



MARINE MAMMAL COMMISSION

18 August 2014

Ms. Jolie Harrison, Chief
Permits and Conservation Division
Office of Protected Resources
National Marine Fisheries Service
1315 East-West Highway
Silver Spring, MD 20910-3225

Dear Ms. Harrison:

The Marine Mammal Commission (the Commission), in consultation with its Committee of Scientific Advisors on Marine Mammals, has reviewed the application submitted by Lamont-Doherty Earth Observatory (LDEO), in collaboration with the National Science Foundation (NSF), seeking authorization under section 101(a)(5)(D) of the Marine Mammal Protection Act (the MMPA) to take small numbers of marine mammals by harassment. The taking would be incidental to a marine geophysical survey to be conducted off North Carolina. The Commission also has reviewed the National Marine Fisheries Service's (NMFS) 31 July 2014 notice announcing receipt of the application and proposing to issue the authorization, subject to certain conditions (79 Fed. Reg. 44550).

Some issues raised in previous letters regarding geophysical surveys reflect Commission concerns that apply more broadly to incidental take authorization applications beyond LDEO's proposed application. The Commission has recommended repeatedly that NMFS adjust density estimates using some measure of uncertainty when available density data originate from different geographical areas and temporal scales and that it formulate policy or guidance shaping a consistent approach for how applicants should incorporate uncertainty in density estimates. NMFS has indicated that it is currently evaluating available density information and working on guidance that would outline a consistent approach for addressing uncertainty in specific situations where certain types of data are or are not available (78 Fed. Reg. 57354). Further, the Commission has recommended that NMFS follow a consistent approach for requiring the assessment of Level B harassment takes for specific types of sound sources (e.g., sub-bottom profilers, echosounders, side-scan sonar, and fish-finding sonar) by all applicants who propose to use them. NMFS has indicated that it is evaluating the broader use of those types of sources to determine under what specific circumstances requests for incidental taking would be advisable (or not) and also is working on guidance that would outline a consistent approach for addressing potential impacts from those types of sources (78 Fed. Reg. 57354). The Commission welcomes the opportunity to meet with NMFS to review these higher-level recommendations, as well as those specific to LDEO's application.

Background

LDEO proposes to conduct a high-energy, 2D geophysical survey primarily in the U.S. exclusive economic zone (EEZ), with some portions in international waters, off North Carolina.

The survey would occur for approximately 33 days in September and October 2014. The purpose of the proposed survey is to investigate how the continental crust stretched and separated during the opening of the Atlantic Ocean and magnetism's role during the continental breakup. The survey would be conducted in waters estimated to be 20 to 5,300 m in depth with approximately 5,185 km of tracklines. LDEO would use the R/V *Marcus G. Langseth*, owned by NSF, to operate a 36-airgun array (nominal source levels 246 to 253 dB re 1 μ Pa (peak-to-peak)) at 9 m depth and an 18-airgun array at 6 m depth. The *Langseth* also would tow one hydrophone streamer, 8,000 m in length, and would use 90 ocean-bottom seismometers (OBSs) during the survey. In addition, LDEO would operate a 10.5- to 13-kHz multibeam echosounder and a 3.5-kHz sub-bottom profiler continuously throughout the survey.

NMFS preliminarily has determined that, at most, the proposed activities would result in a temporary modification in the behavior of small numbers of up to 24 species of marine mammals and that any impact on the affected species would be negligible. NMFS 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. NMFS also would authorize the activities only until 31 October to minimize any impacts on migrating North Atlantic right whales. If, however, a right whale is sighted, LDEO would shut down the airguns immediately regardless of the distance of the whale 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 a recent USGS proposed incidental harassment authorization, NMFS proposed to require USGS to power down the array, if possible, when concentrations of humpback, sei, fin, blue, and/or sperm whales (six or more individuals that do not appear to be traveling and are feeding, socializing, etc.) are observed within the Level B harassment zone (based on 160 dB re 1 μ Pa; 79 Fed. Reg. 35642). The Commission is unsure why NMFS did not include the same mitigation measure in the currently proposed authorization, especially since the USGS and LDEO surveys both occur in waters up to more than 5,000 m in depth, in the same geographical region, and during September. Therefore, the Commission recommends that NMFS include a requirement that LDEO power down the array when concentrations of humpback, sei, fin, blue, and/or sperm whales (six or more individuals that do not appear to be traveling and are feeding, socializing, etc.) are observed within the Level B harassment zone (based on 160 dB re 1 μ Pa).

Further, NMFS would require LDEO, to the maximum extent practicable, to conduct the survey from the coast (inshore) and proceed towards the open sea (offshore) to minimize the potential for driving animals towards shore and trapping them in shallow water. The Commission agrees that this measure should be included in the incidental harassment authorization, but believes it should be an explicit requirement rather than qualified with the phrase "to the maximum extent practicable". Accordingly, the Commission recommends that NMFS require LDEO to conduct the survey from the coast (inshore) and proceed towards the sea (offshore), removing the caveat of "to the maximum extent practicable". Lastly, the Commission understands that NMFS would require that LDEO cease operation of the echosounder and sub-bottom profiler when the *Langseth* is in transit and only operate those types of equipment during the airgun survey itself. The Commission believes that requirement should be specified in the final incidental harassment authorization, if that is indeed NMFS's intent, and recommends that NMFS specify in the final authorization that LDEO is not authorized to operate the multi-beam echosounder and sub-bottom profiler during transit.

Staff members from NMFS, LDEO, NSF, U.S. Geological Survey (USGS), and the Commission met in March 2013 to discuss some of the Commission's ongoing concerns regarding the potential effects of geophysical surveys. Although a number of concerns were discussed and several resolved, the following sections highlight areas that, in the Commission's view, warrant further attention.

Justification for the use of the 36-airgun array

In its application, LDEO stated that it was decided that the scientific objectives for most of the survey could not be met using a source smaller than the 36-airgun array, because of the need to image the crust-mantle boundary at a depth of 30 km beneath the continental shelf and slope. LDEO stated that it was decided that the 18-airgun array towed at a shallower depth (6 m vs. 9 m) would be adequate to image the boundary for the remaining portion of the survey (the southern and northernmost portions of the multi-channel hydrophone streamer (MCS) tracklines; see Figure 1 in LDEO's application). However, based on the addendum to the application, it appears that LDEO has changed its plan to use the 36-airgun configuration during the MCS portion of the survey and now proposes to use only the 18-airgun configuration to survey the MCS tracklines. Apparently, LDEO still plans to use the 36-airgun configuration during the OBS portion of the survey, which would occur in water depths as shallow as 20 m.

Neither LDEO nor NMFS provided justification regarding the need to use the full 36-airgun array during the OBS portion¹ of the survey. In the past, LDEO used the 18-airgun configuration with OBSs in water depths ranging from 3,500 to more than 5,000 m in depth off Spain (78 Fed. Reg. 34069). The Commission is unsure why the smaller 18-airgun array could not be used during the OBS portion of the proposed survey off North Carolina, especially when the water depths are as shallow as 20 m. If the water depths are not the primary factor for using the 36-airgun array during the OBS portion of the survey, then presumably the requirement for the larger array is dictated by the receiving devices. If that is the case, the Commission questions whether the MCS could be used in the shallow and intermediate water depths to obtain the needed data rather than using the OBSs. In any event, NMFS has indicated in previous proposed incidental harassment authorizations when smaller arrays could be used to achieve the same objective that the applicant would use such smaller devices, as was the case for the 18-airgun configuration used off of Spain (78 Fed. Reg. 17376). Although LDEO apparently amended its proposed method for the MCS portion of the survey, that type of information is lacking in the *Federal Register* notice² and should be included as part of the mitigation measures. Absent both the justification for the use of the 36-airgun configuration for the OBS portion of the survey and acknowledgement of the use of the 18-airgun configuration for the MCS portion and its implied mitigating effects (if such is the reason), LDEO's process is not transparent and as such may not be justifiable. Therefore, the Commission recommends that NMFS require LDEO to justify the use of the 36-airgun configuration during the OBS portion of the survey. If the same quality of data can be obtained using the smaller 18-airgun configuration with the MCS or OBSs, then the Commission recommends that NMFS require LDEO to use the smaller airgun configuration to minimize impacts on marine mammals.

¹ Based on correspondence from LDEO, the Commission understands that the OBS portion of the survey would be surveyed twice, once to acquire data with the OBSs and once with the streamer.

² This normally is found under the "Planning Phase" portion of the "Proposed Mitigation" section of the notice.

Uncertainty in estimating exclusion and buffer zones

The Commission continues to have concerns regarding the method used to estimate exclusion and buffer zones (based on Level A and B harassment, respectively) and the numbers of takes for NSF-funded geophysical research. These concerns date back to 2010 but please refer to the Commission's 12 March, 19 April, and 24 June 2013 and 31 March and 23 July 2014 letters for detailed rationale. Briefly, LDEO performs acoustic modeling for geophysical research conducted by the *Langseth*. For at least 6 years (and likely more than the last 10 years), LDEO has estimated exclusion and buffer zones using a simple ray trace–based modeling approach that assumes spherical spreading, a constant sound speed, and no bottom interactions (Diebold et al. 2010). That model does not incorporate environmental characteristics of the specific study area including sound speed profiles and refraction within the water column, bathymetry/water depth, sediment properties/bottom loss, or absorption coefficients. However, LDEO continues to believe that its model generally is conservative when compared to in-situ sound propagation measurements of the R/V *Maurice Ewing*'s arrays (i.e., 6-, 10-, 12-, and 20-airgun arrays) and the R/V *Langseth*'s 36-airgun array from the Gulf of Mexico (Tolstoy et al. 2004, Tolstoy et al. 2009, Diebold et al. 2010³). LDEO also has noted the model is most directly applicable to deep water (> 1,000 m), although it uses the model, with the inclusion of substantial correction factors, in intermediate and shallow-water environments (100–1,000 m and < 100 m, respectively) as well. Diebold et al. (2010) noted the limited applicability of LDEO's model when sound propagation is dependent on water temperature, water depth, bathymetry, and bottom-loss parameters—this is especially important for estimating zones for surveys, such as the North Carolina survey, in which the various airgun configurations would be used in waters as shallow as 20 m and as deep as 5,300 m. They further indicated that modeling could be improved by including realistic sound speed profiles within the water column. In addition, Tolstoy et al. (2009) acknowledged that sound propagation depends on water depth, bathymetry, and tow depth of the array and that sound propagation varies with environmental conditions and should be measured at multiple locations.

To estimate the proposed exclusion and buffer zones for the survey off North Carolina, LDEO apparently used in-situ measurements for the 18-airgun array in shallow water only and used LDEO's model, scaling factors⁴, correction factors⁵, and/or low-energy proxies for the other airgun configurations (36-, 18-, and single airgun array) and water depths (shallow, intermediate, and deep water; see Table 1 in LDEO's application for specific details). Presumably, Diebold et al. (2010) served as the basis for the in-situ measurements of the 18-airgun array in shallow water. However, in the case of Diebold et al. (2010), the shallow-water hydrophone was positioned in 50 m of water, which is much deeper than 20 m of water proposed for the survey. The Commission questions the validity of using the Diebold et al. (2010) measurements given that the survey will be conducted in much shallower water⁶. In previous incidental harassment authorizations, LDEO has indicated that the model underestimates the zones in shallow water⁷. The Commission is not surprised by that finding since Diebold et al. (2010) stated the acoustic field in shallow water was dominated by near-vertically traveling reflected and refracted waves, information that is not used within LDEO's

³ Diebold et al. (2010) also presented data on the 18-airgun array from the Gulf of Mexico.

⁴ Based on assumed tow depth differences from LDEO's deep-water model.

⁵ For intermediate water depths, LDEO multiplied the modeled deep-water results by a correction factor of 1.5.

⁶ And the fact that the measurements originated from a different geographical area.

⁷ When LDEO has used its model for shallow water depths, a correction factor of 14.7 has been used.

model. Accordingly, the Commission does not support use of either of the methods⁸ to determine the sizes of the exclusion or buffer zones.

For deep water, LDEO has stated that its model overestimates the received sound levels at a given distance but is still valid for defining exclusion zones at various tow depths. However, LDEO indicated in its application that the calibration data show that at greater distances (4 to 5 km) sound reflected from the sea floor and refracted from the sub-seafloor dominate, while the direct arrivals become weak and/or incoherent (Figures 11, 12, and 16 in Appendix H of the NSF/USGS programmatic environmental impact statement for geophysical surveys (PEIS)). LDEO stated that aside from local topography effects, the region around the critical distance (~5 km in Figures 11 and 12 and ~4 km in Figure 16 in Appendix H of the NSF/USGS PEIS) is where the observed sound levels rise very close to the mitigation model curve. Although the observed sound levels occur primarily below the mitigation model curve, that finding further substantiates the fact that the model is not necessarily indicative of site-specific environmental conditions, including bathymetry and sound speed profiles. The reflective/refractive arrivals are the very measurements that should be accounted for in site-specific modeling and ultimately determine underwater sound propagation. Ignoring those factors is a serious flaw of LDEO's model. In addition, LDEO apparently applied scaling factors to empirical shallow-water zones based on modeled deep-water zones to account for tow depth differences. The Commission is unsure why LDEO would assume that the ratio of modeled zones in deep water would equate to empirical zones in shallow water, as those two quantities are not comparable and LDEO itself has indicated that the model underestimates received levels in shallow water.

Furthermore, the estimated exclusion zone for the proposed survey (36-airgun array towed at 9 m in depth) is smaller⁹ than previously authorized and the buffer zone is larger¹⁰ than previously authorized (75 Fed. Reg. 44770; 76 Fed. Reg. 75525, 49737; 77 Fed. Reg. 25693, 41755). This is a bit perplexing as the Commission is unaware of any changes to LDEO's model¹¹. If the model has not changed, then perhaps the manner in which LDEO is using the model or the inputs to the model have changed. In any case, it is not clear why the zones have changed. NMFS did add a precautionary 3-dB buffer to the exclusion zones in shallow water (which, if the exclusion zones have been underestimated, may be less precautionary than originally intended). Additionally, the estimated shallow-water exclusion zone for the mitigation airgun is smaller than previously authorized or proposed to be authorized¹² (e.g., 77 Fed. Reg. 41755). Therefore, even with NMFS's added 3-dB precautionary buffer, the exclusion zone for the mitigation airgun in shallow water is smaller than previous incidental harassment authorizations. LDEO indicated in its application that the zone was based on empirically derived measurements from the Gulf of Mexico with a scaling factor applied to account for differences in tow depth. The Commission does not understand why LDEO has offered this explanation. For many years, LDEO has indicated that the zones associated

⁸ Shallow-water empirical measurements in deeper waters than proposed by the survey and LDEO's model.

⁹ 927 vs. 940 m for the 180-dB re 1 μ Pa threshold.

¹⁰ 5,780 vs. 3,850 m for the 160-dB re 1 μ Pa threshold.

¹¹ Appendix H of the PEIS has been used in support of LDEO's model since it was available for public review in 2010 and, to the Commission's knowledge, has been unchanged since that time. Those figures have included the maximum sound pressure level trajectories and have been based on sound exposure levels, with a presumed 10 dB difference for sound pressure levels.

¹² 86 m was estimated for this authorization vs. 121 m that included the 3-dB buffer vs. 296 m that was previously authorized.

with the mitigation airgun have been model-estimated and that the tow depth has minimal effect on the maximum near-field output and the shape of the frequency spectrum for the single airgun. Thus, LDEO has assumed that the predicted exclusion zones are essentially the same at different tow depths (i.e., the same values are used for the mitigation gun being towed from 6–15 m in depth; 77 Fed. Reg. 25969). Due to these shortcomings and inconsistencies, the Commission continues to have concerns regarding the estimation of exclusion and buffer zones for NSF-funded geophysical surveys and highlights the need for transparency regarding the methods by which LDEO is estimating those zones. Therefore, the Commission recommends that NMFS require LDEO to explain why the proposed exclusion and buffer zones for the survey are not consistent with those used in past surveys that involved the same airgun configurations (36-, 18-, and single airgun(s)) and tow depths (9 or 6 m) and that occurred in the same water depths (shallow, intermediate, and deep water). Until that information is provided, neither the Commission nor the public can comment meaningfully on the proposed exclusion and buffer zones. Without such information NMFS presumably would not be able to determine that the zones were based on best available science and that the additional 3-dB buffer was in fact precautionary.

Because LDEO has failed to verify the use of its model in conditions other than the Gulf of Mexico, the Commission has recommended that NMFS or the relevant entity estimate exclusion and buffer zones using either empirical measurements from the particular survey site or a model that accounts for 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 March 2013, LDEO indicated that it might be able to compare its model to hydrophone data collected during previous surveys in environmental conditions other than those in the Gulf of Mexico¹³ (i.e., deep and intermediate waters in cold water environments that may have surface ducting conditions, shallow-water environments, etc.). The Commission understands that LDEO has been analyzing hydrophone data from waters off Washington State to allow comparisons of empirically derived estimates to model-estimated exclusion and buffer zones, but those results do not appear to have been published yet. The Commission is pleased to hear of this work and encourages LDEO to make such comparisons at various sites, not just in waters off Washington, if it intends to continue using a model that does not incorporate site-specific parameters. The Commission recommended in its 24 June 2013 letter that such comparisons be made prior to submitting applications for geophysical surveys to be conducted in 2014. The Commission further recommended that if LDEO and NSF either do not have enough data to compare LDEO's modeled results to other environments, or choose not to assess the accuracy of the model, then they should re-estimate the exclusion and buffer zones and associated takes of marine mammals using site-specific parameters (including sound speed profiles, bathymetry, and bottom characteristics) for all future applications that use LDEO's model. Neither approach was used for the proposed incidental harassment authorization.

NMFS has stated repeatedly that NSF, LDEO, and other relevant entities (USGS, Scripps Institution of Oceanography (Scripps)) are providing sufficient scientific justification for their take

¹³ Diebold et al. (2010) supported such an approach, stating that streamer data can provide an accurate assessment of sound exposure levels at the relevant ranges for mitigation in shallow-water environments (≤ 100 m). They further indicated it seems logical and advantageous that those data be monitored in real time to fine tune a priori mitigation zones in shallow-water environments.

estimates. The Commission disagrees with this conclusion, given that the estimates are based on LDEO's model, various scaling and correction factors, unsupported proxies, and/or empirical measurements from the Gulf of Mexico. Recent activities have occurred in areas such as the North Atlantic and the Antarctic rather than the Gulf of Mexico. Environmental conditions in waters off the East Coast include presence of surface ducts, in-water refraction, and bathymetry and sediment characteristics that reflect sound¹⁴. Although a surface duct likely is present in the proposed survey area, none of the site-specific parameters are accounted for in LDEO's model¹⁵.

In a recent sound exposure modeling workshop attended by representatives of numerous entities (including NMFS, LDEO, NSF, USGS, and the Commission), experts confirmed that sound speed profiles and bathymetry/sediment characteristics were the most important factors affecting underwater sound propagation and should be included in related modeling. While LDEO presented various aspects of its model during the workshop and indicated that the model was fast, inexpensive, and simple to use, none of those attributes support its applicability or accuracy. Further, LDEO indicated that the model is more closely related to a source model that compares airgun arrays and that it is not representative of modeling in the actual environment. Therefore, the Commission remains very concerned that the LDEO model is not based on best available science and does not support its continued use. For all of these reasons, the Commission recommends that NMFS (1) require LDEO to re-estimate the proposed exclusion and buffer zones and associated takes of marine mammals using site-specific (including sound speed profiles, bathymetry, and sediment characteristics at a minimum) and operational (including number of airguns, tow depth) parameters for the proposed incidental harassment authorization and (2) impose the same requirement for all future incidental harassment authorizations submitted by LDEO, NSF, USGS, Scripps, Antarctic Support Contract (ASC), or any other relevant entity.

In 2011¹⁶, NSF and USGS modeled sound propagation under various environmental conditions in their PEIS. LDEO and NSF (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). These recent examples indicate that LDEO, NSF, and related entities are capable of implementing the recommended modeling approach, if required to do so by NMFS. The Commission understands the constraints imposed by the current budgetary environment, but notes that other agencies that contend with similar funding constraints incorporate modeling based on site-specific parameters. LDEO, NSF, and related entities (USGS, Scripps, ASC) should be held to that same standard. NMFS recently indicated that it does not prescribe the use of any particular modeling package and does not believe it is appropriate to do so (79 Fed. Reg. 38499). The Commission agrees that NMFS should not instruct applicants to use specific contractors or modeling packages, but it should hold applicants to the same standard, primarily one in which site- and operation-specific environmental parameters are incorporated into the models.

¹⁴ Although not accounted for by LDEO's model.

¹⁵ NMFS has acknowledged that although the acoustic energy within the third and fourth lobes (330–667 Hz) of the impulsive waveform would be trapped in the surface duct and propagated to greater distances, those lobes represent only a fraction of the total acoustic energy (specifically for the LDEO New Jersey survey; 79 Fed. Reg. 38500). The Commission notes that the impulsive waveform includes sound energy in frequencies even greater than 667 Hz, including contributions from mid- and high-frequency sound that may be trapped in the surface duct and propagated further than sound below 330 Hz.

¹⁶ The record of decision was signed in 2012.

NMFS further indicated that based on empirical data (which illustrate the LDEO model's conservative exposure estimates for the Gulf of Mexico and preliminarily for waters off Washington), it found that LDEO's model effectively estimates sound exposures or number of takes and represents the best available information for NMFS to reach its determinations for the authorization. However, for the recent survey off New Jersey (79 Fed. Reg. 38499) and the proposed survey off North Carolina, NMFS increased the exclusion zone in shallow water by 3-dB. The Commission questions why, if NMFS believes the LDEO model is based on best available science, it then extended the exclusion zones to be precautionary. Further, the Commission is unsure why NMFS did not extend the buffer zones and the re-estimate the numbers of takes of marine mammals as well.

Group size and take estimates

In estimating the numbers of potential takes for the proposed incidental harassment authorization, LDEO used the Strategic Environmental Research and Development Program's (SERDP) spatial decision support system (SDSS) Marine Animal Model Mapper tool based on the U.S. Navy's OPAREA Density Estimates (NODE) model¹⁷ to estimate marine mammal densities. NMFS increased the estimated takes for some species (primarily large whales) to average group sizes based on correspondence with various experts. However, NMFS did not apply the same method for other species for which the potential for taking exists but density data were lacking. In addition to the large whale species, the SERDP model did not include data for spinner dolphins¹⁸, Fraser's dolphins, melon-headed whales, pygmy killer whales, false killer whales, or killer whales that have the potential to occur in the waters off North Carolina. Interestingly, USGS requested, and NMFS proposed to authorize, takes of those species for its survey that would precede LDEO's survey in the same general geographical area and at nearly the same time of year. For those species, USGS had estimated the numbers of takes based on average group size.

LDEO and NMFS also proposed to authorize the taking of only one bottlenose dolphin from both the Northern and Southern North Carolina Estuarine Systems (NNCE and SNCE) based on the calculated number of takes rather than accounting for average group size and thereby increasing the number of bottlenose dolphin takes for those two stocks. Bottlenose dolphins generally do not occur as single individuals and taking should not be authorized as such. Because the potential exists to take those species or stocks in numbers greater than what NMFS has proposed, the Commission recommends that NMFS authorize the taking of spinner dolphins, Fraser's dolphins, melon-headed whales, pygmy killer whales, false killer whales, killer whales, NNCE bottlenose dolphins, and SNCE bottlenose dolphins based on at least the average group size.

LDEO did not request the incidental taking of harbor seals based on the low likelihood of occurrence in the survey area in September and October, and NMFS concurred. However, NMFS's 2012 stock assessment report indicated that, although harbor seals are known to occur seasonally along the southern New England to New Jersey coasts from September through late May and scattered sightings and strandings have been reported as far south as Florida, a recently established

¹⁷ Those data originated from the waters within the U.S. EEZ only.

¹⁸ Based on NMFS's 2013 Stock Assessment Report, spinner dolphins were observed within the proposed survey area off North Carolina in 2011.

seasonal haul-out site was documented in 2011 at Oregon Inlet, North Carolina (Todd Pusser, pers. comm.). Oregon Inlet is within the proposed survey area and if harbor seals are not only occurring in the area but hauling out at an established site, NMFS should include their incidental taking in the authorization. Therefore, the Commission recommends that NMFS consult with Mr. Pusser, the appropriate NMFS Science Center, and other researchers in the region (i.e., at University of North Carolina Wilmington and Duke University) to determine the number of harbor seals that could be harassed incidental to the proposed survey and authorize that number in the final authorization.

The Commission understands the LDEO would actually survey the OBS tracklines twice, once for acquiring OBS data and once for recording source shots with the MCS¹⁹. This has not been made clear in either the application or the *Federal Register* notice. However, it does not appear that LDEO, or subsequently NMFS, estimated the ensonified area based on repeating the OBS tracklines, which would likely occur on different days as the streamer would have to be deployed and lines re-surveyed. The Commission also is unsure whether LDEO would deploy the streamer after each OBS trackline to acquire the data concurrently or it would conduct the survey using the OBSs and then deploy the streamer to survey the OBS tracklines again and followed by the MCS tracklines. In either instance, the Commission cannot envision how the full extent of each OBS trackline could be surveyed twice within any given day. Accordingly, the Commission recommends that NMFS require LDEO to re-estimate the total numbers of takes based on the OBS portion of the survey being surveyed twice, which may be as simple as multiplying the takes estimated for the OBS portion of the survey by two.

The *Federal Register* notice indicated that LDEO did not include its normal 25 percent contingency for repeating some of the tracklines, accommodating the turning of the vessel, addressing equipment malfunctions, or conducting equipment testing to complete the survey²⁰. That 25 percent contingency is applied to the line-kilometers of tracklines, inevitably increasing the numbers of takes. The Commission is skeptical that those activities would not be needed as contingency for the proposed survey, especially since the 25 percent contingency was included in LDEO's application. However, since such an increase has not been included in the proposed take estimation analysis in the *Federal Register* notice, the Commission recommends that NMFS specify explicitly in the final incidental harassment authorization that LDEO is not authorized to repeat tracklines, accommodate the turning radius of the vessel, address equipment malfunctions, or conduct equipment testing prior to commencing or during the survey. If a possibility exists that those activities would occur during the survey, then the Commission recommends that NMFS require LDEO to re-estimate the numbers of marine mammals that could be taken during the proposed survey and base its "small numbers" and "negligible impact" determinations on those revised take estimates.

¹⁹ Although the source repetition rate would be different for those two methods (approximately 65 and 22 s, respectively), the source level would be the same with the full 36-airgun array.

²⁰ However, LDEO did include the 25 percent contingency in its application. The Commission is unsure why the contingency was removed for the proposed authorization as published in the *Federal Register* notice. Regardless, it is difficult for the Commission and public to review and comment on any proposed action when the information in the application and *Federal Register* notice is not consistent. In the future, NMFS should address and clarify the reason for those inconsistencies in its *Federal Register* notice or require the applicant to amend its application accordingly. Otherwise, the authorization process includes a level of unnecessary confusion, which constitutes a lack of transparency.

NMFS has yet to develop a clear policy setting forth more explicit criteria and/or thresholds for making small numbers and negligible impact determinations, as recommended by the Commission. Such guidance would be particularly useful in a case like this, in which up to 22 percent of the pantropical spotted dolphin stock in the area could be taken incidentally during the proposed survey activities. In the addendum to LDEO's application, that percentage of the pantropical spotted dolphins was considered an overestimate because the stock assessment report estimates are based on surveys only in U.S. waters rather than the entire range. The Commission is unsure why that percentage would be considered an overestimation because the density estimates upon which the takes were based originated only from U.S. waters as well. In any event, the Commission understands that NMFS is in the process of developing both a clearer policy to outline the criteria for determining what constitutes "small numbers" and an improved analytical framework for determining whether an activity will have a "negligible impact" for the purpose of authorizing takes of marine mammals and that NMFS plans to engage the Commission in that process at the appropriate time (79 Fed. Reg. 13626). The Commission encourages NMFS to complete its policy development as quickly as possible and awaits a meeting to engage in that policy development process.

Mitigation and monitoring measures

NMFS would require LDEO to monitor the area near the survey vessel for at least 30 minutes before, during, and 30 minutes after airgun operations. NMFS 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 baleen whales and large odontocetes, including sperm, pygmy sperm, dwarf sperm, killer, 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. Beaked and sperm whales, in particular, can remain submerged for periods far exceeding 30 minutes. Blainville's and Cuvier's beaked whales have been known to dive to considerable depths (> 1,400 m) and to remain submerged for more than 80 minutes (Baird et al. 2008). The grand mean dive duration for those species of beaked whales during foraging dives has been estimated at approximately 60 minutes (51.3 and 64.5 minutes for Blainville's and Cuvier's beaked whales, respectively; Baird pers. comm.). However, recent data on Cuvier's beaked whales revealed a maximum dive duration of more than 137 minutes and dive depths of more than 2,990 m, both of which set new mammalian dive records. Consistent with previous findings, Schorr et al. (2014) indicated a mean dive duration of 67.4 minutes. Sperm whales also dive to great depths and can remain submerged for up to 55 minutes (Drouot et al. 2004), with a grand mean dive time of approximately 45 minutes (Watwood et al. 2006).

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 and sperm whales), if the animal is not observed to have left the exclusion zone.

In previous letters, the Commission has indicated that monitoring and reporting requirements should be sufficient to provide a reasonably accurate assessment of the manner of taking and the numbers of animals taken by the proposed activity, specifically to verify that only small numbers of marine mammals are being taken and that the impacts are negligible. The Commission continues to believe those assessments need to account for animals at the surface but not detected and for animals present but underwater and not available for sighting, which are accounted for by $g(0)$ and $f(0)$ values. NMFS’s most recent response to the Commission’s comments indicated that the MMPA implementing regulations require that applicants include monitoring that will result in “an increased knowledge of the species, the level of taking or impacts on populations of marine mammals that are expected to be present while conducting activities . . .” This increased knowledge of the level of taking could be qualitative or relative in nature, or it could be more directly quantitative (79 Fed. Reg. 38503). The Commission believes that NMFS misinterpreted its implementing regulations in its response. Those regulations state that applicants are to specify—

The suggested means of accomplishing the necessary monitoring and reporting that will result in increased knowledge of the species, the level of taking or impacts on populations of marine mammals that are expected to be present while conducting activities, and suggested means of minimizing burdens by coordinating such reporting requirements with other schemes already applicable to persons conducting such activity.

Although this portion of the regulations²¹ is not particularly clear, it appears that the phrase “increased knowledge” is intended to modify the clause “of the species” and not “the level of taking or impacts on the populations of marine mammals that are expected to be present while conducting activities”. If the phrase “increased knowledge of” is intended to apply throughout the remainder of the provision, as NMFS suggests, then the portion requiring the applicant to provide “suggested means of minimizing burdens . . .” makes no sense. A better interpretation of the provision is that the applicant is to suggest monitoring and reporting measures that will (1) increase the knowledge regarding the species and (2) provide the necessary information regarding the level of incidental taking that occurs and the impacts of such taking on the affected marine mammal populations. Such an interpretation is consistent with the statutory structure, which under section 101(a)(5)(D)(iv) requires that NMFS “modify, suspend, or revoke an authorization” if it finds, among other things, that the authorized taking is having more than a negligible impact or that more than small numbers

²¹ The Commission also questions whether the cited regulation is even the relevant one upon which NMFS should be relying. It merely specifies what applicants should be suggesting when applying for an incidental take authorization. NMFS has an independent responsibility under the MMPA to specify monitoring and reporting requirements that are sufficient for it determine that the statutory requirements are being met.

of marine mammals are being taken. It is through the prescribed monitoring and reporting requirements that NMFS collects the information necessary to make those determinations. As such, those requirements need to be sufficient to provide accurate information on the numbers of marine mammals being taken and the manner in which they are taken, not merely better information on the qualitative nature of the impacts. Accordingly, the Commission continues to believe that appropriate $g(0)$ and $f(0)$ values are essential for making accurate estimates of the numbers of marine mammals taken during surveys. To be applicable for the proposed survey, 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 NMFS's shipboard surveys).

Therefore, the Commission again recommends that NMFS consult with LDEO, NSF, and other relevant entities (e.g., USGS, Scripps, ASC) to develop, validate, and implement a monitoring program that provides a scientifically sound, reasonably accurate assessment of the types of marine mammal takes and the actual numbers of marine mammals taken by incorporating applicable $g(0)$ and $f(0)$ values. NMFS recently stated that although it does not generally believe that post-activity take estimates using $f(0)$ and $g(0)$ are *required* to meet the monitoring requirement of the MMPA, in the context of the NSF and LDEO's monitoring plan, NMFS agreed that developing and incorporating a way to better interpret the results of their monitoring (perhaps a simplified or generalized version of $g(0)$ and $f(0)$) is a good idea. NMFS further stated it would consult with the Commission and NMFS scientists prior to finalizing the recommendations (79 Fed. Reg. 38503). The Commission welcomes such a meeting.

The Commission looks forward to collaborating with NMFS on the various guidance documents and issues raised in this letter. Please contact me if you have questions concerning the Commission's recommendations.

Sincerely,



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Executive Director

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