such other appropriate matters as the Under Secretary refers to the Panel for review and advice.

DATES: Résumés should be sent to the address, e-mail, or fax specified and must be received by June 26, 2009.

ADDRESSES: Director, Office of Coast Survey, National Ocean Service, NOAA (N/CS), 1315 East West Highway, Silver Spring, MD 20910, fax: 301–713–4019, e-mail: *Hydroservices.panel@noaa.gov*.

FOR FURTHER INFORMATION CONTACT: Captain Steven Barnum, NOAA, Director, Office of Coast Survey, National Ocean Service (NOS), NOAA (N/CS), 1315 East West Highway, Silver Spring, Maryland 20910; Telephone: 301–713–2770, Fax: 301–713–4019; e-mail: *steven.barnum@noaa.gov*.

SUPPLEMENTARY INFORMATION: Under 33 U.S.C. 883a, *et seq.*, NOAA's National Ocean Service (NOS) is responsible for providing nautical charts and related information for safe navigation. NOS collects and compiles hydrographic, tidal and current, geodetic, and a variety of other data in order to fulfill this responsibility. The Hydrographic Services Review Panel provides advice on topics such as ''NOAA's Hydrographic Survey Priorities,'' technologies relating to operations, research and development of data pertaining to:

(a) Hydrographic surveying;
(b) Nautical charting;
(c) Water level measurements;
(d) Current measurements;
(e) Geodetic measurements; and
(f) Geospatial measurements.

The Panel comprises fifteen voting members appointed by the Under Secretary in accordance with section 105 of Public Law 107–372. Members are selected on a standardized basis, in accordance with applicable Department of Commerce guidance. The Co-Director of the Joint Hydrographic Center and two other employees of the National Oceanic and Atmospheric Administration serve as nonvoting members of the Panel. The Director, Office of Coast Survey, serves as the Designated Federal Official (DFO). This solicitation is to obtain candidate applications for one current voting vacancy on the Panel, and for five voting members whose terms expire January 1, 2010, and candidates for voting members who might resign at any time during 2009. Be advised that some voting members whose terms expire January 1, 2010, may be reappointed for another full term if eligible.

Voting members are individuals who, by reason of knowledge, experience, or training, are especially qualified in one or more disciplines relating to hydrographic surveying, tides, currents, geodetic and geospatial measurements, marine transportation, port administration, vessel pilotage, and coastal or fishery management. An individual may not be appointed as a voting member of the Panel if the individual is a full-time officer or employee of the United States. Any voting member of the Panel who is an applicant for, or beneficiary of (as determined by the Under Secretary) any assistance under the Act shall disclose to the Panel that relationship, and may not vote on any other matter pertaining to that assistance.

Voting members of the Panel serve a four-year term, except that vacancy appointments shall be for the remainder of the unexpired term of the vacancy. Members serve at the discretion of the Under Secretary and are subject to government ethics standards. Any individual appointed to a partial or full term may be reappointed for one additional full term. A voting member may serve until his or her successor has taken office. The Panel selects one voting member to serve as the Chair and another to serve as the Vice Chair. The Vice Chair acts as Chair in the absence or incapacity of the Chair but will not automatically become the Chair if the Chair resigns. Meetings occur at least twice a year, and at the call of the Chair or upon the request of a majority of the voting members or of the Under Secretary. Voting members receive compensation at a rate established by the Under Secretary, not to exceed the maximum daily rate payable under section 5376 of title 5, United States Code, when engaged in performing duties for the Panel. Members are reimbursed for actual and reasonable expenses incurred in performing such duties.

Panel members selected to serve on the HSRP FACA committee must complete the following:

(a) Security Clearance (on-line Background Security Check process and fingerprinting conducted through NOAA Workforce Management);

(b) Confidential Financial Disclosure Report—As an SGE you are required to file a Confidential Financial Disclosure Report to avoid involvement in a real or apparent conflict of interest. You may find the Confidential Financial Disclosure Report at the following Web site: *http://www.usoge.gov/forms/form_450.aspx*.

(c) Certification of Status Statement (certifying statement that as an SGE you are not an agent of a foreign principal or a lobbyist—document provided by NOAA).

Dated: May 19, 2009.

Captain Steven Barnum,

NOAA, Director, Office of Coast Survey, National Ocean Service, National Oceanic and Atmospheric Administration.

[FR Doc. E9–12066 Filed 5–22–09; 8:45 am]

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DEPARTMENT OF COMMERCE

National Oceanic and Atmospheric Administration

RIN 0648–XO71

Incidental Takes of Marine Mammals During Specified Activities; Low-Energy Marine Seismic Survey in the Northeast Pacific Ocean, July 2009

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

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

SUMMARY: NMFS has received an application from the Scripps Institution of Oceanography (SIO), a part of the University of California San Diego (UCSD), for an Incidental Harassment Authorization (IHA) to take small numbers of marine mammals, by harassment, incidental to conducting a marine seismic survey in the Northeast Pacific Ocean during July 2009. Pursuant to the Marine Mammal Protection Act (MMPA), NMFS requests comments on its proposal to authorize SIO 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 June 25, 2009.

ADDRESSES: Comments on the application should be addressed to Michael Payne, Chief, Permits, Conservation and Education Division, Office of Protected Resources, National Marine Fisheries Service, 1315 East-West Highway, Silver Spring, MD 20910–3225. The mailbox address for providing email comments is *PR1.0648–XO71@noaa.gov*. Comments sent via e-mail, including all attachments, must not exceed a 10–megabyte file size.

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

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

FOR FURTHER INFORMATION CONTACT:
Howard Goldstein or Ken Hollingshead, 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 to allow, upon request, the incidental, but not intentional, taking of marine mammals by United States citizens who engage in a specified activity (other than commercial fishing) within a specified geographical region if certain findings are made and either regulations are issued or, if the taking is limited to harassment, a notice of a proposed authorization is provided to the public for review.

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

Section 101(a)(5)(D) of the MMPA established an expedited process by which citizens of the United States can apply for an authorization to incidentally take small numbers of marine mammals by harassment. Except with respect to certain activities not pertinent here, the MMPA defines ''harassment'' as:

> any act of pursuit, torment, or annoyance which (i) has the potential to injure a marine mammal or marine mammal stock in the wild [ALevel A harassment@]; or (ii) has the potential to disturb a marine mammal or marine mammal stock in the wild by causing disruption of behavioral patterns, including, but not limited to, migration, breathing, nursing, breeding, feeding, or sheltering [ALevel B harassment@].

Section 101(a)(5)(D) establishes a 45–day time limit for NMFS= review of an application followed by a 30–day public notice and comment period on any proposed authorizations for the incidental harassment of small numbers of marine mammals. Within 45 days of the close of the comment period, NMFS must either issue or deny issuance of the authorization.

Summary of Request

On March 9, 2009, NMFS received an application from SIO for the taking, by Level B harassment only, of small numbers of marine mammals incidental to conducting, under cooperative agreement with the National Science Foundation (NSF), a low-energy marine seismic survey in the Northeast Pacific Ocean. The funding for the survey is provided by the NSF. The proposed survey will occur in an overall area between approximately 44° and 45° N. and 124.5° and 126° W. within the Exclusive Economic Zone (EEZ) of the U.S.A., and is scheduled to occur from July 14–20, 2009. The survey will use a single Generator Injector (GI) airgun with a discharge volume of 45 in^3. Some minor deviation from these dates is possible, depending on logistics and weather.

The proposed survey is virtually identical to one conducted by SIO in 2007 under an IHA issued in September 2007 (NMFS 2007). The proposed SIO 2009 IHA application contains minor updates to the project description, updated marine mammal population sizes based on the most recent NMFS annual stock assessment, an assessment of the relevance of the marine mammal density and distribution data contained in the SIO 2007 IHA application based on cruise reports from the NMFS SWFSC ORCAWHALE 2008 cruise, and updated information on effects of airguns on marine mammals (see Appendix A of SIO's application).

Description of the Specified Activity

SIO plans to conduct an ocean bottom seismograph (OBS) deployment and a magnetic, bathymetric, and seismic survey. The planned survey will involve one source vessel, the R/V *Wecoma* (*Wecoma*), and will occur in the Northeast Pacific Ocean off the coast of Oregon.

The purpose of the research program is to record micro-earthquakes in the forearc to determine whether seismicity on the plate boundary is characteristic of a locked or a freely slipping fault plane. Several earthquakes large enough to be recorded on land-based seismic nets have occurred along this segment in the past several years. The occurrence of ''repeating earthquakes'' (earthquakes with identical waveforms indicating repeated rupture of almost the same fault patch) suggests that this region is at a boundary between a freely slipping and a locked portion of the fault. Some models suggest that the forearc basin north of the seismically active zone may be locked; others suggest that portion of the fault is slipping freely. OBSs have been deployed for a year, and a seismic survey will be used to characterize the shallow sediment structure around the instruments. Also, included in the research is the use of a magnetometer and sub-bottom profiler.

The source vessel, the *Wecoma*, will deploy a single low-energy GI airgun as an energy source (with a discharge volume of 45 in^3) and a 300 m (984 ft), 16 channel, towed hydrophone streamer. Sixteen OBSs were deployed in July and September 2008. They will continue to acquire data during this cruise, and will be recovered before returning to port. The energy to the GI airgun is compressed air supplied by compressors onboard the source vessel. As the GI airgun is towed along the survey lines, the receiving systems will receive the returning acoustic signals.

The seismic program will consist of approximately 21 km (13 mi) of surveys over each of the 16 OBSs (see Figure 1 of SIO's application). Water depths at the seismic survey locations rang from just less than 100 m (328 ft) to almost 3,000 m (9,842 ft) (see Figure 1 of SIO's application). The GI airgun will be operated on a small grid for approximately two hours at each of the 16 OBS sites. There will be additional seismic operations associated with equipment testing, start-ups, and repeat coverage of any areas where initial data quality is substandard.

All planned geophysical data acquisition activities will be conducted by SIO with on-board assistance by the scientists who have proposed the study. The Chief Scientist is Dr. Anne Trehu of Oregon State University. The vessel will be self-contained, and the crew will live aboard the vessel for the entire cruise.

In addition to the seismic operations of the single GI airgun, a 3.5 and 12 kHz sub-bottom profiler will be used continuously throughout the cruise, and a magnetometer may be run on the transit between OBS locations.

Vessel Specifications

The *Wecoma* has a length of 56.4 m (185 ft), a beam of 10.1 m (33.1 ft), and a maximum draft of 5.6 m (18.4 ft). The ship is powered by a single 3,000–hp EMD diesel engine driving a single, controllable-pitch propeller through a clutch and reduction gear, and an electric 350–hp azimuthing bow thruster. An operations speed of 11.1 km/hour (6 knots) will be used during seismic acquisition. When not towing seismic survey gear, the *Wecoma* cruises at 22.2 km/hour (12 knots) and has a maximum speed of 26 km/hour (14 knots). It has a normal operating range of approximately 13,300 km. The *Wecoma* will also serve as the platform from which vessel-based Marine Mammal Visual Observers (MMVO) will watch for animals before and during GI airgun operations.

Acoustic Source Specifications

Seismic Airguns

During the proposed survey, the *Wecoma* will tow a single GI airgun, with a volume of 45 in^3, and a 300 m long streamer containing hydrophones along predetermined lines. Seismic pulses will be emitted at intervals of 10 seconds. At a speed of 6 knots (11.1 km/hour), the 10 second shot spacing corresponds to a shot interval of approximately 31 m (101.7 ft).

The generator chamber of the GI airgun, the one responsible for introducing the sound pulse into the ocean, is 45 in^3. The larger (105 in^3) injector chamber injects air into the previously-generated bubble to maintain its shape, and does not introduce more sound into the water. The 45 in^3 GI airgun will be towed 21 m (68.9 ft) behind the *Wecoma* at a depth of 4 m (13.1ft). The sound pressure field of that GI airgun variation at a tow depth of 2.5 m has been modeled by Lamont-Doherty Earth Observatory (L-DEO) in relation to distance and direction for the GI airgun.

As the GI airgun is towed along the survey line, the towed hydrophone array in the 300 m streamer receives the reflected signals and transfers the data on the on-board processing system. Given the relatively short streamer length behind the vessel, the turning rate of the vessel while the gear is deployed is much higher than the limit of five degrees per minute for a seismic vessel towing a streamer of more typical length (much greater than 1 km). Thus, the maneuverability of the vessel is not limited much during operations.

The root mean square (rms) received levels that are used as impact criteria for marine mammals are not directly comparable to the peak (pk or 0–pk) or peak-to-peak (pk - pk) 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 ''root mean square'' (rms) decibels referred to in biological literature. A measured received level of 160 dB re 1 μPa (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, 2000). 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.

Received sound levels have been modeled by L-DEO for a number of airgun configurations, including one 45 in^3 GI airgun, in relation to distance from the airgun(s) (see Figure 2 of SIO's application). The model does not allow for bottom interactions, and is most directly applicable to deep water. Based on modeling, estimates of the maximum distances from the GI airgun where sound levels of 190, 180, and 160 dB re 1 μPa (rms) are predicted to be received in deep (≤1,000 m) water are shown in Table 1 of SIO's application. Because the model results are for a 2.5 m tow depth, the distances in Table 1 slightly underestimate the distances for the 45 in^3 GI airgun towed at 4 m depth.

Sub-bottom Profiler

Along with the GI airgun operations, one additional acoustical data acquisition system will be operated throughout the cruise. The ocean floor will be mapped with a Knudsen Engineering Model 320BR 12 kHz and 3.5 kHz sub-bottom profiler (SBP). Multi-beam sonar will not be used.

The Knudsen Engineering Model 320BR SBP is a dual-frequency transceiver designed to operate at 3.5 and/or 12 kHz. It is used to provide data about the sedimentary features that occur below the sea floor. The energy from the sub-bottom profiler is directed downward via a 12 kHz transducer (EDO 323B) or a 3.5 kHz array of 16 ORE 137D transducers in a 4x4 arrangement. The maximum power output of the 320BR is 10 kilowatts for the 3.5 kHz section and 2 kilowatts for the 12 kHz section.

The pulse length for the 3.5 kHz section of the 320 BR is 0.8–24 ms, controlled by the system operator in regards to water depth and reflectivity of the bottom sediments, and will usually be 12 or 24 ms in this survey. The system produces one sound pulse and then waits for its return before transmitting again. Thus, the pulse interval is directly dependent upon water depth, and in this survey is 4.5–8 seconds. Using the Sonar Equations and assuming 100 percent efficiency in the system (impractical in real world applications), the source level for the 320BR is calculated to be 211 dB re 1 Pam. In practical operation, the 3.5 kHz array is seldom driven at more than 80 percent of maximum, usually less than 50 percent.

Safety Radii

NMFS has determined that for acoustic effects, using acoustic thresholds in combination with corresponding safety radii is an effective way to consistently apply measures to avoid or minimize the impacts of an action, and to quantitatively estimate the effects of an action. Thresholds are used in two ways: (1) to establish a mitigation shut-down or power-down zone, i.e., if an animal enters an area calculated to be ensonified above the level of an established threshold, a sound source is powered down or shut down; and (2) to calculate take, in that a model may be used to calculate the area around the sound source that will be ensonified to that level or above, then, based on the estimated density of animals and the distance that the sound source moves, NMFS can estimate the number of marine mammals that may be ''taken.''

As a matter of past practice and based on the best available information at the time regarding the effects of marine sound compiled over the past decade, NMFS has used conservative numerical estimates to approximate where Level A harassment from acoustic sources begins: 180 dB re 1 μPa (rms) level for cetaceans and 190 dB re 1 μPa (rms) for pinnipeds. A review of the available scientific data using an application of science-based extrapolation procedures (Southall *et al.*, 2007) strongly suggests that Level A harassment (as well as TTS) from single sound exposure impulse events may occur at much higher levels than the levels previously estimated using very limited data. However, for purposes of this proposed action, SIO's application sets forth, and NMFS is using, the more conservative 180 and 190 dB re 1 μPa (rms) criteria. NMFS also considers 160 dB re 1 μPa (rms) as the criterion for estimating the onset of Level B harassment from acoustic sources like impulse sounds used in the seismic survey.

Emperical data concerning the 180 and 160 dB distances have been acquired based on measurements during the acoustic verification study conducted by L-DEO in the northern Gulf of Mexico from May 27 to June 3, 2003 (Tolstoy *et al.*, 2004). Although the results are limited the data showed that radii around the airguns where the received level would be 180 dB re 1 μPa (rms), the safety criterion applicable to cetaceans (NMFS, 2000), vary with water depth. Similar depth-related variation is likely in the 190 dB distances applicable to pinnipeds.

Correction factors were developed for water depths 100–1,000 m and <100 m.

The empirical data indicate that, for deep water (>1,000 m), the L-DEO model tends to overestimate the received sound levels at a given distance (Tolstoy *et al.*, 2004). However, to be precautionary pending acquisition of additional empirical data, it is proposed that safety radii during GI airgun operations in deep water will be values predicted by L-DEO's model (see Table 1 below). Therefore, the assumed 180 and 190 dB radii are 23 m (75.5 ft) and 8 m (26 ft) respectively.

Empirical measurements indicated that in shallow water (<100 m), the L-DEO model under estimates actual levels. In previous L-DEO projects, the exclusion zones were typically based on measured values and ranged from 1.3 to 15x higher than the modeled values depending on the size of the airgun array and the sound level measured (Tolstoy *et al.*, 2004). During the proposed cruise, similar factors will be applied to derive appropriate shallow water radii from the modeled deep water radii for the GI airgun (see Table 1 below).

Empirical measurements were not conducted for intermediate depths (100–1,000 m). On the expectation that results will be intermediate between those from shallow and deep water, a 1.5x correction factor is applied to the estimates provided by the model for deep water situations. This is the same factor that was applied to the model estimates during L-DEO cruises in 2003. The assumed 180 and 190 dB radii in intermediate depth water are 35 m (115 ft) and 12 m (39.4 ft), respectively (see Table 1 below).

TABLE 1. PREDICTED DISTANCES TO WHICH SOUND LEVELS ≥190, 180, AND 160 dB RE 1 μPA MIGHT BE RECEIVED IN SHALLOW (<100 M; 328 FT), INTERMEDIATE (100–1,000 M; 328–3,280 FT), AND DEEP (>1,000 M; 3,280 FT) WATER FROM THE SINGLE 45 IN^3 GI AIRGUN USED DURING THE SEISMIC SURVEYS IN THE NORTHEASTERN PACIFIC OCEAN DURING JULY 2009. DISTANCES ARE BASED ON MODEL RESULTS PROVIDED BY L-DEO.

Source and Volume	Tow Depth (m)	Water Depth	Predicted RMS Distances (m)		
			190 dB	180 dB	160 dB
Single GI airgun 45 in^3	4	Deep (>1,000 m)	8	23	220
		Intermediate (100–1,000 m)	12	35	330
		Shallow (< 100 m)	95	150	570

Proposed Dates, Duration, and Region of Activity

The *Wecoma* is scheduled to depart from Newport, Oregon, on July 14, 2009 and to return on July 20, 2009. The GI airgun will be used for approximately two hours at each of 16 OBS locations. The program will consist of approximately 7 days of seismic acquisition. The exact dates of the activities may vary by a few days because of weather conditions, repositioning, streamer operations, and adjustments, GI airgun deployment, or the need to repeat some lines if data quality is substandard. The seismic surveys will take place off the Oregon coast in the northeastern Pacific Ocean (see Figure 1 of SIO's application). The overall area within which the seismic surveys will occur is located between approximately 44° and 45° N and 124.5° and 126° W (see Figure 1 of SIO's application). The surveys will take place in water depths just less than 100 m and to almost 3,000 m, entirely within the Exclusive Economic Zone (EEZ) of the U.S.A.

Description of Marine Mammals in the Proposed Activity Area

A total of 32 marine mammal species may occur or have been documented to occur in the marine waters off Oregon and Washington, excluding extralimital sightings or strandings (Fiscus and Niggol, 1965; Green *et al.*, 1992, 1993; Barlow, 1997, 2003; Mangels and Gerrodette, 1994; Von Saunder and Barlow, 1999; Barlow and Taylor, 2001; Buchanan *et al.*, 2001; Calambokidis *et al.*, 2004; Calambokidis and Barlow, 2004). The species include 19 odontocetes (toothed cetaceans, such as dolphins), 7 mysticetes (baleen whales), 5 pinnipeds, and sea otters. Six of the species that may occur in the project area are listed under the Endangered Species Act (ESA) as Endangered, including sperm, humpback, sei, fin, blue, and North Pacific right whales. Another species, the Steller sea lion, is listed as Threatened and may occur in the project area.

The study area is located approximately 25 to 110 km (15.5 to 68.4 mi) offshore from Oregon over water depths from just less than 100 m to almost 3,000 m. Two of the 32 species, gray whales and sea otters, are not expected in the project area because their occurrence off Oregon is limited to very shallow, coastal waters. Three other species, California sea lions, Steller sea lions, and harbor seals, are mainly coastal, and would be rare at most at the OBS locations. Information on the habitat, abundance, and conservation status of the species that may occur in the study area are given in Table 2 (below, see Table 2 of SIO's application). Vagrant ringed seals, hooded seals, and ribbon seals have been sighted or stranded on the coast of California (see Mead, 1981; Reeves *et al.*, 2002) and presumably passed through Oregon waters. A vagrant beluga whale was seen off the coast of Washington (Reeves *et al.*, 2002). Those seven species are not addressed in detail in the summaries in SIO's application.

The six species of marine mammals expected to be most common in the deep pelagic or slope waters of the project area, where most of the survey sites are located, include the Pacific white-sided dolphin, northern right whale dolphin, Risso's dolphin, short beaked common dolphin, Dall's porpoise, and northern fur seal (Green *et al.*, 1992, 1993; Buchanan *et al.*, 2001; Barlow, 2003; Barlow and Forney, 2007; Carretta *et al.*, 2007). The fin whale, Dall's porpoise, and the northern elephant seal were the species sighted most often off Oregon and Washington during the ORCAWALE 2008 surveys (NMFS, 2008).

Table 2 below outlines the marine mammal species, their habitat, abundance, density, and conservation status in the proposed project area. 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 SIO's application.

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Table 2. The occurrence, habitat, regional abundance, conservation status, best and maximum density estimates, number of marine mammals that could be exposed to sound level at or above 160dB re 1μPa, best estimate of number of individuals exposed, and best estimate of number of exposures per marine mammal in or near the proposed low-energy seismic survey area in the Northeast Pacific Ocean. See Tables 2-4 in SIO's application for further detail.

Species	Habitat	Regional Population Size [e]	ESA [a]	Density/ 1000km² (best) [b]	Density/ 1000km² (max) [c]
Mysticetes Eastern Pacific gray whale (Eschrichtius robustus)	Coastal	17,752	NL	N.A.	N.A.
North Pacific right whale (Eubalaena japonica)	Pelagic and coastal	N.A. (Probably less than 100) [f]	EN	0	0
Humpback whale (Megaptera novaeangliae)	Mainly nearshore waters and banks	1,396	EN	0.69	1.50
Minke whale (Balaenoptera acutorostrata)	Pelagic and coastal	898	NL	0.68	1.1
Sei whale (Balaenoptera borealis)	Primarily offshore, pelagic	43	EN	0.13	0.5
Fin whale (Balaenoptera physalus)	Continental slope, mostly pelagic	3,454	EN	0.95	1.3
Blue whale (Balaenoptera musculus)	Pelagic and coastal	1,186	EN	0.19	0.4
Odontocetes Sperm whale (Physeter macrocephalus)	Usually pelagic and deep seas	2,265	EN	1.39	0.58
Pygmy sperm whale (Kogia breviceps)	Deep waters off shelf	N.A.	NL	1.24	2.8
Dwarf sperm whale (Kogia sima)	Deep waters off the shelf	N.A.	NL	0	0
Cuvier's beaked whale (Ziphius cavirostris)	Pelagic	2,171	NL	0	0
Baird's beaked whale (Berardius bairdii)	Pelagic	313	NL	1.64	0.60
Blainville's beaked whale (Mesoplodon densirostris)	Slope, offshore	1,024 [g]	NL	0	0

Hubb's beaked whale (Mesoplodon carlhubbsi)	Slope, offshore	1,024 [g]	NL	0	0
Stejneger's beaked whale (Mesoplodon stejnegeri)	Slope, offshore	1,024 [g]	NL	0	0
Offshore bottlenose dolphin (Tursiops truncatus)	Offshore, slope	3,257	NL	0	0
Striped dolphin (Stenella coeruleoalba)	Off continental shelf	23,883	NL	0.04	0.1
Short-beaked common dolphin (Delphinus delphis)	Shelf and pelagic, seamounts	487,622	NL	14.14	35
Pacific white-sided dolphin (Lagenorhynchus obliquidens)	Offshore, slope	25,233	NL	24.84	33.2
Risso's dolphin (Grampus griseus)	Shelf, slope, seamounts	12,093	NL	12.91	17.3
Northern right whale dolphin (Lissodelphis borealis)	Slope, offshore waters	15,305	NL	19.39	26.7
False killer whale (Pseudorca crassidens)	Pelagic, occasionally inshore	N.A.	NL	0	0
Killer whale (Orcinus orca)	Widely distributed	422 (Offshore)	NL	1.62	2.7
Short-finned pilot whale (Globicephala macrorhynchus)	Mostly pelagic, high-relief topography	245	NL	0	0
Harbor porpoise (Phocoena phocoena)	Coastal and inland waters	37,745 (OR/WA)	NL	N.A.	N.A.
Dall's porpoise (Phocoenoides dalli)	Shelf, slope, offshore	57,549	NL	150.17	250.9
Pinnipeds Northern fur seal (Callorhinus ursinus)	Pelagic, offshore	721,935 [f]	NL	10	100
California sea lion (Zalophus californianus)	Coastal, shelf	238,000	NL	N.A.	N.A.
Harbor seal (Phoca vitulina richardsi)	Coastal	24,732 (OR/WA)	NL	13	N.A.
Steller sea lion (Eumetopias jubatus)	Coastal, shelf	48,519 Eastern U.S. [f]	T	11	N.A.

Northern elephant seal (Mirounga angustirostris)	Coastal, pelagic when migrating	124,000 (CA)	NL	20	200

N.A. – Data not available or species status was not assessed, CA = California, OR = Oregon, WA = Washington

[a] U.S. Endangered Species Act: EN = Endangered, T = Threatened, NL = Not listed

[b] Best estimate as listed in Table 3 of the application.

[c] Maximum estimate as listed in Table 3 of the application.

[d] The numbers of at-sea sightings of California sea lions and northern elephant seals were too small to provide meaningful density estimates (Bonnell et al., 1992); density of northern elephant seals was estimated based on sightings during the ORCAWALE 2008 surveys.

[e] Abundance given for U.S. Eastern North Pacific, or CA/OR/WA stock, whichever is included in the 2007 U.S. Pacific Marine Mammal Stock Assessments (Carretta et al., 2007), unless otherwise stated.

[f] Angliss and Outlaw (2008).

[g] All mesoplodont whales.

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Potential Effects on Marine Mammals

Potential Effects of Airguns

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, and 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). With the possible exception of some cases of temporary threshold shift in harbor seals, 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.

Tolerance

Numerous studies have shown that pulsed sounds from airguns are often readily detectable in the water at distances of many kilometers. For a brief summary of the characteristics of airgun pulses, see Appendix A(3) of SIO's application. However, it should be noted that most of the measurements are for airguns that would be detectable considerably farther away than the GI airgun planned for use in the present project.

Several studies have shown that marine mammals at distances more than a few kilometers from operating seismic vessels often show no apparent response-see Appendix A(5) of SIO'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. Given the relatively small and low-energy GI airgun source planned for use in this project, mammals are expected to be tolerate being closer to this source than would be the case for a larger airgun source typical of most seismic surveys.

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 some situations, multi-path arrivals and reverberation cause airgun sound to arrive 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). In the northeast Pacific Ocean, blue whale calls have been recorded during a seismic survey off Oregon (McDonald *et al.*, 1995). Among odontocetes, there has been one report that sperm whales cease calling when exposed to pulses from a very distant seismic ship (Bowles *et al.*, 1994). However, more recent studies found that sperm whales continued calling in the presence of seismic pulses (Madsen *et al.*, 2002; Tyack *et al.*, 2003; Smultea *et al.*, 2004; Holst *et al.*, 2006; Jochens *et al.*, 2006, 2008). Given the small source planned for use during the proposed survey, there is even less potential for masking of baleen or sperm whale calls during the present study than in most seismic surveys. Masking effects of seismic pulses are expected to be negligible in the case of the small odontocetes given the intermittent nature of seismic pulses. 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). Also, the sounds important to small odontocetes are predominantly at much higher frequencies than the airgun sounds, thus further 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 A (4) of SIO's application.

Disturbance Reactions

Disturbance includes a variety of effects, including subtle changes in behavior, more conspicuous changes in activities, and displacement. Reactions to sound, if any, depend on species, state of maturity, experience, current activity, reproductive state, time of day, and many other factors. If a marine mammal responds 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,'' or affect the stock or the species as a whole. However, if a sound source displaces marine mammals from an important feeding or breeding area for a prolonged period, impacts on animals or on the stock or species could potentially be significant (Lusseau and Bejder, 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, or exposed to a particular level of industrial sound. This practice potentially overestimates the numbers of marine mammals that are affected in some biologically-important manner.

The sound exposure thresholds that are used to estimate how many marine mammals might be harassed by a seismic survey are based on behavioral observations during studies of several species. However, information is lacking for many species. Detailed studies have been done on humpback, gray, bowhead, and on ringed seals. Less detailed data are available for some other species of baleen whales, sperm whales, small toothed whales, and sea otters, but for many species there are no data on responses to marine seismic surveys. Most of those studies have concerned reactions to much larger airgun sources than planned for use in the proposed project. Thus, effects are expected to be limited to considerably smaller distances and shorter periods of exposure in the present project than in most of the previous work concerning marine mammal reactions to airguns.

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 A(5) of SIO's application, 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 received levels of pulses in the 160–170 dB re 1 μPa rms range seem to cause obvious avoidance behavior in a substantial fraction of the animals exposed. In many areas, seismic pulses from large arrays of airguns diminish to those levels at distances ranging from 4.5–14.5 km (2.8–9 mi) from the source. A substantial proportion of the baleen whales within those distances may show avoidance or other strong disturbance reactions to the airgun array. Subtle behavioral changes sometimes become evident at somewhat lower received levels, and studies summarized in Appendix A(5) of SIO's application have shown that some species of baleen whales, notably bowhead and humpback whales, at times show strong avoidance at received levels lower than 160–170 dB re 1 μPa (rms). Reaction distances would be considerably smaller during the proposed project, for which the 160 dB radius is predicted to be 220 to 570 m (722 to 1,870 ft) (see Table 1 above), as compared with several km when a large array of airguns is operating.

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 μPa m 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.* (2000) noted localized displacement during migration of 4 to 5 km (2.5 to 3.1 mi) by traveling pods and 7 to12 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 reactions of an approaching airgun was a sound level of 140 dB re 1 μPa (rms) for humpback whale pods containing females. The standoff range, i.e., the closest point of approach (CPA) of the whales to the airgun, corresponded to a received level of 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 150–169 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.

Among wintering humpback whales off Angola (n = 52 useable groups), there were no significant differences in encounter rates (sightings/hr) when a 24 airgun array (3,147 in^3 or 5,805 in^3) was operating vs. silent (Weir, 2008). There was also no significant difference in the mean CPA distance of the humpback whale sightings when airguns were on vs. off (3,050 m vs. 2,700 m or 10,007 vs. 8,858 ft, respectively).

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, 2007b: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 (e.g., migrating vs. feeding). Bowhead whales migrating west across the Alaskan Beaufort Sea in autumn, in particular, are unusually responsive, with substantial avoidance occurring out to distances of 20–30 km (12.4–18.6 mi) from a medium-sized airgun source at received sound levels of around 120–130 dB re 1 μPa (rms) (Miller *et al.*, 1999; Richardson *et al.*, 1999; see Appendix B (5) of L-DEO's application). 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 160–170 dB re 1 μPa (rms) (Richardson *et al.*, 1986; 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. 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 (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). Gray whales typically show no conspicuous responses to airgun pulses with received levels up to 150 to 160 dB re 1 μPa (rms), but are increasingly likely to show avoidance as received levels increase above that range.

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). Sightings by observers on seismic vessels off the United Kingdom from 1997 to 2000 suggest that, at 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 (Stone, 2003; Stone and Tasker, 2006). However, these whales tended to exhibit localized avoidance, remaining significantly (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 do not necessarily provide information about long-term effects. It is not known whether impulsive noises 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). Bowhead whales 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). In any event, brief exposures to sound pulses from the proposed airgun source are highly unlikely to result in prolonged effects.

Toothed Whales – Little systematic information is available about reactions of toothed whales to noise pulses. Few studies similar to the more extensive baleen whale/seismic pulse work summarized above have been reported for toothed whales. However, systematic studies on sperm whales have been done (Jochens and Biggs, 2003; Tyack *et al.*, 2003; Jochens *et al.*, 2006; Miller *et al.*, 2006), and there is an increasing amount of information about responses of various odontocetes to seismic surveys based on monitoring studies (Stone, 2003; Smultea *et al.*, 2004; Moulton and Miller, 2005; Bain and Williams, 2006; Holst *et al.*, 2006; Stone and Tasker, 2006; Potter *et al.*, 2007; Weir, 2008).

Seismic operators and MMOs 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). 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 sometimes 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 recorded much lower sighting rates of beluga whales within 10–20 km (6.2–12.4 mi) compared with 20–30 km (mi) from an operating airgun array, and observers on seismic boats in that area rarely see belugas (Miller *et al.*, 2005a; 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). The animals tolerated high received levels of sound (pk-pk level >200 dB re 1 μPa) before exhibiting aversive behaviors. For pooled data at 3, 10, and 20 kHz, sound exposure levels during sessions with 25, 50, and 75 percent altered behavior were 180, 190, and 199 dB re 1 μPa^2, respectively (Finneran and Schlundt, 2004).

Results for porpoises depend on species. Dall's porpoises seem relatively tolerant of airgun operations (MacLean and Koski, 2005) and, during a survey with a large airgun array, tolerated higher noise levels than did harbor porpoises and gray whales (Bain and Williams, 2006). However, Dall's porpoises do respond to the approach of large airgun arrays by moving away (Calambokidis and Osmek, 1998; Bain and Williams, 2006). The limited available data suggest that harbor porpoises show stronger avoidance (Stone, 2003; Bain and Williams, 2006; Stone and Tasker, 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 this species 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 A in SIO's application). However, controlled exposure experiments in the Gulf of Mexico indicate that foraging effort is somewhat altered upon exposure to airgun sounds (Jochens *et al.*, 2006, 2008). In the SWSS study, D-tags (Johnson and Tyack, 2003) were used to record the movement and acoustic exposure of eight foraging sperm whales before, during, and after controlled sound exposures of airgun arrays in the Gulf of Mexico (Jochens *et al.*, 2008). Whales were exposed to maximum received sound levels between 111 and 147 dB re 1 μPa (rms) (131 to 164 dB re 1 μPa pk-pk) at ranges of approximately 1.4 to 12. 6 km (0.9 to 7.8 mi) from the sound source. Although the tagged whales showed no horizontal avoidance, some whales changed foraging behavior during full array exposure (Jochens *et al.*, 2008).

There are almost no specific data on the behavioral reactions of beaked whales to seismic surveys. However, northern bottlenose whales (*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 quire long (Baird *et al.*, 2006; Tyack *et al.*, 2006). In any event, 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 A of SIO's application).

Additional details on the behavioral reactions (or the lack thereof) by all types of marine mammals to seismic vessels can be found in Appendix A(5) of SIO's application.

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 and (to a limited degree) pinnipeds 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 theoretically might occur in mammals close to a strong sound source include stress, neurological effects, bubble formation, resonance effects, 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 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).

For toothed whales exposed to single short pulses, the TTS threshold appears to be, to a first approximation, a function of the energy content of the pulse (Finneran *et al.*, 2002, 2005). Given the available data, the received level of a single seismic pulse (with no frequency weighting) might need to be approximately 186 dB re 1 $\mu Pa^2 \cdot s$ (i.e., 186 dB SEL or approximately 221–226 dB pk-pk) in order to produce brief, mild TTS. Exposure to several strong seismic pulses that each have received levels near 190 dB re 1 μPa (rms) (175–180 dB SEL) 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. Levels ≥ 190 dB 1 μPa (rms) are expected to be restricted to radii no more than 95 m (312 ft) from the *Wecoma*'s GI airgun. For an odontocete closer to the surface, the maximum radius with ≥190 dB 1 μPa (rms) would be smaller.

The above TTS information for odontocetes is derived from studies on the bottlenose dolphin and beluga. There is not published TTS information for other species of cetaceans. However, preliminary evidence from harbor porpoise exposed to airgun sound suggests that its TTS threshold may have been lower (Lucke *et al.*, 2007).

For baleen whales, there are no data, direct or indirect, on levels or properties of sound required to induce TTS. The frequencies to which baleen whales are most sensitive are lower than those for odontocetes, 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. In any event, no cases of TTS are expected given three considerations:

(1) Small size of the GI airgun source;

(2) The strong likelihood that baleen whales would avoid the approaching airguns (or vessel) before being exposed to levels high enough for TTS to possibly occur; and

(3) The mitigation measures that are planned.

In pinnipeds, TTS thresholds associated with exposure to brief pulses (single or multiple) of underwater sound have not been measured. Initial evidence from prolonged (non-pulse) exposures suggested that some pinnipeds may incur TTS at somewhat lower received levels than do small odontocetes exposed for similar durations (Kastak *et al.*, 1999, 2005; Ketten *et al.*, 2001; Au *et al.*, 2000). The TTS threshold for pulsed sounds has been indirectly estimated as being an SEL of approximately 171 dB re 1 μPa^2·s (Southall *et al.*, 2007), which would be equivalent to a single pulse with received level approximately 181–186 re 1 μPa (rms), or a series of pulses for which the highest rms values are a few dB lower. Corresponding values for California sea lions and northern elephant seals are likely to be higher (Kastak *et al.*, 2005).

A marine mammal within a radius of less than 100 m (328 ft) around a typical large array of operating airguns might be exposed to a few seismic pulses with levels of greater than or equal to 205 dB, and possibly more pulses if the mammal moved with the seismic vessel. (As noted above, most cetacean species tend to avoid operating airguns, although not all individuals do so.) In addition, ramping up airgun arrays, which is standard operational protocol for large airgun arrays and proposed for this action, should allow cetaceans to move away form the seismic source and avoid being exposed to the full acoustic output of the airgun array. Even with a large airgun array, it is unlikely that the cetaceans would be exposed to airgun pulses at a sufficiently high level for a sufficiently long period to cause more than mild TTS, given the relative movement of the vessel and the marine mammal. The potential for TTS is much lower in this project. With a large array of airguns, TTS would be most likely in any odontocetes that bow-ride or otherwise linger near the airguns. While bow-riding, odontocetes would be at or above the surface, and thus not exposed to strong pulses given the pressure-release effect at the surface. However, bow-riding animals generally dive below the surface intermittently. If they did so while bow-riding near airguns, they would be exposed to strong sound pulses, possibly repeatedly. If some cetaceans did incur TTS through exposure to airgun sounds, this would very likely be mild, temporary, and reversible.

To avoid the potential for injury, NMFS has determined that cetaceans and pinnipeds should not be exposed to pulsed underwater noise at received levels exceeding, respectively, 180 and 190 dB re 1 μPa (rms). As summarized above, data that are now available imply that TTS is unlikely to occur unless odontocetes (and probably mysticetes as well) are exposed to airgun pulses stronger than 180 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, while in other cases, the animal has an impaired ability to hear sounds in specific frequency ranges (Kryter, 1985).

There is no specific evidence that exposure to pulses of airgun sound can cause PTS in any marine mammal, even with large arrays of airguns. However, given the possibility that mammals close to an airgun array might incur TTS, there has been further speculation about the possibility that some individuals occurring very close to airguns might incur PTS (Richardson *et al.*, 1995). Single or occasional occurrences of mild TTS are not indicative of permanent auditory damage.

Relationships between TTS and PTS thresholds have not been studied in marine mammals, but are assumed to be similar to those in humans and other terrestrial mammals. PTS might occur at a received sound level at least several decibels above that inducing mild TTS if the animal were exposed to strong sound pulses with rapid rise time (see Appendix A(5) of SIO's application). 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 >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 μPa^{2}μs (15 dB higher than the TTS threshold for an impulse). Additional assumptions had to be made to derive a corresponding estimate for pinnipeds, as the only available data on TTS thresholds in pinnipeds pertain to non-impulse sound. Southall *et al.* (2007) estimate that the PTS threshold could be a cumulative Mpw-weighted SEL of approximately 186 dB 1 μPa^2·s in the harbor seal to impulse sound. The PTS threshold for the California sea lion and northern elephant seal the PTS threshold would probably be higher, given the higher TTS thresholds in those species.

Southall *et al.* (2007) also note that, regardless of the SEL, there is concern about the possibility of PTS if a cetacean or pinniped receives one or more pulses with peak pressure exceeding 230 or 218 dB re 1 μPa (3.2 bar· m, 0–pk), which would only be found within a few meters of the largest (600–in^3) 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 and shut downs of the airguns when mammals are seen about to enter or within the proposed exclusion zone (EZ), will further reduce the probability of exposure of marine mammals to sounds strong enough to induce PTS, see the section below on Proposed Mitigation and Monitoring.

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 effects, and other types of organ or tissue damage (Cox *et al.*, 2006; Southall *et al.*, 2007). Studies examining such effects are limited. However, resonance (Gentry, 2002) and direct noise-induced bubble formation (Crum *et al.*, 2005) are not expected in the case of an impulsive source like an airgun array. If seismic surveys disrupt diving patterns of deep diving species, this might perhaps result in bubble formation and a form of ''the bends,'' as speculated to occur in beaked whales exposed to sonar. However, there is no specific evidence of this upon exposure to airgun pulses.

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

Strandings and Mortality

Marine mammals close to underwater detonations of high explosives can be killed or severely injured, and their auditory organs are especially susceptible to injury (Ketten *et al.*, 1993; Ketten, 1995). However, explosives are no longer used for marine seismic research or commercial seismic surveys, and have been replaced entirely by airguns or related non-explosive pulse generators. Airgun pulses are less energetic and have slower rise times, and there is no specific evidence that they can cause 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 A(5) of SIO's application 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 hemorrahage or other forms of trauma;

(3) A physiological change such as a vestibular response leading to a behavioral change or stress-induced hemorrahagic 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.

As noted in SIO's application, 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 super-saturated tissue by a behavioral response to acoustic exposure, could be 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 pulses 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 with most of the energy below 1 kHz. Typical military mid-frequency sonars operate at frequencies of 2–10 kHz, generally with a relatively narrow bandwidth at any one time. A further difference between seismic surveys and naval exercises is that naval exercises can involve sound sources on more than one vessel. Thus, it is not appropriate to assume that there is a direct connection between the effects of military sonar and seismic surveys on marine mammals. However, evidence that sonar 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; Fernandez *et al.*, 2004, 2005a,b; Hildebrand, 2005; Cox *et al.*, 2006) suggests that caution is warranted when dealing with exposure of marine mammals to any high-intensity pulsed sound.

There is no conclusive evidence of cetacean strandings or deaths at sea as a result of exposure to seismic surveys, but a few cases of strandings in the general area where a seismic survey was ongoing have led to speculation concerning a possible link between seismic surveys and strandings. Suggestions that there was a link between seismic surveys and strandings of humpback whales in Brazil (Engel *et al.*, 2004) was not well founded based on available data (IAGC, 2004; IWC, 2006). In September 2002, there was a stranding of two Cuvier's beaked whales (*Ziphius cavirostris*) in the Gulf of California, Mexico, when the L-DEO vessel R/V *Maurice Ewing* (*Ewing*) was operating a 20–gun, 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, including avoiding submarine canyons, where deep diving species may congregate, and (3) differences between the sound sources operated by SIO and those involved in the naval exercises associated with strandings.

Potential Effects of Other Acoustic Devices

Sub-bottom Profiler Signals

A SBP will be operated from the source vessel at all times during the planned study. Sounds from the SBP are very short pulses, occurring for 12 or 24 ms once every 4.5 to 8 seconds. Most of the energy in the sound pulses emitted by the SBP is at mid frequencies, centered at 3.5 kHz. The beamwidth is approximately 80° and is directed downward.

The SBP on the *Wecoma* has a maximum source level of 211 dB re 1 μPam. Thus the received level would be expected to decrease to 180 dB and 160 dB approximately 35 m (115 ft) and 350 m (1,148 ft) below the transducer, respectively, assuming spherical spreading. Corresponding distances in the horizontal plane would be substantially lower, given the directionality of this source. 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, and 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 and the brief period when an individual mammal is likely to be within its beam. Furthermore, in the case of most odontocetes, the 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. Therefore, behavioral responses are not expected unless marine mammals are very close to the source.

The source levels of the SBP are much lower than those of the airgun. It is unlikely that the SBP produces pulse levels strong enough to cause hearing impairment or other physical injuries even in an animal that is (briefly) in a position near the source. The SBP is usually operated simultaneously with other higher-power acoustic sources. Many marine mammals will move away in response to the approaching higher-power sources or the vessel itself before the mammals would be close enough for there to be any possibility of effects from the less intense sounds from the SBP. In the case of mammals that do not avoid the approaching vessel and its various sound sources, mitigation measures that would be applied to minimize effects of other sources would further reduce or eliminate any minor effects of the SBP.

As stated above, NMFS is assuming that Level A harassment onset corresponds to 180 and 190 dB re 1 μPa (rms) for cetaceans and pinnipeds, respectively. The precautionary nature of these criteria is discussed in Appendix A(5) of SIO's application, 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 9–13 kHz. Once the OBS is ready to be retrieved, an acoustic release transponder interrogates the OBS at a frequency of 9–11 kHz, and a response is received at a frequency of 9–13 kHz. The burn wire release is then activated, and the instrument is released from the anchor to float to the surface. These signals will be used very intermittently. It is unlikely that the acoustic release signals would have effects on marine mammals through masking, disturbance, or hearing impairment. Any effects likely would be de minimus given the brief exposure at low levels.

Estimated Take by Incidental Harassment

All anticipated takes would be ''takes by harassment,'' involving temporary changes in behavior. The proposed monitoring and mitigation measures are expected to minimize the possibility of injurious takes. (However, as noted earlier, there is no specific information demonstrating that injurious ''takes'' would occur even in the absence of the planned monitoring and mitigation measures.) The sections below describe methods to estimate ''take by harassment'', and present estimates of the numbers of marine mammals that might be affected during the proposed seismic program. The estimates of ''take by harassment'' are based on (1) data concerning marine mammal densities (numbers per unit area) obtained during surveys off Oregon and Washington during 1996, 2001, and 2005 (cetaceans), or 1989 to 1990 (pinnipeds) by NMFS Southwest Fisheries Science Center (SWFSC), and (2) estimates of the size of the 160 dB isolpeths where takes could potentially occur from the proposed seismic survey off the coast of Oregon in the northeastern Pacific Ocean.

Extensive systematic aircraft and ship-based surveys have been conducted for marine mammals offshore of Oregon and Washington (Bonnell *et al.*, 1992; Green *et al.*, 1992, 1993; Barlow 1997, 2003; Barlow and Taylor, 2001; Calambokidis and Barlow, 2004; Barlow and Forney in prep.). The most comprehensive and recent density data available for cetacean species in slope and offshore waters of Oregon are from the 1996, 2001, and 2005 NMFS SWFSC ''ORCAWALE'' or ''CSCAPE'' ship surveys as synthesized by Barlow and Forney (2007). The surveys were conducted up to approximately 550 km (342 mi) offshore from June or July to November or December. Systematic, offshore, at-sea survey data for pinnipeds are more limited. The most comprehensive such studies are reported by Bonnell *et al.* (1992) based on systematic aerial surveys conducted in 1989–1990.

Oceanographic conditions, including occasional El Nino and La Nina events, influence the distribution and numbers of marine mammals present in the Northeast Pacific Ocean, including Oregon, resulting in considerable year-to-year variation in the distribution and abundance of many marine mammal species (Forney and Barlow, 1998; Buchanan *et al.*, 2001; Escorza-Trevino, 2002; Ferrero *et al.*, 2002; Philbrick *et al.*, 2003). Thus, for some species the densities derived from recent surveys may not be representative of the densities that will be encountered during the proposed seismic survey. For this IHA application, cruise reports from the ORCAWALE 2008 surveys (NMFS, 2008) were inspected to assess whether there were any observable changes from the previous surveys of the same area.

Table 3 of SIO's application gives the average and maximum densities for each species of cetacean reported off Oregon and Washington, corrected for effort, based on the densities reported for the 1996, 2001, and 2005 surveys (Barlow and Forney, 2007). The densities from those studies had been corrected, by the original authors, for both detectability bias and availability bias. Detectability bias is associated with diminishing sightability with increasing lateral distance from the trackline. Availability bias refers to the fact that there is <100 percent probability of sighting an animals that is present along the survey trackline.

Table 3 of SIO's application also includes mean density information for three of the five pinnipeds species that occur off Oregon and Washington and mean and maximum densities for one of those species, from Bonnell *et al.* (1992). Densities were not calculated for the other two species because of the small number of sightings on systematic transect surveys. One of those, the northern elephant seal, was the dominant seal sighted during the ORCAWALE 2008 surveys (29 of 33 pinnipeds sighted off Oregon and Washington), so it was included at a density set at twice that of the northern fur seal, the other species sighted during the ORCAWALE 2008 surveys.

It should be noted that the following estimates of ''takes by harassment'' assume that the surveys will be undertaken and completed; in fact, the planned number of line kms has been increased by 25 percent to accommodate lines that may need to be repeated, equipment testing, etc. As is typical on offshore ship surveys, inclement weather, and equipment malfunctions are likely to cause delays and may limit the number of useful line kms of seismic operations that can be undertaken. Furthermore, any marine mammal sightings within or near the designated safety zones will result in the shut-down of seismic operations as a mitigation measure. Thus, the following estimates of the numbers of marine mammals potentially exposed to 160 dB 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.

There is some uncertainty about the representativness of the data and the assumption used in the calculations. However, the approach used is believed to be the best available approach. Also, to provide some allowance for these uncertainties ''maximum estimates'' as well as ''best estimates'' of the numbers potentially affected have been derived. Best and maximum estimates are based on the average and maximum estimates of densities reported primarily by Barlow and Forney (2007) and Bonnell *et al.* (1992) described above. The estimated numbers of potential individuals exposed are presented below based on the 160 dB re 1 μPa (rms) Level B harassment criterion for all cetaceans and pinnipeds. It is assumed that a marine mammal exposed to airgun sounds this strong might change their behavior sufficiently to be considered ''taken by harassment.''

The number of different individuals that may be exposed to GI 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 proposed seismic lines do not run parallel to each other in close proximity, which minimizes the number of times an individual mammal may be exposed during the survey. The best estimates in this section are based on the averages of the densities from the 1996, 2001, and 2005 NMFS surveys, and maximum estimates are based on the highest of the three densities. Table 4 of SIO's application and Table 2 of this **Federal Register** notice show the best and maximum estimates of the number of marine mammals that could potentially be affected during the seismic 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; and
- The area anticipated to be ensonified to that level during GI airgun operations.

The area expected to be ensonified was determined by entering the planned survey lines into a MapInfo Geographic Information System (GIS), using the GIS to identify the relevant areas by ''drawing'' the applicable 160 dB buffer around each seismic line (depending on water and tow depth) and then calculating the total area within the buffers. Areas where overlap occurred (because of intersecting lines) were included only once to determine the area expected to be ensonified. In the proposed survey, there is minimal overlap (5 percent for 160 dB), so virtually no marine mammal would be ensonified above those thresholds more than once.

Applying the approach described above, approximately 208 km2 (80.3 mi^2) would be within the 160 dB isopleth on one or more occasions during the surveys at all 16 OBS locations. For inshore OBS locations, approximately 60 km^2 (23 mi^2) would be within the 160 dB isopleths; that area was used for calculations for the pinniped species that could occur only at those locations. This approach does not allow for turnover in the mammal populations in the study area during the course of the surveys. That might underestimate actual numbers of individuals exposed, although the conservative distances used to calculate the area may offset this. In addition, the approach assumes that no cetaceans will move away or toward the trackline as the *Wecoma* approaches, in response to increasing sound levels prior to the time the levels reach 160 dB. Another way of interpreting the estimates that follow in Table 3 (below) is that they represent the number of individuals that are expected (in the absence of a seismic program) to occur in the waters that will be exposed to ≥160 dB re 1 μPa (rms).

TABLE 3. THE ESTIMATES OF THE POSSIBLE NUMBERS OF MARINE MAMMALS EXPOSED TO SOUND LEVELS GREATER THAN OR EQUAL TO 160 DB DURING SIO'S PROPOSED SEISMIC SURVEY OFF OREGON IN JULY 2009. THE PROPOSED SOUND SOURCE IS A SINGLE GI AIRGUN. 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 2–4 IN SIO'S APPLICATION FOR FURTHER DETAIL.

Species	# of Individuals Exposed (best)[1]	# of Individuals Exposed (max)[1]	Approx. % Regional Population (best)[2]
Mysticetes			
Eastern Pacific gray whale *(Eschrichtius robustus)*	0	0	0
North Pacific right whale (*Eubalaena japonica*)	0	0	0
Humpback whale (Megaptera novaeangliae)	0	2	0
Minke whale(*Balaenoptera acutorostrata*)	0	0	0
Sei whale(*Balaenoptera borealis*)	0	0	0
Fin whale (*Balaenoptera physalus*)	0	1	0
Blue whale (*Balaenoptera musculus*)	0	1	0

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Species	# of Individuals Exposed (best)[1]	# of Individuals Exposed (max)[1]	Approx. % Regional Population (best)[2]
Odontocetes			
Sperm whale (*Physeter macrocephalus*)	0	8	0
Pygmy sperm whale (*Kogia breviceps*)	0	1	N.A.
Dwarf sperm whale (*Kogia sima*)	0	0	0
Cuvier's beaked whale (*Ziphius cavirostris*)	0	0	0
Baird's beaked whale (*Berardius bairdii*)	0	1	0
Blainville's beaked whale (Mesoplodon densirostris)	0	0	0
Hubb's beaked whale(*Mesoplodon carlhubbsi*)	0	0	0
Stejneger's beaked whale (*Mesoplodon stejnegeri*)	0	0	0
Mesoplodon sp. (unidentified)	0	1	0
Offshore bottlenose dolphin (*Tursiops truncatus*)	0	0	0
Striped dolphin (*Stenella coeruleoalba*)	0	0	0
Short-beaked common dolphin (*Delphinus delphis*)	4	9	<0.01
Pacific white-sided dolphin *Lagenorhynchus obliquidens*)	6	9	0.02
Northern right-whale dolphin (*Lissodelphis borealis*)	5	7	0.02
Risso's dolphin (*Grampus griseus*)	3	4	0.03
False killer whale (*Pseudorca crassidens*)	0	0	N.A.
Killer whale (*Orcinus orca*)	0	1	0
Short-finned pilot whale (*Globicephala macrorhynchus*)	0	0	0
Harbor porpoise (*Phocoena phocoena*)	0	0	0
Dall's porpoise (*Phocoenoides dalli*)	39	65	0.1
Pinnipeds			
Northern fur seal (*Callorhinus ursinus*)	3	26	<0.01

TABLE 3. THE ESTIMATES OF THE POSSIBLE NUMBERS OF MARINE MAMMALS EXPOSED TO SOUND LEVELS GREATER THAN OR EQUAL TO 160 DB DURING SIO'S PROPOSED SEISMIC SURVEY OFF OREGON IN JULY 2009. THE PROPOSED SOUND SOURCE IS A SINGLE GI AIRGUN. 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 2–4 IN SIO'S APPLICATION FOR FURTHER DETAIL.—Continued

Species	# of Individuals Exposed (best)[1]	# of Individuals Exposed (max)[1]	Approx. % Regional Population (best)[2]
California sea lion (*Zalophus californianus*)	N.A.	N.A.	N.A.
Steller sea lion (*Eumetopias jubatus*)	1	N.A.	<0.01
Harbor seal (*Phoca vitulina richardsi*)	1	N.A.	<0.01
Northern elephant seal (*Mirounga angustirostris*)	5	52	<0.01

N.A.—Data not available or species status was not assessed
[1] Best estimate and maximum estimate density are from Table 3 of SIO's application.
[2] Regional population size estimates are from Table 2 (above).

Table 4 of SIO's application shows the best and maximum estimates of the number of exposures and the number of individual marine mammals that potentially could be exposed to greater than or equal to 160 dB re 1 µPa (rms) during the different legs of the seismic survey if no animals move away from the survey vessel.

The ''best estimate'' of the 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) (but below Level A harassment thresholds) during the survey is shown in Table 4 of SIO's application and Table 3 (shown above). The maximum estimates have been requested by SIO. The ''best estimate'' total includes 0 baleen whale individuals. These estimates were derived from the best density estimates calculated for these species in the area (see Table 4 of SIO's application). In addition, 0 sperm whales (0 percent of the regional population) as well as 0 beaked whales (0 percent of the regional population). Based on the best estimates, most (85.1 percent) of the marine mammals potentially exposed are dolphins and porpoises; short-beaked common, Pacific white-sided, Northern right-whale, Risso's dolphins and Dall's porpoises are estimated to be the most common species in the area, with best estimates of 4 (<0.01 percent of the regional population), 6 (0.02 percent), 5 (0.02 percent), 3 (0.03 percent), and 39 (0.01 percent) exposed to greater or equal to 160 dB re µPa (rms) respectively. The remainder of the marine mammals that may be potentially exposed are pinnipeds; Northern fur, harbor, and Northern elephant seals, and Steller sea lions are estimated to be the most common species in the area, with best estimates of 3 (<0.01 percent), 1 (<0.01 percent), 5 (<0.01 percent), and 1 (<0.01 percent) exposed to greater or equal to 160 dB re µPa (rms) respectively. Haul-outs of California sea lions and harbor seals are known to be located in the Newport, Oregon area. All of these numbers are considered small relative to the population sizes of the affected species or stocks.

Potential Effects on Marine Mammal Habitat

The proposed SIO seismic survey will not result in any permanent impact on habitats used by marine mammals, or to the food sources they use. The main impact issue associated with the proposed activity will be temporarily elevated noise levels and the associated direct effects on marine mammals, as described above. The following sections briefly review effects of airguns on fish and invertebrates, and more details are included in SIO's application and EA.

Potential Effects on Fish and Invertebrates

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 very limited (see Appendix B of SIO's application). 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. 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.

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 B of SIO's application). For a given sound to result in hearing loss, the sound must exceed, by some specific amount, the hearing threshold of the fish for that sound (Popper, 2005). The consequences of temporary or permanent hearing loss in individual fish on a fish population is unknown; however, it likely depends on the number of individuals affected and whether critical behaviors involving sound (e.g., predator avoidance, prey capture, orientation and navigation, reproduction, etc.) are adversely affected.

Little is known about the mechanisms and characteristics of damage to fish that may be inflicted by exposure to seismic survey sounds. Few data have been presented in the peer-reviewed scientific literature. As far as we know, there are only two 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 (*Coreogonus 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 ''cutoff frequency'') at about one-quarter wavelength (Urick, 1983; Rogers and Cox, 1988).

Wardle *et al.* (2001) suggested that in water, acute injury and death of organisms exposed to seismic energy depends primarily on two features of the sound source: (1) the received peak pressure, and (2) the time required for the pressure to rise and decay. Generally, as received pressure increases, the period for the pressure to rise and decay decreases, and the chance of acute pathological effects increases. According to Buchanan *et al.* (2004), for the types of seismic airguns and arrays involved with the proposed program, the pathological (mortality) zone for fish 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; Hassel *et al.*, 2003; Popper *et al.*, 2005).

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

Physiological Effects – 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 B of SIO's application).

Summary of Physical (Pathological and Physiological) Effects – As indicated in the preceding general discussion, there is a relative lack of knowledge about the potential physical (pathological and physiological) effects of seismic energy on marine fish and invertebrates. Available data suggest that there may be physical impacts on egg, larval, juvenile, and adult stages at very close range. Considering typical source levels associated with commercial seismic arrays, close proximity to the source would result in exposure to very high energy levels. Whereas egg and larval stages are not able to escape such exposures, juveniles and adults most likely would avoid it. In the case of eggs and larvae, it is likely that the numbers adversely affected by such exposure would not be that different from those succumbing to natural mortality. Limited data regarding physiological impacts on fish and invertebrates indicate that these impacts are short term and are most apparent after exposure at close range.

The proposed seismic program for 2009 is predicted to have negligible to low physical effects on the various stags of fish and invertebrates for its relatively short duration (approximately 7 days) and unique survey lines extent. Therefore, physical effects of the proposed program on fish and invertebrates would not be significant.

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.

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 C of SIO's application).

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.

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 C of SIO's application.

Pathological Effects – In water, lethal and sub-lethal injury to organisms exposed to seismic survey sound could 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 single GI gun planned for the proposed program, the pathological (mortality) zone for crustaceans and cephalopods is expected to be within a few meters of the seismic source; however, very few specific data are available on levels of seismic signals that might damage these animals. This premise is based on the peak pressure and rise/decay time characteristics of seismic airgun arrays currently in use around the world.

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

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. Any primary and secondary stress responses (i.e., changes in haemolymph levels of enzymes, proteins, etc.) of crustaceans after exposure to seismic survey sounds appear to be temporary (hours to days) in studies done to date (J. Payne, DFO, pers. comm.). 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. Change 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 exhibiting 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 and catch rate (Andriguietto-Filho *et al.*, 2005). 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).

Because of the reasons noted above and the nature of the proposed activities, the proposed operations are not expected to cause significant impacts on habitats 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.

Subsistence Activities

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

Proposed Mitigation and Monitoring

Mitigation and monitoring measures proposed to be implemented for the proposed seismic survey have been developed and refined during previous SIO and NSF-funded seismic studies and associated environmental assessments (EAs), IHA applications, and IHAs. The mitigation and monitoring measures described herein represent a combination of procedures required by past IHAs for other similar projects and on recommended best practices in Richardson *et al.* (1995), Pierson *et al.* (1998), and Weir and Dolman (2007). The measures are described in detail below.

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

(1) Speed or course alteration, provided that doing so will not compromise operational safety requirements;

(2) GI airgun shut-down procedures; and

(3) Special procedures for situations or species of particular concern, e.g., emergency shut-down procedures if a North Pacific right whale and minimization of approaches to slopes, if possible, to avoid beaked whale habitat.

Two other common mitigation measures, airgun array power-down and airgun array ramp-up, are not possible because only one, low-volume GI airgun will be used for the surveys. The thresholds for estimating Level A harassment take are also used in connection with proposed mitigation.

Vessel-based Visual Monitoring

Marine Mammal Visual Observers (MMVOs) will be based aboard the seismic source vessel and will watch for marine mammals near the vessel during daytime airgun operations and during start-ups of airguns at night. MMVOs 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 MMVOs will also make observations 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 MMVO observations, the GI airgun will be shut-down (see below) when marine mammals are detected within or about to enter a designated EZ that corresponds to the 180 or 190 dB re 1 μPa (rms) isopleths, depending on whether the animal is a cetacean or pinniped . The MMVOs will continue to maintain watch to determine when the animal(s) are outside the EZ, and airgun operations will not resume until the animal has left that EZ. The predicted distances for the 180, and 190 dB EZs are listed according to the water depth in Table 1 above.

During seismic operations off of the coast of Oregon, at least two MMVOs will be based aboard the *Wecoma*. MMVOs will be appointed by SIO with NMFS concurrence. At least one MMVO will monitor the EZ for marine mammals during ongoing daytime GI airgun operations and nighttime startups of the airguns. MMVO(s) will be on duty in shifts no longer than 4 hours duration. The vessel crew will also be instructed to assist in detecting marine mammals 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 *Wecoma* is a suitable platform for marine mammal observations. Observing stations will be on the bridge wings, with observers' eyes approximately 6.5 m (21.3 ft) above the waterline and a 180 degree view outboard from either side, on the whaleback deck in front of the bridge, with observers eyes approximately 7 m (23 ft) above the waterline and approximately 200 degrees view forward, and on the aft control station, with observer's eyes approximately 5.5 m (18 ft) above the waterline and a approximately 180 degree view aft that includes the 40 m (131 ft) (180 dB) radius area around the GI airgun. The eyes of the bridge watch will be at a height of approximately 6.5 m; MMOs will repair to the enclosed bridge during any inclement weather.

During the daytime, the MMVO(s) will scan the area around the vessel systematically with reticle binoculars (e.g., 7x50), Big-eye binoculars (25x150), optical range finders, and with the naked eye. During darkness, night vision devices will be available, when required. The MMVOs will be in wireless communication with ship's officers on the bridge and scientists in the vessel's operations laboratory, so they can advise promptly of the need for avoidance maneuvers or GI airgun shut down.

Speed or Course Alteration – If a marine mammal is detected outside the EZ but is likely to enter based on its position and the relative movement of the vessel and animal, then if safety and scientific objectives allow, the vessel speed and/or course may be adjusted to minimize the likelihood of the animal entering the EZ. Typically, during seismic operations, major course and speed adjustments are often impractical when towing long seismic streamers and large source arrays, but are possible in this case because only one GI airgun and a short streamer will be used.

Shut-down Procedures – The operating airguns(s) will be shut-down if a marine mammal is detected within or approaching the EZ for the single GI airgun source. Following a shut-down, GI 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:

- Is visually observed to have left the EZ;
- Has not been seen within the EZ for 15 min in the case of species with shorter dive durations - small odontocetes and pinnipeds; and
- Has not been seen within the EZ for 30 min in the case of species with longer dive durations - mysticetes and large odontocetes, including sperm, pygmy sperm, dwarf sperm, killer, and beaked whales.

Procedures for Situations or Species of Particular Concern – Special mitigation procedures will be used for these species of particular concern as follows:

(1) The GI airgun will be shut-down if a North Pacific right whale is sighted at any distance from the vessel;

(2) To avoid beaked whale habitat, approach to slopes will be minimized, if possible, during the proposed survey. Avoidance of airgun operations over or near submarine canyons has become a standard mitigation measure, but there are none within or near the study area. Four of the 16 OBS locations are on the continental slope, but the GI airgun is low volume and it will operate only for a short time (approximately 2 hours at each location).

SIO and NSF will coordinate the planned marine mammal monitoring program associated with the seismic survey off the coast of Oregon with applicable U.S. agencies (e.g., NMFS), and will comply with their requirements.

Proposed Reporting

MMVO Data and Documentation

MMVOs 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 shutdown of the seismic source when a marine mammal or sea turtles 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, cloud cover, and sun glare.

The data listed (time, location, etc.) 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 shut-down, will be recorded in a standardized format. Data accuracy will be verified by the MMVOs at sea, and preliminary reports will be prepared during the field program and summaries forwarded to the operating institution's shore facility and to NSF weekly or more frequently. MMVO observations will provide the following information:

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

(2) Information needed to estimate the number of marine mammals potentially 'taken by harassment.' These data will be reported to NMFS.

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

(4) 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 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 submitted to NMFS, 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. The 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.

Endangered Species Act (ESA)

Under Section 7 of the ESA, NSF has begun consultation with the NMFS, Office of Protected Resources, Endangered Species Division on this proposed seismic survey. NMFS will also consult on the issuance of an IHA under section 101(a)(5)(D) of the MMPA for this activity. Consultation will be concluded prior to a determination on the issuance of the IHA.

National Environmental Policy Act (NEPA)

NSF prepared a draft Environmental Assessment titled ''Marine Seismic Survey in the Northeast Pacific, July 2009.'' NSF's draft EA incorporates an ''Environmental Assessment (EA) of a Planned Low-Energy Marine Seismic Survey by the Scripps Institution of Oceanography in the Northeast Pacific Ocean, July 2009'' prepared by LGL Limited, Environmental Research Associates, on behalf of NSF and SIO. NMFS will either adopt NSF's EA or conduct a separate NEPA analysis, as necessary, prior to making a determination on the issuance of the IHA.

Preliminary Determinations

NMFS has preliminarily determined that the impact of conducting the low-energy marine seismic survey in the Northeast Pacific Ocean 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. The provision requiring that the activity not have an unmitigable impact on the availability of the affected species or stock for subsistence uses is not implicated for this proposed action.

For reasons stated previously in this document, the negligible impact determination is supported by:

(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 23 m (75 ft) in deep water, 35 m (115 ft) in intermediate depths, and 150 m (492 ft) in shallow water when the GI airgun is in use 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 pinnipeds would have to closer than 8 m (26 ft) in deep water, 12 m (39 ft) in intermediate depths, and 95 m (312 ft) in shallow water when the GI airgun is in use from the vessel to be exposed to levels of sound (190 dB) believed to have even a minimal chance of causing PTS;

(4) The fact that marine mammals would have to be closer than 220 m (ft) in deep water, 330 m at intermediate depths, and 570 m (ft) in shallow water when the GI airgun is in use from the vessel to be exposed to levels of sound (160 dB) believed to have even a minimal chance at causing TTS; and

(5) The likelihood that marine mammal detection ability by trained observers is high at that short distance from the vessel, enabling the implementation of shut-downs to avoid injury, serious injury, or mortality. As a result, no take by injury or death is anticipated, and the potential for temporary or permanent hearing impairment is very low and will be avoided through the incorporation of the proposed 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 harassment takings is estimated to be small, less than one percent of any of the estimated population sizes, and has been mitigated to the lowest level practicable through incorporation of the measures mentioned previously in this document.

Proposed Authorization

As a result of these preliminary determinations, NMFS proposes to issue an IHA to SIO for conducting a low-energy marine seismic survey in the Northeast Pacific Ocean in July, 2009, provided the previously mentioned mitigation, monitoring, and reporting requirements are incorporated.

Dated: March 19, 2009.

James H. Lecky,

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

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DEPARTMENT OF COMMERCE

National Oceanic and Atmospheric Administration

RIN 0648–XP28

Incidental Taking of Marine Mammals; Taking of Marine Mammals Incidental to the Explosive Removal of Offshore Structures in the Gulf of Mexico

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

ACTION: Notice; issuance of letters of authorization.

SUMMARY: In accordance with the Marine Mammal Protection Act (MMPA) and implementing regulations, notification is hereby given that NMFS has issued one-year Letters of Authorization (LOA) to take marine mammals incidental to the explosive removal of offshore oil and gas structures (EROS) in the Gulf of Mexico.

DATES: These authorizations are effective from June 1, 2009 through May 31, 2010.

ADDRESSES: The application and LOAs are available for review by writing 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 20910–3235 or by telephoning the contact listed here (see **FOR FURTHER INFORMATION CONTACT**), or online 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 Ken Hollingshead, Office of Protected Resources, NMFS, 301–713–2289.

SUPPLEMENTARY INFORMATION: Section 101(a)(5)(A) of the MMPA (16 U.S.C. 1361 *et seq.*) directs the NMFS to allow, upon request, the incidental, but not intentional, taking of small numbers of marine mammals by United States citizens who engage in a specified activity (other than commercial fishing) within a specified geographical region, if certain findings are made by NMFS and regulations are issued. Under the MMPA, the term ''taking'' means to harass, hunt, capture, or kill or to attempt to harass, hunt capture, or kill marine mammals.

Authorization for incidental taking, in the form of annual LOAs, may be granted by NMFS for periods up to five years if NMFS finds, after notification