.S. imports or oil prices. Alaskan oil production will consistently be dwarfed by tight oil production in the lower 48 states in coming decades as companies continue to make oil discoveries around the Permian Basin in Texas and the Bakken Play in the northern Midwest. According to a new analysis by IHS Markit Ltd. the Permian Basin holds another 60 to 70 billion barrels of yet-to-be-pumped oil, which could supply, "every refinery in the U.S. for 12 years and have a market value of about $3.3 trillion at current prices" (Carroll, 2017). Even in Alaska's Prudhoe Bay, companies continue to discover economically

recoverable oil within existing plays[2]. For example, Armstrong and Repsol announced a 1.2 billion barrel discovery on the North Slope of Alaska this past spring, noting the potential to bring 120,000 barrels of oil a day to the market beginning in 2022 (Harball, 2017). Not long after, the same companies announced promising results from an exploration drill in the Horseshoe play, meaning geologically connected discoveries by Caleus Energy, ConocoPhillips, and Armstrong-Repsol in the past year could bring over 400,000 barrels per day of new oil potential from the North Slope (Brehmer, 2017). Each discovery within plays that are already producing commercial oil weakens the commercial appeal of pursuing what oil may exist in the Arctic Refuge, where the lack of transportation infrastructure (roads, pipelines) means higher costs.

Misconceptions on U.S. Oil Import Displacement

Arctic drilling advocates, reinforced by the EIA's 2008 report on the Refuge, suggest that each barrel of oil produced in the Arctic Refuge would reduce U.S. imports by one barrel (Hahn & Passell, 2008). This assumption of a 1:1 ratio of Alaskan production to import reduction neglects existing infrastructure capacity and the flow of oil from Alaska's North Slope to its end-consumers on the West Coast. A recent analysis by DeRosa and Flanagan (2017) uses the National Transportation Fuels Model to simulate increased oil production from the North Slope into the Trans-Alaska Pipeline, which provides some insight into potential impacts of Coastal Plain oil development on pipeline infrastructure. The two primary markets that North Slope oil, including production in the Arctic Refuge, would reach from the Port of Valdez are: 1) delivery to export markets, and 2) shipment to ports on the West Coast of the U.S. (DeRosa & Flanagan, 2017). Should all economically recoverable oil be developed on the Coastal Plain, a nonlinear decline in imports would occur on the West Coast in ports connected to Valdez, with a modest impact on the flow of tight oil from Bakken to Washington and California. After a certain volume threshold, additional production from Alaska would go into storage rather than substitute for imported oil (Fineberg, 2011). Even if oil imports were displaced 1:1, U.S. production would increase domestically by a matter of one to two percent while imports would remain a significant portion of total oil consumption, dropping by, at most, 4 percentage points from 52% to 48% (Fineberg, 2011).

After a forty year ban on exporting oil, the United States began exporting American oil in 2016, and is expected to become one of the top ten exporters globally by 2020 (Slav, 2017). For Arctic Refuge drilling advocates to suggest that the U.S. would benefit from Arctic Refuge drilling because it would reduce America's dependence on foreign oil imports is disingenuous, runs counter to Congress's decision to break the U.S. ban to allow exports and is simply not compelling.

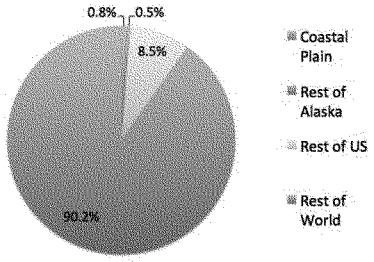
Global Supply

In 2016 world crude oil production averaged 97.23 MBD, while Alaskan production averaged 0.49 MBD, making up approximately 0.5% of total production (Figure 4) (Energy Information Administration, 2016b). Additional production of available, technically recoverable, resources in the Arctic Refuge would total about 0.6% of current

[2] A set of known or postulated oil and gas accumulations sharing similar geologic, geographic, and temporal properties, such as source rock, migration pathway, timing, trapping mechanism, and hydrocarbon type (Klett, et al., 2000).

annual global supply. However it is important to keep in mind that only 1.8 BBO, at most, could be produced before 2035, indicating its overall percent contribution to global supply could vary and ultimately be negligible depending on the rate of global oil consumption, new discoveries in existing wells across the world, and the strategic decisions of OPEC[3] (Energy Information Administration, 2008). As of 2015, OPEC members held a market share of just over 40% of global oil production, allowing a degree of market power over non-OPEC producers who act as a price-taking[4] competitive fringe (Behar & Ritz, 2016). With this market power, OPEC can choose one of two strategies to maintain considerable control over prices, both of which can be optimal for the organization under certain conditions: 1) Accommodate non-OPEC producers to maximize profits via a "high" oil price which allows high-cost non-OPEC countries to remain profitable, or 2) squeeze out non-OPEC producers by driving up production/refusing to cut current supply, thereby driving down price and inducing high-cost producers to exit the market (Behar & Ritz, 2016).

Figure 4. Percent of Global Annual Production of Crude Oil by Region[5]
Source: Adapted from Energy Information Administration, 2016b



With the rapid increase of U.S. shale production in the past decade, many analysts agree that OPEC's decision not to cut production in November 2014, leading to a crude oil price crash, was a strategic move to squeeze out U.S. unconventional oil producers (Behar & Ritz, 2016). Understanding OPEC's past decisions to cut or flood supply provides context for how OPEC may act in the future. These characteristics and trends in the global oil market suggest that any increased production on Alaska's North Slope is only a drop in the barrel in the first instance, and, if it ever were to be an important source of supply it could be subject to OPEC's strategic behavior. High-cost producers/plays, which would include the Arctic, would likely be the first "squeezed" out of the market if OPEC supply expands in the global market, resulting in decreased oil prices.

[3] OPEC (Organization of the Petroleum Exporting Countries) is an intergovernmental organization created in 1960 with the purpose of coordinating and unifying petroleum prices among member countries in order to attain fair and stable prices for producers, regular supply for consumers, and a fair return on capital for investors. The founding members include Iran, Iraq, Kuwait, Saudi Arabia, and Venezuela, and has since been joined by ten other countries (OPEC, 2017).

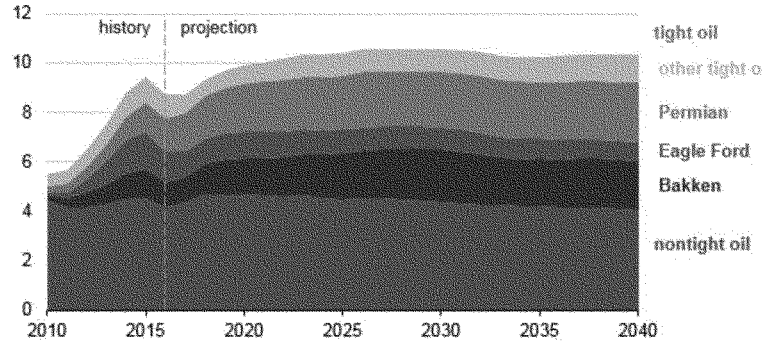
[4] In economics, price-takers are agents that must accept prevailing market prices because their transactions are not a great enough share of the total market to influence prices.

[5] Annual production figures drawn from 2016 EIA reports, Coastal Plain estimate for *peak* annual production retrieved from a 2008 EIA report on hypothetical production from the Arctic Refuge.

The Future of Tight Oil and U.S. Energy Production

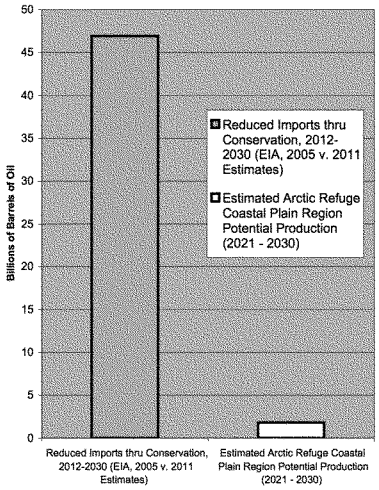
The outcome of the most recent oil production glut in the world market is still unclear; the U.S. tight oil boom drastically altered the structure of U.S. oil production in the past few years, and while OPEC's refusal to cut production left oil prices below $30/BBL at the start of 2016, the falling cost of producing tight oil has kept unconventional U.S. production competing in the world market at lower oil prices (Murphy, 2017). By 2037, which is the approximate time frame the Arctic Refuge would reach peak production if drilling were to be authorized in 2017-2018, tight oil is predicted to make up 57% of U.S. oil production (Figure 5) (Murphy, 2017). Even so, in the next few decades U.S. tight oil will not become a major source of oil in the world. The U.S. only contains 3% of the world's reserves, and even if technical advances allow more U.S. oil to become economically recoverable, U.S. supply will not become a significant portion of world production (Murphy, 2017).

Figure 5. U.S. Oil Production (2010-2040) (million barrels a day)
Source: Energy Information Administration, 2017b



Projections in the demand for oil show a tapering, slowed growth as technological advances and economies of scale make electric alternatives and conservation measures increasingly viable (Energy Information Administration, 2017d). Gains in energy efficiency have proven to have a much more significant impact on oil imports than domestic production; U.S. imports increased annually since the 1980s, but from 2005 to 2011, net petroleum imports decreased by almost 30%, going from 12.5 MBD to less than 9 MBD (Fineberg, 2011). Additional domestic crude oil production is a contributing factor in the trend reversal, but reduced dependence can be largely attributed to lower consumption. Figure 6 quantifies the 25:1 ratio of conservation to production in reducing U.S. oil imports through a discrete timeline, which could be pushed back to 2017-2035 considering at most 1.8 billion barrels of oil could be produced in the Coastal Plain by 2035 if Congress approved drilling today (Fineberg, 2011).

Figure 6. Reduced Oil Imports vs. Potential Coastal Plain Production 2012-2030
Source: Fineberg, 2011



What may not have been foreseen even 5 years ago is the increasing affordability of electric vehicles; from 2014 to 2016, the number of electric vehicles on the road worldwide *tripled,* reaching 1.2 million vehicles last year (International Energy Agency, 2017). The growing niche in the automobile market could displace oil demand of 2 MBD by 2023, enough to create an oil glut equivalent to what triggered the 2014 oil price crash (Randall, 2016). Electric vehicles will soon compete with their gasoline counterparts without the help of subsidies, but policy may continue to shape the automobile market, leading to a more rapid transition away from traditional cars. A handful of nations, including Norway, India, and Germany, have set goals to reach 100% zero-emission cars in the next twenty to thirty years (Pressman, 2017).

Arctic Refuge Drilling Impact on National and Global Oil Prices

While oil prices would influence energy corporations' decisions regarding whether and when to invest in exploration and development of oil in the Arctic National Wildlife Refuge, there is very little chance that oil production from the refuge would have any effect on oil prices or downstream gas prices for consumers. The effect on national oil prices would be brief and minimal at best, largely because prices are determined in the global market and non-OPEC producers act as price-takers rather than price-makers. Increased production within a single region would not lower prices noticeably for consumers, and even if that was the case, Alaskan oil reaches markets on the West Coast and markets for export exclusively (DeRosa & Flanagan, 2017). Hahn and Passell (2008), assert that decreases in crude oil prices associated with production areas currently closed to development, "are likely to be on the order of one percent, and would thus not have a significant impact on prices that consumers pay at the gasoline pump now or in the future."

The most recent government estimates for the oil price impact from potential Arctic Refuge production are approximately ten years old, when oil prices were significantly higher and unconventional oil in the continental United States had not reached the high levels of production achieved in the last five years. In their 2008 analysis on Arctic drilling, the EIA asserted, "Additional oil production ... would only be a small portion of total world production, and would likely be offset in part by somewhat lower production outside the United States." In the EIA reference oil resource case, the peak impact of Arctic drilling would result in a $0.75 decrease in oil per *barrel* in 2025 (what would now be projected in 2035, adjusted to 2017 dollars), a less than one percent impact on prices for consumers at its peak influence (Murse, 2016). This $0.75 price drop per barrel was projected at a time when prices hovered around $131 per barrel, which suggests the absolute price drop may be even smaller as prices currently sit closer to $50 per barrel (United Press International, 2008). The USGS 2009 resource assessment does not provide an estimate for oil price impact in its economic analysis, and the Arctic National Wildlife Refuge Primer provided to Congress by the Congressional Research Service (2011) reinforced the perspective of Alaska and the United States as a price-taker: "Whether oil is produced domestically or imported, it is traded in a global market, and any one part of the market can affect other parts. The result is that oil prices are set in world markets."

World Price Projections

World price projections for the next five years, which precede any point when Arctic oil could reasonably be commercially produced, continue to be revised downwards amid the U.S. shale boom of recent years. Goldman Sachs, JP Morgan, and Credit Suisse all cite increased tight oil production as a reason for short term oil price projections staying relatively low, with Credit Suisse now predicting the price to stay below $60/BBL through 2020 (DiCristopher, 2017). These projections for tight oil production make conventional oil prospects, particularly Arctic drilling, less attractive for oil companies considering profitable exploration in the Arctic may require much higher prices. A recent Deloitte report concludes that the average cost of extracting oil from the Arctic is $75/BBL, which is almost three times the cost of extraction in the Middle East, where a significant historical market share of oil originates (Hoag, 2016).

Figure 7. Weekly U.S. and International Crude Oil Prices
Source: Energy Information Administration, 2017a

America as a Price-Taker

Oil prices are notoriously difficult to predict, as small shocks to oil supply and demand can lead to, "large movements in the price of oil" over time (Arezki, et al., 2017). The difference between changes in national prices versus international prices can be impossible to disentangle. And while natural gas prices fluctuate regionally, they are also tied to crude oil prices, which operate in the world market, meaning any one major producer of oil can impact output and subsequently price (Behar & Ritz, 2016). OPEC's most recent attempt to cut output was offset partly by an increase in supply from Nigeria and Libya, which were exempt from the agreement reached among other OPEC members (DiCristopher, 2017). This development reinforces that any action from a major producer can influence the price of oil, which in turn could impact the profitability of oil production in the Arctic. Regardless, even if OPEC members did not alter output in response to the opening of the Arctic, the increase in supply would have essentially no effect on international prices for oil, making up at most 1% of global production in any given year (Energy Information Administration, 2016b).

The 2014 oil price crash (Figure 7) did not just hurt the prospect of Arctic oil exploration for American companies on Alaska's North Slope; after Shell abandoned its offshore operations, Statoil, Norway's largest energy company, announced it would drop 16 active leases in the Chukchi Sea that were "no longer competitive in Statoil's global portfolio" (Hoag, 2016). Russia, which receives approximately half its state income from oil and gas revenue, only followed through with 2 of the 14 offshore wells it planned to drill in 2017 (Hoag, 2016). These cases augment the relationship between oil prices and Arctic oil production. With an overwhelming amount of the oil supply being produced at a much cheaper cost than Arctic production both in Alaska and outside the U.S., oil prices are a significant factor in potential Arctic production, not the other way around.

Empty Promise of Lower Prices at the Pump

Constituents are often inclined to support legislation that would yield short-term if not immediate relief rather than long-term benefits. Proponents of Arctic drilling claim economic benefits for the American consumer, but fail to provide any details on the timeline, extent, or magnitude of price reductions. According to both the EIA (2008) and USGS (2009), the two government agencies publishing information on potential resources in the Arctic Refuge, commercial production could begin 7 to 10 years after Congressional approval. Once production begins, any impact on prices at the pump would likely only be felt during a single peak production year that happens another 10 years down the road (Energy Information Administration, 2008). At best, consumers would save 1% on gas 15 years from the point in which Congress approves drilling in the Refuge (Energy Information Administration, 2008). Even more likely, which the EIA notes in its most recent analyses, Coastal Plain production would amount to 0.4 percent to 1.2 percent of total world oil consumption in 2030, which is low enough that, "OPEC could neutralize any price impact by decreasing supplies to match the additional production from Alaska" (Lavelle, 2008). Lower gas prices at the pump are simply not a strong argument for drilling in the Arctic, and U.S. government agencies have avoided making any assertion that Arctic drilling would yield any lower prices for consumers perhaps because the economic evidence is absent.

Potential Jobs Associated with Refuge Development

Changes in employment associated with potential oil production in the Arctic National Wildlife Refuge depends on factors including the phase of development (e.g., exploration or production), the number of wells and rigs, specific geographic location, and the type of project (onshore or offshore drilling) (Wood Mackenzie, 2011). In turn, some of these factors depend on economically recoverable discovered oil, global demand and the market price of oil.

In addition to "direct" oil industry jobs in Alaska–jobs with oil producers or oilfield service companies–there are jobs in related industries such as security, catering, accommodations, transportation, engineering services, and pipeline transportation (Fried, 2017). These "indirect" jobs as well as "induced" jobs[6] are commonly estimated using a "multiplier" representing the number of indirect and induced jobs "created" for each direct job. These multipliers are obtained from empirical studies or input-output models (such as RIMS II or IMPLAN[7]).

Because oil is a non-renewable finite resource, even direct oil industry jobs in the Refuge would not be long-term. After peak production, production levels would diminish and employment would decline as well. Once the oil is depleted, companies would abandon the region and related employment would cease.

Refuge Job Projections

Employment estimates for allowing oil and gas leasing in the 1002 Area of the Alaska National Wildlife Refuge vary widely and all are based on higher oil prices than currently prevail. The most recent estimates, prepared for the Institute for Energy Research (an industry trade association), assessed the economic effects of opening restricted Federal lands and waters (Atlantic and Pacific Outer Continental Shelf, Gulf coast, and Alaska National Wildlife Refuge) to oil and gas leasing (Mason, 2013). Results suggest an increase of 61,314 job-years nationwide during the pre-production phase, or 8,759 jobs annually for each of 7 years[8] (Mason, 2013). During production, 199,044 job-years were forecast for the U.S., or 6,635 over each of 30 years (Mason, 2013). These estimates represent less than 0.01% total US employment of 137 million in December 2013 (Bureau of Labor Statistics, 2017). These employment projections are based on economic activity resulting from oil sales at an assumed oil price of $101.34 per barrel (in 2012 dollars), oil reserves of 8 billion barrels, and a multiplier of 5.1 indirect and induced jobs per direct job (Mason, 2013). Because oil prices are about half that today and the oil reserve assumption is based on twenty-year-old model results, these job estimates are overestimates and outdated.

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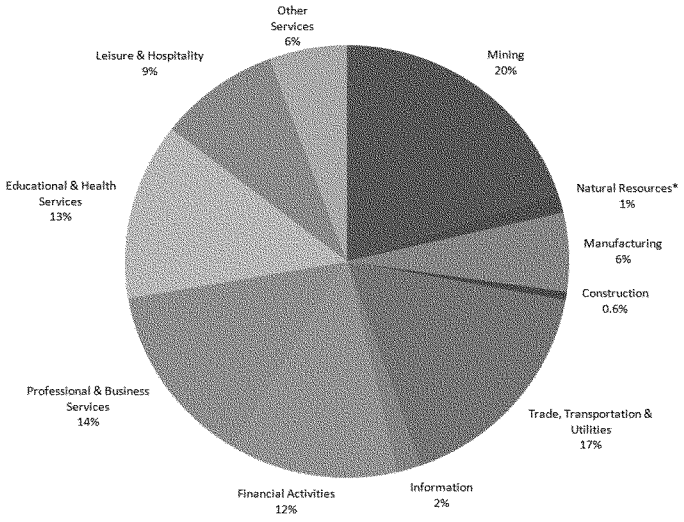
[6] "Induced" employment results when those directly employed in the energy industry and those employed indirectly (at companies doing business with the energy industry) spend their paychecks at grocery stores, service providers, and other businesses in the community.

[7] RIMS II, the Regional Input-Output Modeling System, is available from the U.S. Bureau of Economic Analysis; IMPLAN is a model available from MIG, Inc., a software firm in North Carolina. As with any predictive model, the relative accuracy of results depends on the assumptions, data, and method used.

[8] The author states, "It may help the reader to interpret the resulting jobs numbers as "job-years" or divide the number of jobs by the number of years to establish the number of jobs created for the life of the project. I use the job-years concept .... in reporting my results—the standard method for reporting results of RIMS II analysis — and leave it to the reader to interpret the numbers appropriately" (Mason, 2013, footnote 61).

Mason (2013) also forecast expected employment by industry associated with opening restricted Federal lands and waters to leasing. Jobs in trade, transportation and utilities; professional and business services; educational and health services were projected to represent nearly half (44%) of all new positions (Figure 8) (Mason, 2013). Because the same employment multiplier would apply to all areas considered, based on Mason's assumptions a similar proportion of jobs by industry would apply to potential Refuge oil and gas production.

Figure 8. Jobs Forecast by Industry during Oil and Gas Production
Source: Mason, 2013



The State of Alaska's ANILCA Section 1002(e) Exploration Plan and Special Use Permit Application submitted by Alaska's Governor Parnell to the U.S. Department of the Interior in July, 2013 claimed that oil in the Alaska National Wildlife Refuge would generate, "from about 20,000 to over 170,000 jobs...according to analyses based on data from the Bureau of Labor Statistics" (Ribbink, 2015). As this document is no longer accessible from the

Alaska Department of Environmental Resources[9] further details on these estimates—such as whether jobs were estimated for Alaska or the U.S.—are not readily available.

A study by Wood Mackenzie (2011) for the American Petroleum Institute examining the implications of enacting policies to encourage the development of North American hydrocarbon resources forecast a total of 60,000 new jobs in the U.S. annually for production in the Refuge, with increases each year thereafter. These estimates assume Refuge oil resources of 10.8 BBL; oil priced at $80 per barrel (in 2012 dollars), inflated at 2.5% annually; and a multiplier of 2.5 indirect and induced jobs for every direct job (Wood Mackenzie, 2011).

A much earlier study by Wharton Econometric Forecasting Associates (1990) projected development of oil reserves would create 736,000 new jobs nationwide over 10 years, of which 84,000 would be in the mining sector (Arctic Power, 2001). These are estimates of total jobs – jobs directly associated with the oil operation, as well as indirect and induced jobs: "These jobs would benefit workers in every U.S. state, in supplying equipment and services needed to develop the expected oil discoveries" on the Refuge's coastal plain (Arctic Power, 2001). The results of this nearly 30-year old study have been critiqued by many, including the Congressional Research Service; Economic Policy Institute; and Chemical and Atomic Workers Union (Natural Resources Defense Council, 2001). They found job estimates to be overstated and based on improbable assumptions.

Current Alaska Oil and Gas Industry Employment

Oil and gas industry employment[10] – jobs in oil and gas exploration and oilfield services – averaged 10,156 for the first three months of 2017, about 3% of state employment totaling 315,773 (Alaska Department of Labor and Workforce Development, 2017). The decline in oil prices since 2014 led to job losses for the oil and gas industry in 2016, a 20% reduction compared to 2015 (Fried, 2017; Alaska Department of Labor and Workforce Development, 2017). In 2016 several firms (BP, ExxonMobile, and ConocoPhillips) reduced the number active rigs and other operations in the region (DeMarban, 2016). Shell and Apache Corporation announced they were ending their efforts to find oil in the Alaska region, and ENI, Repsol and Brooks Range Petroleum planned project delays (DeMarban, 2016).

The Alaska Department of Labor and Workforce Development reports that the North Slope of Alaska accounts for two-thirds (66%) of all industry jobs, and Anchorage—which is the headquarters or service center for many firms–for about a quarter (26%) (Fried, 2017). They add that other related jobs are in Valdez, the end of the Trans-Alaska Oil Pipeline (counted as transportation jobs) and in Fairbanks, a major logistic and supply center for the North Slope. Over one-third (36%) of all industry employees are residents of states other than Alaska (Fried, 2017), so major portions of their wages are likely spent out-of-state and do not benefit the state's economy.

Job Forecast through 2024

The Alaska Department of Labor and Workforce Development forecasts there will be 19,652 new jobs in the state by 2024, an increase of 5.8% over the decade (Martz, 2016). A third of the new jobs are projected to be in

[9] This document is no longer available on the Alaska Department of Environmental Resources website: http://dnr.alaska.gov/commis/priorities/ANWR/ANWR_Exploration_Plan_7_9_13.pdf

[10] The Alaska Department of Labor and Workforce Development defines this as North American Industry Classification System codes 211, 213111 and 213112.

health care and social assistance (7,176 jobs) with other substantial additions to accommodation and food service (3,205 jobs) and retail trade (2,744 jobs) (Martz, 2016). Because Alaska's unemployment rate is 7.2% (in September, seasonally adjusted; Alaska Department of Labor and Workforce Development, 2017), greater than the 3% to 5% rate generally associated with full employment, some of these jobs would be filled by people previously unemployed and therefore count as "new." Other openings could be filled by workers already employed in Alaska, or in other states, resulting in no net increase in job creation or decrease in the unemployment rate.

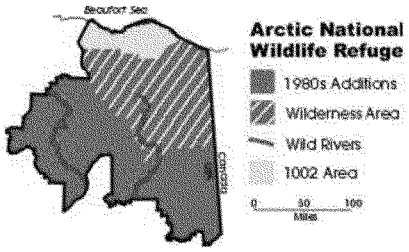
Without credible estimates of the number of jobs that could be associated with potential Arctic Refuge oil and gas development based on current geologic conditions, technology, and forecasts of price and demand, it is difficult to hypothesize the extent to which such opportunities might benefit Alaska in the future. Previous employment estimates of these changes vary widely and rely on out-of-date assessments of oil volume and oil prices nearly twice what they are today. While it is certain that extracting oil from the Coastal Plain would support some employment, the gains would be temporary and may simply represent a shift of jobs from other regions. Newer data and better models of *net* changes in economic well-being—that is, those that consider potential loss of traditional and current economic use of the Arctic Refuge—are needed.

Hypothetical Timeline for Refuge Oil Development

The Arctic National Wildlife Refuge encompasses 19.6 million acres in northeastern Alaska (U.S. Fish and Wildlife Service, 2017). Most of the original Arctic National Wildlife Range established in 1960 was designated as Wilderness in 1980 by the Alaska National Interest Lands Conservation Act (ANILCA) (P.L. 96-487, Dec 2, 1980). The exception has been 1.5 million acres on the coastal plain (Figure 9). Management of that area was addressed in Section 1002 of ANILCA, and is now often referred to as the "1002 Area." The 1002 Area and 10.1 million acres added to the Refuge by ANILCA are "minimal management" areas — managed to, "maintain existing natural conditions and resource values" and open to recreational (including motorized access) and subsistence uses (U.S. Fish and Wildlife Service, 2017).

ANILCA stipulates that the, "production of oil and gas from the Arctic National Wildlife Refuge is prohibited and no leasing or other development leading to production of oil and gas from the [Refuge] shall be under-taken [sic] until authorized by an Act of Congress" (Section 1003). Thus, without Congressional approval, oil and gas development may not occur in the 1002 Area.

Figure 9. Management Areas in the Arctic National Wildlife Refuge
Source: U.S. Fish and Wildlife Service, 2017



Oil & Gas Development Prohibited in the Refuge

Oil and gas development of the coastal plain of the Alaska National Wildlife Refuge has periodically been debated in Congress—as has designation of the area as Wilderness— in the years since ANILCA expanded the Refuge and prohibited oil and gas production within the Refuge. The current Administration has stated that opening the Refuge to drilling is among its top priorities, and in January 2017 bills were introduced in both the House (H.R. 49) and the Senate (S. 49) to allow oil leasing in the Coastal Plain of Alaska (Young, 2017; Murkowski, 2017). In July 2017 the House Subcommittee on Energy and Mineral Resources held an oversight hearing on oil and gas development in Alaska and potential benefits to the U.S. if the Arctic Refuge were opened to exploration and development and if development of the National Petroleum Reserve-Alaska were expanded (House Committee on Natural Resources, 2017). These presumed benefits include an abundance of oil, reduced oil imports, additional federal and state revenues from leasing and royalties, and job creation. The Trump

Administration's budget request for fiscal year 2018 includes $1.8 billion in revenue from federal oil and gas leasing in the Alaska National Wildlife Refuge between fiscal years 2022 and 2027 (as one of many proposed deficit reduction measures) (Office of Management and Budget, 2017).

Timeline of Typical Development

Various U.S. government, industry, and other entities have estimated how long it would take to get from Congressional approval of oil and gas development to actual production. Their estimates range from 7 to 20 years:

- The Energy Information Administration (2002 and 2004) used the 1998 USGS assessment to establish a timeline from approval date to exploration and development of 7 to 12 years (Thomas, et al., 2009).
- The managing director of Hillhouse Resources, an independent oil and gas company in Houston, asserts, "It's going to take seven to fifteen years to finish the seismic review, the geological review, and then begin to develop the technological aspects of building the play" (Granitz, 2013).
- The progression from exploration to development is expected to take about 15 years or more. These long lead times result from the remoteness of the region, concerns for protection of the environment, and the regulatory requirements (Arctic Power, 2013).
- The Brooks Range Petroleum Company (2011) "Brooks Range Petroleum Timeline" projected a 15-year process for exploration to production for their North Slope operation: 2001 exploratory studies, 2014 development, and first oil production 2016.
- The 2009 USGS "Economics of Undiscovered Oil and Gas in the North Slope of Alaska" (Attanasi & Freeman, 2009) considered two scenarios to investigate the effect of timing on the economics of new oil and gas developments: (1) 10 years between discovery and production, and (2) a 20-year delay between discovery and production.

Sample North Slope Alaska Timeframe

The Mineral Leasing Act (1920, as amended) and Federal Onshore Oil and Gas Leasing Reform Act (1987, as amended) govern the leasing of public domain lands for oil and gas (Hatch, 2017).

If one assumes that approval is granted in 2018, development and production could occur between 2025 and 2030 based on U.S. Department of Energy estimates (Thomas, et al., 2009). The steps in their timeline assume a minimum of 10 years to complete development and also that there would be no inordinate delays due to litigation. The timing is envisioned as follows (Table 1) (Hatch, 2017; Thomas, et al. 2009), with the first receipts from production to the U.S. Treasury in 2030:

Table 1. Potential North Slope Exploration and Production Timeline

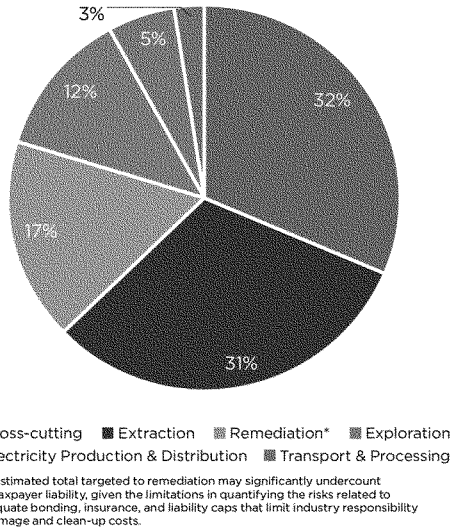
Year(s)	Milestone
2018	Exploration and development in the 1002 Area of the Arctic Refuge approved
2018-2020	Update resource assessments of undiscovered technically recoverable oil
2018 to 2019	2-D seismic data from 1984-1985 reprocessed (1 calendar year) (Werkheiser, et al., 2017; Thomas, et al., 2009)
or	
2018 to 2020	new 3-D seismic survey conducted (2 calendar years) (Werkheiser, et al., 2017; Thomas, et al., 2009)
2020	Nomination of lease parcels by industry and/or BLM, BLM selects parcels, notice of lease sales
2022	First lease sales held, leases issued (for a primary term of 10 years), drilling permits issued
	Lease terms include rentals of $1.50 per acre for the first five years, then $2 per acre thereafter (Hatch, 2017). If a tract does not receive any bids or the minimum acceptable bid, the tract becomes available to be leased non-competitively for a period of two years following the lease sale to the first qualified applicant (Hatch, 2017).
	Permits. Before drilling a well on a Federal or Indian lease, an operator must file an Application for Permit to drill to the Bureau of Land Management (U.S. Department of the Interior, 2014). The processing time for Applications submitted to the Anchorage Field Office was about 40 days, on average, from 2009 to 2013; the national average was 228 days, about 7.5 months (U.S. Department of the Interior, 2014).
2023/2024	First exploration drilling
2025/2026	First "economic" discovery
2026/2027	Evaluation of first "economic" discovery
2027	Field development begins
2030	First production from the 1002 Area First royalty payments to U.S. Treasury **Lease terms** include royalty interest of 12.5% (Hatch, 2017)

In this hypothetical timeline, the first payments to the U.S. Treasury would be for leases in 2022 and royalties from production in 2030, assuming there would be no delays at any step of the process. These years are consistent with the target dates in the administration's proposed budget for fiscal year 2018 which projects receipts in 2022 and 2023, and later in 2026 and 2027 (Office of Management and Budget, 2017). However, as noted above, time estimates from other government and industry sources suggest the first production could begin 5 or 10 years later, or by 2040.

Opening the Refuge: Cost to the American Taxpayer

Fossil fuel subsidies cost American taxpayers billions every year, and while many in the oil industry may deny receiving government handouts, they come in many forms that are often hidden from the public (Redman, 2017). Subsidies can be a mix of tax breaks, tax credits, liability easements, loosened regulations, or government services provided at below-market rates (Leahy, 2017). An Oil Change International ("OCI") report (Redman, 2017) breaks down the types of fossil fuel subsidies in the U.S. from both the federal and state governments, which totaled over $20 billion from 2015 to 2016. OCI defines a fossil fuel subsidy broadly: "any government action that lowers the cost of production, lowers the cost of consumption, or raises the price received by producers." Fossil fuel subsidies can be given as production or consumption support (Figure 10), and there's strong reason to believe the

Figure 10. U.S. Fossil Fuel Subsidies by Stage of Production, 2015-2016
Source: Redman, 2017



development of the Coastal Plain would be no exception as the current administration incentivizes expanding fossil fuel reserves in the name of "energy dominance." A recent study from *Nature Energy* determined that at $50 per barrel, and assuming projects need a 10% rate of return in order to be considered economic,

approximately half of new oil investments are subsidy-dependent and would not be profitable without a government handout (Banarjee, 2017).

Estimated Federal Costs and Savings of Opening the Arctic Refuge

The Department of the Interior ("DOI") has laid out detailed plans for expanded oil exploration in the Arctic Refuge, particularly updating current resource assessments in the 1002 Area on the Refuge's Coastal Plain (Werkheiser et al., 2017). The DOI memo presents two scenarios for updating current resource assessments on the Arctic Refuge. In one, USGS would pay $4.8 million for interpreting, "state-of-the-art industry reprocessing of vintage data" to be completed by the end of 2018 (Werkheiser et al., 2017). In the other, "a new 3-D seismic survey is conducted" and paid for by the private sector, although USGS costs would still be approximately $3.6 million (Werkheiser et al., 2017). (Note that these revised assessments would be just the first step in the process of opening the Arctic to drilling.)

In the Congressional Budget Office analysis for a 2012 bill proposed to open the Arctic Refuge, the estimated administrative costs for a federal leasing program were $8 million in the first five years, or $1.6 million per year (LaFave, et al., 2012). Other implementation costs were expected to total $1 to $2 million annually if the Refuge were to be opened to leasing. Because the previous bill (and both current proposals, S. 49 and H.R. 49) deemed the previous environmental impact statement "sufficient," the cost of complying with any environmental regulation is expected to be minimal (LaFave, et al., 2012).

Drilling proponents tout benefits of drilling in the Arctic Refuge including federal revenue that could help offset the budget deficit. The Trump Administration stands behind this argument, evidenced by the inclusion of Arctic drilling revenue in both the White House 2018 Budget Plan and Congress' blueprint (Office of Management and Budget, 2017; House Budget Committee, 2017). The 2018 House budget, released in July 2017, calls for $5 billion in reconciliations, or savings, from the Natural Resources Committee, $1.5 billion of which is expected to come from the Arctic Refuge (Page, 2017). This sets a dangerous precedent, as any shortfall from the amount assumed by Congress will end up adding to the federal budget deficit.

State Subsidies

The current subsidies received on Alaska's North Slope are a useful indicator for estimating how much future Coastal Plain drilling may cost American taxpayers. Currently, Alaska residents receive the most federal government aid per capita and pay no income or sales tax to the state government. Instead, the state is dependent on the oil and gas industry for approximately 85% of its budget (Semeuls, 2015).

Alaska's total subsidies to fossil fuel production in 2015 totaled about $1.2 billion, which includes over $500 million from a per-taxable-barrel credit for North Slope Production (Redman, 2017). Congressional approval for drilling in the Refuge would have a disproportionate impact on Alaskan taxpayers, who rely on the oil and gas industry for government revenue and thus benefits. The drawbacks to the once-lucrative prospects in the northern part of state have become apparent with lower oil prices: Alaska finds itself in a deep budget deficit, largely because of lower interest in Arctic exploration, reduced production on the North Slope, and generous production subsidies for oil companies on the North Slope (Alaska Oil and Gas Competitive Review Board, 2015). To balance the budget, Alaska's state legislature and governor recently approved oil subsidy cuts that will save the state around $200 million annually (Redman, 2017).

North Slope Lease Bids and Projected Revenue

The Congressional Budget Office's latest estimate of potential federal revenue generated from opening the Refuge assumed the sale of 400,000 acres for drilling at $7,500 an acre, whereas recent bids in Alaska have come in well below $100 an acre (Page, 2017). Alaska's Department of Natural Resources publishes a summary of annual lease sales in Alaska beginning in 1959 (Appendix A) providing data on total acres leased, average price per acre, the total bonus (or cumulative lease bids), and the fixed terms from the sale. Since 2010, the average price per acre on the North Slope has ranged from $14.81 to $80.59, with a weighted average for the cumulative 2,442,868 acres sold in the past six years equaling $41.59. Undoubtedly, North Slope bonus bids are the best indicator of how much federal revenue could be made leasing out the Coastal Plain, and while the minimum bid per acre could be raised, no evidence exists that oil companies may be inclined to pay more for land with no existing infrastructure or proven reserves.

An October 2017 analysis by the Center for American Progress (CAP) found that offering oil and gas leases in the Arctic Refuge will likely amount to no more than $37.5 million in federal revenue over 10 years, which is substantially short of the $1 billion to $1.8 billion that the White House, Congress, and drilling proponents claim could be raised (Lee-Ashley and Rowland, 2017). (Ironically, CAP finds that $1 billion in added federal revenue would not even cover Trump's personal tax breaks under the proposed tax reform plan, which reduces tax revenue by $1.5 trillion annually.)

Another unaddressed issue with projected federal revenue lies in Alaska's current law governing lease sales. Oil and gas revenue is split 90%-10% between the Alaska and federal governments respectively, while the projected federal revenue outlined in the Trump administration budget assumes a 50%-50% split, which is the common practice in the continental U.S. (Alaska Oil and Gas Competitive Review Board, 2015). Some estimates of federal revenue gained from opening the Refuge to oil and gas leasing have assumed the federal government, not Alaska, will get 90% of lease bids, while others assume Alaska would receive half of revenue generated from the bids in the Refuge. This single detail, while not affecting how much total revenue is raised from opening the Arctic Refuge to oil development, explains how the revenue would be distributed and who would end up getting compensated. If 90% of the revenue from leasing federal lands on the Coastal Plain were to be distributed to Alaskans, rather than 50%, the average American taxpayer would end up paying more to offset the resulting increases in the federal deficit.

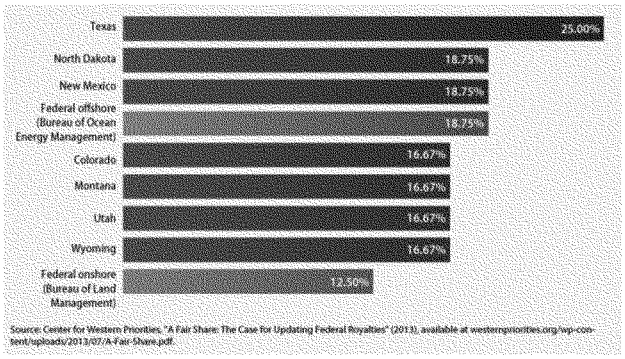
Below-Market Royalty Rates and Estimated Revenue

Royalty payments made on active leases are another source of federal revenue once oil production on federal land has begun, but the federal royalty rate has not been updated since 1920 and stands at 12.5% (Gentile, 2017). While some states, including Texas, Colorado, and Utah, have raised their royalty rates for state lands, Alaska state law offers royalty rates at 12.5%, well below the estimated market rate of 18-25% (Gentile, 2017). This outdated rate is shortchanging American taxpayers, who are receiving a rate 30%-50% less than many private and state royalties.

The total acreage proposed for lease sales in the Arctic Refuge ranges widely, and has a direct impact on the amount of revenue the federal government could expect; H.R. 49, sponsored by Don Young (2017), specifies a minimum of 2,000 acres be leased out on the Coastal Plain, while some of the federal government's estimates

for revenue generation seem to assume all 1.5 million acres in the Coastal Plain area of the Arctic Refuge would be leased for oil exploration and drilling (Young, 2017; Lazzari, 2008). While the federal government is able to claim that leasing production on all 1.5 million acres would generate a certain sum from royalty payments, they are simultaneously providing the oil industry with massive subsidies by only charging a 12.5% royalty rate on lands that should arguably receive at least private market rates, which could be twice the amount the federal government charges.

Figure 11. Federal and State Royalty Rates for Oil and Gas Leases
Source: Gentile, 2015



Subsidized Environmental Risk

Not only would American taxpayers fund production of Arctic oil, but they would be financially liable for oil companies' environmental risks and damage. Being one of the last untouched regions of the planet, the environment of the Arctic Refuge is far more vulnerable than other regions of the world known for oil development, and by way of its remote location, cleanup costs from a spill could be much higher than those witnessed from other spills elsewhere in the U.S. All too often, companies pay for direct costs after the damage is done but are not funding resources on standby in the event of a disaster, which should be accounted for as liability for operating in environmentally fragile or vulnerable regions.

Challenges of Frontier Exploration

The climate, geography, and isolation of the Arctic present challenges to oil and gas exploration and development. The Arctic is defined as the area located north of the Arctic Circle, at the northernmost part of Earth at 66°34′ north latitude (Figure 12). It encompasses the Arctic Ocean and adjacent seas, and parts of Alaska, Canada, Finland, Greenland, Iceland, Norway, Russia, and Sweden. About one-third of the Arctic is land and two-thirds is water. The central Arctic Ocean is ice-covered year-round, and snow and ice are present on land for most of the year (National Snow and Ice Data Center, 2017). Large areas of the land are underlain by permafrost, frozen ground (i.e., soil and rock) that remain at or below 32°F for at least two years (National Research Council of Canada, 1988).

Figure 12. The Arctic Circle
Source: National Snow and Ice Data Center, 2017

Within the Arctic Circle, there are long periods of daylight during the summer and extended darkness during the winter. The sun remains visible at midnight during the summer months ("midnight sun"); in winter, there are

periods of darkness lasting for more than 24 hours ("polar nights") (National Snow and Ice Data Center, 2017). On the North Slope of Alaska, temperatures are below freezing for most of the year, ranging from -20°F in February to 46°F during July. The average annual precipitation is 4 inches or less, mostly in the form of snow (Budzik, 2009).

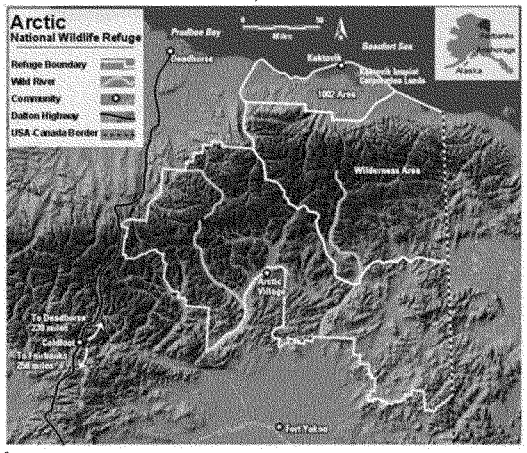
The North Slope Frontier

The North Slope of Alaska is remote and sparsely populated with only one (mostly gravel) narrow road connecting it with the rest of the state (Figure 13). The 415-mile Dalton Highway, built as a haul road between the Yukon River and Prudhoe Bay during construction of the Trans-Alaska Pipeline, begins 84 miles north of Fairbanks and ends at Deadhorse (The Milepost, 2017). There are no paved roads to Arctic Village or Fort Yukon, both of which can be reached by air; Kaktovik is reachable by air and water (North Slope Borough, 2017).

Energy analyst Pavel Molchanov notes that, "Arctic drilling is a textbook example of frontier exploration—that is to say, drilling in remote, historically underexplored regions....Frontier exploration, no matter the specific geography, is inherently high-risk" (Mufson, 2015). The lack of access and infrastructure are obstacles in exploring for oil and gas resources in frontier basins, defined by the Alaska Oil and Gas Competitiveness Board (2015) as areas away from population centers and existing oil and gas production facilities.

Figure 13. The Dalton Highway and North Slope Towns[a]

Source: U.S. Fish and Wildlife Service, 2017



[a] Population in 2010 - Prudhoe Bay: 2,174; Coldfoot: 10; Kaktovik: 239; Arctic Village: 152; Fort Yukon: 583; Fairbanks: 31,535 (U.S. Census Bureau, 2017).

Arctic Development is Costlier, Riskier and Lengthier

The U.S. Energy Information Administration surmised that Arctic oil and natural gas resources are more expensive, riskier, and take longer to develop than comparable deposits found elsewhere in the world (Budzik, 2009). Studies examining the additional costs associated with oil activities in Alaska compared to those in the continental United States found costs are 1.5 to 10 times larger. For example, the capital costs of onshore Alaska North Slope project developments are from 1.5 to 2 times more than similar oil and natural gas projects in Texas (Budzik, 2009). The subzero weather and remote locations mean drilling in Alaska typically costs three times as much as in the lower 48 states, according to industry researcher IHS Markit, Inc. (Mufson, 2015). And, the Alaska Oil and Gas Competitiveness Review Board (2015) found the investment needed to explore and develop the North Slope's oil resources plus transportation to markets to be an order of magnitude higher—that is, ten times as much—than the investment required to produce and transport oil in much of the continental U.S.

Increasing temperatures in the Arctic have shortened winter access across the tundra by more than 50% and led to changes in standards for use of the ice roads that are typically used to reach remote areas during exploratory drilling[11] (Corn, Ratner & Alexander, 2015). The Congressional Research Service suggests that in the rolling terrain of the North Slope, the use of ice roads and pads could be limited due to safety concerns; gravel structures (permitted for exploration on state lands south of Prudhoe Bay) may provide better traction than ice structures. They caution that relying on ice technology may be infeasible in the future, forcing greater use of more expensive gravel structures with longer-lasting environmental impacts—or, projects would need to adapt to a shorter operating season (Corn, Ratner & Alexander, 2015).

Where access is by water, operating costs are increased by the ice-pack conditions that extend over much of the Arctic Ocean. The need for ice-resistant tankers and ice-breaker escorts adds to the cost of transporting oil and natural gas through Arctic waters (Corn, Ratner & Alexander, 2015; Budzik, 2009).

In addition to requiring larger investments than comparable projects elsewhere, the long lead-times required for Arctic projects add risk because economic conditions can change significantly between the time exploration leases are secured and when production begins. For example, crude oil prices could be considerably lower when an Arctic project begins producing than was anticipated at the planning stage. And, longer lead-times reduce the return on capital investment, all other being equal (Budzik, 2009).

[11] These roads may later be linked to large insulated ice pads for housing, storage and maintenance facilities, airfields, and other support (Corn, Ratner, & Alexander, 2015).

Arctic oil and natural gas resource exploration and development are expensive because:

- Harsh winter weather requires that the equipment be specially designed to withstand the frigid temperatures;
- On Arctic lands, poor soil conditions can require additional site preparation to prevent equipment and structures from sinking;
- The marshy Arctic tundra can also preclude exploration activities during the warm months of the year;
- In Arctic seas, the ice-pack can hinder the shipment of personnel, materials, equipment, and oil for long time periods;
- Long supply lines from the world's manufacturing centers require equipment redundancy and a larger inventory of spare parts to insure reliability;
- Limited transportation access and long supply lines reduce the transportation options and increase transportation costs;
- Higher wages and salaries are required to induce personnel to work in the isolated and inhospitable Arctic; and
- Protecting the Arctic environment is costly.

Source: Budzik, 2009

Future Prospects

Ultimately, energy companies make the decision on whether and how much the costs and risks of frontier exploration influence their investment decisions. The president and CEO of the Alaska Oil and Gas Association, Kara Moriarty, has said that low oil prices won't diminish companies' interest in drilling in the 1002 Area; "The reality is companies don't plan on a two-to-three-year horizon, they plan for a 50-60-year one" (Patterson, 2017). But, the EIA cautions, "The high cost and long lead-times of Arctic oil ... development diminish the economic incentive to develop these resources" (Budzik, 2009).

Regarding the potential for oil leasing in the Refuge, the spokeswoman for ConocoPhillips (Alaska's biggest oil producer) says if it, "were to be opened, we'd consider it within our opportunities" and that the area, "would have to compete with other regions for our exploration dollars" (Nussbaum, 2017). In contrast, a senior research manager at industry consultant Wood Mackenzie Ltd. says, "There are a lot of other, cheaper areas that are currently open to exploration that big companies can attack" (Nussbaum, 2017). At this point in time, given the uncertainties regarding how much oil could actually be within the 1002 Area, the probability of development in the frontier even if Congress were to authorize it remains unknown.

Conclusion

Despite the frigid climate and isolation of the Arctic National Wildlife Refuge's Coastal Plain, policymakers and energy industry officials periodically raise the prospect of allowing oil and gas drilling in the region. In contrast to the economic conditions during earlier efforts to open the Refuge, oil prices have dropped substantially, and the increase in oil demand has slowed as conservation and the use of alternative fuels grows. The EIA projects the slower growth in demand to continue at least through mid-century, beyond the time any production could occur if development in the 1002 Area was approved this year. New discoveries from established drilling sites in the continental U.S. as well as Alaska's North Slope/Prudhoe Bay are expected to sustain U.S. production for decades, providing oil for domestic consumption as well as for export.

Even the most optimistic estimates of oil production in the 1002 Area (by the USGS and EIA during the past two decades) are projected to have little effect on U.S. imports, global supply, or prices. Leasing and royalty revenues destined for the U.S. and Alaska coffers, as well as jobs, were projected based on *undiscovered* economically recoverable reserves estimated using now-outdated financial data and technological assumptions. These projections did not consider external costs such as climate change, loss of habitat, human health effects of the release of toxins, and spill preparedness and response. Despite their lack of currency, these projected benefits are still being touted.

Federal taxpayers would subsidize any effort towards opening the Refuge—beginning with the first step of updating the assessments of undiscovered, technically recoverable oil and gas resources per Secretary Zinke's directive in May (U.S. Department of the Interior, 2017). Once completed, these resource assessments would influence the industry's interest in exploring the 1002 Area if development were approved by Congress. Ultimately, though, even the hypothetical revenue from Refuge oil and gas leasing in the Administration's fiscal year 2018 federal budget would do very little to alleviate the federal deficit. Projected receipts from leasing represent less than 0.5% of the total budget deficit reductions proposed (Office of Management and Budget, 2017) and would cost the nation the loss of nonrenewable resources and potentially irreparable ecological harm.

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Appendix A: 2010-2017 Lease Bids on the North Slope

Summary of State Competitive Oil and Gas Lease Sales -- 1959 to Present

Sale Date	Sale	Sale Area	Acres Offered	Acres Leased	Percent Leased	Average $/acre	Bonus Amount	Number of Tracts	Rental Receipts	Net Profit Share	Royalty Rate
5/26/2010	AP 2010	Alaska Peninsula	Areawide	0	N/A	$0.00	N/A	0	$0	Bonus: $5/acre Min	12.5% Royalty
5/26/2010	CI 2010	Cook Inlet	Areawide	104,628	N/A	$16.40	N/A	35	$1,716,407	Bonus: $10/acre Min	12.5% Royalty
10/27/2010	NS 2010	NS Foothills	Areawide	0	N/A	$0.00	N/A	0	$0	Bonus: $5/acre Min	12.5% Royalty
10/27/2010	NS 2010**	North Slope	Areawide	556,663	N/A	$14.61	N/A	123	$8,271,460	Bonus: $10/acre Min	12.5 % & 16.66667% Royalty
10/27/2010	BS 2010A	Beaufort Sea	Areawide	62,955	N/A	$10.06	N/A	21	$634,485	Bonus: $10/acre Min	12.5 % & 16.66667% Royalty
6/22/2011	AP 2011	Alaska Peninsula	Areawide	0	N/A	$0.00	N/A	0	$0	Bonus: $5/acre Min	12.5% Royalty
6/22/2011	CI 2011 A & B	Cook Inlet	Areawide	449,164	N/A	$17.50	N/A	104	$8,214,181	Bonus: $10/300acre Min	12.5% Royalty
12/7/2011	FH 2011	NS Foothills	Areawide	0	N/A	$0.00	N/A	0	$0	Bonus: $10/acre Min	12.5% Royalty
12/7/2011	BS 2011W	Beaufort Sea	Areawide	242,796	N/A	$24.07	N/A	77	$5,845,112	Bonus: $10/5Sacre Min	12.5% & 16.66667% Royalty
12/7/2011	NS 2011W**	North Slope	Areawide	285,194	N/A	$46.69	N/A	166	$12,811,666	Bonus: $10/5Sacre Min	12.5% & 16.66667% Royalty
5/16/2012	AP 2012	Alaska Peninsula	Areawide	0	N/A	$0.00	N/A	0	$0	Bonus: $5/acre Min	12.5% Royalty
5/16/2012	CI 2012W	Cook Inlet	Areawide	129,300	N/A	$35.58	N/A	41	$4,564,459	Bonus: $25/acre Min	12.5% Royalty
11/7/2012	FH 2012	NS Foothills	Areawide	45,476	N/A	$20.86	N/A	8	$948,646	Bonus: $10/acre Min	12.5% Royalty
11/7/2012	BS 2012W	Beaufort Sea	Areawide	80,999	N/A	$17.86	N/A	25	$1,440,988	Bonus: $10/5Sacre Min	12.5% & 16.66667% Royalty
11/7/2012	NS 2012W**	North Slope	Areawide	152,067	N/A	$66.33	N/A	66	$10,542,283	Bonus: $10/5Sacre Min	12.5% & 16.66667% Royalty
5/8/2013	AP 2013	Alaska Peninsula	Areawide	0	N/A	$0.00	N/A	0	$0	Bonus: $5/acre Min	12.5% Royalty
5/8/2013	CI 2013W	Cook Inlet	Areawide	103,322	N/A	$30.72	N/A	24	$3,061,417	Bonus: $25/acre Min	12.5% Royalty
11/6/2013	FH 2013	NS Foothills	Areawide	0	N/A	$0.00	N/A	0	$0	Bonus: $10/acre Min	12.5% Royalty
11/6/2013	BS 2013W	Beaufort Sea	Areawide	2,560	N/A	$20.47	N/A	2	$52,403	Bonus: $10/5Sacre Min	12.5% & 16.66667% Royalty
11/6/2013	NS 2013W**	North Slope	Areawide	157,701	N/A	$32.45	N/A	86	$5,117,149	Bonus: $10/5Sacre Min	12.5% & 16.66667% Royalty
5/7/2014	AP 2014	Alaska Peninsula	Areawide	9,561	N/A	$5.00	N/A	3	$47,807	Bonus: $5/acre Min	12.5% Royalty
5/7/2014	CI 2014W	Cook Inlet	Areawide	63,521	N/A	$46.42	N/A	32	$4,044,467	Bonus: $25/acre Min	12.5% Royalty
11/19/2014	FH 2014	NS Foothills	Areawide	0	N/A	$0.00	N/A	0	$0	Bonus: $10/acre Min	12.5% Royalty
11/19/2014	BS 2014W	Beaufort Sea	Areawide	69,218	N/A	$45.56	N/A	42	$4,522,271	Bonus: $10/5Sacre Min	12.5% & 16.66667% Royalty
11/19/2014	NS 2014W**	North Slope	Areawide	494,530	N/A	$60.56	N/A	254	$39,953,891	Bonus: $10/5Sacre Min	12.5% & 16.66667% Royalty
5/6/2015	AP 2015	Alaska Peninsula	Areawide	0	N/A	$0.00	N/A	0	$0	Bonus: $5/acre Min	12.5% Royalty
5/6/2015	CI 2015W	Cook Inlet	Areawide	20,640	N/A	$32.22	N/A	7	$671,033	Bonus: $25/acre Min	12.5% Royalty
11/18/2015	FH 2015	NS Foothills	Areawide	0	N/A	$0.00	N/A	0	$0	Bonus: $10/acre Min	12.5% Royalty
11/18/2015	BS 2015W	Beaufort Sea	Areawide	0	N/A	$0.00	N/A	0	$0	Bonus: $25/acre Min	16.66667% Royalty
11/18/2015	NS 2015W**	North Slope	Areawide	194,813	N/A	$60.38	N/A	131	$9,511,065	Bonus: $25/acre Min	12.5% & 16.66667% Royalty
5/4/2016	AP 2016	Alaska Peninsula	Areawide	0	N/A	$0.00	N/A	0	$0	Bonus: $5/acre Min	12.5% Royalty
5/4/2016	CI 2016W	Cook Inlet	Areawide	0	N/A	$0.00	N/A	0	$0	Bonus: $10/acre Min	12.5% Royalty
12/14/2016	FH 2016	NS Foothills	Areawide	0	N/A	$0.00	N/A	0	$0	Bonus: $10/acre Min	12.5% Royalty
12/14/2016	BS 2016W	Beaufort Sea	Areawide	32,136	N/A	$25.71	N/A	7	$826,252	Bonus: $25/acre Min	16.66667% Royalty
12/14/2016	NS 2016W **	North Slope	Areawide	580,860	N/A	$28.17	N/A	394	$16,900,450	Bonus: $25/acre Min	12.5% & 16.66667% Royalty
8/23/2017	AP 2017	Alaska Peninsula	Areawide	0	N/A	$0.00	N/A	0	$0	Bonus: $5/acre Min	12.5% Royalty
8/23/2017	CI 2017W	Cook Inlet	Areawide	25,623	N/A	$34.38	N/A	6	$922,765	Bonus: $25/acre Min	12.5% Royalty
TOTAL: 163 Sales									$2,299,178,516		

Written testimony of Timothy J. Fullman, Ph.D. as a requested supplement to the U.S. Senate Energy and Natural Resources Committee hearing on potential oil and gas development in the coastal plain of the Arctic National Wildlife Refuge (1002 Area), held November 2, 2017.

Use of the Arctic National Wildlife Refuge by caribou

The Arctic National Wildlife Refuge is used, with varying frequency, by three of the four caribou herds that calve on the North Slope of Alaska. The Central Arctic Herd uses the Arctic Refuge for summer range, including the coastal plain (Lenart 2015, Arthur and Del Vecchio 2009). The Teshekpuk Caribou Herd occasionally uses parts of the refuge as winter range (Person et al. 2007). The most consistent use of the Refuge is by the Porcupine Caribou Herd, which inhabits the Arctic Refuge throughout the year, including using the coastal plain for calving, insect relief, and other summer habitat (Caikoski 2015). While Porcupine Caribou Herd calving grounds have shifted in concentration between the Arctic Refuge and Canadian Yukon over time in response to year-to-year variation in plant quality and quantity (Griffith et al. 2002), most of the herd has calved on the Arctic Refuge coastal plain in recent years (McFarland et al. 2017). It is important to recognize that even in years in which calving was concentrated in Canada, the herd has used the Arctic Refuge coastal plain for food and insect relief after calving (Griffith et al. 2002). As the Alaska Department of Fish and Game has stated about the PCH, "Over time the entire extent of the calving grounds may be important for caribou" (Caikoski 2015 p.15-11).

In light of this importance, there has been repeated past recognition of the need to protect calving grounds and other sensitive habitat from things that may disturb or disrupt caribou use. This has been reflected in prior prohibition of development within the Arctic Refuge coastal plain, recommendation of wilderness designation for the coastal plain by the U.S. Fish and Wildlife Service (USFWS 2015), and prohibition of leasing in identified "Special Areas" of the nearby National Petroleum Reserve – Alaska by the Bureau of Land Management (BLM 2013).

Development impacts on caribou

Studies of the Central Arctic Herd in relation to development of the Prudhoe Bay development area and expansions to the west provide a cautionary tale about possible effects of energy development on caribou calving and migration within the Arctic National Wildlife

Refuge. The Central Arctic Herd historically used two calving grounds, one in the west between the Colville and Kuparuk rivers and one in the east between the Sagavanirktok and Canning rivers (Lenart 2015). As development expanded from Prudhoe Bay, caribou using the western calving grounds where new development occurred shifted south (Wolfe 2000, Noel et al. 2004, Cameron et al. 2005, Joly et al. 2006, Lenart 2015), while those in the east outside of main development areas did not shift (Wolfe 2000). This shift away from new development likely had consequences for caribou as food availability was lower for development-exposed caribou that shifted calving areas (Wolfe 2000; Griffith et al. 2002) and these caribou showed lower calf body mass (Arthur and Del Vecchio 2009) and birth rate (National Research Council 2003; Cameron et al. 2005), though the herd still grew through this period (Lenart 2015). A review by the United States Geological Survey (USGS) concluded there was no clear biological explanation for the shift in concentrated calving in the west, implicating petroleum development as its likely cause (Griffith et al. 2002). The observation that only the development-exposed portion of the herd showed this shift in calving location casts doubt upon alternative explanations, such as the timing of snowmelt.

The sensitivity to development of female caribou about to give birth and those with young calves has been well documented. Studies of the Central Arctic Herd following expansion of the Kuparuk Development Area, west of Prudhoe Bay, found that use of areas near development declined after infrastructure was established (Cameron et al. 1992, Dau and Cameron 1986) and was lower than expected due to chance within 4 km of roads (Cameron et al. 2005). While a subsequent study reported increasing density of caribou calves within 1 km of roads in the Kuparuk Development Area (Noel et al. 2004), this study was criticized for not taking into account the overall decrease in caribou numbers within the development area when interpreting their findings (Joly et al. 2006). This decrease in numbers occurred despite a rapid increase in herd size during this period and has been suggested to reflect a shift of caribou away from the area of concentrated development (Joly et al. 2006). Caribou with calves also tend to occur farther from development than those without calves and tend to occur less in areas and at times of higher human activity (Haskell et al. 2006). Furthermore, females about to give birth or with very young calves tend to avoid, or are less likely to cross, roads and pipelines during the calving season (Griffith et al. 2002).

Insect activity, primarily that of mosquitoes and oestrid flies, has a strong influence on caribou space use, leading caribou to seek areas of relief from insects, such as the coast, gravel bars and elevated areas (Pollard et al. 1996). Harassment due to insects can have a negative effect on caribou populations, leading to lower rates of calves being born in years following high insect activity (National Research Council 2003). Caribou may also use areas around infrastructure during periods of moderate to high insect activity (Pollard et al. 1996). However, comparisons of lower reproduction rates following years of high insect activity for caribou occupying relatively developed areas compared to those occupying less developed areas led the National Research Council to conclude that by altering caribou movements development "probably exacerbates the adverse effects of insect harassment" (National Research Council 2003 p.115). This is of grave concern as warming conditions in the Arctic are leading to earlier development and increased survival of mosquitoes (Culler et al. 2015).

Some have argued that caribou habituate to human activity, learning not to fear it over time. The evidence for this is equivocal at best. A search of the scientific database *Web of Science* for studies of caribou habituation revealed only three peer-reviewed studies of caribou habituation to oil and gas activity. Two of these look at habituation within the Central Arctic Herd (Haskell et al. 2006, Haskell and Ballard 2008). While both claimed to show evidence of habituation, Haskell et al. (2006) base this largely on use of areas closer to infrastructure during the post-calving period, when insect harassment is a dominant driver of caribou space use. Calving caribou only moved closer to infrastructure during the calving period in one of the three years evaluated (Haskell et al. 2006). The second study (Haskell and Ballard 2008) found no evidence of habituation across years. They observed greater percentages of calves and numbers of caribou per kilometer surveyed in years with earlier snowmelt and inferred this as evidence that caribou habituated to infrastructure during each year, but point out that "[t]he available data were few, so our results may benefit from further verification or falsification" (p.628). The third study identified by the *Web of Science* used 27 years of location data for the Porcupine Caribou Herd to examine winter distribution responses to various human infrastructure and disturbance, including both seismic lines and well sites as well as non-energy infrastructure (Johnson and Russell 2014). They found a decreasing response of caribou to human infrastructure over time, but concurrent decreases in oil and gas activities made it difficult to determine whether this was due to habituation or to regeneration of natural habitats and processes after the cessation of

human activities (Johnson and Russell 2014). Other studies of ungulates have failed to find strong evidence of habituation to industrial development and activity. Boulanger et al. (2012) examined caribou disturbance responses near a diamond mine in Canada and found variation in avoidance responses over time but no clear evidence of habituation. Similarly, recent research on mule deer in the Contiguous United States found that the deer did not habituate to energy development even after a 15-year period and intensive mitigation efforts (Sawyer et al. 2017).

Application of current scientific understanding to the Porcupine Caribou Herd

It is likely that the responses to development observed in the Central Arctic Herd will similarly apply to the Porcupine Caribou Herd. In fact, the USGS pointed out a number of reasons why responses may be greater in the Porcupine Caribou Herd compared to the Central Arctic Herd (Griffith et al. 2002). One major factor is that the coastal plain is narrower within the Arctic Refuge compared to the main Central Arctic Herd range, leaving less room for shifts in space use (see Appendix 1). Another is that the expansion of development and the shift in CACH calving occurred during a period of relatively favorable environmental conditions. Future environmental changes, due to natural fluctuations or climate change, may reduce the ability of caribou to accommodate range shifts. As the National Research Council pointed out in their 2003 report, "although the accumulated effects of industrial development to date have not resulted in large or long-term declines in the overall size of the Central Arctic Herd, the spread of industrial activity into other areas that caribou use during calving and in summer, especially to the east where the coastal plain is narrower than elsewhere, would likely result in reductions in reproductive success, unless the degree to which it disturbs caribou could be reduced" (National Research Council 2003 p.6). Success of mitigation measures to reduce disturbance to movement due to physical barriers has not been determined (Lenart 2015), however the shift in CACH calving distribution to the south in the Milne Point and Kuparuk areas was maintained in spite of use of structures intended to mitigate impacts like elevated pipelines and reduced road density (Griffith et al. 2002).

There is still much that we do not know about caribou and the things that influence their population dynamics. It is important to note that while caribou populations naturally fluctuate, the USGS point out that "reduced calf survival may slow the rate of increase during positive phases of the growth curve of the herd and increase the rate of decline during the negative phases

of the herd's growth curve" (Griffith et al. 2002 p.32). This urges care and a cautionary approach for sensitive Arctic Refuge Coastal Plain habitat.

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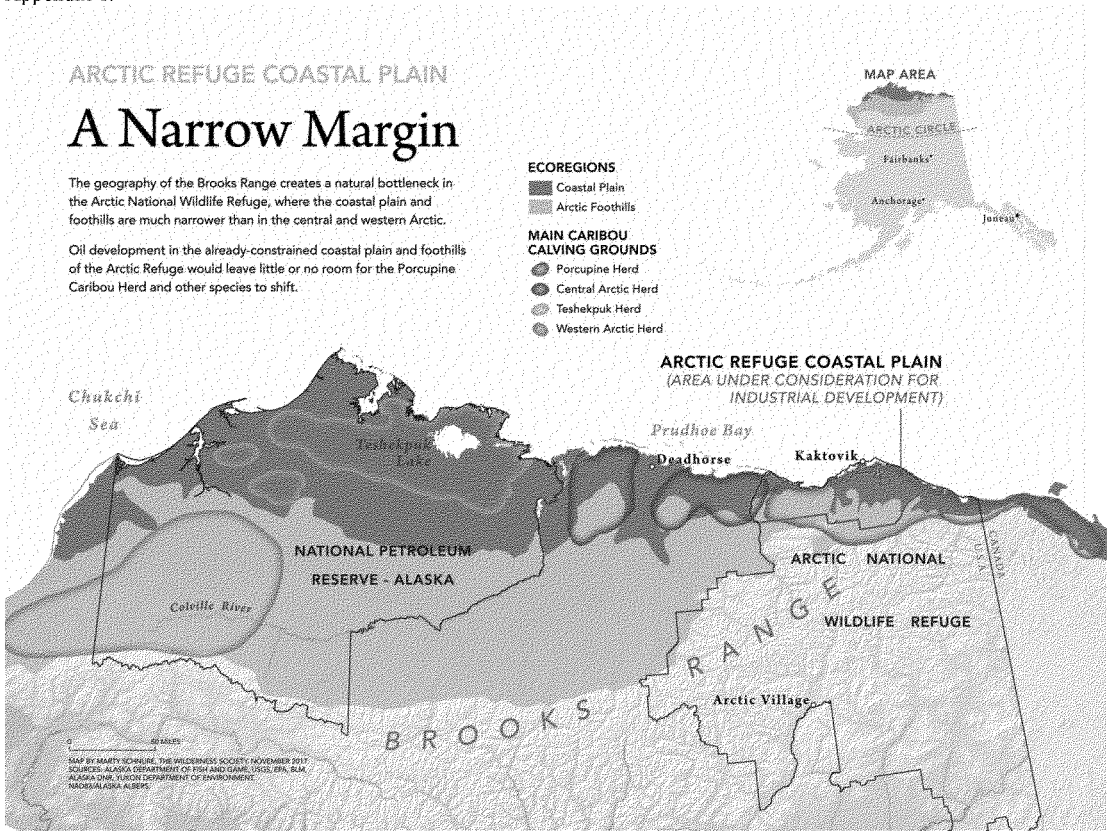
Appendix 1.


ARCTIC REFUGE COASTAL PLAIN
A Narrow Margin
The geography of the Brooks Range creates a natural bottleneck in the Arctic National Wildlife Refuge, where the coastal plain and foothills are much narrower than in the central and western Arctic.
Oil development in the already-constrained coastal plain and foothills of the Arctic Refuge would leave little or no room for the Porcupine Caribou Herd and other species to shift.
ECOREGIONS
Coastal Plain
Arctic Foothills
MAIN CARIBOU CALVING GROUNDS
Porcupine Herd
Central Arctic Herd
Teshekpuk Herd
Western Arctic Herd
MAP AREA
ARCTIC CIRCLE
Fairbanks
Anchorage
Juneau
ARCTIC REFUGE COASTAL PLAIN
(AREA UNDER CONSIDERATION FOR INDUSTRIAL DEVELOPMENT)
Chukchi Sea
Teshekpuk Lake
Prudhoe Bay
Deadhorse
Kaktovik
NATIONAL PETROLEUM RESERVE - ALASKA
Colville River
ARCTIC NATIONAL WILDLIFE REFUGE
BROOKS RANGE
Arctic Village
CANADA
0 60 MILES
MAP BY MARTY SCHNURE, THE WILDERNESS SOCIETY, NOVEMBER 2017.
SOURCES: ALASKA DEPARTMENT OF FISH AND GAME, USGS, EPA, BLM, ALASKA DNR, YUKON DEPARTMENT OF ENVIRONMENT.
NAD83/ALASKA ALBERS.

U.S. Senate Committee on Energy and Natural Resources
November 2, 2017 Hearing: ***The Potential for Oil and Gas Exploration and Development in the Non-Wilderness Portion of the Arctic National Wildlife Refuge, Known as the "1002 Area" or Coastal Plain, to Raise Sufficient Revenue Pursuant to the Senate Reconciliation Instructions included in H. Con. Res. 71***
Questions for the Record Submitted to Mr. Pat Pourchot

Questions from Ranking Member Maria Cantwell

Question 1: I understand that the U.S. Fish and Wildlife Service adopted a Comprehensive Conservation Plan for the Arctic Refuge in 2015, which is still the legal management framework for the refuge, and that plan recommended that virtually all of the Arctic refuge — including the Coastal Plain — should be designated as wilderness.

What public and scientific process did the Fish and Wildlife Service follow in developing and implementing that plan?

Answer: From 2010 to early 2015 the previous Administration undertook an update of the 1988 Comprehensive Conservation Plan (CCP) for the Refuge to ensure that the purposes of the Refuge were being met, to establish management objectives, to incorporate new scientific information on Refuge resources, and other objectives.

Public involvement and scoping was initiated in April 2010. Eight scoping public meetings were held throughout Alaska and in Washington D.C. A total of 94,000 comments were obtained from individuals and organizations during the scoping process.

A number of state and federal agencies were invited to participate in the planning process and to submit scientific information and comments on management options. The Alaska Department of Fish and Game, the Alaska Department of Natural Resources, the Bureau of Land Management, the National Aeronautics and Space Administration participated on the planning team. The U.S. Fish Wildlife Service and the National Marine Fisheries Service were consulted on threatened and endangered species.

Formal consultation was held with nine tribes having geographic and cultural ties to the Refuge.

The draft CCP and environmental statement received over 600,000 comments, most in support of protecting wilderness and wildlife values of the Refuge. During this review period testimony was taken at six public meetings in Alaska, including villages near the Refuge.

Question 2: What was the reasoning behind that plan's recommendation to designate the Coastal Plain as wilderness?

Answer: The new plan recommended that Congress designate the Coastal Plain as wilderness. The CCP Record of Decision concluded that this recommendation best met the legislative purposes of the Refuge and the implementation of the Refuge's mission statement:

This untamed arctic landscape continues to sustain the ecological diversity and special values that inspired the Refuge's establishment. Natural processes continue and traditional cultures thrive with the seasons and changing times; physical and mental challenges test our bodies, minds, and spirit; and we

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honor the land, the wildlife and the native people with respect and restraint. Through responsible stewardship this vast wilderness is passed on, undiminished, to future generations.

The recommendation for wilderness designation was found to be consistent with the Refuge's natural, unaltered landscapes, and natural processes. Wilderness designation would recognize the Coastal Plain's high degree of biological integrity, natural diversity, wildlife habitat, environmental health, wild character, and exceptional opportunities for solitude, adventure, and immersion in the natural world.

Question 3: Is the Coastal Plain of the refuge managed any differently than if it had been formally designated as wilderness?

Answer: The CCP recommended that the "1002 Area" be managed under the FWS's "Minimal Management" standards, an administratively designated management essentially the same as for legislatively designated wilderness.

Questions from Senator Bernard Sanders

Question 1: According to the State of Alaska, there have been over 640 oil spills on Alaska's North Slope since 1995, 13 of which were greater than 10,000 gallons. Since 2009, tens of thousands of gallons of crude oil and drilling fluids have spilled on the North Slope.

In April, a BP oil well leaked crude oil and gas for several days due to damage caused by pressure from thawing permafrost. The Alaska Oil and Gas Conservation Commission issued an emergency order to review all wells on the North Slope of Alaska due to the threat posed by warming permafrost.

Do you agree with the Alaska Oil and Gas Conservation Commission that warming permafrost poses a threat to fossil fuel infrastructure?

Answer: Yes. The BP incident in April was a blowout (i.e., an uncontrolled release of gas and/or oil) from an older, producing well, DS02-03. BP and the Alaska Oil and Gas Conservation Commission (AOGCC) have agreed that thawing permafrost resulted in subsidence affecting this well which, in turn, led to the blowout. It is not clear, however, whether thawing of shallow permafrost or thawing of permafrost from warm well fluids several thousand feet down, or both, caused this serious incident.

Since this incident, BP has:[1]

1. Abandoned the oil reservoir,
2. Secured 14 wells with similar three string casing construction as DS02-03, and
3. Found another well showing substantial subsidence similar to DS02-03.

[1] BP Exploration (Alaska), October 2017 Update, op. cit.

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This type of incident has not occurred previously and shallow permafrost thawing due to climate change-related increases in temperature may be the reason. Though AOGCC's emergency order only is looking at wells of similar design and construction as DS02-03, other well designs also might be affected by thawing permafrost.

Question 2: Are you worried about the risk to both wildlife and communities poised by oil spills, especially with the growing effects of climate change?

Answer: Depending on volume, location, and time of year of occurrence, major oil spills can have significant impacts on wildlife. Summertime releases would have serious impacts on wildlife as migratory birds and calving caribou likely would be utilizing the coastal plain. Additionally, the rivers and wetlands of the coastal plain would not be frozen which would allow oil to spread easily and make oil spill response much more difficult. Bringing heavy equipment and personnel to the coastal plain for oil spill response would have significant adverse effects on wildlife as they likely would leave the nearby area to avoid industrial noise and related response activities.

Should habitat conditions be altered due to climate change, wildlife would face additional stresses. Oil development would reduce prime habitat available in the coastal plain and that, in addition to climate change-related stresses, could result in diminished populations. Arctic Village and other communities that rely on caribou and other wildlife that use the coastal plain would be harmed by reduced wildlife populations.

A major oil spill during winter would have different wildlife impacts. At that time of year, polar bears are denning onshore. Because industrial noise and related activities involved in spill cleanup would be significant, denning female polar bears could be impacted. At a time when Beaufort Sea populations of polar bears are classified as "threatened" under the Endangered Species Act, the loss of polar bear cubs would be damaging to the population.

Question 3: At a time when existing wells are threatened by warming temperatures due to climate change, does it make sense to build *more* wells and risk further oil spills in the Arctic Refuge's pristine environment?

Answer: No. While wells and major oil spills unquestionably would adversely affect wildlife, it's important to recognize that this pristine environment and the characteristics of the Arctic Refuge coastal plain allow wildlife to thrive. With respect to migratory birds that breed on the coastal plain, this pristine environment ensures thriving bird life for species which migrate to all 50 states. If the relatively narrow coastal plain in the Arctic Refuge were utilized for oil development, Porcupine Caribou Herd calving habitat would be greatly diminished, which would have an enormous impact on the Gwich'in and other people who rely on that herd for food and other essential purposes.

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Question 4: The Arctic Refuge is home to hundreds of plant and wildlife species, including America's most iconic animals such as polar bears, grizzly bears, musk ox, wolves and caribou.

This area includes more polar bear den sites than any other area on the north coast of Alaska and has been designated as a critical habitat for these threatened animals, which are listed as a threatened species under the Endangered Species Act.

The Arctic Refuge is also the nesting ground for millions of birds, including waterfowl such as Northern Pintail and Tundra Swans, which migrate from all 50 states.

Do you anticipate that the infrastructure and technology used for extraction will adversely affect this pristine ecosystem?

Answer: Development would involve construction at many different drill site locations, and these locations would be interconnected with many miles of roads and pipelines. There is no question that this infrastructure would dramatically impact the natural environment and alter the wilderness characteristics of the coastal plain.

Development can be expected to adversely impact wildlife and their habitat. There are a number of studies over the past several decades that have shown negative impacts on wildlife of activities associated with oil and gas development on Alaska's North Slope. A comprehensive study was conducted by the National Research Council's Committee on Cumulative Environmental Effects of Oil and Gas Activities on Alaska's North Slope. The 2003 report of the committee documented a number of impacts from North Slope oil development. A summary of the report is attached.

Impacts on caribou. Attached is a 2005 study by Cameron, et. al. discussing impacts of oil development on the Central Arctic Caribou Herd which uses habitat near the Prudhoe Bay oil field. For more a detailed discussion of impacts on caribou see written testimony submitted by Timothy Fullman submitted 11/15/17.

Impacts on birds. Attached is a 2009 study by Liebezeit, et. al. "Influence of human development and predators on nest survival of tundra birds, Arctic Coastal Plain, Alaska". Also attached is a 1993 study by M.W. Miller et. al. "A simulation model of helicopter disturbance of molting Pacific black brant".

Question 5: Do you think that the infrastructure and technology used for extraction will violate the Endangered Species Act?

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Answer: The legislation passed by the Committee on 11/15/17 does not expressly exempt the leasing and development activities called for in the coastal plain from the requirements of the Endangered Species Act (ESA). Consequently, consultation would presumably be required with the US Fish and Wildlife Service and/or the National Marine Fisheries Service on impacts to ESA listed species by proposed exploration, leasing and development actions. Consultation could result in mitigating measures to reduce impacts to ESA species. But past history has shown that not all recommended actions are followed or are effective, and that proposed development can result in adverse impacts on ESA species that cannot be mitigated. The language of this legislation clearly supports leasing and development in the Coastal Plain of the Refuge regardless of such impacts. Consequently, it can be reasonably expected that the infrastructure that would be permitted under this legislation would have significant impacts on ESA-listed species (including polar bears, eiders, and perhaps sea mammals) that cannot be mitigated.

Question from Senator Debbie Stabenow

Question: According to some estimates, drilling in the Arctic Refuge is likely to yield no more than $37.5 million for the U.S. Treasury over ten years.

This isn't surprising when experts from Wall Street investment firms, energy analysts at the CIA, and university professors have all said the economics for drilling in ANWR just don't exist today.

Meanwhile, the fossil fuel industry receives an estimated $20 billion in subsidies every year.

From your perspective, is opening the Arctic Refuge to drilling the most effective way to raise revenue, particularly in light of the potential damages that could occur to this pristine landscape?

Answer. A Key-Log Economics LLC report found that there isn't data supporting that the coastal plain of the Arctic National Wildlife Refuge will be valued enough by oil companies to receive $1 billion in bonus bids. Since 2010, the average price per acre on the North Slope has ranged from $14.81 to $80.59, with a weighted average for the cumulative 2,442,868 acres sold in the past six years equaling $41.59. Undoubtedly, North Slope bonus bids are the best indicator of how much federal revenue could be made leasing out the Coastal Plain, and while the minimum bid per acre could be raised, no evidence exists that oil companies may be inclined to pay more for land with no existing infrastructure or proven reserves.

An October 2017 analysis by the Center for American Progress (CAP) found that offering oil and gas leases in the Arctic Refuge will likely amount to no more than $37.5 million in federal revenue over 10 years, which is substantially short of the $1 billion to $1.8 billion that the White House, Congress, and drilling proponents claim could be raised (Lee-Ashley and Rowland, 2017,

https://www.americanprogress.org/issues/green/news/2017/10/10/440559/arctic-national-wildlife-refuge-101/

Senator Murkowski's drilling bill may actually result in raising the deficit, not lowering it. Because the State of Alaska would receive 50 percent of any revenue generated by lease sales, and because Senator Murkowski's bill calls for two 400,000-acre lease sales, in order to reach the $1 billion federal budget projections, oil companies would have to purchase leases at a rate of $2500 per acre. That's nearly sixty times the average lease sale bid on Alaska's North Slope since 2010, and is simply not realistic, particularly at a time when the price of oil is around $50 per barrel and is projected to remain at that level for the foreseeable future.[2] It is important to note that if lease sales occurred and the projected revenue targets were not met, oil drilling in the Arctic Refuge would actually add to the deficit.

Further, whatever revenue would be generated from the Arctic Refuge drilling proposal cannot be viewed in isolation, but rather needs to be weighed against any subsidies that the federal government may pay out to the oil industry in order to pursue drilling in the Arctic Refuge. Fossil fuel subsidies cost American taxpayers billions every year. Subsidies can be a mix of tax breaks, tax credits, liability easements, loosened regulations, or government services provided at below-market rates, and need to be part of the calculation.

[2] A recent study from the International Energy Agency suggests the price of oil would have to be at about $75/barrel for it to be economically recoverable from the Arctic (http://marketrealist.com/2015/01/breakeven-price-crude-oil-important/).

THE NATIONAL ACADEMIES REPORT IN BRIEF

Cumulative Environmental Effects of Oil and Gas Activities on Alaska's North Slope

Since the 1968 discovery of huge oil reserves in Prudhoe Bay, Alaska's North Slope has been a site of oil exploration and production that, by the end of 2002, had produced about 14 billion barrels (558 billion gallons) of crude oil. North Slope oil currently averages about 15% of total annual domestic oil production of approximately 3.3 billion barrels and 7% of the annual domestic consumption of approximately 7 billion barrels. Active exploration on the arctic coastal plain is now expanding incrementally westward into the National Petroleum Reserve-Alaska, eastward toward the Arctic National Wildlife Refuge, and south toward the foothills of the Brooks Range (see Figure 1).

Northern Alaska's environment and culture have already been significantly affected by oil infrastructure and activities. There have been many benefits to North Slope residents including more jobs and improved medical care and schools. These economic benefits have been accompanied by environmental and social consequences, including effects of the roads, infrastructure and activities of oil exploration and production on the terrain, plants, animals and peoples of the North Slope and the adjacent marine environment.

Although a large body of research has assessed actual and potential effects of oil and gas activities and infrastructure, no integrated, comprehensive analysis of *cumulative* effects has previously been attempted. Cumulative effects can result from individually minor but collectively significant actions taking place over a period of time or within an area. In response to a request from Congress, the National Academies convened the Committee on Cumulative Environmental Effects of Oil and Gas Activities on Alaska's North Slope to assess probable cumulative effects of oil and gas activities on various receptors—that is components of the physical, biological, and human systems of the region. The committee's consensus report assesses both present and likely future cumulative effects on the North Slope and adjacent marine waters for the time period of 1965 to 2025 (in some cases to 2050).

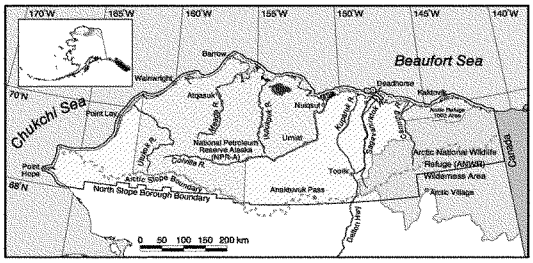

Figure 1. The North Slope (the Arctic Slope) extends from the crest of the Brooks Range to the Arctic Coast, from the Canadian border to Point Hope. Industrial activity has grown from a single operational oil field at Prudhoe Bay to an industrial complex stretching from the Alpine field near the mouth of the Colville River on the west to Badami on the east.

THE NATIONAL ACADEMIES
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Accumulated Effects To Date

Alaska's North Slope is underlain by permafrost— a thick layer of earth material that stays frozen year round. The permafrost is covered by a thin active layer that thaws each summer and supports plant growth for a brief period. If permafrost thaws, the ground surface and the structures it supports will settle. To minimize disruption to the ground surface, the North Slope industrial infrastructure is specially built—pipelines are generally elevated rather than buried, and roads and industrial facilities are raised on thick gravel berms.

For a variety of reasons, nearly all of the roads, pads, pipelines and other infrastructure ever built are still in place. The environmental effects of such structures on the landscape, water systems, vegetation, and animals are manifest not only at the "footprint" itself (physical area covered by the structure) but also at distances that vary depending on the environmental component being affected. The petroleum industry continues to introduce technological innovations to reduce its footprint, for example, directional drilling and the use of ice roads and pads, drilling platforms, and new kinds of vehicles.

For some areas of concern, the committee found no evidence that effects have accumulated. For example, despite widespread concern regarding the damaging effects of frequent oil and saltwater spills on the tundra, most spills to date have been small and have had only local effects. Moreover, damaged areas have recovered before they have been disturbed again. However, a large oil spill in marine waters would likely have substantial accumulating effects on whales and other receptors because current cleanup methods can remove only a small fraction of spilled oil, especially under conditions of broken ice.

For other areas of concern, effects have accumulated, although in some cases efforts by the petroleum industry and regulatory agencies have reduced them. The committee identified the following areas in which there was evidence of effects that have accumulated.

Roads. Roads have had effects as far-reaching and complex as any physical component of the North Slope oil fields. In addition to their direct effects on the tundra, indirect effects are caused by dust, roadside flooding, thawing of permafrost, and roadside snow accumulation. Roads and activities on them also alter animal habitat and behavior and wildland values and can increase access of hunters, tourists, and others to previously inaccessible parts of the region; enhance communication among communities; and increase contacts between North Slope communities and those outside the area.

Damage to Tundra from Off-Road Travel. Surface erosion, water flow and tundra vegetation on the North Slope have been altered by extensive off-road travel. Some damage has persisted for decades. The current 3-dimensional survey method requires a high density of seismic-exploration trails. Networks of these trails now cover extensive areas and are readily visible from the air, degrading visual experiences of the North Slope. Despite technological improvements and increased care taken by operators, the potential for damage to the tundra still exists because of the large number of vehicles and camps used for exploration.

Effects on Animal Populations. Bowhead whales' fall migrations have been displaced by the noise of seismic exploration. Garbage and food provided by people working in oil fields have resulted in higher than normal densities of predators (such as brown bears, arctic foxes, ravens, and glaucous gulls) that prey on the eggs, nestlings, and fledglings of birds. As a result, the reproduction rates of some bird species such as black brant, snow geese, eiders, and probably some shorebirds in industrial areas are, at least in some years, insufficient to balance death rates. These populations may persist in the oil fields only because of immigration of individuals from source areas where birth rates exceed death rates.

The combined effects of industrial activity and infrastructure and the stress imposed by insects in some summers reduced calf production in the Central Arctic caribou herd and may have contributed to the reduction in herd size from 1992 through 1995. In contrast, the herd increased in size from 1995 to 2001, when insect activity was lower. Although accumulated effects have not prevented an increase in the overall size of the Central Arctic Herd, the spread of industrial activity into other areas caribou use for calving and insect relief, especially to the east where the coastal plain is narrower, would likely affect reproductive success, unless the degree to which it disturbs caribou can be reduced.

Interactions of Climate Change and Oil Development. Global and regional climates have changed throughout the Earth's history, but climate changes during the past several decades on the North Slope have been unusually rapid. If recent warming trends in climate continue, as many projections indicate, the effects will accumulate over the next century to alter the extent and timing of sea ice, affect the distribution and abundance of marine and terrestrial plants and animals, and affect permafrost as well as the usefulness of current oil-field technologies and how they affect the environment.

Interference with Subsistence Activities. The Inupiat Eskimo people of the North Slope have a centuries-

old nutritional and cultural relationship with the bowhead whale. Most view offshore industrial activity—both observed effects and the possibility of a major oil spill—as a threat to the bowhead whale and, thereby, to their cultural survival. Because noise from exploratory drilling and marine seismic exploration have caused fall migrating bowhead whales to change their movements, subsistence hunters have been forced to travel greater distances to find whales, increasing their risk of exposure to adverse weather and the likelihood that a whale's tissues will have deteriorated before the carcass can be landed. Recent agreements concerning the timing and placement of exploration in the fall have reduced the effects on subsistence hunters.

The Gwich'in Indians of northeast Alaska and northwest Canada have a centuries-old nutritional and cultural relationship with the Porcupine Caribou Herd. Most Gwich'in oppose any oil development that would threaten the herd, especially on the calving ground, which they consider sacred, and thereby threaten their cultural survival. These threats have accumulated because repeated attempts to develop areas used by the herd have occurred and will probably continue to occur.

Social Changes in North Slope Communities. Most North Slope residents have positive views of many of the economic changes that have resulted from revenue generated by petroleum activities, such as access to better medical care, availability of gas heat for houses, improved plumbing, and higher personal incomes. At the same time, however, balancing the economic benefits of oil activities against the accompanying loss of traditional culture and other societal problems that can occur is often a dilemma for North Slope residents. Without this revenue, the North Slope Borough, the Alaska Native Claims Settlement Act, and hence the Arctic Slope Regional Corporation, would not exist or, if they did, would bear little resemblance to their current form. This discovery of oil and its development on the North Slope has resulted in major, important, and probably irreversible changes to the way of life in communities. These effects accumulate because they arise from several ongoing, interacting causes.

Cumulative Aesthetic, Cultural, and Spiritual Consequences. Many activities associated with oil development have compromised wildland and scenic values over large areas. Some Alaska Natives told the committee that they violate what they call "the spirit of the land," a value central to their relationship with the environment. These consequences have increased in proportion to the area affected by development, and they will persist as long as the landscape remains altered.

Future Accumulation of Effects

The committee assessed possible future accumulation of effects, assuming conditions favorable to continued expansion of oil and gas activities using technology and regulatory oversight at least as good as those currently used.

Response of North Slope Cultures to Declining Revenues. For North Slope residents, the current way of life of North Slope communities made possible by oil and gas activities will be more difficult to maintain when these activities cease as oil is depleted because other sources of funds appear to be modest. Eventual adjustments to reduced financial resources are unavoidable. Their nature and extent will be shaped by adaptations North Slope communities have made to the accumulated effects of the cash economy.

Legacy of Abandoned Infrastructure and Unrestored Landscapes. The network of roads, pads and pipelines, and infrastructure that support production will likely remain in place for many years to come. The oil industry and regulatory agencies have made dramatic progress in reducing the effects of new gravel fill by reducing the size of the gravel footprint required for many types of facilities and substituting ice for gravel for certain types of roads and pads. However, much less attention has been directed to restoring already disturbed sites. To date, only about 1% of the habitat on the North Slope affected by gravel fill has been rehabilitated.

With the exception of well-plugging and abandonment procedures, state, federal, and local agencies have largely deferred decisions regarding the nature and extent of restoration that will be required. Because the obligation to restore sites is unclear, and the costs of dismantlement, removal, and restoration are likely to be very high, the committee judges it unlikely that most disturbed habitats on the North Slope will be restored. Because natural recovery in the Arctic is slow, the effects caused by abandoned and unrestored infrastructure are likely to persist for centuries and could accumulate further as new structures are added.

Expansion of Activities into New Areas. Expansion of oil and gas exploration is spreading into hillier terrain and into coastal plain areas with soils, vegetation and aquatic environments that differ substantially from current areas of activity. To assess effects in these environments, they should be characterized through description of topography, permafrost conditions, sand, gravel, and water availability, hydrological conditions,

and a description of the biotic communities present. In addition, future exploratory activity will probably be carried out in a warming climate, with milder winter temperatures and shorter periods of freezing conditions.

Filling Knowledge Gaps

As industrial activities proceed, it is vital to continue collecting and analyzing information on the North Slope's physical, biological, and human environments to help decision makers in developing and implementing effective natural resources management. Advantage should be taken of opportunities to learn from these activities (adaptive management).

Decisions about where, when, and under what conditions and requirements industrial activities are permitted on the North Slope are made by many different federal, state, regional, and municipal government agencies. To date, decisions have generally been made without a comprehensive slope-wide plan and regulatory strategy that identify the scope, intensity, direction and consequences of industrial activities judged acceptable. A comprehensive framework and plan should be developed for the North Slope so that actions can be evaluated with respect to their compatibility with overall goals, the likely effects of individual activities on all receptors that might be affected by them, and the likelihood that the activities will result in long-term or difficult-to-reverse undesirable effects. Knowledge gaps should be addressed through the following:

- Ecosystem-level research in addition to local ecological studies.
- Studies to understand the types of effects that exist at varying distances beyond the footprint of industrial structures.
- Studies of air pollution that provide a quantitative baseline of spatial and temporal trends in air quality over long periods across the North Slope.
- Studies of effects of seismic exploration and other off-road use on the tundra.
- Research on habitat requirements of caribou, their reproductive physiology and movements, and how natural and anthropogenic disturbance affects them.
- Studies of the effects of noise on the migratory and acoustic behavior of bowhead whales and on their feeding habits in the Alaskan portion of the Beaufort Sea.
- Studies of effects of taking water from lakes on the North Slope for ice roads, pads, and other purposes.
- Studies of methods to reduce effects of oil spills including non-mechanical methods of cleaning up oil spilled in the sea, especially in broken ice.
- Research on the specific benefits and threats that North Slope residents perceive.
- Studies of effects of oil and gas activities on human health including studies of increased use of alcohol and drugs, increased obesity, and other societal ills.

Committee on Cumulative Environmental Effects of Oil and Gas Activities on Alaska's North Slope: Gordon Orians, (Chair), University of Washington; **Thomas Albert,** North Slope Borough; **Gardner Brown,** University of Washington; **Raymond Cameron,** University of Alaska; **Patricia Cochran,** Alaska Native Science Commission; **S. Craig Gerlach,** University of Alaska; **Robert Gramling,** University of Louisiana; **George Gryc,** U.S. Geological Survey; **David Hite,** Geological Consultant, Anchorage; **Mahlon Kennicutt II,** Texas A&M University; **Arthur Lachenbruch,** U.S. Geological Survey; **Lloyd Lowry,** University of Alaska; **Lawrence Moulton,** MJM Research; **Chris Pielou,** Dalhousie University; **James Sedinger,** University of Nevada; **K. June Lindstedt-Siva,** ENSR Consulting and Engineering; **Lisa Speer,** Natural Resources Defense Council; **Donald (Skip) Walker,** University of Alaska; **David Policansky** (Project Director), Board on Environmental Studies and Toxicology.

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Central Arctic Caribou and Petroleum Development: Distributional, Nutritional, and Reproductive Implications

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ABSTRACT. We synthesize findings from cooperative research on effects of petroleum development on caribou (*Rangifer tarandus granti*) of the Central Arctic Herd (CAH). The CAH increased from about 6000 animals in 1978 to 23000 in 1992, declined to 18000 by 1995, and again increased to 27000 by 2000. Net calf production was consistent with changes in herd size. In the Kuparuk Development Area (KDA), west of Prudhoe Bay, abundance of calving caribou was less than expected within 4 km of roads and declined exponentially with road density. With increasing infrastructure, high-density calving shifted from the KDA to inland areas with lower forage biomass. During July and early August, caribou were relatively unsuccessful in crossing road/pipeline corridors in the KDA, particularly when in large, insect-harassed aggregations; and both abundance and movements of females were lower in the oil field complex at Prudhoe Bay than in other areas along the Arctic coast. Female caribou exposed to petroleum development west of the Sagavanirktok River may have consumed less forage during the calving period and experienced lower energy balance during the midsummer insect season than those under disturbance-free conditions east of the river. The probable consequences were poorer body condition at breeding and lower parturition rates for western females than for eastern females (e.g., 1988–94: 64% vs. 83% parturient, respectively; $p = 0.003$), which depressed the productivity of the herd. Assessments of cumulative effects of petroleum development on caribou must incorporate the complex interactions with a variable natural environment.

Key words: behavior, body condition, calving, cumulative effects, demography, fecundity, habitat, *Rangifer*

RÉSUMÉ. On a procédé à une synthèse des résultats de travaux de recherche coopérative concernant les effets de l'exploitation pétrolière sur le caribou (*Rangifer tarandus granti*) formant la harde du centre de l'Arctique (HCA). La population de celle-ci est passée de 6000 têtes en 1978 à 23000 en 1992, puis a diminué à 18000 en 1995 pour augmenter de nouveau à 27 000 en 2000. La production nette des veaux allait de pair avec les changements dans la taille de la harde. Dans la zone de développement de Kuparuk (KDA), située à l'ouest de Prudhoe Bay, l'abondance des caribous qui mettaient bas était inférieure à celle prévue dans une bande de 4 km de part et d'autre des routes, et elle déclinait de façon exponentielle avec la densité routière. Avec une augmentation des infrastructures, on assistait à un déplacement du vêlage à forte densité de la KDA vers des zones de l'intérieur ayant une biomasse de fourrage moins importante. Durant juillet et au début d'août, il était assez rare que les caribous réussissent à traverser les corridors routiers/pipeliniers dans la KDA, surtout lorsqu'ils formaient de vastes agrégations harcelées par les insectes; l'abondance de même que les déplacements des femelles étaient en outre moindres au sein du complexe pétrolier de Prudhoe Bay qu'à d'autres endroits situés le long du rivage arctique. Il est possible que les femelles qui étaient exposées à l'exploitation pétrolière à l'ouest de la rivière Sagavanirktok aient consommé moins de fourrage au cours de la période de vêlage et que, durant la saison des insectes au milieu de l'été, elles aient connu une balance énergétique inférieure à celle des femelles vivant sans perturbations à l'est de la rivière. Les conséquences probables étaient un état corporel de qualité inférieure au moment de l'accouplement, et des taux de parturition plus faibles pour les femelles situées à l'ouest que pour celles situées à l'est (p. ex., de 1988 à 1994: 64 % c. 83 % de parturientes respectivement: $p = 0{,}003$), faisant ainsi baisser la productivité de la harde. Les évaluations des effets cumulatifs de l'exploitation pétrolière sur le caribou doivent intégrer les interactions complexes avec un environnement naturel variable.

Mots clés: comportements, état corporel, vêlage, effets cumulatifs, démographie, fécondité, habitat, *Rangifer*

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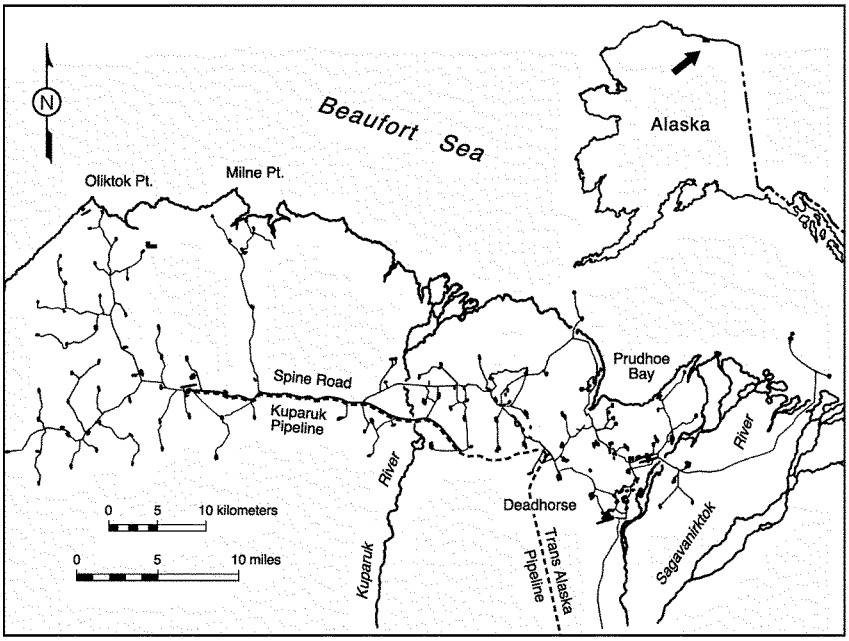

FIG. 1. Roads and facilities in the Kuparuk Development Area (west of the Kuparuk River) and Prudhoe Bay oil field complex (east of the Kuparuk River), Alaska, ca. 1990 (Cameron et al., 1995; reprinted with permission from *Rangifer*).

INTRODUCTION

From the mid-1970s through the mid-1980s, use of calving and midsummer habitats by Central Arctic Herd (CAH) caribou (*Rangifer tarandus granti*) declined near oil field infrastructure on Alaska's Arctic Coastal Plain (Cameron et al., 1979; Cameron and Whitten, 1980; Smith and Cameron, 1983; Whitten and Cameron, 1983a, 1985; Dau and Cameron, 1986). With surface development continuing to expand westward from the Prudhoe Bay oil field complex (Fig. 1), concerns arose that the resultant cumulative losses of habitat would eventually reduce productivity of the herd. Specifically, reduced access of adult females to preferred foraging areas might adversely affect growth and fattening (Elison et al., 1986; Clough et al., 1987), in turn depressing calf production (Dauphiné, 1976; Thomas, 1982; Reimers, 1983; White, 1983; Eloranta and Nieminen, 1986; Lenvik et al., 1988; Thomas and Kiliaan, 1998) and calf survival (Haukioja and Salovaara, 1978; Rognmo et al., 1983; Skogland, 1984; Eloranta and Nieminen, 1986; Adamczewski et al., 1987).

Those concerns, though justified in theory, lacked empirical support. With industrial development in Arctic Alaska virtually unprecedented, there was little basis for predicting the extent and duration of habitat loss, much less the secondary short- and long-term effects on the well-being of a particular caribou herd. Furthermore, despite a general acceptance that body condition and fecundity of females are functionally related for reindeer (*R. t. tarandus*) and caribou, it seemed unlikely that any single model would apply to all subspecies of *Rangifer*, or even within a subspecies, to all geographic regions. We therefore lacked a complete understanding of the behavioral responses of Arctic caribou to industrial development, the manner in which access to various habitats might be affected, and how changes in habitat use might translate into effects on fecundity and herd growth.

Our studies had four objectives: 1) to estimate variation in the size and productivity of the CAH; 2) to estimate changes in the distribution and movements of CAH caribou in relation to oil field development; 3) to estimate the relationships between body condition and reproductive

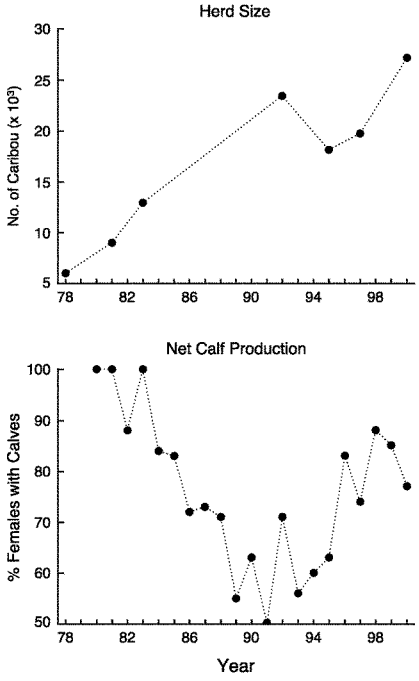

FIG. 2. Photo-census estimates of the Central Arctic caribou herd, 1978–2000 (Whitten and Cameron, 1983b; Alaska Department of Fish and Game files) and net calf production based on observations of radio-collared adult (i.e., sexually mature) females from 10 June through 15 August (Alaska Department of Fish and Game files). Note: Productivity data are not adjusted for differences in sample sizes east and west of the Sagavanirktok River.

performance of female CAH caribou; and 4) to compare the body condition and reproductive success of females under disturbance-free conditions (i.e., east of the Sagavanirktok River) with the status of those exposed to petroleum-related development (i.e., west of the Sagavanirktok River) (Fig. 1).

Status of the Central Arctic Herd

Photocensus results indicate net growth of the CAH from 1978 through 2000 (Fig. 2). Within that long-term trend, however, was a decrease from 1992 to 1995, which coincided with calf production estimates at or below approximately 70%. Calf production was also relatively low during 1989–91, suggesting that herd growth had decelerated or ceased before the 1992 census. Otherwise, periods

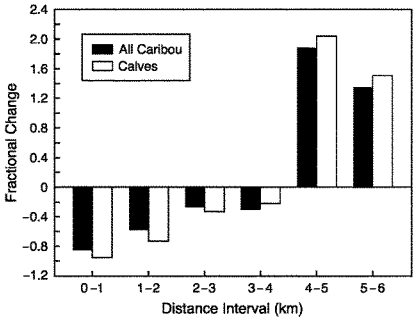

FIG. 3. Changes in mean density of calving caribou from the Central Arctic Herd from 1978–81 (before road construction) to 1982–87 (after road construction) at distances of 0–6 km (in 1 km intervals) from the Milne Point road system, Kuparuk Development Area, Alaska (Cameron et al., 1992b; reprinted with permission from *Arctic*).

of apparent growth were associated with productivity estimates exceeding 70%.

Development-Related Changes in Distribution

Because the CAH is in contact with industrial development from calving time through midsummer, our surveys focused on those two intervals. The calving period is the three-week interval beginning with the peak of calving, i.e., after 50% of the calving has occurred (Russell et al., 2002:31); for the CAH, this peak usually occurs in early June (Cameron et al., 1993). The summer insect season follows, generally extending from late June through early August (White et al., 1975; Dau, 1986).

Changes in the distribution of calving caribou associated with the Kuparuk Development Area (KDA), west of the Kuparuk River (Fig. 1), were quantified by means of strip-transect surveys conducted from a helicopter. After construction of a road system between Milne Point and the Spine Road (Fig. 1), mean caribou abundance declined by more than two-thirds within 2 km of roads and was less than expected, overall, within 4 km, but nearly doubled 4–6 km from roads (Fig. 3). Before road construction, caribou were found in a single, more or less continuous concentration that encompassed the area where roads would subsequently be built. After road construction, a bimodal distribution was clearly apparent, with separate concentrations to the west and east of the road (Fig. 4), indicating avoidance of infrastructure by calving caribou.

These results suggest that roads spaced too closely will depress calving activity within portions of an oil field complex. In fact, relative abundance of caribou in the heavily developed western portion of the KDA showed a significant decline from 1979 through 1987, which was independent of total abundance (Fig. 5). Such declines

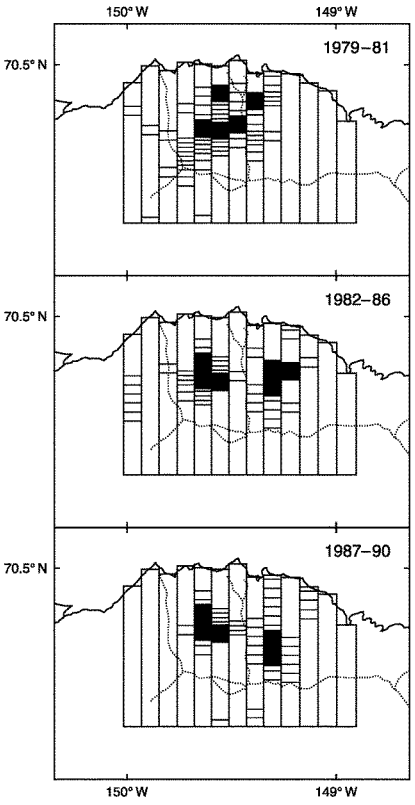

FIG. 4. Changes in mean relative distribution of caribou from the Central Arctic Herd in the Kuparuk Development Area, Alaska, during calving in 1979–81, 1982–86, and 1987–90. Each transect segment was 10.4 km², or 0.9% of the 1150 km² surveyed. Only those segments with more than 0.9% of the total caribou observed are shown. Gradations in line spacing depict caribou densities as multiples of the base density derived from that percentage: wide spacing = less than 3 × base; narrow spacing = 3–5 × base; solid = more than 5 × base (Smith and Cameron, 1992; reprinted with permission).

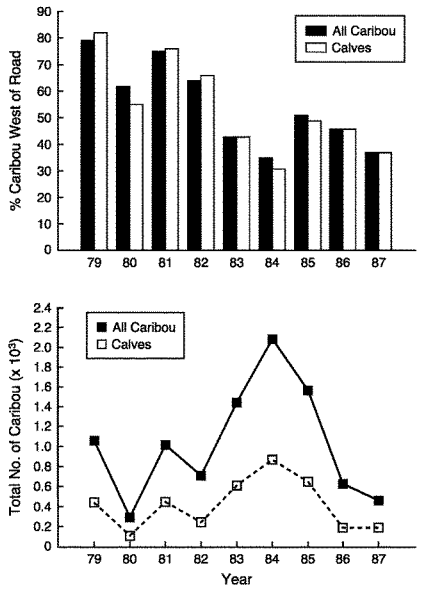

FIG. 5. Histogram shows decline in abundance of calving caribou from the Central Arctic Herd west of the Milne Point road system, Alaska, 1979–87 (Spearman's Rank, $p < 0.02$). Abundance is expressed as a percentage of the total numbers of caribou north of the Spine Road (see Fig. 1), shown in the line graph below (Cameron et al., 1992b; reprinted with permission from *Arctic*).

apparently involve an exponential decrease in caribou density with increasing road density (Fig. 6). The probable consequence is reduced access to preferred foraging habitats (Nellemann and Cameron, 1996, 1998).

Incremental redistribution and local habitat loss within the KDA may have triggered changes on a regional scale. Wolfe (2000) reported an inland shift of concentrated calving activity away from the Milne Point area (Fig. 7), which coincided with an increase in the density of infrastructure.

Ground observations within the KDA provided additional insights on changing distribution and movements. During 1978–90, observations that caribou increasingly avoided zones of intensive construction and production-related activity, especially during the calving period (Smith et al., 1994), corroborated data from strip-transect surveys. Lower success in crossing road/pipeline corridors by large, insect-harassed groups during summer (Smith and Cameron, 1985; Curatolo and Murphy, 1986; Murphy and Curatolo, 1987; Murphy, 1988) may have contributed to relatively greater use of peripheral areas with less surface development and human activity. Primary routes of summer movement have shifted to areas south of Oliktok Point and along the Kuparuk River floodplain (Smith et al., 1994).

An analysis of the summer distribution of radio-collared females during 1980–93 (Cameron et al., 1995) suggested that caribou use of the oil field region at Prudhoe Bay had declined considerably from that noted by Child

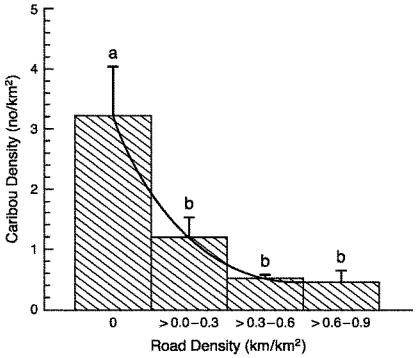

FIG. 6. Relationship between mean (SE) density of calving caribou from the Central Arctic Herd and road density within preferred rugged terrain, Kuparuk Development Area, Alaska, 1987–92. Different letters indicate a significant difference ($p < 0.05$) (Nellemann and Cameron, 1998; reprinted with permission from the *Canadian Journal of Zoology*).

(1973), and White et al. (1975) during the 1970s. Both caribou abundance within the main industrial complex and east-west caribou movements through that area were significantly lower ($p < 0.001$) than in other areas occupied by caribou along the Arctic coast. Conservative calculations yielded an estimated 78% decrease in use by caribou and a 90% decrease in their east-west movements (Cameron et al., 1995), changes apparently in response to intensive development of that region over the past three decades. However, the occurrence of caribou that *do* use the complex during summer is reportedly unrelated to distance from infrastructure (Cronin et al., 1998).

Body Condition and Reproductive Performance

Reproductive success of caribou is highly correlated with nutritional status. The probability of producing a calf varies directly with both body weight and body fat content of sexually mature females during the previous autumn (Cameron et al., 1993, 2000; Cameron and Ver Hoef, 1994; Gerhart et al., 1997). In contrast, calving date and perinatal survival are more closely related to maternal weight shortly after parturition (i.e., estimated prepartum body weight minus weight of fetal tissues) (Fig. 8). Thus, the likelihood of conceiving is probably determined by body condition at breeding, whereas parturition date and calf survival may reflect maternal condition during late gestation.

In theory, these relationships link the nutritional consequences of changes in distribution to the reproductive success of caribou of the CAH. West of the Sagavanirktok River, caribou had reduced access to preferred foraging habitats near roads (Nellemann and Cameron, 1996) and

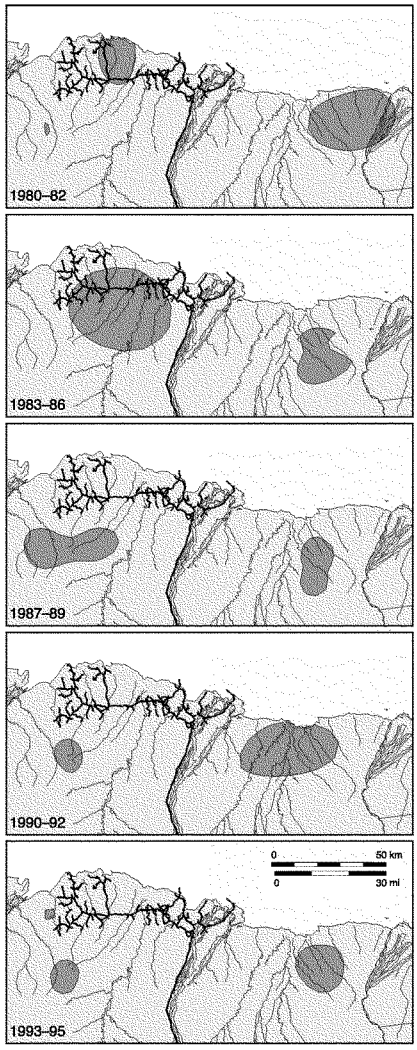

FIG. 7. Shifts in concentrated caribou calving areas of the Central Arctic Herd between the Colville and Canning rivers (note oil field infrastructure, Fig. 1), Alaska, 1980–95 (adapted from Wolfe, 2000: Fig. 3).

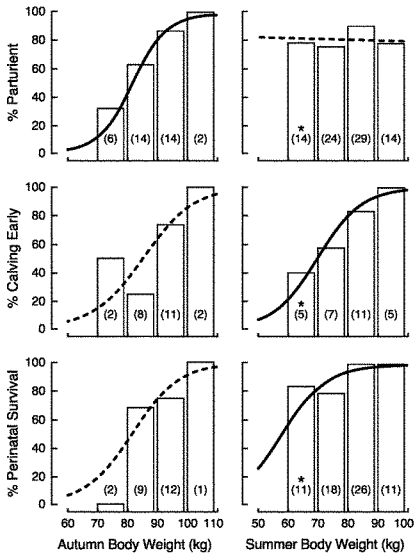

FIG. 8. Logistic regressions of parturition rate, incidence of early calving (on or before 7 June), and perinatal calf survival (> two days postpartum) on autumn and summer body weights of female caribou, Central Arctic Herd, Alaska, 1987–91. Solid lines are significant at $p < 0.05$. The empirical percentages are shown at arbitrary 10 kg intervals of body weight. Numbers in parentheses are sample sizes. *The weight category 60–70 kg includes one female weighing 57 kg (Cameron et al., 1993; reprinted with permission from the *Canadian Journal of Zoology*).

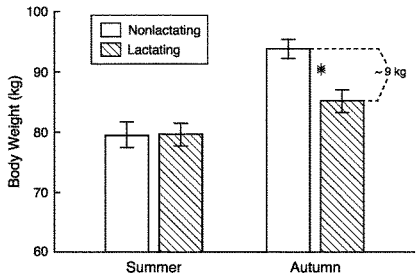

FIG. 9. Mean (SE) body weights of lactating (n = 23) and nonlactating (n = 23) female caribou in summer (July) and autumn (October), Central Arctic Herd, Alaska, 1988–91. *Difference is significant at $p < 0.001$ (Cameron and White, 1996).

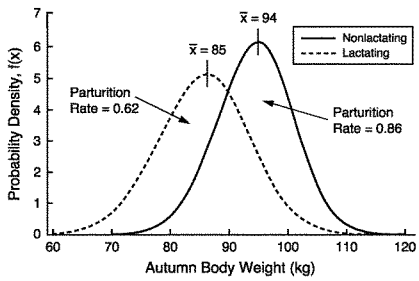

FIG. 10. Distributions of observed autumn (October) body weights for lactating and nonlactating female caribou, Central Arctic Herd, Alaska, 1988–91. The associated parturition rates are integrated estimates derived from the logistic model (Fig. 8) (Cameron and White, 1996).

shifted their concentrated calving area into habitats with lower plant biomass ($p < 0.001$) (Wolfe, 2000). In contrast, forage biomass remained constant ($p = 0.23$) within concentrated calving areas east of the Sagavanirktok River, where no development was present (Wolfe, 2000). Repeated use of lower-quality calving habitats may reduce forage intake by females to the west. Likewise, impaired summer movements between insect-relief habitat and inland feeding areas could depress energy balance (Smith, 1996) and, hence, rates of weight gain.

Indeed, several data sets suggest reduced nutritional status and fecundity of radio-collared females exposed to oil development west of the Sagavanirktok River. Estimates of July and October body weights, over-summer weight gain, the incidence of two pregnancies in successive years, and perinatal calf survival all tended to be lower for females to the west than for those under disturbance-free conditions to the east, although individual differences were not significant at the 95% confidence level (Cameron et al., 1992a). In a more recent analysis of data for 1988–94, however, the mean parturition rate of females west of the Sagavanirktok River was 64% compared with 83% for females to the east ($p = 0.003$, Table 1) (Cameron, 1995). Corresponding frequencies of reproductive pauses (Cameron, 1994; Cameron and Ver Hoef, 1994) were 36% to the west of the river (26 of 73 observations) and 19% to the east (12 of 64 observations) ($p < 0.02$, t-test, ratio method), or approximately one pause every three and five years, respectively (Cameron, 1995). With the opening of the Badami production unit east of the Sagavanirktok River in 1996, the undisturbed status of that area was compromised, rendering further comparisons problematic.

The key constraint on reproduction is lactation: it exacts a substantial cost on summer weight gain, which in turn influences the probability of conceiving that autumn. During 1988–91, weights of all lactating CAH females sampled averaged 9 kg less than those of nonlactating females (Fig. 9), resulting in a projected 28% reduction in parturition rate (Fig. 10). Lower parturition rates of

TABLE 1. Parturition status of 43 radio-collared female caribou,[1] Central Arctic Herd, west and east of the Sagavanirktok River,[2] Alaska, 1988–94. The west side included the Prudhoe Bay oil field complex and Kuparuk Development Area (Fig. 1); the east side had no petroleum-related infrastructure (data from Cameron, 1995).

Year	% Parturient (n)	
	West	East
1988	72.7 (11)	100.0 (8)
1989	53.8 (13)	77.8 (9)
1990	83.3 (12)	100.0 (7)
1991	45.5 (11)	75.0 (12)
1992	72.7 (11)	75.0 (12)
1993	55.6 (9)	62.5 (8)
1994	66.7 (6)	87.5 (8)
Mean parturition rate, %[3]	64.3 ± 5.0	82.5 ± 5.3

[1] All sexually mature.

[2] Individual locations consistently west or east for 2–7 years during the calving period.

[3] t-test, paired comparisons, $p = 0.003$.

females west of the Sagavanirktok River during 1988–94 (Table 1) may reflect a failure to compensate for the metabolic burden of milk production (i.e., through increased forage intake or reduced energy expenditure). The result is consistently poorer condition in autumn and, hence, more frequent reproductive pauses, which contribute to a decline in calf production of the herd (Fig. 2).

Yet the degree to which lactation constrains weight gain does vary. An increase in net calf production during 1996–2000 (Fig. 2) suggests the prevalence of forage and insect conditions that enhanced growth and fattening, despite the demands of milk production and the presence of industrial activity.

CONCLUSIONS

Anthropogenic effects on caribou must be identified and assessed within the framework of a variable natural environment. Favorable foraging and insect conditions would attenuate the consequences of disturbance-induced changes in the quality of habitats occupied. Conversely, adverse conditions would exacerbate those same types of consequences (e.g., NRC, 2003:114–115). Unless analyses are based on multiyear observations of marked individuals and incorporate comparative data on an undisturbed control or reference group, conclusions will be equivocal at best. For example, absent a valid baseline, net growth of the CAH (Fig. 2) is no better evidence of compatibility with development than a net decline would be evidence of a conflict.

The crucial consideration for the future of the CAH and other Arctic caribou herds is whether changes in distribution associated with surface development, by depressing reproduction or survival, will either retard an increase in herd size or accelerate a decrease. Our data, in fact, indicate that productivity can and will decline if the cumulative loss of preferred habitat, when superimposed on natural forces, is sufficient to compromise nutrition.

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We dedicate this review to the memory of Ronald M. Warbelow, who died in 1995 after a long battle with cancer. Equally skilled at the controls of a helicopter or a fixed-wing aircraft, Ron was instrumental in the success of caribou capture and survey programs in the late 1980s and early 1990s. His friendship and enthusiastic participation will not be forgotten.

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Influence of human development and predators on nest survival of tundra birds, Arctic Coastal Plain, Alaska

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Abstract. Nest predation may influence population dynamics of birds on the Arctic Coastal Plain (ACP) of Alaska, USA. Anthropogenic development on the ACP is increasing, which may attract nest predators by providing artificial sources of food, perches, den sites, and nest sites. Enhanced populations or concentrations of human-subsidized predators may reduce nest survival for tundra-nesting birds. In this study, we tested the hypothesis that nest survival decreases in proximity to human infrastructure. We monitored 1257 nests of 13 shorebird species and 619 nests of four passerine species at seven sites on the ACP from 2002 to 2005. Study sites were chosen to represent a range of distances to infrastructure from 100 m to 80 km. We used Cox proportional hazards regression models to evaluate the effects of background (i.e., natural) factors and infrastructure on nest survival. We documented high spatial and temporal variability in nest survival, and site and year were both included in the best background model. We did not detect an effect of human infrastructure on nest survival for shorebirds as a group. In contrast, we found evidence that risk of predation for passerine nests increased within 5 km of infrastructure. This finding provides quantitative evidence of a relationship between infrastructure and nest survival for breeding passerines on the ACP. A posteriori finer-scale analyses (within oil field sites and individual species) suggested that Red and Red-necked Phalaropes combined (*Phalaropus fulicarius*, *P. lobatus*) had lower productivity closer to infrastructure and in areas with higher abundance of subsidized predators. However, we did not detect such a relationship between infrastructure and nest survival for Semipalmated and Pectoral Sandpipers (*Calidris pusilla*, *C. melanotos*), the two most abundant shorebirds. High variability in environmental conditions, nest survival, and predator numbers between sites and years may have contributed to these inconsistent results. We recommend targeted management actions to minimize anthropogenic effects and suggest new research needed on this issue as expanding development is planned for the ACP of Alaska. In particular, we recommend research on demography of key predators and their importance with respect to nest survival, and experimental studies that better address challenges posed by high natural variability.

Key words: Alaska, USA; Arctic Coastal Plain; Cox proportional hazards model; development; infrastructure; nest predator; nest survival; passerines; shorebirds; subsidized predators.

Introduction

Predation can regulate prey populations and influence species composition (Crooks and Soulé 1999). Nest predation, the consumption of eggs or young at active nests, can be the primary factor regulating population growth for some species (George 1987). Anthropogenic development may attract or augment certain nest predators, increasing local nest predation (Haskell et al. 2001, Marzluff 2001). These "subsidized predators" (Soulé et al. 1988) are increasing in our urbanizing world (Marzluff 2001) and, most recently, these increases are occurring in once-remote places including the Arctic (Restani et al. 2001, NAS 2003).

The avifauna of the Arctic Coastal Plain (ACP) is dominated by shorebirds, in respect to both diversity of breeding species and aggregate abundance (Pitelka 1974, U.S. Fish and Wildlife 2005). In addition to shorebirds, the ACP is an important breeding area for waterfowl (Derksen et al. 1981, Johnson 2000), other waterbird species, and passerines. Although millions of shorebirds breed on the ACP, many populations are in decline

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(Howe et al. 1989, Morrison et al. 2006, Bart et al. 2007). Although declines have been attributed to habitat loss and degradation in wintering and stopover areas to the south (Lanctot and Laredo 1994), nest predation is also believed to be a key factor influencing population growth for some species on the ACP (Troy 2000, NAS 2003).

Much of the 98 200-km^2 ACP of Alaska is still undeveloped, although the demand for oil and natural gas will likely spur more development. Currently, relative to the entire ACP, the physical footprint of oil infrastructure is small (as of 2001, 70.23 km^2; NAS 2003) even when land fragmented by the network of infrastructure is included (~2600 km^2; NAS 2003). Direct effects of habitat loss and fragmentation, therefore, may not be major factors affecting bird populations in this region. However, human activity can create disturbances to wildlife, including birds, beyond the physical footprint of infrastructure (Murphy and Anderson 1993, Monda et al. 1994, Johnson et al. 2003). In particular, the influence of subsidized nest predators may extend well beyond infrastructure because the key predators involved are highly mobile (Eberhardt et al. 1982, Poole et al. 2003). If predator distribution and abundance is sufficiently altered by human activity, productivity of tundra birds could be affected at a regional scale.

Human development can lead to increases in subsidized predator populations by altering predator distribution, productivity, and survival (Marzluff et al. 2001, Kristan and Boarman 2007). On the ACP, predators are attracted to areas of human activity by the availability of anthropogenic food (e.g., at landfills and dumpsters) and increased availability of artificial breeding and perch sites (e.g., buildings, bridges, and culverts; Day 1998). In particular, arctic foxes (*Vulpes lagopus*; see Plate 1), Common Ravens (*Corvus corax*), and Glaucous Gulls (*Larus hyperboreus*) can benefit from human presence, and high densities of these species may adversely influence the productivity of prey species. Burgess and Banyas (1993) reported a higher density of fox dens in the Prudhoe Bay region compared to adjacent areas outside of the oil fields, although baseline data on fox populations prior to development are lacking. Eberhardt et al. (1982) found that arctic foxes in areas with oil development were more sedentary than foxes in undeveloped areas and foraged primarily in areas of high human activity. Raven breeding range has expanded into human-altered regions of the ACP, probably due to increased availability of nest sites (Day 1998). In addition, Glaucous Gulls are attracted to human food wastes on the ACP (Murphy et al. 1987), although Noel et al. (2006) found no evidence that Glaucous Gull numbers in Beaufort Sea lagoons were influenced by the presence of humans. In recent years, improved waste management practices within ACP oil fields and villages have reduced the availability of artificial food. However, access to artificial food persists, albeit at lower levels, and artificial breeding and perching sites remain in place.

Despite evidence indicating increased nest predator concentrations in areas of human development on the ACP, few studies have attempted to evaluate effects on the nesting success of prey species. Studying anthropogenic effects on nest success is challenging because the relationship may be influenced by spatial and temporal variation in weather conditions, natural predator–prey population cycles, habitat differences, and other environmental factors.

We measured spatial and temporal patterns of nest survival to evaluate effects of human development on nest predation for tundra-nesting birds. Our objectives were to evaluate nest survival at a regional scale, at sites across the ACP exposed to different levels of infrastructure, and at a local scale (i.e., within the oil fields) where human development is most intensive. We hypothesized that nest survival of tundra birds is inversely related to distance to infrastructure. Finally, we have recommended management actions and new research that will further our knowledge of this issue and help to reduce the impacts of nest predators on nesting birds in areas of human activity on the ACP of Alaska.

Methods

Study sites and plot delineation

We collected data during June and July 2002–2005 at seven sites spanning 390 km on the Arctic Coastal Plain (ACP) of Alaska (Fig. 1). Not all sites were sampled in all years (Table 1). Study sites ranged in size from ~766 km^2 (Prudhoe Bay) to 24 km^2 (Jago). The Prudhoe Bay and Kuparuk study sites were located within oil fields, and all plots at these sites were <5 km from human infrastructure (referred to as "infrastructure" hereafter). Satellite oil fields including Alpine, Northstar, and Endicott lie between study sites. Oil field infrastructure includes gravel roads, airstrips, pipelines, oil production and processing facilities, power stations and lines, gravel mines, and living quarters. Landfills operated by the North Slope Borough are located in the Prudhoe Bay oil field and in the villages of Nuiqsut and Kaktovik. The industrial town of Deadhorse borders the Prudhoe Bay oil field. Infrastructure is typically built on a ~1.5-m gravel layer to prevent thawing of the underlying permafrost. The Prudhoe Bay and Kuparuk sites contain gravel footprints covering 27.9 and 7.5 km^2, respectively. As of 2001, this includes 808 km of roads in Prudhoe Bay and 221 km of roads in Kuparuk (NAS 2003). The nearest Native villages to the study area (Nuiqsut and Kaktovik) also contain substantial amounts of infrastructure, but lie outside the boundaries of the individual study sites (Fig. 1).

All other study sites, with the exception of Prudhoe Bay and Kuparuk, were in remote areas with either no infrastructure (i.e., Teshekpuk, Canning, Jago, Fish Creek) or minimal infrastructure (i.e., Thomson had three abandoned gravel pads). Median distance of nests to infrastructure classified as having a high value for nesting or perching sites was 1.0 km for Kuparuk, 1.3

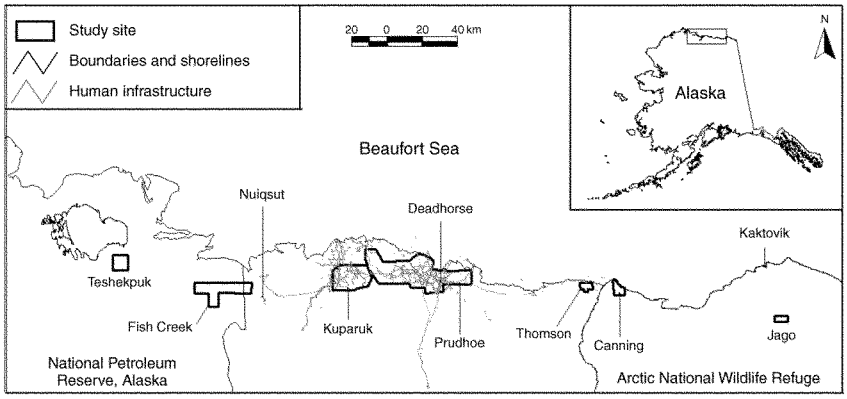

FIG. 1. Study sites sampled from 2002 to 2005 on the Arctic Coastal Plain of Alaska, USA.

km for Prudhoe Bay, 22.7 km for Thomson, 25.6 km for Fish Creek, 29.9 km for Jago, 40.5 km for Canning, and 80.8 km for Teshekpuk.

Habitat at each site was characterized by a mosaic of dry or moist upland tundra, often with high densities of cottongrass tussocks (*Eriophorum* spp.), moist or wet meadows of graminoids or low shrubs, aquatic marshes dominated by sedges (*Carex* spp.) or pendant grass (*Arctophila fulva*), and lakes and ponds. The topography was generally flat, with elevations typically <50 m. Microtopographic features included high- and low-centered polygons, strangmoor/disjunct polygon ridges, hummocks, tussocks, and frost boils (Walker et al. 1980). [A strangmoor (or "string bog") is a bog consisting of slightly elevated ridges and islands with woody or herbaceous plants, alternating with flat, wet sedge mat areas. String bogs occur on slightly sloping surfaces, with ridges at right angles to the direction of water flow.] Mean temperature for June and July during the study was 5.5°C at the Deadhorse Airport (Weather Underground 2008).

We randomly or systematically established 5–24 plots in each study site (Table 1). Most plots were 100 × 1000

TABLE 1. Number of plots and years sampled at each study site and number of shorebird and passerine nests monitored at study sites on the Arctic Coastal Plain, Alaska, 2002–2005.

Study area	No. plots sampled†	Number of nests, by year				Total no. nests
		2002	2003	2004	2005	
Shorebirds						
Teshekpuk	16	...	...	...	67	67
Fish Creek	24	115	91	91	...	297
Kuparuk	24	80	70	78	...	228
Prudhoe	12	...	52	83	63	198
Thomson	24	55	53	...	...	108
Canning	20	49	94	93	102	338
Jago	5	...	...	21	...	21
Total	...	299	360	366	232	1257
Passerines						
Teshekpuk	16	...	...	...	51	51
Fish Creek	24	53	78	65	...	196
Kuparuk	24	46	52	32	...	130
Prudhoe	12	...	12	19	14	45
Thomson	24	43	41	...	...	84
Canning	20	9	34	36	33	112
Jago	5	...	...	1	...	1
Total	...	151	217	153	98	619

Notes: Study areas are Fish and Judy creeks, Kuparuk River, Prudhoe Bay, Canning River Delta, Point Thomson, Teshekpuk, and Jago River. Ellipses indicate that no data were available.

† There were 24 plots sampled at Prudhoe in 2004, 20 plots sampled at Thomson in 2003, and nine plots sampled at Canning in 2002.

m or 200 × 500 m (10 ha), although plots at Jago and four at Canning in 2003 were 400 × 400 m (16 ha). Plots were subdivided into 40 50 × 50 m subplots. Each subplot was further divided into 25 × 25 m quadrats. At the oil field sites, plots were located >100 m from roads and pads to reduce potential effects of disturbance and habitat modification (Troy 2000).

Field methods

We conducted four nest searches on each plot per year during 6 June to 8 July, following methodology adapted from Troy (1993). Nest locations for all species were recorded with a global positioning system (GPS) and were marked by a wooden tongue depressor placed within 5 m of the nest. Searches were conducted from approximately 07:30 to 20:00 hours Alaska Daylight Time. We monitored active nests every 3–7 days until their fate was determined.

We recorded four outcomes for nest fate: success, predation, non-predation failure, or unknown. We estimated nest fate as "successful" or "predated" based on previously established criteria (Troy 1993, Mabee 1997, Martin et al. 1997). A nest was considered successful if at least one chick hatched (in the case of precocial nesters) or fledged (in the case of altricial nesters). Causes of nest failure, other than predation, included inclement weather, abandonment, trampling by caribou or musk ox, and human disturbance. These events were infrequent (1.6%; 30 of 1876 nests), so we combined them in a "non-predation failure" category. Nest fate was classified as "unknown" if we had no clear evidence or had contradictory evidence at the nest site.

Each nest had a "nest lifetime," defined as the period from initiation date (when the first egg was laid) until the termination date (when the nest succeeded, failed, or its fate became unknown). We back-calculated nest initiation dates from nest age estimates obtained by (1) assuming one day for each egg laid when nests were discovered during the laying stage; (2) using published nesting-stage lengths (Poole et al. 2003) if hatch date was known; (3) judging nestling development (passerines only; Hussell and Montgomerie 2002); or (4) egg flotation (Mabee et al. 2006, Liebezeit et al. 2007). If the fate of a nest was observed, this was considered the termination date. If a nest terminated between two final visits, termination date was assigned as the midpoint between these visits. If nest fate was not known, termination date was assigned as the last day the nest was known active (Manolis et al. 2000). We reduced researcher effects on nest predation by using methods described by Martin and Geupel (1993).

We conducted at least three predator surveys on each plot annually. Each survey consisted of three 10-min point counts separated by ≥200 m on the plot centerline (Ralph et al. 1993). We recorded all visual and aural detections of 20 documented or suspected potential nest predators (Table 2; see Poole et al. 2003). Predators observed both within and outside plots (≤300 m from the plot edge) were tallied. We classified nest predators as potentially subsidized (referred to as "subsidized" hereafter) or nonsubsidized, depending on whether the species is known to benefit from human food, waste, or structures (Table 2; see NAS 2003).

We measured a set of "natural" environmental covariates to use in models of background failure rates. "Natural" covariates that we considered most likely to affect nest survival included dominant landform, nest concealment, lemming abundance, and snow cover (Table 2). Dominant landform was recorded for each quadrat using the classification of Walker et al. (1980). We used an ocular estimate of vegetative cover at each nest to estimate overhead concealment (James and Shugart 1970). We indexed lemming abundance because availability of this alternate prey may strongly influence nest predation rates (Summers and Underhill 1987). Lemming abundance was estimated from incidental observations of individuals on study plots per unit time. Sites were classified each year as having "low," "medium," or "high" lemmings (i.e., ≤0.1, >0.1 and <0.25, or ≥0.25 individuals observed per 30 min). We estimated snow cover to the nearest 10% within each subplot at the start of each season.

Analysis

We classified infrastructure into five categories based on potential to provide nest predators with food or sites for perching, nesting, or denning (Table 3): distance to sites with low, medium, and high potential for food availability, and distance to infrastructure with low and high potential to provide den, nest, or perch sites to predators (a combination of vertical height and structural complexity, hereafter termed low- or high-value structures; Table 3). Correlation among infrastructure covariates was accounted for in model fitting. Some types of infrastructure (e.g., active drill rigs) were not stationary. When infrastructure was moved, affected covariates were recalculated.

We measured a second class of infrastructure covariates by calculating the density of the underlying gravel footprint within circular buffers centered on each nest. We used 3-km (TOE3) and 16-km (TOE16) radii for buffers, because these approximated mean home range sizes and movement distances of subsidized predators (Eberhardt et al. 1982, Poole et al. 2003). We used ArcView (version 3.3; Environmental Systems Research Institute, Redlands, California, USA) to measure the proximity of nests to village or oil field structures, and to calculate the density of infrastructure within the defined buffers (Table 2).

We used program CONTRAST (Sauer and Williams 1989) to compare incubation vs. nestling-stage daily survival rates of Lapland Longspurs for all site–year comparisons. We used a one-way analysis of variance with a Bonferroni correction (Krebs 1999) to adjust α levels for a posteriori comparisons of our index of predator activity between sites and years. All descriptive

TABLE 2. Covariates considered during survival model estimation.

Covariate†	Covariate level	Description (number of factor levels)
Natural covariates		
YEAR	site	continuous year effect
YR.FACTOR	site	discrete year effect (5)
SITE	site	study sites (7)
LAND.FORM‡	nest	land form types at each nest (7)
CONCEALMENT	nest	vegetative concealment above each nest
PLOVER	nest	plover nest or non-plover nest
SITE.YEAR	site	combined study site by year (17)
PRED.NON.SUBSIDIZED§	plot	average no. predators that do not use human infrastructure
LN.PRED.NON.SUBSIDIZED¶	plot	LN (PRED.NONSUBIDIZED + C2)
SNOW COVER	plot	percentage snow cover at start of breeding season
LEMMING ABUNDANCE	site	lemming abundance (3): low, medium, high
Human infrastructure covariates		
HIGHFOOD, MEDFOOD, LOWFOOD	nest	distance (km) of nests to nearest human food source, measured to each of three levels (see Table 3)
LN.HIGHFOOD, LN.MEDFOOD, LN.LOWFOOD	nest	LN HIGHFOOD, LN MEDFOOD, LN LOWFOOD
LOWSTRUCT, HIGHSTRUCT	nest	distance (km) of nests to nearest structural feature, measured to each of two levels of structure (see Table 3)
LN.LOWSTRUCT, LN.HIGHSTRUCT	nest	LN LOWSTRUCT, LN HIGHSTRUCT
TOE3, TOE16	plot	gravel footprint area (ha) within 3 km and 16 km of plots, respectively (see Table 3)
LN.TOE3, LN.TOE16¶	plot	LN (TOE3 + C1), LN (TOE 16 + C1)
Subsidized nest predator covariates#		
PRED.SUBSIDIZED	plot	average number of predators that potentially use or are associated with human development
LN.PRED. SUBSIDIZED	plot	LN (PRED.SUBSIDIZED + C2)

† SNOW COVER and LEMMING ABUNDANCE were not included in the modeling analyses (see *Results*).

‡ UNIT0, non-patterned ground; UNIT1, high-centered polygons, center-trough relief > 0.5 m; UNIT2, high-centered polygons, center-trough relief < 0.5 m; UNIT3, low-centered polygons, rim-center relief > 0.5 m; UNIT4, low-centered polygons, rim-center relief < 0.5 m; UNIT5, mixed high- and low-centered polygons; UNIT7, strangmoor and/or disjunct polygon rims; OTHER, frost-boil tundra + vegetated dune + hummocky terrain + open water + upland bluff + reticulate-patterned ground.

§ The most common nonsubsidized predators include Parasitic Jaeger (*Stercorarius parasiticus*), Long-tailed Jaeger (*Stercorarius longicaudus*), Arctic Tern (*Sterna paradisaea*), Sabine's Gull (*Xema sabini*), Snowy Owl (*Nyctea scandiaca*), arctic ground squirrel (*Spermophilus parryii*), and short-tailed weasel (*Mustela erminea*).

¶ C1 and C2 indicate that the smallest positive covariate/2 was added to all values to ensure valid logarithms (C1 = 1.813814, C2 = 0.03267974).

Subsidized predators include Glaucous Gull (*Larus hyperboreus*), Common Raven (*Corvus corax*), arctic fox (*Vulpes lagopus*), red fox (*Vulpes vulpes*), and brown bear (*Ursus arctos*).

analyses were conducted using SYSTAT (version 11.0; Systat Software, Richmond, California, USA). Results were reported as mean ± SE, and were considered significant if $P < 0.05$.

We used a two-step model selection procedure to address two basic questions: (1) "How much of the variation observed is due to natural or background variability?" and (2) "When background variability is controlled, is proximity to infrastructure and (or) index of subsidized nest predators related to nest survival?" During step 1, we fitted a priori background survival models that contained natural covariates only (Table 2). Models were sorted by the P value associated with each model's overall score test, and the best background model was selected as the model with the smallest score P value. We could not use Akaike's information criterion (AIC; Burnham and Anderson 2002) to rank models because of differences in sample size between models. However, for models with the same sample size, AIC resulted in the same ordering as sorting by the score P value. During step 2, we added infrastructure and subsidized predator covariates (Table 2) individually to the best background model to evaluate whether they explained additional variation in survival. In all analyses, we only included nests with known initiation dates found within plot boundaries during scheduled nest searches.

We used a staggered-entry Cox proportional hazards model to evaluate time to predation as a function of our covariates (Cox 1972, Cox and Oakes 1984, Nur et al. 2004). The model potentially contained frailty effects (Clayton and Cuzick 1985, Klein and Moeschberger 1997), time-varying covariate effects, and adjustments for autocorrelation. Events of interest were nest predations. Nest fates other than predation (i.e., success, unknown, or non-predation failure) were considered "censor" events. The proportional hazards model allowed time-varying covariates and staggered entry by using the counting process formulation (Andersen and Gill 1982) of a standard proportional hazards model. The Cox proportional hazards model accommodated time-varying covariates by subdividing nest lifetimes into intervals during which covariates were constant and relating length of the interval to values of covariates

TABLE 3. Human infrastructure types on the Arctic Coastal Plain of Alaska categorized by their potential to provide food and structures that may benefit nest predators.

Infrastructure type	Food potential			Structural value†	
	Low	Med	High	Low	High
Group I					
Production (oil well) pads with drill rig camps			X		X
Alyeska Pump stations #1 and #2			X		X
Operations camp facilities			X		X
Villages (Kaktovik, Nuiqsut, and Deadhorse)			X		X
North Slope Borough Landfill			X	X	
Group II					
Processing facilities, gathering centers, and flow stations		X			X
Warehouse facilities with daily use but no residency		X			X
Group III					
Production (oil well) pads w/o drill rig camps, injection pads	X				X
Active Roads, pullouts, caribou crossings (joined with roads)	X			X	
Docks (West Dock)	X				X
Docks (East Dock)	X			X	
Airport runways				X	
Support pads (power stations, staging areas, warehouses)		X			X
Active gravel mines with elevated piles	X			X	
Bridges	X				X
Group IV					
Inactive Distant Early Warning (DEW) line site					X
Abandoned pads and roads				X	
Inactive gravel mines with elevated piles				X	
Group V					
Pipelines				X	
Power poles, light poles, posts, dish antennae, stacks				X	
Towers					X
Exposed well heads				X	
Unused drill rigs					X
Group VI: Buffer covariates					
3 km, the total area of human-placed gravel within a 3 km radius of the plot center					
16 km, the total area of human-placed gravel within a 16 km radius of the plot center					

Notes: Group I: sites with high availability of food and nesting structures, including residences, dining halls or food services, and tall buildings (>20 ft) or towers that have been used by nesting ravens; they have the highest numbers and activity level of people and traffic, are occupied 24 hours a day, and are used daily for food waste. Group II: sites with moderate levels of food availability, moderate to high levels of human activity, and high availability of nesting structures; they are used 24 hours a day by multiple people and vehicles but have no food service or residences. Group III: sites that may be used daily or less, are not occupied 24 hours a day, lack food service or dumpsters used for food waste, and usually have ≤1 vehicle parked on a daily basis; the only food source would be that transported in vehicles. Group IV: Unused or abandoned pads with no human activity, but with structural components that may be used as den, nest, or perch sites. Group V: structures that generally are not on gravel pads but may be used for perching or, in some cases, nesting; rated high if nests occur annually, low if used for perching but rarely for nesting. Group VI: human-placed gravel on the North Slope acts as a surrogate for all human infrastructure since the footprint of human-placed gravel is directly correlated with infrastructure; almost all facilities are built on a 1–2 m base of gravel to prevent permafrost melt; unlike the distance covariates, these buffer covariates take into account density of human disturbance.

† Rated "high" if infrastructure type is known to be used for nesting or denning; rated "low" if known use is only for perching.

during the interval. Observed data were subdivided into interval-event triplets (a_{ijk}, b_{ijk}, δ_{ijk}), where a_{ijk} and b_{ijk} were the beginning and ending dates of interval k for nest j on study site i, and δ_{ijk} was an indicator function that equaled 1 if the nest was predated during interval k or 0 if the nest either survived or was censored during interval k. Interval start and end dates were computed relative to the earliest observed nest initiation each year.

Frailty effects included in the model were random effects associated with all nests on a plot, and allowed random fluctuations in the baseline hazard for each plot. The frailty effect associated with plot p_i was assumed to be an independent random deviate from a Gamma distribution with mean 1 and unknown variance σ^2.

Cox proportional hazard coefficients and random effect variance (σ^2) were estimated by the method of maximum penalized likelihood (Gray 1992, Therneau et al. 2003) using the R statistical package (version 2.4.1) and its *coxph* and *frailty* functions (*available online*).[10] The Efron approximation was used for tied survival

[10] ⟨http://www.r-project.org⟩

times. The utility of including frailty effects was assessed by both a Wald chi-square test and by inspecting results when frailties were removed from the model. If the Wald chi-square test indicated nonsignificance and coefficients of the fixed effects changed little when frailty effects were removed, we reverted to a regular proportional hazards model by excluding the frailty effects. In addition to testing for the presence of plot frailties, we tested for the presence of subplot frailties in the same way by adding a random effect due to subplot membership. If either frailty effect was significant, the most significant effect was included in the model.

In part, inclusion of frailty effects in the Cox model would have mitigated natural spatial dependencies in nest lifetimes had such dependencies been present. We acknowledge, however, that complicated spatial and temporal dependencies potentially manifesting themselves in other ways may have been present. For this reason we chose to compute final coefficient standard errors and confidence intervals using block bootstrapping (Lahiri 2003), whereby whole plots were randomly resampled with replacement. We considered 95% block bootstrap confidence intervals for infrastructure coefficients that did not contain 0 to be significant predictors of survival, over and above the best set of natural predictors.

The proportional hazards assumption inherent in the Cox model was tested following methods of Grambsch and Therneau (1994) by calculating correlation between scaled Schoenfeld residuals and survival time in models that contained significant infrastructure covariates.

Following the a priori analyses, we conducted a posteriori exploratory analyses using the same modeling approach. We conducted these additional analyses because we hypothesized that pooling species into two groups (i.e., shorebirds and passerines) may have obscured relationships operating at the species level. Therefore, we explored the potential infrastructure and predator effects for the most abundant shorebird species (Semipalmated Sandpiper (*Calidris pusilla*), Pectoral Sandpiper (*C. melanotos*), and phalaropes [Red-necked (*Phalaropus lobatus*) and Red Phalarope (*P. fulicarius*) combined]). We also hypothesized that if effects were expressed only at a fine scale in close proximity to infrastructure, analyzing data at a broad scale across all study sites might mask important relationships. Therefore, we modeled the effect of infrastructure and subsidized predators on species groups separately at each oil field site.

Results

Descriptive analysis results

We monitored 1941 nests, of which 1257 nests representing 13 shorebird species and 619 nests of four passerine species were included in analyses (Tables 1 and 4). The remaining nests were excluded because they were outside plots, were discovered incidentally, belonged to species or groups with inadequate samples sizes, or initiation date could not be estimated. At all sites, the majority of shorebird nests belonged to Pectoral Sandpipers, Semipalmated Sandpipers, and phalaropes. Nearly all of the passerine nests belonged to Lapland Longspurs (*Calcarius lapponicus*; Table 4). There was pronounced spatial and interannual variation in shorebird species composition, most notably in Pectoral Sandpiper and Red Phalarope nest density. Prominent among-site differences included an absence of plover (*Pluvialis* spp.) nests on plots at Canning, few Red-necked Phalarope nests at Thomson, relatively high numbers of Semipalmated Sandpiper nests at Prudhoe Bay in 2005, and high numbers of Red Phalarope nests at Canning in 2002.

Across years and sites, 1035 of 1876 monitored nests (55%) hatched or fledged successfully. Fates were unknown for 371 nests (20%). Nest predation was the most common cause of nest failure ($n = 439$ of 1876 nests; 23%). Other sources of failure included nest abandonment ($n = 21$; 1%), weather ($n = 2$; 0.1%), caribou trampling ($n = 3$; 0.2%), and human disturbance ($n = 4$; 0.2%). For Lapland Longspurs, daily nest survival was significantly higher during the incubation stage than the nestling stage for only one of 16 unique combinations of site and year (Canning 2003; $\chi^2_1 = 11.98$, $P < 0.01$).

The number of predators observed during surveys varied spatially and temporally, although at the two oil field sites we consistently detected more subsidized than nonsubsidized predators. Nonsubsidized predators predominated at Fish Creek and Thomson (Fig. 2). Jaegers (*Stercorarius* spp.) comprised >80% of nonsubsidized predators at all sites in all years, and accounted for 32–77% of total predators. The most common jaeger species was the Parasitic Jaeger (*S. parasiticus*). Frequency of nonsubsidized predators was higher at Thomson than at Fish Creek, Kuparuk, and Prudhoe Bay ($F = 4.406$, df = 6, 319, $P \leq 0.01$). Most sites, except Fish Creek, had at least one year when subsidized predators were detected more often than at the other sites (Fig. 2). Frequency of subsidized predators across years was lower at Fish Creek than at Canning, Kuparuk, and Prudhoe Bay ($F = 3.831$, df = 6, 319, $P \leq 0.05$). At all sites Glaucous Gulls were the most common subsidized predator, comprising ≥75% of all subsidized predators. Common Ravens and arctic foxes accounted for ≤16% and ≤9% of subsidized predators, respectively.

Mean nest concealment varied considerably, with the highest value for passerine nests (57.3% ± 1.1%, mean ± SE) and the lowest for plover nests (0.2% ± 0.1%). Nest concealment for shorebirds other than plovers was 21.4% ± 0.6%. Because of differences in timing in collection of snow cover data among study sites, we were unable to include these data in our background models. However, there were some common patterns observed in the chronology of the spring thaw among sites. Earliest snow melt at all sites occurred in 2002, while 2004 and 2005 had the latest snowmelt.

TABLE 4. Species and total number of nests monitored on the Arctic Coastal Plain, Alaska, 2002–2005.

Species	Species group	No. nests
Greater White-fronted Goose (*Anser albifrons*)	waterfowl	27
Cackling Goose (*Branta hutchinsii*)	waterfowl	1
Northern Pintail (*Anas acuta*)	waterfowl	4
Greater Scaup (*Aythya marila*)	waterfowl	1
King Eider (*Somateria spectabilis*)	waterfowl	16
Long-tailed Duck (*Clangula hyemalis*)	waterfowl	1
Willow Ptarmigan (*Lagopus lagopus*)	other	5
Rock Ptarmigan (*L. mutus*)	other	1
Red-throated Loon (*Gavia stellata*)	other	3
Pacific Loon (*G. pacifica*)	other	3
Black-bellied Plover (*Pluvialis squatarola*)	shorebird	15
American Golden Plover (*P. dominica*)	shorebird	28
Unidentified plover (*P.* spp.)	shorebird	1
Semipalmated Plover (*Charadrius semipalmatus*)	shorebird	1
Bar-tailed Godwit (*Limosa lapponica*)	shorebird	3
Ruddy Turnstone (*Arenaria interpres*)	shorebird	1
Semipalmated Sandpiper (*Calidris pusilla*)	shorebird	359
Pectoral Sandpiper (*C. melanotos*)	shorebird	396
Dunlin (*C. alpina*)	shorebird	71
Stilt Sandpiper (*C. himantopus*)	shorebird	56
Buff-breasted Sandpiper (*Tryngites subruficollis*)	shorebird	10
Long-billed Dowitcher (*Limnodromus scolopaceus*)	shorebird	79
Red-necked Phalarope (*Phalaropus lobatus*)	shorebird	113
Red Phalarope (*P. fulicarius*)	shorebird	124
Arctic Tern (*Sterna paradisaea*)	other	2
Parasitic Jaeger (*Stercorarius parasiticus*)	other	1
Eastern Yellow Wagtail (*Motacilla tschutschensis*)	passerine	2
Savannah Sparrow (*Passerculus sandwichensis*)	passerine	12
Lapland Longspur (*Calcarius lapponicus*)	passerine	598
Common Redpoll (*Carduelis flammea*)	passerine	7
Total		1941

Note: Only passerines and shorebirds were included in the survival analysis; other species/groups were not included due to low sample sizes.

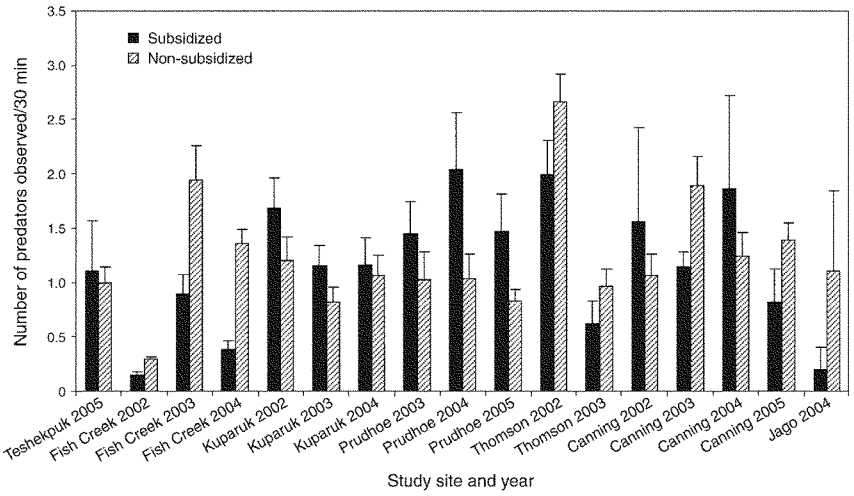

FIG. 2. Number of detections (mean + SE) of subsidized and nonsubsidized predators observed in 30-min visual scans at seven study sites on the Arctic Coastal Plain, Alaska, 2002–2005.

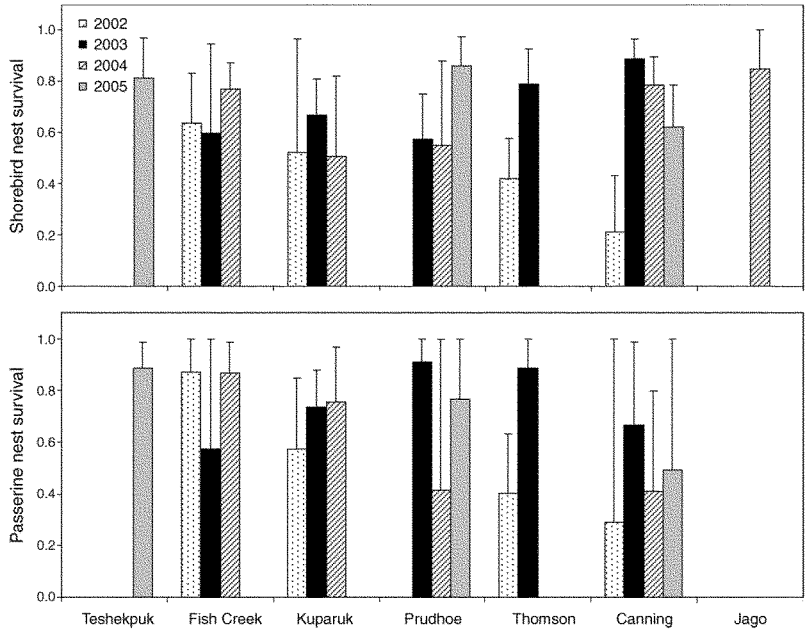

FIG. 3. Mean nest survivorship for the shorebird and passerine groups at each study site and year, calculated from the terminus of respective Kaplan-Meier curves (error bars indicate half-width 95% confidence intervals).

At the three sites where lemming abundance was indexed (Prudhoe Bay, Kuparuk, and Teshekpuk), lemming numbers were low (<0.1 individual observed per 30 min) in all years. Observations at the other study sites indicate that lemmings were also scarce in all years. Since there were no apparent spatial or temporal differences in lemming abundance, these data were not included in our background models.

Modeling results

We did not detect random plot or subplot effects in the background models (plot level: $P = 0.08$–0.28 for shorebirds and 0.27–0.92 for passerines; subplot level: $P = 0.13$–0.29 for shorebirds and 0.92 for passerines). Therefore, we concluded that nest fates were not spatially correlated and we removed random plot and subplot effects from subsequent models.

Overall nest survival fluctuated considerably among years and study sites (Fig. 3). The best-fitting background model for shorebird nests contained SITE.YEAR (Table 5). Overall nest survival for shorebirds ranged from 0.21 at Canning in 2002 to 0.89 at the same study site in the following year. Both Canning and Thomson in 2002 had lower daily survival rates than Fish Creek in 2003 (the reference), whereas Canning in 2003 had higher daily survival rates than Fish Creek in 2003 (Table 6). Daily nest survival for other SITE.YEAR combinations did not differ from that of Fish Creek in 2003.

The best background model for passerine nests contained SITE and CONCEALMENT (Table 5). Overall nest survival for passerines ranged from 0.29 at Canning in 2002 to 0.91 at Prudhoe Bay in 2003 (Fig. 3). The Kuparuk, Canning, and Jago sites had lower survival rates than Fish Creek (the reference; Table 6); however, the Jago River site had only one passerine nest and that nest failed. Survival rates at other study sites (Teshekpuk, Prudhoe Bay, and Thompson) were not significantly different from Fish Creek. The background model for passerines suggested that a 10% increase in CONCEALMENT decreased the instantaneous probability of predation by 7.4%.

Addition of infrastructure covariates to the best background shorebird model did not improve model fit (i.e., 95% confidence intervals for all infrastructure covariates contained 0; Table 7). However, addition of three of 15 infrastructure covariates in the best background passerine model did improve fit for that model (i.e., 95% confidence intervals around the

TABLE 5. Background models fit to nest survival data for the shorebird and passerine groups, sorted by the score test *P* value.

Model terms	No. parameters	*P*
Shorebirds		
SITE.YEAR	16	<0.001
SITE + CONCEALMENT + SITE:CONCEALMENT	13	<0.001
PLOVERS + CONCEALMENT + PLOVERS:CONCEALMENT	3	<0.001
PLOVERS + CONCEALMENT	2	<0.001
SITE + CONCEALMENT	7	<0.001
YR.FACTOR	3	<0.001
YEAR	1	<0.001
PLOVERS	1	<0.001
SITE + YEAR	7	0.001
PREDNONHUM	1	0.004
SITE	6	0.005
SITE + LAND.FORM	13	0.009
CONCEALMENT	1	0.009
CONCEALMENT + LAND.FORM	8	0.032
LN.PRED.NONSUBSIDIZED	1	0.068
LAND.FORM	7	0.132
Passerines		
SITE + CONCEALMENT	7	0.001
SITE + CONCEALMENT + STUDY.SITE:CONCEALMENT	12	0.003
SITE	6	0.004
SITE.YEAR	16	0.006
SITE + YEAR	7	0.007
CONCEALMENT	1	0.015
SITE + LAND.FORM	13	0.026
CONCEALMENT + LAND.FORM	8	0.161
PRED.NONSUBSIDIZED	1	0.192
LAND.FORM	7	0.425
YEAR	1	0.516
YR.FACTOR	3	0.686
LN.PRED.NONSUBSIDIZED	1	0.804

Note: PREDNONHUM is non-human predators.

coefficients of LN.HIGHSTRUCT, TOE16, and LN.TOE3 did not contain 0; Table 7). Grambsch and Therneau (1994) global tests of proportional hazards were not significant (*P* values ranged from 0.10 to 0.25) for these three passerine models, indicating that the proportional hazards assumptions were met.

Nonsubsidized predator abundance did not enter into the best shorebird or passerine background models (Table 5). Likewise, subsidized predator abundance did not explain any remaining variation after accounting for background effects (Table 7). The best-fitting passerine model containing LN.HIGHSTRUCT indicated that a nest's instantaneous probability of survival decreased rapidly within ~1 km of high-value structures, with evidence of decreased survival out to 5 km. For example, if all other factors are held constant, a nest located 2 km from a high-structure feature had a 34% (1 − [exp(−0.61349(log(2)))/exp(−0.61349(log(1)))]) lower hazard than a nest located 1 km from a high-value structure. The hazard decreased 13% between a nest located 4 km and a nest located 5 km from a high-value structure. Thus, the model suggests that in the oil field sites (Prudhoe Bay and Kuparuk) nest survival was lowest (~25–30%) near high-value structures, but increased to ≥50% when distance to infrastructure approached 5 km (Fig. 4).

To illustrate the effect of distance to infrastructure on model predictions, we held concealment constant at 70% for a passerine nest at Prudhoe Bay. The model predicts that such a nest would have a ~32% chance of surviving to fledging during a 50-day breeding season if it was located 300 m from a high-structure feature (Fig. 4). A nest located 1 km from the nearest high-value structure would have ~48% chance of survival, whereas a nest located 5.8 km from the nearest high-value structure would have ~83% chance of survival.

To estimate a typical passerine survival curve for each study site, we computed the median distance to high-structural features at each study site and assumed that a nest was 70% concealed. We estimated one survival curve for each study site and censored the Jago site because it contained only one passerine nest. Nest survival was highest at Fish Creek and lowest at Canning (Fig. 5). Paired sites with similar nest survival values in descending order were Fish Creek and Teshekpuk, Prudhoe Bay and Thomson, and Kuparuk and Canning (Fig. 5).

A posteriori test results

The disparate modeling results for relationships of passerine and shorebird nests to infrastructure led us to explore whether pooling species or the scale of the

TABLE 6. Coefficients of the best-fitting background proportional hazards models; negative coefficients for an effect in either model (shorebird or passerine) imply that survival was higher (i.e., hazard was lower); positive coefficients imply the opposite.

Effect	Coefficient	Exp (coefficient)	Uncorrected SE (coefficient)	Uncorrected Wald Z	Uncorrected Wald P†
Shorebirds					
Canning 2003	−0.883	0.414	0.422	−2.094	**0.036**
Prudhoe 2005	−0.788	0.455	0.468	−1.682	*0.093*
Teshekpuk 2005	−0.695	0.499	0.422	−1.648	*0.099*
Jago 2004	−0.335	0.716	0.622	−0.538	*0.590*
Thomson 2003	−0.213	0.808	0.405	−0.526	*0.600*
Canning 2004	−0.193	0.825	0.346	−0.557	*0.580*
Fish Creek 2002	−0.057	0.945	0.305	−0.186	*0.850*
Fish Creek 2004	0.021	1.022	0.329	0.065	*0.950*
Kuparuk 2002	0.024	1.024	0.330	0.072	*0.940*
Prudhoe 2004	0.275	1.317	0.317	0.869	*0.380*
Canning 2005	0.362	1.436	0.300	1.205	*0.230*
Kuparuk 2003	0.404	1.498	0.325	1.245	*0.210*
Kuparuk 2004	0.425	1.530	0.310	1.371	*0.170*
Prudhoe 2003	0.605	1.831	0.334	1.809	*0.070*
Thomson 2002	1.108	3.028	0.292	3.799	**<0.001**
Canning 2002	1.202	3.327	0.299	4.018	**<0.001**
Passerines					
Teshekpuk	−0.121	0.886	0.499	−0.243	*0.810*
CONCEALMENT	−0.008	0.992	0.003	−2.318	**0.020**
Prudhoe	0.445	1.561	0.413	1.078	*0.280*
Thomson	0.523	1.687	0.307	1.704	*0.088*
Kuparuk	0.806	2.239	0.287	2.807	**0.005**
Canning	0.821	2.273	0.286	2.872	**0.004**
Jago	2.588	13.308	1.027	2.522	**0.012**

Notes: The reference level for the shorebird model was Fish Creek 2003; the reference level for the passerine model was Fish Creek. SE (coefficient), Wald Z, and Wald P are uncorrected for spatial autocorrelation in the data. Wald $P > 0.05$ would remain so if corrected; these values are italicized in the table.

† No spatial dependency in time to predation was found (frailty effects tests), and the background model was not corrected for spatial dependencies. If undetected spatial dependencies existed, the correction would increase P values; thus, boldface P values (those <0.05) could conceivably increase to values >0.05 if corrected for spatial correlation.

original analysis was obscuring responses for individual species or finer spatial scales. We ran similar models for each oil field site and found that TOE16, LN.MEDFOOD, and LN.PRED.SUBSIDIZED at the Kuparuk site explained significant remaining variation when added to the shorebird background model. The significance of these covariates suggests that shorebird nest survival is lower when there is more infrastructure within 16 km of nests, medium-level food sources are nearer, or more subsidized predators are within 300 m of plots. Addition of these same covariates did not improve the best background models for shorebirds at Prudhoe Bay or for passerines at Kuparuk. Insufficient data were available to run similar models for passerines in Prudhoe Bay.

For phalaropes across all sites, LN.HIGHSTRUCT, LN.PRED.SUBSIDIZED, and LN.LOWFOOD significantly improved model fit, suggesting that nests closer to infrastructure and in areas of numerous subsidized predators were less likely to survive. LOWFOOD and LN.LOWFOOD improved model fit for Semipalmated Sandpipers at Kuparuk, although this result suggests that nest survival was actually higher closer to low-food infrastructure, the opposite of what we predicted. Inclusion of infrastructure and subsidized predator covariates did not improve the best background models for all other comparisons ($n = 5$) or there were insufficient data to perform the tests ($n = 2$).

DISCUSSION

Human infrastructure had a negative effect on nest survival for passerines, the second most abundant group of birds nesting on the ACP. Passerine nest survival declined within 5 km of oil field infrastructure that provided nesting, perching, or denning sites for nest predators but increased with the percentage of vegetative cover over a nest. Contrary to our original hypothesis, however, we detected no overall effect of infrastructure (or any other measured covariate) on shorebird (all species pooled) nest survival, the most abundant guild of nesting birds on the ACP.

We considered that differing nesting behavior of passerines and shorebirds might explain the responses that we observed in nest survival. Lapland Longspurs raise altricial young that remain in the nest for 9–11 days after hatch (Hussell and Montgomerie 2002), whereas shorebird young are precocial and typically leave the nest within 24 h of hatching. Begging noise by young

TABLE 7. Coefficients and 95% confidence intervals for infrastructure and subsidized predator effects when added to the best background model. Confidence intervals were computed by bootstrap resampled plots with replacement. Confidence intervals not containing 0 are considered significant predictors of decreased survival.

Development effect	Coefficient	95% bootstrap CI		Contains zero?
		Lower limit	Upper limit	
Shorebirds				
HIGHFOOD	−0.013	−0.040	0.015	yes
LN.HIGHSTRUCT	0.009	−0.237	0.248	yes
TOE3	0.001	−0.003	0.004	yes
LN.TOE3	0.100	−0.180	0.413	yes
TOE16	−0.0001	−0.001	0.001	yes
LN.TOE16	0.024	−0.159	0.137	yes
LN.HIGHFOOD	−0.008	−0.221	0.173	yes
PRED.SUBSIDIZED	0.028	−0.033	0.121	yes
LN.PRED.SUBSIDIZED	0.060	−0.001	0.129	yes
LOWFOOD	−0.011	−0.042	0.019	yes
LN.LOWFOOD	−0.017	−0.300	0.307	yes
MEDFOOD	−0.011	−0.037	0.014	yes
LN.MEDFOOD	−0.248	−0.478	0.198	yes
LOWSTRUCT	−0.010	−0.042	0.021	yes
LN.LOWSTRUCT	−0.199	−0.413	0.016	yes
HIGHSTRUCT	−0.008	−0.036	0.020	yes
Passerines				
HIGHFOOD	−0.036	−0.079	0.003	yes
LN.HIGHSTRUCT	−0.613	−1.031	−0.246	**no**
TOE3	0.004	−0.0002	0.012	yes
LN.TOE3	0.441	0.025	1.071	**no**
TOE16	0.001	0.0004	0.003	**no**
LN.TOE16	0.103	−0.145	0.479	yes
LN.HIGHFOOD	−0.323	−0.617	0.065	yes
PRED.SUBSIDIZED	0.096	−0.025	0.195	yes
LN.PRED.SUBSIDIZED	0.096	−0.022	0.241	yes
LOWFOOD	−0.021	−0.060	0.023	yes
LN.LOWFOOD	−0.280	−0.784	0.422	yes
MEDFOOD	−0.026	−0.056	0.003	yes
LN.MEDFOOD	−0.414	−1.024	0.065	yes
LOWSTRUCT	−0.017	−0.055	0.032	yes
LN.LOWSTRUCT	−0.307	−0.630	0.066	yes
HIGHSTRUCT	−0.026	−0.068	0.010	yes

(Leech and Leonard 1997, Haskell 1999) and increased parental activity at the nest (Martin et al. 2000), during the nestling phase might increase detection and predation at passerine nests. For most site–year comparisons in our study, however, daily survival rate did not differ between incubation-stage and nestling-stage Lapland Longspurs.

The inconsistency of modeling results between the two major groups of nesting birds led us to investigate whether pooling all shorebird species may have obscured significant species-specific effects. The result for phalaropes supported the concept that proximity to infrastructure negatively influenced nest survival for some shorebird species, but neither Pectoral Sandpipers nor Semipalmated Sandpipers showed a similar response. Noting that the infrastructure response for passerines appeared to have a threshold within a few kilometers of infrastructure, we also investigated whether effects were restricted to within the oil field sites. At this finer scale, subsidized predator and infrastructure covariates did enter the shorebird model as significant predictors of lower nest survival for Kuparuk, but not for Prudhoe Bay. Overall, our a posteriori analyses for shorebirds that evaluated species-specific and guild-specific effects of spatial scale did not consistently support (and in one case, contradicted) the findings of the passerine models. Inconsistencies in these results may reflect fundamental differences in how species respond to infrastructure, or may be related to differences in habitat or infrastructure between oil field sites.

We determined that predation was the primary cause of nest failure in our study, and therefore, it follows that nest survival should have been highly correlated with predator activity. Contrary to expectations, our a priori models suggested that neither subsidized nor nonsubsidized predator abundance was related to nest survival. Several explanations are possible: (1) our counts did not adequately measure predator abundance or provide an unbiased estimate of predation risk; (2) predation was confounded by other variables in our modeling approach; and (or) (3) high temporal and spatial variation in predator numbers may have obscured subtle effects.

Our predator counts were probably biased against arctic foxes because they are less active diurnally (Eberhardt et al. 1982), during the period we conducted surveys, and because airborne predators are more

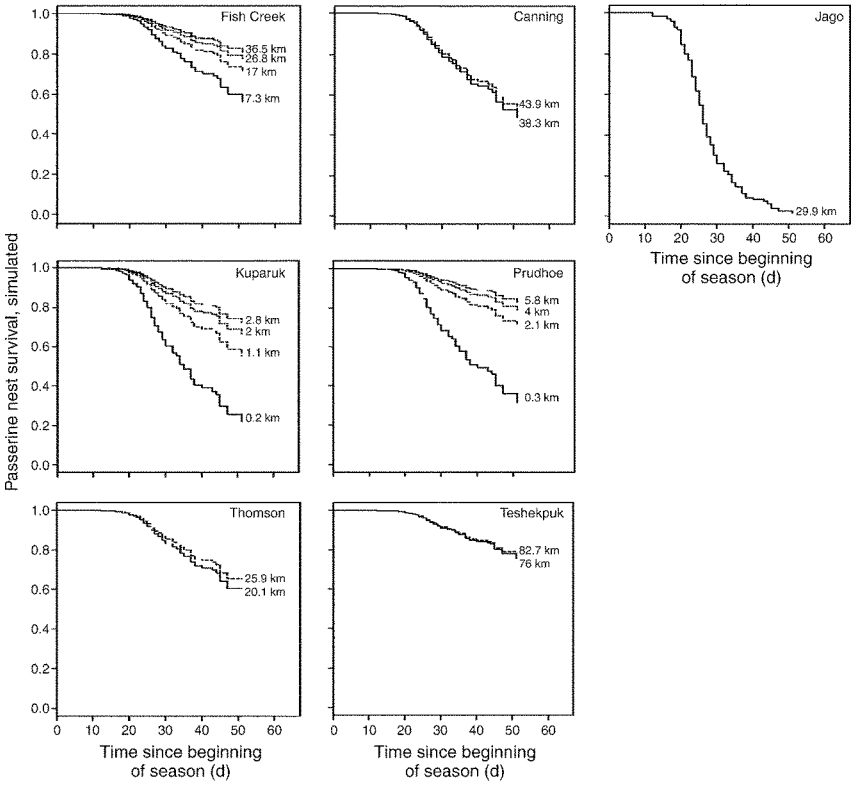

FIG. 4. Simulated survival of passerine nests at varying distances from high-value infrastructure within each study site predicted by the best-fitting proportional hazards model containing SITE, CONCEALMENT, and LN.HIGHSTRUCT. Covariates are described in Table 2. Nest concealment was set at 70%.

conspicuous. Therefore our index of subsidized predator abundance reflects mainly Glaucous Gull and Common Raven activity and provides little useful information to the model if fox predation is actually the dominant cause of nest failure in the oil fields, as suggested by others (Troy 2000, Johnson et al. 2007, Liebezeit and Zack 2008). Arctic fox predation has had devastating effects on some colonies of nesting waterfowl in Alaska (Quinlan and Lehnhausen 1982, Anthony et al. 1991, Johnson 2000) and was a major factor affecting wader populations breeding in the Russian Arctic (Summers and Underhill 1987, Martin and Baird 1988, Underhill et al. 1989, 1993). An ongoing study in Barrow, Alaska suggests that arctic fox removal may result in enhanced shorebird nest survival (R. Lanctot, *unpublished data*). Therefore, the predator species most likely to have been undercounted in our study is also likely to be the most important nest predator of shorebirds and passerines on the ACP.

Our modeling approach may have resulted in failure to detect some infrastructure and subsidized predator effects if they were correlated with study site. If this were the case, inclusion of SITE.YEAR and SITE covariates in the first stage of modeling would reduce the additional explanatory power of covariates related to infrastructure and subsidized predator abundance in the second stage. We therefore may have attributed an infrastructure effect to natural among-site variation. Alternative approaches ran the opposite risk of erroneously attributing natural variation among sites and years to infrastructure effects; thus we chose the more conservative approach to testing our hypothesis.

Our hypothesis that predation of nesting birds would be higher near human infrastructure that attracted predators was derived from observations of concentrations of predators in the oil fields in the 1980s and early 1990s by several of the authors, as well as from corroborating studies (Eberhardt et al. 1983, Burgess et al. 1993, Murphy and Anderson 1993). However, baseline population data for predators on the ACP have not been available or adequate to clearly demonstrate increases from pre-development levels (Truett et al. 1997, Noel et al. 2006). The most abundant subsidized predators in the oil fields, arctic foxes and Glaucous Gulls, may no longer be as concentrated as during the first two decades of oil development. Waste-handling practices in the oil fields improved during the mid-1990s, reducing access to human food waste (CPAI and BP 2005). Subsidized predators that previously were attracted to food waste may have declined over the last decade, but populations have not been monitored closely to judge the effectiveness of these new management practices. The most compelling case of a sustained increase is for Common Ravens, the species for which artificial nesting structures are most important (A. Powell and S. Backensto, *unpublished data*; ConocoPhillips Alaska, Inc., *unpublished data*). Raven numbers from Audubon Christmas Bird Counts increased from 1988 to 2007 at Prudhoe Bay (Patuxent Wildlife Research Center, Laurel, Maryland, USA; data *available online*).[11] Even so, Common Ravens still occur in relatively low numbers (18–25 nests in a 1400-km^2 area of the Prudhoe Bay and Kuparuk oil fields; A. Powell and S. Backensto, *unpublished data*).

Our results confirm that substantial temporal and spatial variability in nest survival occurs in the arctic (Summers and Underhill 1987, Troy 2000). We attempted to control for this natural variability by modeling environmental covariates (Wiens and Parker 1995), but met with limited success. A development (infrastructure) effect, if present, may be small relative to natural variability in the arctic, rendering such effects difficult to detect. It is not unusual for environmental disturbance studies to be complicated by natural variability (Underwood 1994, Wiens and Parker 1995).

Nonetheless, we did detect higher predation risk for passerine nests near oil field facilities. This result, along with evidence of the predator effects from elsewhere in the Arctic (Restani et al. 2001; R. Lanctot, *unpublished data*), is sufficient to warrant continued efforts to minimize predator subsidies. We recommend that new oil field infrastructure and other residential or industrial development in this region be designed to reduce artificial nesting, perching, and denning sites and managed to limit access to food wastes. Because the predation impact that we detected was limited (in terms of affected species and spatial extent), and because the difficulty and cost of redesigning or managing existing artificial nesting and perching structures (e.g., powerlines, buildings, communication towers) is potentially large, we recommend targeted efforts to minimize the influence of individual nest predators when they can be identified. We recommend that predator management always be conducted in conjunction with monitoring to judge effectiveness.

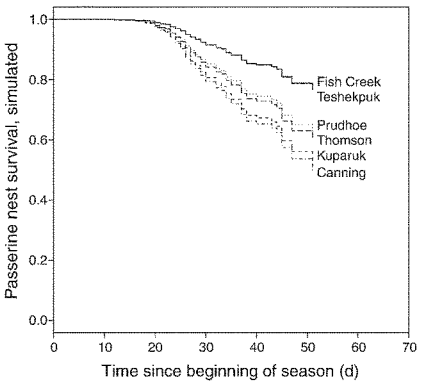

FIG. 5. Passerine nest survival for all study sites predicted by best-fitting proportional hazards model containing SITE, CONCEALMENT, and LN.HIGHSTRUCT. Nest concealment was set to 70%, and distance was set to the median distance to the nearest high-value structure on each study site. The Jago study site is not included because it had only one passerine nest.

Questions raised by this study could be addressed through research on other components of the system. Many factors other than proximity to infrastructure influence populations of predators in the arctic environment. Disease, intraspecific competition, and especially natural food availability play significant roles in predator abundance and distribution (Maher 1974, Underwood and Mosher 1982, Smits et al. 1989). Further research on demography of predator populations and their relative importance with respect to nest survival is needed. In particular, follow-up studies to those in the 1990s on predator abundance in the oil fields (e.g., Burgess et al. 1993, Murphy and Anderson 1993) are needed to assess the efficacy of current waste-control techniques in locations where predators were previously concentrated. Follow-up studies on nest survival should be considered, with special attention paid to study designs that better address the challenges posed by high natural variability. Artificial nest experiments (e.g., Wilson et al. 1998, Kristan and Boarman 2003) should be considered because they allow better control of natural variability, are not as restricted by sample size as natural nest studies, and can be designed to test the importance of specific point sources of infrastructure.

[11] ⟨http://www.audubon.org/bird/cbc/hr/index.html⟩

PLATE 1. Arctic fox (*Vulpes lagopus*) with a Greater White-fronted Goose (*Anser albifrons*) egg, near Prudhoe Bay, Alaska, USA. Photo credit: S. Zack.

Finally, we recommend long-term (i.e., ≥10 years) monitoring of nest survival using a balanced design (all sites monitored in all years) to evaluate an anthropogenic effect that, if present, may be difficult to detect against the background variability inherent in this arctic predator–prey system.

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ECOLOGICAL MODELLING

A simulation model of helicopter disturbance of molting Pacific black brant

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Abstract

We describe a simulation model designed to study the effects of helicopter disturbance on molting Pacific black brant near Teshekpuk Lake, Alaska. Locations of 18 118 brant were digitized into the model based on 10 years of population survey data. Bell 206 and Bell 412 helicopters were simulated flying across the molting grounds along two routes between two airfields. The model determined the behavioral and energetic response of birds encountered by the aircraft during an overflight. Altitude and frequency of overflights were held constant during a simulated 28-day molting period, but were varied among simulations. The model provided the degree of weight loss these birds experienced due to helicopter disturbance. The effects of overflights on brant were classified into five risk categories based on weight. For both routes, the number of flocks and birds in each category was determined for each altitude, aircraft type, and overflight frequency. Simulation results indicated that the model can be used to identify flight-line modifications that result in significantly decreased disturbance to the birds.

Key words: Disturbance; Molting ground; Pacific black brant

1. Introduction

Petroleum-related exploration and development on the Arctic Coastal Plain (Wahrhaftig, 1965) of Alaska has become increasingly controversial, particularly

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with the proposed opening of the Arctic National Wildlife Refuge in Northeast Alaska to these activities. The arctic tundra contains wildlife communities low in species richness but high in number of individuals, and generally is believed to be unstable, albeit resilient to natural disturbances (Krebs, 1985, pp. 587, 685). Natural resource professionals are concerned that human activity in this area may cause potentially irreversible damage to the flora and fauna of the region (Calef et al., 1976; Derksen et al., 1979; Madsen, 1984; Walker and Walker, 1991).

The Pacific black brant (*Branta bernicla nigricans*) is a small goose that molts each year on the central Arctic Coastal Plain (Derksen et al., 1979). These birds are extremely wary, and are more vulnerable to human disturbance than most other geese (Ward and Stehn, 1989). Indeed, human activity may have reduced the number of brant wintering along the coast of California from 50–65% of the population to $< 10\%$ since 1955 (Denson, 1964; Smith and Jensen, 1970).

Numerous studies have reported human disturbance of waterfowl, most notably that caused by aircraft (Gunn and Livingston, 1974; Owens, 1977; Derksen et al., 1979; Madsen, 1984; Belanger and Bedard, 1989; Jensen, 1990). Owens (1977) reported that loud noises such as gun shots flushed wintering dark-bellied brent geese (*B. b. bernicla*). Although the birds quickly became habituated to most sounds, he noted that they were very slow to do so with aircraft, and never habituated to small, low-flying aircraft. D.V. Derksen (United States Fish and Wildlife Service, Anchorage, AK, pers. commun.) first noted displacement of molting brant from a Coastal Plain lake due to aircraft activity in 1979. Helicopters, the preferred mode of transportation by businesses operating on the Arctic Coastal Plain from May to September, are known to cause brant to panic (Owens, 1977). Helicopter disturbance on the molting grounds could be particularly harmful to the birds, as molting is considered by many scientists to be an energetically costly process (Lustick, 1970; Paine, 1972; King, 1974; Williams and Kendeigh, 1982; but see Ankney, 1984). Additional stress on the birds from aircraft overflights during this period might severely inhibit the ability of brant to complete their molt while maintaining or acquiring body reserves adequate for subsequent migration to their staging area.

Studies of disturbance in the wild are difficult when the research involves remote localities and expensive equipment such as helicopters. Not only is it difficult to establish statistically valid controls for the experiments but, for logistical reasons, the size of the experimental site and the number of experimental disturbances must be limited. Consequently, the goal of this study was to use computer simulation modeling to aid in predicting the effects of aircraft overflights over large temporal and spatial scales based on limited data.

The first objective of this study was to develop a spatially explicit simulation model that quantified disturbance of a molting Pacific black brant population resulting from aircraft along flight lines in and around their molting area. The second objective was to simulate the effects of repeated helicopter overflights on the body condition of individual birds. Simulated flight lines that created the least disturbance were identified by comparing the number of brant alarmed, and their body condition at the end of molt.

2. Overview of the problem

The primary molting ground for Pacific black brant is located on the Arctic Coastal Plain between Teshekpuk Lake and Cape Halkett, approximately 130 km southeast of Barrow and 180 km northwest of Prudhoe Bay (Fig. 1). This area extends inland about 30 km from the Arctic Ocean and encompasses more than 2000 km^2 (Derksen et al., 1979). The molting ground lies within the Teshekpuk Lake Special Area (TLSA), an area that was set aside in 1983 primarily to protect fish and wildlife (USBLM, 1983). The TLSA is part of the National Petroleum Reserve and is under jurisdiction of the United States Bureau of Land Management.

Based on 10 years of aerial survey data, up to 22% of the total Pacific black brant population molt each year in the TLSA (R. King, USFWS, Anchorage, unpubl. data). A few brant breed in the area (Derksen et al., 1979), but most of the molters are failed breeders or immature birds (Hansen, 1957) which arrive on the molting grounds near the end of June and stay approximately 4 weeks (Derksen et al., 1979). Like most waterfowl, brant are synchronous molters, losing the ability to fly for most of the time required to replace flight feathers (Bellrose, 1980). This severely reduces their mobility, and they spend most of their flightless period on

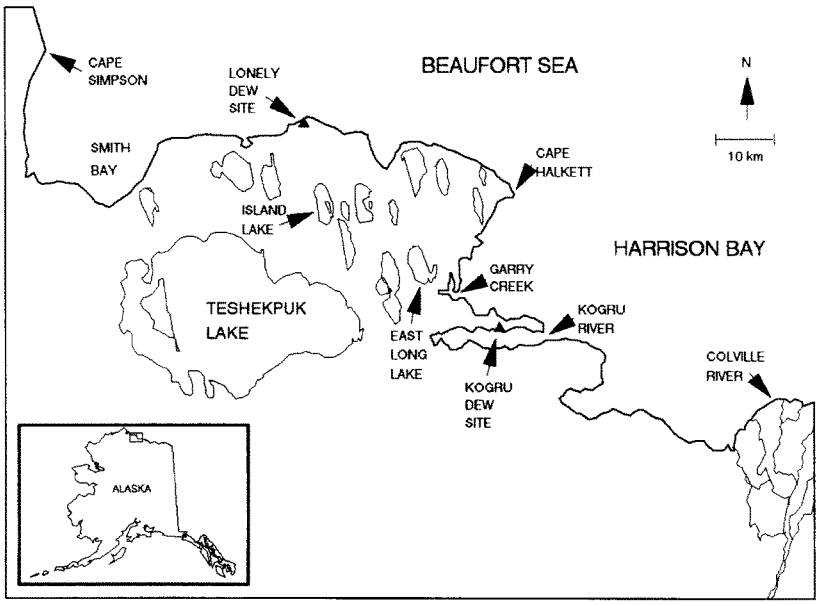

Fig. 1. Pacific black brant molting grounds located on the North Slope of Alaska between Cape Halkett and Teshekpuk Lake (map after Jensen, 1990).

moss flats along the shores of partially drained lakes (Derksen et al., 1982; Jensen, 1990). Upon completion of molt, the birds move first to the Beaufort Sea coast and then to a staging area on the Alaska Peninsula (Jensen, 1990). Because all brant do not begin molting simultaneously, some birds are present on the molting grounds past mid-August.

To determine the effects of helicopter disturbance on molting brant, Jensen (1990) stationed researchers in blinds within sight of the animals as experimental overflights were conducted at East Long Lake (Fig. 1). Observers continuously timed and recorded behavior of the birds during each helicopter pass. Overflights were performed at various altitudes and lateral distances with respect to molting flocks (Jensen, 1990).

As an aircraft approached a flock, the birds first became alert. If the aircraft continued to approach, they began to walk, then run, and eventually seek safety by entering a lake (Derksen et al., 1982; Jensen, 1990). The length of time brant spent in the water ranged from 31 s to 45.1 min (K.C. Jensen, unpubl. data). Such variation in swimming time probably reflects the degree of fright caused by the helicopter. Flocks rarely moved more than 50 m during a single overflight, although they often were displaced > 100 m in response to repeated disturbances (Jensen, 1990).

We considered several variables that influence how brant react to an aircraft: (1) flock size, (2) aircraft type, and (3) aircraft proximity. Experimental overflights were designed to vary these factors to (1) examine the magnitude of disturbance generated under a variety of settings, (2) identify the relationship of each factor to the level of disturbance generated, and (3) identify threshold conditions at which no disturbance took place (Jensen, 1990).

Observations in Alaska suggest large flocks respond to overflights longer than smaller flocks (Jensen, 1990). Once 1 bird became alert and began to run, the entire group often ran to the water. Such social facilitation justifies a model wherein all birds in a flock react the same way at the same time in response to an aircraft. However, synchronous reactions were less common as the size and dispersion of a flock increased.

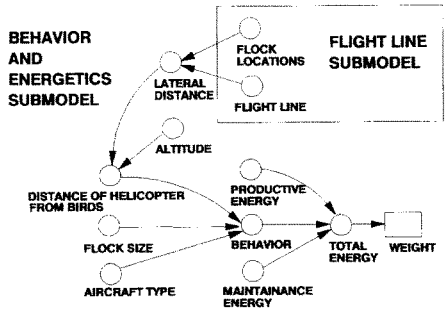

Fig. 2. Conceptualization of the Pacific black brant disturbance model.

Several types of helicopters alarm waterfowl (Ward and Stehn, 1989; Jensen, 1990). Large helicopters cause more disturbance than smaller ones (Ward and Stehn, 1989). Molting brant detected Bell 206 helicopters at a lateral distance of up to 3.5 km (Jensen, 1990). Brant staging at Izembek Lagoon reacted to the larger Bell 205 from as much as twice the distance at which they responded to the Bell 206 (D. Ward, USFWS, Anchorage, pers. commun.).

Aircraft proximity includes two components: (1) lateral distance and (2) altitude. Jensen (1990) reported a negative linear relationship between lateral distance of an overflight and length of disturbance. He also found that duration of disturbance and distance at first reaction varied with altitude. Disturbance decreased significantly when helicopters were above 1070 m.

3. Model design and data

3.1. The conceptual model

The disturbance model consists of two submodels, a Flight-Line (FL) submodel and a Behavior-and-Energetics (BE) submodel (Fig. 2). The FL submodel contains the distribution of molting brant in the TLSA. The program can simulate a helicopter flying over the molting ground in any direction while recording the number, size, and location of all flocks encountered along individual flight lines. The BE submodel determines proximity of the aircraft to each flock recorded by the FL submodel, and describes the reaction of these flocks to overflights of various altitudes. The magnitude of disturbance generated is a function of aircraft type and proximity, as well as flock size. We parameterized this program for both the Bell 206 and the Bell 412 helicopter.

The BE submodel also determines the amount of energy brant expend in response to overflights of various frequencies, then calculates their weight at the end of molt. To do so, the daily energy budget for brant first is calculated by estimating the number of calories the birds ingest while foraging, then allocating that energy to three major functions: (1) production, (2) behavior, and (3) maintenance. Productive energy is that used to grow new flight feathers. Behavioral energy is that used to perform all behaviors (alert, walk, run, swim, feed, rest, preen, bathe and aggression). Maintenance energy primarily is comprised of basal metabolic rate (BMR) and thermoregulation. If the daily energy budget is positive, the birds gain weight; if negative, they lose weight. Helicopter disturbance results in weight loss by (1) causing an increase in the amount of energetically-expensive disturbance behaviors that brant exhibit, and (2) decreasing the amount of foraging time available to the birds. Both the number of flocks and birds found along flight lines and the departure weight of those birds at the end of molt are compared to assess relative impact of aircraft flying alternative routes. Models were written using the software package STELLA (Richmond et al., 1987) and a MacIntosh II™ microcomputer.

3.2. The data base

Aerial survey data gathered over 10 years were used to determine lake usage by brant and average flock size per lake. D.V. Derksen (USFWS, Anchorage, unpubl. data) recorded detailed locations of brant on each lake during 1977 and 1978 aerial surveys. Surveys were flown at the peak of molt in mid-July. Experimental overflights also were flown in mid-July; 140 flights used a Bell 206 from 1987 to 1989; 21 in 1988 used a Bell 412 (Jensen, 1990).

S. Adair and K.C. Jensen (Texas A&M University, College Station, unpubl. data) developed a bioenergetics model to assess long-term weight changes in body weight of a staging brant resulting from a standard helicopter overflight of various frequencies. K. McKnight and E.J. Taylor (Texas A&M University, College Station, unpubl. data) modified and elaborated that model through an extensive review of the literature on avian physiology of foraging ecology. Ward and Stehn (1989) adapted the model for fall staging brant at Izembek Lagoon, Alaska. A behavior submodel presented here has been connected with the bioenergetics model by McKnight and Taylor. Data on body weight of brant at various stages of molt were collected as part of an ongoing research project at Texas A&M University (E.J. Taylor, unpubl. data).

4. Model description

4.1. Flight-Line submodel

The Flight-Line submodel represents that portion of the TLSA used by black brant during the molting season. This area is included on eight United States Geological Survey (USGS) 1:63360 quadrangle maps: Teshekpuk (C-1, C-2, D-1, D-2) and Harrison Bay (C-4, C-5, D-4, D-5). A grid of 2.6-km^2 cells was constructed parallel to longitude 158°48′W extending 88.7 km westward over the molting grounds. Cells were bounded to the north and south by latitude lines published on the maps. Each grid cell was identified with an x and y component.

To determine the number of brant in each grid cell, distributions of the birds within lakes during 1977 and 1978 were averaged. The 10-year average flock size for each lake then was distributed in the same proportion as the 1977–1978 average locations of birds within that lake (Fig. 3). All resulting flocks found in the same grid cell were combined, and this sum recorded in the model. The program contains 18118 birds in 161 grid cells, compared to a 10-year average of 18428 brant estimated from aerial surveys (R.J. King, USFWS, Anchorage, unpubl. data).

Flight lines are simulated by sequencially changing the x and y coordinates of the helicopter as the simulation proceeds. Any brant encountered with the 25-grid cell area centered on the cell containing the helicopter potentially are disturbed. As the helicopter passes each flock within the moving 25-grid cell area, the shortest horizontal distance between the flight line and the flock (lateral distance) is recorded. The lateral distance is used in the behavior and energetics submodel

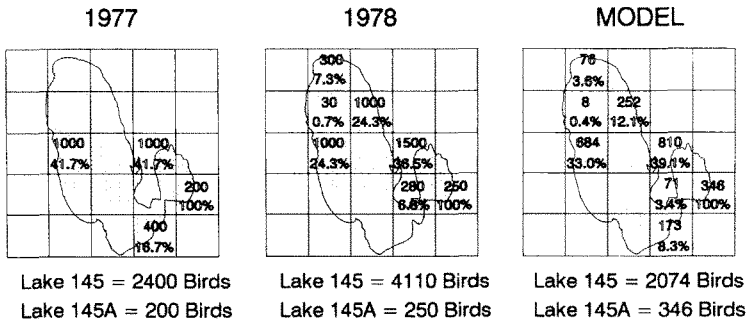

Fig. 3. Distribution of brant on Lakes 145 and 145A. Detailed flock locations were recorded in 1977 and 1978 (D.V. Derksen, USFWS, Anchorage, unpubl. data). The percentage of a lake's total flock size in each grid cell was determined for both years. These percentages were averaged for the model and used to distribute each lake's 10-year average flock size. The top number in each grid cell is the number of brant found there, the bottom number is the percentage of all brant on that lake found in that cell. In 1977, 1000 brant (41.7% of 2400) were observed on the western shore of Lake 145. In 1978, 1000 birds (24.3% of 4110) were found in that same grid cell. For the model 41.7 and 24.3 are averaged to give 33. Therefore 33% of the 10-year average flock size (2074 birds) or 684 brant are assigned to that cell. All brant on Lake 145A were found in one cell. Two cells include portions of both lakes. Brant in those cells inhabited Lake 145 (map after Jensen, 1990).

to calculate the degree to which the birds are disturbed. The number of flocks encountered, the number of birds in each flock, and the x and y coordinate of each flock also are recorded.

4.2. Behavior and Energetics submodel

The BE Submodel (1) summarizes output from the Flight-Line submodel, (2) describes the behavioral response of each flock to either the Bell 206 or the Bell 412 helicopter, (3) calculates the energetic cost of disturbance behaviors, and (4) determines the weight of each bird at the end of wing molt. The BE submodel operates on a daily time-step, with a simulation lasting 28 days, the estimated duration of wing molt (Derksen et al., 1979). Air speed of the helicopter is a constant 100 mph, while altitude and number of overflights/day are driving variables. For any given lateral distance, a large flock probably will react differently to a helicopter than a small flock (Owens, 1977; Jensen, 1990). Thus flocks are categorized into three size-classes (< 26, 26–100, > 100 birds) prior to calculating disturbance behaviors.

4.2.1. Bell 206 helicopter

The behavioral response of brant to the Bell 206 helicopter is taken from field data divided into categories based on flock size, lateral distance, and altitude (Jensen, 1990; K.C. Jensen, unpubl. data). The model has three classes of flock size (< 26, 26–100, > 100 birds), 11 altitudes (150, 305, 460, 610, 760, 915, 1065, 1220,

1525, 1680, 1830 m), and 13 classes of lateral distance (0.000–6.500 km at 0.500-km intervals).

4.2.2. Bell 412 helicopter

Limited data suggest birds first react to large and small helicopters at about the same lateral distance (Ward and Stehn, 1989; Jensen, 1990). However, brant are known to respond to large helicopters at up to twice the latitudinal distance at which they react to smaller ones (D. Ward, USFWS, Anchorage, pers. commun.).

To determine the effects of a large helicopter on molting brant, an algorithm was constructed that converts Bell 206 field data into hypothetical Bell 412 data. We assumed that if birds react to a Bell 412 from twice as far as a Bell 206, they would be disturbed twice as long by the larger helicopter. Birds generally walk and run for relatively short periods of time in response to aircraft. Therefore, most of the additional disturbance time would be spent either alert or swimming. If a threshold decibel level of noise initiated swimming, the louder Bell 412 might cause the birds to enter a lake while further from the flock than the Bell 206. Therefore, most of the additional disturbance time would be spent swimming.

4.2.3. Energetics of foraging and disturbance behavior

Once the birds' reactions to the helicopter are known, their weight at the end of molt is calculated using the bioenergetics model by McKnight and Taylor. Energy used reacting to an aircraft is subtracted from the bird's daily energy budget, thereby lowering the weight of the bird relative to what it would have been in the absence of disturbance. Weight loss also occurs due to lost feeding time while a flock reacts to the helicopter.

To calculate the daily energy budget, the model begins by determining how much energy the birds ingest per day. The dominant foods for brant molting in the TLSA are graminoids growing on moss flats (Derksen et al., 1982; E. Taylor, unpubl. data). Based on an extensive review of the literature, we estimated the net energy obtained from grasses for molting brant as 265 kcal/day. This energy is used to meet the daily demands of production, behavior, and maintenance.

The energetic cost of disturbance behaviors has been calculated using BMR. The following formula for calculating BMR was reported for nonpasserine birds at night by Aschoff and Pohl (1970):

$$\mathrm{BMR} = (307 \times m^{0.734})/4.184,$$

where m is body weight in kg, and BMR is expressed in kcal/day.

This formula was used to estimate BMR and daily energy expenditure of staging greater snow geese (*Chen caerulescens atlanticus*) (Gauthier et al., 1984), and staging Pacific black brant (Ward and Stehn, 1989). The average weight of adult male brant upon arrival to the molting grounds is 1.35 kg (E. Taylor, Texas A&M University, unpubl. data). Using this value,

$$\mathrm{BMR} = (307 \times 1.35^{0.734})/4.184 = 91.45 \text{ kcal/day}.$$

Energetic costs of being alert, walking, running, and swimming are determined as multiples of BMR using behavior coefficients taken from the literature. Gauthier et al. (1984) estimated the cost of alert as 2.1 times BMR and the cost of normal swimming as 2.2 times BMR for greater snow geese. We estimated 4.2 times BMR for brant for disturbance swimming which can include flightless flapping. Wooley and Owen (1978) estimated the cost of walking as 1.7 times BMR for the black duck (*Anas rubripes*). We subtracted 0.1 from this behavior coefficient to account for specific dynamic energy (i.e. the heat produced during the digestion and absorption of food). Running was estimated as 2.8 times BMR for brant. Energy spent was converted to weight loss using a conversion of 13 kcal per 1 g fat (Drent et al., 1981).

5. Model evaluation

Model evaluation focuses on three areas. First, we examine the sensitivity of model behavior to two key modifications that were necessary to convert the model from a Bell 206 to a Bell 412 helicopter. Second, we examine the influence of changes in estimates of BMR and thermoregulation on model behavior. We were interested particularly in the interaction between differences in final weights caused directly by changes in these two variables and differences due to helicopter disturbance. Finally, we evaluate several important assumptions upon which the model is based. Unfortunately, independent field data to evaluate directly the effect of overflights on weight loss and failure to migrate are not available.

5.1. Bell 412 modifications

To convert the model from a Bell 206 to a Bell 412, it was necessary to change both the distance at which birds first respond to the helicopter (and thus the total length of disturbance) and the percent of additional disturbance time spent alert and swimming. We varied the degree to which these variables were changed and summarized simulation results into five weight-loss categories (Table 1).

Table 1
Weight-loss categories used to summarize response of Pacific black brant to aircraft disturbance

Category	Final weight of individual brant (kg)	Weight loss of individual brant (kg)
Not disturbed	1.27	0
No loss	1.27	0
Light loss	1.26–1.15	0.01–0.12
Moderate loss	1.14–1.00	0.13–0.27
Heavy loss	< 1.00	> 0.27

Changing the length of disturbance from 1.5 to 1.8 to 2.0 times as long as the Bell 206 had little impact on the number of birds in each weight-loss category (Fig. 4). The Bell 206 alarmed almost every brant along the flight line examined. Therefore, the Bell 412 could not disturb many additional birds, even though brant could detect it from a greater distance. The larger helicopter forced slightly more birds to swim than did the Bell 206; however, those birds did not swim enough to lose much more weight. Generally, only brant approached very closely by either helicopter experienced much weight loss, and did so regardless of the distance at which they first detected the larger helicopter. Birds further away usually responded longer as the Bell 412 detection distance increased, but not enough to affect weight loss.

Altering the percentage of additional disturbance time spent either alert or swimming from 30 to 60 influenced the number of birds in each weight-loss category (Fig. 5). Swimming is a more energetically expensive behavior than standing alert on shore, and increasing the percentage of time spent swimming increased the number of birds in the heavy weight-loss category. This occurred for both 10 and 50 overflights/day.

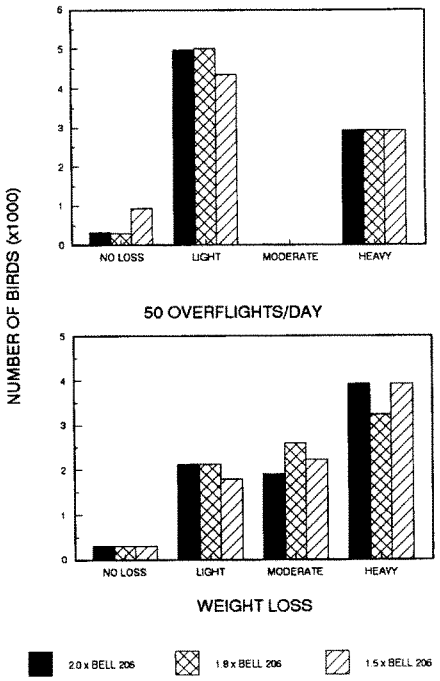

Fig. 4. Effects of changes in total length of disturbance (represented in multiples of Bell 206 disturbance times) on number of birds in each weight-loss category for the Bell 412 algorithm using 10 and 50 overflights/day and altitude = 460 m along the direct route.

5.2. Changes in BMR and thermoregulation

To examine the influence of changes in estimates of BMR and thermoregulation on the number of brant in each final-weight category, we ran a series of simulations representing 50 Bell 412 overflights/day directly between Lonely and Kogru at 460 m altitude. We ran ten simulations with each variable at plus or minus 10% of its baseline value and compared these results to baseline using 2-sample independent t-tests to test for significant differences ($P < 0.05$). Generally, changing thermoregulation did not affect results (Fig. 6A). However, changing BMR strongly influenced the final weight of the birds without disturbance (Table 2), and resulted in significant differences in the number of brant in each final-weight category after flights (Fig. 6B). To determine the extent to which these differences were due to helicopter disturbance and not solely to changes in the bioenergetics model, we adjusted the final-weight categories to reflect the number of birds losing a percentage of their final weight (Fig. 6C). This resulted in no significant

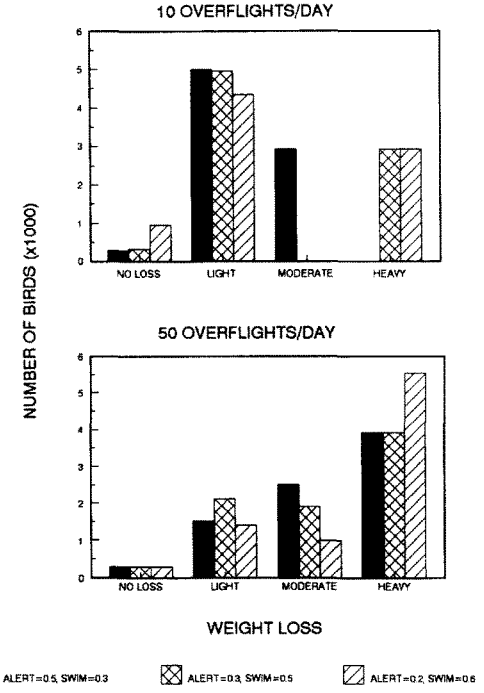

Fig. 5. Effects of changes in the proportion of additional disturbance time spent either alert or swimming on number of birds in each weight-loss category for the Bell 412 algorithm using 10 and 50 overflights/day and altitude = 460 m along the direct route.

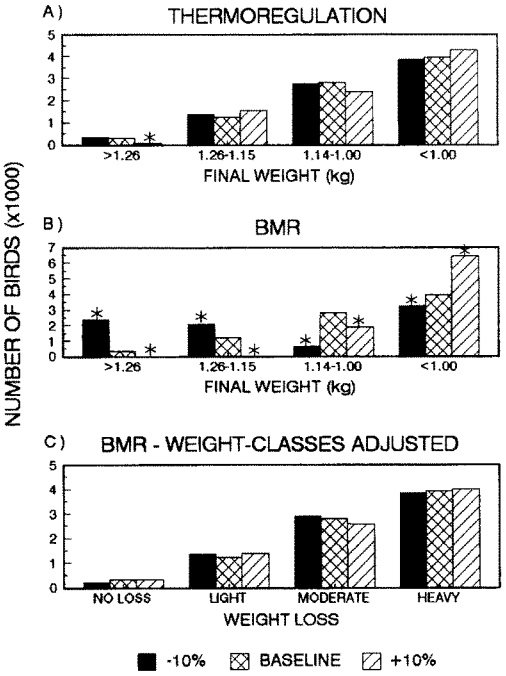

Fig. 6. Effects of indicated changes in the representation of costs of (A) thermoregulation and (B) BMR on number of birds in each weight-loss category for the Bell 412 algorithm using 50 overflights/day and altitude = 460 m along the direct route. In part C, BMR results are summarized with weight-loss categories defined in terms of percentage, rather than absolute, weight loss relative to baseline.

differences from baseline data and indicated that our assessment of the impact of helicopters remained the same regardless of modest changes in BMR.

5.3. Model assumptions

Several assumptions were made in construction of the model: (1) the distribution of flocks on the molting ground remains constant among years, (2) brant do not move between grid cells, (3) the model records all flocks capable of detecting the helicopter, (4) the physiology and energetics of foraging and disturbance behaviors are simulated based on realistic data (Ward and Stehn, 1989).

Flock sizes within the FL submodel are based on 10 years of aerial survey data, but assigned to grid cells determined by only 2 years of detailed distribution information. Between-year variation in distribution of birds across the molting grounds is great. A few lakes were used during only 1 out of 10 years surveyed, yet averaged up to 228 birds/year. Extreme yearly variation in flock size was found at some lakes, while long-term trends were observed at others. The size of flocks on

Table 2
Final weights of undisturbed brant resulting from the indicated changes in the representation of costs of thermoregulation and BMR

Variable	Final weight (kg)
Baseline	1.27
Thermoregulation	
−10%	1.28
+10%	1.27
BMR	
−10%	1.46
+10%	1.12

most lakes showed no trend, but rather apparent random variation. Three lakes received moderate to heavy brant use 9 out of 10 years, but none for 1 year. Only six lakes were used every year by brant. Some year-to-year variability could be due to observer error or poor conditions for observation during the survey.

Most lakes are present in more than one grid cell. No birds were found on some of those lakes during either 1977 or 1978 when detailed mapping of flocks was done, but were present in other years. In general, if most of a lake was confined to one grid cell, all brant were assigned to that cell. Otherwise brant were assigned to the cell containing the highest percentage of wetland shoreline shown on USGS quadrangle maps. If more than one cell contained roughly the same amount of wetland shoreline, or if no cells contained any, brant were randomly placed in one of them. This occurred for 32 lakes, of which, 19 held < 10 brant, while an additional four lakes contained < 20. The remaining nine lakes are relatively large with flocks of 32–245 birds.

In the model, birds can not move between grid cells. This might not cause much error because flightless brant have limited mobility. However, field observations have found that brant will move several hundred meters along a moss flat during a foraging bout. Moreover, brant have been observed swimming across a large (approximately 3 km) lake in response to aircraft disturbance (Derksen et al., 1982) and walking up to 5 km along a lake shore due to repeated overflights. Therefore, birds can and do move between areas represented by different grid cells, but this probably is uncommon.

6. Simulation of aircraft disturbance

Only two airstrips, Lonely and Kogru sites, are present in the molting area. Both commonly are used by businesses as staging sites for local operations and as cache sites for equipment and fuel. We simulated two flight lines between the abandoned airfields to demonstrate the model's usefulness in comparing the impact of alternative routes on molting brant. One, the Direct Route, follows a straight line between Lonely and Kogru, while the other, the Coastal Route, follows the coast. The Direct Route is the most practical flight line between the

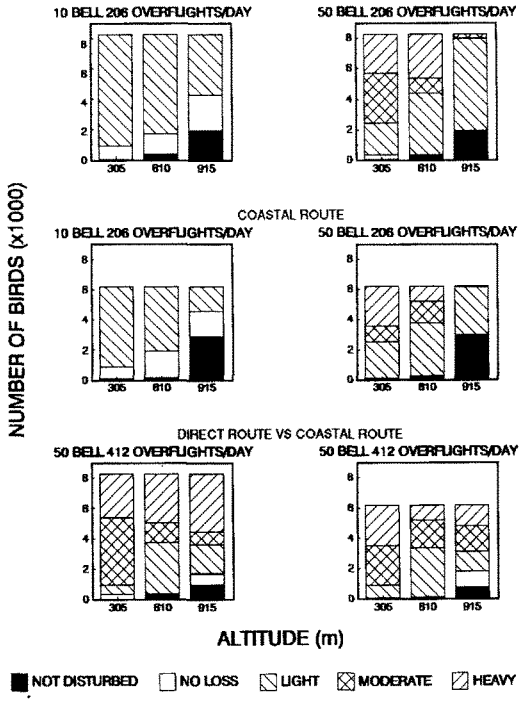

Fig. 7. Weight loss of disturbed brant subjected to helicopter overflights along the direct and coastal routes at three different altitudes.

two airfields, while the coast often serves as a landmark in poor weather. Generally, the Coastal Route reduces disturbance by skirting the edge of the Cape Halkett area, a portion of the molting grounds that is densely populated by brant. The Direct Route, which crosses the cape, encounters over 2000 more birds (8284 vs. 6190) in ten additional flocks (59 vs. 49).

Each route was simulated at three altitudes using 10 and 50 overflights/day with the Bell 206 and 50 overflights/day with the Bell 412 helicopters. Weight loss for every bird along both flight lines was calculated for all altitudes and overflight frequencies. We summarized the number of flocks and birds in each of five weight-loss categories, then examined variation in results both within and between flight lines.

The magnitude of disturbance along a flight line varied with altitude, overflight frequency, and aircraft type (Fig. 7). Overflight altitude was inversely proportional to both the number of birds disturbed and their final weight. Every overflight disturbed most of the birds along both routes. All Bell 412 overflights and those Bell 206 overflights < 915 m caused heavy weight loss in at least 977 birds when either route was flown 50 times/day. Increasing overflight frequency with the Bell

206 generally increased the degree of weight loss, but not the number of birds disturbed. Overall, the Bell 412 had a much greater impact on the molting population than did the Bell 206. Comparison of the two flight lines reveals that aircraft following the Direct Route disturb more birds in every case and usually cause greater weight loss than flights along the Coastal Route.

7. Discussion

The present model should be a useful tool in evaluating the potential impact of helicopter overflights associated with petroleum exploration on Pacific black brant, an important faunal component of the central Arctic Coastal Plain of Alaska. The model is firmly based on field observations and published literature, representing a relatively straightforward synthesis of historical distributional patterns of brant, observed behavioral reactions of brant to helicopter disturbance, and basic concepts of avian energetics. Virtually any possible flightline across the TLSA molting grounds can be simulated.

For example, results of the initial simulations reported here suggest that 3228 birds (18% of the TLSA molting population) would experience heavy weight loss as a result of 50 Bell 412 flights/day at 610 m altitude along the Direct Route. It is doubtful that birds in this condition could successfully complete molt and then migrate to their staging area. This degree of stress on the population might force surviving birds to seek an alternative molting area in subsequent years, the existence of which is unknown.

Alternatively, initial simulations suggest that flying the Coastal Route 50 times/day in a Bell 412 at 610 m reduces the number of birds experiencing heavy weight loss by 68%. However, 1019 birds still experience heavy weight loss. Flying a Bell 206 at 610 m, rather than a Bell 412, results in no birds losing large amounts of weight. Thus, the model can reveal slight changes that result in significant decreases in disturbance. Flying above 760 m in a Bell 206 or 915 m in a Bell 412 along any flight line would greatly reduce the impact of aircraft on molting brant. Unfortunately, low cloud ceilings in this area often prohibit aircraft from flying at that altitude.

As known petroleum reserves are depleted and the demand for oil expands, exploration and development will continue. However, the understanding of wildlife values has grown such that sensitive areas often are now afforded strong protection. Compromise between preservation and development is essential. This model helps identify those compromises required for oil development to coexist with brant on the molting grounds.

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From: jingo788@gmail.com on behalf of Brandon Acton-Bond
To: fortherecord (Energy)
Subject: PROTECT ALASKA"S WILDLIFE REFUGE FROM OIL & GAS COMPANIES
Date: Wednesday, November 15, 2017 11:16:21 AM

Dear Senate Committee on Energy and Natural Resources,

My name is Brandon Acton-Bond and I'm a constituent from Hudson, NY. I'm writing to ask that the committee find other means to produce federal revenue than reopening the Arctic National Wildlife Refuge for oil and gas drilling. We should not destroy protected land and endanger wildlife to fund unnecessary tax breaks for the wealthy. Please pass my message along to the Chairman and other committee members.

Thank you for your time

Brandon Acton-Bond
246 Allen St, Hudson, NY 12534

From: Shauna Agnew
To: fortherecord (Energy)
Subject: For the Record of Nov 2, 2017 Hearing - I oppose drilling in the Arctic National Wildlife Refuge
Date: Wednesday, November 15, 2017 4:23:07 PM

Dear Chairman Murkowski, Ranking Member Cantwell, and Members of the Senate Energy and Natural Resources Committee:

I am writing to oppose opening up parts of the Arctic National Wildlife Refuge to oil and gas exploration and drilling in an effort to generate necessary funds to pass the Tax Bill.
ANWR is a national treasure and we should not be selling our National Treasure in order to shore up this Tax Bill. Opening up ANWR to drilling risks destroying this beautiful and pristine wildlife area. Many Native Americans rely on the ANWR to preserve their way of life. Many species also rely on this land for their survival.
Opening up ANWR for oil and gas exploration and drilling will put these tribes and species at risk of another major environmental disaster and will work to destroy this pristine habitat.
Please do not open up ANWR for oil and gas exploration and drilling.

Thank you for your consideration.

Shauna Agnew

355 E. 3rd Avenue #231

Durango, Colorado 81301

Virus-free. www.avg.com

From: steve agni
To: fortherecord (Energy)
Subject: Limited Access to ANWR
Date: Wednesday, November 01, 2017 12:06:12 PM

Chairman Murkowski, Ranking Member Cantwell, and Members of the Senate Energy and Natural Resources Committee

I am a long time resident of Alaska supporting the proposal to authorize limited oil and natural gas activity within the non-wilderness coastal plain of the Arctic National Wildlife Refuge (ANWR).

The proposal will provide much need oil resources to our economy without any real impact upon the natural environment of the coastal area. This authorization is also critical to maintaining the flow of oil volumes in the Alaska Pipeline (TAPPS) and the overall economy of Alaska.

We must create jobs and the incentive for our young people to continue to live and raise their families in Alaska. The current economic conditions in Alaska are not conducive to employment, family formation and productive behaviors. Many of the social ills presently confronted in Alaska, crime, drug abuse,
and poor child welfare conditions are a direct result of the poor economic conditions and employment levels. Opening ANWR to limited development will be a strong measure to correct these ills and put Alaska back on the road to economic stability.

Thank you for reading this message and acting to open ANWR as proposed.

Steve Agni
Anchorage Alaska
akstevea@hotmail.com
907-229-0583

From: Jon Cook
To: fortherecord (Energy)
Cc: Hoefler, Annie (Energy)
Subject: For the Record of November 2, 2017 Hearing
Date: Wednesday, November 01, 2017 5:08:33 PM

Chairman Murkowski, Ranking Member Cantwell, and Members of the Senate Energy and Natural Resources Committee:

Airport Equipment Rentals, Inc. is the largest equipment leasing company in Alaska and on the North Slope. Our one hundred twenty five employees have helped responsibly develop the North Slope for over twenty years and we support continued responsible development, including that proposed for the 1002 area of ANWR. We support development for the following reasons:

· The proposed ANWR provision would allow development of no more than 2,000 acres of the 1.5 million acres of the Arctic coastal plain – part of the non-wilderness portion of ANWR's 19 million acres. That is equivalent to just 0.01 percent of the entire refuge.

· Responsible oil and gas development in this fraction of ANWR will help ensure America's energy security for decades and allow Alaska – and our nation as a whole – to realize the benefits that come from expanding energy production in Alaska.

· While renewable energy is a growing part of America's energy portfolio, it is still projected to account for a minority of American energy production in 2040. New oil and gas production will be required to power America's economy and can serve as a bridge until renewable energy becomes a dominant energy source decades into the future.

· Energy production from ANWR has the potential to offset a decline in Lower 48 shale oil production, which is expected to commence in approximately a decade. Without limited oil development on the coastal plain, America will be forced to once again increase its reliance on foreign imports. With limited development in ANWR, America and Alaska can continue to grow the economy and reduce dependence on foreign oil.

· The U.S. Geological Survey estimates the 1002 Area is North America's greatest prospect for conventional onshore oil production, with a mean likelihood of containing 10.4 billion barrels of oil and 8.6 trillion cubic feet of natural gas, as well as a reasonable chance of economically producing 16 billion barrels of oil.

· Alaska's economic lifeline, the Trans-Alaska Oil Pipeline System (TAPS), is now running at three-quarters empty. New oil production from ANWR has the potential to reverse throughput in TAPS, a vital component of American energy infrastructure.

· Oil development on a fraction of the coastal plain would create thousands of jobs nationwide, generate billions of dollars in government revenue, keep energy prices for American consumers affordable, and further improve energy security for decades into the future.

· Since the ANWR coastal plain is less than 60 miles from TAPS, development of

energy resources there is one of the most environmentally-sound way to increase oil production in Alaska.

· Thanks to continuing improvements in technology, practices, and oversight, the oil industry has demonstrated over the past 40 years that North Slope energy development and environmental stewardship can and do coexist. The industry has a proven track record of responsible development in sensitive areas, protecting the environment, wildlife and subsistence needs of local residents.

We ask for Senate support of this provision which is critically important to Alaska and the United States.

Regards,

Jon Cook
CFO
Airport Equipment Rentals, Inc.
(907)460-7030

ALASKA CHAMBER

November 1, 2017

Senate Energy & Natural Resources Committee
Senator Lisa Murkowski, Chair
United States Senate
522 Hart Senate Building
Washington, DC 20510

Re: Support for oil and gas exploration and development in Alaska's federal areas.

Dear Senator Murkowski, Ranking Member Cantwell, and Members of the Committee:

The Alaska Chamber supports drilling provisions be included in a budget reconciliation bill that would allow limited oil and gas activity within the non-wilderness coastal plain of the Arctic National Wildlife Refuge (ANWR).

The Chamber is a non-profit founded in 1953 working to promote a positive business environment in Alaska. The Chamber is the voice of small and large business representing hundreds of employers and local chambers across Alaska. Our member companies employ over 100,000 hard-working Alaskans. We have long supported resource development that is both done in a responsible manner and brings economic opportunities to Alaska and its residents.

A long-standing top federal legislative priority for Chamber members is supporting oil and gas exploration within Alaska's federal areas, and the eventual production from those exploration activities. The responsible development of the oil and gas resources found in this portion of ANWR represents thousands of high-paying jobs for Alaskans and a considerable injection of revenue into Alaska's economy.

The Alaska Chamber urges your support for responsible oil and gas development within the non-wilderness portion of ANWR.

Best regards,

Ben Mulligan
Vice President

471 W. 36th Ave., Suite 201, Anchorage, AK 99503 • (907) 278-2722 • alaskachamber.com

Alaska Forest Association

111 Stedman Street
Ketchikan, AK 99901
Phone: 907-225-6114
Fax: 907-225-5920

October 31, 2017

Dear Chairman Murkowski, Ranking Member Cantwell and,
Members of the Senate Energy and Natural Resources Committee.

For Record of November 2, 2017 Hearing

The Alaska Forest Association supports the ANWR drilling provision proposed for the budget reconciliation bill that would allow limited oil and natural gas activity within the coastal plain of the Arctic National Wildlife Refuge (ANWR).

We believe that responsible development of all of our nation's resources can be accomplished with minimal risk to other resources.

The Alaska Forest Association (AFA) is a non-profit business association that was formed in 1957 to represent the interests of the timber industry in Southeast Alaska. The AFA currently manages a pension program, a group health insurance program, a scholarship program for the timber industry and also sponsors the Sustainable Forestry Initiative program for Alaska.

Our understanding is the proposed ANWR provision would allow development of no more than 2,000 acres of the 1.5 million acres of the Arctic coastal plain – part of the non-wilderness portion of ANWR's 19 million acres. That is equivalent to just 0.01 percent of the entire refuge.

Responsible oil and gas development in this fraction of ANWR will help ensure America's energy security for decades and allow Alaska – and our nation as a whole – to realize the benefits that come from expanding energy production in Alaska.

Further, Alaska's economic lifeline, the Trans-Alaska Oil Pipeline System (TAPS), is now running at three-quarters empty. New oil production from ANWR has the potential to reverse throughput in TAPS, a vital component of American energy infrastructure.

Oil development on a fraction of the coastal plain would create thousands of jobs nationwide, generate billions of dollars in government revenue, keep energy prices for American consumers affordable, and further improve energy security for decades into the future.

Thanks to continuing improvements in technology, practices, and oversight, the oil industry has demonstrated over the past 40 years that North Slope energy development and environmental stewardship can and do coexist. The industry has a proven track record of responsible development in sensitive areas, protecting the environment, wildlife and subsistence needs of local residents.

Thank you for the opportunity to comment on this important proposal.

Sincerely,

Owen Graham

Owen Graham
Executive Director
Alaska Forest Association
111 Stedman Suite 200
Ketchikan, AK 99901

Phone 907-225-6114
Email ojgraham@aol.com

ALASKA MINERS
ASSOCIATION

121 W. Fireweed Suite 120 | Anchorage, Alaska | 99503 | 907.563.9229 | alaskaminers.org

October 31, 2017

Senate Energy and Natural Resources Committee
304 Dirksen Senate Building
Washington DC 20510

Re: For the Record of November 2, 2017 Hearing: Passage of the Fiscal Year 2018 budget by the House and Senate to include drilling provisions for limited oil and natural gas activity within the non-Wilderness coastal plain of the Arctic National Wildlife Refuge (ANWR)

Dear Chairman Murkowski, Ranking Member Cantwell, and Members of the Senate Energy and Natural Resources Committee:

The Alaska Miners Association (AMA) writes to express support in advance of the November 2, 2017 hearing for drilling provisions in the 2018 budget in the non-Wilderness coastal plain of ANWR.

AMA is a professional membership trade organization established in 1939 to represent the mining industry in Alaska. We are composed of more than 1,400 members that come from eight statewide branches: Anchorage, Denali, Fairbanks, Haines, Juneau, Kenai, Ketchikan/Prince of Wales, and Nome. Our members include individual prospectors, geologists, engineers, suction dredge miners, small family mines, junior mining companies, and major mining companies, Alaska Native Corporations, and the contracting sector that supports Alaska's mining industry.

Polls have consistently shown Alaskans overwhelmingly support responsible oil and gas development in the non-wilderness portion of ANWR. Alaska's miners are no different: we are acutely aware of the importance responsible resource development is to Alaska's, and indeed, the nation's economy. AMA knows that a healthy, robust oil and gas industry is synonymous with a healthy economy; therefore, the Association frequently adopts positions of support of responsible oil and gas projects. AMA has supported efforts to explore the Refuge for years, arguing that development in the Coastal Plain will lessen our dependence on foreign oil and create new jobs and new revenues.

It is the position of AMA that there is no valid reason why we should not be allowed to access the world-class resources within just a tiny fraction of the coastal plain. We urge the Committee pass the 2018 Budget, including ANWR drilling provisions.

Thank you for your consideration of our comments.

Sincerely,

Deantha Crockett
Executive Director

Alaska State Senate

November 2, 2017

The Honorable Lisa Murkowski
Chairman
U.S. Senate Committee on Energy and Natural Resources
304 Dirksen Senate Office Building
Washington, D.C. 20510

The Honorable Maria Cantwell
Ranking Member
U.S. Senate Committee on Energy and Natural Resources
304 Dirksen Senate Office Building
Washington, D.C. 20510

RE: Support for Responsible Oil and Gas Exploration and Development in the 1002 Study Area in the Arctic National Wildlife Refuge

Dear Chairman Murkowski, Ranking Member Cantwell, and Members of the Committee:

The Alaska State Senate strongly supports efforts by the United States Senate Committee on Energy and Natural Resources (the Committee) to pass legislation meeting the instruction in H. Con. Res. 71 by allowing responsible development in the 1002 area ("1002 area") of the Arctic National Wildlife Refuge ("ANWR"). With a record of over four decades responsibly producing resources on our state' North Slope, Alaska's State Senate firmly holds that access to the 1002 area will grow our national economy, reduce our federal government's deficit, and strengthen our national security.

This year marks the fortieth anniversary of the Trans-Alaska Pipeline System (TAPS). The legislative process in the United States Congress that led to the opening of TAPS was careful and deliberate. Thanks to the wisdom of that decision, over seventeen billion barrels of oil have been safely conveyed through this essential national energy infrastructure.

The development of oil on state lands at Prudhoe Bay, Kuparuk, Endicott, Lisburne, and Milne Point resulted in thousands of family-supporting jobs throughout the United States, in addition to significant revenues to the federal treasury. Alaska contributed to the stability of the country's energy needs. At one point, Alaska's petroleum activities constituted up to a quarter of the nation's entire oil production.

However, TAPS is currently operating at a quarter of its peak throughput, resulting in the technical and engineering challenges of which this Committee is greatly aware. Low TAPS throughput hastens the threat of obsolescence, which would strand the tremendous remaining known reserves on the North Slope, and deprive the United States of a critical plank in the nation's energy security blanket.

The single largest factor that can reverse the projected decline of TAPS throughput is additional resources from federal lands. The petroleum industry, the State of Alaska (the State), and the United States Department of the Interior (Dept. of Interior) consider the 1002 study area to have the highest potential for the discovery of very large, conventional oil and gas accumulations on the North American continent, with estimates of recoverable oil being as much as 10,000,000,000 barrels.

The history regarding the debate to open the 1002 area is lengthy. However, the State, and the Alaska Legislature specifically, have consistently and strongly made its view on this debate known: we have urged the United States Congress to pass legislation opening the 1002 area for oil and gas development. We propose that passing such legislation is not only good policy, but adheres to the intent of existing law, specifically the Alaska National Interest Lands Conservation Act ("ANILCA").

We respectfully remind members of Congress, and this Committee, that the final version of ANILCA was, and remains, a compromise that was carefully crafted to balance two goals: to conserve and protect the nation's lands in Alaska, and to foster economic opportunity for the citizenry. ANILCA doubled the lands of the nation's parks, and tripled the land of our country's refuges, with most of those additions occurring in Alaska, where 100 million federal acres in the state were affected. These changes represent the conservation elements of ANILCA.

Under ANILCA Section 103 (16 U.S.C. 3143), the United States Congress reserved the right to permit oil and gas development and production within the coastal plain of ANWR. In Section 1002 (16 U.S.C. 3142), Congress authorized nondrilling exploratory activity within the coastal plain of ANWR, which is the 1002 study area. These elements represent some of the economic opportunity planks of ANILCA. Opening a small, federally designated area of ANWR for responsible development meets the intent of ANILCA to maintain that healthy and necessary balance.

Since the passage of ANILCA in 1980, the infrastructure on Alaska's North Slope has grown, along with sophisticated spill prevention and response technologies. This infrastructure has moved as far east as Point Thomson, a new development bordering the 1002 area. The closeness between the 1002 area and such modern infrastructure means that only the additional construction of a pipeline to Point Thomson and expansion of existing pipelines to deliver oil into TAPS, and subsequently to market, will be needed.

Additionally, the oil and gas industry has developed directional drilling technology that will allow horizontal drilling in a responsible manner by minimizing the development footprint in the 1002 area. Those same advancements in directional drilling may be capable of drilling from outside the boundaries of the 1002 area. The oil and gas industry utilizes innovative technology, and the best environmental practices in new field developments. Those techniques are directly applicable in the 1002 study area, and would enhance environmental protection beyond our traditionally high standards.

Our interests in seeing the 1002 area opened are not parochial. The resources from this potentially rich, though small, area can contribute enormously to the nation's energy and national security. Of a more pressing matter, the revenues from 1002 area development can create new wealthy, reduce the national deficit, and support repayment of our national debt. We followed the debate the United States Congress on potential amendments to H. Con. Res. 71, and noted that the Committee plays an important role in generating new revenues. We strongly propose that best option for new revenue sources is the development of the 1002 area.

Finally, Alaska has a unique contribution to the United States' foreign policy on energy. Before the United States Congress lifted the ban on exporting crude oil in late 2015, Alaska was the only state in the country that exported oil to nations other than Canada. Between 1996-2004, around 2.7% of Alaska's North Slope production was exported to nation states in the Asia Pacific region.

As the United States looks to address its foreign trade imbalance, and provide global partners with sources of energy from a stable democratic republic, Alaska is positioned to contribute in a significant way. The resources from the 1002 area would play a large role in adding more crude from a known export source, and give the United States' allies a stable supply for their citizens and industries, promoting strong international and economic relations.

The Alaska State Senate respectfully requests the United States Congress, and the Senate Committee on Energy and Natural Resources, to pass legislation opening the 1002 study area for responsible oil and gas development. We ask this in the spirit of our shared goals as Americans, to bring new revenues that reduce our nation's deficit and debt, to create family-supporting jobs and economic prosperity to fellow Americans, to strengthen our national energy supply, and to promote the security of our nation.

Sincerely,

Sen. Pete Kelly
Senate President

Sen. Cathy Giessel

Sen. Anna MacKinnon

Sen. Lyman Hoffman

Sen. Peter Micciche

Sen. Click Bishop

Sen. Gary Stevens

Sen. Donald Olson

Sen. Kevin Meyer

Sen. Natasha Von Imhof

Sen. John Coghill

Sen. David Wilson

Sen. Mia Costello | Sen. Shelly Hughes | Sen. Bert Stedman | Sen. Mike Dunleavy

From:	Aves Thompson
To:	fortherecord (Energy)
Cc:	Hoefler, Annie (Energy); "Dave Heston"; "Jamie Benson"; "Jeremy Miller"; "Jimmy Doyle"; "Joey Crum"; "Josh Norum"; "Mike Moeller"
Subject:	ANWR
Date:	Tuesday, October 31, 2017 3:43:21 PM
Importance:	High

Chairman Murkowski, Ranking Member Cantwell, and Members of the Senate Energy and Natural Resources Committee,

The **Alaska Trucking Association**, a trade association with nearly 200 member companies in Alaska, **supports the opening of the 1002 area of the Arctic National Wildlife Refuge**.
Alaskans have developed the North Slope oil fields responsibly.
Alaska's economic lifeline, the Trans-Alaska Oil Pipeline System (TAPS), is now running at three-quarters empty. New oil production from ANWR has the potential to reverse throughput in TAPS, a vital component of American energy infrastructure.
Oil development on a fraction of the coastal plain would create thousands of jobs nationwide, generate billions of dollars in government revenue, keep energy prices for American consumers affordable, and further improve energy security for decades into the future.
Since the ANWR coastal plain is less than 60 miles from TAPS, development of energy resources there is one of the most environmentally-sound way to increase oil production in Alaska.

The opening of a small portion of ANWR for exploration and production will create huge economic impacts and hundreds of jobs in Alaska. Our industry has suffered along with other businesses in Alaska, as a result of lessened exploration and production activity and this opportunity will provide much needed jobs to support our Alaskan drivers as well as all the support staff needed to deliver the freight.

Please look favorably on this proposal.

Aves Thompson I Executive Director I Alaska Trucking Association I www.aktrucks.org
Office 907 276-1149 I Mobile 907 240-0114 I Fax 907 274-1946

From: Matti Allison
To: fortherecord (Energy)
Subject: Say no to drilling in the Arctic National Wildlife Refuge
Date: Monday, November 06, 2017 3:11:33 PM

Dear Committee members,

I'm writing to ask that the committee find other means to produce federal revenue than reopening the Arctic National Wildlife Refuge for oil and gas drilling. We should not destroy protected land and endanger wildlife to fund unnecessary tax breaks for the wealthy. Please pass my message along to the Chairman and other committee members.

Thank you,

Matti Allison
1529 W. Estes Ave.
Chicago, IL 60626

From: Nadine Ancel
To: fortherecord (Energy)
Cc: Hoefler, Annie (Energy)
Subject: Artic National Wildlife Refuge
Date: Wednesday, November 15, 2017 10:32:15 AM

I am writing to oppose opening up parts of the Arctic National Wildlife Refuge to oil and gas exploration and drilling in an effort to generate necessary funds to pass the Tax Bill.
ANWR is a national treasure and we should not be selling our National Treasure in order to shore up this Tax Bill. Opening up ANWR to drilling risks destroying this beautiful and pristine wildlife area. Many Native Americans rely on the ANWR to preserve their way of life. Many species also rely on this land for their survival.
Opening up ANWR for oil and gas exploration and drilling will put these tribes and species at risk of another major environmental disaster and will work to destroy this pristine habitat.
With the increase in sustainable energy production there is no need for additional drilling. Currently the cost of oil production in the area is more than the actual profit from the sale of the oil produced.
Please do not open up ANWR for oil and gas exploration and drilling.
Thank you for your consideration in this matter.
Nadine Ancel
358 W. Los Ranchitos Dr.
Durango, CO 81301

From: Jeremy Anderson
To: Hoefler, Annie (Energy); fortherecord (Energy)
Subject: For Record of November 2, 2017 Hearing
Date: Thursday, November 02, 2017 1:12:02 PM

Chairman Murkowski, Ranking Member Cantwell, and Members of the Senate Energy and Natural Resources Committee,

My name is Jeremy Anderson. I was born in Alaska and lived here for 30 years.

I support the responsible oil and gas activity in the arctic region of Alaska. The area in contention is 0.01 percent of the entire refuge. In light of the current economic downturn in Alaska we should act now to encourage more development and job creation.

I work on the north slope and have seen first hand the Kuparuk, Prudhoe Bay, Point Thomson, and various other smaller operations. I know for a fact that the operators and those of us that work up there are more concerned about our impact on the state of Alaska than the average person.

Please consider the positive impact for Akaka like myself and make the right decision.

Jeremy Anderson
828 W 56th AVE
Anchorage, AK 99518
907 444-9455

From: mariesing@aol.com
To: fortherecord (Energy)
Subject: Constituent Comment - Protecting the Arctic National Wildlife Refuge
Date: Wednesday, November 15, 2017 11:16:09 AM

To the Senate Committee on Energy and Natural Resources,

My name is Marie Anello, I'm a constituent from New York City.

I'm writing to ask that the committee find other means to produce federal revenue than reopening the Arctic National Wildlife Refuge for oil and gas drilling. We should not destroy protected land and endanger wildlife to fund unnecessary tax breaks for the wealthy.

Area 1002 of the Arctic National Wildilife Refuge is birthing ground to herds of caribou, a staple for indigenous tribes in the area, and any drilling of this area would be devastating. The CBO analysis has already showed that expected revenue from ANWR drilling would be significantly lower than what was suggested by the Trump administration, and furthermore we as a country cannot realistically continue to rely on unsustainable fossil fuels that are destroying our environment and causing irreparable climate change.

I hope the Committee will take my message into account, and I hope that the Senators will choose not to destroy this cherished piece of our nation's environment.

Thank you for your time,

Marie Anello
1825 Riverside Drive
New York, NY 10034

From: Ron Arvin
To: fortherecord (Energy)
Cc: Nina Arvin
Subject: The 1002 Area of ANWR
Date: Tuesday, October 31, 2017 3:38:06 PM

Dear Senator Murkowski,
I support opening the 1002 area in ANWR. I'm a lifelong Alaskan and have worked throughout Alaska in the timber, mining and energy sectors. And each of these sectors have suffered greatly due the overly burdensome regulatory requirements currently in place. That being said, there are strict operational requirements which are followed by every operator and the operations are heavily inspected by state and federal regulators to ensure compliance.
Please support opening the 1002 area of ANWR for oil exploration and extraction.

As a side note, why do we purchase oil from countries that wish to AND do harm to the USA, when we have our own natural resources that can be developed?? This seems crazy to me.

Thank you
Ron Arvin
189 East Nelson
#136
Wasilla Alaska 99654

Ronald Arvin IPhone from Alaska

From: Janis Avery
To: fortherecord (Energy)
Subject: Opposing opening ANWR to new leases for oil and gas extraction
Date: Sunday, November 12, 2017 1:32:07 PM

ANWR is the most precious remaining wilderness in the US. Opening this fragile area to oil and gas drilling puts it at great risk. I am opposed to opening the ANWR to drilling, pipelines or oil tankers. Thank you.

Janis Avery
1829 S Lane St
Seattle, WA 98144

From: Tuckerman Babcock
To: fortherecord (Energy)
Subject: Open the 1002 area of ANWR
Date: Tuesday, October 31, 2017 3:48:05 PM

Honorable Chairman Murkowski and Ranking Member Cantrell,

I endorse opening the 1002 area of the Arctic National Wildlife Refuge to exploration and development.

For more than 40 years, Alaskans and the companies that work here, have demonstrated it is possible to explore and develop these vital resources responsibly.

If you go back to the dire predictions made about Prudhoe Bay development when I was yet in junior high, yo will see that none of them have come to pass.

We Alaskans love our heritage, our wilderness and our wildlife. We know from past experience that none of those things are seriously threatened by oil and gas development.

I am a former Commissioner of the Alaska Oil and Gas Conservation Commission (1993-96) and can attest to the careful consideration the State gives to regulating oil and gas development.

Please consider the record on the North Slope, and the any benefits to the federal treasury and to Alaska from opening the 1002 area of ANWR.

Sincerely,

Tuckerman Babcock
PO Box 910
Kenai, AK 99611

From: cory@samsontug.com
To: fortherecord (Energy)
Cc: Hoefler, Annie (Energy)
Subject: Please open ANWR - from an Alaskan Citizen
Date: Wednesday, November 01, 2017 6:07:46 PM

Chairman Murkowski, Ranking Member Cantwell, and Members of the Senate Energy and Natural Resources Committee,

I am an Alaskan asking you to please open the Arctic National Wildlife Refuge (ANWR), or 1002 Area, to oil and gas exploration and development.

My name is Cory Baggen. I live in Sitka, Alaska, where I was born and raised. I work for my family's company, Samson Tug & Barge. My great grandfather George Baggen founded our company in the early 1900s in Juneau. We started out as a small horse and cart operation called Baggen Transfer. Later we transitioned to the marine transportation industry and moved our headquarters to Sitka. We operate in 14 year round locations across the state, and four in Seattle, Washington. We also serve smaller communities like Adak, Larsen Bay and False Pass seasonally.

Our business depends on a healthy Alaskan economy. We need a strong oil and gas industry in order for our economy, and our company, to survive.

Our small population in Alaska can not pay for all of the infrastructure and services that Alaskans need. We have to have oil tax revenue to balance our budget. The Trans-Alaska Oil Pipeline System (TAPS), is now running at three-quarters empty. New oil production from ANWR has the potential to increase throughput in TAPS, a vital component of American energy infrastructure.

We support oil exploration and extraction in ANWR. There is no reason to not develop this important resource. Opening ANWR to responsible oil and gas development will help ensure America's energy security. This is good for Alaska and for our entire country.

Oil development in ANWR makes sense. ANWR is a very small area in Alaska. It is less than 60 miles from TAPS. Opening ANWR would create thousands of jobs across the country, generate billions of dollars in government revenue and help keep energy prices for Americans affordable.

Alaskans are ready to open ANWR! Please allow us to develop this area in the environmentally safe way that we know (and have proven) we can.

Thank you,

Sincerely

Corella (Cory) Baggen
Vice President
Samson Tug & Barge

From: Sherrill Scott
To: fortherecord (Energy)
Cc: Hoefler, Annie (Energy)
Subject: For Record of November 2, 2017 hearing.
Date: Tuesday, October 31, 2017 6:49:05 PM

Reference: For Record of November 2, 2017 hearing.

Dear Chairman Murkowski, Ranking Member Cantwell, and Members of the Senate Energy and Natural Resources Committee;

Please be advised that I support limited and responsible oil and gas activity in the non-wilderness portion of ANWR. U. S. Geological Survey estimates a mean likelihood of containing 10.4 billion barrels of oil and 8.6 trillion cubic feet of natural gas, as well as a reasonable chance of economically producing 16 billion barrels of oil. This would reduce our dependence on foreign oil as well as create thousands of jobs nationwide.

Sincerely,

/s/ R.V. Bailey

Retired Geologist and Author

R. V. Bailey
1032 S. Durbin Street
Casper, WY 82601
(307) 333-6513
rvbgeol1@gmail.com

From: Frank Baker
To: fortherecord (Energy)
Subject: ANWR
Date: Tuesday, October 31, 2017 2:26:27 PM

I'm a 72-year resident of Alaska and believe the coastal plain area of ANWR can be explored and developed in a safe, responsible manner. The arguments from both sides, pro and con, are well known. The amount of land impacted by such a development would be very small in relation to ANWR. Industry has proven for decades at Prudhoe Bay and other North Slope oil fields that it has the technical expertise to develop hydrocarbon resources efficiently and with minimum environmental impact— with higher standards than anywhere in the world.

Vote to allow limited development in this small portion of ANWR.

Frank Baker
Eagle River, Alaska
(907) 694-4388

Sent from my iPhone

From: Frank Baker <frankebaker@yahoo.com>
Date: October 31, 2017 at 10:25:49 AM AKDT
To: fortherecord@energy.senate.gov
Subject: ANWR

I am a 72-year resident of Alaska and believe the coastal plain area of ANWR can be explored and developed in a safe, responsible manner. The arguments from both sides, pro and con, are well known.

The amount of land impacted by such a development would be very small in relation to ANWR. Industry has proven for decades at Prudhoe Bay and other Norrth Slope oil fields that it has the technical expertise to develop hydrocarbon resources efficiently and with minimum environmental impact, employing higher standards than anywhere in the world.

Please vote to allow limited development in this small portion of ANWR.

Frank E. Baker
Eagle River, AK. 99577
(907) 694-4388

From: Baker, Jeff
To: fortherecord (Energy)
Cc: Hoefler, Annie (Energy)
Subject: For Record of November 2, 2017 Hearing
Date: Tuesday, October 31, 2017 2:55:45 PM

Chairman Murkowski, Ranking Member Cantwell, and Members of the Senate Energy and Natural Resources Committee:

Please accept my testimony in support of opening the 1002 Area of the Arctic National Wildlife Refuge to oil and gas exploration. Responsible oil and gas development on Alaska's North Slope is better than it has ever been. We've leaned over the years to minimize footprint, build safely for both humans and the environment, while developing much needed energy for the country. Area 1002 is relatively small in comparison to the overall ANWR. It's on the Arctic Coastal Plain where the industry has the most experience developing infrastructure projects responsibly. I've seen firsthand the improvements from the initial Prudhoe Bay infrastructure to Kuparuk, to Alpine, and recently Point Thomson. I'm am convinced ANWR will be developed responsibly with minimal impact. A strong oil & gas industry in Alaska is vital to the United Stated energy independence and to Alaska's economy.

Thank you for the opportunity to provide comment.

Jeff Baker, PE
Anchorage, Alaska
907.317.8054

From: Dale Banks
To: fortherecord (Energy)
Subject: Nov 2 Senate Energy and Natural Resources Committee Hearing
Date: Thursday, November 09, 2017 6:35:14 PM

I do not support drilling in the 1002 Coastal Plain area.

Dale Banks

--
Dale Banks
~Owner~
Loopy Lupine Distribution
PO Box 2888
4854 Eagle Place
Homer, AK 99603
www.loopylupine.com
(907) 235-5100 phone
(907) 299-0524 mobile

From: Patti Barber
To: fortherecord (Energy)
Subject: ANWR Support
Date: Wednesday, November 01, 2017 3:44:50 PM

It's time to support the opening of ANWR. There isn't a problem with caribou migration with the current pipeline, in fact they have been known to use the pipeline to warm themselves. Jobs are needed, America needs to support fuels being produced from our oil fields not from foreign countries. I support all efforts to open ANWR.

Patti Barber
17367 E Melin Rd
Palmer, AK 99645

Sent from Mail for Windows 10

Virus-free. www.avast.com

From: Scott Barkdull
To: fortherecord (Energy)
Subject: Limited development of ANWR
Date: Tuesday, October 31, 2017 4:10:00 PM

To: Chairman Murkowski, Ranking Member Cantwell, and Members of the Senate Energy and Natural Resources Committee,
Honorable Lawmakers,

It has come to my attention that there will be a hearing regarding the possible opening of ANWR to limited development soon. I am a lifelong Alaskan and have heard of these talks for many years now and would like to voice my support in allowing limited development in this region. The vast remoteness of this area will hardly be affected by the amount of activity that is planned as this area, if it were a state, would be the 13th largest state in the country. For us to not develop at least a part of it would be an ignorant position. Hardly any people visit the area, it is like having a Diamond that nobody gets to see. Some development is warranted, and what better way than some exploration for energy that could have a long term effect on The United States and Alaska. If we are constantly told to keep our hands in our pockets then how can the State maintain its competitive edge in the future? Please consider opening up this area for limited development.

Sincerely,
Scott A Barkdull
3716 Swenson Ave.
Fairbanks, Alaska 99709
907-374-4437

From: Rebecca Barrows
To: fortherecord (Energy)
Subject: Opposition to Drilling in the Arctic National Wildlife Refuge!
Date: Tuesday, November 14, 2017 1:32:53 PM

I urge you not to reopen this pristine area for oil and gas drilling. We should not destroy protected land and endanger wildlife to fund unnecessary tax breaks for the wealthy.

Rebecca Barrows
2 Wildwood Lane
Goshen, MA 01032

Sent from my iPhone

From: Barth, Bryan
To: fortherecord (Energy)
Subject: ANWR Area 1002
Date: Tuesday, October 31, 2017 7:22:57 PM
Attachments: image001.png
Importance: High

Dear Chairman Murkowski and Ranking Member Cantwell,

I am an Alaskan that supports the opening of the 1002 area of the Arctic National Wildlife Refuge. Alaskans have developed the North Slope oil fields responsibly and will continue to do so with NO effects to the Arctic Caribou herd or any other animal species. We are the caretakers of the environment and we need you to vote in favor of development.

Sincerely,

Bryan Barth
Projects Administrative Supervisor
Price Gregory International, Inc.
PRICE GREGORY
Tel (907) 278.4400 | Direct (907) 257.4159 | Cell (907) 565-9331 | Fax (907) 278.4400
bbarth@pricegregory.com | 301 West Northern Lights Blvd, Suite 300, Anchorage, AK 99503

From: Charley Basham
To: fortherecord (Energy)
Subject: ANWR
Date: Thursday, November 02, 2017 1:57:31 AM

This Alaskan does not support efforts to drill in the Arctic National Wildlife Refuge. The Refuge is one of the last truly wild places in our country, and we need to preserve it. The portion that is being proposed to open to drilling is the birthing grounds for caribou, which are sacred to the Gwich'in people. Once disturbed, this pristine wilderness can never be restored.
Sincerely, Charlotte Basham
1649 Red Fox Drive, Fairbanks, AK 99709

From: lisa beaudreau
To: fortherecord (Energy)
Subject: Fwd: Arctic Wildlife Refuge
Date: Wednesday, November 15, 2017 12:13:49 PM

Protect the Arctic

Millions of acres of the Arctic's North Slope are already open for drilling. The Arctic Refuge was set aside to keep at least one slice of pristine and vital Arctic habitat protected for wildlife.

I'm calling to ask that the committee find other means to produce federal revenue than reopening the Arctic National Wildlife Refuge for oil and gas drilling. We should not destroy protected land and endanger wildlife to fund unnecessary tax breaks for the wealthy. Please pass my message along to the Chairman and other committee members.

Lisa Beaudreau
215 18th ave
Santa Cruz CA 95062

From: Ashley Beck
To: fortherecord (Energy)
Subject: Please protect the Arctic National Wildlife Refuge
Date: Tuesday, November 14, 2017 5:24:18 PM

Hi, my name is Ashley Beck and I'm a constituent from 38265 E. Benton Rd. Temecula, CA 92592.

I'm writing to ask that the committee find other means to produce federal revenue than reopening the Arctic National Wildlife Refuge for oil and gas drilling. We should not destroy protected land and endanger wildlife to fund unnecessary tax breaks for the wealthy. Please pass my message along to the Chairman and other committee members.

Thank you for your time and attention.

Ashley Joy Beck
Makeup Artist
www.ashleyjoybeck.com

From: Michael Beck
To: fortherecord (Energy)
Cc: Hoefler, Annie (Energy)
Subject: Message in support of ANWR Development
Date: Wednesday, November 01, 2017 10:37:46 PM

RE: For Record of November 2, 2017 Hearing

Dear Chairman Murkowski, Ranking Member Cantwell, and Members of the Senate Energy and Natural Resources Committee:

I favor opening the 1002 area of ANWR up for oil development and the following bullet points summarize my opinion quite well:

* For decades, scientific polls have shown Alaskans overwhelmingly support responsible oil and gas development in the non-wilderness portion of ANWR. There is no valid reason why we should not be allowed to access the world-class resources within just a tiny fraction of the coastal plain.

* The proposed ANWR provision would allow development of no more than 2,000 acres of the 1.5 million acres of the Arctic coastal plain – part of the non-wilderness portion of ANWR's 19 million acres. **That is equivalent to just 0.01 percent of the entire refuge**.

* Responsible oil and gas development in this fraction of ANWR will help ensure America's energy security for decades and allow Alaska – and our nation as a whole – to realize the benefits that come from expanding energy production in Alaska.

* While renewable energy is a growing part of America's energy portfolio, it is still projected to account for a minority of American energy production in 2040. New oil and gas production will be required to power America's economy and can serve as a bridge until renewable energy becomes a dominant energy source decades into the future.

* Energy production from ANWR has the potential to offset a decline in Lower 48 shale oil production, which is expected to commence in approximately a decade. Without limited oil development on the coastal plain, America will be forced to once again increase its reliance on foreign imports. With limited development in ANWR, America and Alaska can continue to grow the economy and reduce dependence on foreign oil.

* The U.S. Geological Survey estimates the 1002 Area is North America's greatest prospect for conventional onshore oil production, with a mean likelihood of containing 10.4 billion barrels of oil and 8.6 trillion cubic feet of natural gas, as well as a reasonable chance of economically producing 16 billion barrels of oil.

* Oil development on a fraction of the coastal plain would create thousands of jobs nationwide, generate billions of dollars in government revenue, keep energy prices for American consumers affordable, and further improve energy security for decades into the future.

Best regards,

Mike

Michael Beck

406 Lawton Dr.

Kenai AK 99611

Fish.on@mac.com

(907) 335-3300

From: Elaine Bell
To: fortherecord (Energy)
Subject: ANWR
Date: Tuesday, October 31, 2017 7:24:20 PM

Drilling for oil in the Artic National Wildlife Refuge is not going to hurt anything. Prudhoe Bay has proven the industry does not bother the wildlife. Alaska has proven it can monitor development. Regardless what environmentalists say responsible development is a reality. We love Alaska, we would not promote an industry that hurts it.

Elaine Bell
Haines, Alaska
907-723-2804

From: Mike Bell
To: fortherecord (Energy)
Subject: ANWR
Date: Tuesday, October 31, 2017 6:59:01 PM

Dear Sirs,

I have been an Alaskan resident since 1968. ANWR can be developed responsibly and provide jobs and energy for Americans. I fully support drilling for oil in the Artic. The price of oil may be low currently, but who knows what the world market will be like in ten to fifteen years. That's how long it will take before ANWR would come on line.

Mike Bell
Haines, Alaska
907-766-2501

From: Jen Belle
To: fortherecord (Energy)
Subject: Arctic National Wildlife Refuge
Date: Wednesday, November 15, 2017 1:29:06 PM

I am writing to register my opposition to opening the Arctic National Wildlife Refuge for oil and gas drilling. While I realize that there is a strong money-making argument for doing so, endangering wildlife and damaging this vital land trust is not worth the revenue. Further, fossil fuels companies are making extraordinary profits at this time, and we shouldn't be making any sacrifices to benefit them and their wealthy shareholders at the expense of our national wildlife refuge. Thank you.

Jennifer Belle
6673B NE Windermere Rd.
Seattle, WA 98115

From: Jenny Bell jones
To: fortherecord (Energy)
Cc: Hoefler, Annie (Energy)
Subject: For Record of November 2, 2017 Hearing, ANWR Drilling. "Chairman Murkowski, Ranking Member Cantwell, and Members of the Senate Energy and Natural Resources Committee."
Date: Thursday, November 02, 2017 4:27:12 PM

Chairman Murkowski, Ranking Member Cantwell, and Members of the Senate Energy and Natural Resources Committee: I am an Alaskan resident and have been on the voter rolls for twenty years. Not once during that time has any member of my Congressional Delegation ever contacted me to find out my opinion regarding opening ANWR to drilling so I respectfully provide that opinion here.

I oppose opening the Refuge to drilling. It is a bad move economically and a terrible move for the environment which we all share. I have worked on the North Slope and am fully aware of what oil and gas development there looks like; it is a fallacy that drilling in the Refuge will not create more of the same. The idea that "better technology" results in safer drilling is only true until the point when an accident occurs, and as long as humans are involved those accidents will happen because none of us are perfect. I worked in industrial construction for over 25 years and could tell you all manner of "human error" stories some of which caused serious harm; none of them were the fault of bad technology. A Refuge is a Refuge; if it was needed when it was created it is needed even more today as drilling activities encroach on ever more land around it.

The oil and gas industry is already hiring more non-residents than residents in Alaska so increased development will not likely result in more jobs for Alaskans. If the industry cannot currently fill openings with residents increased development will not change that. There is already increased development in other easier to reach and less environmentally sensitive areas of the State that will create jobs; let us first see if resident hire increases from that development. If indeed a "majority of Alaskans" support this development I ask you to consider the geography of the State. Asking a resident of Anchorage (where the majority of our population resides) whether they support drilling in ANWR is equivalent to asking someone in Boston what they think about fracking in Charleston North Carolina; most will never go there and probably have only a vague idea of what is actually involved in that development. As noted earlier in twenty years no one made any effort to count my voice against that "majority" which raises questions about how that majority was decided.

The world is moving away from fossil fuel use and at the same time there is a glut of oil. Oil produced from ANWR would be very expensive compared to oil from other locations and probably not economic unless there was huge rise in oil prices which is not likely in the near future. Destroying the Refuge under these economic conditions would provide little short-term gain with huge long-term costs.

Lastly I ask you to consider the animals; as a Native person I was raised to respect all species as equals. To date nobody has heard from the animals what they think about the disruption that oil and gas development brings into their lives. You and I may "co-exist" with industrial installations but that does not mean it is healthy for us to do so. If we can afford it we move further away so that we are not living downwind from refineries or next door to coal fired power plants; if we cannot afford it we are stuck with the unhealthy effects and all the stress that comes with them. Consider that the animals are in the second category; they cannot move away and will be stuck with living with all the ill health and stress that comes with a drilling rig next door. I witnessed that "co-existence" on the North Slope with caribou watching while I welded but I had no way to know if their eye sight was damaged because they did not complain. We all have an obligation to preserve places where animals can exist in peace without having to "co-exist" with things that may damage them forever.

Thank you for your consideration of my testimony.

Jenny Bell- Jones,
308 Noyes Street
Fairbanks
Alaska

From: Randy Beltz
To: fortherecord (Energy)
Subject: Chairman Murkowski, Ranking Member Cantwell, and Members of the Senate Energy and Natural Resources Committee
Date: Wednesday, November 01, 2017 2:57:02 PM

Chairman Murkowski, Ranking Member Cantwell, and Members of the Senate Energy and Natural Resources Committee

I am a lifelong Alaskan, proudly born and raised in our great State. My family's history dates back to the Territorial days prior to statehood and will continue with my children and grandchildren living, growing and working in the State.
I am a strong believer in responsibly developing the vast resources that our State has to offer for the good of not only our State but our Country. I would ask that you consider the following points as you all proceed with your hearing on allowing limited oil and gas activities in the ANWR area.

- Polls have consistently shown that we Alaskans overwhelmingly support responsible oil and gas development in the non-wilderness portion of ANWR. There is no valid reason why we should not be allowed to access resources within just a tiny fraction of the coastal plain.
- The proposed ANWR provision under consideration would allow development of no more than 2,000 acres of the 1.5 million acres of the Arctic coastal plain – part of the non-wilderness portion of ANWR's 19 million acres. That is equivalent to just 0.01 percent of the entire refuge.
- Responsible oil and gas development in this fraction of ANWR will help ensure America's energy security for decades and allow Alaska,– and our nation as a whole, to realize the benefits that come from expanding energy production in Alaska.
- While renewable energy is a growing part of America's energy portfolio, it is still projected to account for a minority of American energy production in 2040. New oil and gas production will be required to power America's economy and can serve as a bridge until renewable energy becomes a dominant energy source decades into the future.
- Energy production from ANWR has the potential to offset a decline in Lower 48 shale oil production, which is expected to commence in approximately a decade. Without limited oil development on the coastal plain, America will be forced to once again increase its reliance on foreign imports. With limited development in ANWR, America and Alaska can continue to grow the economy and reduce dependence on foreign oil.
- The U.S. Geological Survey estimates the 1002 Area is North America's greatest prospect for conventional onshore oil production, with a mean likelihood of containing 10.4 billion barrels of oil and 8.6 trillion cubic feet of natural gas, as well as a reasonable chance of economically producing 16 billion barrels of oil.
- Alaska's economic lifeline, the Trans-Alaska Oil Pipeline System (TAPS), is now running at three-quarters empty. New oil production from ANWR has the potential to reverse throughput in TAPS, a vital component of American energy

infrastructure.

- Oil development on a fraction of the coastal plain would create thousands of jobs nationwide, generate billions of dollars in government revenue, keep energy prices for American consumers affordable, and further improve energy security for decades into the future.
- Since the ANWR coastal plain is less than 60 miles from TAPS, development of energy resources there is one of the most environmentally-sound way to increase oil production in Alaska.

Thanks to continuing improvements in technology, practices, and oversight, the oil industry has demonstrated over the past 40 years that North Slope energy development and environmental stewardship can and do coexist. The industry has a proven track record of responsible development in sensitive areas, protecting the environment, wildlife and subsistence needs of local residents. I ask that you support and include the ANWR drilling provision in the budget reconciliation bill.

Respectfully yours,

Randy

Randy Beltz
2109 Cornell Court
Anchorage, AK 99508
Randyb@northstarak.com

From: Joanne
To: fortherecord (Energy)
Subject: Regarding the Senate Committee on Energy and Natural Resources" consid eration of Alaska's "Area 1002
Date: Wednesday, November 15, 2017 12:07:57 PM

Dear Senator Murkowski and Senator Cantwell,

I am concerned about the potential impact of allowing the Secretary of the Interior establish a leasing program for the development and production of oil and gas in Alaska's "Area 1002." The local and global environmental impacts of this decision would be catastrophic in many ways.

Our nation is already struggling with the effects of global climate change (think about those in Puerto Rico, Texas and elsewhere who are still trying to recover from massive hurricanes). It is unconscionable to continue to promote non-renewable energy sources at the cost of the rest of our citizens and the world.

Area 1002 is birthing ground to herds of caribou, a staple for indigenous tribes in the area, and any drilling of this area is controversial at best and certainly questionable. CBO analysis has shown that expected revenue from Arctic National Wildlife Refuge (ANWR) drilling would be significantly lower than suggested by the Trump administration. We should instead stop putting corporate profits ahead of the common good and stop subsidizing the fossil fuel industry elsewhere as a means of recovering costs/increasing revenue.

Thank you for your consideration. When this issue is debated in the Committee on Energy and Natural Resources, I urge you, as a concerned citizen, to do your part to protect Alaska's Wildlife Refuge. I ask that the committee find other means by which to produce federal revenue than reversing the ban on oil and gas drilling in the ANWR. We should not destroy protected public land, endanger wildlife and our planet to fund unnecessary tax breaks for the wealthy.

Sincerely,
Joanne Benkley
95 West Street
Easthampton, MA 01027

From: Cole Bennett
To: fortherecord (Energy)
Subject: Protect Alaska"s wildlife refuge from oil and gas companies
Date: Thursday, November 02, 2017 11:39:01 AM

I'm writing to ask that the committee find other means to produce federal revenue than reopening the Arctic National Wildlife Refuge for oil and gas drilling. We should not destroy protected land and endanger wildlife to fund unnecessary tax breaks for the wealthy. Please pass my message along to the Chairman and other committee members.

Cole Bennett
620 Sayre Ave.
Lexington, KY 40508
859.229.2091

From: Frank Bergstrom
To: fortherecord (Energy)
Cc: Hoefler, Annie (Energy)
Subject: For Record of November 2, 2017 hearing ANWR
Date: Tuesday, October 31, 2017 4:23:11 PM

Chairman Murkowski, Ranking Member Cantwell, and Members of the Senate Energy and Natural Resources Committee:

I am an Alaskan living in Alaska. We have a relatively small population and correspondingly limited economy whose major component is natural resource production, and in particular oil. Polls have consistently shown Alaskans support oil and gas production from ANWR. I personally have visited ANWR on three occasions floating rivers and hunting sheep. There is no valid reason why Alaska should not be allowed to develop its resources as contemplated at statehood. Only a tiny fraction of real estate would be affected, and the environmental effect would be minimal. It is imperative to personally see the minimal impacts of development at Prudhoe to properly assess the entirely acceptable nature of that development, especially when considering how pivotal oil production is to the Alaskan economy and the health and welfare of all Alaskans. The 2,000 acres of ANWR that would potentially be developed are not much more than a fish camp on the coastal plain's 19 million acres of non-wilderness. That is one hundredth of a percent, or one tenth of a permil. It is unreasonable to suggest that wilderness in a non-wilderness area cannot sustain that level of development.

Renewable energy is a fine thing and so is oil. We cannot walk away from oil without increasing the cost of electricity, and more importantly, transportation fuels for the foreseeable future. We need oil, we have oil, and we should be drilling oil where it is proximal to the pipeline. That is, in ANWR. The oil is there, the Alaskan economy requires its development to emerge from recession, and we need throughput in the Trans-Alaska pipeline to maintain the pipeline. Is this not a reasonable compromise?

When we fly over and onto the north slope at Prudhoe we can see how minimal an impact the largest contributor to the Alaskan economy has had over 40 years. It is staggering how minimal the impact is. North slope energy production is a spectacular environmental, social, and economic success. We need to do more! Please let Alaskans manage Alaska. Senator Murkowski is always welcome as are all committee members.

Regards,

Frank Bergstrom
PO Box 22909
Juneau, AK 99802
frank.b@gci.net
907-523-1995

From: Joshua Berry
To: fortherecord (Energy)
Subject: Chairman Murkowski, Ranking Member Cantwell, and Members of the Senate Energy and Natural Resources Committee
Date: Wednesday, November 01, 2017 8:06:57 PM

To whom it may concern:

I, Joshua Berry, a resident of the State of Alaska, am writing in support of the opportunity under consideration by the Senate Energy and Natural Resources Committee to open up a portion of ANWR to responsible oil and gas development. This measure will create many jobs, and provide a massive positive impact on the Alaskan economy, as well as a positive impact on the national economy and national job market.

Since current oil production in Alaska and many other parts of the US is declining or is expected to decline faster than renewable fuels are growing, and the proposed development of ANWR would only utilize a miniscule one hundredth of one percent of the overall area of ANWR, the benefits of this measure far outweigh the potential costs. Much of the infrastructure (TAPS) is already available to transport the oil produced safely and efficiently, and the drilling, production, and transportation of these untapped natural resources will benefit Alaska and the US. Those of us who work in the industry are committed to utilizing the natural resources of Alaska in a safe and environmentally responsible way, and are constantly leveraging new technologies in order to do so.

Regards,

Joshua Berry
Automation Engineer
Dowland-Bach
Automation & Controls Division
Office: 907.550.5851
6130 Tuttle Place, Ste A
Anchorage, AK 99507
http://www.dowlandbach.com/

From: Clay Bezenek
To: fortherecord (Energy)
Date: Tuesday, October 31, 2017 6:46:18 PM

Sen Murkowski,
Sen Cantwell,
All Members of the Senate energy and Natural resources committee,

Thanks for bringing up the idea of expanding the sales area for the potential harvest of oil up north!!
As a 25 yr Alaskan commercial fisherman, I applaud this effort!!
Oil is our bread and butter resource in this state, and the expansion of this potential sales area will greatly enhance our ability as a state to bolster up our states economy.
As a rather new state, this economic boost will help with infrastructure that all the other "mature" states take for granted.
Your vote of support in this matter is greatly appretiated.
Thanks for your time,
Clay Bezenek
1617 water st
Ketchikan Ak
99901

Sent from my iPhone

From: Rep. Chris Birch
To: fortherecord (Energy)
Subject: Support opening the ANWR 1002 set-aside area for oil and gas development
Date: Tuesday, October 31, 2017 4:07:48 PM

Dear Energy Committee,

Thank you for this opportunity to testify in support of congressional fulfillment of the longstanding promise of Alaska oil and gas development in the 1002 set aside area of the Arctic National Wildlife Refuge (ANWR).

- Open the ANWR coastal plain (1002 area) to exploration and production.

- Require timely lease sales.

- Streamline and simplify the permitting process.

- Provide for 50:50 federal/state revenue sharing, rather than the 90:10 percentage split under current law that disadvantages Alaska - alone among oil producing states.

- Alaska favors responsible development and protecting the environment.

- Technically recoverable oil within the ANWR 1002 area (excluding State and Native owner areas) is estimated to be between 4.3 and 11.8 billion barrels, with a mean value of 7.7 billion barrels.

Thanks, Chris

Chris Birch, P.E.
Representative, Alaska House District 26
State Capitol, Room 112
Juneau, AK 99801-1282
(907) 465-4931
rep.chris.birch@akleg.gov
https://m.facebook.com/akrepbirch/

From: g
To: fortherecord (Energy)
Subject: Please do not open up the Alaska"s Arctic National Wildlife Refuge to oil and gas drilling
Date: Tuesday, November 14, 2017 4:12:02 PM

Dear Senate Committee Members on Energy and Natural Resources,

Please do not open up Alaska's Arctic National Wildlife Refuge to oil and gas drilling. Congress banned fossil fuel development and drilling in that area in 1980. While the Trump Administration believes Federal revenue can be levied from drilling in this area, the CBO said that it would bring in less than what the administration anticipates.

In the meantime, there are many species of wildlife that are protected in this area, as well as indigenous tribes whose land would be encroached.

Please do not open up the ANWR - preserve this land, and the environment and tribes that live there. We need to protect these areas for future generations.

Sincerely,
-Jennifer Birkenhead
11 Edgewood Rd
Sharon, MA 02067
781-784-1436

From: Ida Tarbell
To: fortherecord (Energy)
Subject: Don"t Drill in the Arctic National Wildlife Refuge
Date: Wednesday, November 15, 2017 4:39:33 PM

Dear distinguished members of the Senate Committee on Energy and Natural Resources,

I am writing to urge you to prevent drilling in the Arctic National Wildlife Refuge. First of all, our national parks and refuges are treasures that belong to the next generation of Americans. Please don't rob them of their birthright to make a quick buck for a dying industry. Second, as leaders of the free world, we need to wean ourselves off fossil fuels. By burying our heads in the sand and moving forward with new oil development, we are missing a crucial busniess opportunity. American ingenuity and busniess should be leading the way in developing, marketing and selling clean energy products to the rest of the world. By supporting dying models at the expense of wildlife, we are setting ourselves back. Show that you are true Americans and not industry hacks by preventing this project from advancing.

Thank you.

Valerie Bischoff
15792 Fawn Ln
Reno NV 89511

From: John Bitney
To: fortherecord (Energy)
Cc: Hoefler, Annie (Energy)
Subject: Please support ANWR 1002 exploration
Date: Wednesday, November 01, 2017 2:31:14 PM

Chairman Murkowski, Ranking Member Cantwell, and Members of the Senate Energy and Natural Resources Committee

Thank you for this opportunity to express my support for Congress to authorize reasonable exploration of the 1002 area in ANWR.

My family moved to in Alaska in 1967, and my wife's family has lived here since 1948. Both of our families have watched Alaska grow from statehood into the place we call home today.

We trust that you, as our elected leaders, will make the right decision and allow for oil and gas exploration in the 1002 area of ANWR. Its important for our nation, the people of Alaska, and the local residents who have lived on the North Slope for thousands of years.

As Alaskans, no one cares more about developing in a responsible manner more than us. This is our home, our community, and the land where people have subsisted for generations. We care about this place, and we want to see things done right.

The future of our family in Alaska depends on the opportunity for our children and grandchildren to have a good job and a warm house. Your actions will impact their ability to have those opportunities here in Alaska, and also for others across our nation.

Thank you for your time and consideration.

John W. Bitney
PO Box 521072
Big Lake, Alaska 99652
(907) 317-0038

From: Sara Bixler
To: fortherecord (Energy)
Subject: Please DO NOT drill in ANWR
Date: Wednesday, November 15, 2017 2:50:06 PM

I am writing today to state my position on the question of further drilling in the Alaska National Wildlife Refuge -- It cannot be allowed. We have so few spots of pure wildness left, and I strongly believe they should remain as untouched as possible.

But aside from that argument, that particular chunk of land -- vast though it is -- is home to a staggering array of co-dependent wildlife and flora on the tundra that each needs EACH OTHER to remain viable. More drilling will continue a negative cascade effect, and it will end with population decimation (if not species annihilation) and then -- very soon -- the oil reserves will be gone anyway, and it will have been for nothing.

Please know that I STRONGLY DISAGREE with any drilling in ANWR at all. I am a 45 year old registered voter. I have voted in every election since I turned 18. I am a proud American. A mom, a wife, a community member, and I work full-time and pay my taxes, grateful for the social services that they fund.

Thank you for reading.

Sincerely,
Sara Bixler

332 Lear Court
Windsor, CA 95492

Sara C. Bixler
415-847-6647
Saracbixler@gmail.com

From: Maureen BG
To: fortherecord (Energy)
Subject: Artic wildlife refuge.
Date: Tuesday, November 14, 2017 2:08:30 PM

I want to go on the record as opposing any opening of the Arctic National Wildlife Refuge for oil and gas drilling. We should not be drilling in a beautiful pristine wilderness when there are other means of investing in energy. We should be investing in green energy, not drilling for more fossil fuels. This is a giveaway for oil companies at the expense of wildlife and the native people of Alaska. I think we have a short memory when it comes to the danger of oil spills and how the Exxon Valdez destroyed Prudhoe Bay. Please do not consider opening this pristine wilderness. Sincerely Maureen Blais-Gestrich, 5687 Country Walk Lane, Sarasota, Florida, 34233.

From: Renee Bogue
To: fortherecord (Energy)
Subject: Oppose any reopening of the Arctic National Wildlife Refuge for oil and gas drilling.
Date: Tuesday, November 14, 2017 3:46:38 PM

I'm demanding that the committee find other means to produce federal revenue than reopening the Arctic National Wildlife Refuge for oil and gas drilling. We should not destroy protected land and endanger wildlife to fund unnecessary tax breaks for the wealthy.

Renee Bogue
204 Willow Ave. NE
Massillon, OH 44646
330-833-7753

From: Zach Boldrick
To: fortherecord (Energy)
Subject: Chairman Murkowski, Ranking Member Cantwell, and Members of the Senate Energy and Natural Resources Committee
Date: Wednesday, November 01, 2017 1:26:51 PM

My name is Zach Boldrick, I live in Anchorage Alaska and I support the opening of ANWR for resource development. Continuing to develop onshore production I believe is the safest way to extract petroleum that for now is a lynchpin in modern society.

Zach Boldrick, P.E.
Mechanical Engineer
Dowland-Bach Corp
(907) 550-5831
www.dowlandbach.com

From: Marc and Cathy Bond
To: fortherecord (Energy)
Subject: Please Open the ANWR Coastal Plain to Oil & Gas Exploration
Date: Wednesday, November 01, 2017 2:22:07 PM

I write to urge the Senate to vote to allow oil and gas exploration in the Coastal Plain of the Arctic National Wildlife Refuge (ANWR), the area identified in Section 1002 of the Alaska National Interest Lands Conservation Act (ANILCA).

The proposed ANWR provision would allow development of no more than 2,000 acres of the 1.5 million acres of the Arctic coastal plain – part of the non-wilderness portion of ANWR's 19 million acres. That is equivalent to just 0.01 percent of the entire refuge.

Responsible oil and gas development in this fraction of ANWR will help ensure America's energy security for decades and allow Alaska – and our nation as a whole – to realize the benefits that come from expanding energy production in Alaska.

The U.S. Geological Survey estimates the 1002 Area is North America's greatest prospect for conventional onshore oil production, with a mean likelihood of containing 10.4 billion barrels of oil and 8.6 trillion cubic feet of natural gas, as well as a reasonable chance of economically producing 16 billion barrels of oil.

Alaska's economic lifeline, the Trans-Alaska Oil Pipeline System (TAPS), is now running at three-quarters empty. New oil production from ANWR has the potential to reverse throughput in TAPS, a vital component of American energy infrastructure.

Fifty years of studying the Central Arctic Caribou Herd, which lives in and among the current oil and gas development around Prudhoe Bay, demonstrates that caribou easily coexist within and around oil and gas fields. There is no reason to believe that the Porcupine Caribou Herd will suffer from oil and gas development in the 1002 Area.

Please vote for American energy security and American jobs.

Sincerely,
Marc Bond
14270 Park Hills Circle
Anchorage, AK 99516

From: Tom Boutin
To: fortherecord (Energy)
Cc: ""annie_hoefler@energy.senate.gov.""@mail40c28.carrierzone.com
Subject: For Record of November 2, 2017 Hearing
Date: Tuesday, October 31, 2017 3:41:33 PM

Chairman Murkowski, Ranking Member Cantwell, and Members of the Senate Energy and Natural Resources Committee,

Please do everything you can to open the ANWR coastal plain (1002 area) to oil exploration and production. Alaska has demonstrated responsible oil development for 40 years. America needs this oil and these jobs. In all likelihood there are 7.7 billion barrels of oil. Developing that oil will impact only 3 square miles in an area larger than the state of Connecticut.

Please provide for timely lease sales in ANWR. Please require the administration to streamline and simplify the permitting process.

ANWR needs to have a 50 percent-50 percent federal-state revenue sharing, rather than the 90-10 percent split under current law.

Thank you.

Tomas Boutin
15635 Glacier Highway
Juneau, Alaska
(907) 789-7936

From: Bruce Bowler
To: fortherecord (Energy)
Subject: November 2 Hearing on ANWR
Date: Tuesday, October 31, 2017 7:34:41 PM

Chairman Murkowski, Ranking Member Cantwell, and Members of the Senate Energy and Natural Resources Committee.
For Record of November 2, 2017 Hearing

Ladies and Gentlemen:
My wife and I ask that you Open the ANWR coastal plain (1002 area) to exploration and production. Require timely lease sales • Streamline and simplify the permitting process
Provide for a 50 percent-50 percent federal-state revenue sharing, rather than the 90-10 percent split under current law.
We Alaskans favor responsible development and protecting the environment.
The area proposed for drilling is similar to putting a dime on the wall of your living room.

Bruce and Judy Bowler
PO Box 32719
Juneau, Alaska

From: Deryl Box
To: fortherecord (Energy)
Cc: Hoefler, Annie (Energy)
Subject: For Record of November 2, 2017 Hearing
Date: Wednesday, November 01, 2017 11:50:10 AM

Chairman Murkowski, Ranking Member Cantwell, and Members of the Senate Energy and Natural Resources Committee,

I support limited development of the oil and gas resources in the non-wilderness coastal plain of the Arctic National Wildlife Refuge. The long-term economic health of the State of Alaska and the United States of America are in jeopardy if we do not take advantage of the resources that we are blessed with as a state. We have many examples of responsible development in our state, so we know we can develop resources and protect the environment that we all enjoy.

Thank you for the opportunity to express my opinion,

Deryl Box
570 Kentshire Drive
Fairbanks, AK 99709

From: Randy Ikee
To: fortherecord (Energy)
Subject: RE: Drilling in the Artic National Wildlife Refuge
Date: Friday, November 10, 2017 8:23:17 AM

I oppose any legislation to allow exploratory drilling in the Article National Wildlife Refuge.

Although I have not done so for the last 5 years as I've aged, I used to take regular trips in June to the Refuge, mainly hiking along the Jago and Aischilik River drainages to watch birds and the caribou migration. There is no other place like ANWR on earth. It's no lie when people describe it as the American Serengeti. Where else can you stand in the open and see foxes, wolves, grizzlies, snowy owls, and hundreds of caribou from the same vantage point? The area is a national treasure and must be protected from drilling and oil exploration. The money to be extracted by oil exploration and drilling will never make up for the loss of ANWR's wildlife habitat.

Please maintain protection of ANWR from oil exploration.

God Bless You.

Michael Boyd
8429 SE 63rd ST
Mercer Island, WA 98040

From: Becca Brado
To: fortherecord (Energy)
Cc: Hoefler, Annie (Energy)
Subject: Support for ANWR drilling provision
Date: Tuesday, October 31, 2017 7:15:22 PM

Chairman Murkowski, Ranking Member Cantwell, and Members of the Senate Energy and Natural Resources Committee:

When it comes to Energy, it starts with understanding two simple truths:

- Energy is a necessary component of an Economy – a fundamental underpinning of any and every modern Economy.
- The availability and affordability of Energy impacts, for better or worse, all other aspects of an Economy – either greasing the wheels of progress and fueling the engines of economic growth, or draining the well of financial capital and sapping economic vitality.

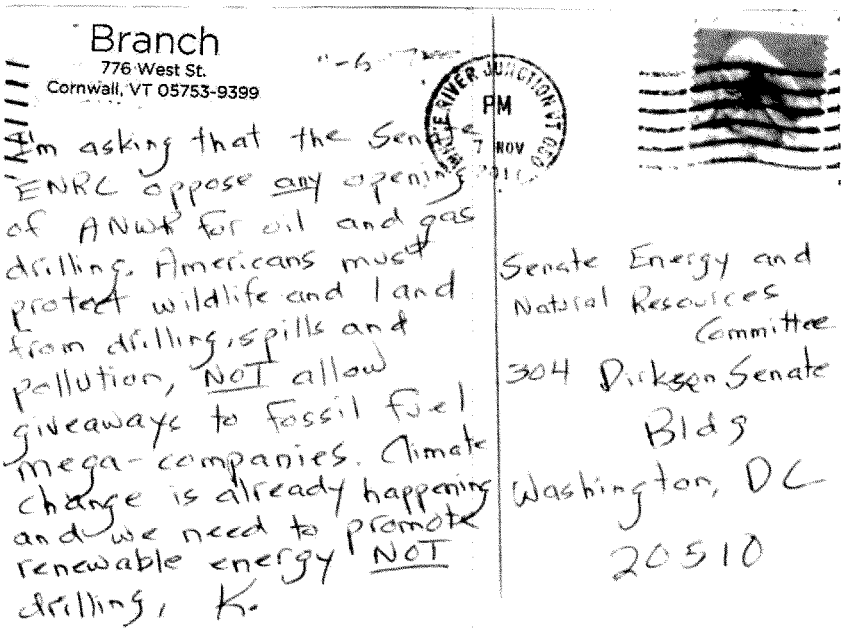
At the Fairbanks Economic Development Corporation, we recognize these truths and how our Community's over-reliance on high priced oil (particularly for space heating and electrical generation) is having an increasingly constrictive effect our local economy and a crushing impact on the finances our homes and businesses.

For these reasons, FEDC expends enormous effort analyzing options to both stabilize and reduce our individual and community cost of energy, and works tirelessly advocating for and seeking to advance our community's most promising renewable, alternative and conventional energy solutions.

Development of a tiny fraction of ANWR has the potential for having a huge impact on the economy of this state, and the country as a whole. Oil development here could mean thousands of jobs, billions of dollars in government revenue, affordable energy prices, and ensure energy security for decades into the future. It also means that much needed new oil will fill the Trans-Alaska Pipeline, which is now running at three-quarters empty.

Thank you,

Becca Brado
Project Manager: Energy, Military & Mining
Director, Young Professionals Council
Fairbanks Economic Development Corporation
330 Wendell Ave, Ste E, Fairbanks, AK 99701
Office: 907-452-2185; Cell: 907-987-2807



Branch
776 West St.
Cornwall, VT 05753-9399

WHITE RIVER JUNCTION VT 050
PM
7 NOV

I'm asking that the Sen... ENRC oppose any opening of ANWR for oil and gas drilling. Americans must protect wildlife and land from drilling, spills and pollution, NOT allow giveaways to fossil fuel mega-companies. Climate change is already happening and we need to promote renewable energy NOT drilling. K.

Senate Energy and Natural Resources Committee
304 Dirksen Senate Bldg
Washington, DC
20510

From: Kim Brandenburg
To: fortherecord (Energy)
Cc: Hoefler, Annie (Energy)
Subject: For Record of November 2, 2017 Hearing
Date: Wednesday, November 01, 2017 7:29:50 PM

To: Chairman Murkowski, Ranking Member Cantwell and Members of the Senate Energy and Resources Committee

My name is Kim Brandenburg and I ***strongly support*** responsible oil and gas development on the Alaska Coastal Plain.

· Polls have consistently shown Alaskans overwhelmingly support responsible oil and gas development in the non-wilderness portion of ANWR. There is no valid reason why we should not be allowed to access the world-class resources within just a tiny fraction of the coastal plain.

· Responsible oil and gas development in this fraction of ANWR will help ensure America's energy security for decades and allow Alaska – and our nation as a whole – to realize the benefits that come from expanding energy production in Alaska.

· While renewable energy is a growing part of America's energy portfolio, it is still projected to account for a minority of American energy production in 2040. New oil and gas production will be required to power America's economy and can serve as a bridge until renewable energy becomes a dominant energy source decades into the future.

· Energy production from ANWR has the potential to offset a decline in Lower 48 shale oil production, which is expected to commence in approximately a decade. Without limited oil development on the coastal plain, America will be forced to once again increase its reliance on foreign imports. With limited development in ANWR, America and Alaska can continue to grow the economy and reduce dependence on foreign oil.

· The U.S. Geological Survey estimates the 1002 Area is North America's greatest prospect for conventional onshore oil production, with a mean likelihood of containing 10.4 billion barrels of oil and 8.6 trillion cubic feet of natural gas, as well as a reasonable chance of economically producing 16 billion barrels of oil.

· Alaska's economic lifeline, the Trans-Alaska Oil Pipeline System (TAPS), is now running at three-quarters empty. New oil production from ANWR has the potential to reverse throughput in TAPS, a vital component of American energy infrastructure.

· Oil development on a fraction of the coastal plain would create thousands of jobs nationwide, generate billions of dollars in government revenue, keep energy prices for American consumers affordable, and further improve energy security for decades into the future.

· Since the ANWR coastal plain is less than 60 miles from TAPS, development of energy resources there is one of the most environmentally-sound way to increase oil production in Alaska.

· Thanks to continuing improvements in technology, practices, and oversight, the oil industry has demonstrated over the past 40 years that North Slope energy development and environmental

stewardship can and do coexist. The industry has a proven track record of responsible development in sensitive areas, protecting the environment, wildlife and subsistence needs of local residents.

Respectfully,

Kim A. Brandenburg
Lead Dispatcher
Teamsters Local 959
751 Old Richardson Hwy. Suite 127
Fairbanks, Ak 99701
907-450-6123
907-452-5051 (fax)

From: Sam Brice
To: fortherecord (Energy)
Cc: Hoefler, Annie (Energy)
Subject: For Record of November 2, 2017 Hearing
Date: Wednesday, November 01, 2017 12:04:26 PM

To Chairman Murkowski, Ranking Member Cantwell, and Members of the Senate Energy and Natural Resources Committee:

As a life-long Alaskan that makes a living in the responsible development of our natural resources and infrastructure while also enjoying the amazing beauties of our great state, I would like to go on record as supporting responsible oil and gas development on the Coastal Plain of Alaska in ANWR.

The proposed ANWR provision would allow development of no more than 2,000 acre of the 1.5 million acres of the Arctic coastal plain - part of the non-wilderness portion of ANWR's 19 million acres. That is equivalent to just 0.01 percent of the entire refuge.

Responsible oil and gas development in this fraction of ANWR will help ensure America's energy security for decades and allow Alaska - and our nation as a whole - to realize the benefits that come from expanding energy production in Alaska.

Alaska's economic lifeline, the Trans-Alaska Oil Pipeline System (TAPS), is now running at three-quarters empty. New oil production from ANWR has the potential to reverse throughput in TAPS, a vital component of American energy infrastructure.

Oil development on a fraction of the coastal plain would create thousands of jobs nationwide, generate billions of dollars in government revenue, keep energy prices for American consumers affordable, and further improve energy security for decades into the future.

Since the ANWR coastal plain is less than 60 miles from TAPS, development of energy resources there is one of the most environmentally-sound way to increase oil production in Alaska.

Thanks to continuing improvements in technology, practices, and oversight, the oil industry has demonstrated over the past 40 years that North Slope energy development and environmental stewardship can and do coexist. The industry has a proven track record of responsible development in sensitive areas, protecting the environment, wildlife and subsistence needs of local residents.

Thank you for allowing me to submit comments on this vitally important decision for the State of Alaska and our nation.

Sam Robert Brice
504 Bennington Drive
Fairbanks, AK 99709

From: Christopher Briggs
To: fortherecord (Energy)
Subject: Protect the Arctic National Wildlife Refuge
Date: Wednesday, November 15, 2017 9:28:28 AM

My name is Christopher and I'm a citizen from 212 N Duke St Durham, NC 27701 and I ask that the committee find other means to produce federal revenue than reopening the Arctic National Wildlife Refuge for oil and gas drilling. We should not destroy protected land and endanger wildlife to fund unnecessary tax breaks for the wealthy. Please pass my message along to the Chairman and other committee members.

--

Christopher Briggs
Chrismbriggs@gmail.com

From: Greg Brooker
To: fortherecord (Energy)
Subject: ANWR opening
Date: Wednesday, November 01, 2017 7:19:16 PM

Senator,

Opening the Arctic to oil exploration and extraction is a great idea for the country as well as Alaska.
The revenues to Alaska from the additional resource development are much needed. The security provided by the ready availability of the oil is good for our United States.
There are no reasonable or realistic reasons not to open the area. As has been demonstrated for over 40 years, the activity has no negative affect on Caribou populations, in some cases it has been beneficial. Other wildlife in the area is also not affected or benefitted, but there is no indication of negative. I have been there and seen the caribou walk under the pipeline as if it didn't exist, I have seen the foxes playing on production pads, small rodents are everywhere around the fields and camps and the foxes and birds of prey are flourishing because of them.

Environmental hazards are mitigated to the point of being non-starters. The companies have honed spill responses to a fine tuned response and remediation reaction, but they seldom have anything to do because the rest of the operations are efficiently operated and maintained. This would not change in ANWR.

Please open the refuge coastal plain, we need the revenue, we need the jobs, we need the product.

Greg Brooker
Wasilla, Alaska
907-373-3977

From: Wiley Brooks
To: fortherecord (Energy)
Subject: I support opening ANWR to responsible exploration
Date: Tuesday, October 31, 2017 3:23:18 PM

"Dear Chairman Murkowski and Ranking Member Cantwell,
I am an Alaskan that supports the opening of the 1002 area of the Arctic National Wildlife Refuge. Alaskans have developed the North Slope oil fields responsibly and will continue to do so with NO effects to the Arctic Caribou herd or any other animal species. We are the caretakers of the environment and we need you to vote in favor of development."

Please be a part of making history and voice your support. Thanks

Wiley Brooks
3013 Eaglek Bay Circle
Anchorage, AK 99515

North Slope Borough

OFFICE OF THE MAYOR

P.O. Box 69
Barrow, Alaska 99723
Phone: 907 852-2611 or 0200
Fax: 907 852-0337 or 2595

Harry K. Brower Jr., Mayor

November 1, 2017

The Honorable Lisa Murkowski
Chair, Committee on Energy and Natural Resources
U.S. Senate
304 Dirksen Senate Office Building
Washington, DC 20510

RE: Senate Committee on Energy and Natural Resources Hearing to Receive Testimony on the Potential for Oil and Gas Exploration in the 1002 Area of the Arctic National Wildlife Refuge

Dear Senator Murkowski:

Thank you for holding a hearing before the Senate Committee on Energy and Natural Resources to receive testimony on the potential for oil and gas exploration and development within the Coastal Plain of the Arctic National Wildlife Refuge, or ANWR.

As you know, the North Slope Borough is the largest municipality in the United States geographically. The Borough encompasses an area of over 95,000 sq. miles—roughly the size of the State of Wyoming. The majority of the Borough's 10,420 residents are Iñupiat, and live a subsistence lifestyle, dependent upon the wildlife resources of our traditional lands and waters for our physical health and our cultural and spiritual well-being.

ANWR is located in the eastern portion of the Borough and encompasses an area of slightly larger than 30,000 sq. miles. That is roughly the same size as Massachusetts, Rhode Island, Vermont and New Hampshire combined. Located within its boundaries of ANWR is Kaktovik, an Iñupiat village with a population of roughly 300.

The North Slope Borough provides essential public services to residents living in all eight of our villages scattered across the North Slope, from the Canadian border in the east to the Chukchi Sea in the west. Our residents value their culture and their traditional way of life. Our residents also value the benefits of technology, education, adequate health care, decent housing, clean drinking water, and fire and police protection.

Prior to the discovery of oil at Prudhoe Bay on the North Slope, our residents had no economy, few jobs and lived well below the poverty level. After the discovery of oil at Prudhoe Bay, the formation of the Borough in the early 1970's enabled us to generate tax revenues from the industrial activities taking place there. The development of the oil resource at Prudhoe Bay has allowed the North Slope Borough to provide our residents with schools, medical facilities and other basic public infrastructure and services that are taken for granted in the rest of the United States. In addition, development of the North Slope oil resource has created a range of employment opportunities for our residents.

As you know, the Iñupiat people have utilized our North Slope oil resources since time immemorial. The Borough's first mayor, Mayor Eben Hopson, put it this way:

"Oil and gas is no new thing among us. Not many people realize that our people have been heating their homes and cooking their food with oil for thousands of years. There are oil seeps throughout our region, and on our way to our hunting camps, we would cut oil-saturated tundra into blocks. Returning from camp in the fall, we would collect these bricks of congealed pitch and tundra and burn them much the same way that urban homeowners use artificial particle logs sold in supermarkets for their fireplaces."

Unfortunately, modern oil production at Prudhoe Bay has declined significantly. That means that our continued ability as a modern government to upgrade infrastructure and provide services within our communities is at risk. A narrowly-tailored oil and gas exploration and development program within ANWR would provide the critically important support we need to continue to invest in infrastructure and public services in our communities, while also protecting our environment, subsistence, caribou, and other important resources in our region.

While I am always mindful of the need to protect the environment and our subsistence way of life, the Borough and the majority of our residents have long supported the careful development of oil and gas resources on the Coastal Plain of ANWR.

Our people, working through the North Slope Borough and our regional corporations, will act in the same careful, responsible, and cautious manner we always have when dealing with our lands and the seas. We have the greatest stake possible in seeing that any and all development is done in such a way as to keep this land safe, because it is our world. It is where we live. It holds the remains of our ancestors. It holds the economic future of our state's children and grandchildren.

Sincerely,

Harry Brower

Harry K. Brower, Jr.
Mayor, North Slope Borough

From: Arthur Brown Sr
To: fortherecord (Energy)
Subject: Opening "1002 Area" of ANWR
Date: Wednesday, November 01, 2017 12:13:48 PM

Dear Committee and Senator Murkowski, I am sending this in support of the opening of the oil and gas exploration and retrieval in the area "1002" or the "Coastal Plain" as our oil production has fallen off, the national need for oil and gas has not declined and we in Alaska want and need this resource to be used for Alaskans and the nation.
Thank you, Arthur L. Brown Sr. theoldman907@gmail.com
Eagle River AK 99577

From: Hamilton Brown
To: fortherecord (Energy)
Subject: Drilling the Arctic National Refuge
Date: Monday, November 13, 2017 11:23:33 AM

Dear Committee:

I am opposed to any legislation to open the Arctic National Wildlife Refuge to drilling. The Arctic is at high risk of environmental degradation and the Refuge is an incredibly diverse ecological area. We do not need more fossil fuels extracted and certainly not more income to pay for the tax giveaway to the rich.

Hamilton Brown
PO Box 399
Arroyo Seco, NM 87514
575 776 1542
d575 770 4291 iPhone
bones40@taosnet.com

From: Lou Brown
To: fortherecord (Energy)
Subject: Opposition to Arctoc Refuge Provision in Tax Plan
Date: Tuesday, November 14, 2017 3:18:15 PM

To: Chairman Murkowski, Ranking Member Cantwell, and Members of the Senate Energy and Natural Resources Committee

For Record of November 2, 2017 Hearing

I am writing to request that this hearing record my **opposition** to the Arctic Refuge Provision in the tax plan currently being debated.

I have been to the Arctic National Wildlife Refuge numerous times and have paddled down the Aichilik from its headwaters to Kaktovik as well as traveling by canoe the length of the Colville to Umiat. I have also paddled the Canning River from the Marsh Fork to the coastal plain and have hiked across the mountain passes and along the rivers of the Brooks Range on many different trips over the 30 years that I have lived in Alaska.

From these experiences I can assure you that the Arctic Refuge "1002 area" (or Coastal Plain) is an incredibly productive and sensitive area that is deserving of preservation for the benefit of animals, birds and future generations. It is important to consider that, in our fast-changing world, these future generations will have fewer and fewer opportunities to experience true wilderness which makes protection of the high-quality wilderness of Alaska of special concern and importance not only to Alaskans but to the global community as well.

Moreover, as you know, the coastal plain is the birthing ground for the almost 200,000 animal Porcupine caribou herd, and is a denning area for soon-to-be-endangered polar bears. It is an irony that the burning of the very fossil fuels that the oil industry is so eager to acquire in the 1002 is today responsible for the endangerment of the polar bear which rely on sea ice for their survival.

Finally, as you are also aware, the 1002 is the nesting and breeding ground for millions of migratory birds whose habitat is fast diminishing in the lower 48 states.

Again, I urge you to strip out the provision in the tax plan that would include revenues from the ANWR to help balance the budget. This issue is much too important to not be debated on its own merits.

Thank you for considering my thoughts on this important matter.

Linda (Lou) Brown
2630 Home Run
Fairbanks, AK 99709

--

Lou Brown
2630 Home Run
Fairbanks, AK 99709
(907) 669-0286
loubrown1952@gmail.com

From: Michelle Brown
To: fortherecord (Energy); Hoefler, Annie (Energy)
Subject: For Record of November 2, 2017 Hearing
Date: Wednesday, November 01, 2017 4:48:49 PM

Chairman Murkowski, Ranking Member Cantwell, and Members of the Senate Energy and Natural Resources Committee:

Polls have consistently shown Alaskans overwhelmingly support responsible oil and gas development in the non-wilderness portion of ANWR. There is no valid reason why we should not be allowed to access the world-class resources within just a tiny fraction of the coastal plain.

The proposed ANWR provision would allow development of no more than 2,000 acres of the 1.5 million acres of the Arctic coastal plain – part of the non-wilderness portion of ANWR's 19 million acres. That is equivalent to just 0.01 percent of the entire refuge.

Responsible oil and gas development in this fraction of ANWR will help ensure America's energy security for decades and allow Alaska – and our nation as a whole – to realize the benefits that come from expanding energy production in Alaska.

While renewable energy is a growing part of America's energy portfolio, it is still projected to account for a minority of American energy production in 2040. New oil and gas production will be required to power America's economy and can serve as a bridge until renewable energy becomes a dominant energy source decades into the future.

Energy production from ANWR has the potential to offset a decline in Lower 48 shale oil production, which is expected to commence in approximately a decade. Without limited oil development on the coastal plain, America will be forced to once again increase its reliance on foreign imports. With limited development in ANWR, America and Alaska can continue to grow the economy and reduce dependence on foreign oil.

The U.S. Geological Survey estimates the 1002 Area is North America's greatest prospect for conventional onshore oil production, with a mean likelihood of containing 10.4 billion barrels of oil and 8.6 trillion cubic feet of natural gas, as well as a reasonable chance of economically producing 16 billion barrels of oil.

Alaska's economic lifeline, the Trans-Alaska Oil Pipeline System (TAPS), is now running at three-quarters empty. New oil production from ANWR has the potential to reverse throughput in TAPS, a vital component of American energy infrastructure.

Oil development on a fraction of the coastal plain would create thousands of jobs nationwide, generate billions of dollars in government revenue, keep energy prices for American consumers affordable, and further improve energy security for decades into the future.

Since the ANWR coastal plain is less than 60 miles from TAPS, development of energy resources there is one of the most environmentally-sound way to increase oil production in Alaska.

Thanks to continuing improvements in technology, practices, and oversight, the oil industry has demonstrated over the past 40 years that North Slope energy development and environmental stewardship can and do coexist. The industry has a proven track record of responsible development in sensitive areas, protecting the environment, wildlife and subsistence needs of local residents.

Michelle Brown
Harvest Alaska
Regulatory Compliance Specialist
(907) 777-8459
mibrown@hilcorp.com

From: Jennifer A Brown
To: fortherecord (Energy)
Cc: Hoefler, Annie (Energy)
Subject: For Record of November 2, 2017 Hearing.
Date: Thursday, November 09, 2017 7:37:32 AM

Dear Chairman Murkowski, Ranking Member Cantwell, and Members of the Senate Energy and Natural Resources Committee,

We do NOT want to see the 1002 area of the Arctic Refuge opened to oil and gas exploration and development. Enough of the North Slope is a network of roads and generators, trash and flares. We believe that the best way to pass on a heritage like the Arctic Refuge to the next generation is intact as we found it. We want it to continue as it always has been, to leave it for you to find that way, rich in life and full of surprises--in the words of Gwich'in elder Sarah James "the world the way the creator made it".

Russ and Jennifer Brown
25 Allen Point Road
South Hero, VT 05486
(802) 372-5168

Virus-free. www.avast.com

From: Thor Brown
To: fortherecord (Energy)
Cc: annie
Subject: Opening ANWAR Area 1002
Date: Wednesday, November 01, 2017 3:52:55 PM

Chair Murkowski, Ranking Member Cantwell, and Members of the Senate Energy and Natural Resources Committee

As a representative of many working Alaskans in the state, I would like to show my support for opening the 1002 Area of ANWAR. With the pipeline operating at a reduced level, jobs and income to the state have been drastically impacted. The area that is being proposed for development is tiny in relation to the overall size of the refuge. In addition to the small relative size of the development area, the technology employed in modern drilling technics are more efficient and smaller than the equipment used in the past. This further reduces the impact on the landscape and the environment as a whole. Onshore drilling is a proven safe and reliable industry that has huge impacts on the state's economy and the incomes of people who live here. Please support the opening of Area 1002 for responsible development, more jobs for Alaskans and better funding to the state for the services we all use.

Thor Brown
Business Representative
International Brotherhood of Teamsters Local 959
520 E. 34th Ave., Suite 102
Anchorage, Alaska 99503
(907) 751-8527 Office
(907) 240-0709 Cell
TBrown@akteamsters.com

From: Zachary Brown
To: fortherecord (Energy)
Subject: Please do not open ANWR for oil drilling
Date: Tuesday, November 07, 2017 2:09:53 PM

To the Senate Committee on Energy and Natural Resources,

My name is Zach Brown, and I am a constituent from Alaska -- my address is PO Box 225, Gustavus, AK 99826.

I am requesting that the committee find other sources of revenue, and not open up the pristine Arctic National Wildlife Refuge for oil drilling. As an Alaska, I know that this is one of the most special places on earth, and it should not be sacrificed in order to provide tax cuts for the wealthy.

Thank you very much for your consideration,
Zach Brown
Gustavus, AK

From: Gawain Brumfield
To: fortherecord (Energy)
Subject: ANWR
Date: Tuesday, October 31, 2017 8:15:22 PM

To whom it may concern,

As a working resident of Alaska in the oil and gas industry I am very much in favor of opening up drilling in ANWR. Our world still needs fossil fuels and to protect our environment and American interests, development should occur in western countries. Why western countries? This reduces our energy dependence on others, grows our economy, and western countries in the 21st century have the best environmental protections in the world.

We develop in America, we develop right, and we protect our environment!

Thank you,

Gawain Brumfield, P.E.
Chief Executive Officer
137 East Arctic Avenue
Palmer, AK 99645
O: 907-745-6988 C: 907-707-9372

This message may contain confidential and/or privileged information. If you are not the intended recipient or believe you have received this message in error, please notify us immediately by responding to the sender and then delete this message from your system.

From: John Brunton
To: fortherecord (Energy)
Cc: email@murkowski.senate.gov
Subject: ANWR
Date: Tuesday, October 31, 2017 12:05:15 PM

As forty year residents of Alaska we are very familiar with the issues surrounding the potential opening of a small portion of the Arctic National Wildlife Refuge for responsible oil and gas development. We have been strong proponents of responsible development for a long time. It is our feeling that the pros and cons of development have been discussed and understood for a generation. Now is the time to finally allow development. The obvious benefits to the State of Alaska and the United States as a whole greatly outweigh the perceived potential negative environmental impacts.
We urge the members of the Senate Energy and Natural Resource Committee to allow the revenue generated by development of Area 1002 to aid in the passage of the Fiscal Year 2018 budget.

John and Jackie Brunton
18630 West Belarde Blvd.
Big Lake, Ak. 99652

From: Lauralot 89
To: fortherecord (Energy)
Subject: Protect the Arctic National Wildlife Refuge
Date: Monday, November 06, 2017 10:11:01 AM

To the Senate Energy and Natural Resources Committee:

I ask that the committee find other means to produce federal revenue than reopening the Arctic National Wildlife Refuge for oil and gas drilling. We should not destroy protected land and endanger wildlife to fund unnecessary tax breaks for the wealthy.

Thank you for your consideration,

Lauren Buch
860 Country Club Rd NE
Corydon, IN 47112

From: Brian Buhler
To: fortherecord (Energy)
Subject: Chairman Murkowski, Ranking Member Cantwell, and Members of the Senate Energy and Natural Resources Committee
Date: Wednesday, November 01, 2017 3:24:17 PM

I believe all the points below should be compelling reasons to move forward work in ANWR.

- Polls have consistently shown Alaskans overwhelmingly support responsible oil and gas development in the non-wilderness portion of ANWR. There is no valid reason why we should not be allowed to access the world-class resources within just a tiny fraction of the coastal plain.
- The proposed ANWR provision would allow development of no more than 2,000 acres of the 1.5 million acres of the Arctic coastal plain – part of the non-wilderness portion of ANWR's 19 million acres. That is equivalent to just 0.01 percent of the entire refuge.
- Responsible oil and gas development in this fraction of ANWR will help ensure America's energy security for decades and allow Alaska – and our nation as a whole – to realize the benefits that come from expanding energy production in Alaska.
- While renewable energy is a growing part of America's energy portfolio, it is still projected to account for a minority of American energy production in 2040. New oil and gas production will be required to power America's economy and can serve as a bridge until renewable energy becomes a dominant energy source decades into the future.
- Energy production from ANWR has the potential to offset a decline in Lower 48 shale oil production, which is expected to commence in approximately a decade. Without limited oil development on the coastal plain, America will be forced to once again increase its reliance on foreign imports. With limited development in ANWR, America and Alaska can continue to grow the economy and reduce dependence on foreign oil.
- The U.S. Geological Survey estimates the 1002 Area is North America's greatest prospect for conventional onshore oil production, with a mean likelihood of containing 10.4 billion barrels of oil and 8.6 trillion cubic feet of natural gas, as well as a reasonable chance of economically producing 16 billion barrels of oil.
- Alaska's economic lifeline, the Trans-Alaska Oil Pipeline System (TAPS), is now running at three-quarters empty. New oil production from ANWR has the potential to reverse throughput in TAPS, a vital component of American energy infrastructure.
- Oil development on a fraction of the coastal plain would create thousands of jobs nationwide, generate billions of dollars in government revenue, keep energy prices for American consumers affordable, and further improve energy security for decades into the future.
- Since the ANWR coastal plain is less than 60 miles from TAPS, development of energy resources there is one of the most environmentally-sound way to increase oil production in Alaska.
- Thanks to continuing improvements in technology, practices, and oversight, the oil industry has demonstrated over the past 40 years that North Slope energy development and environmental stewardship can and do coexist. The industry has a proven track record of responsible development in sensitive areas, protecting the environment, wildlife and subsistence needs of local residents.

Brian Buhler
Dowland-Bach
Senior Automation Engineer
Office:907-550-5857
Mobile:907-231-2938

From: Scott Bumbaugh [mailto:sbumbaugh@hilcorp.com]
To: fortherecord (Energy)
Cc: anniehoefler@energy.senate.gov
Subject: Open ANWR
Date: Wednesday, November 01, 2017 2:00 PM

Chairman Murkowski, Ranking Member Cantwell, and Members of the Senate Energy and Natural Resources Committee,

· Polls have consistently shown Alaskans overwhelmingly support responsible oil and gas development in the non-wilderness portion of ANWR. There is no valid reason why we should not be allowed to access the world-class resources within just a tiny fraction of the coastal plain.

· The proposed ANWR provision would allow development of no more than 2,000 acres of the 1.5 million acres of the Arctic coastal plain – part of the non-wilderness portion of ANWR's 19 million acres. That is equivalent to just 0.01 percent of the entire refuge.

· Responsible oil and gas development in this fraction of ANWR will help ensure America's energy security for decades and allow Alaska – and our nation as a whole – to realize the benefits that come from expanding energy production in Alaska.

· While renewable energy is a growing part of America's energy portfolio, it is still projected to account for a minority of American energy production in 2040. New oil and gas production will be required to power America's economy and can serve as a bridge until renewable energy becomes a dominant energy source decades into the future.

· Energy production from ANWR has the potential to offset a decline in Lower 48 shale oil production, which is expected to commence in approximately a decade. Without limited oil development on the coastal plain, America will be forced to once again increase its reliance on foreign imports. With limited development in ANWR, America and Alaska can continue to grow the economy and reduce dependence on foreign oil.

· The U.S. Geological Survey estimates the 1002 Area is North America's greatest prospect for conventional onshore oil production, with a mean likelihood of containing 10.4 billion barrels of oil and 8.6 trillion cubic feet of natural gas, as well as a reasonable chance of economically producing 16 billion barrels of oil.

· Alaska's economic lifeline, the Trans-Alaska Oil Pipeline System (TAPS), is now running at three-quarters empty. New oil production from ANWR has the potential to reverse throughput in TAPS, a vital component of American energy infrastructure.

· Oil development on a fraction of the coastal plain would create thousands of jobs nationwide, generate billions of dollars in government revenue, keep energy prices for American consumers affordable, and further improve energy security for decades into the future.

· Since the ANWR coastal plain is less than 60 miles from TAPS, development of energy resources there is one of the most environmentally-sound way to increase oil production in Alaska.

· Thanks to continuing improvements in technology, practices, and oversight, the oil industry has demonstrated over the past 40 years that North Slope energy development and environmental stewardship can and do coexist. The industry has a proven track record of responsible development in sensitive areas, protecting the environment, wildlife and subsistence needs of local residents.

As a 27 year Alaskan resident I am in full support for opening ANWR.

Scott Bumbaugh
Lead Operator
Tyonek Platform
907-776-6975
907-776-6978

Recipient Information
To: Senate Energy and Natural Resources Committee
Fax #: 2022246163

faxZERO.com
send a fax for free

Sender Information
From: Janet Burcham
Email address: jkb_04@yahoo.com (from 72.233.221.20)
Phone #: 509
Sent on: Tuesday, November 14 2017 at 12:51 PM EST

Date: Nov. 14, 2017

Title: For Record of November 2, 2017 Hearing

TO: Chairman Murkowski and Ranking Member Cantwell , and Members of the Senate Energy and Natural Resources Committee

I strongly object to opening the Arctic National Wildlife Refuge (ANWR) to oil/gas exploration and drilling. There is no documented need for this destructive exploitation of the largest and best example of our natural landscapes not despoiled by human greed and consumption. It was established for future generations to appreciate in its natural state, and we must not destroy it with short-sighted greed for profit and economic boost to Alaska. This public land belongs to all U.S. citizens, and I, and millions of others, do not want it taken from us by oil/gas drilling.

Janet Burcham
PO 432
Ellensburg, WA 98926

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From: Sean Burton
To: fortherecord (Energy)
Subject: Vote on Alaskan wildlife refuge (Area 1002)
Date: Tuesday, November 14, 2017 2:46:04 PM

Hello, my name is Sean Burton and I am a concerned citizen from 6 Conscience Bay Road Setauket NY, 11733.

I'm writing to ask that the committee find other means to produce federal revenue than reopening the Arctic National Wildlife Refuge for oil and gas drilling. We should not destroy protected land and endanger wildlife to fund unnecessary tax breaks for the wealthy. Please pass my message along to the Chairman and other committee members.

Thank you for your time and attention.

Virus-free. www.avg.com

From: Charlie Bussell
To: fortherecord (Energy)
Cc: ahdowning@ak.net; "Rob Bussell"
Subject: Comments for 1002 lands hearing
Date: Tuesday, October 31, 2017 7:06:33 PM

For the record@energy .senate.gov
Attn: Chairman Murkowski and Ranking member Cantwell:
Subject: comments for use at the Senate Energy and Natural Resources Committee.

I am Charlie Bussell. A former State of Alaska State Representative, and owner of Alaska Bussell Electric Company (Alaska's oldest) as well at The Ditch Witch Equipment dealerships in the Great State of Alaska and the Great State of Hawaii... My entire family and of our employees have been involved with the exploration of Alaska oil and Gas industries from is early days in the 60's to the present time....our record for the many years of Cook Inlet operations and many years on Alaska's North Slope are plain and open for all to see . We have been great stewards of Alaska and clearly only improved the life and the land everywhere we have worked over all those years.....

I fully support the opening of the 1002 area of the Arctic National Wildlife Refuge....it has been our great privilege to have been a part of the responsible development, of not only the oil industry but village life across Alaska vast North. We hope soon to be able to expand our stewardship as caretakers of the environment at these 1002 lands.

We urge you to all vote in favor of development of this are and help us continue to make History in this area of our great State...

Thanks you for your time and positive consideration of this issue./

Charlie & Vicki Bussell
1800 Seat 47th Avenue
Anchorage, Alaska. 99517

From: David Buthman
To: fortherecord (Energy)
Cc: Hoefler, Annie (Energy)
Subject: ANWR
Date: Wednesday, November 01, 2017 1:56:08 PM

TO: Chairman Murkowski, Ranking Member Cantwell, and Members of the Senate Energy and Natural Resources Committee.
REFERENCE: For the Record of November 2, 2017

As an Alaska Resident, please not my strong support for opening ANWR to oil and gas leasing and other commercial activities.
Thank you,
David Buthman
21419 River Park Drive
Eagle River, AK 99577

From: Suzanne Cali
To: fortherecord (Energy)
Subject: Arctic Wildlife Refuge
Date: Tuesday, November 14, 2017 3:28:01 PM

I am opposed to the reopening of the Arctic Wildlife Refuge for oil and gas drilling. Please, no more of the rape of our country.....on countless levels!

Suzanne Cali
caliknit@msn.com
1523 4th Ave. N
Seattle WA 98109

From: Roger Calloway
To: fortherecord (Energy)
Cc: Hoefler, Annie (Energy); aves@aktrucks.org
Subject: ANWR
Date: Tuesday, October 31, 2017 9:36:13 PM

Dear Chairman Murkowski and Ranking Member Cantwell,

I am an Alaskan that supports the opening of the 1002 area of the Arctic National Wildlife Refuge. Alaskans have developed the North Slope oil fields responsibly and will continue to do so with NO effects to the Arctic Caribou herd or any other animal species. We are the caretakers of the environment and we need you to vote in favor of development."

Sincerely:
Roger Calloway
President / Owner
Reliable Transfer Corporation
3421 Hospital Drive
Juneau, Alaska 99801
Phone: 907-789-1490
Fax: 907-789-1272
Cell Phone: 907-723-2896
E-Mail: roger@reliabletransfer.com
"Juneau's and Sitka's Only Locally Owned and Operated Moving & Storage Company"
"Servicing Juneau, Sitka, Alaska and Beyond Since 1914"
"Alaska Veteran Owned Company"

From: liz campbell
To: fortherecord (Energy)
Subject: NO DRILLING for oil or gas in the arctic national wildlife refuge
Date: Monday, November 13, 2017 1:22:22 PM

I am writing in absolute opposition to the proposed addition of drilling for oil and gas on our public lands to "balance our budget"or to be added to any tax bills. It would be more prudent to cut federal subsidies for oil and gas. It is also an unethical and insulting scam to fund more tax cuts for billionaires, Even if this was a direct attempt to make quick money it is unethical in the face of very real global warming and ocean acidification which are already threatening planetary health and ocean health. Our ocean health drives planet health. The Arctic National Wildlife Refuge is a fragile but keystone area that drives Ocean Health. To drill there is to spill there. An oil spill there will wreak havoc on the health of the indigenous cultures that depend on that area to survive and it will stress devastatingly the food chain of our Oceans.
Please do what the public has wanted for years and protect the Arctic National Wildlife Refuge from oil and gas exploration and drilling. Scientists and the Public for years have rallyed against this for good reasons. I understand why Lisa Murkowsky would want to do this for Alaska because her economy is driven by Oil Companies, but our country is huge and opposes this idea and we need to stop extracting and burning oil and gas ASAP. It is ridiculous with the scientific reality of global warming to push this destructive and wrong inclusion to a budget or tax bill.
Thank you,
Liz Campbell
605 N. 64th street
Seattle, Washington 98103
206 972 1400

From: Robby Capps [mailto:rcapps@fwalaska.com]
To: fortherecord (Energy)
Cc: Hoefler, Annie (Energy)
Subject: For Record of November 2, 2017 Hearing
Date: Wednesday, November 01, 2017 9:56 PM

Chairman Murkowski, Ranking Member Cantwell, and Members of the Senate Energy and Natural Resources Committee

REF: **Record of November 2, 2017 Hearing**

Polls have consistently shown Alaskans overwhelmingly support responsible oil and gas development in the non-wilderness portion of ANWR. There is no valid reason why we should not be allowed to access the world-class resources within just a tiny fraction of the coastal plain.

· The proposed ANWR provision would allow development of no more than 2,000 acres of the 1.5 million acres of the Arctic coastal plain – part of the non-wilderness portion of ANWR's 19 million acres. That is equivalent to just 0.01 percent of the entire refuge.

· Responsible oil and gas development in this fraction of ANWR will help ensure America's energy security for decades and allow Alaska – and our nation as a whole – to realize the benefits that come from expanding energy production in Alaska.

· While renewable energy is a growing part of America's energy portfolio, it is still projected to account for a minority of American energy production in 2040. New oil and gas production will be required to power America's economy and can serve as a bridge until renewable energy becomes a dominant energy source decades into the future.

· Energy production from ANWR has the potential to offset a decline in Lower 48 shale oil production, which is expected to commence in approximately a decade. Without limited oil development on the coastal plain, America will be forced to once again increase its reliance on foreign imports. With limited development in ANWR, America and Alaska can continue to grow the economy and reduce dependence on foreign oil.

· The U.S. Geological Survey estimates the 1002 Area is North America's greatest prospect for conventional onshore oil production, with a mean likelihood of containing 10.4 billion barrels of oil and 8.6 trillion cubic feet of natural gas, as well as a reasonable chance of economically producing 16 billion barrels of oil.

· Alaska's economic lifeline, the Trans-Alaska Oil Pipeline System (TAPS), is now running at three-quarters empty. New oil production from ANWR has the potential to reverse throughput in TAPS, a vital component of American energy infrastructure.

· Oil development on a fraction of the coastal plain would create thousands of jobs nationwide, generate billions of dollars in government revenue, keep energy prices for American consumers affordable, and further improve energy security for decades into the future.

· Since the ANWR coastal plain is less than 60 miles from TAPS, development of energy resources there is one of the most environmentally-sound way to increase oil production in Alaska.

· Thanks to continuing improvements in technology, practices, and oversight, the oil industry has demonstrated over the past 40 years that North Slope energy development and environmental stewardship can and do coexist. The industry has a proven track record of responsible development in sensitive areas, protecting the environment, wildlife and subsistence needs of local residents.

Thank You,

Robby Capps
President
F&W Construction
(907) 248-3666

From: Barbara Cash
To: fortherecord (Energy)
Cc: Hoefler, Annie (Energy); Barbara Cash
Subject: For Record of November 2, 2017 Hearing
Date: Wednesday, November 01, 2017 4:24:57 PM

TO: Chairman Murkowski, Ranking Member Cantwell, and Members of the Senate Energy and Natural Resources Committee

RE: For Record of November 2, 2017 Hearing
In Support of Oil and Gas Development in ANWR

Honorable Senators,

As a small business owner in Alaska for 39 years, I strongly support responsible oil and gas development in the 1002 Area of ANWR. The non-wilderness subject area represents .01% of the total refuge, yet has the capacity to ensure America's energy security for decades, even during development of renewable sources.

As North America's greatest prospect for conventional onshore oil production, 1002 Area likely contains 10.4 billion barrels of oil and 8.6 trillion cu ft of natural gas, with a reasonable chance of producing 16 billion barrels of oil (per U.S. Geological Survey). This will help offset the forthcoming decline in continental U.S. shale oil production, grow the economy, and reduce dependence on foreign oil.

Please support this opportunity to create thousands of jobs nationwide, increase government revenue, keep consumer energy prices affordable, and improve our energy security for decades to come.

Most Sincerely,
Barbara L. Cash

Barbara Cash, NCIDQ IIDA LEED AP
President, CEO

RIM Design LLC
645 G Street, Suite 301 :: Anchorage, AK 99501
907.279.6563 Office :: 907.440.9190 Cell
www.RIM-Design.com

From: Larry Cash
To: fortherecord (Energy)
Subject: ANWR
Date: Wednesday, November 01, 2017 5:14:50 PM

I am submitting this memo to register my support for going forward with ANWR for exploration and development. This ANWR exploration and development will contribute substantially to our Country's energy independence and enhance Alaska's economy, creating good jobs and revenue.

Thank you,
Larry

Larry S. Cash FAIA NCARB
CEO

RIM
Alaska California Guam Hawaii

645 G Street, Suite 400, Anchorage, Alaska 99501
907.258.7777 main | 907.240.9474 mobile

lcash@rimarchitects.com

www.rimarchitects.com

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From: Cassidy, Kevin
To: fortherecord (Energy)
Subject: OPEN ANWR
Date: Tuesday, October 31, 2017 7:02:57 PM
Attachments: image003.png

"Dear Chairman Murkowski and Ranking Member Cantwell,

I am an Alaskan that supports the opening of the 1002 area of the Arctic National Wildlife Refuge. Alaskans have developed the North Slope oil fields responsibly and will continue to do so with NO effects to the Arctic Caribou herd or any other animal species. We are the caretakers of the environment, and we need you to vote in favor of development."

Regards,

Kevin Cassidy | **Sr Estimator** | Price Gregory International

PRICE GREGORY

Tel (907) 278.4400 | Tel (907) 257.4133 | Cell (907) 230.4905 | Fax (907) 278.4401
kcassidy@pricegregory.com | 301 West Northern Lights Blvd, Suite 300, Anchorage, AK 99503

From: Kenneth Castleton - (C)
To: fortherecord (Energy)
Subject: My support for development in ANWR
Date: Wednesday, November 01, 2017 4:22:51 PM

I Ken Castleton Fully support the exploration and development of Alaska's resources
I have worked in and around the oil fields for going on 12 years and all the companies I have Worked for are a very Conscientious about the environment and the impact oil and gas can have They have all gone to great lengths to protect and take care of the land and the environment in which they are operating

Ken Castleton
Endicott Chef/NMS Manager
NMS/800 E. Dimond Blvd Suite 3-450 Anchorage Ak 99515
Office 907-659-6601 / Kitchen 907-659-6605 Cell 907-575-3900
E-mail: Kcastleton@hilcorp.com
Alt. Shirley Uptegraft Email: suptegraft@hilcorp.com

From: James Cazort
To: fortherecord (Energy)
Subject: Chairman Murkowski, Ranking Member Cantwell, and Members of the Senate Energy and Natural Resources Committee
Date: Wednesday, November 01, 2017 5:44:57 PM

I support Senator Murkowski's ANWR drilling provision in the budget reconciliation bill that would allow limited oil and natural gas activity within the non-wilderness coastal plain of ANWR. Specific reasons for my support include:

- As Alaskans, we overwhelmingly support **responsible oil and gas development** in the non-wilderness portion of ANWR. There is no valid reason why we should not be allowed to access these world-class resources.
- The proposed ANWR provision would allow development of no more than 2,000 acres of the 1.5 million acres of the Arctic coastal plain – part of the non-wilderness portion of ANWR's 19 million acres.
- Responsible oil and gas development in this fraction of ANWR will allow Alaska to realize the benefits that come from expanding energy production in Alaska and continue to **improve our quality of life**.
- With this proposed limited development in ANWR, America and Alaska can continue to grow our economy and reduce dependence on foreign oil.
- The U.S. Geological Survey estimates the 1002 Area is North America's greatest prospect for conventional onshore oil production, with a mean likelihood of containing 10.4 billion barrels of oil and 8.6 trillion cubic feet of natural gas, as well as a reasonable chance of economically producing 16 billion barrels of oil.
- **Alaska's economic lifeline**, the Trans-Alaska Oil Pipeline System (TAPS), is now running at three-quarters empty. New oil production from ANWR has the potential to reverse throughput in TAPS, a vital component of American energy infrastructure.
- Oil development on a fraction of the coastal plain would create thousands of jobs nationwide, **generate billions of dollars in government revenue**, keep energy prices for American consumers affordable, and further improve energy security for decades into the future.
- Since the ANWR coastal plain is less than 60 miles from TAPS, development of energy resources there is one of the most environmentally-sound way to increase oil production in Alaska.
- Thanks to continuing improvements in technology, practices, and oversight, the oil industry has demonstrated over the past 40 years that North Slope energy development and environmental stewardship can and do coexist. The industry has **a proven track record of responsible development** in sensitive areas, protecting the environment, wildlife and subsistence needs of local residents

James Cazort
Pinnacle Construction, Inc.
4141 Ingra Street, Suite 200
Anchorage, AK 99503
Ph (907) 522-0040 ext. 206
Fax (907) 522-0041
www.PinnacleAK.com

CHAMBER OF COMMERCE
OF THE
UNITED STATES OF AMERICA

NEIL L. BRADLEY
SENIOR VICE PRESIDENT &
CHIEF POLICY OFFICER

1615 H STREET, NW
WASHINGTON, DC 20062
(202) 463-5310

November 15, 2017

The Honorable Lisa Murkowski
Chairman
Committee on Energy and Natural Resources
United States Senate
Washington, D.C. 20510

The Honorable Maria Cantwell
Ranking Member
Committee on Energy and Natural Resources
United States Senate
Washington, D.C. 20510

Chairman Murkowski and Ranking Member Cantwell:

The U.S. Chamber of Commerce strongly supports legislation expected to be considered on November 15, 2017, that would authorize the Secretary of the Interior to establish and administer a competitive oil and gas leasing program in the non-wilderness portion of the Arctic National Wildlife Refuge (ANWR).

The Section 1002 area that would be eligible for leasing under this legislation makes up less than 8% of the refuge, and Congress has previously authorized exploratory activities in this area. The United States Geological Survey estimates that the 1002 area contains as much as 10 billion barrels of technically recoverable oil.

Alaskan energy production remains critical to U.S. energy security. Bringing this additional U.S. oil on-line helps ensure a more secure energy future for the U.S. and our trading partners around the world.

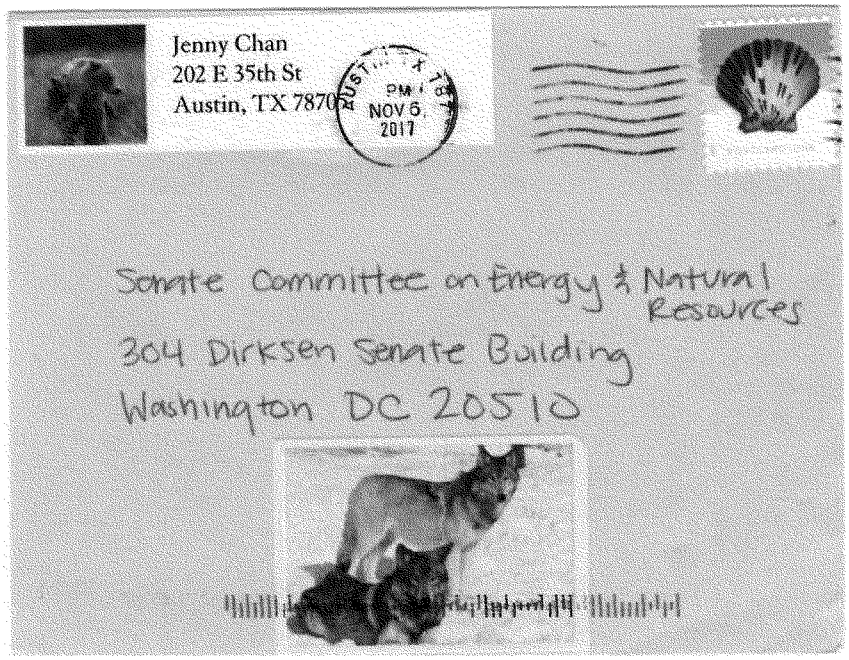
The Trans Alaska Pipeline System (TAPS) celebrated its 40th anniversary this year, having safely transported more than 17 billion barrels of oil primarily to the lower 48 states. However, TAPS throughput today is less than a quarter of its capacity as North Slope production declines. If this trend continues, TAPS must be shut down and dismantled under federal law. New production from the 1002 area has the potential to prolong TAPS viability, and a vital piece of infrastructure, for decades to come.

The Chamber strongly supports this legislation and encourages the Committee to favorably report it.

Sincerely,

Neil L. Bradley

cc: Members of the Senate Committee on Energy and Natural Resources



Senate Committee on Energy & Natural Resources,

I am incredibly concerned to hear that you are considering reopening the Artic National Wildlife Refuge for oil & gas drilling. Please do not destroy protected land just to fund tax breaks for the wealthy!

Thank you,
Jenny

From:	Frank Chandler
To:	fortherecord (Energy)
Cc:	Hoefler, Annie (Energy)
Subject:	For Record of November 2, 2017 Hearing by and of the U.S. Senate Energy and Natural Resources Committee concerning inclusion of a provision int he Budget Reconciliation Bill now before Congress that would allow oil and gas exploration and development i...
Date:	Wednesday, November 01, 2017 8:57:36 PM

Dear Senator Murkowski, and Honorable Committee Members:

Please recommend that a provision be included in the Budget Reconciliation Bill now being considered by Congress that would allow oil and gas exploration and development in National Petroleum Reserve "A" (NPR-A) and in the Arctic National Wildlife Refuge (ANWR). Such legislation would be invaluable to the general welfare of the United States, and particularly to the economic welfare of the State of Alaska, for the following reasons:

1. The United States continues to import vast quantities of oil and gas products from foreign sources, to the detriment of our national security and our balances of payments with the source countries. Development of new prospects in NPR-A and ANWR would reduce our dependence on foreign oil, and would reduce the export of US wealth to foreign nations.

2. Development of NPR-A and ANWR will be an economic boon to the citizens of Alaska, the government of the State of Alaska, the oil-producing companies, the Trans-Alaska Pipeline (which is presently beginning to deteriorate from the effects of insufficient flow for its capacity), the US-flagged shipping vessels that carry crude from Alaska to the Lower 48 states, the Pacific Northwest refiners, and the US consumers of the oil and fuel products that are produced from Alaskan oil.

3. Development of NPR-A and ANWR will strengthen our nation's defenses by reducing our need to import foreign petroleum, and by putting the infrastructure in place to obtain petroleum from NPR-A and ANWR in case of emergencies or disruptions in the global energy supply network.

4. Increased economic activity resulting from oil extraction, transportation, refining, and consumption within the United States will result in increased federal tax revenues, which will consequently reduce the United States' spending deficit.

5. Development of NPR-A and ANWR will provide an economic boost to the moribund economy of Alaska, which has been severely tested by low oil prices in recent years.

6. NPR-A and ANWR are remote, almost completely unpopulated areas, so there would be little or no social disruption from responsibly-performed exploration and development activities. The footprint of any exploration or development would be miniscule compared to the size of the area in which activity would occur, so there would be almost no environmental impact resulting from work in NPR-A and ANWR. Congress can ensure that any exploration and development activity is environmentally sound by producing legislation requiring that short-term disruption of local ecosystems and long-term beneficial improvements to existing conditions be a condition of any activity within NPR-A and ANWR.

7. This is the perfect time to provide a financial incentive for oil companies to explore and develop prospects in NPR-A and ANWR: the current economic hardships being suffered by the people of Alaska (and indeed, most of the US) would be greatly alleviated by the economic activity that development of NPR-A and ANWR would generate.

I, and every Alaskan I know, beg you to consider the economic, social, geopolitical, and environmental benefits of development NOW of oil and gas prospects in NPR-A and ANWR, and to fight to include provisions in the current Budget Reconciliation Bill that would make such exploration and development possible.

With Highest Regard and Greatest Respect,

Frank S. Chandler Jr.
7721 Anne Circle
Anchorage, Alaska 99504-4601

Home Phone (907) 333-6387
Cell/Text (907) 764-1263
frankchandler1@gmail.com

From: Bonnie Chapin
To: fortherecord (Energy)
Subject: Regarding the Arctic National Wildlife Refuge
Date: Friday, November 03, 2017 8:18:20 PM

This area is called a refuge for a reason and should be protected from the oil and gas industries which should see the handwriting on the wall that fossil fuels are a thing of the past. Before long people will all be driving electric vehicles hopefully, and our environment will begin to heal. Hasn't the extreme weather events of this Fall meant anything to you? Don't you have children and grandchildren that you would like to protect from these terrible events?
Sincerely,
Bonnie Chapin

Bonnie Chapin
Abigail Rose & Lily Too
500 Piermont Ave. Piermont, NY 10968
845-359-4649
www.abigailrosestore.com

From: Barbara Chapman
To: fortherecord (Energy)
Subject: No oil or gas drilling in ANWR!!!!
Date: Wednesday, November 15, 2017 3:29:59 PM

I am OPPOSED to any oil or gas drilling in the Arctic National Wildlife Refuge. There are other ways to source energy. This spot is pristine, it must be saved!

Barbara Chapman
8230 Mill Station Rd
Sebastopol CA 95472

Alaska State Legislature

State Capitol, Room 434
Juneau, Alaska 99801-1182
Phone: 907-465-3779
Toll Free: 800-469-3779

145 Main St. Loop
Suite 223
Kenai, Alaska 99611
Phone: 907-283-7223

Representative Mike Chenault
House District 29

FOR THE RECORD OF THE NOVEMBER 2, 2017, HEARING

Chairman Murkowski, Ranking Member Cantwell, and Members of the Senate Energy and Natural Resources Committee:

Please consider this letter of support for the ANWR provision contained within House Concurrent Resolution 71. I am the former Speaker of the Hose and currently hold the position of Minority Whip within the House Republican Caucus. I have been and continue to be an avid supporter for the opening of ANWR.

For decades, scientific polls have shown Alaskans overwhelmingly support responsible oil and gas development in the non-wilderness portion of ANWR. There is no valid reason why we should not be allowed to access the world-class resources within just a tiny fraction of the coastal plain. The proposed ANWR provision would allow development of no more than 2,000 acres of the 1.5 million acres of the Arctic coastal plain – part of the non-wilderness portion of ANWR's 19 million acres. **That is equivalent to just 0.01 percent of the entire refuge**.

Responsible oil and gas development in this fraction of ANWR will help ensure America's energy security for decades and allow Alaska – and our nation as a whole – to realize the benefits that come from expanding energy production in Alaska.

While renewable energy is a growing part of America's energy portfolio, it is still projected to account for a minority of American energy production in 2040. New oil and gas production will be required to power America's economy and can serve as a bridge until renewable energy becomes a dominant energy source, decades into the future.

Energy production from ANWR has the potential to offset a decline in Lower 48 shale oil production, which is expected to commence in approximately a decade. Without limited oil development on the coastal plain, America will be forced to once again increase its reliance on imports. With limited development in ANWR, America and Alaska can continue to grow the economy and reduce dependence on foreign oil.

The U.S. Geological Survey estimates the 1002 Area is North America's greatest prospect for conventional onshore oil production, with a mean likelihood of containing 10.4 billion barrels of oil and 8.6 trillion cubic feet of natural gas, as well as a reasonable chance of economically producing 16 billion barrels of oil.

Rep.Mike.Chenault@akleg.gov

Oil development on a fraction of the coastal plain would create thousands of jobs nationwide, generate billions of dollars in government revenue, keep energy prices for American consumers affordable, and further improve energy security for decades into the future.

Thank you for placing my letter of support on the record. Please don't hesitate to contact me if I can provide further information regarding my support for the opening of ANWR.

Sincerely,

Representative Mike Chenault
Minority Whip
Alaska State House of Representatives

From: Reed Christensen
To: fortherecord (Energy)
Cc: Hoefler, Annie (Energy)
Subject: For Record of November 2, 2017 Hearing
Date: Tuesday, October 31, 2017 5:59:30 PM

Chairman Murkowski, Ranking Member Cantwell, and Members of the Senate Energy and Natural Resources Committee:

Please add my name, comments, and message to the long list of Alaskans who support responsible resource development including development in ANWR.

- The area to be developed is a small fraction of space – the equivalent of a postage stamp on a football field.
- The area is close to existing infrastructure, the Trans Alaska Pipeline System. Pipelines are the safest way to transport oil and gas.
- Alaska and the Nation will benefit from such activity for many years to come.
- Alaska has a proven track record of safe, responsible, resource development. Showing the world that resource development and environmental stewardship can and do co-exist.

I strongly support the opening of ANWR for resource development.
Keep this provision in the legislation and pass the legislation for the benefit of Alaska and the entire United States of America.

Sincerely,

Reed B. Christensen
President
Dowland-Bach Corp
Cell (907) 227-3480
Office (907) 562-5818
www.dowlandbach.com

From: gary christenson [mailto:garycsparky@gmail.com]
To: fortherecord (Energy)
Subject: Nov 2nd ANWR hearing.
Date: Wednesday, November 01, 2017 1:58 PM

Dear Chairman Murkowski, Ranking Member Cantwell, and Members of the Senate Energy and Natural Resources Committee,

As to this week's hearing Thursday, November 2, on an ANWR drilling provision that would allow limited oil and natural gas activity within the non-wilderness coastal plain of the Arctic National Wildlife Refuge (ANWR), ***I strongly support and agree with the following statements from Alaska Oil and Gas Association:***

- For decades, scientific polls have shown Alaskans overwhelmingly support responsible oil and gas development in the non-wilderness portion of ANWR. There is no valid reason why we should not be allowed to access the world-class resources within just a tiny fraction of the coastal plain.

- The proposed ANWR provision would allow development of no more than 2,000 acres of the 1.5 million acres of the Arctic coastal plain – part of the non-wilderness portion of ANWR's 19 million acres. That is equivalent to just 0.01 percent of the entire refuge.

- Responsible oil and gas development in this fraction of ANWR will help ensure America's energy security for decades and allow Alaska – and our nation as a whole – to realize the benefits that come from expanding energy production in Alaska.

- While renewable energy is a growing part of America's energy portfolio, it is still projected to account for a minority of American energy production in 2040. New oil and gas production will be required to power America's economy and can serve as a bridge until renewable energy becomes a dominant energy source decades into the future.

- Energy production from ANWR has the potential to offset a decline in Lower 48 shale oil production, which is expected to commence in approximately a decade. Without limited oil development on the coastal plain, America will be forced to once again increase its reliance on foreign imports. With limited development in ANWR, America and Alaska can continue to grow the economy and reduce dependence on foreign oil.

- The U.S. Geological Survey estimates the 1002 Area is North America's greatest prospect for conventional onshore oil production, with a mean likelihood of containing 10.4 billion barrels of oil and 8.6 trillion cubic feet of natural gas, as well as a reasonable chance of economically producing 16 billion barrels of oil.

- Oil development on a fraction of the coastal plain would create thousands of jobs nationwide, generate billions of dollars in government revenue, keep energy prices for American consumers affordable, and further improve energy security for decades into the future

Gary Christenson
garycsparky@gmail.com
Cell (907)240-4279

From: Robb Christenson
To: fortherecord (Energy)
Cc: Hoefler, Annie (Energy)
Subject: ANWR
Date: Tuesday, October 31, 2017 2:25:48 PM

Dear Chairman Murkowski, Ranking Member Cantwell, and Members of the Senate Energy and Natural Resources Committee,

As to this week's hearing Thursday, November 2, on an ANWR drilling provision that would allow limited oil and natural gas activity within the non-wilderness coastal plain of the Arctic National Wildlife Refuge (ANWR), ***I strongly support and agree with the following statements from Alaska Oil and Gas Association:***

- For decades, scientific polls have shown Alaskans overwhelmingly support responsible oil and gas development in the non-wilderness portion of ANWR. There is no valid reason why we should not be allowed to access the world-class resources within just a tiny fraction of the coastal plain.
- The proposed ANWR provision would allow development of no more than 2,000 acres of the 1.5 million acres of the Arctic coastal plain – part of the non-wilderness portion of ANWR's 19 million acres. That is equivalent to just 0.01 percent of the entire refuge.
- Responsible oil and gas development in this fraction of ANWR will help ensure America's energy security for decades and allow Alaska – and our nation as a whole – to realize the benefits that come from expanding energy production in Alaska.
- While renewable energy is a growing part of America's energy portfolio, it is still projected to account for a minority of American energy production in 2040. New oil and gas production will be required to power America's economy and can serve as a bridge until renewable energy becomes a dominant energy source decades into the future.
- Energy production from ANWR has the potential to offset a decline in Lower 48 shale oil production, which is expected to commence in approximately a decade. Without limited oil development on the coastal plain, America will be forced to once again increase its reliance on foreign imports. With limited development in ANWR, America and Alaska can continue to grow the economy and reduce dependence on foreign oil.
- The U.S. Geological Survey estimates the 1002 Area is North America's greatest prospect for conventional onshore oil production, with a mean likelihood of containing 10.4 billion barrels of oil and 8.6 trillion cubic feet of natural gas, as well as a reasonable chance of economically producing 16 billion barrels of oil.

- Oil development on a fraction of the coastal plain would create thousands of jobs nationwide, generate billions of dollars in government revenue, keep energy prices for American consumers affordable, and further improve energy security for decades into the future.

v/r,

Robb Christenson
Account Representative
Sourdough Express, Inc.
Tel: 907.243.2545
Cell: 907.301.6718
www.sourdoughexpress.com

Chugach
ALASKA CORPORATION

November 1, 2017

Chairman Murkowski, Ranking Member Cantwell, and Members of the Senate Energy and Natural Resources Committee,

Chugach Alaska Corporation (Chugach) is an Alaska Native Regional Corporation established pursuant to the Alaska Native Claims Settlement Act of 1971. As an Alaska Native corporation, we serve the interests of the Alaska Native people of the Chugach region and represent more than 2,500 shareholders. Our family of businesses employ more than 5,000 people, including 600 Alaskans, around the world.

We fully endorse the ANWR drilling provision that will allow limited oil and natural gas activity within the non-wilderness coastal plain of the Arctic National Wildlife Refuge (ANWR).

Prince William Sound (PWS) lies in the heart of the Chugach region, where 17.5 billion barrels of oil have flowed through the Trans-Alaska Pipeline (TAPS) spanning several decades. Part of our corporation's land management strategy includes pursuing business opportunities that stimulate economic development within our communities and support shareholder benefits, while also taking care of our land for generations to come. We believe responsible development – like that proposed in ANWR – can achieve both.

Our subsidiary, Chugach Alaska Services, provides critical staffing and oil spill response services on TAPS. Through our two-and-a-half decade partnership with Alyeska Pipeline Service Company, we've had the honor of protecting the lands and waters in our region, while also creating jobs and economic benefits for our shareholders and all Alaskans.

We're not the only ones who stand ready to protect the local environment through spill prevention and response services. Collectively, our state's oil spill response readiness is some of the most advanced in the world. Stringent shipping regulations and decades of experience across Alaska's operators will continue to allow for the safe passage of oil.

Development of this area will also help us protect the more than one-third of Alaska jobs tied to the oil industry. For the last three years, TAPS has experienced a slight increase in throughput compared to the downward trend that began in the late 1980s. The ANWR drilling provision will help us continue reversing this decline in production. This important development opportunity has the potential to create thousands of jobs and generate billions of dollars in revenues for decades into the future.

We encourage you to consider endorsing the ANWR drilling provision. Chugach is a proponent of responsible development and projects that strengthen Alaska and our people.

Sincerely,

Gabriel Kompkoff
CEO

Chugach Alaska Corporation • 3800 Centerpoint Dr., Suite 1200, Anchorage, AK 99503 • T: 907.563.8866 • F: 907.563.8402

From: michael ciriaco
To: fortherecord (Energy)
Subject: National Wildlife Refuge
Date: Tuesday, November 07, 2017 6:00:12 PM

To whom it may concern,

I'm writing to ask that the committee find other means of revenue rather than reopening the Arctic National Wildlife Refuge for oil and gas drilling. We should not destroy protected land and endanger wildlife to fund unnecessary tax breaks for the wealthy. Please pass this message along to the Chairman and other committee members.

Best,
Mike Ciriaco
1155 N LA Cienega Blvd #508
West Hollywood, CA 90069

From: Christine Clark
To: fortherecord (Energy); Hoefler, Annie (Energy)
Subject: ANWR Support
Date: Wednesday, November 01, 2017 4:36:34 PM

I would like to voice my support for the responsible oil and gas development of the Arctic National Wildlife Refuge.

Responsibly developing our natural resources on the Coastal Plain would be good for Alaska and America.

Christine Clark
Tgi Freight
Phone: (907)522-3088
Fax: (907)562-6295

From: Todd Clark
To: fortherecord (Energy)
Cc: Hoefler, Annie (Energy)
Subject: ANWR Support
Date: Wednesday, November 01, 2017 2:30:57 PM

I would like to voice my support for the responsible oil and gas development of Arctic National Wildlife Refuge.

Developing our natural resources on the Coastal Plain would be good for Alaska and good for America.

Todd Clark
Tgi Freight
4001 Old Int'l Airport Road
Unit 7
Anchorage, AK 99502

Phone 907-522-3088
Fax 907-562-6295
www.tgifreight.com

From: Glenn Clary
To: fortherecord (Energy)
Subject: Vote "YES" to open 1002 area of the ANWR!
Date: Tuesday, October 31, 2017 3:24:06 PM

"Dear Chairman Murkowski and Ranking Member Cantwell,

As a longtime resident of Alaska (38 years) I am proud of how Alaska has responsibly explored and developed oil resources throughout our beautiful state. I am in support of opening the 1002 area of the Arctic National Wildlife Refuge. Past oil developments on the north slopes of Alaska has had position effects to the Arctic Caribou herd and other animal species. We will continue to be good stewards of these valuable resources and would appreciate your vote of confidence in us to continue our tremendous track record of responsible oil development success.

Vote YES to allow the 1002 area of the Arctic National Wildlife Refuge to be opened for development.

Thank you for your time in this matter.

Glenn Clary
7500 Eastbrook Cir.
Anchorage, AK 99504
907-952-2281
gclary@ancbt.org

From: Dave Classick Jr
To: fortherecord (Energy)
Subject: Please do not open the Arctic to Oil and Gas Drilling
Date: Friday, November 03, 2017 2:20:06 PM

To whom it may concern:

I'd like the Committee to find other means to produce federal revenue than reopening the Arctic National Wildlife Refuge for oil and gas drilling. We shouldn't destroy protected land and endanger wildlife so that the super-wealthy can become super-wealthier. It's outrageous. We've all fought so hard for this area to stay undisturbed. This administration is doing SO MUCH harm to our environment and our natural resources. Please don't help them.

Please pass my message along to the Chairman and other committee members for their consideration

Thanks much.

DAVE CLASSICK JR.
HEAD DISTILLER | ESSENTIAL SPIRITS ALAMBIC DISTILLERY
P: 650.962.0546 F: 650.962.0653 dave.classick@gmail.com
California, 94041

COASTAL HELICOPTERS, INC.
8995 Yandukin Dr. Juneau, AK 99801
907-789-5600 Fax 907-789-7076
mwilson@coastalhelicopters.com

November 1, 2017

Re For Record of November 2, 2017 Hearing

Chairman Murkowski, Ranking Member Cantwell, and Members of the Senate Energy and Natural Resources Committee :

Please accept these comments in **support** of **opening** the Arctic National Wildlife Refuge (ANWR) for oil and gas development.

Responsible oil and gas development in .01% of the refuge will help ensure America's (and Alaska's) energy security for decades to come. Thanks to continuing improvements in technology, practices, and oversight, the oil industry has demonstrated over the past 40 years that North Slope energy development and environmental stewardship can and do coexist. The industry has a proven track record of responsible development in sensitive areas, protecting the environment, wildlife and subsistence needs of local residents

The USGS has estimated there are over 10 billion barrels of oil and almost 9 trillion cubic feet of natural gas. The potential economic impact to the country by creating thousands of jobs nationwide and generating billions of dollars in government tax revenues will help keep the nation secure and prosperous.

Michael Wilson
General Manager
Coastal Helicopters, Inc.

From: Susie Cohen
To: fortherecord (Energy)
Subject: Protect Alaska"s Wildlife Refuge
Date: Tuesday, November 14, 2017 5:37:09 PM

I request that the Committee on Energy and Natural Resources find other means to produce federal revenue than reopening the Arctic National Wildlife Refuge for oil and gas drilling. We should not destroy protected land and endanger wildlife to fund unnecessary tax breaks for the wealthy. I fear that by the end of this administration we will have none of these places left. Please pass my message along to the Chairman and other committee members.

Thank you for your time.

Susie Cohen
2 Wildwood Lane
Menlo Park, CA 94025

From: Eric Cole
To: fortherecord (Energy)
Subject: Development of ANWR
Date: Wednesday, November 01, 2017 3:33:07 PM

I absolutely support the development of ANWR for oil and gas exploration.

We need to jobs and we need the revenue in this state more now than ever before.

Eric W. Cole
Construction Machinery Industrial L.L.C.
5302 Commercial Blvd
Juneau, Alaska 99801

907-957-9091 Cell

From: John Collinge
To: fortherecord (Energy)
Subject: ANWR needs to be opened
Date: Tuesday, October 31, 2017 2:26:22 PM

Hello,
I am writing to let you know that I feel very strongly that ANWR needs to be opened for the good of my state of Alaska as well as for the security of the United States. As you know, a small part of the coastal plain is supposed to be dedicated to oil exploration. The oil companies have the art of oil exploration figured out. They do the cleanest drilling and extracting inside of the U. S.
For the record please count this email as support for drilling.
Thank you,
John Collinge
RE/MAX Dynamic Properties
907-440-2785
www.johncollinge.net
propertyAk@gmail.com

From: Connelly
To: fortherecord (Energy)
Cc: Hoefler, Annie (Energy)
Subject: For Record of November 2, 2017 ANWR Drilling Hearing
Date: Wednesday, November 01, 2017 12:24:41 AM

To: Chairman Murkowski, Ranking Member Cantwell, and Members of the Senate Energy and Natural Resources Committee

We are writing to support responsible oil and gas development in the Arctic National Wildlife Refuge. ANWR is 19 million acres and the area of potential development would be no more than 2,000 acres which is .01 percent of the entire refuge. This development will help ensure America's energy security for decades and create thousands of jobs nationwide and billions of dollars in government revenue.

We urge you to support drilling in the non-wilderness area of the Arctic National Wildlife Refuge.

Sincerely,

Steve & Carol Connelly
11860 Nebesna Dr.
Anchorage, AK 99507

From: Karen Conover
To: fortherecord (Energy); Hoefler, Annie (Energy)
Subject: ANWR
Date: Tuesday, October 31, 2017 3:11:21 PM

Dear Chairman Murkowski, Ranking Member Cantwell, and Members of the Senate Energy and Natural Resources Committee,

As to this week's hearing Thursday, November 2, on an ANWR drilling provision that would allow limited oil and natural gas activity within the non-wilderness coastal plain of the Arctic National Wildlife Refuge (ANWR), ***I strongly support and agree with the following statements from Alaska Oil and Gas Association:***

- For decades, scientific polls have shown Alaskans overwhelmingly support responsible oil and gas development in the non-wilderness portion of ANWR. There is no valid reason why we should not be allowed to access the world-class resources within just a tiny fraction of the coastal plain.

- The proposed ANWR provision would allow development of no more than 2,000 acres of the 1.5 million acres of the Arctic coastal plain – part of the non-wilderness portion of ANWR's 19 million acres. That is equivalent to just 0.01 percent of the entire refuge.

- Responsible oil and gas development in this fraction of ANWR will help ensure America's energy security for decades and allow Alaska – and our nation as a whole – to realize the benefits that come from expanding energy production in Alaska.

- While renewable energy is a growing part of America's energy portfolio, it is still projected to account for a minority of American energy production in 2040. New oil and gas production will be required to power America's economy and can serve as a bridge until renewable energy becomes a dominant energy source decades into the future.

- Energy production from ANWR has the potential to offset a decline in Lower 48 shale oil production, which is expected to commence in approximately a decade. Without limited oil development on the coastal plain, America will be forced to once again increase its reliance on foreign imports. With limited development in ANWR, America and Alaska can continue to grow the economy and reduce dependence on foreign oil.

- The U.S. Geological Survey estimates the 1002 Area is North America's greatest prospect for conventional onshore oil production, with a mean likelihood of containing 10.4 billion barrels of oil and 8.6 trillion cubic feet of natural gas, as well as a reasonable chance of economically producing 16 billion barrels of oil.

- Oil development on a fraction of the coastal plain would create thousands of jobs nationwide, generate billions of dollars in government revenue, keep energy prices for American consumers affordable, and further improve energy security for decades into the future.

Sincerely,

Karen Conover
Certified Moving Consultant
Sourdough Transfer, Inc.
(907)456-6040 Office
(907)451-6188 Fax
www.sourdoughtransfer.com

From: Anne Seneca
To: fortherecord (Energy)
Cc: Hoefler, Annie (Energy)
Subject: It"s Time To Open ANWR
Date: Thursday, November 09, 2017 2:32:08 PM

Dear Chairman Murkowski, Ranking Member Cantwell, and Members of the Senate Energy and Natural Resources Committee:

My name is Anne Seneca and I am the President of the Alaska Chapter of Consumer Energy Alliance. CEA is the voice of the energy consumer and we bring together families, households and small businesses that use energy along with other industrial end users to engage in a meaningful dialogue about America's energy future. Additionally, with more than 250 member organizations and 450,000 family and individual members nationwide, our mission is to help provide a voice for those who are forgotten in the energy debate to ensure affordable prices for reliable energy.

CEA Alaska works to raise awareness about Alaska's contribution to domestic energy production for the Lower 48. As you know, Alaska's onshore and offshore production are crucial to the oil supply for America's western region as well as America's geopolitical presence in the Arctic region and America's overall consumer energy prices. Further, energy development underpins every facet of our state's economy and is the lifeblood of thousands of families and communities.

On behalf of our members in AK and over 450,000 individual members all across the United States, CEA AK fully supports the opportunity to develop the 1002 area of ANWR - for several reasons:

- Our economic security: Families, small businesses, seniors living on fixed incomes, and the ~13% of Americans living in poverty need affordable and reliable energy. Development in this tiny fraction of the coastal plan could create thousands of jobs, generate billions of dollars in government revenue, and help keep energy prices affordable for American consumers.

- Our national security: Alaska has long been a rich source of the nation's domestic energy. With Alaska's economic lifeline, the Trans-Alaska Oil Pipeline System (TAPS), now running at three-quarters empty, new oil production from ANWR has the potential to reverse declining throughput in TAPS, a vital component of American energy infrastructure. It could offset potential declines in Lower 48 shale production, helping to ensure that we can continue to make inroads in reducing our reliance on foreign energy and further expanding the state and national economies.

- Our environmental security: Thanks to continuing improvements in technology, practices, and oversight, it has been demonstrated over the past 40 years that North Slope energy development and environmental stewardship can and do coexist. With a proven track record of responsible development in this region, we can better protect~~ing~~ the environment, wildlife and subsistence needs of local residents by meeting our energy needs with home-grown energy developed under a strong regulatory and environmental framework.

I'm sure you can appreciate the positive impact development of the 1002 area would have not only on Alaska, but the nation as a whole. By including the ANWR development provision in the budget reconciliation bill, we can help determine our own destiny when it comes to our energy, national, and environmental security.

Sincerely,

Anne Seneca
President
Consumer Energy Alliance – AK
ceaak@consumerenergyalliance.org
(907)764-0629
200 W. 34th Ave. , Suite 412
Anchorage, AK 99503

CIRI

November 1, 2017

The Honorable Lisa Murkowski
The Honorable Maria Cantwell
Senate Energy and Natural Resources Committee
304 Dirksen Senate Building
Washington, DC 20510

Dear Chairperson Murkowski, Ranking Member Cantwell, and Members of the Senate Energy and Natural Resources Committee:

Cook Inlet Region, Inc. (CIRI) appreciates the opportunity to provide comments in support of the provision to allow oil and gas exploration and drilling in the 1002 area of the Arctic National Wildlife Refuge (ANWR) within the 2018 budget. CIRI is an Alaska Native Regional Corporation formed under the Alaska Native Claims Settlement Act (ANCSA) and one of the largest private landowners in Southcentral Alaska and also an active participant in the oil and gas business in the Cook Inlet Basin.

The Alaska Native Claims Settlement Act (ANCSA) of 1971 and the Alaska National Interest Lands Conservation Act (ANILCA) of 1980 were compromise pieces of legislation, both with promises made in compromise between federal, state, Native and environmental interests nearly 40 years ago. The 1002 area of ANWR is not federally designated Wilderness and one of the great compromises of ANCSA and ANILCA was to leave future drilling in this area up to a future Congress in explicit recognition of its great oil and gas resource potential. Now is the time for Congress to act to allow for this to happen.

Technological advances have significantly reduced the environmental footprint of oil and gas exploration, drilling and production since ANCSA and ANILCA first considered the 1002 area. Advances in 3D seismic, seismic interpretation techniques, well spacing, extended reach drilling, ice roads and pads, and other technologies have transformed the industry, particularly in the Arctic. Alaska leads the world in operating standards and regulatory and environmental oversight.

CIRI understands the need first hand to diversify our nation's energy mix. We developed, own, and operate a utility-scale wind farm that provides power to Anchorage. At the same time, we have active oil and gas leases on our lands that are responsibly operated to meet our state's energy needs. New oil production will continue to be required to meet America's needs and the environmental oversight that occurs on Alaska's North Slope is second to none.

P.O. Box 93330, Anchorage, AK 99509-3330 • P: 907-274-8638 • F: 907-279-8836 • www.ciri.com

CIRI supports responsible resource development and the passage of the 2018 budget, including provisions that would open the ANWR 1002 area to oil and gas exploration and drilling. Thank you for the opportunity to submit comments.

Sincerely,

Cook Inlet Region, Inc.

Sophie Minich
President and Chief Executive Officer

From: Mike Coons
To: fortherecord (Energy)
Cc: Hoefler, Annie (Energy)
Subject: ANWR, 1002 Area Testimony
Date: Tuesday, October 31, 2017 7:49:57 PM

Chairman Murkowski, Ranking Member Cantwell, and Members of the Senate Energy and Natural Resources Committee.

For Record of November 2, 2017 Hearing

First, this is a first where we, Alaskans have been asked to speak up for Alaska in this or any committee. Thank you.

I have worked as a Paramedic on the North Slope of Alaska and have been at Point Thomson which is a stones throw from ANWR boundary and the 1002 area. Not only do I know the truth that this area is not the "pristine" area that those whom oppose any drilling in Alaska show, the Brooks Range which is hundreds of miles to the south. I have been on site when Polar Bears have come into camp, in her mind, with the two cubs, we were breakfast. I have been on rigs on the Beaufort See, north of 1002 and have seen Polar Bears totally ignore us while catching and eating seals below the rig while we were drilling for over 8 hours continuous. The "concern" by animal rights is totally without real merit, period.

The oil industry today is light years ahead of what drilling was at the start of Prudoe Bay, which has been safe, increase in Caribou, plenty of Arctic Fox (all around the building, pads, etc. and do not show any fear of man.

1970's technology for seismic exploration shows Billions of barrels of oil in the 1002 area. I know that the new seismic technology will show much, much more.

One of the constant comments from those opposing 1002 exploration and production has been it will take 10 years to get there. That has always been a lie and with Mr Pruitt (EPA), Zinke (Interior) and President Trump clearing the way from oppressive rules and regulations, we can be producing in 2-4 years.

What those whom oppose 1002 will not understand is that the Alaska Pipeline if allowed to keep decreasing through put will be more dangerous than full. Oil industry can explain the facts far better than I can.

In closing, Alaskans have had our lands stolen by President Carter, Clinton and Obama for far too long. EPA and Interior have shown total disregard to Alaskans when it comes to any mineral and oil development, thus being a major cause for the recession we have now, the unemployment we have now. We Alaskans in the strongest terms possible, demand immediate opening of 1002 so that our State and her people can turn around our economy as well as to dramatically increase our national security by being even more energy independent from middle east oil

Mike Coons
5200 Dorothy Drive
Palmer, AK 99645

From: Scott Cooper
To: fortherecord (Energy)
Cc: Hoefler, Annie (Energy)
Subject: For Record of November 2, 2017 Hearing
Date: Tuesday, October 31, 2017 7:02:57 PM
Attachments: image001.png

Chairman Murkowski, Ranking Member Cantwell, and Members of the Senate Energy and Natural Resources Committee;

I am a firm supporter in the responsible oil and gas development on the Coastal Plain. After working throughout the world the world in many different countries, I can attest first hand, that the Oil & Gas Drilling and Production of Alaska is by far, a leader in protecting the environment along with providing continual and ever improving processes that protect the environmental sensitive habitats and for all of indigenous species of the North Slope. Protecting the environment has been proven to be a paramount necessity by all oil gas operators and services providers.

The development of oil and gas production of the Coastal Plain is important to the growth of the Alaskan and US economy and the future sustainability for all that rely on these natural resources.

Regards

Scott Cooper
Testing Subsea/GeoBalance
Service Coordinator

6900 Arctic Blvd
Anchorage, AK 99518-2146
Email: scott.cooper2@halliburton.com
Office: +1 907-275-2659
Mobile: +1 907-223-6434

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HALLIBURTON

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From: Sally Corbett
To: fortherecord (Energy)
Subject: Protect Alaska"s Wildlife Refuge from oil and gas companies
Date: Tuesday, November 07, 2017 4:03:04 PM

To whom it may concern;
Opening Alaska's wildlife refuge to oil and gas exploration is an obvious ploy to offset the shortfall of Republican's misguided tax plan. The tax plan is once again aimed at giving the upper 1% of American income earners a huge tax break at the expense of the middle class and now caribou, Alaska's indigenous people and the pristine wilderness of Alaska's wildlife refuge. The Republicans once again show that they have been bought off by the oligarchs at the expense of the rest of their constituents, all off the species who live in the refuge, and of course, the future of humankind. Please leave the refuge alone and figure out some fair and long lasting way to tax the American people. The ploy is so transparent to Americans and the rest of the world and it will forever be a black eye on the Republican party if our democracy lasts much longer. The Republicans have sold their soul and our children's future.

Sally Corbett
17500 Beach Drive NE
Lake Forest Park, WA 98155

From: Tim Cowan [mailto:tcowan@hilcorp.com]
To: fortherecord (Energy)
Cc: Hoefler, Annie (Energy)
Subject: For record of November 2, 2017 Hearing
Date: Wednesday, November 01, 2017 2:22 PM

Dear Chairman Murkowski, Ranking Member Cantwell and members of the Senate Energy and Natural Resources Committee.

I support opening ANWR,

- Polls have consistently shown Alaskans overwhelmingly support responsible oil and gas development in the non-wilderness portion of ANWR. There is no valid reason why we should not be allowed to access the world-class resources within just a tiny fraction of the coastal plain.
- The proposed ANWR provision would allow development of no more than 2,000 acres of the 1.5 million acres of the Arctic coastal plain – part of the non-wilderness portion of ANWR's 19 million acres. That is equivalent to just 0.01 percent of the entire refuge.
- Responsible oil and gas development in this fraction of ANWR will help ensure America's energy security for decades and allow Alaska – and our nation as a whole – to realize the benefits that come from expanding energy production in Alaska.
- While renewable energy is a growing part of America's energy portfolio, it is still projected to account for a minority of American energy production in 2040. New oil and gas production will be required to power America's economy and can serve as a bridge until renewable energy becomes a dominant energy source decades into the future.
- Energy production from ANWR has the potential to offset a decline in Lower 48 shale oil production, which is expected to commence in approximately a decade. Without limited oil development on the coastal plain, America will be forced to once again increase its reliance on foreign imports. With limited development in ANWR, America and Alaska can continue to grow the economy and reduce dependence on foreign oil.
- The U.S. Geological Survey estimates the 1002 Area is North America's greatest prospect for conventional onshore oil production, with a mean likelihood of containing 10.4 billion barrels of oil and 8.6 trillion cubic feet of natural gas, as well as a reasonable chance of economically producing 16 billion barrels of oil.
- Alaska's economic lifeline, the Trans-Alaska Oil Pipeline System (TAPS), is now running at three-quarters empty. New oil production from ANWR has the potential to reverse throughput in TAPS, a vital component of American energy infrastructure.
- Oil development on a fraction of the coastal plain would create thousands of jobs nationwide, generate billions of dollars in government revenue, keep energy prices for American consumers affordable, and further improve energy security for decades into the future.
- Since the ANWR coastal plain is less than 60 miles from TAPS, development of energy resources there is one of the most environmentally-sound way to increase oil production in Alaska.
- Thanks to continuing improvements in technology, practices, and oversight, the oil industry has demonstrated over the past 40 years that North Slope energy development and environmental stewardship can and do coexist. The industry has a proven track record of responsible development in sensitive areas, protecting the environment, wildlife and subsistence needs of local residents.

Again,

I support opening ANWR.

Sincerely,

Tim Cowan
Cell 907-398-7318

From: Sara Crapuchettes
To: fortherecord (Energy)
Subject: ANWR
Date: Wednesday, November 01, 2017 9:03:02 PM

Dear Chairman Murkowski and Ranking Member Cantwell,

I am an Alaskan that supports the opening of the 1002 area of the Arctic National Wildlife Refuge. Alaskans have developed the North Slope oil fields responsibly and will continue to do so with NO effects to the Arctic Caribou herd or any other animal species. We are the caretakers of the environment and we need you to vote in favor of development.

Sara Crapuchettes
300 E Dowling Rd unit 1
Anchorage AK 99518

From: Craig Crawford
To: fortherecord (Energy)
Cc: Hoefler, Annie (Energy)
Subject: For Record of November 2, 2017 Hearing Supporting the ANWR Provision
Date: Thursday, November 02, 2017 2:47:04 AM

Craig Crawford

15844 Bridgeview Dr

Anchorage, AK 99516

November 1, 2017

RE: **For Record of November 2, 2017 Hearing**

Dear Chairman Murkowski, Ranking Member Cantwell, and Members of the Senate Energy and Natural Resources Committee

I am a resident of Anchorage, Alaska and have worked on the North Slope actively for over four years. Most recently I led a team building the Pt Thomson facility for Exxon/Mobil where we put in more than 3 million manhours, without a single lost time accident nor significant spill. The Oil and Gas in ANWR is critical for the future of the United States and Alaska. Our ability to discover and recover these critical resources without harm continues to amaze me. Please approve the ANWR provision.

For decades, scientific polls have shown Alaskans overwhelmingly support responsible oil and gas development in the non-wilderness portion of ANWR. There is no valid reason why we should not be allowed to access the world-class resources within just a tiny fraction of the coastal plain. I have been there, worked there and the precautions our workers take are amazing and the area is huge. Development has an absolutely minimal impact. Come visit and see for yourself.

The proposed ANWR provision would allow development of no more than 2,000 acres of the 1.5 million acres of the Arctic coastal plain – part of the non-wilderness portion of ANWR's 19 million acres. **That is equivalent to just 0.01 percent of the entire refuge.**

Responsible oil and gas development in this fraction of ANWR will help ensure America's energy security for decades and allow Alaska – and our nation as a whole – to realize the benefits that come from expanding energy production in Alaska.

While renewable energy is a growing part of America's energy portfolio, it is still projected to account for a minority of American energy production in 2040. New oil and gas production will be required to power America's economy and can serve as a bridge until renewable energy becomes a dominant energy source decades into the future.

Energy production from ANWR has the potential to offset a decline in Lower 48 shale oil production, which is expected to commence in approximately a decade. Without limited oil development on the coastal plain, America will be forced to once again increase its reliance on foreign imports. With limited development in ANWR, America and Alaska can continue to grow the economy and reduce dependence on foreign oil.

The U.S. Geological Survey estimates the 1002 Area is North America's greatest prospect for conventional onshore oil production, with a mean likelihood of containing 10.4 billion barrels of oil and 8.6 trillion cubic feet of natural gas, as well as a reasonable chance of economically producing 16 billion barrels of oil.

Oil development on a fraction of the coastal plain would create thousands of jobs nationwide, generate billions of dollars in government revenue, keep energy prices for American consumers affordable, and further improve energy security for decades into the future.

As an Alaskan I urge you to do the right thing for Alaska and the United States and Approve the ANWR provision.

Thank you for service, and attention.

Sincerely yours,

Craig Crawford

From:	James Crewdson
To:	fortherecord (Energy)
Cc:	Hoefler, Annie (Energy)
Subject:	Comments For Record of November 2, 2017 Hearing
Date:	Tuesday, October 31, 2017 6:08:17 PM

To: Chairman Murkowski, Ranking Member Cantwell, and Members of the Senate Energy and Natural Resources Committee

For Record of November 2, 2017 Hearing

I am a lifelong Alaska resident of 61 years. I am in favor of:

- Opening the ANWR coastal plain (1002 area) to energy exploration and production,
- Requiring timely lease sales,
- A streamlined and simplified permitting process,
- Possibly revising the federal-state revenue sharing split with Alaska retaining no less than 51 percent,
- Implementing reasonable safeguards and oversight to ensure responsible development and protect the environment, and requiring the same level of safeguards and oversight, with third party verification, for any competing energy products marketed in the USA. In short; keep the project(s) safe, responsible, and fair for all the "players".

Thank you for your time and consideration of my comments.

James "Jay" Crewdson, P.E.

Crewdson Engineering LLC
PO Box 671389
18368 Amonson Rd.
Chugiak, AK 99567
907-280-9493
CELLC.1@outlook.com

From: Lance Crosby
To: fortherecord (Energy)
Subject: Limited Access to ANWR
Date: Wednesday, November 01, 2017 7:45:25 PM
Attachments: image001.png

Chairman Murkowski, Ranking Member Cantwell, and the Members of the Senate Energy and Natural Resources Committee:

I lived in Alaska for over 20 years and currently own a food distribution company that employs over 200 Alaskans. I wanted to voice my support to authorize limited oil and natural gas activity within the non-wilderness coastal plain of the Arctic National Wildlife Refuge (ANWR).

The proposal will provide much need oil resources to our economy without any real impact upon the natural environment of the coastal area. This authorization is also critical to maintaining the flow of oil volumes in the Alaska Pipeline (TAPPS) and the overall economy of Alaska.

We must create jobs and the incentive for our young people to continue to live and raise their families in Alaska. The current economic conditions in Alaska are not conducive to employment, family formation and productive behaviors. Many of the social ills presently confronted in Alaska, crime, drug abuse,
and poor child welfare conditions are a direct result of the bad economic conditions and low employment levels in Alaska. Opening ANWR to limited development will be a strong measure to correct these ills and put Alaska back on the road to economic stability.

Thank you for reading this message and acting to open ANWR as proposed.

Lance Crosby
President
Northern Sales Company Inc.
(253)299-0533 direct line
Northern Sales
COMPANY INC

From: Joey Crum
To: fortherecord (Energy); Hoefler, Annie (Energy)
Subject: 1002 section of ANWR
Date: Tuesday, October 31, 2017 4:57:30 PM

Dear Chairman Murkowski and Ranking Member Cantwell.

I'm writing to express my support for drilling in the 1002 section of ANWR. As a 3rd generation Alaskan Oil Field worker I know firsthand that oil development in Alaska is done responsibly by people who believe in environmental stewardship. The oil industry has provided my family and I opportunity for upward mobility that we couldn't get anywhere else. My father was born in the territory of Alaska on Elmendorf Airforce Base in Anchorage and raised in Kelso Washington. Me and 2 of my siblings were born in Longview WA and moved to Alaska in the early 80s to be closer to my dad who had been working in Prudhoe Bay and then and flying home to Washington. I have since taken advantage of the opportunities provided by a stable and growing oil and gas economy and it paid for my undergraduate degree from the University of Puget Sound and Law degree from Gonzaga.

The 1002 section was set aside for oil development at the time of ANWR's formation, and is critical for the people of Alaska to have the ability to provide for ourselves. I have heard the cries my entire life of how drilling in Northern Alaska would destroy the caribou herds and scare off the whales that Native Alaskans depend upon culturally. Yet the caribou are thriving and the whales are still being harvested. Those of us that work in the oil fields are typically extremely active outdoors and value the incredible natural beauty and benefits that Alaska provides. That means that we go above and beyond to protect the environment and incorporate safe and environmentally sound procedures into our work functions. The socioeconomic benefits from this will impact Alaskans and the thousands of out of state workers for generations to come and provide the same type of upward mobility that I have been provided.

Please allow drilling in the 1002 section of ANWR!

Joey Crum JD, ASP
President & CEO
Northern Industrial Training, LLC
Office (907) 357-6400
Fax (907) 357-6430

Training for the future

Northern Industrial Training - Alaska

Northern Industrial Training, LLC is a Candidate for Accreditation
by Commission of the Council on Occupational Education

From: Dave Cruz
To: fortherecord (Energy)
Subject: ANWR
Date: Wednesday, November 01, 2017 11:46:07 AM

I support the opening of Area 1002 for Oil & Gas Development !
My family has been in Alaska for 88 years we have been involved in the Construction Business for the last 36years and employ 400 Alaskans in the Resource Development Industries . Opening ANWR will provide Alaskans with good paying jobs & will continue Energy Independence for the United States .

Thank You

Dave Cruz
President
Cruz Companies
907-746-3144

From: Florence Dacey
To: fortherecord (Energy)
Subject: ANWR
Date: Tuesday, November 14, 2017 1:15:42 PM

Staff:

I ask that the committee find other means to produce federal revenue than reopening the Arctic National Wildlife Refuge for oil and gas drilling. We should not destroy protected land and endanger wildlife to fund unnecessary tax breaks for the wealthy. Please pass my message along to the Chairman and other committee members.

Florence Dacey
710 Union Street
Northfield MN 55057

From: Jen Danby
To: fortherecord (Energy)
Subject: Please Protect ANWR
Date: Tuesday, November 14, 2017 4:42:59 PM

Dear Senate Committee on Energy and National Resources,

Thank you for speaking with me on the phone. I wish to state for the record that as an American citizen I urge you to please protect Alaska's Arctic National Wildlife Refuge and not allow oil drilling on these lands in order to generate revenue or for any other reason.

Please protect our wildlife and our land and protected species. Again, I urge you say no to drilling and protect ANWR. Thank you for fighting for good in America and for protecting America's wildlife and natural habitats.

Sincerely,

Dr. Jennifer Danby

205 West Broadway #7B
Long Beach, NY 11561

phone 646-326-4370

Sent from my iPhone

From: Alx Dark
To: fortherecord (Energy)
Subject: Don"t drill in ANWR
Date: Sunday, November 12, 2017 5:25:49 PM

This refuge is already one of the more delicate refuge environments, under significant stress from global warming. Prudhoe Bay was trashed by drilling in that region. Drilling in ANWR would require a similar, extensive infrastructure of roads and pipelines as has been built in Prudhoe Bay, fragmenting habitat and polluting waterways, and leaving behind toxic waste sites.

Our parks, monuments and refuges are America's greatest unique contribution to western civilization, a reflection of the impact of the frontier on our culture and society. It would be tragic now to destroy these places, rather than innovating new ways to meet our energy needs.

Alx Dark
4018 Burke Ave. N.
Seattle, WA 98103

From: Jack Darsey
To: fortherecord (Energy)
Subject: Chairman Murkowski, Ranking Member Cantwell, and Members of the Senaate Energy and Natural Resources Committee / For Record of November 2, 2017 Hearing
Date: Thursday, November 02, 2017 9:21:37 PM

Chairman Murkowski, Ranking Member Cantwell, and Members of the Senate Energy and Natural Resources Committee

For Record of November 2, 2017 Hearing

Responsible oil and gas development in this fraction of ANWR will help ensure America's energy security for decades and allow Alaska – and our nation as a whole – to realize the benefits that come from expanding energy production in Alaska. The U.S. Geological Survey estimates the 1002 Area is North America's greatest prospect for conventional onshore oil production, with a mean likelihood of containing 10.4 billion barrels of oil and 8.6 trillion cubic feet of natural gas, as well as a reasonable chance of economically producing 16 billion barrels of oil. Thanks to continuing improvements in technology, practices, and oversight, the oil industry has demonstrated over the past 40 years that North Slope energy development and environmental stewardship can and do coexist. The industry has a proven track record of responsible development in sensitive areas, protecting the environment, wildlife and subsistence needs of local residents. With the proof of production and reliable / safe industry practices, now is the time to move forward on ANWR development and allow limited oil / gas production activity within the coastal plain.

Jack Darsey
1204 Channel Way
Kenai, Alaska 99611

From: chappelledaniel@comcast.net (B.Davis)
To: fortherecord (Energy)
Subject: I oppose oil and gas exploration and drilling in the Alaska"s Arctic National Wildlife Refuge
Date: Friday, November 3, 2017 2:53:47 PM

Please pass my message on the the Chairman and other committee members. I oppose any reopening of the Arctic National Wildlife Refuge for gas and oil exploration and/or drilling. We should not destroy protected land and endangered wildlife in exchange to unnecessary giveaways to the fossil fuel companies. It is our responsibility to protect all of these lands and wildlife for future generations.

Bonnie D. Davis, PhD

945 Lake Front Drive

Sacramento, CA 95831

< /html>

From: Regina Daniels
To: fortherecord (Energy)
Cc: Hoefler, Annie (Energy)
Subject: For Record of November 2, 2017 Hearing
Date: Wednesday, November 01, 2017 5:05:00 PM

Chairman Murkowski, Ranking Member Cantwell, and Members of the Senate Energy and Natural Resources Committee:

Please consider that Alaska's economic lifeline, the Trans-Alaska Oil Pipeline System (TAPS), is now running at three-quarters empty. New oil production from ANWR has the potential to reverse throughput in TAPS, a vital component of American energy infrastructure. PLEASE VOTE IN SUPPORT OF OPENING ANWR.

Thank you,

Regina Davis
DAVIS BLOCK & CONCRETE
36122 RAVENWOOD STREET
KENAI | ALASKA | 99611
907.335.3804 DIRECT
907.398.1507 CEL

From: Jen Davison
To: fortherecord (Energy)
Cc: Hoefler, Annie (Energy)
Subject: OPPOSE drilling in Arctic National Wildlife Refuge
Date: Tuesday, November 14, 2017 6:22:46 PM

For Record of November 2, 2017 Hearing

Chairman Murkowski, Ranking Member Cantwell, and Members of the Senate Energy and Natural Resources Committee:

As a US Citizen and environmental scientist, I demand that you oppose drilling in the ANWR. The refuge, one of the largest in the United States, is the nesting place for several hundred species of migratory birds; home to wolves, polar bears, caribou and other mammals; and spawning grounds for Dolly Varden trout and other fish. With climate change putting extreme stress on our polar ecosystems, the Arctic National Wildlife Refuge is truly one of the last refuges for animals and plants to adapt and survive the changes. This bill would allow roads, pipelines, gravel mines and well pads to be erected across the entire birthing grounds of the coastal plain, where caribou calve and where polar bear mothers den. All to pay for tax cuts for the 1%: this is unconscionable. Instead, try not cutting taxes on the 1%, and leave the protection of this sacred place, first protected by Eisenhower and fully protected more than 25 years ago by Congress, as God intended.

Thank you.

~~
Jen Davison
jen.e.davison@gmail.com
134 N 83rd St
Seattle, WA 98103

From: Shaun Debenham
To: fortherecord (Energy)
Cc: Hoefler, Annie (Energy)
Subject: For Record of November 2, 2017 Hearing: Support of ANWR Drilling
Date: Tuesday, October 31, 2017 3:03:02 PM

Chairman Murkowski, Ranking Member Cantwell, and Members of the Senate Energy and Natural Resources Committee,

As a lifelong Alaskan, **I fully support the ANWR provision** of the bill that you are currently hearing. Alaskans have for years been able to responsibly develop oil fields and protect sensitive environments. The two do not have to be mutually exclusive.

Thank you for your service,

Shaun Debenham

Shaun T. Debenham
Debenham Properties
Vice President of Acquisitions and Development
2960 C Street, Suite 202
Anchorage, AK 99503
P: (907) 562-9330
F: (907) 562-9331
E: shaun@debenhamproperties.com

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From: Sydney Deering
To: fortherecord (Energy)
Cc: Hoefler, Annie (Energy)
Subject: ANWR Bill
Date: Wednesday, November 01, 2017 11:05:45 PM

Hello,

I am a life long Alaskan and am currently studying Petroleum Engineering at the University of Alaska. I am very active in the petroleum based organizations, but today I am writing to represent myself.

I support oil and gas activities in the Arctic National Wildlife Refuge. Oil and gas are Alaska's lifeblood and a strong majority of our economy. By supporting the hydrocarbon industry, you are supporting Alaska's future.

As noble as the push for renewables is, the reality of that dream is still in development and requires time before it is technologically feasible to support a growing world without hydrocarbons. I fully support the advancement of renewable energy sources. However, we must understand that we need energy in the present. Hydrocarbons are still the answer for our energy needs today. By continuing to develop oil and gas we are continuing to fuel our economies, our nation, and our world.

This bill proposes to only open a small portion of the Refuge and yet would create jobs, revenue for both the public and private sectors, and further improve energy security. The Trans-Alaska Pipeline System (TAPS) is also running close to empty. Once the pipeline reaches a minimum throughput, the liquids will not be able to retain sufficient heat to remain liquid and complete the 800 mile, unheated journey in the frigid winter and would force a shut down. This would place the future of oil production on the North Slope of Alaska in jeopardy. TAPS and Alaska need a higher throughput of oil which means additional development.

I ask you to please act in favor of oil and gas development.

Thank you for your consideration and your service.
--
Sydney E Deering

President of the Society of Petroleum Engineers UAF
UAF Petroleum Engineering
sedeering@alaska.edu
(907)575-5522

From: Tony DeHaven
To: fortherecord (Energy)
Subject: Chairman Murkowski, Ranking Member Cantwell, and Members of the Senate Energy and Natural Resources Committee
Date: Wednesday, November 01, 2017 1:31:14 PM

I'm writing this email to register my support for opening ANWR to responsible oil & gas production. I've been to the North Slope of Alaska and worked with some of the companies doing business there. I've never seen a group of people who are more considerate to the environment and the protection of wildlife than the community working in Prudhoe Bay.

Regards,

Tony DeHaven
2216 Maudest Pl.
Anchorage, AK 99508

From: Mary DeMocker
To: fortherecord (Energy)
Subject: NO DRILLING the Arctic (just to give the wealthy more tax breaks)
Date: Friday, November 03, 2017 2:45:31 PM

Dearest Committee,

Do NOT drill in the Arctic.

Find other ways to make your revenue in order to give our obscenely rich overlords their new tax breaks.

Do not trash the planet.

Thank you-

Mary DeMocker
1428 East 21st Avenue,
Eugene, OR, 97403

From: richard derkevorkian
To: fortherecord (Energy)
Subject: Oil drilling support
Date: Tuesday, October 31, 2017 11:26:59 PM

Alaska is in a large recession and I support any and all oil production opportunities that may come up! We need to open up oil and gas drilling in the state to sustain Alaska's future and economy.

Richard Derkevorkian
1306 barabara Dr.
Kenai ak, 99611

Sent via the Samsung Galaxy S7, an AT&T 4G LTE smartphone

From: Denny DeWitt
To: fortherecord (Energy)
Cc: Hoefler, Annie (Energy)
Subject: ANWR Petrolium Production
Date: Tuesday, October 31, 2017 3:07:42 PM

I strongly support opening ANWR to exploration and production. Alaskans have shown our commitment to protecting our environment while we access our resources. The economic advantage of access to ANWR is important to Alaska as well as the United States.

Please open access to ANWR

Denny DeWitt

PO Box 34761
Juneau, Alaska 99803-4761
Email: ddewitt@gci.net
Phone: 907 723 6667

From: Julianne Dickerson
To: fortherecord (Energy); Hoefler, Annie (Energy)
Subject: For Record of Nov 2, 2017 Hearing - Alaskan supporting ANWR development
Date: Wednesday, November 01, 2017 9:36:57 PM

Chairman Murkowski, Ranking Member Cantwell, and Members of the Senate Energy and Natural Resources Committee,

For Record of November 2, 2017 hearing, I am a lifelong Alaskan in support of developing the natural resources of our state, including ANWR. Growing up in Kenai and moving back to the state as an adult, I have witnessed the benefits and opportunities oil and gas development brings. As a current employee of the industry, I have seen that this development CAN be done responsibly and to the betterment of our communities, our state, and our country. I am convinced that responsible stewardship of Alaska's natural resources includes developing ANWR.

Regards,
Julianne Dickerson, P.E.
Hilcorp Alaska, LLC
Office: 907.777.8453
Mobile: 907.690.3507
jdickerson@hilcorp.com

From: Dickson, Robert J.
To: fortherecord (Energy)
Subject: Chairman Murkowski, Ranking Member Cantwell, and Members of the Senate Energy and Natural Resources Committee
Date: Wednesday, November 01, 2017 7:20:50 PM

Dear Senator Murkowski,

Please accept this as another Alaska voice in favor of including drilling within the non-wilderness portion of ANWR in the budget reconciliation bill.

The resources for providing energy to the country while providing jobs to Alaskans—and many Washingtonians—are there. There is really no genuine dispute about the presence of the resource. No one explores and produces oil and gas more safely than Alaskans; we've been at it for over 50 years (including Swanson River area), and we've been in the vanguard of doing it safely with respect to both people and the environment.

As you well know, those who argue that most Alaskans don't want drilling are just plain wrong and are relying on "cooked" surveys. Everyone except the zealous environmentalists (who have never been on the North Slope) is emphatically in favor of exploration and production of the hydrocarbons.

Robert J. Dickson
Attorney
Atkinson, Conway & Gagnon
420 L Street, Suite 500
Anchorage AK 99501
(907) 276-1700
Fax: (907) 272-2082
Email: rjd@acglaw.com
Website: www.acglaw.com
www.alaskalawblog.com

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From: sydne didier
To: fortherecord (Energy)
Subject: Opposition to opening the Arctic Wildlife Refuge for oil and gas drilling
Date: Tuesday, November 07, 2017 10:22:33 AM

Dear Members of the Committee,
I am writing to record my opposition to the opening of the Arctic National Wildlife Refuge for oil and gas drilling.

I urge the committee to find another means of raising the revenue requested as this vital national resource MUST be protected, and not exploited to benefit oil and gas companies at the expense of our environment.

Please say NO to the effort to open this land to exploitation which will only benefit the wealthy.

Thank you for your time,
Sydne Didier
62 Hillcrest Place
Amherst, MA 01002

From: Tammy Dieckgraeff
To: fortherecord (Energy)
Subject: Chairman Murkowski, Ranking Member Cantwell, and Members of the Senate Energy and Natural Resources Committee
Date: Wednesday, November 01, 2017 1:22:50 PM

Sending my support for responsible opening and exploration of ANWR.

Regards,

Tammy Dieckgraeff

Dowland-Bach Corp
6130 Tuttle Place
PO Box 230126
Anchorage, AK 99523
phone (907) 562-5818 (ext 801)
direct (907) 550-5801
fax (907) 562-5816

www.dowlandbach.com

From: Jace Digel
To: fortherecord (Energy)
Subject: The Responsible Development of ANWR
Date: Wednesday, November 01, 2017 3:02:41 PM

Dear Chairman Murkowski, Ranking Member Cantwell, and Members of the Senate Energy and Natural Resources Committee:

As a lifelong Alaskan I stand with the majority of Alaskan residents in supporting the development of the non-wilderness portion of the Arctic Wildlife National Refuge (ANWR). Polls have consistently shown the overwhelming support for the development of ANWR and there hasn't been a valid reason why the state of Alaska should not be allowed access to the resources within ANWR.

ANWR is 19 million acres. The proposed development is no more than 2,000 acres of the 1.5 million acres of the coastal plain of ANWR. This is only 0.01 percent of the entire refuge. The responsible development of this tiny fraction of the coastal plain will help ensure America's energy security for decades. It will allow Alaska, and our nation, to benefit from the energy production in this area. ANWR was specifically set aside by Congress and President Carter in 1980 for oil and natural development. This small fraction (0.01 percent of 19 million acres) would provide access to the majority of ANWR's resources.

ANWR would be responsible for creating tens of thousands of American jobs and stimulate economic growth. The resources could generate hundreds of millions of dollars in new federal revenue, which is a new avenue to help pay down the national debt. The potential overall revenue for state, local, and federal taxes for the life of ANWR production could be in the hundreds of billions of dollars, for the development of 0.01 percent of ANWR.

Without new energy production like ANWR our nation will be more dependent on foreign oil. ANWR (also known as 'Area 1002') is North America's greatest prospect for conventional onshore oil production with a likelihood of containing 10.4 billion barrels of oil and 8.6 trillion cubic feet of natural gas, with the reasonable chance of producing 16 billion barrels of oil. Alaska's Trans-Alaska Oil Pipeline System (TAPS) is running at three quarters empty. The ANWR coastal plain is less than 60 miles away from TAPS. New oil production from ANWR has the potential to reverse declining volumes in TAPS making the development of this energy resource one of the most environmentally-sound ways to increase oil production.

There has not been a reasonable argument why the State of Alaska shouldn't be allowed to responsibly develop the natural resources within ANWR. With the continued improvements in technology, practices, and oversight, the oil industry has demonstrated over the past 40 years that energy development and environmental care can and do coexist. The industry has a proven track record of responsible development in sensitive areas, protecting the environment, wildlife and subsistence needs of local residents.

I stand with the majority of Alaskans in the support of the development of ANWR. Thank you for your time and effort in this important matter for not only Alaska, but our nation's future in energy production.

Jace R. Digel
Business Representative
International Brotherhood of Teamsters Local 959
520 E. 34th Ave., Suite 102
Anchorage, Alaska 99503
(907) 751-8572 Office
(907) 952-4084 Cell
jdigel@akteamsters.com

From: Diltz, Hope
To: fortherecord (Energy)
Subject: 1002 Area of ANWR
Date: Tuesday, October 31, 2017 7:26:57 PM
Attachments: image001.png

Dear Chairman Murkowski and Ranking Member Cantwell,
I am an Alaskan that supports the opening of the 1002 area of the Arctic National Wildlife Refuge. Alaskans have developed the North Slope oil fields responsibly and will continue to do so with NO effects to the Arctic Caribou herd or any other animal species. We are the caretakers of the environment and we need you to vote in favor of development.

Hope Diltz
Administrative Assistant
CONAM Construction Co.
907-257-4193 | hdiltz@conamco.com

From: mdipaula1 .
To: fortherecord (Energy)
Subject: Protect Alaska"s Wildlife Refuge (Area 1002) from Oil & Gas Companies
Date: Wednesday, November 15, 2017 11:27:46 AM

I **oppose** the reopening of the Arctic National Wildlife Refuge for oil & gas drilling.

The committee should try and find other means to produce federal revenue instead of destroying the environment.

Keep the Arctic National Wildlife Refuge free from corporate greed.

Thank you.

Mary DiPaula
26 Chesthill Court
Nottingham, MD 21236-4776

From: Teri D
To: fortherecord (Energy)
Subject: No Drilling in the Alaskan Arctic Wildlife Refuge
Date: Wednesday, November 15, 2017 10:05:15 PM

We all need to do this

I am writing to ask that the committee find other means to produce federal revenue than reopening the Arctic National Wildlife Refuge for oil and gas drilling. We should not destroy protected land and endanger wildlife to fund unnecessary tax breaks for the wealthy. Please pass my message along to the Chairman and other committee members.
This area is a national treasure to be preserved, not destroyed. This area provides a home to people, generates money from tourism, and preserves an ecologic system. Please do not destroy this unique region.

Theresa Dippolito MSN, NP-C, CRNP
102 Harmony Road
Levittown PA 19056
Tead102@Verizon.net

Sent from my iPad

From: Gary Dixon
To: fortherecord (Energy)
Cc: Hoefler, Annie (Energy)
Subject: opening of section 1002 ANWR
Date: Wednesday, November 01, 2017 1:33:31 PM

Chair Murkowski, Ranking Member Cantwell, and the Members of the Senate Energy and Natural Resources Committee

This email is in support of opening Section 1002 of ANWR to development. New Oil development in Alaska is crucial to the State's economy and to our Nation. New developments are needed to maintain the current flow of oil through the Trans Alaska Pipeline and to try and add to the current daily output. The Trans Alaska Pipeline has been addressing issues with low through put for a number of years, with projects to keep the oil flowing at low temperatures. New development will not only help our state with the current budget crisis, through oil royalties, but will provide good paying jobs for Alaskans and people living in the lower 48,for many years to come. With an unemployment rate higher than the national average, low throughput, and state budget crisis, now more than ever, we need to explore for new oil in Section 1002. I have worked on the North Slope of Alaska's oil fields since 1985 and in my opinion, the Producers are very cognizant of the environment, the animals and the overall wellbeing of each worker that is working on the North Slope. With new and improving technologies, the impact of these drill sites, are smaller and smaller than ever before. Ice roads are built to provide a way of transporting men, material and equipment needed for these new developments. All of this to minimize the impact to the environment. I urge you to vote to open development in Section 1002 of ANWR.

Thank you

Gary Dixon, Jr.,
Vice President
International Brotherhood of Teamsters Local 959 Alaska
520 E. 34th Avenue
Anchorage, AK 99503
(907) 751-8591 (O)
(907) 250-0027 (C)
(907) 751-8565 (F)

From: David Donley
To: fortherecord (Energy)
Cc: Joey Merrick
Subject: From Sen Dave Donley re ANWR exploration
Date: Tuesday, October 31, 2017 3:43:06 PM

Dear Chair Murkowski and Ranking Member Cantwell,
I am a born and raised Alaskan; and **I support the opening of the 1002 area of the Arctic National Wildlife Refuge**. **I have held elected public office as a democrat, republican and non-partisan for over 16 years. I have traveled by land and air in the 1002 area.** I worked as a firefighter, logger, and construction laborer on the Trans Alaska Pipeline Project. I am a retired member of LIUNA Laborers Local 341. I know the local people support oil exploration; and it will be environmentally protected during exploration and any subsequent production. Alaskans have developed the North Slope oil fields responsibly; and will continue to do so with NO effects to the Arctic Caribou herd or any other animal species. We are the caretakers of the environment and we need you to vote in favor of development."

Senator Dave Donley
6860 Tondi Lane
Anchorage, AK 99507
H: 907-561-8234 / Cell: 907-229-3447 / dd1@gci.net

From: David Donley
To: fortherecord (Energy)
Subject: Support opening ANWAR
Date: Tuesday, October 31, 2017 4:06:11 PM

Dear Chair Murkowski and Ranking Member Cantwell,
I am a born in Washington state and grew up in Washington and Alaska. **I support the opening of the 1002 area of the Arctic National Wildlife Refuge**. I know the local people support oil exploration; and it will be environmentally protected during exploration and any subsequent production. Alaskans have developed the North Slope oil fields responsibly and will continue to do so with NO effects to the Arctic Caribou herd or any other animal species. We are the caretakers of the environment and we need you to vote in favor of development." I have family members that work on the slope in Alaska and live, vote, and pay taxes in WA state. I have a very large family in WA and we are all in favor of This.

Jamie Donley
6860 Tondi Lane
Anchorage, AK 99507
H: 907-561-8234 / Cell: 907-250-6894
akmomjamie@gmail.com

October 31, 2017

Board of Directors
Doyon, Limited
1 Doyon Place, Suite 300
Fairbanks, Alaska 99701-2941

Attention:
Walter Carlo, Chairman
PJ Simon, Vice Chair
Miranda Wright, Treasurer
Christopher Simon, Secretary
Shirley Cleaver, Board Member
Jennifer Fate, Board Member
Erica Frankson, Board Member
Georgianna Lincoln, Board Member
Ester McCarty, Board Member
Sonta Roach, Board Member
Orie G. Williams, Board Member
Jerry Issac, Board Member
Brian Ridley, Board Member

Dear Members of the Board:

We are writing as Doyon shareholders who have a vested interest in the direction, operations and business ventures of Doyon, Limited. It has come to our attention that Doyon is weighing in on issues that will have lasting ramifications on sustaining our Native ways of life for generations to come. We, Doyon shareholders, seek clarification from the Doyon board of directors regarding the proper adherence to Doyon's governance process.

Doyon senior management will testify on Thursday, November 2, 2017 in support of drilling in the calving grounds of the Porcupine Caribou specifically the "1002" area of the

Arctic National Wildlife Refuge. We require a response and acknowledgement from the board prior to the hearing on November 2nd to ensure that this 1995 Resolution has been officially revisited and vetted by the Board of Directors. Because the 1995 resolution was created over twenty years ago when environmental, socioeconomic and legal realities were vastly different the resolution must be re-evaluated before any further action is taken. Additionally, senior management's preemptive decision to support drilling in the calving grounds of the Porcupine Caribou Herd is in defiance of many shareholders and Tanana Chiefs Conference who have recently reaffirmed a standing resolution to support the protection of the Coastal Plain of the Arctic Refuge.

We shareholders rely on our elected Doyon board of directors to ensure that all Doyon actions both relate and adhere to the established Doyon mission. The recent decision of Doyon senior management has failed to fully uphold the Doyon LTD mission:

"To continually enhance our position as a financially strong Native corporation in order to promote the economic and social well-being of our shareholders and our future shareholders, to strengthen our Native way of life, and to protect and enhance our land and resources."

We Doyon shareholders request that, in adherence to our governance process, our elected board of directors halt senior management testimony until the outdated 1995 resolution can be officially revisited and properly vetted. Additionally, when officially revisiting the issue it is vital to consider the following facts:

1. The United Nations Covenant on Economic, Social, and Cultural Rights and the UN Declaration on the Rights of Indigenous Peoples' states 'by no means shall a people be deprived of their main means of subsistence'. As such, this issue threatens the Gwich'in Nation's human rights as they depend upon the Porcupine Caribou Herd for their main means of subsistence.

2. No amount of 'new technology' including directional drilling will eliminate the risk of a catastrophe in the only birthing and calving grounds for the Porcupine Caribou Herd.

In a two week period of time up to 40,000 calves are born in this area. We must take the Precautionary Principle in regards to threatening the entire existence and well-being of this vast caribou herd by disrupting their birthing grounds. Directional drilling has proven to be dangerous as seen with the 210 million gallons of oil spilled in Deepwater Horizon as well as the recent system wide shut down of Alaska's pipelines due to melting permafrost disrupting the it's structural integrity.

3. Alaska wouldn't gain financial benefit for the first 7 years of oil production—the prime production years.

4. The federal government is pushing to open ANWR in order to use the majority of the sale proceeds to cover the federal deficit. Oil companies would have to bid an average of $2,400.00 per acre for each of the roughly 1.5 million acres on the Coastal Plain of the Arctic Refuge to meet the Presidential budget, and over $1,300.00 per acre to meet congressional targets. (Average lease values are $194 per acre).

5. The standing official recommendation to Congress is a Wilderness Designation for the Coastal Plain based on over 3 years of public commentary from Alaskans and other Americans across the Nation. Ignoring the official recommendation and including measures to open the Refuge through the Federal Budget process would undermine our democracy.

6. This doesn't ensure jobs for Alaskans and we are well aware that out of State workers do not contribute to Alaska's economy.

The lessons of our ancestors and elders should always guide our beliefs and actions—it is our responsibility to ensure the health and wellbeing of our people, land and animals. We must (on a macro level/seeing the big picture) work for a better existence for our future generations—ensuring the land is healthy and can sustain the animal's vital for our survival.

This in turn helps ensure the morals, values and traditional knowledge of our ancestors is passed on. This issue as an opportunity for Doyon to show leadership and model the ways in which our Alaska Native Corporations might begin to truly incorporate our own ways of thinking and being into the decision making process and we hope to see more meaningful consultation and dialogue on issues vital to our shareholders.

With respect and faith,
Doyon Shareholders

Misty M. Nickoli
Jody Potts
Marvin Roberts
Sam Alexander
Dorothy Shockley
Malinda Chase
Skye Malemute
Sean L. Nickoli
Isiah A. Nickoli
Justin T. Svendsen
Daisy M. Kelly
James L. Kelly
John F. Kelly
Nikita L. Kelly
Christina M. Edwin
Bernadette Demientieff
Jason Demientieff
Jacob Wright Jr
Peter Horace-Wright
Lexine Demientieff
Thomas Demientieff
Sandra Demientieff
Betty Flitt
Walter Flitt
Daniel Flitt
Lillian Horace
James Johnson, III
Princess Lucaj
Delnor Johnson
Everett Horace

Christina James
Marilyn James
Amos Frank
Angelica Frank
Madison Frank
Ladanian Frank
Roberta Horace
Melinda Peter
Kimberly Carlo
Lynette Frank
Cara Wallace
Mindona Billings
Rhonda Pitka
Hishinlai' Peter
Steve Ginnis
Renee Singh
Margaret Matthew
Julia Matthew
Freddie Olin IV
Doreen Simmonds
Deenaalee Hodgdon
Norvin DeWilde
Brooke Wright
Francine Kazenoff
Diva Folger
John Walsh
Florence Folger
Doug Felix
Shayla Carney
Shelby Fisher-Salmon
Christen Lee
Ami Herbert
Antoinette DeWilde
Donetta Tritt
Julia Fisher-Salmon
Hunter Peter
Allyson Fisher-Salmon
Daryl Shani Fisher-Salmon
Kelly Turner
Aleisha Singh
Amanda Frank
Constance Reimer-Ely
Ariana Ely

Antonio Ely
Malea Marks
Dusty Reimer
Barney Nollner
Chris Ambrose
April Williams
Donald Reimer
Sharon Tyone
James Moses
Cindy Roberts
April Williams
Ariella Derrickson
Michelle Dugay
Sharity Sommer
Josh Peter
Solana Lee
Sasha Housley
Jessica Black
Dede Solomon
Jamie Conn
Edward Alexander
LaVerne Demientieff
Rebecca Newman
Jared Peter
Sunny Guerin
Serena Baker
Renae Nguyen
Karissa Lynn Carroll

*Shareholders will continue to be added to this list

DOYON, LIMITED

BOARD RESOLUTION NO. 95-45

WHEREAS, eighty-five percent of the State of Alaska's revenues for funding social welfare, education and other programs is generated by taxes and royalties on oil production on the North Slope; and

WHEREAS, a very substantial portion of the jobs and the economic activity in Alaska is also based on services and contracts to oil exploration and production; and

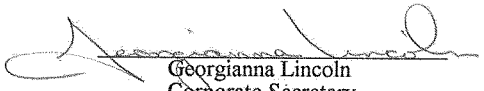
WHEREAS, the revenues, jobs and economic activity from oil development are of critical importance to the present and future well-being of all Alaska citizens including Native people and their village and regional corporations;

NOW THEREFORE BE IT RESOLVED, that the Board of Directors of Doyon, Limited endorses maintaining and increasing state revenues, jobs and activity derived from oil production; and

BE IT FURTHER RESOLVED that meeting the future needs of Alaska's citizens requires that new oil reserves be discovered and placed in production to offset declining production at Prudhoe Bay; and

BE IT FURTHER RESOLVED that opening the Coastal Plain area east of Prudhoe Bay to an environmentally sound, carefully regulated oil and gas leasing program with due protection for the Porcupine Caribou Herd and the subsistence needs of the Gwich'in people through co-management of the Porcupine Caribou Herd by the Gwich'in people is Alaska's best opportunity to replace declining oil production and maintain revenue sources for public programs.

ADOPTED and DATED this 3rd day of June, 1995, at Fairbanks, Alaska.



Georgianna Lincoln
Corporate Secretary
Doyon, Limited

From: Megan Fredericks Dubofsky
To: fortherecord (Energy)
Subject: Protect the Arctic National Wildlife Refuge
Date: Wednesday, November 15, 2017 1:06:03 PM

Hello,

I'm asking that the committee find other means to produce federal revenue than reopening the Arctic National Wildlife Refuge for oil and gas drilling. We should not destroy protected land and endanger wildlife to fund unnecessary tax breaks for the wealthy. Please pass my message along to the Chairman and other committee members.

Megan Fredericks Dubofsky
818 Maxwell Ave
Boulder CO
80304
megan.fredericks@gmail.com

From: Diane Dunham
To: fortherecord (Energy)
Cc: Hoefler, Annie (Energy)
Subject: I support developing ANWR
Date: Wednesday, November 01, 2017 1:44:58 PM

Chairman Murkowski, Ranking Member Cantwell, and Members of the Senate Energy and Natural Resources Committee-

I have worked in the oil and gas industry in Alaska for 15 years. I am also a born and raised in Alaska. And I support developing ANWR. You should too.

Renewable energy vs. resource development is not an either/or issue. The US needs both to flourish. And with the regulatory climate in Alaska in place to protect the environment, we can develop natural resources responsibly.

The state of Alaska relies on oil and gas to provide jobs and fund our state budget. TAPS now runs ¾ empty and with the right development plan, we can fill the pipeline and provide jobs and resource stability in the US. Please join me in support of Alaska's oil and gas industry.

Thank you.

Diane

Diane Dunham I Emergency Response Specialist I Hilcorp Alaska, LLC
3800 Centerpoint Drive, Suite 1400; Anchorage, AK 99503
PO Box 244027 I Anchorage, AK 99524-4027
ddunham@hilcorp.com, 907-777-8315 office I 907-602-6924 mobile
www.hilcorp.com

This email may contain confidential and/or privileged information and is intended for the recipient(s) only. In the event you receive this message in error, please notify me and delete the message.

From: Lara Dunn
To: fortherecord (Energy)
Subject: Please no oil drilling in the Arctic Refuge
Date: Thursday, November 16, 2017 6:41:11 PM

Dear Senate Energy Committee, I heard that the Senate GOP is proposing opening up oil drilling in the Arctic Refuge as a way of recouping dollars in the budget to pass the tax overhaul. The amount of money that might be gained is insignificant as compared to the irrevocable damage to America's most pristine environment from oil rigs & drilling. Please don't do this.
Thank you,
Lara Dunn
1111 Sherman Avenue
Hood River, OR 97031
541-380-0752

From: Dana Durham
To: fortherecord (Energy)
Subject: Oil Drilling on the Coastal Plain of the Arctic National Wildlife Refuge
Date: Wednesday, November 08, 2017 3:25:16 AM

Dana Durham

P. O. Box 1016
Girdwood, Alaska 99587
(907) 783-1187
dizzydunkin@hotmail.com

November 7, 2017

Senate Energy Committee
Washington D.C.

Re: Oil Drilling on the coastal plain of the Arctic National Wildlife Refuge

To Honorable Senators on the Senate Energy Committee,

This committee wants to include opening the Arctic National Wildlife coastal plain for exploration and production of oil in the budget. I can not stand idly by and say nothing.

First of all I feel, as many Alaskans do, that my hands are tied and my voice is muffled by the senators and representatives of the State of Alaska. They talk as if all Alaskans want oil drilling in the coastal plain of the Arctic Refuge. The rest of Congress does not hear the opinions of those not in favor of drilling unless we express them to other members of Congress. For the record many Alaskans, as well as the Gwich'in, do not want drilling in the Arctic Refuge for various reasons.

The physical footprint of drilling has been stated will be small. These claims are misleading.. Personal observations at Prudhoe Bay several years ago showed me what an oil field is like. Not only does the area become like private land, secured from free access, but I saw one flare after another for miles in all directions. The coastal plain of the Arctic Refuge will look the same. The 2000 acres needed for development would not be contiguous. Wells will be drilled wherever there is oil. The coastal plain of the Arctic Refuge will be affected much more because is only about 25 miles wide on average, much narrower than the coastal plain farther to the west. The Arctic Refuge coastal plain will be affected adversely long term, if not forever, by pollution-400 spills per year- gravel roads, airstrips, pipelines for transportation and other components of industrial sprawl.

Recent caribou population studies of the Central Arctic herd have decreased 70% in 6 years in the current oil field area. The Porcupine caribou herd that calves in the Arctic Refuge coastal plain is stable but will decrease in numbers with the presence of oil drilling. Polar bears already stressed from the melting Arctic ice pack, den on the coast in this area will also be adversely impacted.

Drilling in the Arctic Refuge is a humans rights issue. Drilling will have a direct effect on the Porcupine caribou herd, the food security, and ultimately the culture and livelihood of the Gwich'in people.

Drilling will adversely affect jobs. Many wilderness trek companies bring guests to the coastal plain for hiking and rafting trips. If oil drilling was allowed there, the land would be like private land and nobody could travel there for security reasons. Why would one go there anyhow to see wilderness if it is disrupted by oil wells. I have been to the Arctic Refuge four times, two times specifically to the coastal plain. I was blessed in seeing polar bears, many birds, caribou herd about 2500 in number, caribou trails, wolves chasing caribou, Arctic fox, musk ox, etc. I have many wonderful memories of the wilderness in the Arctic Refuge. To allow oil drilling will forever mar this area and not allow future generations to enjoy the area as I.

Alaska is one of the few states to be totally dependent on oil revenue to run its government. Alaska needs to transition from a petroleum-based economy to a renewable energy economy. Let's start now by stripping language from the budget to allow for oil drilling in the Arctic Refuge. After all this oil would only be exported since we have drilled and fracked our way to energy independence. The $1billion revenue lawmakers claim to be generated by drilling in the Arctic Refuge will only make a small dent in the $1.5 trillion debt generated by the budget. Drilling in the Arctic Refuge is not a solution to national debt or the Alaskan oil dependent economy . We can not in good conscience stand by and let our leaders sacrifice the Arctic Refuge, a national treasure, for profit /while Canada has stood by and protected its portion of the Arctic National Wildlife Refuge.

Sincerely yours,

Dana Durham

From: Kevin Durling
To: fortherecord (Energy)
Subject: Chairman Murkowski, Ranking Member Cantwell, and Members of the Senate Energy and Natural Resources Committee
Date: Wednesday, November 01, 2017 1:10:07 PM

As a 40 year Alaskan I support the development of the 1002 area within ANWR.

I and my firm have been active in the development of Alaska's resources since the start of the Alaska Oil Pipe line in 1977 and seen only positive results from this development.
I would like to share the following examples of the positive results that can be expected from opening this area to resource development.

- Responsible oil and gas development in this fraction of ANWR will help ensure America's energy security for decades and allow Alaska – and our nation as a whole – to realize the benefits that come from expanding energy production in Alaska.
- The U.S. Geological Survey estimates the 1002 Area is North America's greatest prospect for conventional onshore oil production, with a mean likelihood of containing 10.4 billion barrels of oil and 8.6 trillion cubic feet of natural gas, as well as a reasonable chance of economically producing 16 billion barrels of oil.
- Oil development on a fraction of the coastal plain would create thousands of jobs nationwide, generate billions of dollars in government revenue, keep energy prices for American consumers affordable, and further improve energy security for decades into the future.
- Energy production from ANWR has the potential to offset a decline in Lower 48 shale oil production, which is expected to commence in approximately a decade. Without limited oil development on the coastal plain, America will be forced to once again increase its reliance on foreign imports. With limited development in ANWR, America and Alaska can continue to grow the economy and reduce dependence on foreign oil.
- Polls have consistently shown Alaskans overwhelmingly support responsible oil and gas development in the non-wilderness portion of ANWR. There is no valid reason why we should not be allowed to access the world-class resources within just a tiny fraction of the coastal plain.
- Thanks to continuing improvements in technology, practices, and oversight, the oil industry has demonstrated over the past 40 years that North Slope energy development and environmental stewardship can and do coexist. The industry has a proven track record of responsible development in sensitive areas, protecting the environment, wildlife and subsistence needs of local residents.

Please include the ANWR drilling provision in the Budget Reconciliation bill currently under review.

Kevin Durling
President
Petroleum Equipment & Services, Inc.
907-248-0066 Office
907-244-0701 Cell
kdurling@pesiak.com
www.pesiak.com

From: Eaton, Benjamin
To: fortherecord (Energy)
Date: Tuesday, October 31, 2017 7:09:48 PM

"Dear Chairman Murkowski and Ranking Member Cantwell,
I am an Alaskan that supports the opening of the 1002 area of the Arctic National Wildlife Refuge. Alaskans have developed the North Slope oil fields responsibly and will continue to do so with NO effects to the Arctic Caribou herd or any other animal species. We are the caretakers of the environment and we need you to vote in favor of development."

Benjamin Eaton | **Mining Division Manager** | CONAM Construction Company

Tel (907) 278.6600 | **Direct (907) 257-4134** | **Cell (907) 947-4187** | **Fax (907) 278.4401**
beaton@conamco.com | **301 West Northern Lights Blvd, Suite 300, Anchorage, AK 99503**

From: David Eby
To: fortherecord (Energy)
Cc: Hoefler, Annie (Energy)
Subject: Support for ANWR Development
Date: Wednesday, November 01, 2017 12:04:46 AM

Chairman Murkowski, Ranking Member Cantwell, and Members of the Senate Energy and Natural Resources Committee,

I support responsible development of oil and gas resources in the non-wilderness portion of ANWR. Working in the industry for several years, and as an Alaksa resident, I have observed the safe and environmentally sound processes used in the Alaska oil industry. I feel that these practices can continue in any development within the ANWR area. Thank you.

David Eby
PO Box 3425
Palmer, Ak. 99645
deby@mtaonline.net

From: Becky hartman edwards
To: fortherecord (Energy)
Subject: Arctic Refuge
Date: Monday, November 06, 2017 10:11:18 AM

To whom it may concern:

I'm writing because I would like the Committee to find other means to produce federal revenue other than reopening the Arctic National Wildlife Refuge for oil and gas drilling. We shouldn't destroy protected land and endanger wildlife so that the super-wealthy can become super-wealthier. It's outrageous. We've all fought so hard for this area to stay undisturbed. This administration is doing SO MUCH harm to our environment and our natural resources. Please don't help them.

Please pass this message along to the committee members and to the Chairman.

Thank you for your time,

Rebecca Hartman Edwards
2337 Observatory Ave.
Los Angeles, CA 90027

From: Candi English
To: fortherecord (Energy)
Cc: Hoefler, Annie (Energy)
Subject: Alaskans who support ANWR
Date: Tuesday, October 31, 2017 5:20:32 PM

Chairman Murkowski, Ranking Member Cantwell, and Members of the Senate Energy and Natural Resources Committee,

My husband and I are the owners of Northern Solutions, an Alaskan-based company that specializes in solving the technically difficult issues that confront the Alaskan Oil and Gas industry, including downhole tool development, specialized labor, shop support, machining services, data management or tool testing. Northern Solutions provides resources that deliver for the oil and gas industry. Cleary we have a huge stake in the future of the industry in Alaska.

I write in favor of including an ANWR drilling provision in a budget reconciliation bill that would allow limited oil and natural gas activity within the non-wilderness coastal plain of the Arctic National Wildlife Refuge (ANWR) for the following reasons.

America can't afford to rely on foreign sources of oil. With limited development in ANWR, America and Alaska can continue to grow the economy and reduce dependence on foreign oil. Energy production from ANWR has the potential to offset a decline in Lower 48 shale oil production, which is expected to begin in about a decade.

The potential for the region is huge - The U.S. Geological Survey estimates the 1002 Area is North America's greatest prospect for conventional onshore oil production, with estimates that it could contain 10.4 billion barrels of oil and 8.6 trillion cubic feet of natural gas, as well as a reasonable chance of economically producing 16 billion barrels of oil.

Alaskans care about our environment, and the industry has a proven track record of responsible development in sensitive areas, protecting the environment, wildlife and subsistence needs of local residents. Thanks to continuing improvements in technology, practices, and oversight, the oil industry has demonstrated over the past 40 years that North Slope energy development and environmental stewardship can and do coexist.

The area in question is less than 0.01 percent of the entire National Wildlife Refuge. Alaskans and the nation should be allowed the access this sliver of land with world-class potential for resources.

Candice English
1270 E. 64th
Anchorage, Alaska 99518
907.336.3343 shop
907.223.7976 cell

Spine & Spur
Deadhorse, Alaska
907.331.7627 Shop

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From: rte4322@aol.com
To: fortherecord (Energy)
Subject: NO to reopening Arctic National Wildlife Refuge for gas and oil
Date: Tuesday, November 14, 2017 3:32:34 PM

Hello,

My name is Rebecca Ensworth from Medina, Ohio. 6515 Bear Swamp Rd., 44256.

Please do not reopen the Arctic National Wildlife Refuge for gas and oil. Please find funding from other ways.

Thank you!
Rebecca Ensworth

From: Erickson, Greg
To: fortherecord (Energy)
Subject: ANWR
Date: Tuesday, October 31, 2017 7:04:23 PM
Attachments: image001.png

**"Dear Chairman Murkowski and Ranking Member Cantwell,
I am an Alaskan that supports the opening of the 1002 area of the Arctic National Wildlife Refuge. Alaskans have developed the North Slope oil fields responsibly and will continue to do so with NO effects to the Arctic Caribou herd or any other animal species. We are the caretakers of the environment and we need you to vote in favor of development." Alaska needs this and thanks for making the right decision,**

Greg Erickson | General Superintendent | Price Gregory International

TIKIGAQ - CONAM, LLC

PRICE GREGORY

Cell number (907) 301-8462
Gerickson@pricegregory.com
301 West Northern Lights Blvd,
Suite 300, Anchorage, AK 99503

From: John Erkmann
To: fortherecord (Energy)
Subject: ANWR
Date: Tuesday, October 31, 2017 5:52:01 PM

With the new technologies available, there is no need to keep ANWR closed to drilling. The areas affected are minuscule compared to the size of the area. Alaska and the Lower 48 need this resource opened. The Alaska pipeline is a good example of careful development with world-class safety provisions.

Please vote to permit access to ANWR for drilling.

John Erkmann

John Erkmann
18410 Kittiwake
Anchorage, Ak. 99516
907 346 2279

From: Dan Fabrello
To: fortherecord (Energy)
Cc: Hoefler, Annie (Energy)
Subject: Supporting ANWR provision - For Record of November 2, 2017 Hearing
Date: Tuesday, October 31, 2017 8:37:19 PM

Dear Chairman Murkowski, Ranking Member Cantwell, and Members of the Senate Energy and Natural Resources Committee.

I am writing in support of ANWR for inclusion in the Record for November 2, 2017 Hearing.
ANWR is an area the size or larger than the State of Connecticut with an area around 20 square miles required to access the recoverable oil that our State needs to be able to access to maintain State budgets and infrastructure. Revenues from exploration and royalties in ANWR that new oil placed in the trans-alaska pipeline will bring will be a welcome and needed benefit for Alaskans. The State of Alaska is in a depression with low oil prices, lack of access to lands that make up our State, highest unemployment in the US and high rates of burglary and opioid use. Much of this stems from the onslaught of outside interests that have shut down or in the process of shutting down all development in Alaska. Our Timber industry is gone, our mining industry in under attack, our oil industry in under attack and we have no prospects on the future of a gas pipe line at this point to help with the funding for our growing State issues or provide living wage jobs for people of Alaska. The continued attack on ANWR needs to stop and the region needs to be accessed for Alaskans Future.

Please support the opening of ANWR.

Thank you for your time and attention.
Respectfully,
Dan Fabrello
2476 ODay Drive
Juneau, Alaska 99801

From: Laurie Fagnani
To: fortherecord (Energy)
Cc: Hoefler, Annie (Energy)
Subject: For Record of November 2, 2017 Hearing
Date: Tuesday, October 31, 2017 4:03:43 PM

I am a resident of Alaska and I support the opening of ANWR.

Opening ANWR will help ensure America's energy security for decades and allow Alaska – and our nation as a whole – to realize the benefits that come from expanding energy production in Alaska. These valuable jobs are critical to Alaska's economy, and to the safety of TAPS – we need to add oil.

Laurie

Laurie Fagnani
Office 907-569-7070
Cell 907-227-3649
3501 Denali Street
Anchorage, AK 99503

From: loussacdr@gmail.com on behalf of Matthew Fagnani
To: fortherecord (Energy)
Subject: US Senate Energy and Natural Resources Committee comments on ANWR
Date: Tuesday, October 31, 2017 4:11:51 PM

October 31, 2017

U.S. Senate Energy and Natural Resources

Chairwomen, the Honorable Senator Lisa Murkowski

304 Dirksen Senate Building

Washington, DC 20510

Re: **I support the opening of ANWR.**

Dear Chairwomen Senator Murkowski and Committee members:

For years, I have been an advocate for opening the ANWR 1002 area of the coastal plains to development. As an Alaskan, my fellow residents and I depend on a healthy oil and gas industry.

For years the environmentalist have been using the opening of ANWR as their salvo for everything that's wrong in Alaska's oil and gas industry. As an Alaskan, I know this to be a false premise. I have high confidence in American ingenuity and thanks to continuing improvements in technology, practices, and oversight; the oil industry has demonstrated over the past 40 years that North Slope energy development and environmental stewardship can, and do, coexist. The industry has a proven track record of responsible development in sensitive areas, protecting the environment, wildlife and subsistence needs of the local area residents.

In Alaska, polls have consistently shown Alaskans overwhelmingly support responsible oil and gas development in the non-wilderness areas of ANWR. There is no valid reason why we should not be allowed to access this world-class resource within just a tiny fraction of the coastal plain. The proposed ANWR provision would allow development of no more than 2,000 acres of the 1.5 million acres of the Arctic coastal plain – part of the non-wilderness portion of ANWR's 19 million acres. That is equivalent to just 0.01 percent of the entire refuge. The affected area of the 1002 area of ANWR is no larger than the Dulles Airport.

This area of ANWR was set aside by Congress, for oil and gas development. I believe that responsible oil and gas development in this portion of ANWR can be done safely and with

environmental safeguards in place. Opening ANWR will help ensure America's energy security for decades and allow Alaska – and our nation as a whole – to realize the benefits that come from expanding energy production in Alaska. Oil development on a fraction of the coastal plain would create thousands of jobs nationwide, generate billions of dollars in State and government revenue, keep energy prices for American consumers affordable, and further improve energy security for decades into the future. Since the ANWR coastal plain is less than 60 miles from TAPS, development of ANWR 1002 area is one of the most environmentally-sound ways to increase oil production in Alaska.

The industry has a proven track record of responsible development in sensitive areas, protecting the environment, wildlife and subsistence needs of local residents.

I support the opening of ANWR.

Respectfully submitted,

Matthew Fagnani

2559 Loussac Dr.

Anchorage, Alaska 99517

From: Mike Fall
To: fortherecord (Energy)
Cc: Hoefler, Annie (Energy)
Subject: ANWR
Date: Wednesday, November 01, 2017 1:32:49 PM

Chairman Murkowski, Ranking Member Cantwell, and Members of the Senate Energy and Natural Resources Committee.

I am in support of opening ANWR to development of its natural resources including oil and gas.

- While renewable energy is a growing part of America's energy portfolio, it is still projected to account for a minority of American energy production in 2040. New oil and gas production will be required to power America's economy and can serve as a bridge until renewable energy becomes a dominant energy source decades into the future.

    - Energy production from ANWR has the potential to offset a decline in Lower 48 shale oil production, which is expected to commence in approximately a decade. Without limited oil development on the coastal plain, America will be forced to once again increase its reliance on foreign imports. With limited development in ANWR, America and Alaska can continue to grow the economy and reduce dependence on foreign oil.

    - The U.S. Geological Survey estimates the 1002 Area is North America's greatest prospect for conventional onshore oil production, with a mean likelihood of containing 10.4 billion barrels of oil and 8.6 trillion cubic feet of natural gas, as well as a reasonable chance of economically producing 16 billion barrels of oil.

    - Alaska's economic lifeline, the Trans-Alaska Oil Pipeline System (TAPS), is now running at three-quarters empty. New oil

production from ANWR has the potential to reverse throughput in TAPS, a vital component of American energy infrastructure.

- Oil development on a fraction of the coastal plain would create thousands of jobs nationwide, generate billions of dollars in government revenue, keep energy prices for American consumers affordable, and further improve energy security for decades into the future.

- Since the ANWR coastal plain is less than 60 miles from TAPS, development of energy resources there is one of the most environmentally-sound way to increase oil production in Alaska.

- Thanks to continuing improvements in technology, practices, and oversight, the oil industry has demonstrated over the past 40 years that North Slope energy development and environmental stewardship can and do coexist. The industry has a proven track record of responsible development in sensitive areas, protecting the environment, wildlife and subsistence needs of local residents.

Michael J. Fall
President
UNIT COMPANY
620 East Whitney Road
Anchorage, Alaska 99501
907.349.6666 * 907.522.3464 f

From: scott fantozzi
To: fortherecord (Energy)
Subject: PROTECT ALASKA"S WILDLIFE REFUGE FROM OIL & GAS COMPANIES
Date: Thursday, November 02, 2017 3:46:59 PM

Hi,

My name is David Fantozzi and I'm a constituent from Cincinnati, Ohio 45202.

I'm writing to ask that the committee find other means to produce federal revenue than reopening the Arctic national wildlife refuge for oil and gas drilling.

We should not destroy protected land and endanger wildlife to fund unnecessary tax breaks for the wealthy.

Thank you,
Scott

David Scott Fantozzi
917-843-2905

From: Glen Faulkner
To: fortherecord (Energy); anniehoefler@energy.senate.gov
Subject: ANWR Development
Date: Wednesday, November 01, 2017 5:25:57 PM

To: Chairman Murkowski, Ranking Member Cantwell, Members of the Senate Energy & Natural Resources Committee

As a lifetime resident in Alaska I am in support of ANWR development. I believe this can be done in a responsible manner that protects the environment while providing State revenue and resources that help create jobs for Alaskan's.

Thank you for your consideration in this matter.

Glen Faulkner
P.O. Box 4242
Soldotna, Ak. 99669

From: Louis Fernandez
To: fortherecord (Energy)
Subject: For Record of November 2, 2017 Hearing
Date: Tuesday, October 31, 2017 8:27:36 PM

Chairman Murkowski, Ranking Member Cantwell, and Members of the Senate Energy and Natural Resources Committee,

I have worked on the North Slope of Alaska since 1981 and can attest that the North Slope energy development and environmental stewardship can and do coexist, most recently demonstrated by the Point Thomson Project. The industry has a proven track record of responsible development in sensitive areas, protecting the environment, wildlife and subsistence needs of local residents.

The proposed ANWR provision would allow development of no more than 2,000 acres of the 1.5 million acres of the Arctic coastal plain - part of the non-wilderness portion of ANWR's 19.0 million acres. This equates to just 0.01 percent of the entire refuge.

Please understand that responsible oil and gas development in this fraction of ANWR will help ensure America's energy security for decades and allow Alaska - and our nation as a whole - to realize the benefits that come from expanding energy production in Alaska.

Thank you for your time to listen to my comments.

Respectfully,
Louis Fernandez, PMP
Udelhoven Oilfield System Services, Inc.
Office: 907.344.1577 | Mobile: 702.241.3918 | E-Mail: lfernandez@udelhoven.com

From: Michael Ferris
To: fortherecord (Energy)
Cc: Hoefler, Annie (Energy)
Subject: For Record of November 2, 2017 Hearing
Date: Tuesday, October 31, 2017 1:49:22 PM

Chairman Murkowski, Ranking Member Cantwell, and Members of the Senate Energy and Natural Resources Committee

My name is Michael S. Ferris and I have lived in Alaska since 1967. Over the years different administration have locked up Alaska and made it harder and harder to develop our Natural Resources. IT is a great day for Alaskans to have the opportunity to develop it resources.

Alaska's economic lifeline, the Trans-Alaska Oil Pipeline System (TAPS), is now running at three-quarters empty. New oil production from ANWR has the potential to reverse throughput in TAPS, a vital component of American energy infrastructure. The proposed ANWR provision would allow development of no more than 2,000 acres of the 1.5 million acres of the Arctic coastal plain – part of the non-wilderness portion of ANWR's 19 million acres. That is equivalent to just 0.01 percent of the entire refuge.

Oil development on this fraction of the coastal plain would create thousands of jobs nationwide, generate billions of dollars in government revenue, keep energy prices for American consumers affordable, and further improve energy security for decades into the future. Since the ANWR coastal plain is less than 60 miles from TAPS, development of energy resources there is one of the most environmentally-sound way to increase oil production in Alaska.

Thanks to continuing improvements in technology, practices, and oversight, the oil industry has demonstrated over the past 40 years that North Slope energy development and environmental stewardship can and do coexist. The industry has a proven track record of responsible development in sensitive areas, protecting the environment, wildlife and subsistence needs of local residents.

I look forward to seeing the ANWR provision left in the current budget reconciliation bill

Sincerely

Michael S. Ferris
Xerox Sales Agent

Alaska Enterprise Solutions
Xerox Authorized Sales Agency
557 E Fireweed Lane
Suite A
Anchorage, AK 99503
office (907) 561-5100
CELL (907) 306-8475
fax (907) 561-5101
email mike@aesalaska.com

From: patricia Fink
To: fortherecord (Energy)
Subject: ANWR
Date: Wednesday, November 01, 2017 2:17:49 AM

Dear Chairman Murkowski and Ranking Member Cantwell,
We support opening the 1002 area of the Arctic Slope oil fields. We as Alaskans have a record of responsibly caring for this area with no effects to animals or the environment. We encourage you to vote in favor of development in the 1002 area.
Sincerely,
Patricia and Siegfried Fink
688 Chena Ridge Rd.
Fairbanks, Ak 99709
907-590-5398

From: Ron Fiscus
To: fortherecord (Energy)
Cc: ""annie_hoefler@energy.senate.gov.""@mail42c28.carrierzone.com
Subject: For Record of November 2, 2017 Hearing
Date: Wednesday, November 01, 2017 9:18:42 AM

For Record of November 2, 2017 Hearing

-

Chairman Murkowski,

This email is to show my family's support for development in ANWR. I'm born and raised in Alaska, my wife has been here since 8th grade and we have three teenage boys. We need more good paying oil field jobs to retain our young people and attract more to keep the state economy growing. Currently our state is losing people, our budget is broke and crime is continuing to climb. And this would also be a good thing for our Country. We need this ANWR development now more than ever.

Thank you,
Fiscus family
Ron, Maureen, Ronnie, Alex, Riley
907-240-3680
7440 Bailey Dr.
Anchorage, Alaska 99502

From: todd.fletcher@wellsfargoadvisors.com
To: fortherecord (Energy)
Subject: Allowing Drilling to Begin in ANWR is a Positive Step Towards Responsible Energy Development - Please vote yes - The State of Alaska Needs It!!!! - Please Vote YES.
Date: Tuesday, October 31, 2017 7:15:22 PM

Todd I. Fletcher
Senior Vice President – Investments
Branch Manager
Wells Fargo Advisors | 3900 C Street, Suite 502 | Anchorage, AK 99503
Tel 907-257-0230 | Fax 907-258-5997

From: Craig Flippo
To: fortherecord (Energy)
Subject: Support for ANWR Exploration and Production
Date: Wednesday, November 01, 2017 3:41:08 PM

I support responsible development in ANWR. I have personally worked in the oil and gas industry for over 40 years (33 of this in Alaska) and the oil companies have the ways and means to safely and successfully bring this this resource to market.
Thanks and feel free to contact me for any further insight.

--
Craig P.Flippo
907-440-8731
flippocp@gmail.com

From: Jenith Flynn
To: fortherecord (Energy)
Cc: Hoefler, Annie (Energy)
Subject: one voice from Anchorage, Alaska- in support of ANWR Drilling
Date: Wednesday, November 01, 2017 12:57:31 PM

Chairman Murkowski, Ranking Member Cantwell, and Members of the Senate Energy and Natural Resources Committee,

My husband and I were both born in Alaska and will forever call it home. I work in construction and my husband is a petroleum drilling engineer.

Responsible resource development is KEY to Alaska's success. Thanks to continuing improvements in technology, practices, and oversight, the oil industry has demonstrated over the past 40 years that North Slope energy development and environmental stewardship **can and do coexist**. The industry has a **proven track record** of responsible development in sensitive areas, protecting the environment, wildlife and subsistence needs of local residents.

Every individual working on the "slope" or in the oil industry understands how special our state is, none of them want to be associated with a spill/incident/accident. Oil development on a fraction of the coastal plain would create thousands of **needed** jobs and generate billions of dollars in government revenue.

Please let me know if you have any questions, thanks for your time and consideration.

Jenith Flynn
davis constructors & engineers inc.
6591 A Street, Suite 300, Anchorage, AK 99518
Main: (907) 562-2336 | Direct: (907) 771-9222 | Mobile (907) 244-0041
Email: jenithf@davisconstructors.com

From: Wyche.Ford@fluor.com
To: fortherecord (Energy)
Cc: Hoefler, Annie (Energy)
Subject: For Record of the November 2 Hearing
Date: Wednesday, November 01, 2017 5:39:48 PM

To:

Chairman Murkowski, Ranking Member Cantwell and Members of the Senate Energy & Natural Resources Committee

I urge your approval of the proposed ANWR provision. As a long term Alaskan with a career spanning 40 years working in the Oil and Gas industry on North Slope projects, I am familiar with the benefits and challenges of development in the ANWR 1002 area. The Alaska industry does this type of work better than any place else in the world. Access to explore and identify the resource opportunity would allow for orderly and minimum impact development.

The 1002 area was specifically set aside for exploration and development. Now is the time to allow for responsible exploration and development.

Regards,

Wyche Ford
President of The Alaska Support Industry Alliance

Wyche Ford | **FLUOR** | Senior Project Director | wyche.ford@fluor.com | Office: 907-865-2022 | Cell: 907-350-1646

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Any views expressed in this message are those of the individual sender and may not necessarily reflect the views of the company.

From: jfoster@gci.net
To: fortherecord (Energy)
Cc: Hoefler, Annie (Energy)
Subject: ANWR
Date: Tuesday, October 31, 2017 5:08:57 PM

For Record of November 2, 2017 Hearing

Chairman Murkowski, Ranking Member Cantwell, and Members of the Senate Energy and Natural Resources Committee

I support opening ANWR 100% and hope that your committee will concur.

Open the ANWR coastal plain (1002 area) to exploration and production. Require timely lease sales. Streamline and simplify the permitting process. Provide for a 50-50 percent federal-state revenue sharing.

Alaska favors responsible development while protecting the environment!

Sincerely yours,

John Wm. Foster
4353 Taku Blvd.
Juneau, AK 99801

From: Parke Fox
To: fortherecord (Energy)
Subject: My name is Parke Fox 7554 Alexander St. Gilroy,Ca. 95020 Please do everything possible to stop oil exploration in our wildlife preserves and everywhere else in Alaska -thank you . My Email is parkefox6@gmail.com
Date: Tuesday, November 14, 2017 5:13:11 PM

Sent from my iPhone

From: Susan Foy
To: fortherecord (Energy)
Subject: Arctic National Wildlife Refuge
Date: Saturday, November 04, 2017 11:18:51 AM

In response to your request for feedback, I propose the Committee find other means to produce federal revenue than reopening the Arctic National Wildlife Refuge for oil and gas drilling. We shouldn't destroy protected land and endanger wildlife so that the super-wealthy can become super-wealthier. We've all fought so hard for this area to stay undisturbed. This administration is doing SO MUCH harm to our environment and our natural resources. Please don't help them. It's your duty to stop the destruction of our national natural resources.

Please pass my message along to the Chairman and other committee members.

Susan Foy

--
Susan Farris Foy
Attorney at Law

www.susanfarrisfoy.com
www.linkedin.com/in/susanffoy
714-773-4367 (office)
714-533-9593 (fax)
CA State Bar # 150008

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From: Dennis Fradley
To: fortherecord (Energy)
Subject: Alaskans support developing 1002 area of ANWR
Date: Wednesday, November 01, 2017 12:53:17 PM

Dear Chairman Lisa Murkowski and Ranking Member Maria Cantrell

My wife and I have been Alaska residents since 1968, before Prudhoe Bay was developed. We remember what Alaska's economy and limited opportunities were like in cities and villages prior to North Slope development, and we can contrast them to the advancements of today that were brought about in large part by the revenues of oil production. We also remember the bitter national debate that sought to prevent the construction of the trans Alaska pipeline through exaggerations and fear mongering of devastation to the environment, wildlife and so forth. As ugly as that debate sometime was, we recognize the positive consequences for the nation and the state as many compromises were negotiated to accommodate major concerns about protecting the environment and lessening negative impacts for people. We believe the facts show that after 40 years of operation (and not counting the maritime Exxon Valdez tanker accident), North Slope production has proven to be the success envisioned back then. Oil development in Alaska a good track record.

One of the many compromises made by Congress regarding Alaska resource development and environmental protection is the deferral of the 1002 coastal area of ANWR in the 1980 ANILCA legislation. The majority of Alaskans that we know are encouraged that Congress may now take action to authorize development. However, similar to what happened during the pipeline construction debate decades ago, we understand the national environmental lobby is flexing its muscle to block your committee's consideration of this matter. We urge you to continue to move forward and work out the compromises to favorably consider opening the coastal plain to oil development.

Dennis and Patricia Fradley
1701 George Bell Circle
Anchorage, AK 99515

From: Cheryl Frasca
To: fortherecord (Energy)
Cc: Hoefler, Annie (Energy)
Subject: For Record of November 2, 2017 Hearing
Date: Tuesday, October 31, 2017 4:28:21 PM

Chairman Murkowski, Ranking Member Cantwell, and Members of the Senate Energy and Natural Resources Committee,

I write this email in support of limited oil and natural gas activity within the non-wilderness coastal plain of the Arctic National Wildlife Refuge (ANWR).

The U.S. Geological Survey estimates the 1002 Area is North America's greatest prospect for conventional onshore oil production, with a likelihood of containing 10.4 billion barrels of oil and 8.6 trillion cubic feet of natural gas. Estimates are that it can be expected that 16 billion barrels of oil can be produced. This would generate billions of dollars in government revenue, create thousands of jobs nationwide, keep energy prices for American consumers affordable, and further improve energy security for decades into the future.

I urge your approval of this provision.

Thank you.

Cheryl Frasca
2415 La Honda Dr.
Anchorage, AK 99517

From: beth@bethsvalleyviews.com
To: fortherecord (Energy)
Subject: Alaska - American Energy Producer & Proud of it!
Date: Wednesday, November 01, 2017 8:07:02 PM
Importance: High

Chair - Senator Murkowski
Ranking Member- Senator Cantwell

I am writing in support of opening the 1002 section of ANWR for commercial resource extraction. Alaskan petroleum leaseholders are extremely conscientious about the environment in which they work and are, therefore, good stewards of the land and the resource(s). Most Alaskans trust them and are grateful for their contribution to our communities and government.

It is imperative that Alaska has the right to develop our resources in a manner which protects the environment. We have a substantial record of professional environmental management on
the North Slope.

Finally and in the strongest of terms, I believe that the intent language contains the 90/10 revenue split that was agreed upon between Alaskans and the Congress at Statehood. The resources of Alaska should not be put on the auction block for financial negotiation. Please adhere to our statehood compact in *every* way so that we can become as independent as we were promised we would be at statehood.

Thank you,
Elizabeth Fread

Beth Fread
Associate Broker
907-354-7759
Beth@BethsValleyViews.com
Lee Realty, LLC
550 E Dunbar Dr., Suite F
Wasilla, AK 99654

From: Christina Freeman
To: fortherecord (Energy)
Subject: Opposed to reopening the Arctic National Wildlife Refuge for oil and gas
Date: Wednesday, November 15, 2017 4:25:24 PM

To Whom it may Concern:

My name is Christina Freeman and my address is 2262 City View Drive, Cleveland, OH 44113. I am writing to ask the Committee not to open the Arctic National Wildlife Refuge for oil and gas drilling. It is my opinion that this will damage our land and wildlife, and that funds reaped as a result will not be worth the cost.

Please vote no.

Sincerely,
Christina Freeman

Mobile: +1 216.644.2503

From: Kathryn Freund
To: fortherecord (Energy)
Subject: Arctic national wildlife refuge
Date: Wednesday, November 15, 2017 12:00:28 PM

My name is Kate Freund, and I'm a constituent from New York, 160 W 71st St, 10023.

I'm calling to ask that the committee find other means to produce federal revenue than reopening the Arctic National Wildlife Refuge for oil and gas drilling. We should not be destroying protected land and endangering wildlife to fund unnecessary tax breaks for the wealthy.

Please pass my message along to the Chairman and other committee members. Thank you for your attention to this matter.

Kate Freund

~~EXPLOITERS~~
FRIENDS
of ANIMALS

November 2, 2017

Re: Testimony on Potential for Oil and Gas Exploration in the Arctic Refuge 1002 Area/ Coastal Plain

On behalf of our 100,000 members and supporters, Friends of Animals submits this testimony opposing oil and gas exploration in the Coastal Plain area of the Arctic National Wildlife Refuge known as area 1002.

Alaska is home to some of the last largely undisturbed areas of wilderness in the world, and the Arctic Refuge is a national treasure that deserves protection. Recent attempts to sneak language in the budget proposal that could open the area to drilling via Senate reconciliation instructions included in H. Con. Res 71 jeopardize this sensitive and irreplaceable ecosystem. Given the importance of the issue to Americans – two-thirds of Americans oppose drilling in the area[1] -- and the potential detrimental and irreversible consequences, such issues have no place in a budget proposal.

Friends of Animals has worked for more than a decade to protect the wildlife in the Refuge, which includes polar bears, wolves, Porcupine caribou and more than a hundred species of migratory birds, from previous back-door attempts to permit oil drilling that would have detrimental effects on their natural behaviors and habitat. Based in Connecticut, Friends of Animals worked closely with its Republican and Democratic Congressional representatives to include the 1.5 million-acre Coastal Plain, the very region currently under consideration in the budget for drilling, in the protected Refuge region. We must continue these efforts to protect this area.

While drilling in the Artic Wildlife Refuge may cause catastrophic consequences and irreversible damage, it comes with little to no benefits. The U.S. Geological Survey had estimated that the Coastal Plain area would only provide a six-month's supply of oil for Americans and would take years to get the supply to market.

Additionally, while drilling proponents claim the drilling in the 1002 region would raise more than $1 billion in revenue for the U.S. Treasury over the next ten years, an analysis by the Center for American Progress found that oil and gas leases would raise less than $40 million.[2]

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[1] Recent polling by the Center on American Progress shows that two-thirds of Americans are opposed to drilling in the Refuge, with a majority "strongly opposed."

[2] The Center for American Progress analysis found that if all 1.5 million acres of the Coastal Plain were sold for oil drilling over the next ten years of a bid of $50 per acre, the federal government, after providing Alaska with the required 50 percent share of federal energy royalties, would receive just $37.5 million.

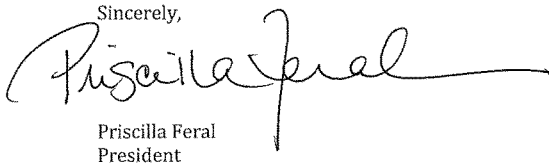
❑ NATIONAL HEADQUARTERS • 777 POST ROAD SUITE 205 • DARIEN, CT 06820 • T 203 656 1522 • F 203 656 0267
■ WILDLIFE LAW PROGRAM • 7500 E. ARAPAHOE RD. SUITE 385 • CENTENNIAL, CO 80112 • T 720 949-7791 FRIENDSOFANIMALS.ORG

Even more concerning, surveys have noted that the oil in the Refuge is not concentrated in one large reservoir but spread out across the coast plain in dozens of small deposits. Thus, infrastructure such as roads and pipelines to produce the oil would have to stretch across the region. This development would destroy the ecosystem, disrupt the Porcupine caribou who use this Coastal Plain as a calving ground, and displace polar bears who build dens there.

Thus, Friends of Animals members stands with the vast majority of Americans, in its request to protect this irreplaceable landscape from seismic testing and drilling activities. Please do everything you can to enact the strongest possible protections for the Arctic landscape, its wildlife and all Americans.

Thank you for your efforts.

Sincerely,



Priscilla Feral
President
Friends of Animals

❑ NATIONAL HEADQUARTERS • 777 POST ROAD SUITE 205 • DARIEN, CT 06820 • T 203 656 1522 • F 203 656 0267
■ WILDLIFE LAW PROGRAM • 7500 E. ARAPAHOE RD. SUITE 385 • CENTENNIAL, CO 80112 • T 720 949-7791 FRIENDSOFANIMALS.ORG

From: Paul Friese
To: fortherecord (Energy); Hoefler, Annie (Energy)
Cc: Paul Friese
Subject: "Chairman Murkowski, Ranking Member Cantwell, and Members of the Senate Energy and Natural Resources Committee
Date: Wednesday, November 01, 2017 11:43:57 AM

For Record of November 2, 2017 hearing

I have lived in Alaska for over 30 years, I have seen the good times and the not so good times. We are currently in one of the not so good times, but we are Alaskans, and we will survive and be better for it. Oil & Gas are critical for Alaska's future, we embrace all the other industries, tourism, fishing, mining, farming, but all of these combined only contribute a small amount towards the state budget. Without oil & gas, Alaska would be a far different place.

I do not know anyone who does not support opening ANWR, we are all in agreement it needs to be done responsibly so that we take great measures to take care of the environment, with the new technologies in this industry, much can be done from a single pad.

Please put me, my wife, and kids down as supporting the opening of ANWR.

Regards,

Paul Friese |VP Alaska Sales | Lynden Transport, Anchorage
O: 907-257-5114 | C: 907-223-6021 | www.lynden.com

Polls have consistently shown Alaskans overwhelmingly support responsible oil and gas development in the non-wilderness portion of ANWR. There is no valid reason why we should not be allowed to access the world-class resources within just a tiny fraction of the coastal plain.

The proposed ANWR provision would allow development of no more than 2,000 acres of the 1.5 million acres of the Arctic coastal plain – part of the non-wilderness portion of ANWR's 19 million acres. That is equivalent to just 0.01 percent of the entire refuge.

Responsible oil and gas development in this fraction of ANWR will help ensure America's energy security for decades and allow Alaska – and our nation as a whole – to realize the benefits that come from expanding energy production in Alaska.

While renewable energy is a growing part of America's energy portfolio, it is still projected

to account for a minority of American energy production in 2040. New oil and gas production will be required to power America's economy and can serve as a bridge until renewable energy becomes a dominant energy source decades into the future.

Energy production from ANWR has the potential to offset a decline in Lower 48 shale oil production, which is expected to commence in approximately a decade. Without limited oil development on the coastal plain, America will be forced to once again increase its reliance on foreign imports. With limited development in ANWR, America and Alaska can continue to grow the economy and reduce dependence on foreign oil.

The U.S. Geological Survey estimates the 1002 Area is North America's greatest prospect for conventional onshore oil production, with a mean likelihood of containing 10.4 billion barrels of oil and 8.6 trillion cubic feet of natural gas, as well as a reasonable chance of economically producing 16 billion barrels of oil.

Alaska's economic lifeline, the Trans-Alaska Oil Pipeline System (TAPS), is now running at three-quarters empty. New oil production from ANWR has the potential to reverse throughput in TAPS, a vital component of American energy infrastructure.

Oil development on a fraction of the coastal plain would create thousands of jobs nationwide, generate billions of dollars in government revenue, keep energy prices for American consumers affordable, and further improve energy security for decades into the future.

Since the ANWR coastal plain is less than 60 miles from TAPS, development of energy resources there is one of the most environmentally-sound way to increase oil production in Alaska.

Thanks to continuing improvements in technology, practices, and oversight, the oil industry has demonstrated over the past 40 years that North Slope energy development and environmental stewardship can and do coexist. The industry has a proven track record of responsible development in sensitive areas, protecting the environment, wildlife and subsistence needs of local residents.

From: John Frost
To: fortherecord (Energy)
Subject: Oil development in ANWR
Date: Wednesday, November 01, 2017 2:05:31 AM

Dear Chairman Murkowski, Ranking Member Cantwell, and Members of the Senate Energy and Natural Resources Committee.

I strongly support oil and gas exploration and development in the tiny portion of the ANWR currently being considered by your committee.

I have lived in Alaska for 45 years and have witnessed the development of Prudhoe Bay and the Trans Alaska Pipeline. I have seen virtually no negatives arising from that development. The extremely small portion of ANWR being considered for development shares many simularities with Prudhoe Bay and would be using the same pipeline if and when markatable quantities of oil are discovered and developed.

I want to emphasize that I am a hunter and conservationist. I deeply value wild places and the creatures of the wilderness. Oil development on the coastal plain of extreme northern Alaska has not hurt caribou and in fact the Central Arctic herd (around Prudhoe Bay and the Haul Road) has thrived when caribou world wide are declining. I have hunted and fished within ANWR since taking my first sheep there in 1974 and most recently have spent at least a week every August for the past five years, flying and camping with my daughter in ANWR.

Thank you for your consideration of my opinion.

Sincerely,

John D Frost MD
907-360-1301
3823 West 100th Avenue
Anchorage, Alaska, 99515

From: Erin Gabbard
To: fortherecord (Energy)
Subject: Arctic National Wildlife Refuge
Date: Wednesday, November 15, 2017 10:11:42 AM

To whom it may concern,

I'm writing to ask that the committee find other means to produce federal revenue than reopening the Arctic National Wildlife Refuge for oil and gas drilling. We should not destroy protected land and endanger wildlife to fund unnecessary tax breaks for the wealthy. Please pass my message along to the Chairman and other committee members.

Thank you for your time and attention.

Sincerely,

Erin Gabbard
6681 W Alexandria Rd
Middletown, OH 45042

From: ggalaska907@aol.com
To: fortherecord (Energy)
Subject: ANWR area 1002
Date: Tuesday, October 31, 2017 3:47:15 PM

"**Dear Chairman Murkowski and Ranking Member Cantwell,**
I have been an Alaskan since 1970 and have been in favor of environmentally friendly development all of my life and I think we should develop area 1002 as soon as possible. 98% of ANWR will still be protected. Alaska needs more oil in our pipeline and this is the solution of the economic dilemma that we are experiencing. Our representatives should ban together and make this happen ASAP!

Sincerely,

George and Peggy Gallagher
7210 E Chester Heights Circle
Anchorage, Ak 99504 907-337-2073

From: Tonya Garnett
To: fortherecord (Energy)
Subject: Protect the Arctic Refuge
Date: Thursday, November 02, 2017 1:22:08 AM

I am an Alaskan and have lived here for 40 years. I want protection of the Arctic national wildlife refuge. I don't want it open for development. This land is sacred and important for future generations to come. We must protect the Caribou Calving grounds. I ask that you represent everyone in Alaska and protect.
Tonya Garnett
907-388-3805

From: Richard Garvin
To: fortherecord (Energy)
Subject: 1002Area of ANWR
Date: Tuesday, October 31, 2017 3:45:55 PM
Importance: High

"Dear Chairman Murkowski and Ranking Member Cantwell,

I am an Alaskan that supports the opening of the 1002 area of the Arctic National Wildlife Refuge. Alaskans have developed the North Slope oil fields responsibly and will continue to do so with NO effects to the Arctic Caribou herd or any other animal species. We are the caretakers of the environment and we need you to vote in favor of development.

Thank you for your time and consideration

Richard H. Garvin
2822 Knik Ave
Anchorage, AK 99517
907-248-4904

From: Jessica Gath
To: fortherecord (Energy)
Subject: Do not reopen the Arctic National Wildlife Refuge for oil and gas drilling
Date: Thursday, November 02, 2017 1:25:19 PM

To Whom It May Concern on the Senate Committee on Energy and National Resources:

I am an American citizen writing to urge you to find other means to produce federal revenue than reopening the National Wildlife Refuge for oil and gas drilling.

We should not destroy protected land and endanger wildlife to fund unnecessary tax breaks for the wealthy.

We have only one planet to live on and no amount of money will be helpful or mean anything once our natural resources are ruined or squandered for the gain of greedy industries such as petroleum.

Sincerely,
Jessica Gath

31 Prospect Place
Brooklyn, NY 11217

From: edwardg
To: fortherecord (Energy)
Subject: No to Reopening the Arctic National Wildlife Refuge for oil and gas drilling
Date: Tuesday, November 14, 2017 10:02:11 PM

Senate Committee on Energy and Natural Resources,

I'm contacting you regarding the debate to allow the Secretary of the Interior to establish a leasing program for the development and production of oil and gas in Alaska's "Area 1002"

I'm requesting that the committee find other means to produce federal revenue than reopening the Arctic National Wildlife Refuge for oil and gas drilling. We should not destroy protected land and endanger wildlife to fund unnecessary tax breaks for the wealthy.

I'm urging the Senate Committee to oppose any reopening of the Arctic National Wildlife Refuge for oil and gas drilling.

Sincerely,
Edward Gee
953 NW Hoquiam Ct
Camas WA 98607

From: tami_gee@comcast.net
To: fortherecord (Energy)
Subject: No to Reopening the Arctic National Wildlife Refuge for oil and gas drilling
Date: Tuesday, November 14, 2017 12:12:27 PM

Senate Committee on Energy and Natural Resources,

I'm contacting you regarding the debate to allow the Secretary of the Interior to establish a leasing program for the development and production of oil and gas in Alaska's "Area 1002"

I'm requesting that the committee find other means to produce federal revenue than reopening the Arctic National Wildlife Refuge for oil and gas drilling. We should not destroy protected land and endanger wildlife to fund unnecessary tax breaks for the wealthy.

I'm urging the Senate Committee to oppose any reopening of the Arctic National Wildlife Refuge for oil and gas drilling.

Sincerely,
Tamara Gee
953 NW Hoquiam Ct
Camas WA 98607

From: Michael C. Geraghty
To: fortherecord (Energy)
Subject: 1002 opening
Date: Wednesday, November 01, 2017 1:43:57 PM

Dear Chairman Murkowski and Ranking member Cantwell:

As a life-long Alaskan I strongly urge the committee to allow exploratory drilling in this very limited area on the edge of ANWR. Responsible resource development should include knowing what resources are present, and that would be the purpose of this exploratory program. The footprint of development is so small, and all the appropriate restrictions will be placed on the operator in terms of harming the environment. Given industry's track record on the North Slope, it is simply fear-mongering and demagoguery to suggest that this very limited program poses some grave threat to the environment or to animal species. Alaskans know better. Thank you for your leadership on this important issue. Mike Geraghty

Michael C. Geraghty | Partner

Oles Morrison Rinker & Baker, LLP
601 West Fifth Avenue, Suite 900 | Anchorage, AK 99501
O: 907.258.0712 | F: 907.258.5519
geraghty@oles.com | www.oles.com | www.procurementplaybook.com

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From: Chad Gerondale
To: fortherecord (Energy)
Cc: Hoefler, Annie (Energy)
Subject: Open ANWR
Date: Tuesday, October 31, 2017 3:15:41 PM

Chairman Murkowski, Ranking Member Cantwell, and Members of the Senate Energy and Natural Resources Committee.

It is time to allow exploration and development of ANWR. For too long we Alaskan's and United States Citizen's have been energy dependent on other countires. This is a step in the right direction.

The number of jobs and opportuities this project will provide is immense in our own organizations view. Since the beginning slide of oil prices, we have seen our annual revenues drop from $100+ million, to about $85 million. Our whole goods revenue has been reduced by 50%, and we have gained market share, so times are tough.

The Alaskan economy needs help, and this would be a start.

Additionally, in a healthy economy, crime, abuse, deliquencies, etc., all negative effects of a poor economy, begin to reduce statistically.

Help Alaska, and the United States Citizens by allowing for opportunities to shore up our energy reserves.

Thank you for your time and this opportunity.

Chad D. Gerondale
Sales Manager
Construction Machinery Industrial, LLC
5400 Homer Drive
Anchorage, Alaska 99518
Cell 907-250-8141
Office 907-563-3822
Home 907-522-0120
chad.gerondale@cmiak.com

From: Wade Gies
To: fortherecord (Energy)
Subject: ANWR
Date: Wednesday, November 01, 2017 8:00:50 PM
Attachments: image002.png

To Whom It May Concern:

I pledge that we as Alaskans and as Americans need to open up ANWR to oil/gas exploration/production.
Please vote yes to open this land up.....

Thanks,

Wade Gies
Branch Manager
Construction Machinery Ind, LLC
2615 20th Avenue
Fairbanks Alaska 99709
(907) 455-9600 Office
(907) 455-9700 Fax
(907) 460-0087 Cell
w.gies@cmiak.com

From: Richard Giessel
To: fortherecord (Energy)
Subject: OPEN the 1002 Area of ANWR to Oil Drilling
Date: Wednesday, November 01, 2017 12:21:28 AM

"Dear Chairman Murkowski and Ranking Member Cantwell,
I am an Alaskan that supports the opening of the 1002 area of the Arctic National Wildlife Refuge. Alaskans have developed the North Slope oil fields responsibly and will continue to do so with NO effects to the Arctic Caribou herd or any other animal species. We are the caretakers of the environment and we need you to vote in favor of development."

Thank you,

Richard Giessel
12701 Ridgewood Road
Anchorage, AK 99516

From: Rebecca Gitzen
To: fortherecord (Energy)
Cc: Casey Sullivan
Subject: ANWR Support
Date: Wednesday, November 01, 2017 3:06:50 PM

To whom it may concern,

I am a lifelong Alaskan, born and raised. I understand how important oil exploration & development is for the State and how important it will be going into the future. With the current economic state here in Alaska, I am afraid our State will be unable to support itself without continued exploration & development opportunities. ANWR is a perfectly proven resource that would bring long lasting economic growth to Alaska. Alaskans have proven that we can development environmentally & economically sustainable fields. It takes time to explore and develop these fields safely so open up ANWR now so we can secure our children's and grandchildren's future in this great State.

Thank you,

Rebecca Gitzen
Procurement Supervisor
Caelus Energy Alaska LLC
3700 Centerpoint Dr., Suite 500
Anchorage, AK 99503
Direct (907) 343-2145
Cell (907) 952-5464/(907) 223-6224
Rebecca.Gitzen@Caelusenergy.com

Statement of Confidentiality:
This message may contain information that is privileged or confidential. If you receive this transmission in error, please notify the sender by reply e-mail and delete the message and any attachments.

From: Jaci Glenn
To: fortherecord (Energy)
Subject: Allow Drilling in ANWR!!!
Date: Wednesday, November 01, 2017 12:55:24 PM

My family came to Alaska in the mid-1970s. My father and uncles were employed in the industries that built the pipeline, and my brother and nephew work in the support industries to continue its production. I am an Insurance professional working and raising my family in Fairbanks, and my teenage son anticipates proudly following in their footsteps. For that to happen, we need to continue the flow of oil in the state of Alaska. Due to the current decline in oil production, there is less need for support up north. I have clients in the trucking industry that had to move operations to other states in order to make a living. I see the industry struggle every day to stay afloat, and more and more clients are looking to relocating outside. We need to stop the job loss. Opening a small portion of ANWR is the most viable option to save this and other support industries, and continue to bring jobs to Alaskans who so desperately need them.

The proposed ANWR provision would allow development of no more than 2,000 acres of the 1.5 million acres of the Arctic coastal plain – part of the non-wilderness portion of ANWR's 19 million acres. That is equivalent to just 0.01 percent of the entire refuge.

· Responsible oil and gas development in this fraction of ANWR will help ensure America's energy security for decades and allow Alaska – and our nation as a whole – to realize the benefits that come from expanding energy production in Alaska.

· While renewable energy is a growing part of America's energy portfolio, it is still projected to account for a minority of American energy production in 2040. New oil and gas production will be required to power America's economy and can serve as a bridge until renewable energy becomes a dominant energy source decades into the future.

· Energy production from ANWR has the potential to offset a decline in Lower 48 shale oil production, which is expected to commence in approximately a decade. Without limited oil development on the coastal plain, America will be forced to once again increase its reliance on foreign imports. With limited development in ANWR, America and Alaska can continue to grow the economy and reduce dependence on foreign oil.

· The U.S. Geological Survey estimates the 1002 Area is North America's greatest prospect for conventional onshore oil production, with a mean likelihood of containing 10.4 billion barrels of oil and 8.6 trillion cubic feet of natural gas, as well as a reasonable chance of economically producing 16 billion barrels of oil.

· Alaska's economic lifeline, the Trans-Alaska Oil Pipeline System (TAPS), is now running at three-quarters empty. New oil production from ANWR has the potential to reverse throughput in TAPS, a vital component of American energy infrastructure.

· Oil development on a fraction of the coastal plain would create thousands of jobs nationwide, generate billions of dollars in government revenue, keep energy prices for American consumers

affordable, and further improve energy security for decades into the future.

· Since the ANWR coastal plain is less than 60 miles from TAPS, development of energy resources there is one of the most environmentally-sound way to increase oil production in Alaska.

· Thanks to continuing improvements in technology, practices, and oversight, the oil industry has demonstrated over the past 40 years that North Slope energy development and environmental stewardship can and do coexist. The industry has a proven track record of responsible development in sensitive areas, protecting the environment, wildlife and subsistence needs of local residents.

There is very little risk and much reward in this provision. I implore you do the responsible thing, the right thing for Alaskans, and pass this provision.
Open AMWR for the people of Alaska.

Thank You,

Jaci

Jaci Glenn, CIC | *Fairbanks Area Manager, Partner*
Insurance Brokers of Alaska | Acrisure Agency Partner
P.O.Box 72660
Fairbanks | Alaska| 99707
1292 Sadler Way | Suite 120
Fairbanks | Alaska | 99701

Office | 907.712.5201 **Fax** | 907.365.5180
Email | jglenn@insurancebrokersak.com
Website | www.insurancebrokersak.com

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From: Tristan Glowa
To: fortherecord (Energy)
Cc: Hoefler, Annie (Energy)
Subject: For Record of November 2, 2017 Hearing
Date: Wednesday, November 01, 2017 9:03:39 AM

For Record of November 2, 2017 Hearing

Dear Chairman Murkowski, Ranking Member Cantwell, and Members of the Senate Energy and Natural Resources Committee,

As an Alaskan, and as a scholar at Yale that has devoted my study to energy and natural resource issues, **I strongly urge you not to recommend oil and gas exploration and development** on the coastal plain of the Arctic National Wildlife Refuge. To do so would risk ecological integrity and indigenous livelihoods as well as further lock Alaska into dependence on fossil energy extraction that undermines our economic resilience as worldwide energy markets transform.

Having visited Arctic Village, Alaska and talked extensively with Gwich'in peers and elders, I have seen how crucial the health of the Porcubine caribou herd is for Gwich'in communities. In contexts like Gwich'in villages where store-bought food is unaffordable due to importation costs, access to caribou is a matter of economic necessity. But given long-standing religious and cultural ties to caribou as well, **the continued health of the caribou herd is a matter of indigenous rights that the oil industry and other Alaskans should not jeopardize.** If oil production takes place on the birthing grounds – as opposed to at other regions of the migratory range – this puts an unacceptable risk on the herd's stability.

Secondly, from the perspective of long-term economic well-being, opening the Refuge to oil production would only feed an inherently unsustainable dependence of the Alaskan economy. Clearly, oil prices have not recovered from their peak over the last decade, and the ramifications for the state budget and economy have been dire. If Alaska's economic strategy is to deepen dependence on fossil fuel extraction, as opening the refuge to production would do, we are tying ourselves to a volatile industry. Oil prices remain much lower than their peak over the previous decade and the oversupply from shale production seems unlikely to subside in the near term. Major car manufacturers worldwide are meanwhile rapidly moving in the direction of electric and autonomous vehicles as a means of transitioning to low-carbon transportation. While this would bode well for global efforts to address climate change, even a minor displacement of oil demand could create a glut and cause an oil crisis of much more major and long-lasting magnitude. With analysts at publications like Bloomberg suggesting such changes could take place within a decade, **to open up the Refuge to oil production would mean banking on a future for the industry that is increasingly tenuous**.

From those perspectives, I must urge strongly that you oppose opening the Coastal Plain for oil development. It is not benign, just, or ultimately smart for economic development to jeopardize Gwich'in lifeways and the integrity of an intact ecosystem in pursuit of increasing production for an industry that may put Alaska at risk of more economic shocks. Instead, **Alaskans are excited for the opportunities that your committee can spur through the development of our renewable energy and ecological resources.** With our state on the frontlines of both climate change and energy challenges, we have the opportunity to instead lead the way in the development of an economy appropriately suited to the 21st Century. **That requires, however, saying no to oil industry expansion of this kind.**

Sincerely,

Tristan Glowa
Fairbanks, Alaska
Yale College, Class of 2018
Political Science and Energy Studies
+1 907-750-8119

From: Ed Gohr
To: fortherecord (Energy)
Cc: Ed Gohr
Subject: Supporting the ANWR provision
Date: Wednesday, November 01, 2017 12:37:57 PM

Attention: Chairman Murkowski, Ranking Member Cantwell, and Members of the Senate Energy and Natural Resources Committee

· For decades, scientific polls have shown Alaskans overwhelmingly support responsible oil and gas development in the non-wilderness portion of ANWR. There is no valid reason why we should not be allowed to access the world-class resources within just a tiny fraction of the coastal plain.

· The proposed ANWR provision would allow development of no more than 2,000 acres of the 1.5 million acres of the Arctic coastal plain – part of the non-wilderness portion of ANWR's 19 million acres. **That is equivalent to just 0.01 percent of the entire refuge**.

· Responsible oil and gas development in this fraction of ANWR will help ensure America's energy security for decades and allow Alaska – and our nation as a whole – to realize the benefits that come from expanding energy production in Alaska.

· While renewable energy is a growing part of America's energy portfolio, it is still projected to account for a minority of American energy production in 2040. New oil and gas production will be required to power America's economy and can serve as a bridge until renewable energy becomes a dominant energy source decades into the future.

· Energy production from ANWR has the potential to offset a decline in Lower 48 shale oil production, which is expected to commence in approximately a decade. Without limited oil development on the coastal plain, America will be forced to once again increase its reliance on foreign imports. With limited development in ANWR, America and Alaska can continue to grow the economy and reduce dependence on foreign oil.

· The U.S. Geological Survey estimates the 1002 Area is North America's greatest prospect for conventional onshore oil production, with a mean likelihood of containing 10.4 billion barrels of oil and 8.6 trillion cubic feet of natural gas, as well as a reasonable chance of economically producing 16 billion barrels of oil.

· Oil development on a fraction of the coastal plain would create thousands of jobs nationwide, generate billions of dollars in government revenue, keep energy prices for American consumers affordable, and further improve energy security for decades into the future.

Thank you for your time,

Ed Gohr
CEO
Delta Constructors
3000 C Street Ste 202
Anchorage, AK 99503
Ed.gohr@deltaconstructors.net
907-771-5805 Direct
907-350-8102 cell

From: Joe
To: fortherecord (Energy)
Cc: Hoefler, Annie (Energy)
Subject: Don"t open the ANWR to oil/gas leases for extraction
Date: Sunday, November 12, 2017 10:19:06 AM

For Record of November 2, 2017 Hearing

Chairman Murkowski, Ranking Member Cantwell, and Members of the Senate Energy and Natural Resources Committee:

Please don't open the ANWR to oil or gas leases for extraction. There are much better ways to do Tax Reform than destroying the wildlife habitat of caribou and wildlife in the treasured Arctic Refuge.

In 50 years what's going to matter most is whether we've preserved a place as unique as the Arctic Refuge.

Thank you,
Joe Goldberg
821 20th Ave S
Seattle, WA 98144

From: Jeff Gonnason
To: fortherecord (Energy)
Cc: Hoefler, Annie (Energy)
Subject: Support for ANWR Exploration & Development
Date: Thursday, November 02, 2017 1:09:21 AM

Chairman Murkowski, Ranking Member Cantwell, and Members of the Senate Energy and Natural Resources Committee:

Please support oil exploration and production in the 1002 Coastal Plain of ANWR, and provide for a 50%-50% federal-state revenue sharing.

Sincerely yours,

Jeff Gonnason, OD
Anchorage, Alaska

Háw'aa

JEFF **GONNASON, OD**

Office 907-276-2080

drjeffg@gmail.com

From: Daniel Gordon
To: fortherecord (Energy)
Subject: arctic national wildlife refuge
Date: Thursday, November 02, 2017 1:27:15 PM

I'm writing to ask that the committee find other means to produce federal revenue than reopening the Arctic National Wildlife Refuge for oil and gas drilling. We should not destroy protected land and endanger wildlife to fund unnecessary tax breaks for the wealthy.

Thank you for your consideration.

Daniel Gordon
19 sunset terr
Tenafly, Nj, 07670

From: Kirk Gothard
To: fortherecord (Energy)
Cc: Hoefler, Annie (Energy)
Subject: ANWR drilling provision in budget reconciliation bill
Date: Wednesday, November 01, 2017 7:54:25 PM

Reference: For Record of November 2, 2017 Hearing

Dear Chairman Murkowski, Ranking Member Cantwell, and Members of the Senate Energy and Natural Resources Committee,

I support drilling in ANWR.

Alaska's economic lifeline, the Trans-Alaska Oil Pipeline System (TAPS), is now running at three-quarters empty. New oil production from ANWR has the potential to reverse throughput in TAPS, a vital component of American energy infrastructure.

Thank you for allowing me the opportunity to voice my opinion.

Kirk Gothard
Pinnacle Construction, Inc.
4141 Ingra Street, Suite 200 | Anchorage | Alaska | 99503
Ph: 907-522-0040 | Fax: 907-522-0041

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From: Stephen Grabacki
To: fortherecord (Energy)
Cc: Hoefler, Annie (Energy)
Subject: For Record of November 2, 2017 Hearing: Open ANWR to oil & gas
Date: Tuesday, October 31, 2017 4:38:58 PM

Dear Chairman Murkowski, Ranking Member Cantwell, and Members of the Senate Energy and Natural Resources Committee --

We support the ANWR drilling provision in the budget reconciliation bill, to allow limited oil and natural gas activity within the non-wilderess coastal plain of the Arctic National Wildlife Refuge (ANWR) because --

Polls have consistently shown Alaskans overwhelmingly support responsible oil and gas development in the non-wilderness portion of ANWR. There is no valid reason why we should not be allowed to access the world-class resources within just a tiny fraction of the coastal plain.

Energy production from ANWR has the potential to offset a decline in Lower 48 shale oil production, which is expected to commence in approximately a decade. Without limited oil development on the coastal plain, America will be forced to once again increase its reliance on foreign imports. With limited development in ANWR, America and Alaska can continue to grow the economy and reduce dependence on foreign oil.

Since the ANWR coastal plain is less than 60 miles from TAPS, development of energy resources there is one of the most environmentally-sound way to increase oil production in Alaska.

Thanks to continuing improvements in technology, practices, and oversight, the oil industry has demonstrated over the past 40 years that North Slope energy development and environmental stewardship can and do coexist. The industry has a proven track record of responsible development in sensitive areas, protecting the environment, wildlife and subsistence needs of local residents.

Thank you for your attention. Best regards, -- Steve

Stephen T. (Steve) Grabacki, FP-C
President, and Certified Fisheries Professional
FISHEYE Consulting
P.O.Box 100506
Anchorage, Alaska
99510-0506 USA
+1-907-272-5600
fisheyecon@gmail.com

From: kent gray
To: Hoefler, Annie (Energy)
Cc: fortherecord (Energy); Kent Gray
Subject: Drilling In ANWR - Not Recommended By Current Oilfield Worker
Date: Thursday, November 09, 2017 5:20:16 PM

Hello Miss Hoefler,

My name is Kent Gray. I have been and still am working in Alaska's Prudhoe Bay oil field for over the past 17 years.

My opinion on the opening of ANWR for drilling is as follows:

Do not open up ANWR for drilling, ever, if possible.

Once humans have a foothold in a majestic location such as ANWR, expansion and exploitation can only be the next step. As soon as laws are relaxed and development is permitted in places like ANWR, the corporate world will find loopholes and/or self-serving politicians to further develop and exploit natural areas that were once set aside to be unchanged by humans.

I remember President Bush #2 always claiming that accessing these sensitive areas can be accomplished with a very small footprint. I beg to differ. Once oil companies get in there and a mistake happens, all they will do is ask for forgiveness and pay a relatively small fine for soiling and damaging an irreplaceable component of our natural environment that was not theirs in the first place. Remember the Exxon Valdez..? That area is still recovering after nearly 30 years... Deepwater Horizon, who knows the true extent of the damage to nature and how long a full recovery will take..?

Yes, I work in the oilfield industry. But to me it is just a job and I value the environment and natural world more. I can always get another job, albeit not as good, but once pristine areas like ANWR are opened up for human exploration and exploitation, it can NEVER be returned to its natural state and what it once was will be lost forever. Areas like ANWR were thankfully, yet surprisingly, set aside for 'nature' and all of humanity, not to be exploited by anyone, ever... I would rather pay more for fuel, energy, and commodities than destroy these pristine areas permanently just for a short term cost of goods reduction and short sighted corporate profits. Some things in this world should be left as we humans found them, no matter what the cost...

I understand that 99.9999% of all humans will never see or set foot in places like ANWR, but for me and many others, just knowing that these places exist provide some solace that there are some beautiful, natural places left in this ever shrinking world.

Any questions or comments, please feel free top contact me.

Email: graysy002@yahoo.com / Cell: (540) 819-4710.

I would like to thank you for your time and consideration in this critically important matter.

Sincerely,

Kent Gray

GREATER FAIRBANKS CHAMBER OF COMMERCE

November 1, 2017 via email: fortherecord@energy.senate.gov

Honorable Lisa Murkowski, Chairman
U.S. Senate Committee on Energy & Natural Resources
522 Hart Senate Office Building
United States Senate
Washington, D.C. 20510

RE: Support ANWR 1002 Area exploration and development

Dear Chairman Murkowski, Ranking Member Cantwell and Committee Members:

Please vote to open a limited portion of the non-wilderness area of the Arctic National Wildlife Refuge (ANWR) known as the "1002 Area" or Coastal Plain, to oil and gas exploration and development.

For years, Alaskans have supported the opening of ANWR to oil and gas development. Alaskans from all walks of life including business, labor, Native Alaskans and Alaska natives have seen the positive impacts of the oil industry in our state. Jobs, contracts, and tax revenue are all benefits Alaska receive that has not come at the expense of people, our land and our wildlife. In fact, the industry often serves as a model for health and safety of their employees and environmental stewardship.

Additionally, the Trans-Alaska Pipeline System (TAPS), is now running at three-quarters empty. New oil production from ANWR has the potential to increase throughput in TAPS, a vital component of American energy infrastructure that is currently jeopardized due to low volumes of crude oil that have been transported in recent years.

The Greater Fairbanks Chamber of Commerce is a business advocacy organization that represents over 700 members from all over Interior Alaska. Through the work of our Board of Directors and our Energy, Environment & Natural Resources Committee, we focus on the economical delivery, production and end-use of energy for our residents by advocating for the development and use of Alaskan's natural resources. The Chamber strives to have a working knowledge of technical, financial, and political aspects surrounding development.

DRAFT

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Fairbanks Natural Gas
Flowline Alaska
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Golden Valley Electric Association
Hale & Associates, Inc.
Hilcorp Alaska, LLC
JL Properties, Inc.
Key Bank
Lynden
Matson Alaska
Northrim Bank
Personnel Plus
Sam's Club
Seekins Ford Lincoln
Sourdough Fuel
Spirit of Alaska Federal Credit Union
State Farm Insurance
Tammy Randolph, Agent
Ed Randolph, Agent
Tanana Valley Clinic
TDL Staffing
Tower Hill Mines-Livengood Gold Project
University of Alaska Fairbanks
Verizon Wireless
Yukon Title Company

We believe that ANWR can be responsibly explored and developed. We ask that you vote for the budgetary provision that would open a portion of its Coastal Plain. Alaska and the nation needs the energy security, jobs and economic activity.

Respectfully,

Marisa Sharrah
President/CEO
Fairbanks Chamber

Garry Hutchison
Board Chair
Fairbanks Chamber

Cc: Honorable Lisa Murkowski, Chair, U.S. Senate Committee on Energy & Natural Resources
Honorable Daniel Sullivan, U.S. Senate
Honorable Don Young, U.S. House of Representatives
Honorable Bill Walker, Governor of Alaska
Annie Hoefler, U.S. Senate Committee on Energy & Natural Resources

DRAFT

From: Green, Richard
To: fortherecord (Energy)
Subject: ANWR
Date: Wednesday, November 01, 2017 12:33:04 PM

Allowing limited oil and gas activity within the non-wilderness coastal plain of the Arctic national Wildlife Refuge needs to be pursued. There are ample permitting process in place to ensure the safe development of any resources that may be identified as valuable and doing so just adds another arrow into the Unites States's quiver of energy options.....
Thank you.

Richard Green

Richard Green
108 Wilderness Drive
Fairbanks, Alaska 99712

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From: Randy Greenway
To: fortherecord (Energy)
Subject: ANWR
Date: Tuesday, October 31, 2017 7:02:47 PM

Chairman Murkowski, Ranking Member Cantwell and Members of the Senate Energy and Natural Resources Committee.

I vote yes to opening ANWR to oil and gas developmment.

Regards

Randy Greenway
Manager of Major Projects
Udelhoven Oilfield System Services, Inc.
Office: 907-261-2398
Cell: 907-202-4477
rgreenway@udelhoven.com

From: Allison Griffith
To: fortherecord (Energy)
Cc: Hoefler, Annie (Energy); Allison Griffith; Fred Griffith
Subject: For Record of November 2, 2017 Hearing
Date: Wednesday, November 01, 2017 7:40:49 PM

Chairman Murkowski, Ranking Member Cantwell, and Members of the Senate Energy and Natural Resources Committee,

Alaskans polled have consistently shown overwhelmingly support for responsible oil and gas development in the non-wilderness portion of Arctic National Wildlife Range. We, and our family, support responsible oil and gas development in the non-wilderness portion of ANWR.

The proposed ANWR provision would allow development of no more than 2,000 acres of the 1.5 million acres of the Arctic coastal plain – part of the non-wilderness portion of ANWR's 19 million acres. That is equivalent to just 0.01 percent of the entire refuge

Energy production from ANWR has the potential to offset a decline in Lower 48 shale oil production, which is expected to commence in approximately a decade. Without limited oil development on the coastal plain, America will be forced to once again increase its reliance on foreign imports. With limited development in ANWR, Alaska and America can continue to grow the economy and reduce dependence on foreign oil.

The U.S. Geological Survey estimates the 1002 Area is North America's greatest prospect for conventional onshore oil production, with a mean likelihood of containing 10.4 billion barrels of oil and 8.6 trillion cubic feet of natural gas, as well as a reasonable chance of economically producing 16 billion barrels of oil.

Since the ANWR coastal plain is less than 60 miles from the Trans Alaska Pipeline, development of energy resources there is one of the most environmentally-sound way to increase oil production in Alaska. TAPS is now running at three quarters empty, new oil production has the potential to reverse throughput in TAPS, a vital component of American energy infrastructure.

Additionally, thanks to continuing improvements in technology, practices, and oversight, the oil industry has demonstrated over the past 40 years that North Slope energy development and environmental stewardship can and do coexist. The industry has a proven track record of responsible development in sensitive areas, protecting the environment, wildlife and subsistence needs of local residents.

Sincerely,

Fred and Allison Griffith
12900 Shelburne Road
Anchorage, AK 99516

From: John Grummett
To: fortherecord (Energy)
Subject: Please open ANWAR
Date: Tuesday, October 31, 2017 2:47:31 PM

Sincerely yours,

John Grummett
Vice President
Shattuck & Grummett Insurance
301 Seward Street
Juneau, AK 99801
907-500-9106 Direct Line
johng@sginc.com

Shattuck & Grummett
INSURANCE

From: Nancy Gurny
To: fortherecord (Energy)
Subject: Protect Alaska's Wildlife Refuge
Date: Monday, November 06, 2017 2:27:34 PM

I'm writing to ask that the committee find other means to produce federal revenue than reopening the Arctic National Wildlife Refuge for oil and gas drilling. We should not destroy protected land and endanger wildlife to fund unnecessary tax breaks for the wealthy. Please pass my message along to the Chairman and other committee members.
Sincerely,
Nancy Gurny
5125 Wright Ter
Skokie, IL 60077

From: Haase, Donald J.
To: fortherecord (Energy)
Subject: Opening ANWR to responsible exploration
Date: Tuesday, October 31, 2017 1:52:32 PM

Dear Chairman Murkowski and Ranking Member Cantwell:

As an Alaskan, I support opening the 1002 area of the Arctic National Wildlife Refuge to responsible oil & gas exploration. Since developing the North Slope, there have been no detrimental effects to any animal species. In fact the caribou herd has grown substantially! Alaskans deserve the same access to natural resources as older states were given when they entered the union. We will continue to demonstrate responsible environmental caretaking - as we have for the past 40 years.

Sincerely,

Don Haase
Box 3423
Valdez AK 99686
(907)831-3608

From: E. Phil Haley [mailto:ephaley@gci.net]
Sent: Wednesday, November 1, 2017 7:11 PM
To: Hoefler, Annie (Energy) <Annie_Hoefler@energy.senate.gov>
Subject: 1002 Area of ANWR

Dear Chairman Murkowski and Ranking Member Cantwell,

I'm an Alaskan in support of opening the 1002 area of the Arctic National Wildlife Refuge. Alaskans have developed the North Slope oil fields responsibly and will continue to do so with NO effects to the Arctic Caribou herd or any other animal species. We are the caretakers of the environment and we need you to vote in favor of development.

It makes no sense to rely on producers of oil who are, in no way, accountable to the American people. Oil produced in this country is produced under strict regulation whereas oil produced in other countries is produced with much less oversight. It seems environmentally irresponsible to entrust oil production to countries that have no little or no interest in maintaining the environment.

Thanks to continuing improvements in technology, practices, and oversight, the oil industry has demonstrated over the past 40 years that North Slope energy development and environmental stewardship can and do coexist. The industry has a proven track record of responsible development in:

- **sensitive areas**
- **protecting the environment**
- **wildlife and subsistence needs of local residents**

Thank you for taking this matter under consideration.

Sincerely,

E. Phil Haley
907-227-0808

From: Peter Hall
To: fortherecord (Energy); Diane Miller
Subject: Drill ANWR to pass an unsustainable tax package? You can do better
Date: Thursday, November 09, 2017 11:49:23 AM

Drill in a fragile ecosystem for only $1-5 billion dollars? That is a drop in the deficit budget. Your ideas are pathetic, destructive, and a show complete lack of foresight and complete disregard for the issues that will shape the next century. You should be embarrassed.

Kepp it protected and take an opportunity to build an economy for the people!

--
Peter Hall
Founder & CEO
Hala Gear
Design. Adventure. Better.
Steamboat Springs, CO

970-367-7885
www.halagear.com

From: Lisa Halpern
To: fortherecord (Energy)
Subject: protect Arctic National Wildlife Refuge
Date: Tuesday, November 14, 2017 11:49:07 AM

Hello,

i am writing to add my voice to how critical it is that we find other means to produce federal revenue than reopening the Arctic National Wildlife Refuge for oil and gas drilling. We should not destroy protected land and endanger wildlife to fund unnecessary tax breaks for the wealthy. Please pass my message along to the Chairman and other committee members.

Do the right thing. the planet depends on you.

Thanks,

Lisa

Lisa Halpern
writer | director | producer
p. 206.723.2980 c.206.280.7885
web: www.thirdeyeproductions.org

From: Trish Ham
To: fortherecord (Energy)
Subject: Protect ANWR
Date: Sunday, November 05, 2017 5:37:36 PM

Dear Senate Energy Commission:

I stand in solidarity with the Gwich'in people in opposing drilling in the coastal plain of the Arctic National Wildlife Refuge. I am adamantly against any drilling in ANWR.

Sincerely,
Patricia Ham
48257 Magic Dragon Ln.
Soldotna, AK 99669
Hamstrings@alaska.net

From: ahanley@chugach.net [mailto:ahanley@chugach.net]
Sent: Wednesday, November 01, 2017 11:59 AM
To: fortherecord (Energy)
Subject: Vote to open ANWR

Dear Chairman Murkowski and Ruling member Cantwell,
I have been a proud Alaskan for 46 years and urge you to vote in favor of opening the 1002 area of the Arctic National Wildlife Refuge. My support is based on Alaskans' ability to develop the North Slope oil fields in an environmentally responsible manner with no ill effects to the Arctic caribou herd or any other animal species. Again, I urge you to vote in favor of opening ANWR.

The e-mail message from ahanley@chugach.net should have included my full name.
The message urging the opening of ANWR was from Alyce Hanley, 4007 Brentwood Circ., Anchorage, Ak. 99502

Douglas Hannah
202 E. 35th St.
Austin, TX 78705

AUSTIN TX
PM
NOV 6
2017

Senate Committee on Energy & Natural Resources
304 Dirksen Senate Building
Washington, DC 20510

Dear Committee Chair,

I am writing to express deep concern re: the prospect of ANWR being re-opened to drilling. This land is sensitive ecologically and important to indigenous tribes - it should not be endangered simply to fund unnecessary tax cuts.

Sincerely,
Doug Hannah

From: David Hannum
To: fortherecord (Energy)
Subject: ANWR
Date: Monday, November 06, 2017 1:40:21 PM

Don't open the Alaska National Wildlife Refuge to oil and gas drilling, for then it would no longer be a wildlife refuge.

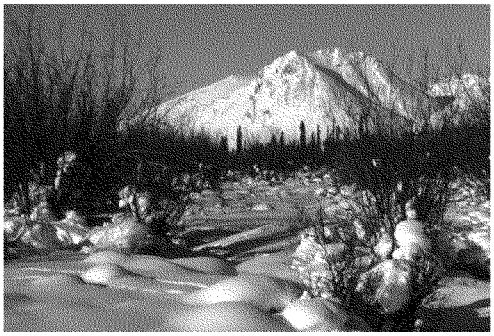
David Hannum
3470 Garnet St
Torrance, CA 90503

From: Edie Harkins [mailto:edie.harkins@gmail.com]
Sent: Tuesday, November 14, 2017 5:49 PM
To: fortherecord (Energy)
Subject: Arctic National Wildlife Refuge

Hello,

Please: No drilling in the ANWF!!

Edie Harkins
1525 W 1650 N Apt 3
Layton IT 84041



From: David Hart
To: fortherecord (Energy)
Cc: Hoefler, Annie (Energy); David Hart
Subject: For Record of November 2, 2017 Hearing
Date: Wednesday, November 01, 2017 4:46:30 PM

Chair Murkowski, Ranking Member Cantwell, and Members of the Senate Energy and Natural Resources Committee,

I wholeheartedly support exploration and development within the 1002 Coastal Plain of ANWR.

The time is now to allow responsible development in ANWR. Alaska's jobs, our US national security and shared US and Alaska revenue are at stake.

Please do all you can to open ANWR for oil and gas exploration and development as soon as possible.

Thank you,
David Hart

David Hart
Sr. Manager, Operations and Production
Caelus Energy Alaska, LLC
3700 Centerpoint Dr., Suite 500 I Anchorage, AK 99503
Direct 907.343.2125 I Cell 907.244.1722
david.hart@caelusenergy.com

Statement of Confidentiality:
This message may contain information that is privileged or confidential. If you receive this transmission in error, please notify the sender by reply e-mail and delete the message and any attachments.

From: Joe Hartley
To: fortherecord (Energy)
Subject: Chairman Murkowski, Ranking Member Cantwell, and Members of the Senate Energy and Natural Resources Committee
Date: Wednesday, November 01, 2017 4:13:19 PM

Dear Lisa,
Thank you for all you and your family have done for us Alaskans.
Alaska needs ANWR.
Nationally ANWR makes sense because of the existing infrastructure to deliver the oil to port.
State wise ANWR makes sense because of the technically trained personnel that are available to safely and environmentally deliver the oil to port.
Personally it makes sense because I remember Alaska before oil transformed Alaska. And today with all of our warts, Alaska is the most magical place in the world, because oil is delivered to port.

Joe Hartley
17453 Alice Loop
Eagle River
Alaska

Sent from my iPhone

From: LHartman [mailto:hartmanco75@gmail.com]
Sent: Wednesday, November 01, 2017 7:26 PM
To: fortherecord (Energy)
Cc: Hoefler, Annie (Energy)
Subject: ANWR hearing 11/2/17

Chairman Murkowski, Ranking Member Cantwell, and Members of the Senate Energy and Natural Resources Committee,

- Polls have consistently shown Alaskans overwhelmingly support responsible oil and gas development in the non-wilderness portion of ANWR. There is no valid reason why we should not be allowed to access the world-class resources within just a tiny fraction of the coastal plain.
- The proposed ANWR provision would allow development of no more than 2,000 acres of the 1.5 million acres of the Arctic coastal plain – part of the non-wilderness portion of ANWR's 19 million acres. That is equivalent to just 0.01 percent of the entire refuge.
- Responsible oil and gas development in this fraction of ANWR will help ensure America's energy security for decades and allow Alaska – and our nation as a whole – to realize the benefits that come from expanding energy production in Alaska.
- While renewable energy is a growing part of America's energy portfolio, it is still projected to account for a minority of American energy production in 2040. New oil and gas production will be required to power America's economy and can serve as a bridge until renewable energy becomes a dominant energy source decades into the future.
- Energy production from ANWR has the potential to offset a decline in Lower 48 shale oil production, which is expected to commence in approximately a decade. Without limited oil development on the coastal plain, America will be forced to once again increase its reliance on foreign imports. With limited development in ANWR, America and Alaska can continue to grow the economy and reduce dependence on foreign oil.
- The U.S. Geological Survey estimates the 1002 Area is North America's greatest prospect for conventional onshore oil production, with a mean likelihood of containing 10.4 billion barrels of oil and 8.6 trillion cubic feet of natural gas, as well as a reasonable chance of economically producing 16 billion barrels of oil.
- Alaska's economic lifeline, the Trans-Alaska Oil Pipeline System (TAPS), is now running at three-quarters empty. New oil production from ANWR has the potential to reverse throughput in TAPS, a vital component of American energy infrastructure.
- Oil development on a fraction of the coastal plain would create thousands of jobs nationwide, generate billions of dollars in government revenue, keep energy prices for American consumers affordable, and further improve energy security for decades into the future.
- Since the ANWR coastal plain is less than 60 miles from TAPS, development of energy resources there is one of the most environmentally-sound way to increase oil production in Alaska.

Thanks to continuing improvements in technology, practices, and oversight, the oil industry has demonstrated over the past 40 years that North Slope energy development and environmental stewardship can and do coexist. The industry has a proven track record of responsible development in sensitive areas, protecting the environment, wildlife and subsistence needs of local residents.

I pledge my support for responsible oil and gas development and urge you to do the same.

David H. Hartman
4901 Hartman Circle
Anchorage, AK 99507

From: Linda Hartman [mailto:lhartman@gci.net]
Sent: Wednesday, November 01, 2017 7:23 PM
To: fortherecord (Energy)
Cc: Hoefler, Annie (Energy)
Subject: ANWR - Hearing 11/2/17

Chairman Murkowski, Ranking Member Cantwell, and Members of the Senate Energy and Natural Resources Committee,

- Polls have consistently shown Alaskans overwhelmingly support responsible oil and gas development in the non-wilderness portion of ANWR. There is no valid reason why we should not be allowed to access the world-class resources within just a tiny fraction of the coastal plain.
- The proposed ANWR provision would allow development of no more than 2,000 acres of the 1.5 million acres of the Arctic coastal plain – part of the non-wilderness portion of ANWR's 19 million acres. That is equivalent to just 0.01 percent of the entire refuge.
- Responsible oil and gas development in this fraction of ANWR will help ensure America's energy security for decades and allow Alaska – and our nation as a whole – to realize the benefits that come from expanding energy production in Alaska.
- While renewable energy is a growing part of America's energy portfolio, it is still projected to account for a minority of American energy production in 2040. New oil and gas production will be required to power America's economy and can serve as a bridge until renewable energy becomes a dominant energy source decades into the future.
- Energy production from ANWR has the potential to offset a decline in Lower 48 shale oil production, which is expected to commence in approximately a decade. Without limited oil development on the coastal plain, America will be forced to once again increase its reliance on foreign imports. With limited development in ANWR, America and Alaska can continue to grow the economy and reduce dependence on foreign oil.
- The U.S. Geological Survey estimates the 1002 Area is North America's greatest prospect for conventional onshore oil production, with a mean likelihood of containing 10.4 billion barrels of oil and 8.6 trillion cubic feet of natural gas, as well as a reasonable chance of economically producing 16 billion barrels of oil.
- Alaska's economic lifeline, the Trans-Alaska Oil Pipeline System (TAPS), is now running at three-quarters empty. New oil production from ANWR has the potential to reverse throughput in TAPS, a vital component of American energy infrastructure.
- Oil development on a fraction of the coastal plain would create thousands of jobs nationwide, generate billions of dollars in government revenue, keep energy prices for American consumers affordable, and further improve energy security for decades into the future.
- Since the ANWR coastal plain is less than 60 miles from TAPS, development of energy resources there is one of the most environmentally-sound way to increase oil production in Alaska.

Thanks to continuing improvements in technology, practices, and oversight, the oil industry has demonstrated over the past 40 years that North Slope energy development and environmental stewardship can and do coexist. The industry has a proven track record of responsible development in sensitive areas, protecting the environment, wildlife and subsistence needs of local residents.

I pledge my support for responsible oil and gas development and urge you to do the same.

Linda Hartman
4901 Hartman Circle
Anchorage, AK 99507

From: Harvey, Garrett
To: fortherecord (Energy)
Subject: Open ANWR - For our Future
Date: Tuesday, October 31, 2017 8:05:57 PM

Dear Chairman Murkowski and Ranking Member Cantwell,

I am an Alaskan that supports the opening of the 1002 area of the Arctic National Wildlife Refuge. Alaskans have developed the North Slope oil fields **responsibly** and will continue to do so with NO effects to the Arctic Caribou herd or any other animal species. We are the caretakers of the environment and we need you to vote in favor of development."

Thank you in advance,

Garrett Harvey
Price Gregory International
Ph: 907-257-4103
Cell: 720-841-0219
PRICE GREGORY

From: Mary Hass
To: fortherecord (Energy)
Subject: Fwd: Open Area 1002
Date: Wednesday, November 01, 2017 4:18:30 PM

Sent from my iPhone

Begin forwarded message:

From: Mary Hass <mary.hass@nitalaska.com>
Date: November 1, 2017 at 9:55:12 AM AKDT
To: "hassfamilyak@yahoo.com" <hassfamilyak@yahoo.com>
Subject: Open Area 1002

Greetings Chairman Murkowksi, Ranking Member Cantwell, and Members of the Senate Energy and Natural Resources Committee,

I am a lifelong Alaskan constituent that supports the opening of the 1002 area of the Arctic National Wildlife Refuge.

We should open this small fraction of the coastal, non-wilderness portion of ANWR for oil and gas development. Opening Area 1002 will create thousands of jobs nationwide and generate billions of dollars in revenue, additionally, reducing energy prices and reducing the need for Americans to purchase oil and gas from foreign countries for decades into the future. The Area 1002 coastal plain is just .01 percent of ANWRs' entire refuge and less than 60 miles from Trans Alaska Pipeline, making development of the energy the most environmentally conscience way to increase oil production.

Responsible Alaskans have developed the North Slope fields for the past 40-years proving that development and environmental stewardship can and do coexist . It frustrates me that constituents opposing the opening of Area 1002 only do so because they think they are being virtuous, yet the only information they have about ANWR is from what they have watched on NOVA while sitting in their *warm* houses and *driving* their multiple vehicles. Let these individuals "go hug a tree" while the actual oil production companies protect the environment and increase oil production vital to our economy.

We need you to Vote in favor of development!

Regards,
Mary Hass
10050 E Ortner Loop
Palmer, AK 99645

November 1, 2017

Chairman Murkowski
Ranking Member Cantwell
Members of the Senate Energy and Natural Resources Committee

Reference: For Record of November 2, 2017 Hearing

Chairman Murkowski,

I appreciate the opportunity to send my comments on the upcoming hearing and urge your support, regarding the Arctic National Wildlife Refuge (ANWR) drilling provision that would allow limited oil and natural gas activity within the non-wilderness coastal plain of the ANWR.

Thanks to continued improvements in technology, practices, and oversight, the oil industry has demonstrated over the past 40 years that North Slope energy development and environmental stewardship can and do coexist. The industry has a proven track record of responsible development in sensitive areas, while protecting the environment, wildlife, and supporting subsistence needs of local residents.

As I understand it, the proposed ANWR provision would allow development of no more than 2,000 acres of the 1.5 million acres of the Arctic coastal plain, equivalent to just 0.01% of the entire refuge. Yet, responsible oil and gas development in this fraction of ANWR will help ensure America's energy security for decades and allow Alaska, and our nation, to realize the benefits of this expansion of energy production. Thousands of jobs nationwide would be created, as well as billions of dollars in government revenue, to keep energy prices for American consumers affordable and improve energy security into the future.

I ask that you consider the benefits to our economy and future while determining your vote.

Thank you very much.

Sincerely,

Shannon Hasty
General Manager
NorthStar Trekking

PO Box 32540, Juneau, AK 99803
866.590.4530 Phone 907.790.4419 Fax
www.northstartrekking.com
info@northstartrekking.com

From: Scott Hayden
To: fortherecord (Energy); Hoefler, Annie (Energy)
Subject: For Record of November 2, 2017 hearing
Date: Wednesday, November 01, 2017 2:43:27 PM

Dear Chariman Murkowski, Ranking Member Cantwell, and Members of the Senate Energy and Natural Resources Committee:

I am a lifelong Alaskan. I grew up in a fly-in community, and now I live in Anchorage and manage an asphalt company.

I used to guide raft trips in the Arctic National Wildlife Refuge. It is a spectacularly beautiful place with incredible wildlife. The caribou have been migrating to and calving in the same location since time immemorial.

It would be a shame to disrupt the caribou calving grounds for the sake of producing more oil in a world already suffering from global warming, sea level rise and ocean acidification all due to the burning of fossil fuels.

I oppose drilling in ANWR.

Sincerely,

Scott Hayden
12304 Hilltop Drive
Anchorage, AK 99515

From: Virginia Hayssen
To: fortherecord (Energy)
Subject: drilling in the Arctic National Wildlife Refuge
Date: Wednesday, November 15, 2017 7:35:10 AM

I write to oppose any leasing program to develop or produce oil and/or gas from the Arctic National Wildlife Refuge 'area 1002'. This area is the birthing area for herds of caribou females. Drilling will disturb calves and leave them open to predators. The predators themselves would probably be considered 'nuisance' animals to the humans drilling. The roads that would be needed will disturb fragile tundra vegetation. Please do NOT open the ANWR especially area 1002 to gas/oil drilling.

--
****
Virginia Hayssen
Mary Maples Dunn Professor, Biological Sciences
Smith College
44 College Lane
Northampton, MA 01063

413 585 3856; FAX 413 585 3786

The book is out !! Hayssen, Orr. 2017. Reproduction in Mammals: The Female Perspective. Johns Hopkins University Press, Baltimore, MD.

https://www.amazon.com/Reproduction-Mammals-Perspective-Virginia-Hayssen/dp/1421423154

https://books.google.com/books?id=vwE2DwAAQBAJ&dq=reproduction+in+mammals+the+female+perspective

http://www.science.smith.edu/msi
pdf files for Mammalian Species are available via this URL

https://www.smith.edu/insight/stories/reproduction.php
A tidbit about mammalian reproduction from a female perspective.

****

From: rhelfer@uci.edu
To: fortherecord (Energy)
Subject: Protect Alaska"s Wildlife Refuge from Oil & Gas Companies - Committee Vote Wed: 5 Calls
Date: Tuesday, November 14, 2017 11:00:28 AM

Dear Committee,

I'm writing to ask that the committee find other means to produce federal revenue than reopening the Arctic National Wildlife Refuge for oil and gas drilling. We should not destroy protected land and endanger wildlife to fund unnecessary tax breaks for the wealthy. Please protect our precious natural resources.

Sincerely,
Rebeca Helfer
62 Murasaki St.
Irvine, CA 92617
(949) 501-6154

From: Helie, John
To: fortherecord (Energy)
Subject: 1002 ANWR
Date: Wednesday, November 01, 2017 1:41:54 PM

Dear Chairman Murkowski & Ranking Member Cantwell,

I would like you to approve opening the 1002 Area of ANWR for responsible development.

I have lived in Alaska for 38 years and hope to be here for years to come and truly believe we need to see this area of land available to responsible drilling. Seems like for years and years we have heard that Alaska gets 90% of its revenues from the petroleum industry and as the through-put of oil decreases we get less and less. I think everyone connected to this issue knows we need responsible oil development in our state to keep the lights on and doors open. It would be a sad day if we have to pay income tax, forfeit the PFD and pay a sales tax because we are too stubborn to acknowledge we need oil companies to stay here and develop our resources.

In summary, please approve this area for responsible drilling, our jobs, our children's jobs probably depend on it.

Thank you very much.

John Helie
8511 Atkins Place
Anchorage, AK 99507

From: Rich Helinski
To: fortherecord (Energy)
Cc: "annie"
Subject: Chairman Murkowski, Ranking Member Cantwell and Members of the Senate Energy and Natural Resouces Committee
Date: Wednesday, November 01, 2017 2:01:25 PM

Chairman Murkowski, Ranking Member Cantwell and Members of the Senate Energy and Natural Resouces Committee:

Having worked on the North Slope of Alaska since 1974, the majority of the time in the environmental field, I fully support the Arctic National Wildlife Refuge (aka 1002 Area) to responsible oil and gas development. I have been fortunate to work for Arco directly for numerous years in the environmental field and participate in the field development and operations. My training and experience has been protection of the environment was always been more important than production and profit and this has never wavered over years; just improved with time.

If you have any questions, please see my contact information below.

Sincerely,

Rich J. Helinski

Rich Helinski, PMP, CSP, ASP, CHST, CHMM
ICE Services, Inc
Project Manager
rhelinski@iceservices.net
907-659-9060 office
907-947-7281 cell
907-670-2275 fax

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From: Michael Helms
To: fortherecord (Energy)
Cc: Hoefler, Annie (Energy)
Subject: For Record of November 2, 2017 Hearing
Date: Wednesday, November 01, 2017 11:01:51 PM
Attachments: WEC Logo.png

Chairman Murkowski, Ranking Member Cantwell, and Members of the Senate Energy and Natural Resources Committee,

I am an Environmental Scientist that lives and works in Alaska. I have lived in Alaska for 27 years and have worked in the environmental industry for the last 7 years. For my entire adult life, this has been an issue I have taken a particular interest in, as it is very important to my profession and to the state which I love and call home.

The environment in Alaska is pristine, and all efforts should be made to protect it. I have seen first hand how oil companies operate in Alaska, and with a few exceptions, they do a very good job. Technology to develop oil and gas has come a long way, minimizing the footprint needed to explore and develop new fields. The 1002 Area of the Arctic National Wildlife Refuge (ANWR) has shown huge potential for massive amounts of oil and gas, and is a very small portion of the overall refuge. While there is critical wildlife habitat for many wildlife species, from migratory birds to polar bears, the overall impact would be minimal. The oil industry in the arctic has learned to adapt as necessary to allow wildlife to exist in something as close as possible to a natural environment. A perfect example of this occurred just this last winter, when a pregnant sow polar bear denned up on the causeway to Endicott Island in the Beaufort Sea, just northeast of Prudhoe Bay. Personnel recognized the polar bear had likely denned there because she was pregnant. As a result, Hilcorp shut down all non-essential operations, minimizing all activity in the area. In the spring, the sow emerged with a healthy cub. This story never will receive as much press as a well blowout or a leak in a pipeline, but these success stories are much more of the norm for arctic oil and gas operations. Companies operating in arctic Alaska work very hard to minimize impacts to all aspects of the environment, including wildlife, spills, and disturbing natural habitat. Vast amounts of resources are used solely for the protection of the environment. While there is always risk associated with any development of resources, in this case, the potential benefits far outweigh the risk.

I still hold out hope that we continue to transition to renewable resources. But, hydrocarbons will be a very big aspect of allowing our global community to get there. Oil and gas will likely still be the primary source of energy for decades to come.

The necessity of hydrocarbons for the near future is not a question. Why not explore areas in the United States that could potentially provide energy security for our country? Development of resources is, and can continue to be, done in an environmentally responsible way. Spills on land are much easier to contain and cleanup than spills offshore. Development of onshore resources should be the priority.

While there seems to be opposition from people outside of Alaska, I believe many have very little knowledge of what they actually oppose. The majority of Alaskans I live and work with,

no matter their professions, from environmental professionals, to fishermen, to various other business men and women, understand the importance of developing ANWR and are in favor of it. Recent polls show that Alaskans are overwhelmingly in favor of development, and these are the people with the most knowledge of what development actually means. Existing infrastructure to get the oil to market is only 60 miles away from the coastal plain. The Trans-Alaska Oil Pipeline System is currently three-quarters empty, and new throughput is essential for the survival of this vital component of American energy infrastructure. Please continue to hear both sides of this debate, as it is important everyone has a voice and their concerns are heard. While no development of natural resources comes without risk, the overall reward far outweighs the risks. The people of Alaska know the development of ANWR coastal plain resources can be done in a responsible way, and want to see it happen.

Respectfully submitted,

Mike Helms
Environmental Scientist
Williwaw Environmental Consulting, LLC
907.242.9441

From: Tom Hendrix
To: fortherecord (Energy)
Cc: Hoefler, Annie (Energy)
Subject: For Record of November 2, 2017 Hearing
Date: Wednesday, November 01, 2017 3:46:12 PM

To: Chairman Murkowski, Ranking Member Cantwell and Members of the Senate Energy and Natural Resources Committee

For: The Record of November 2, 2017 Hearing

Thank you for letting me make comments on the proposed ANWR provision. I am a lifelong Alaskan and as such can testify that for decades scientific polls have shown that Alaskans overwhelmingly support responsible oil and gas development in the non-wilderness portion of ANWR. The footprint for this development would be a small fraction of the coastal plain.

With today's technology. equipment and regulations the industry has demonstrated that the non-wilderness area can be developed and drilled in an environmentally responsible manner. The 2,000 acres of the 1.5 million acres of the Arctic coastal plain –part of the non-wilderness portion of ANWR's 19 million acres only represents only .01% of the entire refuge.

Allowing this development will ensure America's energy security for decades and allow Alaska – and our nation as a whole – to realize the benefits that come from expanding energy production in Alaska. This will back up the lower 48 states shale production that will start to decline in approximately the next decade. Without this very limited oil development on the coastal plain America will be forced once again to increase our reliance on foreign imports.

This limited development will help America and Alaska's economy to grow, it creates jobs across America and in Alaska. It gives our country energy independence.

The USGS estimates the 1002 are is North America's greatest prospect for conventional onshore oil production, with a mean likelihood of containing 10.4 billion barrels of oil and 8.6 trillion cubic feet of natural gas, as well as a reasonable chance of economically producing 16 billion barrels of oil.

As an Alaskan, I support the opening of this area for Alaska and the Nation as a whole. Thank you for letting me go on the record.

Respectfully Submitted,

Tom Hendrix
11034 East John Henry Circle
Palmer, Alaska 99645
thendrix@carlile.biz

From: Joseph R. Henri
To: fortherecord (Energy)
Subject: Opening the 1002 area of ANWR to oil and gas exploration and production
Date: Tuesday, October 31, 2017 8:20:26 PM

Dear Sir or Madam,

There is a current chance for the Congress to allow oil and gas exploration and production in the Section 1002 area of ANWR. Please proceed with all haste to make this happen. The United States needs the development, as does Alaska. Sound economic industrial development is a benefit and a necessity to most thinking Americans.

Thank you.

Joe Henri, an Alaskan for 61 years

****

Joseph R. Henri
PO Box 210556
Anchorage, Alaska 99521-0556
(907)279-1493 phone
(907)279-4785 fax

"Let us develop the resources of our land, call forth its powers, build up its institutions, promote all its great interests, and see whether we also, in our day and generation may not perform something worthy to be remembered."

Daniel Webster

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From: Cynthia Henry
To: fortherecord (Energy)
Cc: Hoefler, Annie (Energy)
Subject: Support for ANWR Drilling
Date: Tuesday, October 31, 2017 5:38:48 PM

October 31, 2017

Chairman Murkowski, Ranking Member Cantwell, and Members of the Senate Energy and Natural Resources Committee:

Thank you for this opportunity to register my support for allowing limited oil and natural gas activity within the non-wilderness coastal plain of the Arctic National Wildlife Refuge.

First, let me say that I have lived in Alaska for more than forty years, but have never worked in the oil or gas industry. My two occupations have been high school English teacher and owner/manager of retail stores. So while I have not worked in the oil industry, I have certainly benefited from all that the industry has provided the citizens of our state. Our quality of life, including an economy with good jobs, good schools, a fine university would not have occurred without the industry. Additionally, our nation has benefited from the domestic oil produced in Alaska over the past four decades.

There are three primary reasons I support opening a small portion of ANWR to oil and gas activity:

1. The oil industry has a proven track record of responsible development in protecting the environment and wildlife.
2. The ANWR coastal plain is located less than 60 miles from the Trans Alaska Pipeline and existing industry infrastructure; this proximity minimizes potential environmental impact.
3. The proposed ANWR provision would allow no more than 2000 acres of the 1.5 million acres of the Arctic coastal plain, and considering the size of the non-wilderness portion of ANWR's 19 million acres, the area proposed for development is a tiny fraction of the vast Arctic Refuge.

Finally, I am in Alaska for the long term. I have two adult sons who live and work in Anchorage and a seven year old grandson. I care about the future of our great state and would never advocate for something which would risk Alaska's environment. This proposal passes the test and I hope you will grant approval.

Cynthia Henry
3216 Riverview Drive
Fairbanks, AK. 99709

From: Mike Herrell
To: fortherecord (Energy)
Subject: oppose reopening the Arctic National Wildlife Refuge for oil and gas drilling
Date: Tuesday, November 14, 2017 11:14:21 AM

I am writing to ask that the committee find other means to produce federal revenue than reopening the Arctic National Wildlife Refuge for oil and gas drilling. We should not destroy protected land and endanger wildlife to fund unnecessary tax breaks for the wealthy. Please pass my message along to the Chairman and other committee members.

Michael Herrell
1007 Huntsman Cir
Franklin TN 37064

From: David Heston
To: fortherecord (Energy); Hoefler, Annie (Energy)
Cc: Ayes Thompson
Subject: ANWR 1002 area
Date: Tuesday, October 31, 2017 6:48:30 PM
Attachments: image001.png

Dear Chairman Murkowski and Ranking Member Cantwell,
I am an Alaskan that supports the opening of the 1002 area of the Arctic National Wildlife Refuge. Alaskans have developed the North Slope oil fields responsibly and will continue to do so with NO effects to the Arctic Caribou herd or any other animal species. We are the caretakers of the environment and we need you to vote in favor of development." annie_hoefler@energy.senate.gov

- While renewable energy is a growing part of America's energy portfolio, it is still projected to account for a minority of American energy production in 2040. New oil and gas production will be required to power America's economy and can serve as a bridge until renewable energy becomes a dominant energy source decades into the future.

- Energy production from ANWR has the potential to offset a decline in Lower 48 shale oil production, which is expected to commence in approximately a decade. Without limited oil development on the coastal plain, America will be forced to once again increase its reliance on foreign imports. With limited development in ANWR, America and Alaska can continue to grow the economy and reduce dependence on foreign oil.

- The U.S. Geological Survey estimates the 1002 Area is North America's greatest prospect for conventional onshore oil production, with a mean likelihood of containing 10.4 billion barrels of oil and 8.6 trillion cubic feet of natural gas, as well as a reasonable chance of economically producing 16 billion barrels of oil.

- Alaska's economic lifeline, the Trans-Alaska Oil Pipeline System (TAPS), is now running at three-quarters empty. New oil production from ANWR has the potential to reverse throughput in TAPS, a vital component of American energy infrastructure.

- Oil development on a fraction of the coastal plain would create thousands of jobs nationwide, generate billions of dollars in government revenue, keep energy prices for American consumers affordable, and further improve energy security for decades into the future.

- Since the ANWR coastal plain is less than 60 miles from TAPS, development of energy resources there is one of the most environmentally-sound way to increase oil production in Alaska.

- Thanks to continuing improvements in technology, practices, and oversight, the oil industry has demonstrated over the past 40 years that North Slope energy development and environmental stewardship can and do coexist. The industry has a proven track record of responsible development in sensitive areas, protecting the environment, wildlife and subsistence needs of local residents.

Dave Heston
(907) 339-5102 | mobile (907)-229-0328

From: Josie Hickel
To: fortherecord (Energy); Hoefler, Annie (Energy)
Subject: ANWR Bill Support Letter
Date: Tuesday, October 31, 2017 5:02:41 PM

Chairman Murkowski, Ranking Member Cantwell, and Members of the Senate Energy and Natural Resources Committee,

I am writing to express my support of the ANWR drilling provision to allow limited oil and natural gas activity within the non-wilderness coastal plain of the Arctic National Wildlife Refuge (ANWR).

Polls have consistently show that Alaskans support responsible oil and gas development in the non-wilderness portion of ANWR. Responsible development in this very small fraction of ANWR will help ensure America's energy security and allow Alaska and our nation to realize the benefits that come from expanding energy production in our state. The USGS estimates that area 1002 is America's greatest prospect for conventional onshore oil production. Development of this area would keep Alaska's economic pipeline, the Trans-Alaska Oil Pipeline System (TAPS) economically viable. This development also has the potential to create thousands of jobs and generate billions of dollars in revenues to support government services for decades into the future.

We have a record of responsible resource development in Alaska, which has been proven over the past 40 years. Technology, improved practices and appropriate oversight have and will continue to improve upon this record and ensure all important protections for the environment, while providing this essential resource and economic opportunity for decades.

I urge you to support this important initiative.

Sincerely,

Johanna "Josie" Hickel

12621 Von Scheben Drive
Anchorage, AK 99516

From: Hickman, Steve
To: fortherecord (Energy)
Subject: ANWR
Date: Wednesday, November 01, 2017 12:36:57 PM
Attachments: image001.png
Importance: High

Responsible drilling in ANWR will boost our country's independence and safety.
Responsible drilling in ANWR will boost our economy in Alaska and our country.

The more oil we produce in America, the less oil will be produced by environmentally and politically irresponsible players elsewhere.

The only reasonable and intelligent solution is for America to produce more of its own oil.

Steve Hickman
Sales
300 E 54th Ave
Anchorage, AK 99518
Cell: 907-244-1959
shickman@polarsupply.com

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From: Jim Hill
To: fortherecord (Energy)
Cc: Hoefler, Annie (Energy)
Subject: For Record of November 2, 2017 Hearing
Date: Tuesday, October 31, 2017 2:50:31 PM

Chairman Murkowski, Ranking Member Cantwell, and Members of the Senate Energy and Natural Resources Committee,

I whole heatedly support and strongly advocate for the initiative to allow limited oil and natural gas development activity in the non wilderness coastal plain of ANWR.

With the majority of Alaskan supporting this development it is a perfect time to access the world-class resources within just a tiny fraction of the coastal plain. The development of just 2000 acres (.01% of ANWR) can bring the Alaska economy back from the brink of recession as the Trans Alaska pipeline is currently running 2/3 empty, and jobs have been in decline for several years. The time is now to support Alaska and Americas lifeline to continued independence. The development area being considered is less than 60 miles from the pipeline and Alaska producers have a 40 plus year history of sound environmental stewardship. Couple this with the likelihood that this development can lead to, as the US Geological Survey estimates, 10.4 billion barrels of oil and 8.6 trillion cubic feet of natural gas, as well as a reasonable chance of economically producing 16 billion barrels of oil. This could help to stabilize energy prices for the next generation, increase jobs in Alaska and other states by the thousands, and generate billions of dollars in revenue for the government.

Please help Alaska and her citizens help lead the way to energy dominance for North America by following the will of her people and opening this development area.

Respectfully,

Jim Hill
Alaska Area Manager
All Pro Alaska
www.AllProak.com
~~380 E. 54th Ave. An~~chorage, AK 99518
907-338-5438 Office 907-632-5989 Cell

From: Jennifer Hinton
To: fortherecord (Energy)
Subject: No Drilling in Alaska
Date: Tuesday, November 14, 2017 3:45:49 PM

I would like my voice to be heard.

NO DRILLING IN ALASKA!!!!!!

My name is Jennifer Hinton
1628 Northwestern RD
Longmont, CO 80503

From: terryhirst@terryhirst.com
To: fortherecord (Energy)
Subject: Artic National Wildlife Refuge
Date: Tuesday, November 14, 2017 1:02:38 PM

Dear Chairman and committee members,

I am writing to ask that the committee find other means to produce federal revenue than reopening the Arctic National Wildlife Refuge for oil and gas drilling. We should not destroy protected land and endanger wildlife to fund unnecessary tax breaks for the wealthy. Please pass my message along to the Chairman and other committee members.

Most Sincerely
Terry Hirst-Hermans; PA 19026
610.789.3553

From: Bruce Hiscock
To: fortherecord (Energy)
Cc: "Northern Alaska Environmental Center"
Subject: Drilling in the Arctic National Wildlife Refuge
Date: Thursday, November 09, 2017 5:16:44 PM

I wish to add my voice in protest of any legislation that would permit drilling in the Arctic National Wildlife Refuge. I have been there, walked the land, seen 70,000 caribou among the other animals. Note- my children's book The Big Caribou Herd - Life in the Arctic National Wildlife Refuge. Drilling would damage the coastal plain the birthing ground of the Porcupine Herd and polar bear denning area. This is the last large piece of pristine land in the USA and should be saved for the animals and our future heritage.
Thank you for your attention,
Bruce Hiscock
Former Alaska resident on Shemya 1952-3
354 Ballou Road
Porter Corners, NY 12859

From: Harold Hollis
To: fortherecord (Energy)
Cc: Hoefler, Annie (Energy)
Subject: ANWR Oil & Gas Development
Date: Thursday, November 02, 2017 1:22:32 PM

Dear Chairman Murkowski, Ranking Member Cantwell, and Members of the Senate Energy and Natural Resources Committee,

As a long time Alaska resident, I wish to express my full support for approval of the drilling provision in the budget reconciliation bill that would allow limited oil and natural gas activity within the non-wilderness coastal plain of ANWR.

I have lived in Alaska for over 35 years and am witness to the continuing improvements in technology, practices, and oversight the oil industry has demonstrated in development of oil and gas resources on the North Slope of Alaska. The industry has a proven track record of responsible development in sensitive areas, and protecting the environment, wildlife and subsistence need of local residents.

This measure is good for our country in providing further energy independence; good for Alaska in providing jobs; and will provide significant added revenues to the Federal coffers.

Please lend your support to this provision in the budget bill.

Thank you.

Harold Hollis, PE | VP, Alaska Region
WHPacific, Inc. | 3111 C St, Ste 300, Anchorage, AK 99503
Direct 907.339.6555 | Mobile 907.250.9195 | Fax 907.339.5327 | hhollis@whpacific.com

From: Sam Bempong
To: fortherecord (Energy)
Subject: Arctic National Wildlife Refuge
Date: Tuesday, November 07, 2017 11:25:16 AM

Hi,

I am writing today to implore the committee to find other means to produce federal revenue than reopening the Arctic National Wildlife Refuge for oil and gas drilling. It worries me greatly that we would consider destroying protected land and endanger wildlife to fund unnecessary tax breaks for the wealthy.

Please pass my message along to the Chairman and other committee members.

Thank you for your time and attention.

Sincerely,

Samantha Honowitz
510-701-0028
SamBempong@gmail.com

"Throughout history, it has been the inaction of those who could have acted, the indifference of those who should have known better and the silence of the voice of justice when it mattered most that has made it possible for evil to triumph."
- Haile Selassie 1892 - 1975

From: Larry Hooton
To: fortherecord (Energy)
Subject: ANWR open comment
Date: Tuesday, October 31, 2017 8:44:44 PM

I fully support opening ANWR to drilling. This has been delayed to long already.

Larry Hooton 34201 Glacier, Juneau AK

Resident of Alaska 47 years.

From: Barbara Horton
To: fortherecord (Energy)
Subject: Artic National Wildlife Refuge
Date: Monday, November 06, 2017 2:28:26 PM

I oppose the opening of the ANWR to oil companies to gain federal income!! I urge the committee to find other means to produce federal revenue!

Barbara A.Horton
136 Diamond Rd
Salem, VA 24153
Sent from my iPhone

Honorable Chairwoman Murkowski and Ranking Member Cantwell,

I have lived in Alaska for 55 years and have benefited from our resources in many ways. My husband was born in Skagway and raised in Dyea and Haines in the timber business. I have commercially fished with my father in Southeast, I have helped to build scenic byways in the wilderness now enjoyed by millions to include the Klondike Highway, I have worked on the Alaska Pipeline from Pump 1 to Valdez. These character building jobs have identified me as a real Alaskan and has allowed my husband and I to raise our families here and be productive citizens. We are slowly losing grasp to develop our resources, thus, both of our children have moved out of state due to lack of opportunity in the past couple of decades in normal resource positions.

I urge you to vote 'YES' to open the 10-02 area of the Arctic National Wildlife Refuge (ANWR). I believe that opportunity will encourage my children to return, especially my son, his wife and 3 young boys.

We are responsible stewards of our environment. I know this as I have spent many years working developing and working in this of industry. Please consider the positions of us who wear the actual shoes along this path. Alaska needs us.

Kathy Hosford

PO Box 286

Skagway/Dyea, Alaska 99840

From: Terry Howard
To: fortherecord (Energy)
Cc: Hoefler, Annie (Energy)
Subject: FW: For Record of November 2, 2017 Hearing
Date: Wednesday, November 01, 2017 4:29:39 PM

To: Chairman Murkowski, Ranking Member Cantwell and Members of the Senate Energy and Natural Resources Committee

For: The Record of November 2, 2017 Hearing

Thank you allowing me to provide my perspective on the proposed ANWR provision. I am a lifelong Alaskan and, as such, can testify that Alaskans overwhelmingly support responsible oil and gas development in the non-wilderness portion of ANWR. The footprint for this development would be a small fraction of the coastal plain.

With today's technology, equipment, and regulations, the industry has demonstrated that the non-wilderness area can be developed and drilled in an environmentally responsible manner. The 2,000 acres of the 1.5 million acres of the Arctic coastal plain –part of the non-wilderness portion of ANWR's 19 million acres only represents .01% of the entire refuge.

Allowing this development will help ensure America's energy security for decades and allow Alaska – and our nation as a whole – to realize the benefits that come from expanding energy production in Alaska. This will back up the lower 48 states shale production that will start to decline in approximately the next decade. Without this very limited oil development on the coastal plain, America will be forced once again to increase our reliance on foreign imports. Additionally, this limited development will help America and Alaska's economy to grow. Responsible development of natural resources, creates jobs across America and in Alaska.

As an Alaskan, I support the opening of this area for Alaska and the Nation as a whole. Thank you for letting me go on the record.

Respectfully Submitted,

Terry Howard
11328 Quest Circle
Anchorage, AK. 99515
terryhoward@carlile.biz

From:	Jacob Howdeshell
To:	fortherecord (Energy)
Cc:	Hoefler, Annie (Energy)
Subject:	For Record of November 2, 2017 Hearing: ANWR
Date:	Thursday, November 02, 2017 2:58:32 AM

Chairman Murkowski,
Ranking Member Cantwell,
Members of the Senate Energy and Natural Resources Committee:

My name is Jacob Howdeshell, resident of North Pole, Alaska. I am a life-long Alaskan and an 11-year member of Laborers' Local 942 where I currently work as a representative of nearly 600 Construction Craft Laborers across the state, many of whom build the infrastructure and pipelines that expand our North Slope oil fields each year.

First, let me thank Chairman Murkowski, Member Cantwell and the entirety of the Senate Energy and Natural Resources Committee for the opportunity to give testimony on an issue of vital importance to not only Alaska, but to the nation as a whole.

As a lifelong Alaskan as well as a 28-year resident of the Interior I have long been a spectator to the what the conversation about ANWR has been over the years.

Thankfully I have spent over a decade working in several capacities within the oil fields of the North Slope, gaining invaluable insight into how the fields are developed, managed, and issues mitagated. The majority of those workers that construct new developments in Alaska are Alaskans that take pride and care in their work, and hold all participants to account in the 5 w's of responsible resource development.

I have had the pleasure to be a part of the initial developments at Pt. Thompson, as well as witness the initial phases of construction at ConocoPhillips' CD-5 and GMT-1 drill sites as exploration takes Alaska further west into the NPR-A. All of these projects take outside investment, state support, and stakeholder buy-in to come to fruition. The 1002 area of ANWR will be no different. There will obviously be robust conversation from all perspectives to ensure that any development is carried out with the highest standards in regard to safety, environmental stewardship, and responsible and reasonable resource development.

This development will ensure that the United States becomes and remains energy independent in an evolving and volatile world marketplace, and will give that independence a stable foundation to build from looking towards the future of the nation's energy infrastructure.

I urge the Senate Energy and Natural Resources Committee to approve the limited development plan for the 1002 area as proposed, so that proper discourse can occur to bring those natural resources contained in that limited area to be brought to market to benefit Alaska, Alaskans, and the United States of America.

I again would like to thank the Committee for their time and efforts in these vital matters, and recognize their service to the people of this great nation.

Best Regards,

Jacob Howdeshell
Business Representative
Laborers' Local 942

From: Andy Hughes
To: fortherecord (Energy)
Cc: Hoefler, Annie (Energy)
Subject: Subject: Bill opening the Arctic National Wildlife Refuge Coastal Plain for exploration and production of oil
Date: Wednesday, November 01, 2017 2:14:24 PM

Chairman Murkowski, Ranking Member Cantwell, and Members of the Senate Energy and Natural Resources Committee:

For Record of November 2, 2017 Hearing

Opening the ANWAR coastal plain (1002 area) is important to my family to enable Alaska time to continue to grow and develop a more diverse and sustainable economy. My state is a young state with minimal infrastructure. Inadequate transportation, power, and communications infrastructure restricts access and development of Alaska's future economic potential contribution to our nation.

- Opening the ANWR coastal plain (1002 area) to exploration and production will require timely lease sales and a streamlined-simplified permitting process
- Provide for a 50 percent-50 percent federal-state revenue sharing, rather than the 90-10 percent split under current law.
- Alaska favors responsible development and protecting the environment.
- Technically recoverable oil within the ANWR 1002 area (excluding State and Native areas) is estimated to be between 4.3 and 11.8 billion barrels (95- and 5-percent probability range), with a mean value of 7.7 billion barrels

Please include my comments in the record of the November 2, 2017 Hearing.

Andy Hughes,
3200 Malissa Drive,
Juneau, Alaska 99801-9017

From: Mike Hughes
To: fortherecord (Energy)
Subject: Open ANWR
Date: Wednesday, November 01, 2017 12:16:24 PM

Dear Chairman Murkowski and Ranking Member Cantwell,

I am an Alaskan that *SUPPORTS* the opening of the 1002 area of the Arctic National Wildlife Refuge. Alaskans have developed the North Slope oil fields responsibly and will continue to do so with NO effects to the Arctic Caribou herd or any other animal species. We are the caretakers of the environment and we need you to vote in favor of development."

Thanks, and Have a great day,
Mike Hughes
Eagle Building Services, Inc.
2525 Blueberry Road Suite 105
Anchorage, Alaska 99503
(907) 277-6356 office
(907) 351-9360 cell
mike@ebsak.com
www.ebsak.com

From: Richard Hughes
To: fortherecord (Energy)
Cc: Hoefler, Annie (Energy)
Subject: FOR RECORD OF NOVEMBER 2, 2017 HEARING - ANWR
Date: Wednesday, November 01, 2017 1:27:58 PM

I am an Alaskan living in Fairbanks and doing business in Alaska and am submitting comments in support of the provision to include for drilling in the non-wilderness (1002 Area) coastal plain of the Arctic National Wildlife Refuge (ANWR). Points of importance include:

- Alaskans overwhelmingly support responsible oil and gas development in the non-wilderness portion of ANWR
- The provisions would allow development of no more than 2,000 acres of the 1.5 million acres of the Arctic coastal plain – part of the non-wilderness portion of ANWR's 19 million acres
- Responsible oil and gas development in this fraction of ANWR will help ensure America's energy security for decades and allow Alaska and our nation to realize the benefits that come from expanding energy production
- Renewable energy has a long way to go and a long time to replace non-renewable energy resources; we must develop our oil, gas and coal resources
- ANWR energy production has the potential to offset decline in L48 oil shale production in the near future
- The USGS estimates that the 1002 Area of ANWR has the potential of producing 16 billion barrels of oil and 8.5 trillion cubic feet of natural gas
- The Trans-Alaska Oil Pipeline System (TAPS) is now only ¼ full and declining to an uneconomic condition
- Thousands of jobs would be created nationwide as well as billions of dollars in government revenue
- The technological improvements in development and operational practices and oversight has demonstrated over 40 years that the North Slope energy development and stewardship can and do exist.

Your consideration is greatly appreciated.

Yours truly,

Richard A. Hughes, PE
H2T Mine Engineering Services, LLP
318 Juneau Ave.
Fairbanks, AK 99701-3768
(907) 347-1521, Fax: 451-6537
http://www.h2tmes.com

From: Sue Hughes
To: fortherecord (Energy)
Subject: Please do not open Arctic National Wildlife Refuge
Date: Tuesday, November 14, 2017 12:14:17 PM

Dear Committee Members,

Please do not open the any of the Arctic Refuge to oil and gas drilling.

These are the main reasons why I oppose drilling here:

1. A clean environment and thriving wildlife are important to me - for myself and my children to be able to enjoy these wild places and because what happens in distant places does spread throughout the oceans and the air we breathe.

2. Oil and gas companies have demonstrated an in ability to deal with catastrophic failures and accidents in difficult locations (ie the Gulf spill). It doesn't get any more difficult that the Arctic.

Thanks for considering my comments.

Susan Hughes
797 Charles Court
Incline Village, NV 89451
suehughes747@gmail.com
775-287-7026 (cell)

From: Amanda Humphrey
To: fortherecord (Energy)
Subject: Opposition to the planned expansion of federal lands
Date: Wednesday, November 15, 2017 5:38:23 PM

To whom it may concern

My name is Amanda Ragalevsky Humphrey and I live at 354 Upham st Melrose MA 02176.

I writing to voice my opposition to expanded drilling on federal lands as proposed by senator murkowski of Alaska. Energy independence and growth can be better achieved by expanding green technology for a local and sustainable future for America that will create lasting economic stability for millions of Americans.

This bill is a short sighted opportunistic assault on valuable natural resources.

Thank you
Amanda Humphrey

Sent from my iPhone

From: Lowell
To: fortherecord (Energy)
Subject: Chairman Murkowski, Ranking Member Cantwell, and Members of the Senate Energy and Natural Resources Committee
Date: Wednesday, November 01, 2017 2:34:32 PM

I support the opening of the non-wilderness portion of ANWR for oil development. I have been an Alaskan for forty-one years. During this time I have been very concerned about the declining oil production flowing into the Trans Alaska Pipeline.

- Polls have consistently shown Alaskans overwhelmingly support responsible oil and gas development in the non-wilderness portion of ANWR. There is no valid reason why we should not be allowed to access the world-class resources within just a tiny fraction of the coastal plain.
- Alaska's economic lifeline, the Trans-Alaska Oil Pipeline System (TAPS), is now running at three-quarters empty. New oil production from ANWR has the potential to reverse throughput in TAPS, a vital component of American energy infrastructure.
- Oil development on a fraction of the coastal plain would create thousands of jobs nationwide, generate billions of dollars in government revenue, keep energy prices for American consumers affordable, and further improve energy security for decades into the future.
- Since the ANWR coastal plain is less than 60 miles from TAPS, development of energy resources there is one of the most environmentally-sound way to increase oil production in Alaska.
- Thanks to continuing improvements in technology, practices, and oversight, the oil industry has demonstrated over the past 40 years that North Slope energy development and environmental stewardship can and do coexist. The industry has a proven track record of responsible development in sensitive areas, protecting the environment, wildlife and subsistence needs of local residents.

Lowell Humphrey
10550 Shivalik Circle
Anchorage, AK 99507

Email: questarlh@gmail.com

From: CAH
To: fortherecord (Energy)
Subject: Alaska 1002
Date: Tuesday, October 31, 2017 9:59:24 PM

Dear Chairman Murkowski and Ranking Member Cantwell:

I am an Alaskan that supports the opening of the 1002 area of the Arctic National Wildlife Refuge. Alaskans have developed the North Slope oil fields responsibly and will continue to do so with NO effects to the Arctic Caribou herd or any other animal species.

We are the caretakers of the environment and we need you to vote in favor of development. We have more than 40 years on the North Slope to demonstrate this can be done and done well.

Your consideration is appreciated!!

Christine Hutchison
907/252-7442
designone@gci.net

From: Garry Hutchison
To: fortherecord (Energy)
Subject: Support Developing ANWR
Date: Tuesday, October 31, 2017 7:17:54 PM

Senators, good afternoon.

Please accept this e mail as my support for developing the oil and gas resources in the Alaska National Wildlife Reserve. These lands were meant for development and with the advances in technologies, now is the time to put these assets in the Alaska oil pipeline. This important infrastructure is caring only 25 percent of its capacity to the world market.

Including the measure as a budget item is an excellent idea and makes perfect sense since ANWR is located on federal land and would generate revenue for the federal general fund.

Thank you again for your efforts and we look forward to a brighter economic environment for Alaska and the United States of America.

Garry Hutchison
Kohler, Schmitt & Hutchison, P.C.
Ph. (907) 456-6676, fax (907) 456-6431

www.kshcpa.com

From: Joan Hyman
To: fortherecord (Energy)
Subject: Do NOT open the Arctic National Wildlife Refuge for gas and oil drilling
Date: Thursday, November 02, 2017 11:24:46 AM

Dear members of the Senate Committee on Energy and Natural Resources,

I am writing to express my strong opposition to ending the 37 year ban on fossil fuel drilling and opening ANWR to drilling, for the following reasons.

1) It is long past time for our economy to move from extractive energy sources which add to the accelerating hazards of excessive carbon in the atmosphere (drought, floods, rising sea levels, catastrophic storms, acidifying ocean- all of which threaten the lives and well-being of life in the United States and all around the world)

2) Area 1002 should continue to be protected for its value in studying natural resources and the protection of wildlife. It is the birthing grounds for caribou, a significant food staple for Indigenous Americans. The 1.5 million acres of pristine land should be studied as a natural resource and maintained to increase our scientific knowledge.

3) The touted possible financial benefits (which are not a justifiable for the harms that would be caused) are questionable. The CBO analysis indicates that the predicted revenue from ANWR drilling would be SIGNIFICANTLY LOWER than suggested by th Trump administration.

Please protect Alaska's pristine, protected lands for fossil fuel companies' profits.

Respectfully,

Joan K Hyman
43 Argyle Park
Buffalo, NY 14222

International Union of Operating Engineers
AFFILIATED WITH THE AMERICAN FEDERATION OF LABOR AND CONGRESS OF INDUSTRIAL ORGANIZATIONS

November 14, 2017

The Honorable Lisa Murkowski
522 Hart Senate Office Building
Washington, DC 20515

The Honorable Maria Cantwell
511 Hart Senate Office Building
Washington, DC 20515

Dear Chairman Murkowski and Ranking Member Cantwell:

The International Union of Operating Engineers wholeheartedly endorses the policy decision to allow drilling and exploration for energy resources in a small part of the Arctic National Wildlife Refuge (ANWR). Changing this policy will catalyze thousands of jobs in the manufacturing and construction sectors, improving American national security, enhancing federal revenue, and, importantly, increasing the flow of oil through the Trans-Alaska Pipeline System, sustaining it well into the future.

The International Union of Operating Engineers represents almost 400,000 working men and women in the United States and Canada, thousands of whom build the nation's transportation, pipeline, and energy infrastructure. The IUOE is one of four unions that are signatory to the National Pipeline Agreement. In Alaska, we build the ice roads, bridges, and pipelines and other related facilities that keep the country's energy supply flowing.

The ten-year budget horizon simply fails to capture the long-range benefit of developing these resources. Studies of North Slope energy development have shown that – depending on oil and gas prices over the long-term development of the area, which are estimate to reach $100 a barrel in 2040 – tens of thousands of jobs will be created by permitting energy production on just 2,000 acres of the 19-million acre Arctic National Wildlife Refuge, or less than 0.1% of ANWR's total acreage.

Jobs in the construction sector related to this development represent some of the best work opportunities available for members of the Operating Engineers and other hardworking, blue-collar Americans. Average hourly earnings for all workers in the "oil and gas pipeline" industry group of the construction sector reach over $33.50, according to the most recent data available from the Bureau of Labor Statistics. Hourly earnings for all private sector workers average just over $26.50. Wages in the oil and gas segment of the construction industry are over 25% higher than private sector wages throughout the United States.

The Trans-Alaska Pipeline System is operating at roughly 25% capacity. Running so far below capacity exposes the pipeline to water damage, jeopardizing the integrity of the whole system. As the economic lifeline for the state, the Trans-Alaska Pipeline System's demise would be devastating to Alaskan families and would introduce a major supply shock to the Lower 48 and refineries in the Pacific Northwest in particular.

JAMES T. CALLAHAN
GENERAL PRESIDENT

BRIAN E. HICKEY
GENERAL SECRETARY-TREASURER

GENERAL VICE PRESIDENTS
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RUSSELL E. BURNS
JAMES M. SWEENEY
ROBERT T. HEENAN
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MICHAEL GALLAGHER
GREG LALEVEE
TERRANCE E. MCGOWAN
MARK MAIERLE
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EDWARD J. CURLY
WILLIAM LYNN
BRIAN COCHRANE

GENERAL COUNSEL
BRIAN POWERS

Opening ANWR can play a key role in the nation's energy and jobs agenda, and, for that reason, the International Union of Operating Engineers respectfully requests that you support the policy to allow energy development in the 1002 Area, the sliver of ANWR long-designated for resource extraction.

Thank you for your consideration.

Sincerely,

James T. Callahan
General President

cc: The Honorable Dan Sullivan
The Honorable Don Young
Daren Konopaski, Business Manager and General Vice President, IUOE Local 302

From: Doug Isaacson
To: fortherecord (Energy)
Subject: SUPPORT Opening ANWR "1002 area"
Date: Tuesday, October 31, 2017 4:04:37 PM
Importance: High

Dear Chairman Murkowski and Ranking Member Cantwell,

I am an elected official who has served on City Councils, as a Mayor, and as a State Legislator; I appreciate your service, and that of each Committee member, and the deliberations you will have concerning opening the "1002 Area" of the Arctic National Wildlife Refuge (ANWR).

I support, and have long supported, the opening of the 1002 area of the Arctic National Wildlife Refuge. It was a set-aside in ANILCA—a promise to Alaskans for jobs and revenue; a promise to America for energy security, as long as we could develop the resources with sensitivity to the wildlife and environment. Since Prudhoe Bay was first developed on State lands, Alaskans have ensured responsible development of the North Slope oil fields and will continue to do so. Positive management of our lands and resources have benefited the Arctic Caribou herd and other animal species. We are the caretakers of the environment. **I ask you to vote in favor of developing the 1002 Area.**

Thank you.

Doug Isaacson

Doug Isaacson
1003 Shirley Turnaround
North Pole, Alaska 99705
douglas.isaacson@gmail.com

From: Pete Iverson
To: fortherecord (Energy); Hoefler, Annie (Energy)
Subject: I support drilling in ANWR
Date: Wednesday, November 01, 2017 9:57:03 PM

Chairman Murkowski, Ranking Member Cantwell, and Members of the Senate Energy and Natural Resources Committee

Polls have consistently shown Alaskans overwhelmingly support responsible oil and gas development in the non-wilderness portion of ANWR. There is no valid reason why we should not be allowed to access the world-class resources within just a tiny fraction of the coastal plain.

The proposed ANWR provision would allow development of no more than 2,000 acres of the 1.5 million acres of the Arctic coastal plain – part of the non-wilderness portion of ANWR's 19 million acres. That is equivalent to just 0.01 percent of the entire refuge.

Responsible oil and gas development in this fraction of ANWR will help ensure America's energy security for decades and allow Alaska – and our nation as a whole – to realize the benefits that come from expanding energy production in Alaska.

While renewable energy is a growing part of America's energy portfolio, it is still projected to account for a minority of American energy production in 2040. New oil and gas production will be required to power America's economy and can serve as a bridge until renewable energy becomes a dominant energy source decades into the future.

Energy production from ANWR has the potential to offset a decline in Lower 48 shale oil production, which is expected to commence in approximately a decade. Without limited oil development on the coastal plain, America will be forced to once again increase its reliance on foreign imports. With limited development in ANWR, America and Alaska can continue to grow the economy and reduce dependence on foreign oil.

The U.S. Geological Survey estimates the 1002 Area is North America's greatest prospect for conventional onshore oil production, with a mean likelihood of containing 10.4 billion barrels of oil and 8.6 trillion cubic feet of natural gas, as well as a reasonable chance of economically producing 16 billion barrels of oil

Alaska's economic lifeline, the Trans-Alaska Oil Pipeline System (TAPS), is now running at three-quarters empty. New oil production from ANWR has the potential to reverse throughput in TAPS, a vital component of American energy infrastructure.

Oil development on a fraction of the coastal plain would create thousands of jobs nationwide, generate billions of dollars in government revenue, keep energy prices for American consumers affordable, and further improve energy security for decades into the future.

Since the ANWR coastal plain is less than 60 miles from TAPS, development of energy resources there is one of the most environmentally-sound way to increase oil production in Alaska.

Thanks to continuing improvements in technology, practices, and oversight, the oil industry has demonstrated over the past 40 years that North Slope energy development and environmental stewardship can and do coexist. The industry has a proven track record of responsible development in sensitive areas, protecting the environment, wildlife and subsistence needs of local residents.

Pete Iverson
43530 Ross Drive
Soldotna, AK 99669

From:	whalingjam@aol.com
To:	fortherecord (Energy)
Subject:	For Record of November 2, 2017 Full Committee Hearing to Receive Testimony on the Potential for Oil and Gas Exploration in the 1002 Area
Date:	Thursday, November 16, 2017 2:31:10 PM

For Record of November 2, 2017 Full Committee Hearing to Receive Testimony on the Potential for Oil and Gas Exploration in the 1002 Area

Dear Energy and Natural Resources Committee members,
I am writing to ask the committee to find other means to produce federal revenue than reopening the Arctic National Wildlife Refuge for oil and gas drilling . We should not jeopardize. a national treasure by destroying protected land and endangering wildlife to fund unnecessary tax breaks for the wealthy. This seems even more shortsighted as we are faced with the need to reduce CO2 emissions by reducing our use of fossil fuels- not increasing them just to achieve a short- term political goal.

Thank you,
Christopher James
1024 Mariposa Ave
Berkeley, CA 94707

From: Kevin Jardell
To: fortherecord (Energy)
Subject: Arctic National Wildlife Refuge
Date: Tuesday, October 31, 2017 4:45:43 PM

Dear Chairman Murkowski and Ranking Member Cantwell,

While I am disheartened and frankly disgusted and embarrassed by the current political environment within both the Executive and Legislative branches of our government, I nonetheless pick up the proverbial pen to write to both of you, who have at times demonstrated a professional thoughtful moderate pragmatism, with hope that you will thoughtfully consider Alaskan's perspectives.

As an individual registered as an independent, I write to ask that you support opening the 1002 area of the Arctic National Wildlife Refuge. I have worked in and around Alaska State Government for over twenty years. Alaska has been and remains a responsible steward of our natural resources. The United States is also recognized to be a world leader in responsible development of resources. It is without argument that the 1002 area can be developed in a responsible manner with zero net effects on the Arctic Caribou herd or other species. Truth is the debate over opening the 1002 area of ANWR is more about the politics of a larger debate over fossil fuels and the politics of fund raising for lower 48 organizations. The debate over opening the 1002 area is not about caribou, renewable energy, the local environment or climate change. Standing alone opening the 1002 will not impact any of these items in any significant way. This is about Alaska providing energy resources in a responsible way to provide jobs and revenue. Jobs that support families. Revenue that funds education, Medicaid, conservation programs and frankly all aspects of government.

Please look past the rhetoric, focus on the facts, be thoughtful and pragmatic and support Alaska, support the United States and support opening the 1002 area of ANWR.

Regards,

Kevin

Kevin Jardell
T: 907.321.4540 | E: kevin@kjardell.com | W: kjardell.com

From: Bill Jeffress
To: fortherecord (Energy)
Cc: Hoefler, Annie (Energy)
Subject: Open ANWR to Limited Development
Date: Tuesday, October 31, 2017 6:15:35 PM

Dear Chairman Murkowski, Ranking Member Cantwell, and Members of the Senate Energy and Natural Resources Committee:

The proposed ANWR provision in the budget reconciliation bill would allow development of no more than 2,000 acres of the 1.5 million acres of the Arctic coastal plain – part of the non-wilderness portion of ANWR's 19 million acres. That is equivalent to just 0.01 percent of the entire refuge. This fraction of ANWR will help ensure America's energy security for decades and allow Alaska – and our nation as a whole – to realize the benefits that come from expanding energy production in Alaska.

With the continuous improvements in technology, practices, and oversight, the oil industry has demonstrated over the past 40 years that North Slope energy development and environmental stewardship can and do coexist. The industry has a proven track record of responsible development in sensitive areas, protecting the environment, wildlife and subsistence needs of local residents.

I urge the Committee to pass the 2018 Budget, including ANWR drilling provisions.

Thank you for your consideration of my comments.

Respectfully,

Bill Jeffress
2031 Brandilyn Street
Anchorage, Alaska 99516
(907) 952-6062

From: Roger Jenkins
To: fortherecord (Energy)
Subject: ANWR Hearing
Date: Tuesday, October 31, 2017 4:22:17 PM

Gentlemen:
I'm Roger Jenkins and have resided at 2201 Roosevelt Drive, Anchorage, Alaska since 1984.
I was a member of the 14th Alaska Legislature (1985-87) and spent 17 Days in August of 1980 in D.C. observing the ANILCA Process (95 Degree Heat & Same Humidity)
As you know, Section 1002 of ANWR was a compromise along with others (Most of which have become broken promises)
It is now only prudent and reasonable to rise arise above the political noise and allow development of a small area of ANWR for the good of all of us.
My best and Thank you.

From: Jimmerson, Mark (HSS sponsored)
To: fortherecord (Energy)
Subject: YES, please OPEN ANWAR!!!!!
Date: Tuesday, October 31, 2017 4:02:30 PM

We need help!! Our State budget shortfall is hurting all Alaskans, and we need more private sector work in Alaska. We have proven we can do it responsibly.

Thanks

Mark

Mark Jimmerson, CDM | General Manager
NMS | 4675 Glacier Highway
Direct 907 780-6806 | Mobile 907 209-8124 | Fax 866 268-5780 |
mark.jimmerson@nmsusa.com

From: Laura Joans
To: fortherecord (Energy)
Subject: Please REJECT the Tax Bill due to its potential negative impact on the Arctic
Date: Friday, November 03, 2017 8:03:14 PM

Please do not reopen the Arctic National Wildlife Refuge for oil and gas drilling.
Not everything warrants more income - our environment, this Earth can only tolerate so much damage.

If part of this new Tax Bill supports drilling in the Arctic, please do what ever you can to STOP it.
Thank you,
Laura Joans
1574 Delaney Ferry
Nicholasville Kentucky
40356

Sent from my iPhone

From: Barbara Joels
To: fortherecord (Energy)
Subject: Preserving the Arctic National Wildlife Refuge
Date: Tuesday, November 14, 2017 1:44:18 PM

Dear Chairman and Members of the Senate Committee on Energy and Natural Resources:

My name is Barbara Joels. I'm a constituent from Bridgewater, New Jersey 08873.

I'm writing to ask that the Committee find other means to produce federal revenue than reopening the Arctic National Wildlife Refuge for oil and gas drilling. We should not destroy protected land and endanger wildlife to fund unnecessary tax breaks for the wealthy.

Thank you for taking my opinion into account.

Sincerely,

Barbara J. Joels

7 Railroad Place
Bridgewater, NJ 08807

From: Dave Johnson
To: fortherecord (Energy)
Subject: ANWR
Date: Wednesday, November 01, 2017 11:56:24 AM
Attachments: image001.png

Dear Chairman Murkowski and Ranking Member Cantwell,
I am an Alaskan that supports the opening of the 1002 area of the Arctic National Wildlife Refuge. Alaskans have developed the North Slope oil fields responsibly and will continue to do so with NO effects to the Arctic Caribou herd or any other animal species. We are the caretakers of the environment and we need you to vote in favor of development.
Please, let's not miss this opportunity.

Best regards,

Thanks,
Dave Johnson, VP
Samson Electric Inc.
3125 N. Van Horn Rd.
Fairbanks, Alaska 99701
Phone (907) 451-0252
Fax (907) 451-6103
dj@sei-ak.com

From: Judd Johnson
To: fortherecord (Energy)
Cc: anniehoefler@energy.senate.gov
Subject: US Senate Energy & Natural Resources Committee Hearing on ANWR Bill
Date: Wednesday, November 01, 2017 12:06:40 PM

-Chairman Murkowski,
Ranking Member Cantwel and
Members of the Senate Energy and Natural Resources Committee

As a lifelong Alaskan, I have witnessed the responsible development of much of the existing Oil and Gas infrastructure in Alaska.
As a long-term employee of an Alaskan Oil and Gas contractor my family and I have weathered the ups and downs in Alaska Oil and Gas investments in the State, the last of which I would offer that our current tax policy is complicit.

ANWR is the future to a stable and self-supporting economy within the State. If managed and developed correctly, this minuscule portion of lands and the resources within, will provide a future for my 7 year old son and generations of Alaskans to come.
Not only will the successful development of this ideally located resource ensure stability to the Alaska economy, but it also has the potential to fill the TAPS pipeline, generate billions of dollars of government revenue and thousands of jobs for years to come.

Again as a lifelong Alaskan and father, I far too enjoy Alaska's wildlife and wilderness to irresponsibly jeopardize these natural wonders. The Oil and Gas industry in Alaska, has a proven track record of environmental stewardship and responsible development of the North Slope.
The opening of this small portion of non-wilderness lands, would significantly reduce our dependence on foreign oil and provide economic stimulus to both the State and Nation.

We are independent bunch here in Alaska, shouldn't the US be as well?

I fully support the passage of this bill, and call on you to do the same.

Thank You

Judd Johnson
Construction Estimating Manager
Anchorage Office (907)-375-1570
Work Cell (907)-947-7679
Udelhoven Oilfield System Services Inc.

From: Lana Johnson
To: fortherecord (Energy)
Subject: 1002 area of ANWR
Date: Tuesday, October 31, 2017 2:54:48 PM

Dear Chairman Murkowski and Ranking Member Cantwell,
I am an Alaskan who supports the opening of the 1002 area of the Arctic National Wildlife Refuge. Alaskans have developed the North Slope oil fields responsibly, and will continue to do so with NO effects to the Arctic Caribou herd or any other animal species. We are the caretakers of the environment and we need you to vote in favor of development. Thank you.

SI Communications

Lana Johnson
Senior Vice President

W: 907.569.7070
3501 Denali Street, Suite 202
Anchorage, AK 99503
msialaska.com

From: Johnson, Mitchell/ANF
To: fortherecord (Energy)
Cc: Hoefler, Annie (Energy)
Subject: For Record of November 2, 2017 Hearing
Date: Wednesday, November 01, 2017 4:19:51 PM

Chairman Murkowski, Ranking Member Cantwell, and Members of the Senate Energy and Natural Resources Committee,

Oil development is not only part of Alaska's economic lifeline; it is also the sole economic lifeline of my family. My wife and I both work in the oil and gas industry and have for the last ten years. Our family home in Palmer and our six children all came to be because of the successful oil industry. Now, as we look to another year of recession, we face the reality of losing both of our livelihoods at once. This harsh reality reaffirms that the state of Alaska and the petrochemical industries need to explore new developments and invest in our futures. With new expansion into ANWR the entire state and industry could be boosted financially. This boost would create certainty and job security for my family and hundreds to others. Knowing we do not need to relocate to another state or find alternative living arrangement for our six children would be very reassuring. As I look around me I see my friends and loved ones losing their jobs and relocating on a weekly basis. They have repeatedly lost their homes and everything they have worked so hard for.

The recession in Alaska must stop. Your help opening exploration in ANWR could potentially lead us and all Alaskans out of this economic disaster.

Respectfully,

Mitch Johnson
D (907) 267-2626
C (907) 433-9597
E mitchell.johnson@ch2m.com

From: John Jolly
To: fortherecord (Energy)
Cc: Hoefler, Annie (Energy)
Subject: AMWR
Date: Tuesday, October 31, 2017 2:16:21 PM

Chairman Murkowski
Ranking Member Cantwell
Senate Energy and Natural Resources Committee

It is vital to Alaska and our economy to act on this matter now.

The proposed ANWR provision would allow development of no more than 2,000 acres of the 1.5 million acres of the Arctic coastal plain – part of the non-wilderness portion of ANWR's 19 million acres. **That is equivalent to just 0.01 percent of the entire refuge**.

99.99% of the people who are opposed to this action, have NEVER SET FOOT on any part of the ANWR, nor will they ever.

Let's make this happen.

Thank You,

John Jolly
General Manger
(907) 349-2581, ext. 203
WORLD WIDE MOVERS, INC.

From: Matt Jolly
To: fortherecord (Energy)
Cc: Hoefler, Annie (Energy)
Subject: For Record of November 2, 2017 Hearing
Date: Wednesday, November 01, 2017 12:23:24 PM

Chairman Murkowski, Ranking Member Cantwell, and Members of the Senate Energy and Natural Resources Committee,

Polls have consistently shown Alaskans overwhelmingly support responsible oil and gas development in the non-wilderness portion of ANWR. There is no valid reason why we should not be allowed to access the world-class resources within just a tiny fraction of the coastal plain.

The proposed ANWR provision would allow development of no more than 2,000 acres of the 1.5 million acres of the Arctic coastal plain – part of the non-wilderness portion of ANWR's 19 million acres. That is equivalent to just 0.01 percent of the entire refuge.

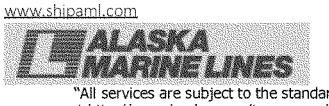
Responsible oil and gas development in this fraction of ANWR will help ensure America's energy security for decades and allow Alaska – and our nation as a whole – to realize the benefits that come from expanding energy production in Alaska.

Alaska's economic lifeline, the Trans-Alaska Oil Pipeline System (TAPS), is now running at three-quarters empty. New oil production from ANWR has the potential to reverse throughput in TAPS, a vital component of American energy infrastructure.

Since the ANWR coastal plain is less than 60 miles from TAPS, development of energy resources there is one of the most environmentally-sound ways to increase oil production in Alaska.

Thanks to continuing improvements in technology, practices, and oversight, the oil industry has demonstrated over the past 40 years that North Slope energy development and environmental stewardship can and do coexist. The industry has a proven track record of responsible development in sensitive areas, protecting the environment, wildlife and subsistence needs of local residents.

Matt Jolly | Account Manager – Central Alaska
1048 Whitney Rd | Anchorage, AK 99501
907-339-5151 Office | 907-830-4825 Cell
www.shipaml.com



"All services are subject to the standard terms and conditions of our Surface Transportation Board tariff (available at http://www.lynden.com/terms-conditions.html) and the bill of lading published therein. Any bill of lading or other shipping document issued shall not be effective to the extent it conflicts with our terms and conditions. By shipping with Alaska Marine Lines, you are acknowledging acceptance of our terms and conditions."

For Record of November 2, 2017 Hearing

Dear Chairman Murkowski, Ranking Member Cantwell, and Members of the Senate Energy and Natural Resources Committee,

My name is Jenna Jonas. My address is 2240 Railroad Drive, Fairbanks AK 99709. I am writing because I am an Alaskan who strongly opposes opening the Arctic National Wildlife Refuge to oil and gas development.

To me, the Arctic National Wildlife Refuge represents what is best about Alaska, big, wild ecosystems. Alaska's wilderness also provides me with the best job in the world. In the summer I work as a wilderness guide leading backpacking, rafting, canoe, and basecamp trips in our beautiful Arctic National Wildlife Refuge, National Petroleum Reserve- Alaska, Gates of the Arctic Park and Preserve, and more. In the winter, my husband and I own and operate a small dogsledding business based out of our homestead on the Tanana River south of Fairbanks. We take visitors from around the world on everything from short dogsled rides to week-long expeditions in the Arctic and Interior. I dearly love this land and the life it makes possible for me to enjoy. As a wilderness guide, I have spent time on the Coastal Plain and know it to be a vital and sensitive place. It is a world-class wilderness area that with very minimal investment can continue to produce tourism revenue for generations to come. The oil industry is at odds with the tourism industry that I participate in. People come to Alaska to see its wild places, its pure and unpolluted landscapes that are gone from so many other places.

I know how much Alaska has relied on oil development to fuel our growth and prosperity in these last 40 years. It doesn't seem like a good investment to me to be so dependent on oil for our economy. We need to diversity and capitalize on other resources, so as to avoid the painful boom and bust cycle that time and again has been experienced we rely on a singular commodity.

If we drill for oil in the Arctic Refuge, even with the best, newest, fanciest technology, we are bound to make mistakes. Mistakes are human nature, they have happened at Prudhoe bay and they will happen elsewhere. But some mistakes can't be fixed. The Exxon Valdez spill, Deepwater Horizon (which also relied on directional drilling), they continue to have repercussions that we can barely understand. The Coastal Plain (1002 area) is critical habitat for the porcupine caribou herd (a vital subsistence resource), migratory birds, and denning polar bears. I believe that even given the best technology and precautions, drilling for oil and gas would be destructive to these animals and the people who rely on them.

I do not think that drilling for more oil and gas in the arctic is the right direction to move given the scientific consensus that human emissions of CO2 and other greenhouse gases are causing climate change that is already harming our state, people, and resources. I find Senator Murkowski's argument that we need the money from drilling to repair climate change damage in Alaska offensive and backwards.

The connection between developing the Coastal Plain of the Arctic Refuge and climate change is two-fold. First, increased disturbance of the tundra from industrial infrastructure thaws permafrost and releases huge amounts of stored carbon into the atmosphere, creating a positive feedback loop that multiplies the effects of climate change (Schuur et al., 2015). The Arctic is warming twice as fast as any other place on earth (Pithan and Mauritsen, 2014) and it is more sensitive to that warming because it is so cold: a few degrees warmer in the tropics doesn't change much, but a few degrees warmer in the Arctic is devastating.

We are experiencing these effects today. In Alaska, there are currently 31 towns and villages that are in imminent danger of rising sea levels; each one is estimated to cost $100 million to relocate. In some areas

we are losing 70 feet of coast per year. Further oil and gas development would also cause habitat fragmentation and degradation, pollution, and introduce invasive species. These factors combined mean permanent damage to the fragile Coastal Plain ecosystem which is already facing many challenges.

Second, according to overwhelming scientific consensus, climate change is occurring primarily because of human activity, including burning fossil fuels. If we continue to drill for, transport, process, and ultimately burn more oil, we will only exacerbate this problem. Drilling for more oil ensures burning more oil and releasing more carbon dioxide into the atmosphere, causing more climate change.

I am acutely aware of the negative impact that warmer temperatures, ocean level rise, unpredictable weather, and all of the others ills of climate change will have on this state in my lifetime. As someone who hunts, fishes and harvests a good chunk of my food, shelter and income, I am seriously concerned about the impact of climate change on our beautiful, bountiful state.

As an Alaskan with a stake in this issue, I have been part of the debate and public process a number of times. I was part of the US Fish and Wildlife Service's last planning process, the 2012 "Comprehensive Conservation Plan" and sat through hours of hearings in Fairbanks and Anchorage. At those hearings and throughout that process, many Alaskans spoke and the majority of them opposed drilling. In state hearings on HJR 5 in 2016, the majority of Alaskans who testified again testified against opening the Refuge to oil and gas exploration. It appears that our leaders do not want to take the time to listen to their constituents this time.

The tired argument that both Murkowski and Sullivan prop up is that drilling would "lessen our dependence on unstable foreign energy sources". This is an outdated argument; the US is currently exporting oil and this has not reduced the number of military conflicts that we are engaged in.

Oil development may have been the economic driver of Alaska's past, but I do not think it is a responsible choice to power our future. When I think of the economy of Alaska's future I think of investing in our thriving fishing industry, in education, tourism, and technology.

To me this all comes back to this decision before you- to open the Coastal Plain, the Arctic Refuge's biological heart, to oil and gas development. If we take this route we will burn more fossil fuels, creating more climate change and our future will become increasingly bleak. If, however we respect the refuge for what it is- a birthing place for the Porcupine caribou herd, a nesting ground for countless species of migratory birds, critical winter denning area for threatened polar bears, a hunting ground for the Inupiat. If we treat it like a refuge (which is what it is) then it can live on, as it has for thousands of years as generations of humans have chosen to let it be- wild and bountiful and as my friend Sarah James would say, "the world the way that the creator made it." If we do this then we leave something to our children that was never ours to take in the first place.

This is how we can take care of Alaska and this country- by supporting development that will help us thrive in the long term, not fuel the destruction of our world for the benefit of a few in the short term.

Our wild places will continue to grow in value as they become increasingly rare on this planet. I pray that you, our leaders, have the wisdom and forethought to make sure they will be here for the next generation and the next one after that, as Alaskans have done for generations before.

Here is a letter to the editor that I submitted for the record:

Drilling in the Arctic Refuge- Now Scarier than Ever!

The debate about what to do with the "1002 area" of the Arctic National Wildlife Refuge has been simmering since 1980 when ANILCA set aside 1.5 million acres of the Refuge's Coastal Plain for further study. The move was a congressional punt, passing a puzzle on for future decision makers with more information. Since 1980 much has happened that should be seen as relevant to this decision.

Since 1980 Alaskans have experienced the boom and bust cycle that comes with placing all of your bets on one singular commodity whose value is dictated by a global market. Our recent budget crisis should highlight this adequately.

Since 1980 the world's population has increased by over 2 billion. And the rate of consumption in the developed world has increased in parallel.

Since 1980 Alaskans have experienced first-hand the devastation of what happens when oil development doesn't go according to plan. The 1989 Exxon Valdez oil spill continues to have repercussions on our coast. The 2010 Deepwater Horizon disaster occurred while using the "directional drilling" technology that Murkowski is currently recommending for the Arctic Refuge.

Since 1980 the world's scientists have reached the conclusion that climate change is caused by people emitting greenhouse gasses. Drilling in the Arctic refuge would increase climate chaos. Since 1980 the world has warmed by 1.4 degrees Fahrenheit causing increasingly intense storms, coastal erosion, rampant wildfires, glacial recession and more, all readily observable in Alaska's arctic, which is warming at twice the rate of the rest of the planet.

Since 1988 the Gwich'in people who rely on resources from the Coastal Plain or as they refer to it, "the sacred place where life begins" have consistently opposed development.

Since 1980 many scientists have studied, as section 1002 mandated, the fish, wildlife, the impacts of oil and gas exploration and development, and production on the Refuge's Coastal Plain. There was the initial 1987 resource study by the Department of the Interior, the 1998 USGS petroleum resource assessment, the Fish and Wildlife Service's Comprehensive Conservation Plan of 2012. They found that the refuge is more fragile than first anticipated. They found that the caribou, polar bears, and millions of migratory birds are vitally bound to the Coastal Plain as a nursery for their young.

Since 1980 thousands of travelers have visited the Arctic National Wildlife Refuge, many of them on tours guided by Alaskans, producing sustainable tourism income.

Since 1980, millions of acres of Alaska have been leased for oil and gas exploration and development. An industrial maze of roads, generators, and infrastructure has expanded.

Since 1980 the United States has gone from an importer of oil to an exporter of oil, without gaining any appreciable amount of increased national security.

Since 1980 we have had many opportunities to study, debate, and, in the case of our congressional delegation, yell about drilling in the Arctic National Wildlife Refuge.

Never since 1980 have we had an administration so vehemently opposed to environmental protections. Never since 1980 have we had a leader of the EPA who had formerly sued the EPA, who is known to

coordinate strategy directly with the oil companies. Never since 1980 have we had a president who prefers bullying to leadership, fiction to fact.

Since time immemorial, millions of creatures have thrived in the Arctic National Wildlife Refuge, one of the world's last intact ecosystems. Hundreds of polar bear cubs have blinked their eyes and emerged from their dens. Thousands of subsistence hunters have breathed deeply and imagined themselves the first to put their foot down in exactly this patch of earth. Millions of caribou have taken their first wobbly steps onto the Coastal Plain's flower-dotted tundra. May we have the wisdom to take stock of the changes since Congress's demand that we learn more. May we protect this magical place for future generations to learn and marvel over as we have.

From: katie mae jones
To: fortherecord (Energy)
Subject: Protest Alaskan Wildlife
Date: Tuesday, November 14, 2017 3:04:13 PM

I'm writing to ask that the committee find other means to produce federal revenue than reopening the Arctic National Wildlife Refuge for oil and gas drilling. We should not destroy protected land and endanger wildlife to fund unnecessary tax breaks for the wealthy. Please pass my message along to the Chairman and other committee members.

Thank you,
Katie Jones
2139 E Old Oxford Rd Apt B
Chapel Hill, NC 27514
~"no economy on a dead planet"

From: Jennifer Jordan
To: fortherecord (Energy)
Subject: Arctic National Wildlife Refuge for oil and gas drilling.
Date: Monday, November 06, 2017 11:39:55 AM

Senate Committee on Energy and Natural Resources:

I'm writing to ask that the committee find other means to produce federal revenue than reopening the Arctic National Wildlife Refuge for oil and gas drilling. We should not destroy protected land and endanger wildlife to fund unnecessary tax breaks for the wealthy. Please pass my message along to the Chairman and other committee members.

Thank you for your time and attention.

Jennifer M. Jordan
69 Spencer Rd 34J
Boxborough, MA 01719

From: Bel [mailto:rglenjordan@gmail.com]
Sent: Tuesday, November 14, 2017 3:43 PM
To: fortherecord (Energy)
Subject: NO to ANWR Drilling Please

To:
US Senate Committee on Energy and Natural Resources

From:
R Glen Jordan
(aka Bel@Alt_Bellwether on Twitter)
129 Apache Circle
Conroe, Texas 77304
1-915-239-3398

RE: Proposed Drilling in ANWR

Senator Murkowski and Estimed Committee Members,

ANWR was specifically set aside to protect it from these very proposed exploitations. Should we go ahead and drill anyway for the sake of a dirty and dying industry? Is there any doubt that within one hundred years our citizens will look back at such a move with disdain for those who foolishly pursued and perpetuated it? I beseech your better selves to eschew the proposed drilling endeavor within the Arctic National Wildlife Refuge and allow at least this one beautiful piece of the Great State of Alaska to remain primordial and clean.

Perhaps our focus would be better served in the furtherance of the now fast-growing renewable energy resources instead of invading this small, pristine vista of wilderness.

Whatever you decide, please don't let a temporal oligarch push an agenda in a bid for self-aggrandizing accolades at the expense of such natural beauty.

Best regards,

R Glen Jordan

From: Bel [mailto:rglenjordan@gmail.com]
Sent: Wednesday, November 15, 2017 11:20 AM
To: fortherecord (Energy)
Subject: Leave ANWR Pristine

To:
US Senate Committee on Energy and Natural Resources

From:
R Glen Jordan
(aka Bel@Alt_Bellwether on Twitter)
129 Apache Circle
Conroe, Texas 77304
1-915-239-3398

RE: Proposed Drilling in ANWR

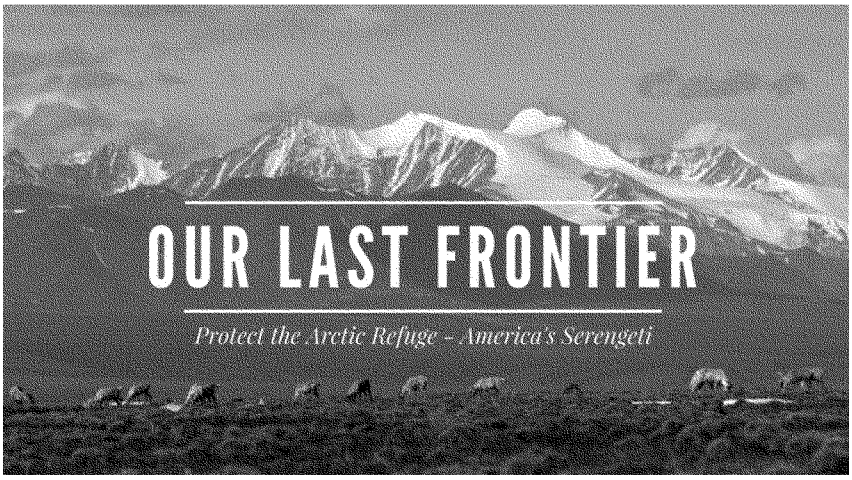
Senator Murkowski and Esteemed Committee Members,

As you debate the notion of piercing the permafrost to get at the black money glop that is destroying our environment, please recall why the Arctic National Wildlife Refuge was set up in the first place.

Let's not do something we'll all regret. There are other places to drill.

Best Regards,

Ron Jordan



From: Ronald Jordan
To: fortherecord (Energy)
Subject: ANWR Support
Date: Tuesday, October 31, 2017 8:44:57 PM

To the Senate Energy Committee

Having worked next to ANWR back in the late 70's and early 80's. My observation is that the Companies that drilled next to ANWR took extreme precautions while drilling to prevent any damage of the environment surrounding the drilling site. I worked as A sub contractor to Exxon, SHIO, and Mobil Oil for about 6 years on various locations. At that time I did not see where it disturbed the migration of wildlife through and around the drilling locations.

From what I have seen in the present is that the companies have improved their safety protocols while drilling and in the transportation of materials to support the drilling programs. I feel that the exploration drilling will leave A small foot print in ANWR per location as in the past.

New oil in ANWR will help in American energy independence.

Thank you
Ronald Jordan
8170 Woodgreen Cir.
Anchorage, AK, 99518
907-952-9522

Sent from Outlook

From: Jumps, Satonya
To: fortherecord (Energy)
Subject: For Record of November 2, 2017, Hearing
Date: Tuesday, October 31, 2017 4:41:48 PM
Importance: High

Chairman Murkowski, Ranking Member Cantwell, and Members of the Senate Energy and Natural Resources Committee:

I am writing to ask your support for opening a portion of the Arctic National Wildlife Refuge (ANWR) to drilling.

For decades, multiple polls have shown that Alaskans overwhelmingly support responsible oil and gas development in the non-wilderness portion of ANWR. There is no valid reason why we should not be allowed to access the world-class resources within just a tiny fraction of the coastal plain.

The proposed ANWR provision would allow development of no more than 2,000 acres of the 1.5 million acres of the Arctic coastal plain—part of the non-wilderness portion of ANWR's 19 million acres. **That is equivalent to just 0.01 percent of the entire refuge**.

Responsible oil and gas development in this fraction of ANWR will help ensure America's energy security for decades and allow Alaska—and our nation as a whole—to realize the benefits that come from expanding energy production in Alaska.

While renewable energy is a growing part of America's energy portfolio, it is still projected to account for a minority of American energy production in 2040. New oil and gas production will be required to power America's economy and serve as a bridge until renewable energy becomes a dominant energy source decades into the future.

Energy production from ANWR has the potential to offset a decline in Lower 48 shale oil production, which is expected to be experienced in approximately a decade. Without limited oil development on the coastal plain, America will be forced to once again increase its reliance on foreign imports. With limited development in ANWR, America and Alaska can continue to grow the economy and reduce dependence on foreign oil.

The U.S. Geological Survey estimates the 1002 Area is North America's greatest prospect for conventional onshore oil production, with a mean likelihood of containing 10.4 billion barrels of oil and 8.6 trillion cubic feet of natural gas, as well as a reasonable chance of economically producing 16 billion barrels of oil.

Oil development on a fraction of the coastal plain would create THOUSANDS of jobs nationwide, generate billions of dollars in government revenue, keep energy prices for American consumers affordable, and further improve energy security for decades into the future.

I firmly believe we need to access our country's resources to prevent dependence on other countries. Opening a portion of ANWR to responsible development is a necessary step toward that end.

Thank you.

Satonya Jumps

4766 Grumman St.
Anchorage, Alaska 99507

907.229.3139

From: Scott Jungwirth
To: "fortherecord@energy.senate.gov"
Cc: "annie_hoefler@energy.senate.gov"
Subject: For Record of November 2, 2017 Hearing
Date: Tuesday, October 31, 2017 8:15:42 PM

Chairman Murkowski, Ranking Member Cantwell, and Members of the Senate Energy & Natural Resources Committee:

I am a long-time (40+ years) Alaskan that supports responsible oil and gas development in the non-wilderness portion of ANWR. It is in the best interest of Alaska, its residents, and America to responsibly develop 2,000 acres of ANWR's 19 million acres. Responsible oil and gas development in this fraction of ANWR will help ensure America's energy security for decades and allow Alaska - and our nation as a whole – to realize the benefits that come from expanding energy production in Alaska. Oil and gas development in this small fraction of the coastal plain would create thousands of jobs nationwide, generate billions of dollars in government revenue, keep energy prices for American consumers affordable, and further improve energy security for decades into the future. Please take these points into consideration when you review this measure.

Scott Jungwirth
Vice President, Administration & Finance
Cruz Companies Alaska
2525 C Street, Suite 305
Anchorage, Alaska 99503
(907) 777-8212 (desk)
(907) 360-8686 (cell)
sjungwirth@cruzconstruct.com

From: Shawn Kahler
To: fortherecord (Energy)
Subject: Chairman Murkowski, Ranking Member Cantwell, and Members of the Senate Energy and Natural Resources Committee
Date: Wednesday, November 01, 2017 1:16:47 PM

My name is Shawn Kahler I am a lifelong Alaskan and I support the opening of ANWR 100%.
Thank you.

Shawn Kahler
skahler@dowlandbach.com
Dowland-Bach
6130 Tuttle Place
Anchorage Alaska 99508

William D & Carol G Kane
PO Box 520502
Big Lake, AK 99652 – 0502
Phone: (907) 355-2467
Email: hrkane@gmail.com

To: "Chairman Murkowski, Ranking Member Cantwell, and Members of the Senate Energy and Natural Resources Committee."

From: William D. Kane
Carol G. Kane

Re: OIL & GAS LETTER OF SUPPORT

As full time residents of Alaska since 1982 and property owners on Big Lake since 1987, we fully support the following responsible oil and gas development on the Coastal Plain as noted by John MacKinnon, Executive Director AGC of ALASKA.

• Continuing improvements in technology, practices, and oversight, the oil industry has demonstrated over the past 40 years that North Slope energy development and environmental stewardship can and do coexist. The industry has a proven track record of responsible development in sensitive areas, protecting the environment, wildlife and subsistence needs of local residents.

• Polls have consistently shown Alaskans overwhelmingly support responsible oil and gas development in the non-wilderness portion of ANWR. There is no valid reason why we should not be allowed to access the world-class resources within just a tiny fraction of the coastal plain.

• Responsible oil and gas development in this fraction of ANWR will help ensure America's energy security for decades and allow Alaska – and our nation as a whole – to realize the benefits that come from expanding energy production in Alaska.

• Energy production from ANWR has the potential to offset a decline in Lower 48 shale oil production, which is expected to commence in approximately a decade. Without limited oil development on the coastal plain, America will be forced to once again increase its reliance on foreign imports. With limited development in ANWR, America and Alaska can continue to grow the economy and reduce dependence on foreign oil.

• Alaska's economic lifeline, the Trans-Alaska Oil Pipeline System (TAPS), is now running at three-quarters empty. New oil production from ANWR has the potential to reverse throughput in TAPS, a vital component of American energy infrastructure.

Thank you for your leadership and full support of this Oil and Gas Letter of Support.

From: Miranda Kaplan
To: fortherecord (Energy)
Subject: Comment on reopening ANWR
Date: Tuesday, November 14, 2017 4:51:38 PM

Dear Senator Murkowski and committee members,

My name is Miranda Kaplan, and I am sending this e-mail to register my opposition to the reopening of the Arctic National Wildlife Refuge for oil and gas drilling. I believe this would be an extremely short-sighted decision that would destroy irreplaceable natural resources for the sake of a fossil fuel industry we should be trying to invest *less* in for the future, not more. I urge the committee members to seek out alternative means of creating federal revenue that do not endanger these valuable lands and the wildlife that lives on them.

Thank you for your time.

Miranda Kaplan
1412 May Avenue SE
Atlanta, GA 30316

From: Nick Karnos
To: fortherecord (Energy)
Cc: Hoefler, Annie (Energy)
Subject: For Record of November 2, 2017 Hearing
Date: Wednesday, November 01, 2017 3:14:12 PM

To: Chairman Murkowski, Ranking Member Cantwell, and Members of the Senate Energy and Natural Resources Committee

I want to make sure to make it clear that I support opening ANWR for petroleum exploration and development . Anything and everything we can do to wean the US off the need for crude imports is welcome and wanted.

The coastal plain of ANWR is a barren wasteland of underused and unexplored resources, and a minute fraction of arctic wilderness area. Given the fact that the people of this state, along with our industry partners have successfully developed identical geography for the last 50 years, the time has come for an eastward expansion of Alaska's energy industry.

Please do whatever can be done to help attract investment and development of the energy industry in Alaska for generations to come.

NK

Nick Karnos
13721 Jarvi Dr.
Anchorage, AK 99515

From: Jeff Karraker
To: fortherecord (Energy)
Subject: Objection to Drilling in ANWR
Date: Wednesday, November 15, 2017 11:45:01 AM

As someone who worked in the Brooks Range for 5 years I have seen the damage caused by the development at Prudhoe Bay. Melting of the permafrost, detritus from hauling and drilling activities have forever scarred the area. The industry says they can do better, but they don't. Don't pay for the flawed Tax Bill by desecrating the Arctic in an area that is the last refuge for biodiversity of the quality that is found in ANWR. Take another look and don't look for easy solutions that will haunt us for years. Our energy needs are not at the point that we need to consider such rash action.

Thank you for the opportunity to address this important decision.

Mary J Karraker
221 Jenkins Ranch Rd #H
Durango, CO 81301
970-259-0428

From: Jan Keller
To: fortherecord (Energy)
Subject: Arctic National Wildlife Refuge - comment
Date: Wednesday, November 08, 2017 12:48:37 PM

To the Senate Committee on Energy and Natural Resources:
My name is Jennifer Keller and I'm a U.S. citizen. My address is 115 146th Ave SE, Bellevue, WA 98007.
I urge the committee to find other means to produce federal revenue than reopening the Arctic National Wildlife Refuge for oil and gas drilling. We should not destroy protected land and endanger wildlife to fund unnecessary tax breaks for the wealthy.
The Arctic Refuge (including the Coastal Plain) requires our protection, and should keep its wilderness designation. It should absolutely be preserved, for both wildlife and people. Bear, musk ox, waterfowl, and caribou need this pristine wilderness--it's their home. Indigenous communities depend on the health of the Refuge. It is essential that we keep a full commitment to protect this unique place.

Thank you for taking my comment.
Jennifer Keller

From: Judy Kelly
To: fortherecord (Energy)
Subject: Protecting the Arctic National Wildlife Refuge
Date: Tuesday, November 14, 2017 3:51:52 PM

I want the committee to find other means to produce federal revenue than reopening the Arctic National Wildlife Refuge for oil and gas drilling.
I do not want to destroy **protected land and endanger wildlife** to fund unnecessary tax breaks for the wealthy. z

Judy Kelly
815 S Pine St,
Tacoma, WA, 98405
253-272-89 43

From: Sen. Pete Kelly
To: fortherecord (Energy)
Cc: Hoefler, Annie (Energy)
Subject: For Record of November 2, 2017 Hearing on ANWR
Date: Tuesday, October 31, 2017 5:48:47 PM

Dear Chairman Murkowski, Ranking Member Cantwell, and Members of the Senate Energy and Natural Resources Committee,

I write in strong support of opening the Arctic National Wildlife Refuge (ANWR) to oil and gas development, and in particular, of the ANWR drilling provision now under consideration by your committee.

Like many Alaskans I represent as a state Senator, I support responsible resource development. Alaska has a stellar track record of responsible oil and gas development in our Arctic region, and this track record should support opening ANWR's coastal plain. The rich oil and gas resources of this region should be explored and developed without further delay. It is time we unlock these tremendous reserves for development by world-class companies, for the benefit of our local communities, our state, and our nation.

Your committee is likely well-aware of the economic and national security benefits ANWR development would bring. These benefits will continue flowing for generations, along with the oil that supports trade balances; enhances our national security; employs hard workers with living wages; and fuels our state and federal treasuries. In Alaska, we see these benefits close-up. In my home community of Fairbanks, when the North Slope oil companies are busy, so are my constituents – those who own and operate support businesses, those who are employed directly with oil companies, and those who enjoy the trickle-down economic benefits of strong wages circulating in our city.

Finally, the impact of oil development in ANWR to our state treasury – and to the federal treasury – cannot be understated. These revenues from lease bids, royalties, and taxes help support so many necessary and valued needs, in Alaska and in the United States. I urge your action to unlock the tremendous potential of ANWR's coastal plain.

Thank you for your consideration,

Sen. Pete Kelly

Alaska State Senate

From: Holly Kelty
To: fortherecord (Energy)
Subject: Chairman Murkowksi and Ranking Member Cantwell
Date: Tuesday, October 31, 2017 2:08:50 PM

Dear Chairman Murkowski and Ranking Member Cantwell:

I am a life-long Alaskan resident that supports the opening of the 1002 area of the Arctic National Wildlife Refuge. Alaskans have developed the North Slope oil fields responsibly and will continue to do so with NO negative effects to the Arctic Caribou herd (positive effects are well documented) or any other animal species. We are the caretakers of the environment and we need you to vote in favor of development.

Regards,

Holly Kelty
907.229.7420 Cell
holly@lcgak.com

P.O. Box 145, Delta Junction, AK 99737, USA
3204 International Street, Fairbanks, AK 99701, USA

Tel: +1 907 895 2841
Fax: +1 907 895 2866

To; Chairman Murkowski,
Ranking Member Cantwell, and
Members of the Senate Energy and Natural Resources Committee.

Ref: For Record of November 2, 2017 Hearing

Support for ANWR November 1, 2017

I would like to add a few comments of support for the development of Alaska's natural resources, some of these points may have been passed along;

1) Polls have consistently shown Alaskans overwhelmingly support for the responsible oil and gas development in the non-wilderness portion of ANWR. The foot print: There is no valid reason why we should not be allowed to access the world-class resources within just a tiny fraction of the coastal plain. Responsible oil and gas development in this fraction of ANWR will help ensure America's energy security for decades and allow Alaska – and our nation as a whole – to realize the benefits that come from expanding energy production in Alaska.

2) Potential; Energy production from ANWR has the potential to offset a decline in Lower 48 shale oil production, which is expected to commence in approximately a decade. Without limited oil development on the coastal plain, America will be forced to once again increase its reliance on foreign imports. With limited development in ANWR, America and Alaska can continue to grow the economy and reduce dependence on foreign oil.

3) Additional Benefit; Alaska's economic lifeline, the Trans-Alaska Oil Pipeline System (TAPS), is now running at three-quarters empty. New oil production from ANWR has the potential to reverse throughput in TAPS, a vital component of American energy infrastructure. In addition to the above, Oil development on a fraction of the coastal plain would create thousands of jobs nationwide, generate billions of dollars in government revenue, keep energy prices for American consumers affordable, and further improve energy security for decades into the future.

4) Oil Production and the Environment are proven: Thanks to continuing improvements in technology, practices, and oversight, the oil industry has demonstrated over the past 40 years that North Slope energy development and environmental stewardship can and do coexist. The industry has a proven track record of responsible development in sensitive areas, protecting the environment, wildlife and subsistence needs of local residents.

Development of ANWAR has the ability to not only help the nation but closer to home, it has the ability to help reduce the ever worrisome question of; Energy cost due to lack of development of our known resource. Don't let this happen! The responsible development of ANWAR is the right thing to do.

Thanks

Chris Kennedy
General Manager
SMM Pogo Mine

From: I
To: fortherecord (Energy)
Subject: oil development in Alaska
Date: Wednesday, November 01, 2017 2:28:11 PM

Dear Sirs,

Please let us develop our resources here in the Alaska. There's no good reasons to keep these areas closed to development. The current technology means a very small industrial footprint, and big-time controls on the whole process.

We need to stop buying oil from people who hate us. And we should be exporting, giving Russia and the Middle East both a run for their money.

Thanks,
Wenda Kennedy
PO Box 8545
Nikiski, Alaska 99635
907 776-7655

From: Colleen Kilroy
To: fortherecord (Energy); Hoefler, Annie (Energy)
Subject: Open the 1002 Area of ANWR
Date: Tuesday, October 31, 2017 9:20:51 PM

Dear Chairman Murkowksi, Ranking Member Cantwell, and Members of the Senate Energy and Natural Resources Committee,

I am an Alaskan that supports the opening of the 1002 area of the Arctic National Wildlife Refuge. Alaskans have developed the North Slope oil fields responsibly and will continue to do so with NO effects to the Arctic Caribou herd or any other animal species. We are the caretakers of the environment and we need you to vote in favor of development.

I am a training coordinator and work as a contractor for Alyeska Pipeline Service company. I have been to Prudhoe Bay, the Pump Stations, and Valdez. I have seen first-hand the utmost care and concern that Alaskans have for the environment, especially in these industrial facilities. They place drip pans underneath their parked vehicles to ensure that no fluids touch the ground. They are responsible about their waste management so as to not attract animals to the facilities. They halt operations if wildlife should cross their path.

I am a strong supporter of green energy and environmental responsibility. My husband and I carpool to work, or work from home when we can. We make an effort to reduce our waste, re-use what we can, and recycle what we cannot. We buy local to reduce carbon emissions of shipping up to Alaska. All this being said, I am also a huge proponent of responsible resource development. I see no conflict between the two and Alaska has proven that they can do resource development while protecting the environment. Thanks to continuing improvements in technology, practices, and oversight, the oil industry had demonstrated over the past 40 years that North Slope energy development and environmental stewardship can and do coexist. The industry has a proven track record of responsible development in sensitive areas, protecting the environment, wildlife, and subsistence needs of local residents.

While renewable energy is a growing part of America's energy portfolio, it is still projected to account for a minority of American energy projection in 2040. New oil and gas production will be required to power America's economy until renewable energy becomes a dominant source. Oil production from ANWR would create thousands of jobs nationwide, generate billions of dollars in government revenue, keep energy prices affordable for American consumers, and improve energy security for decades into the future.

Please open the 1002 area of the Arctic National Wildlife Refuge for the future of Alaska and for our nation.

Regards,
Colleen Kilroy
Program Administrator
Northern Industrial Training, LLC
3700 Centerpoint Dr, Suite 102
Anchorage, AK 99503
Colleen.kilroy@nitalaska.com
Main Office: 907-743-7700

From: Carrie King
To: fortherecord (Energy)
Subject: Protect the ANWR
Date: Thursday, November 02, 2017 1:50:51 PM

To the Senate Committee on Energy and Natural Resources,

I'm writing to ask that the committee find other means to produce federal revenue than reopening the Arctic National Wildlife Refuge (ANWR) for oil and gas drilling. We should not destroy protected land and endanger wildlife to fund unnecessary tax breaks for the wealthy. Please pass my message along to the Chairman and other committee members.

Thank you for your time,

Carrie King
1434 W 25th Ave
Eugene, OR 97405

From: Janet King
To: fortherecord (Energy)
Subject: Opinion re. reopening Arctic National Wildlife Refuge for drilling
Date: Tuesday, November 14, 2017 6:33:37 PM

TO: Senate Committee on Energy and Natural Resources

Dear Chairman and Committee Members,

I'm writing to ask that the committee find other means to produce federal revenue than reopening the Arctic National Wildlife Refuge for oil and gas drilling.. This is particularly beautiful land, sacred for the local indigenous people, and we should not destroy protected land and endanger wildlife to fund unnecessary tax breaks for the wealthy.

Thank you for your time and attention.

Sincerely,

Janet A. King, 1116 Walnut St., Berkeley, CA 94707

From: Arti Kirch
To: fortherecord (Energy)
Subject: Please vote against opening ANWR for oil and gas drilling
Date: Wednesday, November 15, 2017 11:30:33 AM

Dear Members and Chair of the Senate Committee on Energy and Natural Resources,

Per "Subject", I implore you not to open Alaska's Arctic National Wildlife Refuge to oil and gas drilling.

I am dismayed that we, the taxpayers of this country, would yet again subsidize the extraordinary wealth that we have created for the highly profitable oil and gas industry. In addition, Murphy's Law will apply: a toxic event is not a matter of "if" but "when" and it would be all the more destructive in the critical but fragile Arctic lands.

I urge you strongly to insist that the petroleum industry continue its ongoing and well-remunerated petroleum extraction in practically every state in this country. I ask you: if the industry is full of such smart people -- and it is! -- why can't they continue to make a buck without tearing up yet more public land?

Regards,
Marian Kirch
1750 Lynwood Drive
Concord CA 94519

From: Dennis Kirkpatrick
To: fortherecord (Energy)
Cc: Hoefler, Annie (Energy)
Subject: For Record of November 2, 2017 Hearing
Date: Thursday, November 02, 2017 5:05:56 PM

Chairman Murkowski, Ranking Member Cantwell, and Members of the Senate Energy and Natural Resources Committee,

Dear Committee members,

Labor Trust Services in Anchorage is an employee benefits firm that administers pension and healthcare benefits for tens of thousands of Union employees. It's no secret that the working man has struggled mightily as the Alaska economy has been victimized by the price of oil and as development, construction, and tourism businesses have emphasized operation expense reductions (layoffs). There are REAL Alaskans struggling to get by, and we see the desperation growing as people lose benefits due to employment cuts and are forced to take their retirement benefits before they can afford to retire permanently.

If this trend persists, these tens of thousands of people will become less self-sufficient and will increase the pressure on the States entitlement programs. As stewards of the financial health of Alaska communities, I know you already realize that you are elected by real Alaskans, and that these Alaskans who elect you are desperate for help. Please consider the needs of the typical Alaska citizen today and don't be overwhelmed by the pessimistic propaganda of environmental groups that may have points worth considering in the long-term, but who do not care for the plight of the average Alaskan RIGHT NOW. Due to continuing improvements in technology, practices, and oversight, the oil industry has demonstrated over the past 40 years that North Slope energy development and environmental stewardship can and do coexist. The industry has a proven track record of responsible development in sensitive areas, protecting the environment, wildlife and subsistence needs of local residents.

Please prioritize the needs of REAL Alaska citizens and support the ANWR drilling provision to allow limited oil and natural gas activity within the non-wilderness coastal plain of the Arctic National Wildlife Refuge (ANWR).

Thank you, Dennis

Dennis M. Kirkpatrick
President
Welfare & Pension Administration Service, Inc.
P: (206) 441-7574 Ext. 3920
C: (206) 310-1559
E: dennis@wpas-inc.com
OUR OFFICE HAS MOVED!
Effective March 27, 2017, our new office street address is:
Welfare & Pension Administration Service, Inc.
7525 SE 24th Street Suite 200
Mercer Island, WA 98040
Please take a moment to update your records accordingly
This transmittal may contain confidential information intended solely for the addressee. If you are not the intended recipient, you are hereby notified that you have received this transmittal in error; any review, dissemination, distribution or copying of this transmittal is strictly prohibited. If you have received this communication in error, please notify us immediately and delete this message and all attachments. Thank you.

From: Emily Kloc
To: fortherecord (Energy)
Subject: Opposition to the Tax Reform Bill that Opens the Arctic Refuge to Development
Date: Tuesday, November 21, 2017 12:46:53 PM

Dear Energy Committee Members,

As an Alaskan, I listened intently to your hearing about possible drilling in the Arctic Refuge. I strongly oppose any tax reform bill that includes opening the Arctic Refuge to development.

If someone came to you and said that they would like to set up a drill rig in your church, what would you say? If they assured you it wouldn't take up too much space and it wouldn't disrupt things too much because it's footprint would be small, what would you say? If they told you it was good for the economy and national security to put this drilling rig in the center of your place of worship, what would you say?

I imagine that none of these arguments would convince you to allow oil drilling in the middle of a place you consider sacred. But this is what some of you are asking the Gwich'in people to allow in a place they consider sacred.

Senator Murkowksi said "My husband and I have raised our boys [in Alaska] and I hope that they lead long and healthy lives in a place that is so beautiful and so gorgeous that it sometimes takes your breath away." Governor Walker said "I have a goal as governor that future generations will be able to have the same benefits growing up in Alaska that I had growing up in Alaska."

These two statements are what the Gwich'in people are asking for when they oppose drilling in the Arctic Refuge. They want their children and grandchildren to be able to live long and healthy lives and have the same benefits that they do. One of these benefits is being able to continue harvesting caribou. As the late traditional Chief Moses Sam of Arctic Village said when describing his upbringing on the land (as described by Sam Alexander), "I was never hungry. It was a rich life."

Please remember these words and don't let the Gwich'in people go hungry, either physically or spiritually. In order for the Gwich'in people to continue to live a "rich life" you must vote against any tax reform bill that includes opening development in the Arctic Refuge.

Sincerely,

Emily Kloc
1307 W 39th Pl
Anchorage, AK 99503

From: Rebecca Knight
To: fortherecord (Energy)
Cc: Hoefler, Annie (Energy)
Subject: SENR_For Record of November 2, 2017 Hearing
Date: Thursday, November 02, 2017 7:55:13 AM

Dear Chairman Murkowski, Ranking Member Cantwell, and Members of the Senate Energy and Natural Resources Committee:

I am a 42-year Alaska resident.

I oppose any opportunistic attempt to attach a provision that will result in opening the Arctic National Wildlife Refuge Coastal Plain to oil development.

First, there is no supporting evidence that attachment of an Arctic National Wildlife Refuge drilling provision to must-pass, tax reform legislation will achieve the purported goal of raising $1 billion in federal revenue. The price of a barrel of oil is too low and there is little hope it will increase due to advancements in other clean energy technologies.

Second, the American people—mainstream Republicans and Democrats alike—do not want the Refuge opened to oil development as evidenced by decades of debate on the issue. The failure of Congress to do open the Refuge despite these decades of responsible debate is a testament to keeping the refuge in its current condition.

Please do not allow it to advance out of your committee.

Sincerely,

Rebecca Knight
PO Box 1331
Petersburg, AK 99833

From: Doug Knutson
To: fortherecord (Energy)
Cc: Hoefler, Annie (Energy)
Subject: ANWR for drilling exploration
Date: Wednesday, November 01, 2017 3:20:30 PM
Attachments: image001.png

Dear Chairman Murkowski, Ranking Member Cantwell and members of the Senate Energy and Natural Resources Committee

I am an Alaskan that supports the opening of the 1002 area of the Arctic National Wildlife Refuge.

Alaskans have developed the North Slope oil fields responsibly for many years and will continue to do so with NO effects to the Arctic Caribou herd or any other animal species.

We are the caretakers of the environment and we sure appreciate a vote in favor of development."

Doug Knutson
VP of Operations
Food Services of America
10420 Olive Lane
Anchorage AK 99515

O - 907-267-1722
C – 907-229-4076

From: Lori Koon
To: fortherecord (Energy)
Subject: Drilling in the Arctic National Refuge
Date: Sunday, November 12, 2017 1:16:20 PM

It is imperative that no drilling occurs in the Arctic National Refuge because we are moving away from fossil fuels and this area supports many different species of animals and birds.
Is drilling occurs, it will just be a matter of time before there is a spill. It will also stop the migration of many animals ultimately causing their extinction.
I am a member of Indivisible SF and we insist that there is no drilling for fossil fuels in the Arctic National Refuge!
Thank you,
Lori Koon
275 Lexington St A
San Francisco CA 94110

Sent from my iPad

From: Monica Kopp
To: fortherecord (Energy)
Cc: Hoefler, Annie (Energy)
Subject: For Record of November 2, 2017 Hearing: Please say NO to Oil Development in ANWR
Date: Thursday, November 16, 2017 7:56:16 AM

For Chairman Murkowski, Ranking Member Cantwell, and Members of the Senate Energy and Natural Resources Committee:

For Record of November 2, 2017 Hearing

I am writing to *oppose* oil and gas development in Arctic National Wildlife Refuge's 1002 area. As an Alaska resident, biologist, hunter, subsistence user, and someone who has dedicated their life to living light on the land, I see this issue as putting a Band-aid on a problem that will only harm Alaskans, Americans, and our planet.

It's not about saving the caribou, or polar bears, or any of the flashy things people talk about. It's about the long-term effects that drilling in the Arctic National Wildlife Refuge would bring.

It's about not continuing down this rabbit-hole that is oil dependence. We need to shift Alaska's economy if we are going to address budget issues. The oil won't last.

It's about listening to our neighbors.

It's about preserving some of the last intact wilderness in the world.

Thank you for your time, and please--consider our grandchildren when you make this important decision.

Sincerely,

Monica Kopp
2240 Railroad Drive
Fairbanks, AK 99709

From: RANDALL KOWALKE
To: fortherecord (Energy)
Cc: Aaron Downing (ahdowning@ak.net)
Subject: Opening ANWR
Date: Tuesday, October 31, 2017 1:06:58 PM

"Dear Chairman Murkowski and Ranking Member Cantwell,
I am an Alaskan that supports the opening of the 1002 area of the Arctic National Wildlife Refuge. Alaskans have developed the North Slope oil fields responsibly and will continue to do so with NO effects to the Arctic Caribou herd or any other animal species. We are the caretakers of the environment and we need you to vote in favor of development."

Randall and Karen Kowalke
PO Box 516
Willow, Alaska 99688

From: Lee Ann Kreig
To: fortherecord (Energy)
Subject: YES to ANWR opening
Date: Monday, November 13, 2017 12:58:47 PM

Dear Chairman Murkowski and Ranking Member Cantwell,

I support the opening of the 1002 area of the Arctic National Wildlife Refuge. Alaskans have developed the North Slope oil fields responsibly and will continue to do so with NO effects to the Arctic Caribou herd or any other animal species.

We are the caretakers of the environment and we need you to vote in favor of development.

Sincerely,
Lee Ann Kreig
3818 Clay Products Dr.
Anchorage, AK 99517

From: Ray Kreig
To: fortherecord (Energy)
Subject: YES to ANWR opening please
Date: Tuesday, October 31, 2017 2:25:59 PM

Dear Chairman Murkowski and Ranking Member Cantwell,

I support the opening of the 1002 area of the Arctic National Wildlife Refuge. Alaskans have developed the North Slope oil fields responsibly and will continue to do so with NO effects to the Arctic Caribou herd or any other animal species.

We are the caretakers of the environment and we need you to vote in favor of development.

Sincerely,

Ray Kreig

==========
Ray Kreig
RA Kreig & Associates
201 Barrow #1
Anchorage Alaska 99501-2429
(907) 276-2025 fax (907) 258-9614 home (907) 243-8951 cell (907) 360-7462
ray@kreig.com www.kreig.com
==========

From: Annette Kreitzer
To: fortherecord (Energy)
Subject: Opening 1002 Area of ANWR
Date: Wednesday, November 01, 2017 12:13:46 PM

Chairman Murkowksi and Ranking Member Cantwell:

To quote former U.S. Senator Bob Bartlett of Alaska - "Never before in the history of the United States has there been so great an opportunity to establish resources policy geared to the growth of a magnificent economy and the welfare of a people."

He was speaking to delegates at the Alaska Constitutional Convention, but his words ring true today as you consider opening a portion of the Alaska National Wildlife Refuge to oil and gas development.

I am an Alaskan and I **support opening** the 1002 area of the Arctic National Wildlife Refuge. Alaskans have developed the North Slope oil fields responsibly and will continue to do so with no effects to the Arctic Caribou herd or any other animal species. We are the caretakers of the environment and we need you to vote in favor of development.

Sincerely,

Annette Kreitzer
Juneau, Alaska

For Record of November 2, 2017 Hearing

Carolyn Kremers
PO Box 84223
Fairbanks, Alaska 99708
(907) 347-8885
ckremers@mosquitonet.com

November 6, 2017

Dear Chairman Lisa Murkowski, Ranking Member Maria Cantwell, and Members of the Senate Evergy and Natural Resources Committee:

Thank you for this opportunity to submit testimony for the hearing on the Arctic Refuge, held November 2, 2017. ***I am an Alaskan strongly opposed to oil and gas development in the Arctic National Wildlife Refuge.*** *Therefore I'm submitting as my testimony this poem, called "The Arctic Refuge Coastal Plain: Twelve Motets." Please read it in its entirety. Thank you very much.*

Sincerely,
Carolyn Kremers
Fairbanks, Alaska

The Arctic Refuge Coastal Plain: Twelve Motets
1999-2017

1.

From the south: river rafts, kayaks, inflatable canoes.
From the north: polar bear mothers coming to make dens.
From the east: 120,000 caribou.
From the Platte River, New England, the Rocky Mountains, Hawaii,
South America, Asia, Africa, Australia, Antarctica: millions of birds.
From Kaktovik: Inupiat hunters traveling by boat or snowmachine.
From the Gwich'in: no one. This place is sacred.

2.

Anyone who has been here
and listened
for more than a day
understands.
Or can, or might.

A tiny blue butterfly flits
to a yellow poppy.
Lands. Folds up

like a brown leaf.

This destination is far
and very wet. Songbirds,
dragonflies, fat bumblebees:
all are buzzing, whirring, humming, singing.
Their wings are powered not by oil
but by energy from the sun.
Already they have taught us much.
Where is our patience to keep listening?

3.

In the twenty-first century,
some politicians used the word *footprint*.

They said they wanted to put it
in the birthing grounds
of the Arctic Refuge Coastal Plain.

They called this primal place
The 1002 Area
and compared it to the size
of Long Island, New York.

The footprint
would be only two thousand acres,
they said, with drill pads,
oil wells, pipelines, ice roads.

(There was little water
to make ice roads.)

They seemed to think
that only numbers were needed
to paint this picture.

4.

We never saw,
we've only heard stories,
read about, seen paintings
of the multitudes of bison
that wandered the rich grasslands
and dry ravines of the Great Plains
and the forests of northwest Canada.

No one knows
the total number of bison
before Europeans arrived,
but estimates range
from thirty to sixty million.

Never encountering a fence,
a road or machinery,
those endless herds
gave food,
clothing, shelter,
and hope
to human beings like us.

5.

If the people understood
their relationship
to all the four-leggeds and bushes and rocks and raindrops and leaves and thunder and bugs
around them,

if the people could fathom
their vulnerability
to the oceans and jet stream
and thinning ice,

they would want
to protect this piece of coast

for its own sake
and for the planet
and for their children and their children's children,
in perpetuity.

Until the sun becomes a cinder.

6.

Some people said
they would do whatever they could
to keep drilling
out of the Refuge.
They gave money.
They wrote letters, made phone calls,
published editorials, articles,

books, poems, photographs.
They persuaded friends and relatives,
flew to Washington DC,
wore buttons, armbands, polar bear suits,
carried signs, sang songs, stood
in the rain and snow and hot sun.
Some of them said they would take part,
if necessary, in civil disobedience.

They said they would go to jail.

7.

I have read
that the ecosystems of the world are linked
by birds. Such a beautiful, musical image—
  arctic tern to Antarctica
    buff-breasted sandpiper to Argentina
      northern wheatear to Morocco
        sandhill crane to Mexico
          tundra swan to South Carolina.
If the ecosystems of the world are linked
by birds, though, what happens
if some of the links

get broken?

8.

Five days and nights in April, 2007:
a trip by snowmachine
to photograph the Coastal Plain
before it turns to spring –

Boulders in the river, tumbling
yet mute, suspended
in transparent turquoise ice

A single snowy owl,
its eyes like yellow coins

The wind-swept snow and jumbled sea,
the filigree

No chirping chickadees,
no distant hum of traffic

5

No sounds
except

the whine of wind
that quickly covers all our tracks:

Two snowmachines, two sleds,
two male voices and one female

A hammering
of tent pegs into hard ice

Water
poured from a bottle
to freeze
and lock the tent pegs in

Soft *poof!*
of three caribou pelts
tossed inside the tent to insulate
the Arctic Oven's canvas floor

Percussive fugue of parkas
and sleeping bags
zipping and unzipping

The pumping pumping
pumping propane stove

Fog, white on white.

Some days the sun
burns through the fog
in silken veils—
apricot, saffron, watermelon

Frigid wind

Silence

Wind

9.

November 2013 to December 2014

Dear Senators from Alabama, Arizona, Arkansas, California, Colorado, Connecticut, Delaware, Florida, Georgia, Hawaii, Idaho, Illinois, Indiana, Iowa, Kansas, Kentucky, Louisiana, Maine, Maryland, Massachusetts, Michigan, Minnesota, Mississippi, Missouri, Montana, Nebraska, Nevada, New Hampshire, New Jersey, New Mexico, New York, North Carolina, North Dakota, Ohio, Oklahoma, Oregon, Pennsylvania, Rhode Island, South Carolina, South Dakota, Tennessee, Texas, Utah, Vermont, Virginia, Washington, West Virginia, Wisconsin, and Wyoming:

Most Alaska politicians refuse to support protection
of the Arctic Refuge Coastal Plain.
Or else they're afraid to.
What about you?
Please know that many Alaskans are not afraid.
Please help us seek wilderness protection
for this irreplaceable piece of the Circumpolar North.
In the face of climate change
and the urgent need for citizens worldwide
to turn away from dependence on fossil fuels, **please**
support S. 1695
and designate the Coastal Plain as wilderness.

10.

After President O's administration announces on January 26, 2015,
that it will designate the Arctic Refuge Coastal Plain as wilderness,
Senator M (AK) holds a televised press conference:

"This administration has effectively declared war on Alaska," she says.
"That's my view of it. And those are some pretty tough words. But what we saw
on Sunday with the announcement that this administration is going to move towards
permanent wilderness status for ANWR—and what this administration is poised to do
the balance of this week, based on conversations with the Secretary of the Interior
and her deputy—it is a 1-2-3 *kick* to the gut of Alaska's economy. And we have said
as a delegation that we *will* not stand it. We *will* not tolerate and we *will* do everything
that we can to push back against an administration that has taken a look at Alaska
and decided, 'It's a nice little snow-globe up there and we're gonna keep it that way.' "

7

11.

Dear Senator M,

You speak with a stormy face and mighty voice, as if for all Alaskans.
You admonish the President and the Secretary of the Interior
  for choosing sustainability, an intact ecosystem, and the future of the planet.
You threaten to wield your power,
  as Chair of the Senate Energy and Natural Resources Committee,
like an oligarch with a gun.

Your voice is angry and it is loud.

But loud does not equate
with truth
        nor transformation.

12.

Pay attention, says the Earth
to all the earthlings,
including President T

Be resourceful

Consider, remember, heed

Bear witness and
        / resist.

  Embrace
  Be humbled, amazed

From: linda kriel
To: fortherecord (Energy); Hoefler, Annie (Energy)
Subject: No Drilling in ANWAR
Date: Saturday, November 18, 2017 12:31:50 PM

Chairman Murkowski, Ranking Member Cantwell, and Members of the Senate Energy and Natural Resources Committee:

For Record of November 2, 2017 Hearing, I oppose the inevitable destruction of ANWAR by oil/gas drilling.
This pristine wilderness has been designated for wildlife & should remain so. Once it has been contaminated it will be gone forever. Don't let it's destruction be your legacy.

Linda Kriel
1314 3rd Ave
Newport, MN 55055

From: Tristan L"Heureux
To: fortherecord (Energy)
Subject: Arctic National Wildlife Refuge
Date: Friday, November 03, 2017 12:49:28 PM

Senate Committee for Energy and Natural Resources,

My name is Tristan L'Heureux and I'm a constituent from Dublin, OH.

I'm contacting you to ask that the committee find other means to produce federal revenue than reopening the Arctic National Wildlife Refuge for oil and gas drilling. We should not destroy protected land and endanger wildlife to fund unnecessary tax breaks for the wealthy. Please pass my message along to the Chairman and other committee members.

You may contact me at this address or by phone at 614-678-1319

Best regards,

-Tristan
Sent from my iPhone

From: Nathan La Porte
To: fortherecord (Energy)
Subject: Opposition to fossil fuel drilling in ANWR
Date: Thursday, November 02, 2017 11:14:40 AM

Dear members of the Energy and Natural Resources Committee,

I am writing to submit a public comment to be included in the record for your hearings on leasing portions of the Arctic National Wildlife Refuge for fossil energy development. I'm asking that you abandon this plan and seek other means to produce federal revenue without destroying pristine, protected land and endangering wildlife, especially not to fund tax breaks for the wealthy. Federal land is held by the government in trust to the American people and we have a responsibility to protect it for future generations and the environment, and not to exploit it for short-term financial and political gain.

Thank you very much,
Nathan La Porte
1455 W Sunnyside Ave
Chicago, IL 60640
(202) 329-2688

From: Kristen Bealer
To: fortherecord (Energy)
Subject: Protect Alaska"s Wildlife Refuge
Date: Tuesday, November 14, 2017 10:14:29 AM

I'm writing to ask that the committee find other means to produce federal revenue than reopening the Arctic National Wildlife Refuge for oil and gas drilling. We should not destroy protected land and endanger wildlife to fund unnecessary tax breaks for the wealthy.

Thank you,

Kristen Lagerstam
318 w Mackie Street
Beaver Dam, WI 53916

From: Kay Lakey
To: fortherecord (Energy)
Subject: Artic National Wildlife Refuge please ban oil and gas exploration or drilling.
Date: Thursday, November 02, 2017 5:02:43 PM

To the committee,
I am asking the committee to not allow any oil or gas exploration or drilling in the Artic National Wildlife Refuge.
It is a precious area for the calving of the huge Porcupine caribou herd. Please Do Not destroy it.

Kay Lakey

Lakey Physical Therapy
kaylakey@msn.com
P: 206-523-7086
F: 206-517-5304

From: Jake Lampert
To: fortherecord (Energy)
Subject: National Wildlife Refuge
Date: Monday, November 13, 2017 4:47:24 PM

Dear Senate Committee on Energy and Natural Resources-

I'm writing to ask that the committee find other means to produce federal revenue than reopening the Arctic National Wildlife Refuge for oil and gas drilling. We should not destroy protected land and endanger wildlife to fund unnecessary tax breaks for the wealthy. Please pass my message along to the Chairman and other committee members.

Thank you,
Jake Lampert
15435 Harrisberg Court
Chesterfield, MO 63017

Adrian & Marilyn Lane
P. O. Box 875096
4747 E. Highwood Dr.
Wasilla, AK 99687

To: "Chairman Murkowski, Ranking Member Cantwell, and Members of the Senate Energy and
Natural Resources Committee."

From: Adrian and Marilyn Lane

Re: OIL & GAS LETTER OF SUPPORT

As full time residents of Alaska since 1984, we fully support the following responsible oil and gas development on the Coastal Plain as noted by John MacKinnon, Executive Director AGC of ALASKA:

• Continuing improvements in technology, practices, and oversight, the oil industry has demonstrated over the past 40 years that North Slope energy development and environmental stewardship can and do coexist. The industry has a proven track record of responsible development in sensitive areas, protecting the environment, wildlife and subsistence needs of local residents.

• Polls have consistently shown Alaskans overwhelmingly support responsible oil and gas development in the non-wilderness portion of ANWR. There is no valid reason why we should not be allowed to access the world-class resources within just a tiny fraction of the coastal plain.

• Responsible oil and gas development in this fraction of ANWR will help ensure America's energy security for decades and allow Alaska – and our nation as a whole – to realize the benefits that come from expanding energy production in Alaska.

• Energy production from ANWR has the potential to offset a decline in Lower 48 shale oil production, which is expected to commence in approximately a decade. Without limited oil development on the coastal plain, America will be forced to once again increase its reliance on foreign imports. With limited development in ANWR, America and Alaska can continue to grow the economy and reduce dependence on foreign oil.

• Alaska's economic lifeline, the Trans-Alaska Oil Pipeline System (TAPS), is now running at three-quarters empty. New oil production from ANWR has the potential to reverse throughput in TAPS, a vital component of American energy infrastructure.

Thank you for your leadership and full support of this Oil and Gas Letter of Support

From: Morgan Laner
To: fortherecord (Energy)
Subject: Thoughts on the Oil Drilling in Alaska
Date: Tuesday, November 14, 2017 2:22:43 PM

Hello,

I'm emailing to ask that the committee find other means to produce federal revenue than reopening the Arctic National Wildlife Refuge for oil and gas drilling. We should not destroy protected land and endanger wildlife to fund unnecessary tax breaks for the wealthy. Please pass my message along to the Chairman and other committee members.

Constituent Address: 1000 Holt Avenue #1720, Winter Park FL 32789.

Thank you,

Morgan Laner
Rollins College | class of 2018
Lead Sustainability Coordinator | EcoRollins President
mlaner@rollins.edu | 214.315.3431

From: Mike Lash
To: fortherecord (Energy)
Cc: Hoefler, Annie (Energy)
Subject: For Record of November 2, 2017 Hearing
Date: Wednesday, November 01, 2017 12:51:37 PM

Chairman Murkowski, Ranking Member Cantwell, and Members of the Senate Energy and Natural Resources Committee,

I am an Anchorage, Alaska resident and manager of a commercial truck dealership business that employs 30 outstanding Alaskans and Americans. The opening of the non-wilderness coastal plain of ANWR is of vital importance to Alaska, our employees and America, and I urge you to support the movement of a budget reconciliation provision to allow oil and natural gas development in this area. Second only to our constitution, energy has become a central cornerstone to America's republic. Our healthcare, infrastructure, communications and military have come to depend on reliable energy. There is no better place to develop our oil and gas than the completely remote and uninhabited area of the Arctic National Wildlife Refuge. The responsible companies that have developed the North Slope oilfields have a proven record of safe and efficient practices. We look forward to your support.

Regards,

Michael A. Lash
Anchorage, AK
(907) 274-5553

From: Fred Lasher
To: fortherecord (Energy)
Cc: Hoefler, Annie (Energy)
Subject: Please open ANWR
Date: Tuesday, October 31, 2017 4:03:20 PM

Chairman Murkowski, Ranking Member Cantwell and Members of the Senate Energy and Natural Resources Committee:

I would like to go on record as supporting the opening of ANWR to responsible oil and gas development. As a citizen of Fairbanks Alaska, I've seen first-hand that North Slope oil and gas fields can, and have been, developed with very little impact on the environment, reducing America's energy cost and providing good jobs for Alaskans and others. Please support ANWR oil and gas development.

Fred Lasher

Fairbanks Alaska
Ph (907) 455-1280

From: Robert Latto
To: fortherecord (Energy)
Subject: OPEN ANWR
Date: Wednesday, November 01, 2017 12:19:10 AM

Dear Sirs,

It is way past time to allow responsible oil and gas exploration in ANWR ... It is a huge reserve and modern drilling would only take up a minute part of it ... Besides it has been proven in Prudhoe that the drilling activity is beneficial to the resident caribou herd and other animals benefit as well from this ...

I am a 60 year resident of the Great State of Alaska..

Respectfully,

Robert G. Latto

7655 Jewel Lake Road
Anchorage, Alaska 99502

From: Connie Lawrence
To: fortherecord (Energy)
Subject: Arctic National Wildlife Refuge
Date: Friday, November 03, 2017 12:01:52 PM

Chairman & Committee Members.

I'm emailing to ask that the committee **find other means to produce federal revenue** than reopening the Arctic National Wildlife Refuge for oil and gas drilling. We should not destroy protected land and endanger wildlife to fund unnecessary tax breaks for the wealthy.

Thank you

Connie Dolan Lawrence
11703 Taylorcrest Rd.
Houston, TX 77024

From: Silvia Daeumichen
To: fortherecord (Energy)
Subject: AMWR
Date: Wednesday, November 01, 2017 7:24:44 PM

Dear Senators,

I as an Alaskan am taking action against drilling in the Arctic National Wildlife Refuge. I stand in solidarity with the Gwi'chin people because I too grew up with the caribou and want to protect them. The porcupine caribou herd will be badly affected if we drill in their calving grounds. We are stewards of the earth. It's the peoples job to protect the earth and it's inhabitants. Why drill for more oil when we already know that burning fossil fuels is ruining our climate? We need to change our ways. This is earth is my future.

Willow Leaves, 11 years old

From: Bill Leight
To: fortherecord (Energy)
Subject: 1002 Area of ANWR
Date: Tuesday, October 31, 2017 1:56:37 PM

"Dear Chairman Murkowski and Ranking Member Cantwell:

I am an Alaskan that supports the opening of the 1002 area of the Arctic National Wildlife Refuge. Alaskans have developed the North Slope oil fields responsibly and will continue to do so with NO effects to the Arctic Caribou herd or any other animal species. We are the caretakers of the environment and we need you to vote in favor of development."
I First came to Alaska in 1956 / left in 1958 / came back and lived in Nome from 1959 to 1968 / went outside to college / upon graduation took a job in Texas / came back to Anchorage in 1972 to present date. We do not need "outsiders" oil to keep our Country alive…..let's use our own oil.

Sincerely,

William Leight
2400 Scarborough Dr.
Anchorage, Alaska 99504

From: Loren Leman
To: fortherecord (Energy)
Subject: ANWR 1002 Area
Date: Tuesday, October 31, 2017 8:37:31 PM

Dear Senators Murkowski, Cantwell, and other committee members,

I am a lifelong Alaskan of Alaska Native heritage who supports the opening of the 1002 area of the Arctic National Wildlife Refuge. Many of us have been working tirelessly since 1980 to make this happen. In fact, as an elected State of Alaska official I testified to Congress about this many years ago before a committee chaired by a different Senator Murkowski. North Slope oil and gas has been developed responsibly, improvements in technology continue to be made, the planned development footprint is very small, and we will continue to protect the environment and all wildlife, including caribou and whales. I like to think of Alaskans as the real caretakers of our land. We live and work here--and want it protected for our children and grandchildren. Finding and developing the resources under it responsibly is the best way to provide economic benefit to the United States and still provide that protection.

Loren Leman, P.E.
PO Box 190773
Anchorage, Alaska 99519-0773
(907) 243-2000

Consulting civil/environmental engineer
former Representative, Senator, and Lieutenant Governor, Alaska

Testimony of David W. Levine, M.D., M.P.H.
For the Record of the Senate Energy and Natural Resources Committee Hearing
November 2, 2017

Chairman Murkowski, Ranking Member Cantwell, and the other members of the Senate Committee on Energy and Natural Resources, thank you for this opportunity to submit this testimony for the record of the hearing on the proposal to open the Arctic National Wildlife Refuge to oil leasing and development in order to meet a "one billion dollar budget reconciliation instruction" as part of the fiscal year 2018 tax legislation. The rushed process which the committee is undertaking to consider authorizing oil development in the Arctic National Wildlife Refuge and the substance of this proposal are misguided.

I have been involved in Alaska environmental and energy issues, in general, and the Arctic National Wildlife Range, in particular, since 1975. I had the good fortune to live in Alaska for several years. I worked with the Alaska Coalition and the Sierra Club on the Alaska National Interest Lands Act (ANILCA) and Alaska energy issues, including route options for a proposed natural gas pipeline from the North Slope to the lower 48 states. I have travelled across the North Slope including the Arctic National Wildlife Refuge, Prudhoe Bay, and several parts of the National Petroleum Reserve Alaska. I have directly observed many of the ecological features that make the Arctic National Wildlife Refuge so unique and important. More recently, my connection to arctic issues in "The Great Land" has been vicariously through the eyes of my oldest son who serves as a crew member aboard an Alaskan oceanographic research ship. On expeditions studying the effects of global warming in the Arctic Ocean he has seen firsthand the impact of climate change on both the marine environment and the Alaska Native communities along the Arctic coast.

The case for protecting the Arctic National Wildlife Refuge and prohibiting oil development in the refuge's coastal plain is even stronger today than in the past. There is no economic, budgetary, national security, energy policy, environmental or scientific justification for a rushed legislative process to open up the wildlife refuge to oil development.
The one day of hearings and rush to vote on this proposal as part of an unrelated tax bill is the opposite of the careful, in-depth consideration the committee and the Congress as a whole should devote to this issue.

During the committee's November 2nd hearing there seemed to be some confusion between the methods and potential impacts of "oil exploration" versus "oil development." Proponents of opening up the Arctic National Wildlife Refuge seem effusive in describing "winter only" "low impact" exploration and are very vague about the potential impact of any subsequent oil development. You can be certain that oil development entails extensive industrialization and wide ranging impacts on the Arctic National Wildlife Refuge. In this context, use of such terms as "best science", "small footprint" and "responsible energy development" are misleading and ironic. It is incorrect to suggest that the "best science" provides a virtually no impact method to industrialize the wildlife refuge's coastal Plain. Among other findings of current "best science" is that global warming is having significant impacts on thawing North Slope permafrost. To date, arctic construction best practices have relied on

stable permafrost. At the very least, before authorizing any development in the Arctic National Wildlife refuge, the committee should hold hearings on the impact of climate change on permafrost and arctic engineering.

While it is commendable that Alaska's United States Senators and Governor acknowledge the reality of climate change, it is perplexing that they are proposing plans for the Arctic National Wildlife Refuge that exacerbate, rather than address, climate change. Among other values, the Arctic National Wildlife Refuge provides a unique laboratory to study an intact arctic ecosystem that is undeveloped. There are significantly better energy policy options for both Alaska and the nation outside the Arctic National Wildlife Refuge. In fact, there are so many better options that any oil leasing in the wildlife refuge is likely to yield even less revenue than currently claimed projections. Risking the Arctic National Wildlife Refuge for a "one billion dollar budget reconciliation" out of a projected Republican tax proposal 1.7 trillion dollar deficit would be extremely irresponsible.

David W. Levine, M.D.
93 Carlton Road
Newton, MA 02468
dwlevinemd@verizon.net

From: Ak Steve
To: fortherecord (Energy)
Subject: ANWR
Date: Tuesday, October 31, 2017 2:13:20 PM

Dear Senate,
Please pass the ANWR drilling provision that would allow limited oil and natural gas activity within the non-wilderness coastal plain of the Arctic National Wildlife Refuge (ANWR).

Steve Lewis
2020 Steeple Drive
Anchorage, Ak. 99516
907-602-2707
lgroupy2k@gmail.com

From: Liebing, Mike V
To: fortherecord (Energy)
Cc: Hoefler, Annie (Energy)
Subject: For Record of November 2, 2017 Hearing - Support of Coastal Plain Development
Date: Wednesday, November 01, 2017 2:23:25 PM

November 1, 2017

Senator Lisa Murkowski
Chairperson Senate Committee on Energy and Natural Resources
522 Hart Senate Office Building
Washington, DC 20510

Chairman Murkowski, Ranking Member Cantwell, and Members of the Senate Energy and Natural Resources Committee:

I send this letter today in strong support of the development of the non-wilderness area of the ANWR Coastal plain as currently proposed in the budget reconciliation bill. I write this in part to state that many of the people we see on the nightly news who represent themselves as defenders of Alaska are neither Alaskans nor representative of the vast majority of true Alaskans on this issue. Many represent extreme environmentalist groups who have no stake in the long term interest of Alaska and are simply using the issue as a fund raiser for their lower 48 coffers. I am a lifelong Alaskan. I have deep roots in the State as my grandparents originally came to South Eastern Alaska in the 1920s and my mother was actually born in Ketchikan in 1921. After a brief return to Washington State they homesteaded in the Mat-Su Area in 1932 and my family has remained as residents since then. I was raised to love and appreciate the amazing splendor and to be in awe of the incredible natural beauty that surrounds us every day. As such, I do not support every development project that is proposed and strongly support tough rules and regulations on any development of natural resources that disturbs or impacts the surroundings of that development. I believe that the state has a world class set of protections in place for natural resources and a close examination of the history of oil and gas development on the north slope of Alaska for the past 45 years clearly bares out that truth. The native peoples of Kaktovik who are the closest to this development and on whom it will have the most direct impact are also in majority support of responsible development of this resource.

The area in question today has long been recognized and the greatest untapped potential energy source in the entire United States. While this area is vast to a scale that is unimaginable to many who read the propaganda put out by those opposed to its development, the foot print of development is incredibly small and thus the risk of damage to the environment is reduce by an equal percentage. To help visualize the impacted area, If ANWR were a football field, the oil development envisioned in this bill would take place on a patch approximately 2 ' x 3'. Further, the development of the 6 square feet would be governed by a set of rules, regulations and permitting process that takes up several large bookcases. Many members of the public have been lead to believe that pursuing development of the coastal plain is a reversal of environmental policy and "robbing " from ANWR. This is yet another deceptive argument from the environmental movement that is absolute hogwash. We need to make it clear to everyone that developing this sliver of ANWR

was absolutely envisioned in the creation of ANWR and is in keeping with both the letter of the law and the spirit of the importance of this national energy resource. The regions proximity to the existing north slope infrastructure and access to the trans-Alaska pipeline allow for very little extra impact in order to actually deliver the energy contained there to the market. We don't need to build a "Keystone" or "Dakota Access Pipeline" to move this oil.

Energy is security. Those of us in our 50s and older remember clearly, the extreme disruption that can caused when we become dependent on other countries for the energy that drives our economy and thus our security. In the past 10 years we have seen a positive and decisive shift in not only who we are dependent on, but also reducing that dependence considerably. The shale oil and gas revolution in many parts of the country contributed enormous amounts to the known recoverable reserves. Those reserves however are much shorter lived than traditional oil formations and will be in steep decline in another decade. While we know that the country's energy consumption is changing and there is a decided shift away from fossil fuels and to greener technology, no reasonable assessment can show that trend eliminating our need for oil and gas until well into the second half of this century. We still need to find and develop sources of oil and gas to fill this gap. We can either fill that gap with domestically sourced products where its extraction is covered by the strictest environmental laws and the economic benefits flow into our economy or we can source it from unstable places where we have no control over its development and the benefits flow to regimes with "different" priorities. As leaders of this nation, it is irresponsible to pretend we don't need a new "Bridge" oil supply even if you are totally committed to the green energy revolution.

In closing, thank you for your efforts to move our country towards a plan for energy security. The development of the oil contained in the coastal plain is an important element of that plan. Let me reiterate. The majority of Alaskans recognize the importance of this development to both the state and the nation and strongly support it. The development will be done according to the strictest environmental standards on earth. The development is absolutely in keeping with vision of laws that created ANWR. Lastly the nation needs this energy supply to allow us a secure path to a greener energy future.

Michael V. Liebing
1365 S Jewel Street
Palmer AK 99645
(907) 227-2575

From: Matthew Linder
To: fortherecord (Energy)
Cc: Hoefler, Annie (Energy)
Subject: Support for drilling in ANWR from a true Alaskan
Date: Wednesday, November 01, 2017 2:25:35 PM

Chairman Murkowski, Ranking Member Cantwell, and Members of the Senate Energy and Natural Resources Committee.

I support drilling in ANWR for our Home Land security and for Alaska's economy. I have lived in Alaska for over 47 years and have been blessed by what the oil industry has done for me and my family. I have worked on the North Slope for over 36 years. Keep pushing to open the ANWR, it is good for our country and good for our State.

Thank you,

Matthew Linder
Milne Point- Sr. Hilcorp Wellsite Supervisor
(907) 670-3387 office
(907) 943-1068 Cell

From: kipsbay29@gmail.com on behalf of Josh Lipsman
To: fortherecord (Energy)
Subject: ANWR
Date: Tuesday, November 14, 2017 2:24:53 PM

I'm writing to ask that the committee find other means to produce federal revenue than reopening the Arctic National Wildlife Refuge for oil and gas drilling. We should not destroy protected land and endanger wildlife to fund unnecessary tax breaks for the wealthy. Please pass my message along to the Chairman and other committee members. Thank you.

Josh Lipsman
35 So. Franklin St.
Athens, NY 12015

From: Donn Liston
To: fortherecord (Energy)
Subject: Open the 1002 area of the Arctic National Wildlife Refuge to development!
Date: Tuesday, October 31, 2017 1:52:07 PM

"Dear Chairman Murkowski and Ranking Member Cantwell:

I am an Alaskan who supports opening of the 1002 area of the Arctic National Wildlife Refuge.

Alaskans have developed the North Slope oil fields responsibly and will continue to do so with NO effects to the Arctic Caribou herd or any other animal species.

We are the caretakers of the environment and we need you to vote in favor of development."

DONN

--
Donn Liston
907-696-9000
22051 Upper Canyon Dr.
Eagle River, AK 99577

From: Sharon Liu
To: fortherecord (Energy)
Subject: Keep out of Arctic National Wildlife Refute for Oil and Gas drilling
Date: Wednesday, November 15, 2017 2:05:47 PM

Find other means to produce federal revenue than reopening the Arctic National Wildlife Refuge for oil and gas drilling. We should not destroy a very fragile environment and endanger wildlife to fund unnecessary tax breaks for the wealthy. The ultra wealthy already keep their money off shore and find loopholes to pay a smaller % of taxes compared to the rest of us working at professional jobs Please pass my message along to the Chairman and other committee members

--
Dr. Sharon L. Liu
805-907-2296

From: Tamara Lloyd
To: fortherecord (Energy)
Cc: annie_hoffler@energy.senate.gov
Subject: REAL ALASKANS FOR ANWAR
Date: Wednesday, November 01, 2017 4:03:10 PM

Chairman Murkowski
Ranking Member Cantwell and;
Members of the Senate Energy and Natural Resources Committee,

I am a long time resident of the state of Alaska and fully support responsible oil and gas development on the Coastal Plain(ANWR) this is vital to our economy as it provides jobs and will continue to for many years to come. What the people opposing this does not realize is where this is located and how responsible development happens here in Alaska as we care for our environment too, whether it be for hunting, fishing, trapping or anything else.

- Polls have consistently shown Alaskans overwhelmingly support responsible oil and gas development in the non-wilderness portion of ANWR. There is no valid reason why we should not be allowed to access the world-class resources within just a tiny fraction of the coastal plain.
- The proposed ANWR provision would allow development of no more than 2,000 acres of the 1.5 million acres of the Arctic coastal plain – part of the non-wilderness portion of ANWR's 19 million acres. That is equivalent to just 0.01 percent of the entire refuge.
- Responsible oil and gas development in this fraction of ANWR will help ensure America's energy security for decades and allow Alaska –and our nation as a whole – to realize the benefits that come from expanding energy production in Alaska.
- While renewable energy is a growing part of America's energy portfolio, it is still projected to account for a minority of American energy production in 2040. New oil and gas production will be required to power America's economy and can serve as a bridge until renewable energy becomes a dominant energy source decades into the future.
- Energy production from ANWR has the potential to offset a decline in Lower 48 shale oil production, which is expected to commence in approximately a decade. Without limited oil development on the coastal plain, America will be forced to once again increase its reliance on foreign imports. With limited development in ANWR, America and Alaska can continue to grow the economy and reduce dependence on foreign oil.
- The U.S. Geological Survey estimates the 1002 Area is North America's greatest prospect for conventional onshore oil production, with a mean likelihood of containing 10.4 billion barrels of oil and 8.6 trillion cubic feet of natural gas, as well as a reasonable chance of economically producing 16 billion barrels of oil.
- Alaska's economic lifeline, the Trans-Alaska Oil Pipeline System (TAPS), is now running at three-quarters empty. New oil production from ANWR has the potential to reverse throughput in TAPS, a vital component of American energy infrastructure.
- Oil development on a fraction of the coastal plain would create thousands of jobs nationwide, generate billions of dollars in government revenue, keep energy prices for American consumers affordable, and further improve energy security for decades into the future.
- Since the ANWR coastal plain is less than 60 miles from TAPS, development of energy resources there is one of the most environmentally-sound way to increase oil production in Alaska.
- Thanks to continuing improvements in technology, practices, and oversight, the oil industry has demonstrated over the past 40 years that North Slope energy development and environmental stewardship can and do coexist. The industry has a proven track record of responsible development in sensitive areas, protecting the environment, wildlife and subsistence needs of local residents.

Tamara Lloyd
P.O. Box 964
Kasilof, AK 99610

From: Kate Loewenstein
To: fortherecord (Energy)
Subject: Request of the committe
Date: Tuesday, November 14, 2017 11:40:07 AM

Hello,

I'm calling to ask that the committee find other means to produce federal revenue than reopening the Arctic National Wildlife Refuge for oil and gas drilling. We should not destroy protected land and endanger wildlife to fund unnecessary tax breaks for the wealthy. Please pass my message along to the Chairman and other committee members.

Thank you,

Kate Loewenstein
918 W. Belmont
Chicago, IL 60657
217-836-0701

--
Kate Loewenstein, LCSW/Director of Clinical Operations/ 217-836-0701 / NMK & Associates / www.nmkassociates.com

From: Kodi Long
To: fortherecord (Energy)
Cc: Hoefler, Annie (Energy)
Subject: ANWR
Date: Tuesday, October 31, 2017 4:53:41 PM

Chairman Murkowski, Ranking Member Cantwell, and Members of the Senate Energy and Natural Resources Committee,

As a father, husband, and Alaskan, I fully support responsible oil and gas development in the 1002 area of ANWR. It is in the best interest of the Nation, Alaska, and its residents to responsibly access and develop the 1002 area of ANWR. The "1002 Area" represents only .01% of the entire refuge. Additionally, there are millions of more acres protected throughout the state. The current producing areas of the North Slope, and the recent Point Thompson project are prime examples of how Alaska can responsibility develop and produce oil in sensitive areas. Please consider the well-being of Alaskans when you consider this measure. These are hard economic times in the State of Alaska and this could create economic opportunity for Alaskans and the state beyond. Timely lease sales and a streamlined permitting process are quintessential to start exploration and production. As an Alaska, I support a 50/50 federal-state revenue sharing. Please move forward and open the ANWR Coastal Plain 1002 area to exploration and production.

Thank You,

Kodi Long

Kodi Long / Project Manager / Cruz Construction, Inc.
(Office) 907-761-6607 / (Cell) 907-315-6604 / Kodi.long@cruzconstruct.com

From: John Lovdahl
To: fortherecord (Energy)
Subject: ANWR Oil and Gas Development
Date: Wednesday, November 01, 2017 12:16:49 PM

Chairman Murkowski, Ranking Member Cantwell, and Members of the Senate Energy and Natural Resources Committee

I am writing this in favor of responsible oil and gas development of the 2,000 acres of the arctic coastal plain – part of the non-wilderness portion of the ANWR's 19 million acres. The development of oil and gas in this fraction of ANWR will help ensure America's energy security for decades and allow Alaska, and our nation as a whole, to realize the benefits that come from expanding energy production in Alaska.

Energy production from ANWR has the potential to offset a decline in Lower 48 shale oil production, which is expected to commence in approximately a decade. With responsible development in ANWR, America and Alaska can continue to grow the economy and reduce dependence on foreign oil.

Alaska already has the Trans-Alaska Oil Pipeline System (TAPS) that is now running at ¾ empty. New oil production from ANWR has the potential to reverse throughput in TAPS and is a vital component of American energy infrastructure. The development on that fraction of the coastal plain will create thousands of jobs nationwide, generate billions of dollars in government revenue, keep energy prices for American consumers affordable, and further improve energy security for decades to come.

America and Alaska shouldn't wait another 40 years to tap into the known reserves that exist in ANWR. The oil and gas industry has a proven track record of responsible development in sensitive areas protecting the environment, wildlife, and subsistence needs of local residents.

John Lovdahl
Resident of Alaska since 1973
(907)360-1060

From: Shawn Lowry
To: fortherecord (Energy)
Cc: ""annie_hoefler@energy.senate.gov,""@p-ess-ppmx3.senate.gov
Subject: For Record of November 2, 2017 Hearing
Date: Wednesday, November 01, 2017 2:57:01 PM

Chairman Murkowski, Ranking Member Cantwell, and Members of the Senate Energy and Natural Resources Committee,

I am writing today, as once again 1002 section of ANWR has found its way into the political arena. I am in favor of responsible resource development in the state of Alaska and strongly support the opening of 1002 section of ANWR.
Over the past 40 years the oil industry has demonstrated that North Slope energy development and environmental stewardship can and do coexist. I have worked in the North Slope oilfields and can attest that through continuing improvements in technology, practices, and oversight, the industry has a proven track record of responsible development in sensitive areas, protecting the environment, wildlife and subsistence needs of local residents. I do not believe there is a more wildlife and environmentally minded culture in the industry then there is here in Alaska.
For me the bottom line is about jobs and the economy, not only here in Alaska, but nationwide. Oil development on a fraction of the coastal plain would create thousands of jobs nationwide, generate billions of dollars in government revenue, keep energy prices for American consumers affordable, and further improve energy security for decades into the future, as well as strengthen the local economy and help to stabilize the future of the TAPS infrastructure.
I have the privilege to represent hundreds of tradesmen and women working on TAPS, and in the oilfields each year. To me, this is a personal matter because the oil industry brought my family to Alaska when I was a very little boy. The industry continues to keep me here, and I know it can provide a life for my children's future as well as my grandchildren through responsible resource development, including the 1002 area of ANWR.

Thank you for your consideration.

Shawn D. Lowry
I.U.O.E. Local 302 Field Representative
3002 Lathrop St. Fairbanks, AK. 99701
Office (907) 452-8131, ext 224
Cell (907) 590-0612
Fax (907) 452-1424

From: drac@acsalaska.net
To: fortherecord (Energy)
Subject: Open ANWR to responsible oil development.
Date: Tuesday, October 31, 2017 2:43:36 PM

Hello,
My wife and I would like to voice our opinion in support of oil development within the Arctic National Wildlife Refuge. Responsible development on the coastal plain of ANWR only makes sense and will not adversely effect the wildlife as opponents wrongly claim. As a worker in the Prudhoe bay oil fields, I witnessed the Caribou herds using the pipelines as shelter from the wind and they were not adversely effected at all. In fact they probably were helped by the windbreak.
Thank You and please open responsible oil development on the Coastal plain.
Sincerely,
Peter and Denise Lundquist
Fairbanks, Alaska
907-322-2651 cell
drac@acsalaska.net

From: Neil MacKinnon
To: fortherecord (Energy)
Cc: Hoefler, Annie (Energy)
Subject: ANWR
Date: Tuesday, October 31, 2017 2:46:57 PM

Dear Chairman Murkowski, Ranking Member Cantwell, and Members of the Senate Energy and Natural Resources Committee

The country needs the oil, the income and the jobs that using the small bit of the non wilderness protion of ANWR will allow. If you allow it. It will not harm the caribou or other wildlife.
I fully support and urge Congress to free the treasure under ANWR for the good of the country.

Neil MacKinnon
1114 Glacier Ave.
Juneau, Alaska 99801

From: terry mallon
To: fortherecord (Energy)
Subject: No to arctic drilling
Date: Thursday, November 02, 2017 12:46:28 PM

To Whom it May Concern,
I am writing to ask that the committee find other means to produce federal revenue than reopening the Arctic National Wildlife Refuge for oil and gas drilling. We should not destroy protected land and endanger wildlife to fund unnecessary tax breaks for the wealthy.
Please pass my email to the Chairman and other committee members and also add it to the public record.
Thank you.
Teresa Mallon
848 County Line Road
Bryn Mawr, PA 19010

From: sharon malloy
To: fortherecord (Energy)
Subject: ANWR
Date: Tuesday, November 14, 2017 1:39:27 PM

Hello
I am writing to urge policy makers not to approve any drilling in the Arctic National Wildlife Refuge. This pristine and important land needs to be protected, not exploited.

Thank you

Sharon Malloy
2113 Rangeview Lane
Longmont Colorado 80501
303-588-4452

From: Tom Maloney
To: fortherecord (Energy)
Subject: YES ON ANWR
Date: Tuesday, October 31, 2017 3:06:23 PM
Attachments: image001.jpg

As an Alaskan for nearly 30 years, I have seen TAPS throughput go from approximately 2.1 million barrels a day to around one fourth of the peak amount today. This is no way to run a pipeline, which is the heart beat of Alaska. Alaskans overwhelmingly support opening ANWR. It will take only a very small footprint with today's technological advances like extended reach drilling.

My son, Sam, was born and raised in Alaska. He graduated from King Career Center, and he received a degree in welding and non-destructive testing from UAA. Currently, he is enrolled in an outstanding process technology program at UAA to be a plant operator. More production will mean more great careers for young Alaskans like Sam. He should get the same opportunities that his father did while working on the original TAPS construction.

ANWR YES. Thanks, TOM

Tom Maloney
Chief Executive Officer
Ahtna Netiye' Inc.
110 W. 38th Ave. Suite 100
Anchorage, AK 99503
Ph(907)868-8201
tmaloney@ahtna.net

From: Jennifer Mangino
To: fortherecord (Energy)
Subject: Opposed to reopening the Arctic National Wildlife Refuge for oil and gas
Date: Wednesday, November 15, 2017 5:14:29 PM

To Whom it may Concern:

My name is Jennifer Mangino and my address is 22860 Detroit Ave #319, Cleveland, OH 44113. I am writing to ask the Committee not to open the Arctic National Wildlife Refuge for oil and gas drilling. It is my opinion that this will damage our land and wildlife, and that funds reaped as a result will not be worth the cost.

Please vote no.

Sincerely,
Jennifer Mangino

Mobile: 330-573-3916

From: Joni Manuel
To: fortherecord (Energy)
Subject: Open 1002 area of ANWR
Date: Wednesday, November 01, 2017 2:36:47 AM

Dear Chairman Murkowski and Ranking Member Cantwell,

I am an Alaskan voter that supports the opening of the 1002 area of the Arctic National Wildlife Refuge. Alaskans have developed the North Slope oil fields responsibly and will continue to do so with NO effects to the Arctic Caribou herd or any other animal species. We are the caretakers of the environment and we need you to vote in favor of development. Development is a requirement for a healthy economy in Alaska.

Thank you for your consideration.

Joni Manuel
PO Box 83102
Fairbanks, AK 99708

From: Paul Manuel
To: fortherecord (Energy)
Subject: 1002 area of ANWR
Date: Wednesday, November 01, 2017 2:36:45 AM

Dear Chairman Murkowski and Ranking Member Cantwell,

I am an Alaskan living in Fairbanks that supports the opening of the 1002 area of the Arctic National Wildlife Refuge. Alaskans have developed the North Slope oil fields responsibly and will continue to do so with NO effects to the Arctic Caribou herd or any other animal species. We are the caretakers of the environment and we need you to vote in favor of development.

Thank you,

Paul Manuel
PO Box 83102
Fairbanks, AK 99708

From: Julie Mao
To: fortherecord (Energy)
Subject: Do not drill in ANWR
Date: Wednesday, November 15, 2017 10:26:02 AM

Hello,

I oppose the proposed energy exploration/mining in the Arctic National Wildlife Refuge. The refugee is fragile habitat and among the last wild places in this country. It should not be disturbed for short-term monetary gains.

We should be looking toward developing renewable and nuclear energy, rather than oil and gas (and coal), both for environmental and national economic reasons. Other countries like China will become the leaders in renewable energy, while the US is setting itself up for economic and technological failure if we continue down this road of promoting fossil fuel energy.

Thank you,
Julie Mao
2600 S Oakhurst Court #8
Glenwood Springs, CO 81601

From: Joe Marchetti
To: fortherecord (Energy)
Cc: Hoefler, Annie (Energy)
Subject: ANWR Coastal Plain
Date: Wednesday, November 01, 2017 2:49:12 PM

Chairman Murkowski, Ranking Member Cantwell, and Members of the Senate Energy and Natural Resources Committee,

As a lifelong Alaskan I am thankful to see the Senate taking up the issue of opening the 1002 area of ANWR to exploration. Alaska has a strong history and an exemplary track record of responsible and safe resource development. Opening the 1002 for development is the responsible decision environmentally as well as economically. Other countries produce oil without the regulatory controls and environmental oversight that we benefit from. These factors make domestic production an environmentally conscientious alternative to and competition for foreign oil.
Legislation opening the ANWR costal plain should include provisions to streamline and simplify permitting processes and should require timely lease sales. Federal-State revenue sharing should be established at a 50/50 rate rather than the 90/10 rate under current law.

With projections of recoverable oil reserves upward of 11 billion barrels in the 1002 area this decision could have an incredible positive impact on the Starr and federal economy. It could also have a significant impact on our national security bu reducing our reliance on foreign oil.

Thank you for your time and consideration of such an important issue.

Joe Marchetti
(907) 440-6431
7621 Lotus Dr.
Anchorage, AK 99502

From: Sally Marinucci
To: fortherecord (Energy)
Cc: Hoefler, Annie (Energy)
Subject: For Record of November 2, 2017 Hearing
Date: Wednesday, November 01, 2017 1:20:38 PM

Chairman Murkowski, Ranking Member Cantwell, and Members of the Senate Energy and Natural Resources Committee;

Please accept this email as a way to show my support of responsible oil and gas development in the non-wilderness portion of ANWR (the 1002 Area). As an Alaskan, I recognize the opportunity this would provide for my state, my Alaskan friends and family, and our nation.

I work for a small Alaskan company that has grown over the years, largely due to resource development, and I hope to continue to see this company and our Alaskan economy grow.

I also have a profound respect and appreciation for the Alaskan environment and all it has to offer. I wholeheartedly believe, that with the vast improvements in technology and the shift in focus towards safe and environmentally conscience work practices; resource development and environmental sustainability ***are not*** mutually exclusive.

I am proud of our great State and the work that has been done here, and I hope that we are able to continue to safely cultivate our resources for the benefit of all through the development of the 1002 Area of ANWR.

Respectfully yours,

Sally V. Marinucci

Office Manager
Fairweather, LLC
301 Calista Court, Anchorage, AK 99518
sally.marinucci@fairweather.com
Office: 907-267-4605 / Cell: 907-306-8602

From: Erica Marken
To: fortherecord (Energy)
Subject: Arctic National Wildlife Refuge
Date: Wednesday, November 15, 2017 12:59:15 PM

Dear Esteemed Members of the Senate Committee on Energy and Natural Resources,

I am strongly against the opening up the Arctic National Wildlife Refuge for oil and gas exploration or drilling and other commercial interests. My ancestors fought in the Civil War for the ideals of our new nation - the ideals that became enshrined in the U.S. Constitution and Bill of Rights. They did not fight to allow corporations a free hand with the great wild treasures of this country. They did not fight so that we taxpayers could subsidize corporate profits and greed. This is a money grab pure and simple.

There are other ways to generate federal funds like investing in green energy and being a competitor in this powerful emerging market. Why are you allowing our public lands to be exploited by an antiquated, dying industry and imperiling America's stature in the emerging green industry? An industry which could greatly benefit from the renowned, and still as relevant as ever, American ingenuity!

Please vote against reversing the ban on drilling for oil and gas in the Arctic National Wildlife Refuge. We need to preserve our great American heritage, not exploit and destroy it!

Thank you,

Erica Marken
767 S 900 E
Salt Lake City, UT 84102

From: Anne Markward
To: fortherecord (Energy)
Cc: Hoefler, Annie (Energy)
Subject: Arctic Drilling makes no sense
Date: Wednesday, November 15, 2017 12:41:02 PM

There is currently a world wide glut of oil on the market.

Why would we tap into one of last, greatest reserves NOW instead of holding it, like the crown jewels, for a less prosperous day? We're not going to get over our need for oil any decade soon.

Please, save the Arctic resource for when / if we really need it in the future.

Anne

Anne Markward
Durango CO 81301
970 779 8796

From: Cheryl Markwood
To: fortherecord (Energy)
Subject: Alaska
Date: Wednesday, November 01, 2017 2:52:35 AM

As an Alaskan resident, I whole heartedly support and in courage the opening of ANWR here in Alaska. You can count on Alaska to help produce and support energy production for our country. Please open ANWR...

Cheryl Markwood
(907) 347-4720
Fairbanks, Alaska

Sent from my iPad Pro

From: Lisa Marquiss
To: fortherecord (Energy); Hoefler, Annie (Energy)
Cc: Aves Thompson
Subject: ANWR
Date: Tuesday, October 31, 2017 6:20:22 PM
Attachments: image001.png

Chairman Murkowksi, Ranking Member Cantwell, and Members of the Senate Energy and Natural Resources Committee

Dear Chairman Murkowski and Ranking Member Cantwell,
I am an Alaskan that supports the opening of the 1002 area of the Arctic National Wildlife Refuge. Alaskans have developed the North Slope oil fields responsibly and will continue to do so with NO effects to the Arctic Caribou herd or any other animal species. We are the caretakers of the environment and we need you to vote in favor of development. Responsible oil and gas development in this fraction of ANWR will help ensure America's energy security for decades and allow Alaska – and our nation as a whole – to realize the benefits that come from expanding energy production in Alaska

Lisa Marquiss | Corporate Director of Safety & Compliance | www.carlile.biz | DOT 190356

907-343-3238 (office)
907-632-2439 (cell)

Carlile
#SafetyDriven

Safety committed through thoughts, decisions and ACTIONS.

From: Philip Marshall
To: fortherecord (Energy)
Subject: Opposition to the Senate Bill to Open ANWR for Oil/Gas Development
Date: Saturday, November 11, 2017 11:17:10 PM

Dear Staff;

As resident Alaskans for almost forty years, we oppose allowing oil and gas development in either ANWR or the NPR-A because of the irrevocable damage it will do to this wilderness. We have no more on this planet and it is illogical to sully it for more petroleum products that only compound our climate change problems.

Sincerely,

Philip Marshall, Woodcarver and Janet L. Marshall
Polhavn Woodfabrik
1300 Skyline Drive
Fairbanks, Alaska 99712
Tel: (907) 457-3895
E-mail: pmarshall@acetekk.com
Web: www.polhavnwoodfabrik.com

From: Lauren Martin
To: fortherecord (Energy)
Subject: PROTECT ALASKA"S WILDLIFE REFUGE FROM OIL & GAS COMPANIES
Date: Tuesday, November 07, 2017 9:29:33 AM

Hi,

I'm emailing to ask that the committee find other means to produce federal revenue than reopening the Arctic National Wildlife Refuge for oil and gas drilling. We should not destroy protected land and endanger wildlife to fund unnecessary tax breaks for the wealthy. Please pass my message along to the Chairman and other committee members.

Thank you for your time,

Lauren Martin

331 S Davisson St, Apt B,

Bloomington, IN 47403

--
Lauren Martin
Graphic Design Intern
Oliver Winery

From: Susannah Martin
To: fortherecord (Energy)
Subject: Please DO NOT OPEN THE ANWR TO OIL AND GAS DRILLING!
Date: Friday, November 03, 2017 1:20:03 PM

Hello,

My name is Susannah Martin and I'm a constituent from Oakland, CA - my zip code is 94608.

I'm emailing to ask that the committee find other means to produce federal revenue than reopening the Arctic National Wildlife Refuge for oil and gas drilling. We should not destroy protected land and endanger wildlife to fund unnecessary tax breaks for the wealthy. Please pass my message along to the Chairman and other committee members.

Thank you for your time,

Susannah Martin
5200 Adeline Street, Unit 258
Oakland, CA 94608

From: Alex Martinsons
To: fortherecord (Energy)
Subject: Chairman Murkowski, Ranking Member Cantwell, and Members of the Senate Energy and Natural Resources Committee
Date: Wednesday, November 15, 2017 10:12:12 AM

Dear Senate Committee on Energy and Natural Resources,

I completely oppose the recent proposed legislation that aims to open the Coastal Plain in ANWR. As a teenager, I backpacked throughout ANWR in the summers, exploring its diverse mountain ranges, wildlife, and ecosystems. I believe this area should be protected, not exploited by corporations with short sighted profits in mind. We must save areas like these for future generations, and I oppose all of your efforts to ruin this national treasure. Please vote no on this legislative proposal.

--

Alex Martinsons
Master of Public Administration, 2012
Evans School of Public Affairs
University of Washington
847.220.0415

From: Barry Matteson
To: fortherecord (Energy)
Subject: ANWR
Date: Tuesday, October 31, 2017 3:51:28 PM

Chairman Murkowski, Ranking Member Cantwell, and Members of the Senate Energy and Natural Resources Committee;

For decades, scientific polls have shown Alaskans overwhelmingly support responsible oil and gas development in the non-wilderness portion of ANWR. There is no valid reason why we should not be allowed to access the world-class resources within just a tiny fraction of the coastal plain.

- The proposed ANWR provision would allow development of no more than 2,000 acres of the 1.5 million acres of the Arctic coastal plain – part of the non-wilderness portion of ANWR's 19 million acres. **That is equivalent to just 0.01 percent of the entire refuge**.

- Responsible oil and gas development in this fraction of ANWR will help ensure America's energy security for decades and allow Alaska – and our nation as a whole – to realize the benefits that come from expanding energy production in Alaska.

Barry Matteson
Anchorage Alaska
5310 Bishops Castle Circle 99516
907-301-1521

From: Jodie Mavis
To: fortherecord (Energy)
Cc: annie_hoefler@energysenate.gov
Subject: For Record of November 2, 2017 Hearing
Date: Tuesday, October 31, 2017 6:31:22 PM

Dear Chairman Murkowski, Ranking Member Cantwell, and Members of the Senate Energy and Natural Resource Committee,

I support the opening of ANWR because it is imperative to our economy.

Jodie Mavis
Udelhoven Oilfield System Services, Inc.
184 E. 53rd Ave. Anchorage, Alaska 99518

From: Pam May
To: fortherecord (Energy)
Cc: kittcatdoc@gmail.com
Subject: ANWR
Date: Thursday, November 02, 2017 1:52:08 AM

Dear Chairman Murkowski and Ranking Member Cantwell,
I am an Alaskan that supports the opening of the 1002 area of the Arctic National Wildlife Refuge. Alaskans have developed the North Slope oil fields responsibly and will continue to do so with NO effects to the Arctic Caribou herd or any other animal species. We are the caretakers of the environment and we need you to vote in favor of development

Dr. Pamela May-Ross
907-232-2154

Anna McClain
8942 NE Ward West Road
Bainbridge Island, WA
98110

SEATTLE WA 980
08 NOV 2017 PM 2 L

Senate Committee on
Energy and Natural Resources
304 Dirksen Senate Building
Washington, DC 20510

20510-

Hello,
I'm a constituent from Bainbridge Island, WA
I'm writing to you to ask that the committee
find alternative ways to come up with the
$1 billion savings !!!

Please preserve Alaska's protected lands
and the wildlife that depends on
them. No leasing to fossil fuel
companies - Please !!!

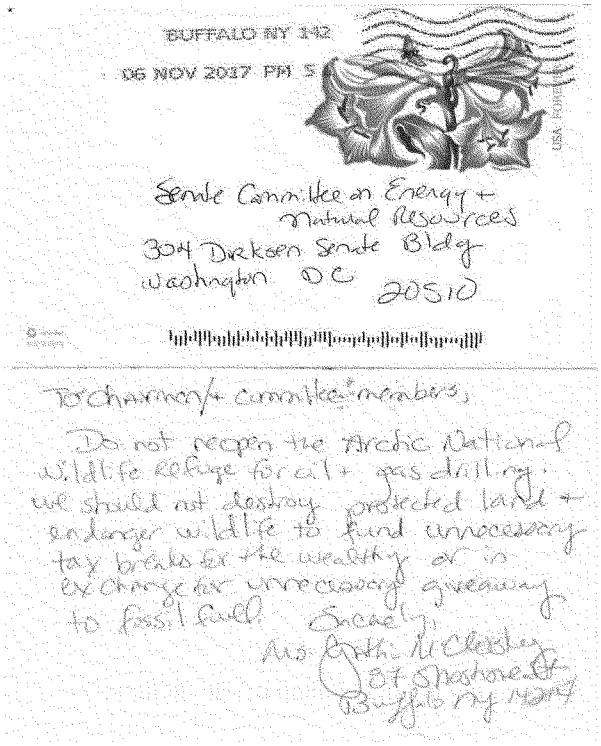
Thank you for passing my message
on to committee members!

Anna McClain

From: cynde6@juno.com
To: fortherecord (Energy)
Subject: Protect Alaska"s Wilderness
Date: Thursday, November 02, 2017 10:04:22 PM

I'm writing to ask that the committee find other means to produce federal revenue than reopening the Arctic National Wildlife Refuge for oil and gas drilling. We should not destroy protected land and endanger wildlife to fund unnecessary tax breaks for the wealthy. Please pass my message along to the Chairman and other committee members.

Respectfully yours,
Ms. Cynthia McCloskey
87 Shoshone St
Buffalo, NY 14214



From: Carol McCormick
To: fortherecord (Energy)
Subject: In favor of ANWR
Date: Wednesday, November 01, 2017 2:58:51 PM

Dear Committee:

As a Alaskan, I am in favor of responsible oil and gas development in ANWR. Alaska is faced with a budget crisis and many families are financially strapped due to unemployment. Alaska is known for it's abundant resources; it's what this state has to bank on. Moreover, oil and gas companies really do tread lightly on the environment in a number of ways, something most people don't understand.

What shampoo and lotion do you use? Because if it contains palm oil know that orangutans are poached for this oil and there are only 550 left in natural habitat today. The asphalt road in the lower 48 that you drive on likely crosses a migratory path. Does traffic cease to let wildlife cross? No, but it does on the North Slope. So, before anti-ANWR Washington decides ANWR should be hands off, consider how we all affect the environment.

Carol McCormick
53460 Lumber Dr
Kenai, Alaska 99611

From: Casey McCormick
To: fortherecord (Energy)
Subject: No Drilling in ANWR
Date: Wednesday, November 08, 2017 12:57:29 PM

Dear Senate Energy Committee,

Please do not support drilling for oil in Alaska's pristine Arctic National Wildlife Refuge. The refuge's coastal plain should be permanently off -limit to drilling, due to the area's fragile ecosystem that is home to polar bears, caribou, musk oxen and more than 200 species of migratory birds.

This would be a sin to the environment, which is already being destroyed by greed, money, and politics.

Sincerely,
Casey McCormick

--

CASEY MCCORMICK

E / cmm.mccormick@gmail.com

P / 419.205.0754

From: Dan McCrummen
To: fortherecord (Energy)
Cc: Hoefler, Annie (Energy)
Subject: Opening the Arctic National Wildlife Refuge Coastal Plain for exploration and production of oil
Date: Wednesday, November 01, 2017 11:44:33 AM

Chairman Murkowski, Ranking Member Cantwell, and Members of the Senate Energy and Natural Resources Committee,

I have been an Alaskan for 28 years; I chose to move here, stay and work here, and raise my family here. I am tired of Outside groups telling us what to do with our natural resources. I don't try and influence how much corn is grown in Nebraska or what is done in the bayous of Louisiana. We're a big state, there are plenty of areas environmentalist can go and commune with nature without trying to lock down the entire state. I fully support opening the ANWR coastal plain for exploration and production of oil.

Thank you for considering my opinion,

Hugh D. "Dan" McCrummen
4410 Windfall Ave
Juneau, AK 99801

From: Robert Mcdaniel - Alaska
To: fortherecord (Energy)
Subject: Strong Supporter of opening ANWR to responsible oil and gas development
Date: Tuesday, October 31, 2017 6:17:34 PM

With continuous improvements in technology and environmental practices, the oil industry has demonstrated over the past 40 years that North Slope energy development and environmental stewardship can and do coexist. The industry has a proven track record of responsible development in sensitive areas, protecting the environment, wildlife and subsistence needs of local residents.

Robert McDaniel
Alaska District Operations Manager

6900 Arctic Blvd
Anchorage, AK 99518
Email: robert.mcdaniel@halliburton.com
Office: +1 907-275-2621
Mobile: +1 907-229-8842
Fax: +1 907-275-2650

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From: Andrew McDonnell
To: fortherecord (Energy)
Subject: Opposition to Oil Exploration in the Arctic National Wildlife Refuge
Date: Thursday, November 02, 2017 2:12:41 PM

Dear Senator Murkowski, Chair of the Energy and Natural Resources Committee:

As a constituent of yours from Alaska, I am opposed to opening a part of the Arctic National Wildlife Refuge to Oil Exploration and Development.

Please consider the following : 1) this pristine landscape is a national treasure, 2) it has immense value in its undeveloped state as an ecological and cultural resource, and 3) further development of oil resources in the Arctic will exacerbate climate change to a level that scientists have deemed dangerous.

Please also consider the findings of McGLade and Ekins, 2015, published in the scientific journal Nature that finds:

"Our results suggest that, globally, a third of oil reserves,
half of gas reserves and over 80 per cent of current coal reserves should
remain unused from 2010 to 2050 in order to meet the target of
2 C. We show that development of resources in the Arctic and any
increase in unconventional oil production are incommensurate with
efforts to limit average globalwarming to 2 C.Our results showthat
policy makers' instincts to exploit rapidly and completely their territorial
fossil fuels are, in aggregate, inconsistent with their commitments
to this temperature limit. Implementation of this policy
commitment would also render unnecessary continued substantial
expenditure on fossil fuel exploration, because any new discoveries
could not lead to increased aggregate production."

Thus, proceeding with development in the Arctic endangers many Alaskans and Americans that are exposed to the risks of climate change. This is not an acceptable approach.

Thank you for considering my comments,

Dr. Andrew McDonnell
2595 Allen Adale Rd.
Fairbanks, AK 99709
phone: 951-265-5224

From: lilly@lillymcelroy.com
To: fortherecord (Energy)
Subject: Protect the Arctic National Wildlife Refuge!
Date: Tuesday, November 14, 2017 10:40:50 AM

Dear Senate Committee on Energy and Natural Resources,

I'm writing to ask that the committee find other means to produce federal revenue than reopening the Arctic National Wildlife Refuge for oil and gas drilling. We should not destroy protected land and endanger wildlife to fund unnecessary tax breaks for the wealthy.

Thank you.

Lilly McElroy
2227 Tennessee St.
Lawrence, KS 66046

From: Connie
To: fortherecord (Energy)
Subject: In Support of opening the 1002 of ANWR
Date: Wednesday, November 01, 2017 12:44:00 AM

Dear Chairman Murkowski and Ranking Member Cantwell,

I am an Alaskan, living in Juneau, and I support the opening of the 1002 area of the Arctic National Wildlife Refuge (ANWR). Alaskans have a strong record of responsible development of our natural resources including decades of operation of the North Slope oil fields. Responsible development can be done without harming the caribou or other wildlife of the coastal plain.

The promise to Alaska at statehood was to allow the responsible development of our natural resources. Alaska and America could surely use more domestic energy, not only for our national security, but also for the welfare of the citizens. The 1002 area is a tiny part of the Refuge that was intentionally set aside for potential future development and the time has come to make it part of the energy solutions for our state and our nation.

Please know that we here in Alaska are the caretakers of the environment and we need you to vote in favor of development.

I encourage a YES vote for Alaska's and America's future,

Connie McKenzie
PO Box 22925
Juneau, Alaska 99802

From: Lee McKenzie
To: fortherecord (Energy)
Subject: ANWR
Date: Wednesday, November 01, 2017 12:43:24 PM

"Dear Chairman Murkowski and Ranking Member Cantwell,

I am an Alaskan and a business owner that supports the opening of the 1002 area of the Arctic National Wildlife Refuge. Alaskans have developed the North Slope oil fields responsibly and will continue to do so with NO effects to the Arctic Caribou herd or any other animal species. We are the caretakers of the environment and we need you to vote in favor of development."

Lee McKenzie
President

TrailerCraft, Inc. / Freightliner of Alaska
(907) 563-3238 (office)
(907) 440-8785 (Cell)
(907) 561-4995 (fax)
www.trailercraft.com

"Like" us on Facebook at
www.facebook.com/TrailerCraft.FreightlinerofAlaska

From: Garrett McLean
To: fortherecord (Energy); Hoefler, Annie (Energy)
Subject: For Record of November 2, 2017 Hearing on ANWR
Date: Wednesday, November 01, 2017 10:00:38 PM

Chairman Murkowski, Ranking Member Cantwell, and Members of the Senate Energy and Natural Resources Committee,

Below are a few points that I support in the development of the Arctic National Wildlife Refuge:

-Polls have consistently shown Alaskans overwhelmingly support responsible oil and gas development in the non-wilderness portion of ANWR. There is no valid reason why we should not be allowed to access the world-class resources within just a tiny fraction of the coastal plain.

-The proposed ANWR provision would allow development of no more than 2,000 acres of the 1.5 million acres of the Arctic coastal plain – part of the non-wilderness portion of ANWR's 19 million acres. That is equivalent to just 0.01 percent of the entire refuge.
-Responsible oil and gas development in this fraction of ANWR will help ensure America's energy security for decades and allow Alaska – and our nation as a whole – to realize the benefits that come from expanding energy production in Alaska.
-While renewable energy is a growing part of America's energy portfolio, it is still projected to account for a minority of American energy production in 2040. New oil and gas production will be required to power America's economy and can serve as a bridge until renewable energy becomes a dominant energy source decades into the future.
-Energy production from ANWR has the potential to offset a decline in Lower 48 shale oil production, which is expected to commence in approximately a decade. Without limited oil development on the coastal plain, America will be forced to once again increase its reliance on foreign imports. With limited development in ANWR, America and Alaska can continue to grow the economy and reduce dependence on foreign oil.
-Alaska's economic lifeline, the Trans-Alaska Oil Pipeline System (TAPS), is now running at three-quarters empty. New oil production from ANWR has the potential to reverse throughput in TAPS, a vital component of American energy infrastructure.
-Oil development on a fraction of the coastal plain would create thousands of jobs nationwide, generate billions of dollars in government revenue, keep energy prices for American consumers affordable, and further improve energy security for decades into the future.

-Since the ANWR coastal plain is less than 60 miles from TAPS, development of energy resources there is one of the most environmentally-sound way to increase oil production in Alaska.

-Thanks to continuing improvements in technology, practices, and oversight, the oil industry has demonstrated over the past 40 years that North Slope energy development and environmental stewardship can and do coexist. The industry has a proven track record of responsible development in sensitive areas, protecting the environment, wildlife and subsistence needs of local residents.

Please consider these points in making your decisions about the development of ANWR.

Thanks for your time,

Garrett McLean
Operator – Hilcorp Alaska
Steelhead Platform
(907) 776-6830

From:	McMullen, Craig
To:	fortherecord (Energy)
Cc:	Hoefler, Annie (Energy)
Subject:	For Record of November 2, 2017 Hearing
Date:	Wednesday, November 01, 2017 2:27:50 PM
Attachments:	image003.png image004.png image005.png image007.png image008.png image009.png image010.png

Chairman Murkowski, Ranking Member Cantwell, and Members of the Senate Energy and Natural Resources Committee:

As a lifelong Alaskan, born and raised in our State capital and a graduate of UAF, I'd like to express my support for opening ANWR to responsible oil and gas development. Polls have consistently shown Alaskans overwhelmingly support responsible oil and gas development in the non-wilderness portion of ANWR. There is no valid reason why we should not be allowed to access the world-class resources within just a tiny fraction of the coastal plain. How tiny, you may ask? 0.01% of the non-wilderness portion of ANWR's 19 million acres. The proposed ANWR provision would allow development of no more than 2,000 acres of the 1.5 million acres of the Arctic coastal plain (part of the non-wilderness portion of ANWR).

I call myself an American, before I call myself an Alaskan; as an American, responsible oil and gas development in this fraction of ANWR will help ensure our countries energy security for decades and allow our nation to realize the benefits that come from expanding energy production in Alaska.

As an Alaskan, I feel that the opinions of people and interest groups who live and operate outside of Alaska, shouldn't carry the same weight has my support and the support of my fellow Alaskan's. This should be a resounding message from the people of Alaska to our leaders to pass the proposed ANWR provision.

While renewable energy is a growing part of America's energy portfolio, it is still projected to account for a minority of American energy production in 2040. New oil and gas production will be required to power America's economy and can serve as a bridge until renewable energy becomes a dominant energy source decades into the future.

Energy production from ANWR has the potential to offset a decline in Lower 48 shale oil production, which is expected to commence in approximately a decade. Without limited oil development on the coastal plain, America will be forced to once again increase its reliance on foreign imports. With limited development in ANWR, America and Alaska can continue to grow the economy and reduce dependence on foreign oil.

The U.S. Geological Survey estimates the 1002 Area is North America's greatest prospect for conventional onshore oil production, with a mean likelihood of containing 10.4 billion barrels of oil and 8.6 trillion cubic feet of natural gas, as well as a reasonable chance of economically producing 16 billion barrels of oil.

Alaska's economic lifeline, the Trans-Alaska Oil Pipeline System (TAPS), is now running at three-quarters empty. New oil production from ANWR has the potential to reverse throughput in TAPS, a

vital component of American energy infrastructure. Oil development on a fraction of the coastal plain would create thousands of jobs nationwide, generate billions of dollars in government revenue, keep energy prices for American consumers affordable, and further improve energy security for decades into the future. Since the ANWR coastal plain is less than 60 miles from TAPS, development of energy resources there is one of the most environmentally-sound way to increase oil production in Alaska.

Thanks to continuing improvements in technology, practices, and oversight, the oil industry has demonstrated over the past 40 years that North Slope energy development and environmental stewardship can and do coexist. The industry has a proven track record of responsible development in sensitive areas, protecting the environment, wildlife and subsistence needs of local residents.

Craig McMullen, P.E.

Materials Sales Manager
Alaska Region
11471 Lang Street
Anchorage, Alaska 99515
Direct 907-267-5246
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From: Vicki McMullin
To: fortherecord (Energy)
Subject: drilling in ANWR
Date: Friday, November 03, 2017 10:32:26 AM

I strongly oppose opening the Arctic National Wildlife Refuge up for drilling. This is a pristine, one of a kind ecosystem that once harmed will never be returned to its original state. The small amount of oil that is said to be available there is not worth the damage it will do the environment and all the animals that live there. Do not ruin this national treasure!

Vicki McMullin
112 N 49th St
Seattle WA 98103

From: Stefanie McQuality
To: fortherecord (Energy)
CC: Hoefler, Annie (Energy)
Subject: ANWR
Date: Tuesday, October 31, 2017 6:56:57 PM

Dear Chairman Murkowski, Ranking Member Cantwell, and Members of the Senate Energy and Natural Resources Committee

I am an Alaskan that supports the opening of the 1002 area of the Arctic National Wildlife Refuge. Alaskans have developed the North Slope oil fields responsibly and will continue to do so with NO effects to the Arctic Caribou herd or any other animal species. We are the caretakers of the environment and we need you to vote in favor of development.

Points to consider in your comments:

- Polls have consistently shown Alaskans overwhelmingly support responsible oil and gas development in the non-wilderness portion of ANWR. There is no valid reason why we should not be allowed to access the world-class resources within just a tiny fraction of the coastal plain.
- The proposed ANWR provision would allow development of no more than 2,000 acres of the 1.5 million acres of the Arctic coastal plain – part of the non-wilderness portion of ANWR's 19 million acres. That is equivalent to just 0.01 percent of the entire refuge.
- Responsible oil and gas development in this fraction of ANWR will help ensure America's energy security for decades and allow Alaska – and our nation as a whole – to realize the benefits that come from expanding energy production in Alaska.
- While renewable energy is a growing part of America's energy portfolio, it is still projected to account for a minority of American energy production in 2040. New oil and gas production will be required to power America's economy and can serve as a bridge until renewable energy becomes a dominant energy source decades into the future.
- Energy production from ANWR has the potential to offset a decline in Lower 48 shale oil production, which is expected to commence in approximately a decade. Without limited oil development on the coastal plain, America will be forced to once again increase its reliance on foreign imports. With limited development in ANWR, America and Alaska can continue to grow the economy and reduce dependence on foreign oil.
- The U.S. Geological Survey estimates the 1002 Area is North America's greatest prospect for conventional onshore oil production, with a mean likelihood of containing 10.4 billion barrels of oil and 8.6 trillion cubic feet of natural gas, as well as a reasonable chance of economically producing 16 billion barrels of oil.
- Alaska's economic lifeline, the Trans-Alaska Oil Pipeline System (TAPS), is now running at three-quarters empty. New oil production from ANWR has the potential to reverse throughput in TAPS, a vital component of American energy infrastructure.
- Oil development on a fraction of the coastal plain would create thousands of jobs nationwide, generate billions of dollars in government revenue, keep energy prices for American consumers affordable, and further improve energy security for decades into the future.
- Since the ANWR coastal plain is less than 60 miles from TAPS, development of energy resources there is one of the most environmentally-sound way to increase oil production in Alaska.
- Thanks to continuing improvements in technology, practices, and oversight, the oil industry has demonstrated over the past 40 years that North Slope energy development and environmental stewardship can and do coexist. The industry has a proven track record of responsible development in sensitive areas, protecting the environment, wildlife and subsistence needs of local residents.

Thank you,

Stefanie McQuality | Alaska Office Manager
Alaskan Express Service, Inc.
1800 W. 48th Ave
Anchorage, Alaska 99517
Office (907) 342-3030 Ext 7202 | Cell (907) 529-5684 Fax (907) 342-3070
smcquality@alaskanexpress.com
www.alaskanexpress.com

From: Frank McQueary
To: fortherecord (Energy)
Cc: Hoefler, Annie (Energy)
Subject: ANWR
Date: Wednesday, November 01, 2017 6:03:15 PM
Importance: High

Dear Senators: For the record I am a 64 year resident of Alaska and am not affiliated with the oil industry. I would hope that my voice would carry more weight than that of the myriads of folks who will send in letters sponsored by out of state anti-oil interests.
Alaska has a very good history of responsible development. The herds of caribou on the North Slope are thriving after 40 years in spite of the predictions of disaster by the anti-development hysterics of the 1970's who predicted disaster. Just as the flora and fauna of ANWR will continue to flourish should you decide to honor the country's original commitment to Alaska to allow development in the 1002 are.

Alaska needs this and the country needs this. Just do it!

Cordially

Frank E McQueary
907-223-7528

From: Curtis McQueen
To: fortherecord (Energy)
Subject: Support ANWR Development
Date: Wednesday, November 01, 2017 2:12:06 PM

My name is Curtis J. McQueen and I am the CEO of a native corporation representing the aboriginal peoples of Anchorage Alaska. We welcome the new jobs and our State is hurting and could use a shot in the arm. Thank you. 1-907-696-2828

From: Samantha Meldrum
To: fortherecord (Energy)
CC: Hoefler, Annie (Energy)
Subject: ANWR
Date: Tuesday, October 31, 2017 6:57:22 PM

Chairman Murkowski, Ranking Member Cantwell, and Members of the Senate Energy and Natural Resources Committee,

"Dear Chairman Murkowski and Ranking Member Cantwell,
I am an Alaskan that supports the opening of the 1002 area of the Arctic National Wildlife Refuge. Alaskans have developed the North Slope oil fields responsibly and will continue to do so with NO effects to the Arctic Caribou herd or any other animal species. We are the caretakers of the environment and we need you to vote in favor of development."

Points to consider in your comments:

- Polls have consistently shown Alaskans overwhelmingly support responsible oil and gas development in the non-wilderness portion of ANWR. There is no valid reason why we should not be allowed to access the world-class resources within just a tiny fraction of the coastal plain.
- The proposed ANWR provision would allow development of no more than 2,000 acres of the 1.5 million acres of the Arctic coastal plain – part of the non-wilderness portion of ANWR's 19 million acres. That is equivalent to just 0.01 percent of the entire refuge.
- Responsible oil and gas development in this fraction of ANWR will help ensure America's energy security for decades and allow Alaska – and our nation as a whole – to realize the benefits that come from expanding energy production in Alaska.
- While renewable energy is a growing part of America's energy portfolio, it is still projected to account for a minority of American energy production in 2040. New oil and gas production will be required to power America's economy and can serve as a bridge until renewable energy becomes a dominant energy source decades into the future.
- Energy production from ANWR has the potential to offset a decline in Lower 48 shale oil production, which is expected to commence in approximately a decade. Without limited oil development on the coastal plain, America will be forced to once again increase its reliance on foreign imports. With limited development in ANWR, America and Alaska can continue to grow the economy and reduce dependence on foreign oil.
- The U.S. Geological Survey estimates the 1002 Area is North America's greatest prospect for conventional onshore oil production, with a mean likelihood of containing 10.4 billion barrels of oil and 8.6 trillion cubic feet of natural gas, as well as a reasonable chance of economically producing 16 billion barrels of oil.
- Alaska's economic lifeline, the Trans-Alaska Oil Pipeline System (TAPS), is now running at three-quarters empty. New oil production from ANWR has the potential to reverse throughput in TAPS, a vital component of American energy infrastructure.
- Oil development on a fraction of the coastal plain would create thousands of jobs nationwide, generate billions of dollars in government revenue, keep energy prices for American consumers affordable, and further improve energy security for decades into the future.
- Since the ANWR coastal plain is less than 60 miles from TAPS, development of energy resources there is one of the most environmentally-sound way to increase oil production in Alaska.
- Thanks to continuing improvements in technology, practices, and oversight, the oil industry has demonstrated over the past 40 years that North Slope energy development and environmental stewardship can and do coexist. The industry has a proven track record of responsible development in sensitive areas, protecting the environment, wildlife and subsistence needs of local residents.

Thank you,

Samantha Meldrum
Alaskan Express

1800 W. 48th Ave Suite 1
Anchorage, AK 99517
Office: (907) 342-3030 Ext: 7203
Fax: (907) 342-3070
smeldrum@alaskanexpress.com

www.alaskanexpress.net

From:	Matt Melton
To:	fortherecord (Energy)
Cc:	Hoefler, Annie (Energy)
Subject:	For Record of November 2, 2017 Hearing U.S. Senate Energy & Natural Resources Committee hearing on ANWR Bill
Date:	Wednesday, November 01, 2017 1:21:51 PM
Importance:	High

Chairman Murkowski, Ranking Member Cantwell, and Members of the Senate Energy and Natural Resources Committee,

Below are reasons to support the limited and responsible development of the non-wilderness coastal plain of the Arctic National Wildlife Refuge.

- Polls have consistently shown Alaskans overwhelmingly support responsible oil and gas development in the non-wilderness portion of ANWR. There is no valid reason why we should not be allowed to access the world-class resources within just a tiny fraction of the coastal plain.
- The proposed ANWR provision would allow development of no more than 2,000 acres of the 1.5 million acres of the Arctic coastal plain – part of the non-wilderness portion of ANWR's 19 million acres. That is equivalent to just 0.01 percent of the entire refuge.
- Responsible oil and gas development in this fraction of ANWR will help ensure America's energy security for decades and allow Alaska – and our nation as a whole – to realize the benefits that come from expanding energy production in Alaska.
- While renewable energy is a growing part of America's energy portfolio, it is still projected to account for a minority of American energy production in 2040. New oil and gas production will be required to power America's economy and can serve as a bridge until renewable energy becomes a dominant energy source decades into the future.
- Energy production from ANWR has the potential to offset a decline in Lower 48 shale oil production, which is expected to commence in approximately a decade. Without limited oil development on the coastal plain, America will be forced to once again increase its reliance on foreign imports. With limited development in ANWR, America and Alaska can continue to grow the economy and reduce dependence on foreign oil.
- The U.S. Geological Survey estimates the 1002 Area is North America's greatest prospect for conventional onshore oil production, with a mean likelihood of containing 10.4 billion barrels of oil and 8.6 trillion cubic feet of natural gas, as well as a reasonable chance of economically producing 16 billion barrels of oil.
- Alaska's economic lifeline, the Trans-Alaska Oil Pipeline System (TAPS), is now running at three-quarters empty. New oil production from ANWR has the potential to reverse throughput in TAPS, a vital component of American energy infrastructure.
- Oil development on a fraction of the coastal plain would create thousands of jobs nationwide, generate billions of dollars in government revenue, keep energy prices for American consumers affordable, and further improve energy security for decades into the future.
- Since the ANWR coastal plain is less than 60 miles from TAPS, development of energy resources there is one of the most environmentally-sound way to increase oil production in Alaska.

- Thanks to continuing improvements in technology, practices, and oversight, the oil industry has demonstrated over the past 40 years that North Slope energy development and environmental stewardship can and do coexist. The industry has a proven track record of responsible development in sensitive areas, protecting the environment, wildlife and subsistence needs of local residents.

Most importantly, Alaska needs this. The federal government has eroded its promise to allow Alaskans to produce our resources, we now have the highest unemployment rate of any state in the nation (7.2%, compared to 4.3% nationally). The Trans-Alaska Pipeline System is just one-quarter full. And the State is running a massive budget deficit that may force us to cut essential services. The jobs and revenues created from responsible development in the 1002 Area will help our state overcome these challenges. And that's why Senator Murkowski will continue this fight, along with the Alaska delegation, to protect our state's future.

Kinds regards,

Matt Melton

Matt Melton | General Manager

(907) 348.2348 | Cell (907) 330.4550 | **24 Hour (907) 348.2365**
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From: Joey Merrick
To: fortherecord (Energy)
Cc: Hoefler, Annie (Energy)
Subject: Subject: For Record of November 2, 2017 Hearing
Date: Tuesday, October 31, 2017 8:54:36 PM

Dear Chairman Murkowski, Ranking Member Cantwell, and Members of the Senate Energy and Natural Resources Committee:

Thank you for holding a hearing on the potential for oil and gas exploration and development in the non-wilderness section of the Arctic National Wildlife Refuge, called the 1002 Area, through budget reconciliation and for inviting distinguished witnesses from Alaska to provide testimony. To enhance U.S. energy security and encourage local economic growth, the Alaska District Council of Laborers urges the Committee to allow oil and gas exploration and development in the 1002 Area.

According to the U.S. Geological Survey, the 1002 Area is the greatest opportunity in North America for onshore oil production. And responsible oil and gas development in the 1002 Area will ensure U.S. energy security and generate economic growth in Alaska. For instance, the Trans-Alaska Pipeline System (TAPS)—Alaska's economic engine—is currently three-quarters empty, and new production from ANWR could extend the economic life of TAPS. In addition, development of the 1002 Area, a fraction of the coastal plain, would produce thousands of jobs across the country and generate government revenue.

Given the proximity of the 1002 Area to TAPS, such energy development is an environmentally and economically efficient means to expand oil production. The oil industry has shown that environmental stewardship and natural resources development go hand in hand on the North Slope given the ongoing technological improvements and state-of-the-art industry practices.

Thank you for the opportunity to comment.

A.J. "Joey" Merrick II
Laborers' Local 341, Business Manager/Secretary
Alaska District Council of Laborers, President

Joey Merrick
Laborers' Local 341
2501 Commercial Dr.
Anchorage, AK 99501
Ph. 907-341-0341
Fax. 907-341-0342

From: Keith Merrick
To: fortherecord (Energy)
Subject: Open the Coastal Plain of ANWR to Oil & Gas Exploration
Date: Wednesday, November 01, 2017 6:00:30 PM
Attachments: image005.png
image006.png

These are public lands intended to benefit the public. A wildlife refuge is not park land. It needed to be effectively managed for all of the stakeholders whether local to the region or distant. A wildlife refuge and oil & gas development can successfully coexist on the coastal plain as they have in other areas of Alaska (KNWR) as well as within the highly regulated areas in and around the Prudhoe Bay, Kuparuk, and Alpine Fields. Open it up for thoughtful exploration. If commercial quantities do not exist then it becomes a non-issue.

GCI BUSINESS
Keith Merrick, PE | GCI Business – Industry Solutions
Senior Staff Engineer
3000 C Street | Suite 102 | Anchorage, AK 99503
8588 Katy Freeway | Suite 226 | Houston, TX 77024
Office: 907-868-6041 | Cellular: 907-360-5572
Email: kmerrick@gci.com
Web: https://www.gci.com/business/solutions/industrial-telecom

From: Karen Kassik-Michelsohn
To: fortherecord (Energy)
Cc: Hoefler, Annie (Energy)
Subject: Chairman Murkowski, Ranking Member Cantwell, and Members of the Senate Energy & Natural Resources Committee
Date: Tuesday, October 31, 2017 2:39:21 PM

We totally support the opening of ANWR and the potential to open more land for oil production!

Karen Kassik Michelsohn, CPBD, Fellow AIBD
Michelsohn and Daughter Construction, Inc.
3410 Balchen Dr., Anchorage, AK 99517
Office 907-522-3375, Cell 407-468-6150
Karen@MandDconst.com
www.Houzz.com/pro/kkassik/michelsohn-and-daughter
First Vice President of American Institute of Building Design
Vice President of Anchorage Home Builders Association
"Builder of the Year" of Anchorage Homes Builders Association

From: Philip P Micklin
To: fortherecord (Energy)
Subject: ANWR
Date: Saturday, November 11, 2017 12:51:58 PM

Senate Energy Committee,

Do not allow drilling in the Alaska National Wildlife Refuge Coastal Plain. This is the heart of the Refuge and absolutely critical to the ecologic health of the entire Refuge. Also, drilling makes no economic sense as the oil will be very expensive to produce.

Philip MIcklin
1618 Grove St.
Kalamazoo, MI 49006

From: Dale Miller
To: fortherecord (Energy)
Subject: ANWR Provision, : For Record of November 2, 2017 Hearing
Date: Wednesday, November 01, 2017 12:52:57 PM

Chairman Murkowski, Ranking Member Cantwell, and Members of the Senate Energy and Natural Resources Committee,

I am writing today in the hope that your committee will consider my comments as you take up the ANWR provision in the Budget Reconciliation Bill that would allow limited oil and gas activity in the non-wilderness coastal plain of the Arctic National Wildlife Refuge (ANWR).

Polls have consistently shown Alaskans overwhelmingly support responsible oil and gas development in the non-wilderness portion of ANWR. There is no valid reason why we should not be allowed to access the world-class resources within just a tiny fraction of the coastal plain.

The proposed ANWR provision would allow development of no more than 2,000 acres of the 1.5 million acres of the Arctic coastal plain – part of the non-wilderness portion of ANWR's 19 million acres. That is equivalent to just 0.01 percent of the entire refuge.

American reliance on foreign oil has declined substantially do to the increased domestic production, but Lower 48 shale oil production is expected to start declining in just a few short years. Without limited development on the coastal plain, America will once again be forced to depend on importing foreign oil imports, which as you know increases the security risk to the National Security of America. With limited ANWR development, America and Alaska can continue to grow the economy while reducing dependence on foreign imports. The U.S. Geological Survey estimates there is a reasonable chance of producing upwards of 15 billion barrels of oil from this area.

Oil development on a fraction of the coastal plain would create thousands of jobs nationwide, generate billions of dollars in government revenue, keep energy prices for American consumers affordable, and further improve energy security for decades into the future.

Oil production on the North Slope in Alaska has demonstrated the industry can develop sensitive areas such as this in a responsible, environmentally protective manner, while creating thousands of well-paying jobs, which generate billions of dollars in government revenue.

In closing, I urge the Committee to include the ANWR drilling provision in the Budget Reconciliation Bill.

Sincerely,

Dale Miller
Business Representative,
Teamsters Local 959
520 E. 34th. Avenue, Suite 102
Anchorage, Alaska 99503
dmiller@akteamsters.com
Work (907) 751-8526

From: Greg Miller
To: fortherecord (Energy)
Cc: Hoefler, Annie (Energy)
Subject: ANWR; November 2nd Committee Hearing regarding "1002 Area"
Date: Tuesday, October 31, 2017 7:15:43 PM

Chairman Murkowski, Ranking Member Cantwell, and Members of the Senate Energy & Natural Resources Committee:

I am a husband, business owner, and Alaskan that supports responsible oil and gas development in the non-wilderness portion of ANWR. It is in the best interest of Alaska and its residents to responsibly develop 2,000 acres of ANWR's 19 million acres. The "1002 Area" represents only .01% of the entire refuge. Additionally, there are millions of more acres protected throughout the state. Please consider the well-being of Alaskans when you consider this measure. These are hard economic times in the State of Alaska and this could create economic opportunity for Alaskans.

Take Care,

Greg Miller */ Kenai Operations Manager / Cruz Construction, Inc.*
C: 907 690 0989 / gmiller@cruzconstruct.com / ***cruzconstruct.com***

From: Jeff Miller
To: fortherecord (Energy)
Cc: Hoefler, Annie (Energy)
Subject: November 2nd Committee Hearing regarding "1002 Area"
Date: Tuesday, October 31, 2017 4:23:52 PM

Chairman Murkowski, Ranking Member Cantwell, and Members of the Senate Energy & Natural Resources Committee:

I am a husband, father, business owner, and Alaskan that supports responsible oil and gas development in the non-wilderness portion of ANWR. It is in the best interest of Alaska and its residents to responsibly develop 2,000 acres of ANWR's 19 million acres. The "1002 Area" represents only .01% of the entire refuge. Additionally, there are millions of more acres protected throughout the state. Please consider the well-being of Alaskans when you consider this measure. These are hard economic times in the State of Alaska and this could create economic opportunity for Alaskans.

Kind Regards,

Jeff D. Miller

Jeff D. Miller
V.P. of Operations
Cruz Companies
7000 E. Palmer-Wasilla Hwy
Palmer, AK 99645
907-746-3144

From: Mike Miller
To: fortherecord (Energy)
Cc: Hoefler, Annie (Energy)
Subject: 1002 Area of ANWR
Date: Tuesday, October 31, 2017 4:23:47 PM

Chairman Murkowski, Ranking Member Cantwell, and Members of the Senate Energy and Natural Resources Committee

1. Polls have consistently shown Alaskans overwhelmingly support responsible oil and gas development in the non-wilderness portion of ANWR. There is no valid reason why we should not be allowed to access the world-class resources within just a tiny fraction of the coastal plain.
2. The proposed ANWR provision would allow development of no more than 2,000 acres of the 1.5 million acres of the Arctic coastal plain – part of the non-wilderness portion of ANWR's 19 million acres. That is equivalent to just 0.01 percent of the entire refuge.
3. Responsible oil and gas development in this fraction of ANWR will help ensure America's energy security for decades and allow Alaska – and our nation as a whole – to realize the benefits that come from expanding energy production in Alaska.
4. While renewable energy is a growing part of America's energy portfolio, it is still projected to account for a minority of American energy production in 2040. New oil and gas production will be required to power America's economy and can serve as a bridge until renewable energy becomes a dominant energy source decades into the future.
5. Energy production from ANWR has the potential to offset a decline in Lower 48 shale oil production, which is expected to commence in approximately a decade. Without limited oil development on the coastal plain, America will be forced to once again increase its reliance on foreign imports. With limited development in ANWR, America and Alaska can continue to grow the economy and reduce dependence on foreign oil.
6. The U.S. Geological Survey estimates the 1002 Area is North America's greatest prospect for conventional onshore oil production, with a mean likelihood of containing 10.4 billion barrels of oil and 8.6 trillion cubic feet of natural gas, as well as a reasonable chance of economically producing 16 billion barrels of oil.
7. Alaska's economic lifeline, the Trans-Alaska Oil Pipeline System (TAPS), is now running at three-quarters empty. New oil production from ANWR has the potential to reverse throughput in TAPS, a vital component of American energy infrastructure.
8. Oil development on a fraction of the coastal plain would create thousands of jobs nationwide, generate billions of dollars in government revenue, keep energy prices for American consumers affordable, and further improve energy security for decades into the future.
9. Since the ANWR coastal plain is less than 60 miles from TAPS, development of energy resources there is one of the most environmentally-sound way to increase oil production in Alaska.
10. Thanks to continuing improvements in technology, practices, and oversight, the oil industry has demonstrated over the past 40 years that North Slope energy development and environmental stewardship can and do coexist. The industry has a proven track record of responsible development in sensitive areas, protecting the environment, wildlife and subsistence needs of local residents.

Thank you for your consideration

Michael D. Miller

Michael D. Miller
9411 Kylie Circle
Anchorage, AK 99502
mdmiller@gci.net
h 907.248.2171
c 907.229.7838

Alaska Legislature
Representative Charisse Millett

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Anchorage, AK 99501
Phone (907) 269-0222
Fax (907) 269-0223

November 14, 2017

Senator Lisa Murkowski
United States Senator, Alaska
522 Hart Senate Office Building
Washington, DC 20510

RE: Opening ANWR

Dear Senator Murkowski:

I write you today in my capacity as the Alaska House of Representative's Minority Leader and nine-year member of the Alaska Legislature. As a lifelong Alaskan, and mother with children and grandchildren who live and work in Alaska, I understand the tremendous economic impact responsible oil and gas development has had on our state.

My comments below reflect my full support of Congress passing legislation that opens the 1002 Area of the Arctic National Wildlife Refuge (ANWR) for oil and gas exploration, development and production.

As you are acutely aware, Alaska is currently mired in its worst recession since the 1980s. Thousands of Alaskans have lost their jobs, left our state in search of better opportunities and many are wondering what the future holds for them and their families. It's a difficult time for our state government as well, as we've faced years of multi-billion-dollar budget deficits stemming from the oil price crash. The last time Alaska faced such difficulties production was considerably higher, with over 1 million barrels of oil flowing through the Trans Alaska Pipeline System (TAPS) each day. Now TAPS sits 3/4 empty, though we have seen encouraging production trends in recent years because of oil tax reform.

Opening ANWR would fundamentally change Alaska's negative economic outlook, and help bring down our unemployment rate, which at 7.2% is the highest in the nation. Studies have estimated that 55,000 jobs would be created throughout the country by opening the non-

wilderness area of ANWR. Surveys of ANWR's potential that were conducted decades ago, with now outdated technology, pegged the total amount of technically recoverable oil in ANWR at 10.4 billion barrels. Such an enormous amount of oil, an amount comparable to Prudhoe Bay, would undoubtedly attract much industry attention and investment.

When Department of Interior Secretary Ryan Zinke came to Alaska in May of this year, he stated the clear mission of the Trump Administration regarding energy development: make America energy dominant! To achieve that goal, Alaska and our vast resources, must be part of the equation. The importance of enabling the development of the 1002 Area of ANWR, an area which was specifically set aside by Congress in 1980 for future development, at this time in our state's history cannot be understated.

The benefits of opening the 1002 Area of ANWR are endless: tens of thousands of jobs, billions of dollars of private sector investment, more oil in TAPS, more revenue for the federal, state and local governments, less reliance on foreign oil, technological advancements, minimal drilling footprint, and an overall positive economic jolt for Alaska.

Those who say energy development in ANWR, and throughout Alaska, cannot be done without irreversible harm to the environment clearly don't know Alaska and our stringent rules governing the development of our resources. For 40+ years Alaskans have successfully and safely developed over 17 billion barrels of oil on the North Slope. Today, we hear the same claims about detrimental harm to caribou and wildlife, should ANWR be opened, that we heard when TAPS was being proposed. However, today there are more caribou across the North Slope than 40 years ago.

Alaskans don't try to influence or control the economic destiny of other states. We don't tell farmers in Iowa that they can't plant corn on their fields, or that dairy farmers in California cannot produce more milk, or that the people of Seattle can't build new buildings to house the headquarters of technology companies. Alaskans simply want to provide for their families and have the same freedom to work and develop their land and resources as the rest of America does. Alaskans do not like non-Alaskans and environmental NGOs, who don't know anything about our struggles, lands or economy, telling us which of our resources we can and cannot develop. ANILCA made it clear that the 1002 Area of ANWR was to be developed – now is that time.

In conclusion, I urge you and your colleagues to pass legislation that finally unlocks ANWR for the people of Alaska.

Sincerely,

Charisse Millett

Charisse Millett
Leader, House Republican Caucus
Alaska State House of Representatives
District 25

From: Andy Mills
To: fortherecord (Energy)
Subject: Request from Andy Mills (Alaskan Constituent) to SUPPORT Opening of 1002 ANWR
Date: Tuesday, October 31, 2017 7:02:37 PM

Dear Chairman Murkowski and Ranking Member Cantwell,

I am an Alaskan, living in Juneau, that supports the opening of the 1002 area of the Arctic National Wildlife Refuge (ANWR). I do believe, having spent time working in the executive branch for the State of Alaska, that Alaskans have developed the North Slope oil fields responsibly and will continue to do so with NO effects to the Arctic Caribou herd or any other animal species.

Alaska is in desperate need of new jobs and America could surely use more domestic energy, not only for our national security, but also for the welfare of the citizens by boosting Alaska's state budget away from our current fiscal woes (drawing on reserves and severely cutting state services under low per-barrel oil, as well as low production).

Please know that we here in Alaska are the caretakers of the environment and we need you to vote in favor of development.

With all my best wishes that you will see your way to voting YES for Alaska's and America's future,
Andy Mills
Juneau, Alaska
907-957-1242 (mobile)

From: Sharon Milton
To: fortherecord (Energy)
Subject: Please Protect Alaska"s Wildlife Refuge From Oil & Gas Companies
Date: Wednesday, November 15, 2017 1:10:18 PM

My name is Sharon Milton, my address is 1900 East 86th Street, Apt. 308, Bloomington, MN 55425.

Please vote to protect Alaska's Arctic National Wildlife Refuge (ANWR) or Area 1002, and do not allow for leasing the protected lands to fossil fuel companies for their own use and development.

Thanks for reading and considering my voice.

Sincerely,

Sharon Milton

Sent from Outlook

From: Faye Mitchell
To: fortherecord (Energy)
Subject: PROTECT ALASKA"S WILDLIFE REFUGE FROM OIL & GAS COMPANIES
Date: Friday, November 03, 2017 12:41:29 PM

We are both writing today to ask that the committee find other means to produce federal revenue than reopening the Arctic National Wildlife Refuge for oil and gas drilling. We should not destroy protected land and endanger wildlife to fund unnecessary tax breaks for the wealthy. Please pass my message along to the Chairman and other committee members.

Thank you for your time,
Faye Mitchell and Michael Herrell
1007 Huntsman Cir
Franklin TN 37064
502.693.9004

From: Faye Mitchell
To: fortherecord (Energy)
Subject: oppose reopening the Arctic National Wildlife Refuge for oil and drilling
Date: Tuesday, November 14, 2017 11:10:25 AM

I am writing to ask that the committee find other means to produce federal revenue than reopening the Arctic National Wildlife Refuge for oil and gas drilling. We should not destroy protected land and endanger wildlife to fund unnecessary tax breaks for the wealthy. Please pass my message along to the Chairman and other committee members.

Faye Mitchell
1007 Huntsman Cir
Franklin TN 37064

November 1, 2017

Senator Murkowski
Senator Cantwell
US Senate Energy and Natural Resources Committee

Re: 1002 Area of ANWR

Dear Chairman Murkowski and Ranking Member Cantwell:

Aang (greetings). I am an Alaskan native (Aleut) who was raised and lives a subsistence life relying on all the fish and game resources that God provided us humans. My people have survived on the caribou, fish and waterfowl that have wander Alaska's lands, swim Alaska's water's and fly our sky's for thousands of years and the health of all are critical to this Alaskan.

The good news, these resources are thriving even when oil industry opponents said they couldn't. More good news is industry such as the oil industry has created jobs and a cash economy for Alaskan's and citizens from every corner of our country. Why is a cash economy important to me? Allow me to be blunt-Unlike my forefathers before me, a cash economy allows us to purchase vehicles (like 4 wheelers and boat's) that help us be more successful hunters and better provide for our families. Not to mention, hanging up my spear for a Remington 7MM Mag.

The last good news I have for you, Alaska has 40 years of being responsible caretakers of our environment and stewards of our natural resources and this Alaska native is confident we will only do more of the same in the 1002 area of ANWR. I support the opening of the 1002 area of the Arctic National Wildlife Refuge and urge you to support as well.

Qagaalakutxin (thank you),

John Moller
Juneau, Alaska

Recipient Information
To: Senate Committee on Energy and Natural Resources
Fax #: 12022246163

Sender Information
From: Alison Moore
Email address: aefmoore@yahoo.com (from 73.50.214.7)
Phone #: 0000000000
Sent on: Monday, November 13 2017 at 6:54 PM EST

I'm writing to ask that the committee find other means to produce federal revenue than reopening the Arctic National Wildlife Refuge for oil and gas drilling. We should not destroy protected land and endanger wildlife to fund unnecessary tax breaks for the wealthy. Please pass my message along to the Chairman and other committee members.
Thank you,
Alison Moore
South Bend IN 46617

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From: Cortney Moore
To: fortherecord (Energy)
Cc: Hoefler, Annie (Energy)
Subject: For Record of November 2, 2017 Hearing
Date: Wednesday, November 01, 2017 2:11:22 PM

Chairman Murkowski, Ranking Member Cantwell, and Members of the Senate Energy and Natural Resources Committee

As a long time Alaskan working in the oil and gas sector I am well aware of the oil and gas industries practices and capabilities to provide responsible oil and gas development within our great State. Opening ANWR would provide our Nation with independence while providing our State with jobs and a strong and stable future. The current provision to open a fraction of ANWR should be passed to ensure America's energy security and bridge our nation's energy needs until renewable energy can support the nations demands. It is important to get ahead of an energy crisis rather than behind it. As an Alaskan I have seen both sides of the equation and it is far better for our State and its residents, and our Nation, to have oil and gas companies in place and ready to supply oil and gas as needed, when needed, than rushing out hoping to find it when demand exceeds supply.

The Trans-Alaska Oil Pipeline and North Slope are already equipped and able to support additional growth. ANWR could be North America's greatest prospect for oil production and refill the now depleted TAPS which is a vital component of our Nation's energy infrastructure. Opening oil development in ANWR would create thousands of jobs, generate billions of dollars, stabilize energy prices, and provide energy security and independence for our country.

Alaska has a 40 year history of responsible oil and gas development proving that industry and environmental responsibility can and do coexist. I fully support opening ANWR for responsible development and would like that support known For Record of the November 2nd, 2017 hearing.

Thank you,

Cortney Moore

Cortney Moore | *Pipeline Analyst* | Harvest Alaska, LLC
O: 907.777-8408 | C: 907.227-2011 | cmoore@hilcorp.com
3800 Centerpoint Dr. Ste 1400 | Anchorage | Alaska | 99503

Set a goal SO BIG that you can't achieve it until you grow into the company that can.
~ Unknown

From: Dar Moore
To: fortherecord (Energy)
Subject: Please do not reopen the Arctic National Wildlife Refuge for oil and gas drilling
Date: Thursday, November 02, 2017 2:37:01 PM

To Whom it May Concern:

My name is Dorothy Anna Moore. I am a constituent from 239 John St. Princeton, NJ 08542. I am concerned about the recent move to open the Arctic National Wildlife Refuge for oil and gas drilling. It will permanently disrupt and pollute a delicate ecosystem which native Alaskans depend upon for their livelihoods. Also, the Congressional Budget Office predict this move will not be as lucrative as proponents suggest.

We cannot allow private companies to invade our precious and limited wildlife refuges and harm native peoples for temporary and limited profit. Please do the right thing and do not reopen the Arctic National Wildlife Refuge for oil and gas drilling.

Sincerely,

Dorothy Anna Moore

From: Moore, Marcus
To: fortherecord (Energy)
Cc: Hoefler, Annie (Energy)
Subject: ANWR Development
Date: Wednesday, November 01, 2017 4:29:30 PM

Chairman Murkowski, Ranking Member Cantwell, and Members of the Senate Energy and Natural Resources Committee

My grandfather homesteaded at Lake Otis and Dowling in 1946. Our extended family is all still living in Alaska. With the exception of a 4 year tour in the Marines I have been here 50 years. I love this state and it blows my mind that we are in the second year of recession when we have this great wealth of resources literally at our feet. I have never written to any political party before and, honestly, I probably won't ever again. I don't have much faith in this letter doing much good. But, for what it's worth, PLEASE OPEN ANWR!

Thank You for listening, Mortimer Marcus Moore

Marcus Moore
General Foreman
7941 Sandlewood Place
Anchorage, AK 99507
907.344.3436 Office
907.349.1813 Fax
907.748.2801 Mobile
www.northernpowerline.com
www.npcesllc.com

From: Samuel Moore
To: fortherecord (Energy)
Subject: In Support of Responsible Resource Development
Date: Tuesday, October 31, 2017 10:07:57 PM

Dear Chairman Murkowski and Ranking Member Cantwell,

I am an Alaskan that supports responsible resource development here in Alaska.

With that in mind, I fully support the opening of the 1002 area of the Arctic National Wildlife Refuge.

Alaskans have long supported responsible resource development throughout our great state. Alaskans have also long developed the North Slope oil fields responsibly and will continue to do so with no negative effects to our environment, to the Arctic Caribou herd, or any other animal species. We are the caretakers of the environment and we need you to vote in favor of development. It's important for American jobs, economic opportunity, and national security. Please support the opening of this opportunity.

Regards,

Sam Moore

--
Samuel A. Moore

2225 Arctic Boulevard #304
Anchorage, AK 99503-1902

Mobile: (907) 229-5329
Facebook : Twitter : Linkedin

From: Moore, Seneca
To: fortherecord (Energy)
Subject: Against revering the ban on drilling for oil in the Arctic National Wildlife Refuge
Date: Saturday, November 18, 2017 9:41:23 AM

Dear Esteemed Members of the Senate Committee on Energy and Natural Resources,

I am strongly against the opening up the Arctic National Wildlife Refuge for oil and gas exploration or drilling and other commercial interests. My ancestors fought in the Civil War for the ideals of our new nation - the ideals that became enshrined in the U.S. Constitution and Bill of Rights. They did not fight to allow corporations a free hand with the great wild treasures of this country. They did not fight so that we taxpayers could subsidize corporate profits and greed. This is a money grab pure and simple.

There are other ways to generate federal funds like investing in green energy and being a competitor in this powerful emerging market. Why are you allowing our public lands to be exploited by an antiquated, dying industry and imperiling America's stature in the emerging green industry? An industry which could greatly benefit from the renowned, and still as relevant as ever, American ingenuity!

Please vote against reversing the ban on drilling for oil and gas in the Arctic National Wildlife Refuge. We need to preserve our great American heritage, not exploit and destroy it!

Thank you,

Seneca Moore,

309 Gold St. #21F, Brooklyn NY 11201

--
Seneca Moore, PhD, RN
Principal Technical Advisor
Health Programs Group
Management Sciences for Health
US-New York United States
Direct: +1 646-677-8113
E-mail: simoore@msh.org
Skype: senecaiptsam

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From: Julie Morris
To: fortherecord (Energy)
Subject: Open ANWR 1002
Date: Tuesday, October 31, 2017 6:35:10 PM

"Dear Chairman Murkowski and Ranking Member Cantwell,
I am an Alaskan that supports the opening of the 1002 area of the Arctic National Wildlife Refuge. Alaskans have developed the North Slope oil fields responsibly and will continue to do so with NO effects to the Arctic Caribou herd or any other animal species. We are the caretakers of the environment and we need you to vote in favor of development."

Homefire Country Inn
PO Box 3035
Anderson, Alaska 99744
90-582-1895
Julie Morris

From: Mark Morris
To: fortherecord (Energy)
Cc: Hoefler, Annie (Energy)
Subject: Testimony on Arctic National Wildlife Refuge aka 1002 Area
Date: Tuesday, October 31, 2017 8:19:22 PM

Chairman Murkowski, Ranking Member Cantwell and Members of the Senate Energy and Natural Resources Committee:

Please open the 1002 area of the Arctic National Wildlife Refuge to responsible oil and gas development. I have seen firsthand the responsible development of the north slope coastal plain of Alaska for removing it's rich oil and gas reserves. The commitment of the developments I have been involved in to protect the environment is second to none. For example, on the Pt Thomson Project I was told that if I stopped my pick up truck along a road and got out and "took a leak" I and my entire firm would be removed from the project. This development is located immediately west of ANWR. Our firm designed the electrical, lighting, and navaids for the new airstrip at the project. We worked diligently to reduce the footprint of the runway, taxiway, and access roads. We used vegetable oil in the transformers. We used very low glare lighting to reduce impact to migrating birds. As an Alaskan I love my beautiful state and want to preserve it for my children and their children's children. The time has come to develop our country's petroleum resources to the maximum benefit of our nation. We need to increase the number of good, high paying jobs in our country. We need to provide a strong economic future for our children. We need to expand our tax base. The time to act is now. Saying no in order to preserve our environment is ignoring the reality that we can do both. We can develop our oil and gas reserves and protect our environment while doing so. We already are.

Do not delay, please act now. Open ANWR 1002 Area.

Mark Morris, PE
Principal
MORRIS ENGINEERING GROUP LLC
2375 Jordan Ave #7 | Juneau, AK 99801 | Office: 907-789-3350

From: Gene Mountcastle [mailto:GMountcastle@wtpe.com]
To: fortherecord (Energy); Hoefler, Annie (Energy)
Subject: ANWR
Date: Wednesday, November 01, 2017 3:20 PM

"Dear Chairman Murkowski and Ranking Member Cantwell,

I am an Alaskan that supports the opening of the 1002 area of the Arctic National Wildlife Refuge. Alaskans have developed the North Slope oil fields responsibly and will continue to do so with NO effects to the Arctic Caribou herd or any other animal species. We are the caretakers of the environment and we need you to vote in favor of development."

Points to consider in your comments:

- Polls have consistently shown Alaskans overwhelmingly support responsible oil and gas development in the non-wilderness portion of ANWR. There is no valid reason why we should not be allowed to access the world-class resources within just a tiny fraction of the coastal plain.
- The proposed ANWR provision would allow development of no more than 2,000 acres of the 1.5 million acres of the Arctic coastal plain – part of the non-wilderness portion of ANWR's 19 million acres. That is equivalent to just 0.01 percent of the entire refuge.
- Responsible oil and gas development in this fraction of ANWR will help ensure America's energy security for decades and allow Alaska – and our nation as a whole – to realize the benefits that come from expanding energy production in Alaska.
- While renewable energy is a growing part of America's energy portfolio, it is still projected to account for a minority of American energy production in 2040. New oil and gas production will be required to power America's economy and can serve as a bridge until renewable energy becomes a dominant energy source decades into the future.
- Energy production from ANWR has the potential to offset a decline in Lower 48 shale oil production, which is expected to commence in approximately a decade. Without limited oil development on the coastal plain, America will be forced to once again increase its reliance on foreign imports. With limited development in ANWR, America and Alaska can continue to grow the economy and reduce dependence on foreign oil.
- The U.S. Geological Survey estimates the 1002 Area is North America's greatest prospect for conventional onshore oil production, with a mean likelihood of containing 10.4 billion barrels of oil and 8.6 trillion cubic feet of natural gas, as well as a reasonable chance of economically producing 16 billion barrels of oil.
- Alaska's economic lifeline, the Trans-Alaska Oil Pipeline System (TAPS), is now running at three-quarters empty. New oil production from ANWR has the potential to reverse throughput ir TAPS, a vital component of American energy infrastructure.
- Oil development on a fraction of the coastal plain would create thousands of jobs nationwide, generate billions of dollars in government revenue, keep energy prices for American consumer affordable, and further improve energy security for decades into the future.
- Since the ANWR coastal plain is less than 60 miles from TAPS, development of energy resources there is one of the most environmentally-sound way to increase oil production in Alaska.
- Thanks to continuing improvements in technology, practices, and oversight, the oil industry has demonstrated over the past 40 years that North Slope energy development and environmental stewardship can and do coexist. The industry has a proven track record of responsible development in sensitive areas, protecting the environment, wildlife and subsistence needs of local residents.

Gene Mountcastle
General Manager-Alaska
Western Peterbilt, LLC
Cell: 907-350-4042
gmountcastle@westernpeterbilt.com

From: David Mulholland
To: fortherecord (Energy)
Subject: ANWR
Date: Wednesday, November 01, 2017 3:23:51 PM

Dear Senator Murkowski, and all the other members of the Energy Committee,

I would like to support the opening of ANWR. Alaskans have shown great responsibility with development so far, and I see no reason it would change. Our economy is so limited in Alaska, and frankly we have been in an economic free-fall over the last couple of years. Any delay in utilizing our great resources is adding to the loss of jobs and people in Alaska. I urge you to open our resources as soon as possible.

Thank you!

David Mulholland, DC, CCSP, DABCI, MCS-P
Mulholland Chiropractic Center, LLC
2020 Abbott Rd, Suite 2
Anchorage, Alaska 99507
Phone: 907-770-5700
Fax: 907-770-5701

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Visit our office at:
www.mulhollandchiropractic.com

From: Kris Mulholland
To: fortherecord (Energy)
Subject: ANWR
Date: Tuesday, October 31, 2017 9:25:09 PM

"Dear Chairman Murkowski and Ranking Member Cantwell,
I am an Alaskan that supports the opening of the 1002 area of the Arctic National Wildlife Refuge. Alaskans have developed the North Slope oil fields responsibly and will continue to do so with NO effects to the Arctic Caribou herd or any other animal species. We are the caretakers of the environment and we need you to vote in favor of development."

Kristi Mulholland
5116 Cape Seville Dr
Anchorage AK 99516
907-244-1369

Sent from my iPhone

From: Barry Munsell
To: fortherecord (Energy)
Cc: Hoefler, Annie (Energy)
Subject: ANWR provision
Date: Wednesday, November 01, 2017 9:19:06 PM

Dear Chairman Murkowski, Ranking Member Cantwell, and Members of the Senate Energy and Natural Resources Committee.

For Record of November 2, 2017 Hearing

I am writing to support opening the ANWR coastal plain (1002 area) to exploration and production.

We need to require timely lease sales and streamline and simplify the permitting process.

We also need to provide for a 50 percent-50 percent federal-state revenue sharing, rather than the 90-10 percent split under current law.

We need to do this taking into account that Alaskan's want responsible development while also protecting the environment and given advances in horizontal drilling, development will have little impact on the area.

Given that technically recoverable oil within the ANWR 1002 area (excluding State and Native areas) is estimated to be between 4.3 and 11.8 billion barrels (95- and 5-percent probability range), with a mean value of 7.7 billion barrels this development is vital to Alaska's future.

Barry R Munsell
907-232-6177
bmunsell@ak.net
PO Box 876211
Wasilla, AK 99687

From: David Myers [mailto:dmyers@stgincorporated.com]
Sent: Wednesday, November 01, 2017 8:46 PM
To: fortherecord (Energy)
Cc: Hoefler, Annie (Energy)
Subject: 1002 Area - ANWR

Chairman Murkowski, Ranking Member Cantwell, and Members of the Senate Energy and Natural Resources Committee,

For national security (energy or otherwise), please allow responsible oil and gas development within the small fraction (no more than 2,000 acres of the 1.5 million acres) of the Arctic Coastal Plain – part of the non-wilderness portion of ANWR's 19 million acres – equivalent of 0.01 percent of the entire refuge.

While renewable energy is a growing and very important part of America's energy portfolio (I should know I have helped in the development of many renewable projects and sit on the board for the non-profit: Renewable Energy Alaska Project), it is still projected to account for the minority of American energy production for the foreseeable future. New oil and gas production will be required to power America's economy and should serve as a bridge until renewable energy becomes a dominant energy source decades from now.

Oil development on a fraction of the coastal plain would create thousands of jobs nationwide, generate billions of dollars in government revenue, keep energy prices for American consumers affordable, and further improve energy security for decades into the future. Moreover, since the ANWR coastal plain is less than 60 miles to TAPs, development of energy resources there is one of the most environmentally-sound way to increase oil production in Alaska – let's fill our pipe!

Thank you all for your continued service!

Sincerely,

David Myers
Director of Business Development
STG Incorporated and Alaska Crane
907-644-4664 Main
907-348-4218 Direct
907-227-7133 Cell

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"22 CFR Part 125.4 (b) (9) applicable."

From: Pamela Myers-Lewis
Sent: Tuesday, October 31, 2017 4:09 PM
To: fortherecord (Energy)
Subject: For Record of November 2, 2017, Hearing

Chairman Murkowski, Ranking Member Cantwell, and Members of the Senate Energy and Natural Resources Committee:

I am writing to ask your support for opening a portion of the Arctic National Wildlife Refuge (ANWR) to drilling.

For decades, multiple polls have shown that Alaskans overwhelmingly support responsible oil and gas development in the non-wilderness portion of ANWR. There is no valid reason why we should not be allowed to access the world-class resources within just a tiny fraction of the coastal plain.

The proposed ANWR provision would allow development of no more than 2,000 acres of the 1.5 million acres of the Arctic coastal plain—part of the non-wilderness portion of ANWR's 19 million acres. That is equivalent to just 0.01 percent of the entire refuge.

Responsible oil and gas development in this fraction of ANWR will help ensure America's energy security for decades and allow Alaska—and our nation as a whole—to realize the benefits that come from expanding energy production in Alaska.

While renewable energy is a growing part of America's energy portfolio, it is still projected to account for a minority of American energy production in 2040. New oil and gas production will be required to power America's economy and serve as a bridge until renewable energy becomes a dominant energy source decades into the future.

Energy production from ANWR has the potential to offset a decline in Lower 48 shale oil production, which is expected to be experienced in approximately a decade. Without limited oil development on the coastal plain, America will be forced to once again increase its reliance on foreign imports. With limited development in ANWR, America and Alaska can continue to grow the economy and reduce dependence on foreign oil.

The U.S. Geological Survey estimates the 1002 Area is North America's greatest prospect for conventional onshore oil production, with a mean likelihood of containing 10.4 billion barrels of oil and 8.6 trillion cubic feet of natural gas, as well as a reasonable chance of economically producing 16 billion barrels of oil.

Oil development on a fraction of the coastal plain would create THOUSANDS of jobs nationwide, generate billions of dollars in government revenue, keep energy prices for American consumers affordable, and further improve energy security for decades into the future.

I firmly believe we need to access our country's resources to prevent dependence on other countries. Opening a portion of ANWR to responsible development is a necessary step toward that end.

Thank you.
Pamela Myers-Lewis
2633 Meadow Lark Way
Anchorage, Alaska 99507
907-538-2229

From: Marcy Nadel
To: Hoefler, Annie (Energy); fortherecord (Energy)
Subject: For Record of November 2, 2017 Hearing
Date: Wednesday, November 01, 2017 12:25:07 AM

Chairwoman Murkowski, Ranking Member Cantwell, and Members of the Senate Energy and Natural Resources Committee,

As an Alaskan I would like to implore you to refrain from opening Area 1002 of the Arctic National Wildlife Refuge to oil and gas development. There are many reasons that leaving the Refuge intact is the best choice, I will describe my own personal top three.

First, the Refuge is the calving grounds of the Porcupine caribou herd and is home to a number of migratory bird species, among other animals. The Gwich'in rely on the caribou for food and tradition.

Second, we should be wary of the boom and bust cycle of oil development. The Alaskan economic downturn of the last few years and drastic budget cuts passed by the legislature remind us that when extractive resources run out it is locals who suffer the most. We need to be diversifying our economy right now, not continuing the cycle.

Third, I work in the field of environmental remediation and have learned first hand that where there is oil there will be oil spills. In addition to spewing even more cabon into our atmosphere, developing the Refuge would threaten the senastive Artic ecosystems it was designed to preserve. There is no way to responsibly develop this resource. Let's keep it in the ground.

Thank you for hosting a public hearing on this matter and for accepting testimony from those who will be the most affected, the Gwich'in and Alaskans in general.

Sincerely,
Marcy Nadel
193 Java Lane
Fairbanks, AK

From: David Nees
To: fortherecord (Energy)
Subject: From an Alaskan
Date: Wednesday, November 01, 2017 2:43:09 AM

Thank you for opening the 1002 to development, those of us who live in Alaska understand the small amount of land that is being opened.
Having arrived here in 1979,I have benefitted from the oil economy, both in good times and bad.
I was fortunate to visit Prudeau bay as a teacher, thank you ARCO.
I was amazed to see what a little area it is in the vastness of the North Slope, after flying over Fairbanks there were no lights for hours, until a small light was on the horizon. It took another hour to get there.
While at the oil facility I saw the polar bear guards on the buildings,to keep the bear visitors out while keeping the humans safe.
I saw the caribou warning signs. The focus and attention is to keep the environment hospitable to humans and wildlife, there was even a summer program that picked up any thrash the wind had blown on the tundra.
Prudeau Bay iscleaner then most parks I have been to Seattle, New York and Utah.

America needed Alaska oil to end the Arab oil embargo in the 1970's and we need Alaska's oil to create jobs and wealth for the United states.

Open the 1002 we have 40 years of proving we can do Arctic oil safely and responsibly.

David Nees
2542 Curlew
Anchorage Alaska

From: Nelson, Dan
To: fortherecord (Energy)
Cc: Hoefler, Annie (Energy)
Subject: ANWR Provision
Date: Wednesday, November 01, 2017 7:30:16 PM

To: Chairman Murkowski, Ranking Member Cantwell, and Members of the Senate Energy and Natural Resources Committee,

Respectfully request the approval of ANWR provision that would allow limited oil and natural gas activity within the non-wilderness coastal plain of the Arctic National Wildlife Refuge (ANWR). The proposed ANWR provision would allow development of no more than 2,000 acres of the 1.5 million acres of the Arctic coastal plain – part of the non-wilderness portion of ANWR's 19 million acres. That is equivalent to just 0.01 percent of the entire refuge. This would help decrease America's dependence on foreign oil. It will help feed the lifeline of Alaska's economy. Alaskan's want responsible development. Due to proximity of the ANWR Coastal plain to the Trans Alaska pipeline it is one of the most environmentally sound ways to up domestic oil production. Please vote to approve this provision.

Thank you for your time.

Daniel Nelson
Alaskan
395 Endicott Dr
Soldotna AK 99669

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From: Daria Nelson
To: fortherecord (Energy)
Subject: Oppose any reopening of the ANWR for oil and gas drilling
Date: Tuesday, November 14, 2017 4:39:00 PM

Committee on Energy and Natural Resources:

I'm requesting that the committee find other means to produce federal revenue than reopening the ANWR for oil and gas drilling.
Protected land and endangered wildlife should not be destroyed to fund unnecessary tax breaks for the wealthy.
Please pass my message on to the Chairman and other committee members.

Thank you,

Daria Nelson
39047 Shoreview DR NE
Hansville, WA 98340

From: Lori Nelson
To: fortherecord (Energy)
Cc: Hoefler, Annie (Energy)
Subject: For Record of November 2, 2017 Hearing on ANWR
Date: Tuesday, October 31, 2017 1:44:23 PM

Senate Energy and Natural Resources Committee

Attn:
Chairman Murkowski
Ranking Member Cantwell
Members of the Committee

Alaskans overwhelmingly support responsible oil and gas development in the non-wilderness portion of ANWR. I'm a proud Alaska resident and mother who would like to have a healthy job market and economy in the future for my son. Therefore, I feel it's important to note that Alaska's economic lifeline, the Trans-Alaska Oil Pipeline System (TAPS), is now running at three-quarters empty! New oil production from ANWR has the potential to reverse throughput in TAPS, a vital component of America's energy infrastructure and Alaska's economic well-being. Please support the ANWR drilling provision in a budget reconciliation bill that would allow limited oil and natural gas activity within the non-wilderness coastal plain of the Arctic National Wildlife Refuge.

Lori Nelson | Manager, External Affairs | Hilcorp Alaska, LLC
O: 907.777.8392 | F: 907.777.8590 | lnelson@hilcorp.com
3800 Centerpoint Dr., Suite 1400 | Anchorage | Alaska | 99503

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From: Margaret Nelson [mailto:mnelsonrealestate@gmail.com]
To: fortherecord (Energy)
Subject: Support for ANWR
Date: Wednesday, November 01, 2017 5:00 PM

"Dear Chairman Murkowski and Ranking Member Cantwell,

I am an Alaskan that supports the opening of the 1002 area of the Arctic National Wildlife Refuge. Alaskans have developed the North Slope oil fields responsibly and will continue to do so with NO effects to the Arctic Caribou herd or any other animal species. We are the caretakers of the environment and we need you to vote in favor of development."

Sincerely,

Margaret Nelson, Broker
Denali Real Estate
of Rose Capital, Inc.
www.DenaliRealEstate.com
MNelson@DenaliRealEstate.com
facebook.com/margaretnelsonrealestate
(907)632-4594

From: Mark Nelson
To: fortherecord (Energy)
Subject: ANWR Development
Date: Tuesday, October 31, 2017 5:54:57 PM

Chairman Murkowski, Ranking Member Cantwell, and Members of the Senate Energy and Natural Resources Committee:

I would like to express my support for oil and gas exploration and production in ANWR. Alaska has a history of successfully producing oil and gas in sensitive areas without harmfully impacting the local environment. I believe we can take these practices into ANWR without harming the wildlife in the refuge.

Regards,

Mark Nelson
4113 Chess Dr
Anchorage, AK 99508

From: Meghan Nelson
To: fortherecord (Energy)
Subject: Support ANWR
Date: Wednesday, November 01, 2017 2:49:05 AM

Good evening,

I am writing in SUPPORT of opening ANWR.

Our nation (as well as my state of Alaska) needs to develop the resources that our country holds. ANWR holds a storehouse of petroleum that can help support our nation and our economy for years to come. It would be foolhardy to continue sitting on such a valuable commodity. As an Alaskan, I fully support utilizing our natural resources in a responsible manner.

I also support adjusting the revenue sharing between the federal and state government so that the people of Alaska can also benefit from resource development. The federal government currently holds the majority of Alaska's vast natural resources and it is time to allow Alaskans a share of what is available here, including the extraction of oil from our land.

Help the United States and the state of Alaska by opening ANWR to drilling and allowing the revenues to infuse the economy.

Thank you.

Sincerely,

Meghan L. Nelson
PO Box 211423
Auke Bay , Alaska 99821

From: Zak Nelson
To: fortherecord (Energy)
Subject: ANWR
Date: Thursday, November 02, 2017 4:08:47 PM

Hello,

My name is Zak and I'm writing to ask that the committee find other means to produce federal revenue than reopening the Arctic National Wildlife Refuge for oil and gas drilling. We should not destroy protected land and endanger wildlife to fund unnecessary tax breaks for the wealthy. Please pass my message along to the Chairman and other committee members.

Zak Nelson
10737 Burke Ave N
Seattle, WA

From: Drew Neuerburg
To: fortherecord (Energy)
Subject: FW: For Record of November 2, 2017 Hearing
Date: Wednesday, November 01, 2017 3:58:40 PM

To: Chairman Murkowski, Ranking Member Cantwell and Members of the Senate Energy and Natural Resources Committee

For: The Record of November 2, 2017 Hearing

Thank you for letting me make comments on the proposed ANWR provision. I am a lifelong Alaskan and as such can testify that for decades scientific polls have shown that Alaskans overwhelmingly support responsible oil and gas development in the non-wilderness portion of ANWR. The footprint for this development would be a small fraction of the coastal plain.

With today's technology. equipment and regulations the industry has demonstrated that the non-wilderness area can be developed and drilled in an environmentally responsible manner. The 2,000 acres of the 1.5 million acres of the Arctic coastal plain –part of the non-wilderness portion of ANWR's 19 million acres only represents only .01% of the entire refuge.

Allowing this development will ensure America's energy security for decades and allow Alaska – and our nation as a whole – to realize the benefits that come from expanding energy production in Alaska. This will back up the lower 48 states shale production that will start to decline in approximately the next decade. Without this very limited oil development on the coastal plain America will be forced once again to increase our reliance on foreign imports.

This limited development will help America and Alaska's economy to grow, it creates jobs across America and in Alaska. It gives our country energy independence.

The USGS estimates the 1002 are is North America's greatest prospect for conventional onshore oil production, with a mean likelihood of containing 10.4 billion barrels of oil and 8.6 trillion cubic feet of natural gas, as well as a reasonable chance of economically producing 16 billion barrels of oil.

As an Alaskan, I support the opening of this area for Alaska and the Nation as a whole. Thank you for letting me go on the record.

Respectfully Submitted,

Drew Neuerburg
3101 Brookridge Cir
Anchorage, AK 99504

From: Tony Noethlich
To: fortherecord (Energy)
Subject: ANWR
Date: Tuesday, October 31, 2017 3:02:49 PM

Dear Chairman Murkowski and Ranking Member Cantwell,
I am an Alaskan that supports the opening of the 1002 area of the Arctic National Wildlife Refuge. Alaskans have developed the North Slope oil fields responsibly and will continue to do so with NO effects to the Arctic Caribou herd or any other animal species. We are the caretakers of the environment and we need you to vote in favor of development.
Please, let's not miss this opportunity.

Thank you for your time.

Tony Noethlich
Project Manager/ Estimator
Samson Electric, Inc.
129 W. Potter Drive
Anchorage, AK 99518
(907) 336-1258 ph
(907) 336-1257 fx

From: Will Noling
To: fortherecord (Energy)
Subject: Arctic National Wildlife Refuge
Date: Wednesday, November 15, 2017 11:44:26 AM

My name is Will Noling and I'm a constituent from 138 Maple Street Brooklyn NY 11225. I'm writing to ask that the committee find other means to produce federal revenue than reopening the Arctic National Wildlife Refuge for oil and gas drilling. We should not destroy protected land and endanger wildlife to fund unnecessary tax breaks for the wealthy. Please pass my message along to the Chairman and other committee members.

Thank you
Will Noling

From: Allen O"Bannon
To: fortherecord (Energy)
Cc: Hoefler, Annie (Energy)
Subject: proposal to drill in ANWR
Date: Monday, November 06, 2017 7:15:21 PM

Chairman Murkowski, Ranking Member Cantwell, and Members of the Senate Energy and Natural Resources Committee.

For Record of November 2, 2017 Hearing

I would like to comment on the proposal to allow drilling on the Arctic National Wildlife refuge. I have spent over 20 years traveling in or guiding in the refuge. It is one of my main sources of employment during the summer and is a very special place to me. I have flown many times between Barrow and Deadhorse so I have a sense of what drilling will look like in the refuge. In no way can I condone any drilling or exploration for oil in ANWR. It is a special place, the only place in the entire United Sates that is an arctic coastal plain not open to drilling. Do we really want to lose that?

Why is it that politicians are willing to support industry at any cost. Does not the Grand Canyon hold a special place as a wild place in our minds. The arctic coastal plain is just as special.

Please reconsider your stances on drilling in ANWR. Once it is done it will be destroyed for ever.

Thanks

Allen O'Bannon
9055 Village Way
Victor, ID 83455

From: Kathleen O"Connell
To: fortherecord (Energy)
Cc: Hoefler, Annie (Energy)
Subject: ANWR Drilling Provision
Date: Tuesday, October 31, 2017 8:02:09 PM

Dear Chairman Murkowski, Ranking Member Cantwell, and Members of the Senate Energy and Natural Resources Committee,

I am writing to you to support the inclusion of an ANWR drilling provision in the Fiscal Year 2018 budget. As an Alaskan, I love our beautiful surroundings, our abundant wildlife, and the purity of our air, land, and waters. I have worked in and around the oil industry for the last 34 years and I have witnessed responsible development. I have confidence in our State and Federal regulators to enforce the law. I respect our oil industry leaders and know they understand that sound environmental practices and safe operations are good business. I support development in ANWR because I know it can and will be done responsibly. ANWR is in relatively close proximity to the Trans Alaska Pipeline, so it will be easy to get product to market. The Trans Alaska Pipeline is in excellent condition, has a significant amount of available capacity, and is ready to take more product to market. In fact, the Trans Alaska Pipeline is only ¼ full and may not continue to operate if North Slope production continues to decline.

While renewable energy is a growing market that I support, I am a realist and realize it will take another 20-40 years before there is enough resources in place to meet consumer demand. It would be prudent to allow responsible developers to pursue ANWR and keep the Trans Alaska Pipeline operating and delivering energy to America. Alaskans overwhelming support responsible oil and gas development in the non-wilderness portion of ANWR as consistently shown by Polls – there is no valid reason for not allowing responsible development.

Sincerely,
Kathleen O'Connell
1018 G Street
Anchorage, AK 99501
907-301-0193

From: . SW AK SURVEYING LLC
To: fortherecord (Energy)
Cc: Hoefler, Annie (Energy)
Subject: ANWR
Date: Wednesday, November 01, 2017 11:09:30 AM

Dear Chairman Murkowski, Ranking Member Cantwell, and Members of the Senate Energy and Natural Resources Committee,

I am writing to express my support for the ANWR provision you are considering at the hearing Nov. 2. I am a lifelong Alaskan and have benefited from the responsible development of Alaska's oil resources, as have my children. The tiny fraction of ANWR being considered for development is important for our future in Alaska and will help support the nation's energy needs as renewable energy is developed over the next decades. We have the expertise and commitment to develop this resource without harm to our environment.

Please support the responsible use of Alaska's resources and allow us to support our state.

Sincerely,
Christine O'Connor
2800 N Park Dr
Wasilla, AK 99654
907-355-5775

From: Anne O"Donnell
To: fortherecord (Energy)
Subject: No Drilling Leases in ANWR
Date: Wednesday, November 15, 2017 10:01:20 AM

Dear Committee Members,

I am AGAINST opening the sensitive Arctic National Wildlife Refuge to oil and gas drilling for any reason, but especially if the leasing fees are used to offset a tax cut for the wealthiest Americans and corporations.

Fossil fuel is a dying industry. It makes no sense to damage one of our few surviving wilderness areas for short-term gain, especially since the administration's estimate of the revenue generated is likely over-optimistic.

The fossil fuels in ANWR need to stay in the ground. Burning them will make the effects of climate change even more catastrophic than they are already going to be.

Thank you for your consideration.

==========

Anne Stewart O'Donnell
4814 Harvard Rd.
College Park, MD 20741
571-201-1709

From: Margaret Okamoto
To: fortherecord (Energy)
Cc: Hoefler, Annie (Energy)
Subject: Proposed Legislation to Drill in ANWR
Date: Tuesday, November 14, 2017 12:45:35 AM

Margaret Okamoto
2563 6th Avenue W
Seattle, WA 98119
margaretokamoto@yahoo.com

November 13, 2017

Chairman Murkowski
Ranking Member Cantwell
Members of the Senate Energy and Natural Resources Committee
cc. Annie Hoefler

RE: For Record of November 2, 2017 Hearing

Dear Chairman Murkowski, Ranking Member Cantwell, and Members of the Senate Energy and Natural Resources Committee:

I am writing in opposition to opening ANWR to oil and gas leases for extraction.

"In 2013, then Secretary of the Interior Ken Salazar signed off on a sweeping management plan that earmarked 11.8 million acres, 52% of the petroleum reserve, for potential oil and gas development. This area was thought to hold 72% of the recoverable oil according to estimates at the time. This plan was a compromise painstakingly hammered out and agreed to by sportsmen, Native villages and major environmental groups."*

Why isn't this sufficient??

"More than 40 years ago, Congress recognized that the reserve had more value than simply oil. The 1976 Naval Petroleum Reserves Act gave the Department of the Interior the novel mandate to explore the energy resources 'in a manner which will assure the maximum protection' of 'surface values' such as wildlife, subsistence hunting and recreation."*

It seems to me after reading this New York Time Article that the 2013 management plan does indeed do just that. Are we so greedy that we need to destroy wildlife and its habitat and further decimate Native populations in pursuit of dollars that could as easily be made under the 2013 plan? For the ecological health of ANWR and Alaska as well as that of the "lower 48," we can ill afford to wear blinders.

Please take to heart the 1976 Naval Petroleum Reserves Act. I urge you to oppose opening ANWR any more than already provided for in the 2013 management plan.

Sincerely,
Margaret Okamoto.

* Christopher Solomon, The New York Times, Sunday, November 12, 2017

From:	Stacy Oliva
To:	fortherecord (Energy)
Cc:	Hoefler, Annie (Energy)
Subject:	For Record of November 2, 2017 Hearing/Support-1002 Area of ANWR
Date:	Wednesday, November 01, 2017 4:29:42 PM

Dear Chairman Murkowski, Ranking Member Cantwell and Members of the Senate Energy and Natural Resources Committee,

I am an Alaskan that supports the opening of the 1002 area of the Arctic National Wildlife Refuge.

Responsible oil and gas development in this fraction of ANWR will help ensure America's energy security for decades and allow Alaska – and our nation as a whole – to realize the benefits that come from expanding energy production in Alaska. New oil and gas production will be required to power America's economy and can serve as a bridge until renewable energy becomes a dominant energy source decades into the future.

Polls have consistently shown Alaskans overwhelmingly support responsible oil and gas development in the non-wilderness portion of ANWR. There is no valid reason why we should not be allowed to access the world-class resources within just a tiny fraction of the coastal plain. The proposed ANWR provision would allow development of no more than 2,000 acres of the 1.5 million acres of the Arctic coastal plain – part of the non-wilderness portion of ANWR's 19 million acres. That is equivalent to just 0.01 percent of the entire refuge.

Oil development on a fraction of the coastal plain would create thousands of jobs nationwide, generate billions of dollars in government revenue, keep energy prices for American consumers affordable, and further improve energy security for decades into the future. Thanks to continuing improvements in technology, practices, and oversight, the oil industry has demonstrated over the past 40 years that North Slope energy development and environmental stewardship can and do coexist. **The industry has a proven track record of responsible development in sensitive areas, protecting the environment, wildlife and subsistence needs of local residents.**

Thank you for your consideration,

Stacy A. Oliva
PO Box 8567
Nikiski, Alaska 99635
907-776-8656 office
907-252-1600 cell
stacy.oliva@gmail.com

From: lupine@alaska.net
To: fortherecord (Energy); Hoefler, Annie (Energy)
Subject: For Record of November 2, 2017 Hearing ANWR drilling provision
Date: Tuesday, October 31, 2017 11:49:04 PM
Importance: High

To: Chairman Murkowski, Ranking Member Cantwell, and Members of the Senate Energy and Natural Resources Committee

My husband, Chris R Opheim Sr., and I, Kathleen Opheim, would like to go on record as being in support of responsible oil and gas development on the Coastal Plain of the Arctic National Wildlife Refuge.

For decades, Alaskans have overwhelmingly supported responsible oil and gas development in the non-wilderness portion of ANWR. We should be allowed to access the world-class resources within this tiny 0.01% of the coastal plain that is a part of the proposed ANWR provision which would allow development of no more than 2,000 acres of the 1.5 million acres of the Arctic coastal plain.

We do agree that renewable energy is the best way to go, however new oil and gas production will be required to power America's economy until renewable energy becomes a dominant energy source decades into the future.

The U.S. Geological Survey estimates the 1002 Area is North America's greatest prospect for conventional onshore oil production, with a mean likelihood of containing 10.4 billion barrels of oil and 8.6 trillion cubic feet of natural gas, as well as a reasonable chance of economically producing 16 billion barrels of oil. Oil development on this fraction of the coastal plain would create thousands of jobs nationwide, generate billions of dollars in government revenue, keep energy prices for American consumers affordable, and further improve energy security for decades into the future.

Energy production from ANWR has the potential to offset a decline in Lower 48 shale oil production, which is expected to begin in approximately a decade. Without limited oil development on the coastal plain, America will be forced to once again increase its reliance on foreign imports. With limited development in ANWR, America and Alaska can continue to grow the economy and reduce dependence on foreign oil.

Thank you for your support of the proposed ANWR drilling provision.

Sincerely,

Chris R and Kathleen Opheim
PO Box 907
Kasilof AK 99610

From: MYRNA ORENSTEIN
To: fortherecord (Energy)
Subject: Protect the Alaska"s Wildlife and Refuge!
Date: Tuesday, November 07, 2017 4:38:48 PM

My name is Myrna Orenstein
I live at 913 Lee Street
Evanston, Illinois 60202

Please protect Alaska's Wildlife and Refuge. Keep corporations out! REMEMBER THE EXXON VALDEZ!

I would like corroboration that you received and recorded my request.

Thank you, and have a nice day.

Myrna Orenstein

Myrna Orenstein, Ph.D.
"Smart but Stuck: Overcoming frustrations from Learning Disabilities"
Third Edition

From: Yuko Ota
To: fortherecord (Energy)
Subject: Opposing ANWR drilling
Date: Wednesday, November 15, 2017 11:26:21 AM

Hello, my name is Yuko Ota, I'm a constituent from Brooklyn, NY.

I'm contacting you to state my opposition to opening the Arctic National Wildlife Refuge for oil and gas drilling; the land in the ANWR is our country's legacy, and should not be destroyed for the sake of fossil fuels and tax cuts for the wealthy.

Thank you for your time.

--Yuko Ota
328 E. 5th St. Apt. #3
Brooklyn NY 11218 USA

From: Mike O"Toole
To: fortherecord (Energy)
Cc: anniehoefler@energy.senate.gov
Subject: In Support of ANWR
Date: Tuesday, October 31, 2017 5:34:57 PM
Attachments: image001.png

Chairman Murkowski,

I support the drilling in ANWR as a Alaska Citizen and owner of Atigun Oilfield Equipment Rentals.

Alaska has a vast supply of Oil and Gas and needs to drill and produce its resources.

Alaska has always been a resource producing state and it's also of very important part of the United States energy independence.

Best

Michael J. O'Toole
President
Office 907-776-3371
Fax 907-776-5778
P.O. Box 381
Kenai Alaska 99611
motoole@atiguninc.com

From: Yasuhiro Ozuru
To: fortherecord (Energy)
Cc: Hoefler, Annie (Energy)
Subject: On drilling in the Arctic Refuge For Record of November 2, 2017 Hearingg
Date: Wednesday, November 01, 2017 12:59:18 AM

Chairman Murkowski, Ranking Member Cantwell, and Members of the Senate Energy and Natural Resources Committee

My name is Yasuhiro Ozuru, I am a resident of Anchorage AK for 9 years. I am writing this email to comment on the drilling in Arctic Refuge.

I strongly oppose the opening of the Arctic Refuge for oil/gas exploration for the following reasons:

1) Most importantly this will risk the loss of the most precious and ecologically important area in the world. There is no other place like the coastal plain of Arctic Refuge in the world. - the unique environment support bird migration across the world and calving of a large caribou population.

2) As far as I know, the US is already the biggest producer of oil in the world, so energy independence cannot be the reason for action. Also there are many sources of cheaper oil elsewhere in the US.

3) Alaska is experiencing a serious state budget crisis and is in the recession. But the trigger of this economic situation is over-dependence on oil. I believe private sector is still doing relatively well. Recession began due to state budget crisis triggered by the low oil price. We appreciate the oil development as the driver of Alaska economy in the past, but I believe it cannot be driver of future economy. Things change. In order to the state of Alaska to prosper, we (state of Alaska) need to change, by finding alternative drivers of economy. Further drilling will delay the change and many people here privately knows that - it is like providing drug to a drug addict.

4) Many people in Alaska knows that opening of the refuge is to fill the anticipated hole in the federal budget resulting from the proposed tax cut. Further, many perceive this tax cut benefit rich people more. In this sense, this seems not be a prudent policy - imposing difficulty to minority (for example Gwich'in living in the refuge by introducing threat to their main food source) to help the tax cut for rich. - this is not just.

Based on these reasons, I cannot find any sensible reasons to support the decision to open the Arctic Refuge for oil/gas exploration. I am hoping that this committee will make a rational decision by carefully considering all the possible consequences, many of which, I believe to be negative as I listed.

Thank you very much for your attention.

Sincerely,
Yasuhiro Ozuru
8901 Winchester Street
Anchorage AK 99507

From: Mark Pachak
To: fortherecord (Energy)
Cc: Hoefler, Annie (Energy)
Subject: Support FOR ANWR Development
Date: Wednesday, November 01, 2017 5:28:06 PM

RE: For Record of November 2, 2017 Hearing

Honorable Chair Murkowski, Ranking Member Cantwell, and Members of the Senate Energy and Natural Resources Committee,

I am an Alaska resident and I strongly SUPPORT the proposed provision for responsible oil and gas development on the minutely small portion the Coastal Plain area of the non-wilderness portion of ANWR.

Please consider the many overwhelmingly positive benefits of this provision in countering the highly sensationalized, exaggerated, and remotely possible, environmental risks in registering your vote to allow this provision to be approved.

Thank you,
Mark Pachak
4330 Sage Circle
Anchorage, Alaska 99516

Sent from my iPhone

From: Jay Page
To: fortherecord (Energy)
Cc: Hoefler, Annie (Energy)
Subject: Opening 1002 area of ANWR
Date: Tuesday, October 31, 2017 7:51:29 PM

Chairman Murkowski, Ranking Member Cantwell, and Members of the Senate Energy and Natural Resources Committee,

I was a 23 year-old laborer on construction of the Trans Alaska Pipeline in the mid 1970's. That remote job in and around Thompson Pass and Keystone Canyon gave a poor boy from Tacoma a grub stake to a successful life the last 42 years. I worked alongside Gene Jackson from NYC, Plino Bonella from Costa Rica, Silvario Mendoza from Mexico and Irish driller Desmond Duffy. I don't know how many came from a poor single parent home and the opportunity to work on a project like this changed their lives – but I suspect there were very many. An ongoing project in the 1002 area and construction of needed infrastructure will provide thousands of jobs nationwide and can be a lifetime game changer for young people like it did for me.

The non wilderness coast plain designated for responsible extraction of oil represents but .01 percent of the 19 million acre refuge. It is just 60 miles from the existing Trans Alaska pipeline that is only running at 1/3 of capacity. The 1002 area is North America's greatest prospect for conventional onshore drilling. America must sustain oil production in Alaska to bridge the gap to alternative sources of energy that will not come to commercial capacities of 25 or more years. Also, the little known fact is, if throughput in the Trans Alaska pipeline drops below what can be pushed to tankers in Valdez, the pipeline – by contract – must be disassembled and shipped out at the owners' expense. That will leave stranded vast amounts of oil and gas for our lifetimes.

This common sense development should not be a political football. Oil development from Alaska is a necessity to offset a decline in Lower 48 shale oil production which is expected to commence in about ten years. We all depend on petroleum products and will for decades to come. This is our opportunity to assure that we will have what we need from a domestic source.

I urge you to support this development as a part of your overall budget effort.

Jay D. Page
1642 Cara Loop
Anchorage, AK 99515

907 242 6624

From: Tom Pappalardo
To: fortherecord (Energy)
Subject: Opposed to reopening the Arctic National Wildlife Refuge for oil and gas
Date: Thursday, November 16, 2017 8:42:04 AM

To Whom it may Concern:

My name is Tom Pappalardo and my address is 2195 Eldred Ave, Lakewood, Ohio 44107. I am writing to ask the Committee not to open the Arctic National Wildlife Refuge for oil and gas drilling. It is my opinion that this will damage our land and wildlife, and that funds reaped as a result will not be worth the cost.

Please vote no.

Sincerely,
Tom Pappalardo

Tom Pappalardo
Enterprise Advisor
Hyland Global Services | Hyland Software, Inc.
440.788.6561 | phone

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From: Carol Parsons
To: fortherecord (Energy)
Subject: Arctic drilling
Date: Tuesday, November 14, 2017 7:35:30 PM

We all need to do this

I am writing to ask that the committee find other means to produce federal revenue than reopening the Arctic National Wildlife Refuge for oil and gas drilling. We should not destroy protected land and endanger wildlife to fund unnecessary tax breaks for the wealthy. Please pass my message along to the Chairman and other committee members
Sincerely
Carol Parsons
US citizen and protector of the earth
241 PONTIAC ST
LESTER PA 19029

Sent from my iPhone

From: Judy Patrick
To: fortherecord (Energy)
Cc: Hoefler, Annie (Energy)
Subject: For Record of November 2, 2017 Hearing on ANWR (support)
Date: Tuesday, October 31, 2017 7:35:48 PM

Dear Chairman Murkowski, Ranking Member Cantrell, and Members of the Senate Energy and Natural Resources Committee,

Please open the non-wilderness area of ANWR to oil and gas exploration and development.

I have spent the past 25+ years photographing oil and gas activity on Alaska's North Slope and I can say first hand that it is being carried out in a careful and environmentally safe way. From "duck ponds" to catch every little drop of fluid that may leak from a vehicle to containment dikes around facilities to drilling moratoriums during critical migration seasons; today's oil and gas companies go the extra mile to be good neighbors and stewards of our resources, and deserve the opportunity to explore what is believed to be a huge oil reserve under ANWR.

With the Trans-Alaska Pipeline (TAPS) running almost empty, opening ANWR is timely and makes economic sense for Alaska and America. Additionally TAPS has proven to be a reliable transporter of crude oil, and we should continue using it as long as possible for everyone's benefit.

I'm sure you will hear many loud and banging arguments against opening ANWR from people who have never even been to Alaska, much less the Arctic, and I suggest that the vast majority, if not all of those comments, are based on information that is outdated, inaccurate and just plain wrong.

I ask for your support to open ANWR.

Thank-you for the opportunity to comment.

Judy Patrick
4331 S. Santana Dr.
Wasilla, AK 99654
907-223-4704

From: Sue Payne
To: fortherecord (Energy)
Subject: PROTECT ALASKA"S WILDLIFE REFUGE FROM OIL & GAS COMPANIES
Date: Tuesday, November 14, 2017 2:21:50 PM

To the Senate Committee on Energy and Natural Resources:

I'm writing to implore the committee to find other means to produce federal revenue than reopening the Arctic National Wildlife Refuge for oil and gas drilling. Please do not destroy protected land and endanger wildlife to fund unnecessary tax breaks for the wealthy. Please pass my message along to the Chairman and other committee members.

Thank you for your time and attention to this crucial issue.

Sincerely yours,

Suzanne Payne

244 Grove St.

Northampton, MA 01060

413-586-5032

Sent from my iPad

From: Mary Ann Pease [mailto:maryann.pease.map@gmail.com]
To: fortherecord (Energy)
Cc: Hoefler, Annie (Energy)
Subject: ALASKA supports ANWR GAS DEVELOPMENT----The time to act is NOW!!!
Date: Tuesday, October 31, 2017 11:22 PM

Senate Energy Committee-

As an Alaskan and staunch supporter of development of Alaska's vast natural resources, I encourage you to support all efforts for oil and gas development in the non-wilderness portion of ANWR.

The United States and World economies are far too reliant on Middle East Oil and it is time to actively support Alaska's oil resources for the betterment of our economy and a stable and secure source of energy for the Future.

For decades, scientific polls have shown Alaskans overwhelmingly support responsible oil and gas development in the non-wilderness portion of ANWR. There is no valid reason why we should not be allowed to access the world-class resources within just a tiny fraction of the coastal plain.

- The proposed ANWR provision would allow development of no more than 2,000 acres of the 1.5 million acres of the Arctic coastal plain – part of the non-wilderness portion of ANWR's 19 million acres. **That is equivalent to just 0.01 percent of the entire refuge**.
- Responsible oil and gas development in this fraction of ANWR will help ensure America's energy security for decades and allow Alaska – and our nation as a whole – to realize the benefits that come from expanding energy production in Alaska.
- While renewable energy is a growing part of America's energy portfolio, it is still projected to account for a minority of American energy production in 2040. New oil and gas production will be required to power America's economy and can serve as a bridge until renewable energy becomes a dominant energy source decades into the future.
- Energy production from ANWR has the potential to offset a decline in Lower 48 shale oil production, which is expected to commence in approximately a decade. Without limited oil development on the coastal plain, America will be forced to once again increase its reliance on foreign imports. With limited development in ANWR, America and Alaska can continue to grow the economy and reduce dependence on foreign oil.
- The U.S. Geological Survey estimates the 1002 Area is North America's greatest prospect for conventional onshore oil production, with a mean likelihood of containing 10.4 billion barrels of oil and 8.6 trillion cubic feet of natural gas, as well as a reasonable chance of economically producing 16 billion barrels of oil.
- Oil development on a fraction of the coastal plain would create thousands of jobs nationwide, generate billions of dollars in government revenue, keep energy prices for American consumers affordable, and further improve energy security for decades into the future.

Regards

Mary Ann Pease
MAP Consulting, LLC
907-529-9719
mpease@acsalaska.net

From: Amy Peloza
To: fortherecord (Energy)
Cc: Hoefler, Annie (Energy)
Subject: For Record of November 2, 2017 Hearing
Date: Wednesday, November 01, 2017 2:33:24 PM

Chairman Murkowski, Ranking Member Cantwell, and Members of the Senate Energy and Natural Resources Committee:

Please consider my comments below IN SUPPORT of responsible oil and gas development in ANWR. As a resident of Alaska and working in the oil and gas industry here for over 20 years, I've seen firsthand what responsible development and production looks like. I live it every day. Thanks to continuing improvements in technology, practices, and oversight, the oil industry has demonstrated over the past 40 years that North Slope energy development and environmental stewardship can and do coexist. The industry has a proven track record of responsible development in sensitive areas, protecting the environment, wildlife and subsistence needs of local residents.

Alaskans support responsible oil and gas development in the non-wilderness portion of ANWR. There is no valid reason why we should not be allowed to access the world-class resources within just fraction (2,000 acres of the 1.5 million acres) of the coastal plain.

Responsible oil and gas development in this fraction of ANWR will help ensure America's energy security for decades and allow Alaska – and our nation as a whole – to realize the benefits that come from expanding energy production in Alaska.

While renewable energy is a growing part of America's energy portfolio, it is still projected to account for a minority of American energy production in 2040. New oil and gas production will be required to power America's economy and can serve as a bridge until renewable energy becomes a dominant energy source decades into the future.

Energy production from ANWR has the potential to offset a decline in Lower 48 shale oil production, which is expected to commence in approximately a decade. Without limited oil development on the coastal plain, America will be forced to once again increase its reliance on foreign imports. With limited development in ANWR, America and Alaska can continue to grow the economy and reduce dependence on foreign oil.

The U.S. Geological Survey estimates the 1002 Area is North America's greatest prospect for conventional onshore oil production, with a mean likelihood of containing 10.4 billion barrels of oil and 8.6 trillion cubic feet of natural gas, as well as a reasonable chance of economically producing 16 billion barrels of oil.

Alaska's economic lifeline, the Trans-Alaska Oil Pipeline System (TAPS), is now running at three-quarters empty. New oil production from ANWR has the potential to reverse throughput in TAPS, a vital component of American energy infrastructure.

Oil development on a fraction of the coastal plain would create thousands of jobs nationwide, generate billions of dollars in government revenue, keep energy prices for American consumers affordable, and further improve energy security for decades into the future.

Since the ANWR coastal plain is less than 60 miles from TAPS, development of energy resources there is one of the most environmentally-sound way to increase oil production in Alaska.

Thank you,

Amy Peloza
Waste Environmental Specialist

Hilcorp Alaska, LLC
3800 Centerpoint Drive, Suite 1400
Anchorage, AK 99503
(907) 777-8348 – office
(907) 317-0521 – cell
Email: apeloza@hilcorp.com

From: Henry Penney
To: fortherecord (Energy)
Cc: Hoefler, Annie (Energy)
Subject: Support of ANWR Development
Date: Tuesday, October 31, 2017 3:17:27 PM

Chairman Murkowski
Ranking Member Cantwell
Members of the Senate Energy and Natural Resources Committee

My name is Henry Penney. Like Senator Murkowski, I am a lifelong Alaskan born in the Territory of Alaska. We have seen many, many changes here since statehood in 1959. In my opinion, the most impactful change was the discovery and development of oil and gas.

Given the size of Alaska (better than twice that of Texas), our small population (less than 750,000), and arctic location, we face challenges that are unimaginable in the rest of the United States. Oil and gas development has provided us with the resources improve life for our people. There is still however much to be done.

Oil and gas development has generally been very good for our state. Yes, we've made a few mistakes, but we've learned from them. Limited, responsible oil and gas development in the non-wilderness portion of ANWR will be good for our state and the country.

As noted above, Alaska is big – better than twice the size of Texas. We have plenty of space for responsible oil and gas development AND wilderness preservation areas.

Thank you for your time. I hope you will support the ANWR provision.

Henry Penney
2091 Shepherdia Drive
Anchorage, AK 99508

907-276-2222 Work
907-278-0896 Fax
907-223-6639 Mobile
hpenney@pencoak.com
hpenney@aol.com

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From: Stan Pennington
To: fortherecord (Energy)
Subject: Protect Alaska"s Wildlife Refuge from Oil and Gas Companies
Date: Wednesday, November 15, 2017 11:38:50 AM

I am Stanley W. Pennington and am a constituent from Colorado Springs, CO 80907

Please find other means to produce federal revenue than reopening the Arctic National Wildlife Refuge for oil and gas drilling. We should not destroy protected land and endanger wildlife to fund unnecessary tax breaks for the wealthy.

Please pass my message along to the Chairman and other committee members.

Thanks,

Stanley W Pennington
2414 Magellan St
Colorado Springs, CO 80907

From: Robert Perkins
To: fortherecord (Energy)
Subject: 1002 ANWR
Date: Tuesday, October 31, 2017 3:37:01 PM

Dear Chairman Murkowski and Ranking Member Cantwell,
Please support opening the 1002 Area of ANWR. I have worked on the North Slope in the 1970's and hunt, fish, and have recreated north of Brooks Range in the years since. The oil development has had no negative effect on the Caribou population. The North Slope oil producers are subject to some of the strictest environmental regulations and severest oversight of any industry in the world. The US economy will benefit from the continuation of low energy prices in the future – it will take 10 years for ANWR oil to reach market.

Dr. Robert A. Perkins, PE
Professor of Civil and Environmental Engineering
University of Alaska Fairbanks
Fairbanks 99775
907 474 7694
raperkins@alaska.edu

From:	Darcy Peter
To:	fortherecord (Energy)
Cc:	Hoefler, Annie (Energy)
Subject:	Chairman Murkowski, Ranking Member Cantwell, and Members of the Senate Energy and Natural Resources Committee
Date:	Wednesday, November 15, 2017 7:12:18 PM
Attachments:	image001.png

For Record of November 02, 2017 Hearing.

While I can see how drilling for oil can be appealing and beneficial in the financial short-term of things, as both a Gwich'in woman who would like to continue to live off the land and lead a traditional lifestyle for my children/grandchildren and as an Arctic scientist, I cannot support the drilling for ANWR. A refuge is supposed to be a PROTECTED area of land that cannot be touched or harmed. Drilling for oil in the Arctic (ANWR) will:

1. Release copious amounts of stored vulnerable carbon (CO2/CH4) into the atmosphere which will GREATLY increase greenhouse gas emissions and contribute to the global climate crisis. As a result, coastal Alaska Native communities (who are in no way equipped to deal with oil spill clean-ups or increased air temperatures) will have to deal with increases in oil spill clean-ups, erosion and permafrost thaw, which they have no capacity to do. Imagine an oil spill in the Yukon River and what that would mean for Gwich'in fishing/subsistence way of life… that's what will more than likely happen to coastal communities.
2. Be a step **away** from utilizing renewable energy, which would, again, contribute hugely to climate change via increase ambient air temperatures (oil & gas as a primary energy source is 110% environmentally detrimental).
3. Serve as Trump's foot in the door to complete environmental takeover; it will greatly increase the likelihood of drastically expanding the "sliver" of the refuge to complete oil drilling. If we were to allow oil drilling in "such a small area of the refuge" now, the chances of opening the ENTIRE refuge to drilling is grossly increased. Look at Prudhoe Bay.
4. Be monumentally lethal to the caribou herd's breeding grounds. Government officials say, "the migration pattern will just shift to the side," but they don't shift, they end. They die. If caribou can't go to the place they're wired to return to every year, they will die, meaning Gwich'in people/interior natives will no longer be able to hunt caribou, which is vital in our subsistence.

I also believe that because the federal government demanded that Alaska Native's belong to a corporation (ex/ Doyon, Bristol Bay, ASRC, Ahtna, etc.) after western contact, the ONLY job or priority of these federally demanded "native" corporations is to make money. As you may or may not know, there are many different entities present in villages: there are corporations, tribal governments, city officials, etc. that can all exist within one community (Beaver, Fort Yukon, Ruby, etc.). This does not mean that Native corporations (Doyon, etc.) speak for or represent native people, because at the root, the only goal is profit. All the corporations care about is money and all the city officials care about is the development of the city (schools, councils,

roads, etc.). This means that the Tribal governments in these Alaska Native villages are the ONLY entity present that represent and stand for what **the people** want and need, to make sure their voices are heard. I strongly believe that the mere development and existence of Native corporations is inherently colonialism; it is the federal government's attempt to get Alaska's indigenous people reliant on a federal system, and exploit the native people who disagree and are not reliant (who is, the majority of the time, Alaska Natives who live in the villages). I don't believe that oil drilling will benefit Alaska Native people at all because we don't need roads, we don't need clinics or schools (that likely won't even stay open due to lack of population)… we don't need anything. All we're asking is to **continue to live the way we have been, which is living off the land and hunting caribou and moose**.

This was not a "hearing" to hear all opinions of ANWR drilling; it was more like vultures attacking those who don't support oil drilling. There was one individual (**Samuel Alexander**) who is not part of a corporation or agency, he is merely a Gwich'in man who seems to be the only one standing up for Alaska's indigenous people. He brought up amazing topics like:
"We're connected to the caribou. All I hear is constant talk about how we need to develop this and that. We're constantly being told that we need to develop: develop jobs and income and infrastructure. What I think we need is a little understanding of the sustainability of the life that we live as Gwich'in. We're not sitting here asking for anything. We're not saying 'we need hospitals, we need schools, we need all these things. We're not saying 'give us money.' What we're saying is 'let us live as Gwich'in. Because we already recognize the wealth that we have as a people. There's nothing that you can give us. We recognize it's something that can be taken away from us. So, when we talk about the land and we talk about the caribou, it's in reverence to them."

"It's funny because I hear constant talk about how we need economic development, economic development. But what does that mean? I think that's not a recognition that the subsistence economy is a real thing. I find it hard to understand. Why would a Gwich'in person want to work a 40 hours a week job so they can turn around and buy organic food? How does that make sense to anybody? Why would you do that? So, I'm going to go work harder so I can buy food of lower quality? How does that make sense? That doesn't make sense to me. That's why we're perplexed at what you say when you're talking about progress. Is progress eating spam? Is that progress? I don't think so. Here, down in the states, when you want to talk about status, people talk about going to Whole Foods and eating organic food. That's status. You're saying it's important for our health to eat organic food. So what is all this drilling for? So that we can have money to do what? To live like Gwich'in? We already live like Gwich'in. We're not trying to change anything in that regard. I think you can learn a lot by seeing how we live."

Oil drilling will do absolutely nothing for the Alaska Native people. It will be yet another step towards colonialism and exploitation. You don't see the Native people from Prudhoe Bay filling all of those oil jobs; people from the Lower 48 travel up here to take those jobs, and a lot of the time they're gusuks who are more educated than Alaska Natives, therefore are more appealing to other gusuks.

Also, Alaska is at the end of our ropes. As a state, we cannot continue to sustain/fund the government via oil. What's going to happen when we have no more oil and all of our fish and wildlife are dead, and our environment is destroyed as a result? What's going to happen when our culture is dead as a result? We won't have money, ~1/2 of Alaska Native villages won't exist, and those still remaining will likely have to move to other communities (drastically impacting our identity/culture), tourism (revenue) will greatly decrease, and we'll likely have to re-draw Alaska's borders due to the drastic environmental impacts of climate change. Our cultures will die, and we'll be broke with no resources.

Blessings,

Darcy L. Peter (Koyukon & Gwich'in Athabascan)
Research Assistant
Alaska Institute for Justice
Research & Policy Institute
431 W. 7th Ave. Suite 208
Anchorage, Alaska 99501
907-297-2774 (office)
907-347-0000 (cell)
907-279-2450 (fax)
www.akijp.org

Alaska Immigration Justice Project • Language Interpreter Center • Research & Policy Institute

From: anrpetro@gci.net
To: fortherecord (Energy)
Cc: Hoefler, Annie (Energy)
Subject: For Record of November 2, 2017 Hearing
Date: Wednesday, November 01, 2017 5:04:45 PM

Chairman Murkowski, Ranking Member Cantwell and Members of the Senate Energy and Natural Resources Committee:

Opening ANWR's 1002 area to oil and gas exploration and development is a proactive step you can take to advance America's energy security while boosting both the Alaska and the U.S.'s economies (both public and private sectors). The vast majority of Alaskans support this provision as it allows exploration on a tiny fraction in the non-wilderness portion of the 19 million acre refuge. I support responsible resource development and encourage you to do the same - for the benefit of all Americans.

Renewable energy is growing, but is projected to account for a minority of energy production and needs through 2040. Use of oil and gas continue to be needed to power our economy and provide a bridge until renewable energy becomes more economical and dominant.

Thank you for advancing America's responsible resource use and economy by supporting exploration and development in ANWR's 1002 area.

Thank you,
Andy & Rachael Petro

Andy & Rachael Petro
59 Avalon Terrace
Wenatchee, WA 98801

November 1, 2017

The Honorable Lisa Murkowski
U.S. Senate – Alaska
The Honorable Maria Cantwell
U.S. Senate – Washington
Members – Senate Energy and Natural Resources Committee

Dear Chairman Murkowski and Ranking Member Cantwell:

FOR RECORD OF NOVEMBER 2, 2017 HEARING

Please consider this as a strong message of support for including the ANWR drilling provision in the Budget reconciliation bill that you will be hearing in committee tomorrow.

For many years, my family and I have supported opening the 10-02 area of the Coastal Plan to allow for exploration and possible development. We are a fifth-generation Alaskan family who have spent our lives working for the betterment of Alaska and her economy. We understand the need to balance responsible natural resource development with the obligation to protect our environment.

Alaskans have proven to the world that we can do this – forty plus years of oil and gas industry development on the North Slope of Alaska is evidence that development can be done responsibly while at the same time providing an economic foundation for our State.

I appreciate the work you all are doing in committee and trust that you will allow the ANWR provision to remain in the bill so it can be voted on by all members of the Senate.

Respectfully,

Gail Phillips
Former Speaker of the Alaska House of Representatives
1136 Northpointe Bluff Drive
Anchorage, Alaska 99501
907-277-4867
gailphil@alaska.net

From: Ron Pichler
To: fortherecord (Energy)
Cc: Hoefler, Annie (Energy)
Subject: Opening ANWR to Exploration Drilling and Development
Date: Wednesday, November 01, 2017 4:54:50 PM

11/1/17

Ref: Opening Coastal Plain of ANWR to Exploration Drilling and Development

Chairman Murkowski, Ranking Member Cantwell and Members of the Senate Energy and Natural Resources Committee,

I'm writing to support your vote to open the coastal plain of ANWR to oil and gas exploration drilling and development. As a life long Alaskan I have supported this area of ANWR to be open for oil and gas development. As you may be aware, the Alaskan economy is in an economic down turn, unemployment in our state is high and predictions for the future of the economy improving are 2-3 years off. Alaskans need the jobs that can be provided through safe, responsible development of our states natural resources. By opening this area to development it would help our states economy by providing the much needed employment and the nation would benefit from the added inventory of USA owned oil and gas. Please vote to OPEN the Coastal Plain of the ANWR to oil and gas exploration and development.

Thank You

Ron Pichler
President - Denali Drilling, Inc.
8240 Petersburg Street
Anchorage, Ak 99507
Office - 907-562-2312
Cell - 907-440-2290
www.denalidrilling.com

From: Jeremy P
To: fortherecord (Energy)
Subject: Arctic National Wildlife
Date: Saturday, November 11, 2017 9:55:09 AM

I'm writing to ask that the committee find alternative means for federal revenue instead of reopening the Arctic National Wildlife Refuge for oil and gas drilling. Please don't let this protected land and the wildlife to which if provides life become endangered. Please hold this national sanctuary in trust for future generations of children, so that they can also witness the beauty of this great land.

Please pass this message along to the Chairman and other committee members.

I am a constituent from Jenkintown PA.

Jeremy Pitcairn
316 Evergreen Rd
Jenkintown PA 19046

From: Ronald Place
To: fortherecord (Energy); Hoefler, Annie (Energy)
Subject: It"s Time To Open ANWR!
Date: Tuesday, November 21, 2017 3:26:10 PM

Dear Chairwoman Murkowski,

It is time to open ANWR for oil exploration. By accessing and developing this tiny fraction of the coastal plain to responsible energy development, ANWR will have a positive impact on Alaska's families and businesses, as well as the country as a whole. The positive effects of developing this area would be felt immediately with the creation of thousands of jobs, the generation of billions in new revenue, and would help reduce our dependence on foreign sources of oil.

Alaska's economic vitality has long been intertwined with those in the Lower 48. Many companies are key investors in Alaska's multi-billion dollar seafood, tourism, shipping and retail industries. Since the inception of the Trans Alaska Pipeline System (TAPS), Alaska has provided American workers with high-paying careers in the oil industry and thousands of American companies with a steady demand of fuels for goods and services that we all depend on each and every day. Responsible oil exploration in Alaska is not just the life-blood of the Last Frontier, it is the answer to meeting our energy demands, providing family supporting wages, and economic development to communities in Alaska and beyond.

With advances in new applications and technology, we can safely explore this 1002 area of ANWR. I encourage you all to approve this measure that would have a positive impact on the entire country and show that responsible energy development can and does coexist with Alaska's environment and its wildlife.

Ronald Place

Po Box 468, Klawock, Alaska

From: Jim & Jan Plaquet [mailto:jandjplaquet@gci.net]
Sent: Tuesday, October 31, 2017 7:59 PM
To: fortherecord (Energy)
Subject: Chairman Murkowski, Ranking Member Cantwell, and Members of the Senate Energy & Natural Resources Committee

This year's Presidential and Congress elections were all about developing Alaska's Natural Resources. If we make available these resources much employment, state revenue and prosperity will be provided. It's about jobs. Job's for today's Alaskan's and jobs that today's high school and college students will be desperately seeking here at home when the time comes for them to start their working lives. One thing that might help is action in Congress to open the coastal plain of the Arctic National Wildlife refuge for oil and gas exploration and development.

In, fact, 78 percent of Alaskans support oil exploration in the 1002 area. Every Alaskan Governor and every legislature and elected congressional representative and senator from Alaska have supported responsible development. The opening of ANWR to exploration has everything to do with Alaska's right to develop its natural resources. With Prudhoe Bay oil reserves in decline, it is essential that new areas be opened for oil exploration and development. The Trans-Alaska Pipeline is operating at less than one-third of it's original capacity of 2.2 million barrels a day.

Government and industry experts predict huge amounts of oil and gas lie beneath the coastal plain, enough to serve America's needs for 30 years and more. Upwards to 16 billion barrels of oil and 18 trillion cubic feet of natural gas are estimated to lie within the 1002 area of ANWR. Oil exploration in ANWR would take place on just 2,000 acres of its 1.5 million acre coastal plain, which amounts to a tiny fraction of Alaska's protected lands. The land is on the coastal plain, a tiny sliver of the huge wildlife refuge. Congress excluded the "1002 area" from ANWR's large Wilderness block in a compromise struck under ANILCA. The compromise doubled the size of the Arctic Refuge and designated 8 million acres Wilderness. Congress also mandated a study of the 1002 area's environment and petroleum resources. In 1987. the Department of the Interior concluded oil development would have minimal impact on wildlife and recommended Congress open the coastal plain to development.

The essential needs of Alaska's working families all across this vast and beautiful state depend on the responsible development of our natural resources. For us, environmentally responsible development in a tiny portion of the Arctic Refuge means jobs and the opportunity to improve our schools and other public services. The opening of ANWR to exploration would be the best economic news to hit this state in many years. It would mean thousands of jobs for Fairbanks workers and billions of dollars in revenue for the State of Alaska. ANWR would create high paying jobs for Fairbanks to earn and enjoy a livable wage.

Green activists have shut down most of Alaska's large job producing industries, harassed many of the rest and blocked oil exploration on the coastal plain of ANWR. Their goals are to withdraw more land in Alaska, prevent timbering in Alaska, prevent mining in Alaska, prevent oil and gas

development in Alaska. However the greatest challenge that Alaska faces is a lack of urgency. Alaskans need to wake up to what the extremists are doing to us. Alaska already contains 58 million acres of federal Wilderness, an area larger than the combined size of New York, New Jersey, Connecticut, Rhode Island, Massachusetts, Vermont and New Hampshire. Alaska accounts for 53 percent of America's federal Wilderness areas. Environmentally conscious obstruction is something else entirely.

Prudhoe Bay oil is in decline and it is essential that new areas be opened for exploration and development. Opening ANWR to oil and gas exploration will benefit the State of Alaska through increased revenues and the citizens of Fairbanks with jobs and income. Alaskans need to work in the oil patch and development our most important natural resource laying thousands of feet below the tundra's surface.

Jim Plaquet is a 42 year member of the International Union of Operating Engineers Local 302

1444 2nd Ave
Fairbanks, AK 99701
Cell# 388-6063

From: Mimi Plevin-Foust
To: fortherecord (Energy)
Subject: Don"t open ANWR for gas and oil exploration or drilling
Date: Tuesday, November 28, 2017 5:09:36 PM

I am writing to strongly urge you NOT to allow this pristine nature preserve to be despoiled by gas or oil exploration, drilling or development of any kind. There is no evidence that doing so will lead to the revenue projections of the Trump administration and that land is simply not needed to help the U.S. meet its energy requirements.

Furthermore, experts agree that oil and gas development in this area would permanently and irreversibly disrupt the ecological integrity of the refuge which is a home to an extraordinary array of wildlife, including threatened species like the polar bear and many others. The native people living and hunting on the refuge depend on having a permanently protected refuge for their very survival. 200 species of birds migrate from the refuge to every state in the U.S. and to other continents. You can learn more about this at: http://refugeassociation.org/advocacy/refuge-issues/arctic/.

Finally, in the battle to save our planet from climate change, scientists have discovered that the pristine, undeveloped areas of the earth can help us cool and preserve the entire planet. Rather than develop the precious preserved acres we now have left like ANWR, we need to preserve even more of our country to prevent catastropic climate havoc from ruining the rest of our country and the world.

I strongly urge you to do everything in your power to protect this precious haven.

Sincerely,

Mimi Plevin-Foust
2700 Coventry Road
Shaker Hts., OH 44120
Freelance Writer, Poet & Content Creator
http://mimiplevinfoust.com/
(216) 551-3389
Service is the rent that you pay for room on this earth. ~Shirley Chisholm

From: Don Pohland
To: fortherecord (Energy)
Cc: Hoefler, Annie (Energy)
Subject: For Record of November 2, 2017 Hearing on ANWR
Date: Wednesday, November 01, 2017 1:27:17 PM

To Chairman Murkowski, Ranking Member Cantwell, and Members of the Senate Energy and Natural Resources Committee:
I have been made aware of a hearing tomorrow on an ANWR drilling provision. Please note my support of opening a portion of ANWR for oil and gas exploration and drilling activity.
Thank you

Don Pohland
3800 W 43rd Ave
Anchorage, AK 99517
donp@jlproperties.com

From: Steve Post
To: fortherecord (Energy)
Subject: ANWR support
Date: Thursday, November 02, 2017 11:18:49 AM
Attachments: image005.png

Chairman Murkowski, Ranking Member Cantwell, and Members of the Senate Energy and Natural Resources Committee

Alaska has been home for over 20 years. I help run a company that employs roughly 75 people with most directly related to the responsible development of Alaska's resources. At the end of the day it is simply helping us put a roof over our head, foo on the table and new shoes to go to school and work in. ANWR represents great promise to support Alaska's economy to continue to provide jobs for the people of our State.

I would ask that you consider the following points as you all proceed with your hearing on allowing limited oil and gas activities in the ANWR area.

- Polls have consistently shown that we Alaskans overwhelmingly support responsible oil and gas development in the non-wilderness portion of ANWR. There is no valid reason why we should not be allowed to access resources within just a tiny fraction of the coastal plain.
- The proposed ANWR provision under consideration would allow development of no more than 2,000 acres of the 1.5 million acres of the Arctic coastal plain – part of the non-wilderness portion of ANWR's 19 million acres. That is equivalent to just 0.01 percent of the entire refuge.
- Responsible oil and gas development in this fraction of ANWR will help ensure America's energy security for decades and allow Alaska,– and our nation as a whole, to realize the benefits that come from expanding energy production in Alaska.
- While renewable energy is a growing part of America's energy portfolio, it is still projected to account for a minority of American energy production in 2040. New oil and gas production will be required to power America's economy and can serve as a bridge until renewable energy becomes a dominant energy source decades into the future.
- Energy production from ANWR has the potential to offset a decline in Lower 48 shale oil production, which is expected to commence in approximately a decade. Without limited oil development on the coastal plain, America will be forced to once again increase its reliance on foreign imports. With limited development in ANWR, America and Alaska can continue to grow the economy and reduce dependence on foreign oil.
- The U.S. Geological Survey estimates the 1002 Area is North America's greatest prospect for conventional onshore oil production, with a mean likelihood of containing 10.4 billion barrels of oil and 8.6 trillion cubic feet of natural gas, as well as a reasonable chance of economically producing 16 billion barrels of oil.
- Alaska's economic lifeline, the Trans-Alaska Oil Pipeline System (TAPS), is now

running at three-quarters empty. New oil production from ANWR has the potential to reverse throughput in TAPS, a vital component of American energy infrastructure.

- Oil development on a fraction of the coastal plain would create thousands of jobs nationwide, generate billions of dollars in government revenue, keep energy prices for American consumers affordable, and further improve energy security for decades into the future.
- Since the ANWR coastal plain is less than 60 miles from TAPS, development of energy resources there is one of the most environmentally-sound way to increase oil production in Alaska.

Thanks to continuing improvements in technology, practices, and oversight, the oil industry has demonstrated over the past 40 years that North Slope energy development and environmental stewardship can and do coexist. The industry has a proven track record of responsible development in sensitive areas, protecting the environment, wildlife and subsistence needs of local residents. I ask that you support and include the ANWR drilling provision in the budget reconciliation bill.

Respectfully yours,

Steve

Steve Post

Vice President
907-263-0117
907-227-5897 cell
790 Ocean Dock Rd
Anchorage, AK 99501

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STATEMENT FOR THE RECORD OF
GENERAL JOSEPH W. RALSTON

BEFORE THE

COMMITTEE ON ENERGY AND NATURAL RESOURCES
U.S. SENATE

HEARING RECORD FOR

HEARING TO RECEIVE TESTIMONY ON THE POTENTIAL FOR OIL AND GAS EXPLORATION IN THE 1002 AREA

NOVEMBER 8, 2017

Chairwoman Murkowski, I submit the following testimony to discuss the key national security and geostrategic benefits of expanding the United States' access to new oil and natural gas reserves in the 1002 area of the Arctic National Wildlife Refuge (ANWR). I have served as Special Envoy for Countering the Kurdistan Workers Party (PPK), Vice Chairman of the Joint Chiefs of Staff, and the Supreme Allied Commander for NATO. Through my experiences in the military, national security, and foreign policy fields, I have seen the importance of energy not just as a resource to fuel our military and economy, but as a geostrategic resource that can realign our interests and position in the world in relation to our allies and our rivals. Securing America's domestic resources to supply our military and our allies is a vital tool in addressing our adversaries' influence in various regions across the world. Thus, in my opinion opening the 1002 area of ANWR will add to the U.S.'s existing energy dominance and further allow us to project our position as a stabilizing force in the world.

Energy security is increasingly becoming a key military and geopolitical strategic issue that cannot be ignored. Russia's invasion and annexation of Crimea was in part due to Ukraine's

attempts to secure their energy resources and reduce dependence on Russian natural gas. Additionally, Rosneft and Gazprom along with other Russian oil and gas interests have been investing in the Middle East, Asia, and South America to secure interests in pipelines and state run companies. Through these investments, Russia seeks to influence policies and buy power in unstable regions. Recent investments by Rosneft in a pipeline in the Kurdish Region of Iraq have shown Russia's intent to look beyond Syria in the Middle East. Further, as oil prices have stayed low in many regions, we have seen regimes like Venezuela destabilize and create security and humanitarian crisis. Russian investments in Venezuela have raised concerns that Russia could exert political influence over the county, but also a default could lead to Russian control of companies like Citgo, which is 4% of the American refining sector. Finally, as recognized in a recent book by Harvard Professor Meghan L. O'Sullivan, it has been the U.S. oil and natural gas boom and global price decline far more than sanctions that have impacted Russia's economy in the past 5 years.

What is clear is that our enemies will not hesitate to use energy as a strategic resource and increasing our production and global energy presence will be vital in the future to ensure our National Security. Thus, to face the realities of modern threats and develop long term strategic security planning, the United States and its allies must explore and secure stable supplies of domestic oil and gas. Developing our Arctic resources in the 1002 area can help fuel U.S. energy dominance at home and abroad.

Energy Security and Resilience:

The Department of Defense over a 7 year period from 2007 to 2014 consumed approximately 762 million barrels of oil. According the 2016 DOD Energy report in 2014 alone, the "DOD consumed 87.4 million barrels of fuel … to deploy and sustain worldwide

mission." This oil fuels our jets, helicopters, troop transports, and supplies our troops with the food, equipment and resources they need to be the most capable fighting force in the world and protect America's interest at home and abroad. To achieve our missions and protect our service men and women, we must continue to develop and secure robust and resilient supplies of oil to fuel our military. To ensure our energy security and project U.S. energy dominance we must look to our domestic oil supply.

To achieve this goal Congress must open the 1002 area of the Arctic National Wildlife Refuge. The vast untapped resources in the 1002 area of the Arctic National Wildlife Refuge offer an opportunity for the U.S. to develop a secure supply line of expanded domestic reserves to fuel our military. The U.S. Geological Survey has estimated that as much as 11 billion barrels of oil could be recoverable from this area. That is nearly 125 years of supply at 2014 demand levels for the military alone.

Strategic Arctic:

While we are debating whether to invest in the Arctic, other nations are pushing forward to stake ground and invest in the economy and defense interests of this opening region.

Russia is pushing full steam ahead to claim prominence in the Arctic. They even planted a titanium flag on the North Pole. They have not stopped with simple gestures of intention. Instead they have doubled down on building new Arctic bases, energy facilities and infrastructure, and airfields from which they can stage and project power. To supplement and support these assets Russia boasts a fleet of over 40 icebreakers including the world's largest military designed icebreaker. The United States has two. Even China is moving into this space to capitalize on our inaction. China is beginning to think and act like a "near-Arctic" state.

The U.S. has not kept pace with this investment or challenge in the Arctic. Instead we have abdicated our position in the Arctic, letting our icebreaker fleet dwindle and until the most recent administration, consistently locking up our Arctic resources and putting the U.S. on a path to abandoning our presence in the region. To correct these failures, the Trump Administration and Congress have signaled a shift to strategically building our Arctic presence. From moving forward with lease sales in the Beaufort and Chukchi seas to developing offshore exploration and production, to expanding exploration and production in the NPR-A the Administration has made a commitment to keeping pace with Russian activity in the Arctic. The 1002 Area would be another clear signal of U.S. intent to remain an Arctic power and preserve future options in the energy and security context.

In conclusion, as General James Jones and I wrote last summer "Energy and natural resources have long provided the lifeblood for economic investment and growth, buoying the local economy, supporting communities on the North Slope, and providing a foundation for continued military investment. With a resurgent Russia and complicated border issues that require intricate diplomacy, it is time for the U.S. to resume its place as a global leader in the Arctic and back its claims with action."

From: Martha Raynolds
To: fortherecord (Energy)
Subject: For Record of November 2, 2017 Hearing
Date: Friday, November 03, 2017 11:59:15 AM

Dear Senator Murkowski and others Members of the Senate Energy and Natural Resources Committee,

I would also like to speak up for the value of wilderness for humans. I worked on a project that mapped human effects on the landscape around Nuiqsut. Around the village are a few trails, headed in the main directions away from town. The rest of the tundra is relatively undisturbed. But across the Colville River, in the area of the Alpine oilfield, the areas is criss-crossed by trails easily visible in satellite imagery. Every few hundred yards there is another trail – perhaps a seismic line, perhaps a construction road. Despite regulations to limit the impacts of tundra travel by requiring frozen, snow-covered ground, it it obvious that the footprint of economic development has damaged huge areas of fragile tundra vegetation. This area is no longer wilderness, in the sense of an undisturbed landscape that can bring a feeling of peace to a human heart damaged by our unhealthy relationship to our planet. It is yet another landscape that has been subjugated to our economic prioritization.

It breaks my heart to think that the coastal plain of the National Arctic Wildlife Refuge might go this same route. Studies I worked on back in the 80s clearly showed the impacts of seismic exploration. And that was the old, wide-spread 2-D seismic. Modern, 3-D seismic exploration is much tighter, with many more, closely spaced lines that compress and scuff the fragile tundra vegetation that protects the permafrost.

I urge you to protect the only sliver of the Alaska Coastal Plain that is designated a "Refuge". There are so many reasons to not open it - philosophical, biological, ethical, even economic. There is only one reason to open it - politics. What a poor reason to waste this jewel.

Sincerely,
-- Martha Raynolds
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-
Martha Raynolds

MarthaRaynolds@gmail.com
(907) 479-3726

From: Sheldon Reber
To: fortherecord (Energy)
Subject: Senate Committee on Energy and Natural Resources: Do Not Open the Arctic National Wildlife Refuge for Oil and Gas Drilling
Date: Thursday, November 02, 2017 12:07:57 PM

Senate Committee on Energy and Natural Resources

I'm writing to ask that the committee find other means to produce federal revenue than reopening the Arctic National Wildlife Refuge for oil and gas drilling. We should not destroy protected land and endanger wildlife to fund unnecessary tax breaks for the wealthy. Please pass my message along to the Chairman and other committee members.

Sheldon J. Reber
1838 Slater Street
Santa Rosa, CA 95404

From: ashleyreed@gci.net
To: fortherecord (Energy)
Subject: Opening the 1002 Area of ANWR
Date: Tuesday, October 31, 2017 2:53:36 PM

Dear Chair Murkowski and Ranking Member Cantwell:

I am writing in support of opening the 1002 Area of ANWR. The negative hyperbole and opposition surrounding the opening of ANWR tends to be based on misguided and incorrect information.

The 1002 Area of ANWR represents about 1% of the refuge. The rules and regulations surrounding its development will be more stringent and environmentally sound than anywhere else on our planet.

The 1002 Area of ANWR represents a tremendous opportunity to strengthen our nation's energy security. Likewise, it will provide substantial revenues to both the Federal and State of Alaska's treasury.

The Alaska Native residents overwhelmingly support the responsible development of ANWR. They know that their subsistence lifestyle is not harmed by oil development. The catastrophic predictions and decimation of the area's wildlife based on oil production were simply overstated fear mongering that never panned out. In fact, the North Slope's caribou herd is stronger today than it was prior to Prudhoe Bay and other North Slope oil development.

A vote in support of opening ANWR is a vote that will create jobs, add to our Federal treasury, enhance our nation's energy security and improve the lifestyles of Alaska's indigenous people. A vote against opening the 1002 Area represents a callous disregard for the people of Alaska and the Alaska Natives that call the North Slope their home, creates a larger Federal deficit, does nothing to help our nation's goal of reaching energy independence and is little more than spineless politicians pandering to environmentalists and Democratic elitists who care little about working men and women.

I hope and trust that you will stand up for America and support opening the 1002 Area of ANWR. It's time to decide to put ANWR to work for America instead of allowing it to continue to be just a fund raising mechanism for anti-development environmental groups.

Regards,

Ashley Reed
2504 Loussac Drive
Anchorage, AK 99517
907. 229. 4049
Sent via BlackBerry by AT&T

From: Everett Reed
To: fortherecord (Energy)
Subject: For Record of November 2, 2017 Hearing
Date: Tuesday, October 31, 2017 4:42:50 PM

We favor responsible development of all of our energy resources, including those in ANWR to make our country energy self-sufficient and independent. It also seems a bit elitist and arrogant to exploit and develop resources in other countries while ignoring those in our own.

Alaskan Voters
Everett & Carol Reed
11351 Discovery View Dr # 106
Anchorage AK 99515

From: Mark Reese
To: fortherecord (Energy)
Subject: ANWAR Hearing
Date: Friday, November 03, 2017 2:46:01 PM

To whom it may concern:

I'm calling to ask that the committee find other means to produce federal revenue than reopening the Arctic National Wildlife Refuge for oil and gas drilling. We should not destroy protected land and endanger wildlife to fund unnecessary tax breaks for the wealthy. Please pass my message along to the Chairman and other committee members.
Sincerely,

Mark Reese
913 W. Agatite #2
Chicago, IL 60640
773.255.3249

From: Forrest Reeve
To: fortherecord (Energy)
Cc: Hoefler, Annie (Energy)
Subject: I support opening ANWR
Date: Thursday, November 02, 2017 3:59:12 AM

Chairman Murkowski, Ranking Member Cantwell and Members of the Senate Energy & Natural Resources Committee,

I would like to express my support for opening the Arctic National Wildlife Refuge (ANWR) for much needed oil and gas development. Recent years have been filled with declines in production and loss of jobs, negatively effecting our economy as a whole. My belief is that opening ANWR will be the economic stimulus that Alaska needs.

"The will to work of everyone in the country is the best guarantee of national survival."
-Bhumibol Adulyadej

Sincerely,

Forrest Reeve
7511 Labrador Circle
Anchorage, Alaska 99502

From: Renee Limoge Reeve
To: fortherecord (Energy)
Cc: Hoefler, Annie (Energy)
Subject: I support opening ANWR
Date: Wednesday, November 01, 2017 8:55:08 PM

Chairman Murkowski, Ranking Member Cantwell and Members of the Senate Energy & Natural Resources Committee,

I am contacting you today to express my full support for opening a small portion of the Arctic National Wildlife Refuge for responsible oil and gas development.

When it comes to the marriage between development and the environment, no one on the planet does a better job that Alaska. The companies and contractors who do business here love this state and want to see the extraction of our resources coexist with the Alaska we know and love. And we do just that.

Natural resource development is the lifeblood of our state, please allow us to do what we do best and not only provide jobs and a healthy economy for our state, but also provide oil and gas for the United States. We can be a huge part of energy security for the country. Please allow development in the 1002.

Respectfully,

Renee Limoge Reeve
7511 Labrador Circle
Anchorage, AK 99502

Renee Limoge Reeve

From: Jesse Reh
To: fortherecord (Energy)
Cc: Hoefler, Annie (Energy)
Subject: ANWR
Date: Wednesday, November 01, 2017 7:59:10 PM

"Dear Chairman Murkowski and Ranking Member Cantwell,

I am an Alaskan that supports the opening of the 1002 area of the Arctic National Wildlife Refuge. Alaskans have developed the North Slope oil fields responsibly and will continue to do so with NO effects to the Arctic Caribou herd or any other animal species. We are the caretakers of the environment and we need you to vote in favor of development."

I Believe this would be critical for Alaska's economy, and would provide jobs and infrastructure for Alaskans. I think that renewable energy is important for America's future, But I also think that new oil and gas production will be required to serve as a bridge until renewable energy becomes a dominant source which could be years into the future. I also believe that energy development and environmental stewardship can coexist.

Thank You

Jesse Reh
Parts Manager
Western Peterbilt LLC.
3000peger rd. Fairbanks
P:907-474-0939 | C:907-251-7354

From: buckrice1@earthlink.net
To: fortherecord (Energy)
Cc: Randy A. Ruedrich
Date: Wednesday, November 01, 2017 7:48:34 AM

Dear Chairman Murkowski and Ranking Member Cantwell,

I am a former Alaska resident and a career oilfield and environmental professional that supports the opening of the 1002 area of the Arctic National Wildlife Refuge. The oil industry in Alaska has developed the North Slope oil fields responsibly and will continue to do so with NO effects to the Arctic Caribou herd or any other animal species. We are the caretakers of the environment and we need you to vote in favor of development.

Donald E. "Buck" Rice
141 VZCR 1314
Grand Saline, TX 75140

From: Chris Rich
To: fortherecord (Energy)
Cc: Hoefler, Annie (Energy)
Subject: Supporting ANWR
Date: Wednesday, November 01, 2017 2:31:30 PM

Chairman Murkowski, Ranking Member Cantwell, and Members of the Senate Energy and Natural Resources Committee,

I fully support the development of the ANWR. Not only do I support the proposed 2000 acres to be opened but I strongly believe the entire reserve should be open to development.

Thank you
Chris Rich
PO Box 1151
Sterling, AK 99672
907-953-2109

From: Joe Riggs
To: fortherecord (Energy)
Cc: Hoefler, Annie (Energy)
Subject: ANWR development support
Date: Monday, October 30, 2017 11:40:35 PM

Chairman Murkowski, Ranking Member Cantwell, and Members of the Senate Energy and Natural Resources Committee.

As an Alaskan, an avid outdoorsman, someone who has spent time recreating on the Arctic Coastal Plain, and a father to a 4th generation Alaskan family, I fully support the long awaited opening of ANWR to responsible resource development.

Thank you,

Joe Riggs
Anchorage AK
907-317-0013

Sent from my iPad from somewhere in Alaska.

From: Jacqueline Rodkewich
To: fortherecord (Energy)
Subject: Arctic refuge
Date: Wednesday, November 15, 2017 10:13:37 AM

Drilling in the arctic refuge can not be allowed due to the deleterious effects of drilling.

Thank you.

Jacqueline Rodkewich
1603 Adams St Ne
Minneapolis MN
55413

From: Bruce Rodman
To: fortherecord (Energy)
Subject: Prohibit Drilling on Arctic Wildlife Refuge
Date: Wednesday, November 15, 2017 9:19:48 PM

Dear Senators,

Please do not open up for drilling in the pristine Artic Wildlife Wildlife area.

We have very little wilderness left and it is critically important to hang onto what we have. The future IS renewable energy. I am an American and I don't want my children and grandchildren to die from effects of climate change. We need to get off fossil fuels now!

97% of scientists say climate change caused by man is real! The United States is the only country that is not supporting the Paris climate accords.

Our planet doesn't need more drilling. What it does need is a moratorium on new drilling!

Please, please retain the Arctic Wildlfe Refuge to be free of drilling.

Bruce E Rodman
16 Ophir Drive
Durango, CO 81301

From: Patrick Rose
To: fortherecord (Energy); Hoefler, Annie (Energy)
Subject: US Senate & Natural Resource Committee hearing on ANWR Bill
Date: Tuesday, October 31, 2017 7:55:23 PM

For Record of November 2nd, 2017 Hearing

Dear Chairman Murkowski and Ranking Member Cantwell,

I am an Alaskan that supports the opening of the 1002 area of the Arctic National Wildlife Refuge. Alaskans have developed the North Slope oil fields responsibly and will continue to do so with NO effects to the Arctic Caribou herd or any other animal species. We are the caretakers of the environment and we need you to vote in favor of development."

- Polls have consistently shown that Alaskans are in favor for responsible oil and gas development in the non-wilderness portion of ANWR.
- Responsible oil and gas development in this fraction of ANWR will propel America's Energy Independence for decades.
- Alaska's economics are dependent on the Trans-Alaska Oil Pipeline System (TAPS). With new production in ANWR we will reverse decline in oil production

Thank you for thinking or America and Alaska First,

Patrick Rose
Northern Industrial Training, LLC.
Business Development Manager
3700 Centerpoint Dr. Suite 102
Anchorage, AK 99503
Main: 907-743-7700
Direct: 907-743-7704
Cell: 907-982-8315

Northern Industrial Training, LLC is a Candidate for Accreditation by Commission of the Council on Occupational Education

From: Molly Rosen
To: fortherecord (Energy)
Subject: Arctic National Wildlife Refuge
Date: Wednesday, November 15, 2017 8:42:29 AM

I strongly urge this committee to find other revenue sources and NOT open the Arctic National Wildlife Refuge for oil and gas drilling. This would be a travesty for wildlife and climate change. Please defend our communities, our natural heritage, and our clean energy future, and do not side with big polluters.

Molly Rosen
510-502-4303

From: Jean Ross
To: fortherecord (Energy); Hoefler, Annie (Energy)
Date: Sunday, November 12, 2017 9:00:55 AM

To Chairman Murkowski, Ranking Member Cantwell, and Members of the Senate Energy and Natural Resources Committee,

Please protect the Arctic National Wildlife Refuge (ANWR) from oil and gas exploration. We can ill afford further fossil fuel extraction if we're going to have any chance of keeping global warming to 2 degrees Celsius. We must protect the habitat for the wildlife that is already struggling for their survival.

For the record I strongly oppose any exploitation of the resources in the ANWR & the ANWR provision to open the ANWR to oil/gas leases for extraction.

Sincerely,
Jean Ross
3624 Bryant Ave. S.
Minneapolis, MN 55409

From: Randy Ruedrich
To: fortherecord (Energy)
Subject: Open 1002 Area of the Arctic National Wildlife Refuge NOW
Date: Wednesday, November 01, 2017 2:27:21 PM

Dear Chairman Murkowski and Ranking Member Cantwell,

As an Alaskan who has worked in petroleum production of more than 40 years, I urge the opening of the 1002 area of the Arctic National Wildlife Refuge. Alaskans have developed the North Slope oil fields responsibly and will continue to do so with NO negative impacts to the Central Arctic Caribou herd or any other animal species.

The surface impact can be limited to an combined area smaller than the Dulles International Airport. With improved Drilling practices and sound environmental conservation, this natural resource development can provide employment to Alaskans, buy required materials and supplies from other states and create state and federal tax revenue in a growing economy.

Alaskans need you to vote in favor of development now.

Randy Ruedrich
1515 W 13th Avenue
Anchorage, Alaska. 99501

From: Greg Ruge - (C)
To: fortherecord (Energy)
Subject: ANWR development comment with adressee
Date: Thursday, November 02, 2017 2:15:41 AM

TO: "Chairman Murkowski, Ranking Member Cantwell, and Members of the Senate Energy and Natural Resources Committee."

Please be advised that I do feel we need to support clean exploration and drilling in ANWR. It will increase the economy of our state and decrease foreign dependence on oil. Which we will still need for at least the next 40 years. To some there is a warranted fear of unbridled development which would damage our environment. However, it has been proven that we can develop our energy supplies on the North Slope of Alaska in a clean, efficient and safe manner. I have close to 30 years experience on the North Slope and have 20 more years in the rest of the world. Prudhoe Bay is by far the cleanest most environmentally friendly field I have ever seen and I truly feel we can have an extremely minimal environmental impact. Please vote yes to opening ANWR to developmental drilling.

Thank you

Greg Ruge GRC

Wellhead specialist
Hilcorp Alaska, Milne Point
907-670-3448 Office
907-203-0135 Mobile

From: R T RUSH
To: fortherecord (Energy)
Subject: Arctic National Wildlife Refuge
Date: Tuesday, November 14, 2017 3:18:33 PM

Hi, my name is RT Rush and I'm a constituent from Euless, TX 76039. I'm writing to ask that the committee find other means to produce federal revenue than reopening the Arctic National Wildlife Refuge for oil and gas drilling. We should not destroy protected land and endanger wildlife to fund unnecessary tax breaks for the wealthy. Please pass my message along to the Chairman and other committee members.

Thank you,
RT Rush
207 E. Harwood Rd.
Apt. 28
Euless, TX 76039

From: Greg Rutkowski
To: fortherecord (Energy)
Cc: Hoefler, Annie (Energy)
Subject: For Record of November 2, 2017 Hearing
Date: Wednesday, November 01, 2017 3:58:47 PM

Chairman Murkowski, Ranking Member Cantwell, and Members of the Senate Energy and Natural Resources Committee,

As an Alaska resident for more than 17 years, I strongly support oil and gas development in ANWR.

Polls have consistently shown Alaskans overwhelmingly support responsible oil and gas development in the non-wilderness portion of ANWR. There is no valid reason why we should not be allowed to access the world-class resources within just a tiny fraction of the coastal plain.

The proposed ANWR provision would allow development of no more than 2,000 acres of the 1.5 million acres of the Arctic coastal plain – part of the non-wilderness portion of ANWR's 19 million acres. That is equivalent to just 0.01 percent of the entire refuge.

Responsible oil and gas development in this fraction of ANWR will help ensure America's energy security for decades and allow Alaska – and our nation as a whole – to realize the benefits that come from expanding energy production in Alaska.

Thank you,

Gregory Rutkowski
17624 Laoana Circle
Eagle River, AK 99577

From: gretarybus@gmail.com on behalf of Greta Rybus
To: fortherecord (Energy)
Subject: For the Official Record
Date: Wednesday, November 15, 2017 1:25:07 PM

Greeting to the committee-

I'm emailing about several things of concern:

- To urge the committee find other means to produce federal revenue than reopening the Arctic National Wildlife Refuge for oil and gas drilling.

- To urge the committee to foster, develop, and invest in renewable energy sources for American people, like solar. It could create far more jobs than fossil fuel extraction, while keeping our environment safe for future generations, preventing pollution, and helping mitigate climate change.

- To stop emphasizing and investing in coal as a part of America's energy landscape. Consider starting a new program that would give coal members training and employment in renewable energy, which will not only provide jobs but will help the health of the worker.

- To urge Trump and his administration to rejoin the agreements of the Paris Accords. To be the only country who isn't taking part of a global effort is diplomatically weak and harmful for our country.

- Consider that taking care of our beautiful country is a form of patriotism, and prioritizing public access to a healthy environment is more important than corporate interest.

Thank you,
Greta Rybus
128 Emery St. Apt 2
Portland, Maine 04102
USA

--
Greta Rybus | Photographer

208.830.1332
greta@gretarybus.com
www.gretarybus.com

From: lori.ryser@goldenalaska.biz
To: fortherecord (Energy)
Cc: Hoefler, Annie (Energy)
Subject: Support ANWR
Date: Wednesday, November 01, 2017 2:08:38 PM

Chairman Murkowski, Ranking Member Cantwell, and Members of the Senate Energy and Natural Resources Committee,

I encourage you to be in support of the ANWR provision. Our State needs this to sustain a healthy economy and will open up work opportunities for Alaska's.

Please support ANWR!

Very Respectfully,

Lori Ryser
Golden Alaska Excavating, LLC
PO Box 8908
Kodiak, AK 99615

Office: 2011 Mill Bay Rd #2
907.942.2747 Rick Cell
907.539.6490 Lori Cell
907.486.5490 Office
888.848.2913 Fax
Women-Owned Small Business
www.goldenalaska.biz
www.facebook.com/goldenakexcavating
"We Dig Kodiak"

From: Shamu Sadeh
To: fortherecord (Energy)
Subject: comments on ANWR
Date: Wednesday, November 15, 2017 12:24:10 PM

I am shamu sadeh from Falls Village, CT 06031. Please do not open up ANWR or any protected federal lands to oil and gas drilling!
Thanks
shamu

--
Adamah: Cultivating the Soul and the Soil
Apply to the Adamah Fellowship!
Visit a Pickle Market

Shamu Fenyvesi Sadeh
Adamah Director
860 824-5991 x300

From: Mike Samson
To: fortherecord (Energy)
Subject: Support Opening 1002 area of ANWR
Date: Tuesday, October 31, 2017 2:48:08 PM

Dear Chairman Murkowski and Ranking Member Cantwell,
I am an Alaskan that supports the opening of the 1002 area of the Arctic National Wildlife Refuge. Alaskans have developed the North Slope oil fields responsibly and will continue to do so with NO effects to the Arctic Caribou herd or any other animal species. We are the caretakers of the environment and we need you to vote in favor of development.
Please, let's not miss this opportunity.

Best regards,

Michael Samson

Michael Samson
President,
Samson Electric, Inc.
907-451-0252
ms@sei-ak.com

From: Keith Sanfacon
To: fortherecord (Energy)
Subject: Alaskan for ANWR Drilling
Date: Wednesday, November 01, 2017 3:26:49 PM

Not all of ANWR – just the 1002 area that was set aside for petroleum development.

I have worked on the North Slope both as a regulator and for industry. This part of Alaska has been developed responsible in the past and will continue to be developed responsibly in the future.

Do not succumb to political pressure and emotional outcry – let the facts and history guide your decision making.

Respectfully,

Keith Sanfacon
Alaska Integrity Group

Hilcorp Alaska, LLC
Office (907) 777-8423 | Cell (801) 455-1764

From: Santa Claus [mailto:santaclaus@usa.net]
Sent: Tuesday, October 31, 2017 10:10 PM
To: fortherecord (Energy); Hoefler, Annie (Energy)
Cc: marisa@fairbankschamber.org
Subject: Comments on current ANWR Bill

Chairman Murkowski, Ranking Member Cantwell, and Members of the Senate Energy & Natural Resources Committee:

Regarding the current ANWR Bill, please note the following:

www.insideclimatenews.org/news/31102017/alaska-oil-wells-review-ordered-thawing-permafrost-cracked-casing-north-slope

America and Alaska can continue to grow the economy and reduce dependence on foreign oil. Development of alternative energy resources (wind, solar, hydro) would create thousands of jobs nationwide, generate billions of dollars in government revenue, keep energy prices for American consumers affordable, and further improve energy security for decades into the future.

Thank you for your consideration, Santa

Santa Claus
PO Box 55122
North Pole, AK 99705
www.SantaClausNorthPoleAlaska.com

Weren't we just saying its not safe to drill? #ProtectTheArctic #Alaska

Alaska Orders Review of All North Slope Oil Wells Afte...

Thawing permafrost cracked the casing on a BP oil well earlier this year, startin...

INSIDECLIMATENEWS.ORG

From: Mike Satre
To: fortherecord (Energy)
Cc: Hoefler, Annie (Energy)
Subject: Open the 1002 Area of ANWR to Oil and Gas Exploration and Development
Date: Wednesday, November 01, 2017 4:54:49 PM

Chairman Murkowski, Ranking Member Cantwell, and Members of the Senate Energy and Natural Resources Committee:

Please register the support of this Alaskan and his family for opening up the 1002 area of ANWR to oil and gas development.

Responsible resource development is the linchpin of Alaska's economy. We have proven over decades that we can and will develop in this area in a way that protects its inhabitants and its ecosystem in a way that will benefit our entire country.

My wife, Sarah, is a public school teacher of over 19 years and her future employment depends on continued oil and gas development in the North Slope, NPR-A and ANWR. My daughter, Miriam, is in first grade and her ability to receive a first class public school education is almost entirely dependent on responsible resource development as well. I work in the mining industry so I experience on a daily basis how development and environmental responsibility work hand in hand to benefit our community, our state, and our nation.

We strongly urge you to open the 1002 area now...we have been waiting for this for decades!

Thank you for your consideration,

Mike, Sarah and Miriam Satre
9356 Turn St
Juneau, Alaska 99801

We also wholeheartedly endorse the following statements that have been forwarded to the committee from various organizations:

- While renewable energy is a growing part of America's energy portfolio, it is still projected to account for a minority of American energy production in 2040. New oil and gas production will be required to power America's economy and can serve as a bridge until renewable energy becomes a dominant energy source decades into the future.
- Energy production from ANWR has the potential to offset a decline in Lower 48 shale oil production, which is expected to commence in approximately a decade. Without limited oil development on the coastal plain, America will be forced to once again increase its reliance on foreign imports. With limited development in ANWR, America and Alaska can continue to grow the economy and reduce dependence on foreign oil.
- The U.S. Geological Survey estimates the 1002 Area is North America's greatest prospect for conventional onshore oil production, with a mean likelihood of containing 10.4 billion barrels of oil and 8.6 trillion cubic feet of natural gas, as well as a reasonable chance of economically producing 16 billion barrels of oil.
- Alaska's economic lifeline, the Trans-Alaska Oil Pipeline System (TAPS), is now running at three-quarters empty. New oil production from ANWR has the potential to reverse throughput in TAPS, a vital component of American energy infrastructure.
- Oil development on a fraction of the coastal plain would create thousands of jobs nationwide, generate billions of dollars in government revenue, keep energy prices for American consumers affordable, and further improve energy security for decades into the future.
- Since the ANWR coastal plain is less than 60 miles from TAPS, development of energy resources there is one of the most environmentally-sound way to increase oil production in Alaska.
- Thanks to continuing improvements in technology, practices, and oversight, the oil industry has demonstrated over the past 40 years that North Slope energy development and environmental stewardship can and do coexist. The industry has a proven track record of responsible development in sensitive areas, protecting the environment, wildlife and subsistence needs of local residents.

From: Cyndi Saunders
To: fortherecord (Energy)
Subject: Please support the ANWR
Date: Wednesday, November 01, 2017 4:33:55 PM

Please support the ANWR initiative

No foreign oil
For the good ol' USA
And for Alaska

Have a super grand day,
Cyndi Saunders
6400 Woodmont dr
Anchorage AK 99516
907 227-4682

40 year resident of Alaska
And I vote !

Sent from my iPhone

From: Michael Sauvageau
To: fortherecord (Energy)
Cc: Hoefler, Annie (Energy)
Subject: For Record of November 2, 2017 Hearing
Date: Tuesday, October 31, 2017 7:11:39 PM

For Record of November 2, 2017 Hearing

Chairman Murkowski, Ranking Member Cantwell, and Members of the Senate Energy and Natural Resources Committee

I respectfully request that you open the ANWR coastal plain (1002 area) to exploration and production.
Require timely lease sales and streamline and simplify the permitting process.

I and the majority of Alaskans favor responsible development and protecting the environment.

I support the current law of a 90 – 10 split.

America and Alaska need this development to move forward in a timely manner.

Thank you for your consideration.

Regards,
Mike Sauvageau
PO Box 671948
Chugiak, Ak. 99567

From: Jill Schaefer
To: fortherecord (Energy)
Subject: Chairman Murkowski, Ranking Member Cantwell, and Members of the Senate Energy and Natural Resources Committee
Date: Wednesday, November 01, 2017 1:20:24 PM

Chairman Murkowski, Ranking Member Cantwell, and Members of the Senate Energy and Natural Resources Committee,

As an Alaskan, raising a family here, I urge you to allow ANWR to be open to exploration and drilling. Let Alaskans show you the way to responsibly develop our resources. We have made it clear that we support harvesting our resources and have a proven track record of doing so while taking the up-most care of our beautiful landscapes and animal populations. Below, are just some of the points you should consider while making your decision.

1. Polls have consistently shown Alaskans overwhelmingly support responsible oil and gas development in the non-wilderness portion of ANWR. There is no valid reason why we should not be allowed to access the world-class resources within just a tiny fraction of the coastal plain.
2. The proposed ANWR provision would allow development of no more than 2,000 acres of the 1.5 million acres of the Arctic coastal plain – part of the non-wilderness portion of ANWR's 19 million acres. That is equivalent to just 0.01 percent of the entire refuge.
3. Responsible oil and gas development in this fraction of ANWR will help ensure America's energy security for decades and allow Alaska – and our nation as a whole – to realize the benefits that come from expanding energy production in Alaska.
4. While renewable energy is a growing part of America's energy portfolio, it is still projected to account for a minority of American energy production in 2040. New oil and gas production will be required to power America's economy and can serve as a bridge until renewable energy becomes a dominant energy source decades into the future.
5. Energy production from ANWR has the potential to offset a decline in Lower 48 shale oil production, which is expected to commence in approximately a decade. Without limited oil development on the coastal plain, America will be forced to once again increase its reliance on foreign imports. With limited development in ANWR,

America and Alaska can continue to grow the economy and reduce dependence on foreign oil.

6. The U.S. Geological Survey estimates the 1002 Area is North America's greatest prospect for conventional onshore oil production, with a mean likelihood of containing 10.4 billion barrels of oil and 8.6 trillion cubic feet of natural gas, as well as a reasonable chance of economically producing 16 billion barrels of oil.
7. Alaska's economic lifeline, the Trans-Alaska Oil Pipeline System (TAPS), is now running at three-quarters empty. New oil production from ANWR has the potential to reverse throughput in TAPS, a vital component of American energy infrastructure.
8. Oil development on a fraction of the coastal plain would create thousands of jobs nationwide, generate billions of dollars in government revenue, keep energy prices for American consumers affordable, and further improve energy security for decades into the future.
9. Since the ANWR coastal plain is less than 60 miles from TAPS, development of energy resources there is one of the most environmentally-sound way to increase oil production in Alaska.
10. Thanks to continuing improvements in technology, practices, and oversight, the oil industry has demonstrated over the past 40 years that North Slope energy development and environmental stewardship can and do coexist. The industry has a proven track record of responsible development in sensitive areas, protecting the environment, wildlife and subsistence needs of local residents.

I respectfully ask that you listen to Alaskans and don't have your mind muddied by environmental groups that are not Alaskans and do not care about facts but only their agenda.

Respectfully,
Jill Schaefer
Alaska Support Industry Alliance
Kenai Operations Manager
Cell (907) 841-8185
www.alaskaalliance.com

This email has been scanned for spam and malware by The Email Laundry.

From: Dan Schok
To: fortherecord (Energy)
Cc: Hoefler, Annie (Energy)
Subject: Support for ANWR Development
Date: Wednesday, November 01, 2017 3:26:34 PM

Dear Chairman Murkowski, Ranking Member Cantwell, and Members of the Senate Energy and Natural Resources Committee

I own and operate a small welding business here in Fairbanks. The majority of my work is sent to the North Slope and our workload is tied to the oil companies and their contractors. I have 26 full time, year round employees who count on me and the oil company work to keep this business going. On their behalf I would like to say the effort to open ANWR is important and greatly appreciated. Any new developments in Alaska directly impact our workload and eventually my employee's paychecks, bank accounts and general wellbeing. I worry we are sometimes forgotten when these decisions are made in Washington. This email is a reminder that what you do does have an important impact on my business, my employees and I suspect many others in Alaska.

Thanks
Dan Schok
Owner
The Welding Shop, Inc.
907/457-3426

From: Genevieve Schok
To: fortherecord (Energy)
Cc: Hoefler, Annie (Energy)
Subject: Open ANWR
Date: Tuesday, October 31, 2017 4:01:12 PM

Chairman Murkowski, Ranking Member Cantwell, and Members of the Senate Energy and Natural Resources Committee,

Please accept this email as written testimony regarding opening ANWR in Alaska for development.

My family owns and operates a corrosion coating and welding facility here in the heart of Alaska, Fairbanks. The ability for us to employ local workers is dependent upon the safe and responsible development of our States natural resources. In fact, the livelihood of Alaska relies on us being a resource development state.

Alaska and the United States needs this production to come online.

The jobs created here in state and nationwide would be in the thousands. Government revenues would swell as would the entire economy.

Now is the time to keep American energy independent. Now is the time to open ANWR , as originally indented, to drilling. Thank you for your time, I kept this short for expediency.

Sincerely,

Genevieve Schok Jr.
Flowline Alaska
1881 Livengood Ave.
Fairbanks, AK 99701
W (907) 456-4911
C (480) 209-0029

From: KATHY SCHUTTE
Sent: Wednesday, November 01, 2017 3:23 PM
To: fortherecord (Energy)
Subject: For Record of November 2, 2017 Hearing

November 1, 2017

To: Chairman Murkowski
Ranking Member Cantwell
Members of the Senate Energy and Natural Resources Committee
Re: For Record of November 2, 2017 Hearing

There is no valid reason why we should not be allowed to access the world-class resources within just a tiny fraction of the coastal plain – just 0.01 percent of the entire refuge

Responsible oil and gas development of ANWR will help ensure America's energy security for decades and allow Alaska, and our Nation, to realize the benefits that come from expanding energy production in Alaska.

With limited development in ANWR, America and Alaska can continue to grow the economy and REDUCE DEPENDENCE ON FOREIGN OIL. Bring those jobs home!!

TAPS is now running at three-quarters EMPTY. New oil production has the potential to reverse throughput in TAPS, a vital component of American energy infrastructure.

Since the ANWR coastal plain is less than 60 miles from TAPS, development of energy resources there is one of the most environmentally-sound ways to increase oil production in Alaska.

Thanks to continuing improvements in technology, practices, and oversight, the oil industry has demonstrated over the past 40 years that North Slope energy development and environmental stewardship can and do coexist. The industry has a proven track record of responsible development in sensitive areas, protecting the environment, wildlife and subsistence needs of local residents.

Alaska was granted statehood in large part because it was known that it was rich in natural resources that could be developed to support itself. Denying access to those resources defeats that goal.

Finally, be skeptical of the small percentage of Alaskans who are against responsible development in ANWR – it's very likely they are being fed biased and false information by outside environmental groups determined to shut Alaska down to any sort of development and keep it as their private park.

PLEASE DO THE RIGHT THING FOR THE STATE OF ALASKA AND ITS CITIZENS!

Gage Schutte
P.O. Box 10945
Fairbanks, AK 99710

From: KATHY SCHUTTE [mailto:kschutte@gci.net]
Sent: Wednesday, November 01, 2017 3:18 PM
To: fortherecord (Energy)
Subject: for Record of November 2 2017 Hearing

November 1, 2017

To: Chairman Murkowski
Ranking Member Cantwell
Members of the Senate Energy and Natural Resources Committee
Re: For Record of November 2, 2017 Hearing

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PLEASE DO THE RIGHT THING FOR THE STATE OF ALASKA AND ITS CITIZENS!

Kathy Schutte
P.O. Box 10837
Fairbanks, AK 99710

From: KATHY SCHUTTE [mailto:kschutte@gci.net]
Sent: Wednesday, November 01, 2017 3:19 PM
To: fortherecord (Energy)
Subject: For Record of November 2, 2017 Hearing

November 1, 2017

To: Chairman Murkowski
Ranking Member Cantwell
Members of the Senate Energy and Natural Resources Committee
Re: For Record of November 2, 2017 Hearing

There is no valid reason why we should not be allowed to access the world-class resources within just a tiny fraction of the coastal plain – just 0.01 percent of the entire refuge

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PLEASE DO THE RIGHT THING FOR THE STATE OF ALASKA AND ITS CITIZENS!

Steve Schutte
P.O. Box 10837
Fairbanks, AK 99710

From: Schwab, Christina
To: fortherecord (Energy)
Subject: Open ANWR
Date: Tuesday, October 31, 2017 7:03:05 PM

Dear Chairman Murkowski and Ranking Member Cantwell,

I am an Oilfield working Alaskan. I support the opening of the 1002 area of the Arctic National Wildlife Refuge. I have firsthand witnessed the care and responsibility with which Alaskans have developed the North Slope Oilfields. We will continue to do so with NO effects to the Arctic Caribou herd or any other animal species. We will continue to be the caretakers of our environment. We ask that you please vote in favor of developing the 1002 area.

Thank you!!

Enjoy your day!

Christina D. Schwab
Accounts Receivable
Price Gregory International
Conam Construction Company
Tikigaq/Conam, LLC
Direct line: 907-257-4156

4 November 2017

Energy and Natural Resources Committee Office
304 Dirksen Senate Building
Washington, DC 20510

I'm writing to ask that the committee find other means to produce federal revenue than reopening the Arctic National Wildlife Refuge for oil and gas drilling. We should not destroy protected land and endanger wildlife to fund unnecessary tax breaks for the wealthy.

Eve Schwartz
3308 Merrick Court
Keswick, VA 22947

From: Schwemmer, Henry A
To: fortherecord (Energy)
Subject: Arctic National Wildlife Refuge
Date: Tuesday, November 14, 2017 1:54:49 PM

I oppose, in the strongest possible terms, any effort to open or re-open any part of the Arctic National Wildlife Refuge for the production of gas or oil.

Hank Schwemmer
3707 Cedar St. #103
Austin, TX 78705

SECURING AMERICA'S
FUTURE ENERGY

1111 19TH STREET, NW
SUITE 406
WASHINGTON, DC 20036

TEL: 202-461-2360
FAX: 202-461-2379
SECUREENERGY.ORG

Securing America's Future Energy

Submitted Testimony

To: Senate Energy and Natural Resources Committee, Chairwoman Lisa Murkowski

From: Securing America's Future Energy

Date: November 1, 2017

The recently passed Senate budget resolution provides the Senate Energy and Natural Resources Committee with a pathway to enhance U.S. energy security by opening Area 1002 of the Alaska National Wildlife Refuge (ANWR). Petroleum production in Alaska peaked in 1988 at over 2 million barrels per day (mbd) and it has steadily declined since that time. It has fallen by over 1.5 mbd over peak 1988 levels and in 2016 averaged just 490,000 barrels per day (b/d).

Throughout most of the 1980s and into the mid-1990s, Alaskan production represented over one-fifth of total U.S. crude oil production—a development that greatly increased U.S. energy security. Similarly, today, opening Area 1002—a small part of the Alaskan National Wildlife Refuge—to oil exploration and development can reduce U.S. foreign import dependence.

Increasing domestic oil production is an economic and national security imperative. The United States is the world's largest oil consuming country and a significant net importer, with 92 percent of the nation's transportation energy provided by petroleum. Thanks to this dependence, when oil prices rise, businesses and consumers have no alternatives available at scale. Furthermore, 70 percent of the world's lowest cost oil reserves are sourced from countries that do not share American interests or values. American motorists have sent $1.6 trillion to member states of the Organization of the Petroleum Exporting Countries (OPEC) in the form of oil revenues in the last 10 years alone.

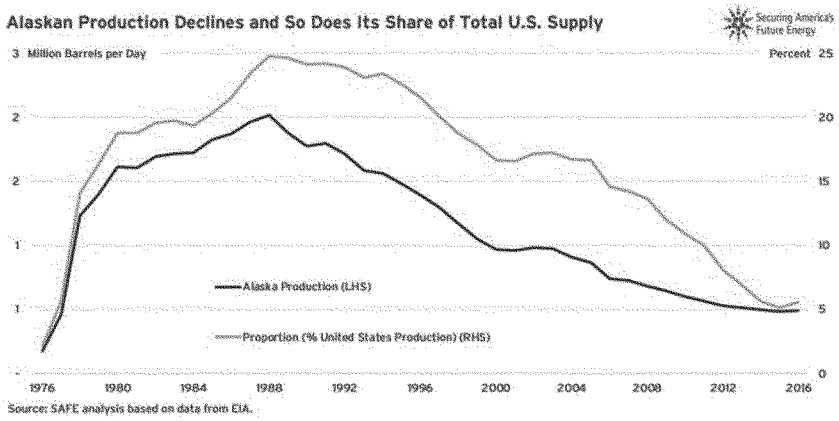
With the attention of many national security and industry analysts focused on U.S. shale oil production and the machinations of Saudi Arabia and the OPEC cartel, it is easy to forget that the petroleum investment cycle requires us to bring on longer lived and bigger projects in order to avoid undersupplied conditions and higher prices in the coming years. Opening Area 1002 provides just such an opportunity, and serves American economic and national security interests.

In 2005, the U.S. Geological Society (USGS) estimated that ANWR contains between 5.7 and 16.0 billion barrels of undiscovered technically recoverable oil. While the precise estimate still needs to be delineated, we know that there is a great deal of petroleum in ANWR. Working off the USGS estimate and other material in 2008, the U.S. Energy Information Administration projected a low case peak production of 510,000 b/d and a high case production of 1.45 mbd. While oil prices were substantially higher in 2008 than today, the industry has made a number of technical advances since 2008 such as 3-D seismic, and horizontal drilling that would partially offset the lower prices and facilitate responsible and cost effective oil production.

While some are concerned with the environmental consequences connected with developing this resource, it should be noted that the U.S. petroleum industry is a world leader in safe development.

Production from Area 1002 would be onshore and therefore would not require more technically challenging offshore activity. Additionally, an extremely large part of the required infrastructure is in place because the Trans-Alaskan Pipeline (TAP) already exists and is underutilized, requiring only a relatively short connecting pipeline to link the new fields with Prudhoe Bay. And this new line, unlike the originally constructed TAP line, transverses much less difficult topography (i.e., it would not have to cross three large mountain ranges).

Our oil industry has also become much better at shrinking the environmental impact of its activities. The advent of horizontal drilling allows for a reduction in the number drill pads necessary to develop a field, and other technological developments have allowed the average size of production pads to be reduced. In the 1970s, it was not uncommon to have drill pads of approximately 20 acres. Now they are much closer to 2 or 3 acres. It should also be noted that this new U.S. production would largely displace foreign produced barrels, and the environmental standards of many of these foreign producers are very poor.



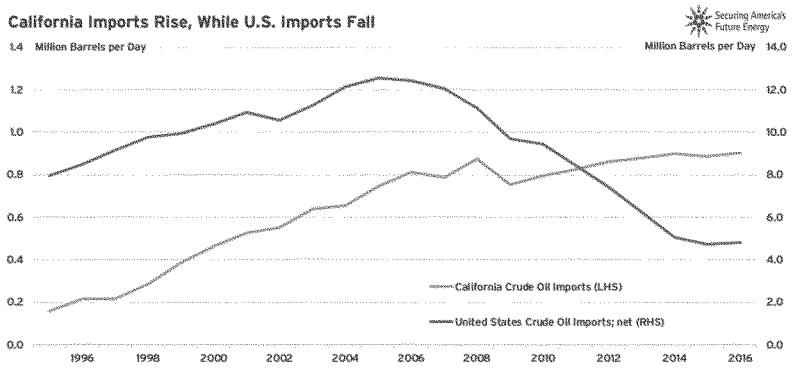
The economic impact of additional petroleum development in Alaska would be substantial. The recently enacted state budget of $4.9 billion represents a 44 percent decrease over the last five years. The employment and revenue impacts of renewed petroleum development would help Alaska regain its fiscal health and deliver improved social services to its residents.

From a security perspective, renewed Alaskan production is a clear win for the United States because it would displace foreign barrels which are much more susceptible to interruption for political purposes. The primary destination of most new Alaskan oil would most likely be refineries in Washington State and California. This so-called "short haul" crude reduces the length of the energy supply lines and in itself enhances energy security. Fewer barrels of oil would have to leave the Persian Gulf and transit at least two major maritime choke points at the Straits of Hormuz and Malacca. In addition to security advantages, the U.S would benefit economically through improved trade terms and balance of payments, in addition to local benefits for Alaska, including employment opportunities for the state's

critical oil and gas industry and the income and state revenue gains. The increased Alaskan production would also exert downward pressure on U.S. refiner acquisition costs, especially on the West Coast, keeping gasoline prices lower and allowing motorists to spend more of their income on other things.

In particular, developing Area 1002 could displace growing Middle East import dependence by states such as California. For most of the 1980s and 1990s, California's petroleum needs, and by extension its source of gasoline and diesel fuel, were largely met by local, in-state production and by oil produced in Alaska. Since 1985, California's production has halved from approximately 400,000 b/d to 200,000 b/d today. Alaskan production peaked at just over 2 mbd in 1988, and in 2016 it produced just under 500,000 b/d. Most of this 1.7 mbd decline has been replaced by imports.

In contrast to the nation as a whole, California has seen its dependence on foreign petroleum significantly increase while U.S. imports have dropped dramatically. As a share of total U.S. demand, net oil imports declined from over 60 percent in 2005, to 25 percent in 2016. In contrast, the import dependence of California's refineries has grown from 40 percent to almost 55 percent during the same period. As the chart below demonstrates, in barrel terms, total U.S. imports fell from 12 mbd to 5 mbd, while California's imports rose from 750,000 b/d to 900,000 b/d.



Source: SAFE analysis based on data from EIA and the California Energy Commission.

The importance of Alaska in meeting California's transportation fuel needs in the 1980s and 1990s cannot be overstated. Alaska's sizable production and relative proximity to California made Alaskan North Slope (ANS) crude a preferred and well-priced petroleum feedstock for the state's refineries. Furthermore, because the transportation costs of moving Alaskan crude to California refiners was lower, this source of petroleum supply helped moderate the state's fuel costs. Given the steady decline of Alaskan production, California has replaced Alaskan oil with imported oil almost on a barrel-for-barrel basis.

California's import dependence is particularly notable because over 50 percent of its foreign crude comes from the Middle East. In contrast, approximately 22 percent of total U.S. imports come from the

Middle East. Import dependence undermines the interests of the nation at large, as oil revenues sent overseas by the United States may support corrupt and oppressive regimes that suppress human rights, fund terrorism, and often work against U.S. foreign policy interests.

SAFE supports improving energy security through a combined approach of increasing petroleum supply while improving efficiency in the vehicle fleet and encouraging the development and deployment of alternative fuel vehicles which will reduce the singular dependence on petroleum in the transportation sector—insulating our economy from oil supply disruptions and price volatility. Since the introduction of the Low Emission Vehicle program in the 1990s, California has reduced the petroleum intensity of its economy while more than doubling output. Aggressive policy efforts to encourage adoption of efficient and zero-emission vehicles were a significant part of this success. Demand reduction measures are a core component of improved energy security, but must be accompanied by strong domestic production to expedite and maximize the scope of benefits.

The development of Area 1002 is necessary, and allowing it to go forward keeps revenue from flowing to foreign producers who often use these funds to undermine and damage U.S. national security interests. By developing more domestic sources of abundant oil supply, the United States can reduce international security risks, guard consumers against danagerous and volatile oil price shocks, and encourage the development of our nationally important oil industry.

From: John Sedor
To: fortherecord (Energy)
Cc: Hoefler, Annie (Energy)
Subject: Supporting ANWR - For Record of November 2, 2017 Hearing
Date: Tuesday, October 31, 2017 5:23:46 PM

Chairman Murkowski, Ranking Member Cantwell, and Members of the Senate Energy and Natural Resources Committee,

I am an attorney in Alaska and have been for over 28 years. I have and continue to represent multi-national corporations in employment matters, individuals with personal and business concerns, businesses (large and small) with labor and employment needs, and I serve as general counsel to over 1/3 of the school districts in Alaska. Economic opportunities for Alaska and Alaskans are important to me. That is why I write in favor of including an ANWR drilling provision in a budget reconciliation bill that would allow limited oil and natural gas activity within the non-wilderness coastal plain of the Arctic National Wildlife Refuge (ANWR).

First, it's important to realize that regardless of the many emails you may receive from those opposed to this type of economic development, Alaskans support opening the non-wilderness portion of ANWR to oil and gas development. The polls are consistent and compelling.

Alaskans support renewable energy as well. We understand, however, that while renewable energy is a growing part of America's energy portfolio, it is still projected to account for a minority of American energy production in 2040. New oil and gas production will be required to power America's economy and can serve as a bridge until renewable energy becomes a dominant energy source decades into the future.

Oil development on a fraction of the coastal plain would create thousands of jobs nationwide, generate billions of dollars in government revenue, keep energy prices for American consumers affordable, and further improve energy security for decades into the future.

Alaska's economic lifeline, the Trans-Alaska Oil Pipeline System (TAPS), is now running at three-quarters empty. New oil production from ANWR has the potential to reverse throughput in TAPS, a vital component of American energy infrastructure.

We're talking about a sliver of land, 2,000 acres, on a 1.5 million acre Arctic Coastal Plain in a 19 million acre refuge. There's simply no valid reason why we should not be allowed access to this world-class resource for the benefit of Alaskans and America.

John Sedor

John M. Sedor, P.C.
SEDOR WENDLANDT EVANS & FILIPPI, LLC
500 L Street, Suite 500
Anchorage, AK 99501
Telephone: (907) 677-3600
Facsimile: (907) 677-3605
Email: sedor@alaskalaw.pro

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From: Paula Seitchik
To: fortherecord (Energy)
Subject: Arctic National Wildlife refuge
Date: Tuesday, November 14, 2017 1:01:38 PM

I am writing to ask that the committee find other means to produce federal revenue than reopening the Arctic National Wildlife Refuge for oil and gas drilling. We should not destroy protected land and endanger wildlife to fund unnecessary tax breaks for the wealthy. Please pass my message along to the Chairman and other committee members"

Paula Seitchik
Berkshire Hathaway Fox and Roach Realtors
2017 Five Star Agent award winner
Paula.Seitchik@foxroach.com
Mobile 215-740-2921

From: David Seymour
To: fortherecord (Energy)
Subject: ANWR
Date: Tuesday, October 31, 2017 3:36:26 PM

Good Afternoon,

Just wanted to drop a line to encourage you to approve the opening of ANWR. I am an Alaskan resident.
As a resident, it bothers me that people from other states have a say in how we Alaskans go forward in regards to our oil production. Living here gives me a much better understanding of the plusses and minuses of
oil production in ANWR. Directional drilling and striving for a clean drill site is the way to go, and
it will give us the economic boost that Alaska needs after a National leader and his party destroyed the oil, gas and coal
industries.

Please understand, I want Alaska to be the cleanest place to live, but if we have no economy, there will be
no one here to enjoy the beauty and wilderness. I have been to ANWR, and they have streams and waterways
that have oil in the water that provides locals with natural oil for lanterns. There would be no interference
with wildlife to provide the needed oil production for Alaska and the Lower 48.

Just my 2 cents worth.

Thank you,

David Seymour
7462 White Hawk Drive
Anchorage, Alaska 99507

(907) 244-3371

From: Stormie Sheppard [mailto:ssheppard@sourdoughexpress.com]
Sent: Wednesday, November 01, 2017 2:29 PM
To: fortherecord (Energy); Hoefler, Annie (Energy)
Subject: ANWR Drilling Provision

Dear Chairman Murkowski, Ranking Member Cantwell, and Members of the Senate Energy and Natural Resources Committee,

As to this week's hearing Thursday, November 2, on an ANWR drilling provision that would allow limited oil and natural gas activity within the non-wilderness coastal plain of the Arctic National Wildlife Refuge (ANWR), ***I strongly support and agree with the following statements from Alaska Oil and Gas Association:***

· For decades, scientific polls have shown Alaskans overwhelmingly support responsible oil and gas development in the non-wilderness portion of ANWR. There is no valid reason why we should not be allowed to access the world-class resources within just a tiny fraction of the coastal plain.

· The proposed ANWR provision would allow development of no more than 2,000 acres of the 1.5 million acres of the Arctic coastal plain – part of the non-wilderness portion of ANWR's 19 million acres. That is equivalent to just 0.01 percent of the entire refuge.

· Responsible oil and gas development in this fraction of ANWR will help ensure America's energy security for decades and allow Alaska – and our nation as a whole – to realize the benefits that come from expanding energy production in Alaska.

· While renewable energy is a growing part of America's energy portfolio, it is still projected to account for a minority of American energy production in 2040. New oil and gas production will be required to power America's economy and can serve as a bridge until renewable energy becomes a dominant energy source decades into the future.

· Energy production from ANWR has the potential to offset a decline in Lower 48 shale oil production, which is expected to commence in approximately a decade. Without limited oil development on the coastal plain, America will be forced to once again increase its reliance on foreign imports. With limited development in ANWR, America and Alaska can continue to grow the economy and reduce dependence on foreign oil.

· The U.S. Geological Survey estimates the 1002 Area is North America's greatest prospect for conventional onshore oil production, with a mean likelihood of containing 10.4 billion barrels of oil and 8.6 trillion cubic feet of natural gas, as well as a reasonable chance of economically producing 16 billion barrels of oil.

· Oil development on a fraction of the coastal plain would create thousands of jobs nationwide, generate billions of dollars in government revenue, keep energy prices for American consumers affordable, and further improve energy security for decades into the future.

Thank You!!

Stormie Sheppard
Accountant
Sourdough Express, Inc.
Tel: 907.452.1181
Fax: 907.452.3331
www.sourdoughexpress.com

From: Susan Sherman
To: fortherecord (Energy)
Subject: ANWR
Date: Monday, November 06, 2017 2:37:45 PM

I oppose oil drilling in ANWR. There are numerous reasons I believe this remote and sacred area should be off limits to development, beginning with the Gwich'in people and their desire to protect their homeland and the Porcupine caribou herd's calving grounds.

I do not believe the amount of oil and revenue from ANWR will outweigh the social and environmental cost. Our resources can be better spent elsewhere, supporting a transition away from fossil fuels and/or more efficiently drilling in areas that are already developed.

Those in favor of opening ANWR argue that drilling can be done with little impact. If this is the case, let's demonstrate it in already developed areas first. Spills still occur regularly. Caribou herds in other parts of the arctic have declined as oil production increases. Prove yourself in these places first, then come talk about ANWR with real examples to back up your claims.

While the coastal plain of ANWR may appear to many to be a "wasteland," it has significant environmental effects, especially as our climate changes. Polar bears, marine life, and dozens of bird species rely on this area in addition to the caribou.

There are many places to develop. Let's please leave this one special place alone. Thank you,

Susan Sherman
Anchorage, AK

--
http://susansherman.wordpress.com/
503-490-0180

From: John Shively [mailto:johnshively@pebblepartnership.com]
To: fortherecord (Energy)
Cc: Hoefler, Annie (Energy)
Subject: ANWR and Oil ang Gas
Date: Wednesday, November 01, 2017 1:52 PM

Chairman Murkowski, Ranking Member Cantwell, and Members of the Senate Energy and Natural Resources Committee,

I support the U.S. Congress taking action to allow oil and gas exploration and development in the 1002 Area of the Arctic National Wildlife Refuge for the following reasons:

- The proposed ANWR provision would allow exploration and development of no more than 2,000 acres of the 1.5 million acres of the Arctic coastal plain – part of the non-wilderness portion of ANWR's 19 million acres. That is equivalent to just 0.01 percent of the entire refuge.
- Responsible oil and gas development in this fraction of ANWR will help ensure America's energy security for decades and allow Alaska – and our nation as a whole – to realize the benefits that come from expanding energy production in Alaska.
- Polls have consistently shown Alaskans overwhelmingly support responsible oil and gas development in the non-wilderness portion of ANWR. There is no valid reason why we should not be allowed to access the world-class resources within just a tiny fraction of the coastal plain.
- While renewable energy is a growing part of America's energy portfolio, it is still projected to account for a minority of American energy production in 2040. New oil and gas production will be required to power America's economy and can serve as a bridge until renewable energy becomes a dominant energy source decades into the future.
- Energy production from ANWR has the potential to offset a decline in Lower 48 shale oil production, which is expected to commence in approximately a decade. Without limited oil development on the coastal plain, America will be forced to once again increase its reliance on foreign imports. With limited development in ANWR, America and Alaska can continue to grow the economy and reduce dependence on foreign oil.
- The U.S. Geological Survey estimates the 1002 Area is North America's greatest prospect for conventional onshore oil production, with a mean likelihood of containing 10.4 billion barrels of oil and 8.6 trillion cubic feet of natural gas, as well as a reasonable chance of economically producing 16 billion barrels of oil.
- Alaska's economic lifeline, the Trans-Alaska Oil Pipeline System (TAPS), is now running at three-quarters empty. New oil production from ANWR has the potential to reverse throughput in TAPS, a vital component of American energy infrastructure.
- Oil development on a fraction of the coastal plain would create thousands of jobs nationwide, generate billions of dollars in government revenue, keep energy prices for American consumers affordable, and further improve energy security for decades into the future.
- Since the ANWR coastal plain is less than 60 miles from TAPS, development of energy resources there is one of the most environmentally-sound ways to increase oil production in Alaska.
- Thanks to continuing improvements in technology, practices, and oversight, the oil industry has demonstrated over the past 40 years that North Slope energy development and environmental stewardship can and do coexist. The industry has a proven track record of responsible development in sensitive areas, protecting the environment, wildlife and subsistence needs of local residents.

Thank you for your consideration.

John Shively
Chairman
907 250 6281

From: SHULTS, Kelly (WG) [mailto:kelly.shults@woodplc.com]
To: fortherecord (Energy)
Cc: 'mailto:annie_hoefler@energysenate.gov'
Subject: For Record of November 2, 2017 Hearing
Date: Wednesday, November 01, 2017 12:28 PM

Dear Chairman Murkowski, Ranking Member Cantwell, and Members of the Senate Energy and Natural Resource Committee,

I support the opening of ANWR because it is imperative to our economy.

Thank you,

Kelly J. Shults
HSSE Supervisor
T: (907) 685-0542|C: (907) 205-9926
E: wghssesupervisor@woodgroup.com

www.woodplc.com
wood.

From: Janna Siller
To: fortherecord (Energy)
Subject: No Reopening of the Arctic National Wildlife Refuge
Date: Wednesday, November 15, 2017 12:49:18 PM

I'm writing to ask that the committee find other means to produce federal revenue than reopening the Arctic National Wildlife Refuge for oil and gas drilling. We should not destroy protected land and endanger wildlife to fund unnecessary tax breaks for the wealthy. Please pass my message along to the Chairman and other committee members.

--
Janna Berger Siller
Farm Director
Adamah
860-824-3003 ext. 3

From: Keith Silver
To: fortherecord (Energy)
Cc: Hoefler, Annie (Energy); Carl Portman
Subject: ANWR
Date: Thursday, November 02, 2017 1:41:18 PM

I am writing in support of opening ANWR to oil field exploration and if warranted, development. The data that USGS is so old and incomplete that they can not predict with any confidence how much oil, if any, is in the 1002 area. The local people in Kaktovik are in support.

With respect to the caribou herd that calves in the area, one need only look to the west where they come through on a regular basis. I previously worked in Deadhorse and the caribou would come through unimpeded by the pipelines, roads, and people there. There is no reason to suggest that the result would be any different in the 1002 area.

It will take years after finding oil via 3D seismic testing before oil is ready to be delivered to the market. Although the US currently enjoys a surplus of oil at low prices, there is no reason to assume that current conditions will prevail at that time. It is only prudent to do an assessment of the area.

Respectfully,

Keith Silver
2511 Ridge Pointe Dr,
Anchorage, AK 99515

907-242-1618

From: Paulette Simpson
To: fortherecord (Energy)
Subject: ANWR
Date: Wednesday, November 01, 2017 2:51:49 PM

To: Chair Murkowski and Ranking Member Cantwell

Please know how much I appreciate the time and effort that you - and your Committee members - devote to your deliberations. As a 42-year resident of Alaska, I support access to the "1002" Area of the Arctic National Wildlife Refuge (ANWR) for oil and gas exploration and production. Alaska's oil industry has developed the North Slope oil fields in a responsible and environmentally sensitive manner. As you know, Alaska is dependent on resource development and currently has the highest unemployment rate in the United States. These jobs are critical to Alaska families.

Thank you for supporting our state.

Paulette Simpson

402 Alaska Belle Court

Douglas, AK 99824

From: William Simpson
To: fortherecord (Energy); Hoefler, Annie (Energy)
Subject: For Record of November 2, 2017 Hearing
Date: Tuesday, October 31, 2017 4:25:10 PM

Chairman Murkowski, Ranking Member Cantwell, and Members of the Senate Energy and Natural Resources Committee

As a lifelong AlaskanI have witnessed decades of responsible development combined with commitment to protecting and respecting the environment, I support resource development on the ANWR coastal plain.

Timely lease sales, streamlining the permitting process, and a 50-50 federal/state revenue sharing are critical to our state.

Please support the ANWR provision on behalf of all Alaskans!

Sincerely,

William L. Simpson
william.simpson49@gmail.com
Sterling, AK 99672

From: Mary Sims
To: fortherecord (Energy)
Subject: 1002 area of the ANWR
Date: Tuesday, October 31, 2017 2:34:21 PM

Chairman Murkowski and Ranking Member Cantwell,

I am an Alaskan that supports the opening of the 1002 area of the Arctic National Wildlife Refuge. Alaskans have developed the North Slope oil fields responsibly and will continue to do so with NO effects to the Arctic Caribou herd or any other animal species. We are the caretakers of the environment and we need you to vote in favor of development.

Mary Sims

PO Box 771721

Eagle River, Alaska 99577

November 1, 2017

Dear Member of Congress:

The Arctic National Wildlife Refuge is a part of God's creation that stands alone in its wilderness, ecological integrity, and beauty. This sacred landscape is also home of the Gwich'in, a Alaska native people who depend upon the Porcupine caribou herd for their daily subsistence. The possibility of oil exploration in the Refuge jeopardizes the ecological integrity of the Refuge and the way of life of the Gwich'in people.

The exploitation of fossil fuels in the Refuge will contribute to climate change and threaten the ten thousand year-old traditions that the Gwich'in people depend upon to survive. The faith community's decades long commitment to protecting the Arctic Refuge is inspired by our dedication to defending all of God's creation, including the fundamental rights of the Gwich'in people.

As members of the faith community, we ask you to grant the Arctic Refuge the strongest possible protection and keep drilling in the Arctic Refuge out of the budget process. It is our hope that you will join us in recognizing that such a precious gift deserves our best efforts at stewardship and preservation by doing all that you can to safeguard the renowned and sacred wilderness of the Arctic National Wildlife Refuge for current and future generations.

Sincerely,

Sister Janet Korn
Sisters of Mercy
Rochester, NY

Sister Mary Ann Binsack
Sisters of Mercy
Rochester, NY

Deirdre Hetzler
Roman Catholic
Fairport, NY

Barbara Kozlowski
Sisters of Mercy
Buffalo, NY

Norine Truax, RSM
Sisters of Mercy
Buffalo, NY

M. Grimes
Sisters of Mercy
Hamburg, NY

Sister Mary Schimscheiner
Sisters of Mercy
Buffalo, NY

Sister Kathy Sisson
Sisters of Mercy
Rochester, NY

Laurie Orman
Sisters of Mercy
Rochester, NY

Sister Mary Ellen Twist
Sisters of Mercy
Buffalo, NY

Sister Nancy Whitley, RSM
Sisters of Mercy
Rochester, NY

Deacon William Coffey
Roman Catholic
Macedon, NY

Kathy Pease
Sisters of Mercy
Rochester, NY

William Irwin
Roman Catholic
Elmira, NY

Sister Nancy O'Brien
Sisters of Mercy
Rochester, NY

Sheila Geraghty
Sisters of Mercy
Rochester, NY

Sister Miriam Nugent
Sisters of Mercy
Rochester, NY

Sister Joan Sherry, RSM
Sisters of Mercy
Orchard Park, NY

Sister Margaret Deegan
Sisters of Mercy
Rochester, NY

Sister Susan Cain
Sisters of Mercy
Rochester, NY

Sister Sally Maloney
Sisters of Mercy
Buffalo, NY

Sister Lucetta Sercu
Sisters of Mercy
Rochester, NY

Sister Marilyn Williams, RSM
Sisters of Mercy
Rochester, NY

Patricia Bell
Sisters of Mercy
Webster, NY

Sister Cristel Mejia
Sisters of Mercy
Buffalo, NY

November 1, 2017

Dear Member of Congress:

The Arctic National Wildlife Refuge is a part of God's creation that stands alone in its wilderness, ecological integrity, and beauty. This sacred landscape is also home of the Gwich'in, a Alaska native people who depend upon the Porcupine caribou herd for their daily subsistence. The possibility of oil exploration in the Refuge jeopardizes the ecological integrity of the Refuge and the way of life of the Gwich'in people.

The exploitation of fossil fuels in the Refuge will contribute to climate change and threaten the ten thousand year-old traditions that the Gwich'in people depend upon to survive. The faith community's decades long commitment to protecting the Arctic Refuge is inspired by our dedication to defending all of God's creation, including the fundamental rights of the Gwich'in people.

As members of the faith community, we ask you to grant the Arctic Refuge the strongest possible protection and keep drilling in the Arctic Refuge out of the budget process. It is our hope that you will join us in recognizing that such a precious gift deserves our best efforts at stewardship and preservation by doing all that you can to safeguard the renowned and sacred wilderness of the Arctic National Wildlife Refuge for current and future generations.

Sincerely,

Sister Kathleen Ann, RSM
Sisters of Mercy
Erie, PA

Elsie Heaney
Daylesford Abbey
Paoli, PA

Sister Placidus McDonald
Sisters of Mercy
Pittsburgh, PA

Sister Andrea Likovich
Sisters of St. Francis
Aston, PA

Sister Bridget McNamara
Sisters of St. Francis
Reading, PA

Sister Susan Fitzpatrick
Pittsburgh, PA

Sister Rita Harasiuk
Institute of the Sisters
Pittsburgh, PA

Sister Phyllis Thompson
Sisters of Mercy
Pittsburgh, PA

Maria Zamberlan
Sisters of Mercy
Pittsburgh, PA

Sister Mary Felice Duska
Sisters of Mercy
Erie, PA

Sister Kathi Sweeney
Sisters of Mercy
Pittsburgh, PA

Sister Malachy O'Neill
Sisters of Mercy
Pittsburgh, PA

Sister Bonnie Heh
Sisters of Mercy
Pittsburgh, PA

Sister Georgine Scarpino
Sisters of Mercy
Pittsburgh, PA

Sister Natalie Rossi
Sisters of Mercy
Erie, PA

Sister Patricia Hespelein
Pittsburgh, PA

Sister Marie Immacule Dana
Sisters of Mercy
Pittsburgh, PA

Sister Rita Panciera
Sisters of Mercy
Erie, PA

From: Kim Skipper
To: fortherecord (Energy)
Subject: 1002 area of ANWR
Date: Wednesday, November 01, 2017 10:35:25 PM

Steven Skipper and Kim Skipper support the opening of, drilling of and producing oil from the 1002 area of the Arctic National Wildlife Refuge (ANWR). Please pass legislation in support of 1002 area of ANWR and help make the US dominate in energy and oil production.

Kim Skipper
907-223-2826
Sent from my iPad

From:	Dave Skoglund
To:	fortherecord (Energy)
Cc:	Hoefler, Annie (Energy)
Subject:	Chairman Murkowski, Ranking Member Cantwell, and Members of the Senate Energy and Natural Resources Committee. For Record of November 2, 2017 Hearing
Date:	Tuesday, October 31, 2017 3:47:22 PM

Chairman Murkowski, Ranking Member Cantwell, and Members of the Senate Energy and Natural Resources Committee:

This email is **For Record of November 2, 2017 Hearing**

Thanks for hearing my comments regarding opening the 1002 area of ANWR to Oil and Gas development. My name is David Skoglund. I Made Alaska home 20 plus years ago. My wife came here as a child and won't let me say how many years she has been an Alaskan as it would indicate her approximate age,(she older than me).I have adopted 2 young sons and I paid for their medical,food, adoption lawyers, clothes and much more with wages from working for oil and gas companies in the Arctic.I have worked in the Arctic primarily in the areas of Environment, Safety, Health and Security. The people I worked with were from Alaska, Washington, places where Y,All is said more than You All, and many men and women who lived in Kaktovik. They all supported responsible oil and gas development in ANWR. I have been in ANWR on foot and love it and the people of Kaktovik and Point Thomson who live nearest to ANWR. The following are some reasons to consider for opening ANWR to oil and gas development.

. All the polls I have seen of Alaskans are supportive of oil and gas development in ANWR.
. It will help the people of the region, Alaska, and the USA.
. Development in the non-wilderness region would only be a tiny fraction of the whole area.
. The USA and Alaska would benefit tremendously in the area of energy security and other ways
. Renewable energy is a great area of science but even predictions based on science indicate we will need hydrocarbons as fuel for many decades to come.
.ANWR is only a short snow machine ride from TAPS-The pipeline from the Arctic to southern Alaska. It transported 2.2 million barrels a day when my wife worked for Alyeska on the pipeline. Today it is at risk of being shutdown due to low oil amounts of around half a million barrels a day.

Thanks again for hearing my reasons for development of oil and gas inside ANWR

David Skoglund
Anchorage Alaska

--
Dave Skoglund
907.244.9167

From: Alex Slivka
To: fortherecord (Energy)
Subject: opinion to support ANWR provision
Date: Tuesday, October 31, 2017 3:15:31 PM

As a longtime resident of Alaska, I support the efforts to allow thoughtful drilling in the Arctic National Wildlife Reserve. At over 19.000,000 acres, ANWR is about the same size as the State of South Carolina. The total drilling footprint in Prudhoe Bay (after more than 40 years of development) is only 12,000 acres. It has never been proven that all the activity in Prudhoe has had any negative impact on wildlife. This constraint is discriminatory in that other resource rich areas of the US (Texas, Oklahoma, South Dakota) are able to thoughtfully develop; Alaska deserves the same opportunity.
Thank you for your consideration,
Alex

Alex Slivka | Director of Institutional Marketing | McKinley Capital Management, LLC | 3301 C. Street, Suite 500, Anchorage, AK 99503 | T: 907-339-1417 | F: 907-561-7142 | aslivka@mckinleycapital.com |

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From: Amber Sloan
To: fortherecord (Energy)
Subject: Chairman Murkowski, Ranking Member Cantwell, and Members of the Senate Energy and Natural Resources Committee
Date: Wednesday, November 01, 2017 1:48:06 PM

Good Morning,

My name is Amber Sloan, and I am a Human Resources Manager for a Natural Resources support company in Anchorage, AK. I am able to see first hand how the loss and gain of jobs in the Natural Resource industry impacts families in Alaska, and I believe that we should be utilizing the resources that we currently have within our state to continue to keep Alaskan's working in Alaska. I hope that our State Representatives will listen to what the majority of Alaskan's want, and do their best to make this happen for us. I believe this will benefit all of us. Thank you for a moment of your time.

--

Amber Sloan

Human Resources Administrator

Fairweather, LLC | 301 Calista Court | Anchorage, AK 99518

907.346.3247 Office | 907.267.4647 Direct

907.830.4817 Cell

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From: Dennis Smedley
To: fortherecord (Energy)
Cc: Hoefler, Annie (Energy)
Subject: For Record of November 2, 2017 Hearing
Date: Wednesday, November 01, 2017 12:57:50 PM

Chairman Murkowski, Ranking Member Cantwell, and Members of the Senate Energy and Natural Resources Committee;

As a lifelong Alaskan who is currently employed in the construction industry I support responsible development in ANWR. Alaska Oil and Gas producers have shown that they are environmentally sensitive and can work in ANWR with only a limited footprint.
Due to the extreme cold conditions producers create ice roads that access the work areas in the winters, and in the summers all trace of the ice roads are gone. In the summer there is only small gravel drilling pads with untouched tundra around them.
Thanks for listening,

Dennis L. Smedley II
Criterion General, Inc.

(907) 277-3200 ext 233 Work
(907) 355-1430 Mobile
(907) 272-8544
denniss@criteriongeneral.com
Criterion General, Inc.
2820 Commercial Drive
Anchorage, AK 99501

From: Beverly Smith
To: fortherecord (Energy)
Cc: Hoefler, Annie (Energy)
Subject: open ANWR
Date: Wednesday, November 01, 2017 8:46:24 PM

To: Chairman Murkowski,Ranking Member Cantwell, and Members of the Senate Energy and Natural Resources Committee,

For Record at November 2, 2017 Hearing

I would like to record my view of being in favor of opening ANWR Coastal Plain (1002 Area). America should be developing its own energy and Alaska can help! The pipeline is already in place but is operating at less than full capacity. It has been stated that there are many millions of barrels of oil in this region. As has been proved on the North Slope, development can be accomplished responsibly, with minimal impact to the environment. In fact, my understanding is that the caribou are doing very well! There is no reason for Americans to be dependent on foreign oil when Alaska has oil fields just waiting to be developed. It is my hope that the Senate Energy and Natural Resources Committee will recommend that Congress gives its permission to open ANWR Coastal Plain (Area 1002).

Thank you,

Sincerely,

Bev Smith
****
Beverly Smith
bevsmith@gci.net
P.O. Box 240976
Douglas, AK 99824
907-364-2468
907-988-2468

From: Smith, Ian
To: fortherecord (Energy)
Subject: ANWR 1002 Provision
Date: Wednesday, November 01, 2017 2:21:23 PM
Attachments: image001.png

Dear Chairman Murkowski and Ranking Member Cantwell,
I am an Alaskan that supports the opening of the 1002 area of the Arctic National Wildlife Refuge. Alaskans have developed the North Slope oil fields responsibly and will continue to do so with NO effects to the Arctic Caribou herd or any other animal species. We are the caretakers of the environment and we need you to vote in favor of development.

Regards,

Ian Smith

IT Support Technician

PRICE GREGORY

Tel (907) 278-4400 | Direct (907) 257-4155 | mobile (907)-575-1039
ismith@pricegregory.com | 301 West Northern Lights Blvd, Suite 300, Anchorage, AK 99503

From: Ron Smith
To: fortherecord (Energy)
Subject: Chairman Murkowski, Ranking Member Cantwell, and Members of the Senate Energy and Natural Resources Committee
Date: Thursday, November 02, 2017 1:10:53 AM
Importance: High

Dear Valued Senate Representative,

I respectfully request your most sincerest consideration to support ANWR development to be allowed in the non-wilderness portion of ANWR.

I am a Lifelong Alaskan, a veteran and an experienced businessman who owns small businesses in Alaska as well as West Virginia and the Pacific Rim. IT is a shame that the businesses outside the state of Alaska now support our Alaskan Corporate, due to such a devastating financial climate in the oil and gas industry in Alaska. Less than 2% of the Arctic Coastal Plain is to be developed. I have been directly involved with as well as witnessed the accountability and costs that the North Slope Operators and venders have endeared while maintaining compliance to the heavy handed regulators from the stringent regulators in the State of AK.

It is not to late to support the oil and gas operators while financial opportunities still exist in Alaska. If ANWR is approved, it may bridge the gap which may potentially be caused by the future projected decline on the lower 48 states. Alaska can sustain American Energy independence. Please don't allow our country to step backwards on this progress.

The TAPS (Trans Alaska Pipeline can accommodate an increase of 65% over current transmission, which would create economies of scale and lower future transportation costs. This would only aid in sustaining improved energy costs.
The diverse groups of Alaskan energy businesses, both up and down stream, have clearly demonstrated the willingness and innovative technology to provide development and transportation of Alaska's energy. Thank you in advance for your positive consideration and continued support in allowing the stewards of Alaska's energy to prove that energy development is truly able to cohabitate responsibly with the environment.

Respectfully,

Ron E. Smith
President
AK Supply, Inc.
Managing Member
AK Constructors, LLC
907-229-0811

From: Brad Snowden
To: fortherecord (Energy)
Subject: Support for opening ANWR 1002 Area
Date: Thursday, November 02, 2017 1:51:51 AM

I having been a resident of Alaska for over 50 years. I have worked on building the pipeline from the North Slope to Valdez. I have also worked on the North Slope in recent years building Ice Roads for exploratory drilling. I support 100% opening ANWR for exploratory drilling!
Without a doubt it is key that we balance how we reap the natural resources mother earth provides with a keen eye to not exploit her to the detriment of ours and our children's future. There is ONLY ONE EARTH!!!
My experience has been that the impact is low and the utmost precautions are taken to provide safety to both the workers and the land!
Access is key!!!

As Sarah Palin would say, "Drill Baby Drill"

Help our country be Energy Independent!

HELP US SELL OUR NATURAL GAS TO CHINA!

Brad Snowden
Alaskan
PO Box 670
Seward, AK 99664
brad@seward.net

From: judysnyder3@aol.com
To: fortherecord (Energy)
Subject: reopening arctic pipeline
Date: Wednesday, November 15, 2017 12:09:32 PM

I masking that yu do not re-open arctic pipeline. This land should be protected. Not drilled to make more money for wealthy. Judy Snyder 9013 W 48th Terr. Merriam Ks. 66203.

From: LAUREL SOFFA
To: fortherecord (Energy)
Subject: Wildlife refuges
Date: Tuesday, November 14, 2017 7:36:51 PM

2209 Fawcett Ave
White Oak, Pa 15131

I am OPPOSED to fracking,oil drilling, and gas drilling on any public lands, wildlife refuges, national parks, and national monuments.

Sincerly,

Laurel M Soffa

November 1, 2017

Honorable Lisa Murkowski, Chairman
U.S. Senate Committee on Energy & Natural Resources
522 Hart Senate Office Building
United States Senate
Washington, D.C. 20510

RE: Support ANWR 1002 Area exploration and development
VIA EMAIL: fortherecord@energy.senate.gov

This is to request your support of the proposal to open the Arctic National Wildlife Refuge (ANWR) Coastal Plain to oil and gas exploration and development.

I believe that those who live in the land will best ensure its stewardship.

Having lived in Alaska for 47 years, I've seen our state benefit from oil development on the North Slope. The economic impact has been a key driver in the growth of our state. Further, the industry has demonstrated its environmental stewardship and care for their employees. They are valued members of our communities.

Alaska's experience has shown that arctic can be responsibly developed. The nation needs the energy security, jobs and positive economic impact that ANWR would potentially provide. Please support the budget provision that would open a portion of its Coastal Plain.

Respectfully,

Rick Solie
1639 Madison Drive
Fairbanks, Alaska 99709

From: Suzanne Sorkin
To: fortherecord (Energy)
Subject: ANWR Drilling
Date: Monday, November 06, 2017 4:34:31 PM

Dear Committee on Energy and Natural Resources,

I am OPPOSED to drilling in the Arctic National Wildlife Refuge (ANWR). Many of us have worked hard for many years to keep this national treasure, which has the largest variety of plant and animal life of any protected area north of the Arctic Circle, safe and pristine. IT IS STILL IMPORTANT TO DO SO!

You are a committee for Natural Resources, as well as energy. Please remember and honor that part of your responsibility to our country.

Thank you,

Suzanne Sorkin, MD
800 Cottageview Dr. #411
Traverse City, MI 49684

Southeast Alaska Indigenous Transboundary Commission

Protecting Tribal Lands and Waterways for Future Generations

Members of Congress:

As an Alaska Tribal organization, we stand in solidarity with the Gwich'in Nation in what is now the United States and Canada. In order to protect the traditional Gwich'in way of life, we oppose oil and gas activities on the Coastal Plain of the Arctic National Wildlife Refuge.

Many Alaskans stand in solidarity for the protection of the Alaska Native traditional way of life. The indigenous hunting and fishing practices, including the harvesting and sharing of fish, game, and other resources and the ceremonies that accompany these practices, provide for the physical, social, cultural, spiritual, and economic well-being and survival of Alaska Natives.

We support protections for the Coastal Plain of the Arctic National Wildlife Refuge, or as it is referred to in the Gwich'in language, "*Iizhik Gwats'an Gwandaii Goodlit*" — the Sacred Place Where Life Begins. The Porcupine Caribou Herd has provided the sustenance for the Gwich'in People for thousands of years and is a main source of their food security. Just as the Gwich'in rely upon the caribou, every Porcupine caribou member relies on the narrow strip of land that is the Coastal Plain of the Arctic Refuge to get its start in life.

This issue is not only about wilderness and oil. It also raises serious questions about the fundamental human and indigenous rights of the Gwich'in people. Protection of the birthing and nursing grounds on the Coastal Plain is a human rights issue to the Gwich'in Nation upheld by the UN International Covenant on Civil and Political Rights which states "In no case may a people be deprived its own means of subsistence." This principle should be respected.

The Coastal Plain remains under threat from those who would drill it for oil and gas. We support the Gwich'in request to protect the Coastal Plain of the Arctic Refuge and urge you to reject any effort to open the Arctic Refuge to oil and gas development.

Sincerely,

Fred O. Olsen Jr

Frederick Olsen, Jr.
Chairman
Southeast Alaska Indigenous Transboundary Commission

From: Scott Spickler
To: fortherecord (Energy)
Cc: Hoefler, Annie (Energy)
Subject: Fwd: Support of ANWR postion
Date: Tuesday, October 31, 2017 4:24:06 PM

Support of ANWR position

For Record of November 2, 2017 Hearing

Chairman Murkowski, Ranking Member Cantwell, and Members of the Senate Energy and Natural Resources Committee

I support opening ANWR 100% and hope that your committee will concur:

- Open the ANWR coastal plain (1002 area) to exploration and production.

Require timely lease sales • Streamline and simplify the permitting process

- Provide for a 50 percent-50 percent federal-state revenue sharing, rather than the 90-10 percent split under current law.

- Alaska favors responsible development and protecting the environment.

- Technically recoverable oil within the ANWR 1002 area (excluding State and Native areas) is estimated to be between 4.3 and 11.8 billion barrels (95- and 5-percent probability range), with a mean value of 7.7 billion barrels.

Scott Spickler
10754 Horizon Dr.
Juneau, AK.99801

From: Wanda Spraggon
To: fortherecord (Energy)
Subject: Fwd: Protect Alaska"s Wildlife Refuge from Oil & Gas Companies
Date: Tuesday, November 14, 2017 4:07:03 PM

Sent from my iPhone

Begin forwarded message:

> Please pass my message along to the Chairman & Committee Members,
> I am emailing & also called to ask that the committee find other means to produce federal revenue than reopening the Article National Wildlife Refuge for oil & gas drilling. We should not destroy protected land & end endanger wildlife to fund unnecessary tax breaks to fossil fuel companies.
>
> Thank you for your time,
> Wanda Spraggon
> 2518 s 13th pl
> La Crosse, WI 54601
> Email: wspraggon6998@charter.net
> Phone: (608) 792-6998
>
> Sent from my iPad

From: Sue Sprinkle
To: fortherecord (Energy)
Subject: Opening the Arctic National Wildlife Refuge Coastal Plain
Date: Tuesday, October 31, 2017 7:45:24 PM

Chairman Murkowski, Ranking Member Cantwell, and Members of the Senate Energy and Natural Resources Committee,

Although, I know the Oil Industry can't wait to open this area up for drilling, THIS Alaskan does not support the move. It's a one-and-only landscape. And it should not be destroyed by industry, roads, or over-populated man camps.

Oil is a dirty, destructive extraction industry that is threatening this landscape. The stress that ANWR and other Alaskan coastal areas are feeling is devastating to the plants, the animals, and the Natives who live there. Why are we trying to destroy it faster?

There are those that claim by keeping this area a wilderness "locks up" the land. Well, if you've been to Prudoe Bay, then you would know that it's a no-go zone for anyone who might be recreating, hunting, or just enjoying the coastal beauty. There is no "free" access to those areas. And you'd like to put ANWR behind Industrial fencing as well.

Keep the Oil Industry out of ANWR. Leave it for those who travel gently along the rivers, and waterways of one of the most beautiful places on earth. It should be for everyone, not the few International Petroleum Corporations who won't care about it when it's used up.

Thank you,

Sue Sprinkle

Creative Partner and Chief Visionary

5th Avenue Design & Graphics, Inc.
1222 Well Street, Suite 3
Fairbanks, AK 99701

PH: (907) 452-4166

From: Sproul, Chad
To: fortherecord (Energy)
Subject: ANWR
Date: Wednesday, November 01, 2017 9:31:50 AM
Attachments: image001.png

Dear Chairman Murkowski and Ranking Member Cantwell,

I am an Alaskan that supports the opening of the 1002 area of the Arctic National Wildlife Refuge. Alaskans have developed the North Slope oil fields responsibly and will continue to do so with NO effects to the Arctic Caribou herd or any other animal species. We are the caretakers of the environment and we need you to vote in favor of development."

Sincerely,

Chad Sproul
Project General Foreman
Conam Construction
907-953-1381
csproul@conamco.com

From: Rob Stapleton
To: fortherecord (Energy)
Subject: Drilling in ANWR
Date: Tuesday, October 31, 2017 5:42:49 PM

To the U.S. Senate Energy and Natural Resources Committee,

I support oil, gas and mining operations in Alaska and have since 1975. The oil industry has come a long ways in terms of drilling improvements, gas and oil pipelines with the utilization of safer standards and technology.

My profession as a photographer in Alaska has taken me to the North Slope oilfields many times. I was witness to the construction of the Trans Alaska Pipeline, First Oil in the pipeline, first Super Tanker into Valdez the terminus of the TAPS pipeline and shot documentary photos and film footage of the construction of gravel islands in the Beaufort Sea.

Unlike the message that Robert Redford erroneously stated in a TV ad some years past that "the forest, trees and animals would be harmed by opening this area up" is ridiculous. Most of the North Slope is Tundra and fresh water lakes with NO trees. North slope caribou wander around drill rigs and pipelines of the Alpine,Kuparuk, Deadhorse, Endicott areas of Prudhoe Bay from the coastline at Barrow (now Utqiagvik) to the Canadian border freely.

ANWR is a potentially rich area that can be drilled safely using directional drilling from gravel islands and on land. Please consider opening up this area for future exploration and production.

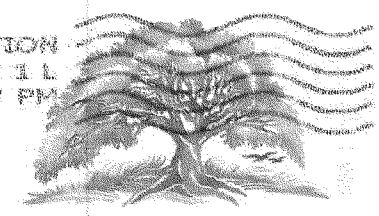
Regards,
Robert E. Stapleton, Jr
1497 N. Heather Meadows Loop
Anchorage, AK 99507

www.Alaskafoto.com
www.alaskafoto.net

Twitter: @AlaskaPix
Twitter:@robstapleton195
(907) 230-9425
Skype: alaskafoto
email: akfotoman@gmail.com

Clay Hill Corners
390 Clay Hill Rd
Hartland, VT 05048
Carol Stedman & Marty Banak

WHITE RIVER JUNCTION VT 050 1 L
NOV 2017 PM



Senate Energy Committee
Chairwoman Lisa Murkowski
304 Dirksen Senate Building
Washington D.C 20510

No drilling in Arctic
Keep artic rigs.
Out of the Artic
Refuge, preserve wildlife
Fish and hapitat. No spills
No pollution NO NO NO.

Carol Stedman

From: KS
To: fortherecord (Energy)
Subject: opposing drilling in the ANWR
Date: Wednesday, November 08, 2017 3:27:48 PM

Hello -- My name is Kimberly Steiner, constituent in Olympia, Washington, 98597, email - savjer@comcast.net.

I am writing to ask that the committee find other means to produce federal revenue than reopening the Arctic National Wildlife Refuge for oil and gas drilling. We should not be destroying protected land and endanger wildlife (such as wolves and caribou) to fund unnecessary tax breaks for the wealthy. Nor should we be endangering wildlife in exchange for an unnecessary giveaway to fossil fuel companies.

We need to be exploring and creating renewable energy, not outdated fossil fuels, as it eventually gets depleted, and, in the meantime, ends up being dangerous for our environment.

Please pass my message along to the Chairman and other committee members.

Sincerely,
Kimberly Steiner
360-561-6806

From: Rebecca Stern
To: fortherecord (Energy)
Subject: Please Protect Alaska"s Wildlife Refuge
Date: Wednesday, November 15, 2017 10:41:33 AM

Dear Committee Chair and Members,

I am writing to ask that the committee find other means to produce federal revenue than reopening the Arctic National Wildlife Refuge for oil and gas drilling. We should not destroy protected land and endanger wildlife to fund unnecessary tax breaks for the wealthy.

Thank you,
Rebecca Stern

87 Central Ave
Burlington, VT 05401

From: Bill Stevens
To: fortherecord (Energy)
Subject: ANER
Date: Wednesday, November 01, 2017 2:06:03 PM

11/01/2017
0945

Dear Chairman Murkowski and Ranking Member Cantwell,
I am an Alaskan that supports the opening of the 1002 area of the Arctic National Wildlife Refuge. I have spent more than 50 years in the Alaska Oil Fields, and *know that Alaskans have developed the North Slope oil fields responsibly and will continue to do so* with NO effects to the Arctic Caribou herd or any other animal species. We are the caretakers of the environment and we need you to vote in favor of development.

Thank you.

William H. Stevens
P.O. Box 8596
Nikiski, Alaska 99635

From: Scott Stewart [mailto:sstewart@arcticcontrols.com]
Sent: Tuesday, October 31, 2017 2:16 PM
To: fortherecord (Energy)
Subject: 1002 - ANWR

Dear Chairman Murkowski,
Ranking Member Cantwell,
and Members of the Senate Energy and Natural Resources Committee.

Reference: For Record of November 2, 2017 Hearing

For decades, scientific polls have shown Alaskans overwhelmingly support responsible oil and gas development in the non-wilderness portion of ANWR. There is no valid reason why we should not be allowed to access the world-class resources within just a tiny fraction of the coastal plain.

The proposed ANWR provision would allow development of no more than 2,000 acres of the 1.5 million acres of the Arctic coastal plain – part of the non-wilderness portion of ANWR's 19 million acres.

That is equivalent to just 0.01 percent of the entire refuge.

Responsible oil and gas development in this fraction of ANWR will help ensure America's energy security for decades and allow Alaska – and our nation as a whole – to realize the benefits that come from expanding energy production in Alaska.

While renewable energy is a growing part of America's energy portfolio, it is still projected to account for a minority of American energy production in 2040. New oil and gas production will be required to power America's economy and can serve as a bridge until renewable energy becomes a dominant energy source decades into the future.

Energy production from ANWR has the potential to offset a decline in Lower 48 shale oil production, which is expected to commence in approximately a decade. Without limited oil development on the coastal plain, America will be forced to once again increase its reliance on foreign imports. With limited development in ANWR, America and Alaska can continue to grow the economy and reduce dependence on foreign oil.

The U.S. Geological Survey estimates the 1002 Area is North America's greatest prospect for conventional onshore oil production, with a mean likelihood of containing 10.4 billion barrels of oil and 8.6 trillion cubic feet of natural gas, as well as a reasonable chance of economically producing 16 billion barrels of oil.

Oil development on a fraction of the coastal plain would create thousands of jobs nationwide, generate billions of dollars in government revenue, keep energy prices for American consumers affordable, and further improve energy security for decades into the future.

Thank you for reading my E-mail on this critical issue.

Best Regards,

Scott A. Stewart
President
Phone: (907) 277-7555
Fax: (907) 277-9295
URL: www.arcticcontrols.com

From: Stinson, Robert
To: fortherecord (Energy)
Subject: Open ANWR
Date: Tuesday, October 31, 2017 7:55:23 PM

Dear Chairman Murkowski and Ranking Member Cantwell,

I am a 43 year Alaskan resident that **supports the opening of the 1002 area of the Arctic National Wildlife Refuge**. I, as well as many other Alaskans, have developed the North Slope oil fields responsibly since the discovery of oil and gas here and will continue to do so with NO effects to the Arctic Caribou herd or any other animal species. We are the caretakers of the environment and continue to be dismayed over the false and misleading information from opponents of development about how the oil and gas industry operates here. The 1002 Area of ANWR is no different than Prudhoe Bay, Kuparuk, Milne Point, Alpine and Pt. Thomson and can be developed in the same best in class manner as those oil fields. We need your vote in favor of development.

Thank you,

Bob Stinson
Price Gregory International, Inc.
Ph: 907-278-4400
Fax: 907-278-3255
PRICE GREGORY

From: SS
To: fortherecord (Energy)
Subject: Vote Yes 1001 ANWR
Date: Tuesday, October 31, 2017 7:20:58 PM
Attachments: Senate 1002 Vote Yes letter 10-31-17 Steve Strait AK.docx

---

October 31, 2017

Vote Yes to Develop 1002 ANWR
Senate Energy and Natural Resources Committee

Dear Chairman Murkowski and Ranking Member Cantwell,
Senate Energy and Natural Resources Committee

As a lifelong Alaskan I am writing in support of oil development in Section 1002 of Arctic National Wildlife Refuge.

Since the 1867 purchase of Alaska from Russia as a Territory and continuing through 1959 Statehood to present, we have been treated as little more than an Colony to the interests of Washington State and Washington DC.

By decisions of congress more than 69% of Alaska is owned by our Federal government. Alaskan's cannot drive to 82% of our communities because roads cannot be built across federal lands. Imagine this situation in New York or Virginia.

Alaska's statehood came with a directive from congress to be self sustaining by developing our oil, timber and fisheries.

We have an excellent environmental track record of oil development on the North Slope of Alaska and Alaskan's as well as the nation have benefited from monetizing our deep resources. Wildlife is healthy and thriving under wise state management practices.

I and the vast majority of Alaskan's encourage you to vote in favor of resource development, jobs and a healthy Alaska economy by Voting YES in Favor of Development of 1002.

Steve Strait
2500 Douglas Dr
Anchorage, Alaska 99517

From: sstrand
To: fortherecord (Energy)
Subject: Chairman Murkowski, Ranking Member Cantwell, and Members of the Senate Energy and Natural Resources Committee
Date: Wednesday, November 01, 2017 8:44:53 PM

As an Alaskan citizen I strongly support opening ANWAR to oil & gas exploration. It is long past due and the old arguments of destroying vast areas of the Coastal Plain are no longer valid. The entire operation can be placed on a 2000 acre pad connected to a 25 mile pipeline in an area the size of South Carolina. In addition, the old argument of depleting the Caribou herds are also no longer valid as the Prudhoe Bay heard has grown from 5K to 30K since the opening of oil & gas operations in the 1970's.

Thank you,
Scott Strand
9001 Spruce Run Circle
Anchorage, AK 99507

From: Karen Strange
To: fortherecord (Energy)
Subject: Preservation of the Arctic National Wildlife Refuge
Date: Wednesday, November 15, 2017 1:51:40 PM

Dear Senators on the Senate Committee on Energy and Natural Resources,

I am writing to ask that that committee find other means of increasing federal revenue than leasing out protected land in Alaska or in ANY part of the United States whose national parks would be compromised. Wealthy individuals or corporations should not be able to lease protected land. Please be an advocate for the American people, for the integrity and health of American soil, and for the indigenous tribes that live on the herds of caribou that would be endangered by oil and gas drilling. Please do NOT lease American protected land for the oil and gas companies to use for profit and unnecessary tax breaks.

Thank you for considering my request.

Karen Strange
2700 Valley View Cove
Round Rock, TX 78681

From: kristen studard
To: fortherecord (Energy)
Subject: ANWR
Date: Thursday, November 02, 2017 5:20:31 PM

Hello,

I'd like to ask that the committee find other means to produce federal revenue than reopening the Arctic National Wildlife Refuge for oil and gas drilling. We should not destroy protected land and endanger wildlife to fund unnecessary tax breaks for the wealthy.

Thank you,
Kristen Studard
1812 N Gramercy Pl #2
Los Angeles, CA 90028

From: William Sullivan - (C)
To: fortherecord (Energy)
Subject: ANWR
Date: Wednesday, November 01, 2017 9:34:09 PM

To whom it may concern
I would like to covey my support for the development of oil and gas in the portion of ANWR that is described in the email I received.
Please add my name to the list of supporters for this project.

Thanks for the opportunity to voice my support
William Sullivan
PO BOX 1473
Soldotna, Alaska 99669

From: Jasah Sumpter
To: fortherecord (Energy)
Subject: RE: Drilling in ANWR
Date: Wednesday, November 01, 2017 1:12:38 PM

I have been a resident of Alaska since 1979. I am opposed to any drilling in ANWR. I believe we should vote NO on any continuing pursuit of Oil or Coal or other dependency on fossil fuels. Spend the money of finding a green energy solution for Alaska's unique environment.

Thank you.

Jasah Sumpter
PO BOX 56542
North Pole, AK 99705

(907) 490-4473

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From: Jerram Swartz
To: fortherecord (Energy)
Subject: Arctic National Wildlife Refuge
Date: Thursday, November 02, 2017 12:46:02 PM

We need to find OTHER MEANS to produce federal revenue than reopening the Arctic National Wildlife Refuge for oil and gas drilling.

The Earth provides us a limited set of resources. Let us not muck it up.

--
Best,

Jerram
310 467-1057

From: Gary Swoffer
To: fortherecord (Energy)
Subject: For Record of November 2, 2017 hearing ANWR
Date: Tuesday, October 31, 2017 2:07:01 PM

Chairman Murkowski, Ranking Member Cantwell, and Members of the Senate Energy and Natural Resources Committee,

- For decades, scientific polls have shown Alaskans overwhelmingly support responsible oil and gas development in the non-wilderness portion of ANWR. There is no valid reason why we should not be allowed to access the world-class resources within just a tiny fraction of the coastal plain.

- The proposed ANWR provision would allow development of no more than 2,000 acres of the 1.5 million acres of the Arctic coastal plain – part of the non-wilderness portion of ANWR's 19 million acres. **That is equivalent to just 0.01 percent of the entire refuge**.

- Responsible oil and gas development in this fraction of ANWR will help ensure America's energy security for decades and allow Alaska – and our nation as a whole – to realize the benefits that come from expanding energy production in Alaska.

- While renewable energy is a growing part of America's energy portfolio, it is still projected to account for a minority of American energy production in 2040. New oil and gas production will be required to power America's economy and can serve as a bridge until renewable energy becomes a dominant energy source decades into the future.

- Energy production from ANWR has the potential to offset a decline in Lower 48 shale oil production, which is expected to commence in approximately a decade. Without limited oil development on the coastal plain, America will be forced to once again increase its reliance on foreign imports. With limited development in ANWR, America and Alaska can continue to grow the economy and reduce dependence on foreign oil.

- The U.S. Geological Survey estimates the 1002 Area is North America's greatest prospect for conventional onshore oil production, with a mean likelihood of containing 10.4 billion barrels of oil and 8.6 trillion cubic feet of natural gas, as well as a reasonable chance of economically producing 16 billion barrels of oil.

- Oil development on a fraction of the coastal plain would create thousands of jobs nationwide, generate billions of dollars in government revenue, keep energy prices for American consumers affordable, and further improve energy security for decades into the future.

Respectfully,

Gary Swoffer
PO Box 60330
Fairbanks, AK 99706-0330

From: Christina Tarr
To: fortherecord (Energy)
Subject: drilling the Arctic National Wildlife Record
Date: Tuesday, November 14, 2017 3:59:49 PM

Hi,

My name is Christina Tarr. I live at 1512 Spruce St., Berkeley, CA 94709.

I am writing to express my opposition to any drilling for oil or gas in the Arctic National Wildlife Refuge.

1. This is one of the few wild places left on earth. Do you know that even building a road creates an "edge" which is disruptive to birds? Do you know that this is one of the great nurseries for many of the ducks and songbirds that we see in the lower 48 states? This great wild places deserves to be left alone!

2. Drilling for oil and gas -- are you kidding me? Are you aware that the climate is changing and it is not going to be easy to keep that change at 2 degrees? Why are we drilling for oil and gas? We need to be looking for green and renewable energy resources, not destroying the wild places on the planet for a dying industry. No, no, no!

3. Who will benefit from this destruction? Do corporations really need a handout? I think no. Tax them harder, put the money into education, and leave the unspoiled arctic alone!!!

I am so angry about this. Americans don't want this. I just visited China, which is a lovely place, actually, except for the pollution. One of the great things about America has been that we've realized that pollution is bad, and that some wild places deserve to be saved. Let's not destroy what has been one of our great strengths.

Leave the Arctic alone.

Thank you,

Christina Tarr

From: Karen Tarver
To: fortherecord (Energy)
Cc: Hoefler, Annie (Energy)
Subject: For Record of November 2017 Hearing - ANWR
Date: Wednesday, November 01, 2017 3:47:47 AM

For Record of November 2017 Hearing on ANWR (Nov 1 or Nov 2)

Dear Chairman Murkowski, Ranking Member Cantwell, and Members of the Senate Energy and Natural Resources Committee,

I had the unique opportunity to travel throughout Alaska for my work. Soon after I moved to Alaska in 1993 I visited the oil fields in Purdue Bay. I was able to see that the exploration and production facilities are carefully inserted into the environment. The companies involved took pride in showing that they can manage environmental concerns along with exploration and production. They were, over 20 years ago, trying to show that ANWR could be used responsibly. While I haven't closely followed the debate on whether this area should be open over the years I did come away from my trips into the Northern part of the state believing that it should be opened. Technically recoverable oil within the ANWR 1002 area (excluding State and Native areas) is estimated to be between 4.3 and 11.8 billion barrels (95- and 5-percent probability range), with a mean value of 7.7 billion barrels.

The environmental issues can be dealt with responsively as they have been over the past 20+ years. Our federal and state government would benefit from opening sections of ANWR and can ensure this by doing the following:

- Open the ANWR coastal plain (1002 area) to exploration and production. Require timely lease sales • Streamline and simplify the permitting process
- Provide for a 50 percent-50 percent federal-state revenue sharing, rather than the 90-10 percent split under current law.

I support the opening of ANWR.

Thank you - Karen

Karen J. Tarver, CPA | Partner
Karen@ermcpa.com
Elgee Rehfeld Mertz, LLC | www.ermcpa.com
9309 Glacier Hwy Suite B-200 | Juneau, Alaska | 99801
(907) 790-6226 **direct** | (907) 789-3178 **main** | (800) 478-3178 **toll free** | (907) 789-7128 **fax**

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From: Mike Tauriainen
To: fortherecord (Energy)
Subject: Open ANWR
Date: Wednesday, November 01, 2017 10:23:52 PM

Dear Senator Murkowski and Senator Cantwell:

I am a lifelong Alaskan. My grandparents came to Alaska in 1898 over the Chilkoot Trail to Dawson and on to Fairbanks. I was born in Fairbanks and love Alaska.

I support opening the 1002 area of the Arctic National Wildlife Refuge for oil and gas development.

We Alaskans have developed the North Slope oil fields responsibly and will continue to do so with no detriment to the Arctic Caribou herd, other resident animals, or the land and waters of Alaska.

We are proven responsible caretakers of the Alaskan environment and we ask you to vote in favor of development.

Kay Tauriainen
Sterling Alaska
kayt@gci.net
907-262-4489

From: Mike Tauriainen
To: fortherecord (Energy)
Subject: ANWR
Date: Wednesday, November 01, 2017 10:01:45 PM

Senators Murkowski and Cantwell,

I support opening the 1002 area of the Arctic National Wildlife Refuge to oil exploration and development.

My first experience on the North Slope of Alaska was in 1969 as an engineer for the Arctic Environmental Engineering Lab working on ice islands in the Beaufort Sea. I subsequently earned a Masters of Science in Arctic Engineering from the University of Alaska after spending time doing research in Port Clarence, Lost River, Barrow, St. Lawrence Island and ice testing during the SS Manhattan trip through the Northwest Passage.

As an Alaskan who understands the Arctic environment and cares deeply for our state and natural environment, I am convinced that developing our natural resources in ANWR can and will be done wisely and safely. This will benefit not only all Alaskans but also the rest of Americans. Alaska has an enviable record of caring for its people and the environment.

The Arctic Caribou herds and other wildlife have flourished in the period 1969 – 2017 during exploration and development of the nearby area. Alaskans care about our wildlife and environment more than anyone else – we live here. I homesteaded with my parents on the Kenai Peninsula in 1959. We have not raped and pillaged our beautiful state and we don't intend to do so in the future.

Please vote in favor of wise development. Please vote for Alaska.

Mike Tauriainen
Sterling Alaska
907-262-4624

From: Ray Tauriainen
To: fortherecord (Energy)
Subject: OPEN 1002 OF ANWAR FOR DRILLING
Date: Thursday, November 02, 2017 11:16:13 AM

Dear Chairman Murkowski and Ranking Member Cantwell,
We are Alaskans who support the opening of the 1002 area of the Arctic National Wildlife Refuge. Alaskans have developed the North Slope oil fields responsibly and will continue to do so with NO effects to the Arctic Caribou herd or any other animal species. We are the caretakers of the environment and we need you to vote in favor of development."

I, Ray, am a nephew to a Nikiski homesteading family and was drawn to Alaska in the 1960's as a member of the U S Military, Fort Richardson, Anchorage, AK. After college my wife and I came to Alaska and I worked in the oil field of the Nikiski Area. I was also a commercial fisherman before retiring a few years ago. It is extremely important that we, as a nation and the state of Alaska, become energy independent. Thank you for your consideration.

Sincerely,
Ray & Sue Tauriainen
40060 Tauriainen Trail
P O Box 8678
Nikiski Alaska 99635
(907) 776-8885

Virus-free. www.avg.com

From: louise teal
To: fortherecord (Energy)
Cc: Hoefler, Annie (Energy)
Subject: For Record of November 2, 2017 Hearing
Date: Tuesday, November 14, 2017 10:35:31 PM

Dear Chairman Murkowski, Ranking Member Cantwell, and Members of the Senate Energy and Natural Resources Committee:

Simply, I oppose opening up the Artic Wildlife National Refuge for oil and gas drilling for any reason.

Louise Teal
PO 3481
Durango, Co 81302

From: Diane Thodos
To: fortherecord (Energy)
Subject: to tally
Date: Tuesday, November 14, 2017 4:51:05 PM

Diane Thodos
Christine Thodos
2668 Orrington Ave.
Evanston IL 60201
847-328-5068

Please tally 3 responses - do not reopen the arctic national wildlife refuge for oil and gas drilling! This is all for unnecessary tax breaks for the wealthy!Pass this message tot he Chairman and other committee members

From: CRAIG THOMPSON
To: fortherecord (Energy)
Subject: ANWR
Date: Tuesday, October 31, 2017 3:00:16 PM

I support limited responsible development in ANWR. Alaska is among the most responsible developers in the world and should not be held from our resources

Thank you

Craig Thompson
Manager
Thompson Logistics LLC
1-907-240-6426 cell
Drcoffee_1@msn.com

From: Jessi Thornton
To: fortherecord (Energy)
Subject: For Record of November 2, 2017 Hearing
Date: Wednesday, November 01, 2017 3:39:29 PM

Dear Chairman Murkowski, Ranking Member Cantwell, and Members of the Senate Energy and Natural Resources Committee,

As an Alaskan, I strongly oppose any oil and gas exploration or drilling in the non-wilderness portion of the Arctic National Wildlife Refuge, known as the "1002 Area" or Coastal Plain.

Here in Alaska, we are on the front lines of climate change. We are witnessing and experiencing the real, devastating impacts to our communities. Alaska is such a beautiful place, not only because of our natural environment, but also because of the many cultures and people that call this place home.

It is vital that we protect the birthing grounds of the Porcupine Caribou herd. I stand with the Gwich'in nation in opposing any and all oil and gas development in the 1002 Area, because this would be a direct threat to the caribou, the food security and ultimately the culture and livelihood of the Gwich'in people. This is a human rights issue, and developing this area would be totally unethical.

In these situations, I think: what is the type of Alaska I want to live in? What is the type of country I want to live in? What future are we building for the next generation?

I want to live somewhere that respects and honors the cultures, history and lives of the indigenous peoples of these lands. I want to live somewhere that builds a future that is healthy and sustainable for our future generations.

I do not want to live in an Alaska, or a United States of America, that is willing to sacrifice an entire people for profit. Do you? Is that truly what you want?

We cannot continue to tie our future to the fossil fuel industry. Lt. Governor Mallot just yesterday made a statement that Alaska's response to climate change "will necessarily revolve around a transition from a petroleum based economy to a renewable energy economy. That will be a critical and necessary focus going forward". I agree with him.

Drilling in the Arctic Refuge is not a solution to our financial problems. I stand firmly in support of the Gwich'in nation, and I respectfully urge you to do so as well.

I ask that you hear the voices of the many, many Alaskans who oppose this, and to please consider this decision with your heart, knowing that the Gwich'in people depend on the Porcupine Caribou.

Thank you for your consideration.

Yours sincerely,

Jessica Thornton
Anchorage, AK 99517
907-952-5753

From: Crystal Tidwell
To: fortherecord (Energy)
Cc: Hoefler, Annie (Energy)
Subject: Support for ANWR
Date: Tuesday, October 31, 2017 8:25:29 PM

Chairman Murkowski, Ranking Member Cantwell, and Members of the Senate Energy & Natural Resources Committee,

As an Operating Engineer and an Alaskan, I fully support moving forward on the ANWR project. Such a tiny piece of land that would make a HUGE impact for our Union members, Alaska and even beyond. Senator Murkowski, I trust that you will hold the Alaskan people's interests at heart and you will make beneficial decisions for us as you have in the past. Please continue pushing for this project. I can't even imagine the positive economic impact it would have on our great state, honestly, it's exciting to think about!
Such close proximity to TAPS and the potential ability to fill our depleting line with oil, the countless jobs created for fellow Alaskan's, the families that would flourish from having access to greater prosperity these oil industry jobs create...it's a no brainer. Please, please, please create a path to move ANWR forward☺

Good luck on the 2nd! Alaska is ready for this!

Crystal Tidwell
Fairbanks Dispatcher, IUOE Local 302
3002 Lathrop St.
Fairbanks, AK 99701
Ph (907)452-8131 x.225
fax (907)452-1434

ctidwell@IUOE302.org

30TH ALASKA STATE LEGISLATURE

REPRESENTATIVE CATHY TILTON
WASILLA
907.465..2199

REPRESENTATIVE TAMMIE WISON
NORTH POLE
907.465.4797

November 2, 2017

The Honorable Lisa Murkowski
Chairman
U.S. Senate Committee on Energy and Natural Resources
304 Dirksen Senate Office Building
Washington, D.C. 20510

The Honorable Maria Cantwell
Ranking Member
U.S. Senate Committee on Energy and Natural Resources
304 Dirksen Senate Office Building
Washington, D.C. 20510

RE: Support for Responsible Oil and Gas Exploration and Development in the 1002 Study Area in the Arctic National Wildlife Refuge

Dear Chairman Murkowski, Ranking Member Cantwell, and Members of the Committee:

The Legislature of the State of Alaska supports the Senate Committee on Energy and Natural Resources' efforts to pass legislation to meet the instruction in H. Con. Res. 71 by allowing for responsible development in the 1002 area of the Arctic National Wildlife Refuge ("ANWR") to grow our economy, reduce the deficit, and improve our national security.

In 1980, Congress passed Public Law 96-847, the Alaska National Interest Lands Conservation Act ("ANILCA"). ANILCA affected over 100 million acres of federal lands in Alaska. The legislation effectively doubled the size of the country's national park and refuge systems and tripled designated "wilderness areas."

Members of Congress, and this Committee, should be reminded that the final version of ANILCA was a carefully crafted compromise. The intent of ANILCA was to reflect Congress' struggle to achieve balance between conservation in Alaska and economic opportunity in the state, pursuant to the Alaska Statehood Compact.[1]

There is much history regarding the debate to open the 1002 area. However, through the years, the State of Alaska and the Alaska State Legislature have remained consistent. We have repeatedly urged the United States Congress to pass legislation opening the 1002 study area for oil and gas development.

Under ANILCA Section 103 (16 U.S.C. 3143), the United States Congress reserved the right to permit oil and gas development and production within the coastal plain of ANWR. In Section 1002

[1] 16 U.S.C. s. 310(d); Public Law 85-508; 72 Stat. 338 (1958).

(16 U.S.C. 3142), Congress authorized nondrilling exploratory activity within the coastal plain of ANWR (the "1002 study area").

While Congress has yet to successfully enact legislation opening the 1002 study area, development of oil on the adjacent state lands at Prudhoe Bay, Kuparuk, Endicott, Lisburne, and Milne Point has resulted in thousands of jobs throughout the United States as well as significant revenues to the federal treasury. Yet North Slope production has declined significantly in the last decade and is forecasted to continue to decline absent additional resources from federal lands. The threats to the Trans Alaska Pipeline System ("TAPS") from declining throughput are well known to the Committee and constitute a substantial risk to both a significant national asset and our nation's energy security.

We have made every effort to encourage responsible production from state lands and today TAPS is currently receiving production from leases at Point Thomson, a new development bordering the 1002 study area. The proximity of new infrastructure means oil produced from the 1002 study area may require only the additional construction of a pipeline to Point Thomson and expansion of the existing pipelines to deliver oil to TAPS and subsequently to market.

Oil and gas exploration and development of the coastal plain of the refuge could result in major discoveries that would reduce our nation's dependency on oil produced by hostile foreign nations and help to balance the nation's trade deficit. The oil industry, the state, and the United States Department of the Interior consider the 1002 study area to have the highest potential for the discovery of very large, conventional oil and gas accumulations on the continent of North America, estimated to be as much as 10,000,000,000 barrels of recoverable oil. The state's and the nation's future energy independence could also be enhanced with additional natural gas production from the North Slope of Alaska. The 1002 study area is expected to contain significant gas reserves and the development of those reserves could also enhance the economic viability of the proposed Alaska liquefied natural gas project.

These resources would not just contribute to our energy and national security, they would also create new wealth that should reduce our national deficit and support the repayment of our national debt. As Congress recognized during the debate on potential amendments to H. Con. Res. 71, the Senate Energy and Natural Resources Committee plays an important role in generating new revenues and we strongly believe that the best option to raise revenues is to open a small portion of the Arctic National Wildlife Refuge to responsible development and to provide a more equitable sharing of the royalty revenues between the state and federal government.

The 1,500,000-acre 1002 study area makes up less than eight percent of the 19,000,000-acre refuge. 8,900,000 of the 19,000,000 acres of the refuge have already been set aside as wilderness. The oil industry has shown at Prudhoe Bay, as well as at other locations along the Arctic coastal plain, that it is capable of conducting oil and gas activity without adversely affecting the environment or wildlife populations. The state will continue to strive to ensure the ongoing health and productivity of the Porcupine and Central Arctic caribou herds and the protection of land, water, and wildlife resources during the exploration and development of the 1002 study area.

The oil and gas industry has developed directional drilling technology that will allow horizontal drilling in a responsible manner by minimizing the development footprint within ANWR, and that directional drilling technology may be capable of drilling from outside of the boundaries of the 1002 study area. The oil industry is using innovative technology and environmental practices in new field developments, and those techniques are directly applicable to operating in the 1002 study area and would enhance environmental protection beyond our traditionally high standards.

The Alaska State Legislature urges that oil and gas exploration, development, and production activity be allowed in the 1002 study area and we are committed to ensuring that development happens in a manner that protects both the environment and the Porcupine caribou herd on which the Iñupiat, Gwich'in, and other local residents depend. That development uses directional drilling and other advances in technology to minimize the development footprint in the 1002 study area, and that development of the 1002 study area provides the maximum benefits to Alaskans and improves the economic and energy security of our nation.

We ask the United States Congress and the Senate Committee on Energy and Natural Resources to pass legislation opening the 1002 study area for responsible oil and gas development, to bring new revenues to the table to reduce the national deficit and debt, create jobs and economic prosperity for Americans, and to strengthen our energy and national security.

Sincerely,

Rep. Cathy Tilton (District 12 – Wasilla)

Rep. Tammie Wilson (District 3 – North Pole)

From: Mark Tornai
To: fortherecord (Energy)
Subject: Potential for oil and gas exploration and development in ANWR
Date: Wednesday, November 01, 2017 1:50:55 PM

Chairman Murkowski, Ranking Member Cantwell, and Members of the Senate Energy and Natural Resources Committee:

I would like to express my support the potential for oil and gas exploration and development in the non-wilderness portion of the Arctic National Wildlife Refuge. Oil development on a fraction of the coastal plain would create thousands of jobs nationwide, generate billions of dollars in government revenue, keep energy prices for American consumers affordable, and further improve energy security for decades into the future. Thanks to continuing improvements in technology, practices, and oversight, the oil industry has demonstrated over the past 40 years that North Slope energy development and environmental stewardship can and do coexist. The industry has a proven track record of responsible development in sensitive areas, protecting the environment, wildlife and subsistence needs of local residents.

Respectfully,

Mark Tornai
EHS Specialist
Hilcorp Alaska
Cook Inlet Operations
Cell: 907-748-3299
Office: 907-283-1372

"Right is right, even if everyone is against it; and wrong is wrong, even if everyone is for it"
William Penn

From: Mead Treadwell
To: fortherecord (Energy)
Subject: Support ANWR opening
Date: Tuesday, October 31, 2017 10:59:56 PM

As you consider measures to make this resource available for exploration, let me add my support. It is high time we open ANWR and require sustainable development which will include protection of wildlife and meeting our energy needs.

Thank you.

Mead Treadwell
Mobile: (907) 223-8128
meadwell@alaska.net
mead@ventureadastra.com
Sent from my iPhone

From: Daniel J. Tucker
To: fortherecord (Energy)
Subject: Please OPEN ANWR area 1002 for reasonable access and development
Date: Wednesday, November 01, 2017 11:44:51 PM
Attachments: B681E9A1-46A7-4A4B-8FC9-6BE890FA7273.png

Dear Chairman Murkowski and Ranking Member Cantwell,

I am an Alaskan that supports the opening of the 1002 area of the Arctic National Wildlife Refuge. Alaskans have developed the North Slope oil fields responsibly and will continue to do so with NO negative effects to the Arctic Caribou herd or any other animal species. In fact most animal herds, groups and populations have increased during the past years of development.

We are the caretakers of the environment and we need you to vote in favor of development. This is long overdue and has been held back by mostly non-resident, fanatical anti-development groups.

- While renewable energy is a growing part of America's energy portfolio, it is still projected to account for a minority of American energy production in 2040. New oil and gas production will be required to power America's economy and can serve as a bridge until renewable energy becomes a dominant energy source decades into the future.

- Energy production from ANWR has the potential to offset a decline in Lower 48 shale oil production, which is expected to commence in approximately a decade. Without limited oil development on the coastal plain, America will be forced to once again increase its reliance on foreign imports. With limited development in ANWR, America and Alaska can continue to grow the economy and reduce dependence on foreign oil.

- The U.S. Geological Survey estimates the 1002 Area is North America's greatest prospect for conventional onshore oil production, with a mean likelihood of containing 10.4 billion barrels of oil and 8.6 trillion cubic feet of natural gas, as well as a reasonable chance of economically producing 16 billion barrels of oil.

- Alaska's economic lifeline, the Trans-Alaska Oil Pipeline System (TAPS), is now running at three-quarters empty. New oil production from ANWR has the potential to reverse throughput in TAPS, a vital component of American energy infrastructure.

- Oil development on a fraction of the coastal plain would create thousands of jobs nationwide, generate billions of dollars in government revenue, keep energy prices for American consumers affordable, and further improve energy security for decades into the future.

- Since the ANWR coastal plain is less than 60 miles from TAPS, development of energy resources there is one of the most environmentally-sound way to increase oil production in Alaska.

- Thanks to continuing improvements in technology, practices, and oversight, the oil industry has demonstrated over the past 40 years that North Slope energy development and environmental stewardship can and do coexist. The industry has a proven track record of responsible development in sensitive areas, protecting the environment, wildlife and subsistence needs of local residents.

This It is long past time for Alaska to be allowed to open for development lands that hold promise to permit the U.S. to continue to exert our energy independence, and for Alaska to participate fully in that process.

I have personally been to numerous areas of the North Slope and have worked intimately with and within the 'developed area' that exists now. I know how much time, effort, expense and attention has been given to responsible, safe, environmentally considerate development of this area.

And I'm more than frustrated with the continued intervention and harassment by the Outside, non-resident environmentalists who are trying to mandate what we do within our state.

This would also mean more jobs would be available in Alaska, to Alaskan's so we can be more independent of the government welfare that supplements lack of income from no work opportunities.

Thank you for considering my comments,

Sincerely,

Daniel J Tucker
4330 E. Wickersham Way
Wasilla, AK 99654-7638
A Proud American since 1950 and Alaskan since 1969

From: Barbara Huff
To: fortherecord (Energy)
Cc: Rick Boyles; Gary Dixon; Bailey, Christy; annie
Subject: Opening of Section 1002 (ANWR)
Date: Tuesday, October 31, 2017 10:18:37 PM

Chair Murkowski, Ranking Member Cantwell and Honorable Members of the Committee:

Thank you for the opportunity to address the Committee on the opening Section 1002 (ANWR). As a thirty nine year Teamster member, I and our members understand how important this is.

Early in the 1980's we thought by this time Prudhoe Bay would be dead or at least in the final throws of a sputtering downward spiral. Every year, it seems doomsday has been nudged back on the time line. This is mainly because of developing technology that has allowed the oil producers in Alaska to keep extending the life of that field. As frontline, hardworking people, our members understand the reality and implications of declining oil production. Loss of good paying jobs, declining state budget and overall negative impact on our state. These are some of the reasons we believe that Section 1002 (ANWR) should be open for development.

Alaska's economic lifeline, the Trans-Alaska Pipeline System (TAPS) is currently running at about three quarters empty. While the producers and developers have been drilling and continuing to add new oil, the finds are not as great as Prudhoe Bay. Likewise, section 1002 is about 60 miles from TAPS. Development of energy resources there is an environmentally sound way to increase oil production in Alaska. It will provide real and substantial benefits to our members and other Alaskans through good paying jobs and new business opportunities.
As some on this committee know, Alaska is a great place to work, raise a family and enjoy our pristine outdoors. A thumbs up to opening Section 1002 for exploration will encourage more Alaskans to stay here in the coming years.

On a final note, I want to mention the environment. Thank goodness, I think we are past the days of "greenies vs oilies" name calling when it comes to protecting our land and its habitat. We all care deeply about protecting this land and its habitat. With respect to the Gwich'in people and their reliance on the animals and the land, it has been shown with modern advanced technology that development of our lands resources can occur with little disturbance to the environment. Our Teamster members have and will continue to support environmentally sound development. Section 1002 can be developed with care and protection for the environment. In this day and age, none of us should expect anything less. I therefore, respectfully request the committee move forward with support for opening Section 1002 (ANWR). Any further delay means reduced revenues and lost job opportunities for not only Alaskan's but workers in the lower 48 also.

Your time and consideration of this matter is greatly appreciated.

Barbara Huff Tuckness
President-Alaska Teamsters Local 959
Director Legislative & Government Affairs
Business Representative/Negotiator
520 E 34th Ave # 102
Anchorage, Ak 99503
Office 907 751-8536/cell 907 227-4572
Fax 907 751-8565

From: George Tuckness
To: fortherecord (Energy)
Cc: Hoefler, Annie (Energy)
Subject: Alaskan Support for oil and gass activity in ANWR
Date: Wednesday, November 01, 2017 4:40:58 PM

Attention: Chairman Murkowski, Ranking Member Cantwell, and Members of the Senate Energy and Natural Resources Committee."

I am writing the committee for the Record of the November 2, 2017 Hearing, to show my support for responsible drilling and exploration for oil and gas within the non-wilderness coastal plain of the Arctic National Wildlife Refuge.

As a citizen of Alaska for 35 years I have become aware of the importance of oil and gas development to the economy of our great State. We need to continue to develop our resources and continue to be a factor in the world's supply of energy. Responsible oil and gas development in this small portion of ANWR will help ensure America's energy security for decades and allow Alaska – and our nation as a whole – to realize the benefits that come from expanding energy production in Alaska. · The proposed ANWR provision would allow development of no more than 2,000 acres of the 1.5 million acres of the Arctic coastal plain – part of the non-wilderness portion of ANWR's 19 million acres. That is equivalent to just 0.01 percent of the entire refuge.

Polls have consistently shown Alaskans overwhelmingly support of responsible oil and gas development in the non-wilderness portion of ANWR. There is no valid reason why we should not be allowed to access the world-class resources within just a tiny fraction of the coastal plain. Alaska's economic lifeline, the Trans-Alaska Oil Pipeline System (TAPS), is now running at three-quarters empty. New oil production from ANWR has the potential to reverse throughput in TAPS, a vital component of American energy infrastructure.

Since the ANWR coastal plain is less than 60 miles from TAPS, development of energy resources there is one of the most environmentally-sound way to increase oil production in Alaska.

In the last 40 years of energy development on the North Slope the oil industry has demonstrated good environmental stewardship. They have a proven track record of responsible development, and protecting the environment. I hope that the committee will take into consideration the above facts and vote in favor of oil and gas development of the aforementioned area of ANWR.

Sincerely, George Tuckness
Responsible Citizen of Alaska
Alaska Associated General Contractors
Board of Directors Member

George Tuckness
Senior Project Manager

Neeser Construction, Inc.
2501 Blueberry Road
Anchorage, Alaska 99503
O. (907) 276-1058
C. (907) 230-9444
F. (907) 276-8533

From: Jacqueline Tupou
To: fortherecord (Energy)
Subject: ANWR
Date: Wednesday, November 01, 2017 3:00:29 PM

I support responsible development of oil within ANWR.

Jacqueline Tupou
8166 Easy Street
Juneau, Alaska 99801

Sent from Yahoo Mail for iPhone

From: Darlene Turner
To: fortherecord (Energy)
Subject: ANWAR
Date: Tuesday, October 31, 2017 3:20:27 PM

"Dear Chairman Murkowski and Ranking Member Cantwell,
I am an Alaskan that supports the opening of the 1002 area of the Arctic National Wildlife Refuge. Alaskans have developed the North Slope oil fields responsibly and will continue to do so with NO effects to the Arctic Caribou herd or any other animal species. We are the caretakers of the environment and we need you to vote in favor of development."
I worked on the north slope for 2 years as the only Alaska State Trooper north of the Brooks Range. I have firsthand knowledge of the development of Kuparuk oil field. I watched as thousands of caribou crossed and re-crossed the oil fields without any impact to them. I witnessed millions of migratory water fowl gave birth to the next generation of birds without any impact from the development of Kuparuk. Please open ANWAR.
Sincerely,
Darlene Turner
Retired Alaska State Trooper
1977-2000.

Darlene J. Turner
A Smiling Bear Bed and Breakfast
2046 Three Sisters Way
Kodiak, Alaska 99615
1-907-486-6390
1-907-539-2811/ cell

From: Yahoo!
To: fortherecord (Energy)
Cc: Hoefler, Annie (Energy)
Subject: For Record of November 2, 2017 Hearing
Date: Wednesday, November 01, 2017 3:11:20 PM

Chairman Murkowski, Ranking Member Cantwell and Members of the Senate Energy and Natural Resources Committee,

I urge you to pass legislation opening the Arctic National Wildlife Refuge (ANWR) to limited oil and gas activity in the non-wilderness coastal plain. Opening ANWR has always enjoyed wide support from Alaskans, traditionally pulling an average of 70 percent support in public opinion surveys and will further reduce America's dependence on foreign oil

Please consider how far oilfield development in Alaska has come since the 1970's. Prudhoe Bay's footprint reflects 1970's technology, Kuparuk is smaller and reflects 1980's technology while the Alpine Field, built in the late 90's is small enough that someone would have to go looking for it to find it. The production footprint in ANWR would take that a step further by using a tiny 0.01 percent of the refuge.

Thousands of new jobs will also be created across the country and generate billions of dollars in revenue for the federal government and the State of Alaska.

For all these reasons and many more I respectfully ask that you support opening ANWR.

Regards,

Jeff Turner
907-569-7070

From: Jim Udelhoven
To: fortherecord (Energy)
Cc: Hoefler, Annie (Energy)
Subject: Opening of the non-wilderness portion of ANWR for development
Date: Tuesday, October 31, 2017 6:56:41 PM

Chairman Murkowski, Ranking Member Cantwell, and Members of the Senate Energy and Natural Resources Committee

I have lived in Alaska for 49 years and I support Responsible oil and gas development in a small portion of ANWR in the 1002 area. This would extend the life of Alaska's 800 mile oil pipeline for 50 years and this is the lives blood of Alaska' economy.

Oil development on a fraction of the coastal plain would create thousands of jobs nationwide and many for Alaska family's. Generate billions of dollars in government revenue. This would keep prices stable and improve energy security for decades in the future.

James Udelhoven
P.O. Box 126
Kasilof AK
99610

From: Sandra Udelhoven
To: fortherecord (Energy)
Subject: ANWR (AKA "1002 Area" "For the Record of November 2, 2017 Hearing"
Date: Tuesday, October 31, 2017 6:30:22 PM

Chairman Murkowski, Ranking Member Cantwell and Members of the Senate Energy and Natural Resources Committee,

In 1980 when I graduated from Kenai High School, Kenai Alaska, the then new Congressman Don Young spoke to my graduating class and told us to get an education.

Why, did he say that-because ANWR was our future.

Well, fast forward to 2017 and I am still waiting for ANWR to open and for oil and gas development to happen.

I vote yes to opening parts of ANWR; if not all of it.

Let's move forward and not wait another thirty-seven years to tell the young population of Alaska ANWR is their future.

Let's make it their future today!

Sincerely,

Sandra Udelhoven
10/31/17

Sandra Udelhoven
Purchasing Manager/Logistics
Udelhoven Oilfield System Services, Inc.
184 East 53rd Avenue
Anchorage, AK 99518-1222
Direct: 907-375-1578
Cell: 907-632-7115
Fax: 907-562-1880
sudelhoven@udelhoven.com
(Embedded image moved to file: pic06334.gif)

UTBB Headquarters
P.O. Box 1252
Dillingham, AK 99576
Telephone: 907- 842-1687
Fax: 907- 842-1853
www.utbb.org

UTBB Member Tribes:
Nondalton Tribal Council
P.O. Box 49
Nondalton, Alaska 99640
Telephone: 907-294-2257
Fax: 907-294-2271

New Stuyahok Traditional Council
P.O. Box 49
New Stuyahok, Alaska 99636
Telephone: 907-693-3173
Fax: 907-693-3179

Levelock Village Council
P.O. Box 70
Levelock, Alaska 99625
Telephone: 907-596-3434
Fax: 907-596-3462

Curyung Tribal Council
P.O. Box 216
Dillingham, Alaska 99576
Telephone: 907-842-2384
Fax: 907-842-4510

Ekuk Village Council
P.O. Box 530
Dillingham, Alaska 99576
Phone: 907-842-3842
Fax: 907-842-3843

Manokotak Village Council
P.O. Box 169
Manokotak, Alaska 99628
Telephone: 907-289-2067
Fax: 907-289-1235

New Koliganek Village Council
P.O. Box 5057
Koliganek, Alaska 99576
Telephone: 907-596-3434
Fax: 907-596-3462

Traditional Council of Togiak
P.O. Box 310
Togiak, Alaska 99678
Telephone: 907-493-5003
Fax: 907-493-5005

Clarks Point Village Council
P.O. Box 90
Clark's Point, Alaska 99569
Telephone: 907-236-1427
Fax: 907-236-1428

Twin Hills Village Council
P.O. Box TWA
Twin Hills, Alaska 99576
Telephone: 907-525-4821
Fax: 907-525-4822

Aleknagik Traditional Council
P.O. Box 115
Aleknagik, AK 99555
Telephone: 907-842-2080
Fax: 907-842-2081

Portage Creek Village Council
1327 E. 72nd Unit B
Anchorage, AK 99518
Telephone: 907-277-1105
Fax: 907-277-1104

Chignik Lake Traditional Council
P.O. Box 33
Chignik Lake, AK 99548
Telephone: 907-845-2212
Fax: 907-8452217

Pilot Point Tribal Council
PO BOX 449
Pilot Point, AK 99649
Telephone: 907-797-2208
Fax:907-797-2258

united
TRIBES OF BRISTOL BAY

November 1, 2017

Members of Congress:

As Alaska tribal governments and organizations, we stand in solidarity with the Gwich'in Nation in what is now the United States and Canada to protect the traditional Gwich'in way of life and oppose oil and gas activities on the Coastal Plain of the Arctic National Wildlife Refuge.

Many tribal organizations here in Alaska stand in solidarity for the protection of the Alaska Native traditional way of life. The indigenous hunting and fishing practices, including the harvesting and sharing of fish, game, and other resources and the ceremonies that accompany these practices, provide for the physical, social, cultural, spiritual, and economic well-being and survival of Alaska Natives.

We support protections for the Coastal Plain of the Arctic National Wildlife Refuge, or as it is referred to in the Gwich'in language, "*Iizhik Gwats'an Gwandaii Goodlit*" — the Sacred Place Where Life Begins. The Porcupine Caribou Herd has provided the sustenance for the Gwich'in People for thousands of years and is a main source of their food security. Just as the Gwich'in rely upon the caribou, every Porcupine caribou member relies on the narrow strip of land that is the Coastal Plain of the Arctic Refuge to get its start in life.

This issue is not only about wilderness and oil. It also raises serious questions about the fundamental human and indigenous rights of the Gwich'in people. Protection of the birthing and nursing grounds on the Coastal Plain is a human rights issue to the Gwich'in Nation and is upheld by the UN International Covenant on Civil and Political Rights which states "In no case may a people be deprived its own means of subsistence." This principle should be respected.

The Coastal Plain remains under threat from those who would drill it for oil and gas. We support the Gwich'in request to protect the Coastal Plain of the Arctic

Refuge and urge you to reject any effort to open the Arctic Refuge to oil and gas development.

Quyana,

Alannah Hurley
UTBB Executive Director
(907) 843-1633
ahurley@utbb.org

From: Archie Vance
To: fortherecord (Energy)
Subject: ANWR 1002
Date: Tuesday, October 31, 2017 4:28:57 PM

Dear Chairman Murkowski and Ranking Member Cantwell,
I am an Alaskan that supports the opening of the 1002 area of the Arctic National Wildlife Refuge. Alaskans have developed the North Slope oil fields responsibly and will continue to do so with NO effects to the Arctic Caribou herd or any other animal species. We are the caretakers of the environment and we need you to vote in favor of development

Best Regards,

Archie S. Vance
HEALTH SAFETY ENVIORNMENTAL INSTRUCTOR
Northern Industrial Training, LLC
3700 Centerpoint Dr - Suite 102
Anchorage, AK 99503
(907) 743-7700

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For Record of November 2, 2017 Hearing November 1, 2017

Attn: Chairman Murkowski, Ranking Member Cantwell, and Members of the Senate Energy and Natural Resources Committee.

The State of Alaska needs your help!

Our company and employees needs your help to create jobs in Alaska.

Polls have consistently shown Alaskans overwhelmingly support responsible oil and gas development in the non-wilderness portion of ANWR. There is no valid reason why we should not be allowed to access the world-class resources within just a tiny fraction of the coastal plain.

- The proposed ANWR provision would allow development of no more than 2,000 acres of the 1.5 million acres of the Arctic coastal plain – part of the non-wilderness portion of ANWR's 19 million acres. That is equivalent to just 0.01 percent of the entire refuge.

- Responsible oil and gas development in this fraction of ANWR will help ensure America's energy security for decades and allow Alaska – and our nation as a whole – to realize the benefits that come from expanding energy production in Alaska.

- While renewable energy is a growing part of America's energy portfolio, it is still projected to account for a minority of American energy production in 2040. New oil and gas production will be required to power America's economy and can serve as a bridge until renewable energy becomes a dominant energy source decades into the future.

- Energy production from ANWR has the potential to offset a decline in Lower 48 shale oil production, which is expected to commence in approximately a decade. Without limited oil development on the coastal plain, America will be forced to once again increase its reliance on foreign

imports. With limited development in ANWR, America and Alaska can continue to grow the economy and reduce dependence on foreign oil.

- The U.S. Geological Survey estimates the 1002 Area is North America's greatest prospect for conventional onshore oil production, with a mean likelihood of containing 10.4 billion barrels of oil and 8.6 trillion cubic feet of natural gas, as well as a reasonable chance of economically producing 16 billion barrels of oil.

- Alaska's economic lifeline, the Trans-Alaska Oil Pipeline System (TAPS), is now running at three-quarters empty. New oil production from ANWR has the potential to reverse throughput in TAPS, a vital component of American energy infrastructure.

- Oil development on a fraction of the coastal plain would create thousands of jobs nationwide, generate billions of dollars in government revenue, keep energy prices for American consumers affordable, and further improve energy security for decades into the future.

- Since the ANWR coastal plain is less than 60 miles from TAPS, development of energy resources there is one of the most environmentally-sound way to increase oil production in Alaska.

- Thanks to continuing improvements in technology, practices, and oversight, the oil industry has demonstrated over the past 40 years that North Slope energy development and environmental stewardship can and do coexist. The industry has a proven track record of responsible development in sensitive areas, protecting the environment, wildlife and subsistence needs of local residents.

Sincerely,

Scott Vierra

Scott Vierra
1670 Circlewood Dr
Anchorage, AK 99516

From: Jayson Vinas [mailto:Anc.Dispatch@sourdoughtransfer.com]
Sent: Wednesday, November 01, 2017 2:33 PM
To: fortherecord (Energy)
Subject: ANWR

Dear Chairman Murkowski, Ranking Member Cantwell, and Members of the Senate Energy and Natural Resources Committee,

As to this week's hearing Thursday, November 2, on an ANWR drilling provision that would allow limited oil and natural gas activity within the non-wilderness coastal plain of the Arctic National Wildlife Refuge (ANWR), ***I strongly support and agree with the following statements from Alaska Oil and Gas Association:***

- For decades, scientific polls have shown Alaskans overwhelmingly support responsible oil and gas development in the non-wilderness portion of ANWR. There is no valid reason why we should not be allowed to access the world-class resources within just a tiny fraction of the coastal plain.

- The proposed ANWR provision would allow development of no more than 2,000 acres of the 1.5 million acres of the Arctic coastal plain – part of the non-wilderness portion of ANWR's 19 million acres. That is equivalent to just 0.01 percent of the entire refuge.

- Responsible oil and gas development in this fraction of ANWR will help ensure America's energy security for decades and allow Alaska – and our nation as a whole – to realize the benefits that come from expanding energy production in Alaska.

- While renewable energy is a growing part of America's energy portfolio, it is still projected to account for a minority of American energy production in 2040. New oil and gas production will be required to power America's economy and can serve as a bridge until renewable energy becomes a dominant energy source decades into the future.

- Energy production from ANWR has the potential to offset a decline in Lower 48 shale oil production, which is expected to commence in approximately a decade. Without limited oil development on the coastal plain, America will be forced to once again increase its reliance on foreign imports. With limited development in ANWR, America and Alaska can continue to grow the economy and reduce dependence on foreign oil.

- The U.S. Geological Survey estimates the 1002 Area is North America's greatest prospect for conventional onshore oil production, with a mean likelihood of containing 10.4 billion barrels of oil and 8.6 trillion cubic feet of natural gas, as well as a reasonable chance of economically producing 16 billion barrels of oil.

- Oil development on a fraction of the coastal plain would create thousands of jobs nationwide, generate billions of dollars in government revenue, keep energy prices for American consumers affordable, and further improve energy security for decades into the future.

THANK YOU,

Jayson Vinas
Anchorage HHG Dispatcher
Anchorage- Sourdough Transfer, Inc.
Tel: 907.561.2333
Fax: 907.561.0789
www.sourdoughtransfer.com

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HOOKED ON SAFETY

To: Chairman Murkowski
Ranking Member Cantwell
Members of the Senate Energy and Natural Resource Committee

I am a 34-year resident of Alaska and have spent 15 of those years working in Prudhoe Bay.

- Polls have consistently shown Alaskans overwhelmingly support responsible oil and gas development in the non-wilderness portion of ANWR. There is no valid reason why we should not be allowed to access the world-class resources within just a tiny fraction of the coastal plain.

- The proposed ANWR provision would allow development of no more than 2,000 acres of the 1.5 million acres of the Arctic coastal plain – part of the non-wilderness portion of ANWR's 19 million acres. That is equivalent to just 0.01 percent of the entire refuge.

- Responsible oil and gas development in this fraction of ANWR will help ensure America's energy security for decades and allow Alaska – and our nation as a whole – to realize the benefits that come from expanding energy production in Alaska.

- While renewable energy is a growing part of America's energy portfolio, it is still projected to account for a minority of American energy production in 2040. New oil and gas production will be required to power America's economy and can serve as a bridge until renewable energy becomes a dominant energy source decades into the future.

- Energy production from ANWR has the potential to offset a decline in Lower 48 shale oil production, which is expected to commence in

approximately a decade. Without limited oil development on the coastal plain, America will be forced to once again increase its reliance on foreign imports. With limited development in ANWR, America and Alaska can continue to grow the economy and reduce dependence on foreign oil.

- The U.S. Geological Survey estimates the 1002 Area is North America's greatest prospect for conventional onshore oil production, with a mean likelihood of containing 10.4 billion barrels of oil and 8.6 trillion cubic feet of natural gas, as well as a reasonable chance of economically producing 16 billion barrels of oil.

- Alaska's economic lifeline, the Trans-Alaska Oil Pipeline System (TAPS), is now running at three-quarters empty. New oil production from ANWR has the potential to reverse throughput in TAPS, a vital component of American energy infrastructure.

- Oil development on a fraction of the coastal plain would create thousands of jobs nationwide, generate billions of dollars in government revenue, keep energy prices for American consumers affordable, and further improve energy security for decades into the future.

- Since the ANWR coastal plain is less than 60 miles from TAPS, development of energy resources there is one of the most environmentally-sound way to increase oil production in Alaska.

- Thanks to continuing improvements in technology, practices, and oversight, the oil industry has demonstrated over the past 40 years that North Slope energy development and environmental stewardship can and do coexist. The industry has a proven track record of responsible development in sensitive areas, protecting the environment, wildlife and subsistence needs of local residents.

Regards,

Todd Vincelette

From: Julie K Wahl
To: fortherecord (Energy)
Subject: The ANWR provision
Date: Wednesday, November 01, 2017 2:33:36 PM

TO: Chairman Murkowski, Ranking Member Cantwell, and Members of the Senate Energy and Natural Resources Committee.

Reference: For Record of November 2, 2017 Hearing

I, the undersigned, stand opposed to drilling in the Arctic National Wildlife Refuge.

Though our congressional delegation often touts the fact that all Alaskans support opening the coastal plain to oil and gas development, this is a misperception. As an Alaskan, I believe that protecting this pristine, wild place for current and future generations alike is in the best interest of our state and nation for the following reasons:

The Arctic Refuge is one of the most biologically diverse area in the entire circumpolar region. Within the Refuge, five ecological life zones remain essentially unmarred by human influence, as they have since the beginning of time. Renowned for its incomparable wildness, the Arctic Refuge stands as an iconic symbol of our nation's resolve to preserve its most treasured landscapes.

The coastal plain located in the Arctic Refuge is the only five percent of Alaska's Arctic coastal plain that has any legislative protections. This small area serves as vital calving grounds for the Porcupine Caribou, denning habitat for female polar bears and their cubs, and nesting grounds for millions of birds each summer. The once-locally extinct musk oxen relies on the coastal plain for vital habitat throughout the entire year. To remove protections for this small portion of the coastal plain and allow oil and gas development would be devastating for these different species.

The Arctic Refuge has sustained the Porcupine Caribou Herd, and thus the Gwich'in people who rely on the herd for their subsistence tradition, for thousands of years. The coastal plain is so important to the Gwich'in that they call it "the sacred place where life begins." Protecting the caribou and the Gwich'in in way of life is a matter of basic human rights.

Tourism is vital to Alaska's economy and plays an important role in the health of Alaskan businesses. Most people visit Alaska because of its spectacular beauty and extraordinary wilderness character. Properly regulated eco-tourism is a sustainable industry dependent on intact ecosystems with high wilderness values such as the Arctic Refuge. Oil and other resource development would have long-term negative consequences on the recreation and tourism industries that rely on these wild lands for their sustainability.

We must pursue alternative ways to meet our energy needs in America. Increasing the fuel efficiency of our automobiles, developing renewable energy sources, and adopting energy efficiency and conservation technologies are safer, cleaner, and quicker alternatives to opening the Arctic Refuge to development. When we are looking at environmental impact we need to draw into those considerations the amount of impact those fossil extractions and use will have on Co2 loading and its climate change accelerating potential. Specifically how that may speed up permafrost melt which will change the ecological system of the Arctic as well as increase the methane gas release from these areas which in turn will speed up climate change.

For these reasons, I stand opposed to opening the Arctic National Wildlife Refuge to oil and gas development. Certain places, like the coastal plain of the Refuge, should be preserved as Wilderness not opened to oil and gas leasing, exploration, or drilling.

Julie K Wahl

akfrogprincess@gmail.com

907.903.8936

4112 Reka Dr O3

Anchorage, Alaska 99515

From: Hannah Wald
To: fortherecord (Energy)
Subject: What if there"s a spill?
Date: Tuesday, November 14, 2017 3:19:34 PM

Senators,

I'm concerned about opening up ANWR to drilling. If there is an accident and a spill - which seems more than likely, given the track record of rig operators - it will be impossible to clean up! It will impact the health of Alaskans and possibly the fishing industry as well.

My understanding is also that drilling in ANWR will not make as much money as drilling proponents are claiming, so the risk/reward calculation here does not favor drilling.

Please reconsider drilling in ANWR!

Regards,

Hannah Wald
632 Azalea Drive
Rockville, MD
20850

Sent from my iPhone

From: Robert Wall - (C)
To: fortherecord (Energy)
Subject: Oil and Gas development in ANWR.
Date: Wednesday, November 01, 2017 3:20:22 PM

To whom it may concern: The time to open ANWR to responsible Oil and Gas drilling has come. As a 38 year resident of Alaska, and a 38 year veteran of the Oil industry here in Alaska, I have seen the O & G activity drop precipitously as the legacy fields slow down, and the broken promises of opening ANWR have hamstrung our State economy. The resulting loss of good paying jobs has hurt our families, our ability to grow our job base, and stymied our futures. I urge the US Government to honor the original intent of ANWR and open it for exploration, and stop using the people of Alaska as pawns in a struggle with the out of control environmental lobbyists and organizations. I can attest to the ability of our directional drilling teams in Alaska to reach out in a 5 mile radius from a single 5 acre pad. The foot prints of our current activities on the slope are minimal, and cleaner than every grocery store parking lot I have ever driven across.

Open ANWR now for the children of Alaska. The best thing a Government can do for a child is give his Mom and Dad hope for the future, we need jobs, and energy independence.

Robert Wall ©
Drill Site Manager
907-398-9191
Sterling Alaska

From: Jason Ward
To: fortherecord (Energy)
Cc: Hoefler, Annie (Energy)
Subject: Support ANWR drilling
Date: Tuesday, October 31, 2017 5:53:57 PM

Chairman Murkowski, Ranking Member Cantwell, and Members of the Senate Energy and Natural Resources Committee

I am an Alaska resident and work in a small business in Anchorage. I am writing in support of drilling in ANWR as it will provide great business opportunity and revenue potential for our state's struggling economy. I believe drilling in ANWR will also further our national goal of becoming a leading energy producer.

Jason Ward
Senior Vice President
Sales and Marketing

Security Aviation
6121 South Airpark Place
Anchorage, Alaska 99502
Main: (907) 248-2677
Fax: (907) 248-6911
Mobile: (907) 230-4318
Email: jward@securityaviation.biz
www.securityaviation.biz

From: wleighty@ptialaska.net
To: fortherecord (Energy)
Subject: "For Record of November 2, 2017 Hearing"
Date: Thursday, November 02, 2017 10:27:46 PM

Chairman Murkowski, Ranking Member Cantwell, and Members of the Senate Energy and Natural Resources Committee,

I am among those who feel we should leave the Arctic National Wildlife Refuge coastal plain untapped. At this point in human history, it is better to turn to renewable sourced energy and leave the petrochemical stock in the ground for future generations, at a time when our grandchildren will really need it for the products of the future. We shouldn't just burn it now.

Thank you for your consideration. Nancy Waterman PO Box 20993 Juneau, AK 99802

From: Kelly Watson
To: fortherecord (Energy)
Subject: Protect the Arctic Do NOT Allow Drilling
Date: Thursday, November 02, 2017 11:38:13 AM

Dear Sirs and MS,
I'm writing to ask that the committee find other means to produce federal revenue than reopening the Arctic National Wildlife Refuge for oil and gas drilling. We should not destroy protected land and endanger wildlife to fund unnecessary tax breaks for the wealthy. Please pass my message along to the Chairman and other committee members.
Thank you.

Dr. Kelly Watson
160 Springview Place
Sequim, Wa
98382

From: Jim Weber
To: fortherecord (Energy)
Cc: Hoefler, Annie (Energy)
Subject: Support of ANWR postion
Date: Tuesday, October 31, 2017 4:00:26 PM
Importance: High

For Record of November 2, 2017 Hearing

Chairman Murkowski, Ranking Member Cantwell, and Members of the Senate Energy and Natural Resources Committee

I support opening ANWR 100% and hope that your committee will concur:

Open the ANWR coastal plain (1002 area) to exploration and production. Require timely lease sales • Streamline and simplify the permitting process
Provide for a 50 percent-50 percent federal-state revenue sharing, rather than the 90-10 percent split under current law.
Alaska favors responsible development and protecting the environment.
Technically recoverable oil within the ANWR 1002 area (excluding State and Native areas) is estimated to be between 4.3 and 11.8 billion barrels (95- and 5-percent probability range), with a mean value of 7.7 billion barrels.

Jim Weber
11426 Discovery Park Drive
Anchorage, AK 99515

From: John Weedman
To: fortherecord (Energy)
Subject: Opening ANWR Coastal Plain
Date: Tuesday, October 31, 2017 7:59:31 PM

The points below reflect my opinion on the need to open and responsibly develope this area.

- Open the ANWR coastal plain (1002 area) to exploration and production. Require timely lease sales • Streamline and simplify the permitting process
- Provide for a 50 percent-50 percent federal-state revenue sharing, rather than the 90-10 percent split under current law.
- Alaska favors responsible development and protecting the environment.
- Technically recoverable oil within the ANWR 1002 area (excluding State and Native areas) is estimated to be between 4.3 and 11.8 billion barrels (95- and 5-percent probability range), with a mean value of 7.7 billion barrels.

Best regards,

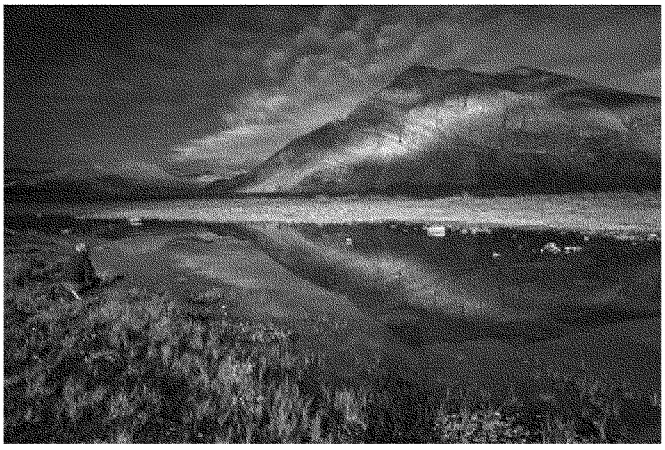
John Weedman

4331 Taku Blvd

Juneau, AK 99801

Melodi Weinberg
4600 Cedar St
Bellaire, Tx 77401

"NO ANWR Drilling!"



From: gabrielle wellman
To: fortherecord (Energy)
Subject: opposing reopening of Arctic National Wildlife Refuge for oil and gas drilling
Date: Friday, November 03, 2017 10:12:03 AM

Dear Senate Committee on Energy and Natural Resources,

My name is Gabrielle Welllman. I live in Blue Hill, Maine. (P.O. Box 148, 04614) My full street address is 42 Clayfield Rd., Blue Hill, ME 04614.

I am writing to urge the Committee to find other means of pruducing federal revenue than reopening the Arctic National Wildlife Refuge for oil and gas drilling. I believe we should not destroy protected land and endanger wild life to fund unnecessary tax breaks for the wealthy and fossil fuel companies.

Let us keep a democracy and not transform our country into a plutocracy!

thank you for recording my opinion,

gabrielle wellman

From: John Wheeler
To: fortherecord (Energy)
Subject: ANWAR
Date: Wednesday, November 01, 2017 4:09:34 PM

Honorable Energy Committee,

I am an Alaska resident for the past 41 years. During this time I have had the pleasure to work throughout this exceptional state. I personally worked on the North Slope back in the 80's when we were building the Kuparuk Oilfield. I was as concerned then as I am today, that any drilling upon the North Slope be done in an environmentally safe and sound matter. I personally witnessed reclaimed drill sites and am proud to say that after restoration to the natural habitat, there was no telltale signs of the location ever having been touched by man. Furthermore, I never encountered a company that did not share this mindset of protecting the land. Ensuring our energy independence is vital to our nation and I urge this committee to open the access to ANWAR-as I am sure you all know, is a significantly small portion (20,000 acres) within the vast 19,286,722 acres which comprises ANWAR. Thank you for your time and consideration.

Regards,

John E Wheeler
32915 Heddell Street
Anchor Point, Alaska 99556

From: Debbie White
To: fortherecord (Energy)
Subject: ANWR
Date: Thursday, November 02, 2017 12:48:54 AM

Is it not time? Yes, it is. Please consider allowing this at last.

Alaska would like to forge it's own future. To do that we need access to our resources, and the ability to develop our resources. It can be done in an environmentally sensitive manner.

Let us continue to prove it.

--
Debbie White, Broker/Owner
Southeast Alaska Real Estate
8585 Old Dairy Road #102
Juneau, AK 99801

907-789-5533 Office
907-789-5504 Fax
907-723-9886 Direct/Cell

From: ken@907customs.com
To: fortherecord (Energy); anniehoefler@energy.senate.gov
Subject: ANWR Development
Date: Wednesday, November 01, 2017 5:39:35 PM

To:

Chairman Murkowski, Ranking Member Cantwell, and Members of the Senate Energy and Natural Resources Committee

As a lifelong Alaskan resident of 43 years, I want to express my support of opening ANWR to oil production. I have worked in the oilfield here in Alaska for 20 plus years, and take great pride in bringing oil & gas safely to market. With the current state of Alaska's budget, I think it is critical to get moving on this. Environmentally speaking, it makes the most sense to me to put additional oil into the existing TAPS line which would require a very small footprint of new development. Tapping into this resource could help support not only Alaskans, but the entire USA for many years to come.

Thank you for listnening,

Kenneth White
47027 Lexington Ct.
Kenai, AK 99611

From: Tiffany Wilkes
To: fortherecord (Energy)
Cc: Hoefler, Annie (Energy)
Subject: For Record of November 2, 2017 Hearing
Date: Wednesday, November 01, 2017 1:33:57 PM

Dear Chairman Murkowski, Ranking Member Cantwell, and Members of the Senate Energy and Natural Resources Committee,

Polls have consistently shown Alaskans overwhelmingly support responsible oil and gas development in the non-wilderness portion of ANWR. There is no valid reason why we should not be allowed to access the world-class resources within just a tiny fraction of the coastal plain.

The proposed ANWR provision would allow development of no more than 2,000 acres of the 1.5 million acres of the Arctic coastal plain – part of the non-wilderness portion of ANWR's 19 million acres. That is equivalent to just 0.01 percent of the entire refuge.

Responsible oil and gas development in this fraction of ANWR will help ensure America's energy security for decades and allow Alaska – and our nation as a whole – to realize the benefits that come from expanding energy production in Alaska.

While renewable energy is a growing part of America's energy portfolio, it is still projected to account for a minority of American energy production in 2040. New oil and gas production will be required to power America's economy and can serve as a bridge until renewable energy becomes a dominant energy source decades into the future.

Energy production from ANWR has the potential to offset a decline in Lower 48 shale oil production, which is expected to commence in approximately a decade. Without limited oil development on the coastal plain, America will be forced to once again increase its reliance on foreign imports. With limited development in ANWR, America and Alaska can continue to grow the economy and reduce dependence on foreign oil.

The U.S. Geological Survey estimates the 1002 Area is North America's greatest prospect for conventional onshore oil production, with a mean likelihood of containing 10.4 billion barrels of oil and 8.6 trillion cubic feet of natural gas, as well as a reasonable chance of economically producing 16 billion barrels of oil.

Alaska's economic lifeline, the Trans-Alaska Oil Pipeline System (TAPS), is now running at three-quarters empty. New oil production from ANWR has the potential to reverse throughput in TAPS, a vital component of American energy infrastructure.

Oil development on a fraction of the coastal plain would create thousands of jobs nationwide, generate billions of dollars in government revenue, keep energy prices for American consumers affordable, and further improve energy security for decades into the future.

Since the ANWR coastal plain is less than 60 miles from TAPS, development of energy resources there is one of the most environmentally-sound way to increase oil production in Alaska.

Thanks to continuing improvements in technology, practices, and oversight, the oil industry has demonstrated over the past 40 years that North Slope energy development and environmental stewardship can and do coexist. The industry has a proven track record of responsible development in sensitive areas, protecting the environment, wildlife and subsistence needs of local residents.

Tiffany J. Wilkes
Regional Material & Equipment Coordinator
Nikiski, Alaska
907-776-6756
907-690-0568 cell

Hilcorp Alaska, LLC
A Company Built on Energy

From: Ryan Williams
To: fortherecord (Energy)
Subject: No drilling in the Arctic National Wildlife Refuge
Date: Tuesday, November 07, 2017 9:36:27 PM

Hello,

As a concerned citizen, I urge you not to reopen the Arctic National Wildlife Refuge to oil and gas drilling.

Thank you,
Ryan

Ryan Williams
108 Cardriff Pl.
Durham, NC 27712
505.401.0462

From: Tom Williams
To: fortherecord (Energy)
Cc: Hoefler, Annie (Energy); tcw-ak@gci.net
Subject: For Record of November 2, 2017 Hearing of the Senate Energy and Natural Resources Committee
Date: Thursday, November 02, 2017 2:19:04 AM
Importance: High

For Record of November 2, 2017 Hearing of the Senate Energy and Natural Resources Committee

Chairman Murkowski, Ranking Member Cantwell, and Members of the Senate Energy and Natural Resources Committee:

I strongly urge the Senate Energy and Natural Resources Committee to take affirmative action to allow exploration and production of oil in the 1002 area of the Alaska National Wildlife Refuge (ANWR) coastal plain.

Reports estimate that there are between 4.3 and 11.8 billion barrels of technically recoverable oil within ANWR's 1002 area. Congress should not miss this opportunity to finally allow and encourage access to this extremely valuable resource, making the United States significantly less dependent on foreign oil and more energy independent in the years to come. In addition, this action will provide a much needed economic boost to resource-rich Alaska, a state that is currently facing and economic downturn, in part because the federal government has restricted or at least significantly hindered our ability to have our resources developed.

To accomplish this please require timely lease sales in ANWR as well as simplify and streamline the permitting process for exploration and production of oil and gas. Congress should also amend the federal/state revenue sharing formula for ANWR production to 50/50 from its current 90/10 formula, ensuring Alaskans receive an equitable allocation of the revenues generated from the development of resources in Alaska.

Alaskans and our government support responsible development that protects the environment from unnecessary damage. With few exceptions, Alaska has a history of being able to effectively do both. The Trans-Alaska pipeline is a good example of responsible development more than 40 years ago. Furthermore, since the construction of the pipeline, exploration, production and environmental protection methods have improved.

As a 40 year resident of Alaska I have personally driven the Dalton Highway (the Trans-Alaska Pipeline Haul Road) from Fairbanks to Deadhorse and back. In addition, I have made three other separate August recreational trips to the north slope of the Brooks Range, twice routing through Deadhorse (Prudhoe Bay) and once routing through Kaktovik (Barter Island). I have viewed first-hand the coastal plain as well as the responsible development of the Trans-Alaska Pipeline. While the Brooks Range is absolutely spectacular, it is significantly different than the coastal plain.

I urge you not to succumb to the dire predictions of those members of environmental groups who oppose opening this valuable resource. Unlike me, many of those who oppose the opening of ANWR have never set foot on the Alaska northern coastal plain. Some people or organizations in their crusade to keep ANWR locked away have even misrepresented the coast plain with images of the north slope of the Brooks Range, which is nearly 100 miles south. We should not keep such a valuable Alaska and national resource locked away. We should minimize that environment impacts of exploration and production in ANWR. We can and we will. But first Congress must act to allow exploration and production of oil in ANWR.

Once again I strongly urge you to do so.

Thank you.

Tom Williams
3170 Fritz Cove Road
Juneau, AK 99801
(907) 789-3170
(907) 957-0071 Cell
tcw-ak@gci.net

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From: Curt Wilson
To: fortherecord (Energy); anniehoefler@energy.senate.gov
Subject: ANWR- Alaska-1002
Date: Tuesday, October 31, 2017 7:27:22 PM

I support the opening of ANWR- 1002. This is very important to Alaska, and the United States. I am an Alaskan Native- and born in Anchorage, I ask that you look favorably on this proposal.

Regards,
Curt Wilson

WILSON BROTHERS DISTRIBUTING CO. INC.

Office: 907.835.2422
Fax: 907.835.2410
Cell: 907.831.2422
Email: curt.wbd@ak.net

From: Kurt Winkler
To: fortherecord (Energy)
Subject: Support for opening of ANWR
Date: Wednesday, November 01, 2017 2:24:04 PM

Please support the opening of ANWR
As a Alaska Business all of our employees (45+) support the opening of ANWR
The country and the state needs it.
Other countries are getting rich on our money and support terrorist as well.
We have the oil and gas - let's develop it, fill the pipeline and create JOBS-JOBS-JOBS plus add to the national treasury.
We like to be independant.

Thank you.

Kurt **W**inkler
President
GLOBAL SERVICES INC.
1701 E. 84th Ave
Anchorage, AK 99507
Phone: 907-349-3342
Fax: 907-349-2015
Cell: 907-242-7605
e-mail: kurt@globalsrvc.com

From: Clint Winzenburg
To: fortherecord (Energy)
Subject: Chairman Murkowski, Ranking Member Cantwell, and Members of the Senate Energy and Natural Resources Committee
Date: Wednesday, November 01, 2017 1:28:30 PM
Attachments: image001.png
image002.png
image003.png

I am writing for my support of opening ANWR here in Alaska. As an employee for an Alaskan company that deals directly with the oil and gas companies, I have seen the decline in business over the last 2 years, along with how the drop in oil prices have affected our businesses and our great state. We are in a financial struggle with our state legislation meeting for a **fourth** time in special session which again, costs our state more money which we cannot afford.

I believe that opening ANWR will bring new exploration, new companies to the Alaska frontier, bring new ideas to our state, and more importantly, new and more oil to help fill our Trans-Alaska Pipeline. We are currently running at only a third capacity full, and having more oil will not only help Alaska, but also our country as a whole. I believe that we can build a safe and fiscally sound infrastructure to tie into already existing facilities or the pipeline to help transport this new oil. If we are smart with our planning, aggressive in our thinking, supplied with new technologies and innovation, we can make this happen which will not harm the environment or the climate. I have been on the north slope many times and also to some of the far reaching native villages here in Alaska, and I have seen no negative impact on people's lives or even the wildlife in the arctic. We have some of the strongest safety regulations in the industry do to our environment here in Alaska and we are a very safety contentious state when it comes to oil production. I also believe that ANWR will bring new and high paying jobs for Alaskans and help put people back to work to help provide for their families and to also help spread those economic wages in Alaska business. This whole situation affects all of us here Alaska, so again, we must open ANWR.

I believe we owe it to our future generations to make Alaska independently strong and to be an oil producing leader for our nation. It is a win, win situation for all of us, especially Alaska.

Respectfully,

Clint Winzenburg
Oil & Gas Sales Account Manager
Alaska Industrial Hardware
2192 Viking Drive
Anchorage, AK 99501
Ph. (907) 263-2421
Fax (907) 258-3054
Cell (907) 230-3224
e-mail: cwinzenburg@aihalaska.com

From: Karyn Wise
To: fortherecord (Energy)
Cc: Hoefler, Annie (Energy)
Subject: ANWR drilling provision
Date: Wednesday, November 01, 2017 3:08:56 PM

Chairman Murkowski, Ranking Member Cantwell, and Members of the Senate Energy and Natural Resources Committee:

It is beyond time to open a small portion, less than 0.01% of the entire Arctic Wildlife Preserve, to oil and gas production.. The oil industry has demonstrated over the last 40 years, since the construction of the Trans-Alaska Pipeline, that North Slope energy development and environmental stewardship can and do coexist, to the benefit of Alaskans and non-Alaskans as well. Allow Alaskans to support themselves with good paying jobs, and advance the goal of energy independence for all Americans by supporting the ANWR drilling provision sponsored by Senator Murkowski in the Budget Reconciliation bill under consideration. As a lifelong Alaskan, I support this effort.

Karyn Wise
2315 Susitna Drive
Anchorage, Alaska 99517
907-243-2367

From: Michael Wise
To: fortherecord (Energy)
Cc: annie_hefler@energy.senate.gov
Subject: For Record of November 2, 2017 Hearing
Date: Wednesday, November 01, 2017 1:39:08 PM

Chairman Murkowski, Ranking Member Cantwell, and Members of the Senate Energy and Natural Resources Committee:

I am emailing you today to show my support for the responsible oil and gas development in ANWR.

Thank you,

Michael Wise
Anchorage, Alaska
907-243-2367

From: mike@mikewodkowski.com
To: fortherecord (Energy)
Subject: Please keep the Arctic protected from industry
Date: Friday, November 03, 2017 3:49:49 PM

I would like to urge the Committee to find other means to produce federal revenue than reopening the Arctic National Wildlife Refuge for oil and gas drilling.

It is illogical that we would reduce our revenue to accommodate a tax cut and then claim that we need to drill in the Arctic because we need the revenue.

Further to that point, if this tax cut is going to boost the economy so wonderfully as is being currently touted, then the revenue from drilling in the Arctic will be un-necessary.

Therefore, the only REAL purpose of allowing drilling in the Arctic and exploiting the fragility of our planet's ecosystem would be greed, plain and simple, in the service of a greedy special interest. I think the Committee knows this already.

And knowing this, yet acting on behalf of industry, rather than the protection of our children's future, would signify an enormous moral failing on behalf of the committee.

We can not afford more moral failings in the governing bodies of this country. Stand for something decent please.

Please pass my message along to the Chairman and other committee members.

Thanks,

Mike Wodkowski
4673 Cleland Ave
Los Angeles, CA 90065

From: Lee Ann Wolff
To: fortherecord (Energy)
Subject: Please don"t drill in Alaska"s Wildlife Refuge
Date: Wednesday, November 15, 2017 10:49:27 AM

To: The Senate Committee on Energy and Natural Resources

Please find other means to produce federal revenue than reopening the Arctic National Wildlife Refuge for oil and gas drilling. We should not destroy protected land and endanger wildlife to fund unnecessary tax breaks for the wealthy.

Let's invest in futuristic, sustainable, renewable forms of clean energy, creating jobs, revenue, and protecting the earth.

Thanks you,

Lee Ann Wolff

LeeAnnTheEditor@gmail.com
865-684-7831
Skype: LeeAnnEditor

From: Yockey, Ken
To: fortherecord (Energy)
Subject: OPEN ANWR
Date: Tuesday, October 31, 2017 7:54:22 PM

Dear Chairman Murkowski and Ranking Member Cantwell,

I am an Alaskan that supports the opening of the 1002 area of the Arctic National Wildlife Refuge. Alaskans have developed the North Slope oil fields responsibly and will continue to do so with NO effects to the Arctic Caribou herd or any other animal species. We are the caretakers of the environment and we need you to vote in favor of development.

Please do the right thing for the Citizens of this Great State! Given the economic recession the State finds itself in, Alaskans need the jobs ANWR will provide, now more than ever!

Thank you for your leadership and for your consideration.

Best Regards,

Ken Yockey

Kenneth Yockey, P.E.
Vice President – Alaska Oil & Gas
Price Gregory International, Inc.
kyockey@pricegregory.com
Ph: 907-278-4400
Direct - 907-257-4128
Cell – 907-244-6692
Fax: 907-278-3255

From: Julia York
To: fortherecord (Energy)
Cc: Hoefler, Annie (Energy)
Subject: Please oppose drilling and exploration of ANWR
Date: Thursday, November 16, 2017 12:37:50 PM

Hello Chairman Murkowski, Ranking Member Cantwell, and Members of the Senate Energy and Natural Resources Committee,

I ask you to oppose the bill proposing the opening of ANWR to oil and gas drilling. Tying the Alaskan economy further to oil and gas drilling is a mistake, especially while Alaskans are directly suffering the effects of climate change and that crisis is only going to worsen. As a young Alaskan, I believe this bill sets Alaska up for a serious crisis in the future where we will have not diversified our economy and won't have the resources we need to help deal with the effects of climate change.

Please oppose this bill, for the future of Alaska.

Thanks,

Julia York
1170 Sundance Loop
Fairbanks, AK 99709
(907) 460-1991

Yukon
Office of the Premier
Box 2703, Whitehorse, Yukon Y1A 2C6

November 1, 2017

The Honorable Lisa A. Murkowski
United States Senate
522 Hart Senate Office Building
Washington, DC 20510-0203

The Honorable Maria Cantwell
United States Senate
511 Hart Senate Office Building
Washington, DC 20510-4705

Dear Honorable Lisa A. Murkowski and Honorable Maria Cantwell:

Since the Arctic National Wildlife Refuge (ANWR) was established in 1980, Congress has faced the decision to protect the refuge as wilderness, or to open it to commercial activity. The debate is not new and neither are the positions on either side. This Senate Committee on Energy and Natural Resources is being asked a simple question: to protect a sensitive habitat and the Porcupine Caribou Herd; or vote for a course of action that endangers the Gwitchin people who have relied on the caribou for thousands of years.

The Gwitchin people have long sought the protection of the Porcupine Caribou Herd and their calving grounds on the coastal plains of ANWR. The Government of Yukon strongly supports this position and stands behind the Vuntut Gwitchin Government. In Canada we have already backed our words with action.

Along the Alaska border, agreements between Indigenous peoples, the Government of Yukon and the Government of Canada protect nearly 8,000 square miles of the Porcupine Caribou Herd's range as national parks land. But protecting this wilderness wasn't without sacrifice. It has meant forgoing the resource revenues in the resource rich Old Crow Flats now protected as wilderness. Collectively, governments and Indigenous peoples chose to refrain from short lived economic gain to protect a herd which has sustained American and Canadian Indigenous peoples for generations. Today, this Committee can make that same choice.

.../2

Caribou have never respected our borders, which is why the United States and Canada entered into agreement to protect this resource. That commitment was a promise to work together to manage the Porcupine Caribou Herd and to avoid adverse effects to its habitat. But beyond that, the United States and Canada agreed to consult each other on any activities, including oil and gas development, that may impact the caribou.

Development in the sensitive calving grounds risks harming the only healthy caribou herd in North America. The Government of Yukon hopes that the Committee will honour the spirit of the agreement in its deliberations.

Sincerely,

Sandy Silver
Premier

cc: Senate Energy and Natural Resources Committee Members

From: Tom Zaurba
To: fortherecord (Energy)
Cc: Hoefler, Annie (Energy)
Subject: For Record of November 2, 2017 Hearing
Date: Tuesday, October 31, 2017 8:59:48 PM

Chairman Murkowski, Ranking Member Cantwell, and Members of the Senate Energy and Natural Resources Committee.

As a lifelong Alaskan of 73 years, I am in full accord with the opening up of ANWR to natural resource development and the extraction of our mineral and petroleum resources contained therein.

Over the past 30+ years I have watched, and suffered the foolishness, of outside arrogant environmental interest hijacking our Alaskan economy under the guise of protecting our natural resources from predation by us "unscrupulous" and short sighted Alaskans.

As a result, our once vibrant Alaska economy, which was based upon the safe and sensible natural resource development (mining, timber, fishing and petroleum) has been decimated by Federal regulation and judicial overreach.

There is a marked difference between true environmentalism with which both man and his environment can successfully co-exist, and to which most of us Alaskans subscribe and practice, and the unconstrained protectionism peddled by zealots that have little if any interest in the welfare of those of us who live in and love this "Great Land".

Enough is enough.

I ask each and every one of you…..Who better to husband our resources than the People that have freely chosen to spend their lives, suffer the hardships, raise their families, are spiritually bound, and will be buried in this magnificent and wonderful place we call Alaska?

Thank you for your time and consideration of my views.

Thomas T. Zaruba
8208 Poplar Avenue
Juneau, Alaska

From: Tom Zimmerman
To: fortherecord (Energy)
Subject: Area 1002 ANWR
Date: Tuesday, October 31, 2017 4:44:30 PM

Dear Chairman Murkowski and Ranking Member Cantwell,

I am an Alaska by choice. I graduated from the University of Alaska Fairbanks, worked on TAPS as a young man and have held a registered guides license since the 70's working in the Arctic regions of the state. I have witnessed first hand the success of the very stringent rules regarding drilling and oil production in the arctic. The arctic caribou herd has increased in size many fold since Prudoe Bay oil discovery.

No where on the planet is oil and gas production more closely regulated. The oil extraction companies have worked hard to minimize their presence. I believe it is not in the best interest of the State of Alaska and the country as a whole to not open a very limited strip of land in area 1002 ANWR. I for one am in favor of the drilling program envisioned.

Sincerely
Tom Zimmerman

--

Tom V Zimmerman
President

2720 Hurst Road
North Pole, AK 99705

(C) 907.378.9222
(D) 907.490.1155
(F) 907.488.7856

AISC Fabricator 2.png

From: Zins, Ryan
To: fortherecord (Energy)
Cc: Hoefler, Annie (Energy); Aves Thompson; Taylor, Chris
Subject: Arctic National Wildlife Refuge - An Alaskan"s Viewpoint
Date: Wednesday, November 01, 2017 2:50:54 PM

Dear Chairman Murkowksi, Ranking Member Cantwell, and Members of the Senate Energy and Natural Resources Committee,

I am an Alaskan that supports the opening of the 1002 area of the Arctic National Wildlife Refuge. I am the Vice President of an Alaskan company that employees upwards of 160 people and one that is directly affected by the actions on the North slope both good and bad. I have had discussions with our employees and have heard nothing but overwhelming support for the opening of the 1002 area. We are strong supporters of industry and our environment and believe that the area will be developed in a responsible way to limit the impact on the local flora and fauna just as other areas have been developed on the slope and throughout our great state. We Alaskans care a great deal about our state and our environment and we put our desire to hand those over to our children and future generations in a condition that is better than we received it in the forefront to any decision we make.

I could make endless comments about the need to open the area for future development/energy independence/job creation/etc. and I believe you no doubt have already received a plethora of those emails. I know your time is valuable and limited so I will make my comments short and to the point. We Alaskans are for the opening of the 1002 area and we make this decision placing our impact on the environment as paramount to all projects in order to develop areas responsibly.

Sincerely,
Ryan Zins

Ryan Zins
VP/General Manager
Anchorage Sand & Gravel Co., Inc.
(907)349-3333