



MARINE MAMMAL COMMISSION

19 April 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 in the northeast Atlantic Ocean from June through July 2013. The Commission also has reviewed the National Marine Fisheries Service's 21 March 2012 notice announcing receipt of the application and proposing to issue the authorization, subject to certain conditions (78 Fed. Reg. 17359).

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 the greatest sound speed from the survey area if sound at any depth travels at a speed greater than 1521.6 m/s;
- require the Observatory to correct beaked whale and fin whale density estimates using the 95 percent confidence intervals and recalculate the estimated numbers of takes—the corrected beaked whale density then should be applied to all beaked whale species (including Cuvier's beaked whale, northern bottlenose whale, and *Mesoplodon* spp.);
- require a clearance time of 60 minutes for deep-diving species (i.e., beaked whales and sperm whales), if the animal was not observed to have left the exclusion zone after a power down or shut down;
- 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 exclusion and buffer zones—such justification should (1) identify those species that the Service 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; and

- consult with the relevant entities (i.e., Lamont-Doherty Earth Observatory, the National Science Foundation, 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 and detection biases associated with the geophysical survey observers.

RATIONALE

Lamont-Doherty Earth Observatory proposes to conduct a 2-D and 3-D geophysical survey in the northeast Atlantic Ocean more than 200 km from Spain. The objectives of the survey are to study the rifted continental to oceanic crust transition in the Deep Galicia Basin. The survey would occur for 39 days in June and July in the area 41.5 to 42.5° N latitude and 11.5 to 17.5° W longitude in the exclusive economic zone of Spain and international waters. It would be conducted in waters ranging in depth from 3,500 to greater than 5,000 m and would involve approximately 5,834 km of tracklines. The Observatory would use the R/V *Marcus G. Langseth*, which is owned by the National Science Foundation, to tow a 36-airgun array (nominal source levels 236 to 265 dB re 1 μ Pa (peak-to-peak)) at 9 m depth. It would fire only 18 of the 36 airguns at a given time (with a maximum discharge volume of 3,300 in³) with a 15- to 20-second interval between firings. The R/V *Langseth* would tow four 6-km hydrophone streamers and would use up to 78 ocean bottom seismometers or ocean bottom hydrophones during the survey. The R/V *Poseidon* would deploy and recover those devices 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 20 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. In addition, the Observatory would avoid, if possible, exposing groups of humpback, sei, fin, blue, and/or sperm whales to sound at 160 dB re 1 μ Pa by powering down, if necessary. For the survey, a group of whales is defined as three or more individuals visually detected that are engaged in activities other than traveling (e.g., feeding, socializing).

Staff members from the National Science Foundation, National Marine Fisheries Service, U.S. Geological Survey, Marine Mammal Commission, and Lamont-Doherty Earth Observatory met several weeks ago to discuss some of the Commission's ongoing concerns regarding the potential effects of these geophysical surveys. A number of concerns were discussed and several resolved. The following paragraphs highlight areas that, in the Commission's view, warrant further attention.

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). For sound-producing activities, scientists and managers establish both zones based on the generation and the measured or modeled propagation of sound from the source, together with 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, refraction within the water column, bathymetry/water depth, sediment properties/bottom loss, or absorption coefficients. However, the Observatory believes that its model generally is conservative (i.e., overestimates) 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). The Observatory has completed some testing of its modeling approach and the model does appear to be conservative based on environmental conditions in the Gulf of Mexico. However, those conditions 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 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 and U.S. Geological Survey subsequently followed that example, by modeling sound propagation under various environmental conditions when they prepared their recent programmatic environmental impact statement for geophysical surveys worldwide. The Observatory and Foundation (in cooperation with Pacific Gas and Electric Company) also used a similar modeling approach in the recent incidental harassment authorization application and associated environmental assessment for a geophysical survey of Diablo Canyon in California (77 Fed. Reg. 58256). All of these issues raise questions regarding the applicability of the Observatory's model for estimating received sound levels at various distances and for establishing exclusion and buffer zones in other parts of the world's oceans.

The Commission also is concerned about the Observatory's model because it incorporates a simple, linear scaling function to adjust for the depth of the towed array. Because sound speed varies with depth, the Commission believes that the Observatory's use of a scaling function should be tested in real-world conditions. To the Commission's knowledge, that type of testing has not been completed to verify the reliability of the scaling function.

Thus, the Commission's concerns are based primarily on the need to test and verify the use of the Observatory's model under the environmental conditions to be encountered with each survey. For that reason, 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, refraction in the water column, bathymetry/water depth, sediment properties/bottom loss, and wind speed). In the recent meeting of staff from the various agencies involved, the Observatory indicated that it possibly could compare its model to hydrophone data collected during previous surveys that would represent environmental conditions other than those in the Gulf of Mexico (i.e., deep and intermediate waters in cold water environments that may have surface ducting conditions, shallow water environments, etc.). It also indicated that the sound speed parameter could be changed within its model. The Observatory has historically used and currently uses 1521.6 m/s as the assumed sound speed. That sound speed may be conservative in some areas where the Observatory conducts its surveys, but it may not be conservative in all areas. The Commission supports such comparisons by the Observatory and looks forward to seeing the results. However, until such time the Observatory has made those comparisons and the results indicate that the Observatory's model does not underestimate propagation of sound in the various environments in which the surveys occur, the Commission believes that exclusion and buffer zones should be precautionary in their design (i.e., large enough to ensure that they provide the expected protection). Therefore, 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 the greatest sound speed from the survey area if sound at any depth travels at a speed greater than 1521.6 m/s. Sound speed profiles can be obtained from the U.S. Naval Oceanographic Office's Generalized Digital Environmental Model database—the database that the National Science Foundation used to develop its programmatic environmental impact statement.

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 in the northeast Atlantic in July 2007 (Anonymous 2009). Except for beaked whales and bottlenose dolphins, all density estimates incorporated adjustments for availability biases (i.e., animals present but under the water's surface and not available for sighting) and detection biases (i.e., animals at the surface but not detected). The density estimates for beaked whales likely were underestimated because they were not corrected for animals missed on the transect line, which is likely quite high for beaked whales that have long dive durations (Anonymous 2009). In addition, the survey report indicated that the estimate for fin whales likely was considerably underestimated because it did not account for any unidentified large whale sightings, many of which were likely to have been fin whales. Despite those potential biases for beaked whales and fin whales, the survey results included 95 percent confidence intervals for densities of those species.

Because of the uncertainty and potential for bias in the survey results, mean density estimates alone do not provide a reliable basis for estimating the numbers of animals that may be taken. For the purpose of risk assessment, the Commission believes that the Service and the Observatory should be able to provide assurances that the impacts will be negligible in the majority of plausible scenarios. Relying only on measures of central tendency (i.e., mean, median, mode) will not provide that assurance because those values are likely to underestimate the actual density for about half of all estimates. A better way to ensure that the estimated numbers of takes that could occur during a survey is precautionary in most instances would be to use a measure of central tendency plus some measure of variability. Perhaps the most common approach in dealing with this type of uncertainty is to use the mean value plus two standard deviations or to use the 95th percentile.

The Commission agrees with that type of cautious approach as a way of providing greater assurance that the numbers of animals taken will, indeed, be negligible. Therefore, Marine Mammal Commission recommends that the National Marine Fisheries Service require the Observatory to correct beaked whale and fin whale density estimates using the 95 percent confidence intervals and recalculate the estimated numbers of takes. The corrected beaked whale density then should be applied to all beaked whale species (including Cuvier's beaked whale, northern bottlenose whale, and *Mesoplodon* spp.), because most of the beaked whale species' distributions in this area overlap and it was generally not possible to identify the species of beaked whales observed.

Mitigation and monitoring measures

The Service would require the Observatory to monitor the area near the survey vessel for at least 30 minutes before, during, and 30 minutes after airgun operations. The Service also would require 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 pinnipeds and 30 minutes in the case of mysticetes and large odontocetes, including sperm, pygmy sperm, dwarf sperm, and beaked whales). Those clearance times may be adequate for some species, but not all species. For small cetaceans, the Commission has recommended a clearance time of at least 15 minutes because their dive times are shorter and generally fall within that limit. For some large cetaceans, the proposed 30-minute clearance time 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." Moreover, 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. Therefore, after either a power down or shutdown, the Marine Mammal Commission recommends that the National Marine Fisheries Service require a clearance

time of 60 minutes for deep-diving species (i.e., beaked whales and sperm whales), if the animal was not observed to have left the exclusion zone.

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 1,116 m. 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 (e.g., beaked whales) and small groups of not-so-cryptic species (e.g., dolphins) at those distances even in good weather during daylight hours. 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 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 availability and detection biases. 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 actual ability of the protected species observers to detect marine mammals rather than a hypothetical optimum derived from scientific studies and based on ideal conditions. Therefore, the Marine Mammal Commission recommends that the National Marine Fisheries Service consult with the relevant entities (i.e., Lamont-Doherty Earth Observatory, the National Science Foundation, 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 and detection biases associated with 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. Although it supports the use of passive acoustics, the Marine Mammal Commission also 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. The Marine Mammal Commission recommends that, after the data are compiled and quality control measures have been completed, 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.

Mr. P. Michael Payne
19 March 2013
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Please contact me if you have questions about the Commission's recommendations or rationale.

Sincerely,

A handwritten signature in blue ink that reads "Timothy J. Ragen". The signature is fluid and cursive, with the first letters of the first and last names being capitalized and prominent.

Timothy J. Ragen, Ph.D.
Executive Director

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