DEPARTMENT OF COMMERCE

National Oceanic and Atmospheric Administration

RIN 0648–XF456

Takes of Marine Mammals Incidental to Specified Activities; Taking Marine Mammals Incidental to a Marine Geophysical Survey in the Southwest Pacific Ocean, 2017/2018

AGENCY: National Marine Fisheries Service (NMFS), National Oceanic and Atmospheric Administration (NOAA), Commerce.

ACTION: Notice; issuance of an incidental harassment authorization.

SUMMARY: In accordance with the regulations implementing the Marine Mammal Protection Act (MMPA) as amended, notification is hereby given that NMFS has issued an incidental harassment authorization (IHA) to Lamont-Doherty Earth Observatory of Columbia University (L–DEO) to incidentally harass, by Level A and Level B harassment only, marine mammals during marine geophysical survey activities in the southwest Pacific Ocean.

DATES: This Authorization is valid from October 27, 2017 through October 26, 2018.

FOR FURTHER INFORMATION CONTACT: Jordan Carduner, Office of Protected Resources, NMFS, (301) 427–8401. Electronic copies of the application and supporting documents, as well as a list of the references cited in this document, may be obtained online at: *www.nmfs.noaa.gov/pr/permits/incidental/research.htm*. In case of problems accessing these documents, please call the contact listed above.

SUPPLEMENTARY INFORMATION:

Background

Sections 101(a)(5)(A) and (D) of the MMPA (16 U.S.C. 1361 *et seq.*) direct the Secretary of Commerce (as delegated to NMFS) to allow, upon request, the incidental, but not intentional, taking of small numbers of marine mammals by U.S. citizens who engage in a specified activity (other than commercial fishing) within a specified geographical region if certain findings are made and either regulations are issued or, if the taking is limited to harassment, a notice of a proposed authorization is provided to the public for review.

An authorization for incidental takings shall be granted if NMFS finds that the taking will have a negligible impact on the species or stock(s), will not have an unmitigable adverse impact on the availability of the species or stock(s) for subsistence uses (where relevant), and if the permissible methods of taking and requirements pertaining to the mitigation, monitoring and reporting of such takings are set forth.

NMFS has defined ''negligible impact'' in 50 CFR 216.103 as an impact resulting from the specified activity that cannot be reasonably expected to, and is not reasonably likely to, adversely affect the species or stock through effects on annual rates of recruitment or survival.

The MMPA states that the term ''take'' means to harass, hunt, capture, or kill, or attempt to harass, hunt, capture, or kill any marine mammal.

Except with respect to certain activities not pertinent here, the MMPA defines ''harassment'' as any act of pursuit, torment, or annoyance which (i) has the potential to injure a marine mammal or marine mammal stock in the wild (Level A harassment); or (ii) has the potential to disturb a marine mammal or marine mammal stock in the wild by causing disruption of behavioral patterns, including, but not limited to, migration, breathing, nursing, breeding, feeding, or sheltering (Level B harassment).

National Environmental Policy Act

NMFS prepared an Environmental Assessment (EA) and analyzed the potential impacts to marine mammals that would result from L–DEO's planned surveys. A Finding of No Significant Impact (FONSI) was signed on October 27, 2017. A copy of the EA and FONSI is available upon request (see **ADDRESSES**).

Summary of Request

On May 17, 2017, NMFS received a request from L–DEO for an IHA to take marine mammals incidental to conducting a marine geophysical survey in the southwest Pacific Ocean. On September 13, 2017, we deemed L–DEO's application for authorization to be adequate and complete. L–DEO's request is for take of 38 species of marine mammals by Level B harassment and Level A harassment. Neither L–DEO nor NMFS expects mortality to result from this activity, and, therefore, an IHA is appropriate. The planned activity is not expected to exceed one year, hence, we do not expect subsequent MMPA incidental harassment authorizations would be issued for this particular activity.

Description of Activity

Researchers from California State Polytechnic University, California Institute of Technology, Pennsylvania State University, University Southern California, University of Southern Mississippi, University of Hawaii at Manoa, University of Texas, and University of Wisconsin Madison, with funding from the U.S. National Science Foundation, propose to conduct three high-energy seismic surveys from the research vessel (R/V) *Marcus G. Langseth* (*Langseth*) in the waters of New Zealand in the southwest Pacific Ocean in 2017/2018. The NSF-owned *Langseth* is operated by L–DEO. One proposed survey would occur east of North Island and would use an 18-airgun towed array with a total discharge volume of ~3,300 cubic inches (in^3). Two other proposed seismic surveys (one off the east coast of North Island and one south of South Island) would use a 36-airgun towed array with a discharge volume of ~6,600 in^3. The surveys would take place in water depths from ~50 to >5,000 m.

The North Island two-dimensional (2-D) survey would consist of approximately 35 days of seismic operations plus approximately 2 days of transit and towed equipment deployment/retrieval. The *Langseth* would depart Auckland on approximately October 26, 2017 and arrive in Wellington on December 1, 2017. The North Island three-dimensional (3-D) survey is proposed for approximately January 5, 2018–February 8, 2018 and would consist of approximately 33 days of seismic operations plus approximately 2 days of transit and towed equipment deployment/retrieval. The *Langseth* would leave and return to port in Napier. The South Island 2-D survey is proposed for approximately February 15, 2018–March 15, 2018 and would consist of approximately 22 days of seismic operations, approximately 3 days of transit, and approximately 7 days of ocean bottom seismometer (OBS) deployment/retrieval.

The proposed surveys would occur within the Exclusive Economic Zone (EEZ) and territorial sea of New Zealand. The proposed North Island 2-D survey would occur within ~37–43° S. between 180° E. and the east coast of North Island along the Hikurangi margin. The proposed North Island 3-D survey would occur over a 15 x 60 kilometer (km) area offshore at the Hikurangi trench and forearc off North Island within ~38–39.5° S., ~178–179.5° E. The proposed South Island 2-D survey would occur along the Puysegur margin off South Island within ~163–168° E. between 50° S. and the south coast of South Island. Please see Figure 1 and Figure 2 in L–DEO's IHA application for maps depicting the

specified geographic region of the proposed surveys.

A detailed description of the planned project is provided in the **Federal Register** notice for the proposed IHA (82 FR 45116; September 27, 2017). Since that time, no changes have been made to the planned activities. Therefore, a detailed description is not provided here. Please refer to that **Federal Register** notice for the description of the specific activity. Specifications of the airgun arrays, trackline distances, and water depths of each of the three proposed surveys are shown in Table 1.

TABLE 1—SPECIFICATIONS OF AIRGUN ARRAYS, TRACKLINE DISTANCES, AND WATER DEPTHS ASSOCIATED WITH THREE PLANNED R/V LANGSETH SURVEYS OFF NEW ZEALAND

	North Island 2-D survey	North Island 3-D survey	South Island 2-D survey
Airgun array configuration and total volume.	36 airguns, four strings, total volume of ~6,600 in^3.	two separate 18-airgun arrays that would fire alternately; each array would have a total discharge volume of ~3,300 in^3.	36 airguns, four strings, total volume of ~6,600 in^3.
Tow depth of arrays	9 m	9 m	9 m.
Shot point intervals	37.5 m	37.5 m *	50 m.
Source velocity (tow speed)	4.3 knots	4.5 knots	4.5 knots.
Water depths	8%, 23%, and 69% of line km would take place in shallow (<100 m), intermediate (100–1,000 m), and deep water (>1,000 m), respectively.	0%, 42%, and 58% of line km would take place in shallow, intermediate, and deep water, respectively.	1%, 17%, and 82% of line km would take place in shallow, intermediate, and deep water, respectively.
Approximate trackline distance	5,398 km	3,025 km	4,876 km.
Percentage of survey tracklines proposed in New Zealand Territorial Waters.	Approximately 9 percent	Approximately 1 percent	Approximately 6 percent.

* The two arrays fire alternately with an approximate distance of 37.5 m traveled between the firing of one array, then the other.

Comments and Responses

NMFS published a notice of proposed IHA in the **Federal Register** on September 27, 2017 (82 FR 45116). During the 30-day public comment period, NMFS received comments from the Marine Mammal Commission (Commission), the Marine Seismic Research Oversight Committee (MSROC) and from members of the general public. NMFS has posted the comments online at: *http://www.nmfs.noaa.gov/pr/permits/incidental.* The following is a summary of the public comments and NMFS' responses.

Comment 1: The Commission expressed concerns regarding L–DEO's method to estimate the extent of the Level A and B harassment zones and the numbers of marine mammal takes. The Commission stated that the model is not the best available science because it assumes spherical spreading, a constant sound speed, and no bottom interactions for surveys in deep water. In light of their concerns, the Commission recommended that NMFS require L–DEO to re-estimate the Level A and Level B harassment zones and associated takes of marine mammals using both operational (including number/type/spacing of airguns, tow depth, source level/operating pressure, operational volume) and site-specific environmental (including sound speed profiles, bathymetry, and sediment characteristics at a minimum) parameters.

NMFS Response: NMFS understands the concerns expressed by the Commission about L–DEO's current modeling approach for estimating Level A and Level B harassment zones. L–DEO has conveyed to NMFS that additional modeling efforts to refine the process and conduct comparative analysis may be possible with the availability of research funds and other resources. Obtaining research funds is typically accomplished through a competitive process, including those submitted to U.S. Federal agencies. The use of models for calculating buffer and exclusion zone radii and for developing take estimates is not a requirement of the MMPA incidental take authorization process. Furthermore, NMFS does not provide specific guidance on model parameters nor prescribe a specific model for applicants as part of the MMPA incidental take authorization process at this time, although we do review methods to ensure their adequacy for prediction of take.

L–DEO's application describes their approach to modeling Level A and Level B harassment zones. In summary, L–DEO acquired field measurements for several array configurations at shallow, intermediate, and deep-water depths during acoustic verification studies conducted in the northern Gulf of Mexico in 2007 and 2008; these were presented in Tolstoy *et al.* (2009). Based on the empirical data from those studies, L–DEO developed a sound propagation modeling approach that predicts received sound levels as a function of distance from a particular airgun array configuration in deep water (Diebold *et al.,* 2010; NSF–USGS 2011). For the planned surveys off the coast of New Zealand, L–DEO modeled Level A and Level B harassment zones using the sound propagation modeling approach described in Diebold *et al.* (2010), based on the empirically-derived measurements from the Gulf of Mexico calibration survey. For deep water (>1000 meters (m)), L–DEO used the deep-water radii obtained from model results down to a maximum water depth of 2,000 m (Figure 2 and 3 in Diebold *et al.,* 2010); the radii for intermediate water depths (100–1,000 m) were derived from the deep-water radii by applying a correction factor (multiplication) of 1.5 (Fig. 16 in Diebold et al., 2010); the radii for shallow-water depths (<100 m) were derived by applying a scaling factor to the empirically derived measurements from the Gulf of Mexico calibration survey (Tolstoy *et al.,* 2009) to account for the differences in tow depth between the Gulf of Mexico calibration survey (6 m) and the planned New Zealand surveys (9 and 12 m).

In 2015, L–DEO explored the question of whether the Gulf of Mexico calibration data adequately informs the model to predict isopleths in other areas by conducting a retrospective sound power analysis of one of the lines acquired during a L–DEO seismic survey offshore New Jersey in 2014 (Crone, 2015). NMFS presented a comparison of the predicted radii (*i.e.,*

modeled isopleths to distances corresponding to Level A and Level B harassment thresholds) with radii based on in situ measurements in a previous notice of issued Authorization for Lamont-Doherty (see 80 FR 27635; May 14, 2015, Table 1).

Briefly, Crone's (2015) analysis, specific to the survey site offshore New Jersey, confirmed that in-situ, site specific measurements and estimates of 160 decibels (dB) root mean square (rms) and 180 dB rms isopleths collected by the *Langseth's* hydrophone streamer in shallow water were smaller than the modeled (*i.e.,* predicted) zones for two seismic surveys conducted offshore New Jersey in shallow water in 2014 and 2015. In that particular case, Crone's (2015) results showed that L–DEO's modeled 180 dB rms and 160 dB rms zones were approximately 28 percent and 33 percent larger, respectively, than the in-situ, site-specific measurements, thus confirming that L–DEO's model was conservative in that case. The following is a summary of two additional analyses of in-situ data that support L–DEO's use of the modeled Level A and Level B harassment zones in this particular case.

In 2010, L–DEO assessed the accuracy of their modeling approach by comparing the sound levels of the field measurements acquired in the Gulf of Mexico study to their model predictions (Diebold *et al.,* 2010). They reported that the observed sound levels from the field measurements fell almost entirely below the predicted mitigation radii curve for deep water (greater than 1,000 m; 3280.8 feet (ft)) (Diebold *et al.,* 2010).

In 2012, L–DEO used a similar process to model distances to isopleths corresponding to the isopleths corresponding to Level A and Level B harassment thresholds for a shallow-water seismic survey in the northeast Pacific Ocean offshore Washington State. L–DEO conducted the shallow-water survey using the same airgun configuration planned for the surveys considered in this IHA (*i.e.,* 6,600 cubic inches (in^3)) and recorded the received sound levels on both the shelf and slope using the *Langseth's* 8 kilometer (km) hydrophone streamer. Crone *et al.* (2014) analyzed those received sound levels from the 2012 survey and confirmed that in-situ, site specific measurements and estimates of the 160 dB rms and 180 dB rms isopleths collected by the *Langseth's* hydrophone streamer in shallow water were two to three times smaller than L–DEO's modeling approach had predicted. While the results confirmed bathymetry's role in sound propagation, Crone *et al.* (2014) were also able to confirm that the empirical measurements from the Gulf of Mexico calibration survey (the same measurements used to inform L–DEO's modeling approach for the planned surveys in the southwest Pacific Ocean) overestimated the size of the predicted isopleths for the shallow-water 2012 survey off Washington State and were thus precautionary, in that particular case.

NMFS continues to work with L–DEO to address the issue of incorporating site-specific information for future authorizations for seismic surveys. However, L–DEO's current modeling approach (supported by the three studies discussed previously) represents the best available information for NMFS to reach determinations for this IHA. As described earlier, the comparisons of L–DEO's model results and the field data collected in the Gulf of Mexico, offshore Washington State, and offshore New Jersey illustrate a degree of conservativeness built into L–DEO's model for deep water, which NMFS expects to offset some of the limitations of the model to capture the variability resulting from site-specific factors. Based upon the best available information (*i.e.,* the three data points, two of which are peer-reviewed, discussed in this response), NMFS finds that the Level A and Level B harassment zone calculations are appropriate for use in this particular IHA. Additionally, results of acoustic modeling represent just one component of the analysis during the MMPA authorization process, as NMFS also takes into consideration other factors associated with the activity (*e.g.,* geographic location, duration of activities, context, sound source intensity, etc.).

Comment 2: The Commission recommended that NMFS use a different data source to estimate densities of New Zealand fur seals and southern elephant seals than was used in the proposed IHA. Specifically, the Commission recommended that NMFS rely on the data presented in the U.S. Navy Marine Species Density Database (NMSDD) to estimate take of these pinniped species. The Commission also recommended that NMFS convene an internal working group to determine what data sources are considered best available for the various species and in the various areas and provide that information to applicants accordingly.

NMFS Response: Density data presented in Bonnell *et al.* (1992) was used in this particular IHA because it was based on systematic aerial at-sea surveys (off Oregon and Washington), whereas the data presented in NMSDD was derived from surveys of hauled out pinnipeds. While the NMSDD data is more recent than the data presented in Bonnell *et al.* (1992), in this case we determined that densities presented in Bonnell *et al.* (1992), which were derived from at-sea surveys, would be more representative of densities for similar taxonomic species in a different area (in this case, New Zealand). It is important to note that the NMSDD data are specific to the west coast of the U.S. and were based on population sizes for the species in the particular geographic ranges for the particular geographic areas of concern for the U.S. Navy, and are therefore useful in estimating densities for those same species in those same particular geographic areas. However, in this case the densities reported for pinnipeds off the U.S. west coast were used to estimate densities of surrogate species in a different geographic area (New Zealand). Thus our selection of the data from Bonnell *et al.* (1992) to extrapolate pinniped densities in New Zealand for this IHA was based on a preference to use data that was based on at-sea surveys to estimate at-sea density. While we acknowledge the usefulness of the NMSDD data for calculating marine mammal densities for ITAs for activities that occur on the U.S. west coast, that does not preclude us from relying on other data sources when activities are planned to occur outside the U.S. In summary, while NMFS has used NMSDD density data to estimate take of pinnipeds in previous ITAs for activities that occurred off the west coast of the U.S., NMFS determined that, for this particular IHA, Bonnell *et al.* (1992) represented the best available information for the marine mammals in the survey area.

Regarding the Commission's recommendation that NMFS convene an internal working group to determine what data sources are considered best available for the various species and in the various areas, NMFS may consider future action to address these issues, but currently intends to address these questions through ongoing interactions with the U.S. Navy, academic institutions, and other organizations.

Comment 3: The Commission recommended that NMFS adjust density estimates using some measure of uncertainty (*i.e.,* coefficient of variation, standard deviation, standard error) rather than the proposed 25 percent contingency, and recommended that NMFS convene a working group to determine how best to incorporate uncertainty in density data that are extrapolated.

NMFS Response: The Commission has recommended previously that NMFS

adjust density estimates using some measure of uncertainty when available density data originate from different geographic areas, temporal scales, and species, especially for actions which will occur outside the U.S. EEZ where site- and species-specific density estimates tend to be scant, such as L–DEO's planned survey. We have attempted to do so in this IHA, and feel the 25 percent correction factor is an appropriate method in this case to account for uncertainties in the density data that was available for use in the take estimates. NMFS is open to consideration of other correction factors for use in future IHAs and looks forward to further discussion with the Commission on how best to incorporate uncertainty in density estimates in instances where density data is limited.

Regarding the recommendation that NMFS convene a working group to determine how best to incorporate uncertainty in density data that are extrapolated, NMFS may consider future action to address these issues, but currently intends to address these questions through ongoing interactions with the U.S. Navy, academic institutions, and other organizations.

Comment 4: The Commission expressed concern regarding methods used to estimate the numbers of takes, including the use of rounding in calculations and recommended that NMFS share the rounding criteria with the Commission.

NMFS Response: NMFS appreciates the Commission's ongoing concern in this matter. Calculating predicted takes is not an exact science and there are arguments for taking different mathematical approaches in different situations, and for making qualitative adjustments in other situations. We believe, however, that the methodology used for take calculation in this IHA, as described in detail in the **Federal Register** notice of the proposed IHA (82 FR 45116; September 27, 2017), remains appropriate. NMFS continues to refine the rounding criteria and will share the criteria with the Commission upon its finalization.

Comment 5: The Commission recommended that NMFS authorize Level A take based on group size of the species when Level A take is anticipated and when the estimated Level A take of a species was less than the group size for the species.

NMFS Response: NMFS considered this recommendation but ultimately concluded that, given the modeled Level A harassment zones in concert with the mitigation measures required in the IHA, it was not realistic to assume a single take by Level A harassment of an individual animal would translate to an entire group of that species being taken by Level A harassment, in all instances. The assumption that if a single individual is taken then an entire group would be taken only applies in the case of instantaneous exposure, as it is extremely unlikely than an entire group of animals would remain within an area long enough to be taken by an accumulation of energy (SEL_{cum}). Therefore, in analyzing this question, we only considered the potential for Level A take of an entire group of the species in the context of peak sound pressure level (SPL). The modeled Level A zones (peak SPL) for marine mammal functional hearing groups are relatively small, especially in the cases of low-frequency cetaceans, mid-frequency cetaceans, phocid pinnipeds and otariid pinnipeds, for which the modeled Level A zones (peak SPL) are all estimated to be less than 50 m (Tables 6, 7 and 8). Coupled with the fact that shutdown of the airguns is required for marine mammals within 100 m of the array (with the exception of short-beaked common dolphins, dusky dolphins and southern right whale dolphins that approach the vessel), it is very unlikely that an entire group of any species of marine mammals in these functional hearing groups would be exposed to the airgun array at levels that would constitute Level A harassment. For instance, in the case of short-finned pilot whales, one take by Level A harassment is estimated during the North Island 2-D survey (Table 10). Though we are not aware of information on the typical group size for short-finned pilot whales off New Zealand, Ross (2006) reported that short-finned pilot whales off Australia tend to occur in groups of 10–30 individuals. The Level A harassment zone (SPL) for short-finned pilot whales (considered to be in the mid-frequency functional hearing group) for the North Island 2-D survey is estimated to be less than 14 m (Table 6). We believe the possibility of a group of 10–30 short-finned pilot whales approaching within 14 m of the airgun array and being taken by Level A harassment, especially considering the mitigation requirement that the array be shut down entirely if a pilot whale approaches within 100 m of the array, is so low as to be discountable.

Even in the case of short-beaked common dolphins, dusky dolphins and southern right whale dolphins that approach the vessel, for which the power down requirement does not apply, we believe the likelihood that a group of bow-riding dolphins would occur within 14 m of the array to be so low as to be discountable. For instance, though common dolphin group size varies depending on season, depth, sea surface temperature, Stockin (2008) reported the most frequently observed group size in the Hauraki Gulf to be 21–30 animals. We believe the possibility of a group of 21–30 dolphins approaching within 14 m of the airgun array and being taken by Level A harassment is so low as to be discountable. Therefore, for the species categorized as low-frequency cetaceans, mid-frequency cetaceans, phocid pinnipeds and otariid pinnipeds, we do not authorize Level A take by group size, when at least one take is estimated to occur for the species.

The Level A harassment zones (peak SPL) for high-frequency cetaceans are estimated at 229.2 m, 119.0 m, and 229.2 m, for the North Island 2-D, North Island 3-D, and South Island 2-D surveys, respectively. We analyzed the potential for a group of any of the species in the high-frequency functional hearing group (that occur in the survey areas) occurring between 229.2 m (largest distance to the isopleth corresponding to the Level A harassment threshold) and 100 m (the distance to the 100 m exclusion zone (EZ) for the smallest element in the array, for all species in the high-frequency functional hearing group) of the array. The species in this group for which Level A take is authorized in this IHA include the hourglass dolphin, spectacled porpoise and pygmy sperm whale. We are not aware of information on the group sizes of these species in the waters off New Zealand. However, based on the best available information, estimated group sizes are lower than the number of takes authorized, when at least 1 Level A take is authorized, for these species: Hourglass dolphin group size was reported as averaging 2–6 individuals in Antarctic waters (Santora, 2012) whereas 15, 10, and 12 takes by Level A harassment are authorized (for North Island 2-D, North Island 3-D, and South Island 2-D survey, respectively); spectacled porpoise group size was reported as 2 individuals in Antarctic waters (Sekiguchi *et al.,* 2006), whereas 6 takes by Level A harassment are authorized for the South Island 2-D survey (with 0 Level A takes predicted for the North Island 2-D and North Island 3-D surveys); *Kogia* spp. mean group size was reported as 1.9 individuals in the California current ecosystem (Barlow, 2010) whereas 6, 4, and 5 takes by Level A harassment are authorized (for North Island 2-D, North Island 3-D, and South Island 2-D survey, respectively). Because the number of

authorized Level A takes are higher than the respective group sizes for these species, we do not authorize Level A take by group size, when at least one take is estimated to occur for the species, for any marine mammal species.

Comment 6: The Commission recommended that NMFS include a take table showing the total numbers of takes for the entire activity area (territorial seas, exclusive economic zones, and high seas).

NMFS Response: NMFS does not authorize takes in the territorial sea. However, we have included a table showing the take estimates in the New Zealand territorial sea (see Table 14).

Comment 7: The Commission recommended that NMFS include pygmy and gingko-toothed beaked whales and dwarf sperm whales in the IHA, based on range estimates and stranding records in New Zealand for these species.

NMFS Response: NMFS has reviewed the available literature available on the strandings of these three species. While stranding records exist for these species in various locations on the coast of New Zealand, these strandings appear to have been isolated events in all cases and do not suggest that the density of these species in the survey area is such that take of these species is likely to occur. Therefore, we do not authorize take of ginkgo-toothed beaked whales, pygmy beaked whales, and dwarf sperm whales in this IHA.

Comment 8: The Commission recommended that NMFS prohibit L–DEO from using power downs during its survey.

NMFS Response: NMFS agrees with the Commission that limiting the use of power downs can be beneficial in reducing the overall sound input in the marine environment from geophysical surveys; as such, NMFS is requiring that power downs in this IHA occur for no more than a maximum of 30 minutes at any time. NMFS is still in the process of determining best practice, via solicitation of public comment, for the use of power downs as a mitigation measure in ITAs for geophysical surveys. We will take into consideration the Commission's recommendation that power downs be eliminated as a mitigation measure as we work toward a determination on best practices for the use of power downs in IHAs for marine geophysical surveys. Ultimately our determination will be based on the best available science and will be communicated clearly to ITA applicants.

Comment 9: The Commission recommended that NMFS condition the IHA to require LDEO to abide by the regulatory requirements of New Zealand's Exclusive Economic Zone and Continental Shelf Act and, through it, the mandatory provisions of the 2013 Code of Conduct for Minimizing Acoustic Disturbance to Marine Mammals from Seismic Survey Operations (Code).

NMFS Response: NMFS does not have the statutory authority to require L–DEO to abide by the regulatory requirements of New Zealand's Exclusive Economic Zone and Continental Shelf Act and, through it, the mandatory provisions of the Code. Under the MMPA, L–DEO must comply with the requirements of the IHA. However, we also encourage L–DEO to comply with the provisions of the Code to the extent possible.

Comment 10: The Commission recommended that NMFS include a mitigation measure requiring shutdown of the airgun array upon observation of a large whale with calf or an aggregation of large whales at any distance, in an effort to minimize impacts on mysticetes and sperm whales that are engaged in biologically-important behaviors (*e.g.,* nursing, breeding, feeding).

NMFS Response: NMFS has included mitigation measures in the final IHA requiring shutdown of the airgun array upon observation of a large whale with calf and upon observation of an aggregation of large whales at any distance, as recommended by the Commission. See the section on Mitigation, below, for more details.

Comment 11: The Commission recommended that NMFS incorporate mitigation measures that would require both visual observations and passive acoustic methods to implement shutdown procedures when any sperm whale, beaked whale, or *Kogia* spp. are detected, which would bolster mitigation efforts as a whole, affording NMFS the ability to further reduce the impacts on those deep-diving species. The Commission also recommended a consistent approach for requiring all geophysical and seismic survey operators to abide by the same general mitigation measures.

NMFS Response: NMFS has included a mitigation measure in the final IHA requiring shutdown of the airgun array upon acoustic detection of a beaked whale, sperm whale, or *Kogia* spp., as recommended by the Commission, with an exception for sperm whales in instances where the acoustic detection can be definitively localized and the sperm whale is confirmed to be located outside the 500 m exclusion zone. See the Response to Comment 13 and the section on Mitigation, below, for further details, including the reasoning behind the shutdown requirement upon acoustic detection and the sperm whale exception.

NMFS considered requirement of shutdown upon visual detection of sperm whales at any distance. We have included a mitigation measure that would require shutdown of the array on acoustic detection of sperm whales at any distance (except in instances where the sperm whale can be definitively localized as being located outside the 500 m EZ). The reasoning behind the shutdown requirement upon acoustic detection is provided in more detail below (see section on Mitigation). Based on the best available information, we believe that acoustic detections of sperm whales would most likely be representative of the foraging behavior we intend to minimize disruption of, while visual observations of sperm whales would represent resting between bouts of such behavior. Occurrence of resting sperm whales at distances beyond the 500 m exclusion zone may not indicate a need to implement shutdown. Therefore, this measure has not been added to the final IHA. This is discussed in greater detail in the Mitigation section, below.

NMFS agrees with the Commission that consistency in mitigation measures across incidental take authorizations (ITAs) for similar activities is a worthwhile goal, to the extent practicable. However, NMFS also must determine the most appropriate mitigation measures for a given ITA, taking into account factors unique to that ITA, such as the type, extent, location, and timing of activities, and therefore, complete consistency in mitigation measures across ITAs for similar activities will not always be possible. NMFS is still in the process of determining best practice, via solicitation of public comment, for the use of a suite of mitigation measures in ITAs for marine geophysical surveys. We will take into consideration the Commission's recommendations with regard to mitigation measures as we work toward determinations on best practices for mitigation measures in IHAs for geophysical surveys. Ultimately our determination will be based on the best available science and will be communicated clearly to ITA applicants.

Comment 12: The Commission expressed concern that reporting of the manner of taking and the numbers of animals incidentally taken should account for all animals in the various survey areas, including those animals directly on the trackline that are not detected, and how well animals are

detected based on the distance from the observer (accounted for by g(0) and f(0) values). The Commission has recommended a method for estimating the number of cetaceans in the vicinity of geophysical surveys based on the number of groups detected and recommended that NMFS require L–DEO to use this method for estimating g(0) and f(0) values to better estimate the numbers of marine mammals taken by Level A and Level B harassment.

NMFS Response: NMFS agrees that reporting of the manner of taking and the numbers of animals incidentally taken should account for all animals taken, including those animals directly on the trackline that are not detected and how well animals are detected based on the distance from the observer, to the extent practicable. NMFS appreciates the Commission's recommendations but we believe that the Commission's described method needs further consideration in relation to the observations conducted during marine geophysical surveys. Therefore, at this time we do not prescribe a particular method for accomplishing this task. We look forward to engaging further both L–DEO, the Commission and other applicants to reach a determination on the most suitable method to for estimating g(0) and f(0) values.

Comment 13: A member of the general public expressed concern regarding the effective dates of the IHA and that there had not been adequate consultation within New Zealand, including that the local indigenous populations were not consulted.

NMFS Response: NMFS has followed and met its statutory obligations with respect to notifying the public of, and requesting comments on, the proposed IHA, and has considered and responded to all public comments received. With respect to concerns regarding communication within New Zealand, including with indigenous groups, NMFS does not have the authority to require communication between L–DEO and the New Zealand government or interested parties within New Zealand. In addition, the MMPA provides authority only to authorize the take of marine mammals that may occur incidental to the activity; NMFS does not permit the activity itself. However, the National Science Foundation, as the funder of the survey, has been in communication with the New Zealand Department of Conservation (NZDOC) regarding the survey, and recommendations from the NZDOC have been incorporated in the IHA. For instance, the power down waiver for bottlenose dolphins has been removed from the IHA based on input received from the NZDOC (see the section on Revisions to the IHA That Have Occurred Since the Proposed IHA, below, for details). The comment also stated that lack of communication with indigenous groups represents a breach of the Treaty of Waitangi; however, the United States is not a Party to the Treaty of Waitangi.

Comment 14: A member of the general public expressed concern regarding potential impacts to marine mammals, including impacts to mother-calf pairs, South Island Hector's dolphins, southern right whales, blue whales, killer whales, sperm whales and beaked whales. The commenter also expressed concern that tourism companies could be hurt financially by the planned surveys

NMFS Response: The commenter expressed concern that the timing of the planned surveys overlaps with calving season for delphinids and that noise from the planned surveys could interfere with mother-calf communication. The commenter did not provide any detailed or substantive information or references to support this statement or change our analyses. We recognize that restricted communication as a result of increased noise from seismic surveys may be of concern, which is why we have incorporated mitigation measures to minimize the potential for this to occur. For instance, the IHA requires that the airgun array be shut down upon observation of a large whale with calf at any distance; additionally, the airgun array would be powered down to a single 40 in^3 airgun if any delphinids (other than those that approach the vessel (*i.e.,* bow ride)) are detected within 500 m of the array. We have determined these measures ensure the least practicable impact on the species potentially affected. The commenter expressed concern regarding potential impacts to blue whales, killer whales, sperm whales and other deep-diving whales. However, the comments specific to blue whales, killer whales, sperm whales and other deep-diving whales did not include any supporting information nor did they recommend any specific action. NMFS believes the mitigation and monitoring measures incorporated in the IHA, including measures specific to sperm whales and other deep diving cetaceans, ensure the least practicable impact on the species potentially affected (see the Mitigation section, below).

The commenter also expressed concern regarding South Island Hector's dolphins, specifically the subpopulation that resides in Te Waewae Bay, noting that they exhibit high site fidelity and that the survey will coincide with Hector's dolphin calving season. We agree with the concerns raised by this comment, especially given the proximity of the planned track lines of the South Island 2-D survey to Te Waewae Bay (see Figure 2 in the IHA application). In response to this concern, we have incorporated a mitigation measure that would require shutdown of the array upon visual detection of South Island Hector's dolphins at any distance. Based on this comment, we have also added a mitigation measure requiring shutdown of the array upon acoustic detection of a Hector's dolphin during North and South Island surveys, if the acoustic detection can be definitively identified as a Hector's dolphin. More information is provided below in the section on Revisions to the IHA That Have Occurred Since the Proposed IHA.

Regarding the concern that tourism companies could be impacted financially by the planned surveys, this statement was not supported by any information and we cannot speculate as to any potential effects to tourism companies as a result of L–DEO's survey. NMFS also does not have any authority under the MMPA to restrict activities based on potential impacts to tourism, as we do not authorize the activity itself, as described above.

Comment 15: A member of the general public expressed concern that the abundances for marine mammals provided in Table 2 in the Notice of the Proposed IHA (82 FR 45116; September 27, 2017) do not reflect abundance estimates for those marine mammals specifically around New Zealand because they incorporate population estimates from the entire Southern Hemisphere. The comment asserted that many of the marine mammal species have unique and important subpopulations. The commenter specifically recommended that the abundance estimates for southern right whale and killer whale be revised.

NMFS Response: The commenter did not suggest specific revisions to abundance estimates, with the exception of southern right whale and killer whale. With respect to southern right whale and killer whale the commenter did not provide specific information to support revisions to our abundance estimates for those species. For southern right whales, the commenter referenced an estimated abundance of 200. The source for this estimate was the Web site of a New Zealand based non-governmental organization; however, this Web site does not cite any literature to support this estimate, therefore we have no way

to verify the accuracy of this figure or revise our abundance estimate based on it. For killer whale abundance, the commenter referenced an estimated abundance of 150–200 individuals. The source for this estimate is a NZDOC Web site; however, this Web site does not cite any literature to support this estimate, therefore we have no way to verify the accuracy of this figure or revise our abundance estimate based on it. The commenter did not provide any specific recommendations regarding revisions to abundance estimates for any other species. The commenter refers to marine mammals abundances described in Baker *et al.* (2016); however, that document does not provide abundance estimates for specific marine mammal species.

With regard to the abundance estimates for the other species in Table 2, we made our findings about the applicable management units and abundance estimates for those species based on the best available information.

Comment 16: A member of the general public expressed concerns with and offered suggestions about some of the mitigation measures. Specific concerns or suggestions raised by the commenter were related to: Mitigation measures for surveys during nighttime and low visibility; the number and location of PSOs relative to the survey vessel; verification of sound propagation modeling; size of exclusion zones; use of power downs; mitigation for the multibeam echosounder (MBES) and sub-bottom profiler (SBP); and shutdown requirements for Hector's dolphins.

NMFS Response: The commenter expressed concern that mitigation measures for surveys during nighttime and low visibility conditions were limited to use of PAM. However, the IHA also requires that L–DEO must provide a night-vision device suited for the marine environment for use during nighttime ramp-up pre-clearance, which must include automatic brightness and gain control, bright light protection, infrared illumination, and optics suited for low-light situations. We have determined that the mitigation measures specific to nighttime and low visibility conditions ensure the least practicable impact on species potentially affected.

The commenter expressed concern that the number of required PSOs is not sufficient, and suggested observers be deployed on other vessels in addition to the *Langseth.* However, we believe that mitigation and monitoring measures required in the IHA can be adequately performed by the number of PSOs required in the IHA, and that this has been demonstrated through numerous monitoring reports submitted for past IHAs for similar activities (*i.e.,* marine geophysical surveys conducted on the *Langseth*) which have used the same number of PSOs and the same PSO staffing configurations as that required in this IHA. We believe the number and location of PSOs required in the IHA ensure the least practicable impact on species potentially affected.

The commenter expressed concern that sound propagation should be verified in the field to ensure accuracy of the sound propagation models. The commenter expressed that this would be of particular concern in regards to the South Island Hector's dolphin subpopulation that has site fidelity to Te Waewae Bay. As described above, NMFS believes that L–DEO's current modeling approach represents the best available information for NMFS to reach determinations for this IHA. We refer the reader to the response to Comment 1, above, for a more detailed discussion of L–DEO's acoustic modeling methodology. In addition, as described above, results of acoustic modeling represent just one component of the analysis during the MMPA authorization process, as NMFS also takes into consideration other factors associated with the activity and, as described herein, our determination of the appropriate distance for mitigation zones is not based on acoustic modeling. With respect to the use of sound source verification to verify the distances to isopleths that coincide with harassment thresholds for Hector's dolphins, we have incorporated a requirement in the IHA that the array must be shut down upon visual or acoustic detection of Hector's dolphins at any distance, as described below.

The commenter expressed concern about the 500 m exclusion zone and recommended that the exclusion zone should be extended to between 1–1.5 km for all species of marine mammals detected visually and/or acoustically, and referred to more conservative zones required by the Code for some marine mammals. As described in the **Federal Register** Notice of the Proposed IHA (82 FR 45116; September 27, 2017), our use of 500 m as the EZ is based on a reasonable combination of factors. This zone is expected to contain all potential auditory injury for all marine mammals (high-frequency, mid-frequency and low-frequency cetacean functional hearing groups and otariid and phocid pinnipeds) as assessed against peak pressure thresholds (NMFS, 2016) (Tables 7, 8, 9). It is also expected to contain all potential auditory injury for high-frequency and mid-frequency cetaceans as well as otariid and phocid pinnipeds as assessed against SEL_{cum} thresholds (NMFS, 2016) (Tables 7, 8, 9). Additionally, the 500 m EZ is expected to minimize the likelihood that marine mammals will be exposed to levels likely to result in more severe behavioral responses. It has also proven to be practicable through past implementation in seismic surveys conducted for the oil and gas industry. A practicable criterion such as the proposed 500 m EZ has the advantage of simplicity while still providing in most cases a zone larger than relevant auditory injury zones, given realistic movement of source and receiver. With respect to the Code, as described above, NMFS does not have the statutory authority to require L–DEO to abide by the requirements of the Code outside a finding that the Code represents mitigation necessary to effect the least practicable impact on the affected marine mammal species or stocks, which is not the case here. However, we encourage L–DEO to comply with the provisions of the Code to the extent possible.

The commenter expressed concern that the use of the single 40 in^3 airgun during power downs adds more sound to the marine environment, though this comment appears to be based on the mistaken impression that the single airgun may be used ''continuously.'' We note that the use of the single 40 in^3 airgun during power downs is, in fact, permitted for no more than 30 minutes at any time (as described in greater detail in the Mitigation section below). The comment did not cite any substantive information regarding power downs or make any recommendations regarding power downs, therefore we do not further revise the requirements specific to power downs in response to this comment.

The commenter expressed concern with the use of the MBES and SBP, citing a report on a mass stranding of melon-headed whales on the Madagascar coast in 2008 that was attributed to use of a MBES (Southall *et al.,* 2013). The commenter also requested that NMFS require that the MBES be shut down in instances when mitigation measures require shutdown of the airgun array.

A Kongsberg EM 122 MBES would be operated continuously during the proposed surveys, but not during transit to and from the survey areas. Due to the lower source level of the MBES relative to the *Langseth's* airgun array, sounds from the MBES are expected to be effectively subsumed by the sounds from the airgun array when both sources are operational. Thus, NMFS has

determined that any marine mammal potentially exposed to sounds from the MBES would already have been exposed to sounds from the airgun array, which are expected to propagate further in the water, when both sources are operational. During periods when the airguns are inactive and the MBES is operational, NMFS has determined that, given the movement and speed of the vessel and the intermittent and narrow downward-directed nature of the sounds emitted by the MBES (each ping emitted by the MBES consists of eight (in water >1,000 m deep) or four (<1,000 m) successive fan-shaped transmissions, each ensonifying a sector that extends 1° fore-aft), the MBES would result in no more than one or two brief ping exposures to any individual marine mammal, if any exposure were to occur.

Regarding the 2008 mass stranding of melon-headed whales in Madagascar, it should be noted that the report to which the commenter refers states that while the MBES was determined as the most likely cause of the stranding event, there was no unequivocal and easily identifiable single cause of the event, such as those that have been implicated in previous marine mammal mortalities (*e.g.,* entanglement, vessel strike, identified disease) or mass stranding events (*e.g.,* weather, extreme tidal events, predator presence, anthropogenic noise) (Southall *et al.,* 2013). The report also notes that the 2008 mass stranding event in Madagascar was the first known such marine mammal mass stranding event closely associated with relatively high-frequency mapping sonar systems such as MBES and that similar MBES systems are in fact commonly used in hydrographic surveys around the world over large areas without such events being previously documented (Southall *et al.,* 2013). The report found that in the case of the 2008 mass stranding event, environmental, social, or some other confluence of factors (*e.g.,* shoreward-directed surface currents and elevated chlorophyll levels in the area preceding the stranding) may have meant that that particular group of whales was oriented relative to the directional movement of the survey vessel (the vessel moved in a directed manner down the shelf-break; Southall *et al.,* 2013, Figure 2) in such a way that an avoidance response caused animals to move into an unfamiliar and unsafe out-of-habitat area (Southall *et al.,* 2013). NMFS is not aware of any marine mammal stranding events that have been documented as a result of exposure to sounds from MBES since the Madagascar mass stranding event in 2008. Based on the best available information, we do not believe the use of the MBES aboard the *Langseth* will result in marine mammal strandings.

The commenter expressed concern that a shutdown requirement upon any observation of Hector´s dolphins at any distance, including upon acoustic detection, is warranted. As described above, based on the best available information, NMFS agrees this measure is warranted, and has incorporated these requirements in the IHA. See the section on Mitigation and the section on Revisions to the IHA That Have Occurred Since the Proposed IHA, below, for details.

In summary, we have determined the mitigation measures contained in the IHA ensure the least practicable impact on marine mammal species potentially affected.

Comment 17: A member of the general public expressed that L–DEO should employ alternative research technologies, including Vibroseis and AquaVib, rather than airguns to perform the planned marine geophysical surveys.

NMFS Response: At this point in time, the alternative technologies identified by the commenter are not commercially viable or appropriate to meet the needs of the planned surveys. With respect to Vibroseis, there is no commercially available marine vibrator system that can be used for the planned surveys. The AquaVib is a modified version of a land seismic vibrator system that is capable of being placed in very shallow water (*i.e.,* a few meters) and in transition zone environments (*i.e.,* marshes, etc.); however the AquaVib would not be suitable for L–DEO's planned surveys. As suggested by the commenter, NMFS has requested the National Science Foundation to continue to review and consider alternative technologies to support future marine geophysical research.

Comment 18: A member of the general public stated that L–DEO should agree to pay for any necropsies of marine mammals that strand around the entire coastline of New Zealand during and after the survey.

NMFS Response: NMFS does not anticipate that the survey will result in strandings of marine mammals. We also do not have the authority to require applicants to fund marine mammal necropsies. However, should any stranded animals be observed during the surveys, we have included reporting measures to ensure L–DEO promptly notifies NMFS and the NZDOC (see the section on Reporting, below).

In addition to the comments above, NMFS received comments from the MSROC and an additional comment from the general public. The comment letter from the MSROC affirmed that there is significant support from the MSROC for the IHA to be issued for the proposed surveys and for the surveys to be conducted. A private citizen expressed concern that animals should not be harmed in the process of surveying or studying them. NMFS considered this comment, however, it did not contain any substantive information regarding the potential for the proposed surveys to harm marine mammals.

Revisions to the IHA That Have Occurred Since the Proposed IHA

Based on public comments and a recalculation of the take estimates in the proposed IHA, we have made revisions to the IHA since we published the notice of the proposed IHA in the **Federal Register** (82 FR 45116; September 27, 2017). Those revisions are described below.

Revisions to the take estimates—Take estimates in the final IHA have been revised slightly since we published the notice of the proposed IHA in the **Federal Register** (82 FR 45116; September 27, 2017), due to a math error in calculating the 25 percent correction factor for uncertainty in density estimates applied to the overall take estimate. This has resulted in higher take estimates in some cases, and lower take estimates in some cases, in comparison to the take estimates described in the notice of the proposed IHA. Revised take estimates are shown in Tables 10, 11, 12 and 13. These revisions have not impacted our preliminary determinations.

Shutdown requirement upon visual detection of an aggregation of large whales at any distance—We have added a mitigation measure that requires that the airgun array be shut down upon visual detection of an aggregation (*i.e.,* six or more animals) of large whales of any species (*i.e.,* sperm whale or any baleen whale) at any distance. This measure is discussed in greater detail in the Mitigation section, below.

Shutdown requirement upon visual detection of South Island Hector's dolphins—We have added a mitigation measure that requires that the airgun array be shut down upon visual detection of a Hector's dolphin during the South Island survey. Hector's dolphins have relatively small home ranges and high site fidelity; a survey in 2002 found that the majority of Hector's dolphins ranged less than 60 km (Brager *et al.*, 2002); along-shore home range is typically less than 50 km (Oremus *et al.*, 2012). There are at least three,

genetically distinct, regional populations of South Island Hector's dolphin (Dawson *et al.* 2004); a genetically distinct and localized population occurs in Te Waewae Bay (Mackenzie and Clement, 2014)). Due to the limited range and high site fidelity of the population of Hector's dolphin that occurs in Te Waewae Bay and the proximity of the planned South Island 2-D survey with Te Waewae Bay (see Figure 2 in the IHA application), NMFS has determined that shutdown of the array upon visual detection of Hector's dolphins during the South Island 2-D survey is warranted.

Shutdown requirement upon acoustic detection of Hector's dolphins, beaked whales, sperm whales, or Kogia spp.— We have added a mitigation measure that requires that the airgun array be shut down upon acoustic detection of Hector's dolphins, beaked whales, sperm whales, or *Kogia* spp. (with an exception for sperm whales only, if the acoustic detection can be localized and it is determined the sperm whale is outside the 500 m EZ). The requirement to shut down the airgun array upon visual detection of a beaked whale or *Kogia* spp. at any distance was included in the **Federal Register** notice of the proposed IHA (82 FR 45116; September 27, 2017) in recognition of the fact that these species are behaviorally sensitive deep divers and it is possible that disturbance could provoke a severe behavioral response leading to injury (*e.g.,* Wursig *et al.,* 1998; Cox *et al.,* 2006). The requirement to shut down the airgun array upon visual detection of a Hector's dolphin at any distance was included in the **Federal Register** notice of the proposed IHA (82 FR 45116; September 27, 2017), specifically for the planned North Island surveys; we have since added the requirement that the array must be shut down upon observation of a Hector's dolphin, at any distance, during the South Island survey (as described above). The intent behind the requirement to shut down upon acoustic detection is the same as that behind the requirement to shut down upon visual detection. As discussed above, shutdown upon visual detection of sperm whales at any distance is not required in the IHA (the reasoning for this decision is described in further detail in the Mitigation section, below). However, we have determined that meaningful measures are warranted to minimize potential disruption of foraging behavior in sperm whales. This measure (*i.e.,* shutdown upon acoustic detection of beaked whales, sperm whales, or *Kogia* spp., with an exception for sperm whales only, if the acoustic detection can be localized and it is determined the sperm whale is outside the 500 m EZ) is discussed in greater detail in the Mitigation section, below.

Revision to power down waiver for certain delphinids—In the **Federal Register** notice of the proposed IHA (82 FR 45116; September 27, 2017), NMFS proposed a waiver to the requirement to power down the array upon marine mammals observed within or approaching the 500 m exclusion zone that would apply specifically to cetaceans of the genera *Tursiops, Delphinus* and *Lissodelphis* that approach the vessel (*e.g.,* bow riding). We have revised this waiver to the requirement to power down the array such that it applies to all small dolphins except spectacled porpoise and bottlenose, hourglass, and Hector's dolphins. We have revised the species for which the power down waiver applies because we had previously mistakenly excluded all dolphins in the genera *Lagenorhynchus* from the power down waiver, based on a concern (which we still hold) that cetaceans considered to be in the high frequency functional hearing group would be more sensitive to airgun sounds; however, as dusky dolphins (*Lagenorhynchus obscurus*) are in fact considered to be in the mid frequency functional hearing group, we believe the power down waiver should apply to dusky dolphins. Additionally, we have removed cetaceans of the genera *Tursiops* (*i.e.,* bottlenose dolphins) from the power down waiver in response to concerns expressed by the NZDOC, as bottlenose dolphins are listed as a species of concern in New Zealand and are particularly susceptible to impacts from human activities due to their coastal nature. Therefore the power down waiver will not apply for bottlenose dolphins. Effectively, the species which are included in the power down waiver are: short-beaked common dolphin (*Delphinus delphis*), dusky dolphin (*Lagenorhynchus obscurus*) and southern right whale dolphin (*Lissodelphis peronii*). Finally, we specified in the proposed IHA that the waiver would only apply if the animals were traveling, including approaching the vessel. However, we have removed that requirement from the IHA, based on an acknowledgement that it would have required subjective on-the-spot decision-making on the part of PSOs, which may have resulted in differential implementation as informed by individual PSOs' experience, background, and/or training.

Description of Marine Mammals in the Area of Specified Activities

Section 4 of the application summarizes available information regarding status and trends, distribution and habitat preferences, and behavior and life history, of the potentially affected species. Additional information regarding population trends and threats may be found in NMFS' Stock Assessment Reports (SAR; *www.nmfs.noaa.gov/pr/sars/*), and more general information about these species (*e.g.,* physical and behavioral descriptions) may be found on NMFS' Web site (*www.nmfs.noaa.gov/pr/species/mammals/*).

Table 2 lists all species with expected potential for occurrence in the southwest Pacific Ocean off New Zealand and summarizes information related to the population, including regulatory status under the MMPA and ESA. The populations of marine mammals considered in this document do not occur within the U.S. EEZ and are therefore not assigned to stocks and are not assessed in NMFS' Stock Assessment Reports (*www.nmfs.noaa.gov/pr/sars/*). As such, information on potential biological removal (PBR; defined by the MMPA as the maximum number of animals, not including natural mortalities, that may be removed from a marine mammal stock while allowing that stock to reach or maintain its optimum sustainable population) and on annual levels of serious injury and mortality from anthropogenic sources are not available for these marine mammal populations.

In addition to the marine mammal species known to occur in planned survey areas, there are 16 species of marine mammals with ranges that are known to potentially occur in the waters of the planned survey areas, but they are categorized as ''vagrant'' under the New Zealand Threat Classification System (Baker *et al.,* 2016). These species are: The ginkgo-toothed whale (*Mesoplodon ginkgodens*); pygmy beaked whale (*M. peruvianus*); dwarf sperm whale (*Kogia sima*); pygmy killer whale (*Feresa attenuata*); melon-headed whale (*Peponocephala electra*); Risso's dolphin (*Grampus griseus*); Fraser's dolphin (*Lagenodelphis hosei*), pantropical spotted dolphin (*Stenella attenuata*); striped dolphin (*S. coeruleoalba*); rough-toothed dolphin (*Steno bredanensis*); Antarctic fur seal (*Arctocephalus gazelle*); Subantarctic fur seal (*A. tropicalis*); leopard seal (*Hydrurga leptonyx*); Weddell seal (*Leptonychotes weddellii*); crabeater seal (*Lobodon carcinophagus*); and Ross seal (*Ommatophoca rossi*). Except for Risso's

dolphin and leopard seal, for which there have been several sightings and strandings reported in New Zealand (Clement 2010; Torres 2012; Berkenbusch *et al.* 2013; NZDOC 2017), the other ''vagrant'' species listed above are not expected to occur in the planned survey areas and are therefore not considered further in this document.

Marine mammal abundance estimates presented in this document represent the total number of individuals estimated within a particular study or survey area. All values presented in Table 2 are the most recent available at the time of publication.

TABLE 2—MARINE MAMMALS THAT COULD OCCUR IN THE PLANNED SURVEY AREAS

Common name	Scientific name	Stock	ESA/MMPA status; strategic (Y/N) [1]	Population abundance [2]
Order Cetartiodactyla—Cetacea—Superfamily Mysticeti (baleen whales)				
Family Balaenidae				
Southern right whale	*Eubalaena australis*	N/A	E/D;Y	[3] 12,000
Family Balaenopteridae (rorquals)				
Humpback whale	*Megaptera novaeangliae*	N/A	-/-; N	[3] 42,000
Bryde's whale	*Balaenoptera edeni*	N/A	-/-; N	[4] 48,109
Common minke whale	*Balaenoptera acutorostrata*	N/A	-/-; N	[5 6] 750,000
Antarctic minke whale	*Balaenoptera bonaerensis*	N/A	-/-; N	[5 6] 750,000
Sei whale	*Balaenoptera borealis*	N/A	E/D;Y	[5] 10,000
Fin whale	*Balaenoptera physalus*	N/A	E/D;Y	[5] 15,000
Blue whale	*Balaenoptera musculus*	N/A	E/D;Y	[3 5] 3,800
Family Cetotheriidae				
Pygmy right whale	*Caperea marginata*	N/A	-/-; N	N/A
Superfamily Odontoceti (toothed whales, dolphins, and porpoises)				
Family Physeteridae				
Sperm whale	*Physeter macrocephalus*	N/A	E/D;Y	[5] 30,000
Family Kogiidae				
Pygmy sperm whale	*Kogia breviceps*	N/A	-/-; N	N/A
Family Ziphiidae (beaked whales)				
Cuvier's beaked whale	*Ziphius cavirostris*	N/A	-/-; N	[5 7] 600,000
Arnoux's beaked whale	*Berardius arnuxii*	N/A	-/-; N	[5 7] 600,000
Shepherd's beaked whale	*Tasmacetus shepherdi*	N/A	-/-; N	[5 7] 600,000
Hector's beaked whale	*Mesoplodon hectori*	N/A	-/-; N	[5 7] 600,000
True's beaked whale	*Mesoplodon mirus*	N/A	-/-; N	N/A
Southern bottlenose whale	*Hyperoodon planifrons*	N/A	-/-; N	[5 7] 600,000
Gray's beaked whale	*Mesoplodon grayi*	N/A	-/-; N	[5 7] 600,000
Andrew's beaked whale	*Mesoplodon bowdoini*	N/A	-/-; N	[5 7] 600,000
Strap-toothed beaked whale	*Mesoplodon layardii*	N/A	-/-; N	[5 7] 600,000
Blainville's beaked whale	*Mesoplodon densirostris*	N/A	-/-; N	[5 7] 600,000
Spade-toothed beaked whale	*Mesoplodon traversii*	N/A	-/-; N	[5 7] 600,000
Family Delphinidae				
Bottlenose dolphin	*Tursiops truncatus*	N/A	-/-; N	N/A
Short-beaked common dolphin	*Delphinus delphis*	N/A	-/-; N	N/A
Dusky dolphin	*Lagenorhynchus obscurus*	N/A	-/-; N	[8] 12,000–20,000
Hourglass dolphin	*Lagenorhynchus cruciger*	N/A	-/-; N	[5] 150,000
Southern right whale dolphin	*Lissodelphis peronii*	N/A	-/-; N	N/A
Risso's dolphin	*Grampus griseus*	N/A	-/-; N	N/A
South Island Hector's dolphin	*Cephalorhynchus hectori hectori*	N/A	T/D;Y	[9] 14,849
Maui dolphin	*Cephalorhynchus hectori maui*	N/A	E/D;Y	[10] 63
False killer whale	*Pseudorca crassidens*	N/A	-/-; N	N/A
Killer whale	*Orcinus orca*	N/A	-/-; N	[5] 80,000
Long-finned pilot whale	*Globicephala melas*	N/A	-/-; N	[5] 200,000
Short-finned pilot whale	*Globicephala macrorhynchus*	N/A	-/-; N	N/A
Family Phocoenidae (porpoises)				
Spectacled porpoise	*Phocoena dioptrica*	N/A	-/-; N	N/A

TABLE 2—MARINE MAMMALS THAT COULD OCCUR IN THE PLANNED SURVEY AREAS—Continued

Common name	Scientific name	Stock	ESA/MMPA status; strategic (Y/N) [1]	Population abundance [2]
Order Carnivora—Superfamily Pinnipedia				
Family Otariidae (eared seals and sea lions)				
New Zealand fur seal	*Arctocephalus forsteri*	N/A	-/-; N	[8] 200,000
New Zealand sea lion	*Phocarctos hookeri*	N/A	-/-; N	[11] 9,880
Family Phocidae (earless seals)				
Leopard seal	*Hydrurga leptonyx*	N/A	-/-; N	[8] 222,000
Southern elephant seal	*Mirounga leonina*	N/A	-/-; N	[8] 607,000

N/A = Not available or not assessed.
[1] Endangered Species Act (ESA) status: Endangered (E), Threatened (T)/MMPA status: Depleted (D). A dash (-) indicates that the species is not listed under the ESA or designated as depleted under the MMPA. Under the MMPA, a strategic stock is one for which the level of direct human-caused mortality exceeds PBR or which is determined to be declining and likely to be listed under the ESA within the foreseeable future. Any species or stock listed under the ESA is automatically designated under the MMPA as depleted and as a strategic stock.
[2] Abundance for the Southern Hemisphere or Antarctic unless otherwise noted.
[3] IWC (2016).
[4] IWC (1981).
[5] Boyd (2002).
[6] Dwarf and Antarctic minke whales combined.
[7] All Antarctic beaked whales combined.
[8] Estimate for New Zealand; NZDOC 2017.
[9] Estimate for New Zealand; MacKenzie and Clement 2016.
[10] Estimate for New Zealand; Baker *et al.* (2016).
[11] Geschke and Chilvers (2009).

All species that could potentially occur in the planned survey areas are included in table 2. However, of the species described in Table 2, the temporal and/or spatial occurrence of one subspecies, the Maui dolphin (also known as the North Island Hector's dolphin), is such that take is not expected to occur as a result of the surveys. The Maui dolphin is one of two subspecies of Hector's dolphin (the other being the South Island Hector's dolphin), both of which are endemic to New Zealand. The Maui dolphin has been demonstrated to be genetically distinct from the South Island subspecies of Hector's dolphin based on studies of mitochondrial and nuclear DNA (Pichler *et al.* 1998). It is currently considered one of the rarest dolphins in the world with a population size estimated at just 55–63 individuals (Hamner *et al.* 2014; Baker *et al.* 2016). Historically, Hector's dolphins are thought to have ranged along almost the entire coastlines of both the North and South Islands of New Zealand, though their present range is substantially smaller (Pichler 2002). The range of the Maui dolphin in particular has undergone a marked reduction (Dawson *et al.* 2001; Slooten *et al.* 2005), with the subspecies now restricted to the northwest coast of the North Island, between Maunganui Bluff in the north and Whanganui in the south (Currey *et al.* 2012). Occasional sightings and strandings have also been reported from areas further south along the west coast as well as possible sightings in other areas such as Hawke's Bay on the east coast of North Island (Baker 1978, Russell 1999, Ferreira and Roberts 2003, Slooten *et al.* 2005, DuFresne 2010, Berkenbusch *et al.* 2013; Torres *et al.* 2013; Patiño-Pérez 2015; NZDOC 2017) though it is unclear whether those individuals may have originated from the South Island Hector's dolphin populations. A 2016 NMFS Draft Status Review Report concluded the Maui dolphin is facing a high risk of extinction as a result of small population size, reduced genetic diversity, low theoretical population growth rates, evidence of continued population decline, and the ongoing threats of fisheries bycatch, disease, mining and seismic disturbances (Manning and Grantz 2016). Due to its extremely low population size and the fact that the subspecies is not expected to occur in the planned survey areas off the North Island, take of Maui dolphins is not expected to occur as a result of L–DEO's activities. Therefore the Maui dolphin is not discussed further beyond the explanation provided here.

We have reviewed L–DEO's species descriptions, including life history information, distribution, regional distribution, diving behavior, and acoustics and hearing, for accuracy and completeness. We refer the reader to Section 4 of L–DEO's IHA application, rather than reprinting the information here. A detailed description of the species likely to be affected by L–DEO's survey, including brief introductions to the species and relevant stocks as well as available information regarding population trends and threats, and information regarding local occurrence, were provided in the **Federal Register** notice for the proposed IHA (82 FR 45116; September 27, 2017). Since that time, we are not aware of any changes in the status of these species and stocks; therefore, detailed descriptions are not provided here. Please refer to that **Federal Register** notice for these descriptions. Please also refer to NMFS' Web site (*www.nmfs.noaa.gov/pr/species/mammals/*) for generalized species accounts.

Potential Effects of Specified Activities on Marine Mammals and Their Habitat

The effects of underwater noise from marine geophysical survey activities have the potential to result in behavioral harassment and, in a limited number of instances, auditory injury (PTS) of marine mammals in the vicinity of the action area. The **Federal Register** notice of proposed IHA (82 FR 45116; September 27, 2017) included a discussion of the effects of anthropogenic noise on marine mammals and their habitat, therefore that information is not repeated here; please refer to that **Federal Register** notice for that information. No instances of serious injury or mortality are

expected as a result of L–DEO's survey activities.

Estimated Take

This section provides an estimate of the number of incidental takes authorized through the IHA, which will inform both NMFS' consideration of whether the number of takes is ''small'' and the negligible impact determination.

Harassment is the only type of take expected to result from these activities. Except with respect to certain activities not pertinent here, section 3(18) of the MMPA defines ''harassment'' as any act of pursuit, torment, or annoyance which (i) has the potential to injure a marine mammal or marine mammal stock in the wild (Level A harassment); or (ii) has the potential to disturb a marine mammal or marine mammal stock in the wild by causing disruption of behavioral patterns, including, but not limited to, migration, breathing, nursing, breeding, feeding, or sheltering (Level B harassment).

Authorized takes are primarily by Level B harassment, as use of the seismic airguns have the potential to result in disruption of behavioral patterns for individual marine mammals. There is also some potential for auditory injury (Level A harassment) to result, primarily for mysticetes and high frequency cetaceans (*i.e., Kogia* spp.), due to larger predicted auditory injury zones for those functional hearing groups. Auditory injury is unlikely to occur for mid-frequency species given very small modeled zones of injury for those species. The mitigation and monitoring measures are expected to minimize the severity of such taking to the extent practicable.

As described previously, no serious injury or mortality is anticipated or authorized for this activity. Below we describe how the take is estimated.

Described in the most basic way, we estimate take by considering: (1) Acoustic thresholds above which NMFS believes the best available science indicates marine mammals will be behaviorally harassed or incur some degree of permanent hearing impairment; (2) the area or volume of water that will be ensonified above these levels in a day; (3) the density or occurrence of marine mammals within these ensonified areas; and (4) and the number of days of activities. Below, we describe these components in more detail and present the exposure estimate and associated numbers of take authorized.

Acoustic Thresholds

Using the best available science, NMFS has developed acoustic thresholds that identify the received level of underwater sound above which exposed marine mammals would be reasonably expected to be behaviorally harassed (equated to Level B harassment) or to incur PTS of some degree (equated to Level A harassment).

Level B Harassment for non-explosive sources—Though significantly driven by received level, the onset of behavioral disturbance from anthropogenic noise exposure is also informed to varying degrees by other factors related to the source (*e.g.,* frequency, predictability, duty cycle), the environment (*e.g.,* bathymetry), and the receiving animals (hearing, motivation, experience, demography, behavioral context) and can be difficult to predict (Southall *et al.,* 2007, Ellison *et al.* 2011). Based on the best available science and the practical need to use a threshold based on a factor that is both predictable and measurable for most activities, NMFS uses a generalized acoustic threshold based on received level to estimate the onset of behavioral harassment. NMFS predicts that marine mammals are likely to be behaviorally harassed in a manner we consider to fall under Level B harassment when exposed to underwater anthropogenic noise above received levels of 120 dB re 1 micropascal (μPa) (rms) for continuous sources (*e.g.* vibratory pile-driving, drilling) and above 160 dB re 1 μPa (rms) for non-explosive impulsive (*e.g.,* seismic airguns) or intermittent (*e.g.,* scientific sonar) sources. L–DEO's activity includes the use of impulsive seismic sources. Therefore, the 160 dB re 1 μPa (rms) criteria is applicable for analysis of Level B harassment.

Level A harassment for non-explosive sources—NMFS' Technical Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammal Hearing (NMFS, 2016) identifies dual criteria to assess auditory injury (Level A harassment) to five different marine mammal groups (based on hearing sensitivity) as a result of exposure to noise from two different types of sources (impulsive or non-impulsive). The Technical Guidance identifies the received levels, or thresholds, above which individual marine mammals are predicted to experience changes in their hearing sensitivity for all underwater anthropogenic sound sources, reflects the best available science, and better predicts the potential for auditory injury than does NMFS' historical criteria.

These thresholds were developed by compiling and synthesizing the best available science and soliciting input multiple times from both the public and peer reviewers to inform the final product, and are provided in Table 3 below. The references, analysis, and methodology used in the development of the thresholds are described in NMFS 2016 Technical Guidance, which may be accessed at: *http://www.nmfs.noaa.gov/pr/acoustics/guidelines.htm.* As described above, L–DEO's activity includes the use of intermittent and impulsive seismic sources.

TABLE 3—THRESHOLDS IDENTIFYING THE ONSET OF PERMANENT THRESHOLD SHIFT IN MARINE MAMMALS

Hearing group	PTS onset thresholds	
	Impulsive *	Non-impulsive
Low-Frequency (LF) Cetaceans	$L_{pk,flat}$: 219 dB; $L_{E,LF,24h}$: 183 dB	$L_{E,LF,24h}$: 199 dB.
Mid-Frequency (MF) Cetaceans	$L_{pk,flat}$: 230 dB; $L_{E,MF,24h}$: 185 dB	$L_{E,MF,24h}$: 198 dB.
High-Frequency (HF) Cetaceans	$L_{pk,flat}$: 202 dB; $L_{E,HF,24h}$: 155 dB	$L_{E,HF,24h}$: 173 dB.
Phocid Pinnipeds (PW) (Underwater)	$L_{pk,flat}$: 218 dB; $L_{E,PW,24h}$: 185 dB	$L_{E,PW,24h}$: 201 dB.
Otariid Pinnipeds (OW) (Underwater)	$L_{pk,flat}$: 232 dB; $L_{E,OW,24h}$: 203 dB	$L_{E,OW,24h}$: 219 dB.

Note: * Dual metric acoustic thresholds for impulsive sounds: Use whichever results in the largest isopleth for calculating PTS onset. If a non-impulsive sound has the potential of exceeding the peak sound pressure level thresholds associated with impulsive sounds, these thresholds should also be considered.

Note: Peak sound pressure (Lpk) has a reference value of 1 μPa, and cumulative sound exposure level (LE) has a reference value of 1μPa2s. In this Table, thresholds are abbreviated to reflect American National Standards Institute standards (ANSI 2013). However, peak sound pressure is defined by ANSI as incorporating frequency weighting, which is not the intent for this Technical Guidance. Hence, the subscript ''flat'' is being included to indicate peak sound pressure should be flat weighted or unweighted within the generalized hearing range. The subscript associated with cumulative sound exposure level thresholds indicates the designated marine mammal auditory weighting function (LF, MF, and HF cetaceans, and PW and OW pinnipeds) and that the recommended accumulation period is 24 hours. The cumulative sound exposure level thresholds could be exceeded in a multitude of ways (*i.e.,* varying exposure levels and durations, duty cycle). When possible, it is valuable for action proponents to indicate the conditions under which these acoustic thresholds will be exceeded.

Ensonified Area

Here, we describe operational and environmental parameters of the activity that will feed into estimating the area ensonified above the relevant acoustic thresholds.

The survey entails use of a 36-airgun array with a total discharge of 6,600 in^3 at a tow depth of 9 m and an 18-airgun array with a total discharge of 3,300 in^3 at a tow depth of 7–9 m. Received sound levels were predicted by L–DEO's model (Diebold *et al.,* 2010) as a function of distance from the 36-airgun array and 18-airgun array and for a single 40-in^3 airgun which would be used during power downs; all models used a 9 m tow depth. This modeling approach uses ray tracing for the direct wave traveling from the array to the receiver and its associated source ghost (reflection at the air-water interface in the vicinity of the array), in a constant-velocity half-space (infinite homogeneous ocean layer, unbounded by a seafloor). In addition, propagation measurements of pulses from the 36-airgun array at a tow depth of 6 m have been reported in deep water (approximately 1600 m), intermediate water depth on the slope (approximately 600–1,100 m), and shallow water (approximately 50 m) in the Gulf of Mexico in 2007–2008 (Tolstoy *et al.* 2009; Diebold *et al.* 2010).

For deep and intermediate-water cases, L–DEO determined that the field measurements cannot be used readily to derive zone of ensonification, as at those sites the calibration hydrophone was located at a roughly constant depth of 350–500 m, which may not intersect all the SPL isopleths at their widest point from the sea surface down to water depths of approximately 2,000 m (See Appendix H in NSF–USGS 2011). At short ranges, where the direct arrivals dominate and the effects of seafloor interactions are minimal, the data recorded at the deep and slope sites are suitable for comparison with modeled levels at the depth of the calibration hydrophone. At longer ranges, the comparison with the mitigation model—constructed from the maximum SPL through the entire water column at varying distances from the airgun array—is the most relevant. Please see the IHA application for further discussion of summarized results.

For deep water (>1,000 m), L–DEO used the deep-water radii obtained from model results down to a maximum water depth of 2000 m. The radii for intermediate water depths (100–1,000 m) were derived from the deep-water ones by applying a correction factor (multiplication) of 1.5, such that observed levels at very near offsets fall below the corrected mitigation curve (See Fig. 16 in Appendix H of NSF–USGS, 2011). The shallow-water radii were obtained by scaling the empirically derived measurements from the Gulf of Mexico calibration survey to account for the differences in tow depth between the calibration survey (6 m) and the planned surveys (9 m). A simple scaling factor is calculated from the ratios of the isopleths determined by the deep-water L–DEO model, which are essentially a measure of the energy radiated by the source array.

Measurements have not been reported for the single 40-in^3 airgun. L–DEO model results are used to determine the 160-dB (rms) radius for the 40-in^3 airgun at a 9 m tow depth in deep water (See LGL 2017, Figure 6). For intermediate-water depths, a correction factor of 1.5 was applied to the deep-water model results. For shallow water, a scaling of the field measurements obtained for the 36-airgun array was used.

L–DEO's modeling methodology is described in greater detail in the IHA application (LGL 2017) and we refer the reader to that document rather than repeating it here. The estimated distances to the Level B harassment isopleth for the *Langseth's* 36-airgun array, 18-airgun array, and the single 40-in^3 airgun are shown in Table 4.

TABLE 4—PREDICTED RADIAL DISTANCES FROM R/V LANGSETH SEISMIC SOURCE TO ISOPLETHS CORRESPONDING TO LEVEL B HARASSMENT THRESHOLD

Source and volume	Water depth (m)	Predicted distance to threshold (160 dB re 1 μPa) [1] (m)
1 airgun, 40 in^3	>1,000	388
	100–1,000	582
	<100	938
18 airguns, 3,300 in^3 ...	>1,000	3,562
	100–1,000	5,343
	<100	10,607
36 airguns, 6,600 in^3 ...	>1,000	5,629
	100–1,000	8,444
	<100	22,102

[1] Distances for depths >1,000 m are based on L–DEO model results. Distance for depths 100–1,000 m are based on L–DEO model results with a 1.5 × correction factor between deep and intermediate water depths. Distances for depths <100 m are based on empirically derived measurements in the Gulf of Mexico with scaling applied to account for differences in tow depth.

Predicted distances to Level A harassment isopleths, which vary based on marine mammal hearing groups, were calculated based on modeling performed by L–DEO using the NUCLEUS software program and the NMFS User Spreadsheet, described below. The updated acoustic thresholds for impulsive sounds (*e.g.,* airguns) contained in the Technical Guidance were presented as dual metric acoustic thresholds using both SEL_{cum} and peak sound pressure metrics (NMFS 2016). As dual metrics, NMFS considers onset of PTS (Level A harassment) to have occurred when either one of the two metrics is exceeded (*i.e.,* metric resulting in the largest isopleth). The SEL_{cum} metric considers both level and duration of exposure, as well as auditory weighting functions by marine mammal hearing group. In recognition of the fact that the requirement to calculate Level A harassment ensonified areas could be more technically challenging to predict due to the duration component and the use of weighting functions in the new SEL_{cum} thresholds, NMFS developed an optional User Spreadsheet that includes tools to help predict a simple isopleth that can be used in conjunction with marine mammal density or occurrence to facilitate the estimation of take numbers.

The values for SEL_{cum} and peak SPL for the *Langseth* airgun array were derived from calculating the modified farfield signature (Table 5). The farfield

signature is often used as a theoretical representation of the source level. To compute the farfield signature, the source level is estimated at a large distance below the array (*e.g.,* 9 km), and this level is back projected mathematically to a notional distance of 1 m from the array's geometrical center. However, when the source is an array of multiple airguns separated in space, the source level from the theoretical farfield signature is not necessarily the best measurement of the source level that is physically achieved at the source (Tolstoy *et al.* 2009). Near the source (at short ranges, distances <1 km), the pulses of sound pressure from each individual airgun in the source array do not stack constructively, as they do for the theoretical farfield signature. The pulses from the different airguns spread out in time such that the source levels observed or modeled are the result of the summation of pulses from a few airguns, not the full array (Tolstoy *et al.* 2009). At larger distances, away from the source array center, sound pressure of all the airguns in the array stack coherently, but not within one time sample, resulting in smaller source levels (a few dB) than the source level derived from the farfield signature. Because the farfield signature does not take into account the large array effect near the source and is calculated as a point source, the modified farfield signature is a more appropriate measure of the sound source level for distributed sound sources, such as airgun arrays. L–DEO used the acoustic modeling methodology as used for Level B takes with a small grid step of 1 m in both the inline and depth directions. The propagation modeling takes into account all airgun interactions at short distances from the source, including interactions between subarrays which are modeled using the NUCLEUS software to estimate the notional signature and MATLAB software to calculate the pressure signal at each mesh point of a grid.

TABLE 5—MODELED SOURCE LEVELS BASED ON MODIFIED FARFIELD SIGNATURE FOR THE R/V LANGSETH 6,600 IN^3 AIRGUN ARRAY, 3,300 IN^3 AIRGUN ARRAY, AND SINGLE 40 IN^3 AIRGUN

	Low frequency cetaceans ($L_{pk,flat}$: 219 dB; $L_{E,LF,24h}$: 183 dB)	Mid frequency cetaceans ($L_{pk,flat}$: 230 dB; $L_{E,MF,24h}$: 185 dB)	High frequency cetaceans ($L_{pk,flat}$: 202 dB; $L_{E,HF,24h}$: 155 dB)	Phocid pinnipeds (underwater) ($L_{pk,flat}$: 218 dB; $L_{E,HF,24h}$: 185 dB)	Otariid pinnipeds (underwater) ($L_{pk,flat}$: 232 dB; $L_{E,HF,24h}$: 203 dB)
6,600 in^3 airgun array (Peak SPL_{flat})	250.77	252.76	249.44	250.50	252.72
6,600 in^3 airgun array (SEL_{cum})	232.75	232.67	232.83	232.67	231.07
3,300 in^3 airgun array (Peak SPL_{flat})	246.34	250.98	243.64	246.03	251.92
3,300 in^3 airgun array (SEL_{cum})	226.22	226.13	226.75	226.13	226.89
40 in^3 airgun (Peak SPL_{flat})	224.02	225.16	224.00	224.09	226.64
40 in^3 airgun (SEL_{cum})	202.33	202.35	203.12	202.35	202.61

In order to more realistically incorporate the Technical Guidance's weighting functions over the seismic array's full acoustic band, unweighted spectrum data for the *Langseth's* airgun array (modeled in 1 hertz (Hz) bands) was used to make adjustments (dB) to the unweighted spectrum levels, by frequency, according to the weighting functions for each relevant marine mammal hearing group. These adjusted/weighted spectrum levels were then converted to pressures (μPa) in order to integrate them over the entire broadband spectrum, resulting in broadband weighted source levels by hearing group that could be directly incorporated within the User Spreadsheet (*i.e.,* to override the Spreadsheet's more simple weighting factor adjustment). Using the User Spreadsheet's ''safe distance'' methodology for mobile sources (described by Sivle *et al.,* 2014) with the hearing group-specific weighted source levels, and inputs assuming spherical spreading propagation and source velocities and shot intervals specific to each of the three planned surveys (Table 1), potential radial distances to auditory injury zones were then calculated for SEL_{cum} thresholds.

Inputs to the User Spreadsheets in the form of estimated SLs are shown in Table 5. User Spreadsheets used by L–DEO to estimate distances to Level A harassment isopleths (SEL_{cum}) for the 36-airgun array, 18-airgun array, and the single 40 in^3 airgun for the South Island 2-D survey, North Island 2-D survey, and North Island 3-D survey are shown in Tables 3, 4, 7, 10, 11, and 12, of the IHA application (LGL 2017). Outputs from the User Spreadsheets in the form of estimated distances to Level A harassment isopleths for the South Island 2-D survey, North Island 2-D survey, and North Island 3-D survey are shown in Tables 6, 7 and 8, respectively. As described above, NMFS considers onset of PTS (Level A harassment) to have occurred when either one of the dual metrics (SEL_{cum} and Peak SPL_{flat}) is exceeded (*i.e.,* metric resulting in the largest isopleth).

TABLE 6—MODELED RADIAL DISTANCES (m) TO ISOPLETHS CORRESPONDING TO LEVEL A HARASSMENT THRESHOLDS DURING NORTH ISLAND 2-D SURVEY

	Low frequency cetaceans ($L_{pk,flat}$: 219 dB; $L_{E,LF,24h}$: 183 dB)	Mid frequency cetaceans ($L_{pk,flat}$: 230 dB; $L_{E,MF,24h}$: 185 dB)	High frequency cetaceans ($L_{pk,flat}$: 202 dB; $L_{E,HF,24h}$: 155 dB)	Phocid pinnipeds (underwater) ($L_{pk,flat}$: 218 dB; $L_{E,HF,24h}$: 185 dB)	Otariid pinnipeds (underwater) ($L_{pk,flat}$: 232 dB; $L_{E,HF,24h}$: 203 dB)
6,600 in^3 airgun array (Peak SPL_{flat})	38.8	13.8	229.2	42.2	10.9
6,600 in^3 airgun array (SEL_{cum})	501.3	0	1.2	13.2	0
40 in^3 airgun (Peak SPL_{flat})	1.8	0.6	12.6	2.0	0.5
40 in^3 airgun (SEL_{cum})	0.4	0	0	0	0

TABLE 7—MODELED RADIAL DISTANCES (m) TO ISOPLETHS CORRESPONDING TO LEVEL A HARASSMENT THRESHOLDS DURING NORTH ISLAND 3-D SURVEY

	Low frequency cetaceans ($L_{pk,flat}$: 219 dB; $L_{E,LF,24h}$: 183 dB)	Mid frequency cetaceans ($L_{pk,flat}$: 230 dB; $L_{E,MF,24h}$: 185 dB)	High frequency cetaceans ($L_{pk,flat}$: 202 dB; $L_{E,HF,24h}$: 155 dB)	Phocid Pinnipeds (Underwater) ($L_{pk,flat}$: 218 dB; $L_{E,HF,24h}$: 185 dB)	Otariid Pinnipeds (Underwater) ($L_{pk,flat}$: 232 dB; $L_{E,HF,24h}$: 203 dB)
3,300 in^3 airgun array (Peak SPL_{flat})	23.3	11.2	119.0	25.2	9.9
3,300 in^3 airgun array (SEL_{cum})	73.1	0	0.3	2.8	0
40 in^3 airgun (Peak SPL_{flat})	1.8	0.6	12.6	2.0	0.5
40 in^3 airgun (SEL_{cum})	0.4	0	0	0	0

TABLE 8—MODELED RADIAL DISTANCES (m) TO ISOPLETHS CORRESPONDING TO LEVEL A HARASSMENT THRESHOLDS DURING SOUTH ISLAND 2-D SURVEY

	Low frequency cetaceans ($L_{pk,flat}$: 219 dB; $L_{E,LF,24h}$: 183 dB)	Mid frequency cetaceans ($L_{pk,flat}$: 230 dB; $L_{E,MF,24h}$: 185 dB)	High frequency cetaceans ($L_{pk,flat}$: 202 dB; $L_{E,HF,24h}$: 155 dB)	Phocid Pinnipeds (Underwater) ($L_{pk,flat}$: 218 dB; $L_{E,HF,24h}$: 185 dB)	Otariid Pinnipeds (Underwater) ($L_{pk,flat}$: 232 dB; $L_{E,HF,24h}$: 203 dB)
6,600 in^3 airgun array (Peak SPL_{flat})	38.8	13.8	229.2	42.2	10.9
6,600 in^3 airgun array (SEL_{cum})	376.0	0	0.9	9.9	0
40 in^3 airgun (Peak SPL_{flat})	1.8	0.6	12.6	2.0	0.5
40 in^3 airgun (SEL_{cum})	0.3	0	0	0	0

Note that because of some of the assumptions included in the methods used, isopleths produced may be overestimates to some degree, which will ultimately result in some degree of overestimate of Level A take. However, these tools offer the best way to predict appropriate isopleths when more sophisticated 3-D modeling methods are not available, and NMFS continues to develop ways to quantitatively refine these tools and will qualitatively address the output where appropriate. For mobile sources, such as the planned seismic surveys, the User Spreadsheet predicts the closest distance at which a stationary animal would not incur PTS if the sound source traveled by the animal in a straight line at a constant speed.

Marine Mammal Occurrence

In this section we provide the information about the presence, density, or group dynamics of marine mammals that will inform the take calculations. The best available scientific information was considered in conducting marine mammal exposure estimates (the basis for estimating take).

No systematic aircraft- or ship-based surveys have been conducted for marine mammals in offshore waters of the South Pacific Ocean off New Zealand that can be used to estimate species densities that we are aware of, with the exception of Hector's dolphin surveys that have occurred off the South Island. Densities for Hector's dolphins off the South Island were estimated using averaged estimated summer densities from the most southern stratum of an East Coast South Island survey (Otago) and a West Coast South Island survey (Milford Sound), both in three offshore strata categories (0–4 nautical miles (nm), 4–12 nm, and 12–20 nm; MacKenzie and Clement 2014, 2016). The estimated density for Hector's dolphins for the South Island 2-D survey was based on the proportion of that survey occurring in each offshore stratum.

For cetacean species other than Hector's dolphin, densities were derived from data available for the Southern Ocean (Butterworth *et al.* 1994; Kasamatsu and Joyce 1995) (See Table 17 in the IHA application). Butterworth *et al.* (1994) provided comparable data for sei, fin, blue, and sperm whales extrapolated to latitudes 30–40° S., 40–50° S., and 50–60° S. based on Japanese scouting vessel data from 1965/66–1977/78 and 1978/79–1987/88. Densities were calculated for these species based on abundances and surface areas provided in Butterworth *et al.* (1994) using the mean density for the more recent surveys (1978/79–1987/88) and the 30–40° S. and 40–50° S. strata, because the planned survey areas are between ~37° S. and 50° S. Densities were corrected for mean trackline detection probability, $g(0)$ availability bias, using mean $g(0)$ values provided for these species during NMFS Southwest Fisheries Science Center ship-based surveys between 1991–2014 (Barlow 2016). Data for the humpback whale was also presented in Butterworth *et al.* (1994), but, based on the best available information, it was determined that the density values presented for humpback whales in Butterworth *et al.* (1994) were likely lower than would be expected in the planned survey areas, thus the density for humpback whales was ultimately calculated in the same way as for the baleen whales for which density data was unavailable. Kasamatsu and Joyce (1995) provided data for beaked whales, killer whales, long-finned pilot whales, and hourglass dolphins, based on surveys conducted as part of the International Whaling Commission/International Decade of Cetacean Research—Southern Hemisphere Minke Whale Assessment, started in 1978/79, and the Japanese sightings survey program started in 1976/77. Densities for these species were calculated based on abundances and surface areas provided in Kasamatsu and Joyce (1995) for Antarctic Areas V EMN and VI WM, which represent the two areas reported in Kasamatsu and Joyce (1995) that are nearest to the planned South Island survey area. Densities were corrected for availability bias using mean $g(0)$ values provided by Kasamatsu and Joyce (1995) for beaked whales, killer whales, and long-fined pilot whales, and provided by Barlow (2016) for the Hourglass dolphin using the mean $g(0)$ calculated for unidentified dolphins during NMFS

Southwest Fisheries Science Center ship-based surveys between 1991–2014.

For the remaining cetacean species, the relative abundances of individual species expected to occur in the survey areas were estimated within species groups. The relative abundances of these species were estimated based on several factors, including information on marine mammal observations from areas near the planned survey areas (*e.g.,* monitoring reports from previous IHAs (NMFS, 2015); datasets of opportunistic sightings (Torres *et al.,* 2014); and analyses of observer data from other marine geophysical surveys conducted in New Zealand waters (Blue Planet, 2016)), information on latitudinal ranges and group sizes of marine mammals in New Zealand waters (*e.g.,* Jefferson *et al.,* 2015; NABIS, 2017; Perrin *et al.,* 2009), and other information on marine mammals in and near the planned survey areas (*e.g.,* data on marine mammal bycatch in New Zealand fisheries (Berkenbush *et al.,* 2013), data on marine mammal strandings (New Zealand Marine Mammal Strandings and Sightings Database); and input from subject matter experts (pers. comm., E. Slooten, Univ. of Otago, to H. Goldstein, NMFS, April 11, 2015)).

For each species group (*i.e.,* mysticetes), densities of species for which data were available were averaged to get a mean density for the group (*e.g.,* densities of fin, sei, and blue whale were averaged to get a mean density for mysticetes). Relative abundances of those species were then averaged to get mean relative abundances (*e.g.,* relative abundance of fin, sei, and blue whale were averaged to get a mean relative abundance for mysticetes). For the species for which density data was unavailable, their relative abundance score was multiplied by the mean density of their respective species group (*i.e.,* relative abundance of minke whale was multiplied by mean density for mysticetes). The product was then divided by the mean relative abundance of the species group to come up with a density estimate. The fin, sei, and blue whale densities calculated from Butterworth *et al.* (1994) were proportionally averaged and used to estimate the densities of the remaining mysticetes. The sperm whale density calculated from Butterworth *et al.* (1994) was used to estimate the density of the other *Physeteridae* species, the pygmy sperm whale. The hourglass dolphin, killer whale, and long-finned pilot whale densities calculated from Kasamatsu and Joyce (1995) were proportionally averaged and used to estimate the densities of the other *Delphinidae* for which density data was not available. For beaked whales, the beaked whale density calculated from Kasamatsu and Joyce (1995) was proportionally allocated according to each beaked whale species' estimated relative abundance value.

We are not aware of any information regarding at-sea densities of pinnipeds off New Zealand. As such, a surrogate species (northern fur seal) was used to estimate offshore pinniped densities for the planned surveys. The at-sea density of northern fur seals reported in Bonnell *et al.* (1992), based on systematic aerial surveys conducted in 1989–1990 in offshore areas off the west coast of the U.S., was used to estimate the numbers of pinnipeds that might be present off New Zealand. The northern fur seal density reported in Bonnell *et al.* (1992) was used as the New Zealand fur seal density. Densities for the other three pinniped species expected to occur in the planned survey areas were proportionally allocated relative to the value of the density of the northern fur seal, in accordance to the estimated relative abundance value of each of the other pinniped species.

NMFS acknowledges there is some uncertainty related to the estimated density data and the assumptions used in their calculations. Given the lack of available data on marine mammal density in the planned survey areas, the approach used is based on the best available data. In recognition of the uncertainties in the density data, we have included an additional 25 percent contingency in take estimates to account for the fact that density estimates used to estimate take may be underestimates of actual densities of marine mammals in the survey area. However, there is no information to suggest that the density estimates used are in fact underestimates.

Take Calculation and Estimation

Here we describe how the information provided above is brought together to produce a quantitative take estimate. In order to estimate the number of marine mammals predicted to be exposed to sound levels that would result in Level A harassment or Level B harassment, radial distances from the airgun array to predicted isopleths corresponding to the Level A harassment and Level B harassment thresholds are calculated, as described above. Those radial distances are then used to calculate the area(s) around the airgun array predicted to be ensonified to sound levels that exceed the Level A harassment and Level B harassment thresholds. The area estimated to be ensonified in a single day of the survey is then calculated (Table 9), based on the areas predicted to be ensonified around the array and the estimated trackline distance traveled per day. This number is then multiplied by the number of survey days (*i.e.,* 35 days for the North Island 2-D survey, 33 days for the North Island 3-D survey, and 22 days for the South Island 2-D survey). The product is then multiplied by 1.25 to account for an additional 25 percent contingency for potential additional seismic operations (associated with turns, airgun testing, and repeat coverage of any areas where initial data quality is sub-standard, as proposed by L–DEO). This results in an estimate of the total areas (km^2) expected to be ensonified to the Level A harassment and Level B harassment thresholds. For purposes of Level B take calculations, areas estimated to be ensonified to Level A harassment thresholds are subtracted from total areas estimated to be ensonified to Level B harassment thresholds in order to avoid double counting the animals taken (*i.e.,* if an animal is taken by Level A harassment, it is not also counted as taken by Level B harassment). The marine mammals predicted to occur within these respective areas, based on estimated densities, are assumed to be incidentally taken. The take estimates were then multiplied by an additional 25 percent contingency in acknowledgement of uncertainties in available density estimates, as described above.

TABLE 9—AREAS (km^2) ESTIMATED TO BE ENSONIFIED TO LEVEL A AND LEVEL B HARASSMENT THRESHOLDS PER DAY FOR THREE PLANNED SEISMIC SURVEYS OFF NEW ZEALAND

Survey	Level B harassment threshold	Level A harassment threshold [1]				
	All marine mammals	Low frequency cetaceans	Mid frequency cetaceans	High frequency cetaceans	Otariid pinnipeds	Phocid pinnipeds
North Island 2-D Survey	1,931.3	144.5	3.9	65.8	3.1	12.0
North Island 3-D Survey	1,067.3	29.1	4.5	47.5	3.9	10.0
South Island 2-D Survey	1,913.4	111.1	4.1	86.3	3.2	12.4

[1] Level A ensonified areas are estimated based on the greater of the distances calculated to Level A isopleths using dual criteria (SEL_{cum} and $_{peak}SPL$).

Note: Estimated areas shown for single day do not include additional 50 percent contingency.

Factors including water depth, array configuration, and proportion of each survey occurring within territorial seas (versus within the EEZ) were also accounted for in estimates of ensonified areas. This was accomplished by selecting a track line for a single day (for each of the three planned surveys) that were representative of the entire planned survey(s) and using that representative track line to calculate daily ensonified areas. Daily track line distance was selected depending on array configuration (*i.e.,* 160 km per day for the planned 2-D surveys, 200 km per day for the planned 3-D survey). Representative daily track lines were chosen to reflect the proportion of water depths (*i.e.,* less than 100 m, 100–1,000 m, and greater than 1,000 m) expected to occur for that entire survey (Table 4) as distances to isopleths corresponding to harassment vary depending on water depth (Table 4), and water depths vary considerably within the planned survey areas (Table 1). Representative track lines were also selected to reflect the amount of effort in the New Zealand territorial sea (versus within the New Zealand EEZ), for each of the three surveys, as L–DEO is not subject to the requirements of the MMPA within the New Zealand territorial sea. For example, for the North Island 2-D survey approximately nine percent of survey effort would occur in the New Zealand territorial sea (Table 1). Thus, representative track lines that were chosen also had approximately 9 percent of survey effort in territorial seas; the resultant ensonified areas within territorial seas were excluded from take calculations.

Estimated takes for all marine mammal species are shown in Tables 10, 11, 12 and 13. As described above, we authorize the incidental takes that are expected to occur as a result of the planned surveys within the New Zealand EEZ but outside of the New Zealand territorial sea.

TABLE 10—NUMBERS OF POTENTIAL INCIDENTAL TAKE OF MARINE MAMMALS AUTHORIZED DURING L–DEO'S NORTH ISLAND 2-D SEISMIC SURVEY OFF NEW ZEALAND

Species	Density (#/1,000 km^2)	Level A takes authorized [1]	Level B takes authorized [1]	Total Level A and Level B takes authorized [1]
Southern right whale	0.24	2	23	25
Pygmy right whale	0.10	1	9	10
Humpback whale	0.24	2	23	25
Bryde's whale	0.14	1	14	15
Common minke whale	0.14	1	14	15
Antarctic minke whale	0.14	1	14	15
Sei whale	0.14	1	14	15
Fin whale	0.25	2	24	26
Blue whale	0.04	0	4	4
Sperm whale	2.89	1	305	306
Cuvier's beaked whale	2.62	1	276	277
Arnoux's beaked whale	2.62	1	276	277
Southern bottlenose whale	1.74	0	184	184
Shepard's beaked whale	1.74	0	184	184
Hector's beaked whale	1.74	0	184	184
True's beaked whale	0.87	0	92	92
Gray's beaked whale	3.49	1	368	369
Andrew's beaked whale	1.74	0	184	184
Strap-toothed whale	2.62	1	276	277
Blainville's beaked whale	0.87	0	92	92
Spade-toothed whale	0.87	0	92	92
Bottlenose dolphin	5.12	1	540	541
Short-beaked common dolphin	10.25	2	1080	1082
Dusky dolphin	5.12	1	540	541
Southern right-whale dolphin	3.07	1	324	325
Risso's dolphin	2.05	0	216	216
False killer whale	3.07	1	324	325
Killer whale	1.91	0	202	202
Long-finned pilot whale	8.28	2	872	874
Short-finned pilot whale	4.10	1	432	433

TABLE 10—NUMBERS OF POTENTIAL INCIDENTAL TAKE OF MARINE MAMMALS AUTHORIZED DURING L–DEO'S NORTH ISLAND 2-D SEISMIC SURVEY OFF NEW ZEALAND—Continued

Species	Density (#/1,000 km²)	Level A takes authorized [1]	Level B takes authorized [1]	Total Level A and Level B takes authorized [1]
Pygmy sperm whale	1.74	6	177	183
Hourglass dolphin	4.16	15	424	439
Hector's dolphin	0	0	0	0
Spectacled porpoise	0	0	0	0
New Zealand fur seal	22.50	4	2373	2377
New Zealand sea lion	0	0	0	0
Southern elephant seal	4.50	3	472	475
Leopard seal	2.25	1	236	237

[1] Includes additional 25 percent contingency for potential additional survey operations and additional 25 percent contingency to account for uncertainties in density estimates.

TABLE 11—NUMBERS OF POTENTIAL INCIDENTAL TAKE OF MARINE MAMMALS AUTHORIZED DURING L–DEO'S NORTH ISLAND 3-D SEISMIC SURVEY OFF NEW ZEALAND

Species	Density (#/1,000 km²)	Level A takes authorized [1]	Level B takes authorized [1]	Total Level A and Level B takes authorized [1]
Southern right whale	0.24	0	13	13
Pygmy right whale	0.10	0	5	5
Humpback whale	0.24	0	13	13
Bryde's whale	0.14	0	8	8
Common minke whale	0.14	0	8	8
Antarctic minke whale	0.14	0	8	8
Sei whale	0.14	0	8	8
Fin whale	0.25	0	13	13
Blue whale	0.04	0	2	2
Sperm whale	2.89	1	159	160
Cuvier's beaked whale	2.62	1	143	144
Arnoux's beaked whale	2.62	1	143	144
Southern bottlenose whale	1.74	0	96	96
Shepard's beaked whale	1.74	0	96	96
Hector's beaked whale	1.74	0	96	96
True's beaked whale	0.87	0	48	48
Gray's beaked whale	3.49	1	191	192
Andrew's beaked whale	1.74	0	96	96
Strap-toothed whale	2.62	1	143	144
Blainville's beaked whale	0.87	0	48	48
Spade-toothed whale	0.87	0	48	48
Bottlenose dolphin	5.12	1	281	282
Short-beaked common dolphin	10.25	2	562	564
Dusky dolphin	5.12	1	281	282
Southern right-whale dolphin	3.07	1	168	169
Risso's dolphin	2.05	0	112	112
False killer whale	3.07	1	168	169
Killer whale	1.91	0	105	105
Long-finned pilot whale	8.28	2	454	456
Short-finned pilot whale	4.10	1	225	226
Pygmy sperm whale	1.74	4	91	95
Hourglass dolphin	4.16	10	219	229
Hector's dolphin	0	0	0	0
Spectacled porpoise	0	0	0	0
New Zealand fur seal	22.50	5	1234	1239
New Zealand sea lion	0	0	0	0
Southern elephant seal	4.50	2	245	247
Leopard seal	2.25	1	123	124

[1] Includes additional 25 percent contingency for potential additional survey operations and additional 25 percent contingency to account for uncertainties in density estimates.

TABLE 12—NUMBERS OF POTENTIAL INCIDENTAL TAKE OF MARINE MAMMALS AUTHORIZED DURING L–DEO'S SOUTH ISLAND 2-D SEISMIC SURVEY OFF NEW ZEALAND

Species	Density (#/1,000 km²)	Level A takes authorized [1]	Level B takes authorized [1]	Total Level A and Level B takes authorized [1]
Southern right whale	0.24	1	15	16
Pygmy right whale	0.10	0	6	6
Humpback whale	0.24	1	12	13
Bryde's whale	0.14	0	0	0
Common minke whale	0.14	1	9	10
Antarctic minke whale	0.14	1	9	10
Sei whale	0.14	1	9	10
Fin whale	0.25	1	15	16
Blue whale	0.04	0	2	2
Sperm whale	2.89	0	190	190
Cuvier's beaked whale	2.62	0	172	172
Arnoux's beaked whale	2.62	0	172	172
Southern bottlenose whale	1.74	0	114	114
Shepard's beaked whale	1.74	0	114	114
Hector's beaked whale	1.74	0	114	114
True's beaked whale	0.87	0	57	57
Gray's beaked whale	3.49	0	229	229
Andrew's beaked whale	1.74	0	114	114
Strap-toothed whale	2.62	0	172	172
Blainville's beaked whale	0.87	0	57	57
Spade-toothed whale	0.87	0	57	57
Bottlenose dolphin	5.12	1	314	315
Short-beaked common dolphin	10.25	1	314	315
Dusky dolphin	5.12	1	502	503
Southern right-whale dolphin	3.07	0	188	188
Risso's dolphin	2.05	0	126	126
False killer whale	3.07	1	188	189
Killer whale	1.91	0	126	126
Long-finned pilot whale	8.28	1	543	544
Short-finned pilot whale	4.10	0	126	126
Pygmy sperm whale	1.74	5	109	114
Hourglass dolphin	4.16	12	261	273
Hector's dolphin	0	0	2	2
Spectacled porpoise	0	6	120	126
New Zealand fur seal	22.50	2	1477	1479
New Zealand sea lion	0	1	591	592
Southern elephant seal	4.50	2	294	296
Leopard seal	2.25	1	147	148

[1] Includes additional 25 percent contingency for potential additional survey operations and additional 25 percent contingency to account for uncertainties in density estimates.

TABLE 13—TOTAL NUMBERS OF POTENTIAL INCIDENTAL TAKE OF MARINE MAMMALS AUTHORIZED DURING L–DEO'S NORTH ISLAND 3-D SURVEY, NORTH ISLAND 2-D SURVEY, AND SOUTH ISLAND 3-D SURVEYS OF THE R/V LANGSETH OFF NEW ZEALAND

Species	Density (#/1,000 km²)	Level A takes authorized [1]	Level B takes authorized [1]	Total Level A and Level B takes authorized [1]	Total authorized Level A and Level B takes as a percentage of population
Southern right whale	0.24	3	51	54	0.45
Pygmy right whale	0.10	1	20	21	N.A.
Humpback whale	0.19	3	48	51	0.12
Bryde's whale	0.00	1	22	23	0.05
Common minke whale	0.14	2	31	33	<0.01
Antarctic minke whale	0.14	2	31	33	<0.01
Sei whale	0.14	2	31	33	0.33
Fin whale	0.25	3	52	55	0.37
Blue whale	0.04	0	8	8	0.21
Sperm whale	2.89	2	654	656	2.19
Cuvier's beaked whale	2.62	2	591	593	0.10
Arnoux's beaked whale	2.62	2	591	593	0.10
Southern bottlenose whale	1.74	0	394	394	0.07
Shepard's beaked whale	1.74	0	394	394	0.07
Hector's beaked whale	1.74	0	394	394	0.07

TABLE 13—TOTAL NUMBERS OF POTENTIAL INCIDENTAL TAKE OF MARINE MAMMALS AUTHORIZED DURING L–DEO'S NORTH ISLAND 3-D SURVEY, NORTH ISLAND 2-D SURVEY, AND SOUTH ISLAND 3-D SURVEYS OF THE R/V LANGSETH OFF NEW ZEALAND—Continued

Species	Density (#/1,000 km^2)	Level A takes authorized [1]	Level B takes authorized [1]	Total Level A and Level B takes authorized [1]	Total authorized Level A and Level B takes as a percentage of population
True's beaked whale	0.87	0	197	197	N.A.
Gray's beaked whale	3.49	2	788	790	0.13
Andrew's beaked whale	1.74	0	394	394	0.07
Strap-toothed whale	2.62	2	591	593	0.10
Blainville's beaked whale	0.87	0	197	197	0.03
Spade-toothed whale	0.87	0	197	197	0.03
Bottlenose dolphin	4.78	3	1135	1138	N.A.
Short-beaked common dolphin	4.78	5	1956	1961	N.A.
Dusky dolphin	7.65	3	1323	1326	11.05
Southern right-whale dolphin	2.87	2	680	682	N.A.
Risso's dolphin	1.91	0	454	454	N.A.
False killer whale	2.87	3	680	683	N.A.
Killer whale	1.91	0	433	433	0.54
Long-finned pilot whale	8.28	5	1869	1874	0.94
Short-finned pilot whale	1.91	2	783	785	N.A.
Pygmy sperm whale	1.74	15	377	392	N.A.
Hourglass dolphin	4.16	37	904	941	0.63
Hector's dolphin	0.04	0	2	2	0.01
Spectacled porpoise	1.91	6	120	126	N.A.
New Zealand fur seal	22.50	11	5084	5095	2.55
New Zealand sea lion	9.00	1	591	592	5.99
Southern elephant seal	4.50	7	1011	1018	0.17
Leopard seal	2.25	3	506	509	0.23

[1] Includes additional 25 percent contingency for potential additional survey operations and additional 25 percent contingency to account for uncertainties in density estimates.

As described above, the take estimates shown in Tables 10, 11, 12 and 13 have been revised slightly since we published the notice of the proposed IHA in the **Federal Register** (82 FR 45116; September 27, 2017). Revised take estimates are higher in some cases, and lower in some cases, in comparison to the take estimates described in the notice of the proposed IHA. These revisions have not affected our preliminary determinations.

It should be noted that the take numbers shown in Tables 10, 11, 12 and 13 are expected to be conservative for several reasons. First, in the calculations of estimated take, 50 percent has been added in the form of operational survey days (equivalent to adding 50 percent to the line km to be surveyed) to account for the possibility of additional seismic operations associated with airgun testing and repeat coverage of any areas where initial data quality is sub-standard, and in recognition of the uncertainties in the density estimates used to estimate take as described above. Additionally, marine mammals would be expected to move away from a loud sound source that represents an aversive stimulus, such as an airgun array, potentially reducing the number of Level A takes. However, the extent to which marine mammals would move away from the sound source is difficult to quantify and is therefore not accounted for in the take estimates shown in 11, 12, 13 and 14.

For some marine mammal species, we authorize a different number of incidental takes than the number of incidental takes requested by L–DEO (see Tables 18, 19 and 20 in the IHA application for requested take numbers). For instance, for several species, L–DEO increased the take request from the calculated take number to 1 percent of the estimated population size. We do not believe it is likely that 1 percent of the estimated population size of those species will be taken by L–DEO's planned surveys, therefore we do not authorize the take numbers requested by L–DEO in their IHA application (LGL, 2017). However, in recognition of the uncertainties in the density estimates used to estimate take as described above, we believe it is reasonable to assume that actual takes may exceed numbers of takes calculated based on available density estimates; therefore, we have increased take estimates for all marine mammal species by an additional 25 percent, to account for the fact that density estimates used to estimate take may be underestimates of actual densities of marine mammals in the survey area. Additionally, L–DEO requested authorization for 10 takes of Hector's dolphins during the North Island 2-D survey (LGL, 2017). However, we do not authorize any takes of Hector's dolphins or Maui dolphins during North Island surveys. We believe the likelihood of the planned North Island 2-D survey encountering a Hector's dolphin or Maui dolphin is so low as to be discountable. As described above, the North Island subpopulation of Hector's dolphin (aka Maui dolphin) is very unlikely to be encountered during either planned North Island survey due to the very low estimated abundance of the subpopulation and due to the geographic isolation of the subpopulation (currently limited to the west coast of the North Island, whereas all planned North Island surveys would occur on the eastern side of the island). As such, we do not authorize any takes of Hector's dolphins or Maui dolphins during L–DEO's planned North Island surveys.

Mitigation

In order to issue an IHA under Section 101(a)(5)(D) of the MMPA, NMFS must set forth the permissible methods of taking pursuant to such

activity, and other means of effecting the least practicable impact on such species or stock and its habitat, paying particular attention to rookeries, mating grounds, and areas of similar significance, and on the availability of such species or stock for taking for certain subsistence uses (latter not applicable for this action). NMFS regulations require applicants for incidental take authorizations to include information about the availability and feasibility (economic and technological) of equipment, methods, and manner of conducting such activity or other means of effecting the least practicable adverse impact upon the affected species or stocks and their habitat (50 CFR 216.104(a)(11)).

In evaluating how mitigation may or may not be appropriate to ensure the least practicable adverse impact on species or stocks and their habitat, as well as subsistence uses where applicable, we carefully consider two primary factors:

(1) The manner in which, and the degree to which, the successful implementation of the measure(s) is expected to reduce impacts to marine mammals, marine mammal species or stocks, and their habitat. This considers the nature of the potential adverse impact being mitigated (likelihood, scope, range). It further considers the likelihood that the measure will be effective if implemented (probability of accomplishing the mitigating result if implemented as planned) the likelihood of effective implementation (probability implemented as planned), and

(2) the practicability of the measures for applicant implementation, which may consider such things as cost, impact on operations, and, in the case of a military readiness activity, personnel safety, practicality of implementation, and impact on the effectiveness of the military readiness activity.

L–DEO has reviewed mitigation measures employed during seismic research surveys authorized by NMFS under previous incidental harassment authorizations, as well as recommended best practices in Richardson *et al.* (1995), Pierson *et al.* (1998), Weir and Dolman (2007), Nowacek *et al.* (2013), Wright (2014), and Wright and Cosentino (2015), and has incorporated a suite of proposed mitigation measures into their project description based on the above sources.

To reduce the potential for disturbance from acoustic stimuli associated with the activities, L–DEO proposed to implement the following mitigation measures for marine mammals:

(1) Vessel-based visual mitigation monitoring;

(2) Vessel-based passive acoustic monitoring;

(3) Establishment of an exclusion zone;

(4) Power down procedures;

(5) Shutdown procedures;

(6) Ramp-up procedures; and

(7) Vessel strike avoidance measures.

In addition to the mitigation measures proposed by L–DEO, NMFS has incorporated the following additional measures:

(1) Shutdown upon observation of a large whale with calf at any distance;

(2) Shutdown upon observation of a Hector's dolphin or Maui dolphin (during North Island 2-D and North Island 3-D surveys only) at any distance;

(3) Shutdown upon observation of an aggregation (6 or more) of large whales of any species at any distance;

(4) Shutdown upon any observation (visual or acoustic) of a beaked whale or *Kogia* spp. at any distance; and

(5) Shutdown upon acoustic detection of a sperm whale (with certain exceptions) at any distance.

As described above, measures (3), (4) and (5) incorporated by NMFS above were added to the suite of mitigation measures after we published the notice of the proposed IHA in the **Federal Register** (82 FR 45116; September 27, 2017), in response to comments received from the Commission.

Vessel-Based Visual Mitigation Monitoring

Protected Species Observer (PSO) observations will take place during all daytime airgun operations and nighttime start ups (if applicable) of the airguns. Airgun operations will be suspended when marine mammals are observed within, or about to enter, designated Exclusion Zones (as described below). PSOs will also watch for marine mammals near the vessel for at least 30 minutes prior to the planned start of airgun operations. PSOs will monitor the entire extent of the modeled Level B harassment zone (Table 3) (or, as far as they are able to see, if they cannot see to the extent of the estimated Level B harassment zone). Observations will also be made during daytime periods when the *Langseth* is underway without seismic operations, such as during transits, to allow for comparison of sighting rates and behavior with and without airgun operations and between acquisition periods.

During seismic operations, a minimum of four visual PSOs will be based aboard the *Langseth.* PSOs will be appointed by L–DEO, with NMFS' approval. During the majority of seismic operations, two PSOs will monitor for marine mammals around the seismic vessel. Use of two simultaneous observers increases the effectiveness of detecting marine mammals around the source vessel. However, during meal times, only one PSO may be on duty. PSO(s) will be on duty in shifts of duration no longer than 4 hours. Other crew will also be instructed to assist in detecting marine mammals and in implementing mitigation requirements (if practical). Before the start of the seismic survey, the crew will be given additional instruction in detecting marine mammals and implementing mitigation requirements. The *Langseth* is a suitable platform for marine mammal observations. When stationed on the observation platform, PSOs will have a good view around the entire vessel. During daytime, the PSO(s) will scan the area around the vessel systematically with reticle binoculars (*e.g.,* 7 x 50 Fujinon), Big-eye binoculars (25 x 150), and with the naked eye.

The PSOs must have no tasks other than to conduct observational effort, record observational data, and communicate with and instruct relevant vessel crew with regard to the presence of marine mammals and mitigation requirements. PSO resumes will be provided to NMFS for approval. At least two PSOs must have a minimum of 90 days at-sea experience working as PSOs during a high energy seismic survey, with no more than eighteen months elapsed since the conclusion of the at-sea experience. One ''experienced'' visual PSO will be designated as the lead for the entire protected species observation team. The lead will coordinate duty schedules and roles for the PSO team and serve as primary point of contact for the vessel operator. The lead PSO will devise the duty schedule such that ''experienced'' PSOs are on duty with those PSOs with appropriate training but who have not yet gained relevant experience, to the maximum extent practicable.

The PSOs must have successfully completed relevant training, including completion of all required coursework and passing a written and/or oral examination developed for the training program, and must have successfully attained a bachelor's degree from an accredited college or university with a major in one of the natural sciences and a minimum of 30 semester hours or equivalent in the biological sciences and at least one undergraduate course in math or statistics. The educational requirements may be waived if the PSO has acquired the relevant skills through alternate training, including (1) secondary education and/or experience

comparable to PSO duties; (2) previous work experience conducting academic, commercial, or government-sponsored marine mammal surveys; or (3) previous work experience as a PSO. The PSO should demonstrate good standing and consistently good performance of PSO duties.

Vessel-Based Passive Acoustic Mitigation Monitoring

Passive acoustic monitoring (PAM) will take place to complement the visual monitoring program and to inform mitigation measures. Visual monitoring typically is not effective during periods of poor visibility or at night, and even with good visibility, is unable to detect marine mammals when they are below the surface or beyond visual range. Acoustic monitoring can be used in addition to visual observations to improve detection, identification, and localization of cetaceans. The acoustic monitoring will serve to inform mitigation measures and to alert visual observers (if on duty) when vocalizing cetaceans are detected. PAM is only useful when marine mammals vocalize, but it can be effective either by day or by night and does not depend on good visibility. PAM will be monitored in real time so that visual observers can be alerted when marine mammals are detected acoustically.

The PAM system consists of hardware (*i.e.,* hydrophones) and software. The ''wet end'' of the system consists of a towed hydrophone array that is connected to the vessel by a tow cable. A deck cable will connect the tow cable to the electronics unit on board where the acoustic station, signal conditioning, and processing system will be located. The acoustic signals received by the hydrophones are amplified, digitized, and then processed by the software.

At least one acoustic PSO (in addition to the four visual PSOs) will be on board. The towed hydrophones will be monitored 24 hours per day (either by the acoustic PSO or by a visual PSO trained in the PAM system if the acoustic PSO is on break) while at the seismic survey area during airgun operations, and during most periods when the *Langseth* is underway while the airguns are not operating. However, PAM may not be possible if damage occurs to the array or back-up systems during operations. One PSO will monitor the acoustic detection system at any one time, in shifts no longer than six hours, by listening to the signals via headphones and/or speakers and watching the real-time spectrographic display for frequency ranges produced by cetaceans.

When a vocalization is detected, the acoustic PSO will take necessary action depending on the species and location of the animal detected. If the species and/or location of the animal(s) warrants immediate shutdown of the array, the acoustic PSO will contact the vessel operator immediately to call for a shutdown (see the section on Mitigation, below, for scenarios that require shutdown based on acoustic detection), If the species and/or location of the animal(s) does not warrant immediate shutdown, the acoustic PSO will contact visual PSOs immediately, to alert them to the presence of marine mammals (if they have not already been detected visually), in order to facilitate a power down or shutdown, if required. The information regarding the marine mammal acoustic detection will be entered into a database.

In summary, a typical daytime cruise will have scheduled two observers (visual) on duty from the observation platform, and an acoustic observer on the passive acoustic monitoring system.

Exclusion Zone and Buffer Zone

An exclusion zone (EZ) is a defined area within which occurrence of a marine mammal triggers mitigation action intended to reduce the potential for certain outcomes, *e.g.,* auditory injury, disruption of critical behaviors. The PSOs will establish a minimum EZ with a 500 m radius for the 36 airgun array and the 18 airgun array. The 500 m EZ will be based on radial distance from any element of the airgun array (rather than being based on the center of the array or around the vessel itself). With certain exceptions (described below), if a marine mammal appears within, enters, or appears on a course to enter this zone, the acoustic source will be powered down (see Power Down Procedures below). In addition to the 500 m EZ for the full arrays, a 100 m exclusion zone will be established for the single 40 in^3 airgun. With certain exceptions (described below), if a marine mammal appears within, enters, or appears on a course to enter this zone the acoustic source will be shut down entirely (see Shutdown Procedures below). Additionally, power down of the full arrays will last no more than 30 minutes maximum at any given time; thus the arrays will be shut down entirely if, after 30 minutes of the array being powered down, a marine mammal remains inside the 500 m EZ (with the exception of spectacled porpoise and bottlenose, hourglass, and Hector's dolphins, as described above).

In their IHA application, L–DEO proposed to establish EZs based upon modeled radial distances to auditory injury zones (*e.g.,* power down would occur when a marine mammal entered or appeared likely to enter the zone(s) within which auditory injury is expected to occur based on modeling) (Tables 6, 7, 8). However, we instead require the 500 m EZ as described above. The 500 m EZ is intended to be precautionary in the sense that it would be expected to contain sound exceeding peak pressure injury criteria for all cetacean hearing groups, while also providing a consistent, reasonably observable zone within which PSOs would typically be able to conduct effective observational effort. Additionally, a 500-m EZ is expected to minimize the likelihood that marine mammals will be exposed to levels likely to result in more severe behavioral responses. Although significantly greater distances may be observed from an elevated platform under good conditions, we believe that 500 m is likely regularly attainable for PSOs using the naked eye during typical conditions.

An appropriate EZ based on cumulative sound exposure level (SEL_{cum}) criteria would be dependent on the animal's applied hearing range and how that overlaps with the frequencies produced by the sound source of interest (*i.e.,* via marine mammal auditory weighting functions) (NMFS, 2016), and may be larger in some cases than the zones calculated on the basis of the peak pressure thresholds (and larger than 500 m) depending on the species in question and the characteristics of the specific airgun array. In particular, the EZ radii would be larger for low-frequency cetaceans, because their most susceptible hearing range overlaps the low frequencies produced by airguns, but the zones would remain very small for mid-frequency cetaceans (*i.e.,* including the ''small delphinoids'' described below), whose range of best hearing largely does not overlap with frequencies produced by airguns.

Use of monitoring and shutdown or power-down measures within defined exclusion zone distances is inherently an essentially instantaneous proposition—a rule or set of rules that requires mitigation action upon detection of an animal. This indicates that definition of an exclusion zone on the basis of cumulative sound exposure level thresholds, which require that an animal accumulate some level of sound energy exposure over some period of time (*e.g.,* 24 hours), has questionable relevance as a standard protocol. A PSO aboard a mobile source will typically have no ability to monitor an animal's position relative to the acoustic source

over relevant time periods for purposes of understanding whether auditory injury is likely to occur on the basis of cumulative sound exposure and, therefore, whether action should be taken to avoid such potential.

Cumulative SEL thresholds are more relevant for purposes of modeling the potential for auditory injury than they are for dictating real-time mitigation, though they can be informative (especially in a relative sense). We recognize the importance of the accumulation of sound energy to an understanding of the potential for auditory injury and that it is likely that, at least for low-frequency cetaceans, some potential auditory injury is likely impossible to mitigate and should be considered for authorization.

In summary, our intent in prescribing a standard exclusion zone distance is to (1) encompass zones for most species within which auditory injury could occur on the basis of instantaneous exposure; (2) provide additional protection from the potential for more severe behavioral reactions (*e.g.,* panic, antipredator response) for marine mammals at relatively close range to the acoustic source; (3) provide consistency for PSOs, who need to monitor and implement the exclusion zone; and (4) to define a distance within which detection probabilities are reasonably high for most species under typical conditions.

Our use of 500 m as the EZ is a reasonable combination of factors. This zone is expected to contain all potential auditory injury for all marine mammals (high-frequency, mid-frequency and low-frequency cetacean functional hearing groups and otariid and phocid pinnipeds) as assessed against peak pressure thresholds (NMFS, 2016) (Tables 6, 7, 8). It is also expected to contain all potential auditory injury for high-frequency and mid-frequency cetaceans as well as otariid and phocid pinnipeds as assessed against SEL_{cum} thresholds (NMFS, 2016) (Tables 6, 7, 8). It has proven to be practicable through past implementation in seismic surveys conducted for the oil and gas industry in the Gulf of Mexico (as regulated by the Bureau of Ocean Energy Management (BOEM) pursuant to the Outer Continental Shelf Lands Act (43 U.S.C. 1331–1356)). In summary, a practicable criterion, such as the EZs described above, has the advantage of simplicity while still providing in most cases a zone larger than relevant auditory injury zones, given realistic movement of source and receiver.

The PSOs will also establish and monitor a 500 m buffer zone (*i.e.,* 500 m in addition to the 500 m EZ). During operation of the airgun arrays, occurrence of marine mammals within the 500 m buffer zone (but outside the 500 m EZ) will be communicated to the vessel operator to prepare for potential power down or shutdown of the acoustic source. The buffer zone is discussed further under Ramp Up Procedures below. PSOs will also monitor the entire extent of the estimated Level B harassment zone (Table 3) (or, as far as they are able to see, if they cannot see to the extent of the estimated Level B harassment zone).

Power Down Procedures

A power down involves decreasing the number of airguns in use such that the smallest single element of the array is in operation (*i.e.,* one 40-in^3 airgun), with the result that the radius of the mitigation zone is decreased to the extent that marine mammals are no longer in, or about to enter, the 500 m EZ. The continued operation of one 40-in^3 airgun is intended to alert marine mammals to the presence of the seismic vessel in the area, and to allow them to leave the area of the seismic vessel if they choose. In contrast, a shutdown occurs when all airgun activity is suspended (shutdown procedures are discussed below). If a marine mammal is detected outside the 500 m EZ but appears likely to enter the 500 m EZ, the array will be powered down before the animal is within the 500 m EZ. Likewise, if a mammal is already within the 500 m EZ when first detected, the array will be powered down immediately. During a power down of the airgun array, the 40-in^3 airgun will be operated.

Following a power down, airgun activity will not resume until the marine mammal has cleared the 500 m EZ. The animal will be considered to have cleared the 500 m EZ if the following conditions have been met:

- It is visually observed to have departed the 500 m EZ; or
- it has not been seen within the 500 m EZ for 15 min in the case of small odontocetes and pinnipeds; or
- it has not been seen within the 500 m EZ for 30 min in the case of mysticetes and large odontocetes, including sperm, pygmy sperm, dwarf sperm, and beaked whales.

This power down requirement will be in place for all marine mammals, with the exception of certain small delphinoids under certain circumstances. As defined here, the small delphinoid group is intended to encompass those members of the Family Delphinidae most likely to voluntarily approach the source vessel for purposes of interacting with the vessel and/or airgun array (*e.g.,* bow riding). This exception to the power down requirement applies solely to specific species of small dolphins: Short-beaked common dolphin, dusky dolphin, and southern right whale dolphin. If there is uncertainty regarding identification (*i.e.,* whether the observed animal(s) belongs to the species described above), the power down or shutdown must be implemented. Note that bottlenose, hourglass, and Hector's dolphins and spectacled porpoise are not included in the power down/shutdown exception.

We include this small delphinoid exception because power-down/shutdown requirements for small delphinoids under all circumstances represent practicability concerns without likely commensurate benefits for the animals in question. Small delphinoids are generally the most commonly observed marine mammals in the specific geographic region and would typically be the only marine mammals likely to intentionally approach the vessel. As described below, auditory injury is extremely unlikely to occur for mid-frequency cetaceans (*e.g.,* delphinids), as this group is relatively insensitive to sound produced at the predominant frequencies in an airgun pulse while also having a relatively high threshold for the onset of auditory injury (*i.e.,* permanent threshold shift). Please see Potential Effects of the Specified Activity on Marine Mammals in the **Federal Register** notice of the proposed IHA (82 FR 45116; September 27, 2017) for further discussion of sound metrics and thresholds and marine mammal hearing. Bottlenose dolphins are excluded from the power down waiver due to concerns from the New Zealand Department of Conservation, while hourglass, spectacled, and Hector's dolphins are excluded from the power down waiver due to their functional hearing range (they are classified as high frequency cetaceans which would make them more susceptible to harassment or possible injury as a result of exposure to airgun sounds).

A large body of anecdotal evidence indicates that small delphinoids commonly approach vessels and/or towed arrays during active sound production for purposes of bow riding, with no apparent effect observed in those delphinoids (*e.g.,* Barkaszi *et al.,* 2012). The potential for increased shutdowns resulting from such a measure would require the *Langseth* to revisit the missed track line to reacquire data, resulting in an overall increase in the total sound energy input to the marine environment and an increase in

the total duration over which the survey is active in a given area. Although other mid-frequency hearing specialists (*e.g.,* large delphinoids) are no more likely to incur auditory injury than are small delphinoids, they are much less likely to approach vessels. Therefore, retaining a power-down/shutdown requirement for large delphinoids would not have similar impacts in terms of either practicability for the applicant or corollary increase in sound energy output and time on the water. We do anticipate some benefit for a power-down/shutdown requirement for large delphinoids in that it simplifies somewhat the total range of decision-making for PSOs and may preclude any potential for physiological effects other than to the auditory system as well as some more severe behavioral reactions for any such animals in close proximity to the source vessel.

A power down could occur for no more than 30 minutes maximum at any given time. If, after 30 minutes of the array being powered down, marine mammals had not cleared the 500 m EZ (as described above), a shutdown of the array will be implemented (see Shut Down Procedures, below). Power down is only allowed in response to the presence of marine mammals within the designated EZ. Thus, the single 40 in^3 airgun, which will be operated during power downs, may not be operated continuously throughout the night or during transits from one line to another.

Shut Down Procedures

The single 40-in^3 operating airgun will be shut down if a marine mammal is seen within or approaching the 100 m EZ for the single 40-in^3 airgun. Shutdown will be implemented if (1) an animal enters the 100 m EZ of the single 40-in^3 airgun after a power down has been initiated, or (2) an animal is initially seen within the 100 m EZ of the single 40-in^3 airgun when more than one airgun (typically the full array) is operating. Airgun activity will not resume until the marine mammal has cleared the 500 m EZ. Criteria for judging that the animal has cleared the EZ will be as described above. A shutdown of the array will be implemented if, after 30 minutes of the array being powered down, marine mammals have not cleared the 500 m EZ (as described above).

The shutdown requirement, like the power down requirement, is waived for dolphins of the following species: Short-beaked common dolphin, dusky dolphin and southern right whale dolphin. If there is uncertainty regarding identification (*i.e.,* whether the observed animal(s) belongs to the species described above), the shutdown will be implemented.

Other Shutdown Requirements—In addition to the shutdown requirement described above, NMFS also requires shutdown of the acoustic source in the event of certain other observations regardless of the defined exclusion zone. While visual PSOs should focus observational effort within the vicinity of the acoustic source and vessel (*i.e.,* approximately 1 km radius), this does not preclude them from periodic scanning of the remainder of the visible area, and there is no reason to believe that such periodic scans by professional PSOs would hamper their ability to maintain observation of areas closer to the source and vessel. These circumstances include:

- Upon observation of a large whale (*i.e.,* sperm whale or any baleen whale) with calf at any distance, with ''calf'' defined as an animal less than two-thirds the body size of an adult observed to be in close association with an adult. Groups of whales are likely to be more susceptible to disturbance when calves are present (*e.g.,* Bauer *et al.,* 1993), and disturbance of cow-calf pairs could potentially result in separation of vulnerable calves from adults. McCauley *et al.* (2000a) found that groups of humpback whale females with calves consistently avoided a single operating airgun, while male humpbacks were attracted to it, concluding that cow-calf pairs are more likely to exhibit avoidance responses to unfamiliar sounds and that such responses should be a focus of management. Behavioral disturbance has been implicated in mother-calf separations for odontocete species as well (Noren and Edwards, 2007; Wade *et al.*, 2012). Separation, if it occurred, could be exacerbated by airgun signals masking communication between adults and the separated calf (Videsen *et al.,* 2017). Absent separation, airgun signals can disrupt or mask vocalizations essential to mother-calf interactions. Reductions in the probability of calf survival for gray whales have been linked to airgun surveys in Russia (Cooke *et al.,* 2016).
- Upon acoustic detection of a sperm whale (except in cases where the location of an acoustically detected sperm whale can be definitively localized as outside the 500 m EZ). Sperm whales are not necessarily expected to display physical avoidance of sound sources (*e.g.,* Madsen *et al.*, 2002a; Jochens *et al.*, 2008; Winsor et al., 2017). Although Winsor *et al.* (2017) report that distances and orientations between tagged whales and active airgun arrays appeared to be randomly distributed with no evidence of horizontal avoidance, it must be noted that their study was to some degree precipitated by an earlier observation of significantly decreased sperm whale density in the presence of airgun surveys (Mate *et al.*, 1994). However, effects on vocal behavior are common (*e.g.,* Watkins and Schevill, 1975; Watkins *et al.*, 1985). The sperm whale's primary means of locating prey is echolocation (Miller *et al.*, 2004), and multiple studies have shown that noise can disrupt feeding behavior and/or significantly reduce foraging success for sperm whales at relatively low levels of exposure (*e.g.,* Miller *et al.*, 2009, 2012; Isojunno *et al.*, 2016; Sivle *et al.*, 2012; Cure *et al.*, 2016). Effects on energy intake with no immediate compensation, as is suggested by disruption of foraging behavior without corollary movements to new locations, would be expected to result in bioenergetics consequences to individual whales.

We also considered requirement of shutdown upon visual detection of sperm whales at any distance. Here, we assume that acoustic detections of sperm whales would most likely be representative of the foraging behavior we intend to minimize disruption of, while visual observations of sperm whales would represent resting between bouts of such behavior. Occurrence of resting sperm whales at distances beyond the exclusion zone may not indicate a need to implement shutdown. If the location of an acoustically detected sperm whale can be definitively localized by the PAM operator as outside the 500 m EZ, then the requirement to shutdown the array is waived. If there is any uncertainty as to whether or not an acoustically detected sperm whale is within the 500 m EZ, shutdown must be implemented.

- Upon any observation (visual or acoustic) of a beaked whale or *Kogia* spp. These species are behaviorally sensitive deep divers and it is possible that disturbance could provoke a severe behavioral response leading to injury (*e.g.,* Wursig *et al.*, 1998; Cox *et al.*, 2006). Unlike the sperm whale, we recognize that there are generally low detection probabilities for beaked whales and *Kogia* spp., meaning that many animals of these species may go undetected. Barlow (1999) estimates such probabilities at 0.23 to 0.45 for Cuvier's and Mesoplodont beaked whales, respectively. However, Barlow and Gisiner (2006) predict a roughly 24–48 percent reduction in the probability of detecting beaked whales during seismic mitigation monitoring efforts as compared with typical research survey

efforts, and Moore and Barlow (2013) noted a decrease in *g*(0) for Cuvier's beaked whales from 0.23 at BSS 0 (calm) to 0.024 at BSS 5. Similar detection probabilities have been noted for *Kogia* spp., though they typically travel in smaller groups and are less vocal, thus making detection more difficult (Barlow and Forney, 2007). Because it is likely that only a small proportion of beaked whales and *Kogia* spp. potentially affected by the planned surveys would actually be detected, it is important to avoid potential impacts when possible.

- Upon visual observation of an aggregation (6 or more) of large whales of any species (*i.e.,* sperm whale or any baleen whale) (*e.g.,* feeding, socializing, etc.). Under these circumstances, we assume that the animals are engaged in some important behavior (*e.g.,* feeding, socializing) that should not be disturbed. By convention, we define an aggregation as six or more animals.
- Upon observation (visual or acoustic) of a Hector's dolphin or Maui dolphin (during North Island and South Island surveys) at any distance. As described above, the Maui dolphin is considered one of the rarest dolphins in the world with a population size estimated at just 63 individuals (Baker *et al.* 2016). It has undergone a marked reduction in range (Dawson *et al.* 2001; Slooten *et al.* 2005), and currently faces a high risk of extinction (Manning and Grantz, 2016). The shutdown requirement for Hector's/Maui dolphin during North Island surveys is designed to avoid any potential for exposure of a Maui dolphin to seismic airgun sounds. Maui dolphins are not expected to occur in the planned survey areas off the North Island based on their current range. However, as described above, there have been occasional sightings of Hector's dolphins off the east coast of the North Island though it is unclear whether those individuals may have originated from the South Island Hector's dolphin populations (Baker 1978, Russell 1999, Ferreira and Roberts 2003, Slooten *et al.* 2005, DuFresne 2010, Berkenbusch *et al.* 2013; Torres *et al.* 2013; Patiño-Pérez 2015; NZDOC 2017). While we have determined the likelihood of L–DEO's planned North Island surveys encountering a Hector's dolphin or Maui dolphin is extremely low, we nonetheless include this measure to further minimize the already extremely unlikely potential for exposure of a Maui dolphin to airgun sounds. Also as described above, Hector's dolphins have relatively small home ranges and high site fidelity and a genetically distinct and localized population occurs in Te Waewae Bay (Mackenzie and Clement, 2014). Due to the limited range and high site fidelity of the population of Hector's dolphin that occurs in Te Waewae Bay and the proximity of the planned South Island 2-D survey with Te Waewae Bay we have included this requirement to protect the South Island Hector's dolphin. The requirement to shut down on acoustic detection applies when the acoustic detection can be positively identified as originating from a Hector's dolphin.
- In the event of a shutdown due to visual observation of a beaked whale, *Kogia* spp., an aggregation of large whales, or large whale with calf, ramp-up procedures will not be initiated until the animal(s) that triggered the shutdown has not been seen at any distance for 30 minutes. In the event of a shutdown due to visual or confirmed acoustic detection of a Hector's or Maui dolphin, ramp-up procedures will not be initiated until the Hector's/Maui dolphin has not been visually or acoustically detected at any distance for 15 minutes. In the event of a shutdown due to acoustic detection of a sperm whale, *Kogia* spp., or beaked whale, ramp-up procedures will not be initiated until the animal(s) that triggered the shutdown has not been detected acoustically for 30 minutes.

Ramp-Up Procedures

Ramp-up of an acoustic source is intended to provide a gradual increase in sound levels following a power down or shutdown, enabling animals to move away from the source if the signal is sufficiently aversive prior to its reaching full intensity. The ramp-up procedure involves a step-wise increase in the number of airguns firing and total array volume until all operational airguns are activated and the full volume is achieved. Ramp-up is required after the array is powered down or shut down due to mitigation. If the airgun array has been shut down for reasons other than mitigation (*e.g.,* mechanical difficulty) for a period of less than 30 minutes, it may be activated again without ramp-up if PSOs have maintained constant visual and acoustic observation and no visual detections of any marine mammal have occurred within the buffer zone and no acoustic detections have occurred. This is the only scenario under which ramp up is not required.

Ramp-up will begin by activating a single airgun of the smallest volume in the array and will continue in stages by doubling the number of active elements at the commencement of each stage, with each stage of approximately the same duration.

If airguns have been powered down or shut down due to PSO detection of a marine mammal within or approaching the 500 m EZ, ramp-up will not be initiated until all marine mammals have cleared the EZ, during the day or night. Visual and acoustic PSOs are required to monitor during ramp-up. If a marine mammal were detected by visual PSOs within or approaching the 500 m EZ during ramp-up, a power down (or shut down if appropriate) will be implemented as though the full array were operational. Criteria for clearing the EZ will be as described above.

Thirty minutes of pre-clearance observation of the 500 m EZ and 500 m buffer zone are required prior to ramp-up following any extended deactivation of the array (*i.e.,* if the array were shut down during transit from one line to another). This 30 minute pre-clearance period may occur during any vessel activity (*i.e.,* transit). If a marine mammal is observed within or approaching the 500 m EZ during this pre-clearance period, ramp-up will not be initiated until all marine mammals have cleared the EZ. Criteria for clearing the EZ will be as described above.

Ramp-up will be planned to occur during periods of good visibility when possible. However, ramp-up is allowed at night and during poor visibility if the 500 m EZ and 500 m buffer zone have been monitored by visual PSOs for 30 minutes prior to ramp-up and if acoustic monitoring has occurred for 30 minutes prior to ramp-up with no acoustic detections during that period. Ramp-up of the array may not occur at night or during poor visibility if the PAM system is not functional.

The operator is required to notify a designated PSO of the planned start of ramp-up as agreed-upon with the lead PSO. A designated PSO must be notified again immediately prior to initiating ramp-up procedures and the operator must receive confirmation from the PSO to proceed. The operator must provide information to PSOs documenting that appropriate procedures were followed. Following deactivation of the array for reasons other than mitigation, the operator is required to communicate the near-term operational plan to the lead PSO with justification for any planned nighttime ramp-up.

L–DEO proposed that ramp up would not occur following an extended power down (LGL 2017). However, as we do not allow extended power downs during the planned surveys, we also do not include this as a mitigation measure; instead, ramp up is required after any power down or shutdown of the array (with the one exception as described above). L–DEO also proposed that ramp up would occur when the airgun array begins operating after 8 minutes without

airgun operations (LGL 2017). However, we instead include the criteria for ramp-up as described above.

Vessel Strike Avoidance

Vessel strike avoidance measures are intended to minimize the potential for collisions with marine mammals. We note that these requirements do not apply in any case where compliance would create an imminent and serious threat to a person or vessel or to the extent that a vessel is restricted in its ability to maneuver and, because of the restriction, cannot comply.

The vessel strike avoidance measures include the following: Vessel operator and crew will maintain a vigilant watch for all marine mammals and slow down or stop the vessel or alter course to avoid striking any marine mammal. A visual observer aboard the vessel will monitor a vessel strike avoidance zone around the vessel according to the parameters stated below. Visual observers monitoring the vessel strike avoidance zone will be either third-party observers or crew members, but crew members responsible for these duties will be provided sufficient training to distinguish marine mammals from other phenomena. Vessel strike avoidance measures will be followed during surveys and while in transit.

The vessel will maintain a minimum separation distance of 100 m from large whales (*i.e.,* baleen whales and sperm whales). If a large whale is within 100 m of the vessel the vessel will reduce speed and shift the engine to neutral, and will not engage the engines until the whale has moved outside of the vessel's path and the minimum separation distance has been established. If the vessel is stationary, the vessel will not engage engines until the whale(s) has moved out of the vessel's path and beyond 100 m. The vessel will maintain a minimum separation distance of 50 m from all other marine mammals (with the exception of short-beaked common dolphins, dusky dolphins and southern right whale dolphins that approach the vessel, as described above). If an animal is encountered during transit, the vessel will attempt to remain parallel to the animal's course, avoiding excessive speed or abrupt changes in course. Vessel speeds will be reduced to 10 knots or less when mother/calf pairs, pods, or large assemblages of cetaceans are observed near the vessel.

Based on our evaluation of the applicant's proposed measures, NMFS has determined that the mitigation measures provide the means of effecting the least practicable impact on the affected species or stocks and their habitat, paying particular attention to rookeries, mating grounds, and areas of similar significance.

Monitoring and Reporting

In order to issue an IHA for an activity, Section 101(a)(5)(D) of the MMPA states that NMFS must set forth requirements pertaining to the monitoring and reporting of such taking. The MMPA implementing regulations at 50 CFR 216.104(a)(13) indicate that requests for authorizations must include the suggested means of accomplishing the necessary monitoring and reporting that will result in increased knowledge of the species and of the level of taking or impacts on populations of marine mammals that are expected to be present in the action area. Effective reporting is critical both to compliance as well as ensuring that the most value is obtained from the required monitoring.

Monitoring and reporting requirements prescribed by NMFS should contribute to improved understanding of one or more of the following:

- Occurrence of marine mammal species or stocks in the area in which take is anticipated (*e.g.,* presence, abundance, distribution, density);
- Nature, scope, or context of likely marine mammal exposure to potential stressors/impacts (individual or cumulative, acute or chronic), through better understanding of: (1) Action or environment (*e.g.,* source characterization, propagation, ambient noise); (2) affected species (*e.g.,* life history, dive patterns); (3) co-occurrence of marine mammal species with the action; or (4) biological or behavioral context of exposure (*e.g.,* age, calving or feeding areas);
- Individual marine mammal responses (behavioral or physiological) to acoustic stressors (acute, chronic, or cumulative), other stressors, or cumulative impacts from multiple stressors;
- How anticipated responses to stressors impact either: (1) Long-term fitness and survival of individual marine mammals; or (2) populations, species, or stocks;
- Effects on marine mammal habitat (*e.g.,* marine mammal prey species, acoustic habitat, or other important physical components of marine mammal habitat); and
- Mitigation and monitoring effectiveness.

L–DEO submitted a marine mammal monitoring and reporting plan in section XIII of their IHA application. Monitoring that is designed specifically to facilitate mitigation measures, such as monitoring of the EZ to inform potential power downs or shutdowns of the airgun array, are described above.

L–DEO's monitoring and reporting plan includes the following measures:

Vessel-Based Visual Monitoring

As described above, PSO observations will take place during daytime airgun operations and nighttime start ups (if applicable) of the airguns. During seismic operations, at least four visual PSOs will be based aboard the *Langseth.* PSOs will be appointed by L–DEO with NMFS approval. During the majority of seismic operations, two PSOs will monitor for marine mammals around the seismic vessel. Use of two simultaneous observers increases the effectiveness of detecting animals around the source vessel. However, during meal times, only one PSO may be on duty. PSOs will be on duty in shifts of duration no longer than 4 hours. Other crew will also be instructed to assist in detecting marine mammals and in implementing mitigation requirements (if practical). During daytime, PSOs will scan the area around the vessel systematically with reticle binoculars (*e.g.,* 7 x 50 Fujinon), Big-eye binoculars (25 x 150), and with the naked eye.

PSOs will record data to estimate the numbers of marine mammals exposed to various received sound levels and to document apparent disturbance reactions or lack thereof. Data will be used to estimate numbers of animals potentially 'taken' by harassment (as defined in the MMPA). They will also provide information needed to order a power down or shutdown of airguns when a marine mammal is within or near the EZ.

When a sighting is made, the following information about the sighting will be recorded:

1. Species, group size, age/size/sex categories (if determinable), behavior when first sighted and after initial sighting, heading (if consistent), bearing and distance from seismic vessel, sighting cue, apparent reaction to the airguns or vessel (*e.g.,* none, avoidance, approach, paralleling, etc.), and behavioral pace; and

2. Time, location, heading, speed, activity of the vessel, sea state, visibility, and sun glare.

All observations and power downs or shutdowns will be recorded in a standardized format. Data will be entered into an electronic database. The accuracy of the data entry will be verified by computerized data validity checks as the data are entered and by subsequent manual checking of the database. These procedures will allow

initial summaries of data to be prepared during and shortly after the field program and will facilitate transfer of the data to statistical, graphical, and other programs for further processing and archiving. The time, location, heading, speed, activity of the vessel, sea state, visibility, and sun glare will also be recorded at the start and end of each observation watch, and during a watch whenever there is a change in one or more of the variables.

Results from the vessel-based observations will provide:

1. The basis for real-time mitigation (airgun power down or shutdown);
2. Information needed to estimate the number of marine mammals potentially taken by harassment, which must be reported to NMFS;
3. Data on the occurrence, distribution, and activities of marine mammals in the area where the seismic study is conducted;
4. Information to compare the distance and distribution of marine mammals relative to the source vessel at times with and without seismic activity; and
5. Data on the behavior and movement patterns of marine mammals seen at times with and without seismic activity.

Vessel-Based Passive Acoustic Monitoring

As described above, the acoustic PSO will monitor the PAM system in real time. When a vocalization is detected, the acoustic PSO will take necessary action depending on the species and location of the animal detected, whether immediately calling for a shutdown or immediately contacting visual PSOs to alert them to the presence of marine mammals in order to facilitate a power down or shutdown, if required.

PAM will also take place to complement the visual monitoring program as described above. Please see the Mitigation section above for a description of the PAM system and the acoustic PSO's duties. The acoustic PSO will record data collected via the PAM system, including the following: An acoustic encounter identification number, whether it was linked with a visual sighting, date, time when first and last heard and whenever any additional information was recorded, position and water depth when first detected, bearing if determinable, species or species group (*e.g.,* unidentified dolphin, sperm whale), types and nature of sounds heard (*e.g.,* clicks, continuous, sporadic, whistles, creaks, burst pulses, strength of signal, etc.), and any other notable information. Acoustic detections will also be recorded for further analysis.

Reporting

A report will be submitted to NMFS within 90 days after the end of the cruise. The report will describe the operations that were conducted and sightings of marine mammals near the operations. The report will provide full documentation of methods, results, and interpretation pertaining to all monitoring. The 90-day report will summarize the dates and locations of seismic operations, and all marine mammal sightings (dates, times, locations, activities, associated seismic survey activities). The report will also include estimates of the number and nature of exposures that occurred above the harassment threshold based on PSO observations, including an estimate of those on the trackline but not detected.

Negligible Impact Analysis and Determination

NMFS has defined negligible impact as an impact resulting from the specified activity that cannot be reasonably expected to, and is not reasonably likely to, adversely affect the species or stock through effects on annual rates of recruitment or survival (50 CFR 216.103). A negligible impact finding is based on the lack of likely adverse effects on annual rates of recruitment or survival (*i.e.,* population-level effects). An estimate of the number of takes alone is not enough information on which to base an impact determination. In addition to considering estimates of the number of marine mammals that might be ''taken'' through harassment, NMFS considers other factors, such as the likely nature of any responses (*e.g.,* intensity, duration), the context of any responses (*e.g.,* critical reproductive time or location, migration), as well as effects on habitat, and the likely effectiveness of the mitigation. We also assess the number, intensity, and context of estimated takes by evaluating this information relative to population status. Consistent with the 1989 preamble for NMFS' implementing regulations (54 FR 40338; September 29, 1989), the impacts from other past and ongoing anthropogenic activities are incorporated into this analysis via their impacts on the environmental baseline (*e.g.,* as reflected in the regulatory status of the species, population size and growth rate where known, ongoing sources of human-caused mortality, or ambient noise levels).

To avoid repetition, our analysis applies to all the species listed in Table 2, given that NMFS expects the anticipated effects of the planned seismic surveys to be similar in nature. Where there are meaningful differences between species or stocks, or groups of species, in anticipated individual responses to activities, impact of expected take on the population due to differences in population status, or impacts on habitat, NMFS has identified species-specific factors to inform the analysis. As described above, we authorize only the takes estimated to occur outside of New Zealand territorial sea (Tables 10, 11, 12 and 13); however, for the purposes of our negligible impact analysis and determination, we consider the total impacts to the affected marine mammal populations resulting from the specified activity, including takes that are expected to occur within the territorial sea (Table 14).

TABLE 14—TOTAL NUMBERS OF POTENTIAL INCIDENTAL TAKE OF MARINE MAMMALS DURING PORTIONS OF L–DEO'S NORTH ISLAND 2-D, NORTH ISLAND 3-D, AND SOUTH ISLAND 2-D SURVEYS THAT OCCUR IN THE NEW ZEALAND TERRITORIAL SEA

Species	Estimated Level A takes [1]	Estimated Level B takes [1]	Total estimated Level A and Level B takes [1]
Southern right whale	0	25	25
Pygmy right whale	0	11	11
Humpback whale	0	24	24
Bryde's whale	0	14	14
Common minke whale	0	16	16
Antarctic minke whale	0	16	16
Sei whale	0	16	16

TABLE 14—TOTAL NUMBERS OF POTENTIAL INCIDENTAL TAKE OF MARINE MAMMALS DURING PORTIONS OF L–DEO'S NORTH ISLAND 2-D, NORTH ISLAND 3-D, AND SOUTH ISLAND 2-D SURVEYS THAT OCCUR IN THE NEW ZEALAND TERRITORIAL SEA—Continued

Species	Estimated Level A takes [1]	Estimated Level B takes [1]	Total estimated Level A and Level B takes [1]
Fin whale	0	25	25
Blue whale	0	6	6
Sperm whale	0	278	278
Cuvier's beaked whale	0	251	251
Arnoux's beaked whale	0	251	251
Southern bottlenose whale	0	169	169
Shepard's beaked whale	0	169	169
Hector's beaked whale	0	169	169
True's beaked whale	0	85	85
Gray's beaked whale	0	334	334
Andrew's beaked whale	0	169	169
Strap-toothed whale	0	251	251
Blainville's beaked whale	0	85	85
Spade-toothed whale	0	85	85
Bottlenose dolphin	0	486	486
Short-beaked common dolphin	0	918	918
Dusky dolphin	0	518	518
Southern right-whale dolphin	0	291	291
Risso's dolphin	0	195	195
False killer whale	0	291	291
Killer whale	0	184	184
Long-finned pilot whale	0	789	789
Short-finned pilot whale	0	368	368
Pygmy sperm whale	1	166	167
Hourglass dolphin	3	394	397
Hector's dolphin	0	1	1
Spectacled porpoise	0	21	21
New Zealand fur seal	0	2141	2141
New Zealand sea lion	0	98	98
Southern elephant seal	0	69	69
Leopard seal	0	35	35

Note: NMFS does not authorize the estimated takes shown in the territorial sea.

[1] Includes additional 25 percent contingency for potential additional survey operations and additional 25 percent contingency to account for uncertainties in density estimates.

NMFS does not anticipate that serious injury or mortality will occur as a result of L–DEO's planned surveys, even in the absence of mitigation. As discussed in the *Potential Effects* section, non-auditory physical effects, stranding, and vessel strike are not expected to occur.

We authorize a limited number of instances of Level A harassment of 21 marine mammal species (Tables 10, 11, 12 and 13). However, we believe that any PTS incurred in marine mammals as a result of the planned activity would be in the form of only a small degree of PTS, not severe hearing impairment, and would be unlikely to affect the fitness of any individuals, because of the constant movement of both the *Langseth* and of the marine mammals in the project area, as well as the fact that the vessel is not expected to remain in any one area in which individual marine mammals would be expected to concentrate for an extended period of time (*i.e.,* since the duration of exposure to loud sounds will be relatively short). Also, as described above, we expect that marine mammals would be likely to move away from a sound source that represents an aversive stimulus, especially at levels that would be expected to result in PTS, given sufficient notice of the *Langseth's* approach due to the vessel's relatively low speed when conducting seismic surveys. We expect that the majority of takes would be in the form of short-term Level B behavioral harassment in the form of temporary avoidance of the area or decreased foraging (if such activity were occurring), reactions that are considered to be of low severity and with no lasting biological consequences (*e.g.,* Southall *et al.,* 2007).

Potential impacts to marine mammal habitat are discussed in the **Federal Register** notice of the proposed IHA (82 FR 45116; September 27, 2017) and are summarized below. Marine mammal habitat may be impacted by elevated sound levels, but these impacts would be temporary. Feeding behavior is not likely to be significantly impacted, as marine mammals appear to be less likely to exhibit behavioral reactions or avoidance responses while engaged in feeding activities (Richardson *et al.,* 1995). Prey species are mobile and are broadly distributed throughout the project area; therefore, marine mammals that may be temporarily displaced during survey activities are expected to be able to resume foraging once they have moved away from areas with disturbing levels of underwater noise. Because of the temporary nature of the disturbance, the availability of similar habitat and resources in the surrounding area, and the lack of important or unique marine mammal habitat, the impacts to marine mammals and the food sources that they utilize are not expected to cause significant or long-term consequences for individual marine mammals or their populations. In addition, there are no mating or calving areas known to be biologically important to marine mammals within the proposed project area.

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project area; therefore, marine mammals that may be temporarily displaced during survey activities are expected to be able to resume foraging once they have moved away from areas with disturbing levels of underwater noise. Because of the temporary nature of the disturbance, the availability of similar habitat and resources in the surrounding area, and the lack of important or unique marine mammal habitat, the impacts to marine mammals and the food sources that they utilize are not expected to cause significant or long-term consequences for individual marine mammals or their populations. In addition, there are no mating or calving areas known to be biologically important to marine mammals within the planned project area.

As described above, the take estimates shown in Tables 10, 11, 12 and 13 have been revised slightly since we published the notice of the proposed IHA in the **Federal Register** (82 FR 45116; September 27, 2017). We have fully considered these revised take estimates in our negligible impact analysis. Additionally, the acoustic ''footprint'' of the planned surveys is small relative to the ranges of the marine mammals potentially be affected. Sound levels would increase in the marine environment in a relatively small area surrounding the vessel compared to the range of the marine mammals within the planned survey area.

The mitigation measures are expected to reduce the number and/or severity of takes by allowing for detection of marine mammals in the vicinity of the vessel by visual and acoustic observers, and by minimizing the severity of any potential exposures via power downs and/or shutdowns of the airgun array. Based on previous monitoring reports for substantially similar activities that have been previously authorized by NMFS, we expect that the mitigation will be effective in preventing at least some extent of potential PTS in marine mammals that may otherwise occur in the absence of the mitigation.

The ESA-listed marine mammal species under our jurisdiction that are likely to be taken by the planned surveys include the southern right, sei, fin, blue, and sperm whale (listed as endangered) and the South Island Hector's dolphin (listed as threatened). We authorize a very limited amount of take for these species (Tables 10, 11, 12 and 13), relative to their population sizes, therefore we do not expect population-level impacts to any of these species. The other marine mammal species that may be taken by harassment during the planned surveys are not listed as threatened or endangered under the ESA. There is no designated critical habitat for any ESA-listed marine mammals within the project area; and of the non-listed marine mammals for which we authorize take, none are considered ''depleted'' or ''strategic'' by NMFS under the MMPA.

NMFS concludes that exposures to marine mammal species and stocks due to L–DEO's planned survey would result in only short-term (temporary and short in duration) effects to individuals exposed. Animals may temporarily avoid the immediate area, but are not expected to permanently abandon the area. Major shifts in habitat use, distribution, or foraging success are not expected.

In summary and as described above, the following factors primarily support our determination that the impacts resulting from this activity are not expected to adversely affect the marine mammal species or stocks through effects on annual rates of recruitment or survival:

- No serious injury or mortality is anticipated or authorized;
- The anticipated impacts of the planned activity on marine mammals would primarily be temporary behavioral changes due to avoidance of the area around the survey vessel;
- The number of instances of PTS that may occur are expected to be very small in number (Tables 10, 11, 12 and 13). Instances of PTS that are incurred in marine mammals would be of a low level, due to constant movement of the vessel and of the marine mammals in the area, and the nature of the survey design (not concentrated in areas of high marine mammal concentration);
- The availability of alternate areas of similar habitat value for marine mammals to temporarily vacate the survey area during the planned surveys to avoid exposure to sounds from the activity;
- The planned project area does not contain known areas of significance for mating or calving;
- The potential adverse effects on fish or invertebrate species that serve as prey species for marine mammals from the planned surveys would be temporary and spatially limited; and
- The mitigation measures, including visual and acoustic monitoring, power downs, and shutdowns, are expected to minimize potential impacts to marine mammals.

Based on the analysis contained herein of the likely effects of the specified activity on marine mammals and their habitat, and taking into consideration the implementation of the monitoring and mitigation measures, NMFS finds that the total marine mammal take from the planned activity will have a negligible impact on all affected marine mammal species or stocks.

Small Numbers

As noted above, only small numbers of incidental take may be authorized under Section 101(a)(5)(D) of the MMPA for specified activities other than military readiness activities. The MMPA does not define small numbers; so, in practice, where estimated numbers are available, NMFS compares the number of individuals taken to the most appropriate estimation of abundance of the relevant species or stock in our determination of whether an authorization is limited to small numbers of marine mammals. Additionally, other qualitative factors may be considered in the analysis, such as the temporal or spatial scale of the activities. Tables 10, 11, 12 and 13 provide numbers of take by Level A harassment and Level B harassment authorized. These are the numbers we use for purposes of the small numbers analysis.

The numbers of marine mammals that we authorize to be taken would be considered small relative to the relevant populations (less than 12 percent for all species) for the species for which abundance estimates are available. No known current worldwide or regional population estimates are available for ten species under NMFS' jurisdiction that could be incidentally taken as a result of the planned surveys: the pygmy right whale; pygmy sperm whale; True's beaked whale; short-finned pilot whale; false killer whale; bottlenose dolphin; short-beaked common dolphin; southern right whale dolphin; Risso's dolphin; and spectacled porpoise.

NMFS has reviewed the geographic distributions and habitat preferences of these species in determining whether the numbers of takes authorized herein are likely to represent small numbers. Pygmy right whales have a circumglobal distribution and occur throughout coastal and oceanic waters in the Southern Hemisphere (between 30 to 55° South) (Jefferson *et al.,* 2008). Pygmy sperm whales occur in deep waters on the outer continental shelf and slope in tropical to temperate waters of the Atlantic, Indian, and Pacific Oceans. True's beaked whales occur in the Southern hemisphere from the western Atlantic Ocean to the Indian Ocean to the waters of southern Australia and possibly New Zealand (Jefferson *et al.,* 2008). False killer whales generally occur in deep offshore tropical to temperate waters (between

50° North to 50° South) of the Atlantic, Indian, and Pacific Oceans (Jefferson *et al.,* 2008). Southern right whale dolphins have a circumpolar distribution and generally occur in deep temperate to sub-Antarctic waters in the Southern Hemisphere (between 30 to 65° South) (Jefferson *et al.,* 2008). Short-finned pilot whales are found in warm temperate to tropical waters throughout the world, generally in deep offshore areas (Olson and Reilly, 2002). Bottlenose dolphins are distributed worldwide through tropical and temperate inshore, coastal, shelf, and oceanic waters (Leatherwood and Reeves 1990, Wells and Scott 1999, Reynolds *et al.* 2000). Spectacled porpoises are believed to have a range that is circumpolar in the sub-Antarctic zone (with water temperatures of at least 1–10 °C) (Goodall 2002). The Risso's dolphin is a widely-distributed species, inhabiting primarily deep waters of the continental slope and outer shelf (especially with steep bottom topography), from the tropics through the temperate regions in both hemispheres (Kruse *et al.* 1999). The short-beaked common dolphin is an oceanic species that is widely distributed in tropical to cool temperate waters of the Atlantic and Pacific Oceans (Perrin 2002), from nearshore waters to thousands of kilometers offshore.

Based on the broad spatial distributions and habitat preferences of these species relative to the areas where the planned surveys are planned to occur, NMFS concludes that the authorized take of these species likely represent small numbers relative to the affected species' overall population sizes, though we are unable to quantify the take numbers as a percentage of population.

Based on the analysis contained herein of the planned activity (including the mitigation and monitoring measures) and the anticipated take of marine mammals, NMFS finds that small numbers of marine mammals will be taken relative to the population size of the affected species.

Unmitigable Adverse Impact Analysis and Determination

There are no relevant subsistence uses of the affected marine mammal stocks or species implicated by this action. Therefore, NMFS has determined that the total taking of affected species or stocks will not have an unmitigable adverse impact on the availability of such species or stocks for taking for subsistence purposes.

Endangered Species Act

Section 7(a)(2) of the Endangered Species Act of 1973 (ESA: 16 U.S.C. 1531 *et seq.*) requires that each Federal agency insure that any action it authorizes, funds, or carries out is not likely to jeopardize the continued existence of any endangered or threatened species or result in the destruction or adverse modification of designated critical habitat. To ensure ESA compliance for the issuance of IHAs, NMFS consults internally, in this case with the ESA Interagency Cooperation Division, whenever we propose to authorize take for endangered or threatened species.

The NMFS Permits and Conservation Division is authorizing the incidental take of six species of marine mammals which are listed under the ESA (the southern right, sei, fin, blue, and sperm whale and South Island Hector's dolphin). Under section 7 of the ESA, we initiated consultation with the NMFS OPR Interagency Cooperation Division for the issuance of this IHA. In October, 2017, the NMFS OPR Interagency Cooperation Division issued a Biological Opinion with an incidental take statement, which concluded that the issuance of the IHA was not likely to jeopardize the continued existence of the southern right, sei, fin, blue, and sperm whale and South Island Hector's dolphin. The Biological Opinion also concluded that the issuance of the IHA would not destroy or adversely modify designated critical habitat for these species.

Authorization

NMFS has issued an IHA to the L–DEO for the potential harassment of small numbers of 38 marine mammal species incidental to marine geophysical surveys in the southwest Pacific Ocean, provided the previously mentioned mitigation, monitoring and reporting requirements are incorporated.

Dated: November 21, 2017.

Donna Wieting,

Director, Office of Protected Resources, National Marine Fisheries Service.

[FR Doc. 2017–25516 Filed 11–24–17; 8:45 am]

BILLING CODE 3510–22–P