DEPARTMENT OF COMMERCE

National Oceanic and Atmospheric Administration

RIN 0648–XD214

Takes of Marine Mammals Incidental to Specified Activities; Taking Marine Mammals Incidental to a Marine Geophysical Survey in the Atlantic Ocean off the Eastern Seaboard, August to September 2014 and April to August 2015

AGENCY: National Marine Fisheries Service (NMFS), National Oceanic and Atmospheric Administration (NOAA), Commerce.

ACTION: Notice; proposed Incidental Harassment Authorization; request for comments.

SUMMARY: NMFS has received an application from the United States (U.S.) Geological Survey (USGS), Lamont-Doherty Earth Observatory of Columbia University (L–DEO), and National Science Foundation (NSF) for an Incidental Harassment Authorization (IHA) to take marine mammals, by harassment, incidental to conducting a marine geophysical (seismic) survey in the Atlantic Ocean off the Eastern Seaboard, August to September 2014 and April to August 2015. Pursuant to the Marine Mammal Protection Act (MMPA), NMFS is requesting comments on its proposal to issue an IHA to USGS to incidentally harass, by Level B harassment only, 34 species of marine mammals during the specified activity.

DATES: Comments and information must be received no later than July 23, 2014.

ADDRESSES: Comments on the application should be addressed to Jolie Harrison, Supervisor, Permits and Conservation Division, Office of Protected Resources, National Marine Fisheries Service, 1315 East-West Highway, Silver Spring, MD 20910. The mailbox address for providing email comments is *ITP.Goldstein@noaa.gov*. Please include 0648–XD214 in the subject line. Comments sent via email, including all attachments, must not exceed a 25-megabyte file size. NMFS is not responsible for email comments sent to addresses other than the one provided here.

Instructions: All comments received are a part of the public record and will generally be posted to *http://www.nmfs.noaa.gov/pr/permits/incidental.htm#applications* without change. All Personal Identifying Information (for example, name, address, etc.) voluntarily submitted by the commenter may be publicly accessible. Do not submit Confidential Business Information or otherwise sensitive or protected information.

An electronic copy of the application may be obtained by writing to the address specified above, telephoning the contact listed below (see **FOR FURTHER INFORMATION CONTACT**) or visiting the Internet at: *http://www.nmfs.noaa.gov/pr/permits/incidental.htm#applications*. The following associated documents are also available at the same internet address: ''Draft Environmental Assessment for Seismic Reflection Scientific Research Surveys during 2014 and 2015 in Support of Mapping the U.S. Atlantic Seaboard Extended Continental Margin and Investigating Tsunami Hazards.'' Documents cited in this notice may also be viewed, by appointment, during regular business hours, at the aforementioned address.

The USGS, which is funding the proposed seismic survey, included with its application a ''Draft Environmental Assessment for Seismic Reflection Scientific Research Surveys during 2014 and 2015 in Support of Mapping the U.S. Atlantic Seaboard Extended Continental Margin and Investigating Tsunami Hazards,'' prepared by RPS Evan-Hamilton, Inc. in association with YOLO Environmental, Inc., GeoSpatial Strategy Group, and Ecology and Environment, Inc., on behalf of USGS, which is also available at the same internet address. Documents cited in this notice may be viewed, by appointment, during regular business hours, at the aforementioned address.

FOR FURTHER INFORMATION CONTACT: Howard Goldstein or Jolie Harrison, Office of Protected Resources, NMFS, 301–427–8401.

SUPPLEMENTARY INFORMATION:

Background

Section 101(a)(5)(A) and (D) of the MMPA (16 U.S.C. 1361 *et seq.*), directs the Secretary of Commerce (Secretary) to allow, upon request, the incidental, but not intentional, taking of small numbers of marine mammals, by United States citizens who engage in a specified activity (other than commercial fishing) within a specified geographical region if certain findings are made and either regulations are issued or, if the taking is limited to harassment, a notice of a proposed authorization is provided to the public for review.

An authorization for the incidental takings shall be granted if NMFS finds that the taking will have a negligible impact on the species or stock(s), and will not have an unmitigable adverse impact on the availability of the species or stock(s) for subsistence uses (where relevant), and if the permissible methods of taking requirements pertaining to the mitigation, monitoring and reporting of such takings are set forth. NMFS has defined ''negligible impact'' in 50 CFR 216.103 as ''. . . an impact resulting from the specified activity that cannot be reasonably expected to, and is not reasonably likely to, adversely affect the species or stock through effects on annual rates of recruitment or survival.''

Except with respect to certain activities not pertinent here, the MMPA defines ''harassment'' as: Any act of pursuit, torment, or annoyance which (i) has the potential to injure a marine mammal or marine mammal stock in the wild [Level A harassment]; or (ii) has the potential to disturb a marine mammal or marine mammal stock in the wild by causing disruption of behavioral patterns, including, but not limited to, migration, breathing, nursing, breeding, feeding, or sheltering [Level B harassment].

Summary of Request

On March 27, 2014, NMFS received an application from the USGS, L–DEO, and NSF (hereafter referred to as USGS) requesting that NMFS issue an IHA for the take, by Level B harassment only, of small numbers of marine mammals incidental to conducting a marine seismic survey within the Exclusive Economic Zone (EEZ) and on the high seas (i.e., International Waters) to map the U.S. Atlantic Eastern Seaboard Extended Continental Shelf (ECS) region and investigate tsunami hazards during August to September 2014 and April to August 2015. USGS plan to use one source vessel, the R/V *Marcus G. Langseth* (*Langseth*) and a seismic airgun array and a hydrophone streamer to collect seismic data as part of the proposed seismic survey in the Atlantic Ocean off the Eastern Seaboard. In addition to the proposed operation of the seismic airgun array and hydrophone streamer, USGS intends to operate a multi-beam echosounder and a sub-bottom profiler continuously during the seismic operations in order to map the ocean floor. The multi-beam echosounder and sub-bottom profiler would not be operated during transits at the beginning and end of the seismic survey. NMFS determined that the IHA application was adequate and complete on May 14, 2014.

Acoustic stimuli (i.e., increased underwater sound) generated during the operation of the seismic airgun array are likely to result in the take of marine mammals. Take, by Level B harassment only, of individuals of 34 species of marine mammals is anticipated to result from the proposed specified activity. Take is not expected to result from the use of the multi-beam echosounder or sub-bottom profiler, for reasons discussed in this notice; nor is take expected to result from collision with the source vessel because it is a single vessel moving at a relatively slow speed (4.5 knots [kts]; 8.5 kilometers per hour [km/hr]; 5.3 miles per hour [mph]) during seismic acquisition within the survey, for a relatively short period of time (approximately two 17 to 18 day legs), and it is likely that any marine mammal would be able to avoid the vessel.

Description of the Proposed Specified Activity

Overview

USGS plans to conduct a marine seismic survey within the EEZ and on the high seas to map the U.S. Atlantic Eastern Seaboard ECS region and investigate tsunami hazards during August to September 2014 and April to August 2015. USGS proposes to use one source vessel, the *Langseth,* and a 36-airgun array and one 8 kilometer (km) (4.3 nautical mile [nmi]) hydrophone streamer to conduct the conventional seismic survey. In addition to the operations of airguns, the USGS intends to operate a multi-beam echosounder and a sub-bottom profiler on the *Langseth* during the proposed seismic survey to map the ocean floor.

Dates and Duration

The *Langseth* would depart from Newark, New Jersey on August 15, 2014. The seismic survey is expected to take approximately 16 days to complete. Approximately one day transit would be required at the beginning and end of the program. When the 2014 survey is completed, the *Langseth* would then transit to Norfolk, Virginia. The survey schedule is inclusive of weather and other contingency (e.g., equipment failure) time. The proposed activities for 2015 would be virtually identical to the proposed activities for 2014 as geographic area, duration, and trackline coverage are similar. The exact dates for the proposed activities in 2015 are uncertain, but are scheduled to occur within the April to August timeframe. The exact dates of the proposed activities depend on logistics and weather conditions.

Specified Geographic Region

The proposed survey would be bounded by the following geographic coordinates:

40.5694° North, −66.5324° West;
38.5808° North, −61.7105° West;
29.2456° North, −72.6766° West;
33.1752° North, −75.8697° West;
39.1583° North, −72.8697° West;

The proposed activities for 2014 would generally occur towards the periphery of the proposed study area (see Figures 1 and 2 of the IHA application). The proposed activities for 2015 would survey more of the central portions of the study area. The tracklines proposed for both 2014 and 2015 would be in International Waters (approximately 80% in 2014 and 90% in 2015) and in the U.S. EEZ. Water depths range from approximately 1,450 to 5,400 meters (m) (4,593.2 to 17,716.5 feet [ft]) (see Figure 1 and 2 of the IHA application); no survey lines would extend to water depths less than 1,000 m.

Detailed Description of the Proposed Specified Activity

USGS, Coastal and Marine Geology Program, (Primary Investigator [PI], Dr. Deborah Hutchinson) proposes to conduct a regional high-energy, two-dimensional (2D) seismic survey in the northwest Atlantic Ocean within the U.S. EEZ and extending into International Waters as far as 648.2 km (350 nmi) from the U.S. coast (see Figure 1 of the IHA application). Water depths in the survey area range from approximately 1,400 to greater than 5,400 meters (m) (4,593.2 to 17,716.5 feet [ft]). The proposed seismic survey would be scheduled to occur in two phases; the first phase during August to September 2014 (for approximately 17 to 18 days), and the second phase between April and August 2015 (for approximately 17 to 18 days, specific dates to be determined). The proposed activities for both Phase 1 and Phase 2 are included in this IHA application (see Figure 2 of the IHA application). Some minor deviation from these dates is possible, depending on logistics and weather.

USGS proposes to use conventional seismic methodology to: (1) Identify the outer limits of the U.S. continental shelf, also referred to as the ECS as defined by Article 76 of the Convention of the Law of the Sea; and (2) study the sudden mass transport of sediments down the continental shelf as submarine landslides that may pose significant tsunamigenic (i.e., tsunami-related) hazards to the Atlantic and Caribbean coastal communities.

The proposed survey would involve one source vessel, the *Langseth*. The *Langseth* would deploy an array of 36 airguns as an energy source with a total volume of approximately 6,600 in^3. The receiving system would consist of one 8,000 m (26,246.7 ft) hydrophone streamer. As the airgun array is towed along the survey lines, the hydrophone streamer would receive the returning acoustic signals from the towed airgun array and transfer the data to the on-board processing system. The data would be processed on-board the *Langseth* as the survey occurs.

Each proposed leg of the survey (2014 and 2015) would be 17 to 18 days in duration (exclusive of transit and equipment deployment and recovery) and would comprise of approximately 3,165 km (1,709 nmi) of tracklines of 2D seismic reflection coverage. The airgun array would operate continuously during the proposed survey (except for equipment testing, repairs, implemented mitigation measures, etc.). Data would continue to be acquired between line changes, as the successive track segments can be surveyed as almost one continuous line. Line turns of 90 and no greater than 120 degrees would be required to move from one line segment to the next. The 2014 proposed survey design consists primarily of the tracklines that run along the periphery of the overall study area, including several internal tracklines (see Figure 2 of the IHA application). The 2015 proposed survey design consists of additional dip and tie lines (i.e., dip lines are lines that are perpendicular to the north-south trend of the continental margin; strike lines are parallel to the margin; and tie lines are any line that connects other lines). The 2015 proposed survey design may be modified based on the 2014 results.

In addition to the operations of the airgun array, a Kongsberg EM 122 multi-beam echosounder and a Knudsen Model 3260 Chirp sub-bottom profiler would also be operated from the *Langseth* continuously during airgun operations throughout the survey to map the ocean floor. The multi-beam and sub-bottom profiler would not operate during transits at the beginning and end of the survey. All planned geophysical data acquisition activities would be conducted by USGS with on-board assistance by the scientists who have proposed the study. The vessel would be self-contained, and the crew would live aboard the vessel for the entire cruise.

Vessel Specifications

The *Langseth,* a seismic research vessel owned by the National Science Foundation (NSF) and operated by the Lamont-Doherty Earth Observatory of Columbia University (L–DEO), would tow the 36 airgun array, as well as the hydrophone streamer(s), along predetermined lines (see Figure 2 of the IHA application). When the *Langseth* is towing the airgun array and the hydrophone streamer(s), the turning rate of the vessel is limited to three degrees per minute (2.5 km [1.5 mi]). Thus, the maneuverability of the vessel is limited during operations with the streamer. The vessel would ''fly'' the appropriate U.S. Coast Guard-approved day shapes (mast head signals used to communicate with other vessels) and display the appropriate lighting to designate the vessel has limited maneuverability.

The vessel has a length of 71.5 m (235 ft); a beam of 17.0 m (56 ft); a maximum draft of 5.9 m (19 ft); and a gross tonnage of 3,834. The *Langseth* was designed as a seismic research vessel with a propulsion system designed to be as quiet as possible to avoid interference with the seismic signals emanating from the airgun array. The ship is powered by two 3,550 horsepower (hp) Bergen BRG–6 diesel engines which drive two propellers directly. Each propeller has four blades and the shaft typically rotates at 750 revolutions per minute. The vessel also has an 800 hp bowthruster, which is not used during seismic acquisition. The *Langseth's* operation speed during seismic data acquisition is typically 7.4 to 9.3 km per hour (hr) (km/hr) (4 to 5 knots [kts]). When not towing seismic survey gear, the *Langseth* typically cruises at 18.5 to 24 km/hr (10 to 12 kts). The *Langseth* has a range of 25,000 km (13,499 nmi) (the distance the vessel can travel without refueling).

The vessel also has an observation tower from which Protected Species Visual Observers (PSVO) would watch for marine mammals before and during the proposed airgun operations. When stationed on the observation platform, the PSVO's eye level would be approximately 21.5 m (71 ft) above sea level providing the PSVO an unobstructed view around the entire vessel. More details of the *Langseth* can be found in the IHA application and the ''Final Programmatic Environmental Impact Statement/Overseas Environmental Impact Statement for Marine Seismic Research funded by the National Science Foundation or Conducted by the U.S. Geological Survey'' (2011) and the Record of Decision (2012) (NSF/USGS PEIS).

Acoustic Source Specifications

Seismic Airguns

The *Langseth* would deploy a 36-airgun array, consisting of two 18 airgun (plus 2 spares) sub-arrays. Each sub-array would have a volume of approximately 3,300 cubic inches (in^3) for a total volume of 6,600 in^3 for the 36-airgun array. The airgun array would consist of a mixture of Bolt 1500LL and Bolt 1900LLX airguns ranging in size from 40 to 360 in^3, with a firing pressure of 1,900 pounds per square inch (psi). The 18 airgun sub-arrays would be configured as two identical linear arrays or ''strings'' (see Figure 2.11 of the NSF/USGS PEIS). Each string would have 10 airguns, with the first and last airguns in the strings spaced 16 m (52.5 ft) apart. Of the 10 airguns, nine airguns in each string would be fired simultaneously (1,650 in^3), whereas the tenth would be kept in reserve as a spare, to be turned on in case of failure of another airgun. The sub-arrays would be fired simultaneously during the survey. The two airgun sub-arrays would be distributed across an area of approximately 12 x 16 m (40 x 52.5 ft) behind the *Langseth* and would be towed approximately 140 m (459.3 ft) behind the vessel. Discharge intervals depend on both the ship's speed. The shot interval would be 50 m (164 ft) during the study. The shot interval would be approximately 20 to 24 seconds (s) based on an assumed boat speed of 4.5 knots. During firing, a brief (approximately 0.1 s) pulse sound is emitted; the airguns would be silent during the intervening periods. The dominant frequency components range from 2 to 188 Hertz (Hz). The firing pressure of the airgun array is 2,000 pounds per square inch (psi).

The tow depth of the airgun array would be 9 m (29.5 ft) during the surveys. Because the actual source is a distributed sound source (36 airguns) rather than a single point source, the highest sound measurable at any location in the water would be less than the nominal source level. In addition, the effective source level for sound propagating in near-horizontal directions would be substantially lower than the nominal omni-directional source level applicable to downward propagation because of the directional nature of the sound from the airgun array (i.e., sound is directed downward).

Hydrophone Streamer

Acoustic signals would be recorded using a system array of one hydrophone streamer, which would be towed behind the *Langseth.* The streamer is Thompson-Marconi SENTRY solid cable construction and is approximately 8 km long. Cable-leveling birds would be used to keep the streamer cable and hydrophone at a constant depth. Cable-leveling birds would be spaced every 300 m (984.3 ft) with extra redundancy at the head and tail sections.

Metrics Used in This Document

This section includes a brief explanation of the sound measurements frequently used in the discussions of acoustic effects in this document. Sound pressure is the sound force per unit area, and is usually measured in micropascals (μPa), where 1 pascal (Pa) is the pressure resulting from a force of one newton exerted over an area of one square meter. Sound pressure level (SPL) is expressed as the ratio of a measured sound pressure and a reference level. The commonly used reference pressure level in underwater acoustics is 1 μPa, and the units for SPLs are dB re 1 μPa. SPL (in decibels [dB]) = 20 log (pressure/reference pressure).

SPL is an instantaneous measurement and can be expressed as the peak, the peak-to-peak (p-p), or the root mean square (rms). Root mean square (rms), which is the square root of the arithmetic average of the squared instantaneous pressure values, is typically used in discussions of the effects of sounds on vertebrates and all references to SPL in this document refer to the root mean square unless otherwise noted.

Characteristics of the Airgun Pulses

Airguns function by venting high-pressure air into the water, which creates an air bubble. The pressure signature of an individual airgun consists of a sharp rise and then fall in pressure, followed by several positive and negative pressure excursions caused by the oscillation of the resulting air bubble. The oscillation of the air bubble transmits sounds downward through the seafloor and the amount of sound transmitted in the near horizontal directions is reduced. However, the airgun array also emits sounds that travel horizontally toward non-target areas.

The nominal source levels of the airgun arrays used by L–DEO on the *Langseth* are 236 to 265 dB re 1 μPa (p-p) and the rms value for a given airgun pulse is typically 16 dB re 1 μPa lower than the peak-to-peak value (Greene, 1997; McCauley *et al.,* 1998, 2000a). However, the difference between rms and peak or peak-to-peak values for a given pulse depends on the frequency content and duration of the pulse, among other factors.

Accordingly, L–DEO has predicted the received sound levels in relation to distance and direction from the 36 airgun array and the single Bolt 1900LL 40 in^3 airgun, which would be used during power-downs. A detailed description of L–DEO modeling for this survey's marine seismic source arrays for protected species mitigation is provided in the NSF/USGS PEIS (see Appendix H). NMFS refers the reviewers to the IHA application and NSF/USGS PEIS documents for additional information.

Predicted Sound Levels for the Airguns

Tolstoy *et al.* (2009) and Diebold *et al.* (2010) reported results for propagation measurements of pulses from the *Langseth*'s 36 airgun, 6,600 in³ array in shallow water (approximately 50 m [164 ft]), intermediate water (a slope site), and deep water depths (approximately 1,600 m [5,249 ft]) in the Gulf of Mexico in 2007 and 2008. Results of the Gulf of Mexico calibration study (Tolstoy *et al.,* 2009; Diebold *et al.,* 2010) showed that radii around the airguns for various received levels varied with water depth and that sound propagation varied with array tow depth.

The L–DEO used the results from the Gulf of Mexico study to determine the algorithm for its model that calculates the mitigation exclusion zones for the 36-airgun array and the single airgun. L–DEO has used these calculated values to determine buffer (i.e., 160 dB) and exclusion zones for the 36 airgun array and previously modeled measurements by L–DEO for the single airgun, to designate exclusion zones for purposes of mitigation, and to estimate take for marine mammals in the northwest Atlantic Ocean. A detailed description of the modeling effort is provided in the NSF/USGS PEIS.

Comparison of the Tolstoy *et al.* (2009) calibration study with the L–DEO's model for the *Langseth'*s 36-airgun array indicates that the model represents the actual received levels, within the first few kilometers and the locations of the predicted exclusion zones. However, the model for deep water (greater than 1,000 m; 3,280 ft) overestimated the received sound levels at a given distance but is still valid for defining exclusion zones at various tow depths. Because the tow depth of the array in the calibration study is less shallow (6 m [19.7 ft]) than the tow depths in the proposed survey (9 m [29.5 ft]), L–DEO used the following correction factors for estimating the received levels during the proposed surveys (see Table 1). The correction factors are the ratios of the 160, 180, and 190 dB distances from the modeled results for the 6,600 in³ airgun arrays towed at 6 m (19.7 ft) versus 9, 12, or 15 m (29.5, 39.4, or 49.2 ft) (LGL, 2008). For a single airgun, the tow depth has minimal effect on the maximum near-field output and the shape of the frequency spectrum for the single airgun; thus, the predicted exclusion zones are essentially the same at different tow depths. The L–DEO's model does not allow for bottom interactions, and thus is most directly applicable to deep water.

Using the model (airgun array and single airgun), Table 1 (below) shows the distances at which three rms sound levels are expected to be received from the 36 airgun array and a single airgun. To avoid the potential for injury or permanent physiological damage (Level A harassment), NMFS's (1995, 2000) current practice is that cetaceans and pinnipeds should not be exposed to pulsed underwater noise at received levels exceeding 180 dB re 1 μPa and 190 dB re 1 μPa, respectively. L–DEO used these levels to establish the proposed exclusion zones. If marine mammals are detected within or about to enter the appropriate exclusion zone, the airguns would be powered-down (or shut-down, if necessary) immediately. NMFS also assumes that marine mammals exposed to levels exceeding 160 dB re 1 μPa may experience Level B harassment. Table 1 summarizes the predicted distances at which sound levels (160, 180, and 190 dB [rms]) are expected to be received from the 36 airgun array and a single airgun operating in deep water depths.

TABLE 1—MEASURED (ARRAY) OR PREDICTED (SINGLE AIRGUN) DISTANCES TO WHICH SOUND LEVELS ≥190, 180, AND 160 DB RE 1 μPA (RMS) COULD BE RECEIVED IN DEEP WATER DURING THE PROPOSED SEISMIC SURVEY IN THE NORTHWEST ATLANTIC OCEAN OFF THE EASTERN SEABOARD, AUGUST TO SEPTEMBER 2014 AND APRIL TO AUGUST 2015

Sound source and volume	Tow depth (m)	Water depth (m)	Predicted RMS radii distances (m)		
			190 dB	180 dB	160 dB
Single Bolt airgun (40 in³)	9	>1,000	13 m (42.7 ft) *100 m would be used for pinnipeds as well as cetaceans.	100 m (328.1 ft)	388 m (1,273 ft).
36 airguns (6,600 in³)	9	>1,000	286 m (938.3 ft)	927 m (3,041.3 ft)	5,780 m (18,963.3 ft).

Along with the airgun operations, two additional acoustical data acquisition systems would be operated from the *Langseth* continuously during seismic operations during the survey. The ocean floor would be mapped with the Kongsberg EM 122 multi-beam echosounder and a Knudsen 320B sub-bottom profiler. These sound sources would be operated continuously from the *Langseth* throughout the cruise, except for during transits at the beginning and end of the proposed survey.

Multi-Beam Echosounder

The *Langseth* would operate a Kongsberg EM 122 multi-beam echosounder concurrently during airgun operations to map characteristics of the ocean floor. The hull-mounted multi-beam echosounder emits brief pulses of sound (also called a ping) (10.5 to 13, usually 12 kHz) in a fan-shaped beam that extends downward and to the sides of the ship. The transmitting beamwidth is 1° or 2° fore-aft and 150° athwartship and the maximum source level is 242 dB re 1 μPa.

Each ping consists of eight (in water greater than 1,000 m) or four (less than 1,000 m) successive, fan-shaped transmissions, each ensonifying a sector that extends 1° fore-aft. Continuous-wave pulses increase from 2 to 15 milliseconds (ms) long in water depths up to 2,600 m (8,350.2 ft), and frequency modulated (FM) chirp pulses up to 100 ms long are used in water greater than 2,600 m. The successive transmissions span an overall cross-track angular extent of about 150°, with 2 ms gaps between the pulses for successive sectors (see Table 1 of the IHA application).

Sub-Bottom Profiler

The *Langseth* would also operate a Knudsen Chirp 3260 sub-bottom profiler continuously throughout the cruise simultaneously with the multi-beam echosounder to map and provide information about the sedimentary features and bottom topography. The beam is transmitted as a 27° cone, which is directed downward by a 3.5 kHz transducer in the hull of the *Langseth.* The nominal power output is 10 kilowatts (kW), but the actual maximum radiated power is 3 kW or 222 dB re 1 μPam. The ping duration is up to 64 milliseconds (ms). The ping interval is three to five seconds, depending on water depth. The sub-bottom profiler is capable of reaching water depths of 10,000 m (32,808.4 ft) and penetrating tens of meters into the sediments.

Both the multi-beam echosounder and sub-bottom profiler are operated continuously during survey operations. The multi-beam echosounder and sub-bottom profiler would not operate during transits at the beginning and end of the proposed seismic survey. Actual operating parameters would be established at the time of the survey.

NMFS expects that acoustic stimuli resulting from the proposed operation of the single airgun or the 36 airgun array has the potential to harass marine mammals. NMFS does not expect that the movement of the *Langseth,* during the conduct of the seismic survey, has the potential to harass marine mammals because of the relatively slow operation speed of the vessel (approximately 4.5 knots [kts]; 8.5 km/hr; 5.3 mph) during seismic acquisition.

Description of the Marine Mammals in the Area of the Proposed Specified Activity

Forty-five species of marine mammal (37 cetaceans [whales, dolphins, and porpoises] including 30 odontocetes and 7 mysticetes, 7 pinnipeds [seals and sea lions], and 1 sirenian [manatees]) are known to occur in the western North Atlantic Ocean study area (Read *et al.,* 2009; Waring *et al.,* 2013). Of those 45 species of marine mammals, 34 cetaceans and 4 pinnipeds could be found or are likely to occur in the proposed study area during the spring/summer/fall months. Several of these species are listed as endangered under the U.S. Endangered Species Act of 1973 (ESA; 16 U.S.C. 1531 *et seq.*), including the North Atlantic right (*Eubalaena glacialis*), humpback (*Megaptera novaeangliae*), sei (*Balaenoptera borealis*), fin (*Balaenoptera physalus*), blue (*Balaenoptera musculus*), and sperm (*Physeter macrocephalus*) whales. Fourteen cetacean species, although present in the wider western North Atlantic Ocean, are considered rare and likely would not be found near the proposed study area. The harbor porpoise (*Phocoena phocoena*) does not occur in deep offshore waters. The four pinniped species (harbor [*Phoca vitulina*], harp [*Phoca groenlandica*], gray [*Halichoerus grypus*], and hooded [*Cystophora cristata*] seals) are also considered coastal species (any sightings would be considered extralimital) and are not known to occur in the deep waters of the proposed survey area. No pinnipeds are expected to be present in the proposed study area. The West Indian manatee (*Trichechus manatus latirostris*) is listed as endangered under the ESA and is managed by the U.S. Fish and Wildlife Service and is not considered further in this proposed IHA notice.

General information on the taxonomy, ecology, distribution, seasonality and movements, and acoustic capabilities of marine mammals are given in sections 3.6.1, 3.7.1, and 3.8.1 of the NSF/USGS PEIS. The general distribution of mysticetes, odontocetes, and pinnipeds in the North Atlantic Ocean is discussed in sections 3.6.3.4, 3.7.3.4, and 3.8.3.4 of the NSF/USGS PEIS, respectively. In addition, Section 3.1 of the ''Atlantic OCS Proposed Geological and Geophysical Activities Mid-Atlantic and South Atlantic Planning Areas Draft Programmatic Environmental Impact Statement'' (Bureau of Ocean Energy Management, 2012) reviews similar information for all marine mammals that may occur within the proposed study area.

Various systematic surveys have been conducted throughout the western North Atlantic Ocean, including within sections of the proposed study area. Records from the Ocean Biogeographic Information System (OBIS) database hosted by Rutgers University and Duke University (Read *et al.,* 2009) were used as the main source of information. The database includes survey data collected during the Cetaceans and Turtle Assessment Program (CeTAP) conducted between 1978 and 1982 that consists of both aerial and vessel-based surveys between Cape Hatteras, North Carolina, and the Gulf of Maine. The database also includes survey data collected during the NMFS Northeast Fisheries Science Center and Southeast Fisheries Science Center stock assessment surveys conducted in 2004 (surveys between Nova Scotia, Canada, and Florida).

No known current regional or stock abundance estimates are available in the proposed study area of the northwest Atlantic Ocean for the Bryde's whale (*Balaenoptera edeni*), Fraser's (*Lagenodelphis hosei*), spinner (*Stenella longirostris*), and Clymene dolphin (*Stenella clymene*), and melon-headed (*Peponocephala electra*), pygmy killer (*Feresa attenuata*), false killer (*Pseudorca crassidens*), and killer whales (*Orcinus orca*). Although NMFS does not have current regional population or stock abundance estimates for these species in the northwest Atlantic Ocean, abundance estimates from other areas such as the northern Gulf of Mexico stock, regional ocean basins (e.g., eastern tropical Pacific Ocean), or global summation are available. These abundance estimates are considered the best available information.

Bryde's whales are distributed worldwide in tropical and sub-tropical waters. In the western North Atlantic Ocean, Bryde's whales are reported from off the southeastern U.S. and the southern West Indies to Cabo Frio, Brazil (Leatherwood and Reeves, 1983). No stock of Bryde's whales has been identified in U.S. waters of the Atlantic coast. The northern Gulf of Mexico population is considered a separate stock and has a best abundance estimate of 33 animals. It has been postulated that the Bryde's whales found in the northern Gulf of Mexico may represent a resident stock (Schmidly, 1981; Leatherwood and Reeves, 1983).

Fraser's dolphins are distributed worldwide in tropical waters and are assumed to be part of the cetacean fauna of the tropical western North Atlantic (Perrin *et al.,* 1994). There are no abundance estimates for either the western North Atlantic or the northern Gulf of Mexico stocks. The western North Atlantic population is provisionally being considered a separate stock for management purposes, although there is currently no information to differentiate this stock from the northern Gulf of Mexico stock. The numbers of Fraser's dolphins off the U.S. or Canadian Atlantic coast are unknown, and seasonal abundance estimates are not available for this stock, since it was rarely seen in any surveys. The population size for Fraser's dolphins is unknown; however, about 289,000 animals occur in the eastern tropical Pacific Ocean (Jefferson *et al.,* 2008).

Spinner dolphins are distributed in oceanic and coastal tropical waters (Leatherwood *et al.,* 1976). This is presumably an offshore, deep-water species, and its distribution in the Atlantic is poorly known (Schmidly, 1981; Perrin and Gilpatrick, 1994). The western North Atlantic population of spinner dolphins is provisionally being considered a separate stock for management purposes, although there is currently no information to differentiate this stock from the northern Gulf of Mexico stock. The numbers of spinner dolphins off the U.S. or Canadian Atlantic coast are unknown, and seasonal abundance estimates are not available for this stock since it was rarely seen in any of the surveys. The best abundance estimate available for the northern Gulf of Mexico spinner dolphins is 11,441 animals.

The Clymene dolphin is endemic to tropical and sub-tropical waters of the Atlantic (Jefferson and Curry, 2003). The western North Atlantic population of Clymene dolphins is provisionally considered a separate stock for management purposes, although there is currently no information to differentiate this stock from the northern Gulf of Mexico stock. The numbers of Clymene dolphins off the U.S. or Canadian Atlantic coast are unknown, and seasonal abundance estimates are not available for this species since it was rarely seen in any surveys. The best abundance estimate for the Clymene dolphin in the western North Atlantic was 6,086 in 2003 and represents the first and only estimate to date for this species in the U.S. Atlantic EEZ; however this estimate is older than eight years and is deemed unreliable (Wade and Angliss, 1997; Mullin and Fulling, 2003).

The melon-headed whale is distributed worldwide in tropical to sub-tropical waters (Jefferson *et al.,* 1994). The western North Atlantic population is provisionally being considered a separate stock from the northern Gulf of Mexico stock. The numbers of melon-headed whales off the U.S. or Canadian Atlantic coast are unknown, and seasonal abundance estimates are not available for this stock, since it was rarely seen in any surveys. The best abundance estimate available for northern Gulf of Mexico melon-headed whales is 2,235 animals.

The pygmy killer whale is distributed worldwide in tropical to sub-tropical waters and is assumed to be part of the cetacean fauna of the tropical western North Atlantic (Jefferson *et al.,* 1994). The western North Atlantic population of pygmy killer whales is provisionally being considered one stock for management purposes. The numbers of pygmy killer whales off the U.S. or Canadian Atlantic coast are unknown, and seasonal abundance estimates are not available for this stock, since it was rarely seen in any surveys. The best abundance estimate available for the northern Gulf of Mexico pygmy killer whale is 152 animals.

The false killer whale is distributed worldwide throughout warm temperate and tropical oceans (Leatherwood and Reeves, 1983). No stock has been identified for false killer whales in U.S. waters off the Atlantic coast. The Gulf of Mexico population is provisionally being considered one stock for management purposes, although there is currently no information to differentiate this stock from the Atlantic Ocean stock. The current population size for the false killer whale in the northern Gulf of Mexico is unknown because the survey data is more than 8 years old; however, the most recent abundance estimate pooled from 2003 to 2004 was 777 animals (Wade and Angliss, 1997; Mullin, 2007).

Killer whales are characterized as uncommon or rare in waters of the U.S. Atlantic EEZ (Katona *et al.,* 1988). Their distribution, however, extends from the Arctic ice-edge to the West Indies, often in offshore and mid-ocean areas. The size of the western North Atlantic stock population off the eastern U.S. coast is unknown. No information on stock differentiation for the Atlantic Ocean population exists, although an analysis of vocalizations of killer whales from Iceland and Norway indicated that whales from these areas may represent different stocks (Moore *et al.,* 1988). The northern Gulf of Mexico population is provisionally being considered a separate stock for management purposes, although there is currently no information to differentiate this stock from the Atlantic Ocean stock. The best abundance estimate available for northern Gulf of Mexico killer whales is 28 animals. There are estimated to be at least approximately 92,500 killer whales worldwide (i.e., 80,000 south of Antarctic Convergence, 445 in Norway, 8,500 in eastern tropical Pacific Ocean, 1,500 in North America coastal waters, and 2,000 in Japanese waters) (Jefferson *et al.,* 2008).Table 2 (below) presents information on the abundance, distribution, population status, and conservation status of the species of marine mammals that may occur in the proposed study area during August to September 2014 and April to August 2015.

TABLE 2—THE HABITAT, OCCURRENCE, RANGE, ABUNDANCE, AND CONSERVATION STATUS OF MARINE MAMMALS THAT MAY OCCUR IN OR NEAR THE PROPOSED SEISMIC SURVEY AREA IN THE NORTHWEST ATLANTIC OCEAN OFF THE EASTERN SEABOARD

[See text and Table 3 in USGS's IHA application for further details]

Species	Habitat	Occurrence	Range in Atlantic Ocean	Population estimate in the North Atlantic region/ stock/other [3]	ESA [1]	MMPA [2]
Mysticetes:						
North Atlantic right whale (*Eubalaena glacialis*).	Pelagic, shelf and coastal	Regular	Canada to Florida	455/455 (Western Atlantic stock).	EN	D
Humpback whale (*Megaptera novaeangliae*).	Mainly nearshore, banks	Regular	Canada to Caribbean	11,600 [4]/823 (Gulf of Maine stock).	EN	D
Minke whale (*Balaenoptera acutorostrata*).	Pelagic and coastal	Regular	Arctic to Caribbean	138,000 [5]/20,741 (Canadian East Coast stock).	NL	NC
Bryde's whale (*Balaenoptera edeni*).	Coastal, offshore	Rare	40° North to 40° South	NA/NA/33 (Northern Gulf of Mexico stock)/20,000 to 30,000 [16] (North Pacific Ocean).	NL	NC
Sei whale (*Balaenoptera borealis*).	Primarily offshore, pelagic	Rare	Canada to New Jersey	10,300 [6]/357 (Nova Scotia stock).	EN	D

TABLE 2—THE HABITAT, OCCURRENCE, RANGE, ABUNDANCE, AND CONSERVATION STATUS OF MARINE MAMMALS THAT MAY OCCUR IN OR NEAR THE PROPOSED SEISMIC SURVEY AREA IN THE NORTHWEST ATLANTIC OCEAN OFF THE EASTERN SEABOARD—Continued

[See text and Table 3 in USGS's IHA application for further details]

Species	Habitat	Occurrence	Range in Atlantic Ocean	Population estimate in the North Atlantic region/stock/other [3]	ESA [1]	MMPA [2]
Fin whale (*Balaenoptera physalus*).	Continental slope, pelagic	Regular	Canada to North Carolina	26,500 [7]/3,522 (Western North Atlantic stock).	EN	D
Blue whale (*Balaenoptera musculus*).	Pelagic, shelf, coastal	Rare	Arctic to Florida	855 [8]/440 (Western North Atlantic stock).	EN	D
Odontocetes:						
Sperm whale (*Physeter macrocephalus*).	Pelagic, slope, canyons, deep sea.	Regular	Canada to Caribbean	13,190 [9]/2,288 (North Atlantic stocks).	EN	D
Pygmy sperm whale (*Kogia breviceps*).	Deep waters off shelf	Rare	Massachusetts to Florida	NA/3,785 (Western North Atlantic stock).	NL	NC
Dwarf sperm whale (*Kogia sima*).	Deep waters off shelf	Rare	Massachusetts to Florida		NL	NC
Cuvier's beaked whale (*Ziphius cavirostris*).	Pelagic, slope, canyons	Rare	Canada to Caribbean	NA/6,532 (Western North Atlantic stock).	NL	NC
Northern bottlenose whale (*Hyperoodon ampullatus*).	Pelagic	Rare	Arctic to New Jersey	40,000 [10]/NA (Western North Atlantic stock).	NL	NC
True's beaked whale (*Mesoplodon mirus*).	Pelagic, slope, canyons	Rare	Canada to Bahamas	NA/7,092 (Western North Atlantic stock).	NL	NC
Gervais' beaked whale (*Mesoplodon europaeus*).	Pelagic, slope, canyons	Rare	Canada to Florida		NL	NC
Sowerby's beaked whale (*Mesoplodon bidens*).	Pelagic, slope, canyons	Rare	Canada to Florida		NL	NC
Blainville's beaked whale (*Mesoplodon densirostris*).	Pelagic, slope, canyons	Rare	Canada to Florida		NL	NC
Bottlenose dolphin (*Tursiops truncatus*).	Coastal, oceanic, shelf break.	Regular	Canada to Florida	NA/77,532 (Western North Atlantic Offshore stock).	NL	NC
Atlantic white-sided dolphin (*Lagenorhynchus acutus*).	Shelf and slope	Regular	Greenland to North Carolina.	10,000 to 100,000s [11]/48,819 (Western North Atlantic stock).	NL	NC
Fraser's dolphin (*Lagenodelphis hosei*).	Shelf and slope	Rare	North Carolina to Florida	NA/NA (Western North Atlantic stock)/289,000 [16] (eastern tropical Pacific Ocean).	NL	NC
Atlantic spotted dolphin (*Stenella frontalis*).	Shelf, offshore	Regular	Massachusetts to Caribbean.	NA/44,715 (Western North Atlantic stock).	NL	NC
Pantropical spotted dolphin (*Stenella attenuata*).	Coastal, shelf, slope	Regular	Massachusetts to Florida	NA/3,333 (Western North Atlantic stock).	NL	NC
Striped dolphin (*Stenella coeruleoalba*).	Off continental shelf, convergence zones, upwelling.	Regular	Canada to Caribbean	NA/54,807 (Western North Atlantic stock).	NL	NC
Spinner dolphin (*Stenella longirostris*).	Mainly nearshore	Rare	Maine to Caribbean	NA/NA (Western North Atlantic stock)/11,441 (Northern Gulf of Mexico stock)/1,250,000 [16] (eastern tropical Pacific Ocean).	NL	NC
Clymene dolphin (*Stenella clymene*).	Coastal, shelf, slope	Rare	North Carolina to Florida	NA/NA (Western North Atlantic stock—6,086 in 2003)/129 (Northern Gulf of Mexico stock).	NL	NC
Short-beaked common dolphin (*Delphinus delphis*).	Shelf, pelagic, seamounts	Regular	Canada to Georgia	NA/173,486 (Western North Atlantic stock).	NL	NC

TABLE 2—THE HABITAT, OCCURRENCE, RANGE, ABUNDANCE, AND CONSERVATION STATUS OF MARINE MAMMALS THAT MAY OCCUR IN OR NEAR THE PROPOSED SEISMIC SURVEY AREA IN THE NORTHWEST ATLANTIC OCEAN OFF THE EASTERN SEABOARD—Continued

[See text and Table 3 in USGS's IHA application for further details]

Species	Habitat	Occurrence	Range in Atlantic Ocean	Population estimate in the North Atlantic region/ stock/other [3]	ESA [1]	MMPA [2]
Rough-toothed dolphin (*Steno bredanensis*).	Pelagic	Rare	New Jersey to Florida	NA/271 (Western North Atlantic stock).	NL	NC
Risso's dolphin (*Grampus griseus*).	Shelf, slope, seamounts	Regular	Canada to Florida	NA/18,250 (Western North Atlantic stock).	NL	NC
Melon-headed whale (*Peponocephala electra*).	Deep waters off shelf	Rare	North Carolina to Florida	NA/NA (Western North Atlantic stock)/2,235 (Northern Gulf of Mexico stock)/45,000 [16] (eastern tropical Pacific Ocean).	NL	NC
Pygmy killer whale (*Feresa attenuata*).	Pelagic	Rare	NA	NA/NA (Western North Atlantic stock)/152 (Northern Gulf of Mexico stock)/39,000 [16] (eastern tropical Pacific Ocean).	NL	NC
False killer whale (*Pseudorca crassidens*).	Pelagic	Rare	NA	NA/NA/777 in 2003–2004 (Northern Gulf of Mexico stock).	NL	NC
Killer whale (*Orcinus orca*).	Pelagic, shelf, coastal	Rare	Arctic to Caribbean	NA/NA (Western North Atlantic stock)/28 (Northern Gulf of Mexico stock)/At least ~92,500 [16] Worldwide.	NL	NC
Short-finned pilot whale (*Globicephala macrorhynchus*).	Mostly pelagic, high relief	Regular	Massachusetts to Florida	780,000 [12]/21,515 short-finned pilot whale 26,535 long-finned pilot whale (Western North Atlantic stock).	NL	NC
Long-finned pilot whale (*Globicephala melas*).	Mostly pelagic	Regular	Canada to South Carolina	NL	NC	
Harbor porpoise (*Phocoena phocoena*).	Shelf, coastal, pelagic	Rare	Canada to North Carolina	~500,000 [13]/79,883 (Gulf of Maine/Bay of Fundy stock).	NL	NC
Pinnipeds:						
Harbor seal (*Phoca vitulina concolor*).	Coastal	Rare	Canada to North Carolina	NA/70,142 (Western North Atlantic stock).	NL	NC
Gray seal (*Halichoerus grypus*).	Coastal, pelagic	Rare	Canada to North Carolina	NA/331,000 (Western North Atlantic stock).	NL	NC
Harp seal (*Phoca groenlandica*).	Ice whelpers, pelagic	Rare	Canada to New Jersey	8.6 to 9.6 million [14]/7.1 million (Western North Atlantic stock).	NL	NC
Hooded seal (*Cystophora cristata*).	Ice whelpers, pelagic	Rare	Canada to Caribbean	600,000/592,100 (Western North Atlantic stock).	NL	NC

NA = Not available or not assessed.
[1] U.S. Endangered Species Act: EN = Endangered, T = Threatened, DL = Delisted, NL = Not listed.
[2] U.S. Marine Mammal Protection Act: D = Depleted, NC = Not Classified.
[3] NMFS Marine Mammal Stock Assessment Reports.
[4] Best estimate for western North Atlantic 1992 to 1993 (IWC, 2014).
[5] Best estimate for North Atlantic 2002 to 2007 (IWC, 2014).
[6] Estimate for the Northeast Atlantic in 1989 (Cattanach *et al.,* 1993).
[7] Best estimate for North Atlantic 2007 (IWC, 2014) .
[8] Central and Northeast Atlantic 2001 (Pike *et al.,* 2009).
[9] North Atlantic (Whitehead, 2002).
[10] Eastern North Atlantic (NAMMCO, 1995).
[11] North Atlantic (Reeves et al., 1999).
[12] *Globicephala* spp. combined, Central and Eastern North Atlantic (IWC, 2014).
[13] North Atlantic (Jefferson *et al.,* 2008).
[14] Northwest Atlantic (DFO, 2012).
[15] Northwest Atlantic (Andersen et al., 2009).
[16] Jefferson *et al.* (2008).

Further detailed information regarding the biology, distribution, seasonality, life history, and occurrence of these marine mammal species in the proposed project area can be found in sections 3 and 4 of USGS's IHA application. NMFS has reviewed these data and determined them to be the best available scientific information for the purposes of the proposed IHA.

Potential Effects of the Specified Activity on Marine Mammals

This section includes a summary and discussion of the ways that the types of stressors associated with the specified activity (e.g., seismic airgun operation, vessel movement, gear deployment) have been observed to impact marine mammals. This discussion may also include reactions that we consider to rise to the level of a take and those that we do not consider to rise to the level of take (for example, with acoustics), we may include a discussion of studies that showed animals not reacting at all to sound or exhibiting barely measureable avoidance). This section is intended as a background of potential effects and does not consider either the specific manner in which this activity would be carried out or the mitigation that would be implemented, and how either of those would shape the anticipated impacts from this specific activity. The ''Estimated Take by Incidental Harassment'' section later in this document will include a quantitative analysis of the number of individuals that are expected to be taken by this activity. The ''Negligible Impact Analysis'' section will include the analysis of how this specific activity would impact marine mammals and will consider the content of this section, the ''Estimated Take by Incidental Harassment'' section, the ''Proposed Mitigation'' section, and the ''Anticipated Effects on Marine Mammal Habitat'' section to draw conclusions regarding the likely impacts of this activity on the reproductive success or survivorship of individuals and from that on the affected marine mammal populations or stocks.

When considering the influence of various kinds of sound on the marine environment, it is necessary to understand that different kinds of marine life are sensitive to different frequencies of sound. Based on available behavioral data, audiograms have been derived using auditory evoked potentials, anatomical modeling, and other data, Southall *et al.* (2007) designate ''functional hearing groups'' for marine mammals and estimate the lower and upper frequencies of functional hearing groups'' for marine mammals and estimate the lower and upper frequencies of functional hearing of the groups. The functional groups and the associated frequencies are indicated below (though animals are less sensitive to sounds at the outer edge of their functional range and most sensitive to sounds of frequencies within a smaller range somewhere in the middle of their functional hearing range):

- Low-frequency cetaceans (13 species of mysticetes): Functional hearing is estimated to occur between approximately 7 Hz and 30 kHz;
- Mid-frequency cetaceans (32 species of dolphins, six species of larger toothed whales, and 19 species of beaked and bottlenose whales): Functional hearing is estimated to occur between approximately 150 Hz and 160 kHz;
- High-frequency cetaceans (eight species of true porpoises, six species of river dolphins, *Kogia* spp., the franciscana [*Pontoporia blainvillei*], and four species of cephalorhynchids): Functional hearing is estimated to occur between approximately 200 Hz and 180 kHz; and
- Phocid pinnipeds in water: Functional hearing is estimated to occur between approximately 75 Hz and 100 kHz;
- Otariid pinnipeds in water: Functional hearing is estimated to occur between approximately 100 Hz and 40 kHz.

As mentioned previously in this document, 38 marine mammal species (34 cetacean and 4 pinniped species) are likely to occur in the proposed seismic survey area. Of the 34 cetacean species likely to occur in USGS's proposed action area, 7 are classified as low-frequency cetaceans (i.e., North Atlantic right, humpback, minke, Bryde's, sei, fin, and blue whale), 24 are classified as mid-frequency cetaceans (i.e., sperm, Cuvier's, True's, Gervais', Sowerby's, Blainville's, Northern bottlenose, melon-headed, pygmy killer, false killer, killer, short-finned, and long-finned whale, bottlenose, Atlantic white-sided, Fraser's, Atlantic spotted, pantropical spotted, striped, spinner, Clymene, short-beaked common, rough-toothed, and Risso's dolphin), and 3 are classified as high-frequency cetaceans (i.e., pygmy sperm and dwarf sperm whale and harbor porpoise) (Southall *et al.,* 2007). A species' functional hearing group is a consideration when we analyze the effects of exposure to sound on marine mammals.

Acoustic stimuli generated by the operation of the airguns, which introduce sound into the marine environment, may have the potential to cause Level B harassment of marine mammals in the proposed survey area. The effects of sounds from airgun operations might include one or more of the following: Tolerance, masking (of natural sounds including inter- and intra-specific calls), behavioral disturbance, temporary or permanent hearing impairment, or non-auditory physical or physiological effects (Richardson *et al.,* 1995; Gordon *et al.,* 2004; Nowacek *et al.,* 2007; Southall *et al.,* 2007; Wright *et al.,* 2007; Tyack, 2009). Permanent hearing impairment, in the unlikely event that it occurred, would constitute injury, but temporary threshold shift (TTS) is not an injury (Southall *et al.,* 2007). Although the possibility cannot be entirely excluded, it is unlikely that the proposed project would result in any cases of temporary or permanent hearing impairment, or any significant non-auditory physical or physiological effects. Based on the available data and studies described here, some behavioral disturbance is expected. A more comprehensive review of these issues can be found in the NSF/USGS PEIS (2011) and L–DEO's ''Draft Environmental Assessment of a Marine Geophysical Survey by the R/V *Marcus G. Langseth* in the Atlantic Ocean off Cape Hatteras, September to October 2014.''

Tolerance

Richardson *et al.* (1995) defines tolerance as the occurrence of marine mammals in areas where they are exposed to human activities or man-made noise. In many cases, tolerance develops by the animal habituating to the stimulus (i.e., the gradual waning of responses to a repeated or ongoing stimulus) (Thorpe, 1963; Richardson, *et al.,* 1995), but because of ecological or physiological requirements, many marine animals may need to remain in areas where they are exposed to chronic stimuli (Richardson, *et al.,* 1995).

Numerous studies have shown that pulsed sounds from airguns are often readily detectable in the water at distances of many kilometers. Several studies have shown that marine mammals at distances more than a few kilometers from operating seismic vessels often show no apparent response (Malme *et al.,* 1985; Richardson *et al.,* 1986; Ljungblad *et al.,* 1988; McCauley *et al.,* 2000a). That is often true even in cases when the pulsed sounds must be readily audible to the animals based on measured received levels and the hearing sensitivity of the marine mammal group. Although various baleen and toothed whales, and (less frequently) pinnipeds have been shown to react behaviorally to airgun pulses under some conditions, at other times marine mammals of all three types have shown no overt reactions. The relative responsiveness of baleen and toothed whales and pinnipeds are quite variable and depend on factors such as species, age, and previous exposures of the animal to human-generated sound.

Masking

The term masking refers to the inability of a subject to recognize the occurrence of an acoustic stimulus as a result of the interference of another acoustic stimulus (Clark *et al.,* 2009). Introduced underwater sound may, through masking, reduce the effective communication distance of a marine mammal species if the frequency of the source is close to that used as a signal by the marine mammal, and if the anthropogenic sound is present for a significant fraction of the time (Richardson *et al.,* 1995).

Masking effects of pulsed sounds (even from large arrays of airguns) on marine mammal calls and other natural sounds are expected to be limited. Because of the intermittent nature and low duty cycle of seismic airgun pulses, animals can emit and receive sounds in the relatively quiet intervals between pulses. However, in some situations, reverberation occurs for much or the entire interval between pulses (e.g., Simard *et al.,* 2005; Clark and Gagnon, 2006) which could mask calls. Some baleen and toothed whales are known to continue calling in the presence of seismic pulses, and their calls can usually be heard between the seismic pulses (e.g., Richardson *et al.,* 1986; McDonald *et al.,* 1995; Greene *et al.,* 1999; Nieukirk *et al.,* 2004; Smultea *et al.,* 2004; Holst *et al.,* 2005a,b, 2006; and Dunn and Hernandez, 2009). However, Clark and Gagnon (2006) reported that fin whales in the North Atlantic Ocean went silent for an extended period starting soon after the onset of a seismic survey in the area. Similarly, there has been one report that sperm whales ceased calling when exposed to pulses from a very distant seismic ship (Bowles *et al.,* 1994). However, more recent studies found that they continued calling in the presence of seismic pulses (Madsen *et al.,* 2002; Tyack *et al.,* 2003; Smultea *et al.,* 2004; Holst *et al.,* 2006; and Jochens *et al.,* 2008). Dilorio and Clark (2009) found evidence of increased calling by blue whales during operations by a lower-energy seismic source (i.e., sparker). Dolphins and porpoises commonly are heard calling while airguns are operating (e.g., Gordon *et al.,* 2004; Smultea *et al.,* 2004; Holst *et al.,* 2005a, b; and Potter *et al.,* 2007). The sounds important to small odontocetes are predominantly at much higher frequencies than are the dominant components of airgun sounds, thus limiting the potential for masking.

Marine mammals are thought to be able to compensate for masking by adjusting their acoustic behavior through shifting call frequencies, increasing call volume, and increasing vocalization rates. For example, blue whales are found to increase call rates when exposed to noise from seismic surveys in the St. Lawrence Estuary (Dilorio and Clark, 2009). The North Atlantic right whales exposed to high shipping noise increased call frequency (Parks *et al.,* 2007), while some humpback whales respond to low-frequency active sonar playbacks by increasing song length (Miller *et al.,* 2000). In general, NMFS expects the masking effects of seismic pulses to be minor, given the normally intermittent nature of seismic pulses.

Behavioral Disturbance

Marine mammals may behaviorally react to sound when exposed to anthropogenic noise. Disturbance includes a variety of effects, including (but not limited to) subtle to conspicuous changes in behavior, movement, and displacement (Nowacek *et al.,* 2007; Tyack, 2009). Reactions to sound, if any, depend on species, state of maturity, experience, current activity, reproductive state, time of day, and many other factors (Richardson *et al.,* 1995; Wartzok *et al.,* 2004; Southall *et al.,* 2007; Weilgart, 2007). These behavioral reactions are often shown as: Changing durations of surfacing and dives, number of blows per surfacing, or moving direction and/or speed; reduced/increased vocal activities; changing/cessation of certain behavioral activities (such as socializing or feeding); visible startle response or aggressive behavior (such as tail/fluke slapping or jaw clapping); avoidance of areas where noise sources are located; and/or flight responses (e.g., pinnipeds flushing into the water from haul-outs or rookeries). If a marine mammal does react briefly to an underwater sound by changing its behavior or moving a small distance, the impacts of the change are unlikely to be significant to the individual, let alone the stock or population. However, if a sound source displaces marine mammals from an important feeding or breeding area for a prolonged period, impacts on individuals and populations could be significant (e.g., Lusseau and Bejder, 2007; Weilgart, 2007).

The biological significance of many of these behavioral disturbances is difficult to predict, especially if the detected disturbances appear minor. However, the consequences of behavioral modification could be expected to be biologically significant if the change affects growth, survival, and/or reproduction. Some of these significant behavioral modifications include:

- Change in diving/surfacing patterns (such as those thought to be causing beaked whale stranding due to exposure to military mid-frequency tactical sonar);
- Habitat abandonment due to loss of desirable acoustic environment; and
- Cessation of feeding or social interaction.

The onset of behavioral disturbance from anthropogenic noise depends on both external factors (characteristics of noise sources and their paths) and the receiving animals (hearing, motivation, experience, demography) and is also difficult to predict (Richardson *et al.,* 1995; Southall *et al.,* 2007). Given the many uncertainties in predicting the quantity and types of impacts of noise on marine mammals, it is common practice to estimate how many mammals would be present within a particular distance of industrial activities and/or exposed to a particular level of sound. In most cases, this approach likely overestimates the numbers of marine mammals that would be affected in some biologically-important manner.

Baleen Whales—Baleen whales generally tend to avoid operating airguns, but avoidance radii are quite variable (reviewed in Richardson *et al.,* 1995; Gordon *et al.,* 2004). Whales are often reported to show no overt reactions to pulses from large arrays of airguns at distances beyond a few kilometers, even though the airgun pulses remain well above ambient noise levels out to much longer distances. However, baleen whales exposed to strong noise pulses from airguns often react by deviating from their normal migration route and/or interrupting their feeding and moving away. In the cases of migrating gray (*Eschrichtius robustus*) and bowhead (*Balaena mysticetus*) whales, the observed changes in behavior appeared to be of little or no biological consequence to the animals (Richardson, *et al.,* 1995). They simply avoided the sound source by displacing their migration route to varying degrees, but within the natural boundaries of the migration corridors (Malme *et al.,* 1984; Malme and Miles, 1985; Richardson *et al.,* 1995).

Studies of gray, bowhead, and humpback whales have shown that seismic pulses with received levels of 160 to 170 dB re 1 μPa (rms) seem to cause obvious avoidance behavior in a substantial fraction of the animals exposed (Malme *et al.,* 1986, 1988; Richardson *et al.,* 1995). In many areas, seismic pulses from large arrays of airguns diminish to those levels at distances ranging from 4 to 15 km (2.2 to 8.1 nmi) from the source. A substantial proportion of the baleen whales within those distances may show avoidance or other strong behavioral reactions to the airgun array. Subtle behavioral changes sometimes become evident at somewhat lower received levels, and studies have shown that some species of baleen whales, notably bowhead, gray, and humpback whales, at times, show strong avoidance at received levels lower than 160 to 170 dB re 1 μPa (rms).

Researchers have studied the responses of humpback whales to seismic surveys during migration, feeding during the summer months, breeding while offshore from Angola, and wintering offshore from Brazil. McCauley *et al.* (1998, 2000a) studied the responses of humpback whales off western Australia to a full-scale seismic survey with a 16-airgun array (2,678 in^3) and to a single airgun (20 in^3) with source level of 227 dB re 1 μPa (p-p). In the 1998 study, they documented that avoidance reactions began at 5 to 8 km (2.7 to 4.3 nmi) from the array, and that those reactions kept most pods approximately 3 to 4 km (1.6 to 2.2 nmi) from the operating seismic boat. In the 2000 study, they noted localized displacement during migration of 4 to 5 km (2.2 to 2.7 nmi) by traveling pods and 7 to 12 km (3.8 to 6.5 nmi) by more sensitive resting pods of cow-calf pairs. Avoidance distances with respect to the single airgun were smaller but consistent with the results from the full array in terms of the received sound levels. The mean received level for initial avoidance of an approaching airgun was 140 dB re 1 μPa (rms) for humpback pods containing females, and at the mean closest point of approach distance from the received level was 143 dB re 1 μPa (rms). The initial avoidance response generally occurred at distances of 5 to 8 km (2.7 to 4.3 nmi) from the airgun array and 2 km (1.1 nmi) from the single airgun. However, some individual humpback whales, especially males, approached within distances of 100 to 400 m (328 to 1,312 ft), where the maximum received level was 179 dB re 1 μPa (rms) (McCauley *et al.,* 1998, 2000b).

Data collected by observers during several seismic surveys in the Northwest Atlantic showed that sighting rates of humpback whales were significantly greater during non-seismic periods compared with periods when a full array was operating (Moulton and Holst, 2010). In addition, humpback whales were more likely to swim away and less likely to swim towards a vessel during seismic vs. non-seismic periods (Moulton and Holst, 2010).

Humpback whales on their summer feeding grounds in southeast Alaska did not exhibit persistent avoidance when exposed to seismic pulses from a 1.64–L (100 in^3) airgun (Malme *et al.,* 1985). Some humpbacks seemed ''startled'' at received levels of 150 to 169 dB re 1 μPa. Malme *et al.* (1985) concluded that there was no clear evidence of avoidance, despite the possibility of subtle effects, at received levels up to 172 dB re 1 μPa (rms). However, Moulton and Holst (2010) reported that humpback whales monitored during seismic surveys in the Northwest Atlantic had lower sighting rates and were most often seen swimming away from the vessel during seismic periods compared with periods when airguns were silent.

Studies have suggested that South Atlantic humpback whales in the South Atlantic Ocean wintering off Brazil may be displaced or even strand upon exposure to seismic surveys (Engel *et al.,* 2004). The evidence for this was circumstantial and subject to alternative explanations (IAGC, 2004). Also, the evidence was not consistent with subsequent results from the same area of Brazil (Parente *et al.,* 2006), or with direct studies of humpbacks exposed to seismic surveys in other areas and seasons. After allowance for data from subsequent years, there was ''no observable direct correlation'' between strandings and seismic surveys (IWC, 2007: 236).

Reactions of migrating and feeding (but not wintering) gray whales to seismic surveys have been studied. Malme *et al.* (1986, 1988) studied the responses of feeding Eastern North Pacific gray whales to pulses from a single 100 in^3 airgun off St. Lawrence Island in the northern Bering Sea. They estimated, based on small sample sizes, that 50 percent of feeding gray whales stopped feeding at an average received pressure level of 173 dB re 1 μPa on an (approximate) rms basis, and that 10 percent of feeding whales interrupted feeding at received levels of 163 dB re 1 μPa (rms). Those findings were generally consistent with the results of experiments conducted on larger numbers of gray whales that were migrating along the California coast (Malme *et al.,* 1984; Malme and Miles, 1985), and Western North Pacific gray whales feeding off Sakhalin Island, Russia (Wursig *et al.,* 1999; Gailey *et al.,* 2007; Johnson *et al.,* 2007; Yazvenko *et al.,* 2007a, b), along with data on gray whales off British Columbia (Bain and Williams, 2006).

Various species of *Balaenoptera* (blue, sei, fin, and minke whales) have occasionally been seen in areas ensonified by airgun pulses (Stone, 2003; MacLean and Haley, 2004; Stone and Tasker, 2006), and calls from blue and fin whales have been localized in areas with airgun operations (e.g., McDonald *et al.,* 1995; Dunn and Hernandez, 2009; Castellote *et al.,* 2010). Sightings by observers on seismic vessels off the United Kingdom from 1997 to 2000 suggest that, during times of good sightability, sighting rates for mysticetes (mainly fin and sei whales) were similar when large arrays of airguns were shooting vs. silent (Stone, 2003; Stone and Tasker, 2006). However, these whales tended to exhibit localized avoidance, remaining significantly further (on average) from the airgun array during seismic operations compared with non-seismic periods (Stone and Tasker, 2006). Castellote *et al.* (2010) reported that singing fin whales in the Mediterranean moved away from an operating airgun array.

Ship-based monitoring studies of baleen whales (including blue, fin, sei, minke, and humpback whales) in the Northwest Atlantic found that overall, this group had lower sighting rates during seismic vs. non-seismic periods (Moulton and Holst, 2010). Baleen whales as a group were also seen significantly farther from the vessel during seismic compared with non-seismic periods, and they were more often seen to be swimming away from the operating seismic vessel (Moulton and Holst, 2010). Blue and minke whales were initially sighted significantly farther from the vessel during seismic operations compared to non-seismic periods; the same trend was observed for fin whales (Moulton and Holst, 2010). Minke whales were most often observed to be swimming away from the vessel when seismic operations were underway (Moulton and Holst, 2010).

Data on short-term reactions by cetaceans to impulsive noises are not necessarily indicative of long-term or biologically significant effects. It is not known whether impulsive sounds affect reproductive rate or distribution and habitat use in subsequent days or years. However, gray whales have continued to migrate annually along the west coast of North America with substantial increases in the population over recent years, despite intermittent seismic exploration (and much ship traffic) in that area for decades (Appendix A in

Malme *et al.,* 1984; Richardson *et al.,* 1995; Allen and Angliss, 2010). The Western North Pacific gray whale population did not seem affected by a seismic survey in its feeding ground during a previous year (Johnson *et al.,* 2007). Similarly, bowhead whales have continued to travel to the eastern Beaufort Sea each summer, and their numbers have increased notably, despite seismic exploration in their summer and autumn range for many years (Richardson *et al.,* 1987; Allen and Angliss, 2010). The history of coexistence between seismic surveys and baleen whales suggests that brief exposures to sound pulses from any single seismic survey are unlikely to result in prolonged effects.

Toothed Whales—There is little systematic information available about reactions of toothed whales to noise pulses. Few studies similar to the more extensive baleen whale/seismic pulse work summarized above have been reported for toothed whales. However, there are recent systematic studies on sperm whales (e.g., Gordon *et al.,* 2006; Madsen *et al.,* 2006; Winsor and Mate, 2006; Jochens *et al.,* 2008; Miller *et al.,* 2009). There is an increasing amount of information about responses of various odontocetes to seismic surveys based on monitoring studies (e.g., Stone, 2003; Smultea *et al.,* 2004; Moulton and Miller, 2005; Bain and Williams, 2006; Holst *et al.,* 2006; Stone and Tasker, 2006; Potter *et al.,* 2007; Hauser *et al.,* 2008; Holst and Smultea, 2008; Weir, 2008; Barkaszi *et al.,* 2009; Richardson *et al.,* 2009; Moulton and Holst, 2010).

Seismic operators and Protected Species Observers (PSOs) on seismic vessels regularly see dolphins and other small toothed whales near operating airgun arrays, but in general there is a tendency for most delphinids to show some avoidance of operating seismic vessels (e.g., Goold, 1996a,b,c; Calambokidis and Osmek, 1998; Stone, 2003; Moulton and Miller, 2005; Holst *et al.,* 2006; Stone and Tasker, 2006; Weir, 2008; Richardson *et al.,* 2009; Barkaszi *et al.,* 2009; Moulton and Holst, 2010). Some dolphins seem to be attracted to the seismic vessel and floats, and some ride the bow wave of the seismic vessel even when large arrays of airguns are firing (e.g., Moulton and Miller, 2005). Nonetheless, small toothed whales more often tend to head away, or to maintain a somewhat greater distance from the vessel, when a large array of airguns is operating than when it is silent (e.g., Stone and Tasker, 2006; Weir, 2008; Barry *et al.,* 2010; Moulton and Holst, 2010). In most cases, the avoidance radii for delphinids appear to be small, on the order of one km (0.5 nmi) or less, and some individuals show no apparent avoidance. Based on observations from seismic surveys off the United Kingdom, small odontocetes exhibited greater avoidance to operating airguns than previously reported (Stone *et al.,* 2003; Gordon *et al.,* 2004; Stone and Tasker, 2006). The observer data also indicated that small odontocetes were feeding less and were interacting with the vessel less during active seismic surveys. Captive bottlenose dolphins and beluga whales (*Delphinapterus leucas*) exhibited changes in behavior when exposed to strong pulsed sounds similar in duration to those typically used in seismic surveys (Finneran *et al.,* 2000, 2002, 2005). However, the animals tolerated high, received levels of sound before exhibiting aversive behaviors.

Results of reactions to seismic operations for porpoises depend on species. The limited available data suggest that harbor porpoises show stronger avoidance of seismic operations than do Dall's porpoises (*Phocoenoides dalli*) (Stone, 2003; MacLean and Koski, 2005; Bain and Williams, 2006; Stone and Tasker, 2006). Dall's porpoises seem relatively tolerant of airgun operations (MacLean and Koski, 2005; Bain and Williams, 2006), although they too have been observed to avoid large arrays of operating airguns (Calambokidis and Osmek, 1998; Bain and Williams, 2006). This apparent difference in responsiveness of these two porpoise species is consistent with their relative responsiveness to boat traffic and some other acoustic sources (Richardson *et al.,* 1995; Southall *et al.,* 2007).

Most studies of sperm whales exposed to airgun sounds indicate that the sperm whale shows considerable tolerance of airgun pulses (e.g., Stone, 2003; Moulton *et al.,* 2005, 2006a; Stone and Tasker, 2006; Weir, 2008). In most cases the whales do not show strong avoidance, and they continue to call. However, controlled exposure experiments in the Gulf of Mexico indicate that foraging behavior was altered upon exposure to airgun sound (Jochens *et al.,* 2008; Miller *et al.,* 2009; Tyack, 2009).

There are almost no specific data on the behavioral reactions of beaked whales to seismic surveys. However, some northern bottlenose whales remained in the general area and continued to produce high-frequency clicks when exposed to sound pulses from distant seismic surveys (Gosselin and Lawson, 2004; Laurinolli and Cochrane, 2005; Simard *et al.,* 2005). Most beaked whales are illusive and tend to avoid approaching vessels of other types (e.g., Wursig *et al.,* 1998). They may also dive for an extended period when approached by a vessel (e.g., Kasuya, 1986), although it is uncertain how much longer such dives may be as compared to dives by undisturbed beaked whales, which also are often quite long (Baird *et al.,* 2006; Tyack *et al.,* 2006). Based on a single observation, Aguilar-Soto *et al.* (2006) suggested that foraging efficiency of Cuvier's beaked whales may be reduced by close approach of vessels. In any event, it is likely that most beaked whales would also show strong avoidance of an approaching seismic vessel, although this has not been documented definitively. In fact, Moulton and Holst (2010) reported 15 sightings of beaked whales during seismic studies in the Northwest Atlantic; seven of those sightings were made at times when at least one airgun was operating. There was little evidence to indicate that beaked whale behavior was affected by airgun operations; sighting rates and distances were similar during seismic and non-seismic periods (Moulton and Holst, 2010).

There are indications that some beaked whales may strand when naval exercises involving mid-frequency sonar operation are ongoing nearby (e.g., Simmonds and Lopez-Jurado, 1991; Frantzis, 1998; NOAA and USN, 2001; Jepson *et al.,* 2003; Hildebrand, 2005; Barlow and Gisiner, 2006; see also the ''Stranding and Mortality'' section in this notice). These strandings are apparently a disturbance response, although auditory or other injuries or other physiological effects may also be involved. Whether beaked whales would ever react similarly to seismic surveys is unknown. Seismic survey sounds are quite different from those of the sonar in operation during the above-cited incidents.

Odontocete reactions to large arrays of airguns are variable and, at least for delphinids and Dall's porpoises, seem to be confined to a smaller radius than has been observed for the more responsive of some mysticetes. However, other data suggest that some odontocete species, including harbor porpoises, may be more responsive than might be expected given their poor low-frequency hearing. Reactions at longer distances may be particularly likely when sound propagation conditions are conducive to transmission of the higher frequency components of airgun sound to the animals' location (DeRuiter *et al.,* 2006; Goold and Coates, 2006; Tyack *et al.,* 2006; Potter *et al.,* 2007).

Pinnipeds—Information on the reaction of pinniped species to pulsed seismic airgun sounds is limited. Based on early observations, pinnipeds appear to be quite tolerant of pulsed sounds. Other reports indicate that pinnipeds were tolerant of loud, pulsed sounds when they were strongly attracted to an area for feeding or reproductive purposes (Mate and Harvey, 1987; Reeves *et al.,* 1996). In most recent studies, avoidance of pinnipeds during seismic surveys has been reported as being relatively small, within 100 to few hundred meters. Many seals remained within 100 to 200 m (328.1 to 656.2 ft) of the survey tracklines while an operating seismic survey passed (Harris *et al.,* 2001; Moulton and Lawson, 2002). Other observations made during seismic surveys in the Chukchi and Beaufort Seas reported that pinnipeds (i.e., ringed seals [*Phoca hispida*]) were observed less when seismic airguns were operating than when they were silent (Miller *et al.,* 2005). In Puget Sound, sighting distances for harbor seals and California sea lions (Zalophus californianus) tended to be larger when airguns were operating (Calambokidis and Osmek, 1998). Previous telemetry work suggests that avoidance and other behavioral reactions may be stronger than evident to date from visual studies (Thompson *et al.,* 1998). Overall, behavioral reactions from pinnipeds to pulsed seismic sounds are variable. It is expected that localized avoidance of operating seismic airguns may occur; however, it cannot be guaranteed that these species would fully avoid an operating seismic vessel during active surveys.

Hearing Impairment and Other Physical Effects

Exposure to high intensity sound for a sufficient duration may result in auditory effects such as a noise-induced threshold shift—an increase in the auditory threshold after exposure to noise (Finneran, Carder, Schlundt, and Ridgway, 2005). Factors that influence the amount of threshold shift include the amplitude, duration, frequency content, temporal pattern, and energy distribution of noise exposure. The magnitude of hearing threshold shift normally decreases over time following cessation of the noise exposure. The amount of threshold shift just after exposure is called the initial threshold shift. If the threshold shift eventually returns to zero (i.e., the threshold returns to the pre-exposure value), it is called temporary threshold shift (TTS) (Southall *et al.,* 2007).

Researchers have studied TTS in certain captive odontocetes and pinnipeds exposed to strong sounds (reviewed in Southall *et al.,* 2007). However, there has been no specific documentation of TTS let alone permanent hearing damage, i.e., permanent threshold shift (PTS), in free-ranging marine mammals exposed to sequences of airgun pulses during realistic field conditions.

Temporary Threshold Shift—TTS is the mildest form of hearing impairment that can occur during exposure to a strong sound (Kryter, 1985). While experiencing TTS, the hearing threshold rises and a sound must be stronger in order to be heard. At least in terrestrial mammals, TTS can last from minutes or hours to (in cases of strong TTS) days. For sound exposures at or somewhat above the TTS threshold, hearing sensitivity in both terrestrial and marine mammals recovers rapidly after exposure to the noise ends. Few data on sound levels and durations necessary to elicit mild TTS have been obtained for marine mammals, and none of the published data concern TTS elicited by exposure to multiple pulses of sound. Available data on TTS in marine mammals are summarized in Southall *et al.* (2007). Table 1 (above) presents the estimated distances from the *Langseth's* airguns at which the received energy level (per pulse, flat-weighted) would be expected to be greater than or equal to 180 or 190 dB re 1 μPa (rms).

To avoid the potential for injury (i.e., Level A harassment), NMFS (1995, 2000) concluded that cetaceans and pinnipeds should not be exposed to pulsed underwater noise at received levels exceeding 180 and 190 dB re 1 μPa (rms), respectively. The established 180 and 190 dB (rms) criteria are not considered to be the levels above which TTS might occur. Rather, they are the received levels above which, in the view of a panel of bioacoustics specialists convened by NMFS before TTS measurements for marine mammals started to become available, one could not be certain that there would be no injurious effects, auditory or otherwise, to marine mammals. NMFS also assumes that cetaceans and pinnipeds exposed to levels exceeding 160 dB re 1 μPa (rms) may experience Level B harassment.

For toothed whales, researchers have derived TTS information for odontocetes from studies on the bottlenose dolphin and beluga. The experiments show that exposure to a single impulse at a received level of 207 kPa (or 30 psi, p-p), which is equivalent to 228 dB re 1 Pa (p-p), resulted in a 7 and 6 dB TTS in the beluga whale at 0.4 and 30 kHz, respectively. Thresholds returned to within 2 dB of the pre-exposure level within 4 minutes of the exposure (Finneran *et al.,* 2002). For the one harbor porpoise tested, the received level of airgun sound that elicited onset of TTS was lower (Lucke *et al.,* 2009). If these results from a single animal are representative, it is inappropriate to assume that onset of TTS occurs at similar received levels in all odontocetes (*cf.* Southall *et al.,* 2007). Some cetaceans apparently can incur TTS at considerably lower sound exposures than are necessary to elicit TTS in the beluga or bottlenose dolphin.

For baleen whales, there are no data, direct or indirect, on levels or properties of sound that are required to induce TTS. The frequencies to which baleen whales are most sensitive are assumed to be lower than those to which odontocetes are most sensitive, and natural background noise levels at those low frequencies tend to be higher. As a result, auditory thresholds of baleen whales within their frequency band of best hearing are believed to be higher (less sensitive) than are those of odontocetes at their best frequencies (Clark and Ellison, 2004). From this, it is suspected that received levels causing TTS onset may also be higher in baleen whales than those of odontocetes (Southall *et al.,* 2007).

Permanent Threshold Shift—When PTS occurs, there is physical damage to the sound receptors in the ear. In severe cases, there can be total or partial deafness, whereas in other cases, the animal has an impaired ability to hear sounds in specific frequency ranges (Kryter, 1985). There is no specific evidence that exposure to pulses of airgun sound can cause PTS in any marine mammal, even with large arrays of airguns. However, given the possibility that mammals close to an airgun array might incur at least mild TTS, there has been further speculation about the possibility that some individuals occurring very close to airguns might incur PTS (e.g., Richardson *et al.,* 1995, p. 372*ff;* Gedamke *et al.,* 2008). Single or occasional occurrences of mild TTS are not indicative of permanent auditory damage, but repeated or (in some cases) single exposures to a level well above that causing TTS onset might elicit PTS.

Relationships between TTS and PTS thresholds have not been studied in marine mammals, but are assumed to be similar to those in humans and other terrestrial mammals (Southall *et al.,* 2007). PTS might occur at a received sound level at least several dBs above that inducing mild TTS if the animal were exposed to strong sound pulses with rapid rise times. Based on data from terrestrial mammals, a precautionary assumption is that the PTS threshold for impulse sounds (such as airgun pulses as received close to the source) is at least 6 dB higher than the

TTS threshold on a peak-pressure basis, and probably greater than 6 dB (Southall *et al.,* 2007).

Given the higher level of sound necessary to cause PTS as compared with TTS, it is considerably less likely that PTS would occur. Baleen whales generally avoid the immediate area around operating seismic vessels, as do some other marine mammals. Some pinnipeds show avoidance reactions to airguns, but their avoidance reactions are generally not as strong or consistent as those of cetaceans, and occasionally they seem to be attracted to operating seismic vessels (NMFS, 2010).

Non-auditory Physiological Effects—Non-auditory physiological effects or injuries that theoretically might occur in marine mammals exposed to strong underwater sound include stress, neurological effects, bubble formation, resonance, and other types of organ or tissue damage (Cox *et al.,* 2006; Southall *et al.,* 2007). Studies examining such effects are limited. However, resonance effects (Gentry, 2002) and direct noise-induced bubble formations (Crum *et al.,* 2005) are implausible in the case of exposure to an impulsive broadband source like an airgun array. If seismic surveys disrupt diving patterns of deep-diving species, this might perhaps result in bubble formation and a form of the bends, as speculated to occur in beaked whales exposed to sonar. However, there is no specific evidence of this upon exposure to airgun pulses.

In general, very little is known about the potential for seismic survey sounds (or other types of strong underwater sounds) to cause non-auditory physical effects in marine mammals. Such effects, if they occur at all, would presumably be limited to short distances and to activities that extend over a prolonged period. The available data do not allow identification of a specific exposure level above which non-auditory effects can be expected (Southall *et al.,* 2007), or any meaningful quantitative predictions of the numbers (if any) of marine mammals that might be affected in those ways. Marine mammals that show behavioral avoidance of seismic vessels, including most baleen whales, some odontocetes, and some pinnipeds, are especially unlikely to incur non-auditory physical effects.

Stranding and Mortality—When a living or dead marine mammal swims or floats onto shore and becomes ‘‘beached’’ or incapable of returning to sea, the event is termed a ‘‘stranding’’ (Geraci *et al.,* 1999; Perrin and Geraci, 2002; Geraci and Lounsbury, 2005; NMFS, 2007). The legal definition for a stranding under the MMPA is that ‘‘(A) a marine mammal is dead and is (i) on a beach or shore of the United States; or (ii) in waters under the jurisdiction of the United States (including any navigable waters); or (B) a marine mammal is alive and is (i) on a beach or shore of the United States and is unable to return to the water; (ii) on a beach or shore of the United States and, although able to return to the water is in need of apparent medical attention; or (iii) in the waters under the jurisdiction of the United States (including any navigable waters), but is unable to return to its natural habitat under its own power or without assistance.’’

Marine mammals are known to strand for a variety of reasons, such as infectious agents, biotoxicosis, starvation, fishery interaction, ship strike, unusual oceanographic or weather events, sound exposure, or combinations of these stressors sustained concurrently or in series. However, the cause or causes of most strandings are unknown (Geraci *et al.,* 1976; Eaton, 1979; Odell *et al.,* 1980; Best, 1982). Numerous studies suggest that the physiology, behavior, habitat relationships, age, or condition of cetaceans may cause them to strand or might pre-dispose them to strand when exposed to another phenomenon. These suggestions are consistent with the conclusions of numerous other studies that have demonstrated that combinations of dissimilar stressors commonly combine to kill an animal or dramatically reduce its fitness, even though one exposure without the other does not produce the same result (Chroussos, 2000; Creel, 2005; DeVries *et al.,* 2003; Fair and Becker, 2000; Foley *et al.,* 2001; Moberg, 2000; Relyea, 2005a, 2005b; Romero, 2004; Sih *et al.,* 2004).

Strandings Associated with Military Active Sonar—Several sources have published lists of mass stranding events of cetaceans in an attempt to identify relationships between those stranding events and military active sonar (Hildebrand, 2004; IWC, 2005; Taylor et al., 2004). For example, based on a review of stranding records between 1960 and 1995, the International Whaling Commission (2005) identified ten mass stranding events and concluded that, out of eight stranding events reported from the mid-1980s to the summer of 2003, seven had been coincident with the use of mid-frequency active sonar and most involved beaked whales.

Over the past 12 years, there have been five stranding events coincident with military mid-frequency active sonar use in which exposure to sonar is believed to have been a contributing factor to strandings: Greece (1996); the Bahamas (2000); Madeira (2000); Canary Islands (2002); and Spain (2006). Refer to Cox *et al.* (2006) for a summary of common features shared by the strandings events in Greece (1996), Bahamas (2000), Madeira (2000), and Canary Islands (2002); and Fernandez *et al.,* (2005) for an additional summary of the Canary Islands 2002 stranding event. USGS would not be using military sonars; therefore, NMFS does not expect these potential effects to marine mammals.

Potential for Stranding from Seismic Surveys—Marine mammals close to underwater detonations of high explosives can be killed or severely injured, and the auditory organs are especially susceptible to injury (Ketten *et al.,* 1993; Ketten, 1995). However, explosives are no longer used in marine waters for commercial seismic surveys or (with rare exceptions) for seismic research. These methods have been replaced entirely by airguns or related non-explosive pulse generators. Airgun pulses are less energetic and have slower rise times, and there is no specific evidence that they can cause serious injury, death, or stranding even in the case of large airgun arrays. However, the association of strandings of beaked whales with naval exercises involving mid-frequency active sonar (non-pulse sound) and, in one case, the co-occurrence of an L–DEO seismic survey (Malakoff, 2002; Cox *et al.,* 2006), has raised the possibility that beaked whales exposed to strong ‘‘pulsed’’ sounds could also be susceptible to injury and/or behavioral reactions that can lead to stranding (e.g., Hildebrand, 2005; Southall *et al.,* 2007).

Specific sound-related processes that lead to strandings and mortality are not well documented, but may include:

(1) Swimming in avoidance of a sound into shallow water;

(2) A change in behavior (such as a change in diving behavior) that might contribute to tissue damage, gas bubble formation, hypoxia, cardiac arrhythmia, hypertensive hemorrhage or other forms of trauma;

(3) A physiological change such as a vestibular response leading to a behavioral change or stress-induced hemorrhagic diathesis, leading in turn to tissue damage; and

(4) Tissue damage directly from sound exposure, such as through acoustically-mediated bubble formation and growth or acoustic resonance of tissues.

Some of these mechanisms are unlikely to apply in the case of impulse sounds. However, there are indications that gas-bubble disease (analogous to ''the bends''), induced in supersaturated tissue by a behavioral response to acoustic exposure, could be a pathologic mechanism for the strandings and mortality of some deep-diving cetaceans exposed to sonar. The evidence for this remains circumstantial and associated with exposure to naval mid-frequency sonar, not seismic surveys (Cox *et al.,* 2006; Southall *et al.,* 2007).

Seismic pulses and mid-frequency sonar signals are quite different, and some mechanisms by which sonar sounds have been hypothesized to affect beaked whales are unlikely to apply to airgun pulses. Sounds produced by airgun arrays are broadband impulses with most of the energy below one kHz. Typical military mid-frequency sonar emits non-impulse sounds at frequencies of 2 to 10 kHz, generally with a relatively narrow bandwidth at any one time. A further difference between seismic surveys and naval exercises is that naval exercises can involve sound sources on more than one vessel. Thus, it is not appropriate to expect that the same effects to marine mammals would result from military sonar and seismic surveys. However, evidence that sonar signals can, in special circumstances, lead (at least indirectly) to physical damage and mortality (e.g., Balcomb and Claridge, 2001; NOAA and USN, 2001; Jepson *et al.,* 2003; Fernández *et al.,* 2004, 2005; Hildebrand 2005; Cox *et al.,* 2006) suggests that caution is warranted when dealing with exposure of marine mammals to any high-intensity sound.

There is no conclusive evidence of cetacean strandings or deaths at sea as a result of exposure to seismic surveys, but a few cases of strandings in the general area where a seismic survey was ongoing have led to speculation concerning a possible link between seismic surveys and strandings. Suggestions that there was a link between seismic surveys and strandings of humpback whales in Brazil (Engel *et al.,* 2004) were not well founded (IAGC, 2004; IWC, 2007). In September 2002, there was a stranding of two Cuvier's beaked whales in the Gulf of California, Mexico, when the L–DEO vessel R/V *Maurice Ewing* was operating a 20 airgun (8,490 in^3) array in the general area. The link between the stranding and the seismic surveys was inconclusive and not based on any physical evidence (Hogarth, 2002; Yoder, 2002). Nonetheless, the Gulf of California incident plus the beaked whale strandings near naval exercises involving use of mid-frequency sonar suggests a need for caution in conducting seismic surveys in areas occupied by beaked whales until more is known about effects of seismic surveys on those species (Hildebrand, 2005). No injuries of beaked whales are anticipated during the proposed study because of:

(1) The high likelihood that any beaked whales nearby would avoid the approaching vessel before being exposed to high sound levels, and

(2) Differences between the sound sources operated by L–DEO and those involved in the naval exercises associated with strandings.

Potential Effects of Other Acoustic Devices

Multi-Beam Echosounder

USGS would operate the Kongsberg EM 122 multi-beam echosounder from the source vessel during the planned study. Sounds from the multi-beam echosounder are very short pulses, occurring for 2 to 15 ms once every 5 to 20 s, depending on water depth. Most of the energy in the sound pulses emitted by this multi-beam echosounder is at frequencies near 12 kHz, and the maximum source level is 242 dB re 1 μPa (rms). The beam is narrow (1 to 2°) in fore-aft extent and wide (150°) in the cross-track extent. Each ping consists of eight (in water greater than 1,000 m deep) or four (in water less than 1,000 m deep) successive fan-shaped transmissions (segments) at different cross-track angles. Any given mammal at depth near the trackline would be in the main beam for only one or two of the nine segments. Also, marine mammals that encounter the Kongsberg EM 122 are unlikely to be subjected to repeated pulses because of the narrow fore–aft width of the beam and would receive only limited amounts of pulse energy because of the short pulses. Animals close to the ship (where the beam is narrowest) are especially unlikely to be ensonified for more than one 2 to 15 ms pulse (or two pulses if in the overlap area). Similarly, Kremser *et al.* (2005) noted that the probability of a cetacean swimming through the area of exposure when a multi-beam echosounder emits a pulse is small. The animal would have to pass the transducer at close range and be swimming at speeds similar to the vessel in order to receive the multiple pulses that might result in sufficient exposure to cause TTS.

Navy sonars that have been linked to avoidance reactions and stranding of cetaceans: (1) Generally have longer pulse duration than the Kongsberg EM 122; and (2) are often directed close to horizontally versus more downward for the multi-beam echosounder. The area of possible influence of the multi-beam echosounder is much smaller—a narrow band below the source vessel. Also, the duration of exposure for a given marine mammal can be much longer for naval sonar. During USGS's operations, the individual pulses would be very short, and a given mammal would not receive many of the downward-directed pulses as the vessel passes by. Possible effects of a multi-beam echosounder on marine mammals are described below.

Stranding—In 2013, an International Scientific Review Panel investigated a 2008 mass stranding of approximately 100 melon-headed whales in a Madagascar lagoon system (Southall *et al.,* 2013) associated with the use of a high-frequency mapping system. The report indicated that the use of a 12 kHz multi-beam echosounder was the most plausible and likely initial behavioral trigger of the mass stranding event. This was the first time that a relatively high-frequency mapping sonar system has been associated with a stranding event. However, the report also notes that there were several site- and situation-specific secondary factors that may have contributed to the avoidance responses that lead to the eventual entrapment and mortality of the whales within the Loza Lagoon system (e.g., the survey vessel transiting in a north-south direction on the shelf break parallel to the shore may have trapped the animals between the sound source and the shore driving them towards the Loza Lagoon). They concluded that for odontocete cetaceans that hear well in the 10 to 50 kHz range, where ambient noise is typically quite low, high-power active sonars operating in this range may be more easily audible and have potential effects over larger areas than low-frequency systems that have more typically been considered in terms of anthropogenic noise impacts (Southall *et al.,* 2013). However, the risk may be very low given the extensive use of these systems worldwide on a daily basis and the lack of direct evidence of such responses previously (Southall *et al.,* 2013).

Masking—Marine mammal communications would not be masked appreciably by the multi-beam echosounder signals given the low duty cycle of the multi-beam echosounder and the brief period when an individual mammal is likely to be within its beam. Furthermore, in the case of baleen whales, the multi-beam echosounder signals (12 kHz) do not overlap with the predominant frequencies in the calls, which would avoid any significant masking.

Behavioral Responses—Behavioral reactions of free-ranging marine mammals to sonars, echosounders, and other sound sources appear to vary by species and circumstance. Observed reactions have included silencing and dispersal by sperm whales (Watkins *et al.,* 1985), increased vocalizations and no dispersal by pilot whales (Rendell and Gordon, 1999), and the previously-mentioned beachings by beaked whales. During exposure to a 21 to 25 kHz ''whale-finding'' sonar with a source level of 215 dB re 1 μPa, gray whales reacted by orienting slightly away from the source and being deflected from their course by approximately 200 m (656.2 ft) (Frankel, 2005). When a 38 kHz echosounder and a 150 kHz acoustic Doppler current profiler were transmitting during studies in the eastern tropical Pacific, baleen whales showed no significant responses, while spotted and spinner dolphins were detected slightly more often and beaked whales less often during visual surveys (Gerrodette and Pettis, 2005).

Captive bottlenose dolphins and a beluga whale exhibited changes in behavior when exposed to 1 s tonal signals at frequencies similar to those that would be emitted by the multi-beam echosounder used by USGS, and to shorter broadband pulsed signals. Behavioral changes typically involved what appeared to be deliberate attempts to avoid the sound exposure (Schlundt *et al.,* 2000; Finneran *et al.,* 2002; Finneran and Schlundt, 2004). The relevance of those data to free-ranging odontocetes is uncertain, and in any case, the test sounds were quite different in duration as compared with those from a multi-beam echosounder.

Hearing Impairment and Other Physical Effects—Given recent stranding events that have been associated with the operation of naval sonar, there is concern that mid-frequency sonar sounds can cause serious impacts to marine mammals (see above). However, the multi-beam echosounder proposed for use by USGS is quite different than sonar used for Navy operations. Pulse duration of the multi-beam echosounder is very short relative to the naval sonar. Also, at any given location, an individual marine mammal would be in the beam of the multi-beam echosounder for much less time given the generally downward orientation of the beam and its narrow fore-aft beamwidth; Navy sonar often uses near-horizontally-directed sound. Those factors would all reduce the sound energy received from the multi-beam echosounder rather drastically relative to that from naval sonar. NMFS believes that the brief exposure of marine mammals to one pulse, or small numbers of signals, from the multi-beam echosounder is not likely to result in the harassment of marine mammals.

Sub-Bottom Profiler

USGS would also operate a sub-bottom profiler from the source vessel during the proposed survey. Sounds from the sub-bottom profiler are very short pulses, occurring for 1 to 4 ms once every few (3 to 6) seconds. Most of the energy in the sound pulses emitted by the sub-bottom profiler is at 3.5 kHz, and the beam is directed downward. The sub-bottom profiler on the *Langseth* has a maximum source level of 204 dB re 1 μPa. Kremser *et al.* (2005) noted that the probability of a cetacean swimming through the area of exposure when a bottom profiler emits a pulse is small—even for a sub-bottom profiler more powerful than that on the *Langseth.* If the animal was in the area, it would have to pass the transducer at close range in order to be subjected to sound levels that could cause TTS.

Masking—Marine mammal communications would not be masked appreciably by the sub-bottom profiler signals given the directionality of the signal and the brief period when an individual mammal is likely to be within its beam. Furthermore, in the case of most baleen whales, the sub-bottom profiler signals do not overlap with the predominant frequencies in the calls, which would avoid significant masking.

Behavioral Responses—Marine mammal behavioral reactions to other pulsed sound sources are discussed above, and responses to the sub-bottom profiler are likely to be similar to those for other pulsed sources if received at the same levels. However, the pulsed signals from the sub-bottom profiler are considerably weaker than those from the multi-beam echosounder. Therefore, behavioral responses are not expected unless marine mammals are very close to the source.

Hearing Impairment and Other Physical Effects—It is unlikely that the sub-bottom profiler produces pulse levels strong enough to cause hearing impairment or other physical injuries even in an animal that is (briefly) in a position near the source. The sub-bottom profiler is usually operated simultaneously with other higher-power acoustic sources, including airguns. Many marine mammals would move away in response to the approaching higher-power sources or the vessel itself before the mammals would be close enough for there to be any possibility of effects from the less intense sounds from the sub-bottom profiler.

Potential Effects of Vessel Movement and Collisions

Vessel movement in the vicinity of marine mammals has the potential to result in either a behavioral response or a direct physical interaction. Both scenarios are discussed below in this section.

Behavioral Responses to Vessel Movement—There are limited data concerning marine mammal behavioral responses to vessel traffic and vessel noise, and a lack of consensus among scientists with respect to what these responses mean or whether they result in short-term or long-term adverse effects. In those cases where there is a busy shipping lane or where there is a large amount of vessel traffic, marine mammals (especially low frequency specialists) may experience acoustic masking (Hildebrand, 2005) if they are present in the area (e.g., killer whales in Puget Sound; Foote *et al.,* 2004; Holt *et al.,* 2008). In cases where vessels actively approach marine mammals (e.g., whale watching or dolphin watching boats), scientists have documented that animals exhibit altered behavior such as increased swimming speed, erratic movement, and active avoidance behavior (Bursk, 1983; Acevedo, 1991; Baker and MacGibbon, 1991; Trites and Bain, 2000; Williams *et al.,* 2002; Constantine *et al.,* 2003), reduced blow interval (Ritcher *et al.,* 2003), disruption of normal social behaviors (Lusseau, 2003, 2006), and the shift of behavioral activities which may increase energetic costs (Constantine *et al.*, 2003, 2004). A detailed review of marine mammal reactions to ships and boats is available in Richardson *et al.,* (1995). For each of the marine mammal taxonomy groups, Richardson *et al.,* (1995) provides the following assessment regarding reactions to vessel traffic:

Toothed whales—''In summary, toothed whales sometimes show no avoidance reaction to vessels, or even approach them. However, avoidance can occur, especially in response to vessels of types used to chase or hunt the animals. This may cause temporary displacement, but we know of no clear evidence that toothed whales have abandoned significant parts of their range because of vessel traffic.''

Baleen whales—''When baleen whales receive low-level sounds from distant or stationary vessels, the sounds often seem to be ignored. Some whales approach the sources of these sounds. When vessels approach whales slowly and non-aggressively, whales often exhibit slow and inconspicuous avoidance maneuvers. In response to strong or rapidly changing vessel noise, baleen whales often interrupt their normal behavior and swim rapidly away. Avoidance is especially strong when a boat heads directly toward the whale.''

Behavioral responses to stimuli are complex and influenced to varying degrees by a number of factors, such as species, behavioral contexts, geographical regions, source characteristics (moving or stationary, speed, direction, etc.), prior experience of the animal and physical status of the animal. For example, studies have shown that beluga whales' reaction varied when exposed to vessel noise and traffic. In some cases, beluga whales exhibited rapid swimming from ice-breaking vessels up to 80 km (43.2 nmi) away, and showed changes in surfacing, breathing, diving, and group composition in the Canadian high Arctic where vessel traffic is rare (Finley *et al.,* 1990). In other cases, beluga whales were more tolerant of vessels, but responded differentially to certain vessels and operating characteristics by reducing their calling rates (especially older animals) in the St. Lawrence River where vessel traffic is common (Blane and Jaakson, 1994). In Bristol Bay, Alaska, beluga whales continued to feed when surrounded by fishing vessels and resisted dispersal even when purposefully harassed (Fish and Vania, 1971).

In reviewing more than 25 years of whale observation data, Watkins (1986) concluded that whale reactions to vessel traffic were ''modified by their previous experience and current activity: Habituation often occurred rapidly, attention to other stimuli or preoccupation with other activities sometimes overcame their interest or wariness of stimuli.'' Watkins noticed that over the years of exposure to ships in the Cape Cod area, minke whales changed from frequent positive interest (e.g., approaching vessels) to generally uninterested reactions; fin whales changed from mostly negative (e.g., avoidance) to uninterested reactions; fin whales changed from mostly negative (e.g., avoidance) to uninterested reactions; right whales apparently continued the same variety of responses (negative, uninterested, and positive responses) with little change; and humpbacks dramatically changed from mixed responses that were often negative to reactions that were often strongly positive. Watkins (1986) summarized that ''whales near shore, even in regions with low vessel traffic, generally have become less wary of boats and their noises, and they have appeared to be less easily disturbed than previously. In particular locations with intense shipping and repeated approaches by boats (such as the whale-watching areas of Stellwagen Bank), more and more whales had positive reactions to familiar vessels, and they also occasionally approached other boats and yachts in the same ways.''

Although the radiated sound from the *Langseth* would be audible to marine mammals over a large distance, it is unlikely that marine mammals would respond behaviorally (in a manner that NMFS would consider harassment under the MMPA) to low-level distant shipping noise as the animals in the area are likely to be habituated to such noises (Nowacek *et al.,* 2004). In light of these facts, NMFS does not expect the *Langseth's* movements to result in Level B harassment.

Vessel Strike—Ship strikes of cetaceans can cause major wounds, which may lead to the death of the animal. An animal at the surface could be struck directly by a vessel, a surfacing animal could hit the bottom of a vessel, or an animal just below the surface could be cut by a vessel's propeller. The severity of injuries typically depends on the size and speed of the vessel (Knowlton and Kraus, 2001; Laist *et al.,* 2001; Vanderlaan and Taggart, 2007).

The most vulnerable marine mammals are those that spend extended periods of time at the surface in order to restore oxygen levels within their tissues after deep dives (e.g., the sperm whale). In addition, some baleen whales, such as the North Atlantic right whale, seem generally unresponsive to vessel sound, making them more susceptible to vessel collisions (Nowacek *et al.,* 2004). These species are primarily large, slow moving whales. Smaller marine mammals (e.g., bottlenose dolphin) move quickly through the water column and are often seen riding the bow wave of large ships. Marine mammal responses to vessels may include avoidance and changes in dive pattern (NRC, 2003).

An examination of all known ship strikes from all shipping sources (civilian and military) indicates vessel speed is a principal factor in whether a vessel strike results in death (Knowlton and Kraus, 2001; Laist *et al.,* 2001; Jensen and Silber, 2003; Vanderlaan and Taggart, 2007). In assessing records in which vessel speed was known, Laist *et al.* (2001) found a direct relationship between the occurrence of a whale strike and the speed of the vessel involved in the collision. The authors concluded that most deaths occurred when a vessel was traveling in excess of 13 kts (24.1 km/hr, 14.9 mph).

USGS's proposed operation of one source vessel for the proposed survey is relatively small in scale compared to the number of commercial ships transiting at higher speeds in the same area on an annual basis. The probability of vessel and marine mammal interactions occurring during the proposed survey is unlikely due to the *Langseth's* slow operational speed, which is typically 4.5 kts (8.5 km/hr, 5.3 mph). Outside of seismic operations, the *Langseth's* cruising speed would be approximately 10 kts (18.5 km/hr, 11.5 mph), which is generally below the speed at which studies have noted reported increases of marine mammal injury or death (Laist *et al.,* 2001).

As a final point, the *Langseth* has a number of other advantages for avoiding ship strikes as compared to most commercial merchant vessels, including the following: The *Langseth's* bridge offers good visibility to visually monitor for marine mammal presence; Protected Species Visual Observers (PSVO) posted during operations would scan the ocean for marine mammals and would be required to report visual sightings of marine mammal presence to crew; and the PSVOs receive extensive training that covers the fundamentals of visual observing for marine mammals and information about marine mammals and their identification at sea. In addition, during airgun operations, a passive acoustic monitoring (PAM) system would be deployed from the *Langseth* that may alert the vessel of the presence of marine mammals in the vicinity of the vessel.

Entanglement

Entanglement can occur if wildlife becomes immobilized in survey lines, cables, nets, or other equipment that is moving through the water column. The proposed seismic survey would require towing of seismic equipment and cables. The large airgun array and hydrophone streamer carries the risk of entanglement for marine mammals. Wildlife, especially slow moving individuals, such as large whales, have a low probability of becoming entangled due to the slow speed of the survey vessel and onboard monitoring efforts. There are no recorded cases of entanglement of marine mammals during the conduct of over 8 years of seismic surveys on the *Langseth.* In May 2011, there was one recorded entanglement of an olive ridley sea turtle (*Lepidochelys olivacea*) in the *Langseth's* barovanes after the conclusion of a seismic survey off Costa Rica. However, the barovanes would not be deployed from the *Langseth* during USGS's proposed seismic survey. There have been cases of baleen whales, mostly gray whales (Heyning, 1990), becoming entangled in fishing lines. The probability for entanglement of marine mammals is considered not significant because of the vessel speed and the monitoring efforts onboard the survey vessel.

The potential effects to marine mammals described in this section of the document do not take into consideration the proposed monitoring and mitigation measures described later in this document (see the ''Proposed Mitigation'' and ''Proposed Monitoring and Reporting'' sections) which, as noted, are designed to effect the least practicable impact on affected marine mammal species and stocks.

Anticipated Effects on Marine Mammal Habitat

The proposed seismic survey is not anticipated to have any permanent impact on habitats used by the marine mammals in the proposed survey area, including the food sources they use (i.e., fish and invertebrates). Additionally, no physical damage to any habitat is anticipated as a result of conducting the proposed seismic survey. While it is anticipated that the specified activity may result in marine mammals avoiding certain areas due to temporary ensonification, this impact to habitat is temporary and was considered in further detail earlier in this document, as behavioral modification. The main impact associated with the proposed activity would be temporarily elevated noise levels and the associated direct effects on marine mammals in any particular area of the proposed project area, previously discussed in this notice. The proposed 2014 and 2015 seismic survey is not operating in a small, defined location. During the proposed 3,165 km (1,709 nmi) and 3,115 km (1,682 nmi) of tracklines in 2014 and 2015, respectively, the vessel would continuously move along the tracklines during the survey. The next section discusses the potential impacts of anthropogenic sound sources on common marine mammal prey in the proposed survey area (i.e., fish and invertebrates).

Anticipated Effects on Fish

One reason for the adoption of airguns as the standard energy source for marine seismic surveys is that, unlike explosives, they have not been associated with large-scale fish kills. However, existing information on the impacts of seismic surveys on marine fish and invertebrate populations is limited. There are three types of potential effects of exposure to seismic surveys: (1) Pathological, (2) physiological, and (3) behavioral. Pathological effects involve lethal and temporary or permanent sub-lethal injury. Physiological effects involve temporary and permanent primary and secondary stress responses, such as changes in levels of enzymes and proteins. Behavioral effects refer to temporary and (if they occur) permanent changes in exhibited behavior (e.g., startle and avoidance behavior). The three categories are interrelated in complex ways. For example, it is possible that certain physiological and behavioral changes could potentially lead to an ultimate pathological effect on individuals (i.e., mortality).

The specific received sound levels at which permanent adverse effects to fish potentially could occur are little studied and largely unknown. Furthermore, the available information on the impacts of seismic surveys on marine fish is from studies of individuals or portions of a population; there have been no studies at the population scale. The studies of individual fish have often been on caged fish that were exposed to airgun pulses in situations not representative of an actual seismic survey. Thus, available information provides limited insight on possible real-world effects at the ocean or population scale. This makes drawing conclusions about impacts on fish problematic because, ultimately, the most important issues concern effects on marine fish populations, their viability, and their availability to fisheries.

Hastings and Popper (2005), Popper (2009), and Popper and Hastings (2009a,b) provided recent critical reviews of the known effects of sound on fish. The following sections provide a general synopsis of the available information on the effects of exposure to seismic and other anthropogenic sound as relevant to fish. The information comprises results from scientific studies of varying degrees of rigor plus some anecdotal information. Some of the data sources may have serious shortcomings in methods, analysis, interpretation, and reproducibility that must be considered when interpreting their results (see Hastings and Popper, 2005). Potential adverse effects of the program's sound sources on marine fish are noted.

Pathological Effects—The potential for pathological damage to hearing structures in fish depends on the energy level of the received sound and the physiology and hearing capability of the species in question. For a given sound to result in hearing loss, the sound must exceed, by some substantial amount, the hearing threshold of the fish for that sound (Popper, 2005). The consequences of temporary or permanent hearing loss in individual fish on a fish population are unknown; however, they likely depend on the number of individuals affected and whether critical behaviors involving sound (e.g., predator avoidance, prey capture, orientation and navigation, reproduction, etc.) are adversely affected.

Little is known about the mechanisms and characteristics of damage to fish that may be inflicted by exposure to seismic survey sounds. Few data have been presented in the peer-reviewed scientific literature. As far as USGS and NMFS know, there are only two papers with proper experimental methods, controls, and careful pathological investigation implicating sounds produced by actual seismic survey airguns in causing adverse anatomical effects. One such study indicated anatomical damage, and the second indicated TTS in fish hearing. The anatomical case is McCauley *et al.* (2003), who found that exposure to airgun sound caused observable anatomical damage to the auditory maculae of pink snapper (*Pagrus auratus*). This damage in the ears had not been repaired in fish sacrificed and examined almost two months after exposure. On the other hand, Popper *et al.* (2005) documented only TTS (as determined by auditory brainstem response) in two of three fish species from the Mackenzie River Delta. This study found that broad whitefish (*Coregonus nasus*) exposed to five airgun shots were not significantly different from those of controls. During both studies, the repetitive exposure to sound was greater than would have occurred during a typical seismic survey. However, the substantial low-frequency energy produced by the airguns (less than 400 Hz in the study by McCauley *et al.* [2003] and less than approximately 200 Hz in Popper *et al.* [2005]) likely did not propagate to the fish because the water in the study areas was very shallow (approximately nine m in the former case and less than two m in the latter). Water depth sets a lower limit on the lowest sound frequency that would propagate (the ''cutoff frequency'') at about one-quarter wavelength (Urick, 1983; Rogers and Cox, 1988).

Wardle *et al.* (2001) suggested that in water, acute injury and death of organisms exposed to seismic energy depends primarily on two features of the sound source: (1) The received peak pressure, and (2) the time required for the pressure to rise and decay. Generally, as received pressure increases, the period for the pressure to rise and decay decreases, and the chance of acute pathological effects increases. According to Buchanan *et al.* (2004), for the types of seismic airguns and arrays involved with the proposed program, the pathological (mortality) zone for fish would be expected to be within a few meters of the seismic source. Numerous other studies provide examples of no fish mortality upon exposure to seismic sources (Falk and Lawrence, 1973; Holliday *et al.,* 1987; La Bella *et al.,* 1996; Santulli *et al.,* 1999; McCauley *et al.,* 2000a,b, 2003; Bjarti, 2002; Thomsen, 2002; Hassel *et al.,* 2003; Popper *et al.,* 2005; Boeger *et al.,* 2006).

An experiment of the effects of a single 700 in^3 airgun was conducted in Lake Meade, Nevada (USGS, 1999). The data were used in an Environmental Assessment of the effects of a marine reflection survey of the Lake Meade fault system by the National Park Service (Paulson *et al.,* 1993, in USGS, 1999). The airgun was suspended 3.5 m (11.5 ft) above a school of threadfin shad in Lake Meade and was fired three successive times at a 30 second interval. Neither surface inspection nor diver observations of the water column and bottom found any dead fish.

Some studies have reported, some equivocally, that mortality of fish, fish eggs, or larvae can occur close to seismic sources (Kostyuchenko, 1973; Dalen and Knutsen, 1986; Booman *et al.,* 1996; Dalen *et al.,* 1996). Some of the reports claimed seismic effects from treatments quite different from actual seismic survey sounds or even reasonable surrogates. However, Payne *et al.* (2009) reported no statistical differences in mortality/morbidity between control and exposed groups of capelin eggs or monkfish larvae. Saetre and Ona (1996) applied a 'worst-case scenario' mathematical model to investigate the effects of seismic energy on fish eggs and larvae. They concluded that mortality rates caused by exposure to seismic surveys are so low, as compared to natural mortality rates, that the impact of seismic surveying on recruitment to a fish stock must be regarded as insignificant.

Physiological Effects—Physiological effects refer to cellular and/or biochemical responses of fish to acoustic stress. Such stress potentially could affect fish populations by increasing mortality or reducing reproductive success. Primary and secondary stress responses of fish after exposure to seismic survey sound appear to be temporary in all studies done to date (Sverdrup *et al.,* 1994; Santulli *et al.,* 1999; McCauley *et al.,* 2000a,b). The periods necessary for the biochemical changes to return to normal are variable and depend on numerous aspects of the biology of the species and of the sound stimulus.

Behavioral Effects—Behavioral effects include changes in the distribution, migration, mating, and catchability of fish populations. Studies investigating the possible effects of sound (including seismic survey sound) on fish behavior have been conducted on both uncaged and caged individuals (e.g., Chapman and Hawkins, 1969; Pearson *et al.,* 1992; Santulli *et al.,* 1999; Wardle *et al.,* 2001; Hassel *et al.,* 2003). Typically, in these studies fish exhibited a sharp startle response at the onset of a sound followed by habituation and a return to normal behavior after the sound ceased.

The Minerals Management Service (MMS, 2005) assessed the effects of a proposed seismic survey in Cook Inlet. The seismic survey proposed using three vessels, each towing two, four-airgun arrays ranging from 1,500 to 2,500 in^3. MMS noted that the impact to fish populations in the survey area and adjacent waters would likely be very low and temporary. MMS also concluded that seismic surveys may displace the pelagic fishes from the area temporarily when airguns are in use. However, fishes displaced and avoiding the airgun noise are likely to backfill the survey area in minutes to hours after cessation of seismic survey. Fishes not dispersing from the airgun noise (e.g., demersal species) may startle and move short distances to avoid airgun emissions.

In general, any adverse effects on fish behavior or fisheries attributable to seismic surveys may depend on the species in question and the nature of the fishery (season, duration, fishing method). They may also depend on the age of the fish, its motivational state, its size, and numerous other factors that are difficult, if not impossible, to quantify at this point, given such limited data on effects of airguns on fish, particularly under realistic at-sea conditions.

Anticipated Effects on Invertebrates

The existing body of information on the impacts of seismic survey sound on marine invertebrates is very limited. However, there is some unpublished and very limited evidence of the potential for adverse effects on invertebrates, thereby justifying further discussion and analysis of this issue. The three types of potential effects of exposure to seismic surveys on marine invertebrates are pathological, physiological, and behavioral. Based on the physical structure of their sensory organs, marine invertebrates appear to be specialized to respond to particle displacement components of an impinging sound field and not to the pressure component (Popper *et al.,* 2001).

The only information available on the impacts of seismic surveys on marine invertebrates involves studies of individuals; there have been no studies at the population scale. Thus, available information provides limited insight on possible real-world effects at the regional or ocean scale. The most important aspect of potential impacts concerns how exposure to seismic survey sound ultimately affects invertebrate populations and their viability, including availability to fisheries.

Literature reviews of the effects of seismic and other underwater sound on invertebrates were provided by Moriyasu *et al.* (2004) and Payne *et al.* (2008). The following sections provide a synopsis of available information on the effects of exposure to seismic survey sound on species of decapod crustaceans and cephalopods, the two taxonomic groups of invertebrates on which most such studies have been conducted. The available information is from studies with variable degrees of scientific soundness and from anecdotal information. A more detailed review of the literature on the effects of seismic survey sound on invertebrates is provided in Appendix D of the NSF/USGS PEIS.

Pathological Effects—In water, lethal and sub-lethal injury to organisms exposed to seismic survey sound appears to depend on at least two features of the sound source: (1) The received peak pressure; and (2) the time required for the pressure to rise and decay. Generally, as received pressure increases, the period for the pressure to rise and decay decreases, and the chance of acute pathological effects increases. For the type of airgun array planned for the proposed program, the pathological (mortality) zone for crustaceans and cephalopods is expected to be within a few meters of the seismic source, at most; however, very few specific data are available on levels of seismic signals that might damage these animals. This premise is based on the peak pressure and rise/decay time characteristics of seismic airgun arrays currently in use around the world.

Some studies have suggested that seismic survey sound has a limited pathological impact on early developmental stages of crustaceans (Pearson *et al.,* 1994; Christian *et al.,* 2003; DFO, 2004). However, the impacts appear to be either temporary or insignificant compared to what occurs under natural conditions. Controlled field experiments on adult crustaceans (Christian *et al.,* 2003, 2004; DFO, 2004) and adult cephalopods (McCauley *et al.,* 2000a,b) exposed to seismic survey sound have not resulted in any significant pathological impacts on the animals. It has been suggested that exposure to commercial seismic survey activities has injured giant squid (Guerra *et al.,* 2004), but the article provides little evidence to support this claim. Tenera Environmental (2011b) reported that Norris and Mohl (1983, summarized in Mariyasu *et al.,* 2004) observed lethal effects in squid (*Loligo vulgaris*) at levels of 246 to 252 dB after 3 to 11 minutes.

Andre *et al.* (2011) exposed four species of cephalopods (*Loligo vulgaris, Sepia officinalis, Octopus vulgaris,* and *Ilex coindetii*), primarily cuttlefish, to two hours of continuous 50 to 400 Hz sinusoidal wave sweeps at 157+/−5 dB re 1 μPa while captive in relatively small tanks. They reported morphological and ultrastructural evidence of massive acoustic trauma (i.e., permanent and substantial alterations [lesions] of statocyst sensory hair cells) to the exposed animals that increased in severity with time, suggesting that cephalopods are particularly sensitive to low frequency sound. The received SPL was reported as 157+/−5 dB re 1 μPa, with peak levels at 175 dB re 1 μPa. As in the McCauley *et al.* (2003) paper on sensory hair cell damage in pink snapper as a result of exposure to seismic sound, the cephalopods were subjected to higher sound levels than they would be under natural conditions, and they were unable to swim away from the sound source.

Physiological Effects—Physiological effects refer mainly to biochemical responses by marine invertebrates to acoustic stress. Such stress potentially could affect invertebrate populations by increasing mortality or reducing reproductive success. Primary and secondary stress responses (i.e., changes in haemolymph levels of enzymes, proteins, etc.) of crustaceans have been noted several days or months after exposure to seismic survey sounds (Payne *et al.,* 2007). It was noted however, that no behavioral impacts were exhibited by crustaceans (Christian *et al.,* 2003, 2004; DFO, 2004). The periods necessary for these biochemical changes to return to normal are variable and depend on numerous aspects of the biology of the species and of the sound stimulus.

Behavioral Effects—There is increasing interest in assessing the possible direct and indirect effects of seismic and other sounds on invertebrate behavior, particularly in relation to the consequences for fisheries. Changes in behavior could potentially affect such aspects as reproductive success, distribution, susceptibility to predation, and catchability by fisheries. Studies investigating the possible behavioral effects of exposure to seismic survey sound on crustaceans and cephalopods have been conducted on both uncaged and caged animals. In some cases, invertebrates exhibited startle responses (e.g., squid in McCauley *et al.,* 2000a,b). In other cases, no behavioral impacts were noted (e.g., crustaceans in Christian *et al.,* 2003, 2004; DFO 2004). There have been anecdotal reports of reduced catch rates of shrimp shortly after exposure to seismic surveys; however, other studies have not observed any significant changes in shrimp catch rate (Andriguetto-Filho *et al.,* 2005). Similarly, Parry and Gason (2006) did not find any evidence that lobster catch rates were affected by seismic surveys. Any adverse effects on crustacean and cephalopod behavior or fisheries attributable to seismic survey sound depend on the species in question and the nature of the fishery (season, duration, fishing method).

Proposed Mitigation

In order to issue an Incidental Take Authorization (ITA) under section 101(a)(5)(D) of the MMPA, NMFS must set forth the permissible methods of taking pursuant to such activity, and other means of effecting the least practicable impact on such species or stock and its habitat, paying particular attention to rookeries, mating grounds, and areas of similar significance, and the availability of such species or stock for taking for certain subsistence uses (where relevant).

USGS has reviewed the following source documents and has incorporated a suite of appropriate mitigation measures into their project description.

(1) Protocols used during previous NSF and USGS-funded seismic research cruises as approved by NMFS and detailed in the NSF/USGS PEIS;

(2) Previous IHA applications and IHAs approved and authorized by NMFS; and

(3) Recommended best practices in Richardson *et al.* (1995), Pierson *et al.* (1998), and Weir and Dolman (2007).

To reduce the potential for disturbance from acoustic stimuli associated with the proposed activities, USGS and/or its designees have proposed to implement the following mitigation measures for marine mammals:

(1) Planning Phase;

(2) Proposed exclusion zones around the airgun(s);

(3) Power-down procedures;

(4) Shut-down procedures;

(5) Ramp-up procedures; and

(6) Special procedures for situations or species of concern.

Planning Phase—Mitigation of potential impacts from the proposed activities began during the planning phases of the proposed activities. USGS considered whether the research objectives could be met with a smaller source than the full, 36-airgun array (6,600 in^3) used on the *Langseth,* and determined that the standard 36-airgun array with a total volume of approximately 6,600 in^3 was appropriate. USGS also worked with L–DEO and NSF to identify potential time periods to carry out the survey taking into consideration key factors such as environmental conditions (i.e., the seasonal presence of marine mammals and other protected species), weather conditions, equipment, and optimal timing for other proposed seismic surveys using the *Langseth.* Most marine mammal species are expected to occur in the study area year-round, so altering the timing of the proposed project from spring and summer months likely would result in no net benefits for those species.

Proposed Exclusion Zones—USGS use radii to designate exclusion and buffer zones and to estimate take for marine mammals. Table 1 (presented earlier in this document) shows the distances at which one would expect marine mammal exposures to received sound levels (160 and 180/190 dB) from the 36 airgun array and a single airgun. (The 180 dB and 190 dB level shut-down criteria are applicable to cetaceans and pinnipeds, respectively, as specified by NMFS [2000].) USGS used these levels to establish the exclusion and buffer zones.

If the PSVO detects marine mammal(s) within or about to enter the appropriate exclusion zone, the *Langseth* crew would immediately power-down the airgun array, or perform a shut-down if necessary (see ''Shut-down Procedures''). Table 1 summarizes the calculated distances at which sound levels (160, 180 and 190 dB [rms]) are expected to be received from the 36 airgun array and the single airgun operating in deep water depths. Received sound levels have been calculated by USGS, in relation to distance and direction from the airguns, for the 36 airgun array and for the single 1900LL 40 in^3 airgun, which would be used during power-downs.

Power-down Procedures—A power-down involves decreasing the number of airguns in use to one airgun, such that the radius of the 180 dB or 190 dB zone is decreased to the extent that the observed marine mammal(s) are no longer in or about to enter the exclusion zone for the full airgun array. During a power-down for mitigation, L–DEO would operate one small airgun. The continued operation of one airgun is intended to (a) alert marine mammals to the presence of the seismic vessel in the area; and (b) retain the option of initiating a ramp-up to full operations under poor visibility conditions. In contrast, a shut-down occurs when all airgun activity is suspended.

If the PSVO detects a marine mammal outside the exclusion zone that is likely to enter the exclusion zone, USGS would power-down the airguns to reduce the size of the 180 dB or 190 dB exclusion zone before the animal is within the exclusion zone. Likewise, if a mammal is already within the exclusion zone, when first detected USGS would power-down the airguns immediately. During a power-down of the airgun array, USGS would operate the single 40 in^3 airgun, which has a smaller exclusion zone. If the PSVO detects a marine mammal within or near the smaller exclusion zone around that single airgun (see Table 1), USGS would shut-down the airgun (see next section).

Resuming Airgun Operations After a Power-down—Following a power-down, the *Langseth* will not resume full airgun activity until the marine mammal has cleared the 180 or 190 dB exclusion zone (see Table 1). The PSVO would consider the animal to have cleared the exclusion zone if:

• The PSVO has visually observed the animal leave the exclusion zone, or

• A PSVO has not sighted the animal within the exclusion zone for 15 minutes for species with shorter dive durations (i.e., small odontocetes or pinnipeds), or 30 minutes for species with longer dive durations (i.e., mysticetes and large odontocetes, including sperm, pygmy sperm, dwarf sperm, and beaked whales); or

• The vessel has transited outside the original 180 dB or 190 dB exclusion zone after a 10 minute wait period.

The *Langseth* crew would resume operating the airguns at full power after 15 minutes of sighting any species with short dive durations (i.e., small odontocetes or pinnipeds). Likewise, the crew would resume airgun operations at full power after 30 minutes of sighting any species with longer dive durations (i.e., mysticetes and large odontocetes, including sperm, pygmy sperm, dwarf sperm, and beaked whales).

Because the vessel would have transited away from the vicinity of the original sighting during the 10 minute period, implementing ramp-up procedures for the full array after an extended power-down (i.e., transiting for an additional 35 minutes from the location of initial sighting) would not meaningfully increase the effectiveness of observing marine mammals approaching or entering the exclusion zone for the full source level and would not further minimize the potential for take. The *Langseth's* PSVOs would continually monitoring the exclusion zone for the full source level while the mitigation airgun is firing. On average, PSVOs can observe to the horizon (10 km or 5.4 nmi) from the height of the *Langseth's* observation deck and should be able to state with a reasonable degree of confidence whether a marine mammal would be encountered within this distance before resuming airgun operations at full-power.

Shut-down Procedures—USGS would shut-down the operating airgun(s) if a marine mammal is seen within or approaching the exclusion zone for the single airgun. USGS would implement a shut-down:

(1) If an animal enters the exclusion zone of the single airgun after USGS has initiated a power-down; or

(2) If an animal is initially seen within the exclusion zone of the single airgun when more than one airgun (typically the full airgun array) is operating (and it is not practical or adequate to reduce exposure to less than 180 dB [rms] or 190 dB [rms]).

Considering the conservation status for the North Atlantic right whale, the airguns would be shut-down immediately in the unlikely event that this species is observed, regardless of the distance from the *Langseth*. Ramp-up would only begin if the North Atlantic right whale has not been seen for 30 minutes.

Resuming Airgun Operations After a Shut-down—Following a shut-down in excess of 10 minutes, the *Langseth* crew would initiate a ramp-up with the smallest airgun in the array (40 in^3). The crew would turn on additional airguns in a sequence such that the source level of the array would increase in steps not exceeding 6 dB per five-minute period over a total duration of approximately 30 minutes. During ramp-up, the PSVOs would monitor the exclusion zone, and if they sight a marine mammal, the *Langseth* crew would implement a power-down or shut-down as though the full airgun array were operational.

During periods of active seismic operations, there are occasions when the *Langseth* crew would need to temporarily shut-down the airguns due to equipment failure or for maintenance. In this case, if the airguns are inactive longer than eight minutes, the crew would follow ramp-up procedures for a shut-down described earlier and the PSVOs would monitor the full exclusion zone and would implement a power-down or shut-down if necessary.

If the full exclusion zone is not visible to the PSVO for at least 30 minutes prior to the start of operations in either daylight or nighttime, the *Langseth* crew would not commence ramp-up unless at least one airgun (40 in^3 or similar) has been operating during the interruption of seismic survey operations. Given these provisions, it is likely that the vessel's crew would not ramp-up the airgun array from a complete shut-down at night or during poor visibility conditions (i.e., in thick fog), because the outer part of the zone for that array would not be visible during those conditions.

If one airgun has operated during a power-down period, ramp-up to full power would be permissible at night or in poor visibility, on the assumption that marine mammals would be alerted to the approaching seismic vessel by the sounds from the single airgun and could move away. The vessel's crew would not initiate ramp-up of the airguns if a marine mammal is sighted within or near the applicable exclusion zones.

Ramp-up Procedures—Ramp-up of an airgun array provides a gradual increase in sound levels, and involves a step-wise increase in the number and total volume of airguns firing until the full volume of the airgun array is achieved. The purpose of a ramp-up is to ''warn'' marine mammals in the vicinity of the airguns, and to provide the time for them to leave the area and thus avoid any potential injury or impairment of their hearing abilities. USGS would follow a ramp-up procedure when the airgun array begins operating after a 10 minute period without airgun operations or when a power-down or shut-down has exceeded that period. USGS and L–DEO have used similar periods (approximately 8 to 10 minutes) during previous USGS and L–DEO seismic surveys.

Ramp-up would begin with the smallest airgun in the array (40 in^3). Airguns would be added in a sequence such that the source level of the array would increase in steps not exceeding six dB per five minute period over a total duration of approximately 30 to 35 minutes (i.e., the time it takes to achieve full operation of the airgun array). During ramp-up, the PSVOs would monitor the exclusion zone, and if marine mammals are sighted, USGS would implement a power-down or shut-down as though the full airgun array were operational.

If the complete exclusion zone has not been visible for at least 30 minutes prior to the start of operations in either daylight or nighttime, USGS would not commence the ramp-up unless at least one airgun (40 in^3 or similar) has been operating during the interruption of seismic survey operations. Given these provisions, it is likely that the airgun array would not be ramped-up from a complete shut-down at night or during poor visibility conditions (i.e., in thick fog), because the outer part of the exclusion zone for that array would not be visible during those conditions. If one airgun has operated during a power-down period, ramp-up to full power would be permissible at night or in poor visibility, on the assumption that marine mammals would be alerted to the approaching seismic vessel by the sounds from the single airgun and could move away. USGS would not initiate a ramp-up of the airguns if a marine mammal is sighted within or near the applicable exclusion zones.

Use of a Small-Volume Airgun During Turns and Maintenance

For short-duration equipment maintenance activities, USGS would employ the use of a small-volume airgun (i.e., 40 in^3 ''mitigation airgun'') to deter marine mammals from being within the immediate area of the seismic operations. The mitigation airgun would be operated at approximately one shot per minute and would not be operated for longer than three hours in duration. The seismic survey's tracklines are continuous around turns and no mitigation airgun would be necessary. For longer-duration equipment maintenance or repair activities (greater than three hours), USGS would shut-down the seismic equipment and not involve using the mitigation airgun.

During brief transits (e.g., less than three hours), one mitigation airgun would continue operating. The ramp-up procedure would still be followed when increasing the source levels from one airgun to the full airgun array. However, keeping one airgun firing would avoid the prohibition of a ''cold start'' during darkness or other periods of poor visibility. Through use of this approach, seismic operations may resume without the 30 minute observation period of the full exclusion zone required for a ''cold start,'' and without ramp-up if operating with the mitigation airgun for under 10 minutes, or with ramp-up if operating with the mitigation airgun over 10 minutes. PSOs would be on duty whenever the airguns are firing during daylight, during the 30 minute periods prior to ramp-ups.

Special Procedures for Situations or Species of Concern—It is unlikely that a North Atlantic right whale would be encountered during the proposed seismic survey, but if so, the airguns would be shut-down immediately if one is visually sighted at any distance from the vessel because of its rarity and conservation status. The airgun array shall not resume firing (with ramp-up) until 30 minutes after the last documented North Atlantic right whale visual sighting. Concentrations of humpback, sei, fin, blue, and/or sperm whales would be avoided if possible (i.e., exposing concentrations of animals to 160 dB), and the array would be powered-down if necessary. For purposes of this proposed survey, a concentration or group of whales would consist of six or more individuals visually sighted that do not appear to be traveling (e.g., feeding, socializing, etc.).

Mitigation Conclusions

NMFS has carefully evaluated the applicant's proposed mitigation measures and has considered a range of other measures in the context of ensuring that NMFS prescribes the means of effecting the least practicable impact on the affected marine mammal species and stocks and their habitat. NMFS's evaluation of potential measures included consideration of the following factors in relation to one another:

(1) The manner in which, and the degree to which, the successful implementation of the measure is expected to minimize adverse impacts to marine mammals;

(2) The proven or likely efficacy of the specific measure to minimize adverse impacts as planned; and

(3) The practicability of the measure for applicant implementation.

Any mitigation measure(s) prescribed by NMFS should be able to accomplish, have a reasonable likelihood of accomplishing (based on current science), or contribute to the accomplishment of one or more of the general goals listed below:

(1) Avoidance or minimization of injury or death of marine mammal wherever possible (goals 2, 3, and 4 may contribute to this goal).

(2) A reduction in the numbers of marine mammals (total number of number at biologically important time or location) exposed to received levels of airgun operations, or other activities expected to result in the take of marine mammals (this goal may contribute to 1, above, or to reducing harassment takes only).

(3) A reduction in the number of times (total number or number at biologically important time or location) individuals would be exposed to received levels of airgun operations, or other activities expected to result in the take of marine mammals (this goal may contribute to 1, above, or to reducing harassment takes only).

(4) A reduction in the intensity of exposures (either total number or number at biologically important time or location) to received levels of airgun operations, or other activities expected to result in the take of marine mammals (this goal may contribute to a, above, or to reducing the severity of harassment takes only).

(5) Avoidance of minimization of adverse effects to marine mammal habitat, paying special attention to the food base, activities that block or limit passage to or from biologically important areas, permanent destruction of habitat, or temporary destruction/disturbance of habitat during a biologically important time.

(6) For monitoring directly related to mitigation—an increase in the probability of detecting marine mammals, thus allowing for more effective implementation of the mitigation.

Based on NMFS's evaluation of the applicant's proposed measures, as well as other measures considered by NMFS or recommended by the public, NMFS has preliminarily determined that the proposed mitigation measures provide the means of effecting the least practicable impact on marine mammal species or stocks and their habitat, paying particular attention to rookeries, mating grounds, and areas of similar significance.

Proposed Monitoring and Reporting

In order to issue an ITA for an activity, section 101(a)(5)(D) of the MMPA states that NMFS must set forth ''requirements pertaining to the monitoring and reporting of such taking.'' The MMPA implementing regulations at 50 CFR 216.104 (a)(13) indicate that requests for ITAs must include the suggested means of accomplishing the necessary monitoring and reporting that would result in increased knowledge of the species and of the level of taking or impacts on populations of marine mammals that are expected to be present in the proposed action area. USGS submitted a marine mammal monitoring plan as part of the IHA application. It can be found in Section 13 of the IHA application. The plan may be modified or supplemented based on comments or new information received from the public during the public comment period or from the peer review panel.

Monitoring measures prescribed by NMFS should accomplish one or more of the following general goals:

(1) An increase in the probability of detecting marine mammals, both within the mitigation zone (thus allowing for more effective implementation of the mitigation) and in general to generate more data to contribute to the analyses mentioned below;

(2) An increase in our understanding of how many marine mammals are likely to be exposed to levels of seismic airguns that we associate with specific adverse effects, such as behavioral harassment, TTS or PTS;

(3) An increase in our understanding of how marine mammals respond to stimuli expected to result in take and how anticipated adverse effects on individuals (in different ways and to varying degrees) may impact the population, species, or stock (specifically through effects on annual rates of recruitment or survival) through any of the following methods:

- Behavioral observations in the presence of stimuli compared to observations in the absence of stimuli (need to be able to accurately predict received level, distance from source, and other pertinent information);
- Physiological measurements in the presence of stimuli compared to observations in the absence of stimuli (need to be able to accurately predict receive level, distance from the source, and other pertinent information);
- Distribution and/or abundance comparisons in times or areas with concentrated stimuli versus times or areas without stimuli;

(4) An increased knowledge of the affected species; and

(5) An increase in our understanding of the effectiveness of certain mitigation and monitoring measures.

Proposed Monitoring

USGS proposes to sponsor marine mammal monitoring during the proposed project, in order to implement the proposed mitigation measures that require real-time monitoring, and to satisfy the anticipated monitoring requirements of the IHA. USGS's proposed ''Monitoring Plan'' is described below this section. The monitoring work described here has been planned as a self-contained project independent of any other related monitoring projects that may be occurring simultaneously in the same region. USGS is prepared to discuss coordination of its monitoring program with any related work that might be done by other groups insofar as this is practical and desirable.

Vessel-Based Visual Monitoring

PSVOs would be based aboard the seismic source vessel and would watch for marine mammals near the vessel during daytime airgun operations and during any ramp-ups of the airguns at night. PSVOs would also watch for marine mammals near the seismic vessel for at least 30 minutes prior to the start of airgun operations after an extended shut-down (i.e., greater than approximately 10 minutes for this proposed cruise). When feasible, PSVOs would conduct observations during daytime periods when the seismic system is not operating (such as during transits) for comparison of sighting rates and behavior with and without airgun operations and between acquisition periods. Based on PSVO observations, the airguns would be powered-down or shut-down when marine mammals are observed within or about to enter a designated exclusion zone.

During seismic operations in the northwest Atlantic Ocean off the Eastern Seaboard, at least five PSOs (four PSVOs and one Protected Species Acoustic Observer [PSAO]) would be based aboard the *Langseth.* USGS would appoint the PSOs with NMFS's concurrence. Observations would take place during ongoing daytime operations and nighttime ramp-ups of the airguns. During the majority of seismic operations, two PSVOs would be on duty from the observation tower (i.e., the best available vantage point on the source vessel) to monitor marine mammals near the seismic vessel. Use of two simultaneous PSVOs would increase the effectiveness of detecting animals near the source vessel. However, during meal times and bathroom breaks, it is sometimes difficult to have two PSVOs on effort, but at least one PSVO would be on duty. PSVO(s) would be on duty in shifts no longer than 4 hours in duration.

Two PSVOs would also be on visual watch during all daytime ramp-ups of the seismic airguns. A third PSAO would monitor the PAM equipment 24 hours a day to detect vocalizing marine mammals present in the action area. In summary, a typical daytime cruise would have scheduled two PSVOs on duty from the observation tower, and a third PSAO on PAM. Other ship's crew would also be instructed to assist in detecting marine mammals and implementing mitigation requirements (if practical). Before the start of the seismic survey, the crew would be given additional instruction on how to do so.

The *Langseth* is a suitable platform for marine mammal observations. When stationed on the observation platform, the eye level would be approximately 21.5 m (70.5 ft) above sea level, and the PSVO would have a good view around the entire vessel. During daytime, the PSVO(s) would scan the area around the vessel systematically with reticle binoculars (e.g., 7 x 50 Fujinon), Big-eye binoculars (25 x 150), and with the naked eye. During darkness or low-light conditions, night vision devices (monoculars) and a forward looking infrared (FLIR) camera would be available, when required. Laser range-finding binoculars (Leica LRF 1200 laser rangefinder or equivalent) would be available to assist with distance estimation. Those are useful in training observers to estimate distances visually, but are generally not useful in measuring distances to animals directly; that is done primarily with the reticles in the binoculars.

When marine mammals are detected within or about to enter the designated exclusion zone, the airguns would immediately be powered-down or shut-down if necessary. The PSVO(s) would continue to maintain watch to determine when the animal(s) are outside the exclusion zone by visual confirmation. Airgun operations would not resume until the animal is confirmed to have left the exclusion zone, or if not observed after 15 minutes for species with shorter dive durations (small odontocetes and pinnipeds) or 30 minutes for species with longer dive durations (mysticetes and large odontocetes, including sperm, pygmy sperm, dwarf sperm, killer, and beaked whales).

Vessel-Based Passive Acoustic Monitoring

Vessel-based, towed PAM would complement the visual monitoring program, when practicable. Visual monitoring typically is not effective during periods of poor visibility or at night, and even with good visibility, is unable to detect marine mammals when they are below the surface or beyond visual range. PAM can be used in addition to visual observations to improve detection, identification, and localization of cetaceans. The PAM system would serve to alert visual observers (if on duty) when vocalizing cetaceans are detected. It is only useful when marine mammals call, but it does not depend on good visibility. It would be monitored in real-time so that the PSVOs can be advised when cetaceans are acoustically detected.

The PAM system consists of both hardware (i.e., hydrophones) and software (i.e., Pamguard). The ''wet end'' of the system consists of a towed hydrophone array that is connected to the vessel by a tow cable. The tow cable is 250 m (820.2 ft) long, and the hydrophones are fitted in the last 10 m (32.8 ft) of cable. A depth gauge is attached to the free end of the cable, and the cable is typically towed at depths 20 m (65.6 ft) or less. The array would be deployed from a winch located on the back deck. A deck cable would connect from the winch to the main computer laboratory where the acoustic station, signal conditioning, and processing system would be located. The acoustic signals received by the hydrophones are amplified, digitized, and then processed by the Pamguard software. The PAM system, which has a configuration of 4 hydrophones, can detect a frequency bandwidth of 10 Hz to 200 kHz.

One PSAO, an expert bioacoustician (in addition to the four PSVOs) with primary responsibility for PAM, would be onboard the *Langseth*. The expert bioacoustician would design and set up the PAM system and be present to operate, oversee, and troubleshoot any technical problems with the PAM system during the proposed survey. The towed hydrophones would ideally be monitored by the PSAO 24 hours per day while within the proposed seismic survey area during airgun operations, and during most periods when the *Langseth* is underway while the airguns are not operating. However, PAM may not be possible if damage occurs to the array or back-up systems during operations. The primary PAM streamer on the *Langseth* is a digital hydrophone streamer. Should the digital streamer fail, back-up systems should include an analog spare streamer and a hull-mounted hydrophone. One PSAO would monitor the acoustic detection system by listening to the signals from two channels via headphones and/or speakers and watching the real-time spectrographic display for frequency ranges produced by cetaceans. The PSAO monitoring the acoustical data would be on shift for no greater than six hours at a time. All PSOs are expected to rotate through the PAM position, although the expert PSAO (most experienced) would be on PAM duty more frequently.

When a vocalization is detected while visual observations (during daylight) are in progress, the PSAO would contact the PSVO immediately, to alert him/her to the presence of cetaceans (if they have not already been seen), and to allow a power-down or shut-down to be initiated, if required. When bearings (primary and mirror-image) to calling cetacean(s) are determined, the bearings would be relayed to the PSVO(s) to help him/her sight the calling animal. During non-daylight hours, when a cetacean is detected by acoustic monitoring and may be close to the source vessel, the *Langseth* crew would be notified immediately so that the proper mitigation measure may be implemented.

The information regarding the call would be entered into a database. Data entry would include an acoustic encounter identification number, whether it was linked with a visual sighting, date, time when first and last heard and whenever any additional information was recorded, position and water depth when first detected, bearing if determinable, species or species group (e.g., unidentified dolphin, sperm whale), types and nature of sounds heard (e.g., clicks, continuous, sporadic, whistles, creaks, burst pulses, strength of signal, etc.), and any other notable information. The acoustic detection can also be recorded for further analysis.

PSO Data and Documentation

PSVOs would record data to estimate the numbers of marine mammals exposed to various received sound levels and to document apparent disturbance reactions or lack thereof. Data would be used to estimate numbers of animals potentially 'taken' by harassment. They would also provide information needed to order a power-down or shut-down of the airguns when a marine mammal is within or near the appropriate exclusion zone. Observations would also be made during daytime periods when the *Langseth* is underway without seismic operations. There would also be opportunities to collect baseline biological data during the transits to, from, and through the study area.

When a sighting is made, the following information about the sighting would be recorded:

1. Species, group size, age/size/sex categories (if determinable), behavior when first sighted and after initial sighting, heading (if consistent), bearing and distance from seismic vessel, sighting cue, apparent reaction to the airguns or vessel (e.g., none, avoidance, approach, paralleling, etc.), and behavioral pace.

2. Time, location, heading, speed, activity of the vessel, Beaufort sea state and wind force, visibility, and sun glare.

The data listed under (2) would also be recorded at the start and end of each observation watch, and during a watch whenever there is a change in one or more of the variables.

All observations and ramp-ups, power-downs, or shut-downs would be recorded in a standardized format. The PSVOs would record this information onto datasheets. During periods between watches and periods when operations are suspended, those data would be entered into a laptop computer running a custom electronic database. The accuracy of the data entry would be verified by computerized data validity checks as the data are entered and by subsequent manual checking of the database. These procedures would allow initial summaries of data to be prepared during and shortly after the field program, and would facilitate transfer of the data to statistical, graphical, and other programs for further processing and archiving.

Results from the vessel-based observations would provide:

1. The basis for real-time mitigation (airgun power-down or shut-down).

2. Information needed to estimate the number of marine mammals potentially taken by harassment, which must be reported to NMFS.

3. Data on the occurrence, distribution, and activities of marine mammals in the area where the seismic study is conducted.

4. Information to compare the distance and distribution of marine mammals relative to the source vessel at times with and without seismic activity.

5. Data on the behavior and movement patterns of marine mammals seen at times with and without seismic activity.

Proposed Reporting

USGS would submit a comprehensive report to NMFS and NSF within 90 days after the end of phase 1 in 2014 and another comprehensive report to NMFS and NSF within 90 days after the end of phase 2 in 2015 for the proposed cruise. The report would describe the proposed operations that were conducted and sightings of marine mammals within the vicinity of the operations. The report would provide full documentation of methods, results, and interpretation pertaining to all monitoring. The 90-day report would summarize the dates and locations of seismic operations, and all marine mammal sightings (i.e., dates, times, locations, activities, associated seismic survey activities, and associated PAM detections). The report would minimally include:

• Summaries of monitoring effort—total hours, total distances, and distribution of marine mammals through the study period accounting for Beaufort sea state and wind force, and other factors affecting visibility and detectability of marine mammals;

• Analyses of the effects of various factors influencing detectability of marine mammals including Beaufort sea state and wind force, number of PSOs, and fog/glare;

- Species composition, occurrence, and distribution of marine mammals sightings including date, water depth, numbers, age/size/gender, and group sizes; and analyses of the effects of seismic operations;
- Sighting rates of marine mammals during periods with and without airgun activities (and other variables that could affect detectability);
- Initial sighting distances versus airgun activity state;
- Closest point of approach versus airgun activity state;
- Observed behaviors and types of movements versus airgun activity state;
- Numbers of sightings/individuals seen versus airgun activity state; and
- Distribution around the source vessel versus airgun activity state.

The report would also include estimates of the number and nature of exposures that could result in ''takes'' of marine mammals by harassment or in other ways. After the report is considered final, it would be publicly available on the NMFS, USGS and NSF Web sites at: *http://www.nmfs.noaa.gov/pr/permits/incidental.htm#iha, http://woodshole.er.usgs.gov/project-pages/environmental_compliance/index.html,* and *http://www.nsf.gov/geo/oce/encomp/index.jsp.*

Notification of Injured or Dead Marine Mammals—In the unanticipated event that the specified activity clearly causes the take of a marine mammal in a manner not permitted by the authorization (if issued), such as an injury, serious injury, or mortality (e.g., ship-strike, gear interaction, and/or entanglement), the USGS shall immediately cease the specified activities and immediately report the incident to the Incidental Take Program Supervisor, Permits and Conservation Division, Office of Protected Resources, NMFS, at 301–427–8401 and/or by email to *Jolie.Harrison@noaa.gov* and *Howard.Goldstein@noaa.gov*, the NMFS Greater Atlantic Region Marine Mammal Stranding Network at 866–755–6622 (*Mendy.Garron@noaa.gov*), and the NMFS Southeast Region Marine Mammal Stranding Network at 877–433–8299 (*Blair.Mase@noaa.gov* and *Erin.Fougeres@noaa.gov*). The report must include the following information:

- Time, date, and location (latitude/longitude) of the incident;
- Name and type of vessel involved;
- Vessel's speed during and leading up to the incident;
- Description of the incident;
- Status of all sound source used in the 24 hours preceding the incident;
- Water depth;
- Environmental conditions (e.g., wind speed and direction, Beaufort sea state, cloud cover, and visibility);
- Description of all marine mammal observations in the 24 hours preceding the incident;
- Species identification or description of animal(s) involved;
- Fate of the animal(s); and
- Photographs or video footage of the animal(s) (if equipment is available).

USGS shall not resume its activities until NMFS is able to review the circumstances of the prohibited take. NMFS shall work with USGS to determine what is necessary to minimize the likelihood of further prohibited take and ensure MMPA compliance. The USGS may not resume their activities until notified by NMFS via letter, email, or telephone.

In the event that USGS discovers an injured or dead marine mammal, and the lead PSO determines that the cause of the injury or death is unknown and the death is relatively recent (i.e., in less than a moderate state of decomposition as NMFS describes in the next paragraph), the USGS would immediately report the incident to the Incidental Take Program Supervisor, Permits and Conservation Division, Office of Protected Resources, at 301–427–8401 and/or by email to *Jolie.Harrison@noaa.gov* and *Howard.Goldstein@noaa.gov,* the NMFS Greater Atlantic Region Marine Mammal Stranding Network (866–755–6622) and/or by email to the Greater Atlantic Regional Stranding Coordinator (*Mendy.Garron@noaa.gov*), and the NMFS Southeast Region Marine Mammal Stranding Network (877–433–8299) and/or by email to the Southeast Regional Stranding Coordinator (*Blair.Mase@noaa.gov*) and Southeast Regional Stranding Program Administrator (*Erin.Fougeres@noaa.gov*). The report must include the same information identified in the paragraph above this section. Activities may continue while NMFS reviews the circumstances of the incident. NMFS would work with the USGS to determine whether modifications in the activities are appropriate.

In the event that USGS discovers an injured or dead marine mammal, and the lead PSO determines that the injury or death is not associated with or related to the authorized activities (e.g., previously wounded animal, carcass with moderate to advanced decomposition, or scavenger damage), the USGS would report the incident to the Incidental Take Program Supervisor, Permits and Conservation Division, Office or Protected Resources, at 301–427–8401 and/or by email to *Jolie.Harrison@noaa.gov* and *Howard.Goldstein@noaa.gov,* the NMFS Greater Atlantic Region Marine Mammal Stranding Network (866–755–6622), and/or by email to the Greater Atlantic Regional Stranding Coordinator (*Mendy.Garron@ noaa.gov*), and the NMFS Southeast Region Marine Mammal Stranding Network (877–433–8299), and/or by email to the Southeast Regional Stranding Coordinator (*Blair.Mase@noaa.gov*) and Southeast Regional Stranding Program Administrator (*Erin.Fougeres@noaa.gov*), within 24 hours of the discovery. The USGS would provide photographs or video footage (if available) or other documentation of the stranded animal sighting to NMFS and the Marine Mammal Stranding Network. Activities may continue while NMFS reviews the circumstances of the incident.

Estimated Take by Incidental Harassment

Except with respect to certain activities not pertinent here, the MMPA defines ''harassment'' as: Any act of pursuit, torment, or annoyance which (i) has the potential to injure a marine mammal or marine mammal stock in the wild [Level A harassment]; or (ii) has the potential to disturb a marine mammal or marine mammal stock in the wild by causing disruption of behavioral patterns, including, but not limited to, migration, breathing, nursing, breeding, feeding, or sheltering [Level B harassment].

TABLE 3—NMFS'S CURRENT UNDERWATER ACOUSTIC EXPOSURE CRITERIA

Impulsive (non-explosive) sound		
Criterion	Criterion definition	Threshold
Level A harassment (injury)	Permanent threshold shift (PTS) (Any level above that which is known to cause TTS).	180 dB re 1 μPa-m (root means square [rms]) (cetaceans). 190 dB re 1 μPa-m (rms) (pinnipeds).
Level B harassment	Behavioral disruption (for impulsive noise)	160 dB re 1 μPa-m (rms).
Level B harassment	Behavioral disruption (for continuous noise)	120 dB re 1 μPa-m (rms).

Level B harassment is anticipated and proposed to be authorized as a result of the proposed marine seismic survey in the northwest Atlantic Ocean off the Eastern Seaboard. Acoustic stimuli (i.e., increased underwater sound) generated during the operation of the seismic airgun array are expected to result in the behavioral disturbance of some marine mammals. There is no evidence that the planned activities for which USGS seeks the IHA could result in injury, serious injury, or mortality. The required mitigation and monitoring measures would minimize any potential risk for injury, serious injury, or mortality.

The following sections describe USGS's methods to estimate take by incidental harassment and present the applicant's and NMFS's estimates of the numbers of marine mammals that could be affected during the proposed seismic program in the northwest Atlantic Ocean. The estimates are based on a consideration of the number of marine mammals that could be harassed by seismic operations with the 36 airgun array to be used. The length of the proposed 2D seismic survey area in 2014 is approximately 3,165 km (1,704 nmi) and in 2015 is approximately 3,115 km (1,682 nmi) in the U.S. ECS region of the Eastern Seaboard in the Atlantic Ocean, as depicted in Figure 1 of the IHA application. For estimating take and other calculations, the 2015 tracklines are assumed to be identical in length to the 2014 tracklines (even though they are slightly shorter).

USGS assumes that, during simultaneous operations of the airgun array and the other sources, any marine mammals close enough to be affected by the multi-beam echosounder and sub-bottom profiler would already be affected by the airguns. However, whether or not the airguns are operating simultaneously with the other sources, marine mammals are expected to exhibit no more than short-term and inconsequential responses to the multi-beam echosounder and sub-bottom profiler given their characteristics (e.g., narrow, downward-directed beam) and other considerations described previously. Such reactions are not considered to constitute ''taking'' (NMFS, 2001). Therefore, USGS provided no additional allowance for animals that could be affected by sound sources other than airguns.

Density estimates for marine mammals within the vicinity of the proposed study area are limited. Density data for species found along the East Coast of the U.S. generally extend slightly outside of the U.S. EEZ. The proposed study area, however, is well beyond the U.S. EEZ, and is well off the continental shelf break. The proposed survey lines for the proposed 2014 survey are located in the far eastern portion of the proposed study area, primarily within the area where little to no density data are currently available. It was determined that the best available information for density data (for those species where density data existed) of species located off the U.S. East Coast was housed at the Strategic Environmental and Development Program (SERDP)/National Aeronautics and Space Administration (NASA)/ NOAA Marine Animal Model Mapper and OBIS–SEAMAP database. Within this database, the model outputs for all four seasons from the U.S. Department of the Navy Operating Area (OPAREA) Density Estimates (NODE) for the Northeast OPAREA and Southeast OPAREA (Department of the Navy 2007a, 2007b) were used to determine the mean density (animals per square kilometer) for 19 of the 38 marine mammals with the potential to occur in the proposed study area. Those species include fin, minke, Atlantic spotted, bottlenose, long-finned and short-finned pilot, pantropical spotted, Risso's, short-beaked common, striped, sperm, rough-toothed, dwarf and pygmy sperm, Sowerby's, Blainville's, Gervais', True's, and Cuvier's beaked whales. Within the NODE document, the density calculations and models both took into account detection probability (f[0]) and availability (g[0]) biases. Model outputs for each season are available in the database. The data from the NODE summer density models, which include the months of June, July, and August, were used as the 2014 survey is proposed to take place between late August and early September. Of the seasonal NODE density models available, it is expected that the summer models are the most accurate and robust as the survey data used to create all of the models were obtained during summer months. The models for the winter, spring, and fall are derived from the data collected during the summer surveys, and therefore are expected to be less representative of actual species density during those seasons.

For those species of marine mammals that did not have density model outputs within the SERDP/NASA/NOAA and OBIS–SEAMAP database, or for those species with density outputs that did not extend into the proposed study area at all (i.e., all four pinniped species and sei whale), but for which OBIS sightings data within or adjacent to the proposed study area exist, the requested take authorization for the mean group size of the species of marine mammal is included. The mean group sizes were determined based on data reported from the Cetacean and Turtle Assessment Program (CeTAP) surveys (CeTAP, 1982).

The estimated numbers of individuals potentially exposed to sound during the proposed 2014 to 2015 survey are presented below and are based on the 160 dB (rms) criterion currently used for all cetaceans and pinnipeds. It is assumed that marine mammals exposed to airgun sounds that strong could change their behavior sufficiently to be considered ''taken by harassment.'' Table 4 shows the density estimates calculated as described above and the estimates of the number of different individual marine mammals that potentially could be exposed to greater than or equal to 160 dB (rms) during the seismic survey if no animals moved away from the survey vessel. The requested take authorization is given in the middle (fourth from the left) column of Table 4. For species for which densities were unavailable as described above, but for which there were Ocean Biogeographic Information System (OBIS) sightings within or adjacent to the proposed study area, USGS has included a requested take authorization for the mean group size for the species.

It should be noted that unlike previous USGS, NSF, and L–DEO seismic surveys aboard the *Langseth,* the proposed survey would be conducted as almost one continuous line. Therefore, the ensonified area for the proposed seismic survey does not include a contingency factor (typically increased 25% to accommodate turns, lines that may need to be repeated, equipment testing, etc.) in line-kilometers. As typical during offshore ship surveys, inclement weather and equipment malfunctions are likely to cause delays and may limit the number of useful line-kilometers of seismic operations that can be undertaken. Also, any marine mammal sightings within or near the designated exclusion zones would result in a power-down and/or shut-down of seismic operations as a mitigation measure. Thus, the following estimates of the numbers of marine mammals potentially exposed to 160 dB (rms) sounds are precautionary and probably overestimate the actual numbers of marine mammals that could be involved. These estimates assume that there would be no weather, equipment, or mitigation delays, which is highly unlikely.

The number of different individuals that could be exposed to airgun sounds with received levels greater than or equal to 160 dB (rms) on one or more occasions can be estimated by considering the total marine area that would be within the 160 dB (rms) radius around the operating seismic source on at least one occasion, along with the expected density of animals in the area. The number of possible exposures (including repeated exposures of the same individuals) can be estimated by considering the total marine area that would be within the 160 dB radius around the operating airguns. In many seismic surveys, this total marine area includes overlap, as seismic surveys are often conducted in parallel survey lines where the ensonified areas of each survey line would overlap. The proposed tracklines in 2014 and 2015 would not have overlap as the individual line segments do not run parallel to each other. The entire survey could be considered one continual survey line with slight turns (no more than 120 degrees) between each line segment. During the proposed seismic survey, the vessel would continue on the extensive survey line path, not staying within a smaller defined area as most seismic surveys often do. The numbers of different individuals potentially exposed to greater than or equal to 160 dB (rms) were calculated by multiplying the expected species density (for those marine mammal species that had density data available) times the total anticipated area to be ensonified to that level during airgun operations (3,165 km of survey lines). The total area expected to be ensonified was determined by multiplying the total trackline distance (3,165 km times the width of the swath of the 160 dB buffer zone (2 times 5.78 km). Using this approach, a total of 36,600 km^2 (10,671 nmi^2) would fall within the 160 dB isopleth throughout the proposed survey in 2014. The proposed survey in 2015 is expected to ensonify an almost identical area (to within 2%); therefore, the same ensonified area of 36,600 km^2 (10,671 nmi^2) was used for calculation purposes since the number of estimated takes would be very similar for each of the two years. The number of estimated takes for the proposed survey in 2015 may need to be seasonally adjusted if the activity takes place in the late spring or early summer. Because it is uncertain at this time whether the 2015 survey would be scheduled in the spring (March, April, and May) or summer (June, July, and August) months, estimated takes were calculated for both seasons. For purposes of conservatively estimating the number of takes, the higher density (for spring or summer) was used for each species since it is not known at this time which season the 2015 proposed survey would take place in the April to August 2015 timeframe. If the 2015 survey occurred in the spring rather than summer, the density data suggests that takes would likely be higher for only the humpback whale, beaked whales, and bottlenose dolphin, and takes would likely be fewer for nine species (i.e., sperm whale, short-finned and long-finned pilot whales, Atlantic spotted, pantropical spotted, striped, Clymene, short-beaked common, and Risso's dolphin), and unchanged for the remaining species.

TABLE 4—ESTIMATED DENSITIES OF MARINE MAMMAL SPECIES AND ESTIMATES OF POSSIBLE NUMBERS OF MARINE MAMMALS EXPOSED TO SOUND LEVELS ≥160 DB DURING USGS'S PROPOSED SEISMIC SURVEY IN THE NORTHWEST ATLANTIC OCEAN OFF THE EASTERN SEABOARD, AUGUST TO SEPTEMBER 2014 AND APRIL TO AUGUST 2015

Species	Density spring/summer ($\#/km^2$) [1]	Calculated take authorization 2014/2015 [i.e., estimated number of individuals exposed to sound levels ≥160 dB re 1 μPa] [2]	Requested take authorization (includes increase to average group size) [3]	Abundance (regional population/stock) [4]	Approximate percentage of estimated of regional population/stock (for requested take) [5]	Population trend [6]
Mysticetes:						
North Atlantic right whale.	NA	0/0	3 + 3 = 6	455/455	1.32/1.32	Increasing.
Humpback whale	0.0010170/0	0/38	38 + 3 = 41	11,600/823	0.35/4.98	Increasing.
Minke whale	0.0000350/ 0.0000360	2/2	2 + 2 = 4	138,000/20,741	0.0014/0.0096	NA.
Bryde's whale	NA	0/0	3 + 3 = 6	NA/NA	NA/NA	NA.
Sei whale	NA	0/0	3 + 3 = 6	10,300/357	0.06/1.68	NA.
Fin whale	0.000060/ 0.000610	3/3	3 + 3 = 6	26,500/3,522	0.02/0.17	NA.
Blue whale	NA	0/0	2 + 2 = 4	855/440	0.47/0.91	NA.
Odontocetes:						
Sperm whale	0.0019050/ 0.0022510	83/83	83 + 83 = 166	13,190/2,288	1.26/7.26	NA.
Pygmy sperm whale.	0.0008850/ 0.008970	33/33	33 + 33 = 66	NA/3,785	NA/1.74	NA.

TABLE 4—ESTIMATED DENSITIES OF MARINE MAMMAL SPECIES AND ESTIMATES OF POSSIBLE NUMBERS OF MARINE MAMMALS EXPOSED TO SOUND LEVELS ≥160 dB DURING USGS'S PROPOSED SEISMIC SURVEY IN THE NORTHWEST ATLANTIC OCEAN OFF THE EASTERN SEABOARD, AUGUST TO SEPTEMBER 2014 AND APRIL TO AUGUST 2015—Continued

Species	Density spring/ summer (#/km²) [1]	Calculated take authorization 2014/2015 [i.e., estimated number of individuals exposed to sound levels ≥160 dB re 1 μPa] [2]	Requested take authorization (includes increase to average group size) [3]	Abundance (regional population/ stock) [4]	Approximate percentage of estimated of regional population/stock (for requested take) [5]	Population trend [6]
Dwarf sperm whale	0.0008850/ 0.0008970	33/33	33 + 33 = 66	NA/3,785	NA/1.74	NA.
Northern bottlenose whale.	NA	0/0	2 + 2 = 4	40,000/NA	0.01/NA	NA.
Cuvier's beaked whale.	0.0021370/ 0.0022870	84/84	84 + 84 = 168	NA/6,532	NA/1.29	NA.
Mesoplodon spp. (i.e., True's, Gervais', Sowerby's, and Blainville's beaked whale.				NA/7,092	NA/2.37	NA.
Bottlenose dolphin	0.0069560/ 0.0066470	244/255	244 + 255 = 499	NA/77,532	NA/0.64	NA.
Atlantic white-sided dolphin.	NA	0/0	54 + 54 = 108	10,000 to 100,000s/ 48,819.	1.08/0.22	NA.
Fraser's dolphin	NA	0/0	100 + 100 = 200	NA/NA	NA/NA	NA.
Atlantic spotted dolphin.	0.0285700/ 0.0288400	1,056/1,056	1,056 + 1,056 = 2,112.	NA/44,715	NA/4.72	NA.
Pantropical spotted dolphin.	0.0194900/ 0.0197600	724/724	724 + 724 = 1,448	NA/3,333	NA/43.44	NA.
Striped dolphin	0.1330000/ 0.1343000	4,916/4,916	4,916 + 4,916 = 9,832.	NA/54,807	NA/17.94	NA.
Spinner dolphin	NA	0/0	65 + 65 = 130	NA/NA	NA/NA	NA.
Clymene dolphin	0.0093110/0	0/341	70 + 341 = 411	NA/NA	NA/NA	NA.
Short-beaked common dolphin.	0.0053940/ 0.0055320	203/203	203 + 203 = 406	NA/173,486	NA/0.23	NA.
Rough-toothed dolphin.	0.004200/ 0.0004260	16/16	16 + 16 = 32	NA/271	NA/11.81	NA.
Risso's dolphin	0.0092150/ 0.0093180	342/342	342 + 342 = 684	NA/18,250	NA/3.75	NA.
Melon-headed whale.	NA	0/0	100 + 100 = 200	NA/NA	NA/NA	NA.
Pygmy killer whale	NA	0/0	25 + 25 = 50	NA/NA	NA/NA	NA.
False killer whale	NA	0/0	15 + 15 = 30	NA/NA	NA/NA	NA.
Killer whale	NA	0/0	7 + 7 = 14	NA/NA	NA/NA	NA.
Short-finned pilot whale.	0.0108000/ 0.0190400	697/697	697 + 697 = 1,394	780,000/21,515	0.18/6.48	NA.
Long-finned pilot whale.	0.0108000/ 0.0190400	697/697	697 + 697 = 1,394	780,000/26,535	0.18/5.25	NA.
Harbor porpoise	NA	0/0	5 + 5 = 10	500,000/79,883	0.002/0.01	NA.
Pinnipeds:						
Harbor seal	NA	0/0	0 + 0 = 0	NA/70,142	NA/NA	NA.
Gray seal	NA	0/0	0 + 0 = 0	NA/331,000	NA/NA	Increasing.
Harp seal	NA	0/0	0 + 0 = 0	8.6 to 9.6 million/7.1 million.	NA/NA	NA.
Hooded seal	NA	0/0	0 + 0 = 0	600,000/592,100	NA/NA	NA.

NA = Not available or not assessed.
[1] OBIS–SERDP–Navy NODE 2007a and 2007b (for those species where density data is available).
[2] Calculated take is estimated density multiplied by the 160 dB ensonified area.
[3] Requested take authorization was increased to group size for species for which densities were not available but that have been sighted near the proposed survey area (CeTAP, 1984).
[4] Stock sizes are best populations from NMFS Stock Assessment Reports where available (see Table 2 in above).
[5] Requested takes expressed as percentages of the larger regional population and NMFS Stock Assessment Reports, where available.
[6] Based on NMFS Stock Assessment Reports.

Applying the approach described above, approximately 36,600 km² would be within the 160 dB isopleth on one or more occasions during the proposed survey in 2014. The proposed survey in 2015 is expected to ensonify an almost identical area (to within 2%); therefore an ensonified area of 36,600 km² was used for the proposed surveys in 2014 and 2015. Because this approach does not allow for turnover in the marine mammal populations in the area during the course of the survey, the actual number of individuals exposed may be underestimated, although the conservative (i.e., probably overestimated) line-kilometer distances used to calculate the area may offset this. Also, the approach assumes that no cetaceans and pinnipeds would move away or toward the trackline as the *Langseth* approaches in response to increasing sound levels before the levels reach 160 dB (rms). Another way of interpreting the estimates that follow is that they represent the number of individuals that are expected (in the absence of a seismic program) to occur in the waters that would be exposed to greater than or equal to 160 dB (rms).

Encouraging and Coordinating Research

USGS would coordinate the planned marine mammal monitoring program associated with the seismic survey with other parties that may have interest in this area and specified activity. USGS would coordinate with applicable U.S. agencies (e.g., NMFS), and would comply with their requirements.

Impact on Availability of Affected Species or Stock for Taking for Subsistence Uses

Section 101(a)(5)(D) of the MMPA also requires NMFS to determine that the authorization would not have an unmitigable adverse effect on the availability of marine mammal species or stocks for subsistence use. There are no relevant subsistence uses of marine mammals implicated by this action. Therefore, NMFS has determined that the total taking of affected species or stocks would not have an unmitigable adverse impact on the availability of such species or stocks for taking for subsistence purposes.

Analyses and Preliminary Determinations

Negligible Impact

Negligible impact is ''an impact resulting from the specified activity that cannot be reasonably expected to, and is not reasonably likely to, adversely affect the species or stock through effects on annual rates of recruitment or survival'' (50 CFR 216.103). A negligible impact finding is based on the lack of likely adverse effects on annual rates of recruitment or survival (i.e., population-level effects). An estimate of the number of Level B harassment takes alone is not enough information on which to base an impact determination. In addition to considering estimates of the number of marine mammals that might be ''taken'' through behavioral harassment, NMFS must consider other factors, such as the likely nature of any responses (their intensity, duration, etc.), the context of any responses (critical reproductive time or location, migration, etc.), as well as the number and nature of estimated Level A harassment takes, the number of estimated mortalities, and effects on habitat.

In making a negligible impact determination, NMFS evaluated factors such as:

(1) The number of anticipated injuries, serious injuries, or mortalities;

(2) The number, nature, and intensity, and duration of Level B harassment (all relatively limited); and

(3) The context in which the takes occur (i.e., impacts to areas of significance, impacts to local populations, and cumulative impacts when taking into account successive/contemporaneous actions when added to baseline data);

(4) The status of stock or species of marine mammals (i.e., depleted, not depleted, decreasing, increasing, stable, impact relative to the size of the population);

(5) Impacts on habitat affecting rates of recruitment/survival; and

(6) The effectiveness of monitoring and mitigation measures.

As described above and based on the following factors, the specified activities associated with the marine seismic survey are not likely to cause PTS, or other non-auditory injury, serious injury, or death. The factors include:

(1) The likelihood that, given sufficient notice through relatively slow ship speed, marine mammals are expected to move away from a noise source that is annoying prior to its becoming potentially injurious;

(2) The availability of alternate areas of similar habitat value for marine mammals to temporarily vacate the survey area during the operation of the airgun(s) to avoid acoustic harassment;

(3) The potential for temporary or permanent hearing impairment is relatively low and would likely be avoided through the implementation of the required monitoring and mitigation measures (including power-down and shut-down measures); and

(4) The likelihood that marine mammal detection ability by trained PSOs is high at close proximity to the vessel.

Table 4 of this document outlines the number of requested Level B harassment takes that are anticipated as a result of these activities. The type of Level B (behavioral) harassment that could result from the proposed action are described in the ''Potential Effects of the Specified Activity on Marine Mammals'' section above, and include tolerance, masking, behavioral disturbance, TTS, PTS, and non-auditory or physiological effects.

For the marine mammal species that may occur within the proposed action area, there are no known designated or important feeding and/or reproductive areas. Many animals perform vital functions, such as feeding, resting, traveling, and socializing, on a diel cycle (i.e., 24 hr cycle). Behavioral reactions to noise exposure (such as disruption of critical life functions, displacement, or avoidance of important habitat) are more likely to be significant if they last more than one diel cycle or recur on subsequent days (Southall *et al.,* 2007). While seismic operations are anticipated to occur on consecutive days, the estimated duration of the survey would last no more than a total of 36 days (a 17 to 18 day leg in August to September 2014 and a 17 to 18 day leg in April to August 2015). Additionally, the seismic survey would be increasing sound levels in the marine environment in a relatively small area surrounding the vessel (compared to the range of the animals). The seismic surveys would not take place in areas of significance for marine mammal feeding, resting, breeding, or calving and would not adversely impact marine mammal habitat. Furthermore, the vessel would be constantly travelling over distances, and some animals may only be exposed to and harassed by sound for less than a day.

NMFS's practice has been to apply the 160 dB re 1 μPa (rms) received level threshold for underwater impulse sound levels to determine whether take by Level B harassment occurs. Southall *et al.* (2007) provide a severity scale for ranking observed behavioral responses of both free-ranging marine mammals and laboratory subjects to various types of anthropogenic sound (see Table 4 in Southall *et al.* [2007]). NMFS has preliminarily determined, provided that the aforementioned mitigation and monitoring measures are implemented, the impact of conducting a marine seismic survey in the northwest Atlantic Ocean off of the Eastern Seaboard, August to September 2014 and April to August 2015, may result, at worst, in a modification in behavior and/or low-level physiological effects (Level B harassment) of certain species of marine mammals. No injuries, serious injuries, or mortalities are anticipated to occur as a result of USGS's planned marine seismic survey, and none are proposed to be authorized by NMFS.

While behavioral modifications, including temporarily vacating the area during the operation of the airgun(s), may be made by these species to avoid the resultant acoustic disturbance, the availability of alternate areas within these areas for species and the short and sporadic duration of the research activities, have led NMFS to preliminary determine that the taking by Level B harassment from the specified activity would have a negligible impact on the affected species in the specified geographic region. Due to the nature, degree, and context of Level B (behavioral) harassment anticipated and described (see ''Potential Effects on Marine Mammals'' section above) in this notice, the activity is not expected to impact rates of annual recruitment or survival for any affected species or stock, particularly given the NMFS and the applicant's proposal to implement mitigation and monitoring measures that would minimize impacts to marine mammals. Based on the analysis contained herein of the likely effects of the specified activity on marine mammals and their habitat, and taking into consideration the implementation of the proposed monitoring and mitigation measures, NMFS preliminarily finds that the total marine mammal take from USGS's proposed marine seismic survey would have a negligible impact on the affected marine mammal species or stocks.

Small Numbers

As mentioned previously, NMFS estimates that 34 species of marine mammals under its jurisdiction could be potentially affected by Level B harassment over the course of the IHA. The population estimates for the marine mammal species that may be taken by Level B harassment are provided in Table 4 of this document. No takes of pinnipeds are expected due to a lack of species observations within the proposed study area, the great distance offshore, and the deep water depths of the proposed study area. It should be noted that the stock populations for each marine mammal species in the NMFS Stock Assessment Reports are generally for species populations in U.S. waters, which may underestimate actual population sizes for species that have ranges that would include waters outside the U.S. EEZ.

NMFS has regional population and/or stock abundance estimates for the northwest Atlantic Ocean for 26 of the species under its jurisdiction that could potentially be affected by Level B harassment over the course of the IHA. The estimate of the number of individual cetaceans by species for which NMFS has such data that could be exposed to seismic sounds with received levels greater than or equal to 160 dB re 1 μPa (rms) during the proposed survey in 2014 and 2015 is as follows: 6 North Atlantic right, 41 humpback, 4 minke, 6 sei, 6 fin, 4 blue, and 166 sperm whales, which would represent 1.32/1.32, 0.353/4.96, 0.0014/0.0096, 0.058/1.68, 0.02/0.17, 0.468/0.909, and 1.259/7.255% of the affected regional populations/stocks, respectively. In addition, 4 northern bottlenose, 168 Cuvier's and *Mesoplodon* (i.e., True's, Gervais', Sowerby's, and Blainville's beaked whales), 66 dwarf sperm, and 66 pygmy sperm whales could be taken by Level B harassment during the proposed seismic survey, which would represent 0.01/unknown, unknown/1.286, unknown/2.369, unknown/1.744, and unknown/1.744% of the regional populations/stocks, respectively. Most of the cetaceans potentially taken by Level B harassment are delphinids; of the delphinids for which NMFS has regional population or stock abundance estimates for the northwest Atlantic Ocean, 499 bottlenose, 108 Atlantic white-sided, 2,112 Atlantic spotted, 1,448 pantropical spotted, 9,832 striped, 406 short-beaked common, 32 rough-toothed, and 684 Risso's dolphins could be taken by Level B harassment during the proposed seismic survey, which would represent unknown/0.644, 1.08/0.221, unknown/4.723, unknown/43.444, unknown/17.939, unknown/0.234, unknown/11.808, and unknown/3.748% of the regional populations/stocks, respectively. Of the remaining species for which NMFS has regional population or stock abundance estimates for the northwest Atlantic Ocean, 1,394 short-finned and 1,394 long-finned pilot whales, and 10 harbor porpoises could be taken by Level B harassment during the proposed seismic survey, which would represent 0.178/6.479, 0.178/5.253, and 0.002/0.013% of the regional population/stocks, respectively.

NMFS makes its small numbers determination on the numbers of marine mammals that would be taken relative to the populations of the affected species or stocks. NMFS calculates the number of animals as a percentage of the stock population for marine mammals in the U.S. EEZ. For USGS's proposed survey, approximately 80% in 2014 and 90% in 2015 of the tracklines occur within International Waters (i.e., the high seas) and are outside of the U.S. EEZ; therefore, the regional population is more applicable for NMFS's small numbers determinations as most of the ensonified area and estimated takes are further than 200 nmi from the U.S. coastline. The requested take estimates represented as a percentage of the stock in Table 4 (above) should be reduced to 20% and 10% of the calculated levels based on the amount of activity (i.e., 80% and 90%) planned to occur outside of the U.S. EEZ in 2014 and 2015. Using the approach of calculating the number of requested take estimates within the U.S. EEZ (20% in 2014 and 10% in 2015), the take estimates provided in the preceding paragraph should change as follows (rounding up): 2 North Atlantic right, 9 humpback, 2 minke, 2 sei, 2 fin, 2 blue, and 26 sperm whales, which would represent 0.44, 1.09, $<$0.01, 0.56, 0.06, 0.46, and 1.14% of the affected stocks, respectively; 26 Cuvier's and *Mesoplodon* (i.e., True's, Gervais', Sowerby's, and Blainville's beaked whales), 11 dwarf sperm, and 11 pygmy sperm whales, which would represent 0.4, 0.37, 0.29, and 0.29% of the affected stocks, respectively; 75 bottlenose, 17 Atlantic white-sided, 318 Atlantic spotted, 218 pantropical spotted, 1,476 striped, 62 short-beaked common, 6 rough-toothed, and 104 Risso's dolphins could be taken by Level B harassment during the proposed seismic survey, which would represent 0.1, 0.04, 0.71, 6.54, 2.69, 0.04, 2.21, and 0.57% of the affected stocks, respectively; and 210 short-finned and 210 long-finned pilot whales, and 2 harbor porpoises, which would represent 0.98, 0.79, and $<$0.01% of the affected stocks, respectively. No takes of pinnipeds are expected within the proposed study area. The requested take estimates represent a small number relative to the affected species' with a known regional population or stock size (i.e., all for which data are available are less than 6.54% of the regional populations).

No known current regional population or stock abundance estimates for the northwest Atlantic Ocean are available for the eight remaining species under NMFS's jurisdiction that could potentially be affected by Level B harassment over the course of the IHA. These species include the Bryde's whale, Fraser's, spinner, and Clymene dolphins, and the melon-headed, pygmy killer, false killer, and killer whales. Therefore, NMFS is using older abundance estimates or abundance estimates from other areas such as the northern Gulf of Mexico stock, regional ocean basins (e.g., eastern tropical Pacific Ocean), or global summation to aid its small numbers determination for these species. These abundance estimates are considered the best available information.

Bryde's whales are distributed worldwide in tropical and sub-tropical waters and their occurrence in the proposed study area is rare. In the western North Atlantic Ocean, Bryde's whales are reported from off the southeastern U.S. and southern West Indies to Cabo Frio, Brazil (Leatherwood and Reeves, 1983). No stock of Bryde's whales has been identified in U.S. waters off the Atlantic coast. The northern Gulf of Mexico population is considered a separate stock and has a best abundance estimate of 33 animals. In addition, there are estimated to be 20,000 to 30,000 animals in the North Pacific Ocean. Based on all of these factors, NMFS finds that the requested take estimate of 6 Bryde's whales represents a small number relative to the affected species' population size.

Fraser's dolphins are distributed worldwide in tropical waters and their occurrence in the proposed study area is rare. There is no abundance estimates for either the western North Atlantic or the northern Gulf of Mexico stocks. The western North Atlantic population is provisionally being considered a separate stock for management purposes, although there is currently no information to differentiate this stock from the northern Gulf of Mexico stock. The numbers of Fraser's dolphins off the U.S. or Canadian Atlantic coast are unknown, and seasonal abundance estimates are not available for this stock, since it is rarely seen in any surveys. The population size for Fraser's dolphins is unknown; however, about 289,000 animals occur in the eastern tropical Pacific Ocean (Jefferson *et al.,* 2008). The estimated number of requested takes for 200 Fraser's dolphins represents 0.06% of the eastern tropical Pacific Ocean population. Fraser's dolphins are distributed worldwide in tropical waters and their occurrence in the proposed study area is rare. Based on all these factors, NMFS finds that the requested take estimate represents a small number relative to the affected species' population size.

Spinner dolphins are found in all tropical and sub-tropical oceans and their occurrence in the proposed study area is rare. The western North Atlantic population of spinner dolphins is provisionally being considered a separate stock for management purposes, although there is currently no information to differentiate this stock from the northern Gulf of Mexico stock. The numbers of spinner dolphins off the U.S. or Canadian Atlantic coast are unknown, and seasonal abundance estimates are not available for this stock since it was rarely seen in any of the surveys. The best abundance estimate available for northern Gulf of Mexico spinner dolphins is 11,441 animals. The estimated number of requested takes of 130 spinner dolphins represents 1.13% of the northern Gulf of Mexico stock. Based on all of these factors, NMFS finds that the requested take estimates represents a small number relative to the affected species' population size.

The Clymene dolphin is endemic to tropical and sub-tropical waters of the Atlantic, including the Caribbean Sea and Gulf of Mexico (Jefferson and Curry, 2003; Jefferson *et al.,* 2008). This species prefer warm waters and records extend from southern Brazil and Angola and north to Mauritania and New Jersey off the U.S. east coast (Jefferson *et al.,* 2008). Their occurrence in the proposed study area is rare. The abundance estimate for the Clymene dolphin in the western North Atlantic was 6,086 in 203; this estimate is older than eight years and is considered unreliable (Wade and Angliss, 1997; Mullin and Fulling, 2003). However, this abundance estimate is the first and only estimate to date for this species in the U.S. Atlantic EEZ and represents the best abundance estimate. The estimated numbers of requested takes of 411 Clymene dolphins represent 6.75% of the western North Atlantic 2003 stock or 318.6% of the northern Gulf of Mexico stock. Based on all of these factors, NMFS finds that the requested take estimate represents a small number relative to the affected species' population or stock size.

Melon-headed whales are distributed worldwide in tropical to sub-tropical waters and their occurrence in the proposed study area is rare. The western North Atlantic population is provisionally being considered a separate stock from the northern Gulf of Mexico stock, although there is currently no information to differentiate this stock from the northern Gulf of Mexico stock. The numbers of melon-headed whales off the U.S. or Canadian Atlantic coast are unknown, and seasonal abundance estimates are not available for this stock, since it was rarely seen in any surveys. The best abundance estimate available for northern Gulf of Mexico melon-headed whales is 2,235 animals. The estimated number of requested takes of 200 melon-headed whales represents 8.94% of the northern Gulf of Mexico stock. Based on all of these factors, NMFS finds that the requested take estimate represents a small number relative to the affected species' population or stock size.

The pygmy killer whale is distributed worldwide in tropical to sub-tropical waters and their occurrence in the proposed study area is rare. The western North Atlantic population of pygmy killer whales is provisionally being considered one stock for management purposes. The numbers of pygmy killer whales off the U.S. or Canadian Atlantic coast are unknown, and seasonal abundance estimates are not available for this stock, since it was rarely seen in any surveys. The best abundance estimate available for the northern Gulf of Mexico pygmy killer whale is 152 animals. In addition, there are estimated to be 39,000 pygmy killer whales in the eastern tropical Pacific Ocean. The estimated number of requested takes of 50 pygmy killer whales represents 32.89% of the northern Gulf of Mexico stock, and 0.13% of the eastern tropical Pacific Ocean. Based on all of these factors, NMFS finds that the requested take estimate represents a small number relative to the affected species' population or stock size.

The false killer whale is distributed worldwide throughout warm temperate and tropical oceans and their occurrence in the proposed study area is rare. No stock has been identified for false killer whales in U.S. waters off the Atlantic coast. The Gulf of Mexico population is provisionally being considered one stock for management purposes, although there is currently no information to differentiate this stock from the Atlantic Ocean stock. The current population size for the false killer whale in the northern Gulf of Mexico is unknown because they survey data is more than 8 years old; however, the most recent abundance estimate pooled from 2004 to 2004 was 777 animals (Wade and Angliss, 1997; Mullin, 2007). The estimated number of requested takes of 30 false killer whales represents 3.86% of the northern Gulf of Mexico stock. Based on all of these factors, NMFS finds that the requested take estimate represents a small number relative to the affected species' population or stock size.

Killer whales are characterized as uncommon or rare in waters of the U.S. Atlantic EEZ (Katona *et al.,* 1988). Their distribution extends from the Arctic ice-edge to the West Indies, often in offshore and mid-ocean areas. There are estimated to be at least approximately 92,500 killer whales worldwide. The size of the western North Atlantic stock population off the eastern U.S. coast is unknown. The northern Gulf of Mexico population is provisionally being considered a separate stock for management purposes, although there is currently no information to differentiate this stock from the Atlantic Ocean stock. The best abundance estimate available for northern Gulf of Mexico killer whales is 28 animals. The estimated number of requested takes of 14 killer whales represents 0.02% of the worldwide population, and 50% of the northern Gulf of Mexico stock. Based on all of these factors, NMFS finds that the requested take estimate represents a small number relative to the affected species' population or stock size.

Based on the analysis contained herein of the likely effects of the specified activity on marine mammals and their habitat, and taking into consideration of the implementation of the mitigation and monitoring measures, NMFS preliminarily finds that small numbers of marine mammals would be taken relative to the populations of the affected species or stocks. See Table 4 for the requested authorized take number of marine mammals.

Endangered Species Act

Of the species of marine mammals that may occur in the proposed survey area, several are listed as endangered under the ESA, including the North Atlantic right, humpback, sei, fin, blue, and sperm whales. Under section 7 of the ESA, USGS has initiated formal consultation with the NMFS, Office of Protected Resources, Endangered Species Act Interagency Cooperation Division, on this proposed seismic survey. NMFS's Office of Protected Resources, Permits and Conservation Division, has initiated formal consultation under section 7 of the ESA with NMFS's Office of Protected Resources, Endangered Species Act Interagency Cooperation Division, to obtain a Biological Opinion evaluating the effects of issuing the IHA on threatened and endangered marine mammals and, if appropriate, authorizing incidental take. NMFS would conclude formal section 7 consultation prior to making a determination on whether or not to issue the IHA. If the IHA is issued, USGS, in addition to the mitigation and monitoring requirements included in the IHA, would be required to comply with the Terms and Conditions of the Incidental Take Statement corresponding to NMFS's Biological Opinion issued to both USGS and NMFS's Office of Protected Resources.

National Environmental Policy Act

With USGS's complete application, USGS provided NMFS a ''Draft Environmental Assessment for Seismic Reflection Scientific Research Surveys During 2014 and 2015 in Support of Mapping the U.S. Atlantic Seaboard Extended Continental Margin and Investigating Tsunami Hazards,'' prepared by RPS Evan-Hamilton, Inc., in association with YOLO Environmental, Inc., GeoSpatial Strategy Group, and Ecology and Environment, Inc., on behalf of USGS. The EA analyzes the direct, indirect, and cumulative environmental impacts of the proposed specified activities on marine mammals including those listed as threatened or endangered under the ESA. Prior to making a final decision on the IHA application, NMFS would either prepare an independent EA, or, after review and evaluation of the USGS EA for consistency with the regulations published by the Council of Environmental Quality (CEQ) and NOAA Administrative Order 216–6, Environmental Review Procedures for Implementing the National Environmental Policy Act, adopt the EA and make a decision of whether or not to issue a Finding of No Significant Impact (FONSI).

Proposed Authorization

As a result of these preliminary determinations, NMFS proposes to issue an IHA to USGS for conducting the high-energy marine seismic survey in the northeast Atlantic Ocean off the Eastern Seaboard, provided the previously mentioned mitigation, monitoring, and reporting requirements are incorporated. The proposed IHA language is provided below:

The NMFS hereby authorizes the U.S. Geological Survey, Pacific Coastal and Marine Geology Science Center, Mail Stop 999, 345 Middlefield Road, Menlo Park, California 94025, Lamont-Doherty Earth Observatory of Columbia University, P.O. Box 1000, 61 Route 9W, Palisades, New York 10964–8000, and National Science Foundation, Division of Ocean Sciences, 4201 Wilson Boulevard, Suite 725, Arlington, Virginia 22230 (herein referred to USGS) under section 101(a)(5)(D) of the Marine Mammal Protection Act (MMPA) (16 U.S.C. 1371(a)(5)(D)), to harass small numbers of marine mammals incidental to a high-energy marine geophysical (seismic) survey conducted by the R/V *Marcus G. Langseth* (*Langseth*) in the northeast Atlantic Ocean off the Eastern Seaboard, August to September 2014 and April to August 2015:

1. This Authorization is valid from August 15, 2014 through August 14, 2015.

2. This Authorization is valid only for the *Langseth's* specified activities associated with seismic survey operations as described in USGS's IHA application and ''Draft Environmental Assessment for Seismic Reflection Scientific Surveys During 2014 and 2015 in Support of Mapping the U.S. Atlantic Seaboard Extended Continental Margin and Investigating Tsunami Hazards'' that shall occur in the following specified geographic area (bounded by the following geographical coordinates):

40.5694° North, –66.5324° West;
38.5808° North, –61.7105° West;
29.2456° North, –72.6766° West;
33.1752° North, –75.8697° West;
39.1583° North, –72.8697° West;

The proposed activities for 2014 will generally occur within the outer portions of the study area. The proposed activities for 2015 will in-fill more of the study area. Water depths range from approximately 1,450 to 5,400 m (see Figure 1 and 2 of the IHA application); no survey lines will extend to water depths less than 1,000 m. The tracklines proposed for both 2014 and 2015 would be in International Waters (approximately 80% in 2014 and 90% in 2015) and in the U.S. EEZ, as specified in USGS's Incidental Harassment Authorization application and the associated USGS Environmental Assessment.

3. *Species Authorized and Level of Takes*

(a) The incidental taking of marine mammals, by Level B harassment only, is limited to the following species in the waters of the northeast Atlantic off the Eastern Seaboard:

(i) *Mysticetes*—see Table 4 for authorized species and take numbers.

(ii) *Odontocetes*—see Table 4 for authorized species and take numbers.

(iii) If any marine mammal species are encountered during seismic activities that are not listed in Table 4 for authorized taking and are likely to be exposed to sound pressure levels (SPLs) greater than or equal to 160 dB re 1 μPa (rms), then the USGS must alter speed or course or shut-down the airguns to avoid take.

(b) The taking by injury (Level A harassment), serious injury, or death of any of the species listed in Condition 3(a) above or the taking of any kind of any other species of marine mammal is prohibited and may result in the modification, suspension or revocation of this Authorization.

4. The methods authorized for taking by Level B harassment are limited to the following acoustic sources without an amendment to this Authorization:

(a) A 36 airgun array with a total volume of 6,600 cubic inches (in^3) (or smaller);

(b) A multi-beam echosounder; and

(c) A sub-bottom profiler.

5. The taking of any marine mammal in a manner prohibited under this Authorization must be reported immediately to the Office of Protected Resources, National Marine Fisheries Service (NMFS), at 301–427–8401 and/or by email to *Jolie.Harrison@noaa.gov* and *Howard.Goldstein@noaa.gov.*

6. *Mitigation and Monitoring Requirements*

The USGS is required to implement the following mitigation and monitoring requirements when conducting the specified activities to achieve the least practicable impact on affected marine mammal species or stocks:

(a) Utilize two, NMFS-qualified, vessel-based PSVO (except during meal times and restroom breaks, when at least one PSVO shall be on watch) to visually watch for and monitor marine mammals near the seismic source vessel during daytime airgun operations (from nautical twilight-dawn to nautical twilight-dusk) and before and during ramp-ups of airguns day or night.

(i) The *Langseth'*s vessel crew shall also assist in detecting marine mammals, when practicable.

(ii) PSVOs shall have access to reticle binoculars (7 x 50 Fujinon), big-eye binoculars (25 x 150), optical range finders, and night vision devices.

(iii) PSVO shifts shall last no longer than 4 hours at a time.

(iv) When feasible, PSVOs shall also make observations during daytime periods when the seismic system is not operating for comparison of animal abundance and behavioral reactions during, between, and after airgun operations.

(v) PSVOs shall conduct monitoring while the airgun array and streamer(s) are being deployed or recovered from the water.

(b) PSVOs shall record the following information when a marine mammal is sighted:

(i) Species, group size, age/size/sex categories (if determinable), behavior when first sighted and after initial sighting, heading (if consistent), bearing and distance from seismic vessel, sighting cue, apparent reaction to the airguns or vessel (e.g., none, avoidance, approach, paralleling, etc., and including responses to ramp-up), and behavioral pace; and

(ii) Time, location, heading, speed, activity of the vessel (including number of airguns operating and whether in state of ramp-up or shut-down), Beaufort sea state and wind force, visibility, and sun glare; and

(iii) The data listed under Condition 6(c)(ii) shall also be recorded at the start and end of each observation watch and during a watch whenever there is a change in one or more of the variables.

Passive Acoustic Monitoring

(c) Utilize the PAM system, to the maximum extent practicable, to detect and allow some localization of marine mammals around the *Langseth* during all airgun operations and during most periods when airguns are not operating. One NMFS-qualified PSO and/or expert bioacoustician (i.e., PSAO) shall monitor the PAM at all times in shifts no longer than 6 hours. An expert bioacoustician shall design and set up the PAM system and be present to operate to oversee PAM, and available when technical issues occur during the survey.

(d) Do and record the following when an animal is detected by the PAM:

(i) Notify the on-duty PSVO(s) immediately of the presence of a vocalizing marine mammal so a power-down or shut-down can be initiated, if required:

(ii) Enter the information regarding the vocalization into a database. The data to be entered include an acoustic encounter identification number, whether it was linked with a visual sighting, date, time when first and last heard and whenever any additional information was recorded, position, and water depth when first detected, bearing if determinable, species or species group (e.g., unidentified dolphin, sperm whale), types and nature of sounds heard (e.g., clicks, continuous, sporadic, whistles, creaks, burst pulses, strength of signal, etc.), and any other notable information. The acoustic detection can also be recorded for further analysis.

Buffer and Exclusion Zones

(e) Establish a 160 dB re 1 μPa (rms) buffer zone as well as 180 and 190 dB re 1 μPa (rms) exclusion zone for marine mammals before the 2-string airgun array (6,600 in^3) is in operation; and a 180 and 190 dB re 1 μPa (rms) exclusion zone before a single airgun (40 in^3) is in operation, respectively. See Table 1 (above) for distances and exclusion zones.

Visual Monitoring at the Start of Airgun Operations

(f) Visually observe the entire extent of the exclusion zone (180 dB re 1 μPa [rms] for cetaceans; see Table 1 [above] for distances) using NMFS-qualified PSVOs, for at least 30 minutes prior to starting the airgun array (day or night).

(i) If the PSVO observes a marine mammal within the exclusion zone, USGS must delay the seismic survey until the marine mammal(s) has left the area. If the PSVO sees a marine mammal that surfaces, then dives below the surface, the PSVO shall wait 30 minutes. If the PSVO sees no marine mammals during that time, he/she should assume that the animal has moved beyond the exclusion zone.

(ii) If for any reason the entire radius cannot be seen for the entire 30 minutes (i.e., rough seas, fog, darkness), or if marine mammals are near, approaching, or within the exclusion zone, the airguns may not resume airgun operations.

(iii) If one airgun is already running at a source level of at least 180 dB re 1 μPa (rms), USGS may start the second airgun, and subsequent airguns, without observing the entire exclusion zone for 30 minutes prior, provided no marine mammals are known to be near the exclusion zone (in accordance with Condition 6[h] below).

Ramp-Up Procedures

(g) Ramp-up procedures at the start of seismic operations or after a shut-down—Implement a ''ramp-up'' procedure when starting-up at the beginning of seismic operations or any time after the entire array has been shut-down for more than 10 minutes, which means starting with the smallest airgun first and adding airguns in a sequence such that the source level of the array shall increase in steps not exceeding approximately 6 dB per 5-minute period. During ramp-up, the PSVOs shall monitor the 180 and 190 dB exclusion zone for cetaceans and pinnipeds, respectively, and if marine mammals are sighted within or about to enter the relevant exclusion zone, a power-down, or shut-down shall be implemented as though the full array were operational. Therefore, initiation of ramp-up procedures from a shut-down or at the beginning of seismic operations requires that the PSVOs be able to view the full exclusion zone as described in Condition 6(m) (below).

Power-Down Procedures

(h) Power-down the airgun(s) if a marine mammal is detected within, approaches, or enters the relevant exclusion zone (as defined in Table 1, above). A power-down means reducing the number of operating airguns to a single operating 40 in^3 airgun, which reduces the exclusion zone to the degree that the animal(s) is no longer in or about to enter it for the full airgun array. When appropriate or possible, power-down of the airgun array shall also occur when the vessel is moving from the end of one trackline to the start of the next trackline.

(i) Following a power-down, if the marine mammal approaches the small designated exclusion zone, the airguns must then be completely shut-down. Airgun activity shall not resume until the PSVO has visually observed the marine mammal(s) exiting the exclusion zone and is not likely to return, or has not been seen within the exclusion zone for 15 minutes for species with shorter dive durations (small odontocetes) or 30 minutes for species with longer dive durations (mysticetes and large odontocetes, including sperm, pygmy sperm, dwarf sperm, killer, and beaked whales).

(j) Following a power-down and subsequent animal departure, the airgun operations may resume at full power. Initiation requires that PSVOs can effectively monitor the full exclusion zones described Condition 6(g). If the PSVO(s) sees a marine mammal within or about to enter the relevant zones, when a course/speed alteration, power-down, or shut-down will be implemented.

Shut-Down Procedures

(k) Shut-down the airgun(s) if a marine mammal is detected within, approaches, or enters the relevant exclusion zone (as defined in Table 1, above). A shut-down means all operating airguns are shut-down (i.e., turned off).

(l) Following a shut-down, if the PSVO has visually confirmed that the animal has departed the relevant exclusion zone (and is not likely to return) within a period less than or equal to 10 minutes after the shut-down, the airgun operations may resume at full power. If the PSVO has not observed the marine mammal(s) exiting the exclusion zone, the airgun operations shall not resume for 15 minutes for species with shorter dive durations (small odontocetes) or 30 minutes for species with longer dive durations (mysticetes and large odontocetes, including sperm, pygmy sperm, dwarf sperm, killer, and beaked whales). Following a shut-down, the *Langseth* may resume following ramp-up procedures described in Condition 6(h).

Speed or Course Alteration

(m) Alter speed or course during seismic operations if a marine mammal, based on its position and relative motion, appears likely to enter the relevant exclusion zone. If speed or course alteration is not safe or practicable, or if after alteration the marine mammal still appears likely to enter the exclusion zone, further mitigation measures, such as a power-down or shut-down, shall be taken.

Survey Operations at Night

(n) Marine seismic surveys may continue into night and low-light hours if such segment(s) of the survey is initiated when the entire relevant exclusion zones are visible and can be effectively monitored.

(o) No initiation of airgun array operations is permitted from a shut-down position at night or during low-light hours (such as in dense fog or heavy rain) when the entire relevant exclusion zone cannot be effectively monitored by the PSO(s) on duty.

Mitigation Airgun

(p) Use of small-volume airgun (i.e., mitigation airgun) during turns and maintenance shall be operated at approximately one shot per minute and would not be operated for longer than three hours in duration. During turns or brief transits between seismic tracklines, one airgun will continue operating.

Special Procedures for Situations or Species of Concern

(q) If a North Atlantic right whale (*Eubalaena glacialis*) is visually sighted, the airgun array shall be shut-down regardless of the distance of the animal(s) to the sound source. The array shall not resume firing until 30 minutes after the last documented whale visual sighting.

(r) Concentrations of humpback (*Megaptera novaeangliae*), sei (*Balaenoptera borealis*), fin (*Balaenoptera physalus*), blue (*Balaenoptera musculus*), and/or sperm whales (*Physeter macrocephalus*) will be avoided if possible (i.e., exposing concentrations of animals to 160 dB), and the array will be powered-down if necessary. For purposes of the survey, a concentration or group of whales will consist of six or more individuals visually sighted that do not appear to be traveling (e.g., feeding, socializing, etc.).

7. Reporting Requirements

The USGS is required to:

(a) Submit a draft comprehensive report on all activities and monitoring results to the Office of Protected Resources, NMFS, within 90 days of the completion of the *Langseth's* cruise in the northwest Atlantic Ocean off the Eastern Seaboard after the end of phase 1 in 2014 and another draft comprehensive report after the end of phase 2 in 2015. This report must contain and summarize the following information:

(i) Dates, times, locations, heading, speed, weather, sea conditions (including Beaufort sea state and wind force), and associated activities during all seismic operations and marine mammal sightings.

(ii) Species, number, location, distance from the vessel, and behavior of any marine mammals, as well as associated seismic activity (number of power-downs and shut-downs), observed throughout all monitoring activities.

(iii) An estimate of the number (by species) of marine mammals that: (A) Are known to have been exposed to the seismic activity (based on visual observation) at received levels greater than or equal to 160 dB re 1 μPa (rms) and/or 180 dB re 1 μPa (rms) for cetaceans and 190 dB re 1 μPa (rms) for pinnipeds with a discussion of any specific behaviors those individuals exhibited; and (B) may have been exposed (based on modeled values for the 36 airgun array) to the seismic activity at received levels greater than or equal to 160 dB re 1 μPa (rms) and/or 180 dB re 1 μPa (rms) for cetaceans and 190 dB re 1 μPa (rms) for pinnipeds with a discussion of the nature of the probable consequences of that exposure on the individuals that have been exposed.

(iv) A description of the implementation and effectiveness of the: (A) Terms and Conditions of the Biological Opinion's Incidental Take Statement (ITS); and (B) mitigation measures of the Incidental Harassment Authorization. For the Biological Opinion, the report shall confirm the implementation of each Term and Condition, as well as any conservation recommendations, and describe their effectiveness, for minimizing the adverse effects of the action on Endangered Species Act-listed marine mammals.

(b) Submit a final report to the Chief, Permits and Conservation Division, Office of Protected Resources, NMFS, within 30 days after receiving comments from NMFS on the draft report. If NMFS decides that the draft report needs no comments, the draft report shall be considered to be the final report.

Reporting Prohibited Take

8. In the unanticipated event that the specified activity clearly causes the take of a marine mammal in a manner prohibited by this Authorization (if issued), such as an injury (Level A harassment), serious injury, or mortality (e.g., ship-strike, gear interaction, and/or entanglement), USGS shall immediately cease the specified activities and immediately report the incident to the Chief of the Permits and Conservation Division, Office of Protected Resources, NMFS, at 301–427–8401 and/or by email to *Jolie.Harrison@noaa.gov* and

Howard.Goldstein@noaa.gov and the NMFS Greater Atlantic Region Marine Mammal Stranding Network at 866–755–6622 (*Mendy.Garron@noaa.gov*), and NMFS Southeast Region Marine Mammal Stranding Network at 877–433–8299 (*Blair.Mase@noaa.gov* and *Erin.Fougeres@noaa.gov*). The report must include the following information:

(a) Time, date, and location (latitude/longitude) of the incident; the name and type of vessel involved; the vessel's speed during and leading up to the incident; description of the incident; status of all sound source use in the 24 hours preceding the incident; water depth; environmental conditions (e.g., wind speed and direction, Beaufort sea state, cloud cover, and visibility); description of marine mammal observations in the 24 hours preceding the incident; species identification or description of the animal(s) involved; the fate of the animal(s); and photographs or video footage of the animal (if equipment is available).

USGS shall not resume its activities until NMFS is able to review the circumstances of the prohibited take. NMFS shall work with USGS to determine what is necessary to minimize the likelihood of further prohibited take and ensure MMPA compliance. USGS may not resume their activities until notified by NMFS via letter, email, or telephone.

Reporting an Injured or Dead Marine Mammal With an Unknown Cause of Death

In the event that USGS discovers an injured or dead marine mammal, and the lead PSO determines that the cause of the injury or death is unknown and the death is relatively recent (i.e., in less than a moderate state of decomposition as described in the next paragraph), USGS will immediately report the incident to the Chief of the Permits and Conservation Division, Office of Protected Resources, NMFS, at 301–427–8401, and/or by email to *Jolie.Harrison@noaa.gov* and *Howard.Goldstein@noaa.gov,* and the NMFS Greater Atlantic Region Marine Mammal Stranding Network (866–755–6622) and/or by email to the NMFS Greater Atlantic Regional Stranding Coordinator (*Mendy.Garron@noaa.gov*), and the NMFS Southeast Region Marine Mammal Stranding Network (877–433–8299) and/or by email to the Southeast Regional Stranding Coordinator (*Blair.Mase@noaa.gov*) and Southeast Regional Stranding Program Administrator (*Erin.Fougeres@noaa.gov*). The report must include the same information identified in Condition 8(a) above. Activities may continue while NMFS reviews the circumstances of the incident. NMFS will work with USGS to determine whether modifications in the activities are appropriate.

Reporting an Injured or Dead Marine Mammal Not Related to the Activities

In the event that USGS discovers an injured or dead marine mammal, and the lead PSO determines that the injury or death is not associated with or related to the activities authorized in Condition 2 of this Authorization (e.g., previously wounded animal, carcass with moderate to advanced decomposition, or scavenger damage), USGS shall report the incident to the Chief of the Permits and Conservation Division, Office of Protected Resources, NMFS, at 301–427–8401, and/or by email to *Jolie.Harrison@noaa.gov* and *Howard.Goldstein@noaa.gov,* and the NMFS Greater Atlantic Marine Mammal Stranding Network (866–755–622), and/or by email to the Greater Atlantic Regional Stranding Coordinator (*Mendy.Garron@noaa.gov*), and the NMFS Southeast Regional Stranding Network (877–433–8299), and/or by email to the Southeast Stranding Coordinator (*Blair.Mase@noaa.gov*) and Southeast Regional Stranding Program Administrator (*Erin.Fourgeres@noaa.gov*), within 24 hours of the discovery. USGS shall provide photographs or video footage (if available) or other documentation of the stranded animal sighting to NMFS and the Marine Mammal Stranding Network. Activities may continue while NMFS reviews the circumstances of the incident.

Endangered Species Act (ESA) Biological Opinion and Incidental Take Statement (ITS)

9. USGS is required to comply with the Terms and Conditions of the ITS corresponding to NMFS's ESA Biological Opinion issued to both USGS and NMFS's Office of Protected Resources, Permits and Conservation Division.

10. A copy of this Authorization and the ITS must be in the possession of all contractors and PSOs operating under the authority of this Incidental Harassment Authorization.

Request for Public Comments

NMFS requests comments on our analysis, the draft authorization, and any other aspect of the notice of proposed IHA for USGS's proposed marine seismic survey in the Atlantic Ocean off the Eastern Seaboard. Please include with your comments any supporting data or literature citations to help inform our final decision on USGS's request for an MMPA authorization. Concurrent with the publication of this notice in the **Federal Register,** NMFS is forwarding copies of this application to the Marine Mammal Commission and its Committee of Scientific Advisors.

Dated: June 16, 2014.

Perry F. Gayaldo,

Deputy Director, Office of Protected Resources, National Marine Fisheries Service.

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