proposed action. The human environment is defined as ''the natural and physical environment and the relationship of people with that environment'' (40 CFR 1508.14). In the context of the EIS, the human environment could include air quality, water quality, underwater noise levels, socioeconomic resources, fisheries, and environmental justice.

Comments concerning this environmental review process should be directed to NMFS (see **ADDRESSES**). See **FOR FURTHER INFORMATION CONTACT** Alexis Gutierrez at *Alexis.Gutierrez@noaa.gov* or at 301–713–2322 for questions. All comments and material received, including names and addresses, will become part of the administrative record and may be released to the public.

Authority: The environmental review of the phase one of the Strategy for Sea Turtle Conservation and Recovery in Relation to Atlantic Ocean and Gulf of Mexico Fisheries will be conducted under the authority and in accordance with the requirements of the National Environmental Policy Act of 1969, as amended (42 U.S.C. 4321 *et seq.*), National Environmental Policy Act Regulations (40 CFR parts, 1500 through 1508), other appropriate Federal laws and regulations, and policies and procedures of NOAA and NMFS for compliance with those regulations.

Scoping Meetings Code of Conduct

The public is asked to follow the following code of conduct at the scoping meetings. At the beginning of each meeting, a representative of NMFS will explain the ground rules (e.g., alcohol is prohibited from the meeting room; attendees will be called to give their comments in the order in which they registered to speak; each attendee will have an equal amount of time to speak; and attendees may not interrupt one another). The NMFS representative will structure the meeting so that all attending members of the public will be able to comment, if they so choose, regardless of the controversial nature of the subject(s). Attendees are expected to respect the ground rules, and those that do not will be asked to leave the meeting.

Special Accommodations

The scoping meetings are physically accessible to people with disabilities. Requests for sign language interpretation or other auxiliary aids should be directed to one of the contacts (see **FOR FURTHER INFORMATION CONTACT**) at least 7 days prior to the meeting. See Council meeting announcement for accessibility information for the briefings to the councils.

Dated: May 1, 2009.

Katy Vincent,

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

[FR Doc. E9–10674 Filed 5–7–09; 8:45 am]

BILLING CODE 3510–22–S

DEPARTMENT OF COMMERCE

National Oceanic and Atmospheric Administration

RIN 0648–XI63

Incidental Takes of Marine Mammals During Specified Activities; Marine Geophysical Survey in the Northeast Pacific Ocean, August – October 2009

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

ACTION: Notice; proposed incidental take authorization; request for comments.

SUMMARY: NMFS has received an application from the Lamont-Doherty Earth Observatory (L-DEO), a part of Columbia University, for an Incidental Harassment Authorization (IHA) to take small numbers of marine mammals, by harassment, incidental to conducting a seismic survey in the northeast Pacific Ocean. Pursuant to the Marine Mammal Protection Act (MMPA), NMFS requests comments on its proposal to authorize L-DEO to take, by Level B harassment only, small numbers of marine mammals incidental to conducting a marine seismic survey during August through October, 2009.

DATES: Comments and information must be received no later than June 8, 2009.

ADDRESSES: Comments on the application should be addressed to Michael Payne, Chief, Permits, Conservation and Education Division, Office of Protected Resources, National Marine Fisheries Service, 1315 East-West Highway, Silver Spring, MD 20910–3225. The mailbox address for providing email comments is *PR1.0648–XI63@noaa.gov*. Comments sent via e-mail, 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 address specified above, telephoning the contact listed below (see **FOR FURTHER INFORMATION CONTACT**), or visiting the internet at: *http://www.nmfs.noaa.gov/pr/permits/incidental.htm#applications*.

Documents cited in this notice may be viewed, by appointment, during regular business hours, at the aforementioned address.

FOR FURTHER INFORMATION CONTACT: Jeannine Cody or Howard Goldstein, Office of Protected Resources, NMFS, (301) 713–2289.

SUPPLEMENTARY INFORMATION:

Background

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

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

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. 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 [ALevel 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 [ALevel B harassment@].

Section 101(a)(5)(D) establishes a 45–day time limit for NMFS= 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. Not later than 45 days after the close of the public comment period, if the Secretary makes the findings set forth in Section 101(a)(5)(D)(i), the Secretary shall issue or deny issuance of the authorization with appropriate conditions to meet the requirements of clause 101(a)(5)(D)(ii).

Summary of Request

On February 11, 2009, NMFS received an application from L-DEO for the taking by Level B harassment only, of small numbers of 33 species of marine mammals incidental to conducting a marine seismic survey within the Exclusive Economic Zone (EEZ) of Canada in the northeast Pacific Ocean during August through October 2009. L-DEO, with research funding from the NSF, is conducting the geophysical data acquisition activities with onboard assistance by Drs. Toomey and Hooft from the University of Oregon, and Dr. Wilcock from the University of Washington.

This survey, also known as the Endeavor Tomography (ETOMO) Study, will take place approximately 250 kilometers (km) (155 miles (mi)) southwest of Vancouver Island, British Columbia, within the Canadian Endeavour Marine Protected Area (MPA) along an 80–km- (50- mi-) long section of the Endeavour segment of the Juan de Fuca Ridge. The Endeavor MPA is a unique ecosystem consisting of hydrothermal vents and associated fauna. Canada officially designated the area as an MPA in March 2003. However, scientific research for the conservation, protection and understanding of the area is permissible under the Canadian Oceans Act of 1996. Regulations regarding this MPA can be found on the Department of Justice Canada website at: *http://laws.justice.gc.ca/en/ShowFullDoc/cr/SOR–2003–87///en*.

The survey will obtain information on the sub-seafloor structure of volcanic and hydrothermal features that form as a result of movements of the Earth's plates; will obtain information on the three-dimensional (3–D) seismic structure of the crust and top-most mantle along an the Endeavour segment; and will define the distribution of magma beneath active volcanoes. Past studies using manned submersibles and remotely piloted vehicles have mapped the locations and characteristics of vent fields along this ridge segment. The ETOMO Study will extend that mapping beneath the seafloor and allow researchers to understand the dynamics of these systems.

Description of the Specified Activity

The planned survey will involve one source vessel, the R/V *Marcus G.Langseth* (*Langseth*), a seismic research vessel owned by the NSF and operated by L-DEO. The proposed project is scheduled to commence on August 17, 2009, and scheduled to end on October 13, 2009. The vessel will depart Astoria, Oregon on August 17, 2009 for transit to the Endeavor MPA, between 47–48° N. and 128–130° W.

To obtain high-resolution, 3–D structures of the area's magmatic systems and thermal structures, the *Langseth* will deploy a towed array of 36 airguns. The *Langseth* will also deploy 64 Ocean Bottom Seismometers (OBS). As the airgun array is towed along the survey lines, the OBSs will receive the returning acoustic signals and record them internally for later analysis. For the ETOMO study, the *Langseth* will not use a hydrophone streamer to receive geophysical data from the airgun array.

The ETOMO study (e.g., equipment testing, startup, line changes, repeat coverage of any areas, and equipment recovery) will take place in deep (between 1200 and 3000 m, 3,280 feet (ft) and 1.8 mi) water and will require approximately 10 days to complete 12 transects of variable lengths totaling 1800 km of survey lines. Data acquisition will include approximately 240 hours of airgun operation. Please see L-DEO's application for more detailed information. The exact dates of the activities will depend on logistics, weather conditions, and the need to repeat some lines if data quality is substandard.

Vessel Specifications

The *Langseth* is a seismic research vessel with a propulsion system designed to be as quiet as possible to avoid interference with the seismic signals. The vessel, which has a length of 71.5 m (235 feet (ft); a beam of 17.0 m (56 ft); a maximum draft of 5.9 m (19 ft); and a gross tonnage of 2925, can accommodate up to 55 people. The ship is powered by two Bergen BRG–6 diesel engines, each producing 3550 horsepower (hp), which drive the 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 operation speed during seismic acquisition is typically 7.4B9.3 km/hour (h) (4–5 knots). When not towing seismic survey gear, the *Langseth* can cruise at 20B24 km/h (11–13 knots). The *Langseth* has a range of 25,000 km (13,499 nautical miles). The *Langseth* will also serve as the platform from which vessel-based marine mammal (and sea turtle) observers will watch for animals before and during airgun operations.

Acoustic Source Specifications

Seismic Airguns

The full airgun array for the survey consists of 36 airguns (a mixture of Bolt 1500LL and Bolt 1900LLX airguns ranging in size from 40 to 360 cubic inches (in^3)), with a total volume of approximately 6,600 in^3 and a firing pressure of 1900 pounds per square inch (psi). The dominant frequency components range from two to 188 Hertz (Hz).

The array configuration consists of four identical linear arrays or strings, with 10 airguns on each string; the first and last airguns will be spaced 16 m (52 ft) apart. For each operating string, nine airguns will be fired simultaneously, whereas the tenth is kept in reserve as a spare, to be turned on in case of failure of another airgun. The four airgun strings will be distributed across an approximate area of 24H16 m (79 x 52 ft) behind the *Langseth* and will be towed approximately 50 to 100 m (164–328 ft) behind the vessel at a tow-depth of 15 m (49.2 ft). The airgun array will fire every 250 m (105 seconds (s)) or 500 m (210 s) depending on which grid or line the *Langseth* surveys. During firing, a brief (approximately 0.1 s) pulse of sound is emitted. The airguns will be silent during the intervening periods.

Multibeam Echosounder

The *Langseth* will operate a Simrad EM120 multibeam echosounder (MBES) simultaneously during airgun operations to map characteristics of the ocean floor. The hull-mounted MBES emits brief pulses of mid- or high-frequency (11.25–12.6 kHz) sound in a fanshaped beam that extends downward and to the sides of the ship. The beamwidth is 1 degree (°) fore-aft and 150° athwartship. The maximum source level is 242 dB re 1 μPa• m (root mean square (rms)). For deep-water operation, each Aping@ consists of nine successive fan-shaped transmissions, each 15 millisecond (ms) in duration and each ensonifying a sector that extends 1° foreBaft. The nine successive transmissions span an overall cross-track angular extent of about 150°, with 16 ms gaps between the pulses for successive sectors. A receiver in the overlap area between two sectors would receive two 15–ms pulses separated by a 16–ms gap. In shallower water, the pulse duration is reduced to 5 or 2 ms, and the number of transmit beams is also reduced. The ping interval varies with water depth, from approximately 5 s at 1000 m (3,281 ft) to 20 s at 4000 m (13,124 ft).

Sub-bottom Profiler

The *Langseth* will operate a sub-bottom profiler (SBP) continuously throughout the cruise with the MBES. An SBP operates at mid- to high frequencies and is generally used simultaneously with an MBES to provide information about the sedimentary features and bottom topography. SBP pulses are directed downward at typical frequencies of approximately 3 18 kHz. However, the dominant frequency component of the SBP is 3.5 kHz which is directed downward in a narrow beam by a hull-mounted transducer on the vessel. The SBP output varies with water depth from 50 watts in shallow water to 800 watts in deep water and has a normal source output (downward) of 200 dB re 1 μPa m and a maximum source level output (downward) of 204 dB re 1 μPa m.

The SBP used aboard the *Langseth* uses seven beams simultaneously, with a beam spacing of up to 15° and a fan width up to 30°. Pulse duration is 0.4 100 ms at intervals of 1 s; a common mode of operation is to broadcast five pulses at 1–s intervals followed by a 5–s pause.

Characteristics of Airgun Pulses

Discussion of the characteristics of airgun pulses has been provided in Appendix B of L-DEO=s application and in previous **Federal Register** notices (see 69 FR 31792, June 7, 2004; 71 FR 58790, October 5, 2006; 72 FR 71625, December 18, 2007; 73 FR 52950, September 12, 2008, or 73 FR 71606, November 25, 2008). Reviewers are referred to those documents for additional information.

Safety Radii

Safety zones are areas defined by the radius of received sound levels believed to have the potential for at least temporary hearing impairment (HESS, 1999). The distance from the sound source at which an animal would be exposed to these different received sound levels may be estimated and is typically referred to as safety radii. These safety radii are specifically used to help NMFS estimate the number of marine mammals likely to be harassed by the proposed activity and in deciding how close a marine mammal may approach an operating sound source before the applicant will be required to power-down or shut down the sound source.

During this study, all survey efforts will take place in deep (greater than 1000 m, 3820 ft) water. L-DEO has summarized the modeled safety radii for the planned airgun configuration in Table 1 which shows the predicted distances at which sound levels (190 decibels (dB), 180 dB, and 160 dB) are expected to be received from the 36–airgun array and a single airgun operating in water greater than 1000 m (3,820 ft) in depth.

TABLE 1. PREDICTED DISTANCES TO WHICH SOUND LEVELS ≥190, 180, AND 160 DB RE 1 μPA MIGHT BE RECEIVED IN DEEP (>1000 M; 3280 FT) WATER FROM THE 36–AIRGUN ARRAY DURING THE SEISMIC SURVEY, AUGUST SEPTEMBER, 2009 (BASED ON L-DEO MODELING).

Source and Volume	Tow Depth (m)	Predicted RMS Distances (m)		
		190 dB	180 dB	160 dB
Single Bolt airgun 40 in^3	6–15*	12	40	385
4 strings 36 airguns 6600 in^3	6	220	710	4670
	9	300	950	6000
	12	340	1120	6850
	15	380	1220	7690

*The tow depth has minimal effect on the maximum near-field output and the shape of the frequency spectrum for the single 40 in^3 airgun; thus the predicted safety radii are essentially the same at each tow depth.

The L-DEO model applied to airgun configuration does not allow for bottom interactions, and thus is most directly applicable to deep water and to relatively short ranges. The calculated distances are expected to overestimate the actual distances to the corresponding Sound Pressure Levels (SPL), given the deep-water results of Tolstoy *et al.* (2004a,b). Additional information regarding how the safety radii were calculated and how the empirical measurements were used to correct the modeled numbers may be found in Appendix A of L-DEO=s Environmental Assessment (EA). The conclusion that the model predictions in Table 1 are precautionary, relative to actual 180- and 190–dB (rms) radii, is based on empirical data from the acoustic calibration of different airgun configurations used by the R/V *Maurice Ewing* (*Ewing*) in the northern Gulf of Mexico. (Tolstoy *et al.*, 2004a,b).

L-DEO conducted a more extensive acoustic calibration study of the *Langseth*=s 36–airgun array in late 2007/early 2008 in the northern Gulf of Mexico (LGL Ltd., 2006; Holst and Beland, 2008). L-DEO is currently modeling the distances to the corresponding Sound Pressure Levels (SPL) (e.g., 190, 180, and 160 dB re 1 μPa (rms)) for various airgun configurations and water depths. Those results are not yet available. However, the empirical data from the 2007/2008 calibration study will be used to refine the exclusion zones proposed above for use during survey, if the data are appropriate and available at the time of the survey.

Description of Marine Mammals in the Activity Area

Thirty-three marine mammal species may occur off the coast of British Columbia, Canada, including 20 odontocetes (toothed cetaceans), 7 mysticetes (baleen whales), 5 pinnipeds, and the sea otter (*Enhydra* sp.). In the United States, sea otters are managed by the U.S. Fish and Wildlife Service (USFWS) and are unlikely to be encountered in or near the Endeavor Marine Protected Area where seismic operations will occur, and are, therefore, not addressed further in this document. Eight of these species are listed as endangered under the U.S. Endangered Species Act of 1973 (ESA), including the Steller sea lion (*Eumetopias jubatus*), the humpback (*Megaptera* *novaeanliae*), sei (*Balaenoptera borealis*), fin (*Balenoptera physalus*), blue (*Balenoptera musculus*), North Pacific right (*Eubalena japonica*), sperm (*Physeter macrocephalus*), and Southern Resident killer (*Orcinus orca*) whales.

This proposed IHA will only address requested take authorizations for cetaceans and pinnipeds. Table 2 below outlines the species, their habitat and abundance in the proposed survey area, the estimated number of exposures (based on average density) to sound levels greater than or equal to 160 dB during the seismic survey if no animals moved away from the survey vessel.

Species	Habitat	Abundance in the NE Pacific	Occurrence in the Survey Area	Estimated Number of Exposures to Sound Levels ≥ 160 dB	Estimated Number of Individuals Exposed to Sound Levels ≥160 dB	Approx. Percent of Regional Population
North Pacific right whale*	Coastal and shelf waters	100–200	Rare and unlikely	0	0	0
Humpback whale*	Coastal waters	>6000	Uncommon	29	6	0.10
Minke whale	Coastal and shelf waters	9000	Uncommon	26	26	0.06
Sei whale	Pelagic	7260 - 12,620	Uncommon	5	1	0.01
Fin whale*	Pelagic, shelf and coastal waters	13,620–18,680	Uncommon	39	8	0.05
Blue whale*	Pelagic, shelf and inshore waters	1186	Uncommon	8	2	0.14
Sperm whale*	Pelagic	24,000	Uncommon	52	10	0.04
Pygmy sperm whale	Deep waters off the shelf	Not available	Common	47	9	Not available
Dwarf Sperm whale	Deep waters off the shelf	Not available	Uncommon	0	0	0.0
Baird's beaked whale	Deep waters and cont. slopes	6000	Common	62	13	0.21
Blainville's beaked whale	Deep waters and cont. slopes	603	Uncommon	8	2	0.28
Cuvier's beaked whale	Pelagic	20,000	Uncommon	0	0	0.0
Hubb's beaked whale	Deep waters and cont. slopes	421	Uncommon	8	2	0.40
Stejneger's beaked whale	Deep waters	421	Uncommon	8	2	0.40
Bottlenose dolphin	Coastal and offshore waters	3257	Rare	0	0	0.0
Striped dolphin	Pelagic	23,883	rare	2	0	0.0
Short-beaked common dolphin	Coastal and offshore waters	487,622	Common	511	104	0.02
Pacific white-sided dolphin	Pelagic, shelf and slope waters	931,000	Common	895	181	0.02
Northern right-whale dolphin	Pelagic, shelf and slope waters	15,305	Common	699	142	0.93
Risso's dolphin	Pelagic	12,093	Common	467	95	0.78
False killer whale	Pelagic	Not available	Rare	0	0	0.0
Killer whale	Widely distributed	8500	Uncommon	61	12	0.15
Short-finned pilot whale	Pelagic	160,200	Uncommon	0	0	00.0

Species	Habitat	Abundance in the NE Pacific	Occurrence in the Survey Area	Estimated Number of Exposures to Sound Levels ≥ 160 dB	Estimated Number of Individuals Exposed to Sound Levels ≥160 dB	Approx. Percent of Regional Population
Dall's porpoise	Offshore and near-shore waters	57,549	Common	5337	1081	1.88
Northern fur seal	Coastal	721,935	Common	360	73	0.01
Total				8,624	1,748	

Table 2. Abundance, preferred habitat, and commonness of the marine mammal species that may be encountered during the proposed survey within the ETOMO survey area. The far right columns indicate the estimated number of each species that will be exposed to ≥160 dB based on average density estimates. NMFS believes that, when mitigation measures are taken into consideration, the activity is likely to result in take of numbers of animals less than those indicated by the column titled NUmber of Individuals Exposed ≥160 dB.
* Federally listed endangered species.

Detailed information regarding the status and distribution of these marine mammals may be found in sections III and IV of L-DEO's application.

Potential Effects of the Proposed Activity on Marine Mammals

Summary of Potential Effects of Airgun Sounds on Marine Mammals

The effects of sounds from airguns 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 project would result in any cases of temporary or permanent hearing impairment, or any significant non-auditory physical or physiological effects. Some behavioral disturbance is expected, but is expected to be localized and short-term.

Tolerance

Numerous studies have shown that pulsed sounds from airguns are often readily detectable in the water at distances of many kilometers. For a brief summary of the characteristics of airgun pulses, see Appendix B of L-DEO's application. Several studies have also shown that marine mammals at distances more than a few kilometers from operating seismic vessels often show no apparent response (tolerance) (see Appendix B (5) of L-DEO's EA). 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 that mammal group. Although various baleen whales, toothed whales, and (less frequently) pinnipeds have been shown to react behaviorally to airgun pulses under some conditions, at other times mammals of all three types have shown no overt reactions. In general, pinnipeds usually seem to be more tolerant of exposure to airgun pulses than cetaceans, with the relative responsiveness of baleen and toothed whales being variable.

Masking

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, although there are very few specific data on this. Because of the intermittent nature and low duty cycle of seismic pulses, animals can emit and receive sounds in the relatively quiet intervals between pulses. However, in some situations, multi-path arrivals and reverberation cause airgun sound to arrive for much or all of the 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). In the northeast Pacific Ocean, blue whale calls have been recorded during a seismic survey off Oregon (McDonald *et al.*, 1995). Among odontocetes, 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 this species continued calling in the presence of seismic pulses (Madsen *et al.*, 2002; Tyack *et al.*, 2003; Smultea *et al.*, 2004; Holst *et al.*, 2006; Jochens *et al.*, 2006, 2008). 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; 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. In general, masking effects of seismic pulses are expected to be negligible, given the normally intermittent nature of seismic pulses. Masking effects on marine mammals are discussed further in Appendix B (4) of L-DEO's EA.

Disturbance Reactions

Disturbance includes a variety of effects, including subtle to conspicuous changes in behavior, movement, and displacement. Based on NMFS (2001, p. 9293), NRC (2005), and Southall *et al.* (2007), L-DEO assumes that simple exposure to sound, or brief reactions that do not disrupt behavioral patterns in a potentially significant manner, do not constitute harassment or ''taking''. By potentially significant, L-DEO means ''in a manner that might have deleterious effects to the well-being of individual marine mammals or their populations''.

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). 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). 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 exposed to a particular level of industrial sound. In most cases, this approach likely overestimates the numbers of marine mammals that would be affected in some biologically-important manner.

The sound criteria used to estimate how many marine mammals might be disturbed to some biologically-important degree by a seismic program are based primarily on behavioral observations of a few species. Detailed studies have been done on humpback, gray (*Eshrichtius robustus*), bowhead (*Balena mysticetes*), and sperm whales, and on ringed seals (*Pusa hispida*). Less detailed data are available for some other species of baleen whales, and small toothed whales, but for many species there are no data on responses to marine seismic surveys.

Baleen Whales

Baleen whales generally tend to avoid operating airguns, but avoidance radii are quite variable. 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, as reviewed in Appendix B (5) of L-DEO's EA, 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. 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 160 170 dB re 1 μPa (rms) seem to cause obvious avoidance behavior in a substantial fraction of the animals exposed (Richardson *et al.*, 1995). In many areas, seismic pulses from large arrays of airguns diminish to those levels at distances ranging from 4–15 km (2.5–9.3 mi) 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 summarized in Appendix B of L-DEO's EA have shown that some species of baleen whales, notably bowhead and humpback whales, at times show strong avoidance at received levels lower than 160 170 dB re 1 μPa (rms).

Responses of humpback whales to seismic surveys have been studied during migration, on summer feeding grounds, and on Angolan winter breeding grounds; there has also been discussion of effects on the Brazilian wintering grounds. McCauley *et al.* (1998, 2000a) studied the responses of humpback whales off Western Australia to a full-scale seismic survey with a 16–airgun, 2678–in^3 array, and to a single 20–in^3 airgun with source level of 227 dB re 1 μPa m (peak to peak). McCauley *et al.* (1998) documented that avoidance reactions began at 5–8 km (3–5 mi) from the array, and that those reactions kept most pods approximately 3–4 km (1.8–2.5 mi) from the operating seismic boat. McCauley *et al.* (2000a) noted localized displacement during migration of 4–5 km (2.5–3.1 mi) by traveling pods and 7–12 km (4.3–7.5 mi) 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 5–8 km (3.1–4.9 mi) from the airgun array and 2 km (1.2 mi) from the single airgun. However, some individual humpback whales, especially males, approached within distances of 100–400 m (328–1312 ft), where the maximum received level was 179 dB re 1 μPa (rms).

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). Malme *et al.* reported that some of the humpbacks seemed startled at received levels of 150 169 dB re 1 μPa and concluded that there was no clear evidence of avoidance, despite the possibility of subtle effects, at received levels up to 172 re 1 FPa on an approximate rms basis.

It has been 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).

There are no data on reactions of right whales to seismic surveys, but results from the closely-related bowhead whale show that their responsiveness can be quite variable depending on their activity (migrating vs. feeding). Bowhead whales migrating west across the Alaskan Beaufort Sea in autumn, in particular, are unusually responsive, with substantial avoidance occurring out to distances of 20 - 30 km (12.4 - 18.6 mi) from a medium-sized airgun source at received sound levels of around 120 130 dB re 1 μPa (rms) (Miller *et al.*, 1999; Richardson *et al.*, 1999; see Appendix B (5) of the EA. However, more recent research on bowhead whales (Miller *et al.*, 2005; Harris *et al.*, 2007) corroborates earlier evidence that, during the summer feeding season, bowheads are not as sensitive to seismic sources. Nonetheless, subtle but statistically significant changes in surfacing respiration dive cycles were evident upon statistical analysis (Richardson *et al.*, 1986). In summer, bowheads typically begin to show avoidance reactions at received levels of about 152 178 dB re 1 μPa (rms) (Richardson *et al.*, 1986, 1995; Ljungblad *et al.*, 1988; Miller *et al.*, 2005).

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 reported in areas ensonified by airgun pulses (Stone, 2003; MacLean and Haley, 2004; Stone and Tasker, 2006). 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). In a study off Nova Scotia, Moulton and Miller (2005) found little difference in sighting rates (after accounting for water depth) and initial sighting distances of balaenopterid whales when airguns were operating versus silent. However, there were indications that these whales were more likely to be moving away when seen during airgun operations. Similarly, ship-based monitoring studies of blue, fin, sei and minke whales offshore of Newfoundland (Orphan Basin and Laurentian Sub-basin) found no more than small differences in sighting rates and swim directions during seismic vs. non-seismic periods Moulton *et al.*, 2005, 2006a,b).

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; Angliss and Outlaw, 2008). 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; Angliss and Outlaw, 2008).

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 and (in more detail) in Appendix B of L-DEO's EA have been reported for toothed whales. However, there are recent systematic studies on sperm whales (Jochens *et al.*, 2006; Miller *et al.*, 2006), and 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; Weir, 2008).

Seismic operators and marine mammal observers 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). 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). In most cases the avoidance radii for delphinids appear to be small, on the order of 1 km less, and some individuals show no apparent avoidance. The beluga (*Delphinapterus leucas*) is a species that (at times) shows long-distance avoidance of seismic vessels. Aerial surveys conducted in the southeastern Beaufort Sea during summer found that sighting rates of beluga whales were significantly lower at distances 10–20 km (6.2–12.4 mi) compared with 20–30 km (12.4–18.6 mi) from an operating airgun array, and observers on seismic boats in that area rarely see belugas (Miller *et al.*, 2005; Harris *et al.*, 2007).

Captive bottlenose dolphins (Tursiops truncates) 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 (*Phocoena phocoena*) show stronger avoidance of seismic operations than do Dall's porpoises (*Phocoenoides dalli*) (Stone, 2003; MacLean and Koski, 2005; Bain and Williams, 2006; Stone and Tasker, 2006). Dall's porpoises seem relatively tolerant of airgun operations (MacLean and Koski, 2005; Bain and Williams, 2006), although they too have been observed to avoid large arrays of operating airguns (Calambokidis and Osmek, 1998; Bain and Williams, 2006). This apparent difference in responsiveness of these two porpoise species is consistent with their relative responsiveness to boat traffic and some other acoustic sources (Richardson *et al.*, 1995; Southall *et al.*, 2007).

Most studies of sperm whales exposed to airgun sounds indicate that the sperm whale shows considerable tolerance of airgun pulses (e.g., Stone, 2003; Moulton *et al.*, 2005, 2006a; Stone and Tasker, 2006; Weir, 2008). In most cases the whales do not show strong avoidance, and they continue to call (see Appendix B of L-DEO's EA for review). However, controlled exposure experiments in the Gulf of Mexico indicate that foraging behavior was altered upon exposure to airgun sound (Jochens *et al.*, 2006). In the Sperm Whale Seismic Study (SWSS), D-tags (Johnson and Tyack, 2003) were used to record the movement and acoustic exposure of eight foraging sperm whales before, during, and after controlled sound exposures of airgun arrays in the Gulf of Mexico (Jochens *et al.*, 2008). Whales were exposed to maximum received sound levels between 111 and 147 dB re 1 μPa rms (131 – 164 dB re 1 μPa pk-pk) at ranges of approximately 1.4 - 12.6 km (0.8 – 7.8 mi) from the sound source. Although the tagged whales showed no horizontal avoidance, some whales changed foraging behavior during full-array exposure (Jochens *et al.*, 2008).

There are almost no specific data on the behavioral reactions of beaked whales to seismic surveys. However, northern bottlenose whales continued to produce high-frequency clicks when exposed to sound pulses from distant seismic surveys (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). 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.

There are increasing indications that some beaked whales tend to 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 ''Strandings and Mortality'' subsection, later). These strandings are apparently at least in part 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 (see ''Strandings and Mortality'', below). Seismic survey sounds are quite different from those of the sonars in operation during the above-cited incidents, and in particular, the dominant frequencies in airgun pulses are at lower frequencies than used by mid-frequency naval sonars.

Odontocete reactions to large arrays of airguns are variable and, at least for delphinids and some porpoises (e.g., Dall's, *Phocoenoides dalli*), seem to be confined to a smaller radius than has been observed for the more responsive of the mysticetes, belugas, and harbor porpoises (refer to Appendix B in L-DEO's EA).

Pinnipeds

Pinnipeds are not likely to show a strong avoidance reaction to the airgun array. Visual monitoring from seismic vessels has shown only slight (if any) avoidance of airguns by pinnipeds, and only slight (if any) changes in behavior see Appendix B (5) of the EA. In the Beaufort Sea, some ringed seals avoided an area of 100 m (328 ft) to (at most) a few hundred meters around seismic vessels, but many seals remained within 100 - 200 m (328 656 ft) of the trackline as the operating airgun array passed by (e.g., Harris *et al.*, 2001; Moulton and Lawson 2002; Miller *et al.*, 2005). Ringed seal sightings averaged somewhat farther away from the seismic vessel when the airguns were operating than when they were not, but the difference was small (Moulton and Lawson, 2002). Similarly, in Puget Sound, sighting distances for harbor seals (*Phoca vitulina*) and California sea lions (*Zalophus californianus*) tended to be larger when airguns were operating (Calambokidis and Osmek, 1998). Previous telemetry work suggests that avoidance and other behavioral reactions may be stronger than evident to date from visual studies (Thompson *et al.*, 1998). Even if reactions of any pinnipeds that might be encountered in the present study area are as strong as those evident in the telemetry study, reactions are expected to be confined to relatively small distances and durations, with no long-term effects on pinniped individuals or populations.

Hearing Impairment and Other Physical Effects

Temporary or permanent hearing impairment is a possibility when marine mammals are exposed to very strong sounds, and temporary threshold shift (TTS) has been demonstrated and studied in certain captive odontocetes and pinnipeds exposed to strong sounds (reviewed in Southall *et al.*, 2007).

Current NMFS policy regarding exposure of marine mammals to high-level sounds is that cetaceans and pinnipeds should not be exposed to impulsive sounds with received levels greater than or equal to 180 and 190 dB re 1 μPa rms, respectively (NMFS 2000). L-DEO has used those criteria to establish the exclusion (i.e., shut-down) zones planned for the proposed seismic survey. However, those criteria were established before there was any information about minimum received levels of sounds necessary to cause auditory impairment in marine mammals. As discussed in Appendix B of the EA: (1) the 180–dB criterion for cetaceans is probably quite precautionary, i.e., lower than necessary to avoid temporary auditory impairment let alone permanent auditory injury; (2) NMFS treats TTS as the upper bound of Level B Harassment. Tissues are not irreparably damaged with the onset of TTS, the effects are temporary (particularly for onset-TTS), and NMFS does not believe that this effect qualifies as an injury; (3) the minimum sound level necessary to cause permanent hearing impairment (''Level A harassment'') is higher, by a variable and generally unknown amount, than the level that induces barely detectable TTS; and (4) the level associated with the onset of TTS is often considered to be a level below which there is no danger of permanent damage. The actual PTS threshold is likely to be well above the level causing onset of TTS (Southall *et al.*, 2007).

Recommendations for new science-based noise exposure criteria for marine mammals, frequency-weighting procedures, and related matters were published recently (Southall *et al.*, 2007). Those recommendations have not, as of early 2009, been formally adopted by NMFS for use in regulatory processes and during mitigation programs associated with seismic surveys. However, some aspects of the recommendations have been taken into account in certain Environmental Impact Statements and small-take authorizations. NMFS has indicated that it may issue new noise exposure criteria for marine mammals that account for the now available scientific data on TTS, the expected offset between the TTS and PTS thresholds, differences in the acoustic frequencies to which different marine mammal groups are sensitive, and other relevant factors. Preliminary information about possible changes in the regulatory and mitigation requirements, and about the possible structure of new criteria, was given by Wieting (2004) and NMFS (2005).

Several aspects of the planned monitoring and mitigation measures for this project are designed to detect marine mammals occurring near the airgun array, and to avoid exposing them to sound pulses that might, at least in theory, cause hearing impairment (see section XI of L-DEO's application). In addition, many cetaceans and (to a limited degree) pinnipeds and sea turtles show some avoidance of the area where received levels of airgun sound are high enough such that hearing impairment could potentially occur. In those cases, the avoidance responses of the animals themselves will reduce or (most likely) avoid any possibility of hearing impairment.

Non-auditory physical effects might also occur in marine mammals exposed to strong underwater pulsed sound. Possible types of non-auditory physiological effects or injuries that might (in theory) occur in mammals close to a strong sound source include stress, neurological effects, bubble formation, and other types of organ or tissue damage. It is possible that some marine mammal species (i.e., beaked whales) may be especially susceptible to injury and/or stranding when exposed to strong pulsed sounds. However, as discussed below, there is no definitive evidence that any of these effects occur even for marine mammals in close proximity to large arrays of airguns. It is unlikely that any effects of these types would occur during the proposed project given the brief duration of exposure of any given mammal, the deep water in the survey area, and the planned monitoring and mitigation measures (see below). The following subsections discuss in somewhat more detail the possibilities of TTS, PTS, and non-auditory physical effects.

Temporary Threshold Shift (TTS)

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. 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).

For toothed whales exposed to single short pulses, the TTS threshold appears to be, to a first approximation, a function of the energy content of the pulse (Finneran *et al.*, 2002, 2005). Given the available data, the received energy level of a single seismic pulse (with no frequency weighting) might need to be approximately 186 dB re 1 μPa^2•s (i.e., 186 dB SEL or approximately 196 201 dB re 1 μPa rms in order to produce brief, mild TTS. Exposure to several strong seismic pulses that each have received levels near 190 dB re 1 μPa rms might result in cumulative exposure of approximately 186 dB SEL and thus slight TTS in a small odontocete, assuming the TTS threshold is (to a first approximation) a function of the total received pulse energy. The 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 190 dB re 1 μPa rms are estimated in Table 1. Levels greater than or equal to 190 dB re 1 μPa rms are expected to be restricted to radii no more than 380 m (1246 ft) (See Table 1). For an odontocete closer to the surface, the maximum radius with greater than or equal to 190 dB re 1 μPa rms would be smaller.

The above TTS information for odontocetes is derived from studies on the bottlenose dolphin and beluga. There is no published TTS information for other types of cetaceans. However, preliminary evidence from a harbor porpoise exposed to airgun sound suggests that its TTS threshold may have been lower (Lucke *et al.*, 2007).

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 (Southall *et al.*, 2007). In any event, no cases of TTS are expected given three considerations: (1) the low abundance of baleen whales in most parts of the planned study area; (2) the strong likelihood that baleen whales would avoid the approaching airguns (or vessel) before being exposed to levels high enough for TTS to occur; and (3) the mitigation measures that are planned.

In pinnipeds, TTS thresholds associated with exposure to brief pulses (single or multiple) of underwater sound have not been measured. Initial evidence from more prolonged (non-pulse) exposures suggested that some pinnipeds (harbor seals in particular) incur TTS at somewhat lower received levels than do small odontocetes exposed for similar durations (Kastak *et al.*, 1999, 2005; Ketten *et al.*, 2001). The TTS threshold for pulsed sounds has been indirectly estimated as being an SEL of approximately 171 dB re 1 μPa^2•s (Southall *et al.*, 2007), which would be equivalent to a single pulse with received level of approximately 181 - 186 dB re 1 μPa (rms), or a series of pulses for which the highest rms values are a few dB lower. Corresponding values for California sea lions and northern elephant seals (*Mirounga angustirostris*) are likely to be higher (Kastak *et al.*, 2005).

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. Those sound levels are not considered to be the levels above which TTS might occur. Rather, they were 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. As summarized above and in Southall *et al.* (2007), data that are now available imply that TTS is unlikely to occur in most odontocetes (and probably mysticetes as well) unless they are exposed to a sequence of several airgun pulses in which the strongest pulse has a received level substantially exceeding 180 dB re 1 μPa rms. On the other hand, for the harbor seal and any species with similarly low TTS thresholds (possibly including the harbor porpoise), TTS may occur upon exposure to one or more airgun pulses whose received level equals the NMFS ''do not exceed'' value of 190 dB re 1 μPa rms. That criterion corresponds to a single-pulse SEL of

175 - 180 dB re 1 μPa^2•s in typical conditions, whereas TTS is suspected to be possible (in harbor seals) with a cumulative SEL of approximately 171 dB re 1 μPa^2•s.

Permanent Threshold Shift (PTS)

When PTS occurs, there is physical damage to the sound receptors in the ear. In severe cases, there can be total or partial deafness, while 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 (Richardson *et al.*, 1995, p. 372*ff*). Single or occasional occurrences of mild TTS are not indicative of permanent auditory damage.

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. PTS might occur at a received sound level at least several decibels above that inducing mild TTS if the animal were exposed to strong sound pulses with rapid rise time see Appendix B (6) of L-DEO's EA. 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). On an SEL basis, Southall *et al.* (2007:441–4) estimated that received levels would need to exceed the TTS threshold by at least 15 dB for there to be risk of PTS. Thus, for cetaceans they estimate that the PTS threshold might be a mammal-weighted (M-weighted) SEL (for the sequence of received pulses) of approximately 198 dB re 1 μPa²•s (15 dB higher than the TTS threshold for an impulse), where the SEL value is accumulated over the sequence of pulses. Additional assumptions had to be made to derive a corresponding estimate for pinnipeds, as the only available data on TTS-thresholds in pinnipeds pertain to non-impulse sound. Southall *et al.* (2007) estimate that the PTS threshold could be a cumulative Mpw-weighted SEL of approximately 186 dB re 1 μPa²•s in the harbor seal exposed to impulse sound. The PTS threshold for the California sea lion and northern elephant seal the PTS threshold would probably be higher, given the higher TTS thresholds in those species.

Southall *et al.* (2007) also note that, regardless of the SEL, there is concern about the possibility of PTS if a cetacean or pinniped received one or more pulses with peak pressure exceeding 230 or 218 dB re 1 μPa (peak), respectively. A peak pressure of 230 dB re 1 FPa (3.2 bar•m, 0–peak) would only be found within a few meters of the largest (360 in³) airgun in the planned airgun array (Caldwell and Dragoset, 2000). A peak pressure of 218 dB re 1 μPa could be received somewhat farther away; to estimate that specific distance, one would need to apply a model that accurately calculates peak pressures in the nearfield around an array of airguns.

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 and sea turtles. The planned monitoring and mitigation measures, including visual monitoring, PAM, power downs, and shut downs of the airguns when mammals are seen within or approaching the exclusion zones, will further reduce the probability of exposure of marine mammals to sounds strong enough to induce PTS.

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 (Gentry, 2002) and direct noise-induced bubble formation (Crum *et al.*, 2005) are not expected in the case of an impulsive 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. Also, the planned mitigation measures (see section XI), including shut downs of the airguns, will reduce any such effects that might otherwise occur.

Strandings and Mortality

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 for marine seismic research or commercial seismic surveys, and 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 mass strandings of beaked whales with naval exercises and, in one case, an L-DEO seismic survey (Malakoff, 2002; Cox *et al.*, 2006), has raised the possibility that beaked whales exposed to strong pulsed sounds may be especially susceptible to injury and/or behavioral reactions that can lead to stranding (e.g., Hildebrand, 2005; Southall *et al.*, 2007). Appendix B (7) of L-DEO's EA provides additional details.

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. There are increasing 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. However, 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 1 kHz. Typical military mid-frequency sonars emit non-impulse sounds at frequencies of 2–10 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 assume that there is a direct connection between the effects of military sonar and seismic surveys on marine mammals. 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; Fernandez *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 pulsed 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 (*Ziphius cavirostris*) in the Gulf of California, Mexico, when the L-DEO vessel R/V *Maurice Ewing* was operating a 20–airgun, 8490–in^3 airgun 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; (2) the proposed monitoring and mitigation measures; and (3) differences between the sound sources operated by L-DEO and those involved in the naval exercises associated with strandings.

Possible Effects of Multibeam Echosounder (MBES) Signals

The Simrad EM120 12–kHz MBES will be operated from the source vessel continuously during the planned study. Sounds from the MBES are very short pulses, occurring for 2–15 ms once every 5 20 s, depending on water depth. Most of the energy in the sound pulses emitted by this MBES is at frequencies near 12 kHz, and the maximum source level is 242 dB re 1 µPa• m (rms). The beam is narrow (1°) in fore-aft extent and wide (150°) in the cross-track extent. Each ping consists of nine 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 Simrad EM120 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 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 an MBES 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 Simrad EM120, and (2) are often directed close to omnidirectionally versus more downward for the Simrad EM120. The area of possible influence of the MBES is much smaller a narrow band below the source vessel. 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 the area.

Masking - Marine mammal communications will not be masked appreciably by the MBES 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 MBES 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 sonar, 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 (*Globicephala* spp.) (Rendell and Gordon, 1999), and the previously-mentioned beachings by beaked whales. During exposure to a 21–25 kHz sonar with a source level of 215 dB re 1 µPa•m, gray whales reacted by orienting slightly away from the source and being deflected from their course by approximately 200 m (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 exhibited changes in behavior when exposed to 1–s tonal signals at frequencies similar to those that will be emitted by the MBES 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 an MBES.

Very few data are available on the reactions of pinnipeds to sonar sounds at frequencies similar to those used during seismic operations. Hastie and Janik (2007) conducted a series of behavioral response tests on two captive gray seals to determine their reactions to underwater operation of a 375–kHz multibeam imaging sonar that included significant signal components down to 6 kHz. Results indicated that the two seals reacted to the sonar signal by significantly increasing their dive durations. Because of the likely brevity of exposure to the MBES sounds, pinniped reactions are expected to be limited to startle or otherwise brief responses of no lasting consequence to the animals.

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 MBES proposed for use by L-DEO is quite different than sonars used for navy operations. Pulse duration of the MBES is very short relative to the naval sonars. Also, at any given location, an individual marine mammal would be in the beam of the MBES for much less time given the generally downward orientation of the beam and its narrow fore-aft beamwidth; navy sonars often use nearhorizontally-directed sound. Those factors would all reduce the sound energy received from the MBES rather drastically relative to that from the sonars used by the navy.

Given the maximum source level of 242 dB re 1 µPa•m rms, the received level for an animal within the MBES beam 100 m (328 ft) below the ship would be approximately 202 dB re 1 µPa rms, assuming 40 dB of spreading loss over 100 m (328 ft) (circular spreading). Given the narrow beam, only one pulse is likely to be received by a given animal as the ship passes overhead. The received energy level from a single pulse ofduration 15 ms would be about 184 dB re 1 μPa^2•s, i.e., 202 dB + 10 log (0.015 s). That is below the TTS threshold for a cetacean receiving a single non-impulse sound (195 dB re 1 μPa^2•s) and even further below the anticipated PTS threshold (215 dB re 1 μPa^2•s) (Southall *et al.*, 2007). In contrast, an animal that was only 10 m (32 ft) below the MBES when a ping is emitted would be expected to receive a level approximately 20 dB higher, i.e., 204 dB re 1 μPa²•s in the case of the EM120. That animal might incur some TTS (which would be fully recoverable), but the exposure would still be below the anticipated PTS threshold for cetaceans. As noted by Burkhardt *et al.*, (2007, 2008), cetaceans are very unlikely to incur PTS from operation of scientific sonars on a ship that is underway.

In the harbor seal, the TTS threshold for non-impulse sounds is about 183 dB re 1 μPa²•s, as compared with approximately 195 dB re 1 μPa²•s in odontocetes (Kastak *et al.*, 2005; Southall *et al.*, 2007). TTS onset occurs at higher received energy levels in the California sea lion and northern elephant seal than in the harbor seal. A harbor seal as much as 100 m (328 ft) below the *Langseth* could receive a single MBES pulse with received energy level of greater than or equal to 184 dB re 1 μPa²•s (as calculated in the toothed whale subsection above) and thus could incur slight TTS. Species of pinnipeds with higher TTS thresholds would not incur TTS unless they were closer to the transducers when a sonar ping was emitted. However, the SEL criterion for PTS in pinnipeds (203 dB re 1 μPa²•s) might be exceeded for a ping received within a few meters of the transducers, although the risk of PTS is higher for certain species (e.g., harbor seal). Given the intermittent nature of the signals and the narrow MBES beam, only a small fraction of the pinnipeds below (and close to) the ship would receive a pulse as the ship passed overhead.

Possible Effects of the Sub-bottom Profiler Signals

An SBP may be operated from the source vessel at times during the planned study. Sounds from the sub-bottom profiler are very short pulses, occurring for 1 4 ms once every second. Most of the energy in the sound pulses emitted by the SBP is at 3.5 kHz, and the beam is directed downward in a narrow beam with a spacing of up to 15° and a fan width up to 30°. The sub-bottom profiler on the *Langseth* has a maximum source level of 204 dB re 1 μPa•m. 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 an SBP more powerful than that on the *Langseth* if the animal was in the area, it would have to pass the transducer at close range and 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 their directionality and the brief period when an individual mammal is likely to be within its beam. Furthermore, in the case of most baleen whales, the SBP 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 SBP are likely to be similar to those for other pulsed sources if received at the same levels. However, the pulsed signals from the SBP are considerably weaker than those from the MBES. Therefore, behavioral responses would not be expected unless marine mammals were to approach very close to the source.

Hearing Impairment and Other Physical Effects: It is unlikely that the SBP 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 SBP is usually operated simultaneously with other higher-power acoustic sources. 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 SBP. In the case of mammals that do not avoid the approaching vessel and its various sound sources, mitigation measures that would be applied to minimize effects of other sources would further reduce or eliminate any minor effects of the SBP.

Possible Effects of the Acoustic Release Signals

The acoustic release transponder used to communicate with the OBS uses frequencies of 9 13 kHz. Once the OBS is ready to be retrieved, an acoustic release transponder interrogates the OBS at a frequency of 9 11 kHz, and a response is received at a frequency of 9 13 kHz. However, these signals will be used very intermittently. The source level of the release signal is 190 dB (re 1 μPa at 1 m). An animal would have to pass by the OBS at close range when the signal is emitted in order to be exposed to any pulses at that level. The sound is expected to undergo a spreading loss of approximately 40 dB in the first 100 m (328 ft). Thus, any animals located 100 m (328 ft) or more from the signal will be exposed to very weak signals (less than 150 dB) that are not expected to have any effects. The signal is used only for short intervals to interrogate and trigger the release of the OBS and consists of pulses rather than a continuous sound. Given the short duration use of this signal and rapid attenuation in seawater it is unlikely that the acoustic release signals would significantly affect marine mammals or sea turtles through masking, disturbance, or hearing impairment. Any effects likely would be negligible given the brief exposure at presumable low levels.

Proposed Monitoring and Mitigation Measures

Monitoring

L-DEO proposes to sponsor marine mammal monitoring during the present 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. L-DEO understands that this monitoring plan will be subject to review by NMFS, and that refinements may be required. 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 regions. L-DEO is prepared to discuss coordination of its monitoring program with any related work that might be done by other groups insofar as this is practical and desirable.

Vessel-based Visual Monitoring

Marine mammal visual observers (MMVOs) will be based aboard the seismic source vessel and will watch for marine mammals and turtles near the vessel during daytime airgun operations and during any start-ups at night. The MMVOs will also watch for marine mammals and turtles near the seismic vessel for at least 30 minutes (min) prior to the start of airgun operations after an extended shut down. When feasible, MMVOs will also observe during daytime periods when the seismic system is not operating for comparison of sighting rates and behavior with versus without airgun operations. Based on the MMVOs' observations, the *Langseth* will power down the airguns or shut down the airguns when marine mammals are observed within or about to enter a designated exclusion zone (EZ). The EZ is a region in which a possibility exists of adverse effects on animal hearing or other physical effects.

During seismic operations in the Endeavour MPA, at least three MMVOs will be based aboard the *Langseth*. MMVOs will be appointed by L-DEO with NMFS concurrence. At least one MMVO, and when feasible, two

MMVOs, will monitor marine mammals and turtles near the seismic vessel during ongoing daytime operations and nighttime start ups of the airguns. Use of two simultaneous observers will increase the proportion of the animals present near the source vessel that are detected. MMVO(s) will be on duty in shifts of duration no longer than 4 h. Other crew will also be instructed to assist in detecting marine mammals and turtles and implementing mitigation requirements (if feasible). Before the start of the seismic survey the crew will be given additional instruction regarding how to do so.

The *Langseth* is a suitable platform for marine mammal and turtle observations. When stationed on the observation platform, the eye level will be approximately 18 m (59 ft) above sea level, and the observer will have a good view around the entire vessel. During daytime, the MMVOs 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 (NVDs) will be available (ITT F500 Series Generation 3 binocularimage intensifier or equivalent), when required. Laser rangefinding 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.

The vessel-based monitoring will provide data to estimate the numbers of marine mammals exposed to various received sound levels, to document any apparent disturbance reactions or lack thereof, and thus to estimate the numbers of mammals potentially ''taken'' by harassment. It will also provide the information needed in order to power down or shut down the airguns at times when mammals and turtles are present in or near the safety radii. 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 power-downs or shut downs will be recorded in a standardized format. Data will be entered into a custom database using a notebook computer. The accuracy of the data entry will be verified by computerized validity data checks as the data are entered and by subsequent manual checking of the database. Preliminary reports will be prepared during the field program and summaries forwarded to the operating institution's shore facility and to NSF weekly or more frequently.

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 per terms of MMPA authorizations or regulations.

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

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

Passive Acoustic Monitoring

Passive acoustic monitoring (PAM) will take place to complement the visual monitoring program. Visual monitoring typically is not effective during periods of bad weather or at night, and even with good visibility, is unable to detect marine mammals when they are below the surface or beyond visual range. Acoustical monitoring can be used in addition to visual observations to improve detection, identification, localization, and tracking of cetaceans. The acoustic monitoring will serve to alert visual observers (if on duty) when vocalizing cetaceans are detected. It is only useful when marine mammals call, but it can be effective either by day or by night, and does not depend on good visibility. It will be monitored in real time so that the visual observers can be advised when cetaceans are detected. When bearings (primary and mirror-image) to calling cetacean(s) are determined, the bearings will be relayed to the visual observer to help him/her sight the calling animal(s).

The PAM system consists of hardware (i.e., hydrophones) and software. The ''wet end'' of the system consists of a low-noise, towed hydrophone array that is connected to the vessel by a ''hairy'' faired cable. 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 lab where the acoustic station and signal conditioning and processing system will be located. The lead-in from the hydrophone array is approximately 400 m (1312 ft) long, and the active part of the hydrophone array is approximately 50 m (164 ft) long. The hydrophone array is typically towed at depths of 20 m (66 ft) to 30 m (98 ft).

The towed hydrophones will be monitored 24 h per day while at the seismic survey area during airgun operations, and during most periods when the *Langseth* is underway while the airguns are not operating. One MMO will monitor the acoustic detection system at any one time, 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. MMOs monitoring the acoustical data will be on shift for 1 6 h at a time. Besides the visual MMOs, an additional MMO with primary responsibility for PAM will also be aboard. All MMOs are expected to rotate through the PAM position, although the most experienced with acoustics will be on PAM duty more frequently.

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

Mitigation

L-DEO's mitigation procedures are based on protocols used during previous L-DEO seismic research cruises as approved by NMFS, and on best practices recommended in Richardson *et al.* (1995), Pierson *et al.* (1998), and Weir and Dolman (2007). The measures are described in detail below this section.

Proposed Exclusion Zones

As noted earlier, L-DEO modeled received sound levels for the 36–airgun array and for a single 1900LL 40–in^3 airgun (which will be used during power downs), in relation to distance and direction from the airguns. Based on the modeling for deep water, the distances from the source where sound levels are predicted to be 190, 180, and 160 dB re 1 μPa (rms) were determined (Table 1). The 180- and 190–dB radii vary with tow depth of the airgun array and range up to 1220 m (4002 ft) and 380 m (1246 ft), respectively. The 180- and 190–dB levels are shut-down criteria applicable to cetaceans and pinnipeds, respectively, as specified by NMFS (2000); these levels were used to establish the exclusion zones (EZ). If the MMO detects marine mammal(s) or turtle(s) within or about to enter the appropriate safety radii, the airguns will be powered down (or shut down if necessary) immediately.

Mitigation During Operations

Mitigation measures that will be adopted during the L-DEO survey include: (1) speed or course alteration, provided that doing so will not compromise operational safety requirements; (2) power-down procedures; (3) shut-down procedures; (4) ramp-up procedures; and (5) special procedures for species of particular concern.

Speed or Course Alteration - If a marine mammal or sea turtle is detected outside the safety zone and, based on its position and the relative motion, is likely to enter the safety zone, the vessel's speed and/or direct course may be changed. This would be done if practicable while minimizing the effect on the planned science objectives. The activities and movements of the marine mammal or sea turtle (relative to the seismic vessel) will then be closely monitored to determine whether the animal is approaching the applicable safety zone. If the animal appears likely to enter the safety zone, further mitigative actions will be taken, i.e., either further course alterations or a power down or shut down of the airguns. Typically, during seismic operations that use hydrophone streamers, the source vessel is unable to change speed or course and one or more alternative mitigation measures (see below) will need to be implemented.

Power-down Procedures - A power-down involves decreasing the number of airguns in use such that the radius of the 180–dB (or 190–dB) zone is decreased to the extent that marine mammals or turtles are no longer in or about to enter the safety zone. A power-down of the airgun array can also occur when the vessel is moving from one seismic line to another. During a power-down for mitigation, one airgun will be operated. The continued operation of one airgun is intended to alert marine mammals and turtles to the presence of the seismic vessel in the area. In contrast, a shut-down occurs when all airgun activity is suspended.

If a marine mammal or turtle is detected outside the EZ but is likely to enter the EZ, and if the vessel's speed and/or course cannot be changed to avoid having the animal enter the safety radius, the airguns will be powered down before the animal is within the EZ. Likewise, if a mammal or turtle is already within the EZ when first detected, the airguns will be powered down immediately. During a power-down of the airgun array, the 40–in^3 airgun will be operated. If a marine mammal or turtle is detected within or near the smaller EZ around that single airgun (Table 1), it will be shut down (see next subsection).

Following a power-down, airgun activity will not resume until the marine mammal or turtle has cleared the EZ. The animal will be considered to have cleared the EZ if it: (1) is visually observed to have left the EZ; or (2) has not been seen within the zone for 15 min in the case of small odontocetes; or (3) has not been seen within the zone for 30 min in the case of mysticetes and large odontocetes, including sperm, pygmy sperm, dwarf sperm, and beaked whales; or (4) the vessel has moved outside the EZ for turtles, i.e., approximately 5 to 20 min, depending on the sighting distance, vessel speed, and tow-depth.

During airgun operations following a power down (or shut down) whose duration has exceeded the limits specified above, the airgun array will be ramped up gradually (see below).

Shut-down Procedures - During a power down, the operating airgun will be shut down if a marine mammal or turtle is seen within or approaching the EZ for a single airgun. Shut-downs will be implemented: (1) if an animal enters the exclusion zone of the single airgun after a power-down has been initiated, or (2) if an animal is initially seen within the exclusion zone of a single airgun when more than one airgun (typically the full array) is operating.

Airgun activity will not resume until the marine mammal or turtle has cleared the EZ, or until the visual marine mammal observer (MMVO) is confident that the animal has left the vicinity of the vessel. Criteria for judging that the animal has cleared the EZ will be as described in the preceding subsection.

The airguns will be shut down if a North Pacific right whale is sighted from the vessel, even if it is located outside the EZ, because of the rarity and sensitive status of this species.

Ramp-up Procedures - A ramp-up procedure will be followed when the airgun array begins operating after a specified period without airgun operations or when a power-down has exceeded that period. It is proposed that, for the present cruise, this period would be approximately 9 min. This period is based on the largest modeled 180–dB radius for the 36–airgun array (see Table 1) in relation to the planned speed of the *Langseth* while shooting the airguns. Similar periods (approximately 8 10 min) were used during previous L-DEO surveys.

Ramp-up will begin with the smallest gun 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 6 dB per 5–min period over a total duration of about 30 - 40 min. During ramp-up, the MMVOs will monitor the safety zone and if marine mammals or turtles are sighted, a course/speed change, power down, or shut down will be implemented as though the full array were operational.

If the complete EZ has not been visible for at least 30 min prior to the start of operations in either daylight or nighttime, ramp-up will not commence 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 EZ 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 and turtles will be alerted to the approaching seismic vessel by the sounds from the single airgun and could move away if they choose. Ramp-up of the airguns will not be initiated if a sea turtle or marine mammal is sighted within or near the applicable zones during the day or close to the vessel at night.

Shutdown if Injured or Dead Whale is Found - In the unanticipated event that any cases of marine mammal injury or mortality are found and are judged likely to have resulted from these activities, L-DEO will cease operating seismic airguns and report the incident to the Office of Protected Resources, NMFS immediately.

Reporting

L-DEO will submit a report to NMFS within 90 days after the end of the cruise. The report will describe the operations that were conducted and sightings of marine mammals and turtles 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 and turtle sightings (dates, times, locations, activities, associated seismic survey activities). 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.

All injured or dead marine mammals (regardless of cause) must be reported to NMFS as soon as practicable. Report should include species or description of animal, condition of animal, location, time first found, observed behaviors (if alive) and photo or video, if available.

Estimated Take by Incidental Harassment

Because of the mitigation measures that will be required and the likelihood that some cetaceans will avoid the area around the operating airguns of their own accord, NMFS does not expect any marine mammals to approach the sound source close enough to be injured (Level A harassment). All anticipated takes would be ''takes by Level B harassment'', as described previously, involving temporary behavioral modifications or low-level physiological effects.

Estimates of the numbers of marine mammals that might be affected are based on consideration of the number of marine mammals that could be disturbed appreciably by approximately 1800 km (1118 mi) of seismic surveys during the proposed seismic program in the Endeavor MPA.

It is assumed that, during simultaneous operations of the airgun array and the other sources, any marine mammals close enough to be affected by the MBES or SBP 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 MBES and SBP given their characteristics (e.g., narrow downward-directed beam) and other considerations described in section I of L-DEO's application. Such reactions are not considered to constitute ''taking'' (NMFS, 2001). Therefore, no additional allowance is included for animals that might be affected by sound sources other than airguns.

Density Estimates

There is very little information on the cetaceans that occur in deep water off the west coast of Vancouver Island, but the waters off Oregon and Washington have been studied in some detail (e.g., Green *et al.*, 1992, 1993; Barlow, 1997, 2003; Barlow and Taylor, 2001; Calambokidis and Barlow, 2004; Barlow and Forney, 2007). The primary data used to provide densities for the proposed project area off southwestern British Columbia (BC) were obtained from the 1996, 2001, and 2005 NMFS/SWFSC ''ORCAWALE'' or ''CSCAPE'' ship surveys off Oregon/Washington, as synthesized by Barlow and Forney (2007). The surveys took place up to approximately 550 km (341 mi) offshore from June or July through November or December. Thus, the surveys included effort in coastal, shelf/slope, and offshore water, and they encompass the August September period for the proposed study. Systematic, offshore survey data for pinnipeds are more limited. The most comprehensive such studies are reported by Bonnell *et al.*, (1992) based on systematic aerial surveys conducted in 1989 1990.

The waters off the west coast of Vancouver Island are included in the same ecological province as Oregon/Washington, the California Coastal Province (Longhurst, 2007). Thus, information on cetaceans from Oregon/Washington is relevant to the proposed offshore study area far offshore of BC. Although densities for BC are available for some cetacean species (see Williams and Thomas 2007), these are for inshore coastal waters and would not be representative of the densities occurring in offshore areas. Although the cetacean densities based on data from Barlow and Forney (2007) better reflect those that will be encountered during the ETOMO study, the actual densities in the Endeavour MPA are expected to be lower still, as the survey effort off Oregon/Washington covered offshore as well as shelf and coastal waters, and it included sightings for summer and fall.

Oceanographic conditions, including occasional El Nino and La Nina events, influence the distribution and numbers of marine mammals present in the NEPO, resulting in considerable year-to-year variation in the distribution and abundance of many marine mammal species (Forney and Barlow, 1998; Buchanan *et al.*, 2001; Escorza-Trevino, 2002; Ferrero *et al.*, 2002; Philbrick *et al.*, 2003; Becker, 2007). Thus, for some species the densities derived from recent surveys may not be representative of the densities that will be encountered during the proposed seismic survey.

Potential Number of Exposures to Sound Levels at or above 160 dB

L-DEO's ''best estimate'' of the potential number of exposures of cetaceans, absent any mitigation measures, to seismic sounds with received levels at or above 160 dB re 1 μPa (rms) is 8,624 (Table 2). It is assumed that marine mammals exposed to airgun sounds this strong might change their behavior sufficiently to be considered ''taken by harassment''.

The number of potential exposures to sound levels at or above 160 dB re 1 μPa (rms) were calculated by multiplying the expected average species density (see section VII of L-DEO's application) times the anticipated minimum area (7302 km2, 4537 mi2) to be ensonified to that level during airgun operations including overlap.

The area expected to be ensonified was determined by entering the planned survey lines into a MapInfo Geographic Information System (GIS), using the GIS to identify the relevant areas by ''drawing'' the applicable 160–dB buffer around each seismic line, and then calculating the total area within the buffers. Areas where overlap occurred (because of closely-spaced lines) were included when estimating the number of exposures.

Number of Individual Cetaceans Exposed to Sound Levels at or above 160 dB

L-DEO's ''best estimate'' of the potential number of different individuals that could be exposed to airgun sounds with received levels at or above 160 dB re 1 μPa (rms) on one or more occasions is 1,748. That total includes 22 baleen whales, 17 of which are considered endangered under the ESA: six humpback whales, two blue whales, one sei whale, and eight fin whales, which would represent small numbers of the regional populations (Table 2). Ten sperm whales and 19 beaked whales could be exposed during the survey as well (Table 2).

Based on numbers of animals encountered during previous L-DEO seismic surveys, the likelihood of the successful implementation of the required mitigation measures, and the likelihood that some animals will avoid the area around the operating airguns, NMFS believes that L-DEO's airgun seismic testing program may result in the Level B harassment of some lower number of individual marine mammals (a few times each) than is indicated by the column titled, Number of Individuals Exposed to ≥160 dB (Request) in Table 2. L-DEO has asked for authorization for take of their best estimate of numbers for each species. Though NMFS believes that take of the requested numbers is unlikely, we still find these numbers small relative to the population sizes.

Potential Effects on Habitat

The proposed seismic survey will not result in any permanent impact on habitats used by marine mammals, or to the food sources they use. The main impact issue associated with the proposed activity will be temporarily elevated noise levels and the associated direct effects on marine mammals.

The *Langseth* will deploy 16 OBS in the vent field grid (see Figure 1 of L-DEO's application), and will deploy another 48 OBS throughout the remaining study area in the Endeavour MPA. L-DEO proposes to use two different types of OBS: (1) the WHOI ''D2'' OBS, which has an anchor made of hot-rolled steel with dimensions 2.5 x 30.5 x 38.1 cm; and (2) the LC4x4, which consists of a an anchor with a 1 m2 piece of steel grating. These OBS anchors will remain upon equipment recovery.

Although OBS placement may disrupt a very small area of seafloor habitat and may disturb benthic invertebrates, the impacts are expected to be localized and transitory. The vessel will deploy the OBS in such a way that creates the least disturbance to the area. The vent area is dynamic, and the natural variability within the system is high; toppling and regrowth of sulphide structures, and death of assemblages are common (Tunnicliffe and Thomson, 1999). Thus, it is not expected that the placement of OBS would have adverse effects beyond naturally occurring changes in this environment, and any effects of the planned activity on marine mammal habitats and food resources are expected to be negligible.

Potential Effects on Fish

Existing information on the impacts of seismic surveys on marine fish and invertebrate populations is very limited (See Appendix D of L-DEO's EA) and the vast majority of the data are in the form of reports and other documents that have not been peer reviewed (Popper and Hastings, 2009).

There are three types of potential effects of exposure to seismic surveys: (1) pathological, (2) physiological, and (3) behavioral.

Pathological Effects - Pathological effects involve lethal and temporary or permanent sub-lethal injury. 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 (see Appendix D of L-DEO's EA). 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. McCauley *et al.* (2003), found that exposure to airgun sound caused observable anatomical damage to the auditory maculae of ''pink snapper'' (*Pagrusauratus*). This damage in the ears had not been repaired in fish sacrificed and examined almost two months after exposure. O n 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) that received a sound exposure level of 177 dB re 1 μPa^2•s showed no hearing loss. 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 approximately 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 9 m (29.5 ft) in the former case and less than 2 m (6.5 ft) 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).

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; Hassel *et al.* 2003; Popper *et al.*, 2005).

Physiological Effects – Physiological effects involve temporary and permanent primary and secondary stress responses. Cellular and/or biochemical responses of fish to acoustic stress such as changes in levels of enzymes and proteins could potentially 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; 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 (see Appendix D of L-DEO's EA).

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 (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.

There is general concern about potential adverse effects of seismic operations on fisheries, namely a potential reduction in the ''catchability'' of fish involved in fisheries. Although reduced catch rates have been observed in some marine fisheries during seismic testing, in a number of cases the findings are confounded by other sources of disturbance (Dalen and Raknes, 1985; Dalen and Knutsen, 1986; Lokkeborg, 1991; Skalski *et al.*, 1992; Engas *et al.*, 1996). In other airgun experiments, there was no change in catch per unit effort (CPUE) of fish when airgun pulses were emitted, particularly in the immediate vicinity of the seismic survey (Pickett *et al.*, 1994; La Bella *et al.*, 1996). For some species, reductions in catch may have resulted from a change in behavior of the fish, e.g., a change in vertical or horizontal distribution, as reported in Slotte *et al.* (2004).

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.

Potential Impacts 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; see also Appendix E of L-DEO's EA).

Pathological Effects – 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; 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 there is no evidence to support such claims.

Benthic invertebrates in the Endeavor MPA are not expected to be affected by seismic operations, as sound levels from the airguns will diminish dramatically by the time the sound reaches the ocean floor at a depth of approximately 2250 m (7382 ft).

Negligible Impact Determination

NMFS has preliminarily determined, provided that the aforementioned mitigation and monitoring measures are implemented, that the impact of conducting a seismic program in the northeast Pacific Ocean may result, at worst, in a temporary modification in behavior and/or low-level physiological effects (Level B Harassment) of small numbers of certain species of marine mammals. While behavioral and avoidance reactions may be made by these species in response to the resultant noise from the airguns, these behavioral changes are expected to have a negligible impact on the affected species and stocks of marine mammals.

While the number of potential incidental harassment takes will depend on the distribution and abundance of marine mammals in the area of seismic operations, the number of potential harassment takings is estimated to be relatively small in light of the population size (see Table 2). NMFS anticipates the actual take of individuals to be lower than the numbers depicted in the table, because those numbers do not reflect either the implementation of the mitigation numbers or the fact that some animals will avoid the sound at levels lower than those expected to result in harassment. Additionally, mitigation measures require that the *Langseth* avoid any areas where marine mammals are concentrated.

In addition, no take by death and/or serious injury is anticipated, and the potential for temporary or permanent hearing impairment will be avoided through the incorporation of the required mitigation measures described in this document. This conclusion is supported by: (1) the likelihood that, given sufficient notice through slow ship speed and ramp-up of the seismic array, marine mammals are expected to move away from a noise source that it is annoying prior to its becoming potentially injurious; (2) TTS is unlikely to occur, especially in odontocetes, until levels above 180 dB re 1 μPa (rms) are reached; (3) the fact that injurious levels of sound are only likely very close to the vessel; and (4) the monitoring program developed to avoid injury will be sufficient to detect (using visual detection and PAM), with reasonable certainty, all marine mammals within or entering the identified safety zones.

Endangered Species Act (ESA)

Under section 7 of the ESA, the National Science Foundation (NSF) has begun consultation on this proposed seismic survey. NMFS will also consult internally on the issuance of an IHA under section 101(a)(5)(D) of the MMPA for this activity. Consultation will be concluded prior to a determination on the issuance of an IHA.

National Environmental Policy Act (NEPA)

On September 22, 2005 (70 FR 55630), NSF published a notice of intent to prepare a Programmatic Environmental Impact Statement/Overseas Environmental Impact Statement (EIS/OES) to evaluate the potential environmental impacts associated with the use of seismic sources in support of NSF-funded research by U.S. academic scientists. NMFS agreed to be a cooperating agency in the preparation of the EIS/OEIS. This EIS/OEIS has not been completed. Therefore, in order to meet NSF's and NMFS' NEPA requirements for the proposed activity and issuance of an IHA to L-DEO, the NSF has prepared an Environmental Assessment of a Marine Geophysical Survey by the *Langseth* in the northeast Pacific Ocean in the Endeavor MPA. NMFS is revi*Ewing* that document and will either adopt NSF's EA or conduct a separate NEPA analysis, as necessary, prior to making a determination of the issuance of the IHA. NMFS has posted NSF's EA on its website at *http://www.nmfs.noaa.gov/pr/permits/incidental.htm#applications*.

Preliminary Conclusions

Based on the preceding information, and provided that the proposed mitigation and monitoring are incorporated, NMFS has preliminarily concluded that the proposed activity will incidentally take, by level B behavioral harassment only, small numbers of marine mammals. There is no subsistence harvest of marine mammals in the proposed research area; therefore, there will be no impact of the activity on the availability of the species or stocks of marine mammals for subsistence uses. No take by Level A harassment (injury) or death is anticipated and harassment takes should be at the lowest level practicable due to incorporation of the mitigation measures proposed in this document.

Proposed Authorization

NMFS proposes to issue an IHA to L-DEO for a marine seismic survey in the northeast Pacific Ocean during August - October 2009, provided the previously mentioned mitigation, monitoring, and reporting requirements are incorporated.

Dated: May 4, 2009.

Helen M. Golde,

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

[FR Doc. E9–10821 Filed 5–7–09; 8:45 am]

BILLING CODE 3510–22–S

DEPARTMENT OF COMMERCE

National Oceanic and Atmospheric Administration

RIN 0648–XO92

Notice of Availability of the Marine Mammal Health and Stranding Response Program Record of Decision

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

ACTION: Notice of Availability (NOA) of Record of Decision.

SUMMARY: The National Marine Fisheries Service (NMFS) announces the availability of the Record of Decision (ROD) for the Marine Mammal Health and Stranding Response Program (MMHSRP). This ROD announces NMFS' decisions for implementing the MMHSRP. Pursuant to the National Environmental Policy Act (NEPA) and implementing regulations, NMFS prepared a Programmatic Environmental Impact Statement (PEIS) that evaluated the potential environmental and socioeconomic effects associated with alternatives for the MMHSRP's activities.

ADDRESSES: Comments or questions regarding the ROD can be sent to David Cottingham, Chief, Marine Mammal and Sea Turtle Division, Office of Protected Resources, National Marine Fisheries Service, 1315 East-West Highway, Room 13635, Silver Spring, MD 20910.

FOR FURTHER INFORMATION CONTACT: Sarah Howlett, Fishery Biologist, NMFS, at (301) 713–2322; facsimile at (301) 427–2522.

SUPPLEMENTARY INFORMATION: A copy of the ROD and the Final PEIS are available at: *http://www.nmfs.noaa.gov/pr/health/eis.htm*.

Dated: May 1, 2009.

Katy M. Vincent,

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

[FR Doc. E9–10676 Filed 5–7–09; 8:45 am]

BILLING CODE S

DEPARTMENT OF COMMERCE

National Oceanic and Atmospheric Administration

RIN 0648–XO84

Small Takes of Marine Mammals Incidental to Specified Activities; Taking Marine Mammals Incidental to Construction and Operation of a Liquefied Natural Gas Facility off Massachusetts

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

ACTION: Notice; proposed incidental harassment authorization; request for comments and information.

SUMMARY: NMFS received an application from Neptune LNG, L.L.C. (Neptune) for take of marine mammals, by Level B harassment, incidental to construction and operation of an offshore liquefied natural gas (LNG) facility in Massachusetts Bay. Under the Marine Mammal Protection Act (MMPA), NMFS is requesting comments on its proposal to issue an incidental harassment authorization (IHA) to Neptune to incidentally take, by harassment, small numbers of several species of marine mammals during construction and operations of the LNG facility for a period of 1 year.

DATES: Comments and information must be received no later than June 8, 2009.

ADDRESSES: Written comments on the application should be addressed to: P. Michael Payne, Chief, Permits, Conservation, and Education Division, Office of Protected Resources, National Marine Fisheries Service, 1315 East-West Highway, Silver Spring, MD 20910–3225. The mailbox address for providing email comments is *PR1.0648–XO84@noaa.gov*. Comments sent via email, including all attachments, must not exceed a 10–megabyte file size. A copy of the application containing a list of references used in this document may be obtained by writing to this address, by telephoning the contact listed below (see **FOR FURTHER INFORMATION CONTACT**) or online at: *http://www.nmfs.noaa.gov/pr/permits/incidental.htm#applications*. Documents cited in this notice may be viewed, by appointment, during regular business hours, at the aforementioned address.

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

The Maritime Administration (MARAD) and U.S. Coast Guard (USCG) Final Environmental Impact Statement (Final EIS) on the Neptune LNG Deepwater Port License Application is available for viewing at *http://www.regulations.gov* by entering the search words ''Neptune LNG.''

FOR FURTHER INFORMATION CONTACT: Candace Nachman, Office of Protected Resources, NMFS, (301) 713–2289 ext. 156.

SUPPLEMENTARY INFORMATION:

Background

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

Authorization for incidental takings may be granted if NMFS finds that the taking will have a negligible impact on the species or stock(s), will not have an unmitigable adverse impact on the availability of the species or stock(s) for subsistence uses, and if the permissible methods of taking and requirements pertaining to the mitigation, monitoring and reporting of such taking are set forth.

NMFS has defined ''negligible impact'' in 50 CFR 216.103 as:

> an impact resulting from the specified activity that cannot be reasonably expected to, and is not reasonably likely to, adversely affect the species or stock through effects on annual rates of recruitment or survival.

Section 101(a)(5)(D) of the MMPA establishes an expedited process by which citizens of the U.S. can apply for an authorization to incidentally take small numbers of marine mammals by harassment. Except for certain categories of 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,