specifically listed in this notice and any issues arising after publication of this notice that require emergency action under section 305(c) of the Magnuson-Stevens Fishery Conservation and Management Act, provided the public has been notified of the Council's intent to take final action to address the emergency.

Special Accommodations

These meetings are physically accessible to people with disabilities. Requests for sign language interpretation or other auxiliary aid should be directed to M. Jan Saunders, (302) 526–5251, at least 5 days prior to the meeting date.

Dated: March 18, 2013.

Tracey L. Thompson,

Acting Deputy Director, Office of Sustainable Fisheries, National Marine Fisheries Service.

[FR Doc. 2013–06486 Filed 3–20–13; 8:45 am]

BILLING CODE 3510–22–P

DEPARTMENT OF COMMERCE

National Oceanic and Atmospheric Administration

RIN 0648–XB155

Endangered Species; File No. 17095–01

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

ACTION: Notice, issuance of permit modification.

SUMMARY: Notice is hereby given that Entergy Nuclear Operations Inc., 450 Broadway, Suite 3, Buchanan, NY 10511 [Responsible Party: John Ventosa], has been issued a permit modification to take shortnose sturgeon (*Acipenser brevirostrum*) and Atlantic sturgeon (*Acipenser oxyrinchus oxyrinchus*) for purposes of scientific research.

ADDRESSES: The permit modification and related documents are available for review upon written request or by appointment in the following offices:

• Permits, Conservation and Education Division, Office of Protected Resources, NMFS, 1315 East-West Highway, Room 13705, Silver Spring, MD 20910; phone (301) 427–8401; fax (301) 713–0376; and

• Northeast Region, NMFS, 55 Great Republic Drive, Gloucester, MA 01930; phone (978) 281–9328; fax (978) 281–9394.

FOR FURTHER INFORMATION CONTACT: Malcolm Mohead or Colette Cairns, (301) 427–8401.

SUPPLEMENTARY INFORMATION: On January 29, 2013, notice was published in the **Federal Register** (78 FR 6072) that a request for a scientific research permit modification to take shortnose sturgeon and Atlantic sturgeon had been submitted by the above-named applicant. The requested permit modification has been issued under the authority of the Endangered Species Act of 1973, as amended (ESA; 16 U.S.C. 1531 *et seq.*) and the regulations governing the taking, importing, and exporting of endangered and threatened species (50 CFR parts 222–226).

Permit No. 17095 currently authorizes the Permit Holder to: Monitor shortnose and Atlantic sturgeon abundance and distribution through the Hudson River Biological Monitoring Program (HRBMP) in the Hudson River from River Mile 0 (Battery Park, Manhattan, NY) to River Mile 152 at Troy Dam (Albany, NY). Researchers are authorized to non-lethally capture, handle, measure, weigh, scan for tags, insert passive integrated transponder and dart tags, photograph, tissue sample, and release up to 82 shortnose sturgeon and 82 Atlantic sturgeon annually. Additionally, researchers are permitted to lethally collect up to 40 shortnose sturgeon and up to 40 Atlantic sturgeon eggs and/or larvae (ELS) annually.

To account for a higher than expected catch per tow sampling performed authorized under Permit No. 17095, the Permit Holder now is authorized to increase the takes of juvenile, sub-adult and/or adult Atlantic sturgeon to 200 fish per year. Takes must not exceed a total of 600 Atlantic sturgeon captured over the permit life. The Permit Holder will also expand the sampling activities for juvenile, sub-adult and adult shortnose sturgeon and Atlantic sturgeon to include upper New York Harbor (~River Mile -2.0). The modification is valid until the permit expires August 28, 2017.

Issuance of this permit, as required by the ESA, was based on a finding that such permit (1) was applied for in good faith, (2) will not operate to the disadvantage of such endangered or threatened species, and (3) is consistent with the purposes and policies set forth in section 2 of the ESA.

Dated: March 18, 2013.

P. Michael Payne,

Chief, Permits and Conservation Division, Office of Protected Resources, National Marine Fisheries Service.

[FR Doc. 2013–06532 Filed 3–20–13; 8:45 am]

BILLING CODE 3510–22–P

DEPARTMENT OF COMMERCE

National Oceanic and Atmospheric Administration

RIN 0648–XC461

Takes of Marine Mammals Incidental to Specified Activities; Marine Geophysical Survey in the Northeast Atlantic Ocean, June to July, 2013

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 Lamont-Doherty Earth Observatory of Columbia University (L–DEO) for an Incidental Harassment Authorization (IHA) to take marine mammals, by harassment, incidental to conducting a marine geophysical (seismic) survey in the northeast Atlantic Ocean, June to July, 2013. Pursuant to the Marine Mammal Protection Act (MMPA), NMFS is requesting comments on its proposal to issue an IHA to L–DEO to incidentally harass, by Level B harassment only, 20 species of marine mammals during the specified activity.

DATES: Comments and information must be received no later than April 22, 2013.

ADDRESSES: Comments on the application should be addressed to P. Michael Payne, Chief, 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–XC461 in the subject line. NMFS is not responsible for email comments sent to addresses other than the one provided here. Comments sent via email, including all attachments, must not exceed a 10-megabyte file size.

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.

A copy of the application containing a list of the references used in this document may be obtained by writing to the above address, telephoning the contact listed here (see **FOR FURTHER INFORMATION CONTACT**) or visiting the Internet at: *http://www.nmfs.noaa.gov/pr/permits/incidental.htm#applications.*

The National Science Foundation (NSF), which owns the R/V *Marcus G. Langseth,* has prepared a draft ''Environmental Analysis of a Marine Geophysical Survey by the R/V *Marcus G. Langseth* for the Northeast Atlantic Ocean, June-July 2013,'' prepared by LGL Ltd., Environmental Research Associates, on behalf of NSF and L–DEO, 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)(D) of the MMPA, as amended (16 U.S.C. 1371 (a)(5)(D)), directs the Secretary of Commerce (Secretary) to authorize, upon request, the incidental, but not intentional, taking of small numbers of marine mammals of a species or population stock, 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, if the taking is limited to harassment, a notice of a proposed authorization is provided to the public for review.

Authorization for the incidental taking of small numbers of marine mammals 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). The authorization must set forth the permissible methods of taking, other means of effecting the least practicable adverse impact on the species or stock and its habitat, and requirements pertaining to the mitigation, monitoring and reporting of such takings. 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.''

Section 101(a)(5)(D) of the MMPA established an expedited process by which citizens of the United States can apply for an authorization to incidentally take small numbers of marine mammals by harassment. Section 101(a)(5)(D) of the MMPA establishes a 45-day time limit for NMFS's review of an application followed by a 30-day public notice and comment period on any proposed authorizations for the incidental harassment of small numbers of marine mammals. Within 45 days of the close of the public comment period, NMFS must either issue or deny the authorization.

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 January 8, 2013, NMFS received an application from the L–DEO 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 on the high seas (i.e., International Waters) and within the Exclusive Economic Zone of Spain during June to July, 2013. L–DEO plan to use one source vessel, the R/V *Marcus G. Langseth* (*Langseth*) and a seismic airgun array to collect seismic data as part of the proposed seismic survey in the northeast Atlantic Ocean.

In addition to the proposed operations of the seismic airgun array and hydrophone streamer, L–DEO intends to operate a multibeam echosounder and a sub-bottom profiler continuously throughout the survey.

Acoustic stimuli (i.e., increased underwater sound) generated during the operation of the seismic airgun array may have the potential to cause a behavioral disturbance for marine mammals in the survey area. This is the principal means of marine mammal taking associated with these activities and L–DEO has requested an authorization to take 20 species of marine mammals by Level B harassment. Take is not expected to result from the use of the multibeam 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 (4.6 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 39 days). It is likely that any marine mammal would be able to avoid the vessel.

Description of the Proposed Specified Activity

L–DEO proposes to conduct a high energy, two-dimensional (2D) and three-dimensional (3D) seismic survey in the northeast Atlantic Ocean, west of Spain (see Figure 1 of the IHA application). Water depths in the survey area range from approximately 3,500 to greater than 5,000 meters (m) (11,482.9 to 16,404.2 feet [ft]). The proposed seismic survey would be scheduled to occur for approximately 39 days during June 1 to July 14, 2013. Some minor deviation from these dates would be possible, depending on logistics and weather.

L–DEO plans to use conventional seismic methodology in the Deep Galicia Basin of the northeast Atlantic Ocean. The goal of the proposed research is to collect data necessary to study rifted continental to oceanic crust transition in the Deep Galicia Basin west of Spain. This margin and its conjugate are among the best studied magma-poor, rifted margins in the world, and the focus of studies has been the faulting mechanics and modification of the upper mantle associated with such margins. Over the years, a combination of 2D reflection profiling, general marine geophysics, and ocean drilling have identified a number of interesting features of the margin. Among these are the S reflector, which has been interpreted to be detachment fault overlain with fault bounded, rotated, continental crustal blocks and underlain by serpentinized peridotite, and the Peridotite Ridge, composed of serpentized peridotite and thought to be upper mantle exhumed to the seafloor during rifting.

To achieve the project's goals, the Principal Investigators (PIs), Drs. D. S. Sawyer (Rice University, J. K. Morgan (Rice University), and D. J. Shillington (L–DEO) propose to use a 3D seismic reflection survey, 2D survey, and a long-offset seismic program extending through the crust and S detachment into the upper mantle to characterize the last stage of continental breakup and the initiation of seafloor spreading, relate post-rifting subsidence to syn-rifting lithosphere deformation, and inform the nature of detachment faults. Ocean Bottom Seismometers (OBSs) and Ocean Bottom Hydrophones (OBHs) would also be deployed during the program. It is a cooperative program with scientists from the United Kingdom, Germany, Spain, and Portugal.

The proposed survey would involve one source vessel, the R/V *Marcus G. Langseth* (*Langseth*). The *Langseth* would deploy an array of 18 airguns as an energy source with a total volume of approximately 3,300 in^3. The receiving system would consist of four 6,000 m (19,685 ft) hydrophone streamers at 200 m (656.2 ft) spacing and up to 78 OBS and OBH instruments. The OBSs and OBHs would be deployed and retrieved by a second vessel, the R/V *Poseidon* (*Poseidon*), provided by the German Science Foundation. As the airgun array is towed along the survey lines, the hydrophone streamers would receive the returning acoustic signals and transfer the data to the on-board processing system. The OBS and OBHs record the returning acoustic signals internally for later analysis.

A total of approximately 5,834 km (3150.1 nmi) of survey lines, including turns, will be shot in a grid pattern with a single line extending to the west (see Figure 1). There will be additional seismic operations in the survey area associated with equipment testing, ramp-up, and possible line changes or repeat coverage of any areas where initial data quality is sub-standard. In L–DEO's estimated take calculations, 25% has been added for those additional operations.

In addition to the operations of the airgun array, a Kongsberg EM 122 multibeam echosounder and a Knudsen Chirp 3260 sub-bottom profiler will also be operated from the *Langseth* continuously throughout the survey. All planned geophysical data acquisition activities would be conducted by L–DEO with on-board assistance by the scientists who have proposed the study. The vessel will be self-contained, and the crew will live aboard the vessel for the entire cruise.

Vessel Specifications

The *Langseth,* a seismic research vessel owned by the NSF, will tow the 36 airgun array, as well as the hydrophone streamer(s), along predetermined lines (see Figure 1 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 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 km/hr (10 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) will watch for marine mammals before and during the proposed airgun operations. When stationed on the observation platform, the PSVO's eye level will 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 NSF/USGS PEIS.

The *Poseidon* is a German-flagged vessel, owned by the Federal State of Schleswig-Holstein and operated by Briese Schiffahrts GmbH &Co. KG. The *Poseidon* has a length of 60.8 m (199.5 ft), a beam of 11.4 m (37.4 ft), and a maximum draft of 4.7 m (15.4 ft). The ship is powered by diesel-electric propulsion. The traction motor produces 930 kW and drives one propeller directly. The propeller has five blades, and the shaft typically rotates at 220 revolutions per minute (rpm). The vessel also has a 394 hp bowthruster, which would not be used during OBS/OBH deployment and retrieval. The *Poseidon* typically cruises at 8.5 kt (11.5 km/hr) and has a range of 7,408 km (4,000 nmi).

Acoustic Source Specifications

Seismic Airguns

The *Langseth* will deploy a 36-airgun array, consisting of two 18 airgun (plus 2 spares) sub-arrays. Each sub-array will have a volume of approximately 3,300 cubic inches (in^3). The airgun array will 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 will be configured as two identical linear arrays or ''strings'' (see Figure 2.11 of the NSF/USGS PEIS). Each string will have 10 airguns, the first and last airguns in the strings are spaced 16 m (52.5 ft) apart. Of the 10 airguns, nine airguns in each string will be fired simultaneously (1,650 in^3), whereas the tenth is kept in reserve as a spare, to be turned on in case of failure of another airgun. The sub-arrays would be fired alternately during the survey. The two airgun sub-arrays will be distributed across an area of approximately 12 x 16 m (40 x 52.5 ft) behind the *Langseth* and will be towed approximately 140 m (459.3 ft) behind the vessel. Discharge intervals depend on both the ship's speed and Two Way Travel Time recording intervals. The shot interval will be 37.5 m (123 ft) during the study. The shot interval will be relatively short, approximately 15 to 20 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 will be silent during the intervening periods. The dominant frequency components range from two to 188 Hertz (Hz).

The tow depth of the airgun array will be 9 m (29.5 ft) during the surveys. Because the actual source is a distributed sound source (18 airguns) rather than a single point source, the highest sound measurable at any location in the water will be less than the nominal source level. In addition, the effective source level for sound propagating in near-horizontal directions will 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 will be recorded using a system array of four hydrophone streamers, which would be towed behind the *Langseth*. Each streamer would consist of Sentry Solid Streamer Sercel cable approximately 6 km (3.2 nmi) long. The streamers are attached by floats to a diverter cable, which keeps the streamer spacing at approximately 100 to 150 m (328 to 492 ft) apart.

Seven hydrophones will be present along each streamer for acoustic measurement. The hydrophones will consist of a mixture of Sonardyne Transceivers. Each streamer will contain three groups of paired hydrophones, with each group approximately 2,375 m (7,800 ft) apart. The hydrophones within each group will be approximately 300 m (984 ft) apart. One additional hydrophone will be located on the tail buoy attached to the end of the streamer cable. In addition, one Sonardyne Transducer will be attached to the airgun array. Compass birds will be used to keep the streamer cables and hydrophones at a depth of approximately 10 m (32.8 ft). One compass bird will be placed at the front end of each streamer as well as periodically along the streamer.

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. SPL does not take the duration of a sound into account.

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). The specific source output for the 18 airgun array is 252 dB (peak) and 259 dB (p-p). 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 have predicted the received sound levels in relation to distance and direction from the 18 airgun array and the single Bolt 1900LL 40 in^3 airgun, which will 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) reported results for propagation measurements of pulses from the Langseth's 36 airgun, 6,600 in^3 array in shallow-water (approximately 50 m [164 ft]) 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) 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 18 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 northeast 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 indicated 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 in^3 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 18 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 will 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 18 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 SURVEY IN THE NORTHEAST ATLANTIC OCEAN, JUNE TO JULY, 2013

Sound source and volume	Tow depth (m)	Water depth (m)	Predicted RMS radii distances (m)	
			180 dB	160 dB
Single Bolt airgun (40 in³)	9	>1,000 m	100 m (328.1 ft)	388 m (1,273 ft)
18 airguns (3,300 in³)	9	>1,000 m	1,116 m (3,661.4 ft)	6,908 m (22,664 ft)

Along with the airgun operations, two additional acoustical data acquisition systems will be operated from the *Langseth* continuously during the survey. The ocean floor will be mapped with the Kongsberg EM 122 multibeam echosounder and a Knudsen 320B sub-bottom profiler. These sound sources will be operated continuously from the *Langseth* throughout the cruise.

Multibeam Echosounder

The *Langseth* will operate a Kongsberg EM 122 multibeam echosounder concurrently during airgun operations to map characteristics of the ocean floor. The hull-mounted multibeam 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* will also operate a Knudsen Chirp 320B sub-bottom continuously throughout the cruise simultaneously with the multibeam 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 maximum output is 1 kilowatt (kW), but in practice, the output varies with water depth. The pulse interval is one second, but a common mode of operation is to broadcast five pulses at one second intervals followed by a 5-second pause.

Both the multibeam echosounder and sub-bottom profiler are operated continuously during survey operations. Given the relatively shallow water depths of the survey area (20 to 300 m [66 to 984 ft]), the number of pings or transmissions would be reduced from 8 to 4, and the pulse durations would be reduced from 100 ms to 2 to 15 ms for the multibeam echosounder. Power levels of both instruments would be reduced from maximum levels to account for water depth. Actual operating parameters will be established at the time of the survey.

NMFS expects that acoustic stimuli resulting from the proposed operation of the single airgun or the 18 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 4.6 knots [kts]; 8.5 km/hr; 5.3 mph) during seismic acquisition.

Dates, Duration, and Specified Geographic Region

The proposed survey would encompass the area between approximately 41.5 to 42.5° North and approximately 11.5 to 17.5° West in the northeast Atlantic Ocean to the west of Spain. The cruise will be in International Waters and in the Exclusive Economic Zone (EEZ) of Spain in water depts. In the range from approximately 3,500 to greater than 5,000 m (see Figure 1 of the IHA application). The exact dates of the proposed activities depend on logistics and weather conditions. The *Langseth* would depart from Lisbon, Portugal or Vigo, Spain on June, 1, 2013 and spend approximately 1 day in transit to the proposed survey area. The seismic survey is expected to take approximately 39 days, with completion on approximately July 12, 2013. When the survey is completed, the *Langseth* will then transit back to Lisbon, Portugal or Vigo, Spain.

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

Thirty-nine marine mammal species (36 cetaceans [whales, dolphins, and porpoises]) (29 odontocetes and 7 mysticetes] and 3 pinnipeds [seals and sea lions]) are known to or could occur in the eastern North Atlantic study area. 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. Nine cetacean species, although present in the wider eastern North Atlantic ocean, likely would not be found near the proposed study area at approximately 42° North because their ranges generally do not extend south of approximately 45° North in the northeastern Atlantic waters (i.e., Atlantic white-sided dolphin [*Lagenorhynchus acutus*] and white-beaked dolphin [*Lagenorhynchus albirostris*]), or their ranges in the northeast Atlantic ocean generally do not extend north of approximately 20° North (Clymene dolphin [*Stenella clymene*]), 30° North (Fraser's dolphin [*Lagenodelphis hosei*]), 34° North (spinner dolphin [*Stenella longirostris*]), 35 ° North (melon-headed whale [*Peponocephala electra*]), 37° North (rough-toothed dolphin [*Steno bredandensis*]), or 40° North (Bryde's whale [*Balaenoptera brydei*] and pantropical spotted dolphin [*Stenella attenuata*]). Although Spitz *et al.* (2011) reported two strandings records of melon-headed whales for the Bay of Biscay, this species will not be discussed further, as it is unlikely to occur in the proposed survey area.

The harbor porpoise (*Phocoena phocoena*) does not occur in deep offshore waters. No harbor porpoise were detected visually or acoustically during summer surveys off the continental shelf in the Biscay Bay area during 1989 and 2007 (Lens, 1991; Basto d'Andrade, 2008; Anonymous, 2009). Pinniped species are also not known to occur in the deep waters of the survey area.

General information on the taxonomy, ecology, distribution, and movements, and acoustic capabilities of marine mammals are given in sections 3.6.1 and 3.7.1 of the NSF/USGS PEIS. One of the qualitative analysis areas defined in the PEIS is on the Mid-Atlantic Ridge, at 26° North, 40° West, approximately 2,800 km (1,511.9 nmi) from the proposed survey area. The general distribution of mysticetes and odontocetes in the North Atlantic Ocean is discussed in sections 3.6.3.4 and 3.7.3.4 of the NSF/USGS PEIS, respectively. The rest of this section deals specifically with species distribution off the north and west coast of the Iberian Peninsula.

Several systematic surveys have been conducted in the Bay of Biscay area, which has been found to be one of the most productive areas and the centre of highest cetacean diversity in the northeast Atlantic Ocean (Hoyt, 2005). The second North Atlantic Sightings Survey (NASS) occurred in waters off the continental shelf from the southern U.K. to northern Spain in July to August, 1989 (Lens, 1991). The Cetacean Offshore Distribution and Abundance in the European Atlantic (CODA) included surveys from the U.K. to southern Spain during July, 2007 (Basto d'Andrade, 2008; Anonymous, 2009). Additional information is available from coastal surveys off northwest Spain (e.g., Lopez *et al.,* 2003), and sighting records off western central (Brito *et al.,* 2009) and southern Portugal (Castor *et al.,* 2010). Records from the Ocean Biogeographic Information System (OBIS) database hosted by Rutgers and Duke University (Read *et al.,* 2009) were also included.

Table 2 (below) presents information on the abundance, distribution, population status, conservation status, and population trend of the species of marine mammals that may occur in the proposed study area during June to July, 2013.

TABLE 2—THE HABITAT, REGIONAL ABUNDANCE, AND CONSERVATION STATUS OF MARINE MAMMALS THAT MAY OCCUR IN OR NEAR THE PROPOSED SEISMIC SURVEY AREA IN THE NORTHEAST ATLANTIC OCEAN

[See text and Table 3 in L–DEO's application for further details.]

Species	Habitat	Population estimate in the North Atlantic	ESA[1]	MMPA[2]
Mysticetes:				
North Atlantic right whale (*Eubalaena glacialis*).	Pelagic, shelf and coastal.	396[3]	EN	D.
Humpback whale (*Megaptera novaeangliae*).	Mainly nearshore, banks.	11,570[4]	EN	D.
Minke whale (*Balaenoptera acutorostrata*).	Pelagic and coastal	121,000[5]	NL	NC.
Sei whale (*Balaenoptera borealis*)	Primarily offshore, pelagic.	12,000 to 13,000[6]	EN	D.
Fin whale (*Balaenoptera physalus*)	Continental slope, pelagic.	24,887[7]	EN	D.
Blue whale (*Balaenoptera musculus*)	Pelagic, shelf, coastal	937[8]	EN	D.
Odontocetes:				
Sperm whale (*Physeter macrocephalus*)	Pelagic, deep sea	13,190[9]	EN	D.
Pygmy sperm whale (*Kogia breviceps*)	Deep waters off the shelf.	395[3 10]	NL	NC.
Dwarf sperm whale (*Kogia sima*)	Deep waters off the shelf.		NL	NC.
Cuvier's beaked whale (*Ziphius cavirostris*).	Slope and Pelagic	6,992[11] 100,000[12]	NL	NC.
Northern bottlenose whale (*Hyperoodon ampullatus*).	Pelagic	40,000[13]	NL	NC.
True's beaked whale (*Mesoplodon mirus*).	Pelagic	6,992[11]	NL	NC.
Gervais' beaked whale (*Mesoplodon europaeus*).	Pelagic	6,992[11]	NL	NC.
Sowerby's beaked whale (*Mesoplodon bidens*).	Pelagic	6,992[11]	NL	NC.
Blainville's beaked whale (*Mesoplodon densirostris*).	Pelagic	6,992[11]	NL	NC.
Bottlenose dolphin (*Tursiops truncatus*)	Coastal, oceanic, shelf break.	19,295[14]	NL	NC D—Western North Atlantic coastal.
Atlantic spotted dolphin (*Stenella frontalis*).	Shelf, offshore	50,978[3]	NL	NC.
Striped dolphin (*Stenella coeruleoalba*)	Off continental shelf	67,414[14]	NL	NC.
Short-beaked common dolphin (*Delphinus delphis*).	Shelf, pelagic, seamounts.	116,709[14]	NL	NC.
Risso's dolphin (*Grampus griseus*)	Deep water, seamounts.	20,479[3]	NL	NC.
Pygmy killer whale (*Feresa attenuata*)	Pelagic	NA	NL	NC.
False killer whale (*Pseudorca crassidens*).	Pelagic	NA	NL	NC.

TABLE 2—THE HABITAT, REGIONAL ABUNDANCE, AND CONSERVATION STATUS OF MARINE MAMMALS THAT MAY OCCUR IN OR NEAR THE PROPOSED SEISMIC SURVEY AREA IN THE NORTHEAST ATLANTIC OCEAN—Continued

[See text and Table 3 in L–DEO's application for further details.]

Species	Habitat	Population estimate in the North Atlantic	ESA[1]	MMPA[2]
Killer whale (*Orcinus orca*)	Pelagic, shelf, coastal	NA	NL EN—Southern resident.	NC D—Southern resident, AT1 transient.
Short-finned pilot whale (*Globicephala macrorhynchus*).	Pelagic, shelf coastal	780,000[15]	NL	NC.
Long-finned pilot whale (*Globicephala melas*).	Mostly pelagic		NC	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] Western North Atlantic, in U.S. and southern Canadian waters (Waring *et al.,* 2012).
[4] Likely negatively biased (Stevick *et al.,* 2003).
[5] Central and Northeast Atlantic (IWC, 2012).
[6] North Atlantic (Cattanach *et al.,* 1993).
[7] Central and Northeast Atlantic (Vikingsson *et al.,* 2009).
[8] Central and Northeast Atlantic (Pike *et al.,* 2009).
[9] For the northeast Atlantic, Faroes-Iceland, and the U.S. east coast (Whitehead, 2002).
[10] Both *Kogia* species.
[11] For all beaked whales (Anonymous, 2009).
[12] Worldwide estimate (Taylor *et al.,* 2008).
[13] Eastern North Atlantic (NAMMCO, 1995).
[14] European Atlantic waters beyond the continental shelf (Anonymous, 2009).
[15] *Globicephala* spp. combined, Central and Eastern North Atlantic (IWC, 2012).

Refer to sections 3 and 4 of L–DEO's application for detailed information regarding the abundance and distribution, population status, and life history and behavior of these other marine mammal species and their occurrence in the proposed project area. The application also presents how L–DEO calculated the estimated densities for the marine mammals in the proposed survey area. NMFS has reviewed these data and determined them to be the best available scientific information for the purposes of the proposed IHA.

Potential Effects 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, 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). 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 ''Programmatic Environmental Impact Statement/Overseas Environmental Impact Statement prepared for Marine Seismic Research that is funded by the National Science Foundation and conducted by the U.S. Geological Survey'' (NSF/USGS, 2011).

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) (Richardson, *et al.,* 1995; Thorpe, 1963), 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. 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 whales 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 are quite variable.

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). DiIorio 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 (DiIorio and Clark, 2009). The North Atlantic right whales (*Eubalaena glacialis*) 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 subtle to conspicuous changes in behavior, movement, and displacement. 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 and bowhead 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.

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 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).

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 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 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 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 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—Little systematic information is 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 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 or less, and some individuals show no apparent avoidance.

Captive bottlenose dolphins (*Tursiops truncatus*) and beluga whales 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 for porpoises depend on species. The limited available data suggest that harbor porpoises show stronger avoidance of seismic operations than do Dall's porpoises (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 (*Hyperoodon ampullatus*) 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 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 explicitly. 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).

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. NMFS believes that to avoid the potential for Level A harassment, 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).

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); Madeir (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.

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 to marine mammals will 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.

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.

Potential Effects of Other Acoustic Devices

Multibeam Echosounder

L–DEO will operate the Kongsberg EM 122 multibeam echosounder from the source vessel during the planned study. Sounds from the multibeam 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 multibeam 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 will 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 multibeam 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 multibeam echosounder. The area of possible influence of the multibeam 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 L–DEO's operations, the individual pulses will 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 multibeam echosounder on marine mammals are described below.

Masking—Marine mammal communications will not be masked appreciably by the multibeam echosounder signals given the low duty cycle of the echosounder and the brief period when an individual mammal is likely to be within its beam. Furthermore, in the case of baleen whales, the multibeam 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 will be emitted by the multibeam echosounder used by L–DEO, 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 multibeam 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 multibeam echosounder proposed for use by L–DEO is quite different than sonar used for Navy operations. Pulse duration of the multibeam 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 multibeam 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 multibeam 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 multibeam echosounder is not likely to result in the harassment of marine mammals.

Sub-Bottom Profiler

L–DEO will 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 second. 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 will 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 multibeam 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 will 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.

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* and support vessels will be audible to marine mammals over a large distance, it is unlikely that marine mammals will 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).

L–DEO's proposed operation of one source vessel and a support 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* and Poseidon's slow operational speed, which is typically 4.6 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; PSOs posted during operations scan the ocean for marine mammals and must report visual alerts of marine mammal presence to crew; and the PSOs receive extensive training that covers the fundamentals of visual observing for marine mammals and information about marine mammals and their identification at sea.

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 approximately 6.4 km^2 (1.9 nmi^2) of equipment and cables. This large of an array 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 slow speed of the survey vessel and onboard monitoring efforts. The NSF has no recorded cases of entanglement of marine mammals during any of their 160,934 km (86,897.4 nmi) of seismic surveys. 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. There have 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 will be temporarily elevated noise levels and the associated direct effects on marine mammals in any particular area of the approximately 6,437 km^2 proposed project area, previously discussed in this notice. 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 L–DEO 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 will 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 testing. 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 testing 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, than 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.

L–DEO has reviewed the following source documents and have 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 recently completed ''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;''

(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 activities, L–DEO 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 begins during the planning phases of the proposed activities. Part of the considerations was whether thy research objectives could be met with a smaller source than the full, 36-airgun array (6,600 in^3) used on the *Langseth,* and it was decided that the scientific objectives could be met using two 18-airgun arrays, operating in ''flip-flop'' mode, and towed at a depth of approximately 9 m. Thus, the source volume would not exceed 3,300 in^3 at any time. The PIs 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 area year-round, so altering the timing of the proposed project likely would result in no net benefits for those species.

Proposed Exclusion Zones—L–DEO 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 18 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].) L–DEO 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 will 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 and 180 dB [rms]) are expected to be received from the 18 airgun array operating in and the single airgun operating in deep water depths. Received sound levels have been calculated by L–DEO, in relation to distance and direction from the airguns, for the 18 airgun array and for the single 1900LL 40 in^3 airgun, which will be used during power-downs.

If the PSVO detects marine mammal(s) within or about to enter the appropriate exclusion zone, the airguns will be powered-down (or shut-down, if necessary) immediately.

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 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. A power-down of the airgun array can also occur when the vessel is moving from the end of one seismic trackline to the start of the next trackline. During a power-down for mitigation, L–DEO will operate one 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 and is likely to enter the exclusion zone, L–DEO will power-down the airguns to reduce the size of the 180 dB exclusion zone before the animal is within the exclusion zone. Likewise, if a mammal is already within the exclusion zone, when first detected L–DEO will power-down the airguns immediately. During a power-down of the airgun array, L–DEO will 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), L–DEO will 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 PSO will consider the animal to have cleared the exclusion zone if:

- The observer has visually observed the animal leave the exclusion zone, or
- An observer 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 exclusion zone after an 8 minute period minute wait period.

The *Langseth* crew will 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 will 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 has transited away from the vicinity of the original sighting during the 8 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* PSOs are continually monitoring the exclusion zone for the full source level while the mitigation airgun is firing. On average, PSOs 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—L–DEO will shut-down the operating airgun(s) if a marine mammal is seen within or approaching the exclusion zone for the single airgun. L–DEO will implement a shut-down:

(1) If an animal enters the exclusion zone of the single airgun after L–DEO 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]).

Considering the conservation status for the North Atlantic right whale, the airguns will be shut-down immediately in the unlikely event that this species is observed, regardless of the distance from the *Langseth.* Ramp-up will 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 8 minutes, the *Langseth* crew will initiate a ramp-up with the smallest airgun in the array (40 in^3). The crew will turn on additional airguns in a sequence such that the source level of the array will increase in steps not exceeding 6 dB per five-minute period over a total duration of approximately 30 minutes. During ramp-up, the PSOs will monitor the exclusion zone, and if he/she sights a marine mammal, the *Langseth* crew will 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 will 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 will follow ramp-up procedures for a shut-down described earlier and the PSOs will monitor the full exclusion zone and will implement a power-down or shut-down if necessary.

If the full exclusion zone is not visible to the PSO for at least 30 minutes prior to the start of operations in either daylight or nighttime, the *Langseth* crew will 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 will not ramp-up the airgun array from a complete shut-down at night or in thick fog, because the outer part of the zone for that array will not be visible during those conditions.

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

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. L–DEO will follow a ramp-up procedure when the airgun array begins operating after an 8 minute period without airgun operations or when a power-down or shut down has exceeded that period. L–DEO has used similar periods (approximately 8 to 10 min) during previous L–DEO surveys.

Ramp-up will begin with the smallest airgun in the array (40 in^3). Airguns will be added in a sequence such that the source level of the array will increase in steps not exceeding six dB per five minute period over a total duration of approximately 35 minutes. During ramp-up, the PSOs will monitor the exclusion zone, and if marine mammals are sighted, L–DEO will 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, L–DEO will 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 will not be ramped-up from a complete shut-down at night or in thick fog, because the outer part of the exclusion zone for that array will not be visible during those conditions. If one airgun has operated during a power-down period, ramp-up to full power will be permissible at night or in poor visibility, on the assumption that marine mammals will be alerted to the approaching seismic vessel by the sounds from the single airgun and could move away. L–DEO will 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

Throughout the seismic survey, particularly during turning movements, and short-duration equipment maintenance activities, L–DEO will 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 (turns may last two to three hours for the proposed project).

During turns or brief transits (e.g., less than three hours) between seismic tracklines, one mitigation airgun will continue operating. The ramp-up procedure will still be followed when increasing the source levels from one airgun to the full airgun array. However, keeping one airgun firing will 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 8 minutes, or with ramp-up if operating with the mitigation airgun over 8 minutes. PSOs will 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, but if so, the airguns will be shut-down immediately if one is sighted at any distance from the vessel because of its rarity and conservation status. The airgun array shall not resume firing until 30 minutes after the last documented whale visual sighting. Concentrations of humpback, sei, fin, blue, and/or sperm whales 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 this proposed survey, a concentration or group of whales will consist of three or more individuals visually sighted that do not appear to be traveling (e.g., feeding, socializing, etc.).

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 adverse 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.

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 IHAs must include the suggested means of accomplishing the necessary monitoring and reporting that will 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 action area.

Proposed Monitoring

L–DEO 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. L–DEO'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. L–DEO is prepared to discuss coordination of their 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 will be based aboard the seismic source vessel and will watch for marine mammals near the vessel during daytime airgun operations and during any ramp-ups of the airguns at night. PSVOs will 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 8 minutes for this proposed cruise). When feasible, PSVOs will 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 will 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 northeast Atlantic Ocean off of Spain, at least five PSOs (four PSVOs and one PSAO) will be based aboard the *Langseth.* L–DEO will appoint the PSOs with NMFS's concurrence. Observations will take place during ongoing daytime operations and nighttime ramp-ups of the airguns. During the majority of seismic operations, two PSVOs will 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 will 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 will be on duty. PSVO(s) will be on duty in shifts no longer than 4 hours in duration.

Two PSVOs will also be on visual watch during all daytime ramp-ups of the seismic airguns. A third PSAO will 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 crew will also be instructed to assist in detecting marine mammals and implementing mitigation requirements (if practical). Before the start of the seismic survey, the crew will 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 will be approximately 21.5 m (70.5 ft) above sea level, and the PSVO will have a good view around the entire vessel. During daytime, the PSVO(s) will scan the area around the vessel systematically with reticle binoculars (e.g., 7 × 50 Fujinon), Big-eye binoculars (25 × 150), and with the naked eye. During darkness, night vision devices will be available (ITT F500 Series Generation 3 binocular—image intensifier or equivalent), when required. Laser range-finding binoculars (Leica LRF 1200 laser rangefinder or equivalent) will 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 will immediately be powered-down or shut-down if necessary. The PSVO(s) will continue to maintain watch to determine when the animal(s) are outside the exclusion zone by visual confirmation. Airgun operations will 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 will 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 will 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 will be monitored in real time so that the PSVOs can be advised when cetaceans are detected.

The PAM system consists of hardware (i.e., hydrophones) and software. 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 less than 20 m (65.6 ft). The array will be deployed from a winch located on the back deck. A deck cable will connect from the winch to the main computer laboratory where the acoustic station, signal conditioning, and processing system will be located. The acoustic signals received by the hydrophones are amplified, digitized, and then processed by the Pamguard software. The system can detect marine mammal vocalizations at frequencies up to 250 kHz.

One PSAO, an expert bioacoustician (in addition to the four PSVOs) with primary responsibility for PAM, will be onboard the *Langseth.* The towed hydrophones will ideally be monitored by the PSAO 24 hours per day while at 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 will 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 will be on shift for one to six hours at a time. All PSOs are expected to rotate through the PAM position, although the expert PSAO (most experienced) will be on PAM duty more frequently.

When a vocalization is detected while visual observations (during daylight) are in progress, the PSAO will 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 will 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 will be notified immediately so that the proper mitigation measure may be implemented.

The information regarding the call will be entered into a database. Data entry will 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 will 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 will be used to estimate numbers of animals potentially 'taken' by harassment. They will also provide information needed to order a power-down or shut-down of the airguns when a marine mammal is within or near the exclusion zone. Observations will also be made during daytime periods when the *Langseth* is underway without seismic operations. There will 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 will 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, sea state, visibility, and sun glare.

The data listed under (2) will 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 will be recorded in a standardized format. The PSOs will record this information onto datasheets. During periods between watches and periods when operations are suspended, those data will be entered into a laptop computer running a custom computer database. The accuracy of the data entry will be verified by computerized data validity checks as the data are entered and by subsequent manual checking of the database. These procedures will allow initial summaries of data to be prepared during and shortly after the field program, and will facilitate transfer of the data to statistical, graphical, and other programs for further processing and archiving.

Results from the vessel-based observations will 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.

L–DEO will submit a comprehensive report to NMFS and NSF within 90 days after the end of the cruise. The report will describe the operations that were conducted and sightings of marine mammals near the operations. The report will provide full documentation of methods, results, and interpretation pertaining to all monitoring. The 90-day report will 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 will 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 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, 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 will 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 will be publicly available on the NMFS and NSF Web sites at: *http://www.nmfs.noaa.gov/pr/permits/incidental.htm#iha* and *http://www.nsf.gov/geo/oce/encomp/index.jsp.*

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 L–DEO 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 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).

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

In the event that L–DEO 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 L–DEO will 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 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 will work with the L–DEO to determine whether modifications in the activities are appropriate.

In the event that L–DEO 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 L–DEO 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,* within 24 hours of the discovery. The L–DEO would provide photographs or video footage (if available) or other documentation of the stranded animal sighting to NMFS.

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].

Level B harassment is anticipated and proposed to be authorized as a result of the proposed marine seismic survey in the northeast Atlantic Ocean. 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 could result in injury, serious injury, or mortality for which L–DEO seeks the IHA. The required mitigation and monitoring measures will minimize any potential risk for injury, serious injury, or mortality.

The following sections describe L–DEO's methods to estimate take by incidental harassment and present the applicant's estimates of the numbers of marine mammals that could be affected during the proposed seismic program in the northeast Atlantic Ocean. The estimates are based on a consideration of the number of marine mammals that could be harassed by seismic operations with the 18 airgun array to be used. The size of the proposed 2D and 3D seismic survey area in 2013 is approximately 5,834 km (3,150.1 nmi), as depicted in Figure 1 of the IHA application.

L–DEO assumes that, during simultaneous operations of the airgun array and the other sources, any marine mammals close enough to be affected by the multibeam 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 multibeam 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, L–DEO provided no additional allowance for animals that could be affected by sound sources other than airguns.

L–DEO used densities presented in the CODA final report for surveys off northwest Spain in 2007 (Anonymous, 2009; Macleod *et al.,* 2009) to estimate how many animals could be exposed during the proposed survey. The density reported for ''unidentified large whale'' was allocated to the humpback whale because there are a number of sightings of humpback whales off northwest Spain, although it wasn't sighted in the CODA surveys and most other large whales were. Macleod *et al.* (2008) didn't provide densities for beaked whale species, only ''beaked whales,'' therefore the density for beaked whales was allocated to Cuvier's beaked whale, as this was the most numerous species of beaked whale sighted during surveys off northwest Spain (see Basto d'Anstrade, 2008). Also, the CODA report (Anonymous, 2008) discussed two predicted high-density areas for beaked whales, in the most north-westerly section (Sowerby's beaked whale and northern bottlenose whale) and the most south-easterly section, the Gulf of Biscay (Cuvier's beaked whale). Except for beaked whales and bottlenose dolphins, all reported densities were corrected for trackline detection probability (f[0]) and availability (g[0]) biases by the authors of the CODA report. L–DEO chose not to correct the other densities, f(0) and g(0) are specific to the location and cetacean habitat. Although there is some uncertainty about the representativeness of the data and assumptions used in the calculations below, the approach used here is believed to be the best available approach. The CODA surveys were in July, 2007 (versus June to mid-July, 2013 for the proposed seismic survey), and CODA survey block 3, the closest to the proposed offshore survey area, includes waters closer to shore and is somewhat farther north (43 to 45° versus 42° North) and extends west to the north of Spain towards the Bay of Biscay.

The estimated numbers of individuals potentially exposed presented below are based on the 160 dB (rms) criterion currently used for all cetaceans. It is assumed that marine mammals exposed to airgun sounds that strong could change their behavior sufficiently to be considered ''taken by harassment.'' Table 3 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 far right column of Table 3. For species for which densities were not calculated as described above, but for which there were Ocean Biogeographic Information System (OBIS) sightings around the Azores, L–DEO has included a requested take authorization for the mean group size for the species.

It should be noted that the following estimates of exposures to various sound levels assume that the proposed survey would be completed; in fact, the esonified areas calculated using the planned number of line-kilometers have been increased by 25% to accommodate turns, lines that may need to be repeated, equipment testing, etc. 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 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, including areas of overlap. During the proposed survey, the transect lines are closely spaced relative to the 160 dB distance. Thus, the area including overlap is 8.2 times the area excluding overlap, so a marine mammal that stayed in the survey area during the entire survey could be exposed approximately 8 times, on average. However, it is unlikely that a particular animal would stay in the area during the entire survey. The numbers of different individuals potentially exposed to greater than or equal to 160 dB (rms) were calculated by multiplying the expected species density times the anticipated area to be ensonified to that level during airgun operations excluding overlap. The area expected to be ensonified was determined by entering the planned survey lines into a MapInfo GIS, using the GIS to identify the relevant areas by ''drawing'' the applicable 160 dB buffer zone (see Table 1) around each seismic line, and then calculating the total area within the buffer zone.

TABLE 3—ESTIMATED DENSITIES OF MARINE MAMMAL SPECIES AND ESTIMATES OF POSSIBLE NUMBERS OF MARINE MAMMALS EXPOSED TO SOUND LEVELS ≥160 DB DURING L–DEO'S PROPOSED SEISMIC SURVEY IN THE NORTHEAST ATLANTIC OCEAN (IN THE DEEP GALICIA BASIN WEST OF SPAIN), JUNE TO JULY, 2013

Species	Reported/estimated density (#/km²)	Calculated take authorization [i.e., estimated number of individuals exposed to sound levels ≥ 160 dB re 1 μPa] (includes 25% contingency)	Requested take authorization with additional 25% (includes increase to group size)	Approximate percentage of estimated of regional population (requested take) [1]
Mysticetes:				
North Atlantic right whale	0	0	0	0
Humpback whale	0.001	8	8	0.07 (0.07)
Minke whale	0	0	3	0 (<0.01)
Sei whale	0.002	16	16	0.13 (0.13)
Fin whale	0.019	153	153	0.62 (0.62)
Blue whale	0	0	2	0 (0.21)
Odontocetes:				
Sperm whale	0.003	24	24	0.18 (0.18)
Kogia spp. (Pygmy and dwarf sperm whale)	0	0	0	0 (0)
Cuvier's beaked whale	0.004	32	32	0.46 (0.46)
Northern bottlenose whale	0	0	4	0 (0.01)
Mesoplodon spp. (i.e., True's, Gervais', Sowerby's, and Blainville's beaked whale	0	0	7	0 (0.1)
Bottlenose dolphin	0.005	40	40	0.21 (0.21)
Atlantic spotted dolphin	0	0	0	0 (0)
Striped dolphin	0.047	378	378	0.56 (0.56)
Short-beaked common dolphin	0.077	620	620	0.53 (0.53)
Risso's dolphin	0	0	4	0 (0.02)
Pygmy killer whale	0	0	0	NA (NA)
False killer whale	0	0	10	NA (NA)
Killer whale	0	0	5	NA (NA)
Short-finned pilot whale	0	0	5	0 (<0.01)
Long-finned pilot whale	0.001	8	8	<0.001 (<0.01)

NA = Not available or not assessed.
[1] Stock sizes are best populations from NMFS Stock Assessment Reports (see Table 2 above).
[2] 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.

Applying the approach described above, approximately 6,437 km² (1,876.7 nmi²) (approximately 8,046 km² [2,345.8 nmi²] including the 25% contingency) would be within the 160 dB isopleth on one or more occasions during the proposed survey. 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 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).

The estimate of the number of individual cetaceans by species 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 is (with 25% contingency) as follows: 8 humpback, 16 sei, 153 fin, and 24 sperm, which would represent 0.07, 0.13, 0.61, and 0.18% of the affected regional populations, respectively. In addition, 43 beaked whales, (including 32 Cuvier's, 4 northern bottlenose, and 7 *Mesoplodon* beaked whales) could be taken by Level B harassment during the proposed seismic survey, which would represent 0.46, 0.01, and 0.1% of the regional populations. Most of the cetaceans potentially taken by Level B harassment are delphinids; bottlenose, striped, and short-beaked common, dolphins, are estimated to be the most common delphinid species in the area, with estimates of 40, 378, and 620, which would represent 0.21, 0.56, and 0.53% of the regional populations, respectively.

Encouraging and Coordinating Research

L–DEO and NSF will coordinate the planned marine mammal monitoring program associated with the seismic survey with other parties that may have interest in this area. L–DEO and NSF will coordinate with applicable U.S. agencies (e.g., NMFS), and will comply with their requirements.

Negligible Impact and Small Numbers Analyses and Determinations

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.'' 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 potential for temporary or permanent hearing impairment is relatively low and would likely be avoided through the implementation of the power-down and shut-down measures;

No injuries, serious injuries, or mortalities are anticipated to occur as a result of L–DEO's planned marine seismic survey, and none are proposed to be authorized by NMFS. Table 3 of this document outlines the number of requested Level B harassment takes that are anticipated as a result of these activities. Further, the seismic surveys will not take place in areas of significance for marine mammal feeding, resting, breeding, or calving and will not adversely impact marine mammal habitat.

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 39 days. Additionally, the seismic survey will be increasing sound levels in the marine environment in a relatively small area surrounding the vessel (compared to the range of the animals), which is constantly travelling over distances, and some animals may only be exposed to and harassed by sound for shorter less than day.

As mentioned previously, NMFS estimates that 20 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 were provided in Table 3 of this document.

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 northeast Atlantic Ocean, June to July, 2013, may result, at worst, in a modification in behavior and/or low-level physiological effects (Level B harassment) of certain species of marine mammals.

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 will 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 a mitigation and monitoring plans to minimize impacts to marine mammals.

The requested take estimates represent a small number relative to the affected species or stock size (i.e., all are less than 1%). See Table 3 for the requested authorized take number of marine mammals.

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 will 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 in the study area (in the northeast Atlantic Ocean) that implicate MMPA section 101(a)(5)(D).

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. L–DEO did not request take of endangered North Atlantic right whales due to the low likelihood of encountering this species during the cruise. Under section 7 of the ESA, NSF 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 will conclude formal section 7 consultation prior to making a determination on whether or not to issue the IHA. If the IHA is issued, NSF and L–DEO, in addition to the mitigation and monitoring requirements included in the IHA, will be required to comply with the Terms and Conditions of the Incidental Take Statement corresponding to NMFS's Biological Opinion issued to both NSF and NMFS's Office of Protected Resources.

National Environmental Policy Act

With L–DEO's complete application, NSF and L–DEO provided NMFS a draft ''Environmental Analysis of a Marine Geophysical Survey by the R/V *Marcus G. Langseth* in the Northeast Atlantic Ocean, June-July 2013,'' prepared by LGL Ltd., Environmental Research Associates, on behalf of NSF and L–DEO. 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, after review and evaluation of the NSF 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, will prepare an independent EA and make a decision of whether or not to issue a Finding of No Significant Impact (FONSI).

Proposed Authorization

NMFS proposes to issue an IHA to L–DEO for conducting a marine seismic survey in the northeast Atlantic Ocean, provided the previously mentioned mitigation, monitoring, and reporting requirements are incorporated. The duration of the IHA would not exceed one year from the date of its issuance.

Information Solicited

NMFS requests interested persons to submit comments and information concerning this proposed project and NMFS's preliminary determination of issuing an IHA (see **ADDRESSES**). 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: March 18, 2013.

Helen M. Golde,

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

[FR Doc. 2013–06504 Filed 3–20–13; 8:45 am]

BILLING CODE 3510–22–P

DEPARTMENT OF DEFENSE

Office of the Secretary

[Docket ID DoD–2013–OS–0055]

Notice of Availability of Environmental Assessment and Draft Finding of No Significant Impact Regarding DLA Energy's Mobility Fuel Purchasing Programs

AGENCY: Defense Logistics Agency Energy (DLA Energy), DoD.

ACTION: Finding of no significant impact.

SUMMARY: As required under the National Environmental Policy Act (NEPA) (42 U.S.C. 4321 et seq.), an environmental assessment (EA) has been prepared to assess the potential environmental impacts associated with the proposed action to continue DLA Energy's current domestic mobility fuel purchase programs. DLA Energy currently operates two programs for mobility fuel contracts, Direct Delivery Fuels (DDF) and Bulk Petroleum, which were considered as part of the EA. The EA also analyzed the no-action alternative. Based on the analysis in the EA, DLA Energy has determined that the proposed action is not a major federal action significantly affecting the quality of the human environment within the context of NEPA. Therefore, the preparation of an environmental impact statement (EIS) is not required.

DATES: Comments on the Draft Finding of No Significant Impact must be postmarked or emailed by April 22, 2013.

ADDRESSES: You may submit comments, identified by the docket ID and title, by any of the following methods:

- *Federal eRulemaking Portal: http://www.regulations.gov*. Follow the instructions for submitting comments.
- *Email: NEPA@dla.mil*. Include the docket ID in the subject line of the message.
- *Mail:* Project Manager for NEPA, DLA Installation Support for Energy, 8725 John J. Kingman Road, Suite 2828, Fort Belvoir, VA 22060.

Note: Before including your address, phone number, email address, or other personal identifying information in your comment, be advised that your entire comment, including your personal identifying information, may be made publicly available at any time. While you can ask in your comment to withhold from public review your personal identifying information, we cannot guarantee that we will be able to do so.

FOR FURTHER INFORMATION CONTACT: Copies of this FONSI, the accompanying EA, and further information concerning the proposed action are available from: Project Manager for NEPA, DLA Installation Support for Energy, 8725 John J. Kingman Road, Suite 2828, Fort Belvoir, VA 22060, (703) 767–8312, *NEPA@dla.mil*. Additional information about the NEPA process can be obtained from the Council on Environmental Quality at *http://ceq.hss.doe.gov/*.

SUPPLEMENTARY INFORMATION: Need for the Proposed Action: DLA Energy is proposing to continue purchases of mobility fuels on behalf of the U.S. Department of Defense (DOD) and other government agencies. The purpose of the proposed action is to fulfill DLA Energy's mission to provide DOD and other government agencies with energy solutions in the most effective and efficient manner possible. The program is needed to fulfill the mobility fuel requirements of the military services and the federal civilian agencies.

Proposed Action: As authorized by federal regulation (10 U.S.C. chapter 137, and DOD Directives 4140.25, 5101.8, and 4140.26–M), DLA Energy acquires and distributes nearly all of the refined petroleum, oil, and lubricants used by the U.S. military through contracting programs that follow the policies defined in the Federal Acquisition Regulation and the Defense Federal Acquisition Regulation Supplement. DLA Energy currently operates two programs for mobility fuel contracts, DDF and Bulk Petroleum, which were considered as part of the EA.

Alternatives Considered: The EA for DLA Energy's Mobility Fuel Purchase Programs, November 2012, evaluates the proposed action and the no-action alternative. Other alternatives were reviewed during the EA development process under the requirements of NEPA but were eliminated from further detailed analysis in the EA because they