pursuant to the provisions of the Foreign-Trade Zones Act, as amended (19 U.S.C. 81a–81u), and the regulations of the Board (15 CFR part 400). It was formally filed on February 16, 2010.

The Luigi Bormioli facility (35 employees, 19 acres, $11.5 million in annual shipments) is located at 1656 Fuldner Rd. (Joey Zorn Blvd.), Barnwell, South Carolina. The facility is used for the storage and distribution of glass fragrance containers and glass tableware products (duty rate ranges from 3 to 38%).

FTZ procedures could exempt Luigi Bormioli from customs duty payments on foreign products that are re-exported (approximately 2 percent of shipments). On its domestic sales, the company would be able to defer duty payments until merchandise is shipped from the plant and entered for consumption. FTZ designation would further allow Luigi Bormioli to realize logistical benefits through the use of weekly customs entry procedures. The request indicates that the savings from FTZ procedures would help improve the facility's international competitiveness.

In accordance with the Board's regulations, Maureen Hinman of the FTZ Staff is designated examiner to evaluate and analyze the facts and information presented in the application and case record and to report findings and recommendations to the Board.

Public comment is invited from interested parties. Submissions (original and 3 copies) shall be addressed to the Board's Executive Secretary at the address below. The closing period for their receipt is April 26, 2010. Rebuttal comments in response to material submitted during the foregoing period may be submitted during the subsequent 15-day period to May 11, 2010.

A copy of the application will be available for public inspection at the Office of the Executive Secretary, Foreign-Trade Zones Board, Room 2111, U.S. Department of Commerce, 1401 Constitution Avenue, NW., Washington, DC 20230–0002, and in the "Reading Room" section of the Board's Web site, which is accessible via *www.trade.gov/ftz.*

For further information, contact Maureen Hinman at *maureen.hinman@trade.gov* or (202) 482–0627.

Dated: February 16, 2010.

Andrew McGilvray,

Executive Secretary.

[FR Doc. 2010–3861 Filed 2–24–10; 8:45 am]

BILLING CODE P

DEPARTMENT OF COMMERCE

Foreign-Trade Zones Board

[Docket 11–2010]

Foreign-Trade Zone 59—Lincoln, NE Application for Subzone CNH America, LLC (Agricultural Machinery Manufacturing) Grand Island, NE

An application has been submitted to the Foreign-Trade Zones Board (the Board) by the Lincoln Foreign Trade Zone, Inc., grantee of FTZ 59, requesting special-purpose subzone status for the agricultural combine and hay tools manufacturing facilities of CNH America, LLC (CNH), located in Grand Island, Nebraska. The application was submitted pursuant to the provisions of the Foreign-Trade Zones Act, as amended (19 U.S.C. 81a–81u), and the regulations of the Board (15 CFR part 400). It was formally filed on February 16, 2010.

The CNH facilities (1,274 employees) consist of two sites in Grand Island, Nebraska on approximately 171.5 acres: *Site 1* (132.52 acres)—main plant located at 3445 W. Stolley Park Road; and *Site 2* (38.93 acres)—warehouse located at 1011 Claude Road. The facilities are used for the manufacture, testing, warehousing and distribution of combines and hay tools. The CNH facilities annually can produce up to 5,960 combines and 4,600 hay tools. Components and materials sourced from abroad (representing 10% of the value of the finished product) include: Articles of plastic (incl. tubes, hoses, fittings, stoppers and lids); articles of rubber (incl. belts, tubes, hoses, grommets, plugs, mountings, sheets, strips); tires; gaskets; washers; safety glass; iron tubes; pipes and fittings; cable; fasteners; springs; articles of steel; sign plates; internal-combustion engines and parts; pumps; filters; parts for agricultural equipment; valves; bearings; transmission shafts; electric motors; generators; clutches; brakes; ignitions; electromagnetic couplings; gears; flywheels; pulleys; electrical lighting or signaling equipment; loudspeakers; heaters; defrosters; resistors; switches; relays; lamps; wires; cables; locks and keys; thermostats and measuring instruments (duty rates range from free to 9%).

FTZ procedures could exempt CNH from customs duty payments on the foreign components used in export production. The company anticipates that some 30 percent of the plant's shipments will be exported. On its domestic sales, CNH would be able to choose the duty rates during customs entry procedures that apply to combines and hay tools (duty-free) for the foreign inputs noted above. FTZ designation would further allow CNH to realize logistical benefits through the use of certain customs entry procedures. The request indicates that the savings from FTZ procedures would help improve the plant's international competitiveness.

In accordance with the Board's regulations, Diane Finver of the FTZ Staff is designated examiner to evaluate and analyze the facts and information presented in the application and case record and to report findings and recommendations to the Board.

Public comment is invited from interested parties. Submissions (original and 3 copies) shall be addressed to the Board's Executive Secretary at the address below. The closing period for their receipt is April 26, 2010. Rebuttal comments in response to material submitted during the foregoing period may be submitted during the subsequent 15-day period to May 11, 2010.

A copy of the application will be available for public inspection at the Office of the Executive Secretary, Foreign-Trade Zones Board, Room 2111, U.S. Department of Commerce, 1401 Constitution Avenue, NW., Washington, DC 20230–0002, and in the "Reading Room" section of the Board's Web site, which is accessible via *www.trade.gov/ftz.*

For further information, contact Diane Finver at *Diane.Finver@trade.gov* or (202) 482–1367.

Dated: February 16, 2010.

Andrew McGilvray,

Executive Secretary.

[FR Doc. 2010–3883 Filed 2–24–10; 8:45 am]

BILLING CODE P

DEPARTMENT OF COMMERCE

National Oceanic and Atmospheric Administration

RIN 0648–XT57

Incidental Takes of Marine Mammals During Specified Activities; Marine Geophysical Survey in the Commonwealth of the Northern Mariana Islands, April to June 2010

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 marine seismic survey in the Commonwealth of the Northern Mariana Islands (CNMI) during April to June 2010. Pursuant to the Marine Mammal Protection Act (MMPA), NMFS requests comments on its proposal to authorize L–DEO to incidentally take, by Level B harassment only, small numbers of marine mammals during the aforementioned activity.

DATES: Comments and information must be received no later than March 29, 2010.

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. The mailbox address for providing e-mail comments is *PR1.0648–XT57@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.

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

FOR FURTHER INFORMATION CONTACT: Howard Goldstein or Jolie Harrison, Office of Protected Resources, NMFS, 301–713–2289.

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.

An authorization for incidental taking of small numbers of marine mammals shall be granted if NMFS finds that the taking will have a negligible impact on the species or stock(s), 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." The authorization must also set forth permissible methods of taking, other means of affecting the least practicable adverse impact on the species or stock and its habitat and requirements for monitoring and reporting such takings.

Section 101(a)(5)(D) of the MMPA established an expedited process by which citizens of the United States can apply for an authorization not to exceed one year 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"].
>
> 16 U.S.C. 1362(18)

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 for any proposed authorizations for the incidental harassment of marine mammals. Within 45 days of the close of the comment period, NMFS, on behalf of the Secretary, makes the findings set forth in clause 101(a)(5)(D)(i) of the MMPA and must either issue the authorization with appropriate conditions to meet the requirements of clause 101(a)(5)(D)(ii) or deny it. NMFS will publish notice of issuance or denial of the authorization within thirty days of issuance or denial.

Summary of Request

On December 16, 2009, NMFS received an IHA application and an Environmental Assessment (EA) from L–DEO for the taking, by Level B harassment only, of small numbers of several species of marine mammals incidental to conducting, with research funding from the National Science Foundation (NSF), a marine seismic survey in the CNMI during April to June, 2010. The CNMI is a commonwealth in a political union with the U.S. The survey will take place in the Exclusive Economic Zone (EEZ) of the U.S. in water depths greater than 2,000 m (6,561.7 ft). The seismic study will use a towed array of 36 airguns with a total discharge volume of approximately 6,600 in^3.

Description of the Specified Activity

L–DEO plans to conduct a seismic survey in the CNMI. The survey will occur in the area 16.5° to 19° North, 146.5° to 150° East within the EEZ (*see* Figure 1 of L–DEO's application). The project is scheduled to occur from April 25 to June 6, 2010. Some minor deviation of these dates is possible, depending on logistics and weather (*i.e.,* the cruise may depart earlier to be extended due to poor weather; there could be extra days (up to three) of seismic operations if collected data are of substandard quality.

L–DEO plans to conduct the seismic survey over the Mariana outer forearc, the trench and the outer rise of the subducting and bending Pacific plate. The objective is to understand the water cycle within subduction-systems. Subduction systems are where the basic building blocks of continental crust are made and where Earth's great earthquakes occur. Little is known about either of these processes, but water cycling through the system is thought to be the primary controlling factor in both arc-crust generation and megathrust seismicity.

An important new hypothesis has recently been suggested that, if correct, will transform our understanding of the water budget of subduction systems. This hypothesis holds that cracking attributable to bending of the subducting plate enables water to penetrate through the subducting crust into the mantle, where it hydrates the mantle by forming the hydrous mineral phase serpentine. This phase is stable to greater depths than the hydrous clay minerals of the crust, where most of the subducting water was previously believed to be held. Thus, if this hypothesis is correct, it provides a mechanism for transporting water far beneath the mantle wedge, where it promotes melting and crust formation, and possibly even deeper into the mantle, providing a whole-earth hydration mechanism that promotes the continued operation of plate tectonics, without which our planet would likely be unable to support life.

The scientists involved in this program will test this hypothesis by measuring mantle seismic sounds speeds, which vary with degree of serpentinization. By comparing these measurements from the Mariana system, which is old and cold with the Costa Rica system, which is young and warm and where similar measurements have recently been made, we should be able to definitively determine whether or not substantial water is taken up by the mantle of subducting plates near the outer rise of seafloor trenches.

The planned survey will involve one source vessel, the R/V *Marcus G. Langseth* (*Langseth*), which will occur in the CNMI. The *Langseth* will deploy an array of 36 airguns (6,600 in^3) as an energy source at a tow depth of 9 m (30 ft). The receiving system will consist of a 6 km (3.7 mi) hydrophone streamer and approximately 85 ocean bottom seismometers (OBSs). As the airgun array is towed along the survey lines, the hydrophone streamer will receive the returning acoustic signals and transfer the data to the on-board processing system. The OBSs record the returning acoustic signals internally for later analysis. The OBSs to be used for the 2010 program will be deployed and most (approximately 60) will be retrieved during the cruise, whereas 25 will be left in place for one year.

The planned seismic survey will consist of approximately 2,800 km (1,739.8 mi) of transect lines within the CNMI (*see* Figure 1 of L–DEO's application). The survey will take place in water depths greater than 2,000 m (6,561.7 ft). All planned geophysical data acquisition activities will be conducted by L–DEO with onboard assistance by the scientists who have proposed the study. The scientific team consists of Dr. Doug Wiens (Washington University, St. Louis, MO) and Daniel Lizarralde (Woods Hole Oceanographic Institution [WHOI], Woods Hole, MA). The vessel will be self-contained, and the crew will live aboard the vessel for the entire cruise.

In addition to the operations of the airgun array, a Kongsberg EM multibeam echosounder (MBES) and a Knudsen 320B sub-bottom profiler (SBP) will be operated from the *Langseth* continuously throughout the CNMI cruise.

Vessel Specifications

The *Langseth* will be used as the source vessel. The Langseth will tow the 36 airgun array along predetermined lines. The *Langseth* will also tow the hydrophone streamer, retrieve OBSs, and may also deploy OBSs. When the *Langseth* is towing the airgun array as well as the hydrophone streamer, the turning rate of the vessel while the gear is deployed is limited to five degrees per minute. Thus, the maneuverability of the vessel is limited during operations with the streamer.

The *Langseth* has a length of 71.5 m (234.6 ft), a beam of 17 m (55.8 ft), and a maximum draft of 5.9 m (19.4 ft). The ship was designed as a seismic research vessel, with a propulsion system designed to be as quiet as possible to avoid interference with the seismic signals. The ship is powered by two Bergen BRG–6 diesel engines, each producing 3,550 horse-power (hp), that drive the two propellers directly. Each propeller has four blades, and the shaft typically rotates at 750 revolutions per minute (rpm). The vessel also has an 800 hp bowthruster, which is not used during seismic acquisition. The operation speed during seismic acquisition is typically 7.4 to 9.3 km/hr (4 to 5 kt). When not towing seismic survey gear, the *Langseth* can cruise at 20 to 24 km/hr (11 to 13 kt). The *Langseth* has a range of 25,000 km (15,534 mi), which is the distance the vessel can travel without refueling. The *Langseth* will also serve as the platform from which vessel-based Protected Species Observers (PSOs) will watch for marine animals before and during airgun operations. NMFS believes that the realistic possibility of a ship-strike of a marine mammal by the vessel during research operations and in-transit during the proposed survey is discountable.

Acoustic Source Specifications—Seismic Airguns

During the proposed survey, the airgun array to be used will consist of 36 airguns, with a total volume of approximately 6,600 in^3. The airgun array will consist of a mixture of Bolt 1500LL and 1900LL airguns. The airguns array will be configured as four identical linear arrays or "strings" (*see* Figure 2 in L–DEO's application). Each string will have 10 airguns; the first and last airguns in the strings are spaced 16 m (52.5 ft) apart. Nine airguns in each string will be fired simultaneously, while 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 24 × 16 m (78.7 × 52.5 ft) behind the *Langseth* and will be towed approximately 140 m (459 ft) behind the vessel. The shot interval will be 37.5 m (123.0 ft) or 150 m (492.1 ft) during the study. The shot interval will be relatively short (approximately 37.5 m or approximately 15 to 18 seconds [s]) for multi-channel seismic surveying with the hydrophone streamer, and relatively long (approximately 150 m or approximately 58 to 73 s) when recording data on the OBSs. The firing pressure of the array is 1,900 pounds per square inch (psi). During firing, a brief (approximately 0.1 s) pulse of sound is emitted. The airguns will be silent during the intervening periods.

Because the actual source is a distributed source (36 airguns) rather than a single point source, the highest sound levels measurable at any location in the water will be less than the nominal source (265 dB re 1 µ Pa·m, peak-to-peak [pk-pk]). In addition, the effective source level for sound propagating in near-horizontal directions will be substantially lower than the nominal source level applicable to downward propagation because of the directional nature of the sound from the airgun array.

TABLE 1—DISTANCES TO WHICH SOUND LEVELS GREATER THAN OR EQUAL TO 190, 180, AND 160 dB RE 1 µPa (RMS) COULD BE RECEIVED IN DEEP (GREATER THAN 1,000 M) WATER DURING THE PROPOSED SURVEY IN THE CNMI, APRIL 25 TO JUNE 6, 2010

Source and volume	Tow depth (m)	Water depth	Predicted RMS distances (m)		
			190 dB	180 dB	160 dB
Single Bolt airgun (40 in^3)	9	Deep (>1,000 m)	12	40	385
4 strings, 36 airguns (6,600 in^3)	9	Deep (>1,000 m)	400	940	3,850

Acoustic Source Specifications—Multibeam Echosounder (MBES) and Sub-bottom Profiler (SBP)

Along with the airgun operations, two additional acoustical data acquisition systems will be operated during the survey. The ocean floor will be mapped with Kongsberg EM 122 MBES and Knudsen 320 SBP. These sound sources will be operated from the *Langseth* continuously throughout the cruise.

The Kongsberg EM 122 MBES operates at 10.5 to 13 (usually 12) kHz and is hull-mounted on the *Langseth.* The transmitting beamwidth is 1° or 2° fore-aft and 150° athwartship. The maximum source level is 242 dB re 1 μPam (rms). Each "ping" consists of eight (in water greater than 1,000 m deep) or four (less than 1,000 m) successive fan-shaped transmissions, each ensonifying a sector that extends 1° fore-aft. Continuous-wave (CW) pulses increase from two to 15 ms long in water depths up to 2,600 m (8,530 ft), and FM chirp pulses up to 100 ms long are used in water greater than 2,600 m. The successive transmissions span an overall cross-track angular extent of about 150°, with 2 ms gaps between pulses for successive sectors.

The Knudsen 320B SBP is normally operated to provide information about the sedimentary features and the bottom topography that is being mapped simultaneously by the MBES. The SBP beam is transmitted as a 27 degree cone, which is directed downward by a 3.5 kHz transducer in the hull of the *Langseth.* The maximum output is 1,000 watts (204 dB), but in practice, the output varies with water depth. The pulse interval is 1 s, but a common mode of operation is to broadcast five pulses at 1 s intervals followed by a 5 s pause.

OBS Description and Deployment

Approximately 85 OBSs will be deployed by the *Langseth* before the survey, in water depths 3,100 to 8,100 m (10,170.6 to 26,574.8 ft). There are three types of OBS deployment:

(1) Approximately 20 broad-band OBSs located on the bottom in a wide two-dimensional (2D) array with a spacing of no more than 100 km (62.1 mi);

(2) Approximately five short-period OBSs tethered in the water column above the trench areas deeper than 6 km; and

(3) Approximately 60 short-period OBSs located on the bottom in a 2D array with a spacing of about 75 km (46.6 mi).

The first two types will be left in place for one year for passive recording, and the third type will be retrieved after the seismic operations. OBSs deployed in water deeper than 5,500 m (18,044.6 ft) will require a tether to keep the instruments at a depth of 5,500 to 6,000 m (18,044.6 to 19,685 ft), as the instruments are rated to a maximum depth of 6,000 m. The lengths of the tethers will vary from 65 to 2,600 m (213.3 to 8,530.2 ft). The tether will fall to the seafloor when the OBS is released.

Two different types of OBSs may be used during the 2010 program. The WHOI "D2" OBS has a height of approximately 1 m (3.3 ft) and a maximum diameter of 50 cm (19.7 in). The anchor is made of hot-rolled steel and weighs 23 kg (50.7 lb). The anchor dimensions are 2.5x30.5x38.1 cm. The LC4x4 OBS from the Scripps Institution of Oceanography (SIO) has a volume of approximately 1 m^3, with an anchor that consists of a large piece of steel grating (approximately 1 m^2). Once an OBS is ready to be retrieved, an acoustic release transponder interrogates the OBS at a frequency of 9 to 11 kHz, and a response is received at a frequency of 9 to 13 kHz. The burn-wire release assembly is then activated, and the instrument is released from the anchor to float to the surface. The anchors will remain on the sea floor.

Proposed Dates, Duration, and Specific Geographic Area

The survey will occur in the following specific geographic area: 16.5° to 19° North, 146.5° to 150° East within the EEZ of the U.S. (*see* Figure 1 of L–DEO's application). Water depths in the survey area range from greater than 2,000 m to greater than 8,000 m (26,246.7 ft). The closest that the vessel will approach to any island is approximately 50 km (31.1 mi) from Alamagan. The exact dates of the activities depend on logistics and weather conditions. The *Langseth* will depart from Guam on April 25, 2010 and return to Guam on June 6, 2010. Seismic operations will be carried out for 16 days, with the balance of the cruise occupied in transit (approximately 2 days) and in deployment and retrieval of OBSs and maintenance (25 days).

Description of Marine Mammals in the Proposed Activity Area

A total of 27 cetacean species, including 20 odontocete (dolphins and small- and large-toothed whales) species and nine mysticetes (baleen whales) are known to occur in the area affected by the specified activities associated with the proposed CNMI marine geophysical survey (*see* Table 2 of L–DEO's application). Cetaceans and pinnipeds, which are the subject of this IHA application, are protected by the MMPA and managed by NMFS in accordance with its requirements. Information on the occurrence, distribution, population size, and conservation status for each of the 27 marine mammal species that may occur in the proposed project area is presented in the Table 2 of L–DEO's application as well as here in the table below (Table 2). The status of certain marine mammal species as threatened or endangered is based on evaluation and listing procedures under the U.S. Endangered Species Act (ESA), the International Union for Conservation of Nature (IUCN) Red List of Threatened Species, and Convention on International Trade in Endangered Species (CITES). Several marine mammal species that may be affected by the proposed IHA are listed as Endangered under Section 4 of the ESA, including the North Pacific right, sperm, humpback, fin, sei, and blue whales.

There are no reported sightings of pinnipeds in the CNMI (*e.g.,* DON, 2005). The dugong (*Dugong dugon*), also listed under the ESA as Endangered, is distributed throughout most of the Indo-Pacific region between approximately 27° North and south of the equator (Marsh, 2002); it seems unlikely that dugongs have ever inhabited the Mariana Islands (Nishiwaki *et al.,* 1979). There have been some extralimital sightings in Guam, including a single dugong in Cocos Lagoon in 1974 (Randall *et al.,* 1975) and several sightings of an individual in 1985 along the southeastern coast (Eldredge, 2003).

Table 2 below outlines the cetacean species, their habitat and abundance in the proposed project area, and the requested take levels. Additional information regarding the distribution of these species expected to be found in the project area and how the estimated densities were calculated may be found in L–DEO's application.

TABLE 2—THE HABITAT, REGIONAL ABUNDANCE, CONSERVATION STATUS, AND BEST AND MAXIMUM DENSITY ESTIMATES OF MARINE MAMMALS THAT COULD OCCUR IN OR NEAR THE PROPOSED SEISMIC SURVEY AREA IN THE CNMI. *See* TABLES 2 TO 4 IN L–DEO'S APPLICATION FOR FURTHER DETAIL

Species	Habitat	Regional population size [a]	ESA [b]	Density/ 1000 km^2 (best) [c]	Density/ 1000 km^2 (max) [d]
Mysticetes:					
North Pacific right whale (*Eubalaena japonica*)	Pelagic and coastal	Few 100s	EN	0.01	0.01
Humpback whale (*Megaptera novaeangliae*)	Mainly nearshore waters and banks.	938–1107 [e]	EN	0.01	0.02
Minke whale (*Balaenoptera acutorostrata*)	Pelagic and coastal	25,000 [f]	NL	0.01	0.02
Bryde's whale *Balaenoptera brydei*)	Pelagic and coastal	20,000–30,000	NL	0.41	0.62
Sei whale (*Balaenoptera borealis*)	Primarily offshore, pelagic	7,260–12,620 [g]	EN	0.29	0.44
Fin whale (*Balaenoptera physalus*)	Continental slope, mostly pelagic	13.620–18.680 [h].	EN	0.01	0.02
Blue whale (*Balaenoptera musculus*)	Pelagic and coastal	N.A.	EN	0.01	0.02
Odontocetes:					
Sperm whale (*Physeter macrocephalus*)	Usually pelagic and deep seas	29,674 [i]	EN	1.23	1.85
Pygmy sperm whale (*Kogia breviceps*)	Deep waters off shelf	N.A.	NL	2.91	4.37
Dwarf sperm whale (*Kogia sima*)	Deep waters off the shelf	11,200 [j]	NL	7.14	10.71
Cuvier's beaked whale (*Ziphius cavirostris*)	Pelagic	20,000 [j]	NL	6.21	9.32
Longman's beaked whale (*Indopacetus pacificus*)	Deep water	N.A.	NL	0.41	0.62
Blainville's beaked whale (*Mesoplodon densirostris*)	Pelagic	25,300 [k]	NL	1.17	1.76
Ginkgo-toothed beaked whale (*Mesoplodon ginkgodens*).	Pelagic	N.A.	NL	0.01	0.02
Rough-toothed dolphin (*Steno bredanensis*)	Deep water	146,000 ETP [j]	NL	0.29	0.44
Common bottlenose dolphin (*Tursiops truncatus*)	Coastal and oceanic, shelf break	243,500 ETP [j]	NL	0.21	0.32
Pantropical spotted dolphin (*Stenella attenuata*)	Coastal and pelagic	800,000 ETP [j]	NL	22.60	33.90
Spinner dolphin (*Stenella longirostris*)	Coastal and pelagic	800,000 ETP [j]	NL	3.14	4.71
Striped dolphin (*Stenella coeruleoalba*)	Off continental shelf	1,000,000 ETP [j]	NL	6.16	9.24
Fraser's dolphin (*Lagenodelphis hosei*)	Waters greater than 1,000 m	289,000 ETP [j]	NL	4.17	6.26
Short-beaked common dolphin (*Delphinus delphis*)	Shelf and pelagic, seamounts	3,000,000 ETP [j]	NL	0.01	0.01
Risso's dolphin (*Grampus griseus*)	Waters greater than 1,000 m, seamounts.	175,000 ETP [j]	NL	0.97	1.46
Melon-headed whale (*Peponocephala electra*)	Oceanic	45,000 ETP [j]	NL	4.28	6.42
Pygmy killer whale (*Feresa attenuata*)	Deep, pantropical waters	39,000 ETP [j]	NL	0.14	0.21
False killer whale (*Pseudorca crassidens*)	Pelagic	40,000 [j]	NL	1.11	0.21
Killer whale (*Orcinus orca*)	Widely distributed	8,500 ETP [j]	NL	0.14	0.21
Short-finned pilot whale (*Globicephala macrorhynchus*).	Mostly pelagic, high-relief topography.	500,000 ETP [j]	NL	1.59	2.39
Sirenians: Dugong (*Dugong dugon*)	Coastal	N.A.	EN	N.A.	N.A.

N.A.—Data not available or species status was not assessed,
[a] North Pacific (Jefferson *et al.,* 2008) unless otherwise indicated.
[b] U.S. Endangered Species Act: EN = Endangered, NL = Not listed.
[c] Best estimate as listed in Table 3 of the application.
[d] Maximum estimate as listed in Table 3 of the application.
[e] Western North Pacific (Calambokidis *et al.,* 2008).
[f] Northwest Pacific and Okhotsk Sea (IWC, 2007a).
[g] North Pacific (Tillman, 1977).
[h] North Pacific (Ohsumi and Wada, 1974).
[i] Western North Pacific (Whitehead, 2002b).
[j] Eastern Tropical Pacific = ETP (Wade and Gerrodette, 1993).
[k] ETP; all *Mesoplodon* spp. (Wade and Gerodette, 1993).

Potential Effects on Marine Mammals

Potential Effects of Airgun Sounds

The effects of sounds from airguns might result in one or more of the following: tolerance, masking of natural sounds, behavioral disturbances, 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 especially permanent hearing impairment, or any significant non-auditory physical or physiological effects. Some behavioral disturbance is expected, but this would be localized and short-term. NMFS concurs with this determination.

The root mean square (rms) received levels that are used as impact criteria for marine mammals are not directly comparable to the peak or peak-to-peak values normally used to characterize source levels of airgun arrays. The measurement units used to describe airgun sources, peak or peak-to-peak decibels, are always higher than the rms decibels referred to in biological literature. A measured received level of 160 dB rms in the far field would typically correspond to a peak measurement of approximately 170 to 172 dB, and to a peak-to-peak measurement of approximately 176 to 178 dB, as measured for the same pulse received at the same location (Greene, 1997; McCauley *et al.,* 1998, 2000a). The precise difference between rms and peak or peak-to-peak values 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 for an airgun-type source.

Tolerance

Numerous studies have shown that pulsed sounds from airguns are often readily detectable in the water at distances of many kilometers. For a summary of the characteristics of airgun pulses, *see* Appendix B (3) of the EA. Numerous studies have shown that marine mammals at distances more than a few kilometers from operating seismic vessels often show no apparent response—*see* Appendix B (5) of L–DEO's application. That is often true even in cases when the pulsed sounds must be readily audible to the animals based on measured received levels and the hearing sensitivity of the 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 are cetaceans, with relative responsiveness of baleen and toothed whales being variable.

Masking

Obscuring of sounds of interest by interfering sounds, generally at similar frequencies, is known as 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 few specific data of relevance. 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 exceptional situations, reverberation occurs for much or all of the interval between pulses (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. The airgun sounds are pulsed, with quiet periods between the pulses, and whale calls often can be heard between the seismic pulses (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; Dunn *et al.,* 2009). In the northeast Pacific Ocean, blue whale calls have been recorded during a seismic survey off Oregon (McDonald *et al.,* 1995). Clark and Gagnon (2006) reported that fin whales in the northeast Pacific Ocean went silent for an extended period starting soon after the onset of a seismic survey in the area. Similarly, there has been one report that sperm whales ceased calling when exposed to pulses from a very distant seismic ship (Bowles *et al.,* 1994). However, more recent studies found that they continued calling the presence of seismic pulses (Madsen *et al.,* 2002; Tyack *et al.,* 2003; Smultea *et al.,* 2004; Holst *et al.,* 2006; Jochens *et al.,* 2008). Dolphins and porpoises commonly are heard calling while airguns are operating (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 the dominant components of airgun sounds, thus limiting the potential for masking. In general, masking effects of seismic pulses are expected to be minor, given the normally intermittent nature of seismic pulses. Masking effects on marine mammals are discussed further in Appendix B (4) of the L–DEO EA.

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 (Richardson *et al.,* 1995; Wartzok *et al.,* 2004; Southall *et al.,* 2007; Weilgart, 2007). If a marine mammal does react to an underwater sound by changing its behavior or moving a small distance, the response may or may not rise to the level of "harassment" to the individual, or affect the stock or the species population as a whole. 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 are likely to be present within a particular distance of industrial activities, and/or exposed to a particular level of industrial sound. In most cases, this practice potentially overestimates the numbers of marine mammals that would be affected in some biologically-important manner.

The sound exposure 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 several species. However, information is lacking for many species. Detailed studies have been done on humpback, gray, bowhead, and sperm whales. Less detailed data are available for some other species of baleen whales, small toothed whales, and sea otters, 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 the L–DEO EA, baleen whales exposed to strong noise pulses from airguns often react by deviating from their normal migration route and/or interrupting their feeding activities and moving away from the sound source. In the case of the 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 demonstrated that seismic pulses with received levels of 160 to 170 dB re 1 μPa (rms) seem to cause obvious avoidance behavior in a substantial fraction of the animals exposed (Richardson *et al.,* 1995). In many areas, seismic pulses from large arrays of airguns diminish to those levels at distances ranging from 4 to 15 km (2.8 to 9 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(5) of the L–DEO 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 to 170 dB re 1 μPa (rms).

Responses of humpback whales to seismic surveys have been studied during migration, on the 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, 2,678 in^3 array, and to a single 20 in^3 airgun with a source level of 227 dB re 1 μPam peak-to-peak. McCauley *et al.* (1998) documented that initial avoidance reactions began at 5 to 8 km (3.1 to 5 mi) from the array, and that those reactions kept most pods approximately 3 to 4 km (1.9 to 2.5 mi) from the operating seismic boat. McCauley *et al.* (2000a) noted localized displacement during migration of 4 to 5 km (2.5 to 3.1 mi) by traveling pods and 7 to 12 km (4.3 to 7.5 mi) by cow-calf pairs. Avoidance distances with respect to the single airgun were smaller (2 km [1.2 mi]) but consistent with the results from the full array in terms of received sound levels. The mean received level for initial avoidance of an approaching airgun was 140 dB re 1 μPa (rms) for humpback whale pods containing females, and at the mean closest point of approach (CPA) distance the received level was 143 dB re 1 μPa (rms). The initial avoidance response generally occurred at distances of 5 to 8 km (3.1 to 5 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 to 400 m (328 to 1,312 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). Some humpbacks seemed "startled" at received levels of 150 to 169 dB re 1 μPa on an approximate rms basis. Malme *et al.* (1985) concluded that there was no clear evidence of avoidance, despite the possibility of subtle effects, at received levels up to 172 re 1 μPa 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 results from 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 the 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 to 30 km (12.4 to 18.6 mi) from a medium-sized airgun source at received sound levels of around 120 to 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.,* 2005a; 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 a received level of about 152 to 178 dB re 1 μPa (rms) (Richardson *et al.,* 1986, 1995; Ljungblad *et al.,* 1988; Miller *et al.,* 2005a).

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. Malme *et al.* (1986, 1988) estimated, based on small sample sizes, that 50 percent of feeding gray whales ceased 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 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 with observations of Western Pacific gray whales feeding off Sakhalin Island, Russia, when a seismic survey was underway just offshore of their feeding area (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, Bryde's, and minke whales) have occasionally been reported in areas ensonified by airgun pulses (Stone, 2003; MacLean and Haley, 2004; Stone and Tasker, 2006), and calls from blue and fin whales have been localized in areas with airgun operations (*e.g.* McDonald *et al.,* 1995; Dunn *et al.,* 2009). 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 and not shooting (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 vs. 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 direction during seismic vs. non-seismic periods (Moulton *et al.,* 2005, 2006a,b).

Data on short-term reactions (or lack of reactions) of 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 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 (*see* 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 prior 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 or the EA have been reported for toothed whales. However, recent systematic studies on sperm whales have been done (Gordon *et al.,* 2006; Madsen *et al.,* 2006; Winsor and Mate, 2006; Jochens *et al.,* 2008; Miller *et al.,* 2009). There is an increasing amount of information about responses of various odontocetes to seismic surveys based on monitoring studies (*e.g.,* Stone, 2003; Smultea *et al.,* 2004; Moulton and Miller, 2005; Bain and Williams, 2006; Holst *et al.,* 2006; Stone and Tasker, 2006; Potter *et al.,* 2007; Hauser *et al.,* 2008; Holst and Smultea, 2008; Weir, 2008; Barkaszi *et al.,* 2009; Richardson *et al.,* 2009).

Seismic operators and observers on seismic vessels regularly *see* dolphins and other small toothed whales near operating airgun arrays, but in general there seems to be a tendency for most delphinids to show some avoidance of operating seismic vessels (Goold, 1996a,b,c; Calambokidis and Osmek, 1998; Stone, 2003; Moulton and Miller, 2005; Holst *et al.,* 2006; Stone and Tasker, 2006; Weir, 2008; Richardson *et al.,* 2009; Barkaszi *et al.,* 2009). However, 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 airgun arrays are firing (Moulton and Miller, 2005). Nonetheless, there have been indications that 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 (Stone and Tasker, 2006; Weir, 2008). In most cases, the avoidance radii for delphinids appear to be small, on the order of 1 km (0.62 mi) or less, and some individuals show no apparent avoidance. The beluga is a species that (at least at times) shows long-distance avoidance of seismic vessels. Aerial surveys during seismic operations in the southeastern Beaufort Sea during summer found that sighting rates of beluga whales were significantly lower at distances 10 to 20 km (6.2 to 12.4 mi) compared with 20 to 30 km (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 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; Finneran and Schlundt, 2004). However, the animals tolerated high received levels of sound before exhibiting aversive behaviors.

Results for porpoises depend on species. The limited available data suggest that harbor porpoises show stronger avoidance of seismic operations than do Dall's porpoises (Stone, 2003; 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 operations 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 in general (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 (Stone, 2003; Moulton *et al.,* 2005, 2006a; Stone and Tasker, 2006; Weir, 2008). In most cases, the whales do not show strong avoidance and continue to call (*see* Appendix B in the L–DEO EA). However, controlled exposure experiments in the Gulf of Mexico indicate that foraging behavior was altered upon exposure to airgun sounds (Jochens *et al.,* 2008; Miller *et al.,* 2009; Tyack, 2009).

There are almost no specific data on the behavioral reactions of beaked whales to seismic surveys. However, northern bottlenose whales (*Hyperodon ampullatus*) 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 (Wursig *et al.,* 1998). They may also dive for an extended period when approached by a vessel (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). It is likely that these beaked whales would normally show strong avoidance of an approaching seismic vessel, but this has not been documented explicitly.

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

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 will be developing new noise exposure criteria for marine mammals that take account of the now-available scientific data on temporary threshold shift (TTS), the expected offset between the TTS and permanent threshold shift (PTS) thresholds, differences in the acoustic frequencies to which different marine mammal groups are sensitive, and other relevant factors. Detailed recommendations for new science-based noise exposure criteria were published in late 2007 (Southall *et al.,* 2007).

Several aspects of the planned monitoring and mitigation measures for this project (*see* below) 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. In addition, many cetaceans are likely to 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 may 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 especially unlikely that any effects of these types would occur during the present project given the brief duration of exposure of any given mammal, the deep water in the study area, and the proposed 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 is the mildest form of hearing impairment that can occur during exposure to a strong sound (Kryter, 1985). While experiencing TTS, the hearing threshold rises and a sound must be stronger in order to be heard. At least in terrestrial mammals, TTS can last from minutes or hours to (in cases of strong TTS) days. For sound exposures at or somewhat above the TTS threshold, hearing sensitivity in both terrestrial and marine mammals recovers rapidly after exposure to the noise ends. Few data on sound levels and durations necessary to elicit mild TTS have been obtained for marine mammals, and none of the published data concern TTS elicited by exposure to multiple pulses of sound. Available data on TTS in marine mammals are summarized in Southall *et al.* (2007). Based on these data, the received energy level of a single seismic pulse (with no frequency weighting) might need to be approximately 186 dB re 1 μPa²·s (*i.e.,* 186 dB SEL or approximately 196 to 201 re 1 μPa [rms]) in order to produce brief, mild TTS. Exposure to several strong seismic pulses that each have received levels near 190 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; however, this 'equal energy' concept is an oversimplification. The distance 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 of L–DEO's application and above. Levels greater than or equal to 190 dB re 1 μPa (rms) are expected to be restricted to radii no more than 400 m. 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. For the one harbor porpoise tested, the received level of airgun sound that elicited onset of TTS was lower (Lucke *et al.,* 2009). If these results from a single animal are representative, it is inappropriate to assume that onset of TTS occurs at similar received levels in all odontocetes (Southall *et al.,* 2007). Some cetaceans apparently can incur TTS at considerably lower sound exposures than are necessary to elicit TTS in the beluga or bottlenose dolphin.

For baleen whales, there are no data, direct or indirect, on levels or properties of sound required to induce TTS. The frequencies to which baleen whales are most sensitive are lower than those to which odontocetes are more 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 relatively low abundance of baleen whales expected in the planned study areas;

(2) The strong likelihood that baleen whales would avoid the approaching airguns (or vessel) before being exposed to levels high enough for there to be any possibility of TTS; and

(3) The mitigation measures that are planned.

To avoid the potential for injury, 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. This sound level is not considered to be the level above which TTS might occur. Rather, it was 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 cetaceans. 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 stronger than 190 dB re 1 μPa (rms).

Permanent Threshold Shift—When PTS occurs, there is physical damage to the sound receptors in the ear. In severe cases, there can be total or partial deafness, whereas in other cases, the animal has an impaired ability to hear sounds in specific frequency ranges (Kryter, 1985).

There is no specific evidence that exposure to pulses of airgun sound can cause PTS in any marine mammal, even with large arrays of airguns. However, given the possibility that mammals close to an airgun array might incur at least mild TTS, there has been further speculation about the possibility that some individuals occurring very close to airguns might incur PTS (Richardson *et al.,* 1995; Gedamke *et al.,* 2008). Single or occasional occurrences of mild TTS are not indicative of permanent auditory damage, but repeated or (in some cases) single exposures to a level well above that causing TTS onset might elicit PTS.

Relationships between TTS and PTS thresholds have not been studied in marine mammals, but are assumed to be similar to those in humans and other terrestrial mammals. 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 the L–DEO 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) 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 an M-weighted SEL (for the sequence of received pulses) of approximately 198 dB re 1 μPa²·s (15 dB higher than the M_{mf}-weighted TTS threshold, in a beluga, for a watergun impulse), where the SEL value is cumulated over the sequence of pulses.

Southall *et al.* (2007) also note that, regardless of the SEL, there is concern about the possibility of PTS if a cetacean or pinniped receives one or more pulses with peak pressure exceeding 230 or 218 dB re 1 μPa (peak), respectively. Thus PTS might be expected upon exposure of cetaceans to either SEL greater than or equal to 198 dB re 1 μPa²·s or peak pressure greater than or equal to 230 dB re 1 μPa. Corresponding proposed dual criteria for pinnipeds (at least harbor seals) are greater than or equal to 186 dB SEL and greater than or equal to 218 dB peak pressure (Southall *et al.,* 2007). These estimates are all first approximations, given the limited underlying data, assumptions, species differences, and evidence that the "equal energy" model may not be entirely correct. A peak pressure of 230 dB re 1 μPa (3.2 bar · m, 0-pk), which would only be found within a few meters of the largest (360 in³) airguns 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 near-field 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 could occur. Baleen whales generally avoid the immediate area around operating seismic vessels, as do some other marine mammals. The planned monitoring and mitigation measures, including visual monitoring, passive acoustic monitoring (PAM) to complement visual observations (if practicable), power-downs, and shut-downs of the airguns when mammals are seen within or approaching the EZs will further reduce the probability of exposure of marine mammals to sounds strong enough to induce PTS.

Strandings and Mortality—Marine mammals close to underwater detonations of high explosives can be killed or severely injured, and their auditory organs are especially susceptible to injury (Ketten *et al.,* 1993; Ketten, 1995). However, explosives are no longer used for marine waters for commercial seismic surveys or (with rare exceptions) for seismic research; they 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 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 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 (Hildebrand, 2005; Southall *et al.,* 2007). Appendix B(6) of the L–DEO 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 vetibular response leading to a behavioral change or stress-induced hemorrhagic diathesis, leading in turn to tissue damage; and

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

Some of these mechanisms are unlikely to apply in the case of impulse sounds. However, there are 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. 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 operate at frequencies of 2 to 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 (at least indirectly) to physical damage and mortality (Balcomb and Claridge, 2001; NOAA and USN, 2001; Jepson *et al.,* 2003; Fernández *et al.,* 2004, 2005a; 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) was not well founded based on available data (IAGC, 2004; IWC, 2007b). In September 2002, there was a stranding of two Cuvier's beaked whales in the Gulf of California, Mexico, when the L–DEO vessel R/V *Maurice Ewing* (*Ewing*) was operating a 20 airgun, 8,490 in^3 array in the general area. The link between the stranding and the seismic survey 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 when 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.

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

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

Potential Effects of Other Acoustic Devices—MBES Signals

The Kongsberg EM 122 MBES will be operated from the source vessel during the planned study. Sounds from the MBES are very short pulses, occurring for 2 to 15 ms once every 5 to 20 s, depending on water depth. Most of the energy in the sound pulses emitted by the MBES is at frequencies centered at 12 kHz, and the maximum source level is 242 dB re 1 μPa (rms). The beam is narrow (1 to 2°) in fore-aft extent and wide (150°) in the cross-track extent. Each ping consists of eight (in water greater than 1,000 m deep) or four (greater than 1,000 m deep) successive fan-shaped transmissions (segments) at different cross-track angles. Any given mammal at depth near the trackline would be in the main beam for only one or two of the nine segments. Also, marine mammals that encounter the MBES are unlikely to be subjected to repeated pulses because of the narrow fore-aft width of the beam and will receive only limited amounts of pulse energy because of the short pulses. Animals close to the ship (where the beam is narrowest) are especially unlikely to be ensonified for more than one 2 to 15 ms pulse (or two pulses if in the overlap area). Similarly, Kremser *et al.* (2005) noted that the probability of a cetacean swimming through the area of exposure when 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 in order to receive the multiple pulses that might result in sufficient exposure to cause TTS. Burkhardt *et al.* (2007) concluded that immediate direct auditory injury was possible only if a cetacean dived under the vessel into the immediate vicinity of the transducer.

Navy sonars that have been linked to avoidance reactions and stranding of cetaceans (1) generally have a longer pulse duration that the Kongsberg EM 122, and (2) are often directed close to horizontally vs. more downward for the MBES. 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 a Navy sonar. During L–DEO's operations, the individual pulses will be very short, and a given marine mammal would not receive many of the downward-directed pulses as the vessel passes by.

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

Behavioral reactions of free-ranging marine mammals to sonars, echosounders, and other sound sources appear to vary by species and circumstance. Observed reactions have included silencing and dispersal by sperm whales (Watkins *et al.,* 1985), increased vocalizations and no dispersal by pilot whales (Rendell and Gordon, 1999), and the previously-mentioned beachings by beaked whales. During exposure to a 21 to 25 kHz "whale-finding" sonar with a source level of 215 dB re 1 μPam, gray whales reacted by orienting slightly away from the source and being deflected from their course by approximately 200 m (656 ft) (Frankel, 2005). When a 38 kHz echosounder and a 150 kHz acoustic Doppler current profiler were transmitting during studies in the Eastern Tropical Pacific, baleen whales showed no significant responses, while spotted and spinner dolphins were detected slightly more often and beaked whales less often during visual surveys (Gerrodette and Pettis, 2005).

Captive bottlenose dolphins and a beluga whale exhibited changes in behavior when exposed to 1 s tonal signals at frequencies similar to those that will be emitted by the 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 either duration as compared with those from an MBES.

NMFS believes that the brief exposure of marine mammals to one pulse, or small numbers of signals, from the MBES are not likely to result in the harassment of marine mammals.

Potential Effects of Other Acoustic Devices—SBP Signals

A SBP will be operated from the source vessel during the planned study. Sounds from the SBP are very short pulses, occurring for 1 to 4 ms once every second. Most of the energy in the sound pulses emitted by the SBP is at 3.5 kHz, and the cone-shaped beam is directed downward. The SBP on the *Langseth* has a maximum source level of 204 dB re 1 μPam. 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 in order to be subjected to sound levels that could cause TTS.

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

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. The pulsed signals from the SBP are somewhat weaker than those from the MBES. Therefore, behavioral responses are not expected unless marine mammals are very close to the source.

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 operated simultaneously with other higher-power acoustic sources, including the airguns. Many marine mammals will move away in response to the approaching higher-power sources or the vessel itself before the mammals would be close enough for there to be any possibility of effects from the less intense sounds from the SBP. In the case of mammals that do not avoid the approaching vessel and its various sound sources, monitoring and mitigation measures that would be applied to minimize effects of other sources would further reduce or eliminate any minor effects of the SBP.

NMFS believes that to avoid the potential for permanent physiological damage (Level A harassment), cetaceans and pinnipeds should not be exposed to pulsed underwater noise at received levels exceeding, respectively, 180 and 190 dB re 1 μPa (rms). The precautionary nature of these criteria is discussed in the L–DEO EA, including the fact that the minimum sound level necessary to cause permanent hearing impairment is higher, by a variable and generally unknown amount, than the level that induces barely-detectable TTS and the level associated with the onset of TTS is often considered to be a level below which there is no danger of permanent damage. NMFS also assumes that cetaceans or pinnipeds exposed to levels exceeding 160 dB re 1 μPa (rms) may experience Level B harassment.

Possible Effects of Acoustic Release Signals

The acoustic release transponder used to communicate with the OBSs uses frequencies of 9 to 13 kHz. These signals will be used very intermittently. It is unlikely that the acoustic release signals would have significant effects on marine mammals through masking, disturbance, or hearing impairment. Any effects likely would be negligible given the brief exposure at presumable low levels.

Estimated Take of Marine Mammals by Incidental Harassment

All anticipated takes would be "takes by Level B harassment," involving temporary changes in behavior. The proposed monitoring and mitigation measures are expected to minimize the possibility of injurious takes or mortality. However, as noted earlier, there is no specific information demonstrating that injurious "takes" or mortality would occur even in the absence of the planned mitigation measures. NMFS believes, therefore, that injurious take or mortality to the affected species marine mammals is extremely unlikely to occur as a result of the specified activities within the specified geographic area for which L–DEO seeks the IHA. The sections below describe methods to estimate "take by harassment", and present estimates of the numbers of marine mammals that could be affected during the proposed seismic program. The estimates of "take by harassment" are based on consideration of the number of marine mammals that might be disturbed appreciably by operations with the 36 airgun array to be used during approximately 2,800 km of seismic surveys in the CNMI study area. The sources of distributional and numerical data used in deriving the estimates are described below.

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 and 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. Such reactions are not considered to constitute "taking" (NMFS, 2001). Therefore, no additional allowance is included for animals that could be affected by sound sources other than airguns.

The only systematic marine mammal survey conducted in the CNMI was a ship-based survey conducted by the U.S. Navy during January to April, 2007 in four legs: January 16 to February 2, February 6 to 25, March 1 to 20, and March 24 to April 12 (SRS—Parsons *et al.,* 2007). The cruise area was defined by the boundaries 10° to 18° North, 142° to 148° East, encompassing an area approximately 585,000 km² including the islands of Guam and the southern CNMI almost as far north as Pagan. The systematic line-transect survey effort was conducted from the flying bridge (10.5 m or 34.5 ft above sea level) of the 56 m (183.7 ft) long M/V *Kahana* using standard line-transect protocols developed by NMFS Southwest Fisheries Science Center (SWFSC). Observers visually surveyed 11,033 km (6,855.6 mi) of tracklines, mostly in high sea states (88 percent of the time in Beaufort Sea states 4 to 6).

L–DEO used the densities calculated in SRS—Parsons *et al.* (2007) for the 12 species sighted in that survey. For eight species not sighted in that survey, but expected to occur in the CNMI, relevant densities are available for the "outer EEZ stratum" of Hawaiian waters, based on a 13,500 km (mi) survey conducted by NMFS SWFSC in August to November, 2002 (Barlow, 2006). Another potential source of relevant densities is the SWFSC surveys conducted in the ETP during summer/fall 1986 to 1996 (Ferguson and Barlow, 2001). However, for five of the remaining seven species that could occur in the survey area, there were no sightings in offshore tropical strata during those surveys, and for another (the humpback whale), there was only one sighting in more than 50 offshore tropical (less than 20° latitude) 5° x 5° strata. For those six species, an arbitrary low density was assigned. The short-beaked common dolphin was sighted in a number of offshore tropical strata, so its density was calculated as the mean of densities in the 17 offshore 5° x 5° strata between 10° North and 20° North.

The densities mentioned above had been corrected, by the original authors, for detectability bias, and in two of the three areas, for availability bias. Detectability bias is associated with diminishing sightability with increasing lateral distance from the track line [$f(0)$]. Availability bias refers to the fact that there is less than 100 percent probability of sighting an animal that is present along the survey track line, and it is measured by g(0). SRS—Parsons *et al.* (2007) did not correct the Marianas densities for g(0), which for all but large (greater than 20) groups of dolphins [where g(0) = 1], resulted in underestimates of density.

There is some uncertainty about the representativeness of the density data and the assumptions used in the calculations. For example, the timing of the surveys was either before (Marianas) or after (Hawaii and ETP) the proposed surveys. Also, most of the Marianas survey was in high sea states that would have prevented detection of many marine mammals, especially cryptic species such as beaked whales and *Kogia* spp. However, the approach used here is believed to be the best available approach. To provide some allowance for these uncertainties, particularly underestimates of densities present and numbers of marine mammals potentially affected have been derived; maximum estimates are 1.5x the best estimates. Densities calculated or estimated as described above are given in Table 3 of L–DEO's application.

The estimated numbers of individuals potentially exposed are based on the 160 dB re 1 Pa (rms) Level B harassment exposure threshold for all cetaceans, *see* Table 4 of L–DEO's application. It is assumed that the species of marine mammals affected by the proposed survey, if exposed to airgun sounds at these levels, might change their behavior sufficiently to be considered "take by Level B harassment."

It should be noted that the following estimates of exposures to various sound levels and related incidental takes by Level B harassment assume that the proposed marine geophysical surveys will be completed. As is typical during offshore ship surveys, inclement weather and equipment malfunctions are likely to cause delays and may limit the number of useful line-km of seismic operations that can be undertaken. Furthermore, any marine mammals sightings within or near the designated EZs will result in the power-down or shut-down of seismic operations as a mitigation measure. Thus the following estimates of the numbers of marine mammals potentially exposed to 160 dB re 1 μPam (rms) sounds are precautionary and probably overestimate the actual numbers of marine mammals that might be involved. These estimates assume that there will be no weather, equipment, or mitigation delays, which is highly unlikely.

Table 4 of L–DEO's application shows the best and maximum estimated number of exposures and the number of different individuals potentially exposed during the seismic survey if no animals moved away from the survey vessel. The requested take authorization, given in the far right column of Table 4 of L–DEO's application, is based on the maximum estimates rather than the best estimates of the numbers of individuals exposed, because of uncertainties associated with applying density data from one area to another.

The number of different individuals that may be exposed to airgun sounds with received levels ≥160 dB re 1 μPa (rms) on one or more occasions was 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. The number of possible exposures (including repeated exposures of the same individuals) can be estimated by considering the total marine area that would be within the 160 dB radius around the operating airguns, including areas of overlap. In the proposed survey, the seismic lines are widely spaced in the proposed survey area, so an individual mammal would most likely not be exposed numerous times during the survey; the area including overlap is only 1.4x the area excluding overlap. Moreover, it is unlikely that a particular animal would stay in the area during the entire survey.

The number of different individuals potentially exposed to received levels ≥160 dB re 1 μPa (rms) was calculated by multiplying:

- The expected species density, either "mean" (*i.e.,* best estimate) or "maximum," times,
- The anticipated minimum area to be ensonified to that level during airgun operations excluding overlap (exposures), or
- The anticipated area to be ensonified to that level during airgun operations excluding overlap (individuals).

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 (*see* Table 1 of L–DEO's application) around each seismic line, and then calculating the total area within the buffers. Areas where overlap were included only once when estimating the number of individuals exposed.

Applying the approach described above, approximately 15,685 km^2 (6,056 mi^2) would be within the 160 dB isopleth on one or more occasions during the survey, where as 21,415 km^2 (8,268.4 mi^2) is the area ensonified to greater than or equal to 160 dB when overlap is included. Because this approach does not allow for turnover in the mammal populations in the study area during the course of the survey, the actual number of individuals exposed could be underestimated. However, the approach assumes that no cetaceans will move away from or toward the trackline as the *Langseth* approaches in response to increasing sound levels prior to the time the levels reach 160 dB, which will result in overestimates for those species known to avoid seismic vessels.

TABLE 3—THE ESTIMATES OF THE POSSIBLE NUMBERS OF MARINE MAMMALS EXPOSED TO SOUND LEVELS GREATER THAN OR EQUAL TO 160 dB DURING L–DEO'S PROPOSED SEISMIC SURVEY IN THE CNMI IN APRIL TO JUNE, 2010*

Species	No. of individuals exposed (best) [1]	No. of individuals exposed (max) [1]	Approx. percent of regional population (best) [2]
Mysticetes:			
North Pacific right whale *(Eubalaena japonica)*	0	1	0
Humpback whale *(Megaptera novaeangliae)*	0	2	0
Minke whale *(Balaenoptera acutorostrata)*	0	0	0
Bryde's whale *(Balaenoptera brydei)*	6	10	0.03
Sei whale *(Balaenoptera borealis)*	5	7	0.05
Fin whale *(Balaenoptera physalus)*	0	2	0
Blue whale *(Balaenoptera musculus)*	0	2	0
Odontocetes:			
Sperm whale *(Physeter macrocephalus)*	19	29	0.07
Pygmy sperm whale *(Kogia breviceps)*	46	68	N.A.
Dwarf sperm whale *(Kogia sima)*	112	168	<0.01
Cuvier's beaked whale *(Ziphius cavirostris)*	97	146	0.49
Longman's beaked whale *(Indopacetus pacificus)*	9	13	N.A.
Blainville's beaked whale *(Mesoplodon densirostris)*	18	28	0.07
Ginkgo-toothed beaked whale *(Mesoplodon ginkgodens)*	0	0	N.A.
Rough-toothed dolphin *(Steno bredanensis)*	5	7	<0.01
Bottlenose dolphin *(Tursiops truncatus)*	3	5	<0.01
Pantropical spotted dolphin *(Stenella attenuata)*	355	532	0.04
Spinner dolphin *(Stenella longirostris)*	49	74	<0.01
Striped dolphin *(Stenella coeruleoalba)*	97	145	0.01
Fraser's dolphin *(Lagenodelphis hosei)*	65	98	0.02
Short-beaked common dolphin *(Delphinus delphis)*	0	0	0

TABLE 3—THE ESTIMATES OF THE POSSIBLE NUMBERS OF MARINE MAMMALS EXPOSED TO SOUND LEVELS GREATER THAN OR EQUAL TO 160 dB DURING L–DEO'S PROPOSED SEISMIC SURVEY IN THE CNMI IN APRIL TO JUNE, 2010*—Continued

Species	No. of individuals exposed (best) [1]	No. of individuals exposed (max) [1]	Approx. percent of regional population (best) [2]
Risso's dolphin (*Grampus griseus*)	15	23	0.01
Melon-headed whale (*Peponocephala electra*)	67	101	0.15
Pygmy killer whale (*Feresa attenuata*)	2	3	<0.01
False killer whale (*Pseudorca crassidens*)	17	26	<0.01
Killer whale (*Orcinus orca*)	2	3	0.04
Short-finned pilot whale (*Globicephala macrorhynchus*)	25	37	<0.01
Sirenians: Dugong (*Dugong dugon*)	0	0	N.A.

* The proposed sound source consists of a 36 airgun, 6,600 in³ array. Received levels are expressed in dB re 1 μPa (rms) (averaged over pulse duration), consistent with NMFS' practice. Not all marine mammals will change their behavior when exposed to these sound levels, but some may alter their behavior when levels are lower (*see* text). *See* Tables 2 to 4 in L–DEO's application for further detail.
N.A.—Data not available or species status was not assessed
[1] Best estimate and maximum density estimates are from Table 3 of L–DEO's application.
[2] Regional population size estimates are from Table 2.

Table 4 of L–DEO's application shows the best and maximum estimates of the number of exposures and the number of different individual marine mammals that potentially could be exposed to greater than or equal to 160 dB re 1 μPa (rms) during the seismic survey if no animals moved away from the survey vessel. For ESA listed species, the maximum estimate and Requested Take Authorization have been increased to the mean group size for the particular species in cases where the calculated maximum number of individuals exposed was between 0.05 and the mean group size (*i.e.,* for North Pacific, right, humpback, fin, and blue whales).

The "best estimate" of the total number of individual marine mammals that could be exposed to seismic sounds with received levels greater than or equal to 160 dB re 1 μPa (rms) during the survey is 1,011 animals and is shown in Table 4 of L–DEO's application and Table 3 (shown above). These estimates were derived from the best density estimates calculated for these species in the area. That total includes 11 baleen whales, five of which are ESA-listed sei whales, or 0.05 percent of the regional population. In addition, 19 ESA-listed sperm whales or 0.07 percent of the regional population could be exposed during the survey, and 121 beaked whales including Cuvier's, Longman's, and Blainville's beaked whales. Most (69.4 percent) of the cetaceans exposed are delphinids; pantropical spotted, striped, and Fraser's dolphins and melon-headed whales are estimated to be the most common species in the area, with best estimates of 355 (0.04 percent of the regional population), 97 (0.01 percent), 65 (0.02 percent), and 67 (0.15 percent) exposed to greater or equal to 160 dB re 1 μPa (rms) respectively.

Potential Effects on Marine Mammal Habitat

The proposed L–DEO seismic survey will not result in any permanent impact on habitats used by marine mammals, including 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, as described 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 EA, respectively.

Potential Effects on Fish

One reason for the adoption of airguns as the standard energy source for marine seismic surveys is that, unlike explosives, they have not been associated with large-scale fish kills. However, existing information on the impacts of seismic surveys on marine fish populations is limited (*see* Appendix D of the EA). There are three types of potential effects on fish and invertebrates from 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 potentially could lead to an ultimate pathological effect on individuals (*i.e.,* mortality).

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

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

Pathological Effects—The potential for pathological damage to hearing structures in fish depends on the energy level of the received sound and the physiology and hearing capability of the species in question (*see* Appendix D of the L–DEO 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. There are only two known valid papers with proper experimental methods, controls, and careful pathological investigation implicating sounds produced by actual seismic survey airguns with adverse anatomical effects. One such study indicated anatomical damage and the second indicated TTS in fish hearing. The anatomical case is McCauley *et al.* (2003), who found that exposure to airgun sound caused observable anatomical damage to the auditory maculae of "pink snapper" (*Pagrus auratus*). This damage in the ears had not been repaired in fish sacrificed and examined almost two months after exposure. On the other hand, Popper *et al.* (2005) documented only TTS (as determined by auditory brainstem response) in two of three fish species from the Mackenzie River Delta. This study found that broad whitefish (*Coregonus nasus*) that received a sound exposure level of 177 dB re 1 $\mu Pa^2 \cdot s$ 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 airgun arrays [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 in the former case and less than 2 m in the latter). Water depth sets a lower limit on the lowest sound frequency that will propagate (the "cut-off frequency") at about one-quarter wavelength (Urick, 1983; Rogers and Cox, 1988).

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

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

Physiological Effects—Physiological effects refer to cellular and/or biochemical responses of fish to acoustic stress. Such stress potentially could affect fish populations by increasing mortality or reducing reproductive success. Primary and secondary stress responses of fish after exposure to seismic survey sound appear to be temporary in all studies done to date (Sverdrup *et al.,* 1994; 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 (*see* Appendix D of the 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; Løkkeborg, 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 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; *see* Appendix E of the L–DEO EA).

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

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

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

Some studies have suggested that seismic survey sound has a limited pathological impact on early developmental stages of crustaceans (Pearson *et al.,* 1994; Christian *et al.,* 2003; DFO, 2004). However, the impacts appear to be either temporary or insignificant compared to what occurs under natural conditions. Controlled field experiments on adult crustaceans (Christian *et al.,* 2003, 2004; DFO, 2004) and adult cephalopods (McCauley *et al.,* 2000a,b) exposed to seismic survey sound have not resulted in any significant pathological impacts on the animals. It has been suggested that exposure to commercial seismic survey activities has injured giant squid (Guerra *et al.,* 2004), but there is no evidence to support such claims.

Physiological Effects—Physiological effects refer mainly to biochemical responses by marine invertebrates to acoustic stress. Such stress potentially could affect invertebrate populations by increasing mortality or reducing reproductive success. Primary and secondary stress responses (*i.e.,* changes in haemolymph levels of enzymes, proteins, *etc.*) of crustaceans have been noted several days or months after exposure to seismic survey sounds (Payne *et al.,* 2007). The periods necessary for these biochemical changes to return to normal are variable and depend on numerous aspects of the biology of the species and of the sound stimulus.

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

During the proposed study, only a small fraction of the available habitat would be ensonified at any given time, and fish species would return to their pre-disturbance behavior once the seismic activity ceased. The proposed seismic program is predicted to have negligible to low behavioral effects on the various life stages of the fish and invertebrates during its relatively short duration and extent.

Because of the reasons noted above and the nature of the proposed activities, the proposed operations are not expected to have any habitat-related effects that could cause significant or long-term consequences for individual marine mammals or their populations or stocks. Similarly, any effects to food sources are expected to be negligible.

Proposed Mitigation

In order to issue an Incidental Take Authorization (ITA) for small numbers of marine mammals under Section 101(a)(5)(D) of the MMPA, NMFS must set forth the permissible methods of taking pursuant to such activity and other means of effecting the least practicable adverse impact on such species or stock and its habitat, paying particular attention to rookeries, mating grounds, and areas of similar significance, and on the availability of such species or stock for taking for certain subsistence uses. As noted, NMFS has determined that the proposed IHA would not impact marine mammals for purposes of their use for subsistence.

Mitigation and monitoring measures and procedures described herein to be implemented for the proposed seismic survey have been developed and refined during previous L–DEO seismic research cruises as approved by NMFS, and associated environmental assessments (EAs), IHA applications, and IHAs, and on recommended best practices in Richardson *et al.* (1995), Pierson *et al.* (1998), and Weir and Dolman (2007). The following information provides more detailed information about the mitigation measures that would be an integral part of the planned activities designed to affect the least practicable impact on stocks and species of affected marine mammals and their habitat. The measures are described in detail below.

Planning Phase

In designing the proposed seismic survey, L–DEO and NSF have considered potential environmental impacts including seasonal, biological, and weather factors; ship schedules; and equipment availability during a preliminary assessment carried out when ship schedules were still flexible. Part of the considerations was whether the research objectives could be met with a smaller source or with a different survey design that involves less prolonged seismic operations.

Proposed Exclusion Zones (EZ)

Received sound levels have been predicted by L–DEO, in relation to distance and direction from the airguns, for the 36 airgun array and for a single 1900LL 40 in^3 airgun, which will be used during power-downs. Results were recently reported for propagation measurements of pulses from the 36 airgun array in two water depths (approximately 1,600 m and 50 m) in the Gulf of Mexico in 2007 to 2008 (Tolstoy *et al.,* 2009). It would be prudent to use the empirical values that resulted to determine EZs for the airgun array. Measurements were not reported for the mitigation airgun, so model results will not be used.

Results of the propagation measurements (Tolstoy *et al.,* 2009) showed that radii around the airguns for various received levels varied with water depth. During the proposed study, all survey effort will take place in deep (greater than 1,000 m) water, so propagation in shallow water is not relevant here. However, the depth of the array was different in the Gulf of Mexico calibration study (6 m or 20 ft) than in the proposed survey (9 m or 30 ft). Because propagation varies with array depth, correction factors have been applied to the distances reported by Tolstoy *et al.* (2009). The correction factors used were the ratios of the 160, 180, and 190 dB distances from the modeled results for the 6,600 in^3 airgun array towed at 6 m and 9 m depths; these distances were used for the L–DEO seismic survey in the Northeast Pacific Ocean (*see* Table 1 in LGL Ltd., 2009). The factors are 1.34 to 1.38 for the 180 to 190 dB distances, and 1.29 for the 160 dB distance. Using the corrected measurements (array) or model (mitigation gun), Table 1 shows the distances at which four rms sound levels are expected to be received from the 36 airgun array and a single airgun. 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 EZs. If the PSVO detects marine mammal(s) within or about to enter the appropriate EZ, the airguns will be powered-down (or shut-down if necessary) immediately (*see* below).

Detailed recommendations for new science-based noise exposure criteria were published in early 2008 (Southall *et al.,* 2007). L–DEO will be prepared to revise its procedures for estimating numbers of mammals "taken," EZs, *etc.,* as may be required by any new guidelines that result. As yet, NMFS has not specified a new procedure for determining EZs. Such procedures, if applicable would be implemented through a modification to the IHA if issued.

Mitigation measures that will be adopted during the proposed CNMI survey include:

(1) Power-down procedures;

(2) Shut-down procedures; and

(3) Ramp-up procedures;

Power-down Procedures—A power-down involves reducing 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 are no longer in or about to enter the EZ. 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 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 (other than right whales [immediate shut-down, *see* end of section]) is detected outside the EZ but is likely to enter the EZ, the airguns will be powered-down to a single airgun before the animal is within the EZ. Likewise, if a mammal 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 is detected within or near the smaller EZ around that single airgun (*see* Table 1 of L–DEO's application and Table 1 above), all airguns will be shut down (*see* next subsection).

Following a power-down, airgun activity will not resume until the marine mammal is outside the EZ for the full array. 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 EZ for 15 minutes in the case for species with shorter dive durations (*e.g.,* small odontocetes); or

(3) Has not been seen within the EZ for 30 minutes in the case for species with longer dive durations (*e.g.,* mysticetes and large odontocetes, including sperm, pygmy sperm, dwarf sperm, killer, and beaked whales).

During airgun operations following a power-down (or shut-down) whose duration has exceeded the limits specified above and subsequent animal departures, the airgun array will be ramped-up gradually. Ramp-up procedures are described below.

Shut-down Procedures—The operating airguns(s) will be shut-down if a marine mammal is detected within or approaching the EZ for a single airgun source. Shut-downs will be implemented (1) if an animal enters the EZ of the single airgun after a power-down has been initiated, or (2) if an animal is initially seen within the EZ of a single airgun when more than one airgun (typically the full array) is operating. Airgun activity will not resume until the marine mammal has cleared the EZ, or until the PSVO is confident that the animal has left the vicinity of the vessel (or the PSVO not observing the animal(s) within the EZ for 15 or 30 min depending upon the species). Criteria for judging that the animal has cleared the EZ will be as described in the preceding subsection.

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 8 minutes. This period is based on the largest modeled 180 dB radius for the 36 airgun array (940 m or 3,084 ft) in relation to the minimum planned speed of the *Langseth* while shooting (7.4 km/hr or 4.6 mi/hr). Similar periods (approximately 8 to 10 minutes) were used during previous L–DEO surveys.

Ramp-up will begin with the smallest airgun in the array (40 in^3). Airguns will be added in a sequence such that the source level of the array will increase in steps not exceeding 6 dB per 5 min period over a total duration of approximately 35 minutes. During ramp-up, the PSVOs will monitor the EZ, and if marine mammals are sighted, a 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 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 marine mammal is sighted within or near the applicable EZ during the day or close to the vessel at night.

Procedures for Species of Particular Concern—One species of particular concern could occur in the study area.

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

Proposed Monitoring and Reporting

In order to issue an ITA for an activity, Section 101(a)(5)(D) of the MMPA states that NMFS must set forth "requirements pertaining to the monitoring and reporting of such taking." The MMPA implementing regulations at 50 CFR 216.104(a)(13) require that requests for IHAs must include the suggested means of accomplishing the necessary monitoring and reporting that will result in increased knowledge of the species and of the level of taking or impacts on populations of marine mammals that are expected to be present.

L–DEO proposes to sponsor marine mammal monitoring during the proposed project, in order to implement the proposed mitigation measures that require real-time monitoring, and to satisfy the anticipated monitoring requirements of the IHA. L–DEO's proposed Monitoring Plan is described below as well as in their IHA application. L–DEO understands that this Monitoring Plan will be subject to review by NMFS, and that refinements may be required as part of the MMPA consultation process.

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

Protected Species Visual Observers (PSVOs) will be based aboard the seismic source vessel and will watch for marine mammals and other protected species near the vessel during daytime airgun operations and during start-ups of airguns at night. PSVOs will also watch for marine mammals near the seismic vessel for at least 30 minutes prior to the start of airgun operations and after an extended shut-down of the airguns. When feasible, PSVOs will also observe during daytime periods when the seismic system is not operating for comparison of sighting rates and animal behavior with vs. without airgun operations. Based on PSVO observations, the airguns will be powered-down or shut-down (*see* below) when marine mammals are detected within or about to enter a designated EZ, and in the case of the North Pacific right whale immediately when any individuals of that species is spotted at any distance. The PSVOs will continue to maintain watch to determine when the animal(s) are outside the EZ in accordance with the criteria established above in the mitigation section, and airgun operations will not resume until the animal has left that EZ. The predicted distances for the safety radius are listed according to the sound source, water depth, and received isopleths in Table 1. The EZ is a region in which a possibility exists of adverse effects on animal hearing or other physical effects.

During seismic operations in CNMI, five PSOs will be based aboard the *Langseth.* PSOs will be appointed by L–DEO with NMFS concurrence. At least one PSVO, and when practical two PSVOs, will monitor for marine mammals and other specified protected species near the seismic vessel during ongoing daytime operations and nighttime start-ups of the airguns. Use of two simultaneous PSVOs will increase the effectiveness of detecting animals near the sound source. PSVO(s) will be on duty in shift of duration no longer than 4 hours. The vessel crew will also be instructed to assist in detecting marine mammals and other specified protected species, and implementing mitigation measures (if practical). 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 observations for marine mammals and other protected species. When stationed on the observation platform, the eye level will be approximately 21.5 m (70.5 ft) above sea level, and the observer will have a good view around the entire vessel. During the daytime, the PSVO(s) will scan the area around the vessel systematically with reticle binoculars (*e.g.,* 7x50 Fujinon), Big-eye binoculars (25x150), and with the naked eye. During darkness, night vision devices (NVDs) will be available (ITT F500 Series Generation 3 binocular-image 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 PSVOs 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' lenses.

Passive Acoustic Monitoring (PAM)

PAM will take place to complement the visual monitoring program, when practicable. Visual monitoring typically is not effective during periods of poor visibility (*e.g.,* 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, and localization 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 condition 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 is approximately 56 m (184 ft) long. The hydrophone array is typically towed at depths less than 20 m (65.6 ft).

The towed hydrophone array will be monitored 24 hours per day while at the survey area during airgun operations, and during most periods when the *Langseth* is underway while the airguns are not operating. One Protected Species Observer 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. PSOs monitoring the acoustical data will be on a shift for one to six hours. Besides the visual PSOs, an additional PSO with primary responsibility for PAM will also be aboard. All PSOs 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 PSO will contact the PSVO immediately to alert him/her to the presence of the cetacean(s) (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 vocalization 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.

L–DEO will coordinate the planned protected species monitoring program associated with the CNMI seismic survey with other parties that may have interest in the area and/or be conducting marine mammal studies in the same region during the proposed seismic survey. L–DEO and NSF will coordinate with applicable U.S. agencies (*e.g.,* NMFS), and will comply with their requirements.

PSVO Data and Documentation

PSVOs will record data to estimate the numbers of marine mammals exposed to various received sound levels and to document apparent disturbance reactions or lack thereof. Data will be used to estimate numbers of animals potentially 'taken' by harassment (as defined in the MMPA). They will also provide information needed to order a power-down or shut-down of the seismic source when a marine mammal is within or near the EZ.

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

(1) Species, group size, and 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 seismic source 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) above 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 seismic source power-downs and shut-downs, will be recorded in a standardized format. The accuracy of data entry will be verified by computerized data validity checks as the data are entered and by subsequent manual checking of the database. These procedures will allow initial summaries of data to be prepared during and shortly after the field program, and will facilitate transfer of the data to statistical, graphical, and other programs for further processing and archiving.

Results for 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 in the area where the seismic study is conducted.

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

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

A report will be submitted to NMFS and NSF within 90 days after the end of the cruise. The report will describe the operations that were conducted and sightings of marine mammals near the operations. The report will be providing full documentation of methods, results, and interpretation pertaining to all monitoring. The 90-day report will summarize the dates and locations of seismic operations, and all marine mammal sightings (dates, times, locations, activities, associated seismic survey activities). The report will also include estimates of the amount and nature of potential "take" of marine mammals by harassment or in other ways.

All injured or dead marine mammals (regardless of cause) will 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.

Negligible Impact and Small Numbers of Marine Mammals Analysis and Determination

The Secretary, in accordance with paragraph 101(a)(5)(D) of the MMPA, shall authorize the take of small numbers of marine mammals incidental to specified activities other than commercial fishing within a specific geographic region if, among other things, he determines that the authorized incidental take will have a "negligible impact" on species or stocks affected by the authorization. NMFS implementing regulations codified at 50 CFR 216.103 states that a "negligible impact is an impact resulting from the specified activity that cannot be reasonably expected to, and is not reasonably likely to, adversely affect the species or stock through effects on annual rates of recruitment or survival."

Based on the analysis contained herein, of the likely effects of the specified activity on marine mammals and their habitat within the specific area of study for the CNMI marine geophysical survey, and taking into consideration the implementation of the mitigation and monitoring measures, NMFS, on behalf the Secretary, preliminarily finds that L–DEO's proposed activities would result in the incidental take of small numbers of marine mammals, by Level B harassment only, and that the total taking from the proposed seismic survey would have a negligible impact on the affected species or stocks of marine mammals.

Impact on Availability of Affected Species for Taking for Subsistence Uses

There is no subsistence hunting for marine mammals in the waters off of the coast of the CNMI that implicates MMPA Section 101(a)(5)(D).

Endangered Species Act (ESA)

Under Section 7 of the ESA, NSF has initiated formal consultation with the NMFS, Office of Protected Resources, Endangered Species Division, on this proposed seismic survey. NMFS Office of Protected Resources, Permits, Conservation and Education Division, has initiated formal consultation under Section 7 of the ESA with NMFS Office of Protected Resources, Endangered Species Division, to obtain a Biological Opinion evaluating the effects of issuing the IHA on threatened and endangered marine mammals and, if appropriate, authorizing incidental take. NMFS will conclude formal Section 7 consultation prior to making a determination on whether or not to issue the IHA. If the IHA is issued, L–DEO will be required to comply with the Terms and Conditions of the Incidental Take Statement corresponding to NMFS' Biological Opinion issued to both NSF and NMFS Office of Protected Resources.

National Environmental Policy Act (NEPA)

With its complete application, L–DEO provided NMFS an EA analyzing the direct, indirect and cumulative environmental impacts of the proposed specified activities on marine mammals including those listed as threatened or endangered under the ESA. The EA, prepared by LGL Environmental Research Associated (LGL) on behalf of NSF and L–DEO is entitled Environmental Assessment of a Marine Geophysical Survey by the R/V *Marcus G. Langseth* in the Commonwealth of the Northern Mariana Islands, April–June 2010 (L–DEO EA). Prior to making a final decision on the IHA application, NMFS will either prepare an independent EA, or, after review and evaluation of the L–DEO EA for consistency with the regulations published by the Council of Environmental Quality (CEQ) and NOAA Administrative Order 216–6, Environmental Review Procedures for Implementing the National Environmental Policy Act, adopt the L–DEO EA and make a decision of whether or not to issue a Finding of No Significant Impact (FONSI).

Preliminary Determinations

NMFS has preliminarily determined that the impact of conducting the specific seismic survey activities described in this notice and the IHA request in the specific geographic region within the U.S. EEZ within the CNMI may result, at worst, in a temporary modification in behavior (Level B harassment) of small numbers of marine mammals. Further, this activity is expected to result in a negligible impact on the affected species or stocks of marine mammals. The provision requiring that the activity not have an unmitigable impact on the availability of the affected species or stock of marine mammals for subsistence uses is not implicated for this proposed action.

For reasons stated previously in this document, the specified activities associated with the proposed survey are not likely to cause TTS, PTS or other non-auditory injury, serious injury, or death to affected marine mammals because:

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

(2) The fact that cetaceans would have to be closer than 940 m (0.6 mi) in deep water when the full array is in use at a 9 m (29.5 ft) tow depth from the vessel to be exposed to levels of sound (180 dB) believed to have even a minimal chance of causing PTS;

(3) The fact that marine mammals would have to be closer than 3,850 m (2.4 mi) in deep water when the full array is in use at a 9 m (29.5 ft) tow depth from the vessel to be exposed to levels of sound (160 dB) believed to have even a minimal chance at causing TTS; and

(4) The likelihood that marine mammal detection ability by trained observers is high at that short distance from the vessel.

As a result, no take by injury, serious injury, or death is anticipated or authorized, and the potential for temporary or permanent hearing impairment is very low and will be avoided through the incorporation of the proposed monitoring and mitigation measures.

While the number of marine mammals potentially incidentally harassed will depend on the distribution and abundance of marine mammals in the vicinity of the survey activity, the number of potential Level B incidental harassment takings (*see* Table 3 above) is estimated to be small, less than a few percent of any of the estimated population sizes based on the data disclosed in Table 2 of this notice, and has been mitigated to the lowest level practicable through incorporation of the monitoring and mitigation measures mentioned previously in this document. Also, there are no known important reproduction or feeding areas in the proposed action area.

Proposed Authorization

As a result of these preliminary determinations, NMFS proposes to issue an IHA to L–DEO for conducting a marine geophysical survey in the CNMI from April to June, 2010, provided the previously mentioned mitigation, monitoring, and reporting requirements are incorporated. The duration of the IHA would not exceed one year from the date of its issuance.

Information Solicited

NMFS requests interested persons to submit comments and information concerning this proposed project and NMFS' preliminary determination of issuing an IHA (*see* **ADDRESSES**). Concurrent with the publication of this notice in the **Federal Register,** NMFS is forwarding copies of this application to the Marine Mammal Commission and its Committee of Scientific Advisors.

Dated: February 19, 2010.

James H. Lecky,

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

[FR Doc. 2010–3869 Filed 2–24–10; 8:45 am]

BILLING CODE 3510–22–P

DEPARTMENT OF COMMERCE

National Oceanic and Atmospheric Administration

RIN 0648–XU21

Magnuson-Stevens Act Provisions; General Provisions for Domestic Fisheries; Application for Exempted Fishing Permit

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

ACTION: Notice; request for comments.

SUMMARY: The Assistant Regional Administrator for Sustainable Fisheries, Northeast Region, NMFS (Assistant Regional Administrator), has made a preliminary determination that the subject Exempted Fishing Permit (EFP) application for the Northeast Fisheries Science Center's (NEFSC) Study Fleet Program contains all of the required information and warrants further consideration. The EFP would exempt fishing vessels from minimum fish sizes and possession and landing limits for the purpose of collecting fishery dependent catch data and biological samples.

Regulations under the Magnuson-Stevens Fishery Conservation and Management Act require publication of this notification to provide interested