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 1μPa (peak-to-peak)). The array would have 36 airguns firing at any given time with a maximum discharge volume of 6,600 in^3. 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

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

Literature Cited

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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

7 March 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 eastern tropical Pacific Ocean from April through May 2011. The Commission also has reviewed the National Marine Fisheries Service's 4 February 2011 *Federal Register* notice announcing receipt of the application and proposing to issue the authorization, subject to certain conditions (76 Fed. Reg. 6430).

RECOMMENDATIONS

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

- require Lamont-Doherty Earth Observatory to (1) provide a full description of the Lamont-Doherty Earth Observatory model as it is used to estimate safety and buffer zones and (2) rerun the model using site-specific information to determine safety and buffer zones and associated takes;
- prior to granting the requested authorization, 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;
- propose to the Lamont-Doherty Earth Observatory that it revise its survey design to add pre- and post-seismic survey assessments as a way of obtaining more realistic baseline abundance estimates of marine mammals;
- require the applicant (1) to report on the number of marine mammals that were acoustically detected for which a power-down or shutdown of the airguns was initiated, (2) specify if the animals also were visually detected, and (3) compare the results from the two methods (visual versus acoustic) to help identify their respective weaknesses;
- condition the authorization to prohibit an eight-minute pause before ramping up after either a power-down or shutdown of the airguns, based on the presence of a marine mammal in the safety zone and the *Langseth's* movement (speed and direction);

- 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 or shutdown and before ramp-up because of a marine mammal sighting within a safety zone; and
- condition the authorization to require Lamont-Doherty Earth Observatory to monitor, document, and report observations during all ramp-up procedures.

RATIONALE

The National Science Foundation is funding Lamont-Doherty Earth Observatory to survey a major plate boundary in Costa Rica's exclusive economic zone. The purpose of the survey is to determine the fault structure and the properties of underlying rocks along the plate boundary. The survey would occur in water depths from less than 100 m to greater than 2,500 m and would consist of approximately 2,510 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 1μPa (peak-to-peak)). The airgun array would have no more than 18 airguns firing at any given time with a maximum discharge volume of 3,300 in^3. The *Langseth* also would tow a receiving system consisting of four hydrophone streamers each 6 km in length. In addition, the applicant 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 19 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. The measures include safety zones and power-down, shutdown, and ramp-up procedures.

The Commission's concerns regarding the proposed authorization are, for the most part, the same as those raised in its previous letters concerning the applicant's request to conduct similar activities in the North Pacific Ocean. The most recent letter dated 21 June 2010 is enclosed.

Uncertainty in Modeling Safety and Buffer Zones

Safety zones are intended to prevent Level A harassment, and buffer zones are used to monitor Level B harassment. Both are established based on the propagation of sound from the sound source. In 2003 and again in 2007–2008, Lamont-Doherty Earth Observatory conducted sound propagation studies using airgun arrays from the R/V *Maurice Ewing* and the *Langseth*, respectively. As noted in Tolstoy et al. (2009), "The seismic source used on the R/V *Langseth* is significantly different from that used on the R/V *Ewing* requiring an updated calibration effort to ensure marine mammal protection." Lamont-Doherty Earth Observatory used the results of the 2007–2008 study to create a model of sound propagation for estimating safety and buffer zones. However, the details of the model are uncertain. The *Federal Register* notice and the application refer

the reader to the associated environmental assessment for model details. The assessment then refers the reader to its Appendix A, but the model information included in Appendix A pertains to studies based on the older information using the *Ewing* and not the *Langseth*. Thus, the details of the model used to support this proposed survey were not available for review.

The modeling details are particularly important in this case because in the 2007–2008 study the model (1) overestimated the measured received sound levels in deep water (>1,000 m), and (2) underestimated (by a factor of 1.7 to 5.2) the measured received sound levels in shallow water (<100). Received sound levels were not evaluated for intermediate depths, so Lamont-Doherty Earth Observatory estimated those levels to be 1.5 times those that would occur (at the same distance from the source) in deep water. Given such uncertainty, it would be helpful to be able to review the details of the model to determine its usefulness.

Preparations for a previous survey off Costa Rica also suggested that the model may provide inconsistent results. That earlier survey used site-specific sound speed profiles and bathymetry in the shallow waters of Drake Bay, which is part of the currently proposed survey area, and in nearby waters of intermediate depth. The modeled site-specific safety radii (safety zone and buffer zone) were 288 and 2,121 m for shallow waters and 295 and 4,511 m for intermediate waters. In contrast, the application and the *Federal Register* notice propose radii of 1,030 and 19,500 m for shallow water and 675 and 5,700 for intermediate waters based on Gulf of Mexico data. The applicant suggests that these radii demonstrate that their safety and buffer zones are precautionary, which may be the case. However, it raises questions regarding the efficacy of the model used to estimate safety and buffer zones for the proposed survey.

In preceding letters, the Commission has argued that estimating safety and buffer zones via a model should be based on conditions where the survey is to 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. Unfortunately, none of those exemplary areas included the eastern tropical Pacific Ocean where the proposed survey is planned. For that reason, the Commission noted in its 24 November 2010 letter (copy enclosed) that the Foundation should be prepared to conduct supplemental environmental analyses under the National Environmental Policy Act when the details of specific studies become clear.

To address all those shortcomings, the Marine Mammal Commission recommends that the National Marine Fisheries require Lamont-Doherty Earth Observatory to (1) provide a full description of the Lamont-Doherty Earth Observatory model as it is used to estimate safety and buffer zones and (2) rerun the model using site-specific information to determine safety and buffer zones and associated takes.

Monitoring Measures

The Service's preliminary determination is based, in part, on the presumed efficacy of the monitoring measures. Those measures depend, in large part, on visual monitoring. However, 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. Even with good visibility, observers are unable to detect marine mammals when they are below the surface or beyond visual range. 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 safety zones—particularly when those zones extend as far as 19.5 km from the vessel. 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 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 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 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 on the length of the periods that 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 effects of seismic disturbance. A more meaningful approach would be to assess abundance in an area before, during, and after the seismic survey to determine how those numbers differ. With that in mind, the Marine Mammal Commission recommends that the National Marine Fisheries Service propose to the Lamont-Doherty Earth Observatory that it revise its survey design to add pre- and post-seismic survey assessments as a way of obtaining more realistic baseline abundance estimates of marine mammals.

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 the

limitations of such monitoring in mind. 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 shutdown radius or in a position such that the ship's movement will place it within the shutdown radius. 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 acoustically detected for which a power-down or shutdown of the airguns was initiated, (2) specify if the animals also were visually detected, and (3) compare the results from the two methods (visual versus acoustic) to help identify their respective weaknesses.

The Service's *Federal Register* notice states that the applicant will monitor the area for at least 30 minutes prior to the planned 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 safety zone, airgun activity will not resume until the marine mammal is outside the safety zone (i.e., the animal visually is observed to have left the safety zone or has not been seen or otherwise detected within the safety 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 states that ramp-up procedures would occur after only eight minutes based on the notion that the movement of the *Langseth* would lead to increasing the distance from the marine mammal. The Commission believes that this limit is inappropriate because it fails to account for the position, swim speed, and heading of the observed marine mammal. If a marine mammal sighted in the safety zone is moving in the same direction as the *Langseth*, or if it is moving in a different direction but changes its heading as the vessel or airgun array approaches, it may remain in the safety zone for periods far longer than eight minutes. Therefore, the Marine Mammal Commission recommends that the National Marine Fisheries Service condition the authorization to prohibit an eight-minute pause before ramping up after a power-down or shutdown of the airguns, based on the presence of a marine mammal in the safety zone and the *Langseth's* movement (speed and direction).

The Commission also continues to believe that the 30-minute pause in activity is insufficient because certain marine mammals in the action area dive for longer periods and may be within the safety zone but not visible to the observers at the end of those periods. 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 these animals each time they return to the surface. Accordingly, monitoring for 30 minutes prior to the planned start or resumption of airgun operations likely is not sufficient to detect those species even if they remain within the safety zone. Therefore, the Marine Mammal Commission recommends that the National Marine Fisheries Service 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 or shutdown and before ramp-up because of a marine mammal sighting within a safety zone.

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 the Service, the Commission, and representatives from the 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 whenever possible. Therefore, the Marine Mammal Commission recommends that the National Marine Fisheries Service condition the authorization to require 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 when to implement this particular monitoring measure.

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

Sincerely,

Timothy J. Ragen

Timothy J. Ragen, Ph.D.
Executive Director

Enclosures

Literature Cited

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