FR 54643) that a request for a scientific research permit to take dead shortnose sturgeon had been submitted by the above-named organization. The requested permit has been issued under the authority of the Endangered Species Act of 1973, as amended (ESA; 16 U.S.C. 1531 *et seq.*) and the regulations governing the taking, importing, and exporting of endangered and threatened species (50 CFR parts 222–226).

This research permit authorizes the collection, receipt and transport of 100 dead shortnose sturgeon, or parts thereof, annually. Researchers would also be authorized the receipt and transport of 50 captive bred, dead shortnose sturgeon annually from any U.S. facility authorized to hold captive sturgeon. In the case of an unusual mortality event, takes may be increased from 100 up to 1,000 animals with written approval from the Director, Office of Protected Resources. This permit does not authorize the harassment or take of any protected species (including live shortnose sturgeon). This permit authorizes the conduct of the aforementioned research over a period of five years.

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

Dated: February 28, 2008.

P. Michael Payne,

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

[FR Doc. E8–4260 Filed 3–4–08; 8:45 am]

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DEPARTMENT OF COMMERCE

National Oceanic and Atmospheric Administration

RIN 0648–XF15

Incidental Takes of Marine Mammals During Specified Activities; Marine Geophysical Surveys in the Eastern Tropical Pacific Ocean in 2007

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) for an Incidental Harassment Authorization (IHA) to take small numbers of marine mammals, by harassment, incidental to conducting two marine seismic surveys in the Eastern Tropical Pacific Ocean (ETP) during 2008. Under the Marine Mammal Protection Act (MMPA), NMFS is requesting comments on its proposed IHA for these activities.

DATES: Comments and information must be received no later than April 4, 2008.

ADDRESSES: 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 e-mail comments is *PR1.0648–XF15@noaa.gov*. NMFS is not responsible for e-mail comments sent to addresses other than the one provided here. Comments sent via e-mail, including all attachments, must not exceed a 10-megabyte file size.

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*.

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

FOR FURTHER INFORMATION CONTACT: Shane Guan, Office of Protected Resources, NMFS, (301) 713–2289, ext 137.

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 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, a notice of a proposed authorization is provided to the public for review.

Authorization 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 certain 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 [Level A harassment]; or (ii) has the potential to disturb a marine mammal or marine mammal stock in the wild by causing disruption of behavioral patterns, including, but not limited to, migration, breathing, nursing, breeding, feeding, or sheltering [Level B harassment].

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 marine mammals. Within 45 days of the close of the comment period, NMFS must either issue or deny issuance of the authorization.

Summary of Request

L–DEO submitted to NMFS an application from L–DEO for the taking, by Level B harassment, of several species of marine mammals incidental to conducting, with research funding from the National Science Foundation (NSF), two marine seismic surveys in the ETP. This project would be conducted with L–DEO's new seismic vessel, the *R/V Marcus G. Langseth (Langseth)*, which would deploy different configurations of airguns and a different bottom-mapping sonar than used previously by L–DEO. The first survey was planned to be approximately 39 days between September and October 2007, and the second one approximately 6 days in between November and December 2007. However, due to scheduling issues with the vessel, the 39-day survey is rescheduled to June and August 2008, and the 6-day survey to April and May 2008.

Description of the Specified Activity

The April–May 6-day survey would examine two important types of seismic behavior of the Quebrada, Discovery, and Gofar fault systems (QDG) to

understand better the behavior of earthquakes and faults in general. The Discovery and Gofar faults generate more foreshocks in the 1,000 s before large earthquakes than anywhere else in the world. Year-long Ocean Bottom Seismometer (OBS) deployments during the survey are designed to use those foreshock sequences to answer questions about how large earthquakes nucleate. Despite accommodating the same amount of plate motion (14 cm/year, or 5.5 in/year) and being composed of similar oceanic crust, the Discovery and Quebrada faults differ in their ability to generate large earthquakes: the Discovery fault routinely generates earthquakes >5.5 in magnitude, whereas the Quebrada fault has had only one such event in the last 25 years. Refraction images of the material properties in both fault zones will show if some subtle difference (*e.g.*, in hydrothermal alteration of the rocks) is responsible for the difference in seismogenic behavior.

The June–August 39-day survey would obtain seismic reflection imaging of the internal structure of the magmatic-hydrothermal system at the fast-spreading mid-ocean ridge of the East Pacific Rise (EPR). Much is already known about processes at the EPR, but the proposed survey will provide an understanding of how the magmatic system, which is known at large spatial scales (1–100 km, or 0.62–62 mi), is coupled to volcanic/hydrothermal/biological systems, which are known at comparatively small spatial scales (0.001–1 km, or 0.00062–0.62 mi). The survey would also provide an understanding of the relationships between the temporal variations in subsurface magma systems and highly transient phenomena observed at the seafloor like faulting, volcanism, and hydrothermal venting.

The seismic surveys will involve one vessel. The source vessel *Langseth* would deploy a 36-airgun array as an energy source. However, for the EPR study, two identical two-string sources will be firing alternately, so that no more than 18 airguns will be firing at any time, with a maximum discharge volume of 3,300 in^3. The *Langseth* would also tow the receiving system, which consists of four 6-km (3.73-mi) hydrophone streamers. For the QDG study, no more than 27 airguns would be fired at any time, with a maximum discharge volume of 4,950 in^3. The *Langseth* would also tow the receiving system, a single 8-km (4.97-mi) streamer, and would also deploy 40 long-term Ocean Bottom Seismometers (OBSs) that would be recovered 1 year after deployment, and another 8–10 short-term OBSs on each line that will be retrieved after the seismic surveys are completed.

The EPR and QDG programs would consist of a maximum of approximately 7,992 km (4,967 mi) and 654 km (406 mi) of surveys, respectively.

The proposed QDG seismic survey would last for approximately 6 days, and the proposed EPR seismic survey would last for approximately 39 days. All activities would be conducted in the period between April and August, 2008. The exact dates of the activities will be depend on ship scheduling, weather conditions, repositioning, streamer operations and adjustments, airgun deployment, or the need to repeat some lines if data quality is substandard.

The QDG seismic survey would also occur in international waters of the ETP, approximately 2,265 km (1,408 mi) off the coast of Ecuador and approximately 1,300 km (808 mi) west of the Galápagos Islands. The overall area within which the seismic survey would occur is located between 3° and 5° S, and between 103° and 106° W. Water depths in the survey area are more than 3,000 m (9,843 ft) deep. The EPR seismic survey would take place in international waters of the ETP, offshore from Mexico and Central America at the East Pacific Rise. The closest land mass to this survey is Mexico, located approximately 890 km (553 mi) away. The overall area within which the seismic survey will occur is located between 8.3° and 10.2° N, and between 104.1° and 104.5° W. The survey would take place in water more than 2,000 m (6,562 ft) deep.

In addition to the operations of the airgun array, a multi-beam bathymetric sonar would be operated from the source vessel continuously throughout the entire cruise, and a lower-energy sub-bottom profiler will also be operated during most of the survey.

Vessel Specifications

The *Langseth* would tow the airgun array and, at times, up to four 6-km (3.7-mi) streamers containing hydrophones along predetermined lines. The operation speed during seismic acquisition is typically 7.4—9.3 km/h (4—5 kt). When not towing seismic survey gear, the *Langseth* can cruise at 20—24 km/h (11—13 kt).

The *Langseth* would also serve as the platform from which vessel-based visual marine mammal observers will watch for marine mammals before and during airgun operations. The characteristics of the *Ewing* that make it suitable for visual monitoring are described under Monitoring, later in this document.

Acoustic Source Specifications

Airguns

The airgun array to be used will consist of 36 airguns, with maximum total discharge volume of approximately 6,600 in^3. The airguns will comprise a mixture of Bolt 1500LL and Bolt 1900LLX airguns. The array will consist of four identical linear arrays or ''strings.'' Each string would have ten airguns; the first and last airguns in the strings are spaced 16 m (52.5 ft) apart. Nine airguns would be fired simultaneously, while the tenth is kept in reserve as a spare, to be turned on in case of failure of another airgun. Two of the four strings would be fired during the EPR survey (18 airguns), and three strings would be fired during the QDG survey (27 airguns). The airgun strings would be distributed across an approximate area of 24 × 16 m (78.7 × 52.5 ft) behind the *Langseth* and would be towed approximately 50–100 m (164–328 ft) behind the vessel. The firing pressure of the array is 2,000 psi. During firing, a brief (~0.1 s) pulse of sound is emitted. During the EPR survey, the shots would be emitted at intervals of ~15 s, corresponding to a shot interval of ~37.5 m (123 ft). During the QDG survey, the shots would be emitted at intervals of ~60 s, corresponding to a shot interval of ~150 m (492 ft). The airguns would be towed at a depth of 7 m (23 ft) during both the QDG and the EPR surveys. The depth at which the source is towed affects the maximum near-field output and the shape of its frequency spectrum. In deeper water, the effective source level for sound propagating in near-horizontal directions is higher than in shallow water; however, the nominal source levels of the array at various tow depths are nearly identical.

Because the actual source is a distributed sound source (up to 27 airguns in these surveys) rather than a single point source, the highest sound levels measurable at any location in the water would be less than the nominal source level. In addition, the effective source level for sound propagating in near-horizontal directions would be substantially lower than the nominal source level applicable to downward propagation because of the directional nature of the sound from the airgun array.

The specifications of each source planned for use are described in Table 1.

TABLE 1.—L–DEO AIRGUN CONFIGURATION AND SPECIFICATION OF EACH SOURCE PLANNED FOR USE IN THE PROPOSED PROJECTS

	18-Airgun array (2 strings)	27-Airgun array (3 strings)
Energy source	18, 2,000 psi Bolt airguns of 40–360 in^3	27, 2,000 psi Bolt airguns of 40–360 in^3.
Source output (downward)	0-pk: 252 dB re 1 microPa-m; pk-pk: 259 dB re 1 microPa-m.	0-pk: 256 dB re 1 microPa-m; pk-pk: 262 dB re 1 microPa-m.
Air discharge volume	Approximately 3,300 in^3	Approximately 4,950 in^3.
Towing depth of energy source	7 m (23 ft)	7 m (23 ft).
Dominant frequency components	0–188 Hz	0–188 Hz.

A detailed discussion of the characteristics of airgun pulses has been provided in L–DEO's application, and in previous **Federal Register** notices (see 69 FR 31792 (June 7, 2004) or 69 FR 34996 (June 23, 2004)). Reviewers are referred to those documents for additional information.

Received sound levels have been predicted by L–DEO in relation to distance and direction from the airguns for the 36-airgun array with 18 and 27 airguns firing and for a single 1900LL 40-in^3 airgun, which would be used during power downs.

The predicted sound contours are shown as sound exposure levels (SEL) in decibels (dB) re 1 $microPa^2$-s. SEL is a measure of the received energy in the pulse and represents the sound pressure level (SPL) that would be measured if the pulse energy were spread evenly across a 1-s period. Because actual seismic pulses are less than 1-s in duration, this means that the SEL value for a given pulse is lower than the SPL calculated for the actual duration of the pulse. The advantage of working with SEL is that the SEL measure accounts for the total received energy in the pulse, and biological effects of pulsed sounds probably depend mainly on pulse energy. SPL for a given pulse depends greatly on pulse duration. A pulse with a given SEL can be long or short depending on the extent to which propagation effects have ''stretched'' the pulse duration. The SPL will be low if the duration is long and higher if the duration is short, even though the pulse energy (and presumably the biological effects) is the same.

Although SEL may be a better measure than SPL when dealing with biological effects of pulsed sound, SPL is the measure that has been most commonly used in studies of marine mammal reactions to airgun sounds and in NMFS practice concerning levels above which ''taking'' might occur. SPL is often referred to as rms or ''root mean square'' pressure, averaged over the pulse duration. As noted above, the rms received levels that are used as impact criteria for marine mammals are not directly comparable to pulse energy (SEL). The SPL (i.e., rms sound pressure) for a given pulse is typically 10–15 dB higher than the SEL value for the same pulse as measured at the same location (Greene *et al.*, 1997; McCauley *et al.*, 1998; 2000). For this project, L–DEO assumes that rms pressure levels of received seismic pulses would be 10 dB higher than the SEL values predicted by L–DEO's model. Thus, the L–DEO assumes that 170 dB SEL can be viewed as 180 dB rms. NMFS considers that this assumption is valid.

It should be noted that neither the SEL nor the SPL (rms) measure is directly comparable to the peak or peak-to-peak pressure levels normally used by geophysicists to characterize source levels of airguns. Peak and peak-to-peak pressure levels for airgun pulses are always higher than the rms dB referred to in much of the biological literature (Greene *et al.*, 1997; McCauley *et al.*, 1998; 2000). For example, a measured received level of 160 dB rms in the far field would typically correspond to a peak measurement of 170–172 dB re 1 microPa, and to a peak-to-peak measurement of 176–178 dB, as measured for the same pulse received at the same location (Greene *et al.*, 1997; McCauley *et al.*, 1998; 2000). The precise difference between rms and peak or peak-to-peak values for a given pulse depends on the frequency content and duration of the pulse, among other factors. However, the rms level is always lower than the peak or peak-to-peak level, and higher than the SEL value, for an airgun-type source.

Empirical data concerning 190, 180, 170, and 160 dB (rms) isopleths in deep and shallow water were acquired for various airgun configurations during the acoustic calibration study of the *Ewing's* 20-airgun, 8,600-in^3 array in 2003 (Tolstoy *et al.*, 2004a; 2004b). The results showed that radii around the airguns where the received level was 180 dB re 1 microPa (rms), the onset point for estimating temporary hearing threshold shift (TTS) in cetaceans (NMFS, 2000), varied with water depth. Similar depth-related variation is likely for 190-dB, the onset point used for estimating TTS in pinnipeds, although these were not measured. The empirical data indicated that, for deep water (>1,000 m, or 3,280 ft), the L-DEO model overestimates the received sound levels at a given distance (Tolstoy *et al.*, 2004a; 2004b). However, to be conservative, the *Ewing*'s modeled distances would be applied to deep-water areas during the proposed study. As very few, if any, mammals are expected to occur below 2,000 m (6,562 ft), this depth was used as the maximum relevant depth.

For the proposed programs in the ETP, the modeled distances are used to estimate deep-water mitigation safety zones; no correction factors are necessary because all activities will take place in deep (> 2,000 m, or 6,562 ft) water. The 180 and 190 dB re 1 microPa (rms) distances define the safety criteria, used for mitigation for cetaceans and pinnipeds, respectively.

The predicted distances to which sound levels higher than 190, 180, and 160 dB re 1 microPa (rms) could be received, based on the model calculation, are shown in Table 2.

TABLE 2.—PREDICTED DISTANCES TO WHICH SOUND LEVELS HIGHER THAN 190, 180, AND 160 DB RE 1 MICROPA (RMS) COULD BE RECEIVED FROM THE AIRGUN ARRAY AND SINGLE AIRGUN PLANNED FOR USE DURING THE SURVEYS IN THE ETP

Source and volume	Min. water depth (m)	Predicted RMS radii (m)		
		190 dB	180 dB	160 dB
Single Bolt airgun (40 in^3)	3000	12	40	385
36-airgun array: 3 strings (4950 in^3)	3000	200	650	4400
36-airgun array: 2 strings (3300 in^3)	2000	140	450	3800

Bathymetric Sonar and Sub-Bottom Profiler

Along with the airgun operations, two additional acoustical data acquisition systems would be operated during parts of the *Langseth*'s cruises. The ocean floor would be mapped with the 12-kHz Kongsberg Simrad EM 120 MBB sonar, and a 2.5–7 kHz sub-bottom profiler would also be operated along with the MBB sonar. These sound sources would be operated from the *Langseth*, at times simultaneously with the airgun array.

The Kongsberg Simrad EM 120 operates at 11.25–12.6 kHz and would be mounted in a sonar pod hung below the hull of the *Langseth.* The beamwidth is 1° fore-aft and 150° athwartship. The maximum source level is 242 dB re 1 microPa at 1 m (rms). For deep-water operation, each ''ping'' consists of nine successive fan-shaped transmissions, each 15 ms in duration and each ensonifying a sector that extends 1° fore-aft. 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 2 ms, and the number of transmit beams is also reduced. The ping interval varies with water depth, from ~5 s at 1,000 m (3,280 ft) to 20 s at 4,000 m (13,123 ft).

The sub-bottom profiler is normally operated to provide information about the sedimentary features and the bottom topography that is simultaneously being mapped by the MBB sonar. The energy from the sub-bottom profiler is directed downward by a 3.5-kHz transducer in the hull of the *Langseth*. The output varies with water depth from 50 watts in shallow water to 800 watts in deep water. Pulse interval is 1 second but a common mode of operation is to broadcast five pulses at 1-s intervals followed by a 5-s pause.

Description of Marine Mammals in the Activity Area

A total of 34 cetacean species and 6 species of pinnipeds are known to or may occur in the ETP. Of the 34 cetacean species, 27 are likely to occur in the proposed survey area. Five of those 27 cetacean species are listed under the U.S. Endangered Species Act (ESA) as endangered: Sperm whale (*Physeter macrocephalus*), humpback whale (*Megaptera novaeangliae*), blue whale (*Balaenoptera musculus*), fin whale (*B. physalus*), and sei whale (*B. borealis*).

The other 22 species that are likely to occur in the proposed survey areas are: Minke whale (*B. acutorostrata*), Bryde's whale (*B. edeni*), Pygmy sperm whale (*Kogia breviceps*), Dwarf sperm whale (*K. simus*), Cuvier's beaked whale (*Ziphius cavirostris*), Longman's beaked whale (*Indopacetus pacificus*), Pygmy beaked whale (*Mesoplodon peruvianus*), Ginkgo-toothed beaked whale (*M. ginkgodens*), Blainville's beaked whale (*M. densirostris*), Rough-toothed dolphin (*Steno bredanensis*), Bottlenose dolphin (*Tursiops truncatus*), Pantropical spotted dolphin (*Stenella attenuata*), Spinner dolphin (*S. longirostris*), Striped dolphin (*S. coeruleoalba*), Fraser's dolphin (*Lagenodelphis hosei*), Short-beaked common dolphin (*Delphinus delphis*), Risso's dolphin (*Grampus griseus*), Melon-headed whale (*Peponocephala electra*), Pygmy killer whale (*Feresa attenuata*), False killer whale (*Pseudorca crassidens*), Killer whale (Orcinus orca), and Short-finned pilot whale (*Globicephala macrorhynchus*).

A detailed description of the biology, population estimates, and distribution and abundance of these species are provided in the L–DEO's IHA application. Additional information regarding the stock assessment of these species are be found in NMFS Pacific Marine Mammal Stock Assessment Report (Carretta *et al.*, 2007), and can also be accessed via the following URL link: *http://www.nmfs.noaa.gov/pr/pdfs/sars/po2006.pdf*.

The most extensive regional distribution and abundance data that encompass the entire study area come primarily from multi-year vessel surveys conducted in the wider ETP by the NMFS Southwest Fisheries Science Center. Information on the distribution of cetaceans inhabiting the ETP has been summarized in several studies (e.g., Polacheck, 1987; Wade and Gerrodette, 1993; Ferguson and Barlow, 2001), and is also described in detail in the L–DEO's IHA application.

Seven species, although present in the wider ETP, likely would not be found in the proposed seismic survey areas. These species are: Pacific white-sided dolphins (*Lagenorhynchus obliquidens*), Baird's beaked whales (*Berardius bairdii*), Long-beaked common dolphins (*Delphinus capensis*), Dusky dolphins (*L. obscurus*), southern right whale dolphins (*Lissodelphis peronii*), Burmeister's porpoises (*Phocoena spinipinnis*), and long-finned pilot whales (*Globicephala melas*) (Leatherwood *et al.*, 1991; Van Waerebeek *et al.*, 1991; Heyning and Perrin, 1994; Brownell and Clapham, 1999; Ferguson and Barlow, 2001; Olson and Reilly, 2002). Accordingly, those species are not considered any further.

Six species of pinnipeds are known to occur in the ETP: The Guadalupe fur seal (*Arctocephalus townsendi*), California sea lion (*Zalophus californianus*), Galápagos sea lion (*Z. wollebaeki*), Galápagos fur seal (*A. galapagoensis*), southern sea lion (Otaria flavescens), and South American fur seal (*A. australis*). However, pinnipeds likely would not be encountered during the proposed seismic surveys. Therefore, they are not considered further here.

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, and at least in theory, temporary or permanent hearing impairment, or non-auditory physical or physiological effects (Richardson *et al.*, 1995). These effects are discussed below, but also in further detail in Appendix B of L–DEO's application.

The potential effects of airguns discussed below are presented without consideration of the proposed

mitigation measures described below. When these measures are taken into account, it is unlikely that this project would result in temporary, or especially, permanent hearing impairment or any non-auditory physical or physiological effects.

Tolerance

Numerous studies have shown that pulsed sounds from airguns are often readily detectable in the water at distances of many kilometers. A summary of the characteristics of airgun pulses is provided in Appendix B of L–DEO's application. Studies have also shown that marine mammals at distances more than a few kilometers from operating seismic vessels often show no apparent response (tolerance) (Appendix B(e)). 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 and small odontocetes seem to be more tolerant of exposure to airgun pulses than are baleen whales.

Masking

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 of relevance. Some whales are known to continue calling in the presence of seismic pulses. Their calls can be heard between the seismic pulses (*e.g.*, Richardson *et al.*, 1986; McDonald *et al.*, 1995; Greene *et al.*, 1999; Nieukirk *et al.*, 2004). Although there has been one report that sperm whales ceased calling when exposed to pulses from a very distant seismic ship (Bowles *et al.*, 1994), a more recent study reports that sperm whales off northern Norway continued calling in the presence of seismic pulses (Madsen *et al.*, 2002). That has also been shown during recent work in the Gulf of Mexico (Tyack *et al.*, 2003; Smultea *et al.*, 2004). Masking effects of seismic pulses are expected to be negligible in the case of the smaller odontocete cetaceans, given the intermittent nature of seismic pulses. 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; 2005b). Also, the sounds important to small odontocetes are predominantly at much higher frequencies than are airgun sounds. Masking effects, in general, are discussed further in LDEO's application Appendix B (d).

Disturbance Reactions

Disturbance includes a variety of effects, including subtle changes in behavior, more conspicuous changes in activities, and displacement.

Reactions to sound, if any, depend on species, state of maturity, experience, current activity, reproductive state, time of day, and many other factors. If a marine mammal does react briefly to an underwater sound by slightly 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 the species as a whole. However, if a sound source displaces a marine mammal(s) from an important feeding or breeding area for a prolonged period, impacts on the animal(s) could be significant.

There are many uncertainties in predicting the quantity and types of impacts of noise on marine mammals. NMFS uses exposures to 180 and 190 dB re 1 microPa rms to estimate the number of animals that may be harassed by a particular sound source in a given area (and also uses those SPLs for use in the development of shutdown zones for mitigation). These estimates are based on behavioral observations during studies of several species. However, information is lacking for many species. Detailed studies have been done on humpback, gray, and bowhead whales, and on ringed seals. Less detailed data are available for some other species of baleen whales, sperm whales, and small toothed whales.

Hearing Impairment and Other Physical Effects

Temporary or permanent hearing impairment is a possibility when marine mammals are exposed to very strong sounds, but there has been no specific documentation of this for marine mammals exposed to sequences of airgun pulses. NMFS's incidental take authorizations generally protect against exposure to impulsive sounds greater than 180 and 190 dB re 1 microPa (rms), for cetaceans and pinnipeds, respectively (NMFS, 2000). Those criteria have been used in defining the safety (shut down) radii planned for the proposed seismic surveys.

Several aspects of the monitoring and mitigation measures proposed for this project are designed to detect marine mammals occurring near the airguns to avoid exposing them to sound pulses that might, at least in theory, cause hearing impairment (see Mitigation and Monitoring section below). In addition, many cetaceans are likely to show some avoidance of the area with high received levels of airgun sound. 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 may also occur in marine mammals exposed to strong underwater pulsed sound. Possible types of non-auditory physiological effects or injuries that theoretically might 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 (*e.g.*, beaked whales) may be especially susceptible to injury and/or stranding when exposed to strong pulsed sounds. However, 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, and the planned monitoring and mitigation measures (see below).

Strandings and Mortality

Marine mammals close to underwater detonations of high explosive can be killed or severely injured, and the auditory organs are especially susceptible to injury (Ketten *et al.*, 1993; Ketten, 1995). Airgun pulses are less energetic and have slower rise times, and there is no proof 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 involving mid-frequency sonar and, in one case, an L–DEO seismic survey, 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.

Seismic pulses and mid-frequency sonar pulses are quite different. Sounds produced by airgun arrays are broadband with most of the energy below 1 kHz. Typical military mid-frequency sonars operate at frequencies of 2–10 kHz, generally with a relatively narrow bandwidth at any one time. 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 pulses can, in special circumstances, lead to physical damage and mortality (NOAA and USN, 2001; Jepson *et al.*, 2003; Fernandez *et al.*, 2005a), even if only indirectly,

suggests that caution is warranted when dealing with exposure of marine mammals to any high-intensity pulsed sound.

In September, 2002, there was a stranding of two Cuvier's beaked whales in the Gulf of California, Mexico, when the L–DEO vessel *Maurice Ewing* was operating a 20 airgun, 8,490 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, that together with the incidents involving beaked whale strandings near naval exercises suggests a need for caution in conducting seismic surveys in areas occupied by beaked whales. No injuries of beaked whales are anticipated during the proposed study, due to the proposed monitoring and mitigation measures.

Possible Effects of Multibeam Bathymetric (MBB) Sonar Signals

The Kongsberg Simrad EM 120 12-kHz sonar will be operated from the source vessel at some times during the planned study. As discussed above, sounds from the MBB sonar are very short pulses, occurring for 15 ms once every 5–20 s, depending on water depth. Most of the energy in the sound pulses emitted by this MBB sonar is at frequencies centered at 12 kHz. 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 Kongsberg Simrad EM 120 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 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 MBB sonar 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 be subjected to sound levels that could cause TTS.

Navy sonars that have been linked to avoidance reactions and stranding of cetaceans (1) generally have a longer pulse duration than the Kongsberg Simrad EM 120, and (2) are often directed close to horizontally vs. downward for the Kongsberg Simrad EM 120. The area of possible influence of the EM 120 is much smaller-a narrow band below the source vessel. The duration of exposure for a given marine mammal can be much longer for a Navy sonar. Possible effects of sonar on marine mammals are outlined below.

Possible Effects of Sub-Bottom Profiler Signals

A sub-bottom profiler would be operated from the source vessel during the planned study. As discussed before, sounds from the sub-bottom profiler are very short pulses, occurring for 1, 2, or 4 ms once every second. Most of the energy in the sound pulses emitted by this sub-bottom profiler is at mid frequencies, centered at 3.5 kHz. The beam width is approximately 30° and is directed downward.

Sound levels have not been measured directly for the sub-bottom profiler used by the *Langseth,* but Burgess and Lawson (2000) measured sounds propagating more or less horizontally from a similar unit with similar source output (205 dB re 1 microPa at 1° m). The 160 and 180 dB re 1 microPa (rms) radii, in the horizontal direction, were estimated to be, respectively, near 20 m (65.6 ft) and 8 m (26.2 ft) from the source, as measured in 13 m (42.7 ft) water depth. The corresponding distances for an animal in the beam below the transducer would be greater, on the order of 180 m (591 ft) and 18 m (59 ft), respectively, assuming spherical spreading.

The sub-bottom profiler on the *Langseth* has a stated maximum source level of 204 dB re 1 microPa at 1 m. Thus, the received level would be expected to decrease to 160 and 180 dB about 160 m (525 ft) and 16 m (53 ft) below the transducer, respectively, again assuming spherical spreading. Corresponding distances in the horizontal plane would be lower, given the directionality of this source (30° beam width) and the measurements of Burgess and Lawson (2000).

Numbers of Marine Mammals Estimated to be Taken

All anticipated takes would be takes by Level B harassment, involving temporary changes in behavior. The proposed mitigation measures will prevent the possibility of injurious takes. The estimates of take are based on consideration of the number of marine mammals that might be disturbed by approximately 654 km (406 mi) of seismic surveys at the QDG study site and approximately 7,992 km (4,967 mi) of seismic surveys at the EPR study site in the ETP.

The anticipated radii of influence of the MBB sonar are less than those for the airgun array. It is assumed that, during simultaneous operations of the airgun array and sonar, any marine mammals close enough to be affected by the sonar would already be affected by the airguns. However, whether or not the airguns are operating simultaneously with the sonar, marine mammals are not expected to be ''taken'' by the sonar given its characteristics (*e.g.*, narrow downward-directed beam) and other considerations described above. Therefore, no additional allowance is included for animals that might be affected by sound sources other than airguns.

There is some uncertainty about how representative the data are for the QDG survey because of the time of year and the validity of the assumptions used below to estimate the potential take by harassment. The data derived from marine mammals surveys that were conducted from the time of year that is different from the proposed QDG seismic surveys. However, the approach used here is based on the best available data. To provide some allowance for those uncertainties, ''best estimates'' and ''maximum estimates'' of the numbers potentially affected have been derived based on the average and maximum estimates of densities reported by Ferguson and Barlow (2001) for the survey blocks encompassing each project study area as presented in Tables 3 and 4 of L–DEO's application.

Basis for Take Estimates

As discussed above, several extensive marine mammal surveys have been conducted in the ETP over numerous years. The most comprehensive data available for the regions encompassing the proposed survey areas are the Ferguson and Barlow (2001) data collected from late July to early December 1986–1996.

Because the proposed QDG survey is planned for April–May 2008, data collected by Ferguson and Barlow (2001) in July–December may not be as representative for the QDG survey. Again, however, it is the best available information. For some species, the densities derived from past surveys may not be representative of the densities that would be encountered during the actual proposed seismic studies. For example, the density of cetaceans sighted during L–DEO's 2003 Hess Deep survey was considerably lower (only one sighting) than the densities anticipated to occur there based on the Ferguson and Barlow (2001) data. The Hess Deep survey occurred in mid-July, and was apparently not well

represented by the Ferguson and Barlow (2001) data collected during the fall, beginning just after the Hess Deep survey.

Despite the above caveats, the Ferguson and Barlow (2001) data still represent the best available data for estimating numbers of animals potentially exposed to the proposed seismic sounds. Average and maximum densities for marine mammals from Ferguson and Barlow (2001) were calculated for each of the project areas based on encompassing and adjacent survey blocks. Maximum densities were either the highest estimated density in any of the blocks or, if that number was zero, the average group size for that species. The densities reported in Ferguson and Barlow (2001) were corrected for both detectability [f(0)] and availability [g(0)] biases, and therefore, are relatively unbiased.

Estimated Number of Takes by Harassment

The number of individuals that may be exposed to airgun sounds with received levels higher than 160 dB re 1 microPa (rms) on one or more occasions can be estimated by considering the total marine area that would be within the 160–dB radius around the operating airgun array on at least one occasion. In the QDG survey, the proposed seismic lines do not run parallel to each other in close proximity, and only one transect line might be surveyed a second time, which minimizes the number of times an individual mammal may be exposed during the survey. In the EPR survey, the seismic lines are parallel and in close proximity, and the entire grid may be surveyed more than twice, which may result in individuals being exposed on two or more occasions. It is not known how much time will pass between the first and the second transit along each line, so it is also possible that different marine mammals could occur in the area during the second pass. Thus, the best estimates in this section are based on a single pass of all survey lines (including turns), and maximum estimates are based on maximum densities, *i.e.*, the highest single-block density among all of the blocks used in the calculations. Tables 3 and 4 show the best and maximum estimates of the number of marine mammals that could potentially be affected during the EPR and QDG seismic surveys, respectively.

The number of individuals potentially exposed to 160 dB re 1 microPa (rms) or higher in each area was calculated by multiplying the expected species density, either ''mean'' (*i.e.*, best estimate) or ''maximum'' (maximum estimate) times by the anticipated minimum area to be ensonified to that level during airgun operations.

TABLE 3.—ESTIMATES OF THE NUMBERS OF DIFFERENT INDIVIDUAL MARINE MAMMALS THAT MIGHT BE EXPOSED TO SOUND LEVELS > 160 DB RE 1 MICROPA (RMS) DURING L–DEO'S PROPOSED EPR SEISMIC PROGRAM IN THE ETP. THE PROPOSED SOUND SOURCE IS AN 18-AIRGUN ARRAY WITH A TOTAL VOLUME OF 3,300 IN^3

["NA" indicates that no percentage of population data were available due to the lack of population estimate]

	Number of individuals exposed to SPL > 160 dB re 1 microPa (rms)		
Species	Best estimate	Percent of regional population based on best estimate	Maximum estimate
Humpback whale	0	0.00	2
Minke whale	0	NA	1
Bryde's whale	3	0.02	7
Sei whale	0	NA	2
Fin whale	0	0.00	2
Blue whale	0	0.03	1
Sperm whale	2	0.01	4
Pygmy sperm whale	0	NA	1
Dwarf sperm whale	66	0.59	87
Cuvier's beaked whale	16	0.08	30
Longman's beaked whale	0	0.00	4
Pygmy beaked whale	0	NA	4
Blainville's beaked whale	0	NA	4
Mesoplodon sp	8	0.03	.....
Rough-toothed dolphin	27	0.02	109
Bottlenose dolphin	18	0.01	38
Spotted dolphin	697	0.03	1327
Spinner dolphin	342	0.02	695
Striped dolphin	303	0.02	792
Fraser's dolphin	5	0.00	47
Short-beaked common dolphin	7	0.00	835
Risso's dolphin	18	0.01	53
Melon-headed whale	5	0.01	30
Pygmy killer whale	9	0.02	46
False killer whale	3	0.01	8
Killer whale	1	0.01	3
Short-finned pilot whale	20	0.01	41

TABLE 4.—ESTIMATES OF THE NUMBERS OF DIFFERENT INDIVIDUAL MARINE MAMMALS THAT MIGHT BE EXPOSED TO SOUND LEVELS > 160 DB RE 1 MICROPA (RMS) DURING L-DEO'S PROPOSED QDG SEISMIC PROGRAM IN THE ETP. THE PROPOSED SOUND SOURCE IS A 27-AIRGUN ARRAY WITH A TOTAL VOLUME OF 4,950 IN^3

["NA" indicates that no percentage of population data were available due to the lack of population estimate]

Number of individuals exposed to SPL > 160 dB re 1 microPa (rms)			
Species	Best estimate	Percent of regional population based on best estimate	Maximum estimate
Humpback whale	0	0.00	1
Minke whale	0	NA	1
Bryde's whale	6	0.05	24
Sei whale	0	NA	2
Fin whale	0	0.00	2
Blue whale	1	0.04	3
Sperm whale	4	0.01	13
Pygmy sperm whale	0	NA	1
Dwarf sperm whale	0	0.00	2
Cuvier's beaked whale	48	0.24	81
Longman's beaked whale	0	0.00	3
Pygmy beaked whale	0	NA	3
Blainville's beaked whale	0	NA	3
Mesoplodon sp	7	0.03	.....
Rough-toothed dolphin	24	0.02	166
Bottlenose dolphin	17	0.01	48
Spotted dolphin	468	0.02	1236
Spinner dolphin	226	0.01	431
Striped dolphin	482	0.03	599
Fraser's dolphin	43	0.01	151
Short-beaked common dolphin	30	0.00	2089
Risso's dolphin	16	0.01	68
Melon-headed whale	7	0.01	38
Pygmy killer whale	3	0.01	16
False killer whale	11	0.03	47
Killer whale	1	0.01	2
Short-finned pilot whale	35	0.02	105

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 intersecting lines) were included only once to determine the minimum area expected to be ensonified to higher than 160 dB re 1 microPa at least once.

Applying the approach described above, 2,492 km^2 (923 mi^2) would be within the 160-dB isopleth on one or more occasions during the EPR survey, and 2,911 km^2 (1,224 mi^2) would be ensonified on one or more occasions during the QDG survey. This approach does not allow for turnover in the marine mammal populations in the study areas during the course of the studies. That might underestimate actual numbers of individuals exposed, although the conservative distances used to calculate the area may offset this. In addition, the approach assumes that no cetaceans would move away or toward the trackline as the *Langseth* approaches in response to increasing sound levels prior to the time the levels reach 160 dB. Another way of interpreting the estimates that follow is that they represent the number of individuals that are expected (in the absence of a seismic program) to occur in the waters that will be exposed to 160 dB re 1 microPa (rms) or higher.

The ''best estimate'' of the number of individual marine mammals that might be exposed to seismic sounds with received levels of 160 dB re 1 microPa (rms) or higher during the EPR survey includes 2 endangered whales (both sperm whales), 24 beaked whales, and 3 Bryde's whales. Pantropical spotted, spinner, and striped dolphins are estimated to be the most common species exposed; the best estimates for those species are 697, 342, and 303, respectively. Estimates for other species are lower (Table 3).

The ''best estimate'' of the number of individual marine mammals that might be exposed to seismic sounds with received levels of 160 dB re 1 microPa (rms) or higher during the QDG survey includes 5 endangered whales (4 sperm whales and 1 blue whale), 55 beaked whales, and 6 Bryde's whales. Striped, spotted, and spinner dolphins are estimated to be the most common species exposed; the best estimates for those species are 482, 468, and 226, respectively. Estimates for other species are lower (Table 4).

The ''best estimate'' of the total number of individual marine mammals that might be exposed to seismic sounds with received levels of 160 dB re 1 microPa (rms) or higher for both surveys, along with the percentage of regional population, is listed in Table 5. It includes two ESA-listed species (6 sperm whales and 1 blue whale), 79 beaked whales, and 9 Bryde's whales. Striped, spotted, and spinner dolphins are estimated to be the most common species exposed; the best estimates for those species are 785, 1,165, and 568, respectively. Estimates for other species are lower (Table 5).

TABLE 5.—ESTIMATES OF THE NUMBERS OF DIFFERENT INDIVIDUAL MARINE MAMMALS THAT MIGHT BE EXPOSED TO SOUND LEVELS > 160 DB RE 1 MICROPA (RMS) DURING L–DEO'S TWO PROPOSED SEISMIC PROGRAM IN THE ETP

["NA" indicates that no percentage of population data were available due to the lack of population estimate]

Total number of individuals exposed to SPL > 160 dB re 1 microPa (rms)		
Species	Best estimate	Percent of regional population based on best estimate
Humpback whale	0	0.00
Minke whale	0	NA
Bryde's whale	9	0.07
Sei whale	0	NA
Fin whale	0	0.00
Blue whale	1	0.04
Sperm whale	6	0.02
Pygmy sperm whale	0	NA
Dwarf sperm whale	66	0.59
Cuvier's beaked whale	64	0.32
Longman's beaked whale	0	0.00
Pygmy beaked whale	0	NA
Blainville's beaked whale	0	NA
Mesoplodon sp	15	0.06
Rough-toothed dolphin	51	0.04
Bottlenose dolphin	35	0.02
Spotted dolphin	1,165	0.05
Spinner dolphin	568	0.03
Striped dolphin	785	0.05
Fraser's dolphin	48	0.01
Short-beaked common dolphin	37	0.00
Risso's dolphin	34	0.02
Melon-headed whale	12	0.02
Pygmy killer whale	12	0.03
False killer whale	14	0.04
Killer whale	2	0.02
Short-finned pilot whale	55	0.03

Potential Impacts to Subsistence Harvest of Marine Mammals

The proposed activities will not have any impact on the availability of the species or stocks for subsistence use described in section 101(a)(5)(D)(i)(II).

Potential Impacts on Habitat and Prey

The proposed seismic survey would not result in any permanent or significant impact on habitats used by marine mammals, or to the food sources they use. The main impact issue associated with the proposed activity would be temporarily elevated noise levels and the associated direct effects on marine mammals, as discussed above. The following sections briefly review effects of airguns on fish and invertebrates, and more details are included in Appendices C and D of the L–DEO's IHA application, respectively.

Effects on Fish

There are three types of potential effects of exposure to seismic surveys: (1) Pathological, (2) physiological, and (3) behavioral. Pathological effects involve lethal and temporary or permanent sub-lethal injury. Physiological effects involve temporary and permanent primary and secondary stress responses, such as changes in levels of enzymes and proteins. Behavioral effects refer to temporary and (if they occur) permanent changes in exhibited behavior (e.g., startle and avoidance behavior). The three categories are interrelated in complex ways. For example, it is possible that certain physiological and behavioral changes could potentially lead to an ultimate pathological effect on individuals (i.e., mortality).

The potential for pathological damage to hearing structures in fish depends on the energy level of the received sound and the physiology and hearing capability of the species in question. For a given sound to result in hearing loss, the sound must exceed, by some specific 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 is unknown; however, it likely depends 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. McCauley *et al.* (2003) found that exposure to airgun sound caused observable anatomical damage to the auditory maculae of ''pink snapper'' (*Pagrus auratus*). This damage in the ears had not been repaired in fish sacrificed and examined almost two months after exposure. On the other hand, Popper *et al.* (2005) found that received sound exposure levels of 177 dB re 1 microPa^2-s caused no hearing loss in broad whitefish (*Coreogonus nasus*) . 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 airgun arrays (less than 400 Hz in the study by McCauley *et al.* (2003) and less than 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 (6.6 ft) in the latter). Water depth sets a lower limit on the lowest sound frequency that will propagate at about one-quarter wavelength (Urick, 1983; Rogers and Cox, 1988).

Except for these two studies, at least with airgun-generated sound treatments, most contributions rely on rather subjective assays such as fish ''alarm'' or ''startle response'' or changes in catch rates by fishers. These observations are important in that they attempt to use the levels of exposures that are likely to be encountered by most free-ranging fish in actual survey areas. However, the associated sound stimuli are often poorly described, and the biological assays are varied (Hastings and Popper, 2005).

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; 2000b; 2003; Bjarti, 2002; Hassel *et al.*, 2003; Popper *et al.*, 2005).

Some studies have reported, some equivocally, that mortality of fish, fish eggs, or larvae can occur close to seismic sources (Kostyuchenko, 1973; Dalen and Knutsen, 1986; Booman *et al.*, 1996; Dalen *et al.*, 1996). Some of the reports claimed seismic effects from treatments quite different from actual seismic survey sounds or even reasonable surrogates. Saetre and Ona (1996) applied a ''worst-case scenario'' mathematical model to investigate the effects of seismic energy on fish eggs and larvae. They concluded that mortality rates caused by exposure to seismic surveys are so low, as compared to natural mortality rates, that the impact of seismic surveying on recruitment to a fish stock must be regarded as insignificant.

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

Behavioral effects 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.

Effects on Invertebrates

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

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. 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; 2000b) 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.

Physiological effects refer mainly to biochemical responses by marine invertebrates to acoustic stress. Such stress potentially could affect invertebrate populations by increasing mortality or reducing reproductive success. Any primary and secondary stress responses (*i.e.*, changes in haemolymph levels of enzymes, proteins, etc.) of crustaceans after exposure to seismic survey sounds appear to be temporary (hours to days) in studies done to date. The periods necessary for these biochemical changes to return to normal are variable and depend on numerous aspects of the biology of the species and of the sound stimulus.

There is increasing interest in assessing the possible direct and indirect effects of seismic and other sounds on invertebrate behavior, particularly in relation to the consequences for fisheries. Changes in behavior could potentially affect such aspects as reproductive success, distribution, susceptibility to predation, and prey availability to marine mammals. Studies investigating the possible behavioral effects of exposure to seismic survey sound on crustaceans and cephalopods have been conducted on both uncaged and caged animals. In some cases, invertebrates exhibited startle responses (*e.g.*, squid in McCauley *et al.*, 2000a; 2000b). In other cases, no behavioral impacts were noted (*e.g.*, crustaceans in Christian *et al.*, 2003; 2004; DFO, 2004).

Effects on Marine Mammal Habitat

The effects of the planned activity on marine mammal habitats and food resources are expected to be negligible, as described above. A small minority of the marine mammals that are present near the proposed activity may be temporarily displaced as much as a few kilometers by the planned activity.

During the proposed survey, most marine mammals will be dispersed throughout the study area. However, concentrations of marine mammals and/or marine mammal prey species have been reported to occur in and near the proposed study area at the time of year when the seismic programs are planned. The countercurrent thermocline ridge at approximately 10° N (in the EPR study area) has been reported to be an important area to cetacean species, as has the Costa Rica Dome, located several hundreds of kilometer to the east of the study area. Although these areas are thought to be important feeding grounds for some marine mammal species, they are not considered critical feeding areas for any of the species that are found there at that time of year.

The proposed activity is not expected to have any habitat-related effects that could cause significant or long-term consequences for individual marine mammals or their populations, since operations at the various sites will be limited in duration.

Proposed Monitoring and Mitigation Measures

Monitoring

L–DEO proposes to sponsor marine mammal monitoring during the present project, in order to implement NMFS's proposed mitigation and monitoring measures.

(1) Proposed Safety Zones

Received sound levels have been predicted by L–DEO in relation to distance and direction from the airguns for the 36-airgun array with 18 and 27 airguns firing and for a single 1900LL 40 in^3 airgun, which will be used during power downs. Those corresponding radii were described above under *Acoustic Source Specifications* and are set out in Table 2 above. A detailed description of the modeling effort is provided in Appendix A of the L–DEO's IHA application.

If marine mammals are detected within or about to enter the relevant safety zone (180 dB for cetaceans, 190 dB for pinnipeds), the airguns will be powered down (or shut down if necessary) immediately.

(2) Vessel-based Visual Monitoring

Vessel-based marine mammal observers (MMOs) will be on board the seismic source vessel, and they will watch for marine mammals near the vessel during daytime airgun operations and during start-ups of airguns at night from power-down only. MMOs will also watch for marine mammals near the seismic vessel for at least 30 minutes prior to the start of airgun operations after an extended shutdown (a shutdown lasting more than 30 minutes). When feasible, MMOs will also make observations during daytime periods when the seismic systems are not operating for comparison of animal abundance and behavior. Based on MMO observations, airguns will be powered down (see below) or, if necessary, shut down completely, when marine mammals are observed within or about to enter the relevant safety zone (see below).

MMOs will be appointed by L–DEO, with NMFS approval. At least one MMO will monitor the safety zone during daytime airgun operations and any nighttime startups. MMOs will work in shifts of 4 hour duration or less. The vessel crew will also be instructed to assist in detecting marine mammals.

The *Langseth* is a suitable platform for marine mammal observations. When stationed on the observation platform, the eye level will be approximately 17.8 m (58.4 ft) above sea level, and the observer will have a good view around the entire vessel. During daytime, the MMO will scan the area around the vessel systematically with reticule binoculars (*e.g.*, 7×50 Fujinon), Big-eye binoculars (25×150), and with the naked eye. Night vision devices will be available for use (ITT F500 Series Generation 3 binocular-image intensifier or equivalent), although they are considered of limited effectiveness in detecting marine mammals. Laser rangefinding binoculars (Leica LRF 1200 laser rangefinder or equivalent) will be available to assist in distance estimation.

(3) Passive Acoustic Monitoring (PAM)

Passive acoustic monitoring (PAM) will take place to complement the visual monitoring program. PAM will involve towing hydrophones that detect frequencies produced by vocalizing marine mammals. Two or more hydrophones are used to allow some localization of the bearing (direction) of the animal from the vessel. PAM can be effective at detecting some animals before they are detected visually (Smultea and Holst, 2003; Smultea *et al.*, 2004). 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. Therefore, acoustic monitoring can improve detection, identification, localization, and tracking of marine mammals in these circumstances. PAM's value is limited, however, by bottom configuration (water depth) and other environmental factors, and in some cases towing the PAM equipment is not practicable. PAM would be operated or overseen by personnel with acoustic expertise.

SEAMAP (Houston, TX) will be used as the primary acoustic monitoring system. This system was also used during previous L–DEO seismic cruises (*e.g.*, Smultea *et al.*, 2004, 2005; Holst *et al.*, 2005a; 2005b). The PAM system consists of hardware (*i.e.*, hydrophones) and software. The ''wet end'' of the SEAMAP 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 (1,312 ft) long, and the active part of the hydrophone array is approximately 56 m (184 ft) long. The hydrophone array is typically towed at depths about 30 m (98 ft).

Dedicated or clean power supply and grounding should be used to operate both hydrophone system and sound acquisition computer(s). Proper steps should be taken to ensure appropriate shielding from any electronic noise and electro magnetic interferences (Radar pulses, GPS etc.) that could introduce noises into the PAM system. An airgun shoots blanking mechanism should be incorporated into the PAM system so that adequate signal gain for PAM can be achieved to detect vocalizing marine mammals in the vicinity.

The acoustical array will be monitored 24 h per day while at the survey area during airgun operations and 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 vocalizations produced by cetaceans. MMOs monitoring the acoustical data will be on shift for 1–6 h. 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, 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). 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, types and nature of sounds heard, and any other notable information. The acoustic detection can also be recorded for further analysis.

Mitigation

Proposed mitigation measures include (1) vessel speed or course alteration, provided that doing so will not compromise operational safety requirements, (2) airgun array power down, (3) airgun array shut down, and (4) airgun array ramp up.

(1) Speed or Course Alteration

If a marine mammal is detected outside the safety zone but is likely to enter it based on relative movement of the vessel and the animal, then if safety and scientific objectives allow, the

vessel speed and/or course will be adjusted to minimize the likelihood of the animal entering the safety zone. NMFS acknowledges that major course and speed adjustments are often impractical when towing long seismic streamers and large source arrays, thus for surveys involving large sources. Therefore the other mitigation measures often will be required.

(2) Power-down Procedures

A power down involves reducing the number of airguns operating to a single airgun in order to reduce the size of the safety zone. The continued operation of one airgun is intended to alert marine mammals to the presence of the seismic vessel nearby.

If a marine mammal is detected within, or is likely to enter, the safety zone of the array in use, and if vessel course and/or speed changes are impractical or will not be effective to prevent the animal from entering the safety zone, then the array will be powered down to ensure that the animal remains outside the smaller safety zone of the single 40-in^3 airgun. If the size of the safety zone for the single airgun will not prevent the animal from entering it, then a shutdown will be required, as described below.

Following a power down, airgun activity will not resume until the marine mammal is outside the safety zone for the full array. The animal will be considered to have cleared the safety zone if it (1) is visually observed to have left the relevant safety zone; or (2) has not been seen within the safety zone for 15 min in the case of small odontocetes; or has not been seen within the safety zone for 30 min in the case of mysticetes and large odontocetes, including sperm, pygmy sperm, dwarf sperm, and beaked whales.

Following a power down and subsequent animal departure as above, the airgun array may resume operations following ramp-up procedures described below.

(3) Shut-down Procedures

If a marine mammal is within or about to enter the safety zone for the single airgun, all airguns will be shut down immediately. Airgun activity will not resume until the animal has cleared the safety zone, as described above.

(4) Ramp-up Procedures

A ramp-up procedure will be followed when an airgun array begins operating after a specified period without operations or at single airgun operation. It is proposed that, for the present cruise, this period would be 4–5 min. This period is based on the largest modeled 180-dB radius for the airgun array to be used in relation to the planned speed of the *Langseth* while shooting.

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. During ramp-up, the MMOs will monitor the safety zone, and if marine mammals are sighted, decisions about course/speed changes, power down and shutdown will be implemented as though the full array were operational.

Initiation of ramp-up procedures from shutdown requires that the full safety zone must be visible by the MMOs. This requirement will preclude starts at night or in thick fog. Ramp-up is allowed from a power down under reduced visibility conditions, but only if at least one airgun has operated continuously with a source level of at least 180 dB re microPa (rms) throughout the survey interruption. It is assumed that the single airgun will alert marine mammals to the approaching seismic vessel, allowing them to move away if they choose. Ramp-up procedures will not be initiated if a marine mammal is observed within the safety zone of the airgun array to be operated.

Data Collection and Reporting

MMOs will record data to estimate the numbers of marine mammals exposed to various received sound levels and to document apparent disturbance reactions or lack thereof. Data will be used to estimate numbers of animals potentially ''taken'' by harassment. They will also provide information needed to order a power down or shutdown of airguns when marine mammals are within or near the safety zone.

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, 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, as well as information regarding airgun power down and shutdown, will be recorded in a standardized format. Data accuracy will be verified by the MMOs at sea, and 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. MMO observations will provide the following information:

(1) The basis for decisions about powering down or shutting down airgun arrays.

(2) Information needed to estimate the number of marine mammals potentially taken by harassment as described above.

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

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

A final report will be submitted 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 near the operations. The report will also provide full documentation of methods, results, and interpretation pertaining to all monitoring. The report will summarize the dates and locations of seismic operations, and all marine mammal sightings (dates, times, locations, activities, associated seismic survey activities), and the amount and nature of potential take of marine mammals by harassment or in other ways.

Endangered Species Act

Under section 7 of the ESA, the NSF has begun consultation on this proposed seismic survey. NMFS will also consult 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)

In April 2007, LGL Ltd. (LGL) prepared a draft *Environmental Assessment of Two Marine Geophysical Surveys by the R/V Marcus G. Langseth in the Eastern Tropical Pacific, 2007* (EA) for L–DEO and NSF. NMFS will review this EA and will either adopt it or prepare its own NEPA document before making a determination on the issuance of the IHA.

Preliminary Determination

Based on the preceding information, and provided that the proposed mitigation and monitoring are incorporated, NMFS has preliminarily determined that the impact of conducting the marine seismic survey in the ETP may result, at worst, in a temporary modification in behavior 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 sizes (see Tables 3, 4, and 5). NMFS anticipates the actual take of individuals to be even lower than the numbers depicted in the tables, because those numbers do not reflect either the implementation of the mitigation numbers or the fact that some animals likely will avoid the sound at levels lower than those expected to result in harassment.

In addition, no take by death and/or injury is anticipated, and the potential for temporary or permanent hearing impairment will be avoided through the incorporation of the mitigation measures described in this document.

Proposed Authorization

NMFS proposes to issue an IHA to L–DEO for a marine seismic survey project in the ETP in April–August 2008, provided the previously mentioned mitigation, monitoring, and reporting requirements are incorporated.

Dated: February 28, 2008.

Helen Golde,

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

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DEPARTMENT OF COMMERCE

National Oceanic and Atmospheric Administration

Notice of Intent To Prepare a Draft Environmental Impact Statement for the Gray's Reef National Marine Sanctuary

AGENCY: Office of National Marine Sanctuaries, National Ocean Service, National Oceanic and Atmospheric Administration, Department of Commerce.

ACTION: Notice of intent to initiate public scoping.

SUMMARY: The National Oceanic and Atmospheric Administration's (NOAA) Office of National Marine Sanctuaries (ONMS) is preparing a draft environmental impact statement to consider the establishment of a research (control) area in Gray's Reef National Marine Sanctuary (GRNMS). Activities are restricted within research areas in order to facilitate better understanding of resources and environmental processes. This notice announces the beginning of public scoping pursuant to the National Environmental Policy Act. The public scoping process, including public scoping meetings, is intended to solicit information and comments on the range and significance of issues related to the establishment of a research area at Gray's Reef. The results of this scoping process will assist NOAA in formulating alternatives for the draft environmental impact statement for the proposed research area. This notice contains times, dates, and locations for scoping meetings.

DATES: Comments will be considered if received by April 21, 2008.

Scoping meetings will be held at:

(1) March 18, 2008, Camden Public Library, 6–8 p.m.

(2) March 20, 2008, Armstrong Center, 6–8 p.m.

(3) March 24, 2008, Statesboro Regional Library, 6–8 p.m.

(4) March 25, 2008, Stevens Wetlands Education Center, 6–8 p.m.

(5) March 27, 2008, Best Western Sea Island Inn, 6–8 p.m.

ADDRESSES: Written comments may be sent to Gray's Reef NMS (Research Area), 10 Ocean Science Circle, Savannah, GA 31411; or by facsimile to 912/598–2367; or to *grnms.researcharea@noaa.gov.*

Scoping meetings will be held at:

(1) Camden Public Library, 1410 Highway 40 East, Kingsland, Georgia 31548.

(2) Armstrong Center, 13040 Abercorn St., Savannah, Georgia 31419.

(3) Statesboro Regional Library, 124 South Main St., Statesboro, Georgia 30458.

(4) Stevens Wetlands Education Center, 600 Cedar St., Richmond Hill, Georgia 31324.

(5) Best Western Sea Island Inn, 1015 Bay St., Beaufort, South Carolina 29902.

FOR FURTHER INFORMATION CONTACT: Becky Shortland (912) 598–2381 or *Becky.Shortland@noaa.gov.*

SUPPLEMENTARY INFORMATION: The National Marine Sanctuaries Act (NMSA), 16 U.S.C. 1431 et seq., authorizes the Secretary of Commerce (Secretary) to designate discrete areas of the marine environment as national marine sanctuaries to protect their special conservation, recreational, ecological, historical, cultural, archaeological, scientific, educational, or esthetic qualities. The NMSA is administered by the National Oceanic and Atmospheric Administration (NOAA) through the Office of National Marine Sanctuaries (ONMS).

The concept of a research (control) area within Gray's Reef National Marine Sanctuary has been under discussion for several years. The concept was first raised in 1999 during the early stages of the GRNMS Management Plan review process at public scoping meetings and was raised again during public research workshops.

Subsequently, the Gray's Reef Sanctuary Advisory Council (SAC), with the approval of the Sanctuary superintendent, formed a research area working group (RAWG) to further consider the concept. The Advisory Council's recommendation to investigate the concept of a marine research area was adopted by GRNMS as a research and monitoring strategy for the Management Plan which was released in 2006.

The RAWG comprised representative constituents of Gray's Reef including: researchers, academics, conservation groups, recreational anglers and divers, educators, commercial fishing, law enforcement and sanctuaries representatives. The working group met initially in May 2004, and then periodically over the course of a year, to discuss the concept in detail. The working group employed a consensus-driven, constituent-based process to address the concept of a marine research area. All participants discussed at length all issues, considerations, priorities and concerns for each step of the process.

The following recommendations were developed by the working group and were referred to the SAC. After reviewing and considering the recommendations, the SAC adopted and submitted them to NOAA GRNMS:

Recommendation #1

Significant research questions exist at Gray's Reef National Marine Sanctuary that can only be addressed by establishing a control (research) area. Therefore, the research area concept should be further explored by NOAA through a public review process.

Recommendation #2

As many appropriate tools as feasible, especially a GIS (Geographic Information Systems, geographic and spatial analysis software) site evaluation tool and a RAWG should be used to investigate a research area with proper siting criteria.