SUPPLEMENTAL ENVIRONMENTAL ASSESSMENT ON THE ISSUANCE OF AUTHORIZATIONS TO TAKE MARINE MAMMALS, BY HARASSMENT, INCIDENTAL TO A PLANNED LOW-ENERGY MARINE SEISMIC SURVEY BY THE UNIVERSITY OF TEXAS, INSTITUTE FOR GEOPHYSICS, IN THE NORTHEAST PACIFIC OCEAN, JUNE-JULY 2008

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Office of Protected Resourced
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Abstract

The National Marine Fisheries Service (NMFS), Office of Protected Resources, proposes to issue an incidental harassment authorization for takes of marine mammals pursuant section 101 (a)(5)(D) of the Marine Mammal Protection Act of 1972 (MMPA, 16 U.S.C. 1361 et seq.). The IHA would cover the take of cetacean and pinniped species in the northeastern Pacific Ocean incidental to a low-energy marine seismic survey (the project or proposed activities) off the coast of Oregon during June-July 2008. The scope, objective, location, timing (seasonality) and need for an IHA for the proposed project are similar to those parameters as evaluated for issuance of a 2007 IHA for marine mammal takes incidental to a low-energy seismic survey in the northeastern Pacific Ocean. NMFS previously adopted that 2007 National Science Foundation (NSF) Environmental Assessment (2007 EA) for the purpose of NMFS NEPA analysis of the 2007 IHA issuance. Based on the analysis in that 2007 EA, NMFS determined that the 2007 project could result in "level B harassment" as defined in the MMPA, but that the issuance of the IHA would not significantly impact the quality of the human environment. This SEA evaluates the potential impacts on the human environment associated with issuance of the proposed 2008 IHA by supplementing the 2007 EA's description of the proposed activities and assessment of potential impacts on marine mammals and the marine environment. This SEA specifically updates the cumulative impact analysis to provide a current assessment of additional reasonably foreseeable and ongoing actions.

Introduction

On March 4, 2008, NMFS received an application from University of Texas, Institute for Geophysics (UTIG) requesting an Incidental Harassment Authorization (IHA) under section 101 (a)(5)(D) of the Marine Mammal Protection Act (MMPA) for June-July 2008. The IHA would cover the take of cetacean and pinniped species in the northeastern Pacific Ocean incidental to a low-energy marine seismic survey off the coast of Oregon.

Lamont-Doherty Earth Observatory (L-DEO) and Scripps Institution of Oceanography (SIO) were previously issued IHA's in 2004 and 2007 in respect to similar operations in the same general area.

Specifically, in April, 2007, an "Environmental Assessment (EA) of a Planned Low-Energy Marine Seismic Survey by the Scripps Institution of Oceanography in the Northeast Pacific Ocean, September 2007" was prepared by LGL Limited, Environmental Research Associates, Inc. (LGL) for the National Science Foundation (NSF) to address the issuance of an IHA for a planned marine geophysical survey on the *R/V Wecoma*. NMFS adopted that "Environmental Assessment of a Planned Low-Energy Marine Seismic Survey by the Scripps Institution of Oceanography in the Northeast Pacific Ocean, September 2007" (2007 EA) for purposes of its own NEPA analysis associated with the issuance of the 2007 IHA, which was issued on September 4, 2007 (72 FR 51622, September 10, 2007). The proposed 2008 survey is similar in scope and action area to the 2007 survey, therefore NMFS is supplementing that 2007 EA for purposes of assessing the 2008 proposed IHA issuance in accordance with the National Environmental Policy Act and its implementing regulations. This Supplemental EA (SEA) incorporates the 2007 EA by reference, and supplements that EA as follows:

1. Provide a description of the proposed 2008 survey project in a revised "Proposed Activities" section.
2. Summarizes the environmental consequences associated with low energy seismic surveys as analyzed in the 2007 EA to provide context for the estimate of marine mammal takes proposed to be authorized specific to the 2008 proposed seismic survey.
3. Updates the cumulative impacts analysis as warranted (see the environmental consequences section).
4. Assesses whether there are significant new circumstances or information relevant to environmental concerns from the 2007 EA via assessment of the extent to which new information, including the description of the proposed activities, does, or does not, change the change the effects analysis of the 2007 EA. This assessment is summarized in the "Overall Conclusion" section of this SEA.

The UTIG, with research funding from the National Science Foundation (NSF), plans to conduct a marine seismic survey in the northeastern Pacific Ocean. The oceanographic research vessel *R/V Thomas G. Thompson* (*R/V Thompson*) would be used for the survey. The *R/V Thompson* is operated by the University of Washington and owned by the U.S. Navy. The primary potential effects to the environment are associated with the survey's use of two Generator Injector (GI) airguns with a discharge volume of up to 60 in^3 each.

Numerous species of marine mammals inhabit the northeastern Pacific Ocean. Several species that could occur within the proposed study area off of Oregon are listed as endangered under the U.S. Endangered Species Act (ESA), including the North Pacific right, humpback, sei, fin, blue, and sperm whales. In addition, the southern resident killer whale stock is also listed as endangered, but is unlikely to occur in offshore waters off

Oregon. Similarly, the threatened Steller sea lion is expected to be rare in the offshore study area. The northern sea otter is also listed as threatened, but is only known to occur in coastal waters. UTIG is proposing a marine mammal monitoring and mitigation program to minimize the impacts of the proposed activity on marine mammals present during conduct of the proposed research, and to document the nature and extent of any effects.

The issuance of the IHA would authorize takes of marine mammals by Level B harassment (as defined by the MMPA) incidental to these geophysical operations. Mitigation and monitoring measures would be set in place to ensure the least practical impact on marine mammals.

I. Purpose and Need

The purpose and need described in the 2007 SIO *R/V Wecoma* EA remains applicable for the proposed issuance of the 2008 IHA. In summary, in 2007 and 2008, the SIO and UTIG has determined that conducting a low-energy marine seismic survey might potentially disturb marine mammals and, accordingly, submitted an application for an IHA under MMPA sections 101(a)(5)(D) for the 2007 survey and, later a separate application for this proposed 2008 survey. NMFS' purpose and need is in accordance with the MMPA. The MMPA calls for NMFS to authorize the taking of small numbers of marine mammals incidental to an otherwise lawful activity (other than commercial fishing) provided that NMFS determines that the action will have a negligible impact on the affected species or stocks of marine mammals; and will not have an unmitigable adverse impact on the availability of those species or stocks of marine mammals intended for subsistence uses and that the permissible methods of taking and requirements pertaining to the mitigation, monitoring, and reporting of such takings are set forth. To be eligible for an IHA, the proposed "taking" (with mitigation and monitoring measures in place) must not cause serious physical injury or death of marine mammals.

Purpose of the Proposed Project

The UTIG plans to conduct an ultra-high resolution 3-dimensional (3-D) seismic survey around the methane vent systems of Hydrate Ridge, off the Oregon coast in the northeastern Pacific Ocean. The cruise would take place ~100 km (62 mi) from shore and is scheduled for 30 June through 19 July, 2008.

The purpose of the seismic survey is to investigate the methane vent systems that exist offshore from the state of Oregon. These systems release methane by active venting at the seafloor. They can also form relatively high concentrations of methane hydrate in the sub seafloor, up to 150 m (492 ft) below the sea bottom. The goal is to image these systems in detail to understand how vent structure directs methane from the subsurface to be vented into the oceans, or potentially stored in the subsurface as methane hydrate. Methane is a significant greenhouse gas, and methane release from vents or from hydrate has a large potential for affecting climate. Hydrates also have a large potential as a global energy resource.

The seismic survey will be used to image the subsurface structures that control venting. The vent systems control whether the methane is directly released into the ocean and atmosphere or stored in methane hydrate. Methane hydrate storage has the potential for rapid dissociation and release into the ocean or atmosphere. The subsurface structure that will be imaged will determine the mechanisms involved in methane venting. The results will be applicable to the numerous vent systems that exist on continental margins worldwide. The data will also be used to design observatories that can monitor and assess the methane fluxes and mechanisms of methane release that operate on Hydrate Ridge.

A more detailed description of the UTIG marine seismic survey is contained in the application, which may be viewed at: http://www.nmfs.noaa.gov/prot_res/PR1/Small_Take/smalltake_info.htm#applications.

II. Alternatives Including Proposed Action

NMFS' alternatives for this supplemental EA are the same as the alternatives described in the 2007 EA: (1) issuance of an IHA for the 2008 *R/V Thompson* survey as proposed, (2) issuance of an IHA for a corresponding seismic survey at an alternative time, and (3) the no action alternative, with no IHA and no seismic survey.

Alternative 1 (Proposed Action). Issue an IHA for conduct of the 2008 survey as that survey is described by UTIG.

UTIG plans to conduct an ultra-high resolution seismic and bathymetric program off the Oregon coast in the northeastern Pacific Ocean. The cruise is scheduled to take place for three weeks, during June 30-July 19, 2008. Two GI airguns will be used for the seismic surveys, a multibeam echosounder, and a chirp echosounder will be operated during the cruise. The exact dates may vary as the project plans become more precise. The purpose of the research program is to map methane vent systems of the Hydrate Ridge, as described above under "Purpose and Need." Specific detail on the proposed activities is addressed in the "Proposed Action" section, below.

For context purposes, a description of the 2007 SIO survey is provided here. In September 2007, SIO conducted an ocean-bottom seismograph deployment and a magnetic, bathymetric, and seismic program off the Oregon coast in the northeastern Pacific Ocean. The cruise occurred over seven days, during September 5-11, 2007. A single GI gun was used for the seismic surveys, and a sub-bottom profiler was operated throughout the cruise. Surveys occurred at 16 sites in the Pacific Ocean between approximately 44° and 45° N and 124.5° and 125° W. The surveys took place in water depths 110-3,050 m (361- 10, 004 ft), entirely with in the Exclusive Economic Zone (EEZ) of the U.S. The *R/V Wecoma* (the one source vessel used) deployed a single low-energy GI gun as an energy source (with a discharge volume of 45 in^3), 16 ocean-bottom seismometers (OBSs) that remain in place for a year, and a 300-m (984 ft), 16-channel,

and towed hydrophone streamer. The survey consisted of approximately 21 km (13 mi) of surveys over each of the 16 OBSs. The single GI gun was operated on a small grid for approximately two hours at each of the 16 OBS sites. The project and associated IHA acknowledged that additional seismic operations associated with equipment testing, startup, and repeat coverage of any areas were authorized where initial data quality was sub-standard.

Low-Energy Seismic Survey Specifications:

Institution:	UTIG	SIO
Vessel:	*R/V Thompson*	*R/V Wecoma*
Dates:	June 30-July 19, 2008	September 5-11, 2007
Location:	~44-45° N, 124.5-126° W	~44-45° N, 124.5-125° W
Array:	two 40-60 in^3 GI airguns	one 45 in^3 GI airgun
Receiver:	P-Cable streamer system	300-m hydrophone streamer 16 OBSs
Other ac. sources:	MBES (Simrad EM300 30-kHz) chirp ES (Knudsen 320BR)	no MBES chirp ES (Knudsen 320BR)
Total hrs of airgun ops:	~150 hrs	~48 hrs

MBES = multibeam echosounder
ES = echosounder

Alternative 2. Issue an IHA for a different time of year.

An alternative to issuing the 2008 IHA for the period requested, and to conducting the project then, is to issue the IHA for another time, and to conduct the project at that alternative time. UTIG considered, but rejected, conducting the seismic survey at a different time of the year and obtaining an IHA. The proposed dates for the cruise are the most suitable dates, from a logistical perspective, for the vessel and its crew. The planned dates are dates when all of the personnel and equipment essential to meet the overall project objectives are available.

If the IHA is issued for another date, it could result in significant delay or rescheduling, not only of the northeastern Pacific Ocean cruise, but also of additional oceanographic research planned by UTIG and other academic research institutions for 2008. Delay or rescheduling of this program would cause considerable disruption to the schedules of the supporting activities, which are essential to the success of the project. As the instruments and vessel support are committed to other programs, rescheduling this program, for which planning and logistics have been developed, would cause large economic, personnel, and scientific disruptions. Those could involve not only the *R/V Thompson* itself but also the supporting instrumentation and other research to be conducted from *R/V Thompson*. This is an alternative considered and eliminated from further analysis in this SEA because the project applicant indicated an IHA for a different time of year does not meet their project purpose.

Alternative 3 (No Action).

An alternative to conducting the proposed activities is the "No Action" alternative, i.e., do not issue an IHA, and do not conduct the operations. If the research were not conducted, the "No Action" alternative would result in no disturbance to marine mammals attributable to the proposed activities. The data from the proposed survey will be used to image the subsurface structures that control venting of methane into the ocean and atmosphere or in methane hydrate. The "No Action" alternative, through forcing cancellation of the planned survey, would result in a loss of opportunity to gather important data and knowledge relevant to a number of research fields.

Proposed Action (Alternative 1)

The project action is Alternative 1, issuance of an IHA for the proposed seismic survey project objectives and context, activities, and mitigation measures as planned by UTIG and described in the subsections below.

Project Objectives and Context

The project objectives and context are described above under Alternative 1, the proposed action and preferred alternative.

Proposed Activities

Location of the Activities

The seismic surveys will take place off the Oregon coast in the northeastern Pacific Ocean. The overall area within which the seismic surveys will occur is located between ~44 and 45° N and 124.5 and 126° W. See Figure 1 of UTIG's application (below). The surveys will take place in water depths ~650-1,200 m (2,132-3,936 ft), entirely within the EEZ of the U.S.A.

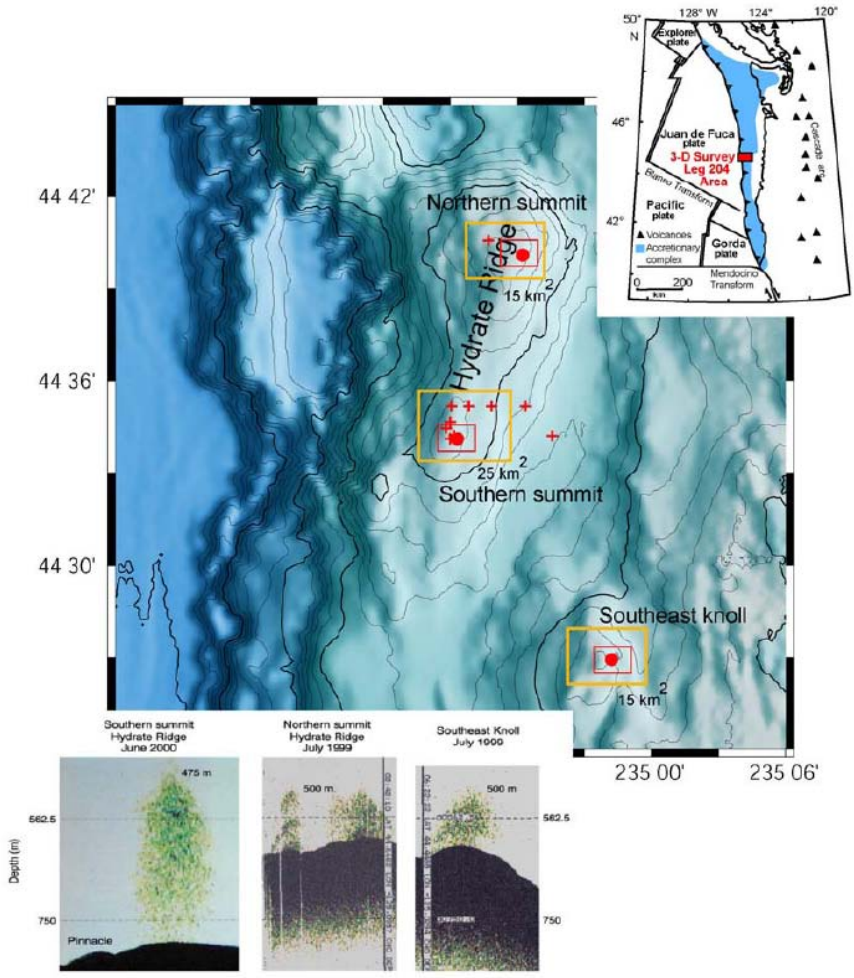

FIGURE 1. Map of the study area, off Oregon in the NEPO, where seismic surveying will take place during June–July 2008. Survey grids are outlined in orange rectangles. Contour interval is 100 m and the bold lines are 1000 m.

Description of Activities

The survey will involve one vessel, the *R/V Thompson*. The source vessel will deploy two low-energy GI airguns as an energy source (with a total discharge volume up to 120 in^3), and a 12-m (39.5 ft) long P-Cable streamer system. As the GI airguns are towed along the survey lines, the P-Cable receiving system will receive the returning acoustic signals.

The seismic program will consist of three survey grids (see Figure 1 of UTIG's application), totaling 975 km (606 mi) of survey lines, including turns, plus additional lines up to 300 km (186 mi) if time permits. Most of the survey (92%) will take place over intermediate (100-1,000 m) depths. There will be some additional seismic operations associated with equipment testing, start-up, and repeat coverage of any areas where initial data quality is sub-standard.

Along with GI airgun operations, additional acoustic systems will be operated at times during the cruise. The Simrad EM300 MBES will be used briefly (up to 2 days) to look at venting into the water column. The 12-kHz frequency of the dual-frequency Knudsen 320BR echosounder will be used during ~1/3 of the cruise. These two systems may or may not be operated simultaneously with the GI airguns. Other acoustical systems available on the *R/V Thompson* will likely not be used during the proposed cruise.

All planned geophysical data acquisition activities will be conducted with assistance by the scientists who have proposed the study, Drs. Nathan Bangs and Matt Hornbach. The vessel will be self-contained, and the crew will live aboard the vessel for the entire cruise.

Schedule

The *R/V Thompson* is scheduled to depart from Seattle Washington, on June 30, 2008 and to return on July 19, 2008. The GI airguns will be used for a total of ~150 hours. The exact dates of the activities may vary by a few days because of weather conditions, repositioning, airgun and streamer operations and adjustments, GI airgun deployment, or the need to repeat some lines if data quality is substandard.

Vessel Specifications

The *R/V Thompson* has a length of 83.5 m (274 ft), a beam of 16 m (52.5 ft), and a full load draft of 5.8 m (19 ft). The ship is equipped with twin 360°-azimuth stern thrusters each powered by a 3,000-hp DC motor and a water-jet bow thruster powered by a 1,600-hp DC motor. The motors are driven by up to three 1,500-kW and three 715-kW generators; normal operations use two 1,500-kW and one 750-kW generator, but this changes with ship speed, sea state, and other variables. An operation speed of 6.5 km/h (3.5 knots) will be used during seismic acquisition. When not towing seismic survey gear, the ship cruises at 22 km/h (12 knots) and has a maximum speed of 26.9 km/h (14.5 knots). It has a normal operating range of ~24,400 km (15,161 mi).

The *R/V Thompson* will also serve as the platform from which vessel-based marine mammal observers will watch for marine mammals and sea turtles before and during airgun operations. The characteristics of the *R/V Thompson* that make it suitable for visual monitoring are described in UTIG's application.

Other details of the *R/V Thompson* include the following:

Owner:	U.S. Navy
Operator:	University of Washington
Flag:	United States of America
Launch Date:	8 July 1991
Gross Tonnage:	3,250 LT
Echosounders:	Simrad EM 300 multibeam, Knudsen 320BR echosounder, Hydrosweep multibeam, EIS-10 navigational echosounder

Acoustic Doppler Current Profiler:	RDI 75-kHz Ocean Surveyor
Compressors for Airguns:	2 x LMF DC, capable of 175 scfm at 2,000 psi
Accommodation Capacity:	60 including 36 scientists

Airgun Description

The *R/V Thompson* will be used as the source vessel. It will tow two GI airguns and the 12-m long P-Cable streamer along predetermined lines. Seismic pulses will be emitted at intervals of ~3.5 s. At a speed of 6.5 km/h (3.5 knots), the 3.5-s spacing corresponds to a shot interval of ~6.3 m (20.7 ft).

The generator chamber of each GI airgun, the one responsible for introducing the sound pulse into the ocean, will be 40 or 60 in^3. The injector chamber (also 40 or 60 in^3) injects air into the previously-generated bubble to maintain its shape, and does not introduce more sound into the water. Thus, the total discharge volume will be 80 to 120 in^3. The two GI airguns will be towed ~29 m (95 ft) behind the ship at a depth of ~1.5 to 3 m (5-10 ft).

As the GI airguns are towed along the survey lines, the towed P-Cable system receives the reflected signals and transfers the data to the on-board processing system. Given the relatively short streamer behind the vessel, the maneuverability of the vessel is not limited much during operations.

Array Specifications:

Energy Source	Two GI airguns, each 40 or 60 in^3
Source output (downward)	0-pk is 7.2 bar-m (237 dB re 1 μPa-m); pk-pk is 14.0 bar m (243 dB)
Towing depth of energy source	~1.5 to 3 m (5-10 ft)
Air discharge volume	~ up to 120 in^3
Dominant frequency components	0-188 Hz

The rms^2 (root mean square) 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 airguns arrays. The measurement units used to describe airgun arrays. The measurement units used to describe airgun sources, peak or peak-to-peak decibels are always higher than the rms decibels referred to in biological literature (Greene 1997; McCauley et al. 1998, 2000). For example, a measured received level of 160 dB re 1 μPa rms in the far field would typically correspond to a peak measurement of ~170-172 dB, and to a peak-to-peak measurement of ~176-178 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.

Multibeam Echosounder Description

A Simrad EM300 30-kHz MBES will be the primary bottom-mapping echosounder during the cruise. The Simrad EM300 transducer is hull-mounted within a transducer pod that is located mid-ship. The system's normal operating frequency is ~30 kHz. The transmit fan-beam is split into either three or nine narrower beam sectors with independent active steering to correct for vessel yaw. Angular coverage is 36° (in Extra Deep Mode, for use in water depths 3000 to 6000 m) or 150° (in shallower water). The total angular coverage of 36° or 150° consists of the 3 or 9 beams transmitted at slightly different frequencies. The sectors are frequency coded between 30 and 34 kHz and they are transmitted sequentially at each ping. Except in very deep water where the total beam is 36° × 1°, the composite fan beam is 150° × 1°, 150° × 2° or 150° × 4° depending on water depth. The 9 beams making up the composite fan beam will overlap slightly if the vessel yaw is less than the fore-aft width of the beam (1, 2, or 4°, respectively). Achievable swath width on a flat bottom will normally be ~5× the water depth. The maximum source level is 237 dB re 1 μPa · m rms (Hammerstad 2005).

In deep water (500–3000 m or 1,640-9,840 ft) a pulse length of 5 ms is normally used. At intermediate depths 100–1000 m or 328-3,280 ft), a pulse length of 2 ms is used, and in shallow water (<300 m or 984 ft), a pulse length of 0.7 ms is used. The ping rate is mainly limited by the round trip travel time in the water up to a ping rate of 10 pings/s in shallow water.

Chirp Echosounder Description

The Knudsen 320BR is a deep-water, dual-frequency echosounder with operating frequencies of 3.5 and 12 kHz. The high frequency (12 kHz) can be used to record water depth or to track pingers attached to various instruments deployed over the side, and that is the mode planned for occasional use in this project. The low frequency (3.5 kHz) is used for sub-bottom profiling. Pulse lengths up to 24 ms and bandwidths to 5 kHz are available. Maximum output power at 3.5 kHz is 10 kW and at 12 kHz it is 2 kW.

Proposed Exclusion Zones (EZs)

The sound pressure field of two 105-in³ GI airguns has been modeled by Lamont-Doherty Earth Observatory (L-DEO) of Columbia University in relation to distance and direction from the GI airguns. The predicted received levels depend on distance and direction from the GI airguns. The model does not allow for bottom interactions and is most directly applicable to close distances and/or deep water. Based on the modeling, estimates of the maximum distances from the GI airguns with a total discharge volume of 210 in³, the values overestimate the distances for two GI airguns with a discharge of up to 120 in³ as planned for use during the proposed survey. However, this use of modeling that overestimates the sound pressure field is appropriate here because those modeled data represent the most current ground-truth information, and are considered the best available science for assessing the volume of water that could be ensonified associated with the proposed research activity.

Empirical data concerning the 180, 170, and 160-dB isopleth zones for various airgun configurations, including a pair of 105 in³ GI airguns, have been acquired based on measurement during an acoustic verification study conducted by L-DEO in the northern Gulf of Mexico (Tolstoy et al. 2004a,b). 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 100-1000 m and <100 m. The proposed survey will occur in depths ~650-1,200 m, so correction factors for the latter are not relevant here. For intermediate/slope waters (100-1,000 m deep), it is assumed that the various radii would be 1.5x the corresponding radii in deep (>1,000 m) water.

The empirical data indicate that, for ***deep water*** (>1000 m), the L-DEO model tends to overestimate the received sound levels at a given distance (Tolstoy et al. 2004a,b). However, to be precautionary pending acquisition of additional empirical data, it is proposed that safety radii during airgun operations in deep water will be the values predicted by L-DEO's model (Table 1). Therefore, the assumed 180- and 190-dB radii are 69 m (226 ft) and 20 m (65.6 ft), respectively.

Empirical measurements were not conducted for ***intermediate depths*** (100–1000 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 previous L-DEO cruises. The assumed 180- and 190-dB radii in intermediate-depth water are 104 m (341 ft) and 30 m (98 ft), respectively (See Table 1 of UTIG's application).

The GI airguns will be shut down immediately when cetaceans or sea turtles are detected within or about to enter the 180-dB re 1 μPa rms radius, or when pinnipeds are detected within or about to enter the 190-dB re 1 μPa rms radius. The 180- and 190-dB shut-down criteria are consistent with guidelines listed for cetaceans and pinnipeds, respectively, by the National Marine Fisheries Service (e.g., NMFS 2000).

Mitigation during Operations

Mitigation measures that are proposed as part of the action by UTIG include (1) vessel speed or course alteration, provided that doing so will not compromise operational safety requirements; (2) GI airgun shut down; (3) GI airgun ramp up; and (4) minimizing approach to slopes and submarine canyons, if possible, because of sensitivity of beaked whales.

Shut-down Procedures

If a marine mammal or turtle is within or about to enter the EZ for the GI airguns, the airguns will be shut down immediately. Following a shut down, GI airgun activity will not resume until the marine mammal or turtle is outside the EZ for the two GI guns. The animal will be considered to have cleared the EZ if it:

1. Is visually observed to have left the EZ;
2. Has not been seen within the EZ for 10 min in the case of small odontocetes and pinnipeds;
3. Has not been seen within the EZ for 15 min in the case of mysticetes and large odontocetes, including sperm, pygmy sperm, dwarf sperm, and beaked whales; or
4. The vessel has moved outside the applicable EZ in the case of a sea turtle sighting, i.e., ~1 min (based on the length of time it would take the vessel to leave the largest modeled EZ of the GI airgun with a speed of 6.5 km/h).

The 10- and 15-min periods specified in (2) and (3), above, are shorter than would be used in a large-source project given the small 180 and 190 dB rms radii for the two GI airguns. GI airguns operations will be able to resume following a shut-down during either the day or night, as the relatively small exclusion zone(s) will normally be visible even at night (based on NSF 90-day Monitoring Reports).

III. Affected Environment

The affected environment was described in NSF's 2007EA and is incorporated here by reference. The environment retains the same characteristics as described in that document. The only expected change relates to the expected occurrence of two species of marine mammals based on the distance offshore of this proposed action (see Marine Mammals subsection below). The overall area within which the three grids of the proposed seismic surveys will occur is located between ~44° and 45° N and between 124.5° and 126° W. The study area for the SIO activity was located ~25-110 km (16-68 mi) from Oregon over water depths ~110-3,050 m (361-10,004 ft) between approximately 44^{o} and 45^{o}N and 124.5^{o} and 125^{o}W, while the proposed seismic survey area for the UTIG activity will be located ~100 km (62 mi) off the Oregon coast in waters 650-1,200 m (2,132-3936 ft).

Marine Mammals

The study area is located ~100 km offshore from Oregon over water depths ~650–1200 m. Two of the 32 species are not expected in the project area because their occurrence off Oregon is limited to very shallow, coastal waters: the gray whale and the sea otter. Three others, the California sea lion, Steller sea lion, and harbor seal, are also mainly coastal, and would be rare in the survey area. Information on the habitat, abundance, and conservation status of the species that may occur in the study area are given in UTIG'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).

The six species of marine mammals expected to be most common in the deep pelagic or slope waters of the project area include the Pacific white-sided dolphin, northern right whale dolphin, Risso's dolphin, short-beaked common dolphin, Dall's porpoise, and northern fur seal (see Green et al. 1992, 1993; Buchanan et al. 2001; Barlow 2003;

Carretta et al. 2007). The sperm whale, pygmy sperm whale, *Mesoplodon* spp., Baird's beaked whale, Cuvier's beaked whale, and northern elephant seal are considered pelagic species, but are generally uncommon in the waters near the survey area.

Sea Turtles

Since 1985, four species of sea turtles have been documented off the coasts of Oregon and/or Washington: the leatherback (*Dermochelys coriacea*), loggerhead (*Caretta caretta*), green (*Chelonia mydas*), and olive ridley (*Lepidochelys olivacea*) turtles (Green et al. 1992; Bowlby et al. 1994; Buchanan et al. 2001). Only the leatherback turtle is likely to occur in the waters off the proposed project area, based on occasional offshore sightings of this species and no documented at-sea sightings of other sea turtles species. The other three species have been documented off the coasts of Oregon or Washington as strandings and are considered extralimital occurrences of those generally warm-water species (Bowlby et al. 1994; Buchanan et al. 2001). Any sea turtle occurring off Oregon and Washington would be a non-nesting individual.

IV. Environmental Consequences

With the exception of new information present here, the NSF 2007 EA adopted by NMFS adequately describes the potential effects on the human environment associated with the proposed 2008 IHA issuance alternatives. This section presents new information related to cumulative impacts. Furthermore, how this new information does, or does not, change the effects analysis of the 2007 EA also is addressed.

Alternative 1: Proposed 2008 Survey and IHA Issuance (Proposed Action)

Summary of Potential Effects of Airgun Sounds

Tolerance

Mysticetes, odontocetes, pinnipeds, sea otters, and sea turtles have all been seen commonly by observers aboard vessels conducting small-source seismic surveys, indicating some degree of tolerance of sounds from small airgun sources (e.g., Calambokidis et al. 2002; Haley and Koski 2004; Holst et al. 2005a; Ireland et al. 2005; MacLean and Koski 2005; see also "site survey" portions of Stone 2003 and Stone and Tasker 2006).

Possible Effects of Sub-bottom Profiler Signals

The Simrad EM300 30-kHz MBES will be operated from the source vessel during ~2 days of the proposed study. Information about this equipment was provided in § I. Sounds from the MBES are very short pulses occurring for 2–5 ms, at a ping rate of up to 10 pings/s depending on depth. Given the minimum water depth in the study area (650 m; 2-way travel time ≥0.9 s), the pulse repetition rate is not likely to exceed 1 ping/s. Most of the energy in the sound pulses emitted by the MBES is at frequencies near 30

kHz- within the audible range for odontocetes and at least some pinnipeds, but probably not for baleen whales (Southall et al. 2008). The beam is narrow (1–4º) in fore-aft extent and wide (150º) in the cross-track extent. Each ping consists of nine beams transmitted at slightly different frequencies. Any given mammal at depth near the trackline would be in the main beam for only one or two of the nine segments. Also, marine mammals that encounter the Simrad EM300 are unlikely to be subjected to repeated pulses because of the narrow fore–aft width of the beam and will receive only limited amounts of pulse energy because of the short pulses. Animals close to the ship (where the beam is narrowest) are especially unlikely to be ensonified for more than one 5 ms pulse (or two pulses if in the overlap area). Similarly, Kremser et al. (2005) noted that the probability of a cetacean swimming through the area of exposure when an MBES emits a pulse is small. The animal would have to pass the transducer at close range and be swimming at speeds similar to the vessel in order to be subjected to sound levels that could cause TTS. Burkhardt et al. (2007) concluded that immediate direct injury was possible only if a cetacean dived under the vessel into the immediate vicinity of the transducer.

Navy sonars that have been linked to avoidance reactions and stranding of cetaceans (1) generally have a longer pulse duration than the Simrad EM300, and (2) are often directed close to horizontally vs. more downward for the MBES. The area of possible influence of the MBES is much smaller—a narrow band below the source vessel. The duration of exposure for a given marine mammal can be much longer for a Navy sonar. Possible effects of an MBES on marine mammals are outlined below.

Masking

Marine mammal communications will not be masked appreciably by the MBES signals given its low duty cycle and the brief period when an individual mammal is likely to be within its beam. Furthermore, in the case of baleen whales, the signals (30 kHz) do not overlap with the frequencies in the calls or with the functional hearing range, which would avoid any possibility of masking.

Behavioral Responses

Behavioral reactions of free-ranging marine mammals to echosounders and other sound sources appear to vary by species and circumstance. Observed reactions have included silencing and dispersal by sperm whales (Watkins et al. 1985), increased vocalizations and no dispersal by pilot whales (Rendell and Gordon 1999), and the previously-mentioned beachings by beaked whales (not associated with echosounders). During exposure to a 21–25 kHz whale-finding sonar with a source level of 215 dB re 1 μPa · m, gray whales showed slight avoidance (~200 m or 656 ft) behavior (Frankel 2005). However, all of those observations are of limited relevance to the present situation. Pulse durations from those sonars were much longer than those of the MBES, and a given mammal would have received many pulses from the naval sonars. During UTIG's operations, the individual pulses will be very short, and a given mammal would not receive many of the downward-directed pulses as the vessel passes by. In the case of baleen whales, the MBES will operate at too high a frequency to have any effect.

Captive bottlenose dolphins and a white whale exhibited changes in behavior when exposed to 1-s pulsed sounds at frequencies similar to those that will be emitted by the MBES used by UTIG, and to shorter broadband pulsed signals. Behavioral changes typically involved what appeared to be deliberate attempts to avoid the sound exposure (Schlundt et al. 2000; Finneran et al. 2002; Finneran and Schlundt 2004). The relevance of those data to free-ranging odontocetes is uncertain, and in any case, the test sounds were quite different in either duration or bandwidth as compared with those from an MBES.

NMFS is not aware of any data on the reactions of pinnipeds to echosounder signals at frequencies similar to the 30-kHz frequency of the *R/V Thompson*'s MBES. Based on observed pinniped responses to other types of pulsed sounds (Harris et al. 2001; Thompson et al. 1998), and the likely brevity of exposure to the MBES sounds, pinniped reactions are expected to be limited to startle or otherwise brief responses of no lasting consequence to the animals.

During a previous low-energy seismic survey from the *R/V Thompson,* the EM300 MBES was in operation most of the time. Many cetaceans and small numbers of fur seals were seen by shipboard marine mammal visual observers (MMVOs), but no specific information about MBES effects (if any) on mammals was obtained (Ireland et al. 2005). These responses (if any) could not be distinguished from responses to the airgun (when operating) and to the ship itself.

It is very unlikely that sub-bottom profiler operations during the planned seismic survey would significantly affect sea turtles through masking, disturbance, or hearing impairment. Any effects would be negligible given the brief exposure and relatively low source level.

As noted earlier, NMFS (2001) has concluded that momentary behavioral reactions "do not rise to the level of taking". Thus, brief exposure of cetaceans or pinnipeds to small numbers of signals from the MBES would not result in a "take" by harassment, even if a brief reaction did occur.

Hearing Impairment and Other Physical Effects

Given recent stranding events that have been associated with the operation of Naval sonar, there is concern that mid-frequency sonar sounds can cause serious impacts to marine mammals (see above). However, the MBES proposed for use by UTIG is quite different than sonars used for navy operations. Pulse duration of the MBES is very short relative to the typical use of naval tactical sonars. Also, at any given location, an individual marine mammal would be in the beam of the MBES for much less time given the generally downward orientation of the beam and its narrow fore-aft beamwidth; navy sonars often use near horizontally directed sound. Those factors would all reduce the sound energy received from the MBES significantly when compared to the tactical sonars used by the Navy.

Although the source level of the Simrad EM300 is not available, the maximum source level of a relatively powerful MBES (Simrad EM120) is 242 dB re 1 μPa rms. At that source level, the received level for an animal within the MBES beam 100 m below the ship would be ~202 dB re 1 μPa rms, assuming 40 dB of spreading loss over 100 m (circular spreading). Given the narrow beam, only one pulse is likely to be received by a given animal. The received energy level from a single pulse of duration 5 ms would be about 179 dB re 1 μPa2 · s, i.e., 202 dB + 10 log (0.005 s). That would be below the TTS thresholds for an odontocete or pinniped exposed to a single non-impulsive sonar transmission (195 and ≥183 dB re 1 μPa2 · s, respectively) and even further below the anticipated PTS thresholds (215 and ≥203 dB re 1 μPa2 · s, respectively) (Southall et al. in press). In contrast, an animal that was only 10 m below the MBES when a ping is emitted would be expected to receive a level 20 dB higher, i.e., 199 dB re 1 μPa2 · s in the case of the EM120. That animal might incur some TTS (which would be fully recoverable), but the exposure would still be below the anticipated PTS threshold for both cetaceans and pinnipeds.

Possible Effects of the Chirp Echosounder Signals

The chirp echosounder will be operated from the source vessel during some periods of the proposed study. Information about the equipment was provided in § II of UTIG's application. Sounds from the chirp echosounder are short pulses, occurring for up to 24 ms once every few seconds. Most of the energy in the sound pulses is at 12 kHz, and the beam is directed downward. The source level of the chirp echosounder is expected to be lower than that of the MBES. Kremser et al. (2005) noted that the probability of a cetacean swimming through the area of exposure when an echosounder 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.

Masking

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

Behavioral Responses

Marine mammal behavioral reactions to other pulsed sound sources are discussed above, and responses to the chirp echosounder are likely to be similar to those for other pulsed sources if received at the same levels. However, the pulsed signals from the chirp echosounder are somewhat weaker than those from the MBES. Therefore, behavioral responses are not expected unless marine mammals are very close to the source. Also, NMFS (2001) has concluded that momentary behavioral reactions "do not rise to the

level of taking." Thus, brief exposure of cetaceans to small numbers of signals from the chirp echosounder would not result in a "take" by harassment.

Hearing Impairment and Other Physical Effects

Source levels of the chirp echosounder are much lower than those of the airguns and the MBES, which are discussed above. Thus, it is unlikely that the chirp echosounder produces pulse levels strong enough to cause hearing impairment or other physical injuries even in an animal is (briefly) in a position near the source. The chirp echosounder is often 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 chirp echosounder. 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 the higher-power sources (see § II [3] of UTIG's application) would further reduce or eliminate any minor effects of the chirp echosounder.

Basis for Estimating "Take by Harassment"

The methods to estimate "takes by harassment" are the same as those described in the 2007 EA. The density estimates have been updated based on recent information, and the most current density's to date are provided in Table 1 below.

Table 1. Densities of marine mammals sighted during surveys off Oregon and Washington, with their appropriate coefficients of variation (CV). Cetacean densities are from Barlow and Forney (2007) and are based on ship transect surveys conducted up to 550 km offshore in 1996, 2001, and/or 2005. Pinniped densities are from at-sea surveys conducted by Bonnell et al. (2002). Densities are corrected for f(0) and g(0). Species listed as endangered or threatened under the ESA are in italics.

Table 1.

	Average Density (#/1000 km²)		**Maximum Density (#/1000 km²)**	
Species	**Density**	**CV[a]**	**Density**	**CV[a]**
Mysticetes				
North Pacific right whale	0	-1	0	-1
Humpback whale	0.69	0.42	1.50	0.48
Minke whale	0.68	0.76	1.1	0.83
Sei whale	0.13	0.83	0.5	0.83
Fin whale	0.95	0.40	1.3	0.57
Blue whale	0.19	0.62	0.4	0.72
Odontocetes				
Sperm whale	1.39	0.58	3.4	0.72
Pygmy sperm whale	1.24	0.94	2.8	0.94

Dwarf sperm whale	0	-1	0	-1
Cuvier's beaked whale	0	-1	0	-1
Baird's beaked whale	1.64	0.60	4.1	0.76
Blainville's beaked whale	0	-1	0	-1
Hubb's beaked whale	0	-1	0	-1
Stejneger's beaked whale	0	-1	0	-1
Mesoplodon spp. (unid.)	0.66	0.83	2.9	0.94
Bottlenose dolphin	0	-1	0	-1
Striped dolphin	0.04	0.94	0.1	0.94
Short-beaked com. dolphin	14.14	0.76	35	0.94
Pacific white-sided dolphin	24.84	0.46	33.2	0.62
North. right-whale dolphin	19.39	0.47	26.7	0.57
Risso's dolphin	12.91	0.45	17.3	0.55
False killer whale	0	-1	0	-1
Killer whale	1.62	0.57	2.7	0.72
Short-finned pilot whale	0	-1	0	-1
Phocoenidae				
Dall's porpoise	150.17	0.26	250.9	0.32
Pinnipeds				
Northern fur seal	10	N.A.	100	N.A.
Steller sea lion	6	N.A.	N.A.	N.A.
Harbor seal	4	N.A.	N.A.	N.A.

N.A.= data not available

[a]CV (Coefficient of Variation) is a measure of a number's variability. The larger the CV, the higher the variability. It is estimated by $0.94 - 0.162 \log_e n$ from Koski et al. (1998), but likely underestimates true variability.

[b] 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).

Potential Number of "Takes by Harassment"

Due to the difference in the airguns and length (distance and time) of the survey proposed for the 2008 IHA as compared to the 2007 IHA, the proposed action results in a different number of estimated "takes by harassment" than the 2007 EA, as summarized in Table 2 below. The methodology for estimating takes by harassment is as described in the 2007 EA, and is summarized below.

Best and Maximum Estimates of the Number of Cetaceans that may be Exposed to ≥160 dB

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 can be estimated by considering the total marine area that would be within the 160-dB radius around the operating GI airguns on at least one occasion. The proposed seismic lines run parallel to each other in close proximity; thus, an individual mammal may be exposed numerous times during the survey. However, it is unlikely that a particular animal would stay in the

area during the entire 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 2 shows the best and maximum estimates of the number of marine mammals that could potentially be exposed to ≥160 dB re 1 μPa rms during the seismic survey.

The number of different individuals potentially exposed to ≥160 dB re 1 μPa rms was calculated by multiplying:
• the expected species density, either "mean" (i.e., best estimate) or "maximum", times
• the anticipated area 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 or 170-dB buffer (see Table 1 of UTIG's application) around each seismic line and then calculating the total area within the buffers. Areas where overlap occurred (because of closely-spaced lines) were included only once to determine the area expected to be ensonified.

Applying the approach described above, ~189 km^2 (117 mi) would be within the 160-dB isopleth on one or more occasions during the survey. Because this approach does not allow for turnover in the mammal populations in the study area during the course of the survey, the actual number of individuals exposed may be underestimated. However, this will be offset to some degree by the fact that the 160 dB (and other) distances assumed here actually apply to a pair of slighter larger GI airguns those to be used in the project. In addition, the approach assumes that no cetaceans will move away or toward the trackline as the *R/V Thompson* approaches in response to increasing sound levels prior to the time the levels reach 160 dB. Another way of interpreting the estimates that follow is that they represent the number of individuals that are expected (in the absence of a seismic program) to occur in the waters that will be exposed to ≥160 dB re 1 μPa rms. With mitigation and monitoring, such as MMVO's that will be visually scanning the ensonified area around the source and implementing measures, NMFS believes that the takes requested by the applicant are overestimates.

Table 2 provides estimates of the possible numbers of marine mammal exposures to the different sound levels, and the numbers of different individuals that might be exposed, during UTIG's proposed seismic survey off Oregon in June-July 2008. The proposed sound source consists of two GI airguns. Received levels of airgun sounds are expressed in dB re 1μPa (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). Delphinids and Dall's propose are unlikely to react to levels below 170 dB. Species in italics are listed under the ESA as *endangered* or *threatened*. The column of numbers in boldface shows the numbers of takes for which authorization is requested.

Table 2.

Species	# of Exposures to Sound Levels ≥160 dB (≥170 dB) Best Estim.	Max Estim.	# of Individuals Exposed to Sound Levels ≥160 dB (≥170 dB) Numb.	% of Region. Pop'n	Max. Estim.	Req. Take Authorization
Mysticetes						
N. Pacific right wh.	0	0	0	0	0	0
Humpback whale	1	2	0	0.01	2	2
Minke whale	1	2	0	0.01	0	0
Sei whale	0	1	0	0.04	1	1
Fin whale	1	2	0	0.01	1	1
Blue whale	0	1	0	0	1	1
Physteridae						
Sperm whale	2	5	0	0.02	8	8
Pygmy sp. whale	2	4	0	0.09	1	1
Dwarf sp. whale	0	0	0	0	0	0
Ziphiidae						
Cuvier's bd. whale	0	0	0	0	0	0
Baird's bd. whale	2	6	0	0.14	4.1	2
Blainville's bd. whale	0	0	0	0	0	0
Hubb's bd. whale	0	0	0	0	0	0
Stejneger's bd. whale	0	0	0	0	0	0
Mesoplodon sp. (un.)	1	4	0	0.01	2.9	1
Delphinidae						
Bottlenose dolphin	0	0	0	0	0	0
Striped dolphin	0	0	0	0	0.1	0
Short-bd. co. dolphin	20 (14)	49	3	<0.01	35	7
Pacific w.-sd dolphin	35 (25)	46	5	0.01	33.2	6
North. r.-wh. dolphin	27 (19)	37	4	0.02	26.7	5
Risso's dolphin	18 (13)	24	2	0.02	17.3	3
False killer whale	0	0	0	0	0	0
Killer whale	2 (2)	4	0	0.07	2.7	1
Short-fin. pilot whale	0	0	0	0	0	0
Phocoenidae						
Harbor porpoise	0	0	0	0	0	0 0
Dall's porpoise	209(150)	349(250)	28	0.03	47	47
Pinnipeds [3]						
Northern fur seal	14 (10)	139 (100)	2	<0.01	19 (12)	19
California sea lion						.
Northern elephant seal						

[1]Best and maximum density estimates are from Table 1, except maximum estimates for endangered species (see text).

[2]Regional population size estimates are from Table 2 of UTIG's application; N.A. means not available.

[3]Steller sea lions and harbor seals are not included because they are coastal and the survey sites are ~100 km offshore.

Best and Maximum Estimates of the Number of Delphinids and Dall's Porpoises that could be Exposed to ≥170 dB

The best and maximum estimates of the numbers of exposures to ≥170 dB for all delphinids during the surveys are 9 and 13, respectively (Table 2). Corresponding estimates for Dall's porpoise are 17 and 29 (Table 2). The estimates are based on the predicted 170-dB radii around the GI airguns to be used during the study and are considered to be more realistic estimates of the number of individual delphinids and Dall's porpoises that may be affected.

Best and Maximum Estimates of the Number of Pinnipeds that could be Exposed to ≥170 dB

The methods described previously for cetaceans were also used to calculate exposure numbers for the one pinniped species likely to be in the survey area and whose densities were estimated by Bonnell et al. (1992). Based on the "best" densities, a single northern fur seal is considered likely to be exposed to GI airgun sounds ≥160 dB re 1 μPa rms. The 'Maximum Estimate' column in Table 2 shows an estimated 19 or 12 northern fur seals that could be exposed to GI airgun sounds ≥160 dB or ≥170 dB re 1 μPa rms, respectively, during the survey. We have also included low maximum estimates for the northern elephant seal, a species that likely would be present but whose density was not calculated because of the small number of sightings on systematic transect surveys. The numbers for which "take authorization" is requested, given in the far right column of Table 2, are based on the maximum 160-dB estimates.

Monitoring Report from SIO's 2007 Marine Seismic Survey

NMFS received a monitoring report titled "Marine Mammal Monitoring during a Low-Energy Seismic and OBS Survey in the NE Pacific ocean by Scripps Institution of Oceanography, on board the OSU Research Vessel *Wecoma*, September 5-11, 2007" from SIO after the completion of their 2007 marine geophysical survey. The IHA for that particular action was issued to SIO on September 4, 2007.

Two NMFS-approved marine mammal visual observers (MMVO's) were onboard during the entire cruise to conduct marine mammal monitoring and mitigation procedures. Each MMVO had previous training and experience with NMFS marine mammal surveys in the Pacific Ocean and field identification of sea turtles. Two geophysical engineers from the Shipboard Technical Support division of SIO were onboard for the full cruise as well. Both had prior experience with conducting seismic surveys under the regulations of an IHA.

The cruise departed Newport, Oregon on September 5, 2007 and returned to Newport on September 11, 2007. The leased air compressor for the seismic source was delayed in shipping and did not arrive before the ship was scheduled to depart. The Chief Scientist decided to depart on time and use the two first two days of the cruise for OBS

deployment. The ship returned to port on September 7 to load the compressor. Seismic operations began on September 8, but were terminated after only one hour due to problems with the compressor. The compressor was repaired at sea, and seismic operations began again on September 9. The seismic surveys continued for 53.5 hours, except for a shut-down period of 5 minutes when a group of Dall's porpoises approached the ship. MMVO's were on watch for 100% of the time when the seismic source was active and most of the daylight hours during non-seismic periods when the ship was underway.

There were 14 sightings of marine mammals and during the cruise. No sea turtles were observed during the survey. The species of marine mammals observed include the humpback whale (*Megaptera novaeangliae*), Pacific-white sided dolphin (*Lagenorhynchus obliquidens*), Dall's porpoise (*Phocoenoides dalli*), killer whale (*Orcinus orca*), California sea lion (*Zalophus californianus*), and northern fur seal (*Callorhinus ursinus*). Only one of these sightings was made while the seismic source was active. A couple of Dall's porpoise approached the vessel to bowride and the seismic source was secured. They were seen to leave the area and the seismic source was re-energized five minutes later. The animals did not enter the safety radius while the source was active. No apparent reaction to the seismic sound source by the Dall's porpoises was observed. The porpoises were never observed to have entered the safety radius of the single airgun.

Cumulative Effects

Cumulative effects refer to the impacts on the environment that result from a combination of past, existing, and reasonably foreseeable activities. Cumulative effects can include multiple causes, multiple effects, effects of activities in more than one locale, and recurring events. Human activities in the region of the proposed seismic survey in the NPO off the coast of Oregon are limited to commercial vessel traffic, fishing, and military activities. The U.S. Navy is in the process of conducting two EISs that address testing and training activities, respectively, off the northwest coast of the U.S. The potential environmental effects of these activities are still undergoing analysis, and no new MMPA authorizations for incidental take have yet been issued. It is reasonably foreseeable that military activities off the northwest coast result in some marine mammal harassment. Those activities, when conducted separately or in combination with other activities, could affect marine mammals and sea turtles in the study area.

NMFS' Southwest Fisheries Science Center (SWFSC) and National Marine Mammal Laboratory (NMML) have scientific research permits to conduct marine mammal surveys and collect data off the U.S. West Coast, including waters offshore of California, Oregon, and Washington. SWFSC's ORCAWALE 2008 survey cruise is a marine mammal assessment survey to estimate the abundance and to understand the distribution of dolphins and whales which are commonly found off the west coast. Other objectives of the cruise are to characterize the pelagic ecosystem within the study area by biological and oceanographic sampling, net sampling, acoustic backscatter methods, and seabird

surveys. Biopsy sampling and photo-identification studies of cetacean species of special interest will also be conducted.

All permits issued by NMFS, including the proposed permits, for research on marine mammals, contain conditions requiring the permit holders to coordinate their activities with the NMFS regional offices and other permit holders conducting research on the same species in the same areas, and, to the extent possible, data are shared to avoid unnecessary duplication of research and disturbance of animals. NMFS does not expect that any serious injuries or unintentional mortalities would occur as a result of the proposed research activities. NMFS does not feel that the number of proposed takes, when added, cumulatively, to the currently authorized research activities occurring in the North Pacific, would adversely impact any marine mammal species. Also, NMFS does not believe disturbances from any research activities under the proposed action would likely reduce the reproduction, numbers, or distribution of marine mammals and, consequently, would not likely have a significant cumulative effect on them.

SIO is currently planning another possible low-energy marine seismic survey on the *R/V Wecoma* in the same area off the coast of Oregon described in the 2007 IHA application and EA. The geophysical cruise will be almost identical to the 2007 action, using a single GI airgun and recovering the 16 OBSs deployed during the previous year (SIO 2007 EA). A possible slight shift in timing may occur during the planned survey, from the second week in September (2007) to the second week of August (2008) or to later in the fall depending on ship scheduling and logistics.

Because the UTIG cruise will add little to activities in the proposed seismic survey area or other activities there are limited, cumulative impacts on marine mammals, sea turtles, and their prey species are expected to be no more than minor and short-term. The relatively low number of each species that experience short-term Level B harassment is not expected to result in a significant cumulative impact when considered in other activities that may occur, and that the discrete number of days limits the potential for this action to synergistically interact with other actions that might be impacting these individuals this far offshore.

Conclusions

Alternative 1. Issue an IHA for conduct of the 2008 survey as that survey is described by UTIG.

The proposed UTIG seismic survey in the NEPO involves towing two GI airguns that would introduce pulsed sounds into the ocean, as well as multibeam and chirp echosounder operations. A towed P-Cable system would be deployed to receive and record the returning signals. Routine vessel operations, other than the proposed GI airgun operations, are conventionally assumed not to affect marine mammals sufficiently to constitute "taking." No "taking" of marine mammals or sea turtles is expected in association with operations of the echosounders given the considerations discussed in §

IV(1)(b) of UTIG's application, i.e., sounds are beamed downward, the beam is narrow, and the pulses are extremely short.

Taking into account the mitigation measures that are planned (see § II of UTIG's application), effects on cetaceans are generally expected to be limited to avoidance of the area around the seismic operation and short-term changes in behavior, falling within the MMPA definition of "Level B harassment." Furthermore, the estimated numbers of animals potentially exposed to sound levels sufficient to cause appreciable disturbance are very low percentages of the regional population sizes. The best estimates of the numbers of individual cetaceans (33 for all species combined) that would be exposed to sounds ≥160 dB re 1 μPa rms during the proposed survey represent, on a species-by-species basis, no more than 0.11% of the regional populations (Table 4). Dall's porpoise is the cetacean species with the highest estimated number of individuals exposed to ≥160 dB (Table 4). Thus, this proposed action is similar to the 2007 EA in that the action is expected to result in takes by Level B harassment only, and no more than a small number of takes of any marine mammal species or stock are anticipated.

Varying estimates of the numbers of marine mammals that might be exposed to GI airgun sounds during the summer 2008 seismic survey in the NEPO are presented in this SEA, depending on the specific exposure criterion (≥160 or ≥170 dB) and density criterion used (best or maximum). The requested "take authorization" for each species is based on the estimated maximum number of individuals that might be exposed to ≥160 dB re 1 μPa rms. That figure likely overestimates (in most cases by a large margin) the actual number of animals that will be exposed to and will react to the seismic sounds. The reasons for that conclusion are outlined above. The relatively short-term exposures are unlikely to result in any long-term negative consequences for the individuals or their populations.

Serious injuries or mortality (Level A harassment) are not anticipated during the seismic survey. Marine mammals are expected to avoid the source vessel and mitigation and monitoring measures implemented by MMVOs are expected to further reduce the potential for Level A harassment during the cruise.

The many cases of apparent tolerance by cetaceans of seismic exploration, vessel traffic, and some other human activities show that marine mammals generally have a capacity to habituate and co-exist with anthropogenic sound sources. Mitigation measures such as controlled speed, course alternation, look outs, non-pursuit, and shut-downs when marine mammals are seen within defined ranges should further reduce short-term reactions, and minimize any effects on hearing sensitivity. In all cases, the effects are expected to be short-term, with no lasting biological consequence. Although there are some differences in the details of the proposed survey itself, this assessment of the proposed 2008 action indicates that the expected environmental consequences are within range of those considered in the 2007 EA in reaching a conclusion that an IHA could be issued and the proposed action would not result in significant impacts to the quality of the human environment.

2. Alternative 2: Another Time

An alternative to issuing the IHA for the period requested, and to conducting the project then, is to issue the IHA for another time, and to conduct the project at that alternative time. The proposed dates for the cruise (June 30- July 19, 2008) are the dates when the personnel and equipment essential to meet the overall project objectives are available.

Marine mammals are expected to be found in the proposed study area regardless of the timing of the survey. Some marine mammal species likely are year-round residents in the northeastern Pacific Ocean, so altering the timing of the proposed project likely would result in no net benefits for those marine mammal species. Other marine mammal species (e.g., blue whale, fin whale, and humpback whale) are migratory, spending the austral summer months in higher latitudes and migrating to lower latitudes to breed in the austral winter. However, densities in the study area and corresponding takes are so low that consideration of conducting the survey at another time to minimize impacts to these species is not warranted. Sea turtles could be encountered at any time of the year.

3. Alternative 3: No Action

Under Alternative 3, NMFS would not issue an IHA and no authority be given to take marine mammals, therefore the seismic survey activity would not occur. Under this alternative, there would be no disturbance to marine mammals and no effects on sea turtles attributable to the proposed activities.

V. Overall Conclusion

While the additional information contained in this supplemental EA gives a better understanding of the activities and cumulative impacts to the human environment, based on the analysis herein there is no significant change to the determinations made in the NMFS' 2007 EA for SIO's activities. Based on the information contained in NMFS 2007 EA and this SEA, NMFS believes that the issuance of an IHA for the proposed UTIG survey would, will not significantly affect the quality of the human environment.

Taking into account the mitigation measures that are planned (speed and course alterations, ramp-ups of GI airguns, GI airgun shut-downs when marine mammals approach or enter the safety radii, and avoidance of slopes and submarine canyons), effects on marine mammals from the preferred alternative are generally expected to be limited to temporary avoidance of the area around the seismic operation and short-term behavioral changes, falling within the MMPA definition of "Level B harassment". No injury or mortality is anticipated. Numbers of individuals of all species taken are expected to be small (relative to species abundance), and the take is anticipated to have a negligible impact on the species or stock.

Although external scoping was not conducted for this SEA, the scope and analysis in this document benefits from extensive prior public review of proposed incidental take authorization for similar actions. NMFS has been authorizing take for multiple seismic

research surveys per year, for several years, and has developed relatively standard mitigation and monitoring measures, which have been vetted to the public many times. For example, the *Federal Register* notice that announced the proposed SIO IHA for the action on the *R/V Wecoma* in 2007 received two public comments, which have been addressed in the *Federal Register* notice announcing the issuance of the final IHA. The *Federal Register* notice for the proposed UTIG IHA for the seismic survey on the *R/V Thompson* in 2008 received one public comment that will be addressed in the *Federal Register* notice announcing the issuance of the final IHA.

In the previous 2007 SIO action and for the proposed 2008 UTIG action, the Marine Mammal Commission (MMC) recommended that NMFS issue the IHA, provided that: (1) the applicant be required to conduct all practicable monitoring and mitigation measures that reasonably can be expected to protect the potentially affected marine mammal species from serious injury; and (2) operations be suspended immediately, pending review by NMFS, if a dead or seriously injured marine mammal is found in the vicinity of the operations and the death or injury could have occurred incidental to the seismic survey. NMFS considered these comments in the development of mitigation measures for this 2008 proposed survey, and believes that the proposed measures that are analyzed here and would be included in an IHA require UTIG to conduct all practicable monitoring and mitigation measures necessary to protect marine mammals from serious injury (i.e., vessel speed and/or course alteration, shutdown procedures, and minimizing approach to slopes and submarine canyons, if possible). NMFS believes that it is highly unlikely that a marine mammal will be exposed to levels of sound likely to result in Level A harassment or mortality given the very small radii of a Level A 'harassment zone' (i.e., 104 m (341 ft) in intermediate waters and 69 m (226 ft) in deep water for 180 dB, and 30 m (98.4 ft) in intermediate waters and 20 m (65.6 ft) in deep water for 190 dB) around the *R/V Thompson's* small airguns and the likely effectiveness of the mitigation measures. This effectiveness of mitigation is based on feedback from monitoring required for prior seismic survey IHAs (see SIO's monitoring reports from low-energy seismic surveys in 2006-2007). Also, NMFS would include the following measure in the 2008 IHA:

> "In the unanticipated event that any cases of marine mammal injury or mortality are judged to result from these activities, UTIG will immediately shut down the airgun and report the incident to NMFS and the local stranding network. Airgun operation will then be postponed until NMFS is able to review the circumstances and work with UTIG to determine whether modifications in the activities are appropriate and necessary."

In regards to the 2007 SIO IHA, NMFS also received one comment from an individual expressing the opinion that the authorization should be denied because this type of activity is much more harmful than the "profiteers" admit, causing extreme harm to the animals, such as brain hemorrhages which cause the death of the animals. No supporting information was provided for these assertions, and NMFS believes that the contrary analyses presented in the EA and our *Federal Register* notice remain correct.

On May 23, 2008, NMFS published the proposed IHA for the low-energy seismic survey on the *R/V Thompson* (73 FR 30076) in the *Federal Register* for public comment. Public comments have been appropriately considered and would be addressed in any Final IHA issued for this action. As of the release of this document, NMFS has received one substantive comment from the MMC for this 2008 action which will be addressed in the Final IHA as noted above.

Prepared by: _____ _____

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The NSF documents listed above are available at:
http://www.nmfs.noaa.gov/prot_res/PR1/Small_Take/smalltake_info.htm#applications