NWR MAINTENANCE BACKLOG AND FISH INTERRELATIONSHIP

OVERSIGHT HEARING

BEFORE THE

SUBCOMMITTEE ON FISHERIES CONSERVATION, WILDLIFE AND OCEANS

OF THE

COMMITTEE ON RESOURCES
HOUSE OF REPRESENTATIVES

ONE HUNDRED FIFTH CONGRESS

FIRST SESSION

ON

Maintenance Backlog at National Wildlife Refuges and the Interrelationship of Bluefish, Striped Bass, and Forage Fish

APRIL 21, 1997—MANAHAWKIN, NJ

Serial No. 105–14

Printed for the use of the Committee on Resources

U.S. GOVERNMENT PRINTING OFFICE
41–073CC WASHINGTON : 1997

COMMITTEE ON RESOURCES

DON YOUNG, Alaska, *Chairman*

W.J. (BILLY) TAUZIN, Louisiana
JAMES V. HANSEN, Utah
JIM SAXTON, New Jersey
ELTON GALLEGLY, California
JOHN J. DUNCAN, JR., Tennessee
JOEL HEFLEY, Colorado
JOHN T. DOOLITTLE, California
WAYNE T. GILCHREST, Maryland
KEN CALVERT, California
RICHARD W. POMBO, California
BARBARA CUBIN, Wyoming
HELEN CHENOWETH, Idaho
LINDA SMITH, Washington
GEORGE P. RADANOVICH, California
WALTER B. JONES, JR., North Carolina
WILLIAM M. (MAC) THORNBERRY, Texas
JOHN SHADEGG, Arizona
JOHN E. ENSIGN, Nevada
ROBERT F. SMITH, Oregon
CHRIS CANNON, Utah
KEVIN BRADY, Texas
JOHN PETERSON, Pennsylvania
RICK HILL, Montana
BOB SCHAFFER, Colorado
JIM GIBBONS, Nevada
MICHAEL D. CRAPO, Idaho
GEORGE MILLER, California
EDWARD J. MARKEY, Massachusetts
NICK J. RAHALL II, West Virginia
BRUCE F. VENTO, Minnesota
DALE E. KILDEE, Michigan
PETER A. DEFAZIO, Oregon
ENI F.H. FALEOMAVAEGA, American Samoa
NEIL ABERCROMBIE, Hawaii
SOLOMON P. ORTIZ, Texas
OWEN B. PICKETT, Virginia
FRANK PALLONE, JR., New Jersey
CALVIN M. DOOLEY, California
CARLOS A. ROMERO-BARCELO, Puerto Rico
MAURICE D. HINCHEY, New York
ROBERT A. UNDERWOOD, Guam
SAM FARR, California
PATRICK J. KENNEDY, Rhode Island
ADAM SMITH, Washington
WILLIAM D. DELAHUNT, Massachusetts
CHRIS JOHN, Louisiana
DONNA CHRISTIAN-GREEN, Virgin Islands
RON KIND, Wisconsin
LLOYD DOGGETT, Texas

LLOYD A. JONES, *Chief of Staff*
ELIZABETH MEGGINSON, *Chief Counsel*
CHRISTINE KENNEDY, *Chief Clerk/Administrator*
JOHN LAWRENCE, *Democratic Staff Director*

SUBCOMMITTEE ON FISHERIES CONSERVATION, WILDLIFE AND OCEANS

Jim Saxton, New Jersey, *Chairman*

W.J. (BILLY) TAUZIN, Louisiana
WAYNE T. GILCHREST, Maryland
WALTER B. JONES, JR., North Carolina
JOHN PETERSON, Pennsylvania
MICHAEL D. CRAPO, Idaho
NEIL ABERCROMBIE, Hawaii
SOLOMON P. ORTIZ, Texas
FRANK PALLONE, JR., New Jersey
SAM FARR, California
PATRICK J. KENNEDY, Rhode Island

HARRY BURROUGHS, *Staff Director*
JOHN RAYFIELD, *Legislative Staff*
CHRISTOPHER STEARNS, *Democratic Counsel*

CONTENTS

NWR MAINTENANCE BACKLOG AND FISH INTERRELATIONSHIP

MONDAY, APRIL 21, 1997

U.S. HOUSE OF REPRESENTATIVES, SUBCOMMITTEE ON FISHERIES CONSERVATION, WILDLIFE AND OCEANS, COMMITTEE ON RESOURCES,

Manahawkin, NJ.

The Subcommittee met, pursuant to notice, at 10 a.m. at Mill Creek Community Center, 1199 Mill Creek Road, Manahawkin, New Jersey, Hon. Jim Saxton (Chairman of the Subcommittee) presiding.

Mr. SAXTON. Thank you, everybody, for being here and thank you, especially, for being here on time so that we can begin this hearing on two subjects that are extremely important to all of us. The refuge operations and maintenance backlog will be part of this hearing, which obviously relates directly to the Forsythe Refuge and many other wildlife refuges around the country. We will also discuss the interrelationship among bluefish, striped bass, and forage fish, which is an ongoing topic of concern.

Before we begin to discuss the wildlife refuge issue and the striped bass, bluefish, forage fish issue, we have with us this morning a good friend of mine, Mr. John Rogers, who is the acting director of the U.S. Fish and Wildlife Service, and with him is Will Goebel, G-O-E-B-E-L, who is a wildlife artist and some of his art was chosen last year for the Federal wildlife stamp.

And John, let me just turn this over to you for just a moment, Mr. Director, and you have a presentation to make, I believe.

Mr. ROGERS. Thank you very much, Mr. Chairman. As you indicated, we do have a very important presentation to make this morning.

The Fish and Wildlife Service for about six months has been looking for an appropriate opportunity to present you with a token of our appreciation for your ongoing interest in the Fish and Wildlife Service and National Wildlife Refuge issues.

What we have is a copy of Will Goebel's winning duck stamp art from last year as a token of our appreciation. It is, of course, a wonderful piece of art, but it symbolizes both your district as well as the National Wildlife Refuge system. So it's a pair of surf scooters and the background is the historic Barnegat Light. It is the only duck stamp depiction that has contained any structures, certainly the only one to ever contain a historic structure. It is very important because one knows—everyone knows that hunters must have a duck stamp with them when they're waterfowl hunting, and the proceeds from this stamp go to purchase lands for the National

Wildlife Refuge Systems, so it very nicely ties together both art and the wildlife world. And on behalf of the Fish and Wildlife Service I would like to present this to you.

Will Goebel, the artist.

Mr. SAXTON. Will, welcome back to New Jersey. This is quite an honor for the people of the third congressional district, which includes, of course, Barnegat Light and Barnegat Bay. Those of you who have visited my office know that when you come in the front door you see a number of wildlife prints, particularly waterfowl prints, from a local organization, the Barnegat Bay Museum folks from Tuckerton, and if you wander on into my inner office you'll find another wall covered with wildlife waterfowl prints, and so this will make a great addition to the office of the third congressional district in Washington, D.C.

So John, we thank you, and, Will, congratulations to you on your art having been selected. This is a great picture of sea ducks and Barnegat Lighthouse, and the print will be most appreciated by those who visit the office, 339 Cannon Building, incidentally, if anybody wishes to come and visit. So Will, thank you very much for your participation.

All right, on a more official note, let me welcome all of you here today. The Subcommittees on Fisheries Conservation, Wildlife and Oceans will now officially come to order.

STATEMENT OF THE HON. JIM SAXTON, A U.S. REPRESENTATIVE FROM NEW JERSEY; AND CHAIRMAN, SUBCOMMITTEE ON FISHERIES CONSERVATION, WILDLIFE AND OCEANS

Mr. SAXTON. We are meeting today to discuss two issues of great importance. The first issue is the operation and maintenance backlog in the National Wildlife Refuge System, and of course, we chose this area for a number of reasons, not the least of which is that the wildlife refuge is located within yards of here, and it, obviously, was named for my predecessor in Congress.

The Edwin B. Forsythe National Wildlife Refuge was created in 1984 by Public Law 98–293. The act consolidated the Barnegat and Brigantine National Wildlife Refuges into a single refuge. Barnegat was created in 1967 and Brigantine in 1939. The Cape May National Wildlife Refuge was created in 1989.

In 1995 the Forsythe and Cape May Refuges were placed under a unified management. These refuges are referred to collectively as the Jersey Coast Refuges. They were established to protect migratory birds, to protect and conserve wetlands, and for the conservation and protection of wildlife resources.

This might be a good point for me to pause and to just say that, obviously, we are protective in the strictest sense of the word of the Wildlife Refuge System and continue to try to find ways to enhance it, both by enlarging it, and by acquiring uplands to protect the wetlands that are currently such an important part of the refuge system here in New Jersey.

I have here a map, which I picked up a week ago today, when I visited for half a day, I guess, the wildlife refuge here, which is known as the Forsythe Refuge, and as John helps me hold this up, you can see what I'm sure look like little spots to you in the audience, but they are actually migratory birds, and each of these mi-

gratory birds indicates the location of a wildlife refuge someplace in our country.

We're way up here in the north, and as you can see, as we move across the country, there are many refuges which the Federal Government finances for two basic purposes. One, of course, is for the benefit of wildlife. In case of the wildlife refuge, there are many species which habitate the area, but also, of equal importance, we also have a purpose of the wildlife, although it is called a secondary purpose, and that is for historic human use of the areas, and we believe, I believe in particular, that that is extremely important, because while it's important to have places for wildlife to live and to do well, it is equally important for us to be able to study that wildlife and to conduct historic uses of fishing and crabbing and hunting and other uses that are related.

So we, generally, across the country, set aside 60 percent of the refuges strictly for use by wildlife and 40 percent for use by human beings as well as wildlife. And I think that's very important to point out as we move forward.

The Forsythe Refuge currently contains 42,000 acres and has an approved land acquisition boundary of 60,000. Cape May contains 8,300 acres with an approved land acquisition boundary of 17,000 acres. Slightly more than $50 million has been spent to acquire property at the refuges. The administration's fiscal year 1998 budget requests $2 million for Forsythe and $3 million for Cape May land acquisition from the Land and Water Conservation Fund.

This is particularly important, and you'll hear me talk about this very often. The 42,000 acres which we currently have is extremely important. It includes some uplands, but a limited amount. I think it is vitally important. I believe that unless we acquire uplands which otherwise could be developed someday, that the very existence, as we know it, of the Forsythe Refuge and other refuges is at least in question and possibly threatened.

Throughout the nation, and this is important, there is a backlog of operations and maintenance for refuges that is, to me, quite alarming. I am looking forward to hearing from our witnesses about specific problems throughout the refuge system and most particularly in the Forsythe Refuge. And incidentally, this is the second in a series of five hearings which we are holding in different parts of the country.

I am also pleased to note that the Resources Committee is seeking an increase of nearly $9 million above the administration's request for refuge operation and maintenance.

The second issue that we'll deal with, partly during the first panel, but then more completely later in the hearing, is the interrelationship among bluefish, striped bass, and forage fish. Bluefish and striped bass are migratory species of fish that are common along the U.S. east coast. Both are highly prized by anglers and for their fighting abilities, and both support commercial fisheries. Both species have also a long history of major population swings. Bluefish and striped bass require similar habitat and food supplies, and many of their food sources, including menhaden and blue crabs, support important commercial fisheries themselves. Many fishermen and fisheries scientists believe that the interaction of all these species is very important in their population trends and that these

interactions are not taken into account in the current management policies.

The purpose of the hearing is to examine the interrelationships between these important species, discuss the effectiveness of present single-species management plans in light of these interactions, and determine what further study will be required to address these issues.

Let me just take care of one housekeeping chore. Over the past twelve years that I've served in Congress, I have received many requests by constituents of the Third District and other districts in the southern part of the State to come in and talk about wildlife-related issues. And without fail, I believe I have tried to do so, both in my office and in public meetings and hearings around the district.

Today is different. Today, while the public is invited to be here, we have tried to assemble a series of witnesses who deal with these issues in their professions on an ongoing basis. The purpose of today's hearing, therefore, is to hear from these witnesses, and while we would like to hear from members of the public today, we are able to do so only in writing, because of time constraints. If there are, at the same time, members of the public who feel a burning desire to help us with information, I will be more than happy to schedule additional meetings in the very near future.

Also, let me just say that we are being broadcast live on radio, so, witnesses, I just wanted to mention that, so that you are all aware of it.

Let me move now to our first panel of witnesses, Mr. John Rogers, the acting director of the U.S. Fish and Wildlife Service, which, of course, is housed within the Department of Interior. John will discuss with us, in his opening statement, the issues involving the Forsythe and other refuges around the country and the maintenance backlog. And also on the first panel, and this is the only panel that is divided between the two issues, is Mr. Richard Schaefer, the Chief of the Office of Intergovernmental and Recreational Fisheries, National Marine Fisheries Service, which is located, not in the Department of Interior, but the Department of Commerce.

I would also just like to mention that there is a little light panel with a red, yellow and green light. We have put that there for kind of a guideline only. If you run over into the red light district please try to wrap your comments up when the red light comes on. However, if you run over, that's all well and good.

So John, thank you for being here. Why don't you begin at this point with your discussion of your perspective on the refuge issues that we are here to discuss this morning.

STATEMENTS OF JOHN ROGERS, ACTING DIRECTOR, U.S. FISH AND WILDLIFE SERVICE, DEPARTMENT OF THE INTERIOR; ACCOMPANIED BY ROBERT STREETER, ASSISTANT DIRECTOR FOR REFUGES AND WILDLIFE, AND STEVE ATZERT, MANAGER, FORSYTHE NATIONAL WILDLIFE REFUGE

Mr. ROGERS. Thank you, Mr. Chairman, and thank you for inviting us to be here today to discuss the maintenance backlog facing the Fish and Wildlife Service's National Wildlife Refuge System.

I'm accompanied by Dr. Robert Streeter, Assistant Director for Refuges and Wildlife, and Mr. Steve Atzert, manager of the Forsythe National Wildlife Refuge.

For nearly a century the National Wildlife Refuge System has been one of America's greatest treasures. From a single island off the coast of Florida set aside by Theodore Roosevelt in 1903, the system has grown to 509 refuges, covering more than 92 million acres. It is the world's largest system of land set aside exclusively for wildlife conservation. The very existence of the system and the 30 million people who visit it each year is a reflection of the deep love and respect Americans have for wild creatures and wild places.

Any system of lands, of course, though requires maintenance, and the National Wildlife Refuge System is no exception. If we want to maintain and enhance biological resources, while at the same time accommodating the public's growing appetite for wildlife-dependent recreation, we must be willing to make an investment in these lands and the facilities on them.

Unfortunately, over the years we have not committed the necessary financial resources to properly maintain the refuge system, and we are reaping the consequences of those actions today. We have more than $4.5 billion in assets on national wildlife refuges, including thousands of water management facilities, 2,700 miles of dikes, 6,500 miles of roads, and more than 1,000 buildings.

Many of these facilities are in poor condition because of a long history of limited funding for maintenance, as the Department of Interior's Inspector General pointed out in its 1992 audit. As a result, we currently have a maintenance backlog of $505 million.

The Service's 2,200 refuge employees are as dedicated a group of people as you will find in the Federal Government, but sometimes their dedication needs an assist from a backhoe. Several private industry studies indicate that annual maintenance reinvestment rates, ranging from 1.5 to 4 percent of the value of the capital assets, is necessary to maintain those assets.

This would indicate a minimum amount of $67.5 million should be applied annually to arrest the growth rate of maintenance backlogs. The fiscal year 1998 funding request for this routine maintenance is $31.7 million.

In addition to increases in its budgets for annual operational maintenance, substantial increases are needed disbursed over a reasonable period to address the backlog itself. The fiscal year 1998 budget request for this is $33.8 million, $10 million above fiscal '97 as a start in addressing these needs.

Deferring maintenance and allowing backlogs to accumulate costs the taxpayer more in the long run. Facilities that are not maintained properly deteriorate faster and generally use more energy than properly maintained ones. They need to be replaced long before they would have to be if they were maintained properly. To use an analogy, it's like not changing the oil in your car. Saves a little money in the short run, but costs a great deal in the long run.

Likewise, as these facilities deteriorate the cost of repairing and replacing them increases. More important, delaying maintenance hinders our refuge manager's ability to manage wildlife for the ben-

efit of all Americans, and it reduces our ability to open refuges to wildlife-dependent recreation.

The 1992 departmental audit, I mentioned a minute ago, found that because of budget shortfalls the service was not maintaining refuges in a manner that would effectively enhance and protect wildlife habitat or provide a safe and aesthetic experience for visitors.

Americans spend tens of billions of dollars each year on wildlife-dependent recreation supporting hundreds of thousands of jobs. Many communities around wildlife refuges depend on visitors' dollars to bolster their economies. The gradual deterioration caused by poor maintenance of refuge facilities ultimately will be felt by these communities.

We realize that this is an era of tight budgets, but we are doing what we can to improve the way we use the funds we do have. For example, we are developing comprehensive management plans for our refuges. These plans define objectives, document the status of resources, and provide a blueprint for refuge management. The 1998 budget request includes an increase of just under $2 million to allow the completion or initiation of 14 new plans, covering 29 refuges, including one for the Forsythe Refuge that Mr. Atzert manages.

The ingenuity, energy, and enthusiasm of our employees have carried us far, but the reality is that human capability must be matched with material, with equipment, and with horsepower. Our employees work hard to manage a natural national treasure that is cherished by millions of Americans, and they need and deserve the funds to do the job right.

Thank you, Mr. Chairman, for the opportunity to appear this morning. I'd be happy to answer any questions, and if I can't, I know I've got plenty of able help.

[The prepared statement of Mr. Rogers may be found at end of hearing.]

Mr. SAXTON. Thank you, John. I'm tempted to ask questions at this point, but I think what we'll do is follow standard procedure and move over to hear from Dick Schaefer. Dick, thank you for being here this morning. You may proceed.

STATEMENT OF RICHARD SCHAEFER, DIRECTOR, OFFICE OF INTERGOVERNMENTAL AND RECREATIONAL FISHERIES, NATIONAL MARINE FISHERIES SERVICE, DEPARTMENT OF COMMERCE, ACCOMPANIED BY JEFFREY CROSS, DIRECTOR, SANDY HOOK MARINE RESEARCH LABORATORY, NATIONAL MARINE FISHERIES SERVICE

Mr. SCHAEFER. Thank you, Mr. Chairman. I appreciate this opportunity to appear before you and your committee this morning to address the public interest in possible stock interactions between bluefish and striped bass, and other related concerns.

At this time, I would also like to introduce Dr. Jeffrey Cross, who sits on my left, who is the Director of the Sandy Hook Marine Research Laboratory of the National Marine Fisheries Service. Dr. Cross is accompanying me because of his scientific expertise in several of the areas intended to be addressed by your hearing.

Because of limited time, I will keep my remarks very brief and will simply summarize much of what is already contained in my written testimony which you have in your possession. And, in that regard, Mr. Chairman, I would request that you allow my written testimony to be entered into the public record?

Mr. SAXTON. Without objection.

Mr. SCHAEFER. Thank you, Mr. Chairman.

Anecdotal assertions about alternating cycles of striped bass and bluefish abundance can be found in the popular literature well back into the last century. Interest in this issue, then, is hardly anything new. However, there exists little hard quantitative data to validate these assertions, and even less scientific evidence that would suggest cause and effect with respect to these anecdotal observations.

Therefore, the issue remains open to initiate scientific inquiry that might shed some light on this matter. In that regard, we are pleased that, through your efforts and that of your Committee, Congress has seen fit to provide $785,000 to the National Marine Fisheries Service in its fiscal '97 budget to look further into the matter of striped bass/bluefish interactions.

Further, it is my understanding that our Northeast Fisheries Science Center in Woods Hole, Massachusetts is currently in the process of transferring much of that appropriation to Rutgers University under a cooperative agreement to carry out a considerable portion of those initial investigations.

I might add, Mr. Chairman, that I can't think of a more outstanding academic institution to assist in carrying out such studies. Of course, simply because I'm a native of New Jersey and an alumnus of the University, I wouldn't want you to think my view is biased in any particular way. But oh, if they could only play football and basketball, too.

On the matter of striped bass and bluefish foraging, and the abundance and availability of forage fishes, I also have little to offer. Both species are primarily sight feeders and feeders of opportunity. That is, they will eat just about anything that is easily available to them when they are hungry.

Earlier in my career, when I was working as a fisheries scientist, I conducted feeding habit studies on both whiting off New Jersey, and on striped bass along the south shore of Long Island, New York. I found that whiting fed primarily on themselves; that is, they are cannibalistic. With respect to striped bass, I found that they feed primarily on very small crustaceans in the spring and on a wide variety of fin fishes in the fall.

As far as bluefish are concerned, my own anecdotal observations are that one should not dangle any valued body parts in the water when that species is in a feeding frenzy. It is documented, for example, that, on occasion, some people in Florida have been bitten by bluefish while bathing in the Atlantic surf.

And with that, Mr. Chairman, I would conclude my opening remarks and stand ready to answer any questions you might have for me. Thank you very much.

[The prepared statement of Mr. Schaefer may be found at end of hearing.]

Mr. SAXTON. Thank you very much. What I'd like to do is to go back to subject one, if I may, and this will not be the pattern of the hearing, incidentally. Once we finish with these witnesses, we will move on to others who are expert, and we will divide the subjects into two separate panels. But let me ask John, the popular notion, at least in many public sectors, when it comes to wildlife refuge management, is that there is 42,000 acres in terms of the Forsythe Refuge, and that it is land, that it was acquired, and it's wetlands, and it's out there, and somehow it takes care of itself.

Would you or one of the folks who are with you explain in some detail the activities that the Fish and Wildlife Service undertakes in order to keep a refuge in good operative condition and how it involves the public at the same time?

Mr. ROGERS. Yes, Mr. Chairman, we can, I'm sure, engage in considerable discussion on this issue. A piece of land that serves as habitat for wildlife, back in historic times, may have been left alone because of the entire ecosystem of which it was a part had natural—was naturally and normally functioning. Today, unfortunately, national wildlife refuges are islands, many times in a sea of agriculture, often in a sea of urban environment. At any rate, they're parts of fundamentally changed systems. Thus, the Fish and Wildlife Service or any manager of wildlands, must continually and, at their own hands, mimic or duplicate or otherwise encourage natural processes.

Water regimes are one of the most important that comes to mind. We have, as I mentioned earlier, thousands of water control structures that attempt to create impoundments where impoundments, natural lakes, have been destroyed that mimic tidal flow in other areas so that the marine creatures, estuarine creatures can have access to freshwater.

We do a lot of prescribed burns in areas where—that were normally subject to natural fires, and with our country's history of fire suppression, natural fire regimes have been altered. One of the biggest and most—and least known impacts on wild systems is the impact of exotics. Exotic plants gobble up thousands of acres per year on our national wildlife refuge system, and they must be sometimes individually controlled, and in other areas we have to both create, develop, and utilize, either biological controls or other controls of noxious invasive plant species, as well as animal species in some areas.

So then to make the areas accessible and safely accessible to the public, we must maintain road and trail systems, visitor centers, other use facilities which require an extensive infrastructure to do what we think is a very important job, and that is, make these areas available when and where compatible with the wildlife mission to the American public.

Mr. SAXTON. Thank you. One of the primary reasons that we're here today is to use the Forsythe as an example so that we can highlight for others who don't, perhaps, focus on these issues as closely as we do, the importance of proper management.

Now, as I understand it, and please feel free to answer this in any way you choose, the Forsythe Refuge, many years ago, was a natural estuarine system, and that many of the activities that go on that benefit wildlife today are efforts and the expenditure of

funds that try to duplicate as much as humanly possible an estuarine system similar to the one that was there many years ago, so that particularly migratory birds will have an atmosphere in which they can, not only survive, but propagate and feel like they are truly at home in a system like the one that used to be here.

Would you, or one of the people who are with you, explain what it is that we do and how difficult it is?

Mr. ROGERS. I'd be happy to do that, Mr. Chairman. It's kind of like the TV lawyer shows have asked and answered. You came very close to what is necessary, and my best answer is to defer to the expertise of Mr. Atzert.

Mr. SAXTON. We're going to hear from Steve Atzert, who is the refuge manager at Forsythe.

Mr. ATZERT. Yes, Mr. Chairman. Is this the appropriate—OK. Good.

First, I'd like to talk a little bit about what's happened to a lot of our coastal streams along the Jersey shore in the last 50 years. We've had a lot of lagoon developments. Where previously the streams would sort of meander through a tidal marsh, allowing freshwater and brackish salt water to mix together and create a very good environment with lots of flushing to provide food coming in and then flushing materials out for fish to use back that might be in the deeper waters, over the years these lagoon impoundments have basically destroyed a lot of these tidal exchange areas. They've created many deep areas, deep and shallow areas, filled in other areas, so that we do not have a lot of the brackish water exchange, interchange areas that we used to have.

That's one of the reasons that we have the Brigantine impoundments and why they're so important to maintain, is that a lot of these shallow streams just don't exist anymore.

Mr. SAXTON. Now, impoundments are areas that have been walled off through the use of levies and dikes and——

Mr. ATZERT. Right, it's a fancy name for an artificial lake.

Mr. SAXTON. For an artificial lake. Now, that's necessary and—as I understand it, because it used to be, as you just described, that there were—we'll disregard that for the question and answer period. For those who can't see, we have this red light system that goes on, and we've been talking about this issue for five minutes, but we're going to go on anyway.

Historically, salt water and freshwater merge in an estuarine system. And when that happens the tide comes in, and the salt water floods an area, and the tide goes out, and freshwater returns, and as the water level goes up and down there are certain effects that that causes twice a day.

Mr. ATZERT. Correct.

Mr. SAXTON. Can you describe that?

Mr. ATZERT. All right, well, one of the most important things about salt marshes, that they are about the most productive ecosystem, ecocommunity in the world. They put your Iowa corn fields to shame. There's a lot of primary production going on there.

When the tide comes up, some of the materials will get suspended and then get flushed out with outgoing tide, and it could be little shrimps, could be, you know, little copepods. The young bluefish out in the bays will be eating those things up, the her-

rings. It's like having a slug of food coming out of the marsh twice a day.

You need the spartina marshes to produce that. You know, once you divide it up into a lagoon development you have lost that. So that's one reason that the tidal marshes are so important. They're very, very productive, and it's like a twice daily slug of food going out to the back bays.

Mr. SAXTON. Now, the Forsythe was established in 1939, and we've been enlarging it off and on ever since. My understanding is that that is primarily because the Forsythe has become a kind of a haven which migratory waterfowl use as a place to stop and eat on their way north, and then again on their way south in the fall; is that correct?

Mr. ATZERT. That's correct, and the impoundment at Brigantine is one of the biggest attractors—attractions that we have. We'll have 30,000 snow geese in there in the fall. Very important for them. They'll stay usually untill about the middle of December and then fly farther south. During that time they are utilizing the spartina grasses that are outside of the impoundment, but they do love to use the freshwater environment or the brackish water environments in the east pool and the west pool for loafing areas.

Mr. SAXTON. So the area known to you as impoundments and to those of us who are visitors of the area, we can call the impoundments, too, but to where I go to see a lot of pretty birds, those areas actually are not there just so people can drive their cars out those dikes and those levies. They're there so that wildlife, food source, and other habitat aspects can be enhanced and protected.

Mr. ATZERT. Absolutely. That was the original reason. It's just that when you build a dike, and they have to be fairly substantial out there, you have a place to put a road, not only for maintenance use but for people to get out and actually see what we are doing on their behalf.

Mr. SAXTON. Now, Acting Director Rogers testified that our national maintenance backlog is over a half a billion dollars, $505 million to be precise. And I suspect that there are some projects at the Forsythe which you would think could be undertaken if you had more resources.

Mr. ATZERT. You're correct on that, Mr. Chairman.

Mr. SAXTON. And some of those activities that you could undertake would be fairly important to maintain the system that we have just very carefully tried to describe.

Would you like to tell us about some of those projects?

Mr. ATZERT. Certainly.

As you are aware, we are finishing off our rehabilitation of the west impoundment and the east impoundment, hopefully this year. And when that is completed we're going to go and—well, I shouldn't say we're going to—our next highest priority is to re-slope the north dike, which is an integral part of the west impoundment area and also an integral part of our automotive tour route that is used by almost, I think, about 170,000 people each year.

What has happened over the years is that the marshes to the north of the impoundment have received substantial use by the snow geese and have created mud flats which are excellent habitat type for the shore birds when they come through in the spring, but

at the same time, it does create an area where waves can be kicked up by the wind, and over the years the water erosion has been gnawing away at the north dike.

We now have cut banks. The dikes are usually supposed to be sloped at a three to one slope. We now have a little beach and then a—maybe a two- or three-foot vertical drop in some areas.

Mr. SAXTON. Now, in this case Mother Nature has given us an abundance of snow geese, and the snow geese have come through the area, and they have transformed what was previously, I guess you could call it, a naturally vegetated breakwater and have transformed it into a mud flat, which is fine, because that's part of Mother Nature's process as well. But the north dike of the impoundments has now become the breakwater and is washing away.

Mr. ATZERT. Correct. That's absolutely correct.

Mr. SAXTON. And how much money is needed for this project?

Mr. ATZERT. We estimate about $200,000.

Mr. SAXTON. $200,000, and that would be used for fill known as rip-rap?

Mr. ATZERT. Well, we would probably use our own—try to get one of our own excavators to re-slope the dike, pulling the trail in from the former borrow pit or borrow ditch that was along the north slope, and then come back and set some rip-rap, which is stone, probably one- to two-foot size rip-rap down to the base to soak up the wave action.

Mr. SAXTON. And if this is not accomplished then someday, maybe not too far into the future, the north dike could break through.

Mr. ATZERT. Correct, and then we have to, you know, fix the break, which is first of all additional moneys. Second of all we would use our ability to manage the water in the west impoundment for the sake of, let's say, spring migratory shore birds coming through and then in the fall for the ducks coming through.

What we try to do is we'll be using one side of the west impoundment as a reservoir and the other side as a moist soil unit to stimulate marsh vegetation to grow, and as the summer proceeds, this vegetation would grow higher and higher, and we would flood it. Then in September, just before the ducks come back, so that they could swim around and use the pantry; if the area's not flooded the ducks can't use it.

Mr. SAXTON. Now, getting away from the north dike for just a moment, without being specific with everything you need to do, in terms of these kinds of projects, is the backlog of work that needs to be done on these kinds of projects which—and the activities which you undertake to keep the refuge operable and efficient, are there other projects? And if so, what are the nature of them, and if you could just describe that briefly.

Mr. ATZERT. One that would be high on our list would be to rehabilitate the dike at Lilly Lake. That dike was built back in the '20's. About five to seven years ago we purchased the area. That's now our responsibility. It's the only freshwater fishing opportunity on the refuge. And also that dike would hold back water that we could use to manage the main impoundments at Brigantine.

Another thing that we need to be dealing with is the office facility that we have at the Barnegat unit. We're in a trailer. Trailers

are designed for temporary facilities. Hopefully, the National Wildlife Refuge at the Barnegat Division is going to be here in perpetuity. Trailers are only good for so long. They start to fall apart. Very high maintenance on those.

We'd like to get around to building a modular-type office for our office up here at the Barnegat Division. Cape May has no storage facilities whatsoever right now, and if you're going to start doing habitat management, you need equipment. To further the life of the equipment it's good to have it under cover. Also, it prevents people from borrowing things from Uncle that they like. And that has happened on occasions.

The maintenance building down there, a storage facility down there, we figure, would be over $200,000.

So these are the kinds of things we're talking about.

Mr. SAXTON. Well, I look forward to working through these issues with you, as you know, and we'll be talking about them more. I just thought it was important to get some of those things on the record, because the record that we take back to Washington with us will be shared with other Members of Congress.

John, Mr. Rogers, let me return to you to just explore one other issue. As you may have heard me say in the past, I believe that public support for the refuge system is essential. That goes without saying.

So to the extent that we can involve members of the public in activities on refuges like the Forsythe, public support will be enhanced.

I understand that there are something in the neighborhood of 98,000 birders who visit this refuge each year and contribute over $4 million to the local economy. And I also know—and incidentally, if it sounds like I know some of the answers to these questions before I ask them, it's only because I spent last Monday with Tracy Castleman down at the refuge looking at these, looking at some of these issues.

I know that, with regard to this question, you are planning to enhance nature trails, re-open some nature trails, and perhaps there are a number of other things that you are doing or planning to do, John, to enhance public participation at this refuge and other refuges around the country.

The question is two-part. On a national level, what are we doing with regard to this subject, and, specifically, at the Forsythe, what are we doing?

Mr. ROGERS. On a national level, you correctly state that both public participation, public enjoyment, and public involvement in the refuge are critical, both for the support of the refuge and also for the education of the people who use the refuges.

Public participation is a critical involvement component of the comprehensive planning process, that is, where we principally and officially derive the input of the public into where we should be going with management and development of a particular refuge.

Second, public use of the refuge system is paramount where it is—while dependent on the wildlife resources existing on that refuge and where it is compatible with the purposes for which the refuge was established.

Too frequently our public use ability is impaired because of the lack of funding for developing the kinds of facilities you spoke briefly about, that is, trail systems, boardwalks, road access—safe road access, and the like. So the public is a critical component of the refuge system, first through the comprehensive planning process and our ongoing interaction with the public as neighbors, and second, because the refuges are there. Once they are fulfilling their wildlife missions, they're there for the public to use and enjoy where it is dependent and compatible with the wildlife mission.

For the specifics on Forsythe, I defer, once again, to Steve.

Mr. ATZERT. Talking about public use. Let me talk about public use first.

We are currently working on opening a trail at the Reedy Creek unit of the Barnegat Division up in Brick Township. We'd like to get that done. I'm looking at Tracy—June 10?

Mr. CASTLEMAN. June 7.

Mr. ATZERT. We're looking to dedicate that trail on June 7th of this year. Something else we're working on right now is a partnership with people around Barnegat. Allison Banks, our Barnegat Division Manager, has been working with two citizens in Barnegat as well as with the township. The township is interested in putting in a fitness trail, and we will be putting up a observation platform at the Barnegat impoundments so that people can stop on their walk around the fitness trail and observe nature up close.

We are currently working with a group in Cape May County that's interested in putting in a trail through the Cedar Swamp Division. The trail location is also a priority for the State trail system.

They're trying to put together a trail from Cape May all the way up to Manumuskin in Cumberland County. And this two-mile stretch would be part of that. So we're working with townships of Dennis, Borough of Woodbine and Middle Township on that particular trail, and hopefully we'll be getting the county involved as well.

Mr. SAXTON. Thank you. Do you subscribe to the National Guidelines of 60 percent of the refuge being used for wildlife only and 40 percent being used for other historic human uses?

Mr. ATZERT. Well, that's more than a guideline. That's one of our—one of the laws, and I believe it requires that we not open more than 40 percent of an area to migratory game bird hunting unless the Secretary of the Interior determines that opening up a greater area would be beneficial to the refuge and to the species involved.

Mr. SAXTON. And did you have a new hunting program last year involving non-migratory Canada geese?

Mr. ATZERT. Yes, we did. This past January and February, during the States resident Canada goose season, we opened up the impoundment at Brigantine for the first time ever to controlled hunt, and we did that five Wednesday mornings, and the idea was to give people an opportunity to get—to shoot those geese.

We do have a problem in this State with resident geese. We did not do it every day. The idea was to shoot them one day and then let them sort of settle back in, and then come back the following

week. We also worked with some of the local golf courses to sort of coordinate efforts to reduce the population in the area.

Mr. SAXTON. Well, thank you. I think that last question may have been a difficult one for you to answer for a variety of reasons, but Commissioner Shinn, who is also here, who will be the lead witness on the next panel, and I know full well of the impact of the non-migratory geese and the difficult issues that they have brought to us over the last decade or so.

John, with your permission, let me address a question to Bob Streeter, if I may.

As you know, the practice of the U.S. Fish and Wildlife Service, relative to acquisition of refuge property, has historically been to acquire additional property through whatever funding mechanisms we have from time to time, and upon acquisition those lands were immediately closed to all historic human uses until a management plan was adopted.

I understand that there has recently been some change in that policy. Can you explain what the new policy is?

Mr. STREETER. Yes, Mr. Chairman, I'd be happy to.

The past policy was, basically, any new lands added to the refuge system would be closed until we could do a compatibility determination process, and then they would be open by regulation.

We are now looking at another way of going about it, which we think is a lot more neighbor friendly. The policy that was implemented, first of all, through an executive order that was signed last year by the President basically says, as we move to acquire new lands, before we acquire them, we will make a determination of which of the existing uses can be continued on, at least, an interim basis after we would acquire those lands. So that the public involved, the public or the neighbors, know what our plans are immediately after acquiring that land, and then, as we move through the comprehensive planning process that John talked about that we hope to have completed if we get our '98 budget, we hope to have completed over the next eight years, there will be full public involvement then as we do the comprehensive planning in a longer term framework.

But the bottom line is we want to let our neighbors know what those lands will be used for, what they can be used for of the existing uses right after we purchase them, rather than immediately closing them. And we have some examples that have already—we've been able to implement that plan or that policy through this last year already.

Mr. SAXTON. Well, I appreciate that very much. We have had some cases here in New Jersey, particularly the most notable of which was Bonnet Island, which was a very visible part of the Forsythe Refuge, which the refuge system acquired some years ago, and immediately closed it by erecting a gate with a sign that said, "Keep out." And it was not good public relations, and I'm very pleased that we have now changed that policy.

Go ahead.

Mr. STREETER. May I make one other comment, Mr. Chairman?

It does cause some strains with our existing refuge operations. Steve might be able to address that better, but in general, we have a refuge budget, we acquire new land, and we haven't gotten addi-

tional money to manage a particular use, but we are hoping that, through partnerships and through making adjustments, we can modify our operations to provide that use as compatible.

Mr. SAXTON. Thank you very much.

I'm going to turn now to Dick Schaefer. Let me thank you all very much for your participation.

Congressman Pallone has arrived, and we want to welcome the gentleman from the north shore area of coastal New Jersey, and so while he's getting settled, let me ask Dick Schaefer a couple of questions.

Dick, historically—well, first, let me say what brought this forage fish issue to my attention as it relates to bluefish and striped bass, and I don't know that anybody has the answers, and that's why we've sent Ken Able to find the answers. But essentially, we seem to see different behavior from different—different behavior exhibited. I'm not sure if it's different, or what is apparently different behavior.

During the decade of the '70's and early '80's the striped bass disappeared from our coastal areas, not completely but for as far as—as far as fishermen were concerned, they had disappeared. And then they came back, and we all know why, or we all think we know why that was, because of some different human behavior, which may have been environmental in nature, in part, and which may have been regulatory, in part, based on a partnership of the State and Federal Government formed on that issue.

More recently bluefish seem to have moved offshore and come back to visit us occasionally, but by and large the biomass seems to be offshore. And at least, the third party of this, I guess, third issue is that forage fish, including Barnegat Bay, its blue crabs, seem to be in shorter supply than at any time that I can remember. And the bunker—also known as menhaden and other forage fish species—seem to be in shorter supply.

Is that an accurate description? And if so, can you elaborate on anything that you may have, in terms of information, that might be helpful to us?

Mr. SCHAEFER. Let me try, to the best of my knowledge, Mr. Chairman. I will admit, I certainly don't have the market cornered on the information on this subject.

As you correctly point out, striped bass stocks have recovered over the last ten years to a level which is as high as that stock has ever—we've ever witnessed in human history, and we're pleased with that for the very reasons that you mention.

Current status of scientific information on bluefish is that they are in a period of current decline, as you also observe. The stock, many believe, is being overfished, but that is not the sole reason, probably, for the decline. It's probably synergistic with environmental effects that are poorly understood at this time.

As I indicated in my testimony, we don't have any evidence. I'm unaware of any evidence that would suggest any causal effects between striped bass abundance and the current dearth, if you will, of bluefish.

Blue crabs have relatively short life cycles, and their levels of abundance are influenced strongly by environmental effects. For example, I happen to have a house on the Chesapeake Bay, and

last year blue crabs were in very short supply, as you indicate, and the early indications this year are that the blue crab population is probably pretty healthy. So these annual fluctuations in blue crab abundance are not particularly unusual, but the scientists in the Chesapeake, at least, tell us that the stock is maintaining itself at an historically average level.

As far as menhaden are concerned, I frankly don't know much about the current status of that fishery. Perhaps Dr. Cross can help me out, but that fishery has gone on for years. It's pretty dependent upon recruitment of young fish in the southern part of the range, and by that I mean the Chesapeake Bay, North Carolina fisheries, and as the fish age, the fisheries to the north, New Jersey and north, are more dependent upon older age classes. It's an inshore fishery, occurs largely within State waters, always has, fisheries largely pursued with purse seines. It's almost—it's a very clean fishery in terms of what is caught.

I used to go on menhaden boats early in my career and the percentage of other species taken as bycatch was one percent or less, very, very minimal. But that doesn't answer your question directly.

The interactions between all these species, you mentioned, as I say, is poorly understood, and I think is going to take a lot of scientific investigation to try to validate these observations, if you would.

Mr. SAXTON. With regard to menhaden, what is your tendency to say, with regard to the fishery currently? Is it in bad shape, is it kind of in a normal cycle, or——

Mr. SCHAEFER. I'm going to ask Dr. Cross to help me on that one. I think he would probably have more information on the current status of the stock than I do.

Dr. CROSS. Actually, I'll probably defer to the representatives from the Atlantic States Marine Fisheries Commission, since it is responsible for looking at that fishery, but the landings have been fairly consistent for over the last decade.

Mr. SAXTON. Are there any other species of forage fish or species that we would generally refer to as forage fish which are in short supply?

Dr. CROSS. Some of the species that run up the rivers, like shad, river herring, we've seen declines in their populations but, on the other hand, some of the off-shore species, like mackerel, herring from farther north, are at very healthy population levels. So I guess the evidence is mixed.

Mr. SAXTON. What would you say to near-shore fishermen who have noticed that there seem to be—this is, of course, anecdotal reports—that seem to be of very short supply of menhaden?

Dr. CROSS. I'm afraid I don't have an answer for that question.

Mr. SAXTON. Unless Congressman Pallone has any questions for this panel, I would like to just say, at this point, that we've got two more panels to address these two issues separately, and so I want to thank all of you for being here with us today, particularly those of you who came from out of town. We've appreciated your participation, and we'll look forward to working with you on these and other issues as we move forward.

OK, if I may call Panel II. We are going to proceed with Panel II. Let me just introduce the members of this panel. Mr. Robert

Shinn, who is the Commissioner of the Department of Environmental Protection, is with us, and if you folks would come forward and take your places at the table. Mr. Frank Bittner, President of the New Jersey Federation of Sportsmen's Clubs; Ms. Joan Koons, President of the Board of Trustees of a group that we know as ALO, or Alliance for a Living Ocean; Mr. Willie DeCamp, who is President of the Save Barnegat Bay, Ocean County, Izaak Walton League. And we welcome all of you here. I might point out at this point that Commissioner Shinn is here. He just handed me a note, however, that he has a telephone conference call which he must make, and he will rejoin us in something in the neighborhood of 15 or 20 minutes.

So while we are waiting for him to rejoin us, we will begin with Joan Koons, and of course, we're now switching our subject back to the Forsythe and issues that are related to it. We are anxious to hear from all of the members of this panel. We'll proceed with Ms. Koons and then Willie DeCamp, and, again, the little lights indicate a time limit; however, don't worry if you tend to be a little bit longer than the allocated five minutes.

Joan, you may begin.

STATEMENT OF JOAN KOONS, PRESIDENT, BOARD OF TRUSTEES, ALLIANCE FOR A LIVING OCEAN

Ms. KOONS. I thank you, Congressman Saxton and Congressman Pallone and the Subcommittee on Fisheries Conservation, Wildlife, and Oceans, for this chance to testify.

My testimony will spotlight one acquisition that our grass roots group holds so dear. For the last few years the Alliance for a Living Ocean, ALO, has had the honor of being a facilitator for the Edwin B. Forsythe National Wildlife Refuge, Bonnet Island Unit. Various schools and organizations, such as Ocean Nature and Stafford Township Intermediate School, have used this refuge as an educational site. Our volunteer guide points out indigenous flora, fauna, and birds which stop over as they use the major flyway on the east coast. Water quality and how people affect it by non-point source pollution is stressed repeatedly.

As we look across the bay to the development on Long Beach Island we feel the need to preserve areas such as the Bonnet Island refuge. The importance of these protected areas cannot be overstated. However, individuals should be able to visit the refuge to further understand their importance.

ALO has made the Bonnet Island area its spring cleanup target. Each April volunteers clean the grass area littered with highway debris concentrating on the pond and bay beach area. At this point in time it is almost impossible to access its trails. Our volunteers have brought out thousands of pounds of debris, including old cars. Now we are ready to use it to teach the worth of non-point source pollution control and the necessity of preserving wetlands.

In 1996 a mitigation project was begun on Bonnet Island in accordance with a New Jersey Department of Environmental Protection ruling. The project included a pond and the planting of various indigenous plants. The plantings were done under the supervision of Dr. Eugene Vivian of ACES Environmental. He instructed an ALO volunteer on how to monitor the health of the project and ob-

serve the wildlife. The trails were not maintained in a manner that the volunteer could access and observe this project.

Bonnet Island is a sheltering place for flocks of herons, glossy ibis, black ducks, brants, tree sparrows, juncos, red-winged blackbirds, harriers, sharp-shinned hawks, yellow-rumped warblers, white egrets, et cetera. The pond area shows evidence of raccoon, red fox, and deer footprints.

In August, 1997, ALO will be completing its tenth year. We look forward to making the education of residents and visitors alike to our barrier island area a priority. We hope to factor in the use of Bonnet Island as an educational laboratory. However, we are met with frustration when the land is there and our facilitators cannot access it properly because the designated pathways are not maintained. We want to be partners. We want to help the U.S. Fish and Wildlife Service; however, we do not have extensive funding that would make this possible. We are asking the Federal Government to re-evaluate the appropriation of adequate funds for proper maintenance of refuge properties. We have the greatest respect for the management staff in our area and desire to work fully with them.

ALO is proud to be a facilitator of this property. We have come to love and understand its value to the ecosystem. The Alliance for a Living Ocean is committed to this important partnership with the U.S. Fish and Wildlife Service.

Mr. SAXTON. Joan, thank you very much. If I may just postpone my questions for you for just a minute. Commissioner Shinn is with us, and he's got an extremely busy schedule, and he's been here for over an hour already, and I know that he has got other things that he needs to do, so, Willie, with your permission, if we may go to Commissioner Shinn at this point to hear his testimony, and—what is your timeframe period this morning?

Mr. SHINN. I'm fine for the next——

Mr. SAXTON. OK. OK. Proceed. Thank you.

STATEMENT OF ROBERT SHINN, COMMISSIONER, NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION, ACCOMPANIED BY THOMAS W. McCLOY, ADMINISTRATOR, NEW JERSEY MARINE FISHERIES ADMINISTRATION

Mr. SHINN. Great. And good morning, and thank you, and good morning, Frank. It's good to see you with us. It's funny some of the shore issues divide themselves, and we see a lot more with Frank and the dredging issues that are focused to the north.

I appreciate the opportunity to be here this morning. Of course, I'm Bob Shinn, Commissioner of the New Jersey Department of Environmental Protection. I could probably shorten my testimony a great deal by simply saying there's not enough money and there's not enough fish, but as you know, the bridge to solving that issue is a lot of public understanding of the problem and a lot of work in the estuary to enhance the habitat to create more fish to start with.

New Jersey is home to five national wildlife refuges totaling more than 60,000 acres. These refuges combined with New Jersey's own wildlife management areas, parks and forests, create a key link in the long-term protection of New Jersey's wildlife resources. I'm happy to say the high degree of cooperation between the State

and Federal wildlife management personnel has further enhanced the value of this linkage.

Refuges provide important opportunities for hunting, fishing, birding, and other wildlife associated forms of recreation.

Our nation's wildlife system is a success story we can all be proud of. The system holds much potential for improving fish and wildlife habitat and for providing recreational opportunities for people.

These important opportunities cannot be realized without adequate operation and maintenance funding. I strongly support an increase in the funding requested and appropriated for these high priority activities.

Land acquisition for the purpose of habitat protection and public use and enjoyment is a high priority. Funding for operations and maintenance should not come at the expense of land acquisition efforts. Separate funding mechanisms should be available to support land acquisition and operation and maintenance.

The department's biologists within the Division of Fish, Game and Wildlife participate actively in the service's ecosystem teams landscape management and the service is an important component of our developing programs. Both of the above approaches to wildlife conservations are designed to establish partnerships to manage species across agency lines.

Without sufficient O & M funding, the service is hampered in developing partnerships with other agencies, particularly in regard to developing compatible GIS capabilities.

The service is also hindered in providing much needed facilities for wildlife-associated recreation. Trails, observation blinds, boat launch ramps, and other similar facilities which are in great demand in New Jersey are rarely developed, due to the shortfalls in operation and maintenance funding.

General non-facility wildlife-associated uses, such as hunting, fishing, and birding, are also restricted due to lack of operation and maintenance funding. The excessive administrative burdens placed upon the refuge managers make it difficult, if not impossible, to open areas to traditional compatible uses for many years, and sometimes decades.

Areas that have compatibly supported wildlife-associated recreation for literally centuries are closed to these uses once they become part of a national wildlife refuge. This is a result of the manager's responsibility to re-write history time and time again for every use proposed on a refuge.

There is general agreement among wildlife scientists that most wildlife-associated recreation is compatible with refuge purposes in most situations. Although I applaud the President's efforts to encourage compatible wildlife-associated recreation, the Federal legislation under which the refuges are administered needs to be improved.

Now, let me take a couple of minutes to talk about other subjects that you are addressing today.

Predator-prey relationships in marine species are generally poorly understood.

Bluefish and striped bass are primarily fish eaters in their adult stages. When they are in the same area, they are probably competi-

tors for forage species. Bluefish and striped bass extensively utilize estuaries as nursery areas. Striped bass appear to rely more heavily on invertebrates, such as small shrimp and amphipods in their early stages.

By the middle of the summer both species rely on small fish for a substantial portion of their diet.

Both bluefish and striped bass are opportunistic feeders, but if given the opportunity, striped bass prefer soft-rayed species such as Atlantic menhaden, river herring, bay anchovies and silversides.

Bluefish diets may be more diverse, including butterfish, menhaden, round herring, sand lance, Atlantic mackerel, bay anchovy, young weakfish, spot and Atlantic croaker.

Although some predation of small striped bass by large bluefish and vice versa may occur, those species do not seem to make up a significant portion of their diets. Several studies indicated that predation of striped bass by other species did not contribute to the decline of striped bass in the late '70's and early '80's.

There have been periods of time such as the early to middle '70's and possibly earlier when both striped bass and bluefish were at relatively high levels of abundance.

Prey species, such as menhaden, bay anchovy, and silversides are very abundant. With a wide variety and large biomass of prey species available throughout the range of striped bass and coastal bluefish, the likelihood of prey items constituting a limited factor for bluefish or striped bass population is not high.

Obviously, I don't have all the answers solving either the money or the fish population issues; however, some very positive things are happening throughout the area.

Number one, Barnegat Bay Estuary Plan, and you've been a significant part of that, and together with the governor, I think are the primary reason that that came to fruition. And the interest in that program and the information and general data that we already have recorded on our geographic information system has really given us a jump start in that estuary program.

Increase in pump-outs are already starting to lead to no discharge areas, which is going to give us a major improvement in our estuary.

New Jersey's new Draft Water Shed Plan, which I just released last week, starts to look at our discharges in a different vein and look at something we've talked about for 20 years, non-point pollution on a very regimented basis.

An aggressive Green Acres acquisition program. In the last three years we've purchased individually and jointly with non-profits, and certainly partnering with New Jersey Fish and Wildlife, the State's acquired over 77,000 acres over three years, and if you look back to 1961, our average acquisition over three years was 30,000 acres. So we've significantly enhanced our acquisition program.

A new plan for the coast to be launched on the 29th of this month, the Coastal Master Plan is more of a consensus document than a top down plan, but we've got all the issues, from sea level rise to all the issues with barge unloading and litering and all the issues that impact our coast and have in the recent past.

Our GIS program, and that's something I mentioned in my formal remarks, but we would like to see more Federal involvement

on our GIS program. It's geographic information computerized mapping with overlay capabilities. But we're getting all of our wildlife habitats, all of our wetlands areas, all of our parks, facilities. Our new acquisition program, I talked to you briefly about the other day, that maps all the acquisition, Federal and State agencies, non-profit, local, county mapping which really puts together, for the first time in a single map, all the linkages that are created by everybody that's interested in land acquisition and points up some new priorities that, I think, we've got to address in, not only shore protection, but in stream corridor protection and headwaters protection, and it gives us a little bit of a new vision in where we're headed with acquisition. And there's an ideal opportunity for enhancing our partnership with the Federal Government in this effort.

I think today's—I'd particularly like to commend the Committee and yourself on today's hearing. I think the information gap on what happens in preserve areas, and what suffers when you don't have adequate funding to provide operational maintenance, and one of the most effective areas that I think we need to focus on going forward is the public education and interpretation. If we don't do that, we're not educating our young people on what this environmental balance that we're just coming into understanding on in recent years, what it means to our long-term survivability on the planet and what it means to our economy.

The economics of environmental protection and the economy, as you know, are closely linked in probably no stronger place than they are right where we're sitting. But a strong environment means a strong economy, certainly, on the coast and, I think, throughout New Jersey.

So I thank you for the opportunity to testify today, and wish you a lot of luck in your hearing efforts.

Mr. SAXTON. Thank you. Commissioner, before you leave, and with the permission of the other two witnesses on this panel, I'd just like to ask you a couple of questions, if I may.

Before I do that, let me thank you for giving the governor and I so much credit on the Barnegat Bay's inclusion in the National Estuary Program. You're being much too kind.

Frank and I worked, and I think we can both agree with this statement, Frank and I worked together for a decade trying to get Barnegat Bay named as part of the estuary system, and it wasn't until you became commissioner that we were able to get that done, and I know how much you contributed to that, and so thank you for the kudos, but you should look in a mirror when you say those words, because you were primarily responsible for getting it done, and Frank and I both appreciate it.

Mr. SHINN. Those partnerships work great.

Mr. SAXTON. Yes, they do.

Let me ask you two questions. One about the striped bass program, which has obviously, an extremely heavy involvement with State and Federal partnership, with the State playing today, in my opinion, the major role.

Is it working—while the results are obvious, as Dick Schaefer pointed out, we've got more striped bass today than anytime in recorded history. If you'd just like to comment on it from a State per-

spective, and is there anything that we ought to know that we could do differently? Obviously, New Jersey has some special aspects that work pretty well with regard to the program.

Just in a general sense.

Mr. SHINN. When I was sitting in the audience listening to the testimony I was thinking back to my high school days when I spent most of that time in the summers mating on fishing boats and it was really common to go out and pick up two or 250 snapper blues, and most of those would be a pound and a quarter or less. And if you wanted to get a decent size bluefish, you had to go to the Barnegat Ridge, north or south ridge, and you might pick up a four or five-pound blue, but in recent years we've been picking up larger fish, not only close to the coast, right offshore, but in the inlets and in the bays, which would be totally unheard of in the '50's.

The dynamics of the small fish versus the large fish, I have to tell you, I totally don't understand. But the one thing I think I've got a fairly clear picture of, that the quality of the bay water and the quality of the estuary in general has a very large dynamic on breeding characteristics of fish.

And I think we're at a fortunate time to bring focus on the Barnegat Bay estuary. I think if we can improve the water quality, and I think there are some significant management activities we can undertake to improve the water quality, the pump-outs, the handling of storm drainage.

We know a lot about the Barnegat Bay. We've got a lot of data on our GIS system. An aggressive acquisition program, I think, is part of that strategy, but certainly we need maintenance money, too, to carry out these strategies once the acquisition is done.

I think there are man-made things we can do to enhance fish population, fish population enhancement, and I think we're on our way to doing it, and there's probably some better science that's on the horizon than I've talked about, but I think enhanced environmental quality in the estuary is a key ingredient to enhancing fish population.

Mr. SAXTON. Thank you. Let me change the subject.

There is a species in New Jersey known as the glass eel. I'm told that because they can bring as much as $300 a pound today, there is—in Japan—I am told that today there is tremendous pressure in this fishery. Is New Jersey making certain that these eels will not be overfished, and is there something that the Federal Government ought to know and do in order to assist in your efforts?

Mr. SHINN. Let me get some able assistance on that subject. My knowledge of that specific area is not that great so——

Mr. SAXTON. Fair enough.

Mr. SHINN. I brought help with me.

Mr. SAXTON. This is——

Mr. MCCLOY. Tom McCloy, with the New Jersey Marine Fisheries Administration.

The glass eel fishery has existed for a number of years. In the last few years it has taken on more importance as more people realize the economic benefits to be made from that, and as a consequence more people have gotten into it.

Last year we had a considerable number of problems which we tried to resolve through regulatory actions, restricting the gear, re-

stricting the season, etcetera. I'm not sure it helped a lot considering what occurred this year. We had more people doing it, theoretically at least, with less efficient gear. The problems associated with the fishery were extremely exasperated, even over last year. Trespass problems, buoying problems on streams, even instances, I'm sure you read about in the paper, of individuals carrying firearms, et cetera.

Because of this we're taking a very critical look at regulations for next year. And incidentally, the season just closed yesterday. So we're going to be taking a hard look at that to see what steps we need to basically try and address those problems that occurred this year. Maybe nothing less than a total ban would be required in order to accomplish that.

You should be aware that the Atlantic States Marine Fisheries Commission is also developing a plan for the American eel, which—this is the younger life stage of the glass eel, and although that plan is not coming on line probably for another year or two, we're looking to them for some kind of guidance, also.

Mr. SAXTON. Thank you very much.

Mr. Shinn, let me just ask one last question, and then I'm going to turn to Congressman Pallone for his questions.

You mentioned in your testimony the extensive holdings that both the State of New Jersey and private organizations have, in terms of environmentally sensitive land in the coastal areas.

Obviously, we're here to discuss, as well, or primarily, I guess I should say, the Federal role in this regard. Is there an opportunity for partnerships among private, State and Federal landholders, and would you comment on that briefly?

Mr. SHINN. Absolutely.

I think we're fortunate that we have a great relationship with the Federal agencies, but I think we can take that to the next step. I think—I keep talking about GIS all the time, but I think it's our information data base and the department. We've got 18 or 21 counties up on the system. The Barnegat Estuary Plan is going to be on the GIS system, and it's going to be on the internet probably by the end of the summer. But we have about 50 plus software packages out to non-profits, so environmental groups are working on this computerized mapping data base themselves.

We see it from a watershed perspective, GIS base, so that all the data, as mapped on GIS, if you've got an unidentified pipe or you've got a discharge in a certain area in a swamp that's hard to identify, you can use global positioning to nail that site down. So it's just an exceptional mapping base to work with in a watershed context.

So we found, also, that working with non-profits, like Trusts for Public Land, who have been very active in this particular region, has given us an extra lever to work on land acquisition, and we can actually buy more land per dollar by using non-profits in the exercise.

So I think even enhancing a very good partnership that we have now is on the horizon. And of course, it gets tough when resources are short, because everybody's trying to put fires out, and we've certainly been through that exercise, as well. But I think really getting the state of the resource to the optimum and creating part-

nerships to the optimum extent possible, and not only governmental but also private involvement.

I heard several people were interested in putting trails in different areas of the refuge, and I think that's great, and I think those are the kind of things that are going to let us do more from a public perspective in areas of tight budget times.

So I think working closer together, leveraging our resources, both governmentally and privately, and trying to, I guess, blend over those tough areas where you go from governmental to private for the public benefit, some—there are some difficult barriers there, but I think working through them, and I think we can get there. And I think we need to.

Mr. SAXTON. Thank you very much.

Before returning to Willie DeCamp and Joan Koons, Willie for his testimony and then questions for both, Mr. Pallone, would you like to address some questions to Mr. Shinn?

Mr. PALLONE. Thank you, Mr. Chairman.

Let me just follow up on what Jim just said. With regard to possible State, local cooperation with the Federal Government, the one thing that cries out through all this with the National Wildlife Refuge is the lack of funding. And it's very difficult for us to make the case, not only for additional acquisition, but even for operations and maintenance. We can make the case, but the money isn't there, and we don't have the ability, because of the atmosphere in Washington right now, to convince a majority of our colleagues, to do a lot more.

I'm just wondering what you face and whether or not, in terms of operations and maintenance, because I know that we've already heard from Ms. Koons, and we're going to hear from others, I'm sure, about the problem of keeping up.

Is there a source of funding or other ideas in terms of volunteer groups? These volunteer groups are doing as much as they can, but it's just so frustrating, because we know the statistics are out there as to what should be done and how much it's going to cost, and we don't appropriate the money to do it.

I'm just wondering if you had some ideas, Mr. Commissioner.

Mr. SHINN. Well, there are some——

Mr. PALLONE. I don't really have any, I'm not trying to put you on the spot, because I know it's tough at every level, but——

Mr. SHINN. Yeah. No, it's certainly—some good things have happened over the last twelve months or so.

Number one, there was two questions on the ballot, one was—gave the department four percent of the corporate business tax, which is roughly $46 million plus a year that the department has for specifically identified items.

And the other was the bond issue which, as you know, went for dredging and other economic development projects. They were, to me, aside from having the money, which is very, very welcome, they were good indicators that there's strong public support for environmental—the environment, open-space type activities, plus getting our ports viable from a dredging perspective.

In addition to that, we have a committee that's being chaired by Assemblywoman Ogden, who you know very well——

Mr. PALLONE. Sure.

Mr. SHINN. [continuing]—who is looking at the stable source of funding for our parks and maintenance included, and as a primary pre-requisite, because funding goes up and down with budget cycles, and you've been through that drill before——

Mr. PALLONE. Exactly.

Mr. SHINN. [continuing]—and know it well. So I guess we've really moved our site remediation program—it's in transition right now, but I think there were $70 million in that bond issue for site remediation. That'll probably be our last site remediation bond issue, and now we'll go to stable source of funding under the corporate business tax. Fifty percent of those dollars was dedicated to site remediation.

So we've gotten the department, in the last three years, off of fees and fines, and on budget, and it was a difficult time to do that transition, as you know, but I think the good news is we can set environmental priorities and fund them and not be a fee-driven agency. Plus we've got site remediation moving to a stable source of funding. And my goal, ultimately, is to have our park system on a stable source of funding, and I think we'll be much more able to address the issues that we're talking about today, because operation and maintenance and adequately staffing parks—we're adding parks in New Jersey. We've added a couple of parks over the last couple of years.

So it's really a challenge to keep up with the demand. The public demand for our park system, while other States are sort of waning, is increasing annually. So the more increase you have, the more staff requirements that are—particularly interpretation. I think we're missing the boat, by and large, in an area that I'd like to spend more effort on, is interpretation of our park system and bring more school children through the system, because I think that's where our future lies, and I think that's where we need to focus our efforts.

Mr. PALLONE. I appreciate that. I think that, particularly, the stable source of funding is so crucial. I mean, because that's what we face, you know, the, as you say, ups and downs in terms of Federal funding levels in a given year. And I just wish that we could address the problems in the same way.

Mr. SHINN. I think exactly what's going on here today is part of the solution. All of us have been around this business long enough to know what drives the system is the public, and if you—I think we've seen strong indications of the public's concern for environmental quality, and I think by having these kinds of hearings, talking about the nitty-gritty problems of managing a reserve that normally don't come on the public screen.

I think we're getting a better understanding as well put our environmental problems out there. And one thing the GIS system has done for us, we've put out lists of—our known contaminated site list in the State of New Jersey contains some 8,600 sites. For the first time, we've put out a package. The GIS system puts all these sites out there, underground storage tanks, superfund sites, spill fund sites, brownfields, the whole litany of impacted sites. So you can go on a GIS system or call an 800 number and say, "Gee, my home is here. Is there a site around my home, either one that I

have or one that I'm buying," and just find that information out in a snap.

So I think that kind of data and sharing of data is what's going to get all of our problems out to the public and get a better recognition of what we're trying to deal with as governmental officials from a public perspective.

Mr. PALLONE. OK, well, thank you very much.

Thank you, Mr. Chairman.

Mr. SAXTON. OK, Willie and Joan, thank you for bearing with us.

Bob, I don't know whether you have any more time to spend with us. If you do, you're welcome to stay; if you're tight on time——

Mr. SHINN. I'd love to stay, but this schedule that drives me won't let me.

So thank you very much for——

Mr. SAXTON. Thank you for being with us. We've——

Mr. SHINN.—thank you for letting me jump in and do this.

Mr. SAXTON. We've enjoyed your participation and——

Mr. SHINN. OK, but I will leave a couple of experts on the issue if you need any more information.

Mr. SAXTON. Thank you. We appreciate it.

Willie, thank you for bearing with us, and you may proceed.

Mr. DECAMP. Thank you very much.

Mr. SAXTON. This is Willie DeCamp from the Save Barnegat Bay and the Izaak Walton League.

STATEMENT OF WILLIAM DECAMP, JR., PRESIDENT, SAVE BARNEGAT BAY, OCEAN COUNTY IZAAK WALTON LEAGUE

Mr. DECAMP. Which are the same thing. Save Barnegat Bay is the Ocean County Chapter of the Izaak Walton League of America, and I thank you very much for inviting me to testify. Congressman Saxton and Congressman Pallone, hello.

Mr. PALLONE. Good to see you.

Mr. DECAMP. You've both been long-time vigorous supporters of the Forsythe Refuge, and of one of the main projects of Save Barnegat Bay, which has been to expand the Forsythe Refuge, and it's great to be here and participate with your continuing support.

Save Barnegat—if I may, I have submitted my written testimony, and I would just like to summarize it verbally.

Mr. SAXTON. Please.

Mr. DECAMP. Save Barnegat Bay is a not-for-profit organization, and we're dedicated to land conservation in the Barnegat Bay Watershed as well as promoting water quality, two interrelated concepts, and we have worked hard to support the Forsythe Refuge and to promote acquisition in Barnegat Bay.

One of the important things, I think, that the refuge does, is it passes along natural habitat and all of our—the nature values that we want to pass along to posterity in a more reliable form, I think, than the other vehicle, which is land use regulation, can do.

One of the concerns I have as I back off and look overall at the big picture is that land use regulation gets whittled away. The distinguished individual just speaking might not agree with that or might feel a little bit differently than I, but, you know, I see developments get approved that I thought when a wetlands law passed or when Cafer II passed were not going to be approved. And if this

goes on over the course of decades, then I begin to see that land acquisition from willing sellers really is the most reliable method of guaranteeing to future generations that the habitat will be conserved.

Joan and I, I guess, offer the local perspective. We're not trying to advance our, you know, parochial interests, but we, perhaps we can supply examples of local instances of the problems in regard to management and maintenance of the Forsythe Refuge or of the national system.

One of the concerns that I have, as I tried to prepare for this hearing, is that I think that staffing is a big problem, and that may not be the focus of this hearing. You're looking at physical improvements and buildings and what not, which are—definitely need remedial work and continued support. But a lot of the problems, I think, that the managers have, and maybe they're just being good sports and not saying it, is that they are just plain understaffed.

The—you take the Forsythe and the Cape May refuges, as one refuge, they stretch from Cape May all the way up to northern Ocean County to Brick Township, and they have something like a dozen employees or somewhere in that area. And they have only one person to police the refuge, and I don't know that they have a biologist on hand at the moment.

Mr. SAXTON. They're getting one.

Mr. DECAMP. They're getting one.

Mr. SAXTON. Yes.

Mr. DECAMP. Good. So just—my plea would be, through any mechanism possible, to see that the refuge gets properly staffed, gets more staffed, and I would concur that maintenance is a problem also. You see it in little ways, like as the refuge expands gates. We need gates to keep dumpers out; hopefully gates that people could walk around, but just there are many trails in the upland areas which do need to be conserved. And trails themselves, at Reedy Creek, a trail is appropriate and needed, and so, too, at Barnegat where they're working on one, but this takes staff and money. And kiosks and observation areas are also needed.

In the area of partnerships, just to take one area, you really see the impact of funding, I think, because partnerships do work, and they just have a way of creating momentum, but you get to the point where the Fish and Wildlife Service can't bring as much to the table as they should be able to, to make partnerships viable. Eventually you just reach the point where they're overstretched. If you have volunteers, like I think they want to use Americor volunteers, they need oversight. If we have a trash cleanup at Reedy Creek or if ALO has a trash cleanup on Bonnet Island, someone's got to show up from the Fish and Wildlife Service.

So just to make the whole thing work, even when you have partnerships, you don't want to fall below a certain threshold, or it just doesn't work well.

In terms of public involvement, the Fish and Wildlife Service has been increasingly open, and they held, I think they call them scoping meetings in many townships around Cape May and Ocean County, also, to take public suggestions and to involve the public. But you need to be careful there, too, because if people come to a public hearing, and they raise some legitimate problem, and, you

know, it's a good one, and then the Fish and Wildlife people are sort of stuck in the position, "Well, we can't put a trail there, because we don't have the staff, or we can't do this or that." Then it can promote public cynicism.

And I—the point that I'll just conclude with is to really echo your view, Congressman Saxton, that you expressed and that Congressman Pallone, I know you agree also, that public support is very important for the wildlife refuge and—because that's the neighbor. And in order to have public support you can't just have sort of an iron curtain around the refuge, and I know we're moving—we never had that, but we're moving even farther away from that, and I believe that what is really needed is sort of a flexible boundary to the refuge. That's the expression that I use, where there are some places where you can just go and take a walk, and it doesn't even need to be an educational trail. Not every trail needs to be educational. Some places there are educational trails; other places you can fish, you can hunt, and in other places, because they're endangered species or maybe there's a habitat that could be damaged by trampling, like beachhead or something, that you just—people have to stay out because it's appropriate, either seasonally or all the time to not be there.

But it is so very important to allow people to be on the refuge, to see the refuge, so they can be reminded of the many things that it's doing for them.

And I would—in summary, my views are a little more extensive in writing, and I thank you.

[The prepared statement of Mr. deCamp may be found at end of hearing.]

Mr. SAXTON. Thank you very much. I appreciate your both bringing your perspectives to this.

On the subject of staffing, I know that you both agree on this subject. I know Joan agrees, because she's been involved with ALO in carrying out work which, perhaps, could be done by, if there were sufficient personnel at Forsythe to do the work and, Willie, I know that you agree with it, because you just said so, and I know that some of the staff at Forsythe who are here today agree, because some of them work 18 or 20 hours a day in the daytime managing the refuge, and at nighttime policing, and they don't have to do that. They do it because they're good people, and they do it because of their commitment, particularly in terms of the glass eel problem that we talked about with Commissioner Shinn, most recently, in going out—in the middle of the night in—at high tide, I guess, or whenever it is that glass eels are vulnerable, and trying to do what they can to enforce the law on the refuge.

So people are stretched a long way to try to accomplish what needs to be done at the Forsythe. We have authorized, incidentally, 34 positions for Forsythe, which are less than, I guess, a third are currently filled. We do hope that we will get an additional biologist, as I indicated to you during your testimony, Willie, and I hope that we also get two additional staffers next year. It looks like we may.

So staffing is certainly a problem, and Frank and I have recognized this, as well.

Now, let me ask you—let me ask you both to respond to this question, because it is central to carrying out the public part of the

program where we try to get as much public support for the program as we can.

The Fish and Wildlife Service is preparing a comprehensive management plan for Forsythe. And you both mentioned, I believe, that there are opportunities for input. Are your groups participating in this effort and what additional habitat protection and visitor access projects do your groups intend to propose and support for the new management plan?

Ms. KOONS. Well, ALO's interest, primarily, is Bonnet Island, because we do a great deal of school education, and we do a lot of eco tours. Primarily we're a barrier island group, but that causeway destination is just such a vital part of this, and we would really love to have a very unspoiled nature trail with a very simple platform.

I guess, the greatest thing we would ask for would maybe be at least one good quality binocular system that you could look over and see the developed lands on both sides of that causeway and just leave it as natural as possible, so you can experience the two worlds, the world that you're standing in, the natural world, and then looking over to see the developed areas that many of us live in.

And I really, the times that I have been in there since I testified last, one day I was there with a school, and there were 11 blue herons. I have never seen 11 blue herons on one spot, and they were sitting right around the salt marsh area near the new pond. And it was—you didn't have to say another word to the whole 60 children, nothing. Nothing else was necessary.

So that is what we would like to see in that particular area. We cannot also say enough about the staff, the Forsythe Refuge. The people are wonderful to work with, and our group would like to continue and go into the future as a vital part of this partnership.

Mr. SAXTON. Thank you. Willie?

Mr. DECAMP. I'd like to echo what Joan said about the staff of the refuge being great and friendly and hard-working under difficult circumstances. I've been doing outreach for the management plan of the refuge. We've been participating, and in a way we're not really asking for very much, and in a way we are.

The—what we want to see, and I think what's happening, is public—the ability of people to take walks on the refuge, to hunt, to fish where appropriate. Walking trails are important. I think that when people have traditionally walked, you know, taken a walk in the woods in their neighborhood, and then suddenly it becomes part of the refuge, and if it's an area where you don't have critical habitat, it's a—maybe a buffer area, appropriate buffer area, then just the ability to have the refuge boundary be permeable there, have someone take a walk there, really makes a difference. It can make the difference between the neighborhood really liking having the refuge as a part of their neighborhood, or the people feeling testy.

So that is something to be desired, and it interrelates with staff and with maintenance, because the Fish and Wildlife management, obviously, doesn't want the sense that the refuge is just running out of control. They want to be able to keep some kind of reason-

able oversight. But I don't think it's that big a deal if a few people bring trash in, if more people than that are bringing trash out.

You know, you have to sort of look at your garbage budget, if you will. And so, there are a lot of places where I think that you want the refuge to be pretty sort of open. Maybe not with a marked trail, but marked trails are good, too, and we favor observation decks. And the work on the impoundment is necessary. We also think in the area of that western impoundment is—are places where there could be trails, if funds were available. And you know, one thing we are definitely not trying to do is to turn the refuge concept into a park concept. We appreciate that the resource is the important thing, and that you have to say no in substantial areas to public involvement, but you don't have to say no everywhere.

Mr. SAXTON. Thank you.

Mr. Pallone, do you have questions at this time?

Mr. PALLONE. I just wanted to ask—well, first, let me commend the two of you, again. I worked with Willie for a long time when I represented the area where Reedy Creek is, and he was so much involved in organizing to add it to the refuge, and I want to say to Joan, I think I've met you at the office there in Beach Haven on occasion.

Ms. KOONS. Even bought a shirt.

Mr. PALLONE. Exactly, with my kids coming to story time. So I know how much all of you are involved.

My only question is, and it may be not possible, because of the nature of the organizations, but in terms of this partnership, you basically adopted the Forsythe Refuge in various ways. But in terms of actually enforcing, and making sure people don't go and dump garbage, the trails are maintained. Is it a regular program that you maintain? I mean, do you have people that just volunteer on a regular basis to work with the—with the Wildlife Service, or is it being involved like having a beach cleanup or a cleanup once in awhile?

In other words, do you already actually do enforcement or cleanup in a systematized way with them, pursuant to a schedule? Is that something that's possible?

Mr. DECAMP. Well, you know, I don't want to sort of pretend to be, you know, more involved than I am, and our group has more supporters farther north on the bay. So up at Reedy Creek we've done more. And that's, you know, how it tends to work. Wherever most of your supporters are, that's sort of the neighborhood concept.

Mr. PALLONE. Right. Right.

Mr. DECAMP. We have cleanups once or twice a year.

Mr. PALLONE. Right.

Mr. DECAMP. And we get people together, and what I can say mainly is we're bringing it out faster than it's coming in.

Mr. PALLONE. But what I'm saying, Willie, is if there were more people working, let's say as Congressman Saxton said, that the staff was significantly increased. Would it be possible to systematize the volunteer organizations with them, you know, in terms of cleanup or enforcement, or we're just talking about once a year or twice a year or something like that?

Mr. DECAMP. It's possible to systematize to a degree. I mean, you can't squeeze too hard——

Mr. PALLONE. Right.

Mr. DECAMP. [continuing]—any volunteer format. But one of the things that'll happen is just people in the neighborhood who care about the area will ring me or will ring Allison Banks or whomever. So it works that way, just with people driving by and seeing something.

Ms. KOONS. People tell you, when people are out there walking dogs, they tell you when somebody was selling balloons that—which was a double header for my group at the gate one time, and yes, I think the public will adopt it the same as we have. And I don't think that that would be an impossibility in the future. It's having the access to get in there without coming out with hundreds of ticks on you each time that's so vital.

And I don't want to take your time, but one thing I haven't heard discussed at all today, and it's certainly a concern to our group, and that's the liability problem, that in the future, if there was more partnering, where does the liability start and stop? At this point, I understand when we take educational access, then we take on the liability. And if you're going to have open house to the public, I think that's something that should be very carefully examined.

Mr. PALLONE. OK, well, thanks a lot. I appreciate it.

Mr. SAXTON. Thank you. I have no other questions. I just have one observation, and that relates to, you were just discussing the volunteer effort that would be possible.

I would just say that volunteers are wonderful, and when I was down at the refuge last Monday, the thought occurred to me that I could put a little blurb, and I know Frank could, too, in his newsletter, you know, "Sign up to volunteer at the --" however, volunteers have to be managed. And they have to be able to, you know, know what to do and when to do it and where to show up and where not to walk and all these kinds of things, and so I don't know whether it's possible or not, but maybe we can leverage a lot more labor out of the next one or two full-time employees, in terms of some kind of volunteer management.

I don't know whether that makes sense or not, but it's something that you and I, Frank, can discuss with Steve and Tracy at some point in the future.

Thank you very much, both of you, for being with us this morning and for your forbearance for Commissioner Shinn.

I would like to ask unanimous consent at this point that the statement of Frank Bittner, the President of the New Jersey Federation Sportsmen's Clubs, be included in the record.

[The prepared statement of Mr. Bittner may be found at end of hearing.]

Mr. SAXTON. And at this point we will close this part of the hearing and move on to our next panel of witnesses to further discuss the bluefish, striped bass, forage fish issue.

With us for this panel are Mr. Jack Dunnigan, who is the Director of the Atlantic States Marine Fisheries Commission; Dr. Ken Able, Director of the Rutgers University Marine Field Station; Mr. Charles Bergmann of Lund's Fishery, Inc. of Cape May; Mr. Tom Fote, Legislative Chairman of the New Jersey Coast Anglers Asso-

ciation; and Mr. Jim Donofrio, Executive Director of the Recreational Fishing Alliance.

As you're all taking your seats, I'd like to welcome you here. Obviously, we all have a great deal in common in wanting to have adequate, healthy fisheries, and so our intent is to try to move toward that goal.

Let me just open this panel by saying this. As Chairman of the Subcommittee in the 104th Congress, which was two years ago, our committee was known as the Fisheries, Wildlife, and Ocean Subcommittee. This year we added a word to the title. It is now called the Fisheries Conservation, Wildlife and Ocean Subcommittee, and we did that because we want to have an opportunity for fish to be plentiful, for commercial fishermen to have access to them, and for recreational fishermen to have access to them. And to the extent that people like Ken Able can help us understand the science behind it, and the rest of you can help us understand the desires and helpfulness of the user groups, we will be able to move in that direction.

So let me ask Jack Dunnigan if he will begin. Jack is with the Atlantic States Marine Fisheries Commission. Jack, the floor is yours.

STATEMENT OF JOHN H. DUNNIGAN, DIRECTOR, ATLANTIC STATES MARINE FISHERIES COMMISSION

Mr. DUNNIGAN. Thank you very much, Mr. Chairman. It is a pleasure to be able to be here today, and once again, let me thank the committee for the opportunity to spend a day outside of Washington, D.C. and near the coast of one of the finest coasts that we have along the Atlantic Ocean in New Jersey.

And at this time I think I would ask that my formal testimony be included for the record, and I'll just make a few comments that I think are pertinent.

Mr. SAXTON. It will be, without objection.

Mr. DUNNIGAN. Thank you, Mr. Chairman.

I recognize that this is the panel on forage fish, but I can't let the moment escape without saying something about the earlier discussion about refuges, because in reality these issues really are related to each other.

The United States Fish and Wildlife Service provides important support to the Atlantic Coastal States as they go through their business of conserving and managing Atlantic coastal fisheries. And a lot of the discussion so far this morning has been about partnerships. And the service is a terrific partner working with the States. It's often a controversial agency, but frankly, the commission believes that it's a great agency, and it's one that's worthy of support.

And it's also very important to note, and I've talked to Director Rogers about this, about the—not just the support they give us in our management planning, working on committees and providing scientific advice, but also the fact that they have these refuges, these are a tremendous part of the coastal habitat all along the Atlantic coast that supports fisheries.

And the proper support and management of this habitat is critical to the long-term productivity of all of these resources. So what-

ever you folks can do to help support their programs is going to be beneficial, not just for all of the wonderful things that have been talked about by the earlier panels, but also in helping to support the productivity and the conservation and management of our valuable Atlantic coastal fisheries.

Mr. Chairman, the hearing this morning on the interrelationship of striped bass and bluefish and lots of other species along the Atlantic coast follows up on a hearing that you held in Toms River last year. And so, I'd like to begin by highlighting a couple of things that have happened in the period since then.

Mr. SAXTON. That hearing, for the record, was based essentially on bluefish, where they are habitating today, why they're not as plentiful in shore areas.

Mr. DUNNIGAN. Right.

Mr. SAXTON. Proceed.

Mr. DUNNIGAN. Thank you.

The striped bass population along the Atlantic coast, Mr. Chairman, continues to grow, continues to show all of the signs that we've been watching for the last couple of years of a recovered species and continuing to grow and growing well into the future. We're now in a position of having extremely strong year classes in many years out of the last six, and as a result, we can look forward to having productive and viable striped bass fisheries well into the future, so long as we maintain a cautious and prudent management program. And the States that work through the Atlantic States Marine Fisheries Commission are convinced that that's what they have underway.

Bluefish continue to appear to be in trouble. There was a new stock assessment that's been done since last year. It generally tends to reaffirm all of the findings that we had had before, that the resource continues to suffer from a lack of availability, probably due, mainly, to a failure of recruitment on an ongoing basis over a number of years, and that we need to—the fishery is overfished. In a legal sense it's overfished, because the fishing mortality rate is higher than the rate contained in the Cooperative Fishery Management Plan that the commission and the Mid-Atlantic Fishery Management Council have. And so this is a species that we need to continue to be concerned about and to devote attention to.

On the question of interactions among species, what we have had since last year, really, is the beginnings of some good work that needs to be done to look into this issue, and I think that it's a direct result of the inquiries that the committee made last year.

Some funding was provided in the fiscal 1997 budget, as Mr. Schaefer testified earlier. That funding is making its way through the system and getting out to people like Ken Able and others, so that the important work can be done to continue to follow up on the concerns that you have, and, frankly, they're concerns that are reflected by all of the managers of these fisheries along the Atlantic coast.

Mr. Chairman, I guess part of the sad news is that the administration's proposed budget for fiscal 1998 didn't pick up on the leadership that Congress exerted last year in putting this funding into the budget for the National Marine Fishery Service, that $785,000 is not included in the President's request.

And we think that that's very important funding. The Atlantic States Marine Fisheries Commission supports that work, believes that it needs to be continued if we're going to ever get to the bottom of some of these very difficult and controversial issues about the interrelationship of species, and we would strongly encourage the Congress to continue its leadership in this regard and do what you can to try to get that funding back into the budget for fiscal 1998.

Mr. Chairman, with that, I think I'll let the time go to the other members of the panel. Again, it's a pleasure to be here, and thank you very much for inviting me.

[The prepared statement of Mr. Dunnigan may be found at end of hearing.]

Mr. SAXTON. Thank you very much, Jack. Our next witness, Dr. Ken Able, is the Director of Rutgers University Marine Field Station, and at the current time is using some of those Federal moneys that Jack Dunnigan just talked about. We got the $785,000, I believe, is the correct number this year, and Jack is concerned about continuing that program next year, and Ken Able is the guy who is carrying out that program. So Ken, we are anxious to hear from you.

STATEMENT OF KENNETH ABLE, DIRECTOR, RUTGERS UNIVERSITY MARINE FIELD STATION

Mr. ABLE. Thank you very much for inviting me to this session this morning.

I'll make my comments very brief. Many more details are provided on the written testimony.

One of the reasons we're here today is that fish life histories are very complex. They go through many more stages than mammals and birds and that kind of thing, and so they're very difficult to—very difficult to understand. Larvae act differently than the juveniles. The juveniles act differently than the adults. And so understanding their life history is of paramount importance, because they often act as different species.

Thus, understanding interactions have to cover all these life history stages. And that's why I've provided some information on the first year in the life of these two species in my written testimony.

I focused on the first year for this testimony, because, and I think most fisheries, biologists around the world, would probably agree that 99.99 percent of the mortality that occurs in the life of a fish, or in the population of a fish, occurs during that first year.

And that's probably a worldwide consensus on that kind of issue. And so, much of the emphasis should be placed on that first year. Unfortunately, we don't know much about that for many species, even those of economic importance, and that includes striped bass and bluefish, for example.

In addition, we have to realize that many of our populations in the mid-Atlantic, by including these two species, are highly migratory. So they're crossing State and Federal boundaries all the time, and that makes management a lot more of an issue.

But again, they have complex life histories. And that simply is the reason why we don't understand everything that should be going on today. If it were simple, we'd have all the answers. We

clearly do not. And the only way to arrive at those answers is much more attention.

As an example, bluefish spawn in—south of Cape Hatteras during the spring, and many of those larvae move up into estuaries like Barnegat Bay into the spring. They find their way up there through regular patterns, being carried up by the Gulf Stream and so on. The adults also move up and spawn off the Jersey coast, and those individuals come in. So we have two groups of bluefish, young bluefish, coming in every year, in the spring and the fall.

Some originate south of Hatteras off North Carolina, South Carolina; some originate off New Jersey. Again, which of those groups contributes most to recruitment? It varies from year to year. But again, an example of a level of complexity that we don't quite understand.

Striped bass migrate long distances to go up into freshwaters to spawn. What controls their movements, the migration of the adults and how those young survive is unknown. It is not easy to say what these answers are. And then if you talk about interactions between these two, it's very difficult.

If you talk about interactions between these two and their prey species, the question becomes even more difficult.

Is it impossible to arrive at some answers? Probably not, but it's going to require much more attention than we've given them in the past.

As an example, if you just look at the life histories of the two species, as I provided in the written testimony, they seem to overlap, primarily in estuaries, during their first year and primarily in large estuaries. So that maybe if we are intent on looking at interactions, that's where the effort should focus, in the Hudson River, in Delaware Bay, in Chesapeake Bay.

Unfortunately, Chesapeake Bay, where we know most about many species, is not represented at Barnegat Bay. They're very different in their morphology, in the number of people that live around them and the pollutant levels and so on. So studying Chesapeake Bay intensively does not allow us to simply extrapolate to other systems, such as Barnegat Bay.

So there's a spacial component as well. We need to study many of these different estuaries. It's a daunting problem.

I think we could make some progress. There has been significant progress, such that now we know something about what controls striped bass survival, and we're doing a much better job, and therefore, there are more striped bass around. It would be nice if we could say we could do the same thing for bluefish.

I'll simply end my comments by saying there are complex life histories, there's much to be learned, we think we can make significant end roads, and we're willing to do anything we can to help in this goal.

Thank you.

[The prepared statement of Mr. Able may be found at end of hearing.]

Mr. SAXTON. Ken, thank you very much. I look forward to the question period.

I'd like to, at this time, introduce Charles Bergmann, with the Lund's Fisheries in Cape May. Obviously, a very important aspect

of New Jersey life is the commercial fishery, and we welcome you here this morning, Mr. Bergmann.

STATEMENT OF CHARLES BERGMANN, LUND'S FISHERY, INC., CAPE MAY, NEW JERSEY

Mr. BERGMANN. Thank you, Mr. Chairman and Congressman Pallone.

Thank you for giving me the opportunity to testify before you today. First of all, I need to make a disclaimer. I'm a member of the New Jersey Marine Fishery Council and, as you note on the card here, the Mid Atlantic Fishery Management Council.

My testimony today may or may not be indicative of their feelings, but it's my own testimony and not theirs.

Striped bass spawn in the estuary systems along the Atlantic coast. As noted in the studies in the Chesapeake Bay, Delaware Bay, Little Egg Harbor, and the Hudson River estuaries, the diets vary within these systems but hold to the same pattern.

The very young bass primarily feed on invertebrates, worms, shrimp, small fish, at age one. Striped bass feed on invertebrates during the first—first of the year and then gradually switch to invertebrates in the latter part of year one. The diet at this time varies according to which estuary is studied. The most common sources of forage include bay anchovies, Atlantic menhaden, weak fish, spot, herring, summer flounder, naked goby and bluefish.

After year two, their diets consist almost entirely of fin fish and sand eels.

Bluefish, on the other hand, spawn offshore, depend entirely on winds and tides to move the larvae into the estuaries. During this process the bluefish larvae must pass through large schools of Atlantic mackerel which are hungry predators of the young bluefish.

After surviving the feeding frenzy of the Atlantic mackerel, they must now avoid the increasing presence of age two striped bass. Like the striped bass, the bluefish diet consists primarily of bay anchovies, Atlantic silversides to year one. From year one through year two, the diet is mostly Atlantic menhaden. Years two and older bluefish prey upon spots, croakers and weak fish.

In a study done by the New Jersey Department of Environmental Protection, Division of Fish, Game and Shellfishes, it was pointed out since two-thirds of the recreationally and commercially important fish species along the Atlantic coast are estuary-dependent at some life stage, the study of estuarine food webs has a number of management implications.

Fluctuations in the abundance of estuarine forage organisms may have profound effects on the year to year abundance of harvestable fish. In spite of this, management and environmental protection actions have generally been geared to tolerance levels exhibited by target fish species, ignoring the possibility of higher sensitivity to forage fish to pollution and habitat loss.

This study was done in 1979, and with Mr. Saxton's clean water bills and the new requirements of the Essential Fish Habitat of the Magnuson-Stevens Act, this will surely help to answer some of these concerns.

Many have taken a position that the harvest of menhaden has increased to a point that there is not enough to hold striped bass and bluefish for recreational anglers.

One could answer this with facts. The harvest of menhaden in the Chesapeake Bay comprise 40 percent of the total coast harvest. And the harvest of striped bass by anglers in the same bay has risen from approximately 130,000 fish in 1990 to over 600,000 fish in 1996.

All this was done with 40 percent of the coastwide production of menhaden. Earlier this year, one group used the forage issues to stop an IWP in New Jersey. This group stated a concern that Atlantic mackerel is a forage for bluefish, but what has been pointed out, the reverse is true. Atlantic mackerel prey upon bluefish.

There have been numerous papers done on the feeding habits of both species, but little on what effect, if any, the predator/prey relationship has on the recruitment of each species.

One study has been approved, but as yet, funding has not been appropriated. This research, as well as other projects related to water quality, need to be done.

Mr. Chairman, I wish to thank you for your recent meeting with Mr. Schmitten regarding the joint management of squids, another very important forage fish. And another important forage fish that needs to be addressed is the Atlantic herring. I would invite you, Mr. Chairman, and Congressman Pallone, to join Frank LoBiando in introducing or co-sponsoring a bill to protect these species.

Mr. Chairman, I again wish to thank you and assure you the Cape May Seafood Association is prepared to work with you and your staff on the predatory/prey issues in the future, as well as to participate in any discussion with other subjects of the commercial and recreational fishing industries.

I'd be pleased to try to answer questions at this time.

[The prepared statement of Mr. Bergmann may be found at end of hearing.]

Mr. SAXTON. Thank you very much, Mr. Bergmann.

Mr. Tom Fote of the Jersey Coast Anglers Association.

STATEMENT OF THOMAS P. FOTE, LEGISLATIVE CHAIRMAN, NEW JERSEY COAST ANGLERS' ASSOCIATION

Mr. FOTE. The Jersey Coast Anglers Association would like to thank Congressman James Saxton for holding this field hearing on this important subject in New Jersey and Congressman Frank Pallone for attending the hearing.

JCAA is aware that both congressmen understand the importance of ecosystem management to the citizens of New Jersey.

This is a subject near and dear to my heart. The more I learn about fisheries management, the more I realize that we cannot manage interrelated species one at a time. Ecosystem management is looking at the interrelationships of species and managing these species by their interdependency on each other and other environmental factors.

To me, this means that every time we take an action that impacts one species, we need to consider the effect on all the species. In the marine environment, every species is a support for the entire ecosystem. We might be able to overfish one species without

causing a dramatic change in others; however, once we begin to decimate the food stocks for the species, like striped bass or bluefish, we cannot help having a serious negative effect on the species' total population.

Some species are more adaptable and can find alternative forage sources to augment their diet. Striped bass and bluefish, as juveniles, feed on similar prey. Striped bass, however, are opportunistic feeders. As adult they feed by sight, sound, and smell. They will eat almost anything that swims in the bays, oceans, and rivers.

When we impact their basic diet, we may not see a dramatic decrease in striped bass population, because they adapt by eating something else and have a more varied diet to choose from.

Bluefish, however, have very different feeding habits as adult fish. They are primarily sight feeders. They have—we have seen a faster change in the bluefish population than with striped bass due to the decline of menhaden, squid, sand eels, herring and butterfish.

When forage species were particularly prevalent in the 1970's, both predator species were eating the same abundant forage species, and both predator stocks were in abundance.

Even though striped bass appear more adaptable and able to maintain their numbers over a short haul, if we continue to destroy the forage base, we will eventually see the same result as we've seen with bluefish. The striped bass, because of their ability to adapt to a wider range of forage species, have a broader support system. Still, we can only remove so many of their supports before the fishery collapse.

The problem will not just be at the last action we take, but all the actions we have taken, cumulative over the years.

The species that play important roles in the historical diets of both striped bass and bluefish are menhaden, sand eels, squid, mackerel, shad and river herring. My written testimony contains the relevant statistical data.

The point is that a historical staple dietary sources of striped bass and bluefish are under attack and will surely damage those and other key species' viability.

In the ocean, the study of ecosystem management is complex. When we overharvest menhaden, other species like squid, sand eels, mackerel, which have historically made up the difference in the diets of striped bass and bluefish, the stocks of these species have now declined and have left few alternatives to supplement the diet of striped bass and bluefish.

For the last 30 years NMFS has continued to declare some species, especially forage fish, as underutilized. With the collapse of historical fisheries, many commercial fishermen have begun to harvest these underutilized species. There has been a dramatic increase in the harvest of bunker, herring, squid, ling and whiting.

NMFS is not the only fisheries management regime at fault. For example, the menhaden board at the Atlantic States Marine Fisheries Commission consists of five States with the greatest vested interest in the commercial harvest and five members of the commercial harvest industry.

Can I expect them to practice ecosystem management? All boards need to include a balance of all user groups and members who are primarily interested in ecosystem management.

We are totally destroying the delicate ecological balance of nature by our unchecked overfishing, and this will result in a dramatic shift in all predator/prey relationships in our ocean.

In looking at the available data and the natural history of bluefish and striped bass, clearly, there's a scarcity of data after 1980. Since the 1980's, we have spent and continue to spend millions of dollars on monitoring and modeling of striped bass. In comparison, only a small percentage of the money has been spent on collection of biological information.

After 1980, fisheries managements placed the emphasis on population analysis, a simple form of bean counting. Now with the reduction of available funds, scientists are directed toward using statistical modeling procedures as a cost saving method. They spend most of their time developing and maintaining these unproven population estimating techniques.

Fisheries biologists today receive more training in statistics than in biology. A growing number of economists, statisticians, and specialists in population dynamics are sitting on, technical, a committee. Frequently, the goal appears to be the development of statistics that look good on paper rather than reflecting what is occurring in the ecosystem.

This hearing emphasizes forage species and their interrelationships. However, when we look at ecosystem management we must consider many areas. We must consider habitat loss, chemical contamination, physical change, and water quality. Without all the pieces to the puzzle we cannot understand the problem and thus never solve the problem.

And when I'm looking at Barnegat Bay, and I sit on the policy committee of the Barnegat Bay Estuarine Program, which Congressman Saxton and Congressman Pallone helped get some funds for and get us going, we're looking at those ecosystem problems. We're looking at what's trying to happen there.

I was listening to Ken Able's discussion, and basically looking at the young. We also need to look at the adults. In my written testimony I compare them to the lemmings. When they find their available food source is gone, they commit suicide, they basically march into the ocean.

Well, when they do that, then the adults stop producing. They stop producing young. They either abort their young, or they, basically, just don't have any. And they die off. So it also, when we impact the food source of the adult, we're going to have impact on the other future generations, because, basically, they'll cut back. They just won't reproduce.

And I see the red light is lit, so I'll—one parting comment. If you want to learn more about the Barnegat Bay Estuarine program, as Congressman Saxton knows and Congressman Pallone, we're going to put on the Barnegat Bay Festival May 17th, and we've got like 24 different stations throughout the whole estuarine program to cover all those points, to show you what's going on.

And there's a lot of different things. You want to learn how to fly fish or just want to learn the vegetation in the pine barrens. So take a look at the list that's out there.

[The prepared statement of Mr. Fote may be found at end of hearing.]

Mr. SAXTON. Thank you very much. Thank you, Tom, for your testimony, also.

Mr. Jim Donofrio is the executive director of the Recreational Fishing Alliance.

STATEMENT OF JAMES A. DONOFRIO, EXECUTIVE DIRECTOR, RECREATIONAL FISHING ALLIANCE

Mr. DONOFRIO. Good morning, Congressman Saxton, Congressman Pallone.

I want to thank you for your leadership in renaming the Subcommittee to conservation. Putting that word in there was—it just shows that the tone that you're setting, which needs to be set—the reason why I say that, because NMFS was once called the Office of Conservation and Management, and I don't think—we saw very little of either of those over the years, and now we have the Office of Sustainable Fisheries. And as we all know, anyone who's ever fished or any scientist will tell you, in order to have sustainable fisheries, we need to have sustainable forage.

So I want to thank you for holding these forage fish hearings. I think this is a step in the right direction of having sustainable fisheries and living up to the name on the Magnuson-Stevens Act.

It is the opinion of the RFA and our membership, at our board meeting we had in Miami, that there is a looming forage fish crisis across the country. Right now, the east coast, we have problems and also on the west coast with a huge squid fishery that has developed inside of State waters in California, a little bit outside. So it's a touchy problem with no management. But we see this as a national problem, and I think the 105th Congress can address this, and I believe with your leadership and Mr. Pallone working in this spirit of bipartisanship, we will achieve that.

Recreational fishermen and commercial fishermen all agree that forage fish management is prerequisite for sustainable fisheries. Big fish eat little fish. And NMFS has never managed the fisheries of this nation with that consideration. It has been single species management, and, with that, we can never truly have sustainable fishery stocks.

The designation "underutilized" amounts to no more than a death sentence for species. With that type of one-dimensional thinking, as witnessed in the decline with the shark fishing. The finning operations for a foreign market, these fish were deemed underutilized, and now we have a stock decline that might take over 30 years or longer for a recovery. And that situation is not acceptable anymore.

The other comment I want to make here, and I'm just doing an overview, Mr. Chairman, if you don't mind. Fish are not manufactured goods, and they can't be viewed in the same marketing perspective as manufactured trade. And I hear commercial fishermen say to me, "Well, Jim, you know, we trade Toyotas, we do this back and forth."

We can't do that. This perspective needs to be stopped, and, in fact, if you wouldn't mind, I'd like to refer to a document here, which actually talks about that. It's a study, and it's done by the Institute for Environmental Negotiation at the University of Virginia, Richard Collins.

And I'd be glad to bring a copy to Sharon and send it down to her when I'm down there tomorrow.

Mr. SAXTON. Please do.

Mr. DONOFRIO. Yeah. Let me just read to you here about the market in here.

It says fishery issues present a classic case of market failure. As explained by resource economists and environmental theorists, a market failure exists when the conditions necessary for a free market to work effectively are absent. The fishermen's problem is a significant example of market failure toward commons problems. And we believe this is a tragedy of the commons. It's not so much the fishery you're talking about, it's the balance in the ecosystem. It's the balance that is the tragedy of the commons, and this is what we have here when we're addressing forage fish.

It also notes in here that fishing under this, what happens is that in this type of a market you fish beyond maximum sustainable yield.

Because these are not manufactured goods, they're not planted, these are wild fish stocks. So this perspective has to be changed, and I implore upon this Congress to do that.

Also, as far as NMFS goes, the United States National Research Council has made this observation. Fishery scientists and managers have given virtually no consideration to consequences of removing target species on the structure, dynamics, and productivity of the ecosystem, of which the target species are a component.

Another fishery scientist observes that part of the problem with fisheries management is the tendency to manage one species at a time. Marine communities are diverse, and their food chains are complex. In many instances, one fishery is targeted a predator, while another is targeted prey. Yet there is no management coordination between the two, and that backs up my statement in my original testimony there.

On the same note it's been observed that sustainable fish populations depend on biological integrity of the marine ecosystem, which is undermined by overfishing.

Coordinated multi-species management based on recognition of the interaction amongst fishers, sea birds, mammals, and their habitats should be developed and implemented.

I'd like to ask the Congress, and with your leadership, Mr. Saxton, to seek out the appropriations to fund the universities, the scientists that would do the multi-species management. I know it's a very expensive deal, it's very complex, but we have to look at our fisheries more seriously, and I don't think the Department of Commerce has done that. I don't think they recognize the value, the true value of our commercial and recreational fisheries sustainable for the long time.

And let me tell you the feeling I get from addressing clubs all over the country. I just got back from a trip in Florida. Mike Donovan, our development director, got back from a trip in Massachu-

setts, and the people on the street feel that the intent of the Magnuson has never been lived up to. And this is that tragedy of the commons. We felt that we got the foreigners out of here, but NMFS has encouraged foreign markets, so what have we accomplished?

And I think what we need to do is address this multi-species management system, put America first, and if there are extras, truly extras, in the ecosystem then fine, develop these markets, but I think the markets were encouraged prior to having any realistic science on these—on this multi-species interaction. And I think that needs to be considered.

I want to thank you for the opportunity to testify today. Thank you, Mr. Pallone.

[The prepared statement of Mr. Donofrio may be found at end of hearing.]

Mr. SAXTON. Thank you very much.

For any of you who are in the audience who think fisheries management is simple or easy or clear-cut, you have just heard testimony from five people who demonstrate that it is not.

Essentially, we're trying to arrive at Jack Dunnigan's point of view as one of the partners in the regulatory process, and Frank and I from being partners in the legislative process that relate to this issue. We try to sort through all this and come up with legislative and regulatory schemes that accomplish everybody's final goal, which is more of all species.

This morning it seems to me that there have been two notions that have been advanced, and I guess I would like to ask some questions about those two notions.

One notion, which was originally introduced here this morning by Ken Able, I think is fascinating. And that is that, perhaps, of all the things that we ought to be looking at, perhaps the most important is the first year of life for, particularly I guess, the Atlantic bluefish species. And perhaps that's something that we don't know a whole lot about.

The other notion also, certainly, has a basis in fact, and that is that big fish have to have little fish to eat or they're not going to do well or they're not going to stick around the parts where the little fish don't live anymore.

So those are the two notions that I think I heard this morning, and I guess the first is, Ken, let me just pose this question to you, and then anybody else can jump in who wants to.

While your contention is, and obviously, we appropriated a significant amount of money for you to advance your notions, because you're the expert, if the notion is that the primary problem or one of the primary problems or a major problem exists with regard to environmental factors that affect the first year of life, then how do you put into perspective the environmental, including the food issue, fish food issue, for that period of life after the first year?

Mr. ABLE. Well, let me preface my comment by saying I feel much more comfortable with my boots on and a net in my hand than a microphone in front of me. So just bear with me a minute.

I clearly believe that there needs to be a focus on the first year in the life of fishes that—in order to understand some of these fishes. That does not mean that adults are not important. Clearly,

they are. If they're not around there's no reproduction, and there will be no little fish.

I think many of the issues of the predator/prey interactions, some of the most important issues might actually be happening during the first year, as well, though.

From some of our studies, it becomes clear that if an animal grows slow during the summer, it may survive, but it'll grow more slowly. When it enters the winter we see increasing evidence of over-winter mortality, and these fish probably become prey or simply die due to cold temperatures during winter migrations, and they disappear. But we have no record of that mortality. But that mortality may have been initiated during the summer when they grew—when they grew at a slower than normal rate.

So that the mortality may have occurred during the winter, but the cause of that mortality was actually slow growth in a given habitat during the summer. So that, again, commenting on the complexity of these interactions, but the likelihood that predator/prey interactions, i.e., big fish eat little fish, that also can happen during the first year, as well.

To pretend that I know specifically how to answer that question, I just won't do that.

Mr. SAXTON. Mr. Fote.

Mr. FOTE. If we look to the environment off of New Jersey in the '80's and the '70's, we saw all kinds of sand eel population. When those bluefish and striped bass migrated down to the south, they would basically stay in this locale the whole month of November and December, just gorging themselves of the sand eels.

When they went down south they were fat fish. They had a lot of body fat, so they were able to endure the harsh winter, and they were able to winter over.

When the sand eel population started down—dying in '89, you look to this huge crash and it started in the bluefish population. If you look at statistics, we went for catches in the early '80's to 175 million pounds, something like that, recreationally, down to about 34, and it's even getting less and less every year. Why?

Maybe, as we look at nature, we know that when an adult is under stress, when it basically cannot store body fat, when it cannot be in a healthy condition, it just does not produce young the following year. I mean, basically it takes over. Well, they—a lot more—a lot smarter about how to develop their environment than we seem to be. When they're under stress they don't reproduce, because they know their young will not survive.

And I think that plays. And Ken's right, if we don't study the ecosystem in the bays, and that's what we're doing in the Barnegat Bay Estuarine program, trying to get that information, we have no idea what the effect of power plants, the suction that's going on, I mean, with Oyster Creek over the years, how it affects the bay anchovies.

Same thing with Salem Nuclear Power Plant. We know we lose thousands—hundreds of millions of bay anchovy every year, like—something like 50 percent of the population. And especially in the larvae stage, 'cause that's when they get sucked in the power plant. So is that affecting the weak fish, it's defeated in that early stage. And that's the whole kind of interrelationship.

It's like a—Congressman Saxton knows I'm familiar with bicycle wheels. You can break one or two spokes and ride on the wheel, but as soon as you break a couple of more, that wheel collapses, and that's what we're doing with the whole system.

Mr. SAXTON. Any others?

All right. Let me turn, at this point, to Mr. Pallone for whatever questions he may have.

Mr. PALLONE. Thank you, Mr. Chairman, and I appreciate all your testimony, but I have to say that, I guess, as Jim was saying earlier, I get, in many ways, more confused listening to the different views than even before you started. Let me just point out why I'm confused, and you tell me if it's because you disagree or it's because I'm just not understanding completely.

I notice that Mr. Dunnigan talked about—when he was talking about interaction between bluefish and striped bass, he said that—he mentioned that, in the testimony, that a large portion of the bluefish diet consists of young striped bass, and that one study suggested that predation by bluefish was the greatest source of mortality for juvenile striped bass. And it is possible that the proportion of striped bass in their diet could increase the striped bass—in abundance increase.

So if I understand that comment it seems to suggest that as the number of young striped bass increased, then the number of bluefish would also, because there'd be more for them to feed on.

But then I'm listening to what Jim Donofrio said, which basically was that both species are feeding on forage fish, and that if the forage fish are overharvested, the bluefish, because they—I mean, the striped bass, because they seem to be more dominant—well, I guess, get more and the bluefish populations could decline, because there's not enough forage fish left for them.

And then I'm listening to Tom, and you seem to think, Tom, that, at least—unless, again, I'm just going by the testimony here, you mention this study by Dr. Lionel Walford at NMFS at Sandy Hook, who said, essentially, that his research didn't find any correlation between the abundance of bluefish and the—of one species and the decline of the other.

I guess, assuming we're talking about striped bass and bluefish, as well as other species. So I'm totally confused, unless—it seems that you all disagree on what's happening.

Mr. FOTE. No, I think we all agree.

Mr. PALLONE. OK, well, then tell me how, because I'm confused.

Mr. FOTE. What we're saying here, that we can't—the studies basically don't show if the stocks of bluefish are up high, will the stocks of striped bass be low? It doesn't show that.

Mr. PALLONE. OK.

Mr. FOTE. OK, so there's no absolute data out there. What we do see is when the stocks of forage fish are up and down, then some species react to that, as far as the drop in forage fish, faster, because they're less adaptable as adults.

If you look at bluefish and striped bass, they both feed similarly when they're small and juveniles. They feed on shrimp, grass shrimp, and everything else. As they get larger, they have a different kind of feeding habits, and one relies more—if you watch bluefish, it relies more on menhaden, mackerel, fish that swim.

If you look at a striped bass, certain times of the year it's eating nothing but crabs, certain times eating nothing but sand fleas, and certain times eating worms. It's more adaptable. So it has a greater food—I mean, a food base, like the panda. If you look at—in the forest, when the bamboo all dies, they all die.

Mr. PALLONE. Right.

Mr. FOTE. And other species will basically survive, because they eat the panda that's dying, because they can mix their diet up, and that's more, I think, what we're——

Mr. PALLONE. Well, Tom, when I was reading through the different testimony, to me, at least, it seemed that what you were quoting made the most sense, in the sense that you were suggesting that both feed on forage fish, and to the extent that those disappear, there's not sufficient supply, you know. It impacts both of them.

But what I still don't understand if there's a direct relationship between the two species, or is it just that, you know, as the forage fish disappear there's not enough for both, and then we don't know who dominates or who ends up surviving?

Mr. FOTE. It's not a simple answer, 'cause as Dr. Able pointed out, striped bass form in bays and estuaries. It's a lot easier to affect the adult population by nets, recreational fishing and everything else. Bluefish run offshore, so they basically are less susceptible to that spawning targeting. So that can also affect as—Able, I think, can talk for himself, but pointed out, it's a whole lot more complex than simple nuts and bolts. I mean, if we, basically, could give you all the answers of what the interrelationship is, I mean, I'd be worth a million dollars instead of what I'm worth.

Mr. PALLONE. Well, I'm not trying to put you on the spot. I mean, I guess my conclusion of all this, and I'd still like to hear from the others, Mr. Chairman, if that's possible, my conclusion is that we clearly need a lot more studies, because different people are coming to different conclusions, some of which may overlap, but clearly, there's a lot more that needs to be done.

Mr. SAXTON. Let's hear from Mr. Bergmann.

Mr. BERGMANN. Congressman Pallone, just for one issue on bluefish, we could stop fishing on bluefish entirely, recreationally and commercially, and just completely stop, and not necessarily have an effect on their abundance in the estuaries.

As has been noted, they spawn offshore, and they rely on the tides winds to bring them in, into the estuaries. If they don't make it into the estuary system, they die. And I think there needs to be more studies done on the effects of water temperature, salinity, and the clean water on these animals.

Mr. SAXTON. Mr. Donofrio.

Mr. DONOFRIO. Thank you, Mr. Chairman.

Mr. Pallone, thank you. I want to answer Congressman Pallone's question regarding my testimony. As you know, I am not a fishery scientist. In my testimony I make note of my many thousands of days on the water. I still have my 100 ton operator's license. And my primary fishery, in my charter boat days, of course, during the summer months, was bluefishing. And then that would interface into striped bass late in the fall. And based on my on-water observations, as I started as a deck hand in the '60's, when we had—

I believe we had a really truly recovered bass fishery, when we didn't have the truncation in the sizes, and we had tremendous bluefish, and especially one of our hot spots was the Shrewsbury rocks and the acid waters.

And there was tremendous amounts of schools of both. But at the time, we didn't have a squid fishery offshore that was developed for foreign markets. We didn't have a huge menhaden business off our coast. The menhaden industry, reduction industry, actually worked south and stayed in their own waters. They didn't have to venture this far.

So we had a lot of bunker, a lot of menhaden, we had sand eels, we had a multiple variety of bait and enormous amounts of them. And bluefish and striped bass are highly competitive; however, striped bass are such hogs that they will compete and push the bluefish out of an area.

And I believe Michael Laptew from Laptew Productions sent the Chairman a video for the committee to look at. These are underwater shots he does with a snorkel as not to spook the bass. It shows striped bass and bluefish feeding, and you can clearly see here how the striped bass are the dominant feeder.

And you know, we knew that for years. You could see it on your recorders and all, but here's documented photos of these fish feeding.

Mr. PALLONE. But the main point, Jim and Tom, that both of you are making, the way I understand it is that it's the fact that a lot of the forage fish have disappeared that creates this competition and ultimately means that one or both stocks decline.

Mr. SAXTON. Let me—Frank, can I break in? Let me just throw a little gas on the fire here.

Jack, I have a series of faxes here which have Atlantic States Marine Fisheries Commission on them, and in this group of papers there's what appears to be information that says that the menhaden population is extremely well off today. This is a chart, which you're familiar with, yes?

Mr. DUNNIGAN. Um-hum.

Mr. SAXTON. OK, this says that the worst time for menhaden looks—appears to have been in 1975, and then the stock recovered, and then they got nearly in trouble again in 1985, and that by 1995 the stock of menhaden is bigger than it has been since anytime since 1965. Is that what this chart shows?

Mr. DUNNIGAN. I don't actually have it in front of me, but I think that that's probably accurate. Certainly, if it reflects through the assessments through last year that would—that would be consistent.

Menhaden are a very short-lived species, very much dependent on recruitment. They're fished as age zeros and age one fish, so you'll see these sort of wilder fluctuations in that kind of a fish than you would in something like striped bass that lives a long time. And you can have more stability because of a larger number of age classes.

Mr. SAXTON. Is there some reason why nearshore fishermen continually come up to me unprompted and say the menhaden are gone?

Mr. DUNNIGAN. Well, I don't know. Your question, I think, to somebody on the earlier panel was, what would you tell a fisherman if that's what they said to you, and what I would tell them, not being a scientist, is that's very interesting. Let's go talk to the scientist and ask him what they're seeing.

The Commission's Atlantic Menhaden Advisory Committee met in Richmond last week, and under the current menhaden management plan, every year we look at six different triggers. And they're either, you know, on or off, like a binary system, and they determined that one of those was met this year, and the fact that that trigger was met, and the one that was met was recruitment to the age zero population. So it appears that there was low recruitment last year in the coastal fishery. I would assume then that the 1996 year class isn't going to be all that strong. So we may see some of this coming down.

The other five triggers were not met, and so the management board now will have to sit down and decide what to do about that.

A similar thing happened a couple of years ago where that one trigger was met, and it was followed the following year by a very high recruitment.

So this is a species where they tend to go up and down, there tends to be local instances of a lack of availability of them, and I think it would just be incumbent on going to look at the data.

Mr. SAXTON. So you're saying that the spike on that chart that I see may just be an aberration of a count at one particular time in the history of the species, and that it may not be——

Mr. DUNNIGAN. That's right, and it may have just been one very strong year class. When you have a population that's made up of only a very few year classes, and in this case we're looking at two or three, you know, one very strong year class will tend to have that kind of an effect, just as one very poor year class will have a very strong effect moving the spawning stock back down.

Mr. SAXTON. OK, so that data may be suspect in terms of the total biomass of——

Mr. DUNNIGAN. And it may not reflect where the resource is today.

Mr. SAXTON. OK. Frank, I'm sorry, I broke in on your——

Mr. PALLONE. No, that's all right.

Mr. FOTE. If you look at the old data on menhaden, you also will see that there used to be a lot of six and seven and eight-year-old class around. We don't manage that species for longevity, not for the many year classes.

There are—they can grow to nine, ten years old. I mean, that's when they get the bigger bunker. They are longer living. What happens here, because we've been managing those species for reduction and for bait industry, is, basically, now truncated to small year classes, where it can be that function. There's not a lot of year classes left.

I mean, if you look at some of the old data, which I looked at, there's six, seven-year-olds and eight-year-olds that made part of the market. After '65 you don't see that anymore, because we basically——

The same way, if you look in the Potomac River back in the 1830's, they could haul, say, 450 sixty-pound striped bass. Well, I

don't think I've heard of 450 striped bass being on the whole east coast, I mean, in the last couple years. Because there was also 3 million—300 million shad being caught and 300 million river herring. So that was different circumstances, and as we basically truncate the population, we truncate the size that we harvest out of there. It's going to make that much of a difference.

Mr. SAXTON. Jack.

Mr. DUNNIGAN. Just, remember, Mr. Chairman, when you're going back and looking at fish from the 1830's, you're essentially looking at what today we would call a virgin population, an unfished resource. And you don't ever anticipate being able, over the long-term on a maximum sustainable yield basis, as the Magnuson-Stevens Act says, to be able to maintain that kind of a harvest.

In a relatively unfished population, you will get very high returns when you first go into it and start fishing.

So you know, looking at historical data, it's very interesting, and probably important for managers to consider, but it doesn't necessarily tell the whole story over the long-term.

Mr. FOTE. If you look at the Potomac River information, which was very historical, 'cause it basically kept, they kept good records during that period of time. There was a huge amount of—they were in the Potomac River every five minutes with five-mile long nets. That's before we had—that by the 1980's they had a collapsed fishery where they needed 18 hatcheries going on. So they did impact, it wasn't a virgin fishery, and there was a lot of pressure on those fisheries during this period of time.

Mr. SAXTON. OK, we're going to go to Mr. Donofrio and then back to Mr. Pallone.

Mr. DONOFRIO. Thank you, Mr. Chairman. To answer Mr. Pallone's question from before, I don't believe that the—this is my opinion—that the bluefish stocks are in decline. What I believe is that they're being displaced, and that's the point I was trying to make with the forage fish problem.

In order to sustain two populations near the coast, you need to have a big variety of bait and enormous amounts of it. And what I think is happening, as witnessed in the Azures this year, there was a lot of big bluefish in the Azures. So they're going somewhere else. They're a highly migratory pelagic fish, and they will go. And I believe the recovering striped bass fishery, because of their ferocious appetite, they will take over the area, and if there's not a variety of forage fish, and as we all know, the bass were called squid hounds, and I don't know the last time I saw squid along the beach. Years ago they used to spin them up and we caught them, but it's just—there's less and less forage fish, and I believe that's the problem there between the two fisheries, not that there's a decline, maybe, in the stock, but I think that the nature of the striped bass is just pushing them out of the area.

Thank you.

Mr. SAXTON. Mr. Pallone.

Mr. PALLONE. I just wanted to ask Tom Fote—you've mentioned this phenomena of using modeling, for example, and the statistical methods, if you will, as a cost saving device, as opposed to collection of biological information, and I know, Tom, you talk about

that, not only in the context of various fisheries management plans, but also with dredging and environmental issues at different stages.

And it concerns me. I'm not sure I fully understand. I just wanted you to comment on it a little more. I mean, what I see more and more with the EPA and with—and I guess also with NMFS—is just a statistical computer modeling without reference to actual data collection, fish samples, whatever.

Just comment on that a little more, I mean, how that's affecting what we do and why you think it's not—or what do you think we should do to change it?, because obviously if the scientific data's not accurate, and the methods being used are not accurate, then we're going nowhere.

Mr. FOTE. When it was easy to do science and it was cheap to do science, that's what we did, we did a lot of biology. We took a—when Bruce Freeman and Ken Able and Tom McCloy went to—they did a lot of stomach samples to see what was going on with species.

Right now it becomes very expensive, and also, we're under such pressure to produce so much stock for each individual sector of the commercial and recreational fishery, that we've got to prove our figures. So they've gone to this modeling technique. And some of them are very good, but they should be used as a tool, not as the last word. And the problem is, when we look at statistical modeling, it's only as good—I mean, my expertise is not fisheries management, as far as education. It was marketing management. And I learned a long time ago, you can do whatever you want with statistics when you put that—with the information you put in there. And you get whatever answer you want out of the statistics.

Modeling is a tool, but when it comes to the whereall, how we manage a fishery, summer flounder's that way, 'cause the model produces this way, we can allow the harvest, because the model does that.

It's only as good as the information that's put in there. Some of the information has not been peer reviewed. Some of the information has not gone out to scientific journals so they can be questioned by other scientists. I mean, when we basically use—and we do pharmaceutical industry, you put it out in a magazine or the medical industry, and basically you get ripped apart by all your colleagues and made to feel inferior, because you didn't do this, this and that.

We don't do that in fisheries management. We don't publish a lot of what we use. So other scientists can come in and say, "This is a problem here. You've missed a small piece." And we've corrected models going back. Every time I'm looking, we basically go back and say, "Well, we left this out, now we've got to readjust the figures." We did that with recreational statistics. We had to go back 20 years and re-do everything. And who knows if the latest round of changes, basically really reflects the population.

We also don't spend enough money on these statistical models. I mean, to get a confidence level very small, you've got to spend millions and millions and millions of dollars. We're not going to do that. We only spend a small amount to do the whole marine rec-

reational survey along the east coast. And we don't have that money available.

Mr. SAXTON. Can I ask Ken Able to just comment on the general notion of the accuracy of scientific data and peer review?

Mr. ABLE. In the risk of threatening my own career, I could tell you that it's very difficult.

Mr. SAXTON. Frank and I do that every day, so——

Mr. ABLE. Thank you, I appreciate that.

It's very difficult to sample populations of fish. They're very mobile, they move around tremendously, that's one of the problems that the National Marine Fishery Service has, and any agency that tries to sample them, academic scientists, whatever. So that the degree of confidence you have in your numbers is variable, and if the results are peer reviewed and published in the literature, you often state that we expect the numbers to be 100 pounds or whatever per given area, but plus or minus 50 pounds, perhaps. That says that the answer may be 50 or it may be 150. Best estimate is 100.

That kind of variability is inherent in studying fish populations. And that's one of the difficulties that we encounter all the time.

Obviously, if we put it in fishermen's terms, if they knew that they were going to go out and catch three trophy-size striped bass every time, they would go out and do it. They don't do that. Why? Because the fish are moving around, they're not feeding, they're doing a variety of things.

So they have trouble in their own way of sampling fish populations. Everyone else does the same thing, too.

So it's convenient to, you know, comment negatively on the National Marine Fishery Service data values and other people's values. It's just very hard to do. There's extreme variability in these populations, and that's what makes it difficult.

If it was easy, we wouldn't be sitting here. We'd have all the answers. It's not easy. It's just not easy.

Mr. SAXTON. Let me ask you this, changing the subject slightly. We held a hearing a year ago on bluefish, and one of the notions was that bluefish have not diminished so much in biomass, they've just changed the location where we find them, and Mr. Donofrio just advanced that notion again, and that seems, from my point of view, to be a possibility. Do bluefish have an affinity for any particular geographic area of the ocean, or from a scientific point of view, are they fairly mobile?

Mr. ABLE. They're fairly mobile, but those occurring on the east coast undergo more or less regular migrations up and down the east coast. The likelihood that bluefish from the east coast shore showing up in the Azures is not very likely in my estimation.

They have regular migrations. The timing of those migrations are very, very, variable. They're often temperature-dependent, but there are other things going on that we don't quite understand, so that I'd say on the east coast we know with some reasonable confidence what the migrations of the adults are like. We don't know what the migrations of the larvae are like, and that's why I get back to the point that I think that's the most unknown period in the—period that needs the most attention, the first year.

Fishermen, both recreational and commercial, have a very obvious reason for focusing on the adults. That's what they want to

catch, and that's where much of our fisheries management has focused in the past. It, in my opinion, needs to change, and we need to have increased focus on the early life history stages in order to understand what's going on.

Will that solve all the problems? No, but I think it'll help.

Mr. SAXTON. Well, thank you very much.

I have a lot of questions. I don't know that I have any questions further for this panel at this moment. I want to thank you for coming.

Mr. Pallone, do you have any further questions?

Mr. PALLONE. No, thank you very much, and thank all of them and you, Mr. Chairman.

Mr. SAXTON. I just want to express the Subcommittee's appreciation for your being with us today, and I hope that we didn't ask any questions that made any of you uncomfortable, but if we did, that's normal in the fishery management business.

So thank you for being here today, and I look forward to working with you all as we move forward to try to answer some of the questions that have been asked today and to fashion legislation and regulatory policy that will be beneficial to all concerned.

Thank you very much.

[Whereupon, at 12:50 p.m., the Subcommittee was adjourned; and the following was submitted for the record:]

TESTIMONY OF JOHN ROGERS, ACTING DIRECTOR, UNITED STATES FISH AND WILDLIFE SERVICE, DEPARTMENT OF THE INTERIOR, BEFORE THE HOUSE RESOURCES SUBCOMMITTEE ON FISHERIES, WILDLIFE AND OCEANS, OVERSIGHT HEARING ON NATIONAL WILDLIFE REFUGE SYSTEM MAINTENANCE

April 21, 1997

Thank you for inviting us here to discuss with you the maintenance backlog in the National Wildlife Refuge System. As you requested, I am also prepared to discuss the operation and management of the System. I am accompanied by Dr. Robert Streeter, Assistant Director for Refuges and Wildlife, and Stephen Atzert, manager of the Forsythe National Wildlife Refuge.

During the last ninety-four years, since the establishment of Pelican Island National Wildlife Refuge, the National Wildlife Refuge System has evolved into an unparalleled collection of natural resources conserved for wildlife. National Wildlife Refuges are the only protected Federal lands where wildlife comes first. These 509 Refuges, 38 Wetland Management Districts and other interests hold wildlife treasures on more than 92 million acres in all 50 states, the Commonwealth of Puerto Rico, 3 territories, and 5 island possessions. Currently, a small, dedicated force of 2,200 refuge staff administer these diverse holdings for the purpose of preserving a national network of lands and waters for the conservation and management of fish, wildlife, and plant resources of the United States for the benefit of present and future generations.

Since 1992, 1.3 million acres have entered the Refuge System, a testament to the American public's desire to leave a wildlife legacy for future generations. This has been a small step in terms of acreage, but a huge leap in terms of wildlife habitat.

The evolution of the National Wildlife Refuge System throughout this century reflects our changing society. Refuges vary a great deal in structure, purpose, use and management. They include vast Alaskan expanses; varied wetland areas serving as breeding, feeding and resting areas for waterfowl and other wildlife, such as the Forsythe National Wildlife Refuge here; smaller urban refuges with high potential for recreation and education; and sanctuaries for endangered species. Many benefits for the public are garnered from the conservation of wildlife, including opportunities for wholesome recreation and education, community economic benefits, and the assurance of continued fish and wildlife resources for future generations.

Last year, nearly 30 million visitors enjoyed a wildlife experience on refuges. Visitors contributed millions of dollars and a sense of sharing to local economies. Hotels, restaurants, and suppliers benefit from visitors and other refuge activities. Jobs, compensation and other benefits are multiplied many times over the cost of Federal investment. These economic contributions should be considered, in addition to the important biological benefits, as we contemplate the value of well-maintained and

Administration of the National Wildlife Refuge System requires a sizeable investment to maintain and enhance biological resources while at the same time accommodating the public's rapidly growing appetite for wildlife-dependent recreation. The Refuge System has a long and proud history of doing much with very limited budgets; however, increasing responsibilities and rising costs of doing business have resulted in operational and maintenance deficits that are becoming overwhelming. The ingenuity, energy and enthusiasm of our managers and staff have carried us a long way, but the reality is that human capability must be matched with material, equipment and horsepower; sometimes, our ingenuity needs an assist from a backhoe.

Refuge facility maintenance was audited by the Department of the Interior Inspector General in 1992. The survey found that the Fish and Wildlife Service was maintaining refuges in a manner that would neither effectively enhance and protect wildlife habitat nor provide a safe and aesthetic experience for visitors. The reason cited was that funding did not adequately meet needs. To resolve these problems, the Service has undertaken an effort to better identify both maintenance and operational needs, develop a maintenance backlog reduction plan, and complete comprehensive management plans.

Comprehensive management plans provide blueprints for management of the Refuge System. These plans, developed with public involvement, define objectives, document the status of resources, and outline a plan of action to guide management of refuges. The FY 1998 budget request includes $1.93 million to allow completion or initiation of 14 new plans covering 29 units of the NWRS. This new funding when combined with funds provided in previous years will allow remaining refuges to be planned over an 8-year time period.

Among these plans will be a combined Forsythe/Cape May NWR Comprehensive Management Plan, currently in preparation.

The reason for a backlog is fundamental -- the lack of required, routine upkeep and maintenance of any capital asset, coupled with the inability to replace failed equipment and facilities. Capital assets on Refuges are extensive and consist of thousands of water management facilities, 2,700 miles of dikes, 6,500 miles of roads, over 1,000 buildings, as well as other structures and equipment. Accumulated over 94 years, the age and condition of our capital assets varies; their value is conservatively estimated to exceed $4.5 billion. The current maintenance backlog is at least $428 million.

Several private industry studies have recommended annual expenditures for routine

maintenance ranging from 1.5 to 4 percent of the value of capital assets in order to properly maintain them and prevent the occurrence of backlogs. This would indicate a minimum of $67.5 million should be applied annually to arrest the growth of maintenance backlogs. The FY 1998 funding request for routine maintenance is $31.7 million. In addition to increases in budgets for annual operational maintenance, substantial increases are needed, dispersed over a reasonable period, to address the existing backlog of major projects. The FY 1998 budget request for this is $33.8 million, $10 million above FY 1997, as a start in addressing these needs. This figure includes $17.4 million in major maintenance in the refuge operations and maintenance budget, which is devoted to the backlog; as well as $13. million in refuge construction, and $8.7 million in dam and bridge safety funds in the construction account that will go to refuge projects, some of which will address the backlog. A chart which details these figures is attached to my statement.

Deferred maintenance and backlogs actually increase long-term, overall costs. Costs may be direct, as with more rapid deterioration, which translates to higher rehabilitation or replacement costs or greater energy usage from malfunctioning equipment. Curtailment of maintenance on equipment and facilities directly impacts habitat management projects designed to protect wildlife and provide for wildlife dependent recreation. Another important aspect is the human cost associated with maintenance backlogs, including:

areas closed due to health and safety concerns, lack of quality visitor experiences, declining benefits to the local economy, and lowered employee morale -- all are likely to be associated with poorly maintained assets. Deferred maintenance means lost opportunities in the challenge to conserve wildlife and provide for public enjoyment.

Management of the Refuge system in a constrained funding environment has become increasingly more challenging due to a number of factors. Among these are wide-ranging new statutory responsibilities, rising demands for recreation and education programs, increasing conflicts with adjoining land uses, and inflation and higher personnel costs. As a result, annual budgets have been sufficient to address only highest priority needs.

One issue that is often raised is whether there should be further land acquisition for the Refuge System in the face of the growing annual operation and maintenance backlog. Some perceive that the purchase of land for new refuges is a major cause of the annual operating funds backlog. This is an incorrect assumption. A continued emphasis on habitat protection is necessary to prevent the loss of tens of thousands of acres of priceless habitat for wildlife. In reality, the Service has requested funds in the last three years for only three new refuges. They were to be habitats for endangered species or for protecting critically threatened wetlands. Of the three, only one was funded. Most land

acquisition funding is devoted toward completion of existing national wildlife refuges.

Yet even if this were not the case, land acquisition should continue. When the Fish and Wildlife Service acquires land, it ensures that the land's value as wildlife habitat will not be destroyed or degraded. That is the primary purpose of the acquisition program; management, habitat improvements and facilities are all secondary. If we do not protect wildlife habitat, we will not have wildlife -- it is that simple.

In summary, the Refuge System is threatened by years of inadequate operations and maintenance funding. The Administration has been acting to reverse this trend. In the current year, the refuge budget is up 5% ($9 million) over last year. The FY 1998 request takes a further vital step by requesting an 8% increase ($14 million). To continue to maintain a viable Refuge System in the face of limited funding, our strategy for the future involves: 1) targeting acquisition to protect lands that are essential or that provide management efficiencies for existing lands; 2) developing comprehensive plans in a way that engages the American public and focuses on the highest priority projects; 3) continuing to work with the public through volunteerism, cost sharing, Friends organizations, and related efforts; 4) keeping public use and other facilities low impact and low cost as a routine part of our business; 5) raising the awareness of the value of these unique and often poorly understood lands; and 6) fixing what we have. As

stewards, we place a high value on our treasured natural resources and the need to protect and manage them for the benefit of present and future generations.

We believe America does too.

This concludes my formal statement. I will be pleased to respond to any questions you may have.

MAINTENANCE BACKLOG REDUCTION

(Underlined amounts appear in Budget Justifications - Bracketed amounts not included in totals)

	FY97 enacted ($000)	FY98 requested
"Res.Mgmt/Refuge O&M/Maintenance" program element (backlog reduction only)	17,140	17,140
"Construction/Wildlife Refuges"activity (backlog reduction only) *[Total "Construction/Wildlife Refuges" (backlog reduction+other projects)]*	5,311[1] *[8,949]*	8,050[2] *[13,553]*
"Construction/Dam Safety" activity (backlog reduction only) *[Total "Construction/Dam Safety" (backlog reduction+other projects)]*	1,185[3] *[2,530]*	7,315[4] *[9,310*
"Construction/Bridge Safety" activity (backlog reduction only) *[Total "Construction/Bridge Safety" (backlog reduction+other projects)]*	2,200[5] *[2,685]*	1,314[6] *[1,809*
TOTAL - MAINTENANCE BACKLOG REDUCTION	*25,836*	*33,819*

---

[1] ***FY 1997 maintenance backlog reduction projects under Construction/Wildlife Refuges:*** A.C.E. Basin NWR Grove Plantation (360); Alamosa/MonteVista NWR Chicago Ditch Dam (1,460); Bear River Dikes&Canals (611); MS refuges-Panther Swamp NWR roads only (282); Moosehorn office/ maintenance facility (400); SE LA Refuges rehab-Atchafalaya NWR bridge repair only (150), Wichita Mountains WR Road Rehab (2,048) *[Total -5,311]*

[2] ***FY 1998 Maintenance backlog reduction projects under Construction /Wildlife Refuges:*** Crab Orchard NWR rehab sewage treatment facilities (1,659); Santa Ana NWR road rehab (1,208); Tennessee NWR rehab public access road thru Duck River Unit (2,500); Turnbull NWR replace MT bldg (843), Wichita Mountains WR road rehab (1,840) *[Total- 8,050]*

[3] ***FY 1997 maintenance backlog reduction projects under Construction/ Dam Safety:*** Patuxent NWR Cash Lake Dam (485); Wichita Mountains WR Grama Lake & Commanche Dams (700) *[Total-1,185]*

[4] ***FY 1998 maintenance backlog reduction projects under Construction/Dam Safety:*** Patuxent NWR Cash Lake Dam (2,515); Wichita Mountains WR Grama Lake & Commanche Dams (4,800) *[Total-7,315]*

[5] ***FY 1997 maintenance backlog reduction projects under Construction/Bridge Safety:*** Crab Orchard NWR Little Wolf Creek Bridge (550); Region 4 bridge replacement (800); Squaw Creek NWR Davis Creek Bridge (550); White River NWR Big Island Chute Bridge (300) *[Total-2,200]*

[6] ***FY 1998 maintenance backlog reduction projects under Construction/Bridge Safety:*** Shiawassee NWR rehab Houlihan Road bridge (520); St. Marks NWR replace 6 bridges (469); St. Vincent NWR Outlet Creek bridge (186); Tennessee NWR replace 2 bridges (139) *[Total-1,314]*

OPERATIONAL MAINTENANCE

(Underlined amounts appear in Budget Justifications)

	FY97 enacted	***FY98 requested***
	($000)	
Base Operational Maintenance (salaries of Maintenance staff under "Operations" program element in Budget Justifications)	27,350	27,350
Uncontrollable Cost Increase - scheduled Federal pay and retirement cost increases for refuge maintenance staff. (a component of the $4,061,000 increase for uncontrollable costs under "Operations" program element in Budget Justifications)	0	1,000
Operational Maintenance supplies, fuel, small contracts, & replacement parts (under "Maintenance"program element in FY 1997 & "Operations program element in FY 1998)	3,399	3,399
Total - Operational Maintenance salaries, supplies, fuel, small contracts, & replacement parts	***30,749****	***31,749****

TESTIMONY OF

RICHARD H. SCHAEFER
DIRECTOR, OFFICE OF INTERGOVERNMENTAL AND RECREATIONAL FISHERIES
NATIONAL MARINE FISHERIES SERVICE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
U.S. DEPARTMENT OF COMMERCE

BEFORE THE

SUBCOMMITTEE ON FISHERIES CONSERVATION, WILDLIFE, AND OCEANS
COMMITTEE ON RESOURCES
HOUSE OF REPRESENTATIVES

APRIL 21, 1997
MANAHAWKIN, NEW JERSEY

Mr. Chairman, I am Richard Schaefer, Director of the National Marine Fisheries Service's (NMFS) Office of Intergovernmental and Recreational Fisheries. I am accompanied today by Dr. Jeffrey Cross, Chief of the Environmental Processes Division of the Northeast Fisheries Science Center. Dr. Cross is located at our Sandy Hook, NJ, laboratory. We thank you for the opportunity to testify today on the interactions between striped bass, bluefish, and forage fish. Your letter of invitation posed several questions which are addressed below. I will also give a brief overview of the striped bass and bluefish fisheries along the Atlantic Coast of the U.S.

Striped bass (*Morone saxitilis*) and bluefish (*Pomatomus saltatrix*) are important to recreational and commercial fisheries in the northeast and mid-Atlantic coastal region of the U.S. Both species are currently managed on an interjursidictional basis. The decline of striped bass in the 1930s was one of the principal reasons that brought coastal states together to form the Atlantic States Marine Fisheries Commission (ASMFC). A similar decline in striped bass in the 1970s ultimately led Congress to enact the Atlantic Striped Bass Conservation Act and the Interjurisdictional Fisheries Management Act. The striped bass has also served as a focal species in environmental impact assessments conducted in major Atlantic coast estuaries.

The striped bass is an anadromous species found along the Atlantic coast from northern Florida to the St. Lawrence estuary. Four primary stocks occur on the Atlantic coast: Hudson River, Delaware Bay, Chesapeake Bay, and Roanoke River. Striped bass undertake upriver spawning migrations from late winter to early spring, and the stocks north of Cape Hatteras make coastal migrations that are not associated with spawning. Striped bass have a diverse diet and feed on a wide variety of fishes and invertebrates.

Commercial landings of striped bass peaked in the early 1970s at over 6,000 mt, but declined to less than 1,000 mt by 1985. Regulations have maintained striped bass landings at about 800 mt per year since that time. Recreational landings often equal or exceed the commercial harvest. In 1993, the estimated recreational harvest (2,700 mt) was more than three times the commercial

landings (767 mt); with 90% of the striped bass caught by recreational fishermen in 1993 released alive. In 1995, more than 90% of commercial landings and recreational harvest of striped bass were taken within three miles of the coast.

Bluefish is a migratory, pelagic species found along the Atlantic coast. They occur from Maine through Florida, migrating northward in the spring and southward in the fall. Bluefish are voracious predators that feed on a wide variety of fishes and invertebrates. The total catch of bluefish from Maine to Florida peaked in 1980 at an estimated 76,500 mt and has generally declined with some fluctuations to the present. The recreational component of the fishery historically has constituted 80-90% of the total catch. In 1995, over half of the commercial landings and 90% of the recreational harvest of bluefish were taken within three miles of the coast. NMFS estimated that the spawning stock biomass of bluefish declined 74% from 326,000 mt in 1982 to 86,000 mt in 1993.

What interactions between striped bass, bluefish, and forage fish affect the populations and availability of these species?

Direct interactions between the two species probably occur either through predation of one species upon the other, or through competition for food or space. These interactions most likely occur in inshore ecosystems (coastal rivers, estuaries, bays, and nearshore ocean waters) where the life cycles of the two species overlap from early juvenile through adult life stages (Figure 1).

Striped bass spawning occurs up in the freshwater reaches of coastal rivers, river flow transports the eggs and larvae downstream to estuarine nursery areas. The timing of movement of juvenile striped bass out of the estuarine nursery areas and into nearshore ocean waters varies among the stocks. For example, in the Hudson River, age 0 striped bass move out of the river to estuaries in Long Island Sound and New Jersey, and by age 1, these fish participate in coastal migrations. In Chesapeake Bay tributaries, juvenile striped bass generally remain within the bay system for several years, although recent data suggest they may participate in limited seasonal movements outside of the bay. The Roanoke River (North Carolina) stock is similar to the Chesapeake stock in that it uses the Albermarle Sound as a nursery area for several years before entering the coastal migratory group.

Bluefish, conversely, spawn offshore in the spring along the Continental Shelf primarily south of Cape Hatteras, although some spawning may occur during the summer in the shelf waters of the Mid-Atlantic Bight. Larvae from the spring spawning drift north of Cape Hatteras into the Gulf Stream and spread out along the coast in mid-June as the ocean warms. They enter nearshore coastal waters as juveniles and remain there during the summer, when they may be joined by much smaller members of the summer-spawned cohort.

Little is also known about the movement patterns of striped bass and bluefish once they emigrate from estuaries during the fall, but limited data suggest that both species migrate south along the coast. Sampling becomes more difficult once striped bass and bluefish juveniles leave their estuarine nursery areas. Consequently, few studies have examined the marine phase for the juveniles of either species, particularly in a multispecies context.

The food habits of both species have been examined, but rarely from the perspective of available

prey items or potential predators. Studies in the Hudson River have implicated juvenile bluefish as a major predator of larval and juvenile striped bass (Texas Instruments 1976). However, little work has been done to examine the potential impact of predation by juvenile striped bass on bluefish once juvenile stripers become piscivorous (fish eaters). This work would be important for determining whether the current resurgence of striped bass along the Atlantic coast could have a negative impact on the abundance and recruitment of bluefish. Recent declines in the abundance of other estuarine-dependent fishes (American shad, blueback herring, alewife, and Atlantic salmon) may also be due to increased predation by striped bass on juveniles as they emigrate from coastal rivers (Schulze 1996).

Are these interactions related to historic population swings in bluefish and striped bass stocks?

In the past 25 years, recreational catches (landings + releases) of striped bass along the northeast U.S. coast have fluctuated greatly. The stock reached all-time high levels in the early to mid-1970s then dwindled in the mid-1980's to levels low enough to prompt NMFS and the coastal states to adopt stringent measures that restricted landings to allow the coastal migratory stock to recover (USDOI and USDOC 1995). Recently, the catch of striped bass has increased dramatically (Figure 2) as the stock abundance has rebounded (Figure 3); and management agencies have now relaxed the harvest restrictions. The patterns of recreational catches and abundance indices for bluefish have been opposite to the harvest pattern for striped bass; currently, catch and abundance of bluefish are declining in northeast coastal waters (Figures 2 and 3). The alternating cycles of abundance of striped bass and bluefish in northeast U.S. coastal waters have been observed, at least anecdotally, for the past century.

The fact that recovery of the striped bass stocks coincides with the decline in abundance of bluefish, and that bluefish abundance in northeast U.S. waters was at record high levels during the late 1970s and early 1980s when striped bass abundance was low, has renewed speculation among managers, scientists, and harvesters that the high abundance of one of the species may inhibit presence of the other. Attempts to analyze harvest records with statistical tests have not revealed a significant inverse relationship between landings of striped bass and bluefish (SARC 1994), but harvest records do not necessarily reflect abundance. This is true especially as fishing effort becomes more efficient for popular species at the same time as their abundance declines (Hilborn and Walters 1992).

The Stock Assessment Review Committee (SARC), a panel consisting of stock assessment scientists from NMFS, the Atlantic coastal states, and academia, has determined that the recent decline in the abundance of bluefish is most likely being caused by a consistent decline in recruitment, although increases in exploitation in recent years suggest that the stock may also be over-fished (SARC 1994). The SARC attributed the decline in recruitment of bluefish to several possible factors, including changes in the relative contributions of spring- and summer-spawned cohorts to the annual production, changes in the patterns of ocean currents that transport larval bluefish to inshore nursery areas, and interactions with striped bass (SARC 1994).

Are the present single-species management plans the best way to manage these species?

Yes, at the present time a single-species management plan is best. Because of the differences in

their range and distribution, striped bass are appropriately managed by the ASMFC while bluefish fall more appropriately under joint Council and ASMFC purview. Because of the complexity of jusidictional responsibilities for these species, and the lack of information on the interactions of the two species and their predator-prey relationships with other species, a multispecies plan is not practical for striped bass and bluefish.

How should these species be managed to take these interactions into account?

The current management regime for these species is appropriate as long as there is close coordination between the ASMFC and the Mid-Atlantic Fishery Management Council (Council). The Mid-Atlantic states and the ASMFC are members of the Council, therefore a coordination system is already in place.

What research is necessary to obtain a fuller understanding of these interactions?

To obtain a more complete understanding of the interactions between striped bass and bluefish, future research should: (1) determine the nature and extent of species interactions in nearshore coastal and estuarine waters among striped bass, bluefish, and co-occurring forage species; and (2) determine the extent to which natural and human-induced conditions in the inshore ecosystems affect the interactions.

The research program should consist of a combination of controlled laboratory experiments, field studies, and modeling. Laboratory experiments would focus first on predator-prey interactions between striped bass and bluefish, followed by multispecies experiments to determine the potential for competition between the two species for common food resources. Once the potential for direct interactions between the species is defined, it would be tested under a variety of conditions reflecting the range of natural environmental variation in inshore ecosystems and the degree to which those systems are degraded by human activities (e.g., chemical contamination, eutrophication, habitat alteration, and habitat loss). Field studies would establish the basis for the laboratory experiments and test or validate the laboratory findings. Field studies would also focus on multispecies interactions and habitat use.

1. Data Synthesis and Modeling

Examination of multispecies interactions within inshore ecosystems involves extensive laboratory and field investigations of complex natural processes; however, the variety of studies proposed cannot answer the ecosystem questions in isolation. Study findings will be pieces of a larger puzzle that must be consolidated using a modeling framework. A simple model should be developed from a synthesis of available information. This model could be used to identify areas where information is lacking and areas that are critical to achieving the program's objectives. Throughout the course of the research program, the model would be enhanced and complementary models developed as additional information is obtained from laboratory and field studies. Intermediate stages of the models could be used by managers of the research program to define research hypotheses, organize and integrate new information, and test our understanding of multispecies relationships. Ultimately, the model(s) would have predictive capabilities that would enable resource managers to identify the factors associated with inshore ecosystems of the northeast US that are critical in regulating success or failure of striped bass and bluefish

populations.

2. Laboratory Culture and Field Trials

An integral part of experimental studies on egg, larval, and juvenile stages of striped bass, bluefish, and co-occurring species will be the development of appropriate culturing and rearing techniques. Culture techniques are needed because the eggs and larvae are difficult to collect and transport from the field to the laboratory. In support of the field program, laboratory culture should focus initially on the juvenile stages, because growth and survival during these periods can be significant factors in year class success. Juveniles of many inshore species are readily available; and for some, successful holding techniques will have been developed.

3. Field and Laboratory Studies

The main research program on interactions between striped bass and bluefish should focus on identifying the ecological niches of the two species in inshore ecosystems, and determining how their niches are affected by interactions with other species and human-induced stresses. Experimental studies should be designed to investigate questions related to feeding and growth, behavior, and response to biotic and abiotic factors, first separately, and then in a multispecies context. Behavioral studies should be a principal experimental research area since results would provide information about how the two species feed, avoid predation, and respond to environmental change, both natural and anthropogenic in origin. Field studies would focus on selected aspects of early life histories and on multispecies interactions involving life stages from juvenile through adult. Eventually, lab experiments and field studies would be extended to examine interactions with co-occurring species, including potential prey and predators, as well as competitors for prey and habitat, to provide additional input for a multispecies model.

The laboratory experiments would provide the opportunity to address questions raised by results of the field program whereby factors that affect niche requirements could be isolated or controlled, singly or in combination. Studies can be designed in which an animal's response is considered reflective of its capability to respond to environmental changes. Where these changes are due to anthropogenic causes, normal baselines can be established against which the effects of a disturbance can be measured.

4. Program Coordination

Accomplishing the objectives of the proposed research program would require coordination among the different program components (field studies, laboratory experiments, and modeling) and among collaborating researchers at government laboratories and universities. Coordination is necessary in the initial planning of activities and then continuously as results are obtained throughout the life of the program. Initial planning should insure that the field studies and laboratory experiments are complementary, and that both address the information needs of the model. Subsequently, findings of one component may influence how others interpret their results, how experiments and field sampling are designed, and how the model is modified to incorporate new information. Coordination should be accomplished by communication of preliminary results among the investigators through regular meetings and workshops where the implications of results for future research and modeling activities are discussed.

Coordination of the research program with other groups interested in multispecies interactions in coastal waters is also important. The regional fishery management councils, Atlantic States Marine Fisheries Commission, conservation groups, commercial harvesting interests, and the recreational fishing community all have a vested interest in the types of information that will be generated in the proposed program. Feedback on research direction and products during the course of the research program would enable researchers to develop research products that satisfactorily address questions raised by the groups.

Some of the studies outlined above will begin this summer as a result of the generosity of Congress in providing funds for striped bass-bluefish interaction studies in the NMFS appropriation. The program will be developed and administered by the NOAA Cooperative Marine Education and Research Program at Rutgers University in cooperation with the Northeast Fisheries Science Center of NMFS. A workshop of scientists, managers, and other interested parties will be held in the near future to identify research priorities and develop the program. In addition, laboratory and field studies on competition and predation between striped bass and bluefish will begin at the NMFS's James J. Howard Marine Science Laboratory (Highlands, NJ) this summer.

What information is available from past studies that has addressed these questions?

Few studies have been conducted on the interactions between striped bass and bluefish. Existing studies are inadequate to validate the relationship between the two species, or to explain their alternating periods of abundance and decline. Food habits have been examined, but rarely from the perspective of available prey items or potential predators. Interactions between bluefish and striped bass have been shown for age-0 bluefish in the Hudson River (Juanes et al. 1993). Striped bass ranked third in dietary importance of bluefish, although the authors note this may be an underestimate since unidentified remains of gut contents were probably striped bass. McFadden (1977) suggested that the greatest source of mortality for juvenile striped bass in the Hudson River was predation by juvenile bluefish. Striped bass composed a larger proportion of bluefish diets when striped bass abundance was high than when striped bass abundance was low (Texas Instruments 1976; Juanes et al. 1993).

Diet analyses of adult striped bass and bluefish demonstrate considerable overlap, suggesting a potential for competition between the species. Food items common to both species are alewife, herring, menhaden, shad, sand lance, silver hake, silversides, crabs, shrimp, worms, squid, and clams (Smith and Wells 1977; Wilk 1977). Competition may be reduced, however, because of different feeding characteristics (timing, location, food preference, and feeding behavior) of the two species. Side-by-side comparisons of the feeding characteristics of striped bass and bluefish have yet to be performed.

CONCLUSION

Striped bass and bluefish are important recreational and commercial fisheries in the northeast coastal region. The alternating cycles of abundance of striped bass and bluefish have been observed for the past century. The fact that the current recovery of the striped bass stocks coincides with the decline in abundance of bluefish, and that bluefish abundance was at record high levels during the late 1970s and early 1980s when striped bass abundance was low, has

renewed speculation that the high abundance of one of the species may inhibit presence of the other. Interactions between the two species probably occur either by predation of one species on the other, or by competition for food or space. These interactions most likely occur in coastal rivers, estuaries, bays, and nearshore ocean waters where the life cycles of the two species overlap. However, there have been few studies on the interactions between striped bass and bluefish, and existing studies are inadequate to determine the relationship between the two species, or to explain their alternating periods of abundance and decline. A more complete understanding of the interactions between striped bass and bluefish requires work specifically designed to determine (1) the nature and extent of the interactions among striped bass, bluefish, and forage species in nearshore ecosystems, and (2) the extent to which natural and human-induced conditions affect the interactions.

Thank you Mr. Chairman, this concludes my testimony. Dr. Cross and I would be happy to answer any questions you may have.

References Cited

Hilborn, R., and C. J. Walters. 1992. Quantitative fisheries stock assessment: choice, dynamics and uncertainty. Chapman and Hall, New York.

Juanes, F., R. E. Marks, K. A. McKown, and D. O. Conover. 1993. Predation by age-0 bluefish on age-0 anadromous fishes in the Hudson River estuary. Transactions of the American Fisheries Society 122(3):348-356.

McFadden, J. T. 1977. Seven-year summary of the Hudson River estuary. Consolidated Edison Co., New York.

SARC (Stock Assessment Review Committee). 1994. Report of the 18th Northeast regional Stock Assessment Workshop (18th SAW). NOAA/National Marine Fisheries Service. Northeast Fisheries Science Center Reference Document 94-22.

Schulze, M. B. 1996. Using a field survey to assess potential temporal and spatial overlap between piscivores and their prey, and a bioenergetics model to examine potential consumption of prey, especially juvenile anadromous fish, in the Connecticut River estuary. M. S. Thesis, University of Massachusetts, Amherst, Massachusetts.

Smith, W. G., and A. Wells. 1977. Biological and fisheries data on striped bass, *Morone saxatilis* (Walbaum). NOAA/National Marine Fisheries Service, Sandy Hook Laboratory. Technical Series Report No. 4.

Texas Instruments. 1976. Predation by bluefish in the lower Hudson River. Consolidated Edison Co., New York.

USDOI and USDOC (United States Department of Interior and United States Department of Commerce). 1995. Striped bass research study. Report for 1993. Washington, District of Columbia.

Wilk, S. J. 1977. Biological and Fisheries data on bluefish, *Pomatomus saltatrix*, (Linnaeus). NOAA/National Marine Fisheries Service, Sandy Hook Laboratory. Technical Series Report No. 11.

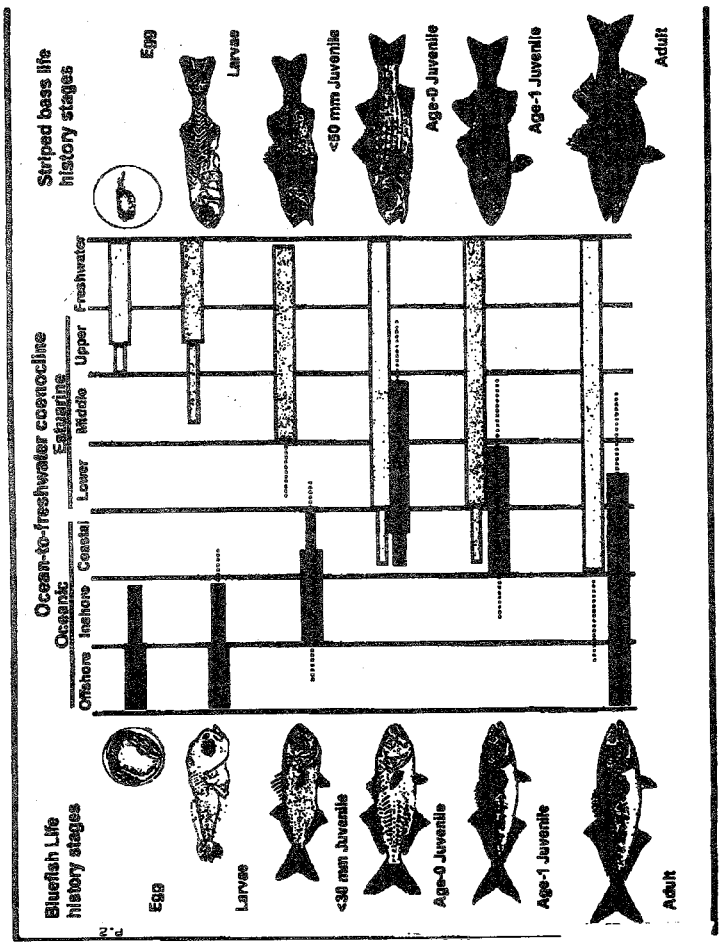
Bluefish Life history stages
Egg
Larvae
<30 mm Juvenile
Age-0 Juvenile
Age-1 Juvenile
Adult
Ocean-to-freshwater coenocline
Oceanic
Offshore
Inshore
Coastal
Estuarine
Lower
Middle
Upper
Freshwater
Striped bass life history stages
Egg
Larvae
<50 mm Juvenile
Age-0 Juvenile
Age-1 Juvenile
Adult

FIGURE 1

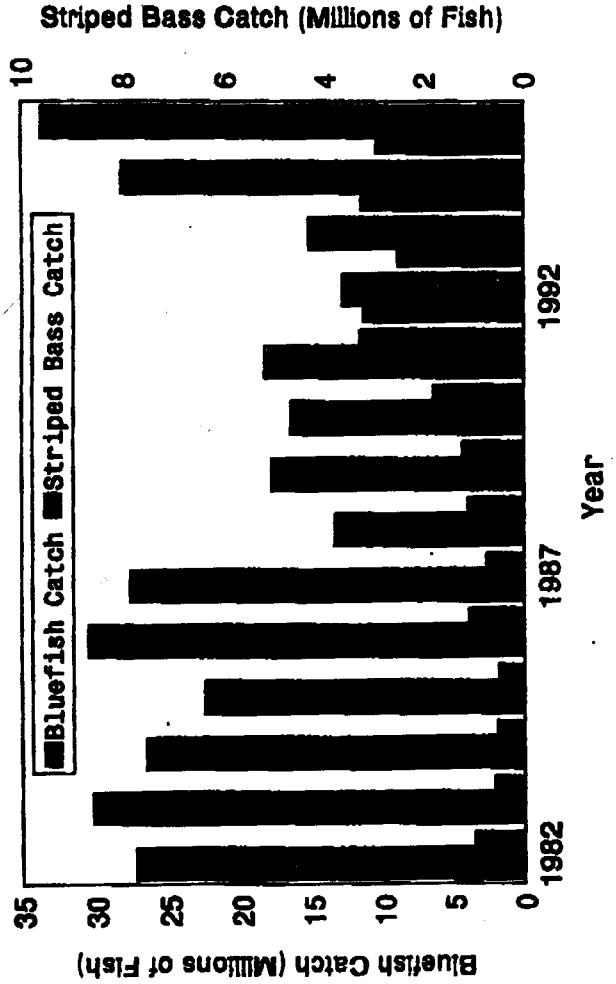

Figure 2. Estimated recreational catches (number of fish landed, released live, and released dead) of bluefish and striped bass along the Atlantic Coast, 1982-1985.

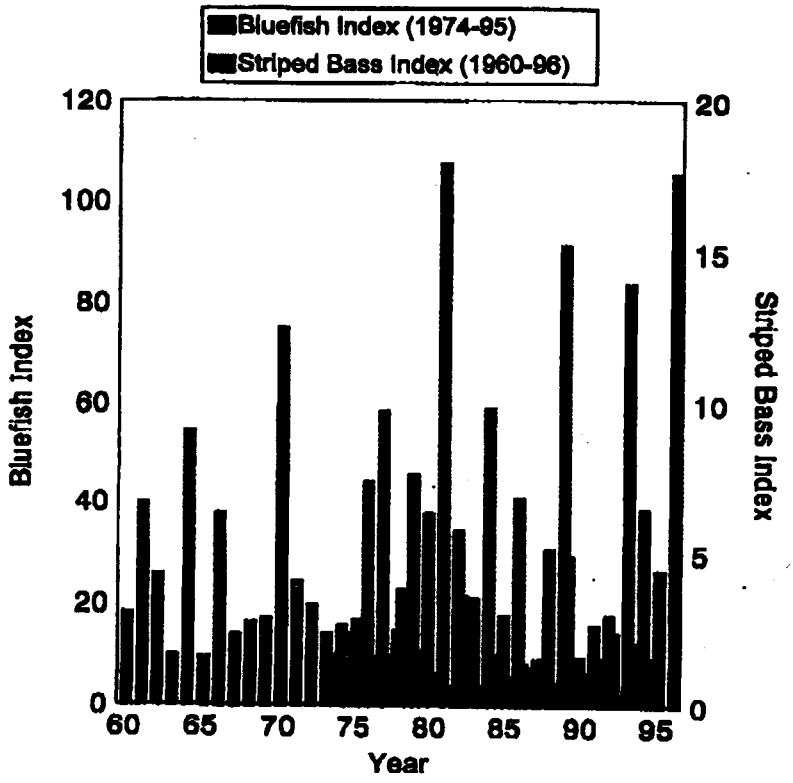

Figure 3. Indices of abundance (survey catch per unit effort) for bluefish and striped bass along the Atlantic coast.

SAVE BARNEGAT BAY

P.O. Box 668
Manahawkin, NJ 08738

April 21, 1997

TESTIMONY OF: William deCamp Jr., President
Save Barnegat Bay
(Ocean County Izaak Walton League)

SUBCOMMITTEE ON FISHERIES CONSERVATION,
WILDLIFE, AND OCEANS

Hon. Jim Saxton, Chairman

at Mill Creek Community Center, Manahawkin, New Jersey

Re: Operation and Maintenance of the National Wildlife Refuge System

Save Barnegat Bay (the Ocean County Chapter of the Izaak Walton League of America) thanks Congressman Saxton and the Subcommittee on Fisheries Conservation, Wildlife and Oceans for the opportunity to testify on the issue of Operation and Maintenance of the National Wildlife Refuge System.

Save Barnegat Bay has devoted itself primarily to promoting land conservation within the Barnegat Bay watershed. Most of our efforts to date have been directed at the expansion of the Edwin B. Forsythe National Wildlife Refuge. Our views on refuge management stem principally from our experience with the Forsythe Refuge - our window on the national system. We offer these views with the intention of providing a perspective on the overall system, not to advance a parochial interest.

We are extremely grateful to Congressman Saxton, to Congressman Pallone, and to other members of this Committee for the energetic role that they have played in conserving environmentally sensitive lands both nationally and within the Barnegat Bay watershed by getting them included in the National Wildlife Refuge System through the mechanism of fair market value purchase from willing sellers. We also applaud the efforts of this Committee to promote a discussion of how land ought to be managed and maintained. Acquisition and maintenance are inextricably linked.

Our National Wildlife Refuges, including the Edwin B. Forsythe Refuge, are improving the lives of both people and wildlife. Among the benefits that the protected lands of these refuges provide for people are: conserving flora, fauna, fish, and birds, protecting endangered species, maintaining migratory flyways, protecting drinking water quality, protecting swimming water quality, providing flood control, providing recreational and educational opportunities, and maintaining the natural habitat and natural beauty of our nation. Also worthy of mention are the economic benefits from tourism that result from protecting these natural qualities.

In furtherance of these and other benefits of our National Wildlife Refuge System, Save Barnegat Bay offers the following thoughts and suggestions:

1 - Land acquisition is a form of land management, and should remain a priority. Because development pressure on natural areas exists both nationally and within the Barnegat Bay watershed, we believe that a continued emphasis on acquisition is appropriate - even if it means that the land is undermanaged for many years into the future. In the realm of land conservation, acquisition is the great challenge of our era; if we save habitat from destruction today, we will have unlimited time in the future in which to work out management strategies. Over the coming decade, acquisition is the activity that will best accomplish the mission of the U.S. Fish and Wildlife Service, which is: "to preserve a national network of lands and waters for the conservation and management of fish, wildlife, and plant resources of the United States for the benefit of present and future generations."

At present our society is relying largely on land use regulation - principally wetlands laws - to secure the needed social and natural values provided by undeveloped lands. Unfortunately the integrity of our land use regulation, especially in the area of wetlands, is in a dramatic decline. In New Jersey, as elsewhere, the political will to say "no", or to say "not that much", to developers is rapidly declining. Land use regulation is eroding through the agency of statewide general permits, nationwide general permits, transition area waivers, transition area averaging, out-of-court settlements, affordable housing considerations, takings considerations, simple mistakes by understaffed regulators, proposed changes in the definition of what a wetland might be, and a myriad of other devices. While more vigorous enforcement of existing land use regulation is greatly to be desired, acquisition from willing sellers at fair market value remains the most reliable mechanism for transmitting natural habitat to posterity.

An appropriate acquisition program, however, cannot be sustained without proper management of lands within the refuge system. Refuges stretched to the limit by understaffing and underfunding will inevitably lose credibility and support with the public. At present the combined Forsythe and Cape May Refuges have about a dozen employees to cover an area of roughly 50,000 acres stretching about eighty miles from Brick Township to Cape May, an area which in the summer season is one of the most densely populated regions of the United States.

2 - The current situation at the Edwin B. Forsythe Refuge illustrates the types of problems that arise from lack of sufficient staff and maintenance funding.

(a) Public Use is becoming more difficult without sufficient funds for staffing and maintenance. Trail access cannot be appropriately maintained and expanded. The Reedy Creek Unit, for example, is in need of a trail that is officially open to the public. At Brigantine, the uplands to the west of the impoundment would make an excellent area for an interpretive trail, but funds and staff time are lacking. Throughout the refuge educational kiosks and observation areas do not exist in sufficient numbers.

(b) Habitat quality cannot be properly maintained without additional funding. The impoundments at Brigantine - which are an incredibly rich biological area - have been overdue for maintenance for years. Controlled burns are also needed on refuge lands in order to prevent succession, especially by phragmites. Policing of dirt bikes is an unmet necessity throughout the refuge. At the Reedy Creek Unit dirt bike activity is gradually eliminating the heather. Jetskis are also a large and growing menace to nesting birds and other wildlife; they are difficult to police under any circumstances. In addition, biological knowledge of the habitat on the part of refuge managers is undoubtedly lacking, because overworked managers lack the time to bushwhack the refuge in different seasons to seek out a more intimate knowledge of its habitat. There is currently only one law enforcement official for the Forsythe and Cape May Refuges; there is currently no field biologist.

(c) Partnerships become more difficult to effectuate when staff and funding are lacking. While we applaud the Service's increased emphasis on partnership projects, an increasingly understaffed and underfunded Fish and Wildlife Service can bring less and less to the table. Volunteer work forces, for example, require Fish and Wildlife Service management, as do programs such as Americorps. Save Barnegat Bay plays a partnership role by organizing trash cleanups and by bringing Green Acres matching funds to land acquisition; Fish and Wildlife Service participation in these partnerships requires staff time and funding.

d) Public Involvement is presently hampered by insufficient staff and funding. Refuge managers simply do not have the time to do the desired outreach, even for the important activity of going to township governing bodies to discuss their problems and needs. In Ocean County alone the Forsythe Refuge includes land in nine townships. A particular difficulty generated by understaffing is that public participation in the decision making process is in jeopardy of becoming participation in name only. The managers cannot live up to the rhetoric of openness if they lack the resources to respond to suggestions. Such deficiencies, if left untended, will inevitably lead to ill will toward the National Wildlife Refuge System.

3 - The Refuge managers are doing a valiant job under extremely difficult circumstances. The people of the Fish and Wildlife Service are truly dedicated. The fact that they are willing to take on new land at a time when they are

understaffed is a sign that they have the big picture in proper focus; less dedicated managers might have pursued their own convenience by advocating a go-slow policy on land acquisition. We believe that the Congress and the President, who control the Service's management purse strings, ought to back up their own dedicated employees with large sustained increases in funding for staff and maintenance.

4 - We support the call of the Cooperative Alliance for Refuge Enhancement (CARE) for increased maintenance funding, as delineated in their document *Restoring America's Wildlife Legacy: A Plan to Rejuvenate Our National Wildlife Refuge System.* As we have sought to demonstrate above, the National Wildlife Refuge System is currently seriously underfunded, especially in relation to staff. If we allow this situation to continue we will fail to hand down to posterity their national, natural heritage with all of its parts intact. It is time to stand up and be counted.

5 - We believe that the boundaries of our National Wildlife Refuges should have wide flexibility: some places should be open for people to walk, fish or hunt without having to get permission; in other places environmental sensitivity may require that the public be prohibited. This type of flexible refuge boundary will help to maintain the public support that the Refuge ultimately needs to survive.

Hiking, fishing, and hunting are three traditional activities of many citizens in our nation. When lands pass from private ownership into a refuge, it is only natural that those who formerly were able to walk, fish and hunt on them - and who are now no longer able to do so - are upset. They feel that something has been lost from their lives, and they are right. We would like to see this problem ameliorated.

In urging a more flexible boundary, however, we do recognize that carrying out the mission of the U.S. Fish and Wildlife Service must frequently involve saying "no". For example we believe in absolute prohibitions on dirt bikes and jetskis on refuge lands and adjacent waters. Where endangered species or possible habitat destruction are involved, the public must usually be prohibited. We are not trying to change the refuge concept into that of a park, but we do believe that nature will be more strongly protected by allowing further measured involvement by people. Accordingly, we support the recent executive order by President Clinton allowing "compatible wildlife-dependent activities" which do not detract from the mission of protecting the biological resource.

One meaningful method of being more considerate when saying "no" to would-be users is to use signs that explain the biological or managerial rationale for excluding the public from certain places. The signs currently used at the gates and boundaries of the refuge system are not especially friendly.

We also believe that trails in wildlife refuges do not need "Interstate"-style maintenance and markings. Not all trails need to be educationally marked. A natural experience is one of the things we are looking for - the fewer artifacts the

better. What was good enough for Daniel Boone will suit us fine.

The Fish and Wildlife Service may wish to reflect further on the regional differences among their refuges. Because the Forsythe Refuge exists in an increasingly suburban environment, the nature of the public's legitimate needs for access may be of a different sort than may be found in more remote or less densely populated regions. By letting people use the Forsythe Refuge - and, where appropriate, other refuges - to a greater extent for walking, fishing and hunting, the Fish and Wildlife Service will strengthen the constituency that it needs to support the National Wildlife Refuge System should it ever come under political or fiscal attack. Posting "No Admittance" signs around the entirety of any refuge is political suicide for the cause of land conservation.

So too is maintaining the National Wildlife Refuge System in a state of insufficient funding.

We are grateful for the opportunity to present our views.

NEW JERSEY STATE FEDERATION OF SPORTSMEN'S CLUBS, INC.
Organized May 24, 1935/Serving over 150,000 members
President Frank Bittner 57 Morris Ave., Neptune City, N.J. 07753
908-280-1755 Fax 908-774-4935

Testimony of Frank C. Bittner, President of the New Jersey State Federation of Sportsmen's Clubs, before the subcommittee of Fisheries Conservation, Wildlife and Ocean of the Committee of Resources of the U.S. House of Representatives, at Mills Creek Community Center, Manahawkin, New Jersey on Monday, April 21, 1997.

The 150,000 member New Jersey State Federation of Sportsmen's Clubs appreciates the opportunity to address the subcommittee today relative to the overall management of the 92 million acre National Wildlife Refuge System and new operations and maintenance backlog in the system has affected the public's activities on refuge land. We are particularly interested in addressing public access on these refuges for compatible wildlife related activities such as fishing, hunting, birding, recreational as well as predator management trapping, crabbing, clamming, etc. and would like to suggest an increased emphasis on the NWR System approach to public access, which should prove beneficial to the US Fish and Wildlife Service, as well as to build public support for the system that is vital in these financially - constrained times.

Although the recreation provided on national wildlife refuges is largely resource intensive, the maintenance of facilities including roads, parking areas, dikes, spillways, boat ramps, buildings and signs, the enhancement of fish and wildlife habitat, administrative support, and the routine patrol of the areas by law enforcement personnel require a substantial expenditure of funds. Operation and maintenance backlog totaling more than 400 million continue to plague the National Wildlife Refuge System. Some stable source of funding is now needed to maintain and operate this important national asset at even a minimal level. We urge congress to provide adequate funding for fish and wildlife programs, like the National Wildlife Refuge System.

Refuge planning in coordination with the states, and other agencies, and affirms the whole of the state fish and wildlife agency in coordinating refuge management with the U.S. Fish and Wildlife Service. We would like to suggest greater attention to population control of certain wildlife species like deer, Canada geese, and predator management (skunk, raccoon, and fox) which directly impact refuge neighbors and the very habitat of the refuge itself. We would like to see every effort made to control these species utilizing sport hunters and recreational trapping, and want to note the tremendous potential recreational benefit of New Jersey citizens and the economy, dependent upon the type of control methods utilized. Where control is necessary we would recommend that New Jersey citizens be given the opportunity to utilize these populations whenever possible.

In summary the State Federation of Sportsmen's Clubs recognizes the values and opportunities related to the National Wildlife Refuge System and how important to the future of our wildlife, as well as to the quality of life of our citizens, to be the recipient of anything less than our best effort relative to the planning for its future. A big part of its future in New Jersey should be to encourage, and maximize where possible, compatible wildlife related recreational activities for New Jersey citizens on national wildlife refuge lands. With proper planning and management, the New Jersey National Wildlife Refuge System of the future should prove to be at least as important to our citizens as it is to our wildlife.

Respectfully submitted

Frank C. Bittner, President
New Jersey State Federation of Sportsmen's Clubs

Testimony of

JOHN H. DUNNIGAN
Executive Director, Atlantic States Marine Fisheries Commission

before the

Subcommittee on Fisheries Conservation, Wildlife and Oceans
Committee on Resources
House of Representatives

Manahawkin, New Jersey
April 21, 1997

Mr. Chairman and Members of the Committee:

Thank you for the opportunity to be here today to discuss our valuable Atlantic coastal fishery resources from the perspective of the states who, along with our federal agency partners, work to provide effective fisheries conservation and management that serves the needs of the coastal fishery resources and the fishermen who depend upon them. This Committee has consistently provided leadership in supporting necessary programs for wise fishery conservation and management, and has had the foresight to look ahead to new problems and new ways of addressing old problems. The question of the relationships among species and how they relate to their environments is becoming more prevalent as an issue for fisheries policy makers, and so the Committee's inquiry into these matters is very timely. On behalf of the Atlantic States Marine Fisheries Commission I appreciate the opportunity to address the issues outlined in your letter of invitation.

Interactions Among Species; Implications for Populations and Availability

The basic questions that the Committee is interested in affect virtually every marine fish population; and your specific interest in Atlantic striped bass and bluefish provides a useful frame of reference for analyzing the basic issues. There are several identified interactions between striped bass and bluefish, including both predator-prey interactions and competition. The nature and magnitude of these interactions will vary geographically, temporally, and with the life stage of each species. Any interaction or competition could affect the population size and availability of the species. In a predator-prey interaction an abundance of predators could be detrimental to abundance of the prey species and, conversely, a lack of prey species could be detrimental to the predator. The predator may change its geographical distribution in response to prey availability, thus affecting predator availability to fishermen. If the two species find themselves in direct competition in a given habitat, the "losing" species may be forced to find other feeding grounds. If other areas offer only marginal prey availability or place the species at greater risk of predation itself, abundance of the displaced species could decline.

During the first months of their lives, bluefish and striped bass interact in a predator-prey relationship. Age-0 bluefish move into the same estuarine habitats important to striped bass larva and juveniles, and prey almost exclusively on fish. A large portion of their diet consists of age-0 anadromous species, including striped bass. In a study in the Hudson River Estuary striped bass and white perch accounted for 14-15% of the diet by weight of age-0 bluefish. In fact, one study suggested that predation by bluefish was the greatest source of mortality for juvenile striped bass. Further, since bluefish are opportunistic feeders, it is possible that the proportion of striped bass

in their diet could increase as striped bass abundance increased. Such an observation was reported in a study from the early 1970's and could be extended to the unexpected conclusion that increased striped bass abundance could increase the prey available to bluefish, thus benefiting the bluefish population. Later in the year, young bluefish are large enough to begin competing with age-1 and 2 striped bass for common prey types.

While the predatory-prey interaction may play an important role during the critical early life period of both bluefish and striped bass, a more lasting interaction is competition. The abundance of any species will be affected by its competition with other species occupying the same habitats. The outcome of this interspecific competition may also influence a species' distribution and thus its availability to fishermen. Bluefish, striped bass, weakfish, and menhaden all follow similar migration patterns and their diets overlap. The dietary overlap of bluefish, striped bass, and weakfish has been studied extensively in Chesapeake Bay. The study found that all three species feed on pelagic forage fishes and that production of these predators depended heavily on only a few prey species. This study and others have shown that when young, predators depend on bay anchovy, and as they get larger menhaden became the primary prey. The clupeid species (e.g., herrings) are also an important prey item in many areas. The end result is that bluefish, striped bass, and weakfish are all occupying similar habitats and following the migration pattern of their preferred prey. Bluefish are likely to find themselves competing with striped bass, weakfish, and with other bluefish at various times throughout their lives.

Affect of Interactions on Population Abundance

Data since the late 1980's shows an increase in striped bass stocks and a concurrent decrease in bluefish stocks. Whether this is merely coincidence, or whether there is a strong cause-effect relationship at work, can only be speculated. Clearly, any interactions between two species may at times influence the abundance of either population. However, there is a plethora of environmental and anthropogenic factors that must also be taken into account. Disappointingly, few of these factors have been examined thoroughly. Although researchers have investigated population trends over time, there has been no scientific evidence offered to suggest that fluctuations in one species have significantly affected abundance of the other. In fact, during the late 1960s bluefish abundance was increasing while striped bass populations were producing dominant year classes and record high catches. So, what else could be going on? For one thing, there is evidence that both species are responding in an expected manner to a couple of factors that have been proven to markedly affect abundance. These factors are fishing mortality and recruitment.

While there are many interactions and processes that affect abundance of a species, few have been identified that have a much impact as recruitment and fishing mortality. Fishing mortality on striped bass was eliminated for a number of years and is restricted currently, while at the same time recruitment has been setting new highs for nearly ten years. On the other hand, bluefish have been fully to over-exploited for at least ten years, and recruitment has been at record low levels for six years in a row. These facts alone can account for much of the rise of

striped bass and fall of bluefish. Interactions between these species certainly can exacerbate these fluctuations, but they are probably not the principal cause.

This of course does not answer the question of why bluefish recruitment has declined. Studies have linked recruitment success to environmental factors such as ocean currents and wind speed and direction. Perhaps environmental conditions have changed over time, or are going through a cycle that is adverse to good recruitment. In order to fully appreciate the factors that have affected bluefish recruitment, we will need to better understand the relationships between recruitment, competition and environmental factors.

Single-species vs. Multi-species Management

Since all marine species are connected in some manner by virtue of sharing the same environment, management of a single species on its own, without reference to other species, can never be an ideal way to effectively address problems in conservation and management. Thus, it is essential at a minimum that fishery management plans directed toward a single species fully consider interactions with other species.

All management plans and assessments take interactions into account through consideration of natural mortality. This term represents the losses of a species to natural causes resulting from all the varied interactions between and within species. While scientists may not be able to determine the magnitude and effects of specific interactions, they can estimate their net impact on the population.

It would be difficult to directly account for interactions on a finer scale because the necessary information largely does not exist. While some correlation between predator-prey abundance and some results of competition may be known, rarely have cause and effect relationships been identified. Although results of the last few years may lead us to believe that reducing striped bass abundance will increase bluefish abundance, to attempt such an experiment would be to take an incredible risk and ignore the role of environmental factors or other unknown interactions. Natural systems in general and marine and estuarine food webs are far too complex to respond in such a simplistic manner.

However, if one attempted to manage several species at once by monitoring and manipulating multi-species interactions, along with regulating fishing effort, the complexity of the management program would grow exponentially. Could bluefish and striped bass be managed as a unit? Probably not, given the previously mentioned interaction with weakfish. Nor could the forage fish be neglected, so many more species would have to be added, including menhaden, bay anchovies, all the clupeid species, sand lance and on and on. Next, the plan must consider the species that prey on striped bass and bluefish, such as tuna and mako shark as well as other bluefish and striped bass. Do we stop menhaden fishing in an attempt to increase the forage base because we think the food supply is limiting? Doing any of these things could have severe consequences beyond our control and even beyond our imagination, because we do not realize nor understand the myriad interactions and feedbacks that are involved. For example, the menhaden fishery likely results in the bulk of the menhaden biomass being made up of small fish. If menhaden fishing is stopped, then menhaden will grow and a greater proportion of the

population could be made up of fish that are too large to provide efficient forage for our bluefish and striped bass populations. So instead of adding to the forage base, we may reduce it. To attempt such manipulations without first identifying clear cause and effect relationships and energy pathways would result in unreasonable risk to the health of all marine populations. The popular literature is full of instances of managers attempting to manage through interactions with disastrous results. Until we identify and understand the many interactions, along with the mechanisms that influence the abundance and availability of a particular species, we should not attempt to manage those that appear to be obvious.

Further Research Needed

There are a number of pressing areas where further research on these interactions is essential. In the most recent Stock Assessment Workshop, alternative explanations for the decline in bluefish were examined. One approach involved examining correlation between bluefish abundance and a number of other predator and prey species. While a number of correlation were identified, further research is necessary to identify the mechanisms that will lead to conceptual and statistical models of bluefish recruitment. Another approach involved investigating possible displacement of bluefish to waters farther offshore. Further research was recognized as necessary to investigate these intriguing hypotheses.

In addition to supporting the recommendations of the Stock Assessment Workshop, the following investigations would also be helpful.

1. Investigate the dietary overlap of bluefish, striped bass, and weakfish coastwide and at all life stages.

2. Attempt to identify the limiting factors of prey production. Is the Atlantic Coast at its carrying capacity of forage fishes and unable to support the current biomass of bluefish and striped bass?

3. Identify the competition factors of bluefish and striped bass. Is one species able to outcompete the other? Will one species change its distribution rather than compete? Is size of predator or prey a factor? Do the factors vary spatially or temporally or with prey species?

4. Determine if density dependent factors are influencing predator-prey interactions or interspecific competition. Is the density of striped bass impacting how they compete with bluefish?

5. Fully evaluate other alternatives, such as environmental factors.

Funding for Research

Mr. Chairman, this last point raises a question relative to the budget proposed by the President for FY 1998. As I have tried to point out, there are significant information gaps that negatively affect our ability to conserve and manage these species. For the current fiscal year, as a result of your hard work and that of the Committee, specific funding was included in the appropriation for the National Marine Fisheries Service to try to address the important issues of interspecies relationships, with an emphasis on Atlantic striped bass and bluefish. This work is just beginning to get under way; and there is no question that the funding provided for FY 1997 could only be considered a start on addressing these critical issues. Unfortunately, the President's budget proposals for FY 1998 do not include this funding item. We can only hope that this is an oversight. I am confident that the officials of the National Marine Fisheries Service recognize the critical nature of this essential work and would treat it as a priority.

The Atlantic States Marine Fisheries Commission supports funding this item in the FY 1998 appropriation at $785,000, the same amount included in the current year. There is little doubt that this work will greatly assist in understanding interspecies relationships and directly contribute to fisheries management that can be more effective and responsive. The Commission encourages you, Mr. Chairman, and the Committee to continue your hard work to ensure that this critical priority continues to be supported.

Mr. Chairman, thank you very much for the opportunity to be here today. I would be pleased to try to answer any questions.

Kenneth W. Able
Rutgers University
Institute of Marine and Coastal Sciences

21 April 1997

Testimony before the U.S. House of Representatives,
Subcommittee on Fisheries
Conservation, Wildlife and Oceans

Mill Creek Community Center
1199 Mill Creek Rd.
Manahawkin, New Jersey 08050

Introduction

In order to understand whether there are important interactions between striped bass, bluefish and the fish they feed upon it is first necessary to have a basic understanding of the life histories of these two important predators. In addition, because most fish species experience their greatest mortalities during the first year of life, it is useful to focus on this portion of the life history in order to understand the timing, duration and location of these potential interactions.

The following comments are summarized from an extensive analysis of the available information for the two species based on a book that has been submitted for publication (Able, K.W. and M.P. Fahay. The First Year in the Life of Estuarine Fishes in the Middle Atlantic Bight. Rutgers University Press).

Bluefish (Pomatomus saltatrix)

Distribution

In the western Atlantic, this coastal, pelagic species ranges from Nova Scotia and Bermuda to Argentina, but they are rare between southern Florida and northern South America (Robins and Ray 1986). They undertake seasonal migrations, traveling in schools of like-sized individuals in temperate and semi-tropical ocean waters world-wide (Briggs 1960; Juanes et al. 1996). They migrate into the Middle Atlantic Bight (i.e. the area between Cape Cod and Cape Hatteras) during the spring and south and/or offshore during fall. They typically occur in bays and estuaries as well as across the entire continental shelf. Juveniles have been reported from all estuaries surveyed within the Middle Atlantic Bight, whereas eggs and/or larvae have been recorded from most.

Reproduction

An important study, based largely on the distribution of eggs and larvae, concluded that there were two discrete spawning events in western Atlantic bluefish. The first occurs during March-May near the edge of the continental shelf of the South Atlantic Bight (i.e. the area from Cape Hatteras to Florida). The second occurs between June and August in the Middle Atlantic Bight (Kendall and Walford 1979). Recent studies have re-examined this conclusion and refined our knowledge of a complex reproductive pattern, supporting the concept of a single, migratory spawning stock (Hare and Cowen 1993; Smith et al. 1994).

Sexual maturity and gonad ripening occur in early spring off Florida, early summer off North Carolina, and late summer off New York (Hare and Cowen 1993). In the New York Bight, gonadosomatic studies indicate both sexes are ripe or ripening between June and September with a strong peak in July (Chiarella and Conover 1991). Larvae re-occur in the South Atlantic Bight in the fall (Collins and Stender 1987) and there are also indications that gonads reach a second peak in ripeness in fishes off Florida in September.

Evidence from an intensive study of the distribution of eggs and larvae in the Middle Atlantic Bight supports the suggestion that the spawning season is a single, protracted one that begins in May off North Carolina (Smith et al. 1994; Berrien and Sibunka in review). Larval occurrences then progress northward as far as Cape Cod where they peak in July. Eggs (Berrien and Sibunka in review) and larvae (Fig. B) occur in central Middle Atlantic Bight continental shelf waters between early July and mid-August. During some years they are concentrated over the inner shelf; in other years they are more widely distributed across the entire shelf (Morse et al. 1987; Smith et al. 1994; Berrien and Sibunka in review).

Description

The pelagic eggs are spherical and range from 0.90 to 1.20 mm (1 mm = .04 inch) in diameter. The yolk is homogeneous, the perivitelline space is narrow, and there is a single oil globule 0.26-0.29 mm in diameter. Larvae hatch at 2.0-2.4 mm with unpigmented eyes and non-functional mouth. Characteristic pigment includes parallel rows of melanophores aligned with the dorsal fin base, anal fin base and midline of the body. All fin rays are ossified by 14.0 mm (approx. ½ inch). See Deuel et al. (1966) and Norcross et al. (1974) for further details of larval development. Juveniles have a usual fish shape without unusual features (Fig. A). The caudal fin is forked and the body is somewhat compressed laterally, with a silvery, unpatterned color. The mouth is large and oblique. All fin spines are strong. Two distinct dorsal fins touch at their bases. The second dorsal fin base is about the same length as the anal fin base. Vert: 26; D: IX, 24-25; A: III, 26-28; Pect: 18; Plv: I, 5.

The First Year

Embryonic and larval development occur in the upper levels (primarily between the surface and 15 m [approx. 49 ft]) of the water column in oceanic waters (Kendall and Naplin 1981). After completion of fin ray development, they go through a pelagic-juvenile stage (Fig. A) characterized by a silvery, laterally compressed body (Deuel et al. 1966; Norcross et al. 1974). This transition occurs at ages of 18-25 days and at sizes between 10 and 12 mm SL (.4-.5 inch Standard Length) (Hare and Cowen 1994). Scales begin to form at about 12 mm on the posterior part of the lateral line region, then proceed forward, until the head is completely scaled at about 37 mm (1.5 inch) (Silverman 1975).

During the spring, oceanographic mechanisms providing for the transport of these developing larvae and pelagic-juveniles from southern waters have been discussed in several papers (Kendall and Walford 1979; Cowen et al. 1993; Hare and Cowen 1993). A recent study has described in detail each step of this transport (Hare and Cowen 1996). After spawning on the outer shelf of the South Atlantic Bight in March-May (Collins and Stender 1987), some larvae are retained there (and enter estuaries south of Cape Hatteras), while others are entrained northeastward by the Gulf Stream. The most developed of these, after entering slope waters off the Middle Atlantic Bight (Hare et al. in prep.), actively swim across the Slope Sea until reaching continental shelf waters. Less developed larvae are entrained in warm-water filaments or streamers associated with warm core rings and this also results in their introduction into continental shelf waters. Evidence accrued from neuston sampling indicates that pelagic-juveniles mass in outer

continental shelf waters in the central part of the Middle Atlantic Bight before actively crossing the shelf toward nursery areas in bays and estuaries of the region (Shima 1989; Cowen et al. 1993) after the shelf/slope temperature front dissipates in late spring or early summer (Hare and Cowen 1996).

In the New York Bight, there are two episodes of ingress by pelagic-juveniles into estuarine habitats (Table A). The first occurs between May 28 and June 15 (Cowen et al. 1993). Studies of the otoliths of these juveniles indicate they are at least 60 days old when they first enter estuaries (McBride and Conover 1991). Therefore, they are presumably the result of a spawning event occurring during late March or early April in waters of the South Atlantic Bight. This initial ingress apparently occurs abruptly, with most of these pelagic-juveniles appearing in estuaries simultaneously (Nyman and Conover 1988). Coincident with this migration, diets change from zooplankton to young-of-the-year (i.e. the first 12 months of life) fishes of several species (Friedland et al. 1988; Marks and Conover 1993; Juanes et al. 1993; 1994). The second pulse of pelagic-juveniles occurs during mid- to late August (McBride and Conover 1991). Presumably, these are the result of summer spawning in the New York Bight. Some authors have suggested that this cohort (or a major part of it) undergoes juvenile development in inner continental shelf waters, rather than entering estuaries (Kendall and Walford 1979). In the late 1950s, the contribution of these two cohorts to the overall population was observed to be approximately equal. However, studies in the New York Bight during the 1980s demonstrated that the spring-spawned cohort strongly dominated (e.g. Chiarella and Conover 1990).

Growth rates vary between life history stages and cohorts. Growth of larvae, before they enter estuaries, ranges from 0.3-0.8 mm per day (Deuel et al. 1966; Hare and Cowen 1994). In comparisons between spring- and summer-spawned cohorts from several years, a summer (1988) group was found to be the slowest growing through the juvenile stage (J. Hare, pers. comm.). A separate study, comparing different groups, found a summer cohort to be the fastest growing among a different set of cohorts (McBride and Conover 1991). Juveniles entering estuaries during the first (spring) recruitment range from about 30 to 70 mm (1.2 to 2.8 inches) in length (Juanes et al. 1996), but this size varies somewhat between years and study sites throughout the Middle Atlantic Bight (Table B). Sizes of fish from the summer spawn are somewhat smaller when they appear in estuaries.

Length frequency histograms resulting from recent sampling in the Great Bay/Little Egg Harbor and Hudson River study areas clearly demonstrate the ingress of both cohorts (Fig. C). Growth rates accelerate after the shift from zooplankton to fish prey in these entering juveniles, with much of the increase expressed in weight (Friedland et al. 1988). Juveniles grow at the rate of 0.9-2.1 mm per day (McBride and Conover 1991; McBride et al. 1995; Juanes et al. 1993; Juanes et al. 1996). Members of the spring-spawned cohort are much larger than those of the summer-spawned cohort at the onset of fall migration (McBride and Conover 1991) and continue to be larger at ages one through four (Lassiter 1962). Size modes of the first (spring) cohort reaches about 13-14 cm (5 - 5.5 inches) by late August in Long Island waters (Nyman and Conover 1988) or 15-20 cm (5 3/4 - 7.8 inches) in New England (McBride et al. in press). By September in Great Bay/Little Egg Harbor, these cohorts are discernible as size modes at about 9 and 15 cm (3.5- 5.75 inches) TL.

There is little available information on specific habitats where bluefish young-of-the-year occur. Most studies of growth and feeding habits, however, have made collections with beach seines indicating occurrence in relatively shallow, estuarine habitats. Other studies have used small otter trawls in slightly deeper water to advantage. There are some indications that young-of-the-year undertake diel and tidal movements between marsh creeks and open bay habitats (Rountree and Able 1993).

Very little is known about fall migration. Our data indicate that young-of-the-year leave estuaries and begin to be collected in the ocean in October (Fig. C). After emigration from estuaries, the limited evidence suggests they move south in coastal waters. Year-round occurrences of all life history stages have been reported from the South Atlantic Bight (Anderson 1968), suggesting a north to south seasonal migration. Tagging studies also support a north/south coastal migration (Miller 1969). But there are also suggestions that certain size classes (at least) overwinter in very deep waters near the edge of the continental shelf in the Middle Atlantic Bight (Hamer 1959; Miller 1969; Wilk 1982b) which implies an inshore/offshore seasonal movement. During most years, the spring-spawned cohort dominates in these emigrating young-of-the-year. A theory that young-of-the-year spawned in summer in the Middle Atlantic Bight 1) use continental shelf waters as a nursery, 2) migrate in the fall to offshore waters south of Cape Hatteras where they spend the winter, and 3) move into estuaries in North Carolina the following spring (Wilk 1982b), has not been supported or refuted. Because they leave the Middle Atlantic Bight at lengths of 50 to 75 mm (2-3 inches) and are reportedly 230 mm FL (mode) (approx. 9.2 inches) the following spring and only 290 to 300 mm (11.6 - 12.0 inches) the following fall (Wilk 1982b), they would be required to achieve fast growth over the winter and very little growth during their summer in North Carolina. Both of these requirements are unsupported and unlikely, but details of winter distributions of all life history stages remain enigmatic.

5

Table A. Differences between spring- and summer-spawned cohorts of bluefish moving into estuaries of the New York Bight, 1987-1988. Data from McBride and Conover (1991).

	Spring-spawned	Summer-spawned
When spawned	March/April	July
Where spawned	South Atlantic Bight	Middle Atlantic Bight
Age at recruitment to estuaries	60-76 days	33-47 days
Size at recruitment to estuaries	< 100 mm (mean = 60 mm)	< 75 mm (mean = 46 mm)
Date of ingress to estuaries	Late-May/Mid-June	Mid-late August
Growth rate before estuarine ingress	0.71-0.85 mm/day	0.91-1.2 mm/day
Growth rate during first summer	1.17-1.35 mm/day	0.57-1.47 mm/day
Approximate size on October 1	180-200 mm FL	70-100 mm FL

Table B. Size at ingress into estuaries for spring- and summer-spawned cohorts of bluefish from a variety of studies in the Middle Atlantic Bight. Locations are ordered from south to north.

Range	Length	Mode	Location	Date	Source
Spring-spawned cohorts					
21-60	mm FL	~40	North Carolina estuaries	Mar/Apr 79-90	McBride et al. 1993
24-36	--	--	Middle Atlantic Bight	--	Wilk 1977
65-75	mm TL	70	Horseshoe Cove, NJ	83/84	Friedland et al. 1988
< 110	mm TL	--	Hudson River	92/93	Juanes et al. 1994
78-?	mm TL	101	Hudson River	89	Juanes et al. 1993
40-60	mm FL	45?	South shore Long Island	85/86	Nyman and Conover 1988
45-65	mm FL	50-60	South shore Long Island and New Jersey	87/88	McBride and Conover 1991 (comment that these were lean years for bluefish)
78-82	mm TL	80	Same as above	81	Same as above
<90	mm TL	--	Great South Bay, NY	88/89	Juanes et al.1994
60-140	mm FL	100	Narragansett Bay, RI	July 88	McBride et al. 1995
50-140	mm FL	70	Same as above	July 89	Same as above
50-100	mm FL	90	Same as above	July 90	Same as above
30-110	mm FL	80	Same as above	July 91	Same as above
Summer-spawned cohorts					
30-37	--	--	New Jersey	Mid/late Aug	Tracy 1910; Bean 1889
47-?	mm TL	--	Hudson River	Aug 89	Juanes et al. 1993
<75	mm FL	--	Long Island & New Jersey	Aug 87/88	McBride and Conover 1991
40-80	mm FL	40	Narragansett Bay	Aug 88	McBride et al. 1995

Striped bass (Morone saxatilis)

Distribution

The striped bass occurs along the Atlantic coast between the St. Lawrence River, Canada and St. Johns River, Florida (Smith and Wells 1977). Within this range different populations occur, many migratory, some non-migratory, and some well established in freshwater lakes. Several principal anadromous (i.e. those that move into fresh water to spawn) stocks have been recognized in the Middle Atlantic Bight, centered in: 1) Roanoke River (North Carolina); 2) Chesapeake Bay and tributaries; 3) Delaware River; and 4) Hudson River. Recent tagging studies indicate that Hudson River fish migrate seasonally and range between Bay of Fundy and Cape Hatteras with the smallest individuals occurring nearest the estuary and the largest wandering farther from the Hudson (Waldman et al. 1990). Members of all populations usually occur very close to the coast, often in the surf zone, although they also occur in shallow areas in bays and estuaries. They frequent sandy bottomed areas where tidal currents are strong. They are less abundant in smaller, shallower estuarine bays in the central part of the Middle Atlantic Bight, but are common to abundant in larger, deeper systems (Stone et al. 1994). Juveniles occur in most estuaries throughout the Middle Atlantic Bight, but eggs and larvae have only been reported from the Hudson River and Chesapeake and Delaware bays.

Reproduction

Major spawning areas include tributaries of the Chesapeake Bay (e.g. Potomac, James, York and many smaller rivers along the eastern shore of Maryland) but significant reproduction also occurs in tributaries to Albemarle Sound, the C&D Canal, and certain tributaries to, and mainstems of, the Delaware and Hudson rivers. It may also occur in in freshwater and low salinity estuarine rivers and streams along the eastern shore of Chesapeake Bay. Spawning is generally reported to occur in the first 40 km (24 miles) upstream from salt water intrusion (Rathjen and Miller 1957). In the Delaware River, spawning activity occurs between river km 94 and 201 (Murawski 1969) where salinity is <3.0 ppt salinity (Wang and Kernehan 1979). Eggs are also abundant in the C & D Canal, where concentrations as high as 110 eggs and 95 larvae/m^3 have been collected (Kernehan et al. 1977). Most spawning in the Hudson River occurs between West Point and Kingston (Smith 1985), and recent collections of eggs have spanned the 90-153 km and 37-164 km areas above salt water (Texas Instruments 1973, cited in Dovel 1981). Collections of eggs in a weekly survey of the Hudson River in 1972 found occurrences only above Haverstraw Bay (about river kilometer 64) (Dovel 1981). Limited spawning activity has also been reported in the Mullica River in southern New Jersey (Hoff 1976). In the Chesapeake and Hudson systems, spawning begins when temperatures reach 11C (approx. 52 °F) (Dovel 1981). In the Delaware Bay region, spawning begins when temperatures reach 14 C (approx. 57 °F)(Fay et al. 1983) and this occurs from early April through mid-June (Wang and Kernehan 1979).

Description

Eggs are spherical, non-adhesive, transparent and have a greenish yolk. There is a single oil

globule ranging from 0.40-0.85 mm (.02 - .03 inch) and the perivitelline space is very wide (65%-85% of diameter). Egg diameter varies widely (1.3-4.6 mm, or .05-.18 inch) and size may be inversely related to salinity (Murawski 1969; Wang and Kernehan 1979). Mean egg diameters from various locations in our study area are, North Carolina: 2.43-2.63 mm; Patuxent River, Maryland: 2.18-2.23 mm; Delaware River tributaries: 1.65 mm; Delaware River: 2.90 mm. Eggs have been described as buoyant, semi-buoyant, or found at various levels within the water column. (For a compilation of details regarding characters of eggs reported by a variety of authors, see Hardy 1978). Larvae hatch at 2.0-3.7 mm TL. The body is slender and the snout-anus length is >50% TL. There are 23-27 myomeres (mean 25) of which 11-13 are preanal. Major pigment accumulations occur over the air bladder, along the postanal ventral edge, on the top of the head and on the opercle. Fin spines and rays begin forming at about 7.0 mm TL and full complements are present at 20 mm TL. The fins of juveniles (Fig. D), have both sharp spines and soft rays. The second dorsal fin base is only slightly longer than the anal fin base. The three anal fin spines are of three discrete lengths (first-short, second-mid-sized and third-long) but are about the same thickness. (In similar-sized white perch [Morone americana], the second anal fin spine is about the same length as the third and is noticeably thicker than the first and third.) The body is not as deep as in juveniles of white perch. The most reliable method for separating juveniles of these two species involves determining patterns of interdigitation of the dorsal fin pterygiophores and neural spines of adjacent vertebrae (Olney et al. 1983). Vert: 24-25; D: VIII-IX, I, 9-14; A: III, 7-13; Pect: 13-19; Plv: I, 5.

The First Year

Hatching occurs after 48 hours incubation at temperatures of about 17-18 C (62.5-64.5°F) but ranges between 29 hours (at 24 C) and 80 hours (at 12 C) (Hardy 1978b). Scales begin forming in juveniles at about 16 mm (approx. .64 inch), and are complete at about 20-30 mm (.80-1.2 inch) (Hardy 1978b).

Growth of young-of-the-year (i.e. the first 12 months of life) appears to be consistent across a number of locations. In the Delaware River population, growth continues from spring through summer and the year class reaches a mode of about 10 cm (3.9 inches) by late fall (Fig. E). The same pattern was evident for Hudson River young-of-the-year combined for six year classes (Fig. F) (Kahnle and Hattala 1988). In another study (McKown 1991b), mean lengths at age and growth rates were found to be consistent between five Hudson River year classes (1983-1987). This study also found a significant difference between lengths of the age 1 size class in the lower Hudson River and in western Long Island embayments, with the latter between 39 and 57 mm larger than the former. Growth apparently ceases during the winter and a similar mode is found the following April, when the year class reaches an age of one.

Habitat use during the first year varies with life history stage. After spawning, there is a net movement of young-of-the-year from upstream locations to those in lower, tidal reaches. Late larvae and early juveniles favor shallow waters with sluggish currents and sand/gravel bottoms for nursery areas (Wang and Kernehan 1979; Boynton et al. 1987). Tidal creeks with similar substrates are also utilized by young-of-the-year (Smith 1971). Young-of-the-year of the Delaware River population migrate downstream from spawning locations and spend their first

summer within the tidal portions of the river. Most young-of-the-year from the Hudson River also move downstream from spawning areas and spend their first summer and winter in the lower Hudson River (McKown 1991b). In this river, young-of-the-year have been found in and around pier pilings (Stoecker et al. 1992; Able and Studholme 1993) and in the lower Hudson River estuary, appear to be more abundant in deep interpier habitats than shallow ones during late summer (Cantelmo and Wahtola 1992). After young-of-the-year overwinter in the lower Hudson River estuary, one-year-olds are found the following spring both in the lower Hudson and in various bays around western Long Island, both on the north and south shores (McKown 1991b), especially Jamaica Bay, Little Neck Bay, Manhasset Bay, and, in some years, Bellport Bay. In years with strong year classes, young-of-the-year are found beyond the lower Hudson River nursery area and are included in the catches of age 1 (and older) in certain of these embayments (McKown 1991b).

The range of acceptable environmental conditions is relatively well-known for this species. An important requirement for the spawning area is a current strong enough to keep the eggs suspended in the water column, lest they settle to the bottom and be smothered by silt (Bigelow and Schroeder 1953). The upper lethal temperature for developing embryos is 27 C (80.6°F) (Morgan and Rasin 1973). Eggs and larvae are less tolerant of salinity fluctuations than adults, and their survival is enhanced in low salinities (2-10 ppt) (Fay et al. 1983). Turbidity also adversely affects larvae's ability to capture prey (Fay et al. 1983). Optimum temperatures for larval growth and survival are 15-22 C (Fay et al. 1983; Funderburk et al. 1991) and rapidly changing temperatures can be detrimental to this life history stage (Hollis 1967). The optimum range for juveniles is 18-23 C (Fay et al. 1983). For dissolved oxygen, the optimum levels for all life history stages is 6-12 mg/liter (Fay et al. 1983). Levels below 2.4 mg/liter are lethal for larvae, and those below 3 mg/liter are lethal for juveniles (Fay et al. 1983).

Pollution and resultant low oxygen levels prevented successful reproduction in the lower Delaware River for a time (Chittenden 1971), but improved water quality in the region over the period 1980-1993 has resulted in increased reproduction and enhanced production and survival of juveniles (Weisberg and Burton 1993). These authors cite a thousand-fold increase in the abundance of juveniles during the decade studied, and correlate this increase with improved water quality, not to an over all increase in the population. In particular, this improvement has resulted in reductions of anoxic conditions which once formed a "block" to migratory species, especially in that part of the river downstream from Philadelphia during late summer. Thus, historically important spawning and nursery areas that had been lost to the population (Chittenden 1971) have been restored to a condition allowing for its use.

In the Delaware River system, young-of-the-year and ensuing year classes may spend two or more years within the estuary before migrating offshore and joining the migratory population (Miller 1995). Most overwinter in deeper portions of the estuary, but some also overwinter in tidal creeks (Smith 1971). Studies in western Long Island embayments indicate that Hudson River progeny may spend up to three years in these estuaries before migrating offshore with the adults. Furthermore, tagging studies of young-of-the-year, age 1 and age 2 suggest that these year classes do not move far from these nursery areas (McKown 1991b).

Possible Interactions

Based on the above, we may be able to predict, for the first year, where interactions between striped bass and bluefish may occur. First, it does not occur during the larval stages because bluefish undergo larval development in the ocean while in striped bass this occurs in the fresh or brackish parts of estuaries. Second, direct or indirect interactions (e.g. competition for forage) are more likely to occur in estuaries during the first summer of life because they can be found in these areas, at somewhat similar sizes. This may be especially true for the larger estuaries (e.g. Hudson River, Delaware Bay) where spawning of striped bass is greater and more consistent and the young-of-the-year are more abundant. Third, interactions are not likely to occur in the fall, winter or spring because bluefish leave the estuaries to enter the ocean for the winter while most striped bass spend the first winter in the estuary where they were spawned.

Literature Cited

The references cited herein are available from the author or from the Subcommittee on Fisheries Conservation, Wildlife and Oceans as Exhibit A.

10

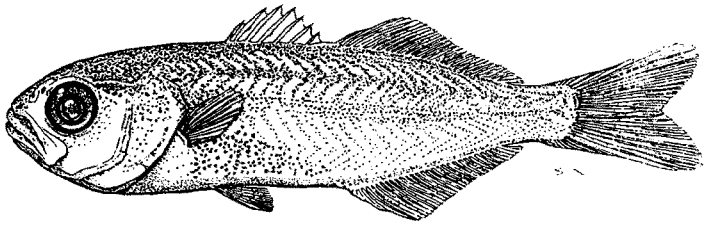

Fig. A. Bluefish (Pomatomus saltatrix) juvenile, 24.3 mm SL (.97" standard length). Collected August 4, 1993, 7-m seine, Great Bay, New Jersey. Illustration: Susan C. Kaiser

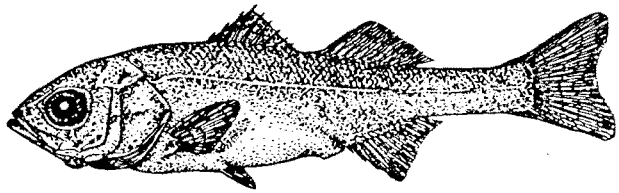

Fig. D. Striped bass (Morone saxatilis) early juvenile, 29.0 mm TL. After Mansueti 1958.

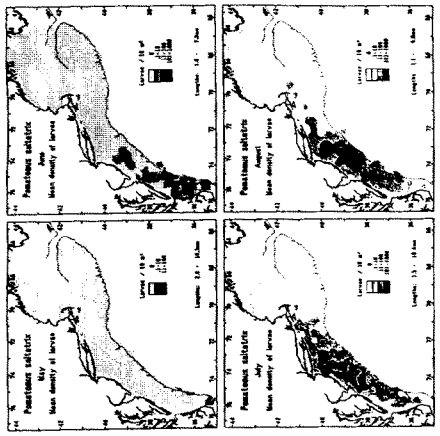

Fig. B. Monthly distributions of bluefish (Pomatomus saltatrix) larvae during MARMAP surveys 1977-1987. Size ranges of larvae collected are indicated in the lower right corner of each panel (after Smith et al. 1994).

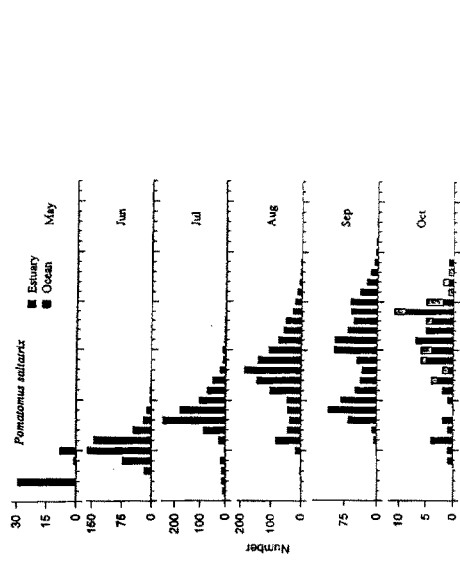

Fig. C. Monthly length frequencies of bluefish (Pomatomus saltatrix) young-of-the-year collected from the Hudson River estuary, Great Bay and Little Egg Inlet. Sources: Thomas et al. 1974; Kahnle 1987; RUMFS: otter trawl (n=66), 1-m beam trawl (n=2) 1-m plankton net (n=35); experimental trap (n=3); LEO-15 2-m beam trawl (n=2); seine (n=24); night light (n=32); gear comparison (n=1); weir (n=1,810)

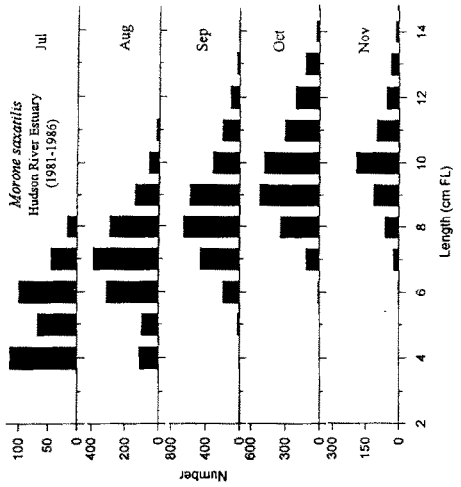

Fig. F. Monthly length frequencies of striped bass young-of-the-year collected from the Hudson River Estuary during bottom-trawl survey of juvenile fishes, 1981-1986 (Kahnle and Hattala 1988). Data from all years combined. Lengths less than 5.0 cm arbitrarily combined as "4.0 cm FL."

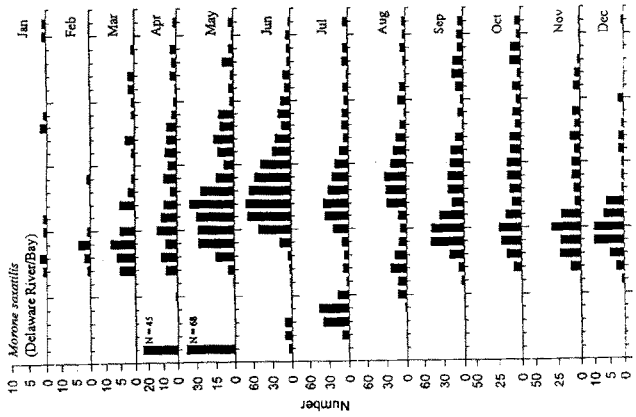

Fig. E Monthly length frequencies of striped bass collected in upper Delaware Bay (1970-1980) and tidal portion of Delaware River (1979-1981). All river collections indicated as 1-cm size class

JERSEY COAST ANGLERS ASSOCIATION
Working For Saltwater Resource & Marine Angler
1201 Route 37 East, Toms River, NJ 08753

Thomas Fote Legislative Chairman
908-270-9102 Fax 908-506-6409

CONGRESSIONAL TESTIMONY
APRIL 21, 199
SUBCOMMITTEE ON FISHERIES, WILDLIFE AND OCEANS

SUBJECT: Interactions of Striped Bass, Bluefish and Forage Species

Thomas P Fote
22 Cruiser Court
Toms River NJ 08753
PH 908-270 9102 Fax 908-506-6409

Jersey Coast Anglers Association would like to thank Congressman James Saxton for holding this field hearing on this important subject in New Jersey and Congressman Frank Pallone for attending this hearing. JCAA is aware that both Congressmen understand the importance of Ecosystem Management to the citizens of New Jersey.

This is a subject near and dear to my heart. The more I learn about fisheries management the more I realize that we can not manage interrelated species one at a time. We keep managing the marine environment species by species when we should be managing the Ecosystem. Ecosystem Management is looking at the interrelationship of species and managing those species by their interdependency on each other and other environmental factors. To me this means that every time we take an action that impacts one species, we need to consider the effect on all species. The marine environment is like a gigantic structure built with many supports. We can pull out one or two of these supports and pretend there is no effect, but the structure will have been weakened. Because the structure has many supports, it is able to sustain the loss of a few. Eventually, however, the stress of the continual undermining of more and more supports results in the collapse of the entire structure. Then people will point at the last support removed as the one

that caused the collapse, but anyone with common sense knows the collapse was imminent as soon as we began removing the original supports.

In the marine environment, every species is a support for the entire ecosystem. We might be able to overfish one species without causing a dramatic change in others. However, once we begin to decimate the food stocks for species like striped bass or bluefish, we cannot help having a serious negative effect on that species' total population. Some species are more adaptable and can find alternative forage sources to augment their diet. Striped bass and bluefish, as juveniles, feed on similar prey. Striped bass are opportunistic feeders. According to a NOAA technical study[1] stomachs of adult stripers have been found to contain alewife, blueback herring, menhaden (locally called bunker), mumichogs, mullet, rock eels, shad, sculpin, silver hake, silversides, smelt, tomcod, weakfish, white perch, lobsters, crabs, shrimp, isopods, gammarid crustaceans, worms, squid, clams and mussels. Over the years, through personal experience, I have seen striped bass feeding on sand eels, American eels, winter flounder, and summer flounder. Striped bass as adults feed by sight, sound (vibrations) and smell. They will eat almost anything that swims in the ocean, bays and rivers. They eat their prey whole because they do not have cutting teeth. When we impact their basic diet, we may not see a dramatic decrease in striped bass population because they adapt by eating something else and have a more varied diet to choose from.

Bluefish, however, have very different feeding habits as adult fish. They are primarily sight feeders[2]. According to the study, adult bluefish consume primarily live fish by eating them whole or by chopping them into pieces. Their feeding is triggered by moving prey. They normally eat menhaden, butterfish, mackerel, squid, mullet, and sand eels. We have seen a faster change in the bluefish population than with striped bass due to the decline of menhaden, squid, sand eels, herring, and butterfish. We can expect any decrease in their normal prey species to have a dramatic and quickly observable effect on the overall population and regional distribution of this species in particular.

When forage species were particularly prevalent in the 1970's, both predator species were eating the same abundant forage species. The abnormally high bluefish and strong striped bass populations during this time could be credited to the concurrent high population of sand eels and menhaden. Just to make the ecosystem point again, the high populations of sand eels are attributed to the collapse of the sea herring fishery in the 1970's because of the overharvesting by foreign fishing vessels. Sea herring are natural predators of sand eels in their larval stage. The population of menhaden rose significantly during the 1970's. This was due to a dramatic decrease in fishmeal production plants along the East Coast. Fishmeal demand dropped because of the increase in soy bean production. With the closing of fishmeal plants we saved the menhaden populations from overharvesting for a while.

Even though striped bass appear more adaptable and able to maintain their numbers over the short haul, if we continue to destroy their forage base, we will eventually see the same result as we have seen with bluefish. The striped bass, because of their ability to adaptable to a wider range of forage species, have a broader support system. Still, we can remove only so many of their

[1] Technical Series Report No.4 "Biological and Fisheries data on striped bass, Morone Saxatilis by W.G Smith and A Wells Stripers"
[2] Species Profiles: Life Histories and Environmental Requirements of Coastal Fishes and Invertebrates (South Atlantic) Bluefish by J.D. Oliver, M.J. Van Den Avyle and E.L. Bozeman, Jr.

supports before the fishery collapses. The problem will not be just the last action we take, but all of the actions we have taken cumulatively over the years.

The species that play important roles in the historical diets of both striped bass and bluefish are menhaden, sand eels, squid, mackerel, shad and river herring. In the last few years, we have seen a collapse in the population of sand eels due to a variety of causes that are difficult to pinpoint. We have seen a dramatic increase in the harvest of menhaden in the New Jersey bait fishery. In 1982, commercial harvesters landed 1,637,357 pounds of menhaden for use as bait. In 1995, New Jersey harvesters landed 36,567,357 pounds ostensibly for the same purpose. The change from 1982 to 1995 represents a 2,100 percent increase in removals. The preliminary numbers for 1996 indicate that processors in Cape May alone have shipped 46 million pounds, another massive increase, even over just 1995 landings. These huge increases in the New Jersey bait harvest represent only a portion of the bait harvest for the entire coast and does not take into account the hundreds of thousands of metric tons of menhaden being stripped from the ocean by commercial boats fishing for the fishmeal reduction industry. To add insult to injury, this bait is being used to fill the dramatically increasing number of crab traps along the East coast and Gulf of Mexico. So, as menhaden populations are decimated, so are the crab populations that striped bass feed on, leaving even fewer prey alternatives for this critically important and economically beneficial species.

In 1986, the squid fishery was very small due to low market demand and the lack of on-shore freezer facilities. Presently the commercial and recreational industries fear that squid stocks are on the verge of collapse because of overharvesting. NMFS has now declared sea herring and mackerel as "underutilized" species so we can safely predict that these species will approach collapse within the next five years. We must change this phony terminology since NMFS' definition of "underutilized" is widely recognized as a death sentence for a species and more closely matches our definition of "on the way to extinction." I will not waste your time with a litany of NMFS failures in the underutilized species category but will simply mention bluefin tuna, sharks, whiting, tilefish, and monkfish. The point is that the historical staple dietary sources of striped bass and bluefish are under attack and will most assuredly damage these and other key predator species viability.

In the 1980's there were numerous articles blaming the collapse of the striped bass and weakfish stocks on the eating habits of bluefish. They were called the "piranhas of the ocean." Now, in the 1990's, we are calling the striped bass piranhas and blaming them for the decrease in the stocks of bluefish, river herring, shad, and crabs. Dr. Lionel Walford, Director of NMFS Sandy Hook Marine Laboratory, studied the rise and fall of striped bass and bluefish populations. His research did not find a correlation between the abundance of one species and the decline of the other species. Will it ever occur to us to blame ourselves?

Whenever I get into discussions about whether one species is responsible for the collapse of another, I am reminded of the article "This Was The Potomac River" by Frederick Tilp. He used the most meticulous records available from colonial times through the 1920's. He indicated that in 1932 the number of shad taken during a usual six week season was 22,500,000 fish. Under similar circumstances the amount of river herring taken was 750,000,000. The record striped bass haul for one seine haul at Sycamore Landing, VA in 1827 was 450 fish averaging 60 pounds. If striped bass are responsible for the decline of river herring and shad, how did they coexist in such

abundance in the early 1800s with hungry 60 pound striped bass in their midst? Using sturgeon as an example of all fish in the Potomac, Mr. Tilp points out that in 1880, 288,000 pounds of sturgeon were landed. By 1890, 60,920 pounds were taken. In 1899, only 45,710 pounds were recorded and in 1976 only 170 pounds were harvested. In the 1990s, we are now discussing closing every sturgeon fishery along the East Coast and the American shad stocks are almost collapsed. Commercial greed and our own shortsighted management strategies are responsible for these and other management follies, not nature.

Nature provides balance very well on its own. It keeps the predator prey relationship in check, but man's greed is the fly in the ointment. For example, look at the lemmings in Alaska. The lemmings go through a cycle that begins at a low number and stocks build through the years when the plants they feed on are in a cycle of abundance. As their stocks increase, the number of predators increase as well. When they become overabundant and overgraze their range, they march en masse into the ocean, drastically reducing their numbers. The following year, the predators, foxes, owls and others, produce fewer offspring. The stocks of both forage species and predators drop in unison and remain in harmony. It is easy to study lemmings because all the dramatic action takes place on land under the watchful eyes of scientists. As a key part of the food chain, changes in the lemming stock are dramatic and easy to observe. The reason I use this analogy is because menhaden, sea herring, mackerel, and butterfish do not reduce their numbers by committing mass suicide, however, humans have mass killing techniques such as purse seines, gill nets, and otter trawls that can accomplish the same results through overfishing, whether stocks are abundant or not. Our techniques have become so sophisticated that we have pushed many species to the brink of extinction.

In the ocean, the study of ecosystem management becomes much more complex. We cannot easily see the changes in stock in the same fashion that we observe changes in the number of lemmings, foxes and owls. For years, menhaden have been a major part of the striped bass and bluefish diet. There are studies to confirm this relationship. When we overharvest menhaden, other species like squid, sand eels and mackerel have historically made up the difference in the diets of striped bass and bluefish. The stocks of these species have now declined and have left few alternatives for supplementing the diet of striped bass and bluefish. For the last thirty years, NMFS has continued to declare some species, especially forage fish, as "underutilized." With the collapse of historical fisheries, many commercial fishermen have begun to harvest these "underutilized" species. There has been a dramatic increase in the harvest of bunker, herring, squid, ling and whiting. Some people do not consider ling and whiting as forage species, but bluefin tuna feed on them regularly. We are totally destroying the delicate ecological balance of nature by our unchecked overfishing and the result will be a dramatic shift in all predator prey relationships in our oceans. We have seen what happens on land when we upset the balance of nature. Flooding, global warming, loss and contamination of potable water, extinction of species, and other man-made catastrophes all take place. When will we ever learn? It is my sincerest hope that the process will begin with this hearing today.

In looking at the available data and the natural history of bluefish and striped bass, clearly there is a paucity of data after 1980. Since the 1980s, we have spent and are continuing to spend millions of dollars on monitoring and modeling of striped bass. In comparison, only a small percentage of the money has been spent on collection of biological information. After 1980, fisheries research placed the emphasis on population analysis, a simple form of "bean counting."

Now, with a reduction in available funds, scientists are directed toward using statistical modeling procedures as a cost saving method. They spend most of their time developing and maintaining these unproven population estimating techniques. Fisheries biologists today receive more training in statistics than in biology. Growing number of economists, statisticians and specialists in population dynamics are sitting on technical committees. Frequently the goal appears to be the development of statistics that look good on paper rather than reflecting what is occurring in the ecosystem. This hearing emphasizes forage species and their interrelationships. However, when we look at ecosystem management we must consider many areas. We must consider habitat loss, chemical contamination, physical change (dams, freshwater withdrawals for irrigation and drinking), and water quality. Without all the pieces to the puzzle, we can not understand the problem and thus never solve the problem.

Release For Tomorrow

Thomas Fote

James A. Donofrio

Executive Director

Recreational Fishing Alliance (RFA)

On behalf of the National Advisory Board and the members of the Recreational Fishing Alliance (RFA), I thank Chairman James Saxton for conducting this hearing. Congressman Saxton you have demonstrated your leadership by renaming the Sub-committee on Fisheries Conservation, Oceans, and Wildlife. Adding the word conservation is a testimony to your commitment to work toward the goal of sustainable fisheries. Also, I want to thank you and your colleague, Congressman Frank Pallone, for working together in the spirit of bi-partisanship for addressing and questioning the National Marine Fisheries Service (NMFS) with regards to the management of the nation's marine resources.

The RFA is a national grassroots lobbying organization that represents the interests of saltwater anglers and the recreational marine industry. The RFA currently has members in forty three states, including all twenty one coastal states, Alaska, Hawaii, and United States protected territories.

It is the opinion of our membership and of our National Advisory Board that the United States has a looming forage fish crisis and is heading in the direction of additional fishery collapses under the current management and thinking.

The marine fisheries of this nation must be managed for the greater benefit of the nation. These resources all interact within the marine eco-system. However, marine fisheries management in this country has been biased toward commercial fishing interests. Fishery management plans (FMPs) have encouraged the export and thus leading to over-exploitation of many of the forage fish species. Foreign nations have no vested interest in the health of our marine eco-system.

Recreational and commercial fishermen can all agree that forage fish management is a prerequisite for healthy and sustainable fish stocks. NMFS has failed to manage fisheries with this consideration. The marine fisheries of this nation have been viewed in the management process as single species stocks, disregarding any and all interaction with other species. If this nation is going to have sustainable fisheries, we must have sustainable forage fish. NMFS has designated most of our valuable forage fish as "underutilized species." That designation is not a scientific definition and is ridiculed by many in the scientific community. As witnessed by some of the stock declines, the "underutilized" species designation amounts to nothing more than a death sentence. These type of "search and destroy" fishery management policies must be halted.

Based on my professional fishing career, that includes thousands of days on the water pursuing both striped bass and bluefish as a professional captain and an owner/operator of a charter fishing boat business, I have observed population cycles with both striped bass and bluefish. Over the years, I have noticed that a strong run of spring mackerel has left coastal waters in New Jersey with a significant amount of "tinker" or juvenile mackerel. These tinker mackerel become a major forage fish of both the striped bass and bluefish, depending on the geographic location.

It is my opinion that both bluefish and striped bass can co-exist with large and healthy populations. However, this is only possible with a large variety of forage fish to support them. It is the competition between these two species for the available forage fish that can add to the dramatic population swings seen in both stocks. Many people believe bluefish is the more aggressive fish when it comes to feeding. From my experience, I can tell you that the striped bass is the dominant species between the two. This fact has been recently been documented on video tape by Michael Laptew, of Laptew Productions. Mr. Laptew's underwater video of striped bass and bluefish habitat clearly shows when the two species feed together, the striped bass is the "boss".

Typically in past years, the season for striped bass would last into the middle of December. From late November until middle December, striped bass and bluefish would be interacting with the mackerel schools. In fact, the tube lures used to catch the targeted striped bass would also attract adult mackerel which would often times be hooked on every tube that was in the water. This clearly demonstrates to me the importance of mackerel as significant forage fish for both striped bass and bluefish at this time of year, as the menhaden stocks had already migrated south.

As I stated earlier, both striped bass and bluefish can co-exist in great numbers as long as there is an enormous supply and variety of forage fish for both species. In years where the forage fish were abundant and healthy, both species had large population numbers. As forage fish harvests and demand increased, fishermen noticed local declines of both species.

Not long ago, the striped bass used to be called the 'squid hound' because its preference for squid. Squid have become over-exploited commercially, and are not seen along the beaches as they were years ago, causing striped bass to feed other forage fish. The menhaden reduction industry has also increased its efforts in northern coastal states that once had large striped bass fisheries in the summer and fall. Regional and state management councils have allowed joint ventures on mackerel and herring and this is also stressing forage fish populations for both of these predators.

The recovering striped bass stocks are further stressing the available biomass of forage fish. These voracious feeders are now competing more heavily for available food. I am doubtful that healthy stocks of striped bass and bluefish can co-exist in any number as long as U.S. commercial harvesters continue to fill the foreign demands for our "underutilized" forage fish.

The disappearance of the larger bluefish populations, I believe, is due to the increase of the striped bass stocks, and the lack of a large enough population of forage fish (mackerel, herring, squid, menhaden) to feed both species. These forage fish are being over-harvested because there is not any multi-species science available that can support a realistic FMP. By default, single specie science remains the "best available" and only science available for fishery managers. It is discouraging to every person who has made their living on the sea to observe fisheries being managed in such a one dimensional manner. One does not need a Ph.D. in fisheries management to recognize the importance of marine species interaction in the sea. On water observation shows us that single species management is a failure.

NMFS, by its own admission, has let eighty two percent of our nation's fisheries become fully-exploited, over-exploited, or collapsed, all because of single species management. This type of management has proven itself to be a failure, it is time for a change. My concerns are shared by the members I represent today and most other fishermen , conservationists, and fishery scientists.

What have we gained?

NMFS has encouraged the over-capitalization of American Fleets, designated numerous species "underutilized," and many state governments are still inviting more foreign investors to buy these precious resources.

It is abominable to think that commercial fishermen are farmers of the sea. Wild fish stocks are not planted. Wild fish stocks belong to every citizen. The Congress must protect these stocks from over-exploitation and foreign greed. Fish are not manufactured goods that can not be viewed with the same

marketing perspective as manufactured trade. Many commercial fishermen argue that we trade with other items, it is not the same with wild fish stocks. This perspective must change. All joint ventures must be halted, the export of forage fish must be stopped until NMFS can provide sound science on species interaction and eco-system management insuring us that there are viable forage fish stocks to support fin fish populations for the United States first. We must not risk shooting ourselves in the foot ecologically for a few industrial fishing operations. The term "underutilized" must be struck from the Magnuson Act and all FMPs. A new way of thinking has to be encouraged and developed if the United States ever wants to have sustainable fisheries.

The Congress must encourage and work with NMFS to seek out realistic science that deals with predator-prey relationships and eco-system management. Remember, in order to have sustainable fisheries, we must first have sustainable forage fish to hold these stocks in our waters.

Thank you for the opportunity to testify on this very important matter. I applaud Congressman Saxton for his leadership in the 105th Congress and on the Sub-committee that he chairs. I am hopeful that these field hearings on the forage fish crisis will be held in all coastal areas of the United States as requested by the Recreational Fishing Alliance.

TESTIMONY OF

Charles E. Bergmann

LUND'S FISHERIES

before the

SUBCOMMITTEE ON FISHERIES CONVERSATION, WILDLIFE, AND OCEANS

COMMITTEE ON RESOURCES

HOUSE OF REPRESENTATIVES

MANAHAWKIN, NEW JERSEY

April 21, 1997

Mr. Chairman and Members of the Committee:

Thank you for giving me the opportunity to testify before you today. I am a member of New Jersey's Marine Fishery Council and the Mid-Atlantic Fishery Council . My testimony today is my own and not that of either of the two Fishery Councils.

Striped bass and bluefish are both opportunistic feeders which not only compete for the same forage but at times in their life cycles seek out each other as a source of forage. To better understand this, one must look to the differences in each of these species.

Striped bass spawn in the estuarine systems along the Atlantic coast. As noted in studies in the Chesapeake Bay, Delaware Bay, Little Egg Harbor, and the Hudson River Estuary, the diets vary within these systems but hold to the same pattern. The very young bass primarily feed on invertebrates (worms, grass shrimp, squid, snails,...) . at age 1, striped bass feed on invertebrates during the first of the year then gradually switch to vertebrates in the latter part of year 1. The diet at this time varies according to which estuary studied. The most common sources of forage include Bay anchovies, Atlantic menhaden, Weakfish, Spot, Herring, Summer Flounder, Naked goby, and Bluefish. After year 2, their diets consist almost entirely of finfish and sand eels.

Bluefish on the other hand spawn offshore and depend entirely on winds and tides to move the larval into the estuaries. During this process, the bluefish larval must pass through large schools of Atlantic Mackerel which are hungry predators of the young bluefish. After surviving the feeding frenzy of the Atlantic Mackerel they must now avoid the increasingly presence of age 2 striped bass. Like the striped bass, the bluefish diet consists primarily of Bay anchovies and Atlantic silversides to year 1. From year 1 through year 2 the diet is mostly Atlantic menhaden, years 2 and older prey upon spots, croakers, and weakfish.

In a study done by New Jersey's Department of Environmental Protection Division of Fish, Game, and Shellfisheries, it was pointed out " Since two-thirds of the recreationally and commercially important fish species along the Atlantic coast are estuarine-dependent at some life stage, the study of estuarine food webs has a number of management implications. Fluctuations in the abundance of estuarine forage organisms may have profound effects on the year-to-year abundance of harvestable fish. In spite of this, management and environmental protection actions have generally been geared to tolerance levels exhibited by target fish species, ignoring the possibly higher sensitivity of their forage base to pollution and habitat loss." This study was done in 1979, and with Mr. Saxton's Clean water bills and the new requirements of essential fish habitat in the Magnuson Stephens Act will surely help to answer this concern.

Many have taken a position that " the harvest of menhaden has increased to a point that there is not enough to hold striped bass and bluefish for recreational anglers". One could answer this with the facts, the harvest of menhaden in the Chesapeake Bay comprises 40% of the total coast harvest and the harvest of striped bass by anglers in the same bay has risen from approximately 130,000 fish in 1990 to over 600,00 fish in 1996. All this was done with 40% of the coast-wide production of menhaden. Earlier this year one group used a forage issue to stop an I.W.P. in New Jersey. This group stated a concern that Atlantic Mackerel is a forage for bluefish, but what has been pointed out, the reverse is true, Atlantic Mackerel prey upon Bluefish. There have been numerous papers done on the feeding habits of both species but little on what affect, if any, the predator-prey relationship has on recruitment of each specie. One study has been approved but as of yet funding has not been appropriated . This research as well as other projects relating to water quality need to be done.

Mr. Chairman, I wish to thank you for your recent meeting with Mr. Schmitten regarding the joint management of squids. As you know squid is another important forage fish which is preyed upon by most species of fish in the ocean. Another of the forage species which we must protect is the Atlantic herring and I invite you to join Mr. LoBiondo in cosponsoring a bill to do this.

Mr. Chairman, I again wish to thank you and assure you the Cape May Seafood Association is prepared to work with you and your staff on the predator-prey issues in the future, as well as to participate in any discussions with other sectors of the commercial and recreational fishing industries. I would be pleased to try and answer any questions you may have.

Some of the papers used are:

1) The Fish Forage Base of the Little Egg Harbor Estuary Patrick J. Festa April, 1979

2) Trophic Resource Partitioning, Diets, and Growth of Sympatric Estuarine Predators Hartman and Brandt 1995

3) Predatory Demand and Impact of Striped Bass, Bluefish, and Weakfish in the Chesapeake Bay: applications of bioenergetics models Hartman and Brandt March 1995

4) Predation by Age-0 Bluefish on Age-0 Anadromous Fishes in the Hudson River Estuary Juanes and Marks 1993

5) Diet of Striped Bass in the Hudson River Estuary Gardinier and Hoff 1982

6) Data Snooping in Response to SAW TOR D for Bluefish: Identify Possible Causes for the Decline in Bluefish Abundance Mark Tercerio NEFSC November 1997

7) Predation By Bluefish In The Lower Hudson River Consolidated Edison Company 20 Feb 1976

8) Interannual Variation in Diet and Condition in Juvenile Bluefish during Estuarine Residency K.D. Friedman, G.C. Garman, A.J. Bejda, A.L. Studholme, and B. Olla 1988

9) Gastric Evacuation Rates of Piscivorous Young-of-the-Year Bluefish Jeffery A. Buckel and David O. Conover AFS 1996

10) Effects of Temperature, Salinity, and Fish Size on Growth and Consumption of Juvenile Bluefish J.A. Buckel, N.D. Steinberg, and D.O. Conover January 1995

11) Opportunist, Selective, and other often-confused terms the predation literature Fabian M. Jaksic 1989

Copies of any report may be obtained by request

○