



MARINE MAMMAL COMMISSION

6 June 2011

Mr. P. Michael Payne, Chief
Permits, Conservation, and Education Division
Office of Protected Resources
National Marine Fisheries Service
1315 East-West Highway
Silver Spring, MD 20910-3225

Dear Mr. Payne:

The Marine Mammal Commission, in consultation with its Committee of Scientific Advisors on Marine Mammals, has reviewed the application submitted by the Lamont-Doherty Earth Observatory seeking authorization under section 101(a)(5)(D) of the Marine Mammal Protection Act to take small numbers of marine mammals by harassment. The taking would be incidental to a marine seismic survey in the western Gulf of Alaska from June through August 2011. The Commission also has reviewed the National Marine Fisheries Service's 6 May 2011 *Federal Register* notice announcing receipt of the application and proposing to issue the authorization, subject to certain conditions (76 Fed. Reg. 26255).

RECOMMENDATIONS

The Marine Mammal Commission recommends that the National Marine Fisheries Service—

- require the Lamont-Doherty Earth Observatory to re-estimate the proposed exclusion and buffer zones and associated takes of marine mammals using site-specific information;
- if the exclusion and buffer zones and takes are not re-estimated, require the Lamont-Doherty Earth Observatory to provide a detailed justification (1) for basing the exclusion and buffer zones for the proposed survey in the Gulf of Alaska on empirical data collected in the Gulf of Mexico or on modeling that relies on measurements from the Gulf of Mexico and (2) that explains why simple ratios were used to adjust for tow depth and median values were applied to intermediate water depths rather than using empirical measurements;
- use species-specific maximum densities rather than best densities to re-estimate the anticipated number of takes;
- if the Service is planning to allow the applicant to resume full power after nine minutes under certain circumstances, specify in the authorization all conditions under which a 9-minute period could be followed by a full-power resumption of the airguns;
- extend the 30-minute period following a marine mammal sighting in the exclusion zone to cover the full dive times of all species likely to be encountered;
- prior to granting the requested authorization, provide additional justification for its preliminary determination that the proposed monitoring program will be sufficient to detect, with a high level of confidence, all marine mammals within or entering the identified exclusion and buffer zones, including (1) identifying those species that it believes can be

- detected with a high degree of confidence using visual monitoring only, (2) describing detection probability as a function of distance from the vessel, (3) describing changes in detection probability under various sea state and weather conditions and light levels, and (4) explaining how close to the vessel marine mammals must be for observers to achieve high nighttime detection rates;
- consult with the funding agency (i.e., the National Science Foundation) and individual applicants (e.g., the Lamont-Doherty Earth Observatory and U.S. Geological Survey) to develop, validate, and implement a monitoring program that provides a scientifically sound, reasonably accurate assessment of the types of marine mammal taking and the number of marine mammals taken;
 - require the applicant to (1) report on the number of marine mammals that were detected acoustically and for which a power-down or shut-down of the airguns was initiated, (2) specify if such animals also were detected visually, and (3) compare the results from the two monitoring methods (visual versus acoustic) to help identify their respective strengths and weaknesses;
 - condition the authorization to require the Lamont-Doherty Earth Observatory to monitor, document, and report observations during all ramp-up procedures;
 - work with the National Science Foundation to analyze these monitoring data to help determine the effectiveness of ramp-up procedures as a mitigation measure for geophysical surveys after the data are compiled and quality control measures have been completed; and
 - condition the incidental harassment authorization to require the Observatory to (1) report immediately all injured or dead marine mammals to the Service and (2) suspend the geophysical survey if a marine mammal is seriously injured or killed and the injury or death could have been caused by the survey (e.g., a fresh dead carcass); if additional measures are not likely to reduce the risk of additional serious injuries or deaths to a very low level, require the Observatory to obtain the necessary authorization for such takings under section 101(a)(5)(A) of the Marine Mammal Protection Act before allowing it to continue this survey or initiate additional surveys.

RATIONALE

The National Science Foundation is funding the Lamont-Doherty Earth Observatory (Observatory) to conduct a geophysical survey to characterize the subduction zone from the Shumagin Islands to east of Kodiak Island, Alaska (from 52.5° to 59° N latitude and 147.5° to 151° E longitude). The Observatory would conduct the survey in water depths from 25 m to greater than 6,000 m, with approximately 2,553 km of tracklines and turns. It would use the R/V *Marcus G. Langseth* towing a 36-airgun array (nominal source levels 236 to 265 dB re 1 μ Pa (peak-to-peak) with a maximum discharge volume of 6,600 in³). The *Langseth* also would tow two hydrophone streamers, 8 km in length, coupled with up to 21 ocean-bottom seismometers. The Observatory also would operate a 10.5–13 kHz multibeam echo sounder during airgun operations and a sub-bottom profiler continuously throughout the cruise.

The Service preliminarily has determined that, at most, the proposed activities would result in a temporary modification in the behavior of small numbers of up to 16 species of marine mammals and that any impact on the affected species would be negligible. The Service also does not anticipate any take of marine mammals by death or serious injury. It also believes that the potential for temporary or permanent hearing impairment will be at the least practicable level because of the proposed mitigation and monitoring measures. Those measures include exclusion and buffer zones and power-down, shut-down, and ramp-up procedures.

The Commission continues to be concerned about certain aspects of this and similar authorizations for geophysical surveys. These concerns have been raised in past Commission letters (e.g., see the enclosed letter from 2 May 2011) regarding geophysical surveys funded by the National Science Foundation.

Uncertainty in Modeling Exclusion and Buffer Zones

Exclusion zones are intended to protect marine mammals that are close enough to a sound source to be injured or killed by exposure to the sound. Buffer zones are used to delineate the area in which Level B harassment may occur and to estimate the number of marine mammals taken. Both zones are established based on the generation and propagation of sound from the source. In 2007–2008, the Observatory conducted sound propagation studies using airgun arrays from the *Langseth* and used the results to create a model of sound propagation for estimating exclusion and buffer zones. However, the model does not account for site-specific environmental parameters, which are crucial to predicting how sound will propagate under survey conditions. The applicant also has stated that its model overestimates received sound levels in deep water ($> 1,000$ m) and underestimates received sound levels in shallow water (< 50 m). Such deviations raise questions regarding the efficacy of the model for estimating received sound levels at certain distances and for establishing exclusion and buffer zones.

In preparation for the Gulf of Alaska survey, the Observatory used that model to estimate exclusion and buffer zones for the mitigation airgun. In contrast, the Observatory applied empirically measured sound levels from the Gulf of Mexico to establish the exclusion and buffer zones for use of the 36-airgun array in Alaska. The Observatory adjusted the exclusion and buffer zones for the 36-airgun array that were obtained at a tow depth of 6 m to zones based on a tow depth of 12 m using the ratios of the applicable zones and depths. However, such an adjustment may not be valid because, as the Observatory itself notes, the relationship between tow depth and sound exposure level is not linear (see Appendix A of the environmental assessment for the proposed survey). In addition, the Observatory used values halfway between the empirical shallow- and deep-water measurements to estimate the received sound levels in intermediate waters (100–1,000 m) rather than using empirical measurements obtained at an intermediate depth for the 36-airgun array, as presented in Appendix A of the environmental assessment. Further, Appendix A did not discuss empirical measurements for the 36-airgun array or modeling of the mitigation airgun in shallow waters, where received levels may have been underestimated.

On numerous occasions the Commission has recommended that the Service or the Observatory estimate the extent of exclusion and buffer zones using either empirical measurements relevant to the particular survey site or a model that takes into account the conditions in the proposed survey area. The model should incorporate operational parameters (e.g., tow depth, source level, number of active airguns) and site-specific environmental parameters (e.g., sound speed profiles, surface ducts, wind speed, bathymetry, and water depth). Indeed, the National Science Foundation's draft programmatic environmental impact statement concerning geophysical surveys reported modeling results for five "exemplary areas," all based on site-specific information. One of those exemplary areas is in the Gulf of Alaska, where the proposed survey is planned. The draft programmatic environmental impact statement indicated that "[t]he summer sound speed profile in the W Gulf of Alaska has a strong sound channel at 70 m depth (Figure B-7). This shallow sound channel is expected to trap much of the acoustic energy from an airgun array at the surface, resulting in ducted propagation and lower transmission loss at this site." The presence of the sound channel and its effect on sound propagation is a case-in-point and raises questions regarding the validity of using Gulf of Mexico information as a basis for sound propagation in the Gulf of Alaska.

To address all such shortcomings, the Marine Mammal Commission recommends that the National Marine Fisheries Service require the Lamont-Doherty Earth Observatory to re-estimate the proposed exclusion and buffer zones and associated takes of marine mammals using site-specific information. If the exclusion and buffer zones and takes are not re-estimated, the Marine Mammal Commission recommends that the Service require the Lamont-Doherty Earth Observatory to provide a detailed justification (1) for basing the exclusion and buffer zones for the proposed survey in the Gulf of Alaska on empirical data collected in the Gulf of Mexico or on modeling that relies on measurements from the Gulf of Mexico and (2) that explains why simple ratios were used to adjust for tow depth and median values were applied to intermediate water depths rather than using empirical measurements.

Uncertainty in Take Estimates

The Observatory estimated the number of takes expected to result from the proposed survey using the size of the buffer zones and associated ensonified areas, coupled with estimates of marine mammal densities. To be precautionary, it increased the size of the ensonified areas by 25 percent. The *Federal Register* notice indicated some uncertainty in the representativeness of the density data based on seasonal, geographical, and habitat-related considerations. Specifically, 25 percent of the data were from a different season, 50 percent of the surveys for cetaceans were from southeastern Alaska, and only three references (two of which are from southeastern Alaska) provide data for species in deep water, where 53 percent of the survey would occur. The *Federal Register* notice then indicated that the Observatory would estimate the number of takes based on best densities (i.e., effort-weighted mean densities) rather than maximum densities measured during an individual survey. The problem here is not with the method per se, but with the data used, which are not consistent with or representative of the proposed survey area. In previous incidental harassment authorizations (e.g., the U.S. Geological Survey's proposed geophysical survey in the central Gulf of Alaska; 76 Fed. Reg. 18187) the Service used maximum densities to estimate takes because of the uncertainty regarding the representativeness of the density data. For that incidental harassment

authorization, the Service recognized the same temporal and geographical differences but not the habitat differences. In the proposed survey, the sources of uncertainty likely are greater, but the Service appears to be using a less cautious approach, which seems counter-intuitive. Given the nature of the uncertainty and the need to ensure adequate protection, the Marine Mammal Commission recommends that the National Marine Fisheries Service use the species-specific maximum densities rather than the best densities to re-estimate the anticipated number of takes.

Mitigation and Monitoring Measures

The Service's *Federal Register* notice states that the Observatory will monitor the area near the seismic vessel for at least 30 minutes prior to the initiation of airgun operations. The notice also states that when airguns have been powered or shut down because a marine mammal has been detected near or within a proposed exclusion zone, airgun activity will not resume until the marine mammal is outside the exclusion zone (i.e., the animal is observed to have left the exclusion zone or has not been seen or otherwise detected within the exclusion zone for 15 minutes in the case of small odontocetes and 30 minutes in the case of mysticetes and large odontocetes, including sperm, pygmy sperm, dwarf sperm, and beaked whales). However, the *Federal Register* notice also indicates that ramp-up procedures could begin only nine minutes after a marine mammal sighting based on the theory that the movement of the *Langseth* would result in sufficient separation during that timeframe. The Observatory has clarified that the 9-minute period would be used only in specific circumstances (i.e., an equipment failure that is fixed quickly when no marine mammals have been observed within the exclusion zone before or during the failure, or when a marine mammal is seen within the exclusion zone but is observed leaving the exclusion zone). The Observatory further explains that, in such instances, it would not complete a full ramp-up cycle (i.e., a 6-dB increase every five minutes) but would restart the airguns at full power. Resumption of the full array after the abbreviated timeframe may be reasonable in those specific circumstances, but may pose an unacceptable level of risk in others. If the Service is planning to allow the Observatory to resume full power after nine minutes under certain circumstances, then the Marine Mammal Commission recommends that the National Marine Fisheries Service specify in the authorization all conditions under which a 9-minute period could be followed by a full-power resumption of the airguns. The Commission also continues to believe that a 30-minute pause in airgun activity following a marine mammal sighting is insufficient to assume that the marine mammal has left the area or will not be exposed to sound levels that could result in injury or death. Certain marine mammal species that occur in the proposed action area dive for longer periods and, although not visible to the observers, may still be within the exclusion zone. Sperm whales and beaked whales, in particular, may stay submerged for periods far exceeding 30 minutes. Blainville's beaked whales dive to considerable depths (> 1,400 m) and can remain submerged for nearly an hour (Baird et al. 2006, Tyack et al. 2006). In addition, observers may not detect marine mammals each time they return to the surface. For these reasons, monitoring for 30 minutes prior to the initiation or resumption of airgun operations likely is not sufficient to detect all marine mammal species within the exclusion zone. The National Marine Fisheries Service has stated that observers would be monitoring the exclusion zones for nearly one hour before airguns are at their maximum output, because 30 minutes would be devoted to monitoring before the airguns are ramped up and it would take nearly

30 minutes for the airguns to ramp up to full power. The Service also believes that it is likely that any marine mammal would be seen during the time it would take to ramp-up the airguns based on the dive times and associated surface intervals of those species. However, the Service does not provide any quantitative data to support this contention and it is not consistent with data collected from marine mammal surveys for cryptic species such as beaked whales, which are difficult to detect even under ideal conditions. Barlow (1999) found that “[a]ccounting for both submerged animals and animals that are otherwise missed by the observers in excellent survey conditions, only 23 percent of Cuvier’s beaked whales and 45 percent of *Mesoplodon* beaked whales are estimated to be seen on ship surveys if they are located directly on the survey trackline.” Thus, at least for certain species, visual monitoring alone is not adequate to detect all marine mammals within the exclusion and buffer zones – particularly when those zones extend as far as 3,850 m from the vessel. The environmental conditions likely to be encountered in the Gulf of Alaska can be expected to make detection even more difficult. It also is not clear that the Service’s explanation considers any movement of the vessel. Therefore, the Marine Mammal Commission again recommends that the National Marine Fisheries Service extend the 30-minute period following a marine mammal sighting in the exclusion zone to cover the full dive times of all species likely to be encountered.

Furthermore, as discussed in the Commission’s previous letters commenting on similar activities by this and other applicants, visual monitoring is not effective during periods of bad weather or at night. Therefore, the Marine Mammal Commission recommends that, prior to granting the requested authorization, the National Marine Fisheries Service provide additional justification for its preliminary determination that the proposed monitoring program will be sufficient to detect, with a high level of confidence, all marine mammals within or entering the identified exclusion and buffer 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 vessel, (3) describe changes in detection probability under various sea state and weather conditions and light levels, and (4) explain how close to the vessel marine mammals must be for observers to achieve high nighttime detection rates. If such information is not available, the Service and the applicant should conduct the studies needed to describe the efficacy of existing monitoring methods and develop alternative or supplemental methods to address current shortcomings.

In addition, the applicant indicates that it will be able to assess possible impacts by comparing estimated marine mammal abundance during periods when the airguns are not firing (i.e., baseline conditions) with periods when they are. The efficacy of this approach depends, in part, on the length of the periods when the airguns are silent. If firing of the airguns causes marine mammals to depart an area and/or alter their behavior, a comparison after the airguns are silenced would be meaningful only if it involved sufficient time for the disturbed marine mammals to return to their normal distribution and/or behavior. If the time for such a return to normalcy exceeds the period that the airguns are silent, then any comparison would be largely meaningless as an indicator of the impact of seismic disturbance. Put frankly, the Commission does not believe that the proposed monitoring method is scientifically sound. The Marine Mammal Protection Act requires that the National Marine Fisheries Service (for the Secretary of Commerce) put forth “requirements pertaining to the monitoring and reporting of such taking.” Although the Act is not explicit on this

point, the Commission believes that Congress's intent was that those monitoring and reporting methods be scientifically sound and yield sufficient information to confirm that the authorized taking is having only negligible impact on the affected species and stocks. That is, the monitoring and reporting requirements should provide a reasonably accurate assessment of the types of taking and the number of animals taken by the proposed activity. Therefore, the Marine Mammal Commission recommends that the National Marine Fisheries Service consult with the funding agency (i.e., the National Science Foundation) and individual applicants (e.g., the Lamont-Doherty Earth Observatory and U.S. Geological Survey) to develop, validate, and implement a monitoring program that provides a scientifically sound, reasonably accurate assessment of the types of marine mammal taking and the number of marine mammals taken. Without such a system in place, the Commission does not see how the Service can continue to assume that this type of survey is having no more than a negligible impact on marine mammal populations.

The *Federal Register* notice states that the applicant also will conduct vessel-based passive acoustic monitoring to augment visual monitoring during daytime operations and at night to help detect, locate, and identify marine mammals that may be present. The Commission supports the use of passive acoustic monitoring for this purpose but also considers it important to keep in mind the limitations of such monitoring. As the Commission has noted in previous correspondence, and as the Service acknowledges, passive acoustic monitoring is effective only when marine mammals vocalize. In addition, the effectiveness of passive acoustic monitoring will depend on the operator's ability to locate a vocalizing cetacean and determine whether it is within the power-down or shut-down radii or in a position such that the ship's movement will place it within the power-down or shut-down radii. Cetaceans that are on the trackline may be particularly hard to detect but are of relatively greater concern than animals not on the trackline because they could go undetected through visual monitoring alone. Therefore, the Marine Mammal Commission recommends that the National Marine Fisheries Service require the applicant to (1) report on the number of marine mammals that were detected acoustically and for which a power-down or shut-down of the airguns was initiated, (2) specify if such animals also were detected visually, and (3) compare the results from the two monitoring methods (visual versus acoustic) to help identify their respective strengths and weaknesses.

Effectiveness of Ramp-up Procedures

As the Commission has noted in previous correspondence, the effectiveness of ramp-up procedures has yet to be verified empirically. In October 2010 representatives from the Service, Commission, National Science Foundation, Lamont-Doherty Earth Observatory, U.S. Geological Survey, and Scripps Institution of Oceanography met to discuss mitigation and monitoring measures. Among other things, the participants discussed the need to verify the utility of ramp-up procedures. The Commission continues to believe that such verification is important and should be pursued whenever possible. Therefore, the Marine Mammal Commission recommends that the National Marine Fisheries Service condition the authorization to require the Lamont-Doherty Earth Observatory to monitor, document, and report observations during all ramp-up procedures. Such data will provide a stronger scientific basis for determining the effectiveness of, and deciding when to implement, this particular mitigation measure. The National Science Foundation has indicated

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that monitoring data from past surveys are being compiled into a single database. After the data are compiled and quality control measures have been completed, the Marine Mammal Commission recommends that the National Marine Fisheries Service work with the National Science Foundation to analyze these data to help determine the effectiveness of ramp-up procedures as a mitigation measure for geophysical surveys. International researchers also are trying to determine the impacts of seismic airguns and the effectiveness of ramp-up procedures, primarily on humpback whales, during specific life history stages. However, the results of those studies are not expected for three to five years. In the interim, the Commission continues to believe that the Service should be requiring data collection and analysis to assess the effectiveness of ramp-up procedures, given that those procedures are considered a substantial component of the mitigation measures.

Level A Harassment and Mortality

The Observatory is not seeking authorization to take marine mammals by serious injury or mortality. The *Federal Register* notice indicates that the Observatory would report all injured or dead marine mammals to the Service and would judge if an observed injury or death resulted from the proposed activities. However, the Commission believes that the National Marine Fisheries Service should make such a determination after consultation with the Observatory. Therefore, the Marine Mammal Commission recommends that the National Marine Fisheries Service condition the incidental harassment authorization to require the Observatory to (1) immediately report all injured or dead marine mammals to the Service and (2) suspend the geophysical survey if a marine mammal is seriously injured or killed and the injury or death could have been caused by the survey (e.g., a fresh dead carcass). The Service should investigate the incident to assess the cause and full impact (e.g., the types of injuries, the number of animals involved) and to determine what modifications in survey procedures are needed to avoid additional injuries or deaths. Full investigation of such incidents is essential to provide information regarding the potential impact of geophysical surveys on marine mammals. If additional measures are not likely to reduce the risk of additional serious injuries or deaths to a very low level, the Service should require the Observatory to obtain the necessary authorization for such takings under section 101(a)(5)(A) of the Marine Mammal Protection Act before allowing it to continue this survey or initiate additional surveys.

Please contact me if you have questions about the Commission's recommendations or comments.

Sincerely,

A handwritten signature in black ink, appearing to read "Timothy J. Ragen" followed by a flourish and the letters "for".

Timothy J. Ragen, Ph.D.
Executive Director

Enclosure

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References

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- Tyack, P.L., M. Johnson, N. Aguilar Soto, A. Sturlese, and P.T. Madsen. 2006. Extreme diving of beaked whales. *Journal of Experimental Biology* 209(21):4238–4253.



MARINE MAMMAL COMMISSION

2 May 2011

Mr. P. Michael Payne, Chief
Permits, Conservation, and Education Division
Office of Protected Resources
National Marine Fisheries Service
1315 East-West Highway
Silver Spring, MD 20910-3225

Dear Mr. Payne:

The Marine Mammal Commission, in consultation with its Committee of Scientific Advisors on Marine Mammals, has reviewed the application submitted by the U.S. Geological Survey seeking authorization under section 101(a)(5)(D) of the Marine Mammal Protection Act to take small numbers of marine mammals by harassment. The taking would be incidental to a marine seismic survey in the central Gulf of Alaska in June 2011. The Commission also has reviewed the National Marine Fisheries Service's 1 April 2011 *Federal Register* notice announcing receipt of the application and proposing to issue the authorization, subject to certain conditions (76 Fed. Reg. 18167).

RECOMMENDATIONS

The Marine Mammal Commission recommends that the National Marine Fisheries Service—

- require the U.S. Geological Survey to re-estimate the proposed exclusion and buffer zones and associated takes of marine mammals using site-specific information;
- if site-specific information is not used, then provide a detailed justification for basing the exclusion and buffer zones for the proposed survey in the Gulf of Alaska on empirical data collected in the Gulf of Mexico or on modeling that uses measurements from the Gulf of Mexico and that explains the significance of any deviations in survey method, such as the proposed change in tow depth;
- specify in the authorization all conditions under which an 8-minute period could be followed by a resumption of the airguns at full power;
- extend the 30-minute period following a marine mammal sighting in the exclusion zone to cover the full dive times of all species likely to be encountered;
- provide additional justification for its preliminary determination that the proposed monitoring program will be sufficient to detect, with a high level of confidence, all marine mammals within or entering the identified exclusion and buffer zones, which at a minimum 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 vessel, (3) describe changes in detection probability under various sea state and weather conditions and light levels, and (4) explain how close to the vessel marine mammals must be for observers to achieve high nighttime detection rates;
- consult with the funding agency (i.e., the National Science Foundation) and individual applicants (e.g., the U.S. Geological Survey and Lamont-Doherty Earth Observatory) to

- develop, validate, and implement a monitoring program that provides a scientifically sound, reasonably accurate assessment of the types of marine mammal taking and the number of marine mammals taken;
- require the applicant (1) to report on the number of marine mammals that were detected acoustically and for which a power-down or shutdown of the airguns was initiated, (2) specify if such animals also were detected visually, and (3) compare the results from the two monitoring methods (visual versus acoustic) to help identify their respective strengths and weaknesses;
- condition the authorization, if issued, to require the U.S. Geological Survey to monitor, document, and report observations during all ramp-up procedures; this data will provide a stronger scientific basis for determining the effectiveness of and deciding when to implement this particular mitigation measure; and
- in collaboration with the National Science Foundation, analyze these data to determine the effectiveness of ramp-up procedures as a mitigation measure for geophysical surveys

RATIONALE

The National Science Foundation is funding the U.S. Geological Survey to contract with the Lamont-Doherty Earth Observatory to collect seismic reflection and refraction profiles that would be used to delineate the U.S. extended continental shelf from 53° to 57° N latitude and 135° to 148° E longitude in the central Gulf of Alaska. The survey would occur in water depths from 2,500 m to greater than 6,000 m and would consist of approximately 3,320 km of transect lines and turns. The applicant would conduct the survey using the R/V *Marcus G. Langseth*, which would deploy a 36-airgun array as an energy source (nominal source levels of the airgun arrays are 236 to 265 dB re 1 μ Pa (peak-to-peak)). The array would have 36 airguns firing at any given time with a maximum discharge volume of 6,600 in³. The *Langseth* also would use a receiving system consisting of one towed hydrophone streamer, 8 km in length, together with up to five ocean-bottom seismometers and sonobuoys. The applicant also would operate a 10.5–13 kHz multibeam echo sounder during airgun operations and a sub-bottom profiler continuously throughout the cruise.

The Service preliminarily has determined that, at most, the proposed activities would result in a temporary modification in the behavior of small numbers of up to nine species of marine mammals and that any impact on the affected species would be negligible. The Service also does not anticipate any take of marine mammals by death or serious injury. It also believes that the potential for temporary or permanent hearing impairment will be at the least practicable level because of the proposed mitigation and monitoring measures. Those measures include exclusion and buffer zones and power-down, shutdown, and ramp-up procedures.

The Commission continues to be concerned about certain aspects of this and similar authorizations for geophysical surveys. These concerns have been raised in past Commission letters regarding geophysical surveys funded by the National Science Foundation, such as the enclosed letter from 7 March 2011.

Uncertainty in Modeling Exclusion and Buffer Zones

Exclusion zones are intended to prevent marine mammals from moving close enough to the sound source to be exposed to sound levels that could result in Level A harassment. Buffer zones are used to delineate the area in which Level B harassment is expected and to estimate the number of takes. Both are established based on the propagation of sound from the sound source. In 2007–2008, Lamont-Doherty Earth Observatory conducted sound propagation studies using airgun arrays from the R/V *Langseth* and used those results to create a model of sound propagation for estimating exclusion and buffer zones. However, the Lamont-Doherty model does not account for site-specific environmental parameters. The applicant has stated that the model overestimates received sound levels in deep water (> 1,000 m) and underestimates received sound levels in shallow water (< 50 m). Such deviations raise questions regarding the efficacy of the model for estimating received sound levels at certain distances and for establishing exclusion and buffer zones. For the Gulf of Alaska survey, the applicant only used the model to estimate exclusion and buffer zones for the mitigation airgun. In contrast, the applicant used empirical received sound levels from the Gulf of Mexico to estimate the exclusion and buffer zones for the 36-airgun array. However, details were not provided regarding precisely how the Gulf of Mexico data were used for this purpose and how any difference in survey methods were addressed (e.g., change in tow depth from 6 m in the Gulf of Mexico to 9 m in the proposed survey).

On numerous occasions, the Commission has recommended that the Service or the applicant proposing such studies estimate exclusion and buffer zones either using empirical measurements relevant to the particular survey site or a model that takes into account the conditions where the proposed survey would occur. The model should incorporate operational parameters (e.g., tow depth, source level, and number of active airguns) and site-specific environmental parameters (e.g., sound speed profiles, surface ducts, wind speed, bathymetry, and water depth). Indeed, the National Science Foundation's draft programmatic environmental impact statement reported modeling results for five "exemplary areas," all based on site-specific information. One of those exemplary areas is in the Gulf of Alaska, near where the proposed survey is planned. The draft programmatic environmental impact statement indicated that "[t]he summer sound speed profile in the W Gulf of Alaska has a strong sound channel at 70 m depth (Figure B-7). This shallow sound channel is expected to trap much of the acoustic energy from an airgun array at the surface, resulting in ducted propagation and lower transmission loss at this site." The presence of the sound channel and its effect on sound propagation is a case in point and raises questions regarding the validity of using Gulf of Mexico information as a basis for sound propagation in the Gulf of Alaska.

To address all such shortcomings, the Marine Mammal Commission recommends that the National Marine Fisheries Service require the U.S. Geological Survey to re-estimate the proposed exclusion and buffer zones and associated takes of marine mammals using site-specific information. If the exclusion and buffer zones and takes are not re-estimated, the Marine Mammal Commission recommends that the Service and/or the U.S. Geological Survey provide a detailed justification for basing the exclusion and buffer zones for the proposed survey in the Gulf of Alaska on empirical data collected in the Gulf of Mexico or on modeling that uses measurements from the Gulf of

Mexico and that explains the significance of any deviations in survey method such as the proposed change in tow depth.

Mitigation and Monitoring Measures

The Service's *Federal Register* notice states that the applicant will monitor the area near the seismic vessel for at least 30 minutes prior to the initiation of airgun operations. The notice also states that when airguns have been powered or shut down because a marine mammal has been detected near or within a proposed exclusion zone, airgun activity will not resume until the marine mammal is outside the exclusion zone (i.e., the animal visually is observed to have left the exclusion zone or has not been seen or otherwise detected within the exclusion zone for 15 minutes in the case of small odontocetes and 30 minutes in the case of mysticetes and large odontocetes, including sperm, pygmy sperm, dwarf sperm, and beaked whales). However, the *Federal Register* notice also indicates that ramp-up procedures could begin only eight minutes after a marine mammal sighting based on the theory that the movement of the *Langseth* would result in sufficient separation during that time frame. The U.S. Geological Survey has clarified that the eight-minute period would be used only in specific circumstances (i.e., an equipment failure that is fixed quickly when no marine mammals have been observed within the exclusion zone before or during the failure or when a marine mammal is seen within the exclusion zone but is observed leaving the exclusion zone). The applicant further explains that, in such instances, it would not complete a full ramp-up cycle (i.e., a 6-dB increase every five minutes) but would restart the airguns at full power. Resumption of the full array after the abbreviated time frame may be reasonable in those specific circumstances but may pose an unacceptable level of risk in others. If the Service is planning to allow the applicant to resume full power after eight minutes under certain circumstances, then the Marine Mammal Commission recommends that the National Marine Fisheries Service specify in the authorization all conditions under which an eight-minute period could be followed by a full-power resumption of the airguns.

The Commission also continues to believe that a 30-minute pause in airgun activity following a marine mammal sighting is insufficient to assume that the marine mammal has left the area or will not be exposed to sound levels that could result in injury or death. Certain marine mammal species that occur in the proposed action area dive for longer periods and, although not visible to the observers, may still be within the exclusion zone. Sperm whales and beaked whales, in particular, may stay submerged for periods far exceeding 30 minutes. Blainville's beaked whales dive to considerable depths (> 1,400 m) and can remain submerged for nearly an hour (Baird et al. 2006, Tyack et al. 2006). In addition, observers may not detect marine mammals each time they return to the surface. For these reasons, monitoring for 30 minutes prior to the initiation or resumption of airgun operations likely is not sufficient to detect all marine mammal species within the exclusion zone. The National Marine Fisheries Service has stated that observers would be monitoring the exclusion zones for nearly one hour before airguns are at their maximum output, because 30 minutes would be devoted to monitoring before the airguns are ramped up and it would take nearly 30 minutes for the airguns to ramp up to full power. The Service also believes that it is likely that any marine mammal would be seen during the time it would take to ramp-up the airguns based on the dive times and associated surface intervals of those species. However, the Service does not

provide any quantitative data to support this contention, and it is not consistent with data collected from marine mammal surveys for cryptic species such as beaked whales, which are difficult to detect even under ideal conditions. Barlow (1999) found that “[a]ccounting for both submerged animals and animals that are otherwise missed by the observers in excellent survey conditions, only 23 percent of Cuvier’s beaked whales and 45 percent of *Mesoplodon* beaked whales are estimated to be seen on ship surveys if they are located directly on the survey trackline.” Thus, at least for certain species, visual monitoring alone is not adequate to detect all marine mammals within the exclusion and buffer zones—particularly when those zones extend as far as 3,850 m from the vessel. The environmental conditions likely to be encountered in the Gulf of Alaska can be expected to make detection even more difficult. It also is not clear that the Service’s explanation considers any movement of the vessel. Therefore, the Marine Mammal Commission again recommends that the National Marine Fisheries Service extend the 30-minute period following a marine mammal sighting in the exclusion zone to cover the full dive times of all species likely to be encountered.

Furthermore, as discussed in the Commission’s previous letters commenting on similar activities by this and other applicants, visual monitoring is not effective during periods of bad weather or at night. Therefore, the Marine Mammal Commission recommends that, prior to granting the requested authorization, the National Marine Fisheries Service provide additional justification for its preliminary determination that the proposed monitoring program will be sufficient to detect, with a high level of confidence, all marine mammals within or entering the identified exclusion and buffer 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 vessel, (3) describe changes in detection probability under various sea state and weather conditions and light levels, and (4) explain how close to the vessel marine mammals must be for observers to achieve high nighttime detection rates. If such information is not available, the Service and the applicant should undertake the studies needed to describe the efficacy of existing monitoring methods and develop alternative or supplemental methods to address current shortcomings.

In addition, the applicant indicates that it will be able to assess possible impacts by comparing estimated marine mammal abundance during periods when the airguns are not firing (i.e., baseline conditions) with periods when they are. The efficacy of this approach depends, in part, on the length of the periods when the airguns are silent. If firing of the airguns causes marine mammals to depart an area and/or alter their behavior, a comparison after the airguns are silenced would be meaningful only if it involved sufficient time for the disturbed marine mammals to return to their normal distribution and/or behavior. If the time for such a return to normalcy exceeds the period that the airguns are silent, then any comparison would be largely meaningless as an indicator of the impact of seismic disturbance.

Put frankly, the Commission does not believe that the proposed monitoring method is scientifically sound. The Marine Mammal Protection Act requires that the National Marine Fisheries Service (for the Secretary of Commerce) put forth “requirements pertaining to the monitoring and reporting of such taking.” Although the Act is not explicit on this point, the Commission believes that Congress’s intent was that those monitoring and reporting methods be scientifically sound and

yield sufficient information to confirm that the authorized taking is having only negligible impact on the affected species and stocks. That is, the monitoring and reporting requirements should provide a reasonably accurate assessment of the types of taking and the number of animals taken by the proposed activity. Therefore, the Marine Mammal Commission recommends that the National Marine Fisheries Service consult with the funding agency (i.e., the National Science Foundation) and individual applicants (e.g., the U.S. Geological Survey and Lamont-Doherty Earth Observatory) to develop, validate, and implement a monitoring program that provides a scientifically sound, reasonably accurate assessment of the types of marine mammal taking and the number of marine mammals taken. Without such a system in place, the Commission does not see how the Service can continue to assume that this type of survey is having no more than a negligible impact on marine mammal populations.

The *Federal Register* notice states that the applicant also will conduct vessel-based passive acoustic monitoring to augment visual monitoring during daytime operations and at night to help detect, locate, and identify marine mammals that may be present. The Commission supports the use of passive acoustic monitoring for this purpose but also considers it important to keep in mind the limitations of such monitoring. As the Commission has noted in previous correspondence, and as the Service acknowledges, passive acoustic monitoring is effective only when marine mammals vocalize. In addition, its effectiveness will depend on the operator's ability to locate a vocalizing cetacean and determine whether it is within the power-down or shutdown radii or in a position such that the ship's movement will place it within the power-down or shutdown radii. Cetaceans that are on the trackline may be particularly hard to detect but are of relatively greater concern. Therefore, the Marine Mammal Commission recommends that the National Marine Fisheries Service require the applicant (1) to report on the number of marine mammals that were detected acoustically and for which a power-down or shutdown of the airguns was initiated, (2) specify if such animals also were detected visually, and (3) compare the results from the two monitoring methods (visual versus acoustic) to help identify their respective strengths and weaknesses.

Mitigation Effectiveness

As the Commission has noted in previous correspondence, the effectiveness of ramp-up procedures has yet to be verified empirically. In October 2010 representatives from the Service, the Commission, National Science Foundation, U.S. Geological Survey, Lamont-Doherty Earth Observatory, and Scripps Institution of Oceanography met to discuss mitigation and monitoring measures. Among other things, the participants discussed the need to verify the utility of ramp-up procedures. The Commission continues to believe that such verification is important and should be pursued whenever possible. Therefore, the Marine Mammal Commission recommends that the National Marine Fisheries Service condition the authorization, if issued, to require the U.S. Geological Survey to monitor, document, and report observations during all ramp-up procedures. Such data will provide a stronger scientific basis for determining the effectiveness of and deciding when to implement this particular mitigation measure. The National Science Foundation has indicated that monitoring data from past surveys are being compiled into a single database. After the data are compiled and quality control measures have been completed, the Marine Mammal Commission recommends that the National Marine Fisheries Service, in collaboration with the

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National Science Foundation, analyze these data to determine the effectiveness of ramp-up procedures as a mitigation measure for geophysical surveys. International researchers also are trying to determine the impact of seismic airguns and the effectiveness of ramp-up procedures on a selected marine mammal species during specific life history stages. However, the results of those studies are not expected for three to five years. In the interim, the Commission continues to believe that the Service should be requiring data collection and analysis to assess the effectiveness of ramp-up procedures, given that those procedures are considered a substantial component of the mitigation measures.

Please contact me if you have questions about the Commission's recommendations or comments.

Sincerely,



Timothy J. Ragen, Ph.D.
Executive Director

Enclosure

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