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Incidental Takes of Marine Mammals During Specified Activities; Marine Geophysical Survey in Southeast Asia, March–July 2009; Notice

DEPARTMENT OF COMMERCE

National Oceanic and Atmospheric Administration

RIN 0648–XL89

Incidental Takes of Marine Mammals During Specified Activities; Marine Geophysical Survey in Southeast Asia, March–July 2009

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

ACTION: Notice; issuance and modification of an incidental take authorization.

SUMMARY: In accordance with the Marine Mammal Protection Act (MMPA) regulations, notification is hereby given that NMFS issued and modified an Incidental Harassment Authorization (IHA) to Lamont-Doherty Earth Observatory (L–DEO), a part of Columbia University, for the take small numbers of marine mammals, by harassment, incidental to conducting a marine seismic survey in Southeast (SE) Asia during March–July 2009.

DATES: Effective March 31, 2009, through August 20, 2009.

ADDRESSES: A copy of the IHA and application are available 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. 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 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:

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 (U.S.) citizens who engage in a specified activity (other than commercial fishing) within a specified geographical region if certain findings are made and either regulations are issued or, if the taking is limited to harassment, a notice of a proposed authorization is provided to the public for review.

Authorization 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 (where relevant), 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 U.S. can apply for an authorization to incidentally take small numbers of marine mammals by harassment. Except with respect to certain activities not pertinent here, the MMPA defines ''harassment'' as:

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

16 U.S.C. 1362(18)

Section 101(a)(5)(D) establishes a 45-day time limit for NMFS' review of an application followed by a 30-day public notice and comment period 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 October 27, 2008, NMFS received an application from L–DEO 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 marine seismic survey in SE Asia. The funding for the Taiwan Integrated Geodynamics Research (TAIGER) survey is provided by the NSF. The proposed survey will encompass the area 17°30′–26°30′ N, 113°30′–126° E within the Exclusive Economic Zones (EEZ) of Taiwan, Japan, and the Philippines, and on the high seas, and is scheduled to occur from March 31 to July 20, 2009. Some minor deviation from these dates is possible, depending on logistics and weather.

Taiwan is one of only a few sites of arc-continent collision worldwide; and one of the primary tectonic environments for large scale mountain building. The primary purpose of the TAIGER project is to investigate the processes of mountain building, a fundamental set of processes which plays a major role in shaping the face of the Earth. The vicinity of Taiwan is particularly well-suited for this type of study, because the collision can be observed at different stages of its evolution, from incipient, to mature, and finally to post-collision.

As a result of its location in an ongoing tectonic collision zone, Taiwan experiences a great number of earthquakes, most are small, but many are large and destructive. This project will provide a great deal of information about the nature of the earthquakes around Taiwan and will lead to a better assessment of the earthquake hazards in the area. The information obtained from this study will help the people and the earthquake hazards in the area. The information obtained from this study will help the people and government of Taiwan to better prepare for future seismic events and may thus mitigate some of the loss of life and economic disruptions that will inevitably occur.

The action is planned to take place in the territorial seas and EEZ's of foreign nations, and will be continuous with the activity that takes place on the high seas. NMFS does not authorize the incidental take of marine mammals in the territorial seas of foreign nations, as the MMPA does not apply in those waters. However, NMFS still needs to calculate the level of incidental take in territorial seas as part of the analysis supporting issuance of an IHA in order to determine the biological accuracy of the small numbers and negligible impact determination.

Description of the Specified Activity

The planned survey will involve one source vessel, the R/V *Marcus G. Langseth* (*Langseth*), which will occur in SE Asia. The *Langseth* will deploy an array of 36 airguns (6,600 in^3) as an energy source at a tow depth of 6–9 m (20–30 ft). The receiving system will consist of a hydrophone streamer and approximately 100 ocean bottom seismometers (OBSs). The *Langseth* will deploy an 8 km (5 mi) long streamer for most transects requiring a streamer; however, a shorter streamer (500 m to 2

km or 1,640 ft to 1.2 mi) will be used during surveys in Taiwan (Formosa) Strait. As the airgun array is towed along the survey lines, the hydrophone streamer will receive the returning acoustic signals and transfer the data to the on-board processing system. The OBSs record the returning acoustic signals internally for later analysis. The OBSs to be used for the TAIGER program will be deployed and retrieved numerous times by a combination of 4 or 5 Taiwanese support vessels, as well as the *Langseth*. The *Langseth* will also retrieve 20 OBSs that were deployed in the study area during previous years to record earthquake activity.

Approximately 100 OBSs will be deployed during the survey. OBSs will likely be deployed and retrieved by the *Langseth* as well as a combination of 4 to 5 Taiwanese vessels. The Taiwanese vessels to be used include two 30 m (98.4 ft) vessels (the R/V *Ocean Researcher 2* and the R/V *Ocean Researcher 3*) and two vessels greater than 60 m (196.8 ft) in length (R/V *Fisheries Research I* and the Navy ship *Taquan*). The R/V *Ocean Research I* may also be used if the *Langseth* is not used to deploy OBSs. The OBS deployment spacing will vary depending on the number of instruments available and shiptime. The nominal spacing is 15 km (9.3 mi), but this will vary from as little as 5 km (3.1 mi) to perhaps as much as 25 km (15.5 mi). The OBSs will be deployed and recovered several (2 to 4) times. 60 of the 100 OBSs may be deployed from the *Langseth*. All OBSs will be retrieved at the end of the study.

Up to 3 different types of OBSs may be used during the 2009 program. The Woods Hole Oceanographic Institution (WHOI) ''D2'' OBS has a height of approximately 1 m (3.3 ft) and a maximum diameter of 50 cm. The anchor is made of hot-rolled steel and weighs 23 kg (50.7 lbs). The anchor dimensions are 2.5 x 30.5 x 38.1 cm. The LC4x4 OBS from the Scripps Institution of Oceanography (SIO) has a volume of approximately 1 m^3 (3.3 ft^2), with an anchor that consists of a large piece of steel grating (approximately 1 m^2 or 3.3 ft^2). Taiwanese OBSs will also be used; their anchor is in the shape of an 'x' with dimensions of 51–76 cm^2 (1.7–2.5 ft^2). 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 assembly is then activated, and the instrument is released from the anchor to float to the surface.

The seismic survey as described in the **Federal Register** notice (73 FR 78294, December 22, 2008) for the proposed IHA was 15,902 km (9,881 mi) in length. After public comment, L–DEO revised the tracklines so that the seismic survey consists of approximately 14,515 km (9,019 mi) of transect lines within the South and East China Seas as well as the Philippine Sea, with the majority of the survey effort occurring in the South China Sea. The total length of the revised tracklines is approximately 9 percent less than the total length of the original tracklines. The survey will take place in water depths ranging from approximately 25 to 6,585 m (82–21,598 ft), but most of the survey effort (approximately 84.4 percent) will take place in water greater than 1,000 m (3,280 ft), 11.4 percent will take place in intermediate depth waters (100–1,000 m or 328–3,280 ft), and 4.2 percent will occur in shallow depth water (less than 100 m or 328 ft).

All planned geophysical data acquisition activities will be conducted by L–DEO with onboard assistance by the scientists who have proposed the study. The scientific team consists of Dr. Francis Wu (State University of New York at Binghamton) and Dr. Kirk McIntosh (University of Texas at Austin, Institute of Geophysics). The vessel will be self-contained, and the crew will live aboard the vessel for the entire cruise.

In addition to the operations of the airgun array, a 12 kHz Simrad EM 120 multibeam echosounder (MBES) and a 3.5 kHz sub-bottom profiler (SBP) will be operated from the *Langseth* continuously throughout the TAIGER cruise.

Dates, Duration, and Region of Activity

The survey will encompass the area from approximately 17°30′–26°30′ N, 113°30′–126° E within the EEZs of Taiwan, Japan, and the Philippines. The vessel will approach mainland Taiwan within 5.2 km (3.2 mi) and mainland China within 116 km (72 mi). The vessel will approach within 3.7 km (2.3 mi) and 105 km (65 mi) of islands off the coast of Taiwan and China, respectively. The closest approach to the Ryuku Islands and Okinawa Islands will be 51.5 km (32 mi) and approximately 400 km (249 mi), respectively. Although the survey will occur at least 32 km (29.9 mi) from Luzon, Philippines, survey lines will take place approximately 28.6 km (17.8 mi) and 8.8 km (5.5 mi) from the Babuyan and Batan islands, respectively. Water depths in the survey area range from approximately 25 to 6,280 m (164–20,603 ft). There are not seismic lines in less than 50 m (164 ft) water depth. The closest seismic line to land is approximately 3.7 km (2.3 mi) from an island off the east coast of Taiwan. The TAIGER program consists of 4 legs, each starting and ending in Kao-hsiung, Taiwan. The first leg is expected to occur from approximately March 31 to April 28, 2009 and will include the survey lines in the South China Sea. The second leg is scheduled for May 3 to June 3, 2009 and will include survey lines around Taiwan. The third leg (approximately June 7–14, 2009) will involve OBS recovery by the *Langseth* only; no seismic acquisition will occur during this leg. The fourth leg, consisting of the survey lines in the Luzon Strait and Philippine Sea, is scheduled to occur from June 18 to July 20, 2009. The program will consist of approximately 103 days of seismic acquisition. The exact dates of the activities depend on logistics and weather conditions.

Safety Radii

L–DEO estimated the safety radii around their operations using a model and by adjusting the model results based on empirical data gathered in the Gulf of Mexico in 2003. Additional information regarding safety radii in general, how the safety radii were calculated, and how the empirical measurements were used to correct the modeled numbers may be found in NMFS' proposed IHA notice (73 FR 78294, December 22, 2008) and L–DEO's application. Using the modeled distances and various correction factors, Table 1 outlines the distances at which three rms sound levels (190 dB, 180 dB, and 160 dB) are expected to be received from the various airgun configurations in shallow, intermediate, and deep water depths.

Source and volume	Tow depth (m)	Water depth	*Predicted RMS Distances (m)*		
			190 dB	180 dB	160 dB
Single Bolt airgun 40 in^3	*6–9	Deep	12	40	385
		Intermediate	18	60	578
		Shallow	150	296	1,050
4 strings 36 airguns 6600 in^3	6–7	Deep	220	710	4,670

Source and volume	Tow depth (m)	Water depth	*Predicted RMS Distances (m)*		
			190 dB	180 dB	160 dB
	.....	Intermediate	330	1,065	5,189
	.....	Shallow	1,600	2,761	6,227
	8–9	Deep	300	950	6,000
	.....	Intermediate	450	1,425	6,667
	.....	Shallow	2,182	3,694	8,000

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 36 airgun array, as well as a single airgun, used during the Central American SubFac and STEEP Gulf of Alaska survey, and planned during the TAIGER SE Asia survey. *The tow depth has minimal effect on the maximum near-field output and the shape of the frequency spectrum for the single 40 in^3 airgun; thus, the predicted safety radii are essentially the same at each tow depth. The most precautionary distances (*i.e.,* for the deepest tow depth, 9m) are shown.

Because the predictions in Table 1 are based in part on empirical correction factors derived from acoustic calibration of airgun configurations different from those to be used on the *Langseth* (*cf.* Tolstoy *et al.,* 2004a,b), L–DEO conducted an acoustic calibration study of the *Langseth's* 36 airgun (approximately 6,600 in^3) array in late 2007/early 2008 in the Gulf of Mexico (LGL Ltd., 2006). Distances where sound levels (*e.g.,* 190, 180, and 160 dB re 1 μPa rms) were received in deep, intermediate, and shallow water will be determined for various airgun configurations. Acoustic data analysis is ongoing and a scientific paper on the *Langseth* calibration study is currently in review for future publication (Tolstoy, pers. comm.). After analysis, the empirical data from the 2007/2008 calibration study will be used to refine the exclusion zones (EZ) proposed above for use during the TAIGER cruise, if the data are appropriate and available for use at the time of the survey.

A more detailed description of the authorized action, including vessel and acoustic source specifications, was included in the proposed IHA notice (73 FR 78294, December 22, 2008).

Comments and Responses

A notice of receipt of the L–DEO application and proposed IHA was published in the **Federal Register** on December 22, 2008 (73 FR 78294). A notice extending the public comment period by 15 days, to February 5, 2009, due to several Federal holidays, was published in the **Federal Register** on January 16, 2009 (74 FR 2995). During the comment period, NMFS received comments from the Marine Mammal Commission (Commission). NMFS also received comments from the Center for Regulatory Effectiveness (CRE), Natural Resources Defense Council (NRDC) (on behalf of International Fund for Animal Welfare, Whale and Dolphin Conservation Society, Cetacean Society International [CSI], Animals Asia Foundation [AAF], New York Whale and Dolphin Action League, Ocean Futures Society, and Jean-Michel Cousteau), Wild at Heart Legal Defense Association (WaH) (on behalf of Changhua County Environmental Protection Union, Clymene Enterprises, Green Party Taiwan, Taiwan Friends of the Global Greens, Leviathan Sciences, Environment and Animal Society of Taiwan, Wild Bird Society of Yunlin, Matsu's Fish Conservation Union, Blue Dolphin Alliance, Hong Kong Dolphin Conservation Society [HKDCS], Dr. Ellen Hines, Taiwan Sustainable Union, Jo Marie V. Acebes, APEX Environmental, Coral Triangle Oceanic Cetacean Program and IUCN Species Survival Commission—Cetacean Specialist Group, Kimberly Reihl, Changhua Coast Conservation Action, Ocean Park Corporation, Dr. Bradley White, Ketos Ecology, CSI, Dr. Wang Ding, Study Centre for Marine Conservation, AAF, International Laboratory for Dolphin Behaviour Research, Mary Speer, and American Cetacean Society), CSI, Linking Individuals for Nature Conservation (LINC), Humane Society International (HSI), Dr. John Wang, Eastern Taiwan Strait Sousa Technical Advisory Working Group (ETSSTAWG), AAF, HKDCS, Dr. Robert Brownell, Dr. Lien-Siang Chou, Dr. Linda Weilgart, Dr. Kirk McIntosh and Dr. Francis Wu (Dr. McIntosh and Dr. Wu), Dr. Lemnuel Aragones, Dr. Joseph Minor and Dr. Christine Wilson and James Minor and Susan Wilson (Minor and Wilson), and a private citizen. The public comments can be found online at: *http://www.nmfs.noaa.gov/pr/permits/incidental.htm.*

The following are their comments, and NMFS' responses.

Extension Requests

Comment 1: Numerous parties expressed concern regarding L–DEO's IHA application under the MMPA to incidentally harass marine mammals during a proposed marine geophysical survey in SE Asia from March–July, 2009, as published in the **Federal Register** (73 FR 78294, December 22, 2008). Many interested persons and organizations requested an extension of the 30-day public comment period to allow for the adequate review of lengthy documents associated with the proposed IHA and prepare responses.

Response: NMFS considered these requests during the 30-day public comment period and published a notice in the **Federal Register** (74 FR 2995, January 16, 2009) extending the public comment period for the proposed IHA from January 21 to February 5, 2009. The 15-day extension is due to the unique circumstances of the timing of the publication of the **Federal Register** notice (74 FR 2995, January 16, 2009) relative to several Federal holidays. The **Federal Register** notice (74 FR 2995, January 16, 2009) published three days before the Christmas holiday, which fell on Thursday, December 25, 2008. The following day, Friday, December 26, 2008 was declared a Federal holiday for executive branch departments and agencies. New Year's Day, a Federal holiday, was the following Thursday, January 1, 2009. The 15-day extension was given in recognition of the fact that the timing of these three holidays led many workers to be away for much of the two-week period and some non-government organizations closed their offices during that period. NMFS is also aware that the proposed action was for a new geographical area rather than a renewal of a prior action, where the associated documents are lengthy and would likely not be familiar to many interested parties. NMFS believes that a 30-day comment period with a 15-day extension (for a total of 45 days) is more than an adequate time period for the public to address concerns and submit comments.

General Comments

Comment 2: The CRE objects to the statement in the proposed IHA (73 FR 78303, December 22, 2008) on page 78303, column one, paragraph three, that states: ''However, controlled exposure experiments in the Gulf of Mexico indicate that foraging behavior

was altered upon exposure to airgun sound (Jochens *et al.,* 2006).'' CRE states that this statement is misleading, and does not accurately reflect the underlying data, and it is not based on the most recent assessment of those data. NMFS' statement cites a 2006 Sperm Whale Seismic Study (SWSS) in the Gulf of Mexico Report which discusses data on foraging behavior and avoidance movements of seven tagged sperm whales in the Gulf of Mexico during exposure to airguns. The CRE requests that NMFS cite the final 2008 Synthesis Report on SWSS which cautions that the ''* * * sample size of seven animals that conducted foraging dives during exposure was too small to provide definitive results * * * the power of the test to detect small changes in foraging success was low, and no conclusions on the biological significance of these effects for an individual animal or for the populations can be made from the data sets available.''

Response: As CRE points out in their letter, L–DEO acknowledges in their application (see Section VI, page 37) that seismic energy alters sperm whale foraging behavior. NMFS acknowledges the commentor's interpretation of 2006 SSWS. However, after reviewing the 2008 Synthesis Report, NMFS believes that the following statement: ''* * * sample size of 7 animals conducted foraging dives during exposure was too small to provide definitive results * * * the power of the test to detect small changes in foraging success was low and no conclusions on the biological significance of these effects for an individual animal or for the population can be made from the data sets available,'' refers to having the statistical power to detect small changes in foraging success. Conversely, page 264 of the 2008 Synthesis Report states the following: ''* * * Our data seem to indicate that airgun exposure—even at low exposure levels observed in this experiment—can result in large reductions in foraging rate for some individual sperm whales.'' Therefore, the proposed IHA notice statement that data indicated alterations in foraging behavior, is supported by one of the conclusions discussed in the 2008 Synthesis Report. NSF and L–DEO presented this study as one of several pieces of information that relate to this topic. Though the commenter has presented an alternate interpretation of the data related to foraging behavior, NMFS finds that the EA provides sufficient analysis of the available data and the information is not such that NMFS' findings.

Comment 3: The Commission is concerned that most of the issues raised in its letter have been raised before and, to their knowledge, little is being done to resolve them. The Commission believes that the action agency and contractor should bear primary responsibility for carrying out the studies needed to reduce the existing uncertainty and that the authorizing and oversight agencies have a degree of responsibility as well.

Response: NMFS has responded to the best of its ability regarding all of the Commission's concerns on various issues during the public comment process.

Comment 4: The Commission is concerned that the opportunity for scientists, conservationists, and other interested parties from other countries to comment on research activities to be conducted by U.S. organizations in foreign waters. Scientists, conservationists, and others are generally unfamiliar with the procedures for permit review and authorization in the U.S. but may have a good understanding of the natural history and vulnerability of potentially affected species. The Commission believes that they should be provided with opportunities to contribute to the evaluation of the potential effects of seismic studies in the context of all other factors that may be affecting these species. If U.S. scientists and institutions are to engage in research activities in the waters of other countries, it stands to reason that our system of review should include sufficient opportunities for foreign parties to comment on potential effects. This might be accomplished in any number of ways, such as extending the comment period to give them additional time to comment and promoting interaction between the research organization and concerned parties from other countries. The Commission believes such participation is appropriate and, in the long run, will facilitate international cooperation on conservation issues, more informed comments, and more risk-averse research methods and mitigation procedures.

Response: NMFS agrees with the Commission's comments. NMFS extended the 30 day public comment for the proposed IHA by an additional 15 days to accommodate requests from the public. *See* Extension Request above.

Comment 5: Dr. McIntosh and Dr. Wu have provided some comments about the nature and significance of our project and also try to allay some of the expressed concerns. As an introductory statement, the research Dr. McIntosh and Dr. Wu plan targets fundamental Earth processes that remain inadequately understood; this includes topics such as the growth and composition of continents and the fundamental processes of building mountains. Dr. McIntosh and Dr. Wu choose to do this research in the Taiwan region because it is the best location, of only a few places globally, where we can study the collision of an oceanic island chain with a continent.

Response: NMFS acknowledges Dr. McIntosh and Dr. Wu's comments.

Comment 6: Dr. McIntosh and Dr. Wu state that as for marine mammal safety, the community of marine mammal biologists can be assured that their project is not a reckless intrusion into the marine habitat of endangered species. In fact, detailed studies have been conducted regarding the possible impacts of this project on marine mammal populations.

Response: NMFS acknowledges Dr. McIntosh and Dr. Wu's comments. NMFS expects the principal scientists to abide by the requirements described in the IHA issued to L–DEO. After issuance of the proposed IHA, L–DEO negotiated with the project's principal scientists to modify the cruise plan and adopt more precautionary mitigation measures for purposes of marine mammal safety in the study area.

Comment 7: Dr. McIntosh and Dr. Wu state that they expect to produce the most comprehensive subsurface images of the rapidly rising Taiwan mountains with their data. These images, along with seismicity recorded by L–DEO's arrays, will form a greatly enhanced basis for evaluating earthquake and tsunami potentials of Taiwan and can thus be used to improve the safety and security of the human population at risk to these phenomena.

Response: NMFS acknowledges Dr. McIntosh and Dr. Wu's comments.

Comment 8: CSI states that the IHA application and EA are similar in many respects to previous L–DEO EA's. The response, however, is not. The response to this authorization request will prove to be unique, a potential watershed in the manner all future seismic surveys should be critiqued by the scientific community. To be helpful, CSI has attached some relevant expert reviews to their comments, even if they are duplicated by others, to ensure that NMFS has the opportunity to include them in the deliberative process. The expert level of opinion and proof stimulated by the IHA application and EA challenges previous assumption and, CSI hopes, will stimulate adequate, directed research to enable appropriate

mitigations to satisfy various laws, including the MMPA.

Response: NMFS received numerous comments from interested parties on L–DEO's proposed IHA for a marine geophysical survey in SE Asia, March to July 2009. NMFS acknowledges CSI's and other interested parties' comments on the proposed IHA and EA during the public comment period. After the issuance of the proposed IHA, L–DEO modified the cruise plan and adopted more precautionary monitoring and mitigation measures. NMFS believes that L–DEO's revised survey as well as the implementation of the monitoring and mitigation measures described in the IHA will have a negligible impact on the affected species or stocks of marine mammals in the study area.

L–DEO and NSF have formally consulted with NMFS' Permits, Conservation, and Education Division under the MMPA regarding the IHA and NMFS' Endangered Species Division regarding a Biological Opinion under Section 7 of the ESA for the marine geophysical survey in SE Asia. NMFS believes L–DEO and NSF have satisfied their responsibilities under the laws of the MMPA and ESA.

Comment 9: CSI states that the MMPA only authorizes the lethal taking of marine mammals under extraordinary circumstances that do not apply to the scientific research proposed by this project. In the opinion of experts, as expressed in the attachments, mortalities are likely. How can NMFS believe that all these experts are wrong, or that associated mortalities would not violate the MMPA? CSI urges NMFS to apply these experts comments to the EA and IHA application deficiencies and to require that the L–DEO proposal address them in the only legal format available to them, an application for a LOA under MMPA Section 101(a)(5)(A–C).

Because the L–DEO's geophysical research will have an incidental impact on marine mammals that experts predict will include mortalities and even extirpation it must apply for a letter of authorization under MMPA section 101(a)(5)(A–C).

Response: While an authorization for taking marine mammals by mortality cannot be authorized under Section 101(a)(5)(D) of the MMPA, those paragraphs do authorize taking by Level A harassment. Level A harassment means any act of pursuit, torment, or annoyance which has the potential to injure a marine mammal or a marine mammal stock in the wild. While it is true that an injury can be so severe that it later may result in mortality, the MMPA does not preclude issuance of an authorization under Section 101(a)(5)(D) of the MMPA for activities that have the potential to cause injury. However, as NMFS shows in this document morality and serious injury are not anticipated to occur during this seismic survey cruise due to implementation of mitigation measures (e.g., ramp-up, power-down, shut-down, temporal and spatial avoidance, procedures for species of particular concern, passive acoustic and visual monitoring, and quiet acoustic periods). Nor is take by injury, serious injury, or mortality authorized. Therefore, issuance of an IHA is appropriate. Monitoring and mitigation measures are discussed later in this document.

Comment 10: CSI states it is a relief to find so many experts willing to contribute their knowledge and experience to this process. They do a far better job than CSI or any NGO could of addressing the specific flaws found in this L–DEO IHA request. While some of these same flaws in previous L–DEO requests have been addressed, they may have been more easily dismissed by NMFS because very few were from world authorities and scientific experts. This time the experts have participated directly, and cannot be dismissed.

Response: NMFS acknowledges CSI's comments and considers all relevant public comments before making a determination on the issuance of the IHA. After issuance of the proposed IHA, L–DEO modified the cruise plan and adopted more precautionary monitoring and mitigation measures in the study area. NMFS believes that L–DEO's revised survey as well as the implementation of the required monitoring and mitigation described in the IHA will have a negligible impact on the affected species or stocks of marine mammals in the study area.

After the issuance of the proposed IHA, L–DEO modified the cruise plan and adopted more precautionary monitoring and mitigation measures in the study area. NMFS believes that L–DEO's revised survey as well as the implementation of the monitoring and mitigation measures described in the IHA will have a negligible impact on the affected species or stocks of marine mammals in the study area.

Comment 11: CSI states that the intent of LGL's comment is to manipulate NMFS into a fast and uncritical decision. By law, the schedules, as well as the scientific and economic values of this project, remain irrelevant to the scope of NMFS' deliberations on the fitness of the proposal.

Response: 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. NMFS received an IHA application from L–DEO on October 27, 2008. NMFS published a notice for the proposed IHA in the **Federal Register** on December 22, 2008 (73 FR 78294). A notice on the 15-day extension of the comment period for the proposed IHA was published on January 16, 2009. NMFS issued an IHA to L–DEO on March 31, 2009 and amended the IHA on May 1, 2009.

After issuance of the proposed IHA, L–DEO modified the cruise plan and adopted more precautionary monitoring and mitigation measures in the study area. NMFS believes that L–DEO's revised survey as well as the implementation of the required monitoring and mitigation described in the IHA will have a negligible impact on the affected species or stocks of marine mammals in the study area. See L–DEO's Supplemental EA.

Comment 12: CSI states that it is well aware that the L–DEO, NSF, and other project supporters represent powerful influences that NMFS must respect. However, CSI trusts that these rational influences also recognize the overwhelming need to define and mitigate anthropogenic affects on the marine environment, with their rapidly accelerating influences on the planet and eventually human societies. Is it necessary to do significant, irrevocable damage to marine life in order to understand geophysical processes?

Response: After issuance of the proposed IHA, L–DEO modified the cruise plan and adopted more precautionary monitoring and mitigation measures in the study area. NMFS believes that L–DEO's revised survey as well as the implementation of the required monitoring and mitigation described in the IHA will have a negligible impact on the affected species or stocks of marine mammals in the study area.

On March 31, 2009, NMFS prepared a Finding of No Significant Impact for L–DEO's marine geophysical survey in SE Asia. NMFS determined that the issuance of an IHA for the take, by harassment, of small numbers of marine mammals incidental to L–DEO's March–July, 2009, seismic survey in SE Asia will not significantly impact the quality of the human environment.

Comment 13: CSI states that in lieu of such loft concerns economic efficiency is an excellent rationale for increased support of appropriate science to

determine adequate mitigations. Without better science this and future proposals will face further challenges that will cause delays in the L–DEO schedule that are likely to have economic consequence. The time and financial loss is neither the fault of the process or the responsibility of NMFS. Why not do the job responsibly?

Response: NMFS acknowledges CSI's comments. An authorization for incidental taking of marine mammals shall be granted if NMFS finds that the taking will have a negligible impact on the species or stock(s), will have an unmitigable adverse impact on the availability of the species or stock(s) for subsistence uses (where relevant), and if the permissible methods of taking and requirements pertaining to the mitigation, monitoring, and reporting of such takings are set forth.

After issuance of the proposed IHA, L–DEO modified the cruise plan and adopted more precautionary monitoring and mitigation measures in the study area. NMFS believes that L–DEO's revised survey as well as the implementation of the required monitoring and mitigation described in the IHA will have a negligible impact on the affected species or stocks of marine mammals in the study area. NMFS and the applicant (L–DEO) have fulfilled their responsibilities under the MMPA and ESA for the issuance of the subject IHA.

Comment 14: CSI states that the fundamental point of CSI's comment and many others, is that this L–DEO project does not qualify for an IHA, according to the criteria at *www.nmfs.noaa.gov/pr/permits/incidental.htm.* The fact that previous L–DEO projects received IHAs does not provide a precedent under which this proposal also should receive an IHA, because no matter how NMFS rationalized those past IHAs this proposal is different, different in scale, scope, and expertise represented by the formal comments and less public complaints it has generated from scientific world authorities and regional and species experts. If these people had been consulted by LGL, the inadequate EA and request would never have been submitted for an IHA. The original intent of the IHA process was to expedite some requests, not all requests. Not this request.

Response: NMFS disagrees with CSI's comments. L–DEO's marine geophysical survey in SE Asia, March to July 2009, qualifies for an IHA according to the criteria on the NMFS Office of Protected Resources Incidental Take Authorizations Web site. Portions of L–DEO's project occurs on the high seas, which is applicable to the MMPA and ESA. Section 101(a)(5)(D) of the MMPA established an expedited process by which citizens of the U.S. can apply for an authorization to incidentally take small numbers of marine mammals by harassment.

After issuance of the proposed IHA, L–DEO modified the cruise plan and adopted more precautionary monitoring and mitigation measures in the study area. NMFS believes that L–DEO's revised survey as well as the implementation of the required monitoring and mitigation described in the IHA will have a negligible impact on the affected species or stocks of marine mammals in the study area.

Comment 15: CSI states that there is little knowledge available for most of the species that inhabit the waters of SE Asia. Even the most basic knowledge about the presence/absence of species is incomplete. Only a small proportion of the large expanse of sea in the region (and mostly coastal waters) has been surveyed systematically for marine mammals. Few estimates of abundance or distribution exists for SE Asian marine mammals an in most cases, this information is for a limited region, often bounded by political rather than biological borders. What little is known clearly shows the region to be an area with a high diversity of marine mammal (and other marine) species.

Response: NMFS agrees that the SE Asia region is likely to have a high diversity of marine mammal species and that impacts on marine mammals should be assessed on the population or stock unit level whenever possible. L–DEO's IHA application provides information on stock abundance in SE Asia (when available), larger water bodies (such as the North Pacific Ocean), and the Eastern Tropical Pacific Ocean (if data was unavailable). NMFS believes that these data are the best scientific information available for estimating impacts on marine mammal species and stocks. However, Congress recognized that information on marine mammal stock abundance may not always be satisfactory. When information is lacking to define a particular population or stock of marine mammals then impacts are to be assessed with respect to the species as a whole (54 FR 40338, September 29, 1989). See relevant discussions throughout this document and L–DEO's Supplemental EA.

Comment 16: CSI states that the study area is a region where marine mammals are facing a myriad of serious threats that have made the continued existence of several marine mammal populations and possibly some species uncertain (note: some of the same threats and activities have resulted in the recent 'functional extinction' of the baiji (Turvey *et al.* 2007), which is endemic to the Yangtze River of China).

Response: L–DEO's EA acknowledges that there are numerous threats to cetaceans in SE Asia including vessel traffic, habitat loss, oil and gas industry, pollution, fisheries, and hunting.

After the issuance of the proposed IHA, L–DEO modified the cruise plan and adopted more precautionary monitoring and mitigation measures. NMFS believes that L–DEO's revised survey as well as the implementation of the required monitoring and mitigation measures described in the IHA will have a negligible impact on the affected species or stocks of marine mammals in the study area. See L–DEO's EA and Supplemental EA.

Comment 17: CSI states that all small cetaceans in Taiwanese waters are threatened by fishermen using hand-harpoons, bycatch in fishing gear, and noise. Those that inhabit coastal waters of western Taiwan also face habitat degradation, pollution, and possibly prey reduction.

Response: NMFS does not regulate activities (including fishing) in Taiwanese waters. L–DEO's EA discusses direct and indirect effects on marine mammals. The numerous threats to cetaceans in SE Asia include vessel traffic, habitat loss, oil and gas industry, pollution, fisheries, and hunting.

After the issuance of the proposed IHA, L–DEO modified the cruise plan and adopted more precautionary monitoring and mitigation measures. NMFS believes that L–DEO's revised survey as well as the implementation of the required monitoring and mitigation measures described in the IHA will have a negligible impact on the affected species or stocks of marine mammals in the study area.

Comment 18: CSI states that some marine mammals have been reduced to numbers so low that even minimal 'takes' will have a large impact on the remaining population.

Response: After the issuance of the proposed IHA, L–DEO modified the cruise plan and adopted more precautionary monitoring and mitigation measures. NMFS believes that L–DEO's revised survey as well as the implementation of the required monitoring and mitigation measures described in the IHA will have a negligible impact on the affected species or stocks of marine mammals in the study area.

Comment 19: CSI states that a number of marine mammals are discussed in their comments to NMFS based on what

is known about their biology, conservation status and threats in the region. This does not imply other marine mammals that are not specifically discussed in detail are ''safer'' from the seismic surveys, in most cases, too little information is available to understand the impacts, which may be as great as or greater than the marine mammals discussed in detail in their comments to NMFS.

Response: NSF's and L–DEO's IHA application, EA, and Supplemental EA sufficiently discusses the marine mammals species and the possible impacts from seismic surveys in the SE Asia region. After issuance of the proposed IHA, L–DEO modified the cruise plan and adopted more precautionary monitoring and mitigation measures. NMFS believes that the implementation of the required monitoring and mitigation measures will result in a negligible impact on affected species and stocks of marine mammals in the study area.

Comment 20: ETSSTAWG states that it should be noted that many seismic surveys are conducted in the Taiwan region every year without requesting IHAs. The actions of private oil and gas companies within the EEZ's of other countries is beyond the jurisdiction of the MMPA, thus they need no such U.S. authorizations. However, this means that L–DEO could become a scapegoat for all survey operation in the region, purely because they have to apply for authorization, as they will clearly be operating partly on the high seas (and thus fall under MMPA jurisdiction) and as they have government funding. This is acknowledged, but until such time as NMFS enforcement confirms the locations and tracks of every survey undertaken globally this situation is unlikely to change.

Response: NMFS is aware of seismic surveys and other activities undertaken worldwide that occur (that may result in incidental takes of marine mammals) without requesting IHAs or LOAs. NMFS may grant IHAs upon request by U.S. citizens who engage in a specified activity (other than commercial fishing) within a specified geographical region. L–DEO and NSF are considered U.S. citizens under the MMPA. The MMPA applies to U.S. citizens in U.S. waters, and the high seas, but does not apply or authorize the incidental take of marine mammals in the territorial seas of foreign nations. The MMPA does not apply to non-U.S. citizens, unless they are conducting a specified activity (other than commercial fishing) that may result in incidental takes of marine mammals in U.S. waters. NMFS can refer reports of possible violations of the MMPA and this subject IHA issued to L–DEO to NOAA Enforcement for investigation.

The IHA is valid only for the *Langseth's* activities associated with seismic survey operations that are specified in L–DEO's EA, Supplemental EA, and IHA application. L–DEO is required to comply with the IHA and the terms and conditions of the Incidental Take Statement corresponding to NMFS' Biological Opinion. L–DEO and NSF will be required to reinitiate consultation with NMFS if the identified action is subsequently modified in a manner that causes an effect that was not considered during the analysis for making the necessary determinations for the issuance of the IHA. L–DEO is required to submit a draft report on all activities and monitoring results to the Office of Protected Resources, NMFS, within 90 days of the completion of the *Langseth's* cruise in SE Asia. The report must contain and summarize information stated in the IHA issued to L–DEO.

Comment 21: WaH is aware that this L–DEO survey proposal is one of a very small number of requests for authorization for geophysical surveys while other user groups, including the oil and gas industry, are not carrying out such EAs or are not subjected to public scrutiny in this way. Rather than allowing the focus to be limited to geological surveys such as L–DEO's, WaH recommends that measures be taken to ensure that all future marine seismic surveys (whether of an academic or commercial nature) are made subject to the same level of scrutiny and transparency, such as by requiring EAs or EISs to be submitted for professional and public review and with all relevant documents (including post-survey reports and relevant local permits, authorizations and licenses) being made publicly available.

Response: All applications submitted to NMFS are subject to public comment periods. During the public comment period, their NEPA documents and incidental take authorization applications are available on the NMFS Web site (*http://www.nmfs.noaa.gov/pr/permits/incidental.htm*) and are reviewed by the Commission. NMFS does not force an agency or other organization to apply for and consult on an incidental take authorization under the MMPA.

General Opposition

Comment 22: A private citizen questioned why this research was being conducted in SE Asia. The commenter also believes the U.S. should not be doing work in the region.

Response: Dr. McIntosh and Dr. Wu, the principal investigators on the seismic survey, state the primary purpose of the TAIGER project is to investigate the fundamental processes of mountain building, which plays a major role in shaping the face of the Earth. Oceanic island chains, or arcs, along convergent tectonic plate boundaries result from a process known as subduction where one of Earth's tectonic plates slides beneath another as they move toward each other. As the lower plate slides beneath the upper plate, its trajectory usually steepens with depth and eventually reaches depths of several hundred (to greater than 700) km. The arc is made up of a chain of volcanoes on the upper plate, and is typically situated above the point where the lower plate is at about 100 km (62 mi) depth. As this process of subduction and volcanism continues through time (millions of years) the crust of the upper plate becomes thicker, and develops properties more like continental crust, which is much thicker and less dense than ocean crust and allows for land surface above sea level. The results of many studies indicates that much of the crust that forms Earth's continents was accumulated through time by island arcs colliding with continents leaving remnants of the arcs attached to the edge of the continents. Despite this general interpretation, the actual processes of how this happens, including growth of collisional mountain belts and deformation of arc and continental crust, is poorly understood and poorly documented. Ancient collision zones have been studied, but they have typically undergone many stages of deformation and erosion, leaving them difficult to interpret. Currently active arc-continent collision zones include Taiwan, Papua New Guinea, and Timor. Of these active collisions, Taiwan is currently the most active. Taiwan is also the most favorable of these to examine the full spectrum of processes as a plate boundary changes from oceanic subduction to arc-continent collision. This transition is a major target of the TAIGER project requiring that L–DEO obtain a series of crustal-scale seismic transects from south of Taiwan, where subduction is active, to northern Taiwan, where the collision has reached mature steady state.

One of the by-products of the collision in Taiwan is the generation of frequent small earthquakes and less frequent, large, destructive earthquakes. By using the relatively small signals from the *Langseth* source array

(compared to those generated by nature) scientists can topographically image the mountains and thereby localize the major breaks or faults underneath the mountains and assess their seismic potential. In addition to linear arrays of seismographs, the *Langseth* signals will also be recorded, as an integrated TAIGER acquisition program, on over 200 land seismographs across the island and 20 OBSs, all of which have been recording earthquakes. Scientists expect to produce the most comprehensive subsurface images of the rapidly rising Taiwan mountains with L–DEO's data. These images, along with seismicity recorded by L–DEO's arrays, will form a greatly enhanced basis for evaluating earthquake and tsunami potentials of Taiwan and can thus be used to improve the safety and security of the human population at risk to these phenomena.

A previous U.S.-Taiwan project (the 1995 TAICRUST project) demonstrated the feasibility of the approach to be used in the TAIGER project, but this project did not include significant seismic data acquisition in the Taiwan Strait. Subsequent analysis showed that seismic profiles across the Taiwan, recorded by seismographs in the strait and on land in Taiwan, are necessary to determine the crustal structure of the Taiwan collisional mountain belt. Thus, the principal scientist's plans in the Taiwan Strait are one of the key elements required for the success of the TAIGER project.

Comment 23: LINC objects to the IHA application and states that other local NGOs have not had time to respond due to the lack of sufficient notice. LINC is concerned that NMFS is eager to approve the L–DEO application and authorize destructive activities in the SE Asia region without verifying that L–DEO has complied with relevant local conservation laws and regulations. LINC strongly urges the NMFS to reject the application of L–DEO until it can be proven that they have (1) complied with local laws and regulations, and (2) have completed a comprehensive consultation with local governments, scientists, researchers, and NGOs based in this region. LINC states that the approval of the current L–DEO application, as is, would demonstrate a clear lack of concern for the conservation laws, threats, and environmental protection efforts in this region.

Response: NMFS believes local NGOs have had sufficient time to respond to the proposed IHA published in the **Federal Register.** A 30-day comment period with a 15-day extension (for a total of 45 days) is more than an adequate time period for the public to address concerns and submit comments. The NMFS has received numerous comments from persons and organizations located nationally and worldwide. Generally, under the MMPA, NMFS may authorize the harassment of small numbers of marine mammals incidental to an otherwise lawful activity, provided 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 (where relevant), and if the permissible methods of taking and requirements pertaining to the mitigation, monitoring and reporting of such takings are set forth to achieve the least practicable adverse impact. L–DEO and NSF have consulted with the various governments in the action area. To date, L–DEO and NSF have received foreign clearance notices from the governments of the Philippines, Taiwan, and Japan. *See* International Legal Compliance below.

Comment 24: Given the large volume of evidence for the association between anthropogenic noise and disturbance in cetaceans and other marine mammal, a precautionary approach is surely required (as recommended by Gordon *et al.,* 2004). AAF urges NMFS to consider the application from L–DEO with information provided, and the findings and recommendations of the independent reviews of the Eastern Taiwan Strait Sousa Technical Advisory Working Group (ETSSTAWG) and others, in mind.

Response: NMFS has developed conservative monitoring, mitigation, and reporting requirements in order to reduce the potential effects of anthropogenic noise on marine mammals. L–DEO and NSF have considered the numerous public comments and revised the seismic survey described in its IHA application. L–DEO's Supplemental EA is in response to the comments received by NMFS through the public comment period associated with the IHA process. L–DEO considered the recommendations from several independent reviewers including ETSSTAWG. NSF received no direct public comments on the draft EA during (or after) the open comment period November 14, 2008 through December 15, 2008. Included in L–DEO's Supplemental EA are a number of changes to the survey design that were made by L–DEO to address specific comments, some received by a number of individuals and agencies, and to enhance measures already included in the original documents to mitigate effects of the proposed survey on marine mammals. NMFS has made its necessary determinations based on L–DEO's revised seismic survey and Supplemental EA.

Comment 25: Several commenters requested that NMFS deny issuing the IHA to L–DEO. They questioned: (1) The adequacy of L–DEO's scientific research and lack of consultation with local experts; (2) the survey's potential to expose ETS humpback dolphins to received levels of 180 dB re 1 μPa (rms) which they believed could cause permanent physiological damage, thus constituting at a minimum Level A harassment; (3) the number of ETS humpback dolphins that L–DEO proposed to harass, stating that the requested take of ETS humpback dolphins to be harassed was likely to exceed a sustainable level of take for the population; (4) the adequacy of the monitoring and mitigation measures for endangered or cryptic species that may be vulnerable to noise impacts (e.g., ETS humpback dolphin and finless porpoise); (5) the timing of the surveys and their impacts on migration routes; (6) biased and non-precautionary assumptions; and (7) the cumulative effects analyses in the EA.

Response: NMFS disagrees with the commenters' argument that NMFS should have denied L–DEO's application for an IHA.

(1) NMFS is charged with issuing IHAs for otherwise lawfully activity. L–DEO's research is otherwise lawful. NMFS opened the proposed IHA to public comment. L–DEO plans to conduct the seismic survey along the Taiwan arc-continental collision in the China and Philippine Seas. Taiwan is one of only a few sites of arc-continent collision worldwide—one of the primary tectonic environments for large-scale mountain building. The primary purpose for the TAIGER project is to investigate the processes of mountain building, a fundamental set of processes which plays a major role in shaping the face of the Earth. The vicinity of Taiwan is particularly well-suited for this type of study, because the collision can be observed at different stages of its evolution, from incipient, to mature, and finally to post-collision. As a result of its location in an ongoing tectonic collision zone, Taiwan experiences a great number of earthquakes; most are small, but many are large and destructive. This project will provide a great deal of information about the nature of the earthquakes around Taiwan and will lead to a better assessment of earthquake hazards in the area. The information obtained from this study will help the people and government of Taiwan to better prepare

for future seismic events and may thus mitigate some of the loss of life and economic disruptions that will inevitably occur.

(2) NMFS disagrees with the commenter's characterization of the potential risk to the ETS sub-population of Indo-Pacific humpback dolphins. After the issuance of the proposed IHA, L–DEO negotiated with the project's principal scientists to modify the cruise plan and adopt more precautionary mitigation measures. L–DEO will limit seismic survey lines to take place at least 20 km from the west coast of Taiwan, except for in the passage between the Penghu Islands and the Waishanding Jhou sandbar, where the survey will pass through the approximately 17.1 km mid-line distance between the two possibly sensitive areas, subject to the limitations imposed by other foreign nations, to minimize the potential for exposing Indo-Pacific humpback dolphins, finless porpoises, and other coastal species to SPLs greater than or equal to 160 dB re 1 μPa (rms). Thus, the precautionary buffer recommended by ETSSTAWG in their comments to NMFS will be maintained, ''at least 13 km and perhaps a more precautionary 15 km of the ETS *Sousa* population—meaning up to around 20 km from shore.'' L–DEO will also shut-down the airgun array if an ETS Indo-Pacific humpback dolphin is visually sighted regardless of the distance of the animal(s) to the sound source. The array will not resume firing until 15 minutes after the last documented whale visual sighting.

(3) NMFS disagrees with the commenter's assertion that the requested take of ETS Indo-Pacific humpback dolphins by harassment is likely to exceed a sustainable level of take for the population. L–DEO's seismic survey was modified after the issuance of the proposed IHA to include more precautionary mitigation measures. The incorporation of precautionary measures reduced the estimated number of ETS Indo-Pacific humpback dolphins expected to be harassed to zero, which is clearly a sustainable level of take for the sub-population.

(4) and (5) NMFS believes that the mitigation and monitoring measures in the IHA are adequate to protect species of concern that may be vulnerable to noise impacts. After issuance of the proposed IHA, L–DEO modified the cruise plan and adopted more precautionary mitigation measures, especially for species that are of particular concern and have cryptic behaviors that may be vulnerable to noise impacts as well as to address concerns on the timing of the surveys and their impacts on migration routes. See Monitoring, Mitigation, Species of Particular Concern, and Temporal and Spatial Avoidance sections below and L–DEO's Supplemental EA for more information. NMFS has included requirements to these effects in the IHA issued to L–DEO.

(6) After issuance of the proposed IHA, L–DEO modified the cruise plan and adopted more precautionary mitigation measures to address concerns of potential impacts of the seismic survey on affected species and stocks of marine mammals in the study area. NMFS believes that L–DEO's IHA application, EA, and Supplemental EA are not biased as they adequately consider alternatives, and provides analysis on the affected environment and environmental consequences of the study area.

(7) The EA adequately addresses the cumulative impacts of a relatively short-term seismic airgun survey in relation to long-term noise and events, such as vessel traffic, habitat loss, oil and gas industry, pollution, fishing, hunting, and other human activities. These other activities are long-term activities which are unaffected by NMFS' action here. Nor does this action, when considered in light of the other activities, become significant.

For more information, see further relevant discussions in this notice, L–DEO's IHA application, EA, and Supplemental EA.

Comment 26: HSI states that while they appreciate L–DEO's efforts to comply with the MMPA and the NEPA, HSI is concerned that this request for an incidental harassment authorization is premature and that in fact a letter of authorization for incidental take may be required. HSUS/HSI strongly urges the NMFS to deny this request as submitted and at a minimum to require L–DEO to resubmit its request with an updated review of the region's marine mammals, a more complete review of relevant literature, modified survey track lines and schedules, and additional mitigation measures.

Response: NMFS does not agree that a Letter of Authorization for incidental take is necessary in this case. Due to the incorporation of monitoring and mitigation measures, including L–DEO's revision of tracklines after the issuance of the proposed IHA and in response to public comments, NMFS does not anticipated a potential for injury, serious injury, or mortality to any marine mammals under the jurisdiction of the MMPA. Based on numerous concerns regarding the proposed IHA, L–DEO has revised its seismic survey and adopted more precautionary mitigation measures. L–DEO has prepared a Supplemental EA in response to the comments received. NSF received no direct public comments on the draft EA during (or after) the open comment period of November 14, 2008 through December 15, 2008. Included are a number of changes to the survey design that were made by L–DEO to address specific comments, some received by a number of individuals and agencies, and to enhance precautionary measures already included in the original documents to mitigate potential effects of the survey on marine mammals.

Comment 27: ETTSTAWG states the L–DEO project, as presently described in the U.S. **Federal Register,** poses an unacceptable risk to the 'critically endangered' population of ETS Indo-Pacific humpback dolphins.

Response: NMFS disagrees with ETSSTAWG's characterization of the risk to the sub-population of ETS Indo-Pacific humpback dolphins. After issuance of the proposed IHA, L–DEO modified the cruise plan and adopted more precautionary mitigation measures, especially considering the 'critically endangered' ETS sub-population of Indo-Pacific humpback dolphins. *See* ''Species of Particular Concern'' section below and other discussions presented in this document.

Comment 28: Dr. Linda Weilgart urges NMFS to reject this application for an IHA and states that L–DEO's powerful array of airguns, and argues that the permit application does not seriously consider the possibility of irreversible harm to marine mammals and the marine environment.

Response: NMFS disagrees with Dr. Weilgart's comments. After issuance of the proposed IHA, L–DEO modified the cruise plan and adopted more precautionary mitigation measures. NMFS believes L–DEO's planned seismic survey, as revised, will have a negligible impact on the affected species and stocks of marine mammals in the study area.

Comment 29: The strong bias in the **Federal Register** notice is disturbing. The notice should be an objective discussion that leaves open whether the agency should issue the authorization or not. As published, however, the notice's language leads inevitably to a decision to issue the authorization, despite the applicant's failure to argue convincingly, as required by law, that the surveys will not result in serious injury or death or even, in this case, Level A harassment. In fact, there is an insufficient scientific basis for concluding that no serious injury, death,

or Level A harassment of any marine mammal species will occur. Accordingly, the NMFS must deny this request as submitted and at a minimum request the applicant to submit a revised application with a more realistic and conservative analysis of potential impacts. If a compelling argument to support the conclusion that only harassment (Level B or Level A) will occur is not forthcoming, then the NMFS must deny the request outright and require the applicant to seek a letter of authorization for incidental take under Section 101(a)(5)(A–C) of the MMPA.

Response: NMFS disagrees with the commenter's characterization of the Notice of Proposed Issuance. Furthermore, as NMFS shows in this document mortality and serious injury are not expected to occur during this seismic survey cruise due to implementation of monitoring and mitigation measures (e.g., ramp-up, power-down, shut-down, passive acoustic and visual monitoring, and quiet acoustic periods) as well as L–DEO's revision of tracklines in the cruise plan. Nor is incidental take by injury, serious injury, or mortality authorized. Therefore, issuance of an IHA is appropriate. The revised survey and monitoring and mitigation measures are discussed further in this document.

Comment 30: Minor and Wilson, as scientists, are greatly saddened to see government funding being used to cause the ''Level B harassment'' of 71,669 cetaceans. Minor and Wilson also doubt that the data that might be gained from the proposed ''taking'' is worth the harm that it will do. Minor and Wilson are concerned about what the proposed undertaking will do to the reputation of U.S. science. Recently, one species of cetacean was declared extinct in this region, and several more endangered species are in the proposed study area. To have a U.S. flagged ship, owned by the NSF, cruising around in the critical habitat of multiple endangered species conducting seismic testing is clearly poor public relations. If another of these species goes extinct soon, the NSF will find itself trying to ''sell'' the notion that its contribution to the extinction was insignificant. The NMFS could make a positive contribution to the long term reputation of U.S. science if it could show some backbone and talk the NSF out of this idiocy.

Response: After issuance of the proposed IHA, L–DEO modified the cruise plan and adopted more precautionary monitoring and mitigation measures. NMFS believes that L–DEO's revised survey as well as the implementation of the monitoring and mitigation measures described in the IHA will have a negligible impact on the affected species or stocks of marine mammals in the study area. See relevant discussions in this document as well as L–DEO's Supplemental EA.

Thresholds

Thresholds—Acoustic Thresholds for Behavior

Comment 31: The proposed IHA notice also draws conclusions that are heavily biased in favor of a finding of ''no impact.'' For example, the notice states that ''many cetaceans * * * are likely to show some avoidance of the area with high received levels of airgun sound * * * [and] the avoidance responses of the animals themselves will reduce or (most likely) avoid any possibility of hearing impairment'' (emphasis added, p. 78303). Setting aside the lack of scientific substantiation for the degree of certainty displayed by this claim, there is no presentation or discussion of the opposing (and equally likely) possibility that many cetaceans might not show avoidance of an area ensonified by airguns because it is important habitat.

Response: NMFS refers the commenter to L–DEO's EA (Chapter 4 and Appendix B) which summarized avoidance response levels to seismic pulses for a number of cetaceans. L–DEO provided ample evidence of avoidance behavior in marine mammals in response to seismic surveys from several peer-reviewed studies including data on gray, bowhead, and humpback whales (Richardson *et al.,* 1995); Gordon *et al.* (2004); humpback whale (McCauley *et al.,* 1998 and 2000a); bowhead whales (Miller *et al.,* 1999; Richardson *et al.,* 1999); and eastern Pacific gray whales (Malme *et al.,* 1986, 1988).

Conversely, the EA discussed the possibility that cetaceans might not exhibit avoidance behavior or may not be as sensitive to seismic sources. L–DEO presents data from peer-reviewed focusing on humpback whales (Malme *et al.,* 1985); bowhead whales (Miller *et al.,* 2005; Harris *et al.,* 2007); and fin and sei whales (Stone, 2003; Stone and Tasker, 2006). For marine mammals that do not avoid the vessel and sound source, L–DEO will implement mitigation measures such as power-downs and shut-downs for animals that enter the respective safety zones to prevent Temporary Threshold Shift (TTS)/Permanent Threshold Shift (PTS) for those respective species.

With the respect to the ETS population of humpback dolphins, NMFS has instituted precautionary mitigation measures to protect these species within their habitat in Taiwanese waters. L–DEO will limit seismic survey lines to take place at least 20 km from the west coast of Taiwan, except for in the passage between the Penghu Islands and the Waishanding Jhou sandbar, where the survey will pass through the approximately 17.1 km mid-line distance between the two possibly sensitive areas, subject to the limitations imposed by other foreign nations, to minimize the potential for exposing Indo-Pacific humpback dolphins, finless porpoises, and other coastal species to SPLs greater than or equal to 160 dB re μPa (rms).

Comment 32: The proposed IHA notice states that ''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'' (p. 78301). It does not, however, consider the reverse; that the failure of a sound source to displace animals from important feeding or breeding habitat may indicate that the area is so important that the animals are willing/forced to tolerate a level of noise exposure that is in fact harmful (see, e.g., the discussion of this concept in Richardson *et al.* 1995). The failure to consider the possibility of an animal not reacting because leaving a prime feeding spot is more costly than moving laterally along a migration pathway is an example of the bias permeating the entire analysis and has contributed to an unacceptably incomplete level of evaluation and discussion regarding impacts and mitigation.

Response: NMFS refers the commenter to page 78302 of the proposed IHA notice, Chapter 4 and Appendix B of the EA for L–DEO's presentation of cetaceans not exhibiting avoidance behavior when exposed to seismic pulses. L–DEO has acknowledged the public's concern for coastal dwelling species in Taiwan, has modified their cruise plan, and has adopted more precautionary monitoring and mitigation measures, especially for species of particular concern. See responses to comments regarding mitigation measures such as the implementation of power-downs and shut-downs for animals discussed within this document as well as within L–DEO's Supplemental EA.

Comment 33: The EA noted that ''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). However, the animals

tolerated high received levels of sound before exhibiting aversive behaviors.'' It should be noted, however, that the animals in the abovementioned Navy studies were reported by Nowacek *et al.* (2007) to be generally ''tested in a context where they were being rewarded for tolerating high levels of noise'' and were ''usually 'punished' in some way * * * for failing to return to the experimental station for additional exposures.'' This was not a problem for their main results as the focus of the work was on to TTS, but the setup does invalidate any conclusions based on the behavioral responses reported in the same studies. For further discussion of the need for precaution in the use of captive studies to set exposure criteria for wild animals, see Parsons *et al.* (2008) and Wright *et al.* (in press).

Response: NMFS acknowledges the commenter's interpretation of captive studies and have taken them into consideration. Thresholds for behavioral response are not based upon captive studies. The 160 dB re 1 µPa threshold was derived from data for mother-calf pairs of migrating gray whales (Malme *et al.,* 1983, 1984) and bowhead whales (Richardson *et al.,* 1985, 1986) responding when exposed to seismic airguns (impulsive sound source).

Comment 34: The idea that behavioral tolerance is a proxy for no impact has no scientific merit. In fact, some fairly sizable impacts have been reported in various species despite a lack of behavioral response. A recent panel of experts also noted that an apparently unresponsive animal may still be undergoing a chronic and/or severe acute stress response, with associated physiological and psychological consequences. These can result from exposure directly, or through masking and other phenomenon indirectly. Thus, taking is entirely possible without observable behavioral disturbance reactions and this needs to be accounted for.

Response: Section 101(a)(5)(D) of the MMPA allows citizens of the United States to take by harassment, small numbers of marine mammals incidental to a specified activity (other than commercial fishing) within a specified geographical region if NMFS is able to make certain findings. NMFS must issue an incidental harassment authorization if 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.

The mitigation measures set forth in the IHA ensure that there will be negligible impacts on the marine mammals. Cetaceans are expected, at most, to show an avoidance response to the seismic pulses. Mitigation measures such as visual marine mammal monitoring, and shut-downs when marine mammals are detected within the defined ranges should further reduce short-term reactions to disturbance, and minimize any effects on hearing sensitivity. Due to these mitigation measures, and other reasons discussed in the Conclusions section of this document, NMFS believes the impacts will be negligible.

Comment 35: Mortality (by human causes) of even a single individual per year from this population may not be sustainable, and unless effective mitigation measures are taken immediately to reduce the threats to this population, it is unlikely that the population will continue to exist (Wang *et al.,* 2004, 2007b). Any single threat has the potential to be the final cause of extinction for this small population of dolphins.

Response: Please note that in response to public comments received on the application and EA, L–DEO has modified the survey design (see L–DEO's Supplemental EA) and adopted more precautionary mitigation measures to protect the critically endangered ETS population, as well as ease potential pressure on other coastal species.

Comment 36: One commenter was concerned about the masking of the noises made by threats, hindering detection of the threats and increasing the impact of the existing threats (e.g., water rushing past a gillnet, commercial shipping) and the chances of mortality.

Response: NMFS expects the masking effects of pulsed sounds on natural sounds or other anthropogenic sounds to be limited. 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. Further, masking effects of seismic pulses are expected to be negligible in the case of the smaller odontocetes, given the intermittent nature of seismic pulses plus the fact that sounds important to these species are predominantly found at much higher frequencies than are the dominant components of airgun sounds.

Marine mammal communications will not be masked appreciably by the multibeam echosounder signals given the low duty cycle of the echosounder and the brief period when an individual mammal is likely to be within its beam. The majority of energy should be concentrated in the beam (Kremser *et al.,* 2005). Furthermore, in the case of baleen whales, the MBES signals (12 kHz) do not overlap with the predominant frequencies in the calls, which would avoid any significant masking. Masking effects on marine mammals are discussed further in Appendix B(4) of L–DEO's EA.

Comment 37: Another commenter was concerned about the impacts on cetaceans due to displacement into other waters. He noted that for populations with low numbers, restricted distributions, displacement may increase energy expenditures by the species already compromised energetically (such as mothers with calves) and increase exposure to other threats (e.g., changes in migration routes may result in animals using waters with higher densities of fishing nets or lines and thus increase their risk of mortality due to entanglement).

Response: The incidental harassment authorization includes mitigation and monitoring measures to reduce potential effects on populations with low numbers and restricted distributions. L–DEO and TAIGER's principal investigators have modified the cruise plan and survey design to protect displacing populations with low numbers and restricted distributions. First, L–DEO will shut down the airgun array immediately if there is a sighting at any distance of the Indo-Pacific humpbacked dolphin or finless porpoise. Second, L–DEO has re-routed the cruise's tracklines offshore Taiwan's west coast by approximately 20 km (10.8 nautical mi) to protect the critically endangered Sousa population and the finless porpoise (except for in the passage between the Penghu Islands and the Waishanding Jhou (Wau-san-ting Chou) sandbar, where the survey will pass through the 17.1 km (9.2 nautical mi) mid-line distance between the two possibly sensitive areas). Finally, L–DEO is restricted to conducting seismic surveys in water depths greater than 200 m (656 ft) in the South China Sea, and as far east as possible from the mainland China side of the Taiwan Strait, to reduce potential for effects on eastern Pacific gray whales, Indo-Pacific humpback dolphins, and finless porpoises.

Comment 38: Given the serious conservation status of the ETS sub-population and the small population size of the JRE provisional population, there must be a higher level of precaution to avoid negative impacts of additional threats on these dolphins. Because even low level noise may increase risks to these dolphins by altering dolphin behavior, increasing ambient noise levels that can 'mask'

biologically important sounds as well as 'mask' sounds that allow the detection of other threats (e.g., the sound of water flowing past gillnets, approaching boats, etc.) should be avoided.

Response: Please see NMFS' responses to comments under the Species of Particular Concern section.

Thresholds—Acoustic Thresholds for TTS and PTS

Comment 39: The notice states that ''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'' (p. 78304). Such a statement is misleading on many levels. For one, marine mammal science has yet to develop ways to measure or identify PTS (permanent threshold shift or permanent hearing loss) in the field. For another, it is known that exposure to loud impulsive sounds such as are produced by airguns can deafen terrestrial species, including people. To state that no specific evidence exists of PTS in marine mammals exposed to airguns when science cannot yet identify such evidence is both specious and disingenuous.

Response: First, mitigation and monitoring requirements under the IHA are expected to prevent TTS, thus preventing PTS. NMFS acknowledges the limitations of current data on the measurement or identification of PTS in marine mammals, let along free-ranging animals.

Recent scientific research on marine mammals and noise, include: estimating hearing capabilities using various behavioral and anatomical techniques; measuring sub-injurious impacts on hearing (temporary threshold shift, or TTS); and estimating lethal and injurious effects of acoustic exposure. Richardson *et al.* (1995) noted, based on terrestrial mammal data, that the magnitude of TTS in marine mammals was expected to depend on the level and duration of noise exposure, among other considerations. Southall *et al.,* (2005) showed that long-term (four to seven years) noise exposure on three experimental pinniped species (northern elephant seal (*Mirounga angustirostris*), harbor seal (*Phoca vitulina*), and California sea lion (*Zalophus californianus*) had caused no change on their underwater hearing thresholds at frequencies of 0.2 to 6.4 kHz.

Finally, NMFS believes that the 180-dB re: 1 µPascal (rms) criteria is a reasonable and precautionary interpretation of the current data at this time. The precautionary nature of these criteria is discussed in Appendix B(6) of L–DEO's application and in previous **Federal Register** notices (*e.g.*, 67 FR 46711, July 16, 2002). The current safety zones of 180 dB re: 1 µPa (rms) for cetaceans is conservative and will protect marine mammals from injury (Level A harassment).

Comment 40: Recent research examining the propagation of airgun noise has shown that, contrary to predictions, received levels can decrease between 5 km and 9 km, but then increase at distances between 9 km and 13 km (Madsen *et al.* 2006). The researchers stated that received levels ''can be just as high * * * at 12 km as at a range of 2 km from the array'' (Madsen *et al.* 2006, p. 2374), ''beyond where visual observers on the source vessel can monitor effectively'' (Madsen *et al.* 2006, p. 2376). Arguably, this suggests that if the goal is to avoid subjecting animals to Level A harassment or worse, seismic surveys should be conducted at a minimum greater than 12 km from the offshore boundary of a coastal species' home range.

Response: With regards to the *Langseth's* survey offshore of Taiwan's west coast, L–DEO has re-routed the survey by approximately 20 km (10.8 nautical mi) to reduce potential effects for marine mammals. For the passage between the Penghu Islands and the Waishanding Jhou (Wau-san-ting Chou) sandbar, the survey will pass through the 17.1 km (9.2 nautical mi) mid-line distance between the two possibly sensitive areas. Please see the Mitigation—Tracklines section for additional information.

Comment 41: HSI notes that the **Federal Register** notice states (p. 78306): NMFS believes that to avoid the potential for permanent physiological damage (Level A harassment), cetaceans and pinnipeds should not be exposed to pulsed underwater noise at received levels exceeding, respectively, 180 and 190 dB re 1 µPa (rms). The precautionary nature of these criteria is discussed in Appendix B (6) of L–DEO'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 [emphasis added]. The language (see emphasis) functionally defining Level A harassment is not found in the MMPA or in its implementing regulations. We advise the NMFS against inserting ''unofficial'' definitions of harassment into notices, regardless of the context (here, it could be argued only hearing impairment was in question, but these words could be taken out of context). This wording could be seen to encompass a broad range of ''damage''—from a wound that heals into a scar (clearly minor) to a crippling injury that leads to death (so clearly not Level A harassment but rather serious injury). It also could be seen to exclude reversible injuries that should be categorized as Level A, not Level B harassment (such as, for example, broken bones that, until healed, could result in lost mating opportunities). We strongly recommend that this language be expunged from any subsequent rule on this application and not used again in any future notices.

Response: NMFS concurs with HSI and offers the following amendment to the language contained in the proposed rule: ''NMFS believes that to avoid the potential for Level A harassment from exposure to pulsed underwater noise, cetaceans and pinnipeds should not be exposed to received levels exceeding, respectively, 180 and 190 dB re 1 µPa (rms). The precautionary nature of these criteria is discussed in Appendix B(6) of L–DEO'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 [emphasis added].''

However, while not redefining the statutory definition, it is necessary for NMFS to include functional definitions of effects that fall into the category of Level A (or B) harassment in order to meet our statutory responsibility to quantify take. For example, for acoustic effects, because the tissues of the ear appear to be the most susceptible to the physiological effects of sound, and because threshold shifts tend to occur at lower exposures than other more serious auditory effects, NMFS has determined that PTS is the best indicator for the smallest degree of injury that can be measured. Therefore, the acoustic exposure associated with onset PTS is used to define the lower limit of the Level A harassment for acoustic effects.

Comment 42: L–DEO should use the more precautionary 15 dB difference being employed in converting the SEL-based safety zones to SPL-based safety zones. (From the EA: ''At the distances where rms levels are 160–190 dB re 1 µPa, the difference between the SEL and SPL values for the same pulse measured at the same location usually average approximately 10–15 dB, depending on the propagation characteristics of the

location (Greene, 1997; McCauley *et al.,* 1998, 2000a; Appendix B). In this EA, we assume that rms pressure levels of received seismic pulses will be 10 dB higher than the SEL values predicted by L–DEO's model. Thus, we assume that 170 dB SEL ~ 180 dB re 1 µPa rms.''). Thus 180 dB rms SPL would be reached with a SEL of 165 dB.

Response: L–DEO's results indicate (for shallow water, at least) the difference between rms and SEL varies between 8 and 13 dB. This result is more or less in line with that found by Madsen *et al.* (2006). The difference is higher at offsets, where the more impulsive direct arrival dominates the sound field, and lower at larger offsets, where the signal is more reverbatory. The range at which the decrease occurs depends a lot on water depth, but it's obvious that to use a 15 dB correction elsewhere would nearly double the numbers as far as offsets. The length of the signal is an important factor as well since there are greater differences between SEL and SPL, which means the signal is shorter, since it stretches as it travels further.

Comment 43: The EA notes that Southall *et al.* (2007) stated that TTS is not injury. However I believe that they have overstated their conclusions. It is true that Southall *et al.* (2007) state: ''[impacts resulting in] * * * TTS rather than a permanent change in hearing sensitivity * * * are within the nominal bounds of physiological variability and tolerance and do not represent physical injury (Ward, 1997).'' However, they also note that ''at present, however, there are insufficient data to allow formulation of quantitative criteria for non-auditory injuries'' and later acknowledge that, while they believe that ''strong behavioral responses to single pulses * * * are expected to dissipate rapidly enough as to have limited long-term consequence'' there are occasions where such responses may ''secondarily result in injury or death (*e.g.,* stampeding)'' (Southall *et al.,* 2007).

Response: In its 2002 Final Rule for SURTASS LFA sonar, NMFS stated that temporary threshold shift (TTS) is not an injury. The required power-down and shut-down zones, if properly implemented, will avoid exposing marine mammals to levels associated with injury and minimize the number of marine mammals exposed to levels associated with TTS (*See* Mitigation section).

With regards to non-auditory injuries, the conclusion that the potential effects on the stocks of marine mammals from non-auditory injuries would be minimal is discussed in the L–DEO's EA. NMFS believes that L–DEO's seismic survey has met all of these requirements and has been operating since 2003 without any known physical injuries to marine animals.

Comment 44: ''Southall *et al.* (2007) also add the following caveat with regards to their report: Finally, we emphasize that exposure criteria for single individuals and relatively short-term (not chronic) exposure events, as discussed here, are insufficient to describe the cumulative and ecosystem-level effects likely to result from repeated and/or sustained human input of sound into the marine environment and from potential interactions with other stressors. Also, the injury criteria proposed here do not predict what may have been indirect injury from acoustic exposure in several cases where cetaceans of mass stranded following exposure to mid-frequency military sonar. Thus, since they did not attempt to consider all possible methods of injury in their deliberations and thus their final figures, they should not be directly applied to management decisions that must, by law, consider the full suite of potential impacts. Direct application of their criteria would thus not be precautionary enough to meet the required legal standards.''

Response: NMFS currently uses the existing thresholds for Level A harassment (sound pressure level of 180 dB re 1 µPa [rms]) (dB SPL), and Level B harassment (160 dB SPL for impulse noise and 120 dB SPL for continuous sound). The science in the field of marine mammals and underwater sound is evolving relatively rapidly. NMFS is in the process of revisiting our acoustic criteria with the goal of developing a framework (Acoustic Guidelines) that allows for the regular and scientifically-valid incorporation of new data into our acoustic criteria. We acknowledge that this model has limitations; however, the limitations are primarily based on the lack of applicable quantitative data. We believe that the best available science has been used in the development of the criteria used in this IHA. We appreciate the input from the public and intend to consider it further as we move forward and develop the Acoustic Guidelines.

Comment 45: It should be noted that repeated TTS can lead eventually to PTS, which would not be classed as injury under these criteria. Other potentially injurious impacts have also been shown to occur below levels that would cause TTS in humans. For example, impaired reading comprehension and recognition memory in children is linked to aircraft noise at exposure levels considerably less than 75 dB (Stansfeld *et al.,* 2005), which, according to the U.S. National Institute on Deafness and Other Communication Disorders (NIDCD, 2007), are unlikely to cause hearing loss (temporary or otherwise) even after long exposure (NIDCD, 2007).

Response: Mitigation and monitoring requirements under the IHA should prevent TTS. While there have been debates among scientists regarding whether a permanent shift in hearing threshold (PTS) can occur with repeated exposures of TTS, at least one study showed that long-term (four to seven years) noise exposure on three experimental pinniped species had caused no change on their underwater hearing thresholds at frequencies of 0.2–6.4 kHz (Southall *et al.,* 2005).

TTS may be considered to be an adaptive process (analogous to the dark adaptation in visual systems) wherein sensory cells change their response patterns to sound. Tissues are not irreparably damaged with the onset of TTS, the effects are temporary (particularly for onset-TTS), and NMFS does not believe that this effect qualifies as an injury.

Comment 46: It is strange that an entire special issue devoted to noise-related stress responses in marine mammals resulting from a multi-disciplinary panel of experts does not get a single mention in this section, even though a discussion of likely impacts is offered in Wright *et al.* (2007a, b) and the other papers within (all of which are cited therein). The papers are cited in Southall *et al.* (2007), which the authors have obviously read. I will not repeat the conclusions here, but suggest they are included within the EA (or more likely an EIS) before this survey begins.

Response: NSF/L–DEO presented the Southall *et al.* (2007) study as one of several pieces of information that relate to this topic. However, NMFS does not solely rely upon NSF's EA to arrive at its determinations. NMFS is aware of Wright *et al.* (2007a, b) paper as well as others published in the International Journal of Comparative Psychology. However, NMFS finds that the information is not such that it will affect NMFS' findings.

Comment 47: There is a high likelihood that many individuals will be exposed to sound levels that qualify as Level A harassment. Any additional threats (especially those where many uncertainties exist about their impacts and that have the potential to cause serious harm or even death) to cetaceans on the brink of extinction are not ''negligible'' for the affected species or stocks.

Response: The mitigation and monitoring requirements under the IHA are expected to prevent TTS (Level B harassment), thus preventing PTS (Level A harassment). NMFS believes that it is very unlikely that Level A harassment will result and, therefore, NMFS has not authorized Level A harassment in this IHA.

The IHA includes mitigation and monitoring measures to reduce the potential for injury or mortality, as well as instituting immediate shutdown protocols for the North Pacific right whale, Western Pacific gray whale, Indo-Pacific humpbacked dolphin, or finless porpoise.

The mitigation measures (e.g., ramp-up, passive acoustic and visual monitoring, and quiet acoustic periods) set forth in the IHA ensure that there will be negligible impacts on the marine mammals by reducing short-term reactions to disturbance and minimizing any effects on hearing sensitivity. Due to these measures, and other reasons discussed in the Conclusions of this document, NMFS believes the impacts will be negligible.

Comment 48: Until the effects of seismic surveys on these shallow water dolphins and the combined and cumulative impacts of all threats can be better understood, a ''safe'' exposure level cannot be determined.

Response: The temporary nature of the activity and the implementation of the new shut-down criteria and mitigation measures as described in the Species of Particular Concern and the Mitigation sections, leads NMFS to believe the activity will have a negligible impact on shallow water populations of the Indo-Pacific humpback dolphin and finless porpoise.

Comment 49: Variability and uncertainty in TTS threshold values. Furthermore the TTS threshold is based on limited information from only a few species of cetaceans. Most of the species of concern (*e.g.,* baleen whales, beaked whales, humpback dolphin, finless porpoise, etc.) have not been examined and there appears to be great variability amongst individual cetaceans tested so interspecific extrapolations need to be considered cautiously (for a review, see Weilgart, 2007).

Response: NMFS acknowledges that the test-animals may not fully represent the range of hearing responses across multiple taxa. However, NMFS has used the best science available to develop these thresholds which have been in effect for almost a decade. The current safety zone of 180 dB rms for cetaceans is conservative and will protect marine mammals from injury (Level A harassment).

Comment 50: The difficulty in predicting sound levels underwater must be taken into account. Madsen *et al.* (2006) reported that seismic sounds did not always attenuate predictably and sound levels can be the same at 2 km as well as at 12km. The same unpredictability was found for sounds from acoustic harassment and deterrent devices, where increasing distance from the sound source did not always result in a reduction of exposure levels (Shapiro *et al.,* 2009). Even within a fraction of a meter, sound level differences may be several orders of magnitude (Wahlberg, 2006 as cited in Shapiro *et al.,* 2009). These studies are inconsistent with classic ideas of sound propagation and attenuation (see Richardson *et al.,* 1995) and are very concerning because the very dynamic nature of the waters of western Taiwan and the concrete walls lining the shoreline may result in the sounds the airguns to reach unexpectedly dangerous exposure levels within the distribution of the ETS population.

Response: Please see NMFS' response to Comment # in this section.

Comment 51: The survey will bring the *Langseth* to waters within 1 km from the shores of Taiwan and right through the middle of almost the entire linear coastal distribution of the eastern Taiwan Strait population. At this distance from shore, the *Langseth* will inevitably subject the entire population to noise levels greater than 180 dB. Even staying at least 2 km from the coastline does absolutely nothing to reduce the noise exposure for these critically endangered (IUCN Red List) dolphins. And based on the values in Table 1 of the **Federal Register** notice, even at 8–10 km from shore, all dolphins will still be exposed to at least 160 dB with an unknown number that may be exposed to > 180 dB.

Response: Please see the Species of Particular Concern section.

Comment 52: Given the threat of noise on the health of the ETS dolphins, the ETSSTAWG recommended a buffer for noise threats out to at least 5 km from shore (note: for an area with an expansive littoral zone such as western Taiwan, ''shore'' can vary greatly with tides; for clarity, ''shore'' is defined here to include the littoral zone at the lowest tide of the year). Calculations of how far out the *Langseth* should be to prevent exposure of ETS dolphins to received levels greater than 160 dB should be based on at least the recommended 5 km buffer boundary (i.e., the waters from shore, as defined above, to 5 km offshore should not be exposed to levels >160dB). Based on the values presented in Table 1 (of the **Federal Register**) the source should not be closer than 13 km from shore. However, given the population's critical status and the underestimated predicted distances for each exposure threshold level (especially for shallow water; see above), greater precaution is needed (i.e., the airguns should be even further from shore).

Response: Please see the Mitigation section in this notice.

Comment 53: For whales that are using the shallow waters (e.g., Taiwan Strait), the predicted distance for exposure levels to be greater than 160 dB was 6,227 to 8,000 m and for 180 dB the distances were 2,761 to 3,694 m. At these distances, detection of whales by observers can be difficult to impossible depending on sighting conditions. Therefore, some whales may be exposed to greater than 180 dB without being detected by observers.

Response: A key factor in estimating the number of undetected mammals that might occur within the 180 dB radius is the fact that many marine mammals move away from an approaching seismic vessel (e.g., Richardson *et al.,* 1995; Stone, 2003). The conventional estimates of the proportions present but missed by visual observations, as described in 73 FR 78294, December 22, 2008, will overestimate (sometimes by very large factors) the numbers of mammals that might be exposed to high levels of sound near the ship. This is an important consideration in assessing possible exposures to high-level sound, especially for the more responsive species, notably some if not all baleen whales, beaked whales, and harbor porpoises. There is also some degree of avoidance by a variety of other odontocetes (Stone, 2003). In order to derive unbiased estimates of numbers that might be exposed to greater than 180 dB, density-based estimates that include allowance for g(0) and f(0) would need further adjustment to allow for an ''avoidance probability'' factor. Such factors are not generally available. They would depend on species and circumstances, and for some species would, if applied, result in a large decrease the estimates of the numbers that would be exposed to high-level sound.

Detectability is a measure of the probability of detecting a marine mammal that is present on a vessel's trackline (i.e., g(0)). L–DEO uses the most applicable detectability values as provided in Koski *et al.* (1998) whenever estimates of marine mammal detectability have not already been calculated. They have compiled previously reported detectability information for various species and

used data on surfacing/dive cycles to estimate detectability values for species or species groups of marine mammals for which there are no published detectability values. Thus the estimates of incidental take in L–DEO's IHA application and the associated NSF EA are either the same (if detectability had already been taken into account) or higher than would be obtained by direct application of previously reported density data.

NMFS acknowledges these limitations. However, acoustic detection has been demonstrated to augment visual detection of marine mammal in population estimates in a number of studies (e.g., Moore *et al.,* 1999; Swartz *et al.,* 2002). The use of PAM will improve the detection of marine mammals by indicating to the MMVOs when a vocalizing animal is potentially near and prompting a shut-down when necessary.

Comment 54: Statements such as ''However, there has been no specific documentation of TTS let alone permanent hearing damage, i.e., PTS, in free-ranging marine mammals exposed to sequences of airgun pulses during realistic field conditions'' are stupid.

Response: NMFS acknowledges the commenter's opinion. However, at the time of publication, the statement that ''there has been no specific documentation of TTS let alone permanent hearing damage, i.e., permanent threshold shift (PTS), in free-ranging marine mammals exposed to sequences of airgun pulses during realistic field conditions,'' was correct. Lucke *et al.,* (2009) recent auditory study on documenting threshold shift in harbor porpoises was published after L–DEO submitted their application.

Monitoring

Comment 55: ETSSTAWG states that a minimum of two MMOs should be used at all times, with one of those having considerable prior experience as a MMO (preferably within the area of Taiwan).

Response: Three MMOs are typically on watch at a time, two MMVOs on the observation tower conducting visual observations and the third monitoring the PAM equipment. On the observation tower, two MMOs are on watch during all daylight hours except during meal times. At least one MMO and one MMVO will be on watch during meal times. The MMOs onboard the *Langseth* are experienced and qualified, and additional regional experts have been brought onboard for this survey.

Comment 56: The Commission recommends that, before issuing the requested authorization, the NMFS provide additional justification for its preliminary determination that the planned monitoring program will be sufficient to detect, with a high level of confidence, all marine mammals within or entering the identified safety zones. At a minimum, such justification should (1) identify those species that it believes can be detected with a high degree of confidence using visual monitoring only, (2) describe detection probability as a function of distance from the observer, (3) describe changes in detection probability at night, and (4) explain how close to the vessel marine mammals must be for observers to achieve the anticipated high nighttime detection rate.

Response: NMFS believes that the planned monitoring program will be sufficient to detect (using visual detection and passive acoustic monitoring [PAM]), with reasonable certainty, most marine mammals within or entering identified safety zones. This monitoring, along with the required mitigation measures (see below), will result in the least practicable adverse impact on the affected species or stocks and will result in a negligible impact on the affected species or stocks.

The *Langseth* is utilizing a team of trained marine mammal observers (MMOs) to both visually monitor from the high observation tower of the *Langseth* and to conduct PAM. However, there are limitations on marine mammal detection, and ramp-ups are required as mitigation measures due to these limitations. This monitoring, along with the required mitigation measures (see below), will result in the least practicable adverse impact on the affected species and/or stocks and will result in a negligible impact on the affected species and/or stocks.

When stationed on the observation platform of the *Langseth,* the eye level will be approximately 17.8 m (58.4 ft) above sea level, so the visible distance (in good weather) to the horizon is 16.5 km (10.3 mi; the largest safety radii is approximately 3.7 km, 2.3 mi). Big eyes are most effective at scanning the horizon (for blows), while 7x50 reticle binoculars are more effective closer in (MMOs also use a naked eye scan). Night vision devices (NVDs) will be used in low light situations. Additionally, MMOs will have a good view in all directions around the entire vessel. Also, nearly 93 percent of the survey lines are in intermediate or deep water depths, where the safety radii are all less than 1.4 km (0.87 mi).

Theoretical distance of this PAM system is tens of kilometers. The PAM is operated both during the day and at night. Though it depends on the lights on the ship, the sea state, and thermal factors, MMOs estimated that visual detection is effective out to between 150 and 250 m (492 and 820 ft) using NVDs and about 30 m (98.4 ft) with the naked eye. However, the PAM operates equally as effectively at night as during the day, especially for sperm whales and dolphins.

The PAM has reliable detection rates out to 3 km (1.9 mi) and more limited ability out to 10s of km. The largest 180-dB safety radii (3.7 km, 2.3 mi), which is the radii within which the *Langseth* is required to shut down if a marine mammal enters, are found when the 36 airgun array is operating in shallow water at a 9 m (29.5 ft) tow depth. Only approximately seven percent of the total 15,902 km survey lines of the planned seismic survey (excluding contingency) will take place in water less than 100 m deep (shallow water). The species most likely to be encountered in the waters off of SE Asia are pantropical spotted, Fraser's, and spinner dolphins, which have relatively larger group sizes (10s to 100s to 1,000s of animals for these various dolphin species), are not cryptic at the surface, and have relatively short dive times (approximately 6 min for some dolphin species), all which generally make them easier to visually detect. Other species that are likely to be encountered during the seismic survey include Bryde's whales and humpback whales, which have relatively long dive times; however they are not cryptic at the surface, have large blows and distinct physical features, all which generally make them easier to visually detect. Furthermore, the vocalizations of most of these species are easily detected by the PAM. During the *Ewing* cruise in the GOM in 2003, MMOs detected marine mammals at a distance of approximately 10 km (6.2 mi) from the vessel and identified them to species level at approximately 2.7 km (1.7 mi) from the vessel, though the bridge of that vessel was only 11 m (36 ft) above the water (vs. the *Langseth* which is more than 17 m (55.8 ft) above sea level). All of the 180-dB safety radii for other water depths and tow depths and for the single 40 in^3 airgun to be used during ramp-ups and power-downs (see below) are less than 2 km (1.2 mi).

The likelihood of visual detection at night is significantly lower than during the day, though the PAM remains just as effective at night as during the day. However, the *Langseth* will not be starting up the airguns unless the safety zone is visible for the entire 30 min prior (i.e., not at night), and therefore in all cases at night, the airguns will already be operating, which NMFS

believes will cause many cetaceans to avoid the vessel, which therefore will reduce the number likely to come within the safety radii. Additionally all of the safety radii in intermediate and deep water depths are smaller than 3 km (1.9 mi) and fall easily with the reliable detection capabilities of PAM.

Comment 57: The Commission recommends that, before issuing the requested authorization, the NMFS clarify the qualifiers ''when practical'' and ''when feasible'' with respect to (1) using two MMOs to monitor the exclusion zone for marine mammals during daytime operations and nighttime start-ups of the airguns, and (2) using MMOs during daytime periods to compare sighting rates and animal behavior when the seismic airguns are operating and when they are not.

Dr. John Wang states that the inadequacy of MMVO coverage in this respect would be wholly inadequate even for small-scale marine mammal surveys where the consequence of failing to detect animals are much less serious.

Response: The *Langseth* carries five trained, NMFS-qualified and experienced MMOs for every seismic study involving use of an airgun system comparable to that planned for the TAIGER project. MMOs are appointed by L–DEO with NMFS concurrence. L–DEO plans to employ a regional expert as one of the MMOs, and negotiations were currently underway with experts from National Taiwan University, Academia Sinica, and National Taiwan Ocean University during the preparation of this notice. L–DEO will have a sixth MMO and regional expert during the second leg of the cruise as well. L–DEO will utilize two (except during meal times), NMFS-qualified, vessel-based MMVOs to watch for and monitor marine mammals near the seismic source vessel during all daytime airgun operations and before and during start-ups of airguns day or night. MMVOs will have access to reticle binoculars (7×50 Fujinon), big-eye binoculars (25x150), and night vision devices to scan the area around the vessel. MMOs will alternate between binoculars and the naked eye to avoid eye fatigue. During all daytime periods, two MMVOs will be on effort from the observation town to monitor greater than 90 percent of the time. During mealtimes it is sometimes difficult to have two MMOs on effort, but at least one MMVO will be on watch during those brief scheduled times. Three MMOs are typically on watch at a time, and typically observe for one to three hours. Two MMVOs will also be on watch during all nighttime start-ups of the seismic airguns. A third MMO will be monitoring the PAM equipment 24 hours a day to detect vocalizing marine mammals present in the action area.

Comment 58: Dr. John Wang states that in shallow waters (Taiwan Strait), the predicted distance for exposure levels of 180dB and 190dB was estimated by L–DEO to be 2,761 to 3,694m and 1,600 to 2,182 m, respectively. At these distances (which are underestimated) and under ideal sighting conditions, detection of finless porpoises by observers is of limited ineffectiveness at the closest range and very ineffective at the greater distances. Sighting effectiveness will drop dramatically even for highly experienced observers in slight seas. Under conditions where white caps are present, sightings of finless porpoises are rarely made and researchers generally stop observations. At several kilometers distance in shallow water, PAM would not be able to detect finless porpoises adequately because finless porpoises are not always actively vocalizing and the very high frequency sounds emitted by porpoises (Akamatsu *et al.,* 1998) attenuate quickly so the PAM's detection range will be limited. Therefore, finless porpoises can and will likely be exposed to >>180dB without being detected especially if sighting conditions are not ideal. For finless porpoises, L–DEO's airguns have the potential to inflict serious permanent injuries or even cause death, directly or indirectly.

Response: There is a scientific methodology to estimate the probability of detection marine mammal on the surface, as explained in detail in Buckland *et al.* (1993). This includes several components, including the probability that the mammal will be at the surface and potentially sightable while within visible range of the observers, the probability that an animal at the surface will in fact be detected, and the relationship between sighting probability and lateral distance from the trackline.

A certain portion of the population is presumed to be submerged at any given time and is therefore unavailable for detection. However, if the ship speed is slow, many of these animals would surface at some point while within visual range of MMVO's aboard the approaching vessel. The speed of the *Langseth,* and other seismic vessels while operating airguns, will generally be four to five knots of vessels conducting marine mammal line transect surveys.

All L–DEO estimates of potential numbers of animals take account of all these factors to the extent that available data allow. Detectability is a measure of the probability of detecting a marine mammal that is present on a vessel's trackline. L–DEO uses the most applicable detectability values as provided in Koski *et al.* (1998) whenever estimates of marine mammal detectability have not already been calculated. They compiled previously reported detectability information on various species and used data on surfacing/dive cycles to estimate detectability values for species or species groups of marine mammals for which there is no published detectability values. Thus the estimates of incidental take in L–DEO's IHA application and Supplemental EA are either the same (if detectability had already been taken into account) or higher than would be obtained by direct application of previously reported density data.

After the issuance of the proposed IHA, L–DEO modified the cruise plan and adopted more precautionary monitoring and mitigation measures. NMFS believes that L–DEO's revised survey as well as the implementation of the required monitoring and mitigation measures described in the IHA will have a negligible impact on the affected species or stocks of marine mammals in the study area. See Effects Analysis, Species of Particular Concern, and L–DEO's Supplemental EA.

Monitoring—PAM

Comment 59: ETSSTAWG asks about the frequency range of the PAM system, and if it is suitable for detecting signals produced by all the marine mammals within the area.

Response: L–DEO's PAM system is suitable for detecting frequencies up to 96 kHz (192 sampling rate). The virtual bandwidth of the new digital array and sound analysis workstation is 96 kHz (the real bandwidth is around 90 kHz), which is at least double when compared to some of the best PAM systems normally available and four times that of most of the basic systems. L–DEO has the potential for expanding the PAM system to a bandwidth of 160 kHz, but a new hydrophone array will need to be designed to add the required special additional sensors. The array is capable of detecting porpoises, but not harbor porpoises (*Phocena phocena*), which have clicks at 140 kHz.

The low frequency sensor end of the PAM system can detect mysticetes, however there is a problem with low frequency noise and vibration induced in the array by movements in towing the acoustic array system, in particular if a short cable and a depressor are used. To allow detection of low frequency waves,

it is necessary to have a long cable towed with a good vibration damping system and the array should be deep and far from the ship. In the past, Right Wave's PAM system has been able to detect frequencies as low as 10 Hz for fin whales (on the NATO Alliance), but due to towing conditions on the *Langseth* the current configuration can detect a minimum low frequency of 100 Hz.

The digital array is suitable for detecting beaked whales, as it can monitor and record at 48 kHz to get their clicks. The PAM's sound analysis and display system has been proven effective for detecting Cuvier's beaked whale clicks (Sirena 2008 cruise in the Alboran Sea). It is important to note here that in order to detect very diverse sound categories, it is necessary to set up a very powerful computer that is able to signal process to produce and display different real-time views, each view well-tailored on that particular signals' characteristics.

The PAM system has been improved and now has a shot blanking system. A new piece of hardware compresses the shots without blanking them. It works on the PAM operator's headphone output and doesn't affect the recording system. This allows the PAM operator to hear faint signals along with the (volume compressed) ''shots'' so that they are always aware of what is occurring underwater.

Comment 60: ETSSTAWG states the MMO operating the PAM system (which should be in addition to the other two at all times) should have considerable experience working with the acoustic signals of many of the marine mammal taxa that are likely to be encountered in the survey.

Response: The MMO operating the PAM system will be on watch in addition to the two MMVOs watching from the observation tower. Right Waves, an Italian bioacoustics company, is providing L–DEO with state-of-the-art underwater acoustic equipment and skilled operators. Right Waves started their studies on underwater acoustics more than 15 years ago at the Interdisciplinary Center for Bioacoustics and Environmental Research (CIBRA) Institute, which is part of the University of Pavia in Italy. They have organized and conducted several research cruises in order to develop their software, hardware, and data collection protocols. The PAM operators have applied acoustic monitoring and mitigation worldwide for both civil and military institutions. Right Waves is currently working with organizations such as WHOI and NATO to provide their expertise in underwater acoustics. They are also involved in writing mitigation policies for the Italian Navy, NATO, and other European organizations. Part of their activities is described and can be found on the CIBRA Web site at *http://www.unipv.it/cibra.* The Right Waves Web site will be available online soon. NMFS considers the operators of L–DEO's PAM system to be qualified and experienced.

Comment 61: The Commission recommends that, before issuing the requested authorization, the NMFS consult with the applicant to clarify and describe the potential conditions that would render the use of PAM impracticable for complementing the visual monitoring program.

Response: Before the issuance of the requested authorization, NMFS consulted with L–DEO to clarify and describe the potential conditions that would render the use of PAM impracticable for complementing the visual monitoring program. L–DEO's lead bioacoustician has stated that there are difficulties with towing the PAM array because the space off the stern of the *Langseth* is mostly filled by the airgun array and streamers. L–DEO tried to tow the PAM from the paravane boom, paravane tow cable, and with floats. Using these methods was not acceptable because the quality of acoustics was considered poor due to tow depth and it also posed a higher risk of totally losing the array. During L–DEO's recent seismic survey near Tonga, PAM operators have found a more successful solution to towing the PAM array by using a depressor (intended to sink fishing gear) that can withstand rough weather and sea conditions. The depressor sinks the PAM array's lead-in cable so that it does not get too close to the airgun array cables. This technique, while it works, can still be improved for a series of reasons. Potential problems that the current PAM set up could experience on the *Langseth* include operations in very shallow waters (20 m or less) and operations in areas with large amounts of fishing gear (longlines, driftnets, etc.) that could lead to entanglement. L–DEO has been provided two new PAM hydrophone arrays that are state-of-the-art, one is a unique digital PAM array.

Comment 62: Dr. John Wang states that L–DEO should address the effectiveness of PAM for detecting very high frequency vocalizations of small cetaceans in shallow waters several kilometers away (due to rapid attenuation of high frequency sounds).

Response: Currently, the detection of high-frequency marine mammals signals in shallow water using PAM has limitations in terms of physics, and perhaps even more limitations in terms of the deployment of hydrophone arrays. The size of the cetacean is not likely to be a factor.

After the issuance of the proposed IHA, L–DEO modified the cruise plan and adopted more precautionary monitoring and mitigation measures, including temporal and spatial avoidance of species of particular concern, which includes some small cetacean species (e.g., Indo-Pacific humpback dolphins and finless porpoises). See NMFS' responses to comments above and L–DEO's Supplemental EA.

Comment 63: Dr. John Wang states that L–DEO should address the ineffectiveness of PAM at determining the location and direction of travel of cetaceans.

Response: One of the major reasons PAM is not a self standing mitigation tool is the limitations of determining range and bearing. For a seismic vessel on a fixed tract, the signal processing to determine a range has not yet arrived. Bearing is useful, but range is the critical measure for purposes of implementing mitigation measures for the safety radii. In a research vessel situation, free to change course, and with highly trained visual and acoustic teams, PAM can be quite effective to track and stay with vocal marine mammals. The potential to improve PAM technology certainly exists. See NMFS' responses to comments above.

Comment 64: CSI states that in shallow water, PAM is unlikely to be effective in detecting finless porpoises. Finless porpoises are not always vocalizing and the high frequency sounds produced by finless porpoises attenuate quickly.

Response: L–DEO's PAM system is capable of detecting the high frequency vocalizations of finless porpoises. See responses to comments regarding finless porpoises in Species of Particular Concern section below. See L–DEO's Supplemental EA for information. After issuance of the proposed IHA, L–DEO modified the cruise plan and adopted additional monitoring and mitigation measures to reduce potential impacts on finless porpoises. NMFS has not authorized any takes of finless porpoises in the IHA issued to L–DEO.

Comment 65: Dr. John Wang states that in shallow water, PAM would be almost completely ineffective at detecting (never mind locating or tracking) cetaceans especially at the predicted rms distances for the different exposure levels. Furthermore, PAM is only capable of detecting cetaceans when they are vocalizing. Some species have been known to reduce

vocalizations during seismic surveys while other species do not vocalize much at or near the surface (e.g., beaked whales).

Response: MFS believes that visual observers and PAM are effective tools for monitoring marine mammals in the affected area during the seismic survey. PAM is required for monitoring on the *Langseth* (when practicable), but not for the implementation of mitigation measures. PAM is used by MMOs and the lead bioacoustician aboard the *Langseth* for the detection of vocalizing marine mammals. Any confirmed marine mammal vocalization detections using PAM are communicated to the MMVOs on watch on the observation tower to help alert the MMVOs to the presence of vocalizing marine mammals in the survey area (not necessarily the safety radii). The use of PAM is therefore used in aid of visual observers, who monitor the applicable safety radii for presence of marine mammals. The detection of marine mammals in the vicinity of the array in turn triggers mitigation requirements specified in the IHA issued to L–DEO.

After the issuance of the proposed IHA, L–DEO modified the cruise plan and adopted more precautionary monitoring and mitigation measures. NMFS believes that the L–DEO's revised survey as well as the implementation of the required monitoring and mitigation measures described in the IHA will have a negligible impact on the affected species or stocks of marine mammals in the study area.

Monitoring—Visual

Comment 66: ETSSTAWG states L–DEO's ability to monitor the exclusion zone (''EZ'') proposed by NMFS cannot be properly evaluated because the EZ has not yet been established and awaits further data from L–DEO's 2007/2008 calibration study. *See* 73 FR 78297, December 22, 2008.

Response: Acoustic data analysis for L–DEO's 2007/2008 calibration study is ongoing. Results from the 2007/2008 calibration study in the Gulf of Mexico are in review and a scientific paper on the *Langseth's* airgun sound source will be published on a future date (Tolstoy, pers. comm.). After the analysis is complete and published, the empirical data from the 2007/2008 calibration study will be used to refine the EZ's for future proposed cruises as appropriate. NMFS considers the results from the 2004 calibration study to be the best scientific data available for L–DEO's purposes of monitoring the EZ's described in Table 1 (above).

Comment 67: Dr. John Wang states that although large pink/white animals (i.e., Indo-Pacific humpback dolphins) are highly visible within 1 km in calm conditions, younger grey and spotted animals can be easily missed. However, beyond 1 km, high atmospheric humidity and smog that is often present along the west coast of Taiwan can reduce visibility of these animals by a considerable but unquantified amount (personal observation) even with optical aids. Furthermore, because these dolphins are often swimming along the shoreline next to the surf, even pink/white dolphins can be easily missed by offshore observers looking inshore towards the surf. Jefferson (2000) showed that humpback dolphin sightings dropped off considerably beyond a perpendicular distance of about 400 to 500 m and none were observed beyond about 1,500 m. Within the predicted (but underestimated) distances for exposure to >180 dB, many dolphins can go undetected by MMVOs.

Response: NMFS agrees that some species of marine mammals can be difficult to visually detect in certain environmental conditions. In order to reduce potential impacts on the ETS sub-population of Indo-Pacific humpback dolphins, L–DEO will limit seismic survey lines to take place at least 20 km from the west coast of Taiwan, except for in the passage between the Penghu Islands and the Waishanding Jhou (Wau-san-ting Chou) sandbar, where the survey will pass through the approximately 17.1 km mid-line distance between the two possibly sensitive areas, subject to the limitations imposed by other foreign nations, to minimize the potential for exposing Indo-Pacific humpback dolphins to SPLs >=160 dB re 1 μPa (rms).

Comment 68: Dr. John Wang states that L–DEO should address the ineffectiveness of MMVOs at detecting cetaceans, especially small cetaceans, under non-ideal sighting conditions (low light, rough seas, rain) and the ineffectiveness of MMVOs at detecting cetaceans, especially small cetaceans, at distances beyond about 1 km but well within the waters ensonified by levels >180 dB in shallow waters (potentially farther than 3.7km).

Response: After issuance of the proposed IHA, L–DEO modified the cruise plan and adopted more precautionary monitoring and mitigation measures. L–DEO will be avoiding areas where some species of small cetaceans that are difficult to visually detect (e.g., Indo-Pacific humpback dolphins and finless porpoises) are likely to occur. A sixth MMO and regional expert will be onboard the *Langseth* for the duration of the survey in order to improve visual detection capabilities. L–DEO will also be using a PAM system in order to detect any vocalizing marine mammals. See L–DEO's Supplemental EA.

Comment 69: Dr. John Wang states that L–DEO should address the ineffectiveness of MMVOs at detecting finless porpoise at distances beyond 1 km under any conditions, but well within the waters ensonified by levels >180dB (possibly >190 dB) in shallow waters (potentially farther than 3.7km).

Response: The monitoring methods for detection of marine mammals on the *Langseth* are relatively standard methods used onboard vessels for conducting marine mammal abundance surveys and under IHA's. The PAM system onboard the vessel is capable of detecting the vocalizations of finless porpoises. A description of the monitoring methods can be found below (see Monitoring and Mitigation). In response to concerns about marine mammal species of particular concern, L–DEO will be avoiding the potential habitat of finless porpoises. L–DEO will shut-down the airgun array immediately if there is a sighting at any distance of finless porpoises in order to prevent exposure of animals to received levels greater than or equal to 160 dB and especially 180 dB. No incidental take of finless porpoises are anticipated or authorized in the IHA issued to L–DEO.

Comment 70: Dr. John Wang states that L–DEO should address the ineffectiveness of MMVOs with little experience with local marine mammal species and conditions (species identification can be problematic even for experienced researchers in this region due to the large number of species). MMVOs that are highly experienced with the fauna and conditions of the region need to be involved.

Response: The *Langseth* normally carries five qualified and experienced MMOs for every seismic study involving use of an airgun system comparable to the array used for this project. L–DEO will also employ a sixth MMO and regional expert for the duration of the survey. MMOs are appointed by L–DEO with NMFS concurrence.

Comment 71: Dr. John Wang states that L–DEO should address MMVO fatigue and lack of vigilance during search (on-duty search times of up to four hours is far too long; should be reduced to rotations of between 30 and 60 minutes at most).

Response: MMO's typically observe for one to three hours. Because there are usually two MMVO's on visual watch at a time, they alternate between visually observing with reticle binoculars (7x50

Fujinon), Big-eye binoculars (25x150), and the naked eye to avoid eye fatigue.

Comment 72: Dr. John Wang states that L–DEO should address the ineffectiveness of night vision equipment for small cetaceans, especially at distances beyond about 1 km but well within the waters ensonified by levels >180dB in shallow waters (potentially farther than 3.7km).

Response: Though it depends on the lights on the ship, the sea state, and thermal factors, MMVOs estimated that visual detection is effective out to between 150 and 250 m using NVDs and about 30 m with the naked eye. However, the PAM operates equally as effectively at night as during the day, especially for sperm whales and dolphins (dolphins and porpoises are the only species likely to be detected in the ''shallow'' depths, where the safety zones are the largest).

Marine geophysical surveys may continue into night and low-light hours is such segment(s) of the survey is initiated when the entire relevant safety zones are visible and can be effectively monitored. No initiation of airgun array operations is permitted from a shut-down position at night or during low-light hours (such as in dense fog or heavy rain) when the entire relevant safety zone cannot be effectively monitored by the MMVOs on duty. NMFS has included a requirement to this effect in the IHA issued to L–DEO.

Comment 73: Dr. John Wang states that L–DEO should address the ineffectiveness of MMVOs at detecting beaked whales, especially when they are very quiet near the surface (detection is known to be very low even for experienced observers in good conditions).

Response: NMFS agrees that beaked whales are difficult to detect at the surface. Three MMOs are typically on watch at a time, two on the observation tower conducting visual observations and the third monitoring the PAM equipment. The MMVOs will alternate between surveying with reticle binoculars (7x50 Fujinon), Big-eye binoculars (25x150), and the naked eye to avoid eye fatigue. The PAM system is capable of detecting beaked whale clicks as well.

Statements have been made in the past that little information is available on beaked whales because they avoid survey vessels. One can presume therefore, that MMOs onboard a vessel conducting seismic operations are unlikely to see beaked whales not only because they are cryptic, but also because beaked whales are likely to avoid an approaching sound source and leave the area.

When operating the sound source(s), L–DEO will minimize approaches to slopes, submarine canyons, seamounts, and other underwater geologic features, if possible, because of sensitivity of beaked whales and possible beaked whale habitat. If concentrations or groups of beaked whales are observed (by visual or passive acoustic detection) at a site such as on the continental slope, submarine canyon, seamount, or other underwater geologic feature just prior to or during the airgun operations, those operations will be powered/shut-down and/or moved to another location along the site, if possible, based on recommendations by the on-duty MMO aboard the *Langseth.* NMFS has included requirements to this effect in the IHA issued to L–DEO.

Comment 74: Dr. John Wang states that L–DEO should address the ineffectiveness of MMVOs at detecting, tracking and following animals entering and exiting the area being ensonified by sounds greater than the thresholds stated (in shallow waters >180dB can be farther than 3.7km).

Response: There are significant limitations to PAM as PAM technology is presently immature, yet constantly improving. PAM is a useful enhancement tool to visual observer efforts and every effort is made to use it when practicable. NMFS believes that visual observers and PAM are effective tools for monitoring marine mammals in the affected area during the seismic survey. PAM is required for monitoring on the *Langseth* (when practicable), but not for the implementation of mitigation measures. PAM is used by MMOs and the lead bioacoustician aboard the *Langseth* for the detection of vocalizing marine mammals. Any confirmed marine mammal vocalization detections using PAM are communicated to the MMVOs on watch on the observation tower to help alert the MMVOs to the presence of vocalizing marine mammals in the survey area (not necessarily the safety radii). The use of PAM is therefore used in aid of visual observers, who monitor the applicable safety radii for presence of marine mammals. The detection of marine mammals in the vicinity of the array in turn triggers mitigation requirements specified in the IHA issued to L–DEO.

After the issuance of the proposed IHA, L–DEO modified the cruise plan and adopted more precautionary monitoring and mitigation measures. NMFS believes that L–DEO's revised survey as well as the implementation of the monitoring and mitigation measures described in the IHA will have a negligible impact on the affected species or stocks of marine mammals in the study area.

Comment 75: Dr. John Wang states that it is unclear how it can be visually observed that an animal has left the EZ if the EZ is more distant than 1 km and during poor sighting conditions. Not detecting an animal within the EZ boundary may be determined erroneously as the animal having left the area rather than observers failing to see the animal. Such situations are likely to occur very frequently when sightings conditions are not ideal and the EZ's distance from source extends beyond 1km. Obviously, this can have serious consequences.

Response: After the issuance of the proposed IHA, L–DEO modified the cruise plan and adopted more precautionary monitoring and mitigation measures. L–DEO will alter speed or course during seismic operations if a marine mammal, based on its position and relative motion, appears likely to enter the relevant safety zone. If speed or course alteration is not safe or practicably, or if after alteration the marine mammal still appears likely to enter the safety zone, further mitigation measures, such as a power-down or shut-down, will be taken. Following a power-down, if the marine mammal approaches the smaller designated safety radius, the airguns must then be completely shut-down. Airgun activity will not resume until the MMVO has visually observed the marine mammal(s) exiting the safety radius and is not likely to return, or has not been seen within the radius for 15 min (species with shorter dive durations—smaller odontocetes) or 30 min (species with longer dive durations—mysticetes and large odontocetes, including sperm, pygmy sperm, dwarf sperm, killer, and beaked whales). Following a power-down or shut-down and subsequent animal departure, airgun operations may resume following ramp-up procedures described in the IHA. NMFS has included requirements to these effects in the IHA issued to L–DEO. NMFS believes that L–DEO's revised survey as well as the implementation of the required monitoring and mitigation measures described in the IHA will have a negligible impact on the affected species or stocks of marine mammals in the study area.

Comment 76: Dr. John Wang states that secondary support vessels should be used to search for cetaceans with MMVOs to cover a sufficient amount of water to reduce the number of marine mammals being exposed to >160 dB.

Response: Prior to issuing this IHA, NMFS thoroughly investigated all

measures that might reduce the incidental taking of marine mammals to the lowest level practicable. Monitoring and mitigation measures are discussed later in this document. Mitigation measures, such as aerial overflights or support vessels to look for marine mammals prior to an animal entering a safety zone, may be given consideration if the safety zone cannot be adequately monitored from the source vessel. Consideration also must be given to aircraft/vessel availability, access to nearby airfields, distance from an airfield to the survey area, and the aircraft's flight duration. These are serious safety issues regarding aircraft flights over water that must be considered prior to requiring aerial overflights. Additional consideration must be give to the potential for aircraft to also result in Level B harassment since a plane or helicopter would need to fly at low altitudes to be effective.

Even if aircraft or a second vessel are not necessary or feasible to monitor a safety zone, they might be appropriate to monitor shorelines (presumably for strandings related to the activity). For this survey, the most appropriate monitoring is for the MMOs onboard the *Langseth* to observe visually and using the PAM system.

Comment 77: CSI states that based on the table of predicted rms distances for different received levels, MMVOs may be completely ineffective for detecting small cetaceans in shallow coastal waters because the distance from source will be great even for 190 dB received level (1,600 to 2,182 m); for 180 dB, the distances can be 2,761 to 3,694 m from source and for 160 dB, the distances are 6,227 to 8,000 m. Again, these distances must be considered underestimates because the coastal waters of western Taiwan in which some cetaceans inhabit are much shallower than 100 m (e.g., the critically endangered ETS sub-population of Indo-Pacific humpback dolphin are in waters from 1.5 to 15 m deep; finless porpoises and Indo-Pacific bottlenose dolphins are often commonly observed in waters shallower than about 50 m). Finless porpoises are difficult to detect even if they are within several hundred meters and sighting is during excellent conditions and by experienced observers (note: excellent weather conditions for sighting cetaceans in the waters around most of Taiwan, especially western Taiwan, are very limited). Nighttime visual detection of these coastal species is impossible at the distances shown above even with night-vision equipment. MMVOs have limited effectiveness in detecting many deep-diving species such as beaked whales and *Kogia* sp. These are all difficult species to observe and study by experienced researchers. Barlow (1999) reported that very few beaked whales are detected even in prime sighting conditions by cetacean researchers, Barlow and Gisiner (2006) estimated that less than 2% of the beaked whales are likely to be observed by typical mitigation monitoring (this estimation did not account for observer experience, which will greatly affect detection). With such a low detection rate, other mitigation measures dependent upon detection and tracking will be compromised. None of the mitigation measures takes into account sighting conditions. This is important as several of the mitigation measures are dependent upon observers sighting marine mammals.

Response: NMFS agrees that some deep-diving species (such as beaked whales and *Kogia* sp.), which may be found in the study area, are cryptic at the surface and difficult to observe. The *Langseth* carried five qualified and experienced MMOs for every seismic study involving use of an airgun system comparable to that used for this project. MMOs are appointed by L–DEO with NMFS concurrence. L–DEO is also employing a regional expert as a sixth MMO.

After the issuance of the proposed IHA, L–DEO modified the cruise plan and adopted more precautionary monitoring and mitigation measures. NMFS believes that the L–DEO's revised survey as well as the implementation of the required monitoring and mitigation measures described in the IHA will have a negligible impact on the affected species or stocks of marine mammals in the study area. See Species of Particular Concern and L–DEO's Supplemental EA.

Comment 78: CSI states that L–DEO claims that ''marine mammal detection by MMVOs is high at short distances from the source.'' With the possible exception of 180 dB at 950 m for deep water, the distances mentioned above (especially for operations in shallow waters) are not short for sighting cetaceans (small or large). Detection of most species drops off beyond 1 km from a ship. Even 25x150 (Big-eye) binoculars may have limited use in a region with high humidity and smog in coastal regions (e.g., western Taiwan), which can reduce the clarity of high power optical aids. The detection of finless porpoises at distances beyond 1 km is poor. At 3,694 m, detection for small cetaceans is limited and maybe questionable (especially for finless porpoises) when sighting conditions are sub-optimal. In no way can the detection of small cetaceans in shallow water at distances of several kilometers be considered high. For beaked whales, only a small proportion of the animals are detected by experienced observers in good sighting conditions (Barlow, 1999). As such, beaked whale detection cannot be considered to be high either. Because detection of both shallow water small cetaceans and beaked whales were wrongly concluded to be high, take by injury or death cannot be dismissed and the potential for temporary or permanent hearing impairment is not low and (as discussed above) cannot be avoided by implementing the inadequate mitigation measures proposed.

Response: The *Langseth* travels at a much slower operation speed (four to five kts) than vessels conducting cetacean surveys (typically 10 kts). Statements have been made in the past that little information is available on beaked whales because they avoid survey vessels. One can presume therefore, that MMVO's onboard a vessel conducting seismic operations are unlikely to see beaked whales not only because they are cryptic, but also because the animals would see or hear the slowly approaching vessel and leave the area. NMFS presumes that beaked whales will similarly avoid sources of anthropogenic noise, provided they are afforded sufficient notice of the activity through a gradual increase in noise levels rather than receiving a sudden, loud sound that might inflict a panic reaction or perhaps serious injury.

After the issuance of the proposed IHA, L–DEO modified the cruise plan and adopted more precautionary monitoring and mitigation measures. NMFS believes that the L–DEO's revised survey as well as the implementation of the required monitoring and mitigation measures described in the IHA will have a negligible impact on the affected species or stocks of marine mammals in the study area. *See* Species of Particular Concern and L–DEO's Supplemental EA.

Comment 79: Seismic surveys should not be conducted in poor cetacean sighting conditions (low light, SS>4, rain, heavy fog or haze) until a proven (acceptable to most marine mammal scientists) method for detecting cetaceans is developed for such conditions. Low light and night time seismic surveys should not be permitted at this time.

Dr. John Wang states that detection of marine mammals as part of a mitigation measure has to be at least as effective, but preferably better, at detecting cetaceans as cetacean survey projects because the consequences are more serious if cetaceans are not detected.

Response: MMO's effectively conduct systematic surveys for detecting cetaceans during the seismic cruise onboard the *Langseth.* In addition to visual observations using reticle binoculars, big-eye binoculars, night vision devices, and the naked eye, PAM is used day and night (as practical), which can detect vocalizing marine mammals present in the area. Many dedicated cetacean survey projects use the same or similar equipment as the MMO's onboard the *Langseth.* The *Langseth's* crew will also assist in detecting marine mammal, when practicable.

During ramp-ups of the airgun array, if for any reason the entire radius cannot be seen for the entire 30 min (i.e., rough seas, fog, darkness), or if marine mammals are near, approaching, or in the safety radius, the airguns may not be started up. Marine seismic surveys may continue into night and low-light hours if such segment(s) of the survey is initiated when the entire relevant safety zones are visible and can be effectively monitored. No initiation of airgun array operations is permitted from a shut-down position at night or during low-light hours (such as dense fog or heavy rain) when the entire relevant safety zone cannot be effectively monitored by the MMVOs on duty.

After the issuance of the proposed IHA, L–DEO modified the cruise plan and adopted more precautionary monitoring and mitigation measures. NMFS believes that the L–DEO's revised survey as well as the implementation of the required monitoring and mitigation measures described in the IHA will have a negligible impact on the affected species or stocks of marine mammals in the study area.

Comment 80: The Commission recommends that, before issuing the requested authorization, the NMFS extend the monitoring period to at least one hour before initiation of seismic activities and at least one hour before the resumption of airgun activities after a power-down because of a marine mammal sighting within the safety zone.

Response: As the Commission points out, several species of deep-diving cetaceans are capable of remaining underwater for more than 30 minutes, however, for the following reasons NMFS believes that 30 minutes is an adequate length for the monitoring period prior to the start-up of airguns: (1) Because the *Langseth* is required to ramp-up the time of monitoring prior to start-up of any but the smallest array is effectively longer than 30 minutes (ramp-up will begin with the smallest gun in the array and airguns will be added in sequence such that the source level of the array will increase in steps not exceeding approximately 6 dB per 5 min period over a total duration of 20–30 min), (2) in many cases MMOs are making observations during times when seismic is not being operated and will actually be observing prior to the 30 min observation period anyway, (3) the majority of the species that may be exposed do not stay underwater more than 30 minutes, and (4) all else being equal and if deep diving individuals happened to be in the area in the short time immediately prior to the pre-start-up monitoring, if an animal's maximum underwater time is 45 min, there is only a one in three chance that the last random surfacing would be prior to the beginning of the required 30 min monitoring period.

Also, seismic vessels are moving continuously (because of the long, towed array) and NMFS believes that unless the animal submerges and follows at the speed of the vessel (highly unlikely, especially when considering that a significant part of their movements is vertical [deep-diving]), the vessel will be far beyond the length of the safety radii within 30 min, and therefore it will be safe to start the airguns again.

Mitigation

Comment 81: Dr. John Wang states that the effectiveness of the mitigation measures proposed by L–DEO for reducing threats range between having questionable effectiveness and being entirely inadequate.

Response: After issuance of the proposed IHA, L–DEO modified the cruise plan and adopted more precautionary monitoring and mitigation measures. NMFS believes that L–DEO's revised survey as well as the implementation of the required monitoring and mitigation measures described in the IHA will have a negligible impact on the affected species or stocks of marine mammals in the study area.

Comment 82: NRDC is concerned that L–DEO's EA and NMFS' proposed IHA do not meet the rigorous standards of environmental review required by the NEPA and the MMPA. For example, L–DEO's EA does not properly analyze impacts or adopt adequate mitigation measures. Although the EA notes the lack of scientific information regarding species distribution and acoustic impacts of seismic activities, it nonetheless and without basis concludes that the proposed surveys will have only ''minor'' effects on marine mammal species. NMFS' proposed IHA also notes the lack of density data yet nevertheless concludes, again without basis, that the proposed seismic surveys will have only negligible impacts on marine mammals. And, like L–DEO, NMFS does not propose meaningful mitigation measures.

Response: After issuance of the proposed IHA, L–DEO modified the cruise plan and adopted more precautionary monitoring and mitigation measures. NMFS believes that L–DEO's revised survey as well as the implementation of the required monitoring and mitigation measures described in the IHA will have a negligible impact on the affected species or stocks of marine mammals in the study area. NMFS and NSF have satisfied all requirements of NEPA and the MMPA.

Comment 83: WaH states that while it may be true that some of the planned monitoring and mitigation measures ''would reduce the possibility of injurious effects,'' the proposed monitoring and mitigation measures are inadequate and cannot be argued to prevent the possibility of injurious effects to cetaceans, which are highly likely to occur. The claim in the EA that ''no long-term or significant effects are expected on individual marine mammals * * * the populations to which they belong, or their habitats'' is ill-founded and should be reconsidered in light of the above concerns.

Response: After issuance of the proposed IHA, L–DEO modified the cruise plan and adopted more precautionary monitoring and mitigation measures. NMFS believes that L–DEO's revised survey as well as the implementation of the required monitoring and mitigation measures described in the IHA issued to L–DEO will have a negligible impact on the affected species or stocks of marine mammals in the study area. *See* L–DEO's Supplemental EA.

Comment 84: WaH states that there is a lack of understanding of the distribution and status of the species and populations mentioned in their comments highlights the need for greater precaution and investigation prior to carrying out seismic surveys in this region. However several proposed monitoring and mitigation measures do not reflect the need for precaution, for example: (1) The proposed number of MMOs is insufficient (a minimum of only one observer working during daytime operations, except for 30 minutes before and after ramp-up when this will be increased to two observers); (2) nighttime seismic survey could be (but are not) prohibited, meaning impaired effectiveness of MMVOs and greater reliance on PAM, which

provides no certainty of detection of animals that are not vocalizing.

Response: After issuance of the proposed IHA, L–DEO modified the cruise plan and adopted more precautionary monitoring and mitigation measures. The *Langseth* carries five qualified and experience MMOs for every seismic study involving the use of an airgun system comparable to that planned for this project. L–DEO is employing a regional expert as a sixth MMO. Three MMOs are typically on watch at a time, two on the observation tower conducting visual watch and the third MMO monitoring the PAM equipment. On the tower, two MMVOs are on watch during all daylight hours except during meal times. The scientists conducting the survey have considered the recommendation for no nighttime seismic operations, and have decided that it is not feasible, as limiting the surveys to daytime only would either result in the loss of half of the data or would necessitate doubling the duration of the project. Doubling the duration of the surveys is not possible because the *Langseth* has other research commitments after this cruise, and because of weather conditions associated with the typhoon season. However, the seismic source will not be started if the observers cannot view the entire safety radius for any reason (darkness, for, or rough seas). In addition, PAM is being used day and night as practical, which can detect vocalizing marine mammals present in the study area. NMFS believes that L–DEO's revised survey as well as the implementation of the required monitoring and mitigation measures described in the IHA will have a negligible impact on the affected species or stocks of marine mammals in the study area.

Comment 85: Minor and Wilson are greatly saddened to see the high proportion of cetaceans that are endangered in the proposed study area. Some of the species have population levels that are so low that the loss of a single individual could significantly increase the chances of extinction. Minor and Wilson do not feel that chasing these animals around with a boat that produces seismic ''bangs'' that are still 170 dB at a distance of 7,808 m from the boat will be anything other than harmful to these endangered animals.

Response: After the issuance of the proposed IHA, L–DEO modified the cruise plan and adopted more precautionary monitoring and mitigation measures. NMFS believes that L–DEO's revised survey as well as the implementation of the monitoring and mitigation measures described in the IHA will have a negligible impact on affected species or stocks of marine mammals in the study area.

The principal investigator's intended work in the Taiwan Strait is designed so that seismic energy from the *Langseth* can be recorded by OBSs in the Taiwan Strait and by land instruments. By using both seismic reflections from various rock layers and refracted seismic energy they can determine the thickness of the crust and get an idea of the type of rocks in the crust. If they record data on a long profile they can compare the crustal structure, and, in the case of Taiwan, identify what the structure is before and after deformation caused by the collision with the Luzon volcanic arc. In Taiwan, the affects of collision increase from south to north and also from west to east.

Comment 86: Dr. Linda Weilgart states that the treatment of possible impact is very superficial, and does not take into account that ecological and population-level consequences may result. Especially where many depleted species in the area are faced with a myriad of threats and stressors already, the addition of noise may prove to be the final straw. In nature, cumulative stressors often interact synergistically, particularly if there are several stressors. Noise impacts should not be reduced to merely hearing impairment, though that is certainly possible and serious. Even TTS can compromise an animal's survival, in that its feeding, predator avoidance, and social behavior are impacted. Other behavioral responses such as permanent avoidance of an area that is associated with a frightening, loud noise are also possible.

Response: After the issuance of the proposed IHA, L–DEO modified the cruise plan and adopted more precautionary monitoring and mitigation measures in the study area. NMFS believes that L–DEO's revised survey as well as the implementation of the required monitoring and mitigation measures described in the IHA will have a negligible impact on the affected species or stocks of marine mammals in the study area.

Comment 87: HSI states that the **Federal Register** notice for the proposed IHA and IHA application have failed to consider some key papers in the recent acoustics literature, at least one of which is a significant and telling omission. Madsen *et al.* (2006) is not cited by L–DEO in its application and although it is cited in the EA, the discussion there about its implications for marine mammals with high frequency hearing and the propagation of seismic airgun sounds is shallow. This is unacceptable. Clearly seismic airguns have the capacity to propagate well beyond the exclusion zones proposed by L–DEO and to affect marine mammals with higher frequency hearing, yet the mitigation measures discussed do not address this at all.

Response: A number of comments pointed out shortcomings in the EA and proposed IHA that do not alter the overall conclusions (e.g., particular publications that were not cited); NSF and NMFS are grateful for those comments and have taken note of them for future reference.

After the issuance of the proposed IHA, L–DEO modified the cruise plan and adopted more precautionary monitoring and mitigation measures. NMFS believes L–DEO's revised survey as well as the implementation of the required monitoring and mitigation measures described in the IHA will have a negligible impact on the affected species or stocks of marine mammals in the study area.

Comment 88: CSI states that the current EA is deficient, but its critique will provide stakeholders with resources to define what truly adequate mitigations are possible, while meeting the project's goals. Not only that, but by example, the world's increasingly active, but unregulated seismic industry will benefit from learning what mitigations are most effective.

Response: NMFS disagrees with CSI's comment. NMFS reviewed the EA and determined that it contains an adequate description of the proposed action and reasonable alternatives, the affected environment, the effects of the action, and appropriate monitoring and mitigation measures.

After issuance of the proposed IHA, L–DEO modified the cruise plan and adopted more precautionary monitoring and mitigation measures. NMFS believes that L–DEO's revised survey as well as the implementation of the required monitoring and mitigation measures described in the IHA will have a negligible impact on the affected species or stocks of marine mammals in the study area.

Comment 89: CSI states that previous L–DEO authorizations have proceeded on the assumption that there was no proof of significant impact, without supporting adequate, directed research to validate that claim. The attached expert reviews declare several significant research questions that need to be answered to judge the potential impacts from this proposal. Will L–DEO, the NSF, and other supporters work with the experts to enable adequately mitigated seismic research?

Response: After issuance of the proposed IHA, L–DEO modified the cruise plan and adopted more precautionary monitoring and mitigation measures. NMFS believes that L–DEO's revised survey as well as the implementation of the required monitoring and mitigation measures described in the IHA will have a negligible impact on the affected species or stocks of marine mammals in the study area. NMFS prepared a Finding of No Significant Impact and determined that the issuance of an IHA for the take, by harassment, of small numbers of marine mammals incidental to L–DEO's March to July, 2009, seismic survey in SE Asia will not significantly impact the quality of the human environment, as described in the EA.

Comment 90: Dr. McIntosh and Dr. Wu state that a mitigation plan has been developed that will insure the safety of marine mammals that may be present in the survey areas. With this mitigation plan and lack of documented historical impacts, they deem that injury to marine mammals is exceedingly unlikely and disturbance, if any, would be minimal, local, and short-term. In contrast, the impact of this research on our understanding of fundamental Earth processes is likely to be significant.

Response: NMFS acknowledges the principal investigators' comments and expects L–DEO to comply with all the requirements stipulated in the IHA. After issuance of the proposed IHA, L–DEO negotiated with the project's principal scientists (Dr. McIntosh and Dr. Wu) and modified the cruise plan and adopted more precautionary monitoring and mitigation measures. NMFS believes that L–DEO's revised survey as well as the implementation of the required monitoring and mitigation measures described in the IHA will have a negligible impact on the affected species or stocks of marine mammals in the study area.

Comment 91: Dr. McIntosh and Dr. Wu state the *Langseth* is operated in strict compliance with requirements mandated by NMFS. The underlying guidelines are based on requirements of the ESA and the MMPA. The *Langseth* will have on board five marine mammal observers for visual and acoustic monitoring during all seismic operations. These operations will be ramped-down or shut down if marine mammals or sea turtles enter into the NMFS-approved safety zone. This mitigation plan is similar to those used during previous *Langseth* projects and previous seismic projects on the *Ewing,* the *Langseth's* predecessor. Based on past post-cruise reports, this plan has successfully avoided takes of marine mammals during numerous seismic projects.

Response: NMFS acknowledges the principal investigators' comments and expects L–DEO to comply with all the requirements stipulated in the IHA.

Comment 92: Dr. McIntosh and Dr. Wu state, as noted above, their seismic operations will be in strict compliance with the mitigation practices developed by the NMFS, and we will avoid the sensitive near-coastal habitat. This type of seismic project has been undertaken many times in the past, with marine biological observers present, and has not resulted in any observed impacts. Unlike many sources of marine noise, which emit continuous sound, seismic work involves a short pulse of acoustic energy followed by a significant period of quiet.

Response: NMFS acknowledges the information and comments provided by the principal investigators of L–DEO's TAIGER seismic survey. NMFS fully expects L–DEO to comply with all the requirements stipulated in the IHA.

Comment 93: Dr. McIntosh and Dr. Wu state that the seismic program will pass through any one area at a speed of about 8 km/hr, so any impact will be very limited in time, generally much less than one hour. Furthermore, the planned transects are very widely spaced, so most parts of the Taiwan Strait will be completely unaffected by the project.

Response: NMFS acknowledges the information and comments provided by the principal investigators of L–DEO's TAIGER survey. This information was used by NMFS in making its necessary negligible impact determinations.

Comment 94: ETSSTAWG states that the proposed mitigation practices are inadequate to prevent injury to cetaceans.

Response: NMFS disagrees with ETSSTAWG's comment. After issuance of the proposed IHA, L–DEO modified its cruise plan and adopted more precautionary monitoring and mitigation measures. The combination of all the mitigation and monitoring measures, along with the avoidance responses of many marine mammals, ensure that takings, incidental to this activity, will result in no more than a negligible impact on affected species and stocks of marine mammals and will result in the least practicable impact on these affected species or stocks in the study area. *See* L–DEO's Supplemental EA.

Comment 95: ETSSTAWG recommends that two cetacean observers, not just one, should be on watch at the same time. The duration of watch times should be reduced from 4 to 2 hours to prevent compromised efficiency as a result of fatigue. Also, observers should be familiar with the cetaceans expected in the area, the nature of the local environment (*i.e.*, a locally trained person), operation of the PAM system, and the observation methods required.

Response: The *Langseth* carries five qualified and experienced MMOs for every seismic study involving use of an airgun system comparable to that planned for this project. MMOs are appointed by L–DEO with NMFS concurrence. L–DEO has employed a regional expert as one of the MMOs for the duration of the survey. Three MMOs are typically on watch at a time, two on the observation tower conducting visual observations and the third monitoring the PAM equipment. On the tower, two observers are on watch during all daylight hours except during meal times. MMOs typically observe for one to three hours. Because there are usually two MMOs on the visual watch at a time, they alternate between observing with reticle binoculars (7x50 Fujinon), big-eye binoculars (25x150), and the naked eye to avoid eye fatigue.

Comment 96: Dr. Robert Brownell and Dr. Lien-Siang Chou from National Taiwan University's Institute of Ecology and Evolutionary Biology state that the permit application is only requesting permission for the incidental harassment of marine mammals (Level B) while conducting the proposed marine geophysical survey in SE Asia. The survey area includes the west coast of Taiwan, which is a hot spot for small cetacean mass stranding events (MSEs) or near mass stranding events (NMSEs). Since 1990, at least 16 MSEs or NMSEs involving six species of small cetaceans (pygmy killer whales, rough toothed dolphins, striped dolphins, pantropical spotted dolphins, melon-headed whales, and ginkgo-toothed beaked whales) have occurred during all months of the year except May, August, October, and December. Taiwan has the highest number of pygmy killer whales MSE compared to any other location in the world (Brownell *et al.,* 2009). It is possible that at least some of these MSEs may be related to anthropogenic noise. While ''NMFS has preliminarily determined that the impact of conducting the seismic survey in SE Asia may result, at worst, in temporary modification in behavior (Level B harassment) of small numbers of marine mammals,'' there is no conclusive evidence that the proposed seismic survey will not cause some small cetaceans to strand. Therefore, some mitigation and monitoring plans need to be developed in case any strandings or

NMSEs occur. In addition to the above noted MSEs for Taiwan, one unusual cetacean mortality event occurred in Taiwan between July 19 and August 13, 2005 that involved 23 small cetaceans of seven species. Most of the strandings (74 percent) were beaked and dwarf sperm whales (Yang *et al.,* 2008).

Response: After the issuance of the proposed IHA, L–DEO modified the cruise plan and adopted more precautionary monitoring and mitigation measures. No injury (Level A harassment), serious injury, or mortality is anticipated or authorized. NMFS believes that the implementation of the monitoring and mitigation measures described in the IHA will have a negligible impact on the affected species and stocks of marine mammals in the study area.

Comment 97: Minor and Wilson state that the EA and IHA documents also fail to deal with the reality of the strandings that have been associated with previous airgun operations (including one stranding associated with a previous survey conducted by the proponent, L–DEO). Minor and Wilson think that these strandings clearly constitute something greater than ''Level B harassment.''

Response: After issuance of the proposed IHA, L–DEO modified the cruise plan and adopted more precautionary monitoring and mitigation measures. NMFS believes that the implementation of the monitoring and mitigation measures described in the IHA will have a negligible impact on the affected species or stocks of marine mammals in the study area. No injury (Level A harassment), serious injury, and mortality is anticipated or authorized. See NMFS' responses to relevant discussions in this document.

Comment 98: The Commission recommends that, before issuing the requested authorization, the NMFS require that observations be made during all ramp-up procedures to gather the data needed to analyze and provide a report on their effectiveness as a mitigation measure. CSI states that there are uncertainties about the effectiveness of ramp-up procedures and no data was presented to show that this was indeed useful in reducing impacts.

Response: The IHA requires that MMOs on the *Langseth* make observations for 30 minutes prior to ramp-up, during all ramp-ups, and during all daytime seismic operations and record the following information when a marine mammal is sighted:

(i) Species, group size, age/size/sex categories (if determinable), behavior when first sighted and after initial sighting, heading (if consistent), bearing and distance from seismic vessel, sighting cue, apparent reaction to the airguns or vessel (*e.g.*, none, avoidance, approach, paralleling, *etc.*, and including responses to ramp-up), and behavioral pace; and

(ii) Time, location, heading, speed, activity of the vessel (including number of airguns operating and whether in state of ramp-up or power-down), sea state, visibility, cloud cover, and sun glare.

NMFS has asked NSF and L–DEO to gather all data that could potentially provide information regarding effectiveness of ramp-ups as a mitigation measure. However, considering the low numbers of marine mammal sightings and low numbers of ramp-ups, it is unlikely that the information will result in any statistically robust conclusions for this particular seismic survey. Over the long term, these requirements may provide information regarding the effectiveness of ramp-up as a mitigation measure, provided animals are detected during ramp-up.

Comment 99: Dr. John Wang states that L–DEO did not provide any supporting evidence that ramp-up procedures are effective in reducing impacts on cetaceans. Given that it appears to be an important proposed mitigation measure, effectiveness of such a procedure should be convincing.

Response: As discussed in detail elsewhere in this document, NMFS believes that ramp-up of the seismic airgun array in combination with the slow vessel speed, use of trained and qualified MMOs, PAM, shut-down and power-down procedures, and the behavioral response of marine mammals to avoid areas of high anthropogenic noise all provide protection to marine mammals from injury (Level A harassment), serious injury, or mortality. NMFS believes that L–DEO's revised survey as well as the implementation of the required monitoring and mitigation measures described in the IHA will have a negligible impact on the affected species or stocks in the study area.

Comment 100: CSI states that a shut-down of 30 minutes was proposed. This is clearly not sufficient as several species of concern can stay submerged for more than an hour and remain undetected.

Response: NMFS disagrees with CSI's comment. A shut-down of 30 minutes is a sufficient amount of time. For species with longer dive durations (e.g., mysticetes and large odontocetes, including sperm, pygmy sperm, dwarf sperm, killer, and beaked whales), a significant portion of their travel is spent diving vertically, while the *Langseth* will be traveling horizontally at an operational speed of 7.4 to 9.3 km/hour during seismic acquisition. The *Langseth* is also equipped with a PAM system to detect vocalizing marine mammals.

Comment 101: Dr. John Wang states that the resumption of airgun operations after not observing a small odontocete and ''large'' (following FR) odontocetes (i.e., sperm, dwarf and pygmy sperm whales and beaked whales) for 15 and 30 minutes is baseless. These periods are far too short for species that can stay submerged for greater than 60 minutes. For many species in the region, submergence maximum time is not known. To be precautionary, this shut-down and search time needs to be at least 60 minutes for small cetaceans with no information on submergence time and at least 90 minutes for the ''large'' odontocetes (listed above) to ensure animals have at least one chance of surfacing before power-up.

Response: Several species of deep-diving cetaceans are capable of remaining underwater for more than 30 minutes. However, NMFS believes that 30 minutes is an adequate length for the monitoring period prior to the start-up of airguns (1) because of ramp-up operations, (2) MMOs are usually visually observing and using the PAM system during non-seismic operations, (3) the majority of the marine mammal species in the study area that may be exposed do not stay underwater for more than 30 minutes, and (4) if deep diving animals happened to be in the operation area in the short time immediately prior to the pre-start-up monitoring, if an animal's maximum underwater time is 45 min, there is only a one in three chance that the last random surfacing would be prior to the beginning of the required 30 min monitoring period.

Seismic vessels are moving continuously (because of the long towed array) and NMFS believes that unless the animals submerge and follow at the speed of the vessel (highly unlikely, especially when considering that a significant part of their movements is vertical), the vessel will be far beyond the length of the safety radii within 30 min, and therefore it will be safe to start the airguns again.

The time periods determined for the resumption of airgun operations is based on the dive duration of certain marine mammal species, not necessarily the animal's physical size. Small odontocete and pinniped species are likely to have shorter dive durations than mysticetes and large odontocetes

(including sperm, pygmy sperm, dwarf sperm, killer, and beaked whales), which may have longer dive durations. See NMFS' responses in Monitoring.

Comment 102: Dr. John Wang states that the effectiveness of any shut-downs would depend on: the ability to detect cetaceans, communication of the detection, amount of time for a decision to shut down, and how quickly a shut-down can be executed. No time frame as to how long such a procedure would take after a cetacean is detected was given. Clearly, timing is important for determining the effectiveness of this mitigation measure.

Response: The timing of the implementation of a shut-down or other mitigation measure is dependent on the judgment, recommendation, and communication of the on-duty MMOs aboard the *Langseth* to the airgun personnel. If a marine mammal is detected near, approaching, or in the safety radius, then the on-duty MMO communicates the appropriate mitigation measure via radio and/or phone to the science lab and airgun technicians for immediate action. MMVO's alternate between observing with reticle binoculars, big-eye binoculars, and the naked eye for visual detection and to avoid eye fatigue. PAM is used day and night as practical, which can detect vocalizing marine mammals present in the study area.

Comment 103: Dr. John Wang states that seismic surveys should not be conducted within at least 10 km from areas where a steep shelf wall exists (e.g., east coast of Taiwan) until the effects of reflection and constructive interference on sound levels are better understood.

Response: After issuance of the proposed IHA, L–DEO modified the cruise plan and adopted more precautionary monitoring and mitigation measures. The seismic survey line paralleling the east coast of Taiwan will be moved offshore at least 20 km to decrease potential impacts on species that occur in coastal waters and over the continental slope. NMFS believes that L–DEO's revised survey as well as the implementation of the required monitoring and mitigation measures described in the IHA will have a negligible impact on the affected species or stocks of marine mammals in the study area. *See* L–DEO's Supplemental EA.

Comment 104: HSUS/HSI is concerned about other aspects of the proposed mitigation measures, including the use of only one MMVO (two will be used only ''when practical''— p. 78314); visual detection as the primary mitigation measure, when several vulnerable species are extremely difficult to see even under the best of circumstances (e.g., beaked whales); the use of any mitigation measure(s) at night (there has yet to be designed any suite of nighttime mitigation measures that is even remotely as effective as daytime mitigation measures when it comes to detecting and avoiding marine mammals); the heavy reliance on ramp-up of the airgun arrays (even though there is little if any independent field testing of the assumption that ramp-up causes animals to move away from a sound source); and the failure to consider alternate schedules to avoid the overlap of the surveys with the calving season for several cetacean species in the region.

Response: After issuance of the proposed IHA, L–DEO modified the cruise plan and adopted more precautionary monitoring and mitigation measures. NMFS believes that L–DEO's revised survey as well as the implementation of the required monitoring and mitigation measures described in the IHA will have a negligible impact on the affected species or stocks of marine mammals in the study area. *See* relevant discussions regarding nighttime, ramp-up, temporal and spatial avoidance, and species of particular concern in NMFS' responses to comments here in this document.

Comment 105: ETSSTAWG states that the EA states that ''the current procedures are based on best practices noted by Pierson *et al.* (1998) and Weir and Dolman (2007)''. However, this is clearly not the case since Weir and Dolman (2007) call for, among other things the avoidance of sensitive areas—e.g., the western Taiwan coastline; suspension of airgun use at night; and additional restrictions in adverse weather conditions. For example, the EA states that ''when at all possible, seismic surveying will only take place at least 8–10 km from the Taiwanese coast, particularly the central western coast (~from Taixi to Tongshiao), to minimize the potential of exposing these threatened dolphins to SPLs >160 dB''. The use of the term ''when at all possible'' is not reassuring.

Response: After issuance of the proposed IHA, L–DEO modified the cruise plan and adopted more precautionary monitoring and mitigation measures. NMFS believes that L–DEO's revised survey as well as the implementation of the required monitoring and mitigation measures described in the IHA will have a negligible impact on the affected species or stocks of marine mammals in the study area. See NMFS' responses to relevant discussions regarding temporal and spatial avoidance, species of particular concern, nighttime operations, and others in this document.

Comment 106: ETTSTAWG states that the predicted protection ranges (i.e., safety zones) should be confirmed in the field at each point in the survey that the bottom geography changes substantially. The results should be reported to NMFS immediately and safety zone sizes should be adjusted accordingly.

Response: NMFS believes that a sound source verification field test is not necessary for this project. L–DEO conducted an acoustic calibration study of the *Langseth's* airgun array in late 2007/early 2008 in the Gulf of Mexico (LGL Ltd., 2006). Distances where sound levels were received in deep, intermediate, and shallow waters will be determined for various airgun configurations. Acoustic analysis is ongoing and a scientific paper on the *Langseth* calibration study is currently in review for future publication (Tolstoy, pers. comm.). After analysis, the empirical data from the 2007/2008 study will be used in future NEPA documents and IHA applications. NMFS believes the distances predicted in Table 1 (above) are the best science available.

Comment 107: ETTSTAWG states that the mitigation procedures offered (especially the use of visual detection at night) are known to be insufficient and ineffective. To make the most of the limited effectiveness, and thus offer the greatest protection, I recommend that L–DEO's surveys in the Taiwan Strait (and throughout the operation) shut down at night.

Response: A number of public comments concerned the inability to detect marine mammals from the *Langseth* at night and recommended no nighttime operations. The scientists conducting the survey have considered this recommendation, and have decided that it is not feasible, as limiting the surveys to daytime only would either result in the loss of half of the data or would necessitate doubling the duration of the project. Doubling the duration of the surveys is not possible because the *Langseth* has other research commitments after the TAIGER cruise, and because of weather conditions associated with the typhoon season. It would also incur other potential environmental effects. However, the seismic source will not be started if the MMVOs cannot view the entire safety radius for any reason (darkness, fog, or rough seas). In addition, PAM will be used day and night as practical, which can detect vocalizing marine mammals present in the area.

If a seismic survey vessel is limited to daylight seismic operations, efficiency would be much reduced. For seismic operators in general, a daylight-only requirement would be expected to result in one or more of the following outcomes: cancellation of potentially valuable seismic surveys, reduction in the total number of seismic cruises annually due to longer cruise durations, a need for additional vessels to conduct the seismic operations, or work conducted by non-U.S. operators or non-U.S. vessels when in waters not subject to U.S. law.

MMVOs using NVDs will be on watch during periods prior to and during a ramp-up at night. At other times during the night MMOs will be available, but it is not necessary or very effective for them to be on watch constantly. The use of PAM will improve the detection of marine mammals by indicating to the MMVOs when an animal is potentially near and prompting a power-down or shut-down when necessary. Marine mammals are unlikely to be injured, seriously injured or killed by the noise from approaching seismic arrays nor is it authorized. Thus, limiting seismic shooting to only daylight hours is unnecessary and unlikely to result in less Level B harassment to marine mammals than would conducting 24 hour survey operations.

Because of the need to keep a vessel at-speed in order to successfully tow the hydrophone streamers, the vessel would need to be underway throughout the night whether or not the airguns are fired at night. Additional down-time could be anticipated each day as the vessel maneuvers all night to come back to the shut-down location 30 minutes after daylight. This is unlikely to be successful very often and will likely result in additional time needed for surveys to be completed.

L–DEO completed two tests of the effectiveness of using NVDs (Smultea and Holst, 2003; Holst, 2004). Results of those tests indicated that the NVDs are effective at least to 150 to 200 m (492 to 656 ft) away from certain conditions. That type of NVD is not effective at the much larger 180 dB radii applicable when a large array of airguns is in use. However, it is the smaller zone where the received levels are well above 180 dB where detection of any marine mammals that are present would be of particular importance. The 205 dB zone, within which TTS might occur, is likely to approximately 100 m (328 ft) in radius. That is sufficiently within the range of the NVDs to allow some chance of detecting marine mammals visually within the area of potential TTS during ramp-up. Furthermore, a substantial proportion of the marine mammals that might be within that distance is expected to move away either during ramp-up or, if the airguns were already operating, as the vessel approaches.

Taking into consideration the additional costs of prohibiting nighttime operations and the likely low impact of the activity (given the required monitoring and mitigation measures), NMFS has determined that the IHA's requirements will ensure that the activity will have the least practicable impact on the affected species or stocks for the following reasons. Marine mammals will have sufficient notice of a vessel approaching with operating seismic airguns, thereby giving them an opportunity to avoid the approaching array.

Comment 108: ETSSTAWG recommends that L–DEO must better incorporate changes in bottom topography during the survey into the designation of 'safety zones', and adapt the cruise accordingly.

Response: NMFS is unsure of what ETSSTAWG is stating in its recommendation. After issuance of the proposed IHA, L–DEO has modified its cruise plan and adopted more precautionary monitoring and mitigation measures. L–DEO has re-routed survey tracklines and will implement temporal and spatial restrictions to avoid certain areas that they may be considered significant or core habitat for certain species of particular concern (*see* L–DEO's Supplemental EA). Also, the predicted safety radii for the various sound isopleths from the *Langseth's* airgun array are related to water depth (*see* Table 1 above). Water depths have been categorized as deep (greater than 1,000 m), intermediate (100 to 1,000 m), and shallow (less than 100 m).

Comment 109: ETSSTAWG recommends that the survey effort should be suspended at night as night-time observations are of insufficient acuity to detect cetaceans and that the survey effort should be suspended when adverse weather conditions prevail that would preclude effective spotting (e.g. in fog, rain, heavy seas > Beaufort 3).

Response: NMFS and L–DEO have considered these recommendations, and have decided it is not feasible to include such restrictions, as limiting the surveys to daytime only would either result in the loss of half of the data or would necessitate doubling the duration of the project. Doubling the duration of the surveys is not possible because the *Langseth* has other research commitments after the TAIGER cruise, and because of weather conditions associated with the typhoon season. It would also incur other potential environmental effects. However, the seismic source will not be started if the MMVOs cannot view the entire safety radius for any reason (darkness, fog, or rough seas). In addition, PAM will be used day and night as practical, which can detect vocalizing marine mammals present in the area (see L–DEO's Supplemental EA).

Comment 110: HSI states that L–DEO has ignored the mitigation measure to avoid species temporally and must offer a strong rationale for doing so in any application resubmission. The rationale that resources have already been committed to conducting these surveys during this time period is of course not only unacceptable as a justification; it is also illegal under the NEPA.

Response: NMFS disagrees with HSI's comment. After the issuance of the proposed IHA, L–DEO modified the cruise plan and adopted more precautionary monitoring and mitigation measures. The time for the cruise is the most suitable time logistically for the *Langseth* and the participating scientists. Given the limited weather window for the operations and the fact that marine mammals are widespread in the survey area throughout the year, altering the timing of the proposed project likely would result in no net benefits. Issuing the IHA for another period could result in significant delays and disruptions to the cruise as well as subsequent geophysical studies that are planned by L–DEO for 2009 and beyond. NMFS has fully complied with its obligations under NEPA. *See* Temporal and Spatial Avoidance section below in this document. *See* L–DEO's Supplemental EA for more information.

Comment 111: CSI is concerned with the timing of the proposed seismic surveys, especially regarding dates, locations, and species.

Response: After issuance of the proposed IHA, L–DEO modified the cruise plan and adopted more precautionary monitoring and mitigation measures, which addressed concerns regarding certain locations and species of marine mammals. The time for the cruise is the most suitable time logistically for the *Langseth* and the participating scientists. Given the limited weather window for the operations and the fact that marine mammals are widespread in the survey area throughout the year, altering the timing of the proposed project likely would result in no net benefits. NMFS believes that L–DEO's revised survey as well as the implementation of the required monitoring and mitigation measures described in the IHA will have

a negligible impact on the affected species or stocks of marine mammals in the study area. *See* Temporal and Spatial Avoidance, Species of Particular Concern, and L–DEO's Supplemental EA.

Comment 112: HSI states that it is unclear why the surveys must take place during the proposed time period (March 21 to July 14, 2009). The applicant acknowledges that the best available science shows the ''highest number of marine mammal sightings and species occur during April and June'' (p. 78298) in the region—the overlap with the survey dates is obvious. This also happens to be the calving season for many species in the region. The NMFS should require at a minimum that L–DEO provide clear and substantive justification for the proposed survey schedule. The most effective mitigation measure known is to avoid species spatially and/or temporally.

Response: The seismic survey will provide data integral to advancing scientific understanding of the process of large-scale mountain building. The study is designed to characterize the birth and evolution of a mountain belt, which in turn can provide information on locations and source properties of regional earthquakes. The information is vital to understanding plate tectonic processes and their effects on earthquake occurrence and distribution. The time for the cruise is the most suitable time logistically for the *Langseth* and the participating scientists. Given the limited weather window for the operations and the fact that marine mammals are widespread in the survey area throughout the year, altering the timing of the proposed project likely would result in no net benefits. Issuing the IHA for another period could result in significant delays and disruptions to the cruise as well as subsequent geophysical studies that are planned by L–DEO for 2009 and beyond.

After the issuance of the proposed IHA, L–DEO modified the cruise plan and adopted more precautionary monitoring and mitigation measures, of which include temporal and spatial avoidance of species of particular concern (*see* Temporal and Spatial Avoidance and Species of Particular Concern below). NMFS has included requirements to these effects in the IHA issued to L–DEO. *See* L–DEO's Supplemental EA.

Comment 113: Dr. John Wang states that the period of the proposed survey also overlaps greatly with the presence of the most vulnerable members of marine mammal population (females with young calves) some of which may be found in aggregations or following certain migration routes during this time.

Response: After issuance of the proposed IHA, L–DEO modified the cruise plan and adopted more precautionary monitoring and mitigation measures, which addressed concerns regarding certain locations and species of marine mammals. The time for the cruise is the most suitable time logistically for the *Langseth* and the participating scientists. Given the limited weather window for the operations and the fact that marine mammals are widespread in the survey area throughout the year, altering the timing of the proposed project likely would result in no net benefits. Issuing the IHA for another period could result in significant delays and disruptions to the cruise as well as subsequent geophysical studies that are planned by L–DEO for 2009 and beyond. NMFS believes that L–DEO's revised survey as well as the implementation of the required monitoring and mitigation measures described in the IHA will have a negligible impact on the affected species or stocks of marine mammals in the study area. *See* Temporal and Spatial Avoidance, Species of Particular Concern, and L–DEO's Supplemental EA.

Comment 114: NRDC states that NMFS' proposed IHA does not impose meaningful mitigation measures. For instance, it imposes only voluntary spatial and temporal restrictions, introducing caveats such as avoiding humpback winter concentration areas ''if practicable'' and limiting seismic operations to 8–10 km from the Taiwanese coast ''when possible'' to reduce harm to ETS Indo-Pacific humpback dolphins, effectively leaving decisions on habitat avoidance to the project proponent. 73 FR 78315; see also *NRDC* v. *Gutierrez,* 2008 WL 360852 (N.D. Cal., Feb. 6, 2008) (noting that it is improper for NMFS, as the agency tasked with implementing the MMPA, to shift its burden). Nor, given the distribution of species and the propagation of airgun pulses, would the proposed 2 km coastal avoidance do much to mitigate the harm to the ETS Indo-Pacific humpback dolphin population, whose entire distribution falls within the proposed survey areas. *See* comment letter submitted by Dr. John Wang. Such measures neither meet the agency's statutory burden nor satisfy the strong interest in marine mammal protection that is embodied in the MMPA.

Response: After issuance of the proposed IHA, L–DEO modified the cruise plan and adopted more precautionary monitoring and mitigation measures. L–DEO will limit seismic survey lines to take place at least 20 km from the west coast of Taiwan, except for in the passage between the Penghu Islands and the Waishanding Jhou sandbar, where the survey will pass through the approximately 17.1 km mid-line distance between the two possibly sensitive areas, subject to the limitations imposed by other foreign nations, to minimize the potential for exposing Indo-Pacific humpback dolphins, finless porpoises, and other coastal species to SPLs greater than or equal to 160 dB re 1 μPa (rms). NMFS believes that L–DEO's revised survey as well as the implementation of the required monitoring and mitigation measures described in the IHA will have a negligible impact on the affected species or stocks of marine mammals in the study area. *See* Temporal and Spatial Avoidance, Species of Particular Concern, and L–DEO's Supplemental IHA.

Comment 115: CSI states that calving for most cetacean species in this region is likely in the spring to early summer as evidenced by sightings of many females with young calves during cetacean surveys that have been conducted in Taiwan and the examination of hundreds of carcasses. The proposed survey schedule overlaps greatly with the calving seasons of many species or will occur as females are accompanied by and nursing young calves. This proposed period for the seismic surveys is probably the worst choice of seasons if minimizing the impacts of this activity on marine mammals in this region is a sincere goal.

Response: After the issuance of the proposed IHA, L–DEO modified the cruise plan and adopted more precautionary monitoring and mitigation measures. NMFS believes that L–DEO's revised survey as well as the implementation of the required monitoring and mitigation measures described in the IHA will have a negligible impact on the affected species or stocks of marine mammals in the study area.

In the EA and Supplemental EA, L–DEO and NSF addressed potential impacts of the proposed seismic survey on marine mammals, as well as other species of concern near the survey area, including sea turtles, fish, and invertebrates. The EA evaluates three alternatives: (1) The proposed seismic survey and the issuance of an associated IHA; (2) a corresponding seismic survey at an alternative time, along with issuance of an associated IHA; and (3) a no action alternative, with no IHA and

no seismic survey. The EA assessed impacts to marine mammals, including consideration of impacts to prey species and to marine mammal habitats. A number of monitoring and mitigation measures were proposed as part of the action evaluated in the EA. In consideration of public comments received the Supplemental EA particularly considered adjustments to the preferred alternative and additional mitigation measures. Taking into account the mitigation measures that are planned, the potential effects on marine mammals from the preferred alternative are generally expected to be limited to avoidance of the area around the seismic operation and short-term behavioral changes, falling within the MMPA definition of Level B harassment. No injury (Level A harassment), serious injury, or mortality is anticipated or authorized. Numbers of individuals of all species taken are expected to be small (relative to species abundance).

Comment 116: NRDC states that the additional review of the region's marine mammal population should be undertaken before authorizing incidental takes. Furthermore, meaningful spatial and temporal restrictions on seismic activities must be adopted, as described in further detail at Appendix A.

Response: After issuance of the proposed IHA, L–DEO reviewed information on the region's marine mammal populations, modified the cruise plan, and adopted more precautionary monitoring and mitigation measures. NMFS believes that L–DEO's revised survey as well as the implementation of the required monitoring and mitigation measures described in the IHA will have a negligible impact on the affected species or stocks of marine mammals in the study area. *See* Temporal and Spatial Avoidance below and L–DEO's Supplemental EA.

Comment 117: The Commission recommends that, before issuing the requested authorization, the NMFS require the applicant to take all measures necessary to ensure that the proposed activities are not conducted near the Ryukyu Islands and Babuyan Islands during peak occurrence of the humpback whales in those areas (i.e., February through April).

Response: To mitigate against the potential effects of the seismic survey on humpback whales, particularly mother and calves on the breeding grounds or during the beginning of migration to summer feeding grounds, the surveys that approach the Babuyan Islands have been rescheduled as late as possible to Leg 4 (June 18 to July 20, 2009) (*see* L–DEO's Supplemental EA). The humpback whales that winter and calve in the Ryuku Islands are near Okinawa (Nishiwaki, 1959; Rice, 1989; Darling and Mori, 1993), which is approximately 400 km (249 mi) north of the most northerly survey lines. The *Langseth's* closest approach to the Ryuku Islands is 51.5 km (32 mi), and 26.6 km (16.5 mi) and 8.8 km (5.5 mi) to the Babuyan and Batan Islands, respectively.

L–DEO will avoid the areas (Ogasawara and Ryuku Islands in southern Japan and the Batan and Babuyan Islands in Luzon Strait in the northern Philippines) at the time of peak occurrence (February to April), where concentrations of humpback whales are known to winter, calve, and nurse. Seismic survey lines will be scheduled for as late as possible (June to July) to avoid potential effects of the surveys on humpback whales, particularly mothers and calves on breeding grounds or during the beginning of migration to summer feeding grounds. If concentrations or groups of humpback whales are observed (by visual or passive acoustic detection) prior to or during the airgun operations, those operations will be powered/shut-down and/or moved to another location, if possible, based on recommendations by the on-duty MMO aboard the *Langseth.* Also, if humpback whale mother/calf pairs are visually sighted, the airgun array will be shut-down regardless of the distance of the animal(s) to the sound source. The array will not resume firing until 30 min after the last documented whale visual sighting.

NMFS concurs with the Commissions recommendation and has included a requirement to this effect in the IHA.

Comment 118: WaH states that the potential impacts on western North Pacific humpback whales in the waters of the Babuyan Islands (believed to be calving and nursing grounds for a small population of humpback whales) and Taiwan (e.g., along the east coast and in the Taiwan Strait) and the fact that surveys will occur during the northward migration of mothers and calves is worrying. Mothers and calves may be more sensitive to acoustic disturbance and are probably more susceptible to the impacts of stress responses to disturbance of any kind.

CSI states that the timing of the L–DEO surveys overlaps greatly in space and time with the whales wintering in the Babuyan Islands and coincides spatially and temporally with the northward migration of mothers and neonatal and other young calves from the calving/nursing grounds in the Babuyan waters.

NRDC urges NMFS to restrict L–DEO's access to the Ryuku Islands: exclusion to 200 m depth from December through May and year-round coastal exclusion to 20 km (this is important breeding ground for North Pacific humpback whale, particularly December through May).

Response: Many concerns were raised in public comments about the proposed survey lines scheduled for Leg 2 (April 20 to June 7, 2009) approaching humpback whale breeding areas in the Babuyan and Ryuku Islands. In fact, the humpback whales that winter and calve in the Ryuku Islands are near Okinawa (Nishiwaki, 1959; Rice, 1989; Darling and Mori, 1993), some 400 km north of the most northerly survey. However, a small population of humpbacks does winter and calve in the Babuyan Islands in Luzon Strait (Acebes and Lesaca, 2003; Acebes *et al.,* 2007). The whales may arrive in the area as early as November and leave in May or even June, with peak occurrence during February through March or April (Acebes *et al.,* 2007).

To mitigate against the potential effects of the surveys on humpbacks, particularly mothers and calves on the breeding grounds or during the beginning of migration to summer feeding grounds, the surveys that approach the Babuyan Islands have been rescheduled as late as possible, to Leg 4 (June 18 to July 20, 2009). The *Langseth's* closest approach to the Ryuku and Okinawa Islands are approximately 51.5 and 400 km, respectively.

L–DEO will avoid the areas (Ogasawara and Ryuku Islands in southern Japan and the Batan and Babuyan Islands in Luzon Strait in the northern Philippines) at the time of peak occurrence (February to April), where concentrations of humpback whales are known to winter, calve, and nurse. Seismic survey lines will be scheduled for as late as possible (June to July) to avoid potential effects of the surveys on humpback whales, particularly mothers and calves on breeding grounds or during the beginning of migration to summer feeding grounds. If concentrations or groups of humpback whales are observed (by visual or passive acoustic detection) prior to or during the airgun operations, those operations will be powered-down, shut-down, and/or moved to another location, if possible, based on recommendations by the on-duty MMO aboard the *Langseth.* If humpback whale mother/calf pair is visually sighted, the airgun array will be

shut-down regardless of the distance of the animal(s) to the sound source. The array will not resume firing until 30 min after the last documented whale visual sighting. NMFS has included requirements to these effects in the IHA issued to L–DEO.

Comment 119: CSI has concerns regarding particular mitigation measures. The mitigation measures proposed by L–DEO would be ineffective or have limited effectiveness at best. The claim is that surveys will be delayed as late as possible to avoid humpback whales, but the timing of the surveys overlap the presence of humpback whales greatly and during a time when newborn calves will be accompanying mothers. The surveys will also occur during or near the calving season for most species in the region; this is when females and calves are the most vulnerable. Given the entire period of the proposed survey overlaps with humpback whale concentrations in the Babuyan island sand during the migration period, there is no attempt to avoid this area, and surveying the lines near the Ryuku and Babuyan islands as late as possible within the scheduled period of the surveys does nothing but delay the impact on the animals to a slightly later period because the whales will still be in the area. As such, this measure does not mitigate anything.

Response: After the issuance of the proposed IHA, L–DEO modified the cruise plan and adopted more precautionary monitoring and mitigation measures, which addressed concerns regarding certain locations and species of marine mammals. The time for the cruise is the most suitable time logistically for the *Langseth* and the participating scientists. Given the limited weather window for the operations and the fact that marine mammals are widespread in the survey area throughout the year, altering the timing of the proposed project likely would result in no net benefits. Issuing the IHA for another period could result in significant delays and disruptions to the cruise as well as subsequent geophysical studies that are planned by L–DEO for 2009 and beyond. NMFS believes that L–DEO's revised survey as well as the implementation of the required monitoring and mitigation measures described in the IHA will have a negligible impact on the affected species or stocks of marine mammals in the study area. See NMFS responses above, Species of Particular Concern, and L–DEO's Supplemental EA.

Comment 120: CSI states that the schedule for surveying the Luzon Strait and the Philippine Sea overlaps completely with the period when humpback whales are still in the area (and includes the latter portion of the peak period (April) for humpback whale concentrations in the Babuyan Islands). Therefore it is unclear how the timing of the surveys reduces the impacts on humpback whales as claimed by L–DEO. A large proportion of this population of humpback whales will also be migrating through the Philippine Sea to northern waters at the same time as the proposed surveys. Although the exact migratory routes of most humpback whales are unknown, it is clear that at least some will follow a path that is parallel and fairly close to the shores of eastern Taiwan. One of the proposed survey tracklines of the *Langseth* also follows this course. Many females undertaking the migration at this time will also be accompanied by neonatal calves and these are the most sensitive individuals of the population (McCauley *et al.,* 2000).

Response: After issuance of the proposed IHA, L–DEO modified the cruise plan and adopted more precautionary monitoring and mitigation measures. Additionally, L–DEO will avoid the areas (Ogasawara and Ryuku Islands in southern Japan and the Batan and Babuyan Islands in Luzon Strait in the northern Philippines) at the time of peak occurrence (February to April), where concentrations of humpback whales are known to winter, calve, and nurse. Seismic survey lines will be scheduled for as late as possible (June to July) to avoid potential effects of the surveys on humpback whales, particularly mothers and calves on breeding grounds or during the beginning of migration to summer feeding grounds.

If concentrations or groups of humpback whales are observed (by visual or passive acoustic detection) prior to or during the airgun operations, those operations will be powered-down, shut-down, and/or moved to another location, if possible, based on recommendations by the on-duty MMO aboard the *Langseth. See* Species of Particular Concern and L–DEO's Supplemental EA.

Comment 121: NRDC urges NMFS to restrict L–DEO's access to the Ryukyu Islands: exclusion to 200 m depth from December through May and year-round coastal exclusion to 20 km (this is important breeding ground for North Pacific humpback whale, particularly December through May, as well as year-round habitat for Indo-Pacific bottlenose dolphin).

NRDC also states that mitigation measures should restrict access to the islands between northern Luzon and Taiwan including Babuyan, Batanes, Calayan Islands: exclusion to 200 m depth from December through May, as well as year-round coastal exclusion to 20 km (these are humpback whale breeding grounds, particularly December through May, and reflect high cetacean diversity year-round).

Response: L–DEO will avoid the areas (Ogasawara and Ryuku Islands in southern Japan and the Batan and Babuyan Islands in Luzon Strait in the northern Philippines) at the time of peak occurrence (February to April), where concentrations of humpback whales are known to winter, calve, and nurse. Seismic survey lines will be scheduled for as late as possible (June to July) to avoid potential effects of the surveys on humpback whales, particularly mothers and calves on breeding grounds or during the beginning of migration to summer feeding grounds. If Indo-Pacific bottlenose dolphins are visually sighted, the airgun array will be shut-down regardless of the distance of the animal(s) to the sound source. The array will not resume firing until 15 min after the last documented dolphin sighting. NMFS has included requirements to this effect in the IHA issued to L–DEO. See Species of Particular Concern and L–DEO's Supplemental EA.

Comment 122: CSI states that the routes and months when Western Pacific gray whales may undertake their migration from suspected wintering grounds in the South China Sea are unknown. However, it is likely that the period for the migration is in the spring. Scheduling the seismic surveys in the South China Sea to be conducted in March and April will likely coincide with at least some migrating gray whales. L–DEO did not address this possibility and have not proposed any mitigation measures to avoid this likely overlap of seismic surveys and migrating gray whales.

Response: After issuance of the proposed IHA, L–DEO modified the cruise plan and adopted more precautionary monitoring and mitigation measures. L–DEO will avoid shallow water areas near the mainland China coast and western part of the Taiwan Strait during the Western Pacific gray whale wintering period and migration (December to April). L–DEO will avoid shallow, coastal waters of the South China Sea, and limit seismic survey lines to water depths greater than 200 m in the South China Sea, and as far east as possible from the mainland China side of the Taiwan Strait to reduce potential for effects on Western Pacific gray whales. If a Western Pacific gray whale is visually sighted, L–DEO

will also shut-down the airgun array regardless of the distance of the animal(s) to the sound source. The array will not resume firing until 30 min after the last documented whale visual sighting. NMFS believes that L–DEO's revised survey as well as the implementation of the required monitoring and mitigation measures described in the IHA will have a negligible impact on the affected species or stocks of marine mammals in the study area. See L–DEO's Supplemental EA.

Comment 123: NRDC states that mitigation measures should restrict access to the Strait of Taiwan from October through May (due to gray whale migration, as well as high cetacean density including endangered population of Indo-Pacific humpback dolphins).

Response: After issuance of the proposed IHA, L–DEO modified the cruise plan and adopted more precautionary monitoring and mitigation measures. L–DEO will avoid shallow water areas near the mainland China coast and western part of the Taiwan Strait during Western Pacific gray whale wintering period and migration (December to April). L–DEO will limit seismic survey lines to water depths greater than 200 m in the South China Sea, and as far east as possible from the mainland China side of the Taiwan Strait, to reduce potential for effects on Western Pacific gray whales, Indo-Pacific humpback dolphins, and finless porpoises. NMFS believes that L–DEO's revised survey as well as the implementation of the required monitoring and mitigation measures described in the IHA will have a negligible impact on the affected species or stocks of marine mammals in the study area. *See* Species of Particular Concern, Temporal and Spatial Avoidance, and L–DEO's Supplemental EA.

Comment 124: NRDC urges NMFS to restrict L–DEO's access to all South China Sea from December through May (due to gray whale migration).

Response: L–DEO will avoid shallow water area near the mainland China coast and western part of the Taiwan Strait during the Western Pacific gray whale wintering period and migration (December to April). L–DEO will also avoid shallow, coastal waters of the South China Sea. L–DEO will limit seismic survey lines to water depths greater than 200 m in the South China Sea, and as far east as possible from the mainland China side of the Taiwan Strait, to reduce potential for effects on Western Pacific gray whales. NMFS has included requirements to this effect in the IHA issued to L–DEO.

Comment 125: CSI states that the critically endangered ETS sub-population of Indo-Pacific humpback dolphins will be subjected to greater than 180 dB received levels even if mitigation measures are taken (i.e., to remain offshore of 2 km from shore). Even if the mitigation measures proposed by L–DEO are fully implemented, there will likely be ''Level A harassment'' to the ETS population that could have serious and likely irreversible impacts on this population. Based on the tabled predicted RMS distances for different received levels and accepting the recommendations of the ETSSTAWG for this population that for noise issues an additional (i.e., additional to the 3 km from shore distribution that is known presently for the ETS sub-population) 2 km buffer should be considered, the *Langseth* should not be within 13 km of western coast of Taiwan to avoid exposing dolphins to >160 dB levels. However, the model underestimates the actual levels at different distances. Further compounding the underestimation of levels is the fact that shallow water category is less than 100 m but the ETS population lives in waters less than 25 m. Much better predicted RMS distances for different received levels are needed for very shallow waters. Being 2 km from shore puts the *Langseth* in the middle of the distribution of the ETS population and does absolutely nothing to reduce the exposure level to any dolphin. The only reduction of noise is possibly with the statement that surveying will only take place 8 to10 km from shore but the condition of when possible is not acceptable because this can be a subjective determination by someone not concerned about the impacts on critically endangered populations of cetaceans. Furthermore, as discussed above, 8 to 10 km from shore still may not be sufficient to reduce exposure of the animals to greater than 160 dB and the distribution for the ETS population is further south than Taixi (Wang *et al.,* 2007b). Chou (2006) also believes that some of the waters south of Taixi are an important breeding/nursing area for the ETS population. These mitigation measures are not effective and still pose unacceptable risks to the dolphins of being exposed to greater than 180 dB. The proposed seismic surveys will exposure almost the entire ETS population of humpback dolphins to levels greater than 180 dB. As such, all or almost all ETS dolphins will be exposed to greater than 160 dB levels even if the *Langseth* remains 8 to 10 km from shore.

Response: After the issuance of the proposed IHA, L–DEO modified the cruise plan and adopted more precautionary monitoring and mitigation measures. L–DEO will limit seismic survey lines to take place at least 20 km from the west coast of Taiwan, except for in the passage between the Penghu Islands and the Waishanding Jhou sandbar, where the survey will pass through the approximately 17.1 km mid-line distance between the two possibly sensitive areas, subject to the limitations imposed by other foreign nations, to minimize the potential for exposing Indo-Pacific humpback dolphins finless porpoises, and other coastal species to SPLs greater than or equal to 160 dB re 1 μPa (rms). *See* Species of Particular Concern and L–DEO's Supplemental EA.

Comment 126: The Commission recommends that, before issuing the requested authorization, the NMFS describe the reasons why and the conditions under which the application would need to conduct surveys closer than 8 to 10 km off the coast of Taiwan where threatened Indo-Pacific humpback dolphins are more likely to be exposed to sound pressure levels greater than 160 dB re 1 μPa (rms). The Commission also notes that it makes more sense to use a single distance, rather than a range, to prevent the survey from approaching the Taiwan coast too closely.

Response: The critically endangered ETS sub-population of the Indo-Pacific humpback dolphin is considered a foreign species and is not listed under the ESA. Foreign species are those that occur entirely outside of U.S. territory. NMFS does not, and is not obligated to, designate critical habitat or develop recovery plans for foreign species. NSF and L–DEO's action is planned to take place in the territorial seas and EEZ's of foreign nations, and will be continuous with the activity that takes place on the high seas. NMFS does not authorize the incidental take of marine mammals in the territorial seas of foreign nations, as the MMPA does not apply in those waters. However, NMFS still needs to calculate the level of incidental take in territorial seas as part of the proposed issuance of an IHA in regards to NMFS' analysis of small numbers and negligible impact determination.

After the issuance of the proposed IHA, L–DEO modified the cruise plan and adopted more precautionary monitoring and mitigation measures, especially for the ETS sub-population of Indo-Pacific humpback dolphins. Off

Taiwan's west coast, the cruise tracks have been re-routed offshore by approximately 20 km (12.4 mi) to protect the critically endangered ETS subpopulation of Indo-Pacific dolphins and finless porpoises, as well as ease potential pressure on other coastal species. Thus, L–DEO now plans to maintain the precautionary buffer recommended by ETSSTAWG in their comments to NMFS, ''at least 13 km (8.1 mi) and perhaps a more precautionary 15 km (9.3 mi) of the ETS Sousa population—meaning up to 20 km from shore.''

L–DEO will limit seismic survey lines to take place at least 20 km from the west coast of Taiwan, except for in the passage between the Penghu Islands and the Waishanding Jhou sandbar, where the survey will pass through the approximately 17.1 km mid-line distance between the two possibly sensitive areas, subject to the limitations imposed by other foreign nations, to minimize the potential for exposing Indo-Pacific humpback dolphins, finless porpoises, and other coastal species to SPLs greater than or equal to 160 dB re µPa (rms). NMFS concurs with the recommendations made by interested parties and has included a requirement to this effect in the IHA issued to L–DEO.

Comment 127: CSI states that if the *Langseth* approaches to within 10 km from shore, dolphins using waters east of the Chinmen Islands may be exposed to levels greater than 160 dB and some may be exposed to 180 dB or more depending on where the dolphins are found in their distribution and how close the *Langseth* is to the 25–30 m isobath.

Response: After issuance of the proposed IHA, L–DEO modified the cruise plan and adopted more precautionary monitoring and mitigation measures. The Chinmen Islands are located in the western portion of the Taiwan Strait, approximately 15 km from the coast of mainland China. L–DEO will avoid shallow water areas near the mainland China coast and western part of the Taiwan Strait during December to April. L–DEO will also limit seismic survey lines to water depths greater than 200 m in the South China Sea, and as far east as possible from the mainland China side of the Taiwan Strait, to reduce potential for effects on Western Pacific gray whales, Indo-Pacific humpback dolphins, and finless porpoises. L–DEO has been denied access to the waters of China as well. *See* L–DEO's Supplemental EA.

Comment 128: HSI states that although the **Federal Register** notice and the application note that the rms received level distances are potentially very large for shallow water, there is no effort to address the shortcomings of the proposed mitigation measures under those circumstances. As an example, the most vulnerable cetacean population to be affected by these surveys (i.e., ETS *Sousa*) could be routinely exposed to sound pressure levels of 180 dB re 1 µPa (rms) or greater (the level beyond which Level A harassment might occur), given the track lines proposed. Individual *Sousa* could be at risk of Level A harassment (or worse) at a distance as far from the *Langseth* as 4 km (*see* Table 1, p. 78297). This is well beyond visual (and probably acoustic) detection range, yet there is little effort in the application (or the **Federal Register** notice) to address this shortcoming. The proposal to come no nearer to the west coast of Taiwan than 2 km (and to remain ''when possible''—p. 78315—at least 8 to 10 km offshore) is not sufficient.

Response: After the issuance of the proposed IHA, L–DEO modified the cruise plan and adopted more precautionary monitoring and mitigation measures. L–DEO will limit seismic survey lines to take place at least 20 km from the west coast of Taiwan, except for in the passage between the Penghu Islands and the Waishanding Jhou sandbar, where the survey will pass through the approximately 17.1 km mid-line distance between the two possibly sensitive areas, subject to the limitations imposed by other foreign nations, to minimize the potential for exposing Indo-Pacific humpback dolphins, finless porpoises, and other coastal species to SPLs greater than or equal to 160 dB re 1 µPa (rms).

Comment 129: NRDC states that mitigation measures should include a year-round coastal exclusion in the waters surrounding Taiwan to 20 km (because of Indo-Pacific humpback dolphin and finless porpoise habitat).

Response: After issuance of the proposed IHA, L–DEO modified the cruise plan and adopted more precautionary monitoring and mitigation measures. L–DEO will limit seismic survey lines to take place at least 20 km from the west coast of Taiwan, except for in the passage between the Penghu Islands and the Waishanding Jhou sandbar, where the survey will pass through the approximately 17.1 km mid-line distance between the two possibly sensitive areas, subject to the limitations imposed by other foreign nations, to minimize the potential for exposing Indo-Pacific humpback dolphins, finless porpoises, and other coastal species to SPLs greater than or equal to 160 dB re 1 µPa (rms). The seismic survey line paralleling the east coast of Taiwan will be moved offshore at least 20 km to decrease potential impacts on species that occur in coastal waters and over the continental slope. If an Indo-Pacific humpback dolphin or finless porpoise is visually sighted, the airgun array will be shut-down regardless of the distance of the animal(s) to the sound source. The array will not resume firing until 15 min after the last documented dolphin/porpoise sighting. NMFS has included requirements to these effects in the IHA issued to L–DEO. *See* L–DEO's Supplemental EA.

Comment 130: ETSSTAWG states that the lack of separate consideration of the genetically distinct ETS population of *Sousa* is, of course, a concern. One of the most effective ways to protect cetaceans and their habitat from the impacts of noise (and the cumulative and synergistic impacts in combination with other stressors) is through spatio-temporal restrictions, including marine protected areas (Weilgart, 2006).

Response: NMFS, NSF, and L–DEO have considered the genetically distinct ETS sub-population on Indo-Pacific humpback dolphins in L–DEO's Supplemental EA and issuance of the IHA to L–DEO. Several temporal and spatial restrictions for several cetacean species have been incorporated in the revision of the proposed survey and have been incorporated in NMFS' IHA issued to L–DEO. *See* Temporal and Spatial Avoidance section of this document and L–DEO's Supplemental EA.

Comment 131: WaH states that abundance and other data in SE Asia for sperm whales, which are known to 'startle' in response to seismic surveys and to face numerous threats in the SE Asia region (including acoustic), are unknown, justifying precautionary measures.

Response: After issuance of the proposed IHA, L–DEO modified the cruise plan and adopted more precautionary monitoring and mitigation measures. L–DEO is expected to implement any and all monitoring and mitigation measures described in the IHA that are applicable to sperm whale visual and acoustic detections. If concentrations or groups of sperm whales are observed (by visual or passive acoustic detection) prior to or during the airgun operations, those operations will be powered/shut-down and/or moved to another location, if possible, based on recommendations by the on-duty MMO aboard the *Langseth.* NMFS has included a requirement to this effect in the IHA issued to L–DEO,

as well as additional monitoring and mitigation measures for marine mammals.

Comment 132: Dr. John Wang states that recognizing the sensitivity of beaked whales, L–DEO proposed that as a 'special mitigation procedure' for beaked whales, ''approach to slopes and submarine canyons, if possible, during the proposed survey.'' It is unclear what is meant by 'if possible'. With this condition it is not convincing that the procedure will actually be implemented.

Response: When operating the sound source(s), L–DEO will minimize approaches to slopes, submarine canyons, seamounts, and other underwater geologic features, whenever possible, because of sensitivity of beaked whales and to avoid possible beaked whale habitat. If concentrations or groups of beaked whales are observed (by visual or passive acoustic detection) at a site such as on the continental slope, submarine canyon, seamount, or other underwater geologic feature just prior to or during the airgun operations will be powered-down, shut-down, and/or moved to another location, if possible, based on recommendations by the on-duty MMO aboard the *Langseth.* NMFS has included requirements to this effect in the IHA issued to L–DEO.

After issuance of the proposed IHA, L–DEO modified the cruise plan and adopted more precautionary monitoring and mitigation measures. NMFS believes that the revised survey as well as the implementation of the required monitoring and mitigation measures described in the IHA will have a negligible impact on the affected species or stocks of marine mammals in the study area.

Comment 133: NRDC states that NMFS' proposed mitigation measures focus primarily on visual monitoring. However, research has cast doubt on the ability of shipboard observers to detect whales or for vessels to avoid collisions through visual monitoring, particularly as the size of the vessel increases or visibility decreases (Clyne and Leaper, 1999). Notably, detection rates for marine mammals generally approach only 5 percent. It has been estimated that in anything stronger than a light breeze, only one in fifty beaked whales surfacing in the direct track line of a ship would be sighted; as the distance approaches 1 km, that number drops to zero (Barlow and Gisiner, 2006).

Response: After issuance of the proposed IHA, L–DEO modified the cruise plan and adopted more precautionary monitoring and mitigation measures. NMFS believes that L–DEO's visual monitoring efforts is successful for detecting marine mammals. In addition to extra MMOs and high-powered binoculars, L–DEO will be using a PAM system for acoustically detecting marine mammals in the vicinity of the *Langseth.* NMFS expects that the impacts of the seismic survey action on marine mammals will be temporary in nature and not result in substantial impact to marine mammals or to their role in the ecosystem. The IHA anticipates, and would authorize, Level B harassment only, in the form of temporary behavioral disturbance, of species of cetaceans. Neither Level A harassment (injury), serious injury, nor mortality is anticipated or authorized, and the Level B harassment is not expected to affect biodiversity or ecosystem function. NMFS believes that L–DEO's revised survey as well as the implementation of the required monitoring and mitigation measures described in the IHA will have a negligible impact on the affected species or stocks of marine mammals in the study area. *See* Monitoring, Mitigation, and L–DEO's Supplemental EA.

Comment 134: NRDC urges NMFS to restrict L–DEO's access to submarine canyons off of southwest Taiwan (due to probable sperm and beaked whale habitat); and marine protected areas.

Response: After the issuance of the proposed IHA, L–DEO modified the cruise plan and adopted more precautionary monitoring and mitigation measures in the study area. If concentrations of groups of sperm whales and/or beaked whales are observed (by visual or passive acoustic detection) at a site such as on the continental slope, submarine canyon, seamount, or other underwater geologic feature just prior or during the airgun operations, those operations will be powered/shut-down and/or moved to another location, if possible based on recommendations by the on-duty MMO aboard the *Langseth.* When operating the sound source(s), minimize approaches to slopes, submarine canyons, seamounts, and other underwater geologic features, if possible, because of sensitivity of beaked whales. NMFS expects NSF and L–DEO to adhere to local conservation laws and regulations of nations while in foreign waters, and known rules and boundaries of Marine Protected Areas. In the absence of local conservation laws and regulations or Marine Protected Area rules, L–DEO will continue to use the monitoring and mitigation measures identified in the IHA. NMFS has included requirements to these effects in the IHA issued to L–DEO. *See* Species of Particular Concern below.

Comment 135: NRDC urges NMFS to restrict L–DEO's access to the coastal waters of the South China Sea out to 200 m depth, >20 km including islands from April through June (because of the presence of beaked whales and potential gray whale breeding sites).

Response: L–DEO will limit seismic survey lines to water depths greater than 200 m in the South China Sea, and as far east as possible from the mainland China side of the Taiwan Strait, to reduce potential for effects on Western Pacific gray whales, Indo-Pacific humpback dolphins, and finless porpoises. L–DEO will avoid shallow water areas near the mainland China coast and western part of the Taiwan Strait during the Western Pacific gray wintering period and migration (December to April). L–DEO will avoid shallow, coastal waters of the South China Sea to avoid populations of finless porpoises. NMFS has included requirements to these effects in the IHA issued to L–DEO.

Mitigation—Tracklines

Comment 136: Several interested parties state that with tracklines overlapping known and suspected important habitat for beaked whales, which are known to be particularly sensitive to acoustic impacts, extremely difficult to detect visually, and already facing numerous threats (including acoustic) within their habitat at least in Taiwanese waters, and with almost no data on abundance for beaked whales in SE Asia (as reflected by the IUCN Red List status of three species in the region as ''Data Deficient''), there is a clear potential for significant impacts on beaked whales, and hence a need for great precaution.

Waters along the edge of the continental shelf (especially where the strong, warm, and oligotrophic Kuroshio Current meets the shelf edge and nutrient input from terrestrial sources) are particularly productive and appear to attract cetaceans, including beaked whales. Tracklines that run near and parallel to the edge of the continental shelf around Taiwan will have the greatest impact on cetaceans, being possibly most damaging to beaked whales. However, without more cetacean survey information it is uncertain if just moving tracklines offshore from the shelf edge would be effective in reducing impacts on beaked whales or if the relocation of tracklines would harm different species or other populations offshore.

Response: During the public comment period, concerns were expressed about the survey line that was parallel to and within a few km of the east coast of

Taiwan because of potential effects on coastal species and those that frequent the narrow continental shelf break and steep slopes (e.g., beaked whales and sperm whales). After the issuance of the proposed IHA, L–DEO has moved the survey line further offshore by more than 20 km to decrease potential impacts on species that occur in coastal water and over the continental slope, such as beaked whales. When operating the sound source(s), L–DEO will minimize approaches to slopes, submarine canyons, seamounts, and other underwater geologic features, if possible, because of sensitivity of beaked whales. Also, if concentrations of groups of beaked whales are observed (by visual or passive acoustic detection) prior to or during airgun operations, those operations will be powered-down or shut-down and/or moved to another location along the site, if possible, based on recommendations by the on-duty MMO aboard the *Langseth.* NMFS has included requirements to this effect in the IHA issued to L–DEO.

Comment 137: Dr. John Wang states that many of the proposed tracklines appear to maximize risk to cetacean populations in the waters of Taiwan, some of which are critically endangered under the 2008 IUCN Red List.

Response: NMFS does not authorize the incidental take of marine mammals in the territorial sea of foreign nations, as the MMPA does not apply in those waters. However, NMFS still calculates the level of incidental take in territorial seas as part of the analysis supporting issuance of an IHA in order to determine the biological accuracy of the small numbers and negligible impact determinations for species which cross boundaries. In this case, after the issuance of the proposed IHA, L–DEO modified the cruise plan and adopted more precautionary mitigation measures, especially for species of particular concern. See responses to comments discussed within this document as well as L–DEO's Supplemental EA.

Comment 138: Dr. John Wang states that several tracklines of the proposed seismic survey immediately standout as being very likely to cause great risk to marine mammals in the region. Some of the problematic tracklines include: (1) Coastal waters of western Taiwan; (2) approaches to the mainland of China; (3) the shelf edge along eastern Taiwan and oceanic islands off eastern and northern Taiwan, northern Philippines and the Ryuku archipelago; (4) the shelf edge along the eastern side of the Penghu Channel; and (5) all waters of the Taiwan Strait.

Response: After the issuance of the proposed IHA, L–DEO modified the cruise plan and adopted more precautionary monitoring and mitigation measures to reduce potential effects to marine mammals in the region. NMFS has included requirements to these effects in the IHA issued to L–DEO. *See* responses to comments in this document for further information, as well as L–DEO's Supplemental EA.

Comment 139: Dr. John Wang states L–DEO claimed that when conducting the Luzon Strait/Philippine sea leg of their survey, they will ''attempt to avoid these [for humpback whale] wintering areas at the time of peak occurrence by surveying a * * * slate as possible during each leg of the cruise''. However, the proposed survey schedule overlaps with the peak period of humpback whales in the Babuyan waters (the latter portion of the peak period being April) and a considerable number of humpback whales will still be in the survey area throughout the survey period (many will also be migrating through the waters at the same time the seismic surveys are planned).

Although the exact migratory routes of most humpback whales are unknown, it is clear that at least some will follow a path that is parallel and fairly close to the shores of eastern Taiwan, which is the same path of one of the proposed survey tracklines of the *Langseth.* Some females undertaking the migration at this time will be accompanied by neonatal calves, which are the most sensitive individuals of the population (McCauley *et al.,* 2000). Such a frivolous and empty statement by L–DEO attempting to mitigate its impact is concerning and raises questions about the sincerity of its mitigation measure proposed.

Response: Concerns were raised in several comments about survey lines scheduled for Leg 2 (April 20 to June 7, 2009) approaching humpback whale breeding areas in the Babuyan and Ryukyu Islands. In fact, the humpback whales that winter and calve in the Ryukyu Islands are near Okinawa (Nishiwaki, 1959; Rice, 1989; Darling and Mori, 1993), some 400 km north of the most northerly survey. However, a small population of humpbacks does winter and calve in the Babuyan Islands in Luzon Strait (Acebes and Lesaca, 2003; Acebes *et al.,* 2007). The whales may arrive in the area as early as November and leave in May or even June, with peak occurrence during February through March or April (Acebes *et al.,* 2007).

To mitigate against the potential effects of the surveys on humpbacks, particularly mothers and calves on the breeding grounds or during the beginning of migration to summer feeding grounds, the surveys that approach the Babuyan Islands have been rescheduled as late as possible, to Leg 4 (June 18 to July 20, 2009). L–DEO will avoid areas (Ogasawara and Ryuku Islands in southern Japan and the Batan and Babuyan Islands in Luzon Strait in the northern Philippines) at the time of peak occurrence (February to April), where concentrations of humpback whales are known to winter, calve, and nurse. Seismic survey lines will be scheduled for as late as possible (June to July) to avoid potential effects of the surveys on humpback whales, particularly mothers and calves on breeding grounds or during the beginning of migration to summer feeding grounds. Also, if concentrations or groups of humpback whales are observed (by visual or passive acoustic detection) prior to or during the airgun operations, those operations will be powered/shut-down and/or moved to another location, if possible, based on recommendations by the on-duty MMO aboard the *Langseth.* If humpback whale mother/calf pairs are visually sighted, the airgun array will be shut-down regardless of the distance of the animal(s) to the sound source. The array will not resume firing until 30 min after the last documented whale visual sighting. NMFS has included requirements to these effects in the IHA issued to L–DEO.

Comment 140: Dr. John Wang states that there is a need for cetacean surveys before seismic surveys. Clearly, all tracklines over or near the shelf edge will likely impact many cetaceans. However, without more cetacean survey information, it is uncertain if (a) just moving tracklines away from the shelf edge would be effective in reducing impacts on beaked whales; or (b) if the relocation of tracklines would harm different species in waters further offshore. Recent multiple sightings of ginkgo-toothed beaked whales during dedicated cetaceans surveys of waters off southeast Taiwan demonstrate the importance of such studies. Cetacean surveys in the waters off southwest Taiwan where the important deep Penghu Channel exists are limited. This channel has a steep eastern wall that borders against the southwest shores of Taiwan and helps to funnel a branch of the Kuroshio Current or the South China Sea current to the northern tip of the channel ending in an important area of complex seasonal mixing with the cold China Coastal current (Jan *et al.,* 2002).

Response: L–DEO has moved the seismic survey line paralleling the east

coat of Taiwan offshore at least 20 km to decrease potential impacts on species that occur in coastal waters and over the continental slope. To the maximum extent practicable, L–DEO will schedule seismic operations in inshore and shallow waters during daylight hours and OBS operations to nighttime hours. To the maximum extent practicable, seismic surveys (especially inshore) will be conducted from the coast (inshore) and proceed towards the sea (offshore) in order to avoid trapping marine mammals in shallow water. When operating the sound source(s), L–DEO will minimize approaches to slopes, submarine canyons, seamounts, or other geologic features, if possible, because of sensitivity of beaked whales. If concentrations or groups of beaked whales are observed (by visual or passive acoustic detection) at a site such as on the continental slope, submarine canyon, seamount, or other underwater geologic feature just prior to or during the airgun operations, those operations will be powered-down/shut-down and/or moved to another location, if possible, based on recommendations by the on-duty MMO aboard the *Langseth.* NMFS has included requirements to this effect in the IHA issued to L–DEO.

Comment 141: ETSSTAWG recommends that the section of Leg # 4 running along the western coast of Taiwan should be removed from the L–DEO survey as this represents core habitat for the critically endangered population of ETS *Sousa*.

Response: L–DEO will limit seismic survey lines to take place at least 20 km from the west coast of Taiwan, except for in the passage between the Penghu Islands and the Waishanding Jhou (Wau-san-ting Chou) sandbar, where the survey will pass through the approximately 17.1 km mid-line distance between the two possibly sensitive areas, subject to the limitations imposed by other foreign nations, to minimize the potential for exposing Indo-Pacific humpback dolphins, finless porpoises, and other coastal species to SPLs greater than or equal to 160 dB re μPa (rms). NMFS has included a requirement to this effect in the IHA issued to L–DEO.

Comment 142: Based on the map of the proposed survey track lines found in the L–DEO application (*see* Figure 1, p. 3 of the application), the survey vessel *Langseth* will be operating in the known and suspected habitat of at least two critically endangered cetacean species, the Western Pacific gray whale and the ETS *Sousa.* L–DEO must provide better justification for the track lines—if these are the only tracklines that will accomplish the goals of the research, then L–DEO must explain why and offer a rationale that justifies exposing critically endangered marine mammal populations to Level B harassment and, despite the applicant's assurances to the contrary, potentially Level A harassment and serious injury.

Response: During the public comment period, many concerns were expressed about the potential effects of the proposed survey on Western Pacific gray whales and Indo-Pacific humpback dolphins. After issuance of the proposed IHA, L–DEO modified the cruise plan in a number of ways: (1) L–DEO re-routed the survey lines in the South China Sea south of the Taiwan Strait so that they are now located in water depths >200 m; (2) L–DEO dropped the seismic lines in western Taiwan Strait, and (3) L–DEO adopted more precautionary monitoring and mitigation measures. For example, L–DEO will also shut-down the airgun array if a Western Pacific gray whale is visually sighted at any distance from the vessel. NMFS has included requirements to this effect in the IHA. *See* NMFS' responses to comments for more information regarding the ETS sub-population of Indo-Pacific humpback dolphins, as well as L–DEO's Supplemental EA. NMFS has not authorized the incidental take of Western Pacific gray whales or Indo-Pacific humpback dolphins.

Comment 143: CSI states that with the exception of a very small area where the proposed tracklines take the *Langseth* to the mainland Chinese coast and back to western Taiwan, the *Langseth* will operate in waters within 1 km from the shore of Taiwan and right through the middle (longitudinally) of almost the entire linear coastal distribution of the ETS sub-population, i.e., the proposed trackline almost completely overlaps with the entire distribution of the ETS sub-population. At this distance from shore, the *Langseth* will subject the entire ETS sub-population to noise levels much greater than 180 dB.

CSI also states that even staying greater than or equal to 2 km from the coastline (a proposed mitigation measure to reduce the impact on the ETS sub-population) does absolutely nothing to reduce the noise exposure to these critically endangered dolphins. Even at 8 to 10 km from shore, the survey will still expose all animals to greater than 160 dB and an unknown number would still be exposed to greater than 180 dB. The above statements are conservative because they are based on the predicted rms distances for different levels of exposure (Table 1 in the proposed IHA **Federal Register** notice), which a) underestimates actual exposure levels in shallow waters and b) does not consider reverberations that are likely to occur as a result of the solid concrete walls that are found along much of the central western coast of Taiwan, the very shallow water depths of western Taiwan (also, tidal fluctuation is up to about 5 to 6 m and can affect the depth in which the dolphins are found during exposure), or many sandbars that may force animals to be further offshore from the solid shoreline during lower tides. The grouping of exposures into the very broad category of 'shallow' water (being less than 100 m) is not sufficient to understand the exposure level for a species that occupies water depths at the lowest end of the 'shallow' water category. It is expected that the exposure levels will be much higher at the any given distance from source than the predicted values in the tables. The distance to reduce exposure to noise levels of 160 dB or greater is unknown for dolphins in water depths less than 25 m and could be much greater.

HSI states that the only way to avoid exposing these critically endangered dolphins to Level A harassment (or serious injury)—and also to avoid Level B harassment, to which this fragile population should arguably not be exposed either—is to move the proposed trackline considerably farther offshore than 10 km. There is no way to avoid them on the proposed trackline seasonally, as they are year-round residents. It is unacceptable that L–DEO proposes to run the *Langseth* directly through the only known habitat for this critically endangered population, employing mitigation measures that will clearly be ineffective at preventing Level A harassment and serious injury, let alone Level B harassment.

Response: After issuance of the proposed IHA, L–DEO modified the cruise plan and adopted more precautionary monitoring and mitigation measures. L–DEO will limit seismic survey lines to take place at least 20 km from the west coast of Taiwan, except for in the passage between the Penghu Island and the Waishanding Jhou sandbar, where the survey will pass through the approximately 17.1 km mid-line distance between the two possibly sensitive areas, subject to the limitations imposed by other foreign nations, to minimize the potential for exposing Indo-Pacific humpback dolphins, finless porpoises, and other coastal species to SPLs greater than or equal to 160 dB re 1 μPa (rms). Thus, L–DEO is maintaining the precautionary buffer recommended by ETSSTAWG in their comments to NMFS, ''at least 13 km and perhaps a more precautionary 15 km of

the ETS *Sousa* population—meaning up to around 20 km from shore.'' NMFS has included requirements to this effect in the IHA issued to L–DEO.

Comment 144: CSI states that calculations of how far the *Langseth* should be to prevent the ETS population from being exposed to levels greater than 160 dB should be based on at least the recommended 5 km buffer boundary (i.e., the waters from shore to 5 km offshore should not be exposed to levels greater than 160 dB). However, given the population's critical status and the fact that Table 1 underestimates the actual exposure levels in shallow water, the recommended distance should be even more precautionary, i.e., greater than 13 km from shore based on the values presented in Table 1 of the **Federal Register** notice.

Response: After issuance of the proposed IHA, L–DEO negotiated with the project's principal scientists to modify the cruise plan and adopt more precautionary mitigation measures. Off Taiwan's west coast the cruise tracks have been re-routed by approximately 20 km, except for in the passage between the Penghu Islands and the Waishanding Jhou sandbar, where the survey will pass through the approximately 17.1 km mid-line distance between the two possibly sensitive areas, subject to the limitations of foreign nations, to protect the critically endangered ETS Indo-Pacific humpback dolphin sub-population and the finless porpoise as well as ease potential pressure on other coastal species. Thus, L–DEO is maintaining the precautionary buffer recommended by ETSSTAWG in their public comments to NMFS, ''at least 13 km and perhaps a more precautionary 15 km of the ETS *Sousa* population—meaning up to around 20 km from shore.''

Comment 145: Dr. John Wang states the predicted rms distances for different levels of exposure (Table 1 of the proposed IHA's **Federal Register** notice), underestimates actual exposure levels in shallow waters and does not consider the issues with: reflection, reverberation, rarefaction, superposition and constructive interference (*see* Shapiro *et al.,* 2009) of sound waves in waters that abut concrete sea walls found along much of the central western coast of Taiwan; the very shallow water depths of western Taiwan (with a tidal fluctuation up to about 5–6 m that can affect the depth in which the dolphins are found during exposure); and the many sandbars and some extensive mudflats that can force animals to be further 'offshore' during lower tides.

Response: NMFS believes that while oceanographic conditions may alter sound levels, for purposes of this seismic survey, the model used for predicting received levels in L–DEO's IHA application and EA is the best science available. After the issuance of the proposed IHA, L–DEO has modified the cruise plan and adopted more precautionary monitoring and mitigation measures to reduce impacts on species and stocks of marine mammals in the study area. See NMFS' responses to comments in this document for relevant information.

Comment 146: Dr. John Wang states the water depths in the very broad category of ''shallow'' water (being <100 m in the proposed IHA's **Federal Register** notice) are not sufficient to understand the exposure level for a species (e.g., ETS Indo-Pacific humpback dolphins) that occupies water depths at the lowest end of the ''shallow'' water category. It is expected that the exposure levels will be much higher at any given distance from the source than the predicted values suggested.

Response: After issuance of the proposed IHA, L–DEO modified the cruise plan and adopted more precautionary monitoring and mitigation measures. The revised survey will maintain the precautionary buffer recommended by ETSSTAWG in their comments to NMFS, ''at least 13 km and perhaps a more precautionary 15 km of the ETS *Sousa* population—meaning up to around 20 km from shore.'' *See* L–DEO's Supplemental EA for more information.

Comment 147: Dr. John Wang states the waters of western Taiwan are highly dynamic with seasonal, monthly, daily and diel changes in water salinity, tidal fluctuations, water temperature and surface conditions that can not be explained by the simple model for predicting levels that was used in the L–DEO proposal. Given that a critically endangered population (the ETS sub-population of *Sousa chinensis*), two vulnerable and very difficult species to detect (*i.e.,* finless porpoises) and the Indo-Pacific bottlenose dolphin are found in very shallow waters it is crucial that sound levels under differing conditions in shallow waters be better understood before impacts to cetaceans are trivialized.

Response: NMFS believes that while oceanographic conditions may alter sound levels, for purposes of this seismic survey, the model used for predicting received levels in L–DEO's IHA application and EA is the best science available. After the issuance of the proposed IHA, L–DEO has modified the cruise plan and adopted more precautionary monitoring and mitigation measures to reduce impacts on species and stocks of marine mammals in the study area. See NMFS' responses to comments in this document for more relevant information.

MMPA Concerns

Comment 148: Dr. Robert Brownell states that the possible numbers of marine mammals exposed to sound levels greater than or equal to 160 dB, during the proposed L–DEO seismic survey in SE Asia, should be considered erroneous based on regional population estimates from two main sources. Of the 37 cetacean populations listed in Table 2 of the **Federal Register** notice (78 FR 78294, December 22, 2008), 22 are from the ETP and have no relationship at all to the region to be surveyed in the western North Pacific. Humpback whales are correct. The minke whale and Bryde's whale estimates are generally correct. Omura's whale may be common in some parts of the survey area. Sei, fin, and blue whales are likely to be rare at best in the survey area. For the small cetacean, 15 of the 28 population estimates are from the ETP and these should not be used for the proposed survey area. Sperm whales may be common as opposed to ''uncommon'' in deeper waters off the eastern side of Taiwan and in some parts of the Philippines. The estimate for Pacific white-sided dolphins is for the entire North Pacific and this species as noted is rare or does not occur in most of the proposed survey area. Most of the estimated 5,220 to 10,220 finless porpoise occur in the coastal waters of Japan, not in Taiwan or along the coast of China. In the case of Indo-Pacific humpback dolphins, the estimate of 1,680 animals includes about 100 from Taiwan. The IUCN has listed the subpopulation of these dolphins along the limited part of the western coast of Taiwan as ''critically endangered'' and the subpopulation is estimated at 100 individuals. Based on the problems of the population estimates noted above, the estimates of the possible number of cetaceans exposed in Table 3 of the **Federal Register** notice (78 FR 78294, December 22, 2008) are unrealistic either as the best estimate or maximum.

Response: NMFS acknowledges Dr. Robert Brownell's comment and the information provided. The information included in the proposed IHA has been updated in this *Federal Register* notice based on comments from the public. As noted previously, when information is unavailable on a local population size, NMFS uses either stock or species information on abundance. Since NMFS, uses the best information that is

available, estimating impacts on marine mammals in this manner is appropriate. *See* responses to comments below.

Comment 149: Dr. Robert Brownell states the NMFS Permit Office appears to have preliminarily determined that the proposed seismic surveys will not cause any death or serious injury to cetaceans in the survey area. This is not a precautionary approach and some consideration should be given to the possibility that some beaked whales or schools of other small cetaceans may mass strand in response to the surveys. Brownell *et al.* (2008) reviewed the numerous fisheries that have used sounds to hunt cetaceans. The success of these fisheries shows that numerous species of small cetaceans avoid and move away from a wide variety of anthropogenic sounds, some as simple as hitting two rocks together underwater. Therefore, some advanced plan must be made to respond to any stranding of live animals during the proposed seismic surveys.

Response: The preliminary determination made by NMFS in L–DEO's proposed IHA was not a final determination. NMFS requested comments on its proposal to authorize L–DEO to incidentally take, by Level B harassment only, small numbers of marine mammals during the marine seismic survey in SE Asia during March–July 2009. Based on comments received from the public, L–DEO revised the proposed seismic survey in SE Asia. Conservative monitoring and mitigation measures were enhanced, as compared to those described in the proposed IHA notice. The mitigation and monitoring measures ensure the least practicable adverse impact on marine mammals in the SE Asia study area. L–DEO is not using sound for purposes of creating a drive fishery targeted at hunting or capturing cetaceans as discussed in Brownell *et al.* (2008). Any takes of marine mammals incidental to L–DEO's seismic activities would be Level B harassment due to the implementation of the monitoring and mitigation measures described in the IHA and no injury, serious injury, or mortality is authorized. L–DEO, to the maximum extent practicable, will schedule seismic operations in inshore and shallow waters during daylight hours and OBS operations in nighttime hours; as well as conduct seismic surveys (especially inshore) from the coast (inshore) and proceed towards the sea (offshore) in order to avoid trapping marine mammals in shallow water. Requirements to these effects have been included in the NMFS-issued IHA. NMFS believes L–DEO's revised seismic survey and the implementation of the required monitoring and mitigation measures will have a negligible impact on affected species and stocks of marine mammals in the study area.

Comment 150: NRDC states that there are two types of general exemptions available through the MMPA for activities that incidentally ''take'' marine mammals: permits and incidental harassment authorizations. Until 1994, the only exemptions available under the MMPA were permits, which require the wildlife agencies to promulgate regulations specifying permissible methods of taking. In 1994, however, the MMPA was amended to provide a streamlined mechanism by which proponents can obtain authorization for projects whose takings are by incidental harassment only. 16 U.S.C. 1371(a)(5)(D). Regardless of which process is used, NMFS must prescribe ''methods'' and ''means of effecting the least practicable impact'' on protected species as well as ''requirements pertaining to the monitoring and reporting of such taking.'' 16 U.S.C. 1371(a)(5)(A)(ii), (D)(vi).

Response: The mitigation measures described in the proposed IHA notice have been enhanced subsequently by increased observer personnel, temporal and spatial avoidance of areas, as well as for species of particular concern. NMFS believes that the mitigation and monitoring measures that were imposed under the IHA are complete to the fullest extent practicable, and ensure that the takings will be limited to Level B harassment and will result in a negligible impact on the affected species or stocks of marine mammals in the study area. The mitigation measures described in the proposed IHA notice have been enhanced subsequently by increased observer personnel, temporal and spatial avoidance of areas, as well as for species of particular concern.

Comment 151: Dr. John Wang and CSI state that it has been suggested that recent mass strandings of melon-headed whales were related to the use of naval sonar (in Hawaiian waters—Southall *et al.,* 2006) and seismic surveys (in Madagascan waters) so there is growing concern about the potential impact of such activities on this species. Melon-headed whales, although not a commonly-observed species have been sighted on several occasions in the waters of eastern Taiwan and southwest Taiwan, respectively (Wang *et al.,* 2001a). Seismic surveys along the shelf edge of eastern Taiwan during the daytime will likely have an impact.

Response: NMFS is also concerned about potential impacts on this species due to these recent events. The behavior of melon-headed whales near oceanic islands was recently described in Brownell *et al.* (2009). Due to concerns, the survey line paralleling the east coast of Taiwan was moved offshore by more than 20 km after issuance of the proposed IHA to decrease potential impacts on species that occur in coastal waters and over the continental slope. L–DEO will also, to the maximum extent practicable, schedule seismic operations in inshore and shallow waters during daylight hours and OBS operations during nighttime hours. Requirements to these effects have been included in the NMFS-issued IHA. L–DEO's revised seismic survey incorporating the implementation of the required monitoring and mitigation measures are expected to have a negligible impact on the affected marine mammal species and stocks in the study area.

Comment 152: Dr. John Wang states that seismic surveys should not be conducted in the spring (when many species give birth). The survey period (from 21 March to 14 July) proposed by L–DEO is probably the worst choice of seasons if minimizing impacts to marine mammals is sought. The above scheduling overlaps almost entirely with the confirmed presence of humpback whales, likely presence of gray whales and possible presence of right whales in the region. Calving for most cetacean species (including those that are critically endangered—see above) in this region appear to be in the spring to early summer as evidenced by sightings of many females with neonates and other young calves during cetacean surveys and the examination of hundreds of carcasses (J.Y. Wang, unpublished data). Seismic surveys should not be conducted in the autumn and winter until more information about marine mammals in these waters during these seasons is available.

Response: Conducting the seismic survey during a different time of year is not feasible, as the *Langseth* has other research commitments after the TAIGER cruise. Also there are concerns with weather conditions associated with the typhoon season. Due to concerns regarding humpback whales, Western Pacific gray whales, and other species, L–DEO has revised their planned survey, after issuance of the proposed IHA, to avoid breeding and feeding areas as well as migration routes. See L–DEO's Supplemental EA and relevant discussions in this document. NMFS has included temporal and spatial avoidance restrictions to these effects in the IHA. NMFS believes that the revised survey as well as the implementation of the required monitoring and mitigation

measures will protect species of particular concern in the study area.

Comment 153: CSI states that there is an inappropriate use of data from other areas. The use of data from the Eastern Tropical Pacific for estimating the densities and number of individuals impacted by the proposed seismic survey is completely inappropriate as there is no evidence that the two sites of the Pacific Ocean are comparable. Such extrapolation would not be acceptable to most cetacean scientists. This should be re-examined carefully.

Response: NMFS agrees that impacts should be assessed on the population or stock unit whenever possible. L–DEO's application provides information on stock abundance of some species in SE Asia and larger water bodies (such as the North Pacific Ocean). The data source for each stock estimate is provided. NMFS believes that these data are the best scientific information available for estimating impacts on marine mammal species and stocks. However, information on marine mammal stock abundance may not always be satisfactory. When information is lacking to define a particular population or stock of marine mammals then impacts are assessed with respect to the species as a whole (54 FR 40338, September 29, 1989).

MMPA Concerns—Small Numbers

Comment 154: Minor and Wilson state the summary in the **Federal Register** listing says the proposal is to take ''small'' numbers of marine mammals. However, the actual proposed ''take authorization'' by L–DEO is for 71,669 cetaceans. Minor and Wilson propose that a reasonable upper bound for a small number is what can be counted on their fingers and toes. The **Federal Register** summary that twice used the word ''small'' to describe the number 71,669, while failing to mention the actual number, so misinformed the public that the resulting public consultation process is clearly invalid.

Response: NMFS disagrees with Minor and Wilson's comment. The number stated by Minor and Wilson is the total number of individuals requested in the proposed IHA and must be considered in the appropriate context. An activity affects ''small numbers'' of a species or stock when it is determined that the total taking will be small relative to the estimated population size and relevant to the behavior, physiology, and life history of the species or stock. Furthermore, after issuance of the proposed IHA, L–DEO has revised its seismic tracklines and reduced the estimates of the possible number of marine mammals exposed to certain sound levels during the TAIGER seismic survey. NMFS believes L–DEO's revised seismic survey and the implementation of the required monitoring and mitigation measures will have a negligible impact on affected species and stocks of marine mammals in the study area.

Comment 155: Dr. John Wang disagrees that the proposed survey will have a negligible impact on local species of stocks of marine mammals. The estimated number of individuals affected (>50,000 and with 68.7% of one critically endangered population of dolphins being affected) cannot be considered ''small.''

Response: NMFS believes that the revised seismic survey described in L–DEO's Supplemental EA incorporating the implementation of the monitoring and mitigation measures required in the IHA will have a negligible impact on affected local species and stocks of marine mammals in the TAIGER study area. NMFS believes that the monitoring and mitigation measures described below, which have been enhanced when compared to the proposed IHA notice, ensure the least practicable adverse impact on marine mammals in the SE Asia study area. See response to comment above.

Comment 156: Several interested parties are concerned about impacts of any level of take on small or vulnerable populations. Several cetaceans are in such critically low numbers that even minimal 'takes' can contribute greatly to the demise of these populations. Most of the values in Table 3 do not make any sense to those who have experience with local marine mammal populations in the region (*e.g.,* the take of 64 Cuvier's beaked whales compared with 168 Blainville's beaked whales; a take of 189 killer whales compared with only 68 finless porpoises). These numbers are little better than random guesses. The statement from the **Federal Register** notice is incorrect. L–DEO estimated that 68.7% of the critically endangered ETS population of humpback dolphins will be impacted. Although this is a serious underestimate (explained earlier), it is already a very high proportion of this distinct population and the mitigation measures proposed do not minimize the exposure level to these dolphins. The taking is also expected to include Level A harassment rather than just Level B as claimed by L–DEO. The taking (both Level A and B) of such a large proportion of the ETS dolphins could have an irreversible impact on the continued survival of the population.

Response: Since the issuance of the proposed IHA, L–DEO has revised their seismic survey and will implement additional mitigation measures to address concerns regarding several species of cetaceans in the study area. NMFS has included these as requirements in the IHA. There have been few, if any, systematic aircraft- or ship-based surveys conducted for marine mammals in waters near Taiwan, and the species of marine mammals that occur there is not well known. In the absence of any other density data, L–DEO used the survey effort and sightings in Yang *et al.* (1999) and Wang *et al.* (2001a) to estimate densities of marine mammals in the TAIGER study area. For other areas with an absence of density data, density data from the Eastern Tropical Pacific was used. There is some uncertainty about the representativeness of the density data and the assumptions used in the calculations. Furthermore, NMFS believes that the data provided is the best available information and likely overestimates the potential number of animals affected. NMFS believes that L–DEO's revised seismic survey incorporating the implementation of the monitoring and mitigation measures described in the IHA will have a negligible impact on the affected marine mammal species and stocks in the study area.

Comment 157: Several interested parties have stated that the number of ETS Indo-Pacific humpback dolphins potentially affected by sound levels greater than or equal to 160 dB in L–DEO's proposed IHA is an unacceptably high proportion (68.7 percent of the sub-population). This is by far the largest proportion of any cetacean in the region to be affected. This high proportion in itself is a severe underestimation of the population being impacted, as the *Langseth* will transect the entire distribution of the ETS sub-population. The dolphins, which have no acoustic shelters in these waters, are not capable of escaping to quieter waters and will be completely exposed for the duration of the seismic survey. Over two-thirds cannot be reasonably argued to constitute a ''small number'' of dolphins in any context, let alone the context of there being less than 100 individuals in existence, therefore, the requested level of impacts of this survey exceeds the coverage provided by IHAs. Also, given the proposed tracklines, a likely large but unknown number of ETS Indo-Pacific humpback dolphins will be exposed to levels >180 dB, which may result not only in Level A harassment,

but also permanent injuries or even death.

Response: Since the issuance of the proposed IHA, L–DEO negotiated with the project's principal scientists to modify the cruise plan and adopt more precautionary monitoring and mitigation measures. Off Taiwan's west coast, the cruise tracks have been re-routed offshore by approximately 20 km to protect critically endangered ETS Indo-Pacific humpback dolphins as well as other coastal species. Thus, it is now planned to maintain the precautionary buffer recommended by ETSSTAWG in their comments to NMFS, ''at least 13 km and perhaps a more precautionary 15 km of the ETS *Sousa* population—meaning up to around 20 km from shore'' (see L–DEO's Supplemental EA). L–DEO will also shut-down immediately if there is a sighting of an Indo-Pacific humpback dolphin sighted at any distance from the vessel. Based on the re-routed tracklines, has revised estimates of the possible numbers of ETS Indo-Pacific humpback dolphins exposed to sound levels that would constitute Level B harassment to zero (0 percent of the ETS sub-population). NMFS considers zero to be a ''small number'' and considered the revision in its determinations towards the issuance of the IHA.

L–DEO's action is planned to take place in the territorial seas and EEZ's of foreign nations, and will be continuous with the activity that takes place on the high seas. NMFS does not authorize the incidental take of marine mammals in the territorial seas of foreign nations, as the MMPA does not apply in those waters. However, NMFS still needs to calculate the level of incidental take in territorial seas as part of the analysis supporting issuance of an IHA in order to determine the biological accuracy of the small numbers and negligible impact determinations.

NEPA

Comment 158: WaH states the EA contains several erroneous claims, omissions, and unacceptable proposals with regards to the critically endangered ETS population of Indo-Pacific humpback dolphins (*Sousa chinensis*).

Response: NMFS acknowledges WaH's concerns with the EA's analysis of the ETS population of Indo-Pacific humpback dolphins. Because WaH did not offer specific details, NMFS cannot respond directly to this comment. Please note that in response to public comments received on the application and EA, L–DEO has modified the survey design (see L–DEO's Supplemental EA) and adopted more precautionary mitigation measures to protect the critically endangered ETS population, as well as ease potential pressure on other coastal species.

Comment 159: Several commenters believed that NSF violated the tenets of the NEPA by committing resources for the seismic survey before completing the EA, which they described as pre-decisional, biased, and falling short of the high standard of environmental analysis prescribed by NEPA.

Response: In accordance with NEPA, an irreversible or irretrievable commitment of resources refers to impacts on or losses to resources that cannot be recovered or reversed, i.e., losses are permanent or effects to uses of resources (e.g., mineral resources, natural productivity) that are renewable only over long periods of time. The referenced discussion in the EA is specific to the scheduling of the *Langseth* to make the best use of the vessel to support the NSF science mission. Advance vessel scheduling does not constitute an irreversible or irretrievable commitment of resources as that term is intended under NEPA.

Comment 160: The most comprehensive study undertaken on the impacts of seismic surveys on the fishing industry in Norway in 1996 showed that fishing catches were impacted to as far as 33 km from seismic testing. I can only assume this is also not good for marine mammals who have a limited range, such as *Sousa.* The paper can be found in Norwegian at *http://www.fiskeribladetfiskaren.no/filarkiv/vedlegg/96.pdf.*

Response: NMFS thanks the commenter for providing the link to the article. As the study is in Norwegian, it is not appropriate to compare the size of the airgun array, water depth, and zones of influence between the two activities, for marine mammals until NMFS is able to obtain a translation of the article.

Engas *et al.* (1996) studied on the effects of seismic shooting on local abundance and catch rates of cod (*Gadus morhua*) and haddock (*Melanogrammus aeglefinus*) in the Barents Sea (near Norway). Although the authors reported that trawl catches of cod and haddock and longline catches of haddock declined on average by about 50% (by mass) after seismic operations commenced, they observed that abundance and catch rates returned to pre-shooting levels five days after the cessation of seismic operations.

Finally, NMFS has reviewed L–DEO's EA and supplemental EA and has determined that no more than Level B harassment of marine mammals would occur. Any marine mammal that could be exposed to the seismic survey would likely experience short-term disturbance as supported by prior studies. Marine mammals are expected, at most, to show an avoidance response to the seismic pulses. Further, mitigation measures such as controlled speed, course alteration, visual and passive acoustic marine mammal monitoring, and shut-downs when marine mammals are detected within the defined ranges should further reduce short-term reactions to disturbance, and minimize any effects on hearing sensitivity.

Comment 161: NSF's EA and L–DEO's Assessment Report did not fully analyze impacts on marine mammals; lacked abundance and distribution data for marine mammal species in the proposed waters; failed to assess cumulative impacts, reasonable alternatives, or mitigation measures; and provided no evidence of consultation with local marine mammal experts.

Response: NMFS disagrees with the commenter's assertions. *Please see* NMFS' response to comments in the Effects Analysis and Species of Particular Concern sections.

Comment 162: NEPA requires decision-makers to consider alternatives to their proposed actions. Thus, L–DEO must evaluate reasonable alternatives that would avoid or minimize adverse impacts to the proposed seismic surveys. *See, e.g.,* CFR 1502.1. Yet L–DEO's alternatives analysis analyzes only the specified dates and does not even consider conducting the proposed study during an alternate season, such as winter and fall, which would avoid breeding, calving and migration for many marine mammal species in the proposed survey areas. As discussed in Section II and Appendix A, temporal and spatial avoidance is necessary in order to minimize impacts on marine mammals and therefore must be considered by NMFS and L–DEO.

Response: NMFS disagrees with the commenter's assertion. NMFS has reviewed NSF's EA, and determined that it contains an adequate description of NMFS' proposed action and reasonable alternatives, including a No Action and Another Time Alternative Action (See pages 16 to 17 of the EA). The impacts of the seismic survey action on marine mammals are specifically related to acoustic activities, and these are expected to be temporary in nature and not result in substantial impact to marine mammals. The IHA anticipates, and would authorize, Level B harassment only, in the form of temporary behavioral disturbance, of several species of cetaceans. Neither Level A harassment (injury), serious injury, nor mortality is anticipated nor authorized.

For the purposes of NMFS' Federal action (i.e., the issuance of an MMPA authorization) the alternatives are adequate. Thus, for the reasons stated throughout the text of this notice, NMFS believes that the agency is in compliance with both the MMPA and NEPA.

Comment 163: Several commenters disagreed with the EA's conclusion that the TAIGER seismic survey would add little to the cumulative impacts of anthropogenic noise in the survey area. As such, they alleged that L–DEO: (1) Did not assess the cumulative impacts of multiple sources of noise; (2) failed to consider the synergistic effects of noise with other stressors in producing or magnifying a stress-response; and (3) presented an invalid argument that impacts on marine mammals were expected to be no more than minor and short-term.

Response: NMFS has determined that the EA adequately addressed the cumulative impacts of a short-term, low-intensity seismic airgun survey in relation to long-term noise and taking events, such as vessel traffic, habitat loss, oil and gas industry, pollution, fisheries, and hunting.

NMFS endangered species scientists have conducted a thorough review of the best available information on the cumulative effects of the proposed project. As a result, NMFS issued a BiOp on the proposed action on March 31, 2009 (NMFS, 2009), which stated that the survey was not likely to jeopardize the continued existence of listed marine mammals in the survey area.

L–DEO discusses cumulative effects of noise in the EA (*see* pages 71–79) and drew comparisons between TAIGER and other sources of anthropogenic noise (i.e., vessel traffic, habitat loss, oil and gas industry, pollution, fisheries, and hunting) in the proposed survey areas. These multiple sources of anthropogenic noise are considered to be long-term, continuous activities which are unaffected by NMFS' issuance of an incidental take authorization for Level B harassment only, in the form of temporary behavioral disturbance.

In regards to stating that the impacts of seismic surveys are small compared to other activities, NMFS believes that the signals do not add appreciably to the ambient noise levels, and therefore do not accumulate, or collect, to greater effects. The conclusion reached in the EA that even when considered in combination with other underwater sounds, seismic sound does not add appreciably to the underwater sounds that fish, sea turtles and marine mammals are exposed to, remains valid.

Precautionary Approach

Comment 164: WaH states the proposed mitigation measures are inadequate, do not sufficiently allow for local marine mammal observation conditions, and are weaknesses which augment the risk of impacts in a region where cetacean status and distribution are relatively poorly understood. According to WaH, the lack of reliable information from systematic surveys in the relatively poorly-studied SE Asian region, as in other regions, necessitates the highest levels of precaution in estimating and attempting to mitigate potential impacts. WaH states that even best practice marine mammal visual observation, shut down, and other measures can provide no guarantee against significant impacts on populations in these regions (citing inherently low observation sighting rates for species such as beaked whales and evidence that some species decrease or cease vocalizing in response to seismic surveys). WaH states that L–DEO has not attempted to adopt all available precautionary measures that may help to reduce impacts.

Response: NMFS disagrees with WaH's comments. NMFS believes that the monitoring and mitigation measures ensure the least practicable impacts and ensure that any incidental takings will be limited to Level B harassment and will result in a negligible impact on the affected species or stocks of marine mammals in the study area. As discussed elsewhere in this document, after issuance of the proposed IHA, L–DEO has modified the cruise plan and adopted more precautionary monitoring and mitigation measures to reduce potential impacts on marine mammals. NMFS believes that the implementation of these monitoring and mitigation measures described in the IHA issued to L–DEO will ensure that the seismic survey will have a negligible impact on the affected species and stocks of marine mammals in the study area. *See* L–DEO's Supplemental EA.

Comment 165: HSI states the agency and the applicant focus in great detail on specific results from the limited number of scientific studies on acoustic impacts on marine mammals (when, for example, results show some marine mammal species do not avoid vessels conducting seismic surveys) in order to support their conclusion that impacts from the proposed surveys will be negligible. When specific study results do not support their conclusion of negligible impacts (when, for example, results show that some marine mammal species cease vocalizing when exposed to seismic airguns), they pass over them quickly with little discussion. Similarly, the **Federal Register** notice frequently emphasizes the lack of evidence for impacts, in what seems to be an effort to make the classic (and inappropriate) argument that absence of evidence is evidence of absence of impacts. At no time does the **Federal Register** notice take the position that a lack of information should be treated as grounds for a precautionary approach.

Response: NMFS disagrees with this characterization of the **Federal Register** notice. NMFS relies on the best scientific information available. NMFS believes that the mitigation and monitoring measures that have been imposed under the IHA issued to L–DEO are conservative and ensure the least practicable adverse impacts. Mitigation measures such as power-downs, shut-downs, speed and course alterations, and the use of MMVO's and PAM for visual and acoustic detection will ensure that marine mammals that do not avoid the *Langseth* while operating seismic sound sources will not be potentially impacted during the survey. The monitoring and mitigation measures also ensure that the takings will be limited to Level B harassment and will result in a negligible impact on the affected species or stocks of marine mammals in the study area. After issuance of the proposed IHA, L–DEO modified the cruise plan and adopted more precautionary monitoring and mitigation measures. L–DEO has also subsequently increased observer personnel and re-routed survey tracklines. *See* L–DEO's Supplemental EA.

Comment 166: ETTSTAWG states that the project description must adopt a 'precautionary approach' when extrapolating from the literature to the particular acoustic environment of the study area, and when considering 'unknowns' ('absence of evidence is not evidence of absence').

Response: After issuance of the proposed IHA, L–DEO modified the cruise plan and adopted more precautionary monitoring and mitigation measures. NMFS believes that L–DEO's revised survey as well as the implementation of the monitoring and mitigation measures described in the IHA will have a negligible impact on the affected species or stocks of marine mammals in the study area. *See* NMFS' responses to comments in Precautionary Approach above and other relevant discussions throughout this document.

Comment 167: ETTSTAWG states that since empirical data is not available for L–DEO operations (and what is

available at deep and shallow was from shorter arrays) in intermediate distances, the extrapolation in the EA (''On the expectation that results would be intermediate between those from shallow and deep water, a correction factor of 1.1 to 1.5x was applied to the estimates provided by the model for deep-water situations to obtain estimates for intermediate-depth sites.'') should be much more precautionary. Perhaps L–DEO should use a mean between the shallow and deep water ranges, rather than one adjusted by the apparently arbitrary correction factor. *See* Table 1.

Response: L–DEO acknowledges in their application the shortcomings of the models for predicted sound levels in shallow water. Regarding the model, L–DEO conducted an acoustic calibration study of the *Ewing*'s 20 airgun, 8600 in3 array in the Gulf of Mexico in 2003 (Tolstoy *et al.* 2004a,b). During the study, researchers conducted calibration measurements for a 6, 10, 12, and 20 airgun array configurations at a depth of approximately 30 m (98 ft) to gather empirical data on the measured values (i.e., received sound level) for the 160 to 190 dB re 1 μPa (rms) radii. In the 2003 study, Tolstoy *et al.* (2004b) reported that for the 20 airgun array, the 160-dB radius in shallow water was 33% higher than predicted (Predicted = 9 km [5.5 mi]; Measured = 12 km [7.4 mi]). According to Tolstoy *et al.* (2004b), the results indicated that reverberations played a significant role in received levels of sound in shallow water and that previously estimated radii for 160 and 180 dB had not accounted for bottom reverberations. Thus, the predicted radii were underestimates of the actual distances where the 160 and 180 dB levels occurred in shallow water. The authors recommended that L–DEO extend the radii by an appropriate factor to account for this underestimation. As a result, L–DEO developed correction factors for water depths 100 to 1,000 m (328–3,281 ft) and less than 100 m (328 ft).

For the TAIGER cruise, L–DEO has applied conservative correction factors to develop appropriate shallow water exclusion zones (see Table 1 in 72 FR 78294, December 22, 2008) to mitigate for potential effects on marine mammals. At this time, NMFS believes that this is the best available scientific data for estimating seismic sound propagation and establishing isopleths for the *Langseth*'s airgun configuration. L–DEO has measured the *Langseth*'s seismic source array, and initial results, which do not significantly vary from those stated here, will be published in the future.

Comment 168: Dr. John Wang states the applicant has not attempted to minimize the impacts of its survey; has not taken a precautionary approach in addressing potential impacts, and has not adopted mitigation measures that are effective. Wherever uncertainties in impacts and knowledge exist, the applicant consistently interpreted the uncertainties as supporting its position of little or no impact. Not only are such interpretations biased, misleading and contradictory, but they are scientifically incorrect. Absence of evidence is not evidence of absence of impacts.

Response: After issuance of the proposed IHA, L–DEO revised its seismic survey and adopted more precautionary mitigation measures. NMFS believes that the monitoring and mitigation measures that have been imposed under the IHA issued to L–DEO ensure that the takings will be limited to Level B harassment and will result in a negligible impact on the affected species or stocks of marine mammals in the study area. See L–DEO's Supplemental EA.

Effects Analysis

Comment 169: The concern over anthropogenic noise and its potential effect on cetaceans has led to repeated resolutions by multinational groups and organizations including the Agreement on the Conservation of Small Cetaceans of the Baltic and North Seas (ASCOBANS, 2006), the Agreement on the Conservation of Cetaceans of the Black and Mediterranean Seas (ACCOBAMS, 2004), and the European Commission (2004), for member countries to take precautionary mitigating measures, although to date there has been a continuing failure of most countries to do so (Parsons *et al.,* 2008).

Response: The MMPA requires NMFS to prescribe mitigation measures to achieve the least practicable adverse impact whenever NMFS authorizes take of marine mammals. In this IHA, NMFS prescribed mitigation measures that achieve the least practicable adverse impact, such as: re-routing the cruises tracklines further offshore by approximately 20 km to protect the critically endangered ETS Indo-Pacific humpback dolphins and the finless porpoise; visual marine mammal monitoring, and shut-downs when marine mammals are detected within the defined ranges should further reduce short-term reactions to disturbance, and minimize any effects on hearing sensitivity. The best available scientific information demonstrates that shut-down at 180 dB is conservative. (Southall *et al.,* 2007).

Comment 170: WAHLDA states that even the high number of dolphins estimated in the EA to be potentially harassed does not accurately reflect the potential impact, as the entire ETS humpback dolphin habitat could be ensonified at received levels of >160 dB re 1 μPa (rms), with some dolphins being exposed to received levels of >180dB (rms), with some dolphins being exposed to received levels of >180 dB (rms), given that the survey tracklines pass within 1 km of shore (or 2 km if proposed mitigation measures are applied) [as described in 73 FR 78294, December 22, 2008]; and therefore directly through the shallow, narrow, linear coastal ETS humpback dolphin habitat which extends to 5 km from shore.

Response: The exposure estimates produced by the EA model: (1) Do not take into consideration the implementation of mitigation measures to avoid incidentally harassing marine mammals; (2) assume that the animals do not move away from the *Langseth* before ensonification at received levels greater than or equal to 160 dB; and (3) are based on overestimated densities of several species of marine mammals. As a result, NMFS believes that the exposure estimates are conservative and that the seismic survey may actually affect far fewer marine animals that predicted.

In response to comments received from the public, L–DEO has completed a Supplemental EA for the TAIGER survey. As a result of changes made to the location and timing of survey lines made after the publication of the proposed IHA and **Federal Register** notice, L–DEO has revised take estimates of the possible numbers of marine mammals exposed to different sound levels during L–DEO's proposed TAIGER seismic survey.

L–DEO and TAIGER's principal investigators have modified the cruise plan and survey design, adopted more precautionary mitigation measures to protect the critically endangered ETS population, as well as ease potential pressure on other coastal species. They have re-routed the cruise's tracklines offshore Taiwan's west coast by approximately 20 km (10.8 nautical mi) to protect the critically endangered Sousa population and the finless porpoise (except for in the passage between the Penghu Islands and the Waishanding Jhou (Wau-san-ting Chou) sandbar, where the survey will pass through the 17.1 km (9.2 nautical mi) mid-line distance between the two possibly sensitive areas); and are restricted to conducting seismic surveys in water depths greater than 200 m (656

ft) in the South China Sea, and as far east as possible from the mainland China side of the Taiwan Strait, to reduce potential for effects on western Pacific gray whales, Indo-Pacific humpback dolphins, and finless porpoises. In response to concerns about marine mammal species of special concern because of their low population sizes, L–DEO will shut down the airgun array immediately if there is a sighting at any distance of the Indo-Pacific humpbacked dolphin or finless porpoise. Correspondingly, take estimates of most of the other species will be lower because of the reduction in the ensonified area.

Comment 171: Many of the commenters expressed concern on the possible effects of the seismic surveys on the small population of Indo-Pacific humpback dolphins. They believed that the proposed survey: would cause minor impacts to individuals which may lead to threats to the existence of the ETS population; would expose individuals to noise levels greater than 180 dB leading to serious injury or death; and expose individual to noise levels that may increase the likelihood of negative interactions with boats and gillnets.

Response: NMFS appreciates the outpouring of concern for the well-being of the marine mammals in and around the Taiwan Strait and South China Sea. For reasons discussed in the **Federal Register** notice of receipt of the application (73 FR 78294, December 22, 2009), L–DEO only requested Level B harassment (behavioral harassment) of small numbers of marine mammals, not Level A (injury).

NMFS does not believe that there is any potential for marine mammal mortality to occur incidental to conducting the TAIGER seismic surveys in 2009. NMFS does not expect, nor did it authorize take by mortality or for this proposed activity. Incidental taking will be limited to a temporary and localized disturbance of animals from elevated sound levels from seismic airguns only. The incidental harassment authorization includes mitigation and monitoring measures to reduce the potential for injury or mortality, as well as instituting immediate shutdown protocols for the North Pacific right whale, Western Pacific gray whale, Indo-Pacific humpbacked dolphin, or finless porpoise.

The 160 dB isopleth is currently used for estimating the onset of Level B behavioral harassment for impulse noise sounds. However, as NMFS shows in this document, mortality and serious injury are not expected to occur during this seismic survey cruise due to implementation of mitigation measures (e.g., ramp-up, passive acoustic and visual monitoring, and quiet acoustic periods). 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 mitigation measures. Cetaceans are expected, at most, to show an avoidance response to the seismic pulses. Mitigation measures such as visual marine mammal monitoring, and shut-downs when marine mammals are detected within the defined ranges should further reduce short-term reactions to disturbance, and minimize any effects on hearing sensitivity.

Finally, detecting and scientifically validating a change in a marine mammal population (e.g., trend, demographics) is extremely difficult. It is also unrealistic to expect a single factor to explain population changes. To date, there is no evidence that seismic sound has an effect on individual survival or reproductive success, or population trends or demographics. However, because research on the appropriate temporal and spatial scales has not been conducted, questions concerning the level of impact at such scales remain. NMFS relies on the best available scientific information in determining whether to issue incidental take authorizations and in developing appropriate mitigation and monitoring measures.

Comment 172: Seismic airgun noise has been shown to impact a variety of species from cetaceans, to fish species, to squid, to even invertebrates. The fact that this noise covers a large area at high levels makes this survey potentially dangerous to marine life. There are indications that similar surveys have caused fatal giant squid and beaked whale strandings. While I understand that the *Langseth* probably has a better airgun configuration (safer for marine life) than its predecessor, the *Ewing,* it appears very little was learned from past experience.

Response: The IHA issued to L–DEO, under section 101(a)(5)(D) of the MMPA, provides mitigation and monitoring requirements that will protect marine mammals from any injury or mortality. L–DEO is required to comply with the IHA's requirements. Detailed analyses of underwater noise, especially those from airguns, and impacts to cetaceans, fish, and invertebrates are provided in various documents related to the proposed project. These include: (1) The **Federal Register** notice for the receipt of L–DEO's application (73 FR 78294, December 22, 2008); (2) the EA and SEA for the TAIGER seismic; (3) and the BiOp and ITS. These analyses are supported by extensive scientific research and data. These reviews have led NMFS to conclude that the proposed seismic surveys would have a negligible impact on the affected species or stocks of marine mammals and are not likely to jeopardize the continued existence of any ESA listed species.

The evidence linking giant squid (*Architeuthis dux*) strandings and seismic surveys remains inconclusive at best. Most of the information on acoustic effects on squid is derived from non-peer reviewed sources such as industry reports, government reports, conference proceedings, and news articles. NMFS is aware of two sources that attempted to link giant squid strandings and seismic surveys. The first is a presentation given at the International Council for Exploration of the Sea (ICES) Annual Science Conference in 2004 (Geurra *et al.,* 2004). The authors reported that a total of nine squid stranded or surfaced in the Bay of Biscay in 2001 and 2003 and conducted necropsies on seven of the specimens which were previously frozen and then thawed for examination. In that presentation, Guerra *et al.* (2004) speculated that the mortalities were the result of geologists conducting marine geophysical surveys in the vicinity. However, the authors failed to describe the seismic sources, locations, and durations of the surveys which resulted in a lack of knowledge regarding the spatial and temporal correlation between the squid and the sound source. In addition, there were no controls and the examined animals had been dead long enough for commencement of tissue degradation. The second source, an article in *New Scientist* magazine (MacKenzie, 2004), only summarizes and repeats Guerra *et al.* (2004) claims without additional empirical evidence. Thus, it cannot be used as the best available information for assessing impacts of airgun sounds on marine invertebrates.

As in the case of the giant squid, the scientific evidence linking beaked strandings and seismic surveys still remains inconclusive. However, the association of mass strandings of beaked whales with naval exercises (Malakoff, 2002), has raised the possibility that beaked whales exposed to strong ''pulsed'' sounds may be susceptible to injury and/or behavioral reactions that can lead to stranding (e.g., Hildebrand, 2005; Southall *et al.,* 2007). Suggestions that there was a link between seismic surveys and strandings of humpback whales in Brazil (Engel *et al.,* 2004) were not well founded (IAGC, 2004; IWC, 2007). In September, 2002, two

Cuvier's beaked whales stranded in the Gulf of California, Mexico. The *Ewing* had been operating a 20 airgun, 8,490-in^3 airgun array 22 km offshore the general area at the time that strandings occurred. The link between the stranding and the seismic surveys was inconclusive and not based on any physical evidence (Hogarth, 2002; Yoder, 2002) as some vacationing marine mammal researchers who happened upon the stranding were ill-equipped to perform an adequate necropsy. Furthermore, the small numbers of animals involved and the lack of knowledge regarding the spatial and temporal correlation between the beaked whales and the sound source underlies the uncertainty regarding the linkage between seismic sound sources and beaked whale strandings (Cox *et al.,* 2006).

No injuries of beaked whales are anticipated during the proposed study because of: (1) The high likelihood that any beaked whales nearby would avoid the approaching vessel before being exposed to high sound levels; (2) the proposed monitoring and mitigation measures; and (3) differences between the sound sources operated by the *Langseth* and the *Ewing,* as the *Langseth's* source arrays have a smaller airgun volume than the *Ewing's*.

Comment 173: The possibility of trophic cascades was also unaddressed. Most marine animals are acoustically sensitive. Since components in the marine ecosystem are particularly interlinked, such effects cannot be discounted. It is time serious consideration be given to (possibly) subtle, long-term impacts at the level of the population and ecosystem. These are the effects we should be most concerned about, yet they barely receive any attention in this application.

Response: NMFS acknowledges the public's concern about the effects of seismic sound on prey items of marine mammals. However, NMFS would refer the commenter to Chapter 4 section 5 of the final EA titled ''Direct Effects on Fish and Their Significance''; section 6 titled ''Direct Effects on Invertebrates and Their Significance''; Appendix D: Review Of Potential Impacts Of Airgun Sounds On Fish; and Appendix E: Review Of Potential Impacts Of Airgun Sounds on Marine Invertebrates to see the applicant's analysis and consideration of potentially affected trophic species. NMFS believes that L–DEO sufficiently analyzed the current research on the effects of seismic sound sources on fish and invertebrates.

Comment 174: Minor and Wilson have read the IHA request and are disappointed about the lack of balance in its presentation. The numerous graphs and tables that describe the activity and levels of take are not well supported with data. ''Little is known about'' is a common refrain concerning biological effects, and the document notes that models used underestimate the actual sound levels by as much as 15x (which is a 1,500 percent modeling error).

Response: The L–DEO application, the NSF's EA and SEA, and the BiOp and ITS provided the necessary information and analyses needed for NMFS to determine whether the proposed incidental harassment takings would be of small numbers of marine mammals and would have no more than a negligible impact on marine mammals pursuant to the MMPA. Because Minor and Wilson did not offer specific details on the specific graphs and tables in question, NMFS cannot respond directly to their concerns on the lack of supported data.

NMFS disagrees with the commenters' assertions about the lack of balance in the application. NMFS published the proposed regulations on December 22, 2008 (72 FR 78294) and on January 16, 2009 (74 FR 2995), providing required notice and opportunity for the public to address concerns and submit comments on the application and EA. By its very nature, the process of public review ensures that NMFS' analyses will be balanced and would incorporate the best available scientific information. In response to the public comments received during the public comment period, L–DEO has modified the survey design (see L–DEO's Supplemental EA) and enhanced mitigation measures included in the proposed IHA. Finally, NMFS has incorporated additional mitigation measures to the IHA.

As Minor and Wilson point out in their letter, L–DEO acknowledges in their application the shortcomings of the models for predicted sound levels in shallow water. Regarding the model, L–DEO conducted an acoustic calibration study of the *Ewing's* 20 airgun 8,600-in^3 array in the Gulf of Mexico in 2003 (Tolstoy *et al.,* 2004a,b). During the study, researchers conducted calibration measurements for a 6-, 10-, and 12-, and 20-airgun array configurations at a depth of approximately 30 m (98 ft) to gather empirical data on the measured values (i.e., received sound level) for the 160–190-dB re 1 μPa (rms) radii. In the 2003 study, Tolstoy *et al.* (2004b) reported that for the 20 airgun array, the 160 dB radius in shallow water was 33 percent higher than predicted (predicted = 9 km (5.5 mi); measured = 12 km (7.4 mi)). According to Tolstoy *et al.* (2004b), the results indicated that reverberations played a significant role in received levels of sound in shallow water and that previously estimated radii for 160 and 180 dB had not accounted for bottom reverberations. Thus, the predicted radii were underestimates of the actual distances where the 160 and 180 dB levels occurred in shallow water. The authors recommended that L–DEO extend the radii by an appropriate factor to account for this underestimation. As a result, L–DEO developed correction factors for water depths 100 to1,000 m (328 to 3,281 ft) and less than 100 m (328 ft).

For the TAIGER cruise, L–DEO has applied conservative correction factors to develop appropriate shallow-water exclusion zones (*see* Table 1 in 72 FR 78294, December 22, 2008) to mitigate effects on marine mammals. At this time, this is the best available scientific data for estimating seismic sound propagation for the *Langseth's* airgun configuration. L–DEO has measured the *Langseth's* seismic source array, and has stated that initial results, which do not significantly vary from those stated here, will be published in the future.

Comment 175: The problem that permeates the EA and IHA documents (and the **Federal Register** listing) is the silly assumption that since nobody has done this (impossible) task that there is no reason to suspect that sending 170 dB pulses out for 7,808 m either side of a boat traveling for 1,113 km through the shallow water critical habitat of several endangered species is wrong.

Response: To clarify, NMFS has determined that safety zones should be established at 180 dB (rms) for cetaceans not, 170 dB (rms). The commenter is referring to L–DEO's predicted root mean square (rms) distance for the safety radius/exclusion zone at 170 dB shown in Table 1 of the application (*see* also Table 1 in 72 FR 78294, December 22, 2008). The predicted rms distance of 7,808 m (4.8 mi) is the most precautionary distance which the 170 dB sound level is expected to be received from the 36-airgun array in shallow water.

L–DEO establishes and closely monitors safety zones to ensure, to the greatest extent practicable, that no marine mammals would be injured by the proposed activity. NMFS recognizes that absence of evidence is not the same as having no effect or impact on the marine mammal species. However, NMFS is not relying solely on absence of evidence. All parties involved have used the best information currently available to analyze the impacts to marine mammals as shown in: (1) The **Federal Register** notice for the receipt of

L–DEO's application (73 FR 78294, December 22, 2008); (2) the EA and SEA for the TAIGER seismic; (3) the BiOp and ITS; and (4) numerous and salient public comments received by NMFS during the public comment period. Some of the new information used by NMFS to make its determinations under the MMPA are discussed and summarized in this **Federal Register** notice. Based on the evidence cited, NMFS concludes that the proposed seismic surveys would have a negligible impact on the affected species or stocks of marine mammals and are not likely to jeopardize the continued existence of any ESA-listed species.

Comment 176: The notice in the **Federal Register** states in several places that scientific information on marine mammal species in the SE Asia survey area is minimal or even non-existent. It also notes that data on the impacts of seismic airgun sounds on marine mammals are minimal or lacking. Nevertheless, the NMFS and L–DEO inexplicably and without basis or precaution conclude that the surveys will have negligible impacts on marine mammals. This is unacceptable.

Response: The NMFS recognizes that absence of evidence is not the same as having no effect or impact on the marine mammal species. However, NMFS is not relying solely on absence of evidence to support its determinations. All parties involved have used the best information currently available to analyze the impacts to marine mammals as shown in: (1) The **Federal Register** notice for the receipt of L–DEO's application (73 FR 78294, December 22, 2008); (2) the EA and SEA for the TAIGER seismic; (3) the BiOp and ITS; and (4) numerous and salient public comments received by NMFS during the public comment period. NMFS has incorporated new information to make its determinations under the MMPA are discussed and summarized in this **Federal Register** notice. Based on the evidence cited, NMFS concludes that the proposed seismic surveys would have a negligible impact on the affected species or stocks of marine mammals and are not likely to jeopardize the continued existence of any ESA-listed species.

Comment 177: The discussion of the critically endangered Western Pacific gray whale (*Eschrichtius robustus*) is similarly problematic and does not adequately consider that the surveys will occur in waters presumed to include the population's breeding grounds and migration pathways (which are currently unknown but are placed by expert opinion in the South China Sea). Any resubmission of this application must do a far better job of evaluating the region's marine mammal populations, especially those that are critically endangered.

Response: Please see NMFS' responses to comments under the Species of Particular Concern section. Because of concerns about effects of the proposed survey lines on Western Pacific gray whales, L–DEO has re-routed the survey lines in the South China Sea, south of the Taiwan Strait. The survey lines are now located in water depths greater than 200 m.

Comment 178: The NMFS and L–DEO also ignore the growing body of literature addressing the possible infliction of stress on animals, including marine mammals, due to exposure to noise and how this stress can have significant impacts on individuals and populations (e.g., Wright and Kuczaj, 2007). The discussion in the notice and application (and no doubt the EA) still relies overmuch on observable behavioral reactions, when in fact research (also not cited in the L–DEO documentation) is available that suggests already stressed animals or animals in poor condition may not observably react in the face of human disturbance when more robust animals will (e.g., Beale and Monaghan, 2004). Any resubmission of this request for authorization must expand and improve its discussion of the relevant scientific literature.

Response: The Beale and Monaghan study investigated the effects of disturbance on cliff-dwelling birds. NMFS is aware of only two studies that directly address the physiological stress responses of marine mammals when exposed to sound. Thomas *et al.* (1990) examined behavioral responses of four captive belugas (*Delphinapterus leucas*) to playbacks of noise from SEDCO 708, a semi-submersible drilling platform. Results indicated no elevation in blood epinephrine and norepinephrine levels immediately after the playback. The authors observed no differences in swim patterns, social groupings, and respiration/dive rates before and during playbacks. In the second study, Romano *et al.* (2004) investigated nervous system activation and immune function in two species of captive marine mammals after exposure to a seismic water gun and/or single pure tones and observed that norepinephrine, epinephrine, and dopamine levels increased with increasing sound levels. However, Wright *et al.* (2007) noted that extrapolating these results to wild species should proceed with caution due to the study's small sample sizes, use of captive animals, and other technical limitations with the baseline measurements.

L–DEO's EA (see Chapter 3) provided information on non-auditory physiological effects (including stress) in relation to seismic survey sounds in the EA. However, few studies exist on the quantification of a specific exposure level above which non-auditory effects can be expected. At present, NMFS is unaware of quantitative predictions of the numbers of marine mammals that might exhibit stress when exposed to seismic sounds. NMFS believes that these data presented in the EA were the best scientific information available for estimating impacts on marine mammal species and stocks. [Romano, T. A., Keogh, M. J., Kelly, C., Feng, P., Berk, L., Schlundt, C. E., Carder, D. A. & Finneran, J. J. (2004). Anthropogenic sound and marine mammal health: Measures of the nervous and immune systems before and after intense sound exposure. *Canadian Journal of Fisheries and Aquatic Sciences,* 61, 1,124 to 1,134].

Comment 179: The assumption (repeated several times in the **Federal Register** notice) that animals will move away from the approaching *Langseth* is simply wishful thinking—there is no evidence that this will occur for most species and in some cases (again, e.g., ETS *Sousa*), this is not even an option, as there is essentially nowhere for the animals to move to that will allow them to escape exposure to high levels of seismic sound. These issues are all discussed at greater length by other parties submitting comments and we urge the NMFS to require L–DEO to address these concerns in any resubmission of the application.

Response: Several studies have reported observations of marine mammals exhibiting localized avoidance from areas with operating seismic airgun arrays. L–DEO provides this information in the Chapter 4 and Appendix B of the EA. In the case of critically endangered ETS population and other coastal species, L–DEO and TAIGER's principal investigators have modified the cruise plan and survey design by re-routing the cruise's tracklines offshore Taiwan's west coast by approximately 20 km to protect the ETS and the finless porpoise populations (except for in the passage between the Penghu Islands and the Waishanding Jhou (Wau-san-ting Chou) sandbar, where the survey will pass through the approximately 17.1 km (9.2 nautical mi) mid-line distance between the two possibly sensitive areas); re-routing the proposed survey lines in the South China Sea south of the Taiwan Strait to water depths greater than 200 m; and eliminating survey tracklines in the western Taiwan Strait.

Comment 180: The applicant and the agency must improve their consultation with regional experts on the protected species in the region(s) of interest. Many of the omissions and inaccuracies of the application (and, quite frankly, much of the local resistance to this proposed research) could have been avoided if the applicants had sought out and consulted with regional scientific experts and regional non-governmental organizations (NGO) with relevant expertise.

Response: The conditions of the IHA encourage NSF and L–DEO to coordinate with the Taiwanese government regarding the proposed seismic activity. In December 2008, NMFS published notice of the proposed IHA in the **Federal Register.** During the public comment period, regional scientific experts and regional NGOs with relevant expertise were free to provide comments on the survey. NMFS considered these requests during the 30 day public comment period and published a notice in the **Federal Register** (74 FR 2995, January 16, 2009) extending the public comment period for the proposed IHA to facilitate additional review by regional scientific experts. If a regional expert or regional NGO representative requests to consult on the effects of the seismic survey on protected species in the region, NMFS encourages them to discuss this directly with a representative from L–DEO or NSF.

Finally, based on comments received from the public, including regional experts, L–DEO completed a Supplemental EA for the TAIGER survey. NMFS believes that the monitoring and mitigation measures, which have been enhanced when compared to the proposed IHA notice, ensure the least practicable adverse impact on marine mammals in the SE Asia study area.

Comment 181: According to the tables within the EA, more *Sousa* will be impacted than there actually are *Sousa* in the area. I am unclear on how this meets the ''small number'' criteria. This number would, of course, go up further if the distances reported by Madsen *et al.* (2006—noted above) were taken into account. Of course, these distances would increase the take numbers for all animals in the area.

Response: Since the issuance of the proposed IHA notice, L–DEO negotiated with the project's principal scientists to modify the cruise plan and adopt more precautionary monitoring and mitigation measures. Based on the re-routed tracklines, L–DEO has revised estimates of the possible numbers of ETS Indo-Pacific humpback dolphins exposed to sound levels that would constitute Level B harassment to zero (zero percent of the ETS sub-population). NMFS took the revised tracklines into account when making the necessary MMPA determinations, including small numbers, towards the issuance of the IHA.

Comment 182: The *Langseth* will deploy an 8 km long streamer for most transects requiring a streamer; however, a shorter streamer (500 m to 2 km) will be used during surveys in Taiwan (Formosa) Strait (EA2). Do the effective source levels offered in the EA pertain to the longer or shorted streamers?

Response: The effective source level output from the *Langseth's* airgun array pertains to both the longer and shorter streamers. Streamer lengths generally relate to hydrophones, not airguns, and changes are often due to convenience, particularly to improve maneuverability.

Comment 183: According to the EA, the Multibeam Echosounder and Sub-bottom Profiler have outputs up to 204 dB re 1 μPa m, at the dominant frequency of 3.5 kHz. This is perilously close to the US Navy's AN/SQS–53C tactical mid-frequency sonar system implicated in many of the mass strandings of beaked whales and other cetaceans, which produces 'pings' primarily in the 2.6 to 3.3 kHz range. Another LDEO survey has been associated with a stranding (as acknowledged in the EA: ''* * * association of mass strandings of beaked whales with naval exercises and, in one case, an L–DEO seismic survey (Malakoff, 2002)''). There may thus also be concern for beaked whales and other animals, because, while ''[t]here is no conclusive evidence of cetacean strandings or deaths at sea as a result of exposure to seismic surveys'' (EA), there is also no conclusive evidence that seismic surveys do not lead to strandings or death either.

Response: The evidence linking beaked whale strandings and seismic surveys remains inconclusive at best. In September, 2002, two Cuvier's beaked whales stranded in the Gulf of California, Mexico. The *Ewing* had been operating a 20-airgun, 8,490-in^3 airgun array 22 km offshore the general area at the time that strandings occurred. However, the link between the stranding and the seismic surveys was inconclusive and not based on any physical evidence (Hogarth, 2002; Yoder, 2002) as some vacationing marine mammal researchers who happened upon the stranding were ill-equipped to perform an adequate necropsy. In addition, Cox *et al.* (2006) noted the ''lack of knowledge regarding the temporal and spatial correlation between the [stranding] and the sound source.'' Finally, Hildebrand (2005) illustrated the approximate temporal-spatial relationships between the stranding and the *Ewing's* tracks, but noted that the time of the stranding was not known with sufficient precision for accurate determination of the closest point of approach (CPA) distance of the whales to the *Ewing.*

The MBES and SBP have anticipated radii of influence significantly less than that for the airgun array. For reasons noted in the EA, the 160 dB and 180 dB isopleths of the MBES and SBP are either too small or the acoustic beams are very narrow, making the duration of the exposure and the potential for taking marine mammals by harassment small to non-existent. NMFS believes that it is unlikely that marine mammals would be affected by sub-bottom profiler signals whether operating alone or in conjunction with other acoustic devices since the animals would need to be swimming immediately adjacent to the vessel or directly under the vessel. Additionally, NMFS believes that the MBES and SBP are not likely to be capable of causing marine mammal strandings because of their short duration and brief pings

Comment 184: Several commenters expressed that the impacts of masking (including the physiological and psychological consequences potentially resulting from masking) were likely to be greatest for baleen whales throughout the survey area and requested that the *Langseth* should avoid calving grounds at breeding season, and feeding and migratory habitat for several species of threatened and endangered marine mammals. Several expressed concern for the range of the critically endangered Eastern Taiwan Strait (ETS) population of Indo-Pacific humpbacked dolphin; the partial range of Jiulong River Estuary (JRE) population of Indo-Pacific humpbacked dolphin; calving and migratory habitat for western Pacific humpback whales; a migratory pathway for the critically endangered western Pacific gray whale; and beaked and sperm whale habitat in southeastern and southwestern Taiwan.

Response: Please see NMFS' responses to comments under the Species of Particular Concern section and the response to Comment EA2 under this section. The IHA contains measures to mitigate against the potential effects of the surveys on mother/calf pairs, ETS and JRE humpbacked dolphins, and western Pacific gray whales.

Comment 185: NMFS has determined that the proposed activity ''may result,

at worst, in a temporary modification in behavior (Level B harassment) of small numbers of marine mammals'' and proposes to issue an IHA, which demonstrates that either the reviewers of the proposal lacked knowledge of SE Asian marine mammals or chose to ignore the potential damage such seismic surveys can have on small and critically endangered populations of marine mammals in the region. With a lack of knowledge about even the most basic biology of marine mammals in the region, any determination of the level of impact of the seismic surveys would be little more than a random guess.

Response: Please see NMFS response to Comment EA2 (above) in this section.

Comment 186: The principal investigators responded that the bulk of the energy produced by the *Langseth* sound source is below a frequency of 200 Hz. They also noted that odontocetes communicate in a much higher band of frequencies, typically in the range of 10,000 Hz to several 100,000 Hz. Thus there is very little, if any, overlap in the frequency bands of acoustic energy used by these marine mammals and that of the seismic system. In summary, the investigators agreed with the EA that the surveys were not likely to result in any significant impact on marine life in the area.

Response: NMFS acknowledges the comments from the principal investigators.

Comment 187: NMFS is charged with implementing the MMPA and, to that end, must prescribe methods and means of effecting the least practicable adverse impact on marine mammals. NMFS' proposed IHA falls short of the mark.

Response: Please see NMFS' response to comments (above) under this section. In this IHA, NMFS prescribed mitigation measures that achieve the least practicable adverse impact, such as: re-routing the cruises tracklines further offshore by approximately 20 km (10.8 nautical mi) to protect the critically endangered Sousa population and the finless porpoise (except for in the passage between the Penghu Islands and the Waishanding Jhou (Wau-san-ting Chou) sandbar, where the survey will pass through the 17.1 km (9.2 nautical mi) mid-line distance between the two possibly sensitive areas); visual marine mammal monitoring, and shut-downs when marine mammals are detected within the defined ranges should further reduce short-term reactions to disturbance, and minimize any effects on hearing sensitivity. The IHA includes mitigation and monitoring measures to reduce the potential for injury or mortality, as well as instituting immediate shutdown protocols for the North Pacific right whale, western gray whale, Indo-Pacific humpbacked dolphin, or finless porpoise. No injury, serious injury, or mortality of any marine mammal is anticipated nor is authorized.

Comment 188: Several other baleen whales have been recorded from Taiwanese waters. However, due to almost no survey effort in the waters beyond about 20 km from shore and surveys being most in summer months, little is known about these species, which include: fin, sei, minke, Bryde's and Omura's whales. There are reports of several distinct stocks of some of these species. As a minimum, the impact on each stock of each species should be assessed rather than just at the species level and more work is needed on understanding stock structure before impacts can be understood.

Response: Please see NMFS' response to comments above. Detailed analyses of underwater noise, especially those from airguns, and impacts to cetaceans, fish, and invertebrates are provided in various documents related to the proposed project. NMFS' review of these documents have led to the determination that the proposed seismic surveys would have a negligible impact on the affected species or stocks of marine mammals and are not likely to jeopardize the continued existence of any ESA listed species.

Comment 189: Consideration of cumulative noise impacts. The exposure of these dolphins to total cumulative noise has not been considered. The ETS dolphins live in an environment which is already very noisy (e.g., pile driving and other noise-generating activities during coastal construction, shipping, other seismic surveys (oil and gas, local researchers, etc.). The cumulative impact of all noise sources needs to be examined in context of the contributions by the intense sounds source of the airguns.

Response: Please NMFS' response to NEPA comments. NMFS has determined that the EA adequately addressed the cumulative impacts of a short-term, low-intensity seismic airgun survey in relation to long-term noise and taking events, such as vessel traffic, habitat loss, oil and gas industry, pollution, fisheries, and hunting. NMFS' endangered species scientists have conducted a thorough review of the best available information on the cumulative effects of the proposed project. As a result, NMFS issued a BiOp on the proposed action on March 31, 2009 (NMFS, 2009), which stated that the survey was not likely to jeopardize the continued existence of ESA-listed marine mammals in the survey area.

Comment 190: The blue whale is given the highest level of legislative protection by the Wildlife Conservation Act of Taiwan. If small numbers of western North Pacific blue whales still exist, seismic surveys can have a large impact on the few remaining individuals.

Response: Please see NMFS' response to comments under the Species of Particular Concern section. L–DEO's revised seismic survey is expected to have a negligible impact on populations of blue whales in the study area. Blue whales can be easily detected visually so that L–DEO may implement appropriate mitigation measures.

Comment 191: The project description does not adequately consider the relevant scientific literature on risks of seismic activities to cetaceans. Also, L–DEO completely overlooked physiological impacts on cetaceans (*see* Wright *et al.,* 2007a,b).

Response: L–DEO's EA (see Chapter 3) provided information on non-auditory physiological effects (including stress) in relation to seismic survey sounds in the EA. However, few studies exist on the quantification of a specific exposure level above which non-auditory effects can be expected. At present, NMFS is unaware of quantitative predictions of the numbers of marine mammals that might exhibit stress when exposed to seismic sounds. NMFS believes that these data presented in the EA were the best scientific information available for estimating impacts on marine mammal species and stocks.

All parties involved have used the best information currently available to analyze physiological impacts to marine mammals as shown in: (1) The **Federal Register** notice for the receipt of L–DEO's application (73 FR 78294, December 22, 2008); (2) the EA and SEA for the TAIGER seismic; (3) the BiOp and ITS; and (4) numerous and salient public comments received by NMFS during the public comment period.

International Legal Compliance

Comment 192: L–DEO has stated that it will ''coordinate with Taiwan, China, Japan, and the Philippines, as well as applicable U.S. agencies (e.g., NMFS) and will comply with their requirements'' (p. 78316). This is a promise of action but there is no indication in the **Federal Register** notice how fulfillment of this promise will be verified. HSI and other interested parties state that before NMFS issues an authorization, NMFS must verify that L–DEO has complied with all relevant laws and regulations of the countries

within whose EEZs it will be conducting surveys. NMFS must request and receive the relevant paperwork from the applicant, that L–DEO has a minimum initiated and preferably completed. It cannot take at face value the assurances of L–DEO that such compliance will occur. It is a long-standing concern of HSUS/HSI (and other NGOs, both domestic and international) that U.S. agencies issue environmental permits and authorizations for activities that will in part be conducted within foreign jurisdictions without first verifying that the applicant has complied or even initiated compliance with local laws and regulations of these four nations.

Response: NMFS has communicated with NSF and L–DEO regarding the seismic survey in SE Asia. NMFS has received copies of L–DEO's foreign clearances from Taiwan, Japan, and the Philippines. L–DEO has been denied access to the waters of China. NMFS expects NSF and L–DEO to coordinate with the governments of Taiwan, Japan, and the Philippines, as well as adhere to local conservation laws and regulations of nations while in foreign waters, and known rules and boundaries of Marine Protected Areas (MPA), regarding the marine geophysical activity in SE Asia. In the absence of local conservation laws and regulations or MPA rules, L–DEO will continue to use the monitoring and mitigation measures identified in the IHA. NMFS has included conditions to these effects in the IHA. L–DEO is required to submit a draft report on all activities and monitoring results to the Office of Protected Resources, NMFS, within 90 days of the completion of the *Langseth's* SE Asia cruise (*see* ''Reporting'' section below).

Comment 193: HSI states that far too often, applicants for MMPA Incidental Harassment Authorizations, who are working on geophysical and other projects that do not directly concern marine mammals, but result in their incidental harassment and that will occur at least partially within foreign jurisdictions, fail to consult much or at all with regional entities who can be considered stakeholders in the decisions to authorize such projects. The authorizing agency compounds this failing by accepting the applicant's assurances at face value that sufficient consultation has occurred or will occur. HSI strongly advises the NMFS (and applicants such as L–DEO) to rectify this problem in the future.

Response: NMFS acknowledges HSI's recommendation and expects applicants to comply with all foreign and domestic laws. NMFS encourages applicants to consult with all stakeholders regarding projects in a specified region.

Recommendations for Consultation and Research

Comment 194: Dr. McIntosh and Dr. Wu state they have already contacted marine biologists highly knowledgeable and very concerned about the ecology of all marine mammals in the National Taiwan University, Academica Sinica and the National Taiwan Ocean University. They will continue to provide guidance to the planning of the TAIGER program.

Response: NMFS acknowledges the principal investigators comment.

Comment 195: CSI states that in December, 2008, for the ETSSTAWG (an international working group established in early 2008 to provide scientific guidance and advice to all interest groups) recommended that a buffer for noise threats be out to at least 5 km from shore for the ETS population after reviewing a proposal for designation of Majore Wildlife Habitat for the ETS population (review letter to Wild At Heart Legal Defense Association—dated 29 December, 2008).

Response: After issuance of the proposed IHA, L–DEO negotiated with the project's principal scientists to modify the cruise plan and adopt more precautionary mitigation measures. Off Taiwan's west coast, the cruise tracks have been re-routed offshore by approximately 20 km to protect the 'critically endangered' ETS Indo-Pacific humpback dolphin population and the finless porpoise, as well as ease potential pressure on other coastal species. Thus, the precautionary buffer recommended by ETSSTAWG in their comments to NMFS, ''at least 13 km and perhaps a more precautionary 15 km of the ETS Indo-Pacific humpback dolphin subpopulation—meaning up to around 20 km from shore'' will be adopted. L–DEO will limit seismic survey lines to take place at least 20 km from the west coast of Taiwan, expect for in the passage between the Penghu Islands and the Waishanding Jhou (Wau-san-ting Chou) sandbar, where the survey will pass through the approximately 17.1 km mid line distance between the two possibly sensitive areas, subject to the limitations imposed by other foreign nations, to minimize the potential for exposing the ETS sub-population and other coastal species to SPLs greater than or equal to 160 dB re 1 μPa (rms). NMFS has included conditions to this effect in the IHA as well.

Comment 196: CSI recommends that activities that would increase the risk of extinction of *Sousa chinensis* populations, including physiological and behavioral impacts, not be permitted.

Response: NMFS disagrees with CSI's recommendations. NMFS believes that L–DEO's revised seismic survey as well as the implementation of the required monitoring and mitigation measures will have a negligible impact on the affected species or stocks of marine mammals in the planned study area. L–DEO will limit seismic survey lines to water depths greater than 200 m in the South China Sea, and as far east as possible from the mainland China side of the Taiwan Strait, to reduce potential for effects on Western Pacific gray whales, Indo-Pacific humpback dolphins, and finless porpoises. L–DEO will limit seismic survey lines to take place at least 20 km from the west coast of Taiwan, except for in the passage between the Penghu Islands and the Waishanding Jhou sandbar, where the survey will pass through the approximately 17.1 km mid-line distance between the two possibly sensitive areas, subject to the limitations imposed by other foreign nations, to minimize the potential for exposing Indo-Pacific humpback dolphins, finless porpoises, and other coastal species to SPLs greater than or equal to 160 dB re 1 μPa (rms).

Comment 197: Several interested parties recommend dedicated marine mammal systematic surveys in waters off eastern Taiwan (particularly in waters beyond 20 km from shore where almost no cetacean survey effort exists) and of the Penghu Channel to better understand the region's waters, determine concentrations of beaked whales, and reduce impacts on other cetaceans. Systematic cetacean surveys of the waters of these waters are needed before seismic surveys are conducted so that better planning with adequate information can reduce impacts on marine mammals. Better coverage of the region's waters by cetaceans surveys can also allow fine turning of spatial and temporal avoidance of humpback whales by seismic surveys. Simple strategic scheduling of seismic surveys can eliminate or at least greatly reduce the impacts on this population.

Response: In this case, NMFS does not agree that marine mammal assessment surveys are needed prior to issuing an IHA. When information is unavailable on a local marine mammal population size, NMFS uses either stock or species information on abundance. Also, while information may be lacking for many species of cetaceans, information on some of the locally-found species is found in the L–DEO's IHA application, EA, and Supplemental EA. *See* L–DEO's IHA application, EA,

and Supplemental EA for more information.

In order to reduce impacts on marine mammals, NMFS has included temporal and spatial avoidance requirements in the IHA. See the information in the Monitoring and Mitigation sections below. Also, after the issuance of the proposed IHA, L–DEO has revised the planned seismic survey to reduce potential impacts on marine mammal populations in the study area.

Comment 198: Several interested parties recommend greater local consultation. Extensive consultation with experts on these regions and more studies to better understand the biology of cetaceans in this region can provide expert guidance to greatly reduce the impacts on the seismic surveys. More information exists in publications in local languages that have not been considered by this proposal. Conduct a consultation workshop with scientists who have expertise in local marine mammals, reptiles, fish, and invertebrates to understand better the local sensitive species and waters. Consultation with ETSSTAWG is needed.

Response: L–DEO and NSF have formally consulted with NMFS' Permits, Conservation, and Education Division regarding the IHA and NMFS' Endangered Species Division regarding a Biological Opinion under Section 7 of the ESA for the marine geophysical survey in SE Asia. L–DEO and NSF have also consulted with numerous persons and organizations in the SE Asia region. Below is a timeline of L–DEO's consultation process and issues discussed:

- December 18, 2007—Initial consultation began with LGL Ltd. when Dr. John Richardson contacts Dr. John Wang for a reprint. Dr. John Wang expresses concerns about seismics and mentions that the Indo-Pacific humpback dolphin is being reviewed for critically endangered status.
- August 9, 2008—Meike Holst of LGL Limited contacts Dr. John Wang for reprints. The L–DEO program is discussed via e-mail.
- August 14, 2008—Dr. John Wang copies Robin Winkler of WaH and asks for details on the cruise.
- August 19, 2008—Meike Holst shared details with Dr. John Wang and consults with him further.
- August 20, 2008—Meike Holst assures Robin Winkler of the planned mitigation measures in place and asks about relevant local laws.
- August 30, 2008—Chao-Shing Lee referred Meagan Cummings of L–DEO to Dr. Lien-Siang Chou. Meagan Cummings e-mailed Dr. Lien-Siang Chou and informed her that she planned to send copies of the EA when it became available.
- September 19, 2008—Robin Winkler responds to Meike Holst and copies Dr. Peter Ross. Meike Holst never hears back from Dr. Peter Ross.
- October 2, 2008—Hong Young, Prof. K. T. Shao from the Center for Biodiversity Research (Academica Sinica), and Prof. F. C. Chiu, Director of the Taiwan Ocean Research Institute are contacted by Claudio Fossati, one of L–DEO's lead bioacousticians and MMOs.
- January 13, 2009—Dr. Randall Reeves reviews the EA and recommends contacting Dr. Lien-Siang Chou or Benjamin Kahn based in Cairns, Australia.
- January 19, 2009—Dr. Francis Wu recommends Dr. Lien-Siang Chou. *http://ecology.lifescience.ntu.edu.tw/english/faculty_chou_ls.htm.*
- February 27, 2009—Meagan Cummings contacts Dr. Peter Ross. Dr. Peter Ross recommended an independent review of the program. Meagan Cummings assured him that NMFS was the reviewing agency and they wrote back and forth a few times and was informed that there was a regional expert.
- February 27, 2009 to present—L–DEO has been consulting mainly with Dr. Lien-Siang Chou and her department's graduate students. Meagan Cummings met with Dr. Lien-Siang Chou on March 21, 2009 in Taiwan. L–DEO scheduled a workshop for March 27, 2009 to discuss mitigation measures and visual sighting techniques for finless porpoises.
- March 27, 2009—L–DEO met with Dr. Lien-Siang Chou and her graduate students at National Taiwan University. The discussion points during the meeting included: MMO operations (Big-eye and 7x50 binoculars, visible distances from the observation tower, safety radii, ramp-up, power-down, and shut-down explanations), the Supplemental EA (revised tracklines, proximity to Taiwan, the ETS Indo-Pacific humpback dolphins, finless porpoises), possible carcass and stranding procedures (stranding density and locations during the past 10 years, current protocols for live and dead animals, reporting protocols and notification of the Taiwan Cetacean Society, funding to conduct necropsies, investigate resources to process more animals if there are a significant number of strandings, possible MRI of smaller cetaceans to look at possible effects of sound or pressure, fewer recent strandings than average, public concern has dropped, Taiwan's marine mammal stranding response team, stranding teams divided up between the north and south of Taiwan, discovery and reporting of possible carcasses at sea, and taking carcass samples for DNA analysis), NMFS notification requirements, finless porpoise sighting techniques, current MMO protocols, sampling considerations, regions of concern, beaked whales in Taiwan, population and density of Taiwanese cetaceans, and addressing the media.

Comment 199: Recent estimates of habitat boundaries and noise buffer zones specifically for the ETS Indo-Pacific humpback dolphins are not referred to yet could have easily been acquired through consultation with the ETSSTAWG. The existence of this expert advisory team dedicated to ETS humpback dolphin matters was brought to the attention of one of the principal preparers of the EA by the directors of Wild at Heart Legal Defense Association in an e-mail dated September 19, 2008.

Response: After the issuance of the proposed IHA, L–DEO modified the cruise plan and adopted more precautionary monitoring and mitigation measures. L–DEO will maintain the precautionary buffer recommended by ETSSTAWG in their comments to NMFS, ''at least 13 km and perhaps a more precautionary 15 km of the ETS Sousa population—meaning up to around 20 km from shore.'' L–DEO will limit seismic survey lines to take place at least 20 km from the west coast of Taiwan, except for in the passage between the Penghu Islands and the Waishanding Jhou (Wau-san-ting Chou) sandbar, where the survey will pass through the approximately 17.1 km mid-line distance between the two possibly sensitive areas, subject to the limitations imposed by other foreign nations, to minimize the potential for exposing Indo-Pacific humpback dolphins, finless porpoises, and other coastal species to SPLs greater than or equal to 160 dB re 1 μPa (rms). See relevant responses to comment above for information on consultation.

Comment 200: WaH states that in the event that no attempt was made by LGL to consult with the ETSSTAWG prior to completion of the EA, WaH would recommend that this is done immediately with a view to clarifying some of the concerns relating to harassment of Indo-Pacific humpback dolphins, and that similar consultations be held with other experienced researchers through the region in question.

Response: During the preparation of the IHA application and EA, LGL Ltd. contacted and consulted with regional experts. After the issuance of the proposed IHA, L–DEO modified the

cruise plan and adopted more precautionary monitoring and mitigation measures to address concerns for species of particular concern (*e.g.,* ETS sub-population of Indo-Pacific humpback dolphins). L–DEO also prepared a Supplemental EA. The Supplemental EA is in response to the comments received by NMFS through the public comment period associated with the IHA process. See relevant discussions in this document as well as L–DEO's Supplemental EA.

Species of Particular Concern

Comment 201: NRDC states many genetically distinct populations of cetaceans are found within the enclosed seas of the western Pacific, including the ETS population of Indo-Pacific humpbacked dolphin, South China Sea population of finless porpoise, fin whales, gray whales, and humpback whales. Take estimates should use abundance and density estimates for these distinct populations (rather than estimates for the entire North Pacific) where appropriate.

Response: NMFS agrees that impacts should be assessed on the population or stock unit whenever possible. Due to the lack of systematic aircraft- or ship-based surveys conducted for marine mammals in waters near Taiwan, the species of marine mammals that occur there are not well known. A few surveys have been conducted from small vessels with low observation platforms. In the absence of any other density data, L–DEO used the survey effort and sightings in Yang *et al.* (1999) and Wang *et al.* (2001a) to estimate densities of marine mammals in the TAIGER study area. L–DEO's application provides information on stock abundance and local and regional populations. The data source for each stock estimate is provided in Table 2 of L–DEO's IHA application. There is some uncertainty about the representatives of the density data and the assumptions used in the calculations. Perhaps the greatest uncertainty results from using survey results from the northeast Pacific Ocean.

NMFS believes that this approach and these data are the best scientific information available for estimating impacts on marine mammal species and stocks. However, information on marine mammal stock abundance may not always be complete. When information is lacking to define a particular population or stock of marine mammals then impacts are assessed with respect to the species as a whole (54 FR 40338, September 29, 1989).

Comment 202: Dr. John Wang states that for gray, right, and humpback whales, some common issues arise from the seismic surveys. The timing of the L–DEO surveys overlaps, spatially and temporally, with whales wintering (calving and nursing) in the region's waters (see above) and during the northward migrations of mothers with neonatal or other young calves from these calving/nursing grounds.

Response: After issuance of the proposed IHA, L–DEO revised their seismic survey to include temporal and spatial concerns regarding marine mammals in the study area. Because of concerns about effects of the proposed survey lines on gray whales, the proposed survey lines in the South China Sea south of the Taiwan Strait were re-routed so that they are now located in water depths >200 m. To mitigate against the potential effects of the surveys on humpback whales, particularly mothers and calves on the breeding grounds or during the beginning of migration to summer feeding grounds, the surveys that approach the Babuyan Islands have been rescheduled as late as possible, to Leg 4. Also, L–DEO will shut-down the airgun array immediately if a Western Pacific gray, North Pacific right, and/or humpback whale mother/calf pair are visually sighted at any distance. Requirements to these effects have been included in the NMFS-issued IHA. See responses to comments pertaining to Western Pacific gray and humpback whales below.

Comment 203: CSI states that if small numbers of Western North Pacific blue whales still exist in the region's waters, seismic surveys can have a large impact on the few remaining individuals (even if only a very few whales are disturbed).

Response: After issuance of the proposed IHA, L–DEO modified the cruise plan and adopted more precautionary monitoring and mitigation measures. L–DEO's revised seismic survey is expected to have a negligible impact on populations of blue whales in the study area. Blue whales can be easily detected visually so that the proper mitigation measures may be implemented.

Species of Particular Concern—Pearl River Estuary (PRE), Jiulong River Estuary (JRE), and Eastern Taiwan Strait (ETS) Indo-Pacific Humpback Dolphins

Comment 204: Several interested parties are concerned about the acoustic disturbance that can seriously affect several coastal populations of Indo-Pacific humpback dolphins, notably the ones at the PRE in Guangdong Province, the JRE in Fujian Province (near Xiamen), and along the coastal waters of the ETS. The JRE sub-population of Indo-Pacific humpback dolphins is estimated to be less than 90 individuals (Chen *et al.,* 2008) and faces similar threats. The JRE sub-population is distinct from the ETS sub-population (Wang *et al.,* 2008a), but the level of exchange (if any) with other provisional populations along the mainland Chinese coast is unknown. Other Chinese sub-populations have been studied and have a distribution in adjacent waters of the Chinmen islands and further east are completely unknown and were not surveyed by Chen *et al.* (2008) due to political border issues. Not enough is known about this population to estimate what proportion of dolphins in this small sub-population will be impacted, but it is clear that some will be impacted and with such a small population size, even minimal disturbance can have a large impact on the sub-population. Far less is known about *Sousa chinensis* in other regions so the impact on these dolphins cannot be estimated. However, given the proposed trackline which meets the mainland Chinese coast perpendicularly and closes near the area of Xiamen/Chinmen Islands and near Pingtan (where records of *Sousa chinensis* also exist—*see* Wang, 1999; Zhou, 2004), dolphins of these coastal waters would be expected to be impacted.

The proposed tracklines of these seismic surveys will traverse through areas that will overlap or are in close proximity to these resident humpback dolphin populations, posing serious risks and threats to the livelihood of their daily lives. One of the *Langseth's* proposed tracklines approaches to the mainland Chinese coast is directly in line with the heart of the JRE population. At a distance of 10 km from shore, dolphins using waters east of the Chinmen islands may be exposed to levels greater than 160 dB and some may be exposed to greater than 180 dB depending on where the dolphins are found in their distribution and how close the *Langseth* is to the 25–30 m isobath (which appears to be the depth limit for the species—see Jefferson and Karczmarski, 2001). Not enough is known about this population to estimate the numbers of dolphins that will be impacted. Given such a small population size, even minimal disturbance can have a large impact on the lives of the populations. The animals may be exposed to received levels >180 dB, which would exceed the type of take which L–DEO has applied for.

Response: Because of these concerns about effects of the proposed surveys on Western Pacific gray whales, populations of Indo-Pacific humpback dolphins, and finless porpoises, the

proposed survey lines in the South China Sea south of the Taiwan Strait were re-routed after the issuance of the proposed IHA so that they are now located in water depths >200 m, as recommended by NRDC. The seismic lines in the western Taiwan Strait were dropped. Requirements to these effects have been included in the IHA and no takes of any of the three sub-populations of Indo-Pacific humpback dolphins found in the SE Asia study area is authorized for this seismic survey.

Comment 205: Several interested parties have expressed concern with the safety of the ETS Indo-Pacific humpback dolphin. This 'critically endangered' sub-population is very small at <100 individuals. The distinct population is a year-round resident of a very restricted stretch of shallow coastal waters along western Taiwan (i.e., the ETS). Any single threat (*e.g.,* loss of habitat, pollution, bycatch, and noise) has the potential to be the final cause of extinction. Unless effective mitigation measures are taken to reduce these threats, it is unlikely that the population will continue to exist. Mortality (by human causes) of even a single individual per year from this population is not sustainable.

Seismic surveys in June and July (as well as any other time of the year) will have a serious impact on this critically endangered population. Given their year round residency, there is no season that will reduce the serious impacts of seismic surveys in inshore waters on this population. In June and July, large numbers of cetaceans are found along and near the shelf edge of eastern Taiwan. Conducting seismic surveys close to the shores of Taiwan risks greatly impacting on these cetaceans.

Response: After the issuance of the proposed IHA, L–DEO negotiated with the project's principal scientists to modify the cruise plan and adopt more precautionary mitigation measures. Off Taiwan's west coast, the cruise tracks have been re-routed offshore by approximately 20 km to protect the critically endangered ETS Indo-Pacific humpback dolphins and the finless porpoise, as well as ease potential pressure on other coastal species. Thus, the revised survey will maintain the precautionary buffer recommended by ETSSTAWG in their comments to NMFS, ''at least 13 km and perhaps a more precautionary 15 km of the ETS Sousa population—meaning up to around 20 km from shore.'' *See* L–DEO's Supplemental EA.

Concerns were expressed about the survey line that was parallel to and within a few km of the east coast of Taiwan because of potential effects on coastal species and those that frequent the shelf break and steep slopes, where the continental shelf is narrow. Due to these concerns, the survey line has been moved offshore by more than 20 km to decrease potential impacts on species that occur there.

Requirements to these effects have been included in the IHA. No injury, serious injury, or mortality has been authorized.

Comment 206: HSI states the application and the **Federal Register** notice never indicate that the Eastern Taiwan Strait (ETS) population of the Indo-Pacific humpback dolphin, *Sousa chinensis,* is listed as ''critically endangered'' on the International Union for Conservation of Nature (IUCN) Red List. Instead these two documents lump the entire region's *Sousa* populations together. While the IUCN did list the larger regional Sousa population as ''near threatened,'' it specifically identified the ETS population as separate and ''critically endangered.'' This designation was made well before the December publication of the **Federal Register** notice. The failure to note this, to address the fact that two-thirds of this population (the maximum proportion the notice indicates could be taken—see p. 78311) cannot be considered a ''small number,'' or to address the fact that the survey track lines cover the entire length of this imperiled population's home range is unacceptable and must be rectified by a resubmission of the application.

Response: NMFS acknowledges HSI's comment. L–DEO's Supplemental EA states the ETS sub-population of Indo-Pacific humpback dolphins is considered 'critically endangered' on the IUCN Red List of Threatened Species (IUCN, 2008). *See* L–DEO's Supplemental EA for a detailed description of the revised survey as well as monitoring and mitigation measures. No takes of the ETS Indo-Pacific humpback dolphin sub-population are authorized under the NMFS-issued IHA. *See* response to comment below.

Comment 207: Dr. John Wang and CSI states that *Sousa chinensis* is considered a slow swimming species with average speeds between 3.6 and 7.2 km/hr (Saayman and Tayler, 1979; Jefferson, 2000) but much slower during resting periods (Saayman and Tayler, 1979)—observations of the ETS population (unpublished data) are consistent. As such, the ETS Indo-Pacific humpback dolphins will not be able to outrun the *Langseth* (even while towing airguns, the operating speed is reported to be between 7.4–9.3 km/hr) for extended periods. Even if they were able to outrun the *Langseth,* there would be no escape within their distribution because: (a) The tracklines cover nearly the entire longitudinal length of the ETS sub-population's total distribution and beyond, and (b) no safe acoustic shelters exist. Therefore, nearly the entire population (especially the most vulnerable members: mothers with young calves and other compromised individuals) will be affected by the seismic surveys along western Taiwan regardless of where the dolphins are in their distribution and an unknown but substantial number will be exposed to levels >180dB. Clearly, the proportion of the ETS sub-population to be impacted by the seismic survey (and at dangerous exposure levels) is far too high for any cetaceans let alone one that is critically endangered.

Response: After issuance of the proposed IHA, L–DEO has negotiated with the project's principal scientists to modify the cruise plan and adopt more precautionary mitigation measures. L–DEO will limit seismic survey lines to take place at least 20 km from the west coast of Taiwan, except for in the passage between the Penghu Islands and the Waishanding Jhou sandbar, where the survey will pass through the approximately 17.1 km mid-line distance between the two possibly sensitive areas, subject to the limitations imposed by other foreign nations, to minimize the potential for exposing Indo-Pacific humpback dolphins, finless porpoises, and other coastal species to SPLs greater than or equal to 160 dB re 1 μPa (rms). The buffer zone will reduce the potential impacts to animals, especially to protect the 'critically endangered' ETS Indo-Pacific humpback dolphin sub-population. Requirements to this effect have been included in the NMFS-issued IHA.

Comment 208: Dr. McIntosh and Dr. Wu state that a specific concern expressed by Dr. John Wang is with the safety of the ETS Indo-Pacific humpback dolphin; this species is considered critically endangered. The principal scientists share Dr. Wang's desire to protect this species and plan to avoid seismic work in or near its habitat. This species is known to live in very shallow water environments, primarily in water depths less than 25 meters and typically close to the coast. Dr. McIntosh and Dr. Wu expect seismic operations to occur generally in water depths of 50 m or greater, especially along Taiwan's west coast. With the generally shallow slope of the seafloor in this area this means that our work will typically be farther than 10 km from the coast. Furthermore, we are willing to adjust line positions to provide an adequate buffer zone for the

coastal habitat of these humpback dolphins.

Response: NMFS acknowledges the principal investigators comments. A description of the revised seismic survey can be found in L–DEO's Supplemental EA.

Species of Particular Concern—Deep Diving Species

Comment 209: ETTSTAWG states beaked whales can be expected to be at heightened risk from the L–DEO project, in part because their extended dives make it exceedingly difficult for even trained personnel to spot them.

Response: NMFS agrees that beaked whales are difficult to detect visually, even by trained and experienced MMVOs. In order to minimize potential effects of the seismic surveys, L–DEO will (when operating the sound source), minimize approaches to slopes, submarine canyons, seamounts, an other underwater geologic features, if possible, because of sensitivity to beaked whales. If concentrations of beaked whales are observed (by visual or passive acoustic detection) at a site such as on the continental slope, submarine canyon, seamount, or other underwater geologic feature just prior to or during the airgun operations, those operations will be moved to another location along the site based on recommendations by the on-duty MMVO aboard the *Langseth.* After the issuance of the proposed IHA, L–DEO also re-routed the seismic survey line paralleling the east coast of Taiwan further offshore to decrease potential impacts on species (including beaked whales) over the continental slope, and seismic surveys (to the maximum extent practicable) will be conducted from the coast (inshore) and proceed towards the sea (offshore) in order to avoid trapping marine mammals in shallow water. NMFS believes these mitigation measures should lessen the potential risks to beaked whales.

Species of Particular Concern—Finless Porpoises

Comment 210: Several interested parties have stated that finless porpoises are arguably one of the most difficult species to detect at sea by observers, even in calm conditions, because of its small size, lack of dorsal fin, brief surface time, and usually occurring individually or in small groups, so many will be missed by MMVOs during seismic operations. Depending on the behavior of the animals, they can be near impossible to detect. Jefferson *et al.* (2002) reported that during calm sighting conditions, finless porpoises were observed primarily within 300 m from the trackline (perpendicular distance) and none were observed beyond about 700 m. In low light conditions or even slight seas, detecting finless porpoises is challenging even for researchers experienced with the species. MMVOs will be ineffective at detecting animals within the predicted distance, therefore, an unknown (potentially large) number of finless porpoises will be exposed to much greater noise levels than suggested by L–DEO (especially since detection is effectively zero beyond 1 km, yet the predicted distance for received levels >190 dB is more than 2 km from the source).

Response: NMFS agrees that finless porpoises are arguably one of the most difficult species to detect at sea by observers. NMFS has not authorized any takes of finless porpoises in the IHA issued to L–DEO for this survey. Take estimates for finless porpoises have been reduced to zero because of the elimination of seismic tracklines in shallow water areas where they are likely to occur. In addition to having additional MMVOs and the use of PAM onboard the *Langseth* to detect animals, L–DEO will also shut-down immediately if there is a sighting at any distance of finless porpoises. See responses to previous comments and L–DEO's Supplemental EA.

Comment 211: Dr. John Wang states finless porpoises are arguably the most difficult cetacean to detect at sea by observers, so many will be missed by MMVOs during seismic operations. Therefore, an unknown (potentially large) number of finless porpoises will be exposed to much greater noise levels than suggested by L–DEO (especially since detection is effectively zero beyond 1 km, yet the predicted distance for received levels >190 dB is more than 2 km from the source.

Response: NMFS agrees that finless porpoises are arguably the most difficult cetacean to detect by MMVOs due to their small body size, lack of a dorsal fin, and shy behavior. However, the PAM system onboard the *Langseth* is capable of detecting the clicks of finless porpoises. Finless porpoises are unlikely to be encountered during the survey as L–DEO will avoid shallow water areas near the China coast, western Taiwan Strait, and South China Sea in order to avoid this species. L–DEO will also limit seismic survey lines to water depths greater than 200 m (656 ft) in the South China Sea and as far east as possible from the mainland side of the Taiwan Strait, to reduce potential for effects on finless porpoises. L–DEO is not authorized incidental take of finless porpoise and will shut-down the airgun array if any finless porpoises are visually sighted.

Comment 212: Dr. John Wang states finless porpoises appear to go undergo inshore-offshore migrations seasonally (*see* Jefferson and Hung, 2004) but this is not well understood. During the timing of the proposed seismic surveys, many finless porpoises will be in the Taiwan Strait (as evidenced by bycatch records and some sighting data—J.Y. Wang, unpublished data) and an unknown (but potentially large) number will be exposed to the airgun sounds. Furthermore, the timing also coincides with the presence of many female with newborn calves in these waters. These will be the most vulnerable individuals as they will be less able to escape the wide range of the airguns in shallow waters. The potential impact on finless porpoises is far from negligible and none of the mitigation measures proposed would be effective in reducing the harm.

Response: After issuance of the proposed IHA, L–DEO has negotiated with the project's principal scientists to modify the cruise plan and adopt more precautionary monitoring and mitigation measures. Off Taiwan's west coast, the cruise tracks have been re-routed offshore by approximately 20 km to protect finless porpoise. Because of concerns about effects of the proposed surveys on finless porpoises, the proposed survey lines in the South China Sea south of the Taiwan Strait were also re-routed so that they are now located in water depths >200 m, as recommended by NRDC. The seismic lines in the western Taiwan Strait have been dropped. The proposed survey line paralleling the east coast of Taiwan has also been moved offshore by more than 20 km to decrease potential impacts on species that occur in coastal waters and over the continental slope. The airgun array will be shut-down immediately if there is a sighting at any distance of finless porpoises. Requirements to this effect have been included in the IHA.

Comment 213: CSI and WaH states the anticipated presence of female finless porpoises and their (neonatal) calves in the survey region during the proposed seismic surveys is of great concern, particularly given the fact that these animals will likely be difficult if not completely impossible to detect visually at distances at which they may still be exposed to noise levels >180 dB (rms), and do not vocalize at all times. These will be the most vulnerable individuals as they will be less able to maintain swimming speeds that will allow them to escape the range of the airguns.

Finless porpoises are generally slow-swimmers, but are capable of high speed

bursts. However it is unlikely that such speeds can be maintained for more than a few minutes.

Response: See responses to previous comments pertaining to finless porpoises.

Species of Particular Concern—Western Pacific Gray Whales

Comment 214: CSI states the route(s) and months when Western Pacific gray whales may undertake their migration from a suspected wintering ground(s) in the South China Sea are unknown. However, it is likely that the period for the migration is in the spring. The proposed L–DEO surveys overlap with the period during which these gray whales are expected to be either in their wintering grounds or are undergoing their northward migration through the Taiwan Strait. Scheduling the seismic surveys in the South China Sea to be conducted in March and April will likely coincide with at least some migrating gray whales, and are an additional threat to these highly threatened gray whales. L–DEO did not address this possibility and have not proposed any mitigation measures to avoid this likely overlap of seismic surveys and migrating gray whales. Even the take of a few individuals is projected to cause a continuing decline in the population towards extinction (Cooke *et al.,* 2006).

Response: Winter breeding grounds of the Western Pacific gray whale are not known, but are thought to be located in the South China Sea, along the coast of Guangdong province and Hainan (Wang, 1984; and Zhu, 1998 in Weller *et al.,* 2002a; Rice, 1998). Also, the migration route of the gray whale is ill defined, but very likely extends through Taiwanese waters, probably through the Taiwan Strait. Their occurrence there is possible from December to April. If migration timing is similar to that of the better-known Eastern Pacific gray whale through similar latitudes, southbound migration probably occurs mainly in December to January, and northbound migration mainly in February to April, with northbound migration of newborn calves and their mothers probably concentrated toward the end of that period. Even during migration, gray whales are found primarily in shallow coastal waters. Because of these concerns about the effects of the proposed surveys on gray whales, the proposed survey lines in the South China Sea south of the Taiwan Strait were re-routed after the issuance of the proposed IHA so that they are now located in water depths >200 m, as recommended by NRDC. The seismic lines in the western Taiwan Strait have been dropped. L–DEO will also immediately shut-down the airgun array if there is a sighting of a Western Pacific gray whale at any distance (see L–DEO's Supplemental EA).

Comment 215: In its discussion of disturbance reactions, HSI also notes the proposed IHA's **Federal Register** notice (73 FR 78294, December 22, 2008) use of the Eastern Pacific gray whale's status as an example of a species experiencing ''no impact'' despite living in a noisy environment. The notice states that the whales ''continued to migrate annually * * * with substantial increases in the population over recent years, despite intermittent seismic exploration and much ship traffic'' (73 FR 78302, December 22, 2008). However, the notice ignores the drastic drop in Eastern Pacific gray whale numbers between 1998 and 2000, by perhaps as many as 9,000 animals (Angliss and Outlaw, 2007). While it is certainly debatable to what (if any) degree exposure to various noise sources contributed to this population's decline, to ignore the decline when using the population as an example of a population's increase in the face of exposure to various noise sources is simply bad science.

Response: As a coastal population, the Eastern North Pacific stock of gray whales, are subject to a wide variety of direct and indirect anthropogenic effects off of Mexico, California, Oregon, Washington, Canada, and Alaska. Some of the effects include pollution from chemical contaminants, subsistence harvesting, fishery interactions, ship strikes, and potentially impacts from noise. The population size of the Eastern North Pacific gray whale stock has been increasing over the past several decades. Due to the steady increases in population abundance, this stock of gray whales was removed from the List of Endangered and Threatened Wildlife in 1994, as it was no longer considered Endangered or Threatened under the ESA.

The decline in Eastern Pacific gray whale numbers between 1998 and 2000 may be an indication that the abundance was responding to environmental limitations as the population approaches the carrying capacity of its environment. Visibly emaciated whales (LeBoeuf *et al.,* 2000; Moore *et al.,* 2001) suggest a decline in food resources associated with unusually high sea temperatures in 1997 (Minobe, 2002), which may factor in to the high mortality rates observed in 1999 and 2000 (Gulland *et al.,* 2005). Several factors since this mortality event suggest that the high mortality rate was a short-term acute event and not a chronic situation or trend: (1) Counts of stranded dead gray whales dropped to levels below those seen prior to this event, (2) in 2001 living whales no longer appeared to be emaciated, and (3) calf counts in 2001–2002, a year after the event ended, were similar to averages for previous years (NMFS, 2007; Rugh *et al.,* 2005). It is expected that a population close to or at the carrying capacity of the environment will be more susceptible to fluctuations in the environment (Moore *et al.,* 2001), and assessments indicated that the population is likely close to or above its unexploited equilibrium level (IWC, 2002). It can be predicted that the population will undergo fluctuations in the future that may be similar to the 2-year event that occurred in 1999–2000 (Norman *et al.,* 2000; Perez-Cortes *et al.,* 2000; Brownell *et al.,* 2001; Gulland *et al.,* 2005).

Species of Particular Concern—Humpback Whales

Comment 216: CSI states the schedule for surveying the Luzon Strait and the Philippine Sea overlaps completely with the period when humpback whales are still in the area (and includes the latter portion of the peak period (April) for humpback whale concentrations in the Babuyan Islands). Therefore it is unclear how the timing of the surveys reduces the impacts on humpback whales as claimed by L–DEO. A large portion of this population of humpback whales will also be migrating through the Philippine Sea to northern waters at the same time as the proposed surveys. Although the exact migratory routes of most humpback whales are unknown, it is clear that at least some will follow a path that is parallel and fairly close to the shores of eastern Taiwan. One of the proposed survey tracklines of the *Langseth* also follows this course. Many females undertaking the migration at this time will also be accompanied by neonatal calves and these are the most sensitive individuals of the population (McCauley *et al.,* 2000).

Response: Several commenters raised concerns about survey lines scheduled for Leg 2 (April 20 to June 7, 2009) approaching humpback whale breeding areas in the Babuyan and Ryuku Islands. In fact, the humpback whales that winter and calve in the Ryuku Islands are near Okinawa (Nishiwaki, 1959; Rice, 1989; Darling and Mori, 1993), some 400 km north of the most northerly survey. However, a small population of humpback whales does winter and calve in the Babuyan Islands in Luzon Strait (Acebes and Lesaca, 2003; Acebes *et al.,* 2007). The whales may arrive in the area as early as

November and leave in May or even June, with peak occurrence during February through March or April (Acebes *et al.,* 2007).

To mitigate against the potential effects of the surveys on humpback whales, particularly mothers and calves on the breeding grounds or during the beginning of migration to summer feeding grounds, the surveys that approach the Babuyan Islands have been rescheduled as late as possible, to Leg 4 (June 18 to July 20, 2009). L–DEO will also be required to shut-down immediately if there is a visual sighting at any distance for mother/calf pairs of humpback whales.

Description of Marine Mammals in the Proposed Activity Area

A total of 34 cetacean species, including 25 odontocete (dolphins and small- and large-toothed whales) species and 9 mysticetes (baleen whales) are known to occur in the proposed TAIGER study area (*see* Table 2 of L–DEO's application). Cetaceans and pinnipeds are managed by NMFS and are the subject of this IHA application. Information on the occurrence, distribution, population size, and conservation status for each of the 34 marine mammal species that may occur in the proposed project area is presented in the Table 2 of L–DEO's application as well as here in the table below (Table 2). The status of these species is based on the U.S. Endangered Species Act (ESA), the International Union for Conservation of Nature (IUCN) Red List of Threatened Species, and Convention on International Trade in Endangered Species (CITES). Several species are listed as Endangered under the ESA, including the Western North Pacific gray, North Pacific right, sperm, humpback, fin, sei, and blue whales, and the dugong (*Dugong dugon*). In addition, the Indo-Pacific humpback dolphin is listed as Near Threatened and the finless porpoise is listed as Vulnerable under the 2008 IUCN Red List of Threatened Species (IUCN, 2008).

Although the dugong may have inhabited waters off Taiwan, it is no longer thought to occur there (March *et al.,* n.d.; Chou, 2004; Perrin *et al.,* 2005). Similarly, although the dugong was once widespread through the Philippines, current data suggest that it does not inhabit the Batan or Babuyan Islands or northwestern Luzon (Marsh *et al.,* n.d.; Perrin *et al.,* 2005), where seismic operations will occur. However, the dugong does occur off northeastern Luzon (Marsh *et al.,* n.d.; Perrin *et al.,* 2005) outside the study area. In China, it is only known to inhabit the waters off Guangxi and Guangdong and the west coast of Hanain Island (Marsh *et al.,* n.d.; Perrin *et al.,* 2005), which do not occur near the study area. It is rare in the Ryuku Islands, but can be sighted in Okinawa, particularly off the east coast of the island (Yoshida and Trono, 2004; Shirakihara *et al.,* 2007); some individuals may have previously occurred in the southernmost of the Ryuku Islands, Yaeyama (Marsh *et al.,* n.d.), but these animals have not been documented there recently (Shirakihara *et al.,* 2007). The dugong is managed under the jurisdiction of the U.S. Fish and Wildlife Service (USFWS). The USFWS concurred with L–DEO's determination that the survey is likely to have no effects on the species and no consultation under Section 7 of the ESA is required, therefore, it is not considered further in this analysis.

Wang *et al.* (2001a) noted that during the spring/summer off southern Taiwan, the highest number of marine mammal sightings and species occur during April and June. The number of sightings per survey effort and the number of species were highest directly west of the southern tip of Taiwan and northeast off the southern tip.

Table 2 (below) outlines the cetacean species, their habitat and abundance in the proposed project area, and the requested take levels. Additional information regarding the distribution of these species expected to be found in the project area and how the estimated densities were calculated was included in the notice of the proposed IHA (73 FR 78294, December 22, 2008) and may be found in L–DEO's application.

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 seismic survey area in SE Asia. *See* Tables 2–4 in L–DEO's application for further detail.

TABLE 2

Species	Occurrence in study area in SE Asia	Habitat	Regional population size	Density/ 1000km [b] (best)	Density/ 1000km [c] (max)	Number of indiv. exposed to ≥ 160 dB	Percent of estimated population exposed to ≥ 160 dB
Mysticetes							
Western Pacific gray whale (*Eschrichtius robustus*).	Rare	Coastal	131 [d]	0	0	0	0
North Pacific right whale (*Eubalaena japonica*).	Rare	Pelagic and coastal.	Less than 100 [e]	0	0	0	0
Humpback whale (*Megaptera novaeangliae*).	Uncommon	Mainly near shore waters and banks.	938–1107 [f]	0.89	1.33	6	0.60
Minke whale (*Balaenoptera acutorostrata*).	Uncommon	Pelagic and coastal.	25,000 [g]	0.03	0.04	0	0
Bryde's whale *Balaenoptera brydei*).	Common	Pelagic and coastal.	20,000–30,000 [e h].	0.27	0.41	43	0.17
Omura's whale (*Balaenoptera omurai*).	Common?	Pelagic and coastal.	N.A.	0.03	0.04	4	N.A.
Sei whale (*Balaenoptera borealis*).	Rare	Primarily off-shore, pelagic.	7,260–12,620 [i]	0.03	0.04	4	0.04
Fin whale (*Balaenoptera physalus*).	Rare	Continental slope, mostly pelagic.	13,620–18,680 [j]	0.03	0.04	4	0.03

TABLE 2—Continued

Species	Occurrence in study area in SE Asia	Habitat	Regional population size	Density/ 1000km[b] (best)	Density/ 1000km[c] (max)	Number of indiv. exposed to ≥ 160 dB	Percent of estimated population exposed to ≥ 160 dB
Blue whale (*Balaenoptera musculus*).	Rare	Pelagic and coastal.	N.A.	0.03	0.04	4	N.A.
Odontocetes:							
Sperm whale (*Physeter macrocephalus*).	Common?	Usually pelagic and deep seas.	26,674[k]	0.03	0.04	4	0.01
Pygmy sperm whale (*Kogia breviceps*).	Uncommon	Deep waters ...	N.A.	0	0	.....	N.A.
Dwarf sperm whale (*Kogia sima*).	Common?	Deep waters off shelf.	11,200[e]	4.25	6.68	703	6.28
Kogia sp. (unidentified)	Common?	Deep waters ...	N.A.	0.26	0.40	38	N.A.
Cuvier's beaked whale (*Ziphius cavirostris*).	Likely Common	Pelagic	20,000[e]	0.34	0.75	58	0.29
Longman's beaked whale (*Indopacetus pacificus*).	Rare	Deep water	N.A.	N.A.	N.A.	.....	N.A.
Blainville's beaked whale (*Mesoplodon densirostris*).	Uncommon? ...	Pelagic	25,300[l]	0.89	1.60	153	0.61
Ginkgo-toothed beaked whale (*Mesoplodon ginkgodens*).	Rare	Pelagic	N.A.	N.A.	N.A.	.....	N.A.
Mesoplodon sp. (unidentified).	Uncommon? ...	Pelagic	N.A.	1.55	1.60	268	N.A.
Unidentified beaked whale	Rare	Pelagic	N.A.	0.72	0.94	118	N.A.
Rough-toothed dolphin (*Steno bredanensis*).	Common	Deep water	146,000 ETP[e]	1.33	5.44	212	0.14
Indo-Pacific humpback dolphin (*Sousa chinensis*).	Uncommon	Coastal	1,680 China + Taiwan[e].	24.30	35.36	0	0
Common bottlenose dolphin (*Tursiops truncatus*).	Common	Coastal and oceanic, shelf break.	243,500 ETP[e]	24.30	35.36	4,021	1.65
Indo-Pacific bottlenose dolphin (*Tursiops aduncus*).	Common?	Coastal and shelf waters.	N.A.	43.60	65.40	0	N.A.
Pacific white-sided dolphin (*Lagenorhynchus obliquidens*).	Rare, Likely Absent.	Coastal and pelagic.	930,000–990,000[e].	N.A.	N.A.	0	0
Pantropical spotted dolphin (*Stenella attenuata*).	Common	Coastal and pelagic.	800,000 ETP[e]	120.80	140.97	20,169	2.52
Spinner dolphin (*Stenella longirostris*).	Common	Coastal and pelagic.	800,000 ETP[e]	54.84	88.89	9,485	1.19
Striped dolphin (*Stenella coeruleoalba*).	Common	Coastal and pelagic.	1,000,000 ETP[e].	0.20	0.32	38	0.01
Fraser's dolphin (*Lagenodelphis hosei*).	Common	Waters greater than 1,000 m.	289,000 ETP[e]	96.84	124.14	16,749	5.80
Short-beaked common dolphin (*Delphinus delphis*).	Rare	Shelf and pelagic, seamounts.	3,000,000 ETP[e].	N.A.	N.A.	0	0
Long-beaked common dolphin (*Delphinus capensis*).	Uncommon	Coastal	N.A.	0.05	0.12	10	N.A.
Risso's dolphin (*Grampus griseus*).	Common	Pelagic	175,000 ETP[e]	41.88	67.18	7,209	4.12
Melon-headed whale (*Peponocephala electra*).	Common?	Oceanic	45,000 ETP[e] ..	13.37	20.86	2,173	4.83
Pygmy killer whale (*Feresa attenuata*).	Uncommon	Deep, pantropical waters.	39,000 ETP[e] ..	2.01	3.16	327	0.84
False killer whale (*Pseudorca crassidens*).	Common?	Pelagic	40,000[n]	4.56	4.77	789	1.97
Killer whale *(Orcinus orca*)	Uncommon? ...	Widely distributed.	8,500 ETP[e]	1.00	1.73	166	1.95
Short-finned pilot whale (*Globicephala macrorhynchus*).	Common?	Mostly pelagic, relief topography.	500,000 ETP[e]	3.83	6.43	630	0.13
Finless porpoise (*Neophocaena phocaenoides*).	Common?	Coastal	5,220–10,220 Japan + HK[e].	4.36	6.54	0	0
Sirenians:							

TABLE 2—Continued

Species	Occurrence in study area in SE Asia	Habitat	Regional population size	Density/ 1000km [b] (best)	Density/ 1000km [c] (max)	Number of indiv. exposed to ≥ 160 dB	Percent of estimated population exposed to ≥ 160 dB
Dugong (*Dugong dugon*) ..	Uncommon? ...	Coastal	N.A.	N.A.	N.A.	N.A.	N.A.

N.A.—Data not available or species status was not assessed, ETP—Eastern Tropical Pacific, HK = Hong Kong.
[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] Vladimirov *et al.* (2008).
[e] North Pacific unless otherwise indicated (Jefferson *et al.,* 2008).
[f] Western North Pacific (Calambokidis *et al.,* 2008).
[g] Northwest Pacific and Okhotsk Sea (IWC, 2007a).
[h] Kitakado *et al.* (2008).
[i] Tillman (1977).
[j] Ohsumi and Wada (1974).
[k] Western North Pacific (Whitehead, 2002b).
[l] ETP; all Mesoplodon spp. (Wade and Gerrodette, 1993).
[m] IUCN states that this species should be re-assessed following taxonomic classification of the two forms. The chinensis-type would be considered vulnerable (IUCN, 2008).
[n] ETP (Wade and Gerrodette, 1993).

Potential Effects on Marine Mammals

Potential Effects of Airguns

The 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. Some behavioral disturbance is expected, but this would be localized and short-term.

The notice of the proposed IHA (73 FR 78294, December 22, 2008) included a discussion of the effects of sounds from airguns on mysticetes, odontocetes, and pinnipeds, including tolerance, masking, behavioral disturbance, hearing impairment, and other non-auditory physical effects. Additional information on the behavioral reactions (or lack thereof) by all types of marine mammals to seismic vessels can be found in L–DEO's application and associated EA.

The notice of the proposed IHA also included a discussion of the potential effects of the multibeam echosounder (MBES) and the sub-bottom profiler (SBP). Because of the shape of the beams of these sources and their power, NMFS believes it unlikely that marine mammals will be exposed to either the MBES or the SBP at levels at or above those likely to cause harassment. Further, NMFS believes that the brief exposure of cetaceans to a few signals from the multi-beam bathymetric sonar system is not likely to result in the harassment of marine mammals.

Estimated Take by Incidental Harassment

The notice of the proposed IHA (73 FR 78294, December 22, 2008) included an in-depth discussion of the methods used to calculate the densities of the marine mammals in the area of the seismic survey and the take estimates. Additional information was included in L–DEO's application. A summary is included here.

All anticipated ''takes by harassment'' authorized by this IHA are Level B harassment only, involving temporary changes in behavior. The mitigation measures are expected to minimize the possibility of injurious takes. Take calculations were based on maximum exposure estimates (based on maximum density estimates) vs. best estimates and are based on the 160 dB isopleths of a larger array of airguns. Given these considerations, the predicted number of marine mammals that might be exposed to sounds 160 dB or greater may be somewhat overestimated.

No systematic aircraft- or ship-based surveys have been conducted for marine mammals in waters near Taiwan, and the species of marine mammals that occur there are not well known. A few surveys have been conducted from small vessels (approximately 10–12 m or 33–40 ft long) with low observation platforms (approximately 3 m or 10 ft above sea level) as follows:

- Off the east central coast of Taiwan to a maximum of approximately 20 km (12.4 mi) from shore in water depths up to approximately 1,200 m deep between June 1996 and July 1997 (all cetacean; Yang *et al.,* 1999);
- Off the south coast of Taiwan to a distance of approximately 50 km (mi) and depths greater than 1,000 m (3,280 ft) during April 13–September 9, 2000 (all cetaceans; Wang *et al.,* 2001a);
- Off the west coast of Taiwan close to shore during early April–early August, 2002–2006 (Indo-Pacific humpback dolphins; Wang *et al.,* 2007); and
- Around and between the Babuyan Islands off northern Philippines in waters less than 1,000 m deep during late February-May 2000–2003 (humpback whales; Acebes *et al.,* 2007).

The only density calculated by the authors was for the Indo-Pacific humpback dolphin (Wang *et al.,* 2007). In addition, a density estimate was also available for the Indo-Pacific bottlenose dolphin (Yang *et al.,* 2000 in Perrin *et al.,* 2005).

In the absence of any other density data, L–DEO used the survey effort and sightings in Yang *et al.* (1999) and Wang *et al.* (2001a) to estimate densities of marine mammals in the TAIGER study area. To correct for detection bias (bias associated with diminishing sightability with increasing lateral distance from the trackline), L–DEO used mean group sizes given by or calculated from Wang *et al.* (2001a, 2007) and Yang *et al.,* (1999), and a value for $f(0)$ of 5.32 calculated from the data and density equation in Wang *et al.* (2007); Yang *et al.* (1999), and Wang *et al.* (2001a) did

not give a value for $f(0)$, but they used a vessel and methods similar to those of Wang *et al.* (2007). To correct for availability and perception bias, which are attributable to the less than 100 percent probability of sighting an animals present along the survey trackline, L–DEO used $g(0)$ values calculated using surfacing and dive data from Erickson (1976), Barlow and Sexton (1996), Forney and Barlow (1998), and Barlow (1999): 0.154 for *Mesoplodon* sp., 0.102 for Cuvier's beaked whale, 0.193 for the dwarf sperm whale and *Kogia* sp., 0.238 for the killer whale, and 1.0 for delphinids.

The surveys of Yang *et al.* (1999) and Wang *et al.* (2001a) were carried out in areas of steep slopes and complex bathymetric features, where many cetacean species are known to concentrate. It did not seem reasonable to extrapolate those densities to the overall survey area, which is predominantly in areas of deep water without complex bathymetry. For latter areas, L–DEO used density data from two 5° x 5° blocks in the eastern tropical Pacific Ocean (ETP) surveyed by Ferguson and Barlow (2001): Blocks 87 and 88[2], bounded by 20° N to 25° N (the same latitudes as the proposed survey area and 115° W to 125° W, in deep water and just offshore from Mexico. L–DEO then calculated an overall estimate weighted by the estimated lengths of seismic lines over complex bathymetry or slope (approximately 1,200 km or 746 mi) and over deep, flat, or gently sloping bottom (approximately 12,934 km or 8,037 mi).

The density estimate for the Indo-Pacific hump-backed dolphin is from Wang *et al.* (2007) and applies only to the population's limited range on the west coat of Taiwan. No density data were available for the Pacific white-sided or short-beaked common dolphin for the study area. As these species are rare in the area, densities are expected to be near zero. In addition, density data were unavailable for striped and long-beaked common dolphins. As these two species were not seen during the above-mentioned surveys and are considered uncommon in the TAIGER study area, L–DEO assigned these two species 10 percent of the density estimate of the delphinid occurring in similar habitat in the area with the lowest density (i.e., pygmy killer whale). Also no density estimate was available for finless porpoise. As this species was not sighted during surveys of southern Taiwan in 2000 (Wang *et al.,* 2001a), L–DEO assigned it 10 percent of the lowest density (i.e., Indo-Pacific bottlenose dolphin). Density data were unavailable for Longman's beaked and ginkgo-toothed beaked whales; however, these two species are represented by densities for unidentified beaked whales.

Large whales were not sighted during the surveys by Yang *et al.* (1999) or Wang *et al.* (2001a). The only available abundance estimate for large whales in the area (except that for humpbacks, see below) is that of Shimada *et al.* (2008), who estimated abundances of Bryde's whales in several blocks in the northwestern Pacific based on surveys in 1998–2002, the closest of which to the proceed survey area is the block bounded by 10° N–25° N and 130° E–137.5° E. The resulting abundance and area were used to calculate density. Sperm, sei, Omura's, fin, minke, and blue whales are less common than Bryde's whales in these waters, so L–DEO assigned a density of 10 percent of that calculated for Bryde's whale. North Pacific right, and Western Pacific gray whales are unlikely to occur in the TAIGER study area, thus, densities were estimated to be zero.

For humpback whales in the Babuyan Islands, L–DEO used the population estimate of Acebes *et al.* (2007) and applied it to an area of approximately 78,000 km[2], extending from the north coast of Luzon to just south of Orchid Island to derive a density estimate. That area is a historically well-documented breeding ground that whaling records indicate was used until at least the 1960s (Acebes *et al.,* 2007), and an area where humpbacks have been sighted more recently.

There is some uncertainty about the representatives of the density data and the assumptions used in the calculations. For example, the timing of the surveys of Indo-Pacific humpback dolphins (early April-early August) and humpback whales (late February–May) overlaps the timing of the proposed surveys, but the Bryde's whale surveys (August and September), and those of Yang *et al.* (1999) (year-round) include different seasons, and would not be as representative if there are seasonal density differences. Perhaps the greatest uncertainty results from using survey results from the northeast Pacific Ocean. However, the approach used here 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 densities present and numbers of marine mammals potentially affected have been derived. Best estimates for most species are based on average densities from the surveys of Yang *et al.* (1999), Wang *et al.* (2001a), and Ferguson and Barlow (2001), weighted by effort, whereas maximum estimates are based on the higher of the two densities from the Taiwan surveys and the eastern Pacific survey blocks. For the sperm whales, mysticetes, two delphinids (Indo-Pacific humpback and Indo-Pacific bottlenose dolphins), as well as for the finless porpoise, the maximum estimates are the best estimates multiplied by 1.5. Densities calculated or estimated as described above are given in Table 3 of L–DEO's application.

The estimated numbers of individuals potentially exposed on each leg of the survey are based on the 160 dB re 1 μPa (rms) Level B harassment exposure threshold for cetaceans and pinnipeds. It is assumed that marine mammals exposed to airgun sounds at these levels might experience disruption of behavioral patterns.

It should be noted that the following estimates of takes by harassment assume that the surveys will be fully completed. As is typical during offshore ship surveys, inclement weather and equipment malfunctions are likely to cause delays and may limit the number of useful line-km to seismic operations that can be undertaken. Furthermore, any marine mammal sightings within or near the designated EZ will result in the power-down or shut-down of seismic operations as a mitigation measure. Thus, the following estimates of the numbers of marine mammals exposed to 160 dB sounds 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.

The number of different individuals that may be exposed to airgun sounds with received levels ≥160 dB re 1 μPa (rms) on one or more occasions was estimated by considering the total marine area that would be within the 160 dB radius around the operating airgun array on at least one occasion. The number of possible exposures (including repeated exposures of the same individuals) can be estimated by considering the total marine area that would be within the 160 dB radius around the operating airguns, including areas of overlap. The seismic lines are widely spaced in the survey area, and are further spaced in time because the survey is planned in discrete legs separated by several days. Thus, an individual mammal would not be exposed numerous times during the survey; the areas including overlap are 1.1 to 1.3 times the areas excluding overlap, depending on the leg, so the numbers of exposures are not discussed further. Moreover, it is unlikely that a particular animal would stay in the area during the entire survey.

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

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

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 were limited and included only once to determine the area expected to be ensonified when estimating the number of individuals exposed.

Applying the approach described above and in L–DEO's Supplemental EA, approximately 160,132 km^2 (61,827 mi^2), which is approximately 5 percent less than the original 168,315 km^2, 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 could be underestimated. However, the approach assumes that no cetaceans will move away from or toward the trackline as the *Langseth* approaches in response to increasing sound levels prior to the time the levels reach 160 dB, which will result in overestimates for those species known to avoid seismic vessels.

Table 3 (*see* below) outlines the species, estimated stock population (minimum and best), and estimated percentage of the stock exposed to seismic pulses in the project area. Additional information regarding the status, abundance, and distribution of the marine mammals in the area and how densities were calculated was included in Table 2 (*see* above), the notice of the proposed IHA (73 FR 78294, December 22, 2008) and may be found in L–DEO's application.

The estimates of the possible numbers of marine mammals exposed to sound levels greater than or equal to 160 dB during L–DEO's proposed seismic survey in SE Asia in March–July 2009. The proposed sound source consists of a 36-airgun, 6,600 in^3 array. Received levels are expressed in dB re 1 μPa (rms) (averaged over pulse duration), consistent with NMFS' practice. Not all marine mammals will change their behavior when exposed to these sound levels, but some may alter their behavior when levels are lower (*see* text). *See* Tables 2–4 in L–DEO's application for further detail.

TABLE 3

Species	Number of individuals exposed (best)[1]	Number of individuals exposed (max)[1]	Approx. percent regional population (best)[2]
Mysticetes:			
Western Pacific gray whale			
(*Eschrichtius robustus*)	0	0	0
North Pacific right whale			
(*Eubalaena japonica*)	0	0	0
Humpback whale			
(*Megaptera novaeangliae*)	6	9	0.60
Minke whale			
(*Balaenoptera acutorostrata*)	0	0	0
Bryde's whale			
(*Balaenoptera brydei*)	43	65	0.17
Omura's whale			
(*Balaenoptera omurai*)	4	6	N.A.
Sei whale			
(*Balaenoptera borealis*)	4	6	0.04
Fin whale			
(*Balaenoptera physalus*)	4	6	0.03
Blue whale			
(*Balaenoptera musculus*)	4	6	N.A.
Odontocetes:			
Sperm whale			
(*Physeter macrocephalus*)	4	6	0.01
Pygmy sperm whale			
(*Kogia breviceps*)	.....	.....	N.A.
Dwarf sperm whale			
(*Kogia sima*)	703	1,124	6.28
Kogia sp.			
(unidentified)	38	58	N.A.
Cuvier's beaked whale			
(*Ziphius cavirostris*)	58	131	0.29
Longman's beaked whale			
(*Indopacetus pacificus*)	.....	.....	N.A.
Blainville's beaked whale			
(*Mesoplodon densirostris*)	153	276	0.61
Ginkgo-toothed beaked whale			
(*Mesoplodon ginkgodens*)	.....	.....	N.A.
Mesoplodon sp.			
(unidentified)[3]	268	276	1.06
Unidentified beaked whale[4]	118	155	N.A.
Rough-toothed dolphin			
(*Steno bredanensis*)	212	865	0.14

TABLE 3—Continued

Species	Number of individuals exposed (best)[1]	Number of individuals exposed (max)[1]	Approx. percent regional population (best)[2]
Indo-Pacific humpback dolphin			
(*Sousa chinensis*)	0	0	0
Common bottlenose dolphin			
(*Tursiops truncatus*)	4,021	5,886	1.65
Indo-Pacific bottlenose dolphin			
(*Tursiops aduncus*)	0	0	N.A.
Pacific white-sided dolphin			
(*Lagenorhynchus obliquidens*)	0	0	0
Pantropical spotted dolphin			
(*Stenella attenuata*)	20,169	23,646	2.52
Spinner dolphin			
(*Stenella longirostris*)	9,485	15,373	1.19
Striped dolphin			
(*Stenella coeruleoalba*)	38	60	0.01
Fraser's dolphin			
(*Lagenodelphis hosei*)	16,749	21,470	5.80
Short-beaked common dolphin			
(*Delphinus delphis*)	0	0	0
Long-beaked common dolphin			
(*Delphinus capensis*)	10	23	0.01
Risso's dolphin			
(*Grampus griseus*)	7,209	11,478	4.12
Melon-headed whale			
(*Peponocephala electra*)	2,173	3,424	4.83
Pygmy killer whale			
(*Feresa attenuata*)	327	520	789
False killer whale			
(*Pseudorca crassidens*)	789	825	1.97
Killer whale			
(*Orcinus orca*)	171	297	2.01
Short-finned pilot whale			
(*Globicephala macrorhynchus*)	630	1,069	0.13
Finless porpoise			
(*Neophocaena phocaenoides*)	0	0	0
Sirenians			
Dugong			
(*Dugong dugon*)	.....	.....	N.A.

N.A.—Data not available or species status was not assessed.
[1] Best estimate and maximum estimate density are from Table 3 of L–DEO's application. There will be no seismic acquisition data during Leg 3 of the survey; this, it is not included here in this table.
[2] Regional population size estimates are from Table 2.
[3] Requested takes include Blainville's, and ginkgo-toothed beaked whales.
[4] Requested takes include Cuvier's, Blainville's, ginkgo-toothed, and Longman's beaked whales.

Table 1 of L–DEO's Supplemental EA 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 moved 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 1 of L–DEO's Supplemental EA and Table 3 (shown above). The ''best estimate'' total includes 65 baleen whale individuals, 25 of which are listed as Endangered under the ESA: 6 humpback whales (0.60 percent of the regional population), 4 sei whales (0.04 percent), 4 fin whales (0.03 percent), and 4 blue whales (regional population unknown). These estimates were derived from the best density estimates calculated for these species in the area (*see* Table 1 of L–DEO's Supplemental EA). In addition, 4 sperm whales (0.01 percent of the regional population), as well as 0 Indo-Pacific humpback dolphins (0 percent population, and 0 percent of the eastern Taiwan Strait (ETC) population), 0 finless porpoise (0 percent), and 597 beaked whales (including Longman's and ginkgo-toothed beaked whales) are included in the ''best estimate'' total. Most (97.8 percent) of the cetaceans potentially exposed are delphinids; pantropical spotted, Fraser's, and spinner dolphins are estimated to be the most common species in the area, with best estimates of 20,169 (2.52 percent of the regional population), 16,749 (5.80 percent), and 9,485 (1.19 percent) individuals exposed to greater or equal to 160 dB re µPa (rms) respectively.

Potential Effects on Habitat

A detailed discussion of the potential effects of this action on marine mammal habitat, including physiological and behavioral effects on marine fish and invertebrates was included in the proposed IHA (73 FR 78294, December 22, 2008). Based on the discussion in the proposed IHA notice and the nature of the activities (limited duration), the authorized operations are not expected to have any habitat-related effects that could cause significant or long-term consequences for individual marine

mammals or their populations or stocks. Similarly, any effects to food sources are expected to be negligible.

The L–DEO 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 L–DEO's application and EA, respectively.

Subsistence Activities

There is no legal subsistence hunting for marine mammals in the waters of Taiwan, China, or the Philippines, so the proposed activities will not have any impact on the availability of the species or stocks for subsistence users. Today, Japan still hunts whales and dolphins for ''scientific'' purposes. Up until 1990, a drive fishery of false killer whales occurred in the Penghu Islands, Taiwan, where dozens of whales were taken. Although killing and capturing of cetaceans has been prohibited in Taiwan since August 1990 under the Wildlife Conservation Law (Zhou *et al.,* 1995; Chou, 2004), illegal harpooning still occurs (Perrin *et al.,* 2005). Until the 1990's, there was a significant hunt of around 200 to 300 dolphins annually in the Philippines. Catches included dwarf sperm, melon-headed, and short-finned pilot whales, as well as bottlenose, spinner, Fraser's, and Risso's dolphins (Rudolph and Smeenk, 2002). Reports also indicate that perhaps 5 Bryde's whales were caught annually (Rudolph and Smeenk, 2002), although the last Bryde's whales were caught in 1996 (Reeves, 2002). Successive bans on the harvesting of whales and dolphins were issued by the Philippine Government during the 1990's.

Mitigation and Monitoring

Mitigation and monitoring measures for the seismic survey have been developed and refined during previous L–DEO 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 TAIGER survey include:

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

(2) Power-down procedures;

(3) Shut-down procedures;

(4) Ramp-up procedures;

(5) Temporal and spatial avoidance of sensitive species and areas, provided that doing so will not compromise operational safety requirements (see ''temporal and spatial avoidance,'' below);

(6) Special procedures for situations or species of particular concern, e.g., emergency shutdown procedures if a North Pacific right whale, Western Pacific gray whale, humpback whale mother/calf pairs, Indo-Pacific humpback and bottlenose dolphins, and finless porpoise are sighted from any distance (*see* ''shut-down procedures'' and ''special procedures for species of particular concern'' below); and minimization of approaches to slopes and submarine canyons, if possible, because of sensitivity for beaked whales; and

(7) Additional mitigation measures (*see* ''additional mitigation measures'' below). The thresholds for estimating take are also used in connection with mitigation.

Vessel-Based Visual Monitoring

Vessel-based 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 shutdown of the airguns (i.e., 8 minutes). 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 airguns will be powered-down, or if necessary, shut-down completely (see below), when marine mammals are detected within or about to enter a designated EZ. The MMVOs will continue to maintain watch to determine when the animal(s) are outside the safety radius, and airgun operations will not resume until the animal has left that zone. The predicted distances for the safety radius are listed according to the sound source, water depth, and received isopleths in Table 1.

During seismic operations in SE Asia, at least four MMOs and one bioacoustician will be based aboard the *Langseth* (five total MMOs). MMVOs will be appointed by L–DEO with NMFS concurrence. At least two MMVOs (except during meal times) will monitor the EZ from the observation tower for marine mammals during ongoing daytime operations and nighttime startups of the airguns. Three MMOs are typically on watch at a time, two on the observation tower conducting and the third monitoring the PAM equipment. Use of two simultaneous MMVOs and one bioacoustician will increase the effectiveness of detecting animals near the sound source. MMVOs typically visually observe for one to three hours, and MMVOs will be on duty in shifts of duration no longer than three hours. MMOs and/or the lead bioacoustician will monitor the PAM equipment at all times in shifts of one to six hours. L–DEO has employed a regional expert as at least one of the MMOs, and has negotiated with experts from National Taiwan University, Academia Sinica, and the National Taiwan Ocean University. L–DEO is carrying an additional MMO (six total MMOs), who is a Taiwan regional expert from Dr. Lien-Siang Chou's team, during Leg 2 of the seismic survey (and during Leg 4 as well). 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 was given additional instruction regarding how to do so.

The *Langseth* is a suitable platform for marine mammal observations. When stationed on the observation platform, the eye level will be approximately 18 m (58 ft) above sea level, and the observer will have a good view around the entire vessel. During the daytime, the MMVO(s) will scan the area around the vessel systematically with reticle binoculars (e.g., 7x50 Fujinon), Big-eye binoculars (25x150), and with the naked eye to avoid eye fatigue. During darkness, night vision devices will be available (ITT F500 Series Generation 3 binocular-image intensifier or equivalent), when required. Laser rangefinding binoculars (Leica LRF 1200 laser rangefinder or equivalent) will be available to assist with distance estimation. Those are useful in training MMVOs to estimate distances visually, but are generally not useful in measuring distances to animals directly; that is done primarily with the reticles on the binocular's lenses.

Speed or Course Alteration—If a marine mammal is detected outside the safety radius and based on its position

and the relative motion, is likely to enter the EZ, the vessel's speed and/or direct course may be changed. This would be done if practicable while minimizing the effect on the planned science objectives. The activities and movements of the marine mammal(s) (relative to the seismic vessel) will then be closely monitored to determine whether the animal(s) is approaching the applicable EZ. If the animal appears likely to enter the EZ, further mitigative actions will be taken, i.e., either further course alterations or a power-down or shut-down of the airguns. Typically, during seismic operations, major course and speed adjustments are often impractical when towing long seismic streamers and large source arrays, thus alternative mitigation measures (see below) will need to be implemented.

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

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

Following a power-down, airgun activity will not resume until the marine mammal is outside the EZ for the full array. The animal will be considered to have cleared the EZ if it:

(1) Is visually observed to have left the EZ, or

(2) Has not been seen within the EZ for 15 minutes in the case of species with shorter dive durations—small odontocetes and pinnipeds; or

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

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

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

Considering the conservation status for North Pacific right whales and Western Pacific gray whales, and Indo-Pacific humpback dolphins, the airgun(s) will be shut-down immediately if either of these species are observed, regardless of the distance from the *Langseth.* Due to additional concerns, shut-downs will also occur for visual sightings of humpback whale mother/calf pair, Indo-Pacific bottlenose dolphins and/or finless porpoises. Ramp-up will only begin 30 min after the last documented whale visual sighting, and 15 min after the last documented dolphin/porpoise sighting.

Ramp-up Procedures—A ramp-up procedure will be followed when the airgun array begins operating after a specified period without airgun operations or when a power-down has exceeded that period. It is proposed that, for the present cruise, this period would be approximately 8 minutes. This period is based on the largest modeled 180 dB radius for the 36-airgun array (*see* Table 1 of L–DEO's application and Table 1 here) in relation to the planned speed of the *Langseth* while shooting. Similar periods (approximately 7–10 minutes) were used during previous L–DEO surveys.

Ramp-up will begin with the smallest airgun in the array (40 in^3). Airguns will be added in a sequence such that the source level of the array will increase in steps not exceeding 6 dB per 5 min period over a total duration of approximately 35 minutes. During ramp-up, the MMVOs will monitor the EZ, and if marine mammals are sighted, a course/speed change, power-down, or shut-down will be implemented as though the full array were operational.

If the complete EZ has not been visible for at least 30 min prior to the start of operations in either daylight or nighttime, ramp-up will not commence unless at least one airgun (40 in^3 or similar) has been operating during the interruption of seismic survey operations. Given these provisions, it is likely that the airgun array will not be ramped up from a complete shut-down at night or in thick fog, because the other part of the EZ for that array will not be visible during those conditions. If one airgun has operated during a power down period, ramp-up to full power will be permissible at night or in poor visibility, on the assumption that marine mammals will be alerted to the approaching seismic vessel by the sounds from the single airgun and could move away if they choose. Ramp-up of the airguns will not be initiated if a marine mammal is sighted within or near the applicable EZ during the day or close to the vessel at night.

Temporal and Spatial Avoidance—The *Langseth* will not acquire seismic data in the humpback winter concentration areas during the early part of the seismic program. North Pacific humpback whales are known to winter and calve around Ogasawara (400 km north of the most northerly survey) and Ryuku Islands in southern Japan and in the Babuyan Islands in Luzon Strait in the northern Philippines (Perry *et al.,* 1999a; Acebes *et al.,* 2007; Calambokidis *et al.,* 2008). In the Luzon Strait, a small population of humpback whales may arrive in the area as early as November and leave in May or even June, with a peak occurrence during February through March or April (Acebes *et al.,* 2007). To mitigate against the potential effects of the surveys on humpback whales, particularly mothers and calves on the breeding grounds or during the beginning of migration to summer feeding grounds, the *Langseth* will avoid these wintering areas at the time of peak occurrence, by surveying the lines that approach the Babuyan Islands as late as possible to Leg 4 (June 18 to July 20).

Due to the conservation status of Indo-Pacific humpback dolphins in the Taiwan Strait, particularly the central western coast off Taiwan's west coast (including the Waishanding Jhou sandbar), the cruise tracks will be approximately 20 km (12.4 mi) offshore to protect this sub-population and finless porpoises, as well as to ease potential pressure on other coastal species. This is consistent with the

conservative buffer recommended by ETSSTAWG in their comments to NMFS, ''at least 13 km (8.1 mi) and perhaps a more precautionary 15 km (9.3 mi) to the ETS *Sousa* population (Indo-Pacific humpback dolphin)—meaning up to 20 km from shore'' to minimize the potential of exposing these threatened dolphins to SPLs greater than 160 dB re 1 µPa (rms), subject to the limitations imposed by other foreign nations. Regarding the buffer for the area between the Penghu Islands and the Waishanding Jhou sandbar, the widest point between the closest Penghu island and the sandbar is 34.2 km (21.3); therefore the mid-line for the planned survey is 17.1 km (10.6 mi). The total distance between Taiwan and the Penghu Islands is approximately 45 km and the planned seismic survey line off the west coast of Taiwan is within the territorial sea of Taiwan.

Because of the concerns about potential effects of the seismic surveys on Western Pacific gray whales (wintering areas and migration), Indo-Pacific humpback dolphins, and finless porpoises, the seismic survey lines in the South China Sea south of the Taiwan Strait have been re-routed so that they are now located in water depths greater than 200 m (656 ft), as recommended by NRDC. Those in the Taiwan Strait will be as far east as possible from the mainland China side. The seismic lines that were proposed in the IHA application in the western Taiwan Strait have been dropped.

Because of concerns about potential effects of the seismic surveys on coastal species and those that frequent the continental shelf break and steep slopes (e.g., beaked and sperm whales), the proposed survey line paralleling the east coast of Taiwan (the continental shelf is narrow there) has also been moved offshore by more than 20 km to decrease potential impacts on these species (*see* Figure 1 of L–DEO's Supplemental EA).

Procedures for Species of Particular Concern—Several species of particular concern could occur in the study area. Special mitigation procedures will be used for these species as follows:

(1) The airguns will be shut-down if a North Pacific right whale, Western Pacific gray whale, humpback whale mother/calf pair, Indo-Pacific humpback and bottlenose dolphin, and/or finless porpoise is sighted at any distance from the vessel;

(2) Because of the sensitivity of beaked whales, approach to slopes, submarine canyons, and other underwater geologic features will be minimized, if possible, during the survey (Figure 1 of L–DEO's application); and

(3) If visually sighted, avoidance of concentrations of humpback, sperm, and beaked whales, and dugongs.

Additional Mitigation Measures

(1) To the maximum extent practicable, L–DEO will schedule seismic operations in inshore or shallow waters during daylight hours and OBS operations to nighttime hours.

(2) To the maximum extent practicable, inshore seismic surveys will be conducted from the coast (inshore) and proceed towards the sea (offshore) in order to avoid trapping marine mammals in shallow water.

(3) NSF and L–DEO have coordinated with the governments of Taiwan, Japan, and the Philippines regarding the marine geophysical activity.

(4) NMFS expects NSF and L–DEO to adhere to conservation laws and regulations of nations while in foreign waters, and known rules and boundaries of Marine Protected Areas (MPA). In the absence of local conservation laws and regulations or MPA rules, L–DEO will continue to use the monitoring and mitigation measures identified in the IHA.

Passive Acoustic Monitoring

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

The PAM system consists of hardware (i.e., hydrophones) and software. The ''wet end'' of the system consists of a low-noise, towed hydrophone array that is connected to the vessel by a ''hairy'' faired cable. The array will be deployed from a winch located on the back deck. A deck cable will connect from the winch to the main computer lab where the acoustic station and signal condition and processing system will be located. The lead-in from the hydrophone array is approximately 400 m (1,312 ft) long, and the active part of the hydrophone is approximately 56 m (184 ft) long. The hydrophone array is typically towed at depths less than 20 m (65.6 ft).

The towed hydrophone array will be monitored 24 hours per day while at the survey area during airgun operations, and also during most periods when the *Langseth* is underway while the airguns are not operating. One MMO will monitor the acoustic detection system at any one time, by listening to the signals from two channels via headphones and/or speakers and watching the real time spectrographic display for frequency ranges produced by cetaceans. MMOs monitoring the acoustical data will be on shift for 1–6 hours. Besides the ''visual'' MMOs, an additional MMO with primary responsibility for PAM will also be aboard. However, all MMOs are expected to rotate through the PAM position, although the most experienced with acoustics will be on PAM duty more frequently.

When a vocalization is detected, the acoustic MMO will, if visual observations are in progress, contact the MMVO immediately to alert him/her to the presence of the cetacean(s) (if they have not already been seen), and to allow a power down or shutdown to be initiated, if required. The information regarding the call will be entered into a database. The data to be entered include an acoustic encounter identification number, whether it was linked with a visual sighting, date, time when first and last heard and whenever any additional information was recorded, position and water depth when first detected, bearing if determinable, species or species group (e.g., unidentified dolphin, sperm whale), types and nature of sounds heard (e.g., clicks, continuous, sporadic, whistles, creaks, burst pulses, strength of signal, etc.), and any other notable information. The acoustic detection can also be recorded for further analysis.

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

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 shut-down of the seismic source when a marine mammal or sea turtle 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 shutdown, 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 powering down or 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 per terms of MMPA authorizations or regulations.

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

(4) 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. 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.

Monitoring to Date

During Leg 1 of the TAIGER survey, L–DEO's MMOs onboard the *Langseth* have reported four visual sightings and four acoustic detections during operations in the study area. MMOs have visually sighted a group of sperm whales (approximately 3 individuals), a group of short-finned pilot whales (approximately 36 individuals), an unidentified toothed whale, and a single unidentified sea turtle during the four visual sightings. For the four acoustic detections made, spectrograms resembling known sounds made by sperm whales and melon-headed whales were recorded during visual observations of the sperm whale and unidentified toothed whale, respectively. Spectrograms resembling a call of a melon-headed whale and an unidentified whistle were recorded on different nights. Two of the visual sightings of cetaceans occurred while one airgun was in operations and did not require additional mitigation action. The visual sighting of a group of pilot whales occurred during a period of no seismic activity. A power-down was initiated for the sighting of the single unidentified sea turtle.

During Leg 2 of the TAIGER survey, L–DEO's MMOs onboard the *Langseth* have reported 11 visual sightings and 8 acoustic detections during operations in the study area. No visual or acoustic detections were made during week one of Leg 2. During week two of the Leg 2, MMOs on the *Langseth* recorded six visual sightings of marine mammals (all during seismic operations), two of which sightings required a power-down. MMOs have visually sighted two groups of unidentified dolphins, two groups of unidentified toothed whales (both probable false killer whales), a group of pantropical (approximately 100 individuals), and a group of Fraser's dolphins (approximately 50 individuals). A total of five acoustic detections were of unidentified toothed whales and three of unidentified dolphins. Only one of those acoustic detections was concurrent with a visual sighting (unidentified toothed whale).

During week three of Leg 2, MMOs on the *Langseth* recorded four visual sightings of marine mammals (all during seismic operations), one of which required a power-down. MMOs have visually sighted four groups of unidentified dolphins (one probably bottlenose dolphin group). The groups ranged from approximately 12 to 75 individuals. No acoustic detections were made during week three.

During week four of Leg 2, MMOs on the *Langseth* recorded one visual sighting of spinner dolphins (approximately 75 individuals), and implemented a power-down during the sighting. No other sightings were made during week four. Three acoustic detections of delphinids were made during week three, all on the same day.

No monitoring for marine mammals was conducted during Leg 3 of the TAIGER survey, as it only consisted of OBS operations. During week one of Leg 4, three marine mammal sightings were made. No sightings occurred during seismic periods; thus, not shut-downs or power-downs of the airgun array were required. The sightings included an unidentified sea turtle, sperm whales (approximately two individuals), melon-headed whales (approximately 20 individuals), and unidentified dolphins (approximately 12 individuals). On June 23, 2009, two acoustic detections of delphinids were made, and another delphinid acoustic detection was made on June 28, 2009. All acoustic detections occurred during seismic activity, but none required mitigation measures.

During week one of Leg 4, MMOs on the *Langseth* recorded three marine mammal sightings and an unidentified sea turtle. No sightings occurred during seismic periods; thus, no shut-downs or power-downs of the airgun array were required. The marine mammal sightings included one of sperm whales (approximately 2 individuals), a group of melon-headed whales (approximately 20 individuals), and a group of unidentified dolphins (approximately 12 individuals). On June 23, 2009, two acoustic detections of delphinids were made. On June 28, 2009, an additional delphinid acoustic detection was made. All acoustic detections occurred during seismic activity, but none required mitigation measures.

During week two of Leg 4, MMOs on the *Langseth* recorded two marine mammal sightings. Both sightings of unidentified dolphins (approximately 2

and 100 individuals) occurred during seismic activity, but only one sighting required a power-down of the airgun array. There were no shut-downs due to marine mammal sightings during this period. There were four acoustic detections, all of which occurred during seismic activity.

During week three of Leg 4, MMOs on the *Langseth* recorded one marine mammal sighting. The group of five individual sperm whales consisted of four adults and one calf. This sighting occurred during seismic activity, but did not require the implementation of any mitigation measures. No acoustic detections were made during this period.

During week four of Leg 4, MMOs on the *Langseth* recorded one marine mammal sighting. One sighting of 36 pantropical spotted dolphins (24 adults and 12 calves) was made during this period. This sighting occurred during seismic activity, but did not require the implementation of any mitigation measures. There were two acoustic detections made during this period, both of which occurred during seismic activity.

IHA Modifications

On March 31, 2009, NMFS issued an IHA to L–DEO to take small numbers of marine mammals incidental to conducting a marine geophysical survey in SE Asia, under a cooperative agreement with NSF, as part of the TAIGER program from March–July, 2009. On April 21, 2009, NMFS received a request from L–DEO, asking that IHA conditions (10(u) and 10(w)) be modified for clarification because as currently written, the conditions would effectively preclude the complete execution of Leg 2—the seismic survey line along the west coast of Taiwan. Specifically, condition 10(u) only allowed the survey to occur if the Taiwan Strait were more than 170 km wide throughout its entire length or only in the southern portion of the area. The area between Taixi and Tongshiao, which demarcates the primary distribution of the 'critically endangered' (IUCN, 2008) Indo-Pacific humpback dolphin Eastern Taiwan Strait sub-population, is typically narrower than 170 km. L–DEO stated that the 150 km distance probably originated as an error with an early draft of the Supplemental EA.

Condition 10(w) did not specifically address the maintenance of a conservative buffer from the Penghu Islands and the Waishanding Jhou sandbar. Under the modification to condition 10(w) the planned seismic survey line will only change in the area between the Penghu Islands and the Waishanding Jhou sandbar. The widest point between the closest Penghu island and the sandbar is 34.2 km (21.3 mi); therefore the mid-line for the planned survey is 17.1 km (10.6 mi). The total distance between Taiwan and the Penghu Islands is approximately 45 km and the planned seismic survey line off the west coast of Taiwan is within the territorial sea of Taiwan. Additionally, as requested by L–DEO, distances stated in the IHA now include nautical miles for navigational purposes.

In addition, NMFS clarified condition 10(s). Condition 10(s) needed to be modified to more specifically describe the geographical area of the Taiwan Strait where the first and second legs of the TAIGER survey are being conducted. Prior to the issuance of the original IHA, L–DEO voluntarily dropped the seismic survey tracklines in the western Taiwan Strait for a number of reasons, including concerns about the effects of the surveys on Western Pacific gray whales, Indo-Pacific humpback dolphins, and finless porpoises, and because China denied L–DEO access to their waters. Condition 10(s), as modified, better reflects these circumstances.

A copy of the modified IHA can be found online at: *http://www.nmfs.noaa.gov/pr/pdfs/permits/taiger_iha_modified.pdf.*

On July 13, 2009, NMFS received a request from L–DEO for an additional 16 authorized takes of sperm whales for the remainder of the seismic survey. It is unlikely that his many animals will be exposed to these sound levels, but with the group dynamic for this particular species, additional numbers have been requested to allow for a chance encounter of a large sperm whale group. During vessel operations in the TAIGER study area, there have been 13 individual sperm whales sighted in three groups. On July 8, 2009, five individuals were identified by MMOs to have been exposed to sound levels greater than or equal to 160 dB re 1 μPa (rms) in the study area. These five animals were observed in a single group about 2 km (1.24 mi) from the MMO observation tower (approximately 2.2 km [1.37 mi] from the closest airgun) onboard the *Langseth*. These animals showed similar movement and behavioral responses as those observed outside the 160 dB isopleths. L–DEO has provided additional sighting data as well. Authorized takes of 20 sperm whales (0.08 percent of the regional population) are included in the IHA modified on July 15, 2009.

Endangered Species Act (ESA)

Pursuant to Section 7 of the ESA, NSF has consulted with the NMFS, Office of Protected Resources, Endangered Species Division on this seismic survey. NMFS has also consulted internally pursuant to Section 7 of the ESA on the issuance of an IHA under section 101(a)(5)(D) of the MMPA for this activity. On March 31, 2009, NMFS concluded consultation with NMFS and NSF and issued a Biological Opinion (BiOp), which concluded that the proposed action and issuance of an IHA are not likely to jeopardize the continued existence of North Pacific right, Western Pacific gray, blue, fin, sei, humpback, and sperm whales, and leatherback (*Dermochelys coriacea*), green (*Chelonia mydas*), loggerhead (*Caretta caretta*), hawksbill (*Eretmochelys imbricata*), and olive ridley (*Lepidochelys olivacea*) sea turtles. The BiOp also concluded that designated critical habitat for these species does not occur in the action area and would not be affected by the survey. Relevant Terms and Conditions of the Incidental Take Statement in the BiOp have been incorporated into the IHA.

Since NMFS modified the IHA issued to L–DEO, a review under Section 7 was conducted. On May 1, 2009, NMFS concluded that the proposed revisions to the IHA would not cause adverse effects on species or designated critical habitat. Given this, the consultation requirements have been met and no additional consultation is required for the issuance of the revised IHA.

National Environmental Policy Act (NEPA)

NSF prepared an EA titled ''Marine Seismic Survey in Southeast Asia, March–July 2009'' that references L–DEO's EA and Supplemental EA of a Marine Geophysical Survey by the R/V *Marcus G. Langseth* in Southeast Asia, March–July 2009. LGL Limited, Environmental Research Associates, prepared the EA and Supplemental EA on behalf of L–DEO and NSF. NMFS has adopted NSF's EA and issued a Finding of No Significant Impact (FONSI) for the issuance of the IHA. The modification of the IHA was within the scope of the impacts considered in the EA and used to support the FONSI.

Determinations

NMFS has determined that the impact of conducting the seismic survey in SE Asia 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 action.

For reasons stated previously in this document, this 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 marine mammals would have to be closer than 40 m (131 ft) in deep water, 60 m (197 ft) at intermediate depths, or 296 m (971 ft) in shallow water when a single 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 TTS;

(3) The fact that cetaceans would have to be closer than 950 m (0.6 mi) in deep water, 1,425 m (0.9 mi) at intermediate depths, and 3,694 m (2.3 mi) in shallow water when the full array is in use at a 9 m (29.5 ft) tow depth from the vessel to be exposed to levels of sound (180 dB) believed to have even a minimal chance of causing TTS;

(4) The fact that marine mammals would have to be closer than 6,000 m (3.7 mi) in deep water, 6,667 m (4.1 mi) at intermediate depths, and 8,000 m (4.9 mi) in shallow water when the full array is in use at a 9 m (29.5 ft) tow depth from the vessel to be exposed to levels of sound (160 dB) believed to have even a minimal chance at causing TTS;

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

(6) The use of PAM, which is effective out to tens of km, will assist in the detection of vocalizing marine mammals at greater distances from the vessel;

(7) The incorporation of other required mitigation measures (i.e., ramp-up, power-down, shut-down, temporal and spatial avoidance, special measures for species of particular concern, and additional mitigation measures); and

(8) The relatively limited duration and geographically widespread distances of the seismic survey in the SE Asia study area (approximately 103 days). 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 required monitoring and mitigation measures.

While the number of marine mammals potentially incidentally harassed will depend on the distribution and abundance of marine mammals in the vicinity of the survey activity, the number of potential harassment takings is estimated to be small, relative to the affected species and stock sizes (less than a few 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.

Authorization

As a result of these determinations, NMFS issued and modified an IHA to L–DEO for conducting a marine geophysical survey in SE Asia from March–July, 2009, including the previously mentioned mitigation, monitoring, and reporting requirements.

James H. Lecky,

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

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