MARINE MAMMAL COMMISSION

8 March 2013

Mr. P. Michael Payne, Chief
Permits and Conservation 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 geophysical survey to be conducted along the mid-Atlantic Ridge in the North Atlantic Ocean from April through May 2013. The Commission also has reviewed the National Marine Fisheries Service's 13 February 2012 notice announcing receipt of the application and proposing to issue the authorization, subject to certain conditions (78 Fed. Reg. 10154).

RECOMMENDATIONS

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

- require the 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 numbers of takes are not re-estimated, require the Observatory to provide a detailed justification for (1) basing the exclusion and buffer zones for the proposed survey along the mid-Atlantic Ridge on modeling that does not incorporate site-specific environmental parameters and is only generally comparable to conditions in the Gulf of Mexico, (2) using simple ratios to adjust for tow depth, and (3) applying a correction factor of 1.5 to estimate sound propagation in intermediate water depths;
- require the Observatory to use a density estimate that accounts for uncertainty (e.g., maximum densities, mean densities plus two standard deviations) and recalculate the estimated numbers of takes;
- prohibit an 8-minute pause following the sighting of a marine mammal in the exclusion zone that has not been seen to exit the exclusion zone and extend that pause to cover the maximum dive times of the species likely to be encountered prior to resuming airgun operations after both power-down and shut-down procedures;
- 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—such justification should (1) identify those species that it believes can be detected with a high degree of confidence using visual monitoring only under the expected environmental conditions, (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., Lamont-Doherty Earth Observatory and the 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 numbers of marine mammals taken—the assessment should account for availability biases and the detection biases of the geophysical survey observers;
- require the Observatory to (1) report 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, (3) compare the results from the two monitoring methods (visual versus acoustic) to help identify their respective strengths and weaknesses, and (4) use that information to improve mitigation and monitoring methods; and
- work with the National Science Foundation to analyze monitoring data to assess the effectiveness of ramp-up procedures as a mitigation measure for geophysical surveys.

RATIONALE

The National Science Foundation is funding the Lamont-Doherty Earth Observatory to conduct a 2-D geophysical survey along the mid-Atlantic Ridge approximately 300 km from the Azores. The objectives of the survey are to (1) determine the characteristics of the magma body that supplies heat to the Rainbow hydrothermal field within the Rainbow Massif, (2) determine distribution of different rock types that form the Rainbow Massif, and (3) document faults in the vicinity of the Rainbow Massif to investigate their role in controlling hydrothermal fluid discharge. The survey would occur for 20 days in April and May in the area 35.5 to 36.5º N latitude and 33.5 to 34.5º W longitude in international waters of the North Atlantic Ocean. It would be conducted in waters from 900 to 3,000 m in depth and would involve approximately 2,582 km of tracklines. The Observatory would use the R/V *Marcus G. Langseth* to tow a 36-airgun array (nominal source levels 236 to 265 dB re 1µPa (peak-to-peak) with a maximum discharge volume of 6,600 in^3) at 12 m depth. The R/V *Langseth* would tow one 8-km hydrophone streamer during a portion of the survey and would use up to 46 bottom-mounted seismometers for the other portion of the survey. The R/V *Oceanus* would deploy and recover the seismometers during the survey. The Observatory also would operate a 10.5 to 13 kHz multibeam echosounder and a 3.5 kHz sub-bottom profiler continuously throughout the survey.

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 28 species of marine mammals and that any impact on the affected species would be negligible. The Service 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 monitoring exclusion and buffer zones and using power-down, shut-down, and ramp-up procedures. In addition, the

Observatory would shut down the airguns immediately if and when a North Atlantic right whale is sighted, regardless of the distance from the *Langseth*. Ramp-up procedures would not be initiated until the right whale has not been seen at any distance for 30 minutes. Although the Commission considers the probability of sighting a right whale to be extremely low, it appreciates the extra caution that would be taken by the Observatory to minimize takes by the geophysical survey.

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 14 May 2012) regarding geophysical surveys funded by the National Science Foundation.

Uncertainty in modeling exclusion and buffer zones

Exclusion zones define the area in which marine mammals are close enough to a sound source to be injured (i.e., Level A harassment) or killed by exposure to the sound. Buffer zones delineate the area in which marine mammals are close enough to a sound source to be disturbed to the extent that they change their natural behavior patterns (i.e., Level B harassment). Both zones are established based on the generation and propagation of sound from the source and general assumptions about the responses of marine mammals to sounds at specific sound pressure levels, the latter being based on limited observations of marine mammal responses under known conditions.

For at least six years, the Observatory has estimated exclusion and buffer zones using a simple ray trace–based modeling approach that assumes a constant sound speed with no bottom interactions (Diebold et al. 2010). That model does not incorporate environmental characteristics of the specific study area including sound speed profiles, bathymetry/water depth, sediment properties/bottom loss, or absorption coefficients. However, the Observatory believes that its model generally is conservative when compared to in-situ sound propagation measurements of the R/V *Langseth*'s 36-airgun array from the Gulf of Mexico (Tolstoy et al. 2009; Diebold et al. 2010). Although that appears to be the case, environmental conditions in the Gulf of Mexico are not necessarily indicative of conditions in other parts of the world's oceans. For example, the Gulf of Mexico normally does not exhibit strong surface ducting conditions or strong sound channels that can cause sound to propagate longer distances. In addition, Diebold et al. (2010) demonstrated that the Observatory's model underestimates the near-field sound levels in waters of intermediate depth (600–1,100 m) and far-field sound levels in waters of deep depth (1,600–1,700 m). They also attributed the bias for intermediate depths to a change in the sound speed profiles—an input that the Observatory's model does not take into account. In fact, Diebold et al. (2010) noted the limited applicability of the Observatory's model when sound propagation is dependent on water depth, bathymetry, and bottom-loss parameters.

The Commission's concerns are reinforced by the findings of Tolstoy et al. (2009). That paper acknowledged that sound propagation depends on water depth, bathymetry, and tow depth of the array. It not only stated that sound propagation varies with environmental conditions but also used that variation as justification for measuring sound propagation at multiple locations. The National Science Foundation subsequently followed that example, by modeling sound propagation under various environmental conditions when it prepared its recent programmatic environmental

impact statement for geophysical surveys worldwide and its recent incidental harassment authorization application for a geophysical survey of Diablo Canyon in California (77 Fed. Reg. 58256). All of these issues raise questions regarding the efficacy of the Observatory's model for estimating received sound levels at various distances and for establishing exclusion and buffer zones.

In preparation for the mid-Atlantic Ridge survey, the Observatory used its model to estimate exclusion and buffer zones for the 36-airgun array and the buffer zone for the mitigation airgun. To estimate received sound pressure levels in intermediate waters it used the zones for deep water depths multiplied by a factor of 1.5. Appendix H of the Foundation's programmatic environmental impact statement indicated that the appropriate correction factor would be 1.5 to 1.7 for the few environments modeled, so the 1.5 correction proposed by the Observatory may be marginally adequate. In addition, sound propagation for this survey also will be affected by tow depth of the airgun array. In its application, the Observatory did not stipulate how it adjusted its model that incorporated a tow depth of 6 m to account for a tow depth of 12 m. In previous authorizations, the Observatory made the adjustment using the ratios of the applicable Level A and B harassment zones and tow depths (see Table 1 of 77 Fed. Reg. 58256). However, such adjustments do not appear to be valid because, as the Observatory itself noted, the relationship between tow depth and sound exposure level is not linear (see Figure 6 in Appendix H of the programmatic environmental impact statement).

On numerous occasions the Commission has recommended that the Service or the Observatory estimate exclusion and buffer zones using either empirical measurements from 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/spacing of active airguns) and site-specific environmental parameters (e.g., sound speed profiles, bathymetry/water depth, sediment properties/bottom loss, and wind speed). To address these shortcomings, the Marine Mammal Commission again recommends that the National Marine Fisheries Service require the 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 numbers of takes are not re-estimated, the Marine Mammal Commission recommends that the Service require the Observatory to provide a detailed justification for (1) basing the exclusion and buffer zones for the proposed survey along the mid-Atlantic Ridge on modeling that does not incorporate site-specific environmental parameters and is only generally comparable to conditions in the Gulf of Mexico, (2) using simple ratios to adjust for tow depth, and (3) applying a correction factor of 1.5 to estimate sound propagation in intermediate water depths.

Underestimating the numbers of takes

The Observatory estimated the numbers of takes expected to result from the proposed surveys using the sizes of the buffer zones and associated ensonified areas, coupled with estimates of marine mammal densities. To be precautionary, it also increased the sizes of the ensonified areas by 25 percent. The Observatory based its density estimates on a marine mammal survey conducted along the mid-Atlantic Ridge in 2004 (Waring et al. 2008). The Observatory and the Service acknowledged some uncertainty in the representativeness of those density data and the assumptions used to calculate takes based on (1) the limited marine mammal survey effort in the southern stratum of Waring et al. (2008; i.e., 1,047 km of transects), (2) the marine mammal survey data being

collected north of the proposed geophysical survey area (i.e., 38 to 52° N versus 36 to 36.5° N), and (3) the marine mammal survey being conducted during June rather than April to mid-May. Neither the Observatory nor the Service specified whether the density estimates used were based on a mean or maximum density. 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 the number of takes because of similar uncertainties regarding the density data based on spatial and temporal considerations. Given the similar nature of the uncertainty and the need to ensure adequate protection, the Marine Mammal Commission reiterates its recommendation that the National Marine Fisheries Service require the Observatory to use a density estimate that accounts for uncertainty (e.g., maximum densities, mean densities plus two standard deviations) and recalculate the estimated number of takes.

Mitigation and monitoring measures

The *Federal Register* notice stated that the Observatory will monitor the area near the survey vessel for at least 30 minutes before, during, and 30 minutes after airgun operations. The notice also stated that when airguns have been powered 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 pinnipeds and 30 minutes in the case of mysticetes and large odontocetes, including sperm, pygmy sperm, dwarf sperm, and beaked whales) or the vessel has transited beyond the original 180-dB re 1 μPa exclusion zone after an 8-minute period. That 8-minute period is based on the time it would take the *Langseth*, traveling at 8.5 km/hour, to move beyond the 180-dB re 1 μPa exclusion zone (i.e., 1,116 m for the 36-airgun array being towed at 9 m depth in waters greater than 1,000 m). However, using the same rationale, the waiting period would be 12 minutes for the vessel, traveling at the same speed, to move beyond the largest 180-dB re 1 μPa exclusion zone (i.e., 1,674 km for the 36-airgun array being towed at 15 m depth in waters less between 100 and 1,000 m). Given these differences, the Commission does not concur with the Service's approach, which is the least protective. In addition, the Service indicated that implementing ramp-up procedures for the full array after an extended power down would not meaningfully increase the effectiveness of observing marine mammals approaching or entering the exclusion zone and would not further minimize the potential for take. Here, again, the Commission disagrees with the Service's reasoning. The primary purpose of ramp-up procedures is not to increase the observer effectiveness, but rather give any marine mammals in the area an opportunity to move away from the airgun array before its impulses may harm them. In addition, the utility of ramp-up procedures is not diminished because the ship has moved away from the location where marine mammals were first sighted. Those marine mammals may be moving in the same direction as the vessel or the vessel may encounter additional marine mammals.

In short, the Commission believes that the Service's rationale is incorrect on both biological and physical grounds. The Service's approach appears to require a 15- or 30-minute pause in activity if an animal enters an exclusion zone but, in effect, that pause is not implemented based on the notion that the sound source is moving. That approach does not make sense if the position of the marine mammal is not known. That is, the key considerations driving this measure are the relative positions of the animal and the sound source. Their relative positions over time are best estimated as

a function of their positions when the marine mammal was first sighted plus the speed and heading of the vessel and the speed and heading of the marine mammal. If the vessel and marine mammal are moving in opposite directions, then the marine mammal may leave the exclusion zone relatively quickly. However, if they are moving in the same direction, then the marine mammal may remain in the exclusion zone for a prolonged period. In fact, Miller et al. (2009) determined that sperm whales continued on their course of travel during exposure to airgun sounds. None of those sperm whales diverted to avoid seismic activity at distances of 1–13 km from the vessel, and most whales traveled on a parallel course. Unless the marine mammal is sighted leaving or outside the exclusion zone, it does not make sense to allow the survey to resume after a shorter period of time because (1) the animal spends much of its time underwater where it is not visible, (2) it may change its heading and speed in response to the vessel, and (3) it is not possible to determine the animal's position relative to the vessel or sound source after the initial sighting unless it surfaces again and is observed.

Indeed, the efficacy of this measure depends largely on observations of the marine mammal at the surface. That being the case, the dive time of the possibly affected marine mammals is a central consideration. For small cetaceans, the Commission has recommended a pause time of at least 15 minutes because their dive times are shorter and generally fall within that limit. For some mysticetes and large cetaceans, the proposed 30-minute pause may be inadequate, sometimes markedly so. Sperm whales and beaked whales, in particular, may remain submerged for periods far exceeding 30 minutes. Blainville's and Cuvier's beaked whales dive to considerable depths (> 1,400 m) and can remain submerged for more than 80 minutes (Baird et al. 2008). In addition, observers may not detect marine mammals each time they return to the surface, especially 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. Therefore, the Marine Mammal Commission again recommends that the National Marine Fisheries Service prohibit an 8-minute pause following the sighting of a marine mammal in the exclusion zone that has not been seen to exit the exclusion zone and extend that pause to cover the maximum dive times of the species likely to be encountered prior to resuming airgun operations after both power-down and shut-down procedures.

In addition, 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, especially when the radius of the exclusion zone is approximately 1,674 km in width. Although the *Federal Register* notice states that on average observers can monitor to the horizon (i.e, 10 km), it is unclear how the Observatory expects to see cryptic species (i.e., beaked whales) at those distances even in good weather during daylight hours. Furthermore, the Observatory used Waring et al. (2008) as the basis for the density estimates. Those data yielded effective strip widths of 0.4 to 1.6 km depending on the species; that is, distances that are much less than the Observatory's assumed sighting distance of 10 km. Therefore, the Marine Mammal Commission recommends that, prior to issuing 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 under the expected environmental conditions, (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.

Furthermore, the Observatory indicated 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, but 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 a scientifically sound way of assessing impacts on behavior or distribution. 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 impacts 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. The assessments also should account for animals present but under the water's surface and not available for sighting (i.e., availability bias) and animals at the surface but not detected (i.e., detection bias). Those adjustments are essential for determining accurate estimates of the numbers of marine mammals taken during surveys. To be useful, the corrections should be based on the ability of the protected species observers to detect marine mammals rather than a hypothetical optimum derived from scientific studies (e.g., from Waring et al. 2008). 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., Lamont-Doherty Earth Observatory and the 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 numbers of marine mammals taken—the assessment should account for availability biases and the detection biases of the geophysical survey observers. Until the Service can provide assurances that take estimates are reasonably accurate, the Commission does not see how it 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 Observatory also would 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 radius or in a position such that the ship's movement will place it within the power-down or shut-down radius. Therefore, the Marine Mammal Commission recommends that the National Marine Fisheries Service require the Observatory to (1) report 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, (3) compare the results from the two monitoring methods (visual versus acoustic) to help identify their respective strengths and weaknesses, and (4) use that information to improve mitigation and monitoring methods.

Effectiveness of ramp-up procedures

Although the effectiveness of ramp-up procedures has yet to be verified empirically, the Service would continue to require the 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 that monitoring data from past surveys are being compiled into a single database. The Commission supports that effort by the Foundation. 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 those data to assess the effectiveness of ramp-up procedures as a mitigation measure for geophysical surveys. The Commission continues to believe that the Service should continue to require 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 rationale.

Sincerely,

Timothy J. Ragen

Timothy J. Ragen, Ph.D.
Executive Director

Enclosure

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