

DEPARTMENT OF COMMERCE**National Oceanic and Atmospheric Administration**

[RTID 0648-XA144]

Takes of Marine Mammals Incidental to Specified Activities; Taking Marine Mammals Incidental to a Marine Geophysical Survey in the Northeast Pacific Ocean

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, marine mammals during a marine geophysical survey in the northeast Pacific Ocean.

DATES: This Authorization is effective from May 19, 2021 through May 18, 2022.

FOR FURTHER INFORMATION CONTACT: Amy Fowler, 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: <https://www.fisheries.noaa.gov/permit/incidental-take-authorizations-under-marine-mammal-protection-act>. In case of problems accessing these documents, please call the contact listed above.

SUPPLEMENTARY INFORMATION:**Background**

The MMPA prohibits the “take” of marine mammals, with certain exceptions. 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 incidental take authorization may be provided to the public for review.

Authorization for incidental takings shall be granted if NMFS finds that the

taking will have a negligible impact on the species or stock(s) and will not have an unmitigable adverse impact on the availability of the species or stock(s) for taking for subsistence uses (where relevant). Further, NMFS must prescribe the permissible methods of taking and other “means of effecting the least practicable adverse impact” on the affected species or stocks and their habitat, paying particular attention to rookeries, mating grounds, and areas of similar significance, and on the availability of the species or stocks for taking for certain subsistence uses (referred to in shorthand as “mitigation”); and requirements pertaining to the mitigation, monitoring and reporting of the takings are set forth.

Summary of Request

On November 8, 2019, NMFS received a request from L-DEO for an IHA to take marine mammals incidental to a marine geophysical survey of the Cascadia Subduction Zone off the coasts of Washington, Oregon, and British Columbia, Canada. The application was deemed adequate and complete on March 6, 2020. L-DEO’s request is for take of small numbers of 31 species of marine mammals by Level A and Level B harassment. NMFS published a notice of proposed IHA for public review and comment on April 7, 2020 (85 FR 19580). On May 29, 2020, L-DEO informed NMFS that the project had been delayed by one year and would begin in June 2021.

Description of Proposed Activity*Overview*

Researchers from L-DEO, Woods Hole Oceanographic Institution (WHOI), and the University of Texas at Austin Institute of Geophysics (UTIG), with funding from the National Science Foundation (NSF), and in collaboration with researchers from Dalhousie University and Simon Fraser University (SFU) plan to conduct a high-energy seismic survey from the Research Vessel (R/V) *Marcus G Langseth (Langseth)* in the northeast Pacific Ocean beginning in June 2021. The seismic survey will be conducted at the Cascadia Subduction Zone off the coasts of Oregon, Washington, and British Columbia, Canada. The proposed two-dimensional (2-D) seismic survey will occur within the Exclusive Economic Zones (EEZs) of Canada and the United States, including U.S. state waters and Canadian territorial waters. The survey will use a 36-airgun towed array with a total discharge volume of ~6,600 cubic inches (in³) as an acoustic source, acquiring return signals using both a towed

streamer as well ocean bottom seismometers (OBSs) and ocean bottom nodes (OBNs).

The planned study will use 2-D seismic surveying and OBSs and OBNs to investigate the Cascadia Subduction Zone and provide data necessary to illuminate the depth, geometry, and physical properties of the seismicogenic portion and updip extent of the megathrust zone between the subducting Juan de Fuca plate and the overlying accretionary wedge/North American plate. These data will provide essential constraints for earthquake and tsunami hazard assessment in this heavily populated region of the Pacific Northwest. The primary objectives of the survey planned by researchers from L-DEO, WHOI, and UTIG is to characterize: (1) The deformation and topography of the incoming plate; (2) the depth, topography, and reflectivity of the megathrust; (3) sediment properties and amount of sediment subduction; and (4) the structure and evolution of the accretionary wedge, including geometry and reflectivity of fault networks, and how these properties vary along strike, spanning the full length of the margin and down dip across what may be the full width of the Cascadia Subduction Zone.

Dates and Duration

The survey is expected to last for 40 days, with 37 days of seismic operations, 2 days of equipment deployment, and 1 day of transit. R/V *Langseth* will likely leave out of and return to port in Newport, Oregon, during June–July 2021.

Specific Geographic Region

The survey will occur within ~42–51° N, ~124–130° W. Planned survey tracklines are shown in Figure 1. Some deviation in actual track lines, including the order of survey operations, could be necessary for reasons such as science drivers, poor data quality, inclement weather, or mechanical issues with the research vessel and/or equipment. The survey will occur within the EEZs of the United States and Canada, as well as in U.S. state waters and Canadian territorial waters, ranging in depth 60–4400 meters (m). A maximum of 6,540 kilometers (km) of transect lines will be surveyed. Most of the survey (69 percent) will occur in deep water (>1,000 m), 28 percent will occur in intermediate water (100–1,000 m deep), and 3 percent will take place in shallow water <100 m deep. Approximately 3.6 percent of the transect lines (234 km) will be undertaken in Canadian territorial waters (from 0–12 nautical miles (22.2 km) from shore), with most

effort in intermediate water depths. NMFS cannot authorize the incidental take of marine mammals in the territorial seas of foreign nations, as the MMPA does not apply in those waters.

However, NMFS has still calculated the level of incidental take in the entire activity area (including Canadian territorial waters) as part of the analysis supporting our determination under the

MMPA that the activity will have a negligible impact on the affected species.

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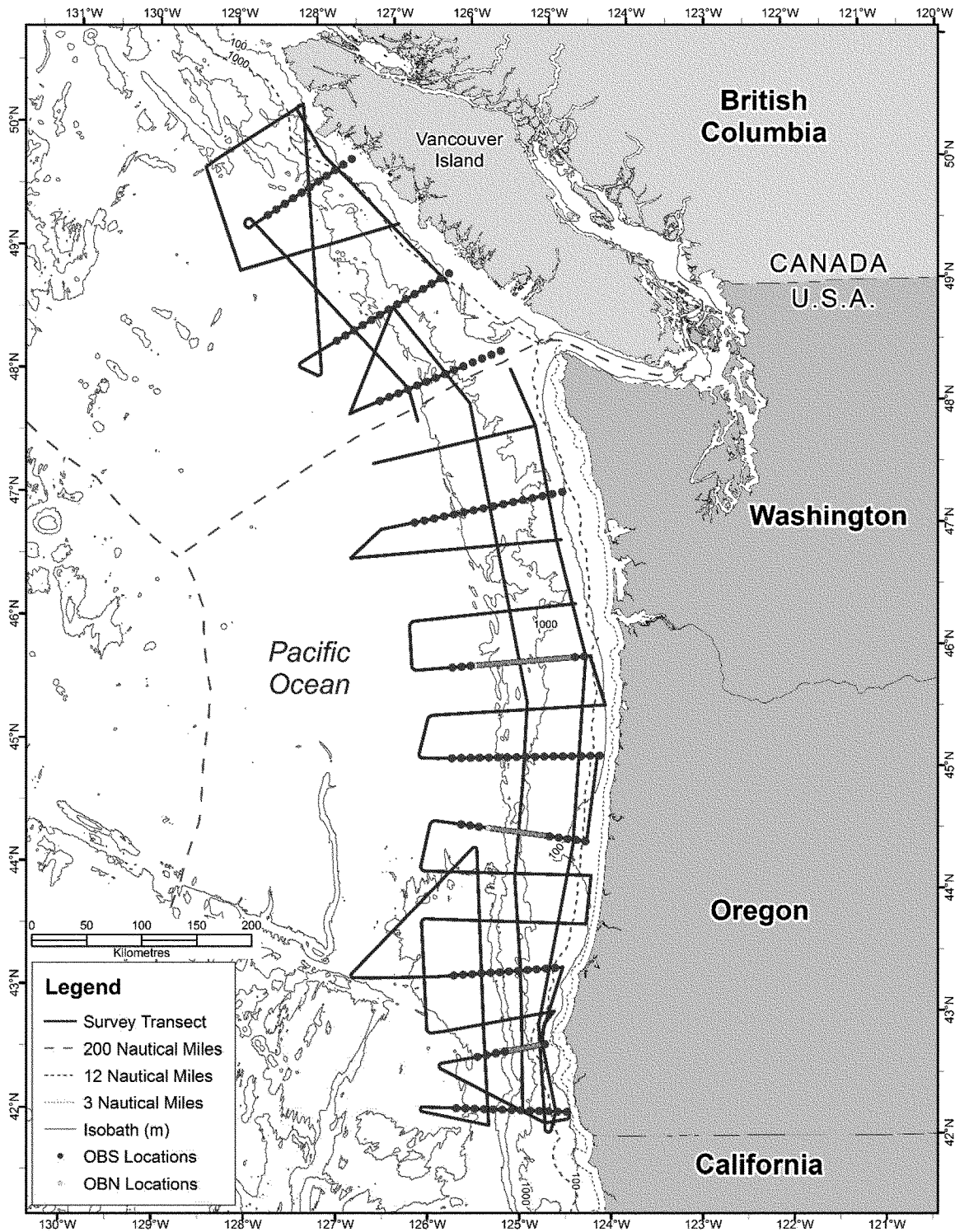


Figure 1. Location of the Planned Seismic Survey in the Northeast Pacific Ocean

Detailed Description of Specific Activity

The procedures to be used for the planned survey will be similar to those used during previous seismic surveys by L-DEO and will use conventional seismic methodology. The surveys will involve one source vessel, R/V *Langseth*. R/V *Langseth* will deploy an array of 36 airguns as an energy source with a total volume of ~6,600 in³. The array consists of 20 Bolt 1500LL airguns with volumes of 180 to 360 in³ and 16 Bolt 1900LLX airguns with volumes of 40 to 120 in³. The airgun array configuration is illustrated in Figure 2–11 of NSF and USGS's Programmatic Environmental Impact Statement (PEIS; NSF-USGS, 2011). The vessel speed during seismic operations will be approximately 4.2 knots (~7.8 km/hour) during the survey and the airgun array will be towed at a depth of 12 m. The receiving system will consist of one 15-km long hydrophone streamer, OBSs, and OBNs. R/V *Oceanus*, which is owned by NSF and operated by Oregon State University, will be used to deploy the OBSs and OBNs. As the airguns are towed along the survey lines, the hydrophone streamer will transfer the data to the on-board processing system, and the OBSs and OBNs will receive and store the returning acoustic signals internally for later analysis.

Long 15-km-offset multichannel seismic (MCS) data will be acquired along numerous 2-D profiles oriented perpendicular to the margin and located to provide coverage in areas inferred to be rupture patches during past earthquakes and their boundary zones. The survey will also include several strike lines including one continuous line along the continental shelf centered roughly over gravity-inferred fore-arc basins to investigate possible segmentation near the down-dip limit of the seismogenic zone. The margin normal lines will extend ~50 km seaward of the deformation front to image the region of subduction bend faulting in the incoming oceanic plate, and landward of the deformation front to as close to the shoreline as can be safely maneuvered. L-DEO plans to survey the southern transects off Oregon first, followed by the profiles off Washington and Vancouver Island, British Columbia.

The OBSs will consist of short-period multi-component OBSs from the Ocean Bottom Seismometer Instrument Center (OBSIC) and a large-N array of OBNs from a commercial provider to record shots along ~11 MCS margin-perpendicular profiles. OBSs will be deployed at 10-km spacing along ~10 profiles from Vancouver Island to

Oregon, and OBNs will be deployed at a 500-m spacing along a portion of three profiles off Oregon. Two OBS deployments will occur with a total of 115 instrumented locations. 60 OBSs will be deployed to instrument seven profiles off Oregon, followed by a second deployment of 55 OBSs to instrument four profiles off Washington and Vancouver Island. The first deployment off Oregon will occur prior to the start of the planned survey, after which R/V *Langseth* will acquire data in the southern portion of the study area. R/V *Oceanus* will start recovering the OBSs from deployment 1, and then re-deploy 55 OBSs off Washington and Vancouver Island, so that R/V *Langseth* can acquire data in the northern portion of the survey area. The OBSs have a height and diameter of ~1 m, and an ~80 kilogram (kg) anchor. To retrieve OBSs, an acoustic release transponder (pinger) is used to interrogate the instrument at a frequency of 8–11 kilohertz (kHz), and a response is received at a frequency of 11.5–13 kHz. The burn-wire release assembly is then activated, and the instrument is released to float to the surface from the anchor, which is not retrieved.

A total of 350 OBNs will be deployed: 179 nodes along one transect off northern Oregon, 107 nodes along a second transect off central Oregon, and 64 nodes along a third transect off southern Oregon. The nodes are not connected to each other; each node is independent from each other, and there are no cables attached to them. Each node has internal batteries; all data is recorded and stored internally. The nodes weigh 21 kg in air (9.5 kg in water). As the OBNs are small (330 millimeters (mm) × 289 mm × 115 mm), compact, not buoyant, and lack an anchor-release mechanism, they cannot be deployed by free-fall as with the OBSs. The nodes will be deployed and retrieved using a remotely operated vehicle (ROV); the ROV will be deployed from R/V *Oceanus*. OBNs will be deployed approximately 17 days prior to the start of the R/V *Langseth* cruise. The ROV will be fitted with a skid with capacity for 32 units, lowered to the seafloor, and towed at a speed of 0.6 knots at 5–10 m above the seafloor between deployment sites. After the 32 units are deployed, the ROV will be retrieved, the skid will be reloaded with another 32 units, and sent back to the seafloor for deployment, and so on. The ROV will recover the nodes 3 days after the completion of the R/V *Langseth* cruise. The nodes will be recovered one by one by a suction mechanism. Take of marine mammals is not expected to

occur incidental to L-DEO's use of OBSs and OBNs.

In addition to the operations of the airgun array, a multibeam echosounder (MBES), a sub-bottom profiler (SBP), and an Acoustic Doppler Current Profiler (ADCP) will be operated from R/V *Langseth* continuously during the seismic surveys, but not during transit to and from the survey area. All planned geophysical data acquisition activities will be conducted by L-DEO with on-board assistance by the scientists who have planned the studies. The vessel will be self-contained, and the crew will live aboard the vessel. Take of marine mammals is not expected to occur incidental to use of the MBES, SBP, or ADCP because they will be operated only during seismic acquisition, and it is assumed that, during simultaneous operations of the airgun array and the other sources, any marine mammals close enough to be affected by the MBES, SBP, and ADCP would already be affected by the airguns. However, whether or not the airguns are operating simultaneously with the other sources, given their characteristics (e.g., narrow downward-directed beam), marine mammals would experience no more than one or two brief ping exposures, if any exposure were to occur. Mitigation, monitoring, and reporting measures are described in detail later in this document (please see Mitigation and Monitoring and Reporting).

Comments and Responses

A notice of NMFS's proposal to issue an IHA to L-DEO was published in the **Federal Register** on April 7, 2020 (85 FR 19580). During the public comment period, NMFS received comment letters from the Marine Mammal Commission (Commission), Ecojustice (on behalf of the David Suzuki Foundation, Georgia Strait Alliance, Raincoast Conservation Foundation, and World Wildlife Fund Canada), Deep Green Wilderness, and a group of environmental non-governmental organizations (ENGOS) including the Center for Biological Diversity (CBD), Natural Resources Defense Council, Orca Relief Citizens Alliance, Friends of the San Juans, Whale and Dolphin Conservation, Friends of the Earth, Oceana, and Orca Conservancy. NMFS has posted the comments online at: <https://www.fisheries.noaa.gov/national/marine-mammal-protection/incidental-take-authorizations-research-and-other-activities>. Please see the letters for full details and rationale. A summary of the comments and our responses are provided here.

Comment 1: Ecojustice requested NMFS deny L-DEO's request for an IHA

because the survey will affect Southern Resident killer whale critical habitat (e.g., Swiftsure and La Perouse Banks) designated in Canada under the Canadian Species at Risk Act (SARA). The commenter asserts that noise production in these areas will both harm or harass individuals and constitute destruction of a portion of Canadian critical habitat.

Response: This comment is beyond the scope of NMFS' proposed action, which is to authorize take of marine mammals incidental to the proposed survey. NMFS does not allow or deny the survey itself, and NMFS' action of authorizing incidental take does not cause effects to critical habitat (in Canada or the U.S.). However, as part of their consultation with Canada's Department of Fisheries and Oceans (DFO) under Canada's SARA, L-DEO has removed all survey tracklines with associated ensonified areas that overlap with Canadian designated killer whale critical habitat at Swiftsure and La Perouse Bank (see Figure 1); therefore, the Canadian critical habitat will not be subject to destruction.

Comment 2: Ecojustice asserts that the critically endangered status of Southern Resident killer whales means there is no acceptable level of take for the species. Similarly, the ENGOs recommended NMFS not issue any take authorization until it has effectively reduced the take of Southern Resident killer whales to zero, citing concern that behavioral disturbance can interfere with reproduction and survival due to lost foraging time.

Response: NMFS disagrees that there is no acceptable level of take for Southern Resident killer whales, and the commenters have not demonstrated that any level of taking of Southern Resident killer whales would result in greater than a negligible impact on the stock. However, we do agree that additional effort to reduce impacts to Southern Resident killer whales is warranted to minimize to the extent practicable the amount of taking as well as the impact of taking that is authorized. In addition to removing tracklines within Canadian designated Southern Resident killer whale critical habitat at Swiftsure and La Perouse Banks (discussed above), L-DEO has removed and modified tracklines between Tillamook Head, Oregon and Barkley Sound, British Columbia, the area in which Southern Resident killer whales have the highest estimated densities (U.S. Navy 2019) and high-use foraging areas (NMFS 2019). The effect of these modifications to the survey plan is that, between these landmarks, the estimated Level B harassment

ensouffied area will not extend into water shallower than the 100-m depth contour. As a result, the total estimated take of Southern Resident killer whales has been reduced from 43 takes by Level B harassment in the proposed IHA (with an additional two takes within Canadian territorial waters, outside NMFS' jurisdiction) to 10 takes by Level B harassment (plus one take by Level B harassment within Canadian territorial waters), which is less than the population of any pod in the Southern Resident stock. This estimated take represents either 10 individual Southern Resident killer whales taken by Level B harassment once over the course of the survey, or a smaller number of individuals taken multiple times (e.g., a single matriline of five animals taken by Level B harassment on two separate days). By avoiding surveying in the areas with highest expected Southern Resident killer whale presence and foraging rates, the likelihood of survey activities resulting in interference in feeding and migration that could result in lost feeding opportunities or necessitate additional energy expenditure to find other good foraging opportunities or migration routes is greatly reduced. Procedural mitigations that avoid the likelihood of injury, such as shutdown measures, also further reduce the likelihood of more severe behavioral responses.

Comment 3: The ENGOs assert that NMFS inadequately considered the impacts of the proposed action on prey availability for Southern Resident killer whales, citing studies showing responses of fish to sound from seismic surveys. The ENGOs also state that NMFS must also consider the fitness of salmon being indirectly affected by the survey's impacts on herring, a key prey species for Pacific salmon.

Response: NMFS disagrees with the suggestion that we ignored effects to prey species. In fact, we considered relevant literature (including that cited by the ENGOs) in finding that the most likely impact of survey activity to prey species such as fish and invertebrates would be temporary avoidance of an area, with a rapid return to pre-survey distribution and behavior, and minimal impacts to recruitment or survival anticipated. While there is a lack of specific scientific information to allow an assessment of the duration, intensity, or distribution of effects to prey in specific locations at specific times and in response to specific surveys, NMFS' review of the available information does not indicate that such effects could be significant enough to impact marine mammal prey to the extent that marine mammal fitness would be affected. We

agree that seismic surveys could affect certain marine mammal prey species, and addressed these potential effects, as well as the potential for those effects to impact marine mammal populations, in our notice of proposed IHA (85 FR 19580; April 7, 2020). As stated in the notice of proposed IHA, our review of the available information and the specific nature of the activities considered herein suggest that L-DEO's proposed survey activities are not likely to have more than short-term adverse effects on any prey habitat or populations of prey species. Further, any impacts to prey species are not expected to result in significant or long-term consequences for individual marine mammals, or to contribute to adverse impacts on their populations.

For additional information on the effects of L-DEO's proposed survey on salmon species present in the survey area, we refer the reader to the Biological Opinion issued by the NMFS Office of Protected Resources, Interagency Cooperation Division (available at <https://www.fisheries.noaa.gov/national/marine-mammal-protection/incidental-take-authorizations-research-and-other-activities>). In summary, fish react to sounds which are especially strong and/or intermittent low-frequency sounds, and behavioral responses such as flight or avoidance are the most likely effects. However, the reaction of fish to airguns depends on the physiological state of the fish, past exposures, motivation (e.g., feeding, spawning, migration), and other environmental factors. While we agree that some studies have demonstrated that airgun sounds might affect the distribution and behavior of some fishes, potentially impacting foraging opportunities or increasing energetic costs (e.g., Fewtrell and McCauley, 2012; Pearson *et al.*, 1992; Skalski *et al.*, 1992; Santulli *et al.*, 1999; Paxton *et al.*, 2017), our review shows that the weight of evidence indicates either no or only a slight reaction to noise (e.g., Miller and Cripps, 2013; Dalen and Knutsen, 1987; Pena *et al.*, 2013; Chapman and Hawkins, 1969; Wardle *et al.*, 2001; Sara *et al.*, 2007; Jorgenson and Gyselman, 2009; Blaxter *et al.*, 1981; Cott *et al.*, 2012; Boeger *et al.*, 2006), and that, most commonly, while there may be impacts to fish as a result of noise from nearby airguns, any effects will be temporary. For example, investigators reported significant, short-term declines in commercial fishing catch rate of gadid fishes during and for up to five days after seismic survey operations, but the catch rate subsequently returned to normal (Engas

et al., 1996; Engas and Lokkeborg, 2002). Other studies have reported similar findings (*e.g.*, Hassel *et al.*, 2004). Skalski *et al.* (1992) also found a reduction in catch rates—for rockfish (*Sebastes spp.*) in response to controlled airgun exposure—but suggested that the mechanism underlying the decline was not dispersal but rather decreased responsiveness to baited hooks associated with an alarm behavioral response. A companion study showed that alarm and startle responses were not sustained following the removal of the sound source (Pearson *et al.*, 1992). Therefore, Skalski *et al.* (1992) suggested that the effects on fish abundance may be transitory, primarily occurring during the sound exposure itself. In some cases, effects on catch rates are variable within a study, which may be more broadly representative of temporary displacement of fish in response to airgun noise (*i.e.*, catch rates may increase in some locations and decrease in others) than any long-term damage to the fish themselves (Streever *et al.*, 2016).

Sound pressure levels (SPLs) of sufficient strength have been known to cause injury to fish and fish mortality and, in some studies, fish auditory systems have been damaged by airgun noise (McCauley *et al.*, 2003; Popper *et al.*, 2005; Song *et al.*, 2008). However, in most fish species, hair cells in the ear continuously regenerate and loss of auditory function likely is restored when damaged cells are replaced with new cells. Halvorsen *et al.* (2012) showed that a temporary threshold shift (TTS) of 4–6 decibel (dB) was recoverable within 24 hours for one species. Impacts would be most severe when the individual fish is close to the source and when the duration of exposure is long—both of which are conditions unlikely to occur for surveys that are necessarily transient in any given location and likely result in brief, infrequent noise exposure to prey species in any given area. For these surveys, the sound source is constantly moving, and most fish would likely avoid the sound source prior to receiving sound of sufficient intensity to cause physiological or anatomical damage. In addition, ramp-up may allow certain fish species the opportunity to move further away from the sound source.

NMFS considered the research referenced by the ENGOs and disagrees with the assertion that “[NMFS] irrationally discounts those impacts,” as well as with the commenters’ interpretation of the literature. A recent comprehensive review (Carroll *et al.*, 2017) found that results are mixed as to

the effects of airgun noise on the prey of marine mammals. While some studies suggest a change in prey distribution and/or a reduction in prey abundance following the use of seismic airguns, others suggest no effects or even positive effects in prey abundance. Regarding Paxton *et al.* (2017), which describes findings related to the effects of a 2014 seismic survey on a reef off of North Carolina, while the study did show a 78 percent decrease in observed nighttime abundance for certain species, it is important to note that the evening hours during which the decline in fish habitat use was recorded (via video recording) occurred on the same day that the seismic survey passed, and no subsequent data is presented to support an inference that the response was long-lasting. Additionally, given that the finding is based on video images, the lack of recorded fish presence does not support a conclusion that the fish actually moved away from the site or suffered any serious impairment because fish may remain present yet not be recorded on video. In summary, this particular study corroborates prior studies demonstrating a startle response or short-term displacement.

The Carroll *et al.* (2017) review article concluded that, while laboratory results provide scientific evidence for high-intensity and low-frequency sound-induced physical trauma and other negative effects on some fish and invertebrates, the sound exposure scenarios in some cases are not realistic to those encountered by marine organisms during routine seismic operations. The review finds that there has been no evidence of reduced catch or abundance following seismic activities for invertebrates, and that there is conflicting evidence for fish with catch observed to increase, decrease, or remain the same. Further, where there is evidence for decreased catch rates in response to airgun noise, these findings provide no information about the underlying biological cause of catch rate reduction (Carroll *et al.*, 2017).

In summary, the scientific literature demonstrates that impacts of seismic surveys on marine mammal prey species will likely be limited to behavioral responses, the majority of prey species will be capable of moving out of the area during surveys, a rapid return to normal recruitment, distribution, and behavior for prey species is anticipated, and, overall, impacts to prey species, if any, will be minor and temporary. Prey species exposed to sound might move away from the sound source, experience TTS, experience masking of biologically relevant sounds, or show no obvious

direct effects. Mortality from decompression injuries is possible in close proximity to a sound, but only limited data on mortality in response to airgun noise exposure are available (Hawkins *et al.*, 2014). The most likely impacts for most prey species in a given survey area would be temporary avoidance of the area. Surveys using towed airgun arrays move through an area relatively quickly, limiting exposure to multiple impulsive sounds. In all cases, sound levels would return to ambient once a survey moves out of the area or ends and the noise source is shut down and, when exposure to sound ends, behavioral and/or physiological responses are expected to end relatively quickly (McCauley *et al.*, 2000b). The duration of fish avoidance of a given area after survey effort stops is unknown, but a rapid return to normal recruitment, distribution, and behavior is anticipated. While the potential for disruption of spawning aggregations or schools of important prey species can be meaningful on a local scale, the mobile and temporary nature of most surveys and the likelihood of temporary avoidance behavior suggest that impacts would be minor.

NMFS believes that no evidence is presented to contradict our conclusions regarding likely impacts to marine mammals due to effects on prey species, *i.e.*, that impacts of the specified activity are not likely to have more than short-term adverse effects on any prey habitat or populations of prey species, and that any effects that do occur are not expected to result in significant or long-term consequences for individual marine mammals, or to contribute to adverse impacts on their populations.

Finally, we note that the National Science Foundation (NSF) is funding a study run by Oregon State University to assess the effects of L-DEO’s survey activities on rockfish, Dungeness crab, and longnose skate. While the species chosen for this study do not represent important prey species for Southern Resident killer whales, which were the primary concern of the ENGOs, the study will provide important information on the effects of seismic surveys on nearshore species.

Comment 4: The ENGOs commented that in making the negligible impact determination, NMFS underestimated the potential harm to the relevant stocks and distinct population segments (DPSs) of humpback whales, adding that the stock definitions for humpback whales are outdated and should match the DPSs as defined under the Endangered Species Act. The ENGOs assert that the takes proposed by NMFS are more than

negligible for the California/Oregon/Washington stock because the annual rate of serious injury and mortality (40.2 humpback whales per year) exceeds the potential biological removal (PBR; 33.4 humpbacks per year). Additionally, for both humpback and blue whales, the ENGOs assert that take by Level A harassment in the form of permanent hearing impairment amounts to serious injury, therefore the negligible impact determination overly relies on the assumption that there will be no serious injury or mortality from the seismic survey.

Response: First, NMFS agrees that the alignment of MMPA stocks and Endangered Species Act (ESA) DPSs of humpback whales is important, and is actively working on rectifying the differences between stocks and DPSs. However, this issue is outside the scope of the action considered here. NMFS disagrees with the ENGOs' assertion that the authorized take of humpback or blue whales (or any species of marine mammal) by Level A harassment constitutes serious injury or has any relation to the PBR of the stock. PBR is defined in the MMPA (16 U.S.C. 1362(20)) 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 is a measure to be considered when evaluating the effects of mortality or serious injury on a marine mammal species or stock. There is no evidence that permanent threshold shift (PTS) can lead to mortality such that it should be considered "serious injury" or "removing" an individual from a stock. Therefore, it is not appropriate to use the PBR metric to directly evaluate the effects of Level A harassment (*e.g.*, PTS) on a stock in the manner suggested by the ENGOs. Given the short duration of exposure, only low levels of hearing impairment are likely to occur, and would not affect the fitness of individual marine mammals or populations.

As shown above, the PBR metric concerns levels of allowable removals from a population. Therefore, the PBR metric is not directly related to an assessment of negligible impact for this specified activity, which does not involve any expected potential for serious injury or mortality. PBR is not an appropriate metric with which to evaluate Level B harassment. However, we appropriately do consider levels of ongoing anthropogenic mortality from other sources, such as vessel strike, in relation to calculated PBR values as an important contextual factor in our

negligible impact analysis, but a direct comparison of takes by harassment to the PBR value is not germane. While it is conceptually possible to link disturbance to potential fitness impacts to individuals over time (*e.g.*, population consequences of disturbance), we have no evidence that is the case here and the take authorized here is not expected to affect the reproduction or survivorship of any individual marine mammals.

Comment 5: The ENGOs assert that the negligible impact determination also relies on an expectation that marine mammals would be likely to move away from the sound source, which contradicts other statements from the notice of proposed IHA that avoidance is not assumed to occur because "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." The commenters go on to state that animals avoiding the sound source still provokes an adverse behavioral reaction which displaces the animal from preferred habitat and potentially toward predators or shore with a risk of stranding.

Response: NMFS does not rely on avoidance behaviors to make its negligible impact determination. NMFS agrees that avoidance of preferred habitat may temporarily limit optimal feeding or other biologically important behaviors. NMFS does not adjust take estimates based on the assumption that marine mammals would avoid the area, as the avoidance itself may constitute behavioral harassment. However, avoiding the sound source prevents the animal from exposure to the highest source levels, reducing the likelihood of temporary (Level B harassment) or permanent hearing impairment (Level A harassment), and reducing the intensity and/or duration of the harassment event. The avoidance is expected to be temporary, and animals are likely to return to the area after the survey vessel has passed through. In consideration of the likelihood of animals to independently avoid the sound source, and the mitigation requirements to shut down the airgun array if animals do approach within a certain distance, NMFS finds that the level of take expected to result from the survey is unlikely to have any impact on fitness or reproduction of individual animals, let alone populations.

Comment 6: Citing studies suggesting that blue whales are especially sensitive to high intensity anthropogenic noise, such as mid-frequency sonar (*e.g.*, Goldbogen *et al.*, 2013), the ENGOs suggest that NMFS' consideration of the

impact of the proposed activities on blue whales may underestimate the adverse impacts on the stock.

Response: As discussed in the notice of proposed IHA, Goldbogen *et al.* (2013) found blue whales feeding on highly concentrated prey in shallow depths were less likely to respond and cease foraging than whales feeding on deep, dispersed prey when exposed to simulated sonar sources, suggesting that the benefits of feeding for blue whales foraging on high-density prey may outweigh perceived harm from the acoustic stimulus, such as the seismic survey. Southall *et al.* (2019b) observed that after exposure to simulated and operational mid-frequency active sonar, more than 50 percent of blue whales in deep-diving states responded to the sonar, while no behavioral response was observed in shallow-feeding blue whales. Southall *et al.* (2019b) noted that the behavioral responses they observed were generally brief, of low to moderate severity, and highly dependent on exposure context (behavioral state, source-to-whale horizontal range, and prey availability). The proposed survey area does not represent a major feeding area for blue whales and any disruption of feeding is likely to be short-term and of low to sometimes moderate severity, with no anticipated effect on reproduction or survival for individual whales or the population as a whole.

Comment 7: Deep Green Wilderness and the ENGOs noted that North Pacific right whales have been documented within the survey area, and recommended NMFS consider the potential effects of the survey on the species. Deep Green Wilderness referred to sightings of a North Pacific right whale at Swiftsure Bank in 2013, and the ENGOs noted an account of a sighting of a North Pacific right whale off northern Vancouver Island in May 2020.

Response: We thank the organizations for providing information on recent observations of North Pacific right whales in the survey area. NMFS shares the commenters' concern regarding the status of this endangered species. Although sightings have been reported in the survey area, the rate of sightings is less than one per year and NMFS has determined the likelihood of the proposed 37-day survey encountering a North Pacific right whale is discountable. However, in the very unlikely event a North Pacific right whale is detected during the survey, at any distance, L-DEO must immediately shut down the airgun array to prevent exposure to potentially injurious sound levels and to minimize the intensity and

duration of any sound exposure, and must immediately report the observation to NMFS and Canada's DFO to further inform research on the distribution of the species.

Comment 8: The ENGOs challenge NMFS' preliminary finding that the proposed take numbers are of no more than small numbers of marine mammals. The ENGOs reference a court decision that they assert supports a lower "small numbers" threshold, and highlight certain species for which the commenters deem the take to be too high.

Response: The reference to a supposed take limit of 12 percent for small numbers comes from a 2003 district court opinion (*Natural Resources Defense Council v. Evans*, 279 F. Supp. 2d 1129 (N.D. Cal. 2003)). However, given the particular administrative record and circumstances in that case, including the fact that our small numbers finding for the challenged incidental take rule was based on an invalid regulatory definition of small numbers, we view the district court's opinion regarding 12 percent as dicta. Moreover, since that time the Ninth Circuit Court of Appeals has upheld a small numbers finding that was not based on a quantitative calculation. (*Center for Biological Diversity v. Salazar*, 695 F.3d 893 (9th Cir. 2012)). To maintain an interpretation of small numbers as a proportion of a species or stock that does not conflate with negligible impact, we use the following framework. A plain reading of "small" implies as corollary that there also could be "medium" or "large" numbers of animals from the species or stock taken. We therefore use a simple approach that establishes equal bins corresponding to small, medium, and large proportions of the population abundance.

NMFS's practice for making small numbers determinations is to compare the number of individuals estimated and authorized to be taken (often using estimates of total instances of take, without regard to whether individuals are exposed more than once) against the best available abundance estimate for that species or stock. We note, however, that although NMFS's implementing regulations require applications for incidental take to include an estimate of the marine mammals to be taken, there is nothing in paragraphs (A) or (D) of section 101(a)(5) that requires NMFS to quantify or estimate numbers of marine mammals to be taken for purposes of evaluating whether the number is small. (See *CBD v. Salazar*.) While it can be challenging to predict the numbers of individual marine mammals that will be

taken by an activity (again, many models calculate instances of take and are unable to account for repeated exposures of individuals), in some cases we are able to generate a reasonable estimate utilizing a combination of quantitative tools and qualitative information. When it is possible to predict with relative confidence the number of individual marine mammals of each species or stock that are likely to be taken, the small numbers determination should be based directly upon whether or not these estimates exceed one third of the stock abundance. In other words, consistent with past practice, when the estimated number of individual animals taken (which may or may not be assumed as equal to the total number of takes, depending on the available information) is up to, but not greater than, one third of the species or stock abundance, NMFS will determine that the numbers of marine mammals taken of a species or stock are small.

Finally, regarding the species highlighted by the ENGOs with proposed take above 20 percent of the stock (Pacific white-sided dolphin, Risso's dolphin, pygmy and dwarf sperm whale, Dall's porpoise, harbor porpoise, northern fur seal and harbor seal), the revised take estimates for all of the aforementioned stocks aside from the California/Oregon/Washington stock of Dall's porpoise and Northern Oregon/Washington Coast stock of harbor porpoise represent under one-third of the stock. The analysis of these two stocks is discussed further in the Small Numbers section of this notice.

Comment 9: The ENGOs further object to NMFS' small numbers determination for the Southern Resident killer whale, for which NMFS proposed to authorize take of more than 57 percent of the stock. Regarding the Southern Resident killer whale take estimate, the ENGOs disagree with NMFS' assumption that the number of individual Southern Resident killer whales taken by Level B harassment will be fewer than the total estimated instances of take due to the historical pattern of Southern Resident killer whales occupying the inland waters of the Salish Sea during the summer months. Additionally, because they travel in pods, the commenters assert that there is risk of exposure of an entire pod to airgun blasting, and state that they are unclear whether such aggregation has been considered.

Response: The ENGO's objection to NMFS' small numbers threshold was addressed in the previous response, but we also note here that using the revised survey tracklines, the authorized take of Southern Resident killer whales

represents only 13.7 percent of the stock, which falls under NMFS' threshold for small numbers, even if all takes represent different individuals taken by Level B harassment. The authorized take is less than the size of any pod of Southern Residents (J, K, or L pods), and is more likely to represent a single matriline (typically two to nine killer whales; Weiss *et al.*, 2020) exposed to the survey on one or two days of the survey. NMFS agrees that the seasonal distribution of Southern Resident killer whales in recent years has deviated from the historical pattern of residency within the Salish Sea (*e.g.*, Shields *et al.*, 2018), but note that our discussion of the distribution of Southern Resident killer whales was in the context of the U.S. Navy density models used to estimate take, which were created with the assumption that the entire population was either within the Salish Sea or outside the Salish Sea on the outer coast at any given time (U.S. Navy 2019). Southern Resident killer whales may be encountered during the survey along the coast, but the revised tracklines are expected to reduce the likelihood of whole pods being exposed to sound from the seismic survey by avoiding surveying in areas of expected high Southern Resident killer whale occurrence. Additionally, L-DEO is required to shut down the airgun array if killer whales (of any ecotype) are observed at any distance. Killer whales are highly visible animals, especially when traveling as large pods as the ENGOs suggest, and we expect PSOs will be able to detect killer whales at sufficient distances to implement shutdown procedures to avoid exposing large pods of killer whales to sounds from the survey.

Comment 10: The ENGOs commented that NMFS must include estimated takes off Canada in making the small numbers determination, adding that since the take prohibition applies outside U.S. waters, the Service must make a small numbers determination that analyzes all of the estimated take. The commenters state that, accordingly, NMFS must demonstrate compliance with these standards and may not issue the authorization without fully analyzing and authorizing all take contemplated under this action. The commenters also state that it is unclear in the small numbers determination whether the takes in Canadian waters have been taken into consideration. The ENGOs also expressed concern that the small numbers determination was based on 1 year of activities and did not consider

the potential renewal of the authorization.

Response: NMFS has not authorized any take of marine mammals within the territorial waters of Canada. An estimate of take that may occur within Canadian territorial waters is presented in Table 11, and the take has been considered in our negligible impact determination as part of the larger implications of the survey on the marine mammal populations and habitat in the survey area. However, our small numbers analysis applies only to the take we have authorized. NMFS has made the necessary small numbers and negligible impact determinations for this authorization.

The ENGOs appear to misunderstand the context in which a potential renewal IHA could be issued for this activity, as well as the requirements for issuing a renewal IHA. Although renewal IHAs in general may be issued in appropriate circumstances for up to another year of identical or nearly identical activities as were covered by the initial IHA, this context is not relevant to the proposed seismic survey. L-DEO would not conduct the survey as planned and then duplicate the survey activities in a subsequent year. Regardless, NMFS would not grant a renewal IHA in those circumstances. However, if the planned survey were unexpectedly delayed for another year, NMFS could consider a request for issuance of a renewal IHA. In order to do so, NMFS would need to review all relevant information, including the status of the affected species or stocks and any other pertinent information, such as information relevant to the small numbers determination. In short, potential consideration of a renewal in this context would necessarily be associated with the same activity associated with this IHA, in the event that it is not conducted during the period of effectiveness for this IHA, and would entail a review of all relevant information to ensure that the findings NMFS has made in support of issuance of this initial IHA remain valid.

Comment 11: The ENGOs recommended NMFS analyze the effects of L-DEO's use of a multi-beam echosounder (MBES) associated with the survey, noting that the proposed equipment (the Kongsberg Simrad E122) is similar to another Kongsberg system that was closely associated with a 2008 mass stranding of melon-headed whales in Madagascar. The ENGOs recommended NMFS apply its take threshold for continuous noise sources (120 dB) rather than its threshold for intermittent sources (160 dB) to the proposed system and revise its take

estimates accordingly. Further, NMFS should not assume, for purposes of making its negligible impact determinations, that the severity of impacts from an airgun array operating concurrently with such an echosounder system would be equivalent to that of an airgun array operating alone.

Response: Although it is correct that an investigation of the stranding event referenced by the ENGOs indicated that use of a high-frequency mapping system (12-kilohertz (kHz) MBES) was the most plausible and likely initial behavioral trigger of the event (with the caveat that there was no unequivocal and easily identifiable single cause), the panel also noted several site- and situation-specific secondary factors that may have contributed to the avoidance responses that led to the eventual entrapment and mortality of the whales (Southall *et al.*, 2013). Specifically, regarding survey patterns prior to the event and in relation to bathymetry, the vessel transited in a north-south direction on the shelf break parallel to the shore, ensonifying deep-water habitat prior to operating intermittently in a concentrated area offshore from the stranding site. This may have trapped the animals between the sound source and the shore, thus driving them towards the lagoon system. Shoreward-directed surface currents and elevated chlorophyll levels in the area preceding the event may also have played a role. The risk of similar events recurring is expected to be very low, given the extensive use of active acoustic systems used for scientific and navigational purposes worldwide on a daily basis and the lack of direct evidence of such responses previously reported. The only report of a stranding that may be associated with this type of sound source is the one reported in Madagascar.

NMFS disagrees with the recommendation that the 120 dB threshold should be applied to estimate takes incidental to use of the MBES. Sound sources can be divided into broad categories based on various criteria or for various purposes. As discussed by Richardson *et al.* (1995), source characteristics include strength of signal amplitude, distribution of sound frequency and, importantly in context of these thresholds, variability over time. With regard to temporal properties, sounds are generally considered to be either continuous or transient (*i.e.*, intermittent). Continuous sounds, which are produced by the industrial noise sources for which the 120-dB behavioral harassment threshold was selected, are simply those whose sound pressure level remains above

ambient sound during the observation period (ANSI, 2005). Intermittent sounds are defined as sounds with interrupted levels of low or no sound (NIOSH, 1998). Simply put, a continuous noise source produces a signal that continues over time, while an intermittent source produces signals of relatively short duration having an obvious start and end with predictable patterns of bursts of sound and silent periods (*i.e.*, duty cycle) (Richardson and Malme, 1993). It is this fundamental temporal distinction that is most important for categorizing sound types in terms of their potential to cause a behavioral response. For example, Gomez *et al.* (2016) found a significant relationship between source type and marine mammal behavioral response when sources were split into continuous (*e.g.*, shipping, icebreaking, drilling) versus intermittent (*e.g.*, sonar, seismic, explosives) types. In addition, there have been various studies noting differences in responses to intermittent and continuous sound sources for other species (*e.g.*, Neo *et al.*, 2014; Radford *et al.*, 2016; Nichols *et al.*, 2015).

Sound sources may also be categorized based on their potential to cause physical damage to auditory structures and/or result in threshold shifts. In contrast to the temporal distinction discussed above, the most important factor for understanding the differing potential for these outcomes across source types is simply whether the sound is impulsive or not. Impulsive sounds, such as those produced by airguns, are defined as sounds which are typically transient, brief (<1 second (sec)), broadband, and consist of a high peak pressure with rapid rise time and rapid decay (ANSI, 1986; NIOSH, 1998). These sounds are generally considered to have greater potential to cause auditory injury and/or result in threshold shifts. Non-impulsive sounds can be broadband, narrowband or tonal, brief or prolonged, continuous or intermittent, and typically do not have the high peak pressure with rapid rise/decay time that impulsive sounds do (ANSI, 1995; NIOSH, 1998). Because the selection of the 160-dB behavioral threshold was focused largely on airgun signals, it has historically been commonly referred to as the "impulse noise" threshold (including by NMFS). However, this longstanding confusion in terminology—*i.e.*, the erroneous impulsive/continuous dichotomy—presents a narrow view of the sound sources to which the thresholds apply, and inappropriately implies a limitation in scope of applicability for the 160-dB behavioral threshold in particular.

An impulsive sound is by definition intermittent; however, not all intermittent sounds are impulsive. Many sound sources for which it is generally appropriate to consider the authorization of incidental take are in fact either impulsive (and intermittent) (e.g., impact pile driving) or continuous (and non-impulsive) (e.g., vibratory pile driving). However, scientific sonars (such as MBESs) present a less common case where the sound produced is considered intermittent but non-impulsive. We note also the commenters' assertion that the system produces "virtually continuous noise output" in support of their recommendation to apply the continuous noise threshold to evaluation of this source. In context of marine mammal hearing, this would mean that the interval between signals would not be discernible to the animal, rendering them effectively continuous. However, echosounder signals are emitted in a similar fashion as odontocete echolocation click trains. Research indicates that marine mammals, in general, have extremely fine auditory temporal resolution and can detect each signal separately (e.g., Au *et al.*, 1988; Dolphin *et al.*, 1995; Supin and Popov, 1995; Mooney *et al.*, 2009), especially for species with echolocation capabilities. Therefore, it is highly unlikely that marine mammals would perceive echosounder signals as being continuous.

Given the existing paradigm—dichotomous thresholds appropriate for generic use in evaluating the potential for behavioral harassment resulting from exposure to continuous or intermittent sound sources—the ENGOs do not adequately explain why potential harassment from an intermittent sound source should be evaluated using a threshold developed for use with continuous sound sources. Therefore, we have not reevaluated L-DEO's use of the MBES using the 120 dB continuous noise threshold.

As discussed in the notice of proposed IHA, due to the lower source level of the MBES relative to the R/V *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. 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. The ENGOs do not offer any evidence in support of their contention that potentially greater impacts than we have considered should be assumed likely in relation to use of this source.

Comment 12: The ENGOs comment that NMFS has failed to implement "means of effecting the least practicable impact" on marine mammals and assert that NMFS relies on mitigation measures that are known to be ineffective (e.g., real-time detection-based measures).

Response: Under section 101(a)(5)(D) of the MMPA, NMFS must set forth the permissible methods of taking by harassment 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 subsistence uses (hereinafter referred to as least practicable adverse impact). NMFS does not have a regulatory definition for least practicable adverse impact.

NMFS disagrees with the assertion that we have failed to meet the least practicable adverse impact standard in this case. NMFS considered all recommended mitigation in the context of both the reduction of impacts on marine mammal species and stocks and their habitat and the practicability of such mitigation in reaching the required set of measures that we believe satisfy the least practicable adverse impact standard.

NMFS' evaluation of potential mitigation measures includes consideration of two primary factors:

(1) The manner in which, and the degree to which, implementation of the potential measure(s) is expected to reduce adverse impacts to marine mammal species or stocks, their habitat, and their availability for subsistence uses (where relevant). This analysis considers such things as the nature of the potential adverse impact (such as likelihood, scope, and range), the likelihood that the measure will be effective if implemented, and the likelihood of successful implementation.

(2) The practicability of the measures for applicant implementation.

Practicability of implementation may consider such things as cost, impact on activities, personnel safety, and practicality of implementation.

While the language of the least practicable adverse impact standard calls for minimizing impacts to affected species or stocks and their habitat, NMFS recognizes that the reduction of impacts to those species or stocks accrues through the application of mitigation measures that limit impacts to individual animals. Accordingly, NMFS' analysis focuses on measures that are designed to avoid or minimize impacts on individual marine mammals that are likely to increase the probability or severity of population-level effects.

While direct evidence of impacts to species or stocks from a specified activity is rarely available, and additional study is still needed to understand how specific disturbance events affect the fitness of individuals of certain species, there have been improvements in understanding the process by which disturbance effects are translated to the population. With recent scientific advancements (both marine mammal energetic research and the development of energetic frameworks), the relative likelihood or degree of impacts on species or stocks may often be inferred given a detailed understanding of the activity, the environment, and the affected species or stocks. This same information is used in the development of mitigation measures and helps us understand how mitigation measures contribute to lessening effects (or the risk thereof) to species or stocks. NMFS also acknowledges that there is always the potential that new information, or a new recommendation that had not previously been considered, becomes available and necessitates re-evaluation of mitigation measures to see if further reductions of population impacts are possible and practicable.

In the evaluation of specific measures, the details of the specified activity will necessarily inform each of the two primary factors discussed above (expected reduction of impacts and practicability) and are carefully considered to determine the types of mitigation that are appropriate under the least practicable adverse impact standard. Analysis of how a potential mitigation measure may reduce adverse impacts on a marine mammal stock or species and practicability of implementation are not issues that can be meaningfully evaluated through a yes/no lens. The manner in which, and the degree to which, implementation of a measure is expected to reduce impacts, as well as its practicability, can

vary widely. For example, a time-area restriction could be of very high value for reducing the potential for, or severity of, population-level impacts (e.g., avoiding disturbance of feeding females in an area of established biological importance) or it could be of lower value (e.g., decreased disturbance in an area of high productivity but of less firmly established biological importance). Regarding practicability, a measure might involve restrictions in an area or time that impede the operator's ability to acquire necessary data (higher impact), or it could mean incremental delays that increase operational costs but still allow the activity to be conducted (lower impact). A responsible evaluation of "least practicable adverse impact" will consider the factors along these realistic scales. Expected effects of the activity and of the mitigation as well as status of the stock all weigh into these considerations. Accordingly, the greater the likelihood that a measure will contribute to reducing the probability or severity of adverse impacts to the species or stock or their habitat, the greater the weight that measure is given when considered in combination with practicability to determine the appropriateness of the mitigation measure, and vice versa. Consideration of these factors is discussed in greater detail below.

1. Reduction of Adverse Impacts to Marine Mammal Species or Stocks and Their Habitat

The emphasis given to a measure's ability to reduce the impacts on a species or stock considers the degree, likelihood, and context of the anticipated reduction of impacts to individuals (and how many individuals) as well as the status of the species or stock.

The ultimate impact on any individual from a disturbance event (which informs the likelihood of adverse species- or stock-level effects) is dependent on the circumstances and associated contextual factors, such as duration of exposure to stressors. Though any proposed mitigation needs to be evaluated in the context of the specific activity and the species or stocks affected, measures with the following types of effects have greater value in reducing the likelihood or severity of adverse species- or stock-level impacts: Avoiding or minimizing injury or mortality; limiting interruption of known feeding, breeding, mother/young, or resting behaviors; minimizing the abandonment of important habitat (temporally and spatially); minimizing the number of individuals subjected to

these types of disruptions; and limiting degradation of habitat. Mitigating these types of effects is intended to reduce the likelihood that the activity will result in energetic or other types of impacts that are more likely to result in reduced reproductive success or survivorship. It is also important to consider the degree of impacts that are expected in the absence of mitigation in order to assess the added value of any potential measures. Finally, because the least practicable adverse impact standard gives NMFS discretion to weigh a variety of factors when determining appropriate mitigation measures and because the focus of the standard is on reducing impacts at the species or stock level, the least practicable adverse impact standard does not compel mitigation for every kind of take, or every individual taken, if that mitigation is unlikely to meaningfully contribute to the reduction of adverse impacts on the species or stock and its habitat, even when practicable for implementation by the applicant.

The status of the species or stock is also relevant in evaluating the appropriateness of potential mitigation measures in the context of least practicable adverse impact. The following are examples of factors that may (either alone, or in combination) result in greater emphasis on the importance of a mitigation measure in reducing impacts on a species or stock: The stock is known to be decreasing or status is unknown, but believed to be declining; the known annual mortality (from any source) is approaching or exceeding the PBR level; the affected species or stock is a small, resident population; or the stock is involved in a UME or has other known vulnerabilities, such as recovering from an oil spill.

Habitat mitigation, particularly as it relates to rookeries, mating grounds, and areas of similar significance, is also relevant to achieving the standard and can include measures such as reducing impacts of the activity on known prey utilized in the activity area or reducing impacts on physical habitat. As with species- or stock-related mitigation, the emphasis given to a measure's ability to reduce impacts on a species or stock's habitat considers the degree, likelihood, and context of the anticipated reduction of impacts to habitat. Because habitat value is informed by marine mammal presence and use, in some cases there may be overlap in measures for the species or stock and for use of habitat.

NMFS considers available information indicating the likelihood of any measure to accomplish its objective. If evidence shows that a measure has

not typically been effective nor successful, then either that measure should be modified or the potential value of the measure to reduce effects should be lowered.

2. Practicability

Factors considered may include those costs, impact on activities, personnel safety, and practicality of implementation.

In carrying out the MMPA's mandate for this action, NMFS applies the previously described context-specific balance between the manner in which and the degree to which measures are expected to reduce impacts to the affected species or stocks and their habitat and practicability for operators. The effects of concern (*i.e.*, those with the potential to adversely impact species or stocks and their habitat), addressed previously in the Potential Effects of the Specified Activity on Marine Mammals and Their Habitat section of the notice of proposed IHA, include auditory injury, severe behavioral reactions, disruptions of critical behaviors, and to a lesser degree, masking and impacts on acoustic habitat. Here, we focus on measures with proven or reasonably presumed ability to avoid or reduce the intensity of acute exposures that have potential to result in these anticipated effects with an understanding of the drawbacks or costs of these requirements, as well as time-area restrictions that would avoid or reduce both acute and chronic impacts. To the extent of the information available to NMFS, we considered practicability concerns, as well as potential undesired consequences of the measures, *e.g.*, extended periods using the acoustic source due to the need to reshoot lines. NMFS also recognizes that instantaneous protocols, such as shutdown requirements, are not capable of avoiding all acute effects, and are not suitable for avoiding many cumulative or chronic effects and do not provide targeted protection in areas of greatest importance for marine mammals. Therefore, in addition to a basic suite of seismic mitigation protocols, we also consider measures that may or may not be appropriate for other activities (*e.g.*, survey plan modifications specific to the action discussed herein), but that are warranted here given the potential for impacts to a stock of particular concern (*i.e.*, Southern Resident killer whales) (see Negligible Impact Analysis and Determination), and the information we have regarding habitat for certain species.

We appreciate the ENGOs suggestions for additional mitigation and monitoring

requirements. However, we note that many of the recommendations require a scale of effort that is not commensurate to the scale of either the underlying activities or the anticipated impacts of the activities on marine mammals covered by this authorization. In other words, many of the recommended measures would necessitate complex and expensive survey designs and methods that are not reasonable in the context of an activity that consists of one mobile source moving across a large area and that will last for only 37 days. As described in the *Mitigation Measures Considered but Eliminated* section of this notice, out of concern for the status of Southern Resident killer whales and proposed critical habitat, NMFS considered implementing a closure area and prohibiting L-DEO from conducting survey operations between the 200-m isobath and the coastline. However, as the main goal of L-DEO's survey is to examine the geologic features of the Cascadia subduction zone along the coastal shelf, NMFS determined that this exclusion would not be practicable. NMFS did ultimately incorporate mitigation measures that are specific to this action and beyond that which is typically required for L-DEO's surveys. Specifically, we have required L-DEO to revise their proposed tracklines to avoid surveying in waters less than 100 m deep in areas with highest estimated Southern Resident killer whale occurrence. We have determined this measure, which will significantly reduce impacts to Southern Resident killer whales while allowing L-DEO to complete its survey objectives, to be practicable. Additionally, L-DEO must use a second vessel traveling ahead of the R/V *Langseth* with additional PSOs to increase the likelihood of detecting Southern Resident killer whales and, therefore, allowing for greater efficacy in implementing shutdown procedures to minimize impacts to animals that may be in the area. Regardless of whether other monitoring plans suggested by the ENGOs would also suffice, NMFS has determined that the mitigation and monitoring required as part of this authorization meets the MMPA requirement for least practicable adverse impact.

Comment 13: The ENGOs suggested NMFS should work with L-DEO and explore ways to conduct the survey without ensonifying designated and proposed Southern Resident killer whale critical habitat, or at minimum, prohibit ramp-up in the proposed and designated critical habitat unless the location of all three pods of Southern Resident killer whales is known to be

within the Salish Sea or in an area not impacted by survey activity on each day of the survey.

Response: As discussed above, NMFS considered prohibiting L-DEO from operating within the proposed critical habitat for Southern Resident killer whales, but determined that the exclusion was not practicable, as it would prevent L-DEO from completing their survey objectives. NMFS has worked with L-DEO to revise the survey tracklines to avoid ensonifying waters less than 100 m deep above the Level B harassment threshold, between Tillamook Head, Oregon and Barkley Sound, British Columbia. As stated above, this area contains the highest estimated density of Southern Resident killer whales. NMFS has not required L-DEO to confirm the location of Southern Resident killer whales before beginning survey activities each day as the location of all three pods is often unknown and waiting for confirmation would not allow L-DEO to complete their research objectives. L-DEO is required to contact several entities (including NMFS, Canada's DFO, Orca Network, and the Whale Museum) on each day of the survey to obtain any recent reports of Southern Resident killer whales in the survey area.

Comment 14: The ENGOs suggested NMFS should consider closures or limits on survey activity in proposed humpback whale critical habitat and biologically important areas for blue whales.

Response: The revised tracklines mentioned above, while primarily intended to avoid areas of highest Southern Resident killer whale occurrence, also reduce survey tracklines in recently finalized humpback whale critical habitat (86 FR 21082; April 21, 2021) and BIAs for humpback whales and other marine mammals (we note that no BIAs for blue whales have been identified in the survey area). Eliminating all tracklines in humpback whale critical habitat would prevent L-DEO from completing their research objectives, as the proposed critical habitat occupies most of the continental shelf area off of the west coast of the U.S., the key area for L-DEO's research. Additionally, the ENGOs do not provide any substantive reasoning for why prohibiting L-DEO from operating within humpback whale critical habitat or BIAs is warranted. As discussed in the Negligible Impact Analysis and Determination section of this notice, L-DEO's activity is not expected to have a lasting physical impact on humpback whale critical habitat, prey within it, or overall humpback whale fitness.

Comment 15: In addition to vessel-based passive acoustic monitoring (PAM), the ENGOs suggested NMFS should require the use of existing moored passive acoustic monitoring systems and installation of temporary hydrophones or sonabuys in the survey area to monitor marine mammal presence.

Response: NMFS appreciates the suggestions regarding increasing acoustic monitoring. However, the existing network of acoustic recorders along the Washington coast is comprised of archival recorders, which are not monitored in real-time. While the deployment of temporary hydrophones and sonabuys in the survey area may aid in detection and monitoring of marine mammals, NMFS does not expect that any additional protection would outweigh the cost and practicability concerns associated with additional personnel required to monitor the systems and relay detections to the research vessel. The use of on-board PAM will adequately alert L-DEO of vocalizing marine mammals in the immediate vicinity of the survey activity.

Comment 16: The ENGOs recommended NMFS should require the use of a support vessel traveling ahead of the R/V *Langseth* in proposed critical habitat for humpback whales and biologically important areas (BIAs) for other cetaceans.

Response: The support vessel referenced by the ENGOs is required to travel approximately 5 km ahead of the R/V *Langseth* while surveying in waters 200 m or less between Tillamook Head, Oregon and Barkley Sound, British Columbia (see Mitigation section of this notice). This area encompasses much of the critical habitat for humpback whales and biologically important areas for other species (e.g., gray whale BIA for migration). The area of the humpback whale critical habitat expected to be surveyed on a given day is only a small portion of the overall critical habitat along the coast. Any impacts to marine mammals in this area are expected to be minor and temporary, and any additional protection that may be provided by requiring L-DEO to use the support vessel outside of the 200-m isobath is not warranted in the context of the expected effects and practicability concerns.

Comment 17: The ENGOs suggested NMFS should prohibit survey activity in low-visibility conditions.

Response: NMFS disagrees that survey activity should be prohibited in low-visibility conditions. Any requirement to cease operations during low visibility conditions, including at

night, would not only be impracticable, it would also likely result in greater impacts to marine mammals, as such a measure would require operations to continue for significantly more time, to make up for lost operations during low-visibility times. Ramp-up of the acoustic source, when necessary, may occur at times of poor visibility (including nighttime), assuming that a pre-clearance period has been observed. If the pre-clearance period occurs at nighttime, the pre-clearance watch would be conducted only by the acoustic observer.

Comment 18: The ENGOs suggested NMFS should consider whether aerial observations would have less impact (than the support vessel).

Response: Similar to the suggestion of deploying additional PAM systems above, NMFS has determined it is not practicable to require L-DEO to use aerial monitoring systems. NMFS does not expect that any additional protection would outweigh the cost and practicability of additional personnel required to monitor the systems and relay detections to the research vessel.

Comment 19: The ENGOs suggested the 1,500-meter exclusion zone, which is required for beaked whales, should apply for other marine mammal species that they suggest are particularly sensitive — such as harbor porpoises, Steller sea lions, baleen whales (except gray whales) and Southern Resident killer whales. The commenters suggest that the presence of Southern Residents should trigger a shut-down whenever they are detected, regardless of distance.

Response: NMFS disagrees that a larger standard exclusion zone is warranted for the species and groups suggested by the ENGOs. The standard exclusion zone for all marine mammals included in the IHA is 500 m, with larger exclusion zones or shutdown requirements for certain species and/or scenarios. NMFS' 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 and ease of implementation for protected species observers (PSOs), who need to monitor and implement the exclusion zone; and (4) define a distance within which detection probabilities are reasonably high for most species under typical conditions. The use of 500 m as the zone is not based directly on any quantitative

understanding of the range at which auditory injury would be entirely precluded or any range specifically related to disruption of behavioral patterns. Rather, NMFS believes it is based on a reasonable combination of factors. In summary, a practicable criterion such as this has the advantage of familiarity and simplicity while still providing in most cases a zone larger than relevant auditory injury zones, given realistic movement of source and receiver. Increased shutdowns, without a firm idea of the outcome the measure seeks to avoid, simply displace survey activity in time and increase the total duration of acoustic influence as well as total sound energy in the water, which NMFS seeks to avoid. In keeping with the four broad goals outlined above, and in context of the information given here, the standard 500-m exclusion zone is appropriate. The ENGOs do not provide any substantive reasoning for a larger zone.

The proposed IHA included the requirement to shut down the airgun array if killer whales (of any ecotype) are visually or acoustically detected at any distance and NMFS has retained this requirement in the final authorization.

Comment 20: The ENGOs suggested NMFS should require L-DEO to use the lowest practicable source level for airgun usage.

Response: L-DEO has selected the equipment necessary to achieve their research objectives. We have evaluated the specified activity as defined by the applicant, including changes agreed-upon with NMFS in order to provide additional protection for Southern Resident killer whales, and made the necessary findings to authorize taking of marine mammals incidental to L-DEO's survey activities. We also note that an expert panel was convened by the Bureau of Ocean Energy Management to determine whether it would be feasible to develop standards to determine a lowest practicable source level. The panel determined that it would not be reasonable or practicable to develop such metrics (see Appendix L in BOEM, 2017).

Comment 21: The ENGOs suggested NMFS should require in situ sound source verification to determine accurate exclusion zones. Similarly, the Commission recommended NMFS require L-DEO analyze the data recorded on the OBSs and OBNs to determine the extents of the Level B harassment zones in shallow-, intermediate-, and deep-water depths and specify how the in-situ zones compare to the Level B harassment

zones specified in the final authorization.

Response: As stated above, the exclusion zones are not necessarily based on specific acoustic parameters, thus sound source verification is not necessary in the context of exclusion zones. Regarding the Commission's recommendation to conduct analysis of OBS data, L-DEO has not previously undertaken the type of analysis suggested by the Commission, and indicated to NMFS that it does not have the expertise or capability to do so at this time. In addition, we note that the Commission's recommendation is vague; detailed direction would be needed from the Commission on how to accomplish the recommended effort. This would need to include agreement on the analytical approach in order to meet expectations and to ensure acceptance of results. The Commission's recommendation does not acknowledge the time it would take to perform the analysis or the level of effort and cost that would be involved, e.g., experts needed to obtain and review data, performing detailed comparative analysis, preparation of a report. Based on these concerns, NMFS believes that the recommendation is not practicable.

Also, implementation of this recommendation would not provide any additional conservation value (e.g., improvement in mitigation effectiveness) for the proposed survey. The analysis would be retrospective and could be used to help inform analysis of future surveys in the same area. NSF is considering funding a survey of the Queen Charlotte Fault, north of the planned survey area for this action, but the survey would be completed before the acoustic data from this survey suggested by the Commission could be analyzed. NMFS is not aware of any other NSF-proposed seismic surveys on the R/V *Langseth* for this region in the foreseeable future that could incorporate the in situ data, if analyzed.

Comment 22: The ENGOs suggested NMFS should prohibit the use of the Kongsberg Simrad 122 MBES in shallow water because the system's lower frequencies were designed for use in deeper water.

Response: The ENGOs provide no justification for prohibiting the use of the MBES in shallow water aside from describing its characteristics. As discussed in previous comment responses, NMFS has determined the MBES is not likely to result in take of marine mammals and has no reason to believe that the use of the Kongsberg Simrad 122 in shallow water is cause for concern. The ENGOs do not provide any substantive argument to the contrary.

Comment 23: The ENGOS suggested NMFS should require L-DEO to immediately cease survey activities if any authorized take limits are exceeded or if a take of an unauthorized species occurs (e.g., take of a North Pacific right whale).

Response: NMFS agrees with the ENGOS that L-DEO must shut down the airgun array if a marine mammal species for which take was not authorized, or a species for which authorization was granted but the takes have been met, approaches the Level A or Level B harassment zones. This requirement was included in the notice of proposed IHA but was inadvertently omitted from the draft IHA. The final authorization includes this requirement.

Comment 24: The ENGOS suggested NMFS should require L-DEO to immediately cease survey activities if a take of an unauthorized level or intensity occurs, (e.g., serious injury or mortality of any species or take of a Southern Resident killer whale by Level A harassment). The ENGOS further suggest that if take is found to have been exceeded, then there should be an investigation and additional mitigation to avoid any additional take before activities can resume. Similarly, the Commission recommended NMFS include in all draft and final authorizations an explicit requirement to cease activities if a marine mammal is injured or killed during the specified activities, including by vessel strike, until NMFS reviews the circumstances involving any injury or death that is likely attributable to the activities and determines what additional measures are necessary to minimize additional injuries or death.

Response: NMFS does not expect that the proposed activities have the potential to result in injury or mortality to marine mammals and therefore does not agree that a blanket requirement for project activities to cease would be warranted. NMFS does not agree that a requirement for a vessel that is operating on the open water to suddenly stop operating is practicable, and it is unclear what mitigation benefit would result from such a requirement in relation to vessel strike. The Commission does not suggest what measures other than those prescribed in this IHA would potentially prove more effective in reducing the risk of strike. Therefore, we have not included this requirement in the authorization. NMFS retains authority to modify the IHA and cease all activities immediately based on a vessel strike and will exercise that authority if warranted.

With respect to the Commission's recommendation that NMFS include

these requirements in all proposed and final IHAs, NMFS determines the requirements for mitigation measures in each authorization based on numerous case-specific factors, including 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. As NMFS must make these determinations on a case by case basis, we therefore do not agree with this recommendation.

Comment 25: The ENGOS suggested NMFS impose a ship speed limit of 10 knots or less at all times to reduce noise and prevent ship strikes, with an exception for rare emergency or safety necessities. While the vessel conducting the survey is likely to be traveling well under 10 knots, NMFS should make this a requirement of any crew-transfer vessels used in the project.

Response: NMFS has analyzed the potential for ship strike resulting from L-DEO's planned activity and has determined that the mitigation measures specific to ship strike avoidance are sufficient to avoid the potential for ship strike. These include: A requirement that all vessel operators reduce vessel speed to 10 knots (18.5 km/hour) or less when any large whale, any mother/calf pairs, pods, or large assemblages of non-delphinoid cetaceans are observed within 100 m of an underway vessel; a requirement that all survey vessels maintain a separation distance of 100 m or greater from all large whales, and 500 m or greater from any sighted North Pacific right whale (if a whale is observed but cannot be confirmed as a species other than a right whale, the vessel operator must assume that it is a right whale and take appropriate action); a requirement that if protected species are sighted while a vessel is underway, the vessel must take action as necessary to avoid violating the relevant separation distance (e.g., attempt to remain parallel to the animal's course, avoid excessive speed or abrupt changes in direction until the animal has left the area); and a requirement that if marine mammals are sighted within the relevant separation distance, the vessel must reduce speed and shift the engine to neutral, not engaging the engines until animals are clear of the area. Finally, we note that all crew will be aboard the R/V *Langseth* through the entire survey, and there will not be any crew transfer vessels. We have determined that the ship strike avoidance measures are sufficient to ensure the least practicable adverse

impact on species or stocks and their habitat and therefore we do not include the 10 knot ship speed limit recommended by the ENGOS.

Comment 26: The ENGOS recommended NMFS require L-DEO to minimize the use of lines and cables and ensure that they are not flexible to reduce entanglement risk.

Response: As discussed in the notice of proposed IHA, no incidents of entanglement of marine mammals with seismic survey gear have been documented in over 54,000 nautical miles (nmi; 100,000 km) of previous NSF-funded seismic surveys when observers were aboard (e.g., Holst and Smultea 2008; RPS 2019; RPS 2021). Although entanglement with the streamer is theoretically possible, it has not been documented during tens of thousands of miles of NSF-sponsored seismic cruises or, to our knowledge, during hundreds of thousands of miles of industrial seismic cruises. Entanglement in OBSs and OBNs is also not expected to occur. There are a relative few deployed devices, and no interaction between marine mammals and any such device has been recorded during prior NSF surveys using the devices. There are no meaningful entanglement risks posed by the proposed survey, and therefore although we encourage L-DEO to use lines and cables that minimize entanglement risk, NMFS has not included the recommended requirement as a condition in the final authorization.

Comment 27: The ENGOS state that marine mammal strandings are most likely to result when a sound source is moving directly toward the shore. Therefore, the ENGOS suggested NMFS should require reconfigured tracklines to avoid these approaches when the airguns are firing.

Response: There is no conclusive evidence that exposure to airgun noise results in behaviorally-mediated forms of injury (i.e., mass stranding events). Behaviorally-mediated injury has been primarily associated with beaked whales exposed to mid-frequency active (MFA) naval sonar. As described in the notice of proposed IHA, tactical sonar is very different from the noise produced by airguns. One should therefore not expect the same reaction to airgun noise as to these other sources. The ENGOS reference a survey conducted by L-DEO in 2002 that was contemporaneous with and reasonably associated spatially with the stranding of two Cuvier's beaked whales. However, the event was not considered a "true atypical mass stranding" (according to Frantzis (1998)) as used in the analysis of Castellote and Llorens (2016). While we agree with the

authors that this lack of evidence should not be considered conclusive, it is clear that there is very little evidence that seismic surveys should be considered as posing a significant risk of acute harm to beaked whales or other mid-frequency cetaceans. Although NMFS does not expect that stranding is a potential outcome of this survey activity, we also note that certain tracklines closest to shore (*i.e.*, in waters less than 100 m deep in areas with highest estimated Southern Resident killer whale occurrence) have been eliminated, further reducing the risk of this outcome. We have considered the potential for the proposed surveys to result in marine mammal stranding and have concluded that, based on the best available information, stranding is not expected to occur. Therefore, we have not adopted the ENGOs recommendation to reconfigure the survey tracklines.

Comment 28: Both the ENGOs and Commission object to NMFS' potential consideration of a renewal IHA for this action, and in general. The ENGOs assert that IHA renewals are not permissible under the MMPA and instead recommend that applicants request a multi-year permit and accordingly reevaluate the effects of the action based on multiple years of take. The Commission recommended NMFS refrain from issuing IHA renewals for any authorization and instead use an abbreviated **Federal Register** notice process, which is similarly expeditious and fulfills NMFS' intent to maximize efficiencies. If NMFS continues to propose to issue IHA renewals, the Commission recommends that NMFS (1) stipulate that a renewal is a one-time opportunity (a) in all **Federal Register** notices requesting comments on the possibility of a renewal, (b) on its web page detailing the renewal process, and (c) in all draft and final authorizations that include a term and condition for a renewal and (2) if NMFS declines to adopt this recommendation, explain fully its rationale for not doing so.

Response: NMFS' IHA renewal process meets all statutory requirements. All IHAs issued, whether an initial IHA or a renewal IHA, are valid for a period of not more than one year. In addition, the public has at least 30 days to comment on all proposed IHAs, with a cumulative total of 45 days for IHA renewals. As noted above, the *Request for Public Comments* section of the notice of proposed IHA made clear that the agency was seeking comment on both the initial proposed IHA and the potential issuance of a renewal for this project. Because any renewal (as explained in the *Request for Public*

Comments section of the notice of proposed IHA) is limited to another year of identical or nearly identical activities in the same location (as described in the Description of Proposed Activity section) or the same activities that were not completed within the 1 year period of the initial IHA, reviewers have the information needed to effectively comment on both the immediate proposed IHA and a possible 1 year renewal, should the IHA holder choose to request one in the coming months.

While there will be additional documents submitted with a renewal request, for a qualifying renewal these will be limited to documentation that NMFS will make available and use to verify that the activities are identical to those in the initial IHA, are nearly identical such that the changes would have either no effect on impacts to marine mammals or decrease those impacts, or are a subset of activities already analyzed and authorized but not completed under the initial IHA. NMFS will also confirm, among other things, that the activities will occur in the same location; involve the same species and stocks; provide for continuation of the same mitigation, monitoring, and reporting requirements; and that no new information has been received that would alter the prior analysis. The renewal request will also contain a preliminary monitoring report, but that is to verify that effects from the activities do not indicate impacts of a scale or nature not previously analyzed. The additional 15-day public comment period provides the public an opportunity to review these few documents, provide any additional pertinent information and comment on whether they think the criteria for a renewal have been met. Between the initial 30-day comment period on these same activities and the additional 15 days, the total comment period for a renewal is 45 days.

In addition to the IHA renewal process being consistent with all requirements under section 101(a)(5)(D), it is also consistent with Congress' intent for issuance of IHAs to the extent reflected in statements in the legislative history of the MMPA. Through the provision for renewals in the regulations, description of the process and express invitation to comment on specific potential renewals in the Request for Public Comments section of each proposed IHA, the description of the process on NMFS' website, further elaboration on the process through responses to comments such as these, posting of substantive documents on the agency's website, and provision of 30 or 45 days for public review and comment

on all proposed initial IHAs and renewals respectively, NMFS has ensured that the public "is invited and encouraged to participate fully in the agency decision-making process."

NMFS does not agree with the Commission and therefore does not adopt the Commission's recommendation that NMFS use an abbreviated **Federal Register** notice instead of IHA renewal. NMFS has previously provided responses to this specific recommendation in multiple notices, including 84 FR 52464 (October 2, 2019). NMFS does agree with the Commission's recommendation that NMFS specify that IHA renewals are a one-time opportunity in all **Federal Register** notices requesting comments on the possibility of an IHA renewal, in all associated proposed and final IHAs, and on our website. NMFS has specified this in the final IHA for L-DEO's activities and has been including this in **Federal Register** notices and proposed and final authorizations since last year.

Comment 29: The ENGOs recommended NMFS and L-DEO explore whether the proposed research could be conducted using alternative technologies or approaches that are less harmful to marine mammals. More broadly, and beyond the scope of this action, the ENGOs recommended NMFS engage with NSF to invest in research that explores alternative technologies.

Response: NMFS agrees with the ENGOs that development and use of technologies that reduce the environmental impact of geophysical surveys is a laudable objective and may be warranted in some cases. Alternative technologies are in various stages of development, and none of the systems with the potential to replace airguns as a seismic source are currently commercially available for use on a scale of activity such as that considered herein. Although some alternative technologies are available now, or will be in the next several years, for select uses, none are at a stage where they can replace airgun arrays outright. However, some may be used in select environments when commercially available. Such technologies may be evaluated in the future as they become commercially available and on a scale commensurate to the need. In summary, while we agree that alternative technologies may be beneficial, the ENGOs do not suggest any specific technologies or approaches and the suggestion that NMFS engage with NSF to research these methods is outside the authority provided to NMFS by the MMPA. However, NMFS would consider participating in related efforts

by the ENGOs or other entities interested in these technologies.

Comment 30: The ENGOs and the Commission recommended NMFS require L-DEO to use the method proposed by the Commission to estimate take and apply relevant corrections for airgun activity in daylight vs nighttime (including dawn and dusk) to better estimate the numbers of marine mammals taken by Level A and B harassment. The Commission further recommends that NMFS require L-DEO to specify in the final monitoring report (1) the number of days on which the airgun array was active and (2) the percentage of time and total time the array was active during daylight vs nighttime hours (including dawn and dusk).

Response: NMFS appreciates the Commission's development of a recommended approach to better estimate the numbers of marine mammals that may have been taken during geophysical survey activities, including marine mammals that were not detected. The "Commission's method" (see the Commission's letter for additional discussion and citation to a full description provided in an addendum to a May 1, 2019 Commission comment letter) involves correction of marine mammal sightings data through use of proxies for marine mammal detectability ($f(0)$) and platform/observer bias on marine mammal detection ($g(0)$), and extrapolation of corrected marine mammal sightings data based on the assumed extent of the Level B harassment zones.

However, NMFS does not concur with the recommendation to require L-DEO to implement this approach because we do not have confidence in the reliability of estimates of potential marine mammal take that would result from use of the approach. The Commission does not address the multiple assumptions that must be made in order to have confidence in the estimates that would be produced through application of the method. For example, the assumption that the application of proxy values for $g(0)$ and $f(0)$ is appropriate is not justified (including application of $f(0)$ values to species for which no value is available and assuming that application of $f(0)$ to species in a wholly different region is appropriate). Notably, $g(0)$ values are typically derived on a platform-specific basis, and even for specific observers—not generalized across platforms, as the Commission's method would require.

Separately, the appropriate application of distance sampling methods requires that certain

assumptions are valid, and the Commission does not explain why these assumptions should be assumed to be valid during a seismic survey, as compared with typical line-transect surveys operating without an active acoustic source. For example, a key underlying concept of distance sampling methodology is that the probability of detecting an animal decreases as its distance from the observer increases. This cannot be assumed true during an active seismic survey. NMFS believes it unlikely that the numerous assumptions inherent to application of the Commission's method would be accepted in a research context (where distance sampling approaches are typically applied).

Furthermore, the area over which observations are to be extrapolated through the Commission's method is a modeled ensonified area. We do not believe it appropriate to assume a modeled ensonified area is always accurate for purposes of estimating total take. In purporting to estimate total takes, the method ignores the fact that marine mammals exposed to a level of received sound assumed to cause take for analytical purposes may not in fact respond behaviorally in a way that equates to take, especially at great distance from the source.

NMFS believes it is important to focus on collection and reporting of empirical data that can directly inform an assessment of the effects of a specified activity on the affected species or stock. While there may be value in an assessment of potential unobserved take, we need to proceed cautiously in the development of derived values given our low confidence in multiple inputs. NMFS is currently more broadly evaluating monitoring requirements, including data collection, interpretation, and reporting, as well as the specific issue the Commission has raised, and is committed to developing improved approaches.

NMFS does concur with the Commission's recommendation that NMFS require L-DEO to specify in the final monitoring report (1) the number of days on which the airgun array was active and (2) the percentage of time and total time the array was active during daylight vs nighttime hours (including dawn and dusk). This requirement has been added to the final authorization.

Comment 31: The Commission asserts that L-DEO and other NSF-affiliated entities have not complied with all of the requirements set forth in certain final IHAs, and recommends that, should the alleged shortcomings occur again, NMFS refrain from issuing any further authorizations to L-DEO and

other NSF-affiliated entities until such time that the monitoring reports include all of the required information.

Response: NMFS appreciates the Commission's concern and will consider any future requests for incidental take authorization from NSF-affiliated entities according to the requirements of the MMPA.

Comment 32: Noting its disagreement with L-DEO's approach to estimating the size of various ensonified areas, the Commission recommends that NMFS require L-DEO to either (1) re-estimate the proposed Level A and B harassment zones and associated takes of marine mammals using (a) both operational and site-specific environmental parameters, (b) what the Commission believes to be a comprehensive source model and (c) what the Commission believes to be an appropriate sound propagation model for the proposed IHA or (2) collect or provide the relevant acoustic data to substantiate that its modeling approach is conservative for both deep- and intermediate-water depths beyond the Gulf of Mexico. In addition, the Commission recommends that NMFS (1) explain why sound channels with downward refraction, as well as seafloor reflections, are not likely to occur during the geophysical survey, (2) specify the degree to which both of those parameters would affect the estimation (or underestimation) of Level B harassment zones in deep- and intermediate- water depths, (3) explain why L-DEO's model and other modeling approaches provide more accurate, realistic, and appropriate Level A and B harassment zones than BELLHOP (a different propagation model favored by the Commission), particularly for deep- and intermediate-water depths, and (4) explain why, if L-DEO's model and other modeling approaches are considered best available science, other action proponents that conduct seismic surveys are not implementing similar methods, particularly given their simplicity.

Response: As noted by the Commission, these comments reflect a longstanding disagreement between NMFS and the Commission regarding L-DEO's approach to modeling the output of their airgun array and its propagation through the water column. NMFS has previously responded to similar Commission comments on L-DEO's modeling approach. We refer the reader to previous **Federal Register** notices providing responses rather than repeat them here (e.g., 84 FR 60059, November 07, 2019; 84 FR 54849, October 11, 2019; 84 FR 35073, July 22, 2019). Regardless of the addition of

slightly different points or modifications to the language with which the Commission expresses these points, the gist of the Commission's disagreement with L-DEO's modeling approach remains the same. NMFS believes that its prior responses have adequately explained the rationale for not following the Commission's recommendations and, importantly, why L-DEO's modeling approach is adequate.

Comment 33: The ENGOs asserted that NMFS must prepare an Environmental Impact Statement and cannot rely on the NSF's Environmental Assessment (EA) because they believe that there are significant environmental impacts. The CBD's comments on the NSF's draft EA were incorporated by reference in the ENGOs' comment letter on the proposed IHA. CBD's comments on NSF's draft EA primarily concerned Southern Resident killer whales, similar to the concerns addressed above.

Response: The NSF's draft EA, which NMFS adopted, was revised in consideration of CBD's comments (and those of other public commenters) and adequately analyzes the effects of the action. The commenters do not provide any information to support their claim of significant environmental impacts under NEPA. NMFS has reviewed the NSF's final EA, determined it to be sufficient, and adopted that EA and signed a Finding of No Significant Impact (FONSI).

Comment 34: The ENGOs expressed doubt that the proposed activities were permissible under the ESA because they would jeopardize the continued existence of Southern Resident killer whales, North Pacific right whales, humpback whales, and blue whales, among other protected species and adversely modify proposed critical habitat. The proposed action clearly affects listed species as well as proposed and designated critical habitat, and therefore both NMFS and the NSF must undergo consultation under the ESA. The ENGOs urged NMFS to fulfill our commitment to complete consultation before authorizing any take of marine mammals, and requested a public comment period on the products of the consultation. The ENGOs strongly believe that NMFS cannot authorize the specified activities because they will jeopardize the recovery and survival of Southern Resident killer whales and North Pacific right whales.

Response: NMFS has completed consultation under the ESA on our proposal to authorize take of listed marine mammals incidental to L-DEO's survey activities. The NMFS Office of Protected Resources, Interagency Cooperation Division issued a Biological

Opinion concluding that the proposed action is not likely to jeopardize the continued existence of ESA-listed blue whales, fin whales, sei whales, sperm whales, Central America DPS humpback whales, Mexico DPS humpback whales, Southern Resident killer whale DPS, and Guadalupe fur seals and is not likely to destroy or adversely modify Steller sea lion or humpback whale critical habitat. There is no designated critical habitat in the action area for the other listed species. The Interagency Cooperation Division determined that a public comment period on the Biological Opinion was not warranted. The final Biological Opinion is available on our website at: <https://www.fisheries.noaa.gov/national/marine-mammal-protection/incidental-take-authorizations-research-and-other-activities>.

Comment 35: The ENGOs asserted that NMFS cannot approve the proposed activity without first consulting with the states of Washington and Oregon under the Coastal Zone Management Act (CZMA). The CZMA authorizes states with federally approved coastal management programs to review applications for Federal licenses or permits to conduct activities in, or outside of, the coastal zone that affects land uses, water uses, or natural resources within the coastal zone to ensure the activity is fully consistent with the state's management plan.

Response: The NSF submitted consistency determinations to Washington and Oregon. Both the Washington State Department of Ecology and Oregon Coastal Management Program, the respective CZMA authorities for Washington and Oregon, concurred with the NSF's determinations. NMFS' action of authorizing take of marine mammal is incidental to the NSF's action of conducting the survey, therefore NMFS is not required to independently submit consistency determinations under CZMA.

Comment 36: The ENGOs and Deep Green Wilderness expressed concern that the proposed survey overlaps with Olympic Coast National Marine Sanctuary (OCNMS). The ENGOs reference the National Marine Sanctuaries Act (NMSA), which aims to maintain the natural biological communities in the national marine sanctuaries, and to protect, and, where appropriate, restore and enhance natural habitats, populations, and ecological processes. To achieve these purposes, the NMSA requires that Federal agency actions internal or external to a national marine sanctuary, including private activities authorized by licenses, leases,

or permits that are likely to destroy, cause the loss of, or injure any sanctuary resource are subject to consultation with the Secretary. The ENGOs noted that the action agency must follow the recommendations of the Secretary to avoid injury to any sanctuary resource or otherwise act to prevent and mitigate damage to such resources.

Response: NMFS satisfied our responsibilities under section 304(d) of the NMSA. NMFS and the NSF drafted a joint Sanctuary Resource Statement (SRS) to consult with the NOAA Office of National Marine Sanctuaries (ONMS) under the NMSA. ONMS provided two recommended alternatives to minimize injury and to protect sanctuary resources: (1) Limit operations in OCNMS to daylight hours only regardless of depth; and (2) use of the secondary support vessel aiding in marine mammal observations throughout the entire sanctuary. NMFS has included these recommendations in the final IHA.

Changes From the Proposed IHA to Final IHA

There are numerous changes from the proposed IHA, starting with the timing of the survey. The survey was initially proposed to occur in summer 2020 but was delayed until summer 2021. Since conclusion of the public comment period in May 2020, NMFS has reviewed newly available information, including recent draft Stock Assessment Reports, information on relevant Unusual Mortality Events, and other scientific literature, and incorporated this information into our analysis of impacts on marine mammals and their habitat.

In addition to the timing changes, the survey tracklines have been modified to avoid surveying in the areas with the highest expected occurrence of Southern Resident killer whales. Between Tillamook Head, Oregon and Barkley Sound, British Columbia, L-DEO's planned tracklines have been truncated or removed entirely such that the ensonified area does not extend within the 100-meter (m) depth contour (see Estimated Take section for description of the Level B harassment zones and ensonified area). In addition to removing tracklines in nearshore shallow waters along the coast, L-DEO also modified tracklines such that the ensonified area will not extend within Canadian designated Southern Resident and Northern Resident killer whale critical habitat. Additionally, under consultation with Canada DFO, L-DEO removed all tracklines in waters 100 m or less in Canadian waters. Thus north of Tillamook Head, Oregon, no surveys

will occur in waters 100 m or less (see Figure 1). Based on informal recommendations from the Commission, NMFS recalculated the densities of Steller sea lions by applying the appropriate pup and non-pup growth rates of the population in Washington and British Columbia. Takes of all species and stocks have been recalculated using the revised tracklines and resulting ensonified areas. Additionally, NMFS has revised the mitigation requirements regarding use of a second support vessel and daylight-only operations in waters 200 m or less. The proposed IHA required the use of the support vessel and limited operations to daylight only along the entire survey area in waters 200 m or less. In consideration of operational practicability, we have revised that requirement to apply only between Tillamook Head, Oregon and Barkley Sound, British Columbia. Based on consultation with the Olympic Coast National Marine Sanctuary (OCNMS), the final IHA requires L-DEO to use the support vessel and operate only during daylight hours within the OCNMS, regardless of water depth. OCNMS has also been added to the list of entities L-DEO must contact each day to obtain sightings reports of Southern Resident killer whales in the survey area and, in turn, report their own sightings of killer whales to the Sanctuary. Finally, as

recommended by the Commission, we have clarified the required elements that must be included in L-DEO's monitoring report.

Description of Marine Mammals in the Area of Specified Activities

Sections 3 and 4 of the application summarize 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's Stock Assessment Reports (SARs; <https://www.fisheries.noaa.gov/national/marine-mammal-protection/marine-mammal-stock-assessments>) and more general information about these species (e.g., physical and behavioral descriptions) may be found on NMFS's website (<https://www.fisheries.noaa.gov/find-species>).

Table 1 lists all species with expected potential for occurrence in the survey area and summarizes information related to the population or stock, including regulatory status under the MMPA and ESA and potential biological removal (PBR), where known. For taxonomy, we follow Committee on Taxonomy (2020). PBR is 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 (as described in NMFS's SARs). While no mortality is anticipated or authorized here, PBR and annual serious injury and mortality from anthropogenic sources are included here as gross indicators of the status of the species and other threats.

Marine mammal abundance estimates presented in this document represent the total number of individuals that make up a given stock or the total number estimated within a particular study or survey area. NMFS's stock abundance estimates for most species represent the total estimate of individuals within the geographic area, if known, that comprises that stock. For some species, this geographic area may extend beyond U.S. waters. All managed stocks in this region are assessed in NMFS's U.S. Pacific and Alaska SARs. All MMPA stock information presented in Table 1 is the most recent available at the time of publication and is available in the 2019 SARs (Caretta *et al.*, 2020; Muto *et al.*, 2020) and draft 2020 SARs (available online at: <https://www.fisheries.noaa.gov/national/marine-mammal-protection/draft-marine-mammal-stock-assessment-reports>). Where available, abundance and status information is also presented for marine mammals in Canadian waters in British Columbia.

TABLE 1—MARINE MAMMALS THAT COULD OCCUR IN THE SURVEY AREA

Common name	Scientific name	Stock	ESA/MMPA status; strategic (Y/N) ¹	Stock abundance (CV, N _{min} , most recent abundance survey) ²	PBR	Annual M/SI ³
Order Cetartiodactyla—Cetacea—Superfamily Mysticeti (baleen whales)						
Family Eschrichtiidae: Gray whale	<i>Eschrichtius robustus</i>	Eastern North Pacific	-/-; N	26,960 (0.05, 25,849, 2016)	801	131
Family Balaenopteridae (rorquals): Humpback whale	<i>Megaptera novaeangliae</i>	California/Oregon/Washington. Central North Pacific	-/-; Y	2,900 (0.05, 2,784, 2014)	16.7	>42.1
Minke whale	<i>Balaenoptera acutorostrata</i>	California/Oregon/Washington. Central North Pacific	-/-; Y -/-; N	10,103 (0.30, 7,891, 2006) .. 636 (0.72, 369, 2014)	83 3.5	26 >1.3
Sei whale	<i>Balaenoptera borealis</i>	Eastern North Pacific	E/D; Y	519 (0.4, 374, 2014)	0.75	>0.2
Fin whale	<i>Balaenoptera physalus</i>	California/Oregon/Washington. Northeast Pacific	E/D; Y E/D; Y	9,029 (0.12, 8,127, 2014) 3,168 (0.26, 2,554, 2013)	81	>43.7
Blue whale	<i>Balaenoptera musculus</i>	Eastern North Pacific	E/D; Y E/D; Y	1,496 (0.44, 1,050, 2014)	5.1 1.2	0.6 >19.4
Superfamily Odontoceti (toothed whales, dolphins, and porpoises)						
Family Physeteridae: Sperm whale	<i>Physeter macrocephalus</i>	California/Oregon/Washington.	E/D; Y	1,997 (0.57, 1,270, 2014)	2.5	0.4
Family Kogiidae: Pygmy sperm whale	<i>Kogia breviceps</i>	California/Oregon/Washington.	-/-; N	4,111 (1.12, 1,924, 2014)	19	0
Dwarf sperm whale	<i>Kogia sima</i>	California/Oregon/Washington.	-/-; N	Unknown (Unknown, Unknown, 2014).	Undetermined	0
Family Ziphiidae (beaked whales): Cuvier's beaked whale ...	<i>Ziphius cavirostris</i>	California/Oregon/Washington.	-/-; N	3,274 (0.67, 2,059, 2014)	21	<0.1

TABLE 1—MARINE MAMMALS THAT COULD OCCUR IN THE SURVEY AREA—Continued

Common name	Scientific name	Stock	ESA/ MMPA status; strategic (Y/N) ¹	Stock abundance (CV, N _{min} , most recent abundance survey) ²	PBR	Annual M/SI ³
Baird's beaked whale	<i>Berardius bairdii</i>	California/Oregon/Wash- ington.	-/-; N	2,697 (0.6, 1,633, 2014)	16	0
Mesoplodont beaked whales.	<i>Mesoplodon spp.</i>	California/Oregon/Wash- ington.	-/-; N	3,044 (0.54, 1,967, 2014)	20	0.1
Family Delphinidae:						
Bottlenose dolphin	<i>Tursiops truncatus</i>	California/Oregon/Wash- ington offshore.	-/-; N	1,924 (0.54, 1,255, 2014)	11	>1.6
Striped dolphin	<i>Stenella coeruleoalba</i>	California/Oregon/Wash- ington.	-/-; N	29,211 (0.2, 24,782, 2014)	238	>0.8
Common dolphin	<i>Delphinus delphis</i>	California/Oregon/Wash- ington.	-/-; N	969,861 (0.17, 839,325, 2014).	8,393	>40
Pacific white-sided dol- phin.	<i>Lagenorhynchus obliquidens</i>	California/Oregon/Wash- ington. British Columbia ⁴	-/-; N N/A	26,814 (0.28, 21,195, 2014) 22,160 (unknown, 16,522, 2008).	191 Unknown	7.5 Unknown
Northern right whale dol- phin.	<i>Lissodelphis borealis</i>	California/Oregon/Wash- ington.	-/-; N	26,556 (0.44, 18,608, 2014)	179	3.8
Risso's dolphin	<i>Grampus griseus</i>	California/Oregon/Wash- ington.	-/-; N	6,336 (0.32, 4,817, 2014)	46	>3.7
False killer whale	<i>Pseudorca crassidens</i>	N/A	N/A	N/A	N/A	N/A
Killer whale	<i>Orcinus orca</i>	Offshore Southern Resident Northern Resident West Coast Transient	-/-; N E/D; Y -/-; N -/-; N	300 (0.1, 276, 2012) 73 (N/A, 73, 2019) 302 (N/A, 302, 2018) 349 (N/A, 349, 2018)	2.8 0.13 2.2 3.5	0 >0.4 0.2 0.4
Short-finned pilot whale	<i>Globicephala macrorhynchus.</i>	California/Oregon/Wash- ington.	-/-; N	836 (0.79, 466, 2014)	4.5	1.2
Family Phocoenidae (por- poises):						
Harbor porpoise	<i>Phocoena phocoena</i>	Northern Oregon/Wash- ington Coast. Northern California/Southern Oregon. British Columbia ⁴	-/-; N -/-; N N/A	21,487 (0.44, 15,123, 2011) 35,769 (0.52, 23,749, 2011) 8,091 (unknown, 4,885, 2008).	151 475 Unknown	>3.0 >0.6 Unknown
Dall's porpoise	<i>Phocoenoides dalli</i>	California/Oregon/Wash- ington. British Columbia ⁴	-/-; N N/A	25,750 (0.45, 17,954, 2014) 5,303 (unknown, 4,638, 2008).	172 Unknown	0.3 Unknown
Order Carnivora—Superfamily Pinnipedia						
Family Otariidae (eared seals and sea lions):						
Northern fur seal	<i>Callorhinus ursinus</i>	Eastern Pacific	-/D; Y	608,143 (0.2, 514,738, 2018).	11,067	387
California sea lion	<i>Zalophus californianus</i>	California U.S.	-/D; N -/-; N	14,050 (N/A, 7,524, 2013) 257,606 (N/A, 233,515, 2014).	451 14,011	1.8 >321
Steller sea lion	<i>Eumetopias jubatus</i>	Eastern U.S. British Columbia ⁴	-/-; N N/A	43,201 (see SAR, 43,201, 2017). 4,037 (unknown, 1,100, 2008).	2,592 Unknown	113 Unknown
Guadalupe fur seal	<i>Arctocephalus philippii townsendi.</i>	Mexico to California	T/D; Y	34,187 (N/A, 31,019, 2013)	1,062	>3.8
Family Phocidae (earless seals):						
Harbor seal	<i>Phoca vitulina</i>	Oregon/Washington Coastal British Columbia ⁴	-/-; N N/A	Unknown (Unknown, Un- known, 1999). 24,916 (Unknown, 19,666, 2008).	Undetermined Unknown	10.6 Unknown
Northern elephant seal	<i>Mirounga angustirostris</i>	California Breeding	-/-; N	179,000 (N/A, 81,368, 2010)	4,882	8.8

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—NMFS marine mammal stock assessment reports online at: <https://www.fisheries.noaa.gov/national/marine-mammal-protection/marine-mammal-stock-assessments>. CV is coefficient of variation; N_{min} is the minimum estimate of stock abundance. In some cases, CV is not applicable.

3—These values, found in NMFS's SARs, represent annual levels of human-caused mortality plus serious injury from all sources combined (e.g., commercial fisheries, ship strike). Annual M/SI often cannot be determined precisely and is in some cases presented as a minimum value or range. A CV associated with estimated mortality due to commercial fisheries is presented in some cases.

4—Best *et al.* (2015) total abundance estimates for animals in British Columbia based on surveys of the Strait of Georgia, Johnstone Strait, Queen Charlotte Sound, Hecate Strait, and Dixon Entrance. These rows represent British Columbia abundance estimates, where available, but do not represent additional stocks.

5—The California/Oregon/Washington stock of Mesoplodont beaked whales includes six species of beaked whales. Of the six species represented in this stock, only Blainville's beaked whales, Hubbs' beaked whales, and Stejneger's beaked whales are expected to be encountered or taken.

All species that could potentially occur in the planned survey areas are included in Table 1. However, additional species have been recorded in the specified geographic region but are considered sufficiently rare that take is not anticipated. The temporal and/or spatial occurrence of North Pacific right whales (*Eubalaena japonica*) is such that take is not expected to occur, and they are not discussed further beyond the explanation provided here. Only 82 sightings of right whales in the entire eastern North Pacific were reported from 1962 to 1999, with the majority of these occurring in the Bering Sea and adjacent areas of the Aleutian Islands (Brownell *et al.*, 2001). Most sightings in the past 20 years have occurred in the southeastern Bering Sea, with a few in the Gulf of Alaska (Wade *et al.*, 2011). Despite many miles of systematic aerial and ship-based surveys for marine mammals off the coasts of Washington, Oregon and California over several years, only seven documented sightings of right whales were made from 1990 to 2000 (Waite *et al.*, 2003), and NMFS only aware of two documented sightings in the area since then. Because of the small population size and the fact that North Pacific right whales spend the summer feeding in high latitudes, the likelihood that the planned survey would encounter a North Pacific right whale is discountable.

In addition, the Northern sea otter (*Enhydra lutris kenyoni*) may be found in coastal waters of the survey area. However, sea otters are managed by the U.S. Fish and Wildlife Service and are not considered further in this document.

A detailed description of the species likely to be affected by L-DEO's geophysical 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 of proposed IHA (85 FR 19580; April 7, 2020). Since that time, NMFS has published the draft 2020 SARs with updated abundance, PBR, and/or mortality information for the Eastern Pacific stock of northern fur seals, West Coast Transient stock of killer whales, Central North Pacific stock of humpback whales, Northeast Pacific and California/Oregon/Washington stocks of fin whale, Eastern North Pacific Southern Resident stock of killer whales, and Eastern North Pacific Stock and Pacific Coast Feeding Group of gray whales. The relevant information for these stocks has been updated in Table 1, however the status of these species and stocks has not changed; therefore detailed descriptions are not

provided here. Please refer to the **Federal Register** notice of proposed IHA for these descriptions. Please also refer to NMFS' website (<https://www.fisheries.noaa.gov/find-species>) for generalized species accounts.

Biologically Important Areas and Critical Habitat

Biologically Important Areas (BIAs) for feeding gray whales along the coasts of Washington, Oregon, and California have been identified, including northern Puget Sound, Northwestern Washington, and Grays Harbor in Washington, Depoe Bay and Cape Blanco and Orford Reef in Oregon, and Point St. George in California; most of these areas are of importance from late spring through early fall (Calambokidis *et al.*, 2015). BIAs have also been identified for migrating gray whales along the entire coasts of Washington, Oregon, and California; although most whales travel within 10 km from shore, the BIAs were extended out to 47 km from the coastline (Calambokidis *et al.*, 2015). The planned survey will occur during the late spring/summer feeding season, when most individuals from the eastern North Pacific stock occur farther north. Nonetheless, individual gray whales, particularly those from the PCFG could be encountered in nearshore waters of the project area.

Prior to 2016, humpback whales were listed under the ESA as an endangered species worldwide. Following a 2015 global status review (Bettridge *et al.*, 2015), NMFS delineated 14 distinct population segments (DPS) with different listing statuses (81 FR 62259; September 8, 2016) pursuant to the ESA. The DPSs that occur in U.S. waters do not necessarily equate to the existing stocks designated under the MMPA and shown in Table 1. Because MMPA stocks cannot be partitioned, *i.e.*, parts managed as ESA-listed while other parts managed as not ESA-listed, until such time as the MMPA stock delineations are reviewed in light of the DPS designations, NMFS considers the existing humpback whale stocks under the MMPA to be endangered and depleted for MMPA management purposes (*e.g.*, selection of a recovery factor, stock status).

Within the survey area, three DPSs may occur: The Hawaii DPS (not listed), Mexico DPS (threatened), and Central America DPS (endangered). On April 21, 2021, NMFS issued a final rule to designate critical habitat in nearshore waters of the North Pacific Ocean for the endangered Central America DPS and the threatened Mexico DPS of humpback whale (86 FR 21082). Critical habitat for the Central America DPS and

Mexico DPS was established within the California Current Ecosystem (CCE) off the coasts California, Oregon, and Washington, representing areas of key foraging habitat. Off Washington and northern Oregon, the critical habitat extends from the 50-m isobath out to the 1200-m isobath; off southern Oregon (south of 42°10' N), it extends out to the 2000-m isobath. L-DEO's easternmost planned tracklines occur within designated humpback whale critical habitat along the coast.

Critical habitat for humpbacks has been designated under Canadian law in four locations in British Columbia (DFO 2013), including in the waters of the survey area off southwestern Vancouver Island. The other three locations are located north of the survey area at Haida Gwaii (Langara Island and Southeast Moresby Island) and at Gil Island (DFO 2013). These areas show persistent aggregations of humpback whales and have features such as prey availability, suitable acoustic environment, water quality, and physical space that allow for feeding, foraging, socializing, and resting (DFO 2013). A small portion of L-DEO's planned tracklines overlap with Canadian designated humpback whale critical habitat off southwest Vancouver Island.

BIAs for feeding humpbacks along the coasts of Oregon and Washington, which have been described from May to November, are all within approximately 80 km from shore, and include the waters off northern Washington, and Stonewall and Heceta Bank, Oregon (Calambokidis *et al.*, 2015). Some segments of L-DEO's planned tracklines overlap with these BIAs.

The U.S. Southern Resident killer whale critical habitat designated under the ESA currently includes inland waters of Washington relative to a contiguous shoreline delimited by the line at a depth of 6.1 m relative to extreme high water (71 FR 69054; November 29, 2006). On September 19, 2019, NMFS published a proposed rule to revise designated Southern Resident killer whale critical habitat to include 40,472.7 km² of marine waters between the 6.1-m depth contour and the 200-m depth contour from the U.S. international border with Canada south to Point Sur, California (84 FR 49214; September 19, 2019). The planned survey tracklines overlap with NMFS' proposed expanded Southern Resident critical habitat.

In Canada, Southern Resident killer whales are listed as Endangered under the Species at Risk Act (SARA), and critical habitat has been designated in the trans-boundary waters in southern British Columbia, including the

southern Strait of Georgia, Haro Strait, and Strait of Juan de Fuca (SOR/2018–278, December 13, 2018; SOR/2009–68, February 19, 2009; DFO 2018). The continental shelf waters off southwestern Vancouver Island, including Swiftsure and La Pérouse Banks have also been designated as critical habitat for Southern Resident and Northern Resident killer whales (SOR/2018–278, December 13, 2018). As discussed above, L–DEO’s initial proposed survey tracklines that overlapped with Canadian designated critical habitat for killer whales have been eliminated.

Federally designated critical habitat for Steller sea lions in Oregon and California includes all rookeries (NMFS 1993). Although the Eastern DPS was delisted from the ESA in 2013, the designated critical habitat remains valid (NOAA 2019e). The critical habitat in Oregon is located along the coast at Rogue Reef (Pyramid Rock) and Orford Reef (Long Brown Rock and Seal Rock). The critical habitat area includes aquatic zones that extend 0.9 km seaward and air zones extending 0.9 km above these terrestrial and aquatic zones (NMFS 1993). L–DEO’s planned tracklines lie about 9 and 13 km away from the two Oregon units of Steller sea lion critical habitat.

Unusual Mortality Events

On May 30, 2019, NMFS declared an unusual mortality event (UME) for gray whales after elevated numbers of strandings occurred along the U.S. west coast. As of April 5, 2021, a total of 430 stranded gray whales have been reported, including 209 in the United States (93 in Alaska, 50 in Washington, 9 in Oregon, and 57 in California), 205 in Mexico, and 16 in Canada. Full or partial necropsy examinations were conducted on a subset of the whales. Preliminary findings in several of the whales have shown evidence of emaciation. These findings are not consistent across all of the whales examined, so more research is needed. The UME is ongoing, and NMFS continues to investigate the cause(s). Additional information about the UME is available at <https://www.fisheries.noaa.gov/national/marine-life-distress/>

2019-2020-gray-whale-unusual-mortality-event-along-west-coast.

Increased strandings of Guadalupe fur seals have occurred along the entire coast of California. Guadalupe fur seal strandings began in January 2015 and were eight times higher than the historical average. Strandings have continued since 2015 and have remained well above average through 2019. Strandings are seasonal and generally peak in April through June of each year. Strandings in Oregon and Washington became elevated starting in 2019 and have continued to present. Strandings in these two states in 2019 are five times higher than the historical average. Guadalupe fur seals have stranded alive and dead. Those stranding are mostly weaned pups and juveniles (1–2 years old). The majority of stranded animals showed signs of malnutrition with secondary bacterial and parasitic infections. NMFS has declared a UME for Guadalupe fur seals along the entire U.S. West Coast; the UME is ongoing and NMFS is continuing to investigate the cause(s). For additional information on the UME, see <https://www.fisheries.noaa.gov/national/marine-life-distress/2015-2020-guadalupe-fur-seal-unusual-mortality-event-california>.

Elevated strandings of California sea lion pups occurred in Southern California between January 2013 and September 2016. As a result, NMFS declared a UME. The UME was confined to pup and yearling California sea lions, many of which were emaciated, dehydrated, and underweight for their age. A change in the availability of sea lion prey, especially sardines, a high value food source for nursing mothers, was a likely contributor to the large number of strandings. Sardine spawning grounds shifted further offshore in 2012 and 2013, and while other prey were available (market squid and rockfish), these may not have provided adequate nutrition in the milk of sea lion mothers supporting pups, or for newly-weaned pups foraging on their own. Although the pups showed signs of some viruses and infections, findings indicate that this event was not caused by disease, but rather by the lack of high quality, close-by food sources for nursing

mothers. Current evidence does not indicate that this UME was caused by a single infectious agent, though a variety of disease-causing bacteria and viruses were found in samples from sea lion pups. The investigative team examined multiple potential explanations for the high numbers of malnourished California sea lion pups observed on the island rookeries and stranded on the mainland in 2013. For more information, see <https://www.fisheries.noaa.gov/national/marine-life-distress/2013-2017-california-sea-lion-unusual-mortality-event-california>.

Marine Mammal Hearing

Hearing is the most important sensory modality for marine mammals underwater, and exposure to anthropogenic sound can have deleterious effects. To appropriately assess the potential effects of exposure to sound, it is necessary to understand the frequency ranges marine mammals are able to hear. Current data indicate that not all marine mammal species have equal hearing capabilities (*e.g.*, Richardson *et al.*, 1995; Wartzok and Ketten, 1999; Au and Hastings, 2008). To reflect this, Southall *et al.* (2007) recommended that marine mammals be divided into functional hearing groups based on directly measured or estimated hearing ranges on the basis of available behavioral response data, audiograms derived using auditory evoked potential techniques, anatomical modeling, and other data. Note that no direct measurements of hearing ability have been successfully completed for mysticetes (*i.e.*, low-frequency cetaceans). Subsequently, NMFS (2018) described generalized hearing ranges for these marine mammal hearing groups. Generalized hearing ranges were chosen based on the approximately 65 dB threshold from the normalized composite audiograms, with the exception for lower limits for low-frequency cetaceans where the lower bound was deemed to be biologically implausible and the lower bound from Southall *et al.* (2007) retained. Marine mammal hearing groups and their associated hearing ranges are provided in Table 2.

TABLE 2—MARINE MAMMAL HEARING GROUPS (NMFS, 2018)

Hearing group	Generalized hearing range *
Low-frequency (LF) cetaceans (baleen whales)	7 Hz to 35 kHz.
Mid-frequency (MF) cetaceans (dolphins, toothed whales, beaked whales, bottlenose whales)	150 Hz to 160 kHz.
High-frequency (HF) cetaceans (true porpoises, <i>Kogia</i> , river dolphins, cephalorhynchid, <i>Lagenorhynchus cruciger</i> & <i>L. australis</i>).	275 Hz to 160 kHz.
Phocid pinnipeds (PW) (underwater) (true seals)	50 Hz to 86 kHz.

TABLE 2—MARINE MAMMAL HEARING GROUPS (NMFS, 2018)—Continued

Hearing group	Generalized hearing range *
Otariid pinnipeds (OW) (underwater) (sea lions and fur seals)	60 Hz to 39 kHz.

* Represents the generalized hearing range for the entire group as a composite (*i.e.*, all species within the group), where individual species' hearing ranges are typically not as broad. Generalized hearing range chosen based on ~65 dB threshold from normalized composite audiogram, with the exception for lower limits for LF cetaceans (Southall *et al.* 2007) and PW pinniped (approximation).

The pinniped functional hearing group was modified from Southall *et al.* (2007) on the basis of data indicating that phocid species have consistently demonstrated an extended frequency range of hearing compared to otariids, especially in the higher frequency range (Hemilä *et al.*, 2006; Kastelein *et al.*, 2009; Reichmuth and Holt, 2013).

For more detail concerning these groups and associated frequency ranges, please see NMFS (2018) for a review of available information. 31 marine mammal species (25 cetacean and six pinniped (four otariid and two phocid) species) have the reasonable potential to co-occur with the planned survey activities. Please refer to Table 1. Of the cetacean species that may be present, six are classified as low-frequency cetaceans (*i.e.*, all mysticete species), 15 are classified as mid-frequency cetaceans (*i.e.*, all delphinid and ziphiid species and the sperm whale), and four are classified as high-frequency cetaceans (*i.e.*, porpoises and *Kogia* spp.).

Potential Effects of Specified Activities on Marine Mammals and Their Habitat

The effects of underwater noise from L-DEO's geophysical survey activities have the potential to result in behavioral harassment of marine mammals in the vicinity of the survey area. The notice of proposed IHA (85 FR 19580; April 7, 2020) included a discussion of the effects of anthropogenic noise on marine mammals and the potential effects of underwater noise from L-DEO's geophysical survey activities on marine mammals and their habitat. That information and analysis is incorporated by reference into this final IHA determination and is not repeated here; please refer to the notice of proposed IHA (85 FR 19580; April 7, 2020). The referenced information includes a summary and discussion of the ways that the specified activity may impact marine mammals and their habitat. Consistent with the analysis in our prior Federal Register notices for similar L-DEO surveys and after independently evaluating the analysis in L-DEO's application, we determine that the survey is likely to result in the takes described in the Estimated Take section

of this document and that other forms of take are not expected to occur.

The Estimated Take section later in this document includes a quantitative analysis of the number of individuals that are expected to be taken by this activity. The Negligible Impact Analysis and Determination section considers the content of this section, the Estimated Take section, and the Mitigation section, to draw conclusions regarding the likely impacts of these activities on the reproductive success or survivorship of individuals and how those impacts on individuals are likely to impact marine mammal species or stocks.

Description of Active Acoustic Sound Sources

The notice of proposed IHA provided a brief technical background on sound, on the characteristics of certain sound types, and on metrics used in the proposal inasmuch as the information was relevant to the specified activity and to a discussion of the potential effects of the specified activity on marine mammals found later in this document. Please see that document (85 FR 19580; April 7, 2020) for additional information. For general information on sound and its interaction with the marine environment, please see, *e.g.*, Au and Hastings (2008); Richardson *et al.* (1995); Urick (1983).

Estimated Take

This section provides an estimate of the number of incidental takes authorized through this IHA, which will inform both NMFS' consideration of "small numbers" 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 will primarily be by Level B harassment, as use of seismic airguns has the potential to result in disruption of behavioral patterns for individual marine mammals. There is also some potential for auditory injury (Level A harassment) for mysticetes and high frequency cetaceans (*i.e.*, porpoises, *Kogia* spp.). 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.

Generally speaking, 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. We note that while these basic factors can contribute to a basic calculation to provide an initial prediction of takes, additional information that can qualitatively inform take estimates is also sometimes available (*e.g.*, previous monitoring results or average group size). Below, we describe the factors considered here in more detail and present the take estimate.

Acoustic Thresholds

NMFS uses 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.*, 2012). 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 Level B harassment when exposed to underwater anthropogenic noise above received levels of 120 dB re 1 microPascal (μPa) root mean square (rms) for continuous (*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 planned 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 (Version 2.0) (Technical Guidance, 2018) 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). L-DEO's planned seismic survey includes the use of impulsive (seismic airguns) sources.

These thresholds are provided in the table below. The references, analysis, and methodology used in the development of the thresholds are described in NMFS 2018 Technical Guidance, which may be accessed at <https://www.fisheries.noaa.gov/national/marine-mammal-protection/marine-mammal-acoustic-technical-guidance>.

TABLE 3—THRESHOLDS IDENTIFYING THE ONSET OF PERMANENT THRESHOLD SHIFT

Hearing group	PTS onset acoustic thresholds* (received level)	
	Impulsive	Non-impulsive
Low-Frequency (LF) Cetaceans	Cell 1: $L_{pk,flat}$: 219 dB; $L_{E,LF,24h}$: 183 dB	Cell 2: $L_{E,LF,24h}$: 199 dB.
Mid-Frequency (MF) Cetaceans	Cell 3: $L_{pk,flat}$: 230 dB; $L_{E,MF,24h}$: 185 dB	Cell 4: $L_{E,MF,24h}$: 198 dB.
High-Frequency (HF) Cetaceans	Cell 5: $L_{pk,flat}$: 202 dB; $L_{E,HF,24h}$: 155 dB	Cell 6: $L_{E,HF,24h}$: 173 dB.
Phocid Pinnipeds (PW) (Underwater)	Cell 7: $L_{pk,flat}$: 218 dB; $L_{E,PW,24h}$: 185 dB	Cell 8: $L_{E,PW,24h}$: 201 dB.
Otariid Pinnipeds (OW) (Underwater)	Cell 9: $L_{pk,flat}$: 232 dB; $L_{E,OW,24h}$: 203 dB	Cell 10: $L_{E,OW,24h}$: 219 dB.

* 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 (L_{pk}) has a reference value of 1 μPa , and cumulative sound exposure level (L_E) has a reference value of $1\mu\text{Pa}^2\text{s}$. 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 identifying the area ensonified above the acoustic thresholds, which include source levels and acoustic propagation modeling.

L-DEO's modeling methodology is described in greater detail in the IHA application (LGL 2019). The planned 2D survey will acquire data using the 36-airgun array with a total discharge volume of 6,600 cubic inches (in^3) at a maximum tow depth of 12 m. L-DEO model results are used to determine the 160-dBrms radius for the 36-airgun array in deep water ($\leq 1,000$ m) down to a maximum water depth of 2,000 m. Water depths in the project area may be up to 4,400 m, but marine mammals are generally not anticipated to dive below 2,000 m (Costa and Williams 1999). Received sound levels were predicted by L-DEO's model (Diebold *et al.*, 2010) which 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 600–1100 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, the field measurements cannot be used readily to derive Level A and Level B harassment isopleths, as at those sites the calibration hydrophone was located at a roughly constant depth of 350–500 m, which may not intersect all the sound pressure level (SPL) isopleths at their widest point from the sea surface down to the maximum relevant water depth for marine mammals of ~2,000 m. 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 model—constructed from the maximum SPL through the entire water column at varying distances from the airgun array—is the most relevant.

In deep and intermediate-water depths, comparisons at short ranges between sound levels for direct arrivals recorded by the calibration hydrophone and model results for the same array tow depth are in good agreement (Fig. 12 and 14 in Appendix H of NSF-USGS, 2011). Consequently, isopleths falling within this domain can be predicted reliably by the L-DEO model, although they may be imperfectly sampled by measurements recorded at a single depth. At greater distances, the calibration data show that seafloor-reflected and sub-seafloor-refracted arrivals dominate, whereas the direct arrivals become weak and/or incoherent. Aside from local topography effects, the region around the critical distance is where the observed levels rise closest to the model curve. However, the observed sound levels are found to fall almost entirely below the

model curve. Thus, analysis of the Gulf of Mexico calibration measurements demonstrates that although simple, the L-DEO model is a robust tool for conservatively estimating isopleths. For deep water (>1,000 m), L-DEO used the deep-water radii obtained from model results down to a maximum water depth of 2,000 m.

A recent retrospective analysis of acoustic propagation from use of the R/V *Langseth* sources during a 2012 survey off Washington (*i.e.*, in the same location) suggests that predicted (modeled) radii (using the same approach as that used here) were 2–3 times larger than the measured radii in shallow water. (Crone *et al.*, 2014). Therefore, because the modeled

shallow-water radii were specifically demonstrated to be overly conservative for the region in which the current survey is planned, L-DEO used the received levels from multichannel seismic data collected by the R/V *Langseth* during the 2012 survey to estimate Level B harassment radii in shallow (<100 m) and intermediate (100–1,000 m) depths (Crone *et al.*, 2014). Streamer data in shallow water collected in 2012 have the advantage of including the effects of local and complex subsurface geology, seafloor topography, and water column properties, and thus allow determination of radii more confidently than using data from calibration experiments in the Gulf of Mexico.

The survey will acquire data with a four-string 6,600-in³ airgun array at a tow depth of 12 m while the data collected in 2012 were acquired with the same airgun array at a tow depth of 9 m. To account for the differences in tow depth between the 2012 survey and the planned 2021 survey, L-DEO calculated a scaling factor using the deep water modeling (see Appendix D in L-DEO’s IHA application). A scaling factor of 1.15 was applied to the measured radii from the airgun array towed at 9 m.

The estimated distances to the Level B harassment isopleth for the R/V *Langseth*’s 36-airgun array are shown in Table 4.

TABLE 4—PREDICTED RADIAL DISTANCES TO ISOPLETHS CORRESPONDING TO LEVEL B HARASSMENT THRESHOLD

Source and volume	Tow depth (m)	Water depth (m)	Level B harassment zone (m) using L-DEO model
36 airgun array, 6,600-in ³	12	>1000 100–1000 <100	^a 6,733 ^b 9,468 ^b 12,650

^aDistance based on L-DEO model results.
^bDistance based on data from Crone *et al.* (2014).

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 source modeling software program and the NMFS User Spreadsheet, described below. The acoustic thresholds for impulsive sounds (*e.g.*, airguns) contained in the Technical Guidance were presented as dual metric acoustic thresholds using both cumulative sound exposure level (SEL_{cum}) and peak sound pressure metrics (NMFS 2018). 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 R/V *Langseth* airgun array were derived from calculating the modified far-field 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 harassment 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.

For a more complete explanation of this modeling approach, please see “Appendix A: Determination of Mitigation Zones” in the IHA application.

TABLE 5—MODELED SOURCE LEVELS BASED ON MODIFIED FARFIELD SIGNATURE FOR THE 6,600-IN³ AIRGUN ARRAY

	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})	252.06	252.65	253.24	252.25	252.52
6,600 in ³ airgun array (SEL _{cum})	232.98	232.84	233.10	232.84	232.08

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 R/V *Langseth’s* airgun array (modeled in 1 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 (4.2 knots) and shot intervals (37.5 m) specific to the planned survey, 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 for the 36-airgun array for the surveys are shown in Table A–3 in Appendix A of the IHA application. Outputs from the User Spreadsheets in the form of estimated distances to Level A harassment isopleths for the survey are shown in Table 6. 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

Source (volume)	Threshold	Level A harassment zone (m)				
		LF cetaceans	MF cetaceans	HF cetaceans	Phocids	Otariids
36-airgun array (6,600 in ³)	SEL _{cum}	426.9	0	1.3	13.9	0
	Peak	38.9	13.6	268.3	43.7	10.6

Note that because of some of the assumptions included in the methods used (*e.g.*, stationary receiver with no vertical or horizontal movement in response to the acoustic source), isopleths produced may be overestimates to some degree, which will ultimately result in some degree of overestimation of Level A harassment. However, these tools offer the best way to predict appropriate isopleths when more sophisticated 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 this seismic survey, 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.

Auditory injury is unlikely to occur for mid-frequency cetaceans, otariid pinnipeds, and phocid pinnipeds given very small modeled zones of injury for those species (up to 43.7 m), in context of distributed source dynamics. The

source level of the array is a theoretical definition assuming a point source and measurement in the far-field of the source (MacGillivray, 2006). As described by Caldwell and Dragoset (2000), an array is not a point source, but one that spans a small area. In the far-field, individual elements in arrays will effectively work as one source because individual pressure peaks will have coalesced into one relatively broad pulse. The array can then be considered a “point source.” For distances within the near-field, *i.e.*, approximately 2–3 times the array dimensions, pressure peaks from individual elements do not arrive simultaneously because the observation point is not equidistant from each element. The effect is destructive interference of the outputs of each element, so that peak pressures in the near-field will be significantly lower than the output of the largest individual element. Here, the relevant peak isopleth distances for these three hearing groups would in all cases be expected to be within the near-field of the array where the definition of source level breaks down. Therefore, actual

locations within this distance of the array center where the sound level exceeds the relevant criteria would not necessarily exist. In general, Caldwell and Dragoset (2000) suggest that the near-field for airgun arrays is considered to extend out to approximately 250 m. For full discussion of these concepts, please see our notice of proposed IHA (85 FR 19580; April 7, 2020).

In consideration of the received sound levels in the near-field as described above, we expect the potential for Level A harassment of mid-frequency cetaceans, otariid pinnipeds, and phocid pinnipeds to be de minimis, even before the likely moderating effects of aversion and/or other compensatory behaviors (*e.g.*, Nachtigall *et al.*, 2018) are considered. We do not believe that Level A harassment is a likely outcome for any mid-frequency cetacean, otariid pinniped, or phocid pinniped and have not authorized any Level A harassment for these species.

Marine Mammal Occurrence

In this section we provide the information about the presence, density,

and group dynamics of marine mammals that will inform the take calculations.

Extensive systematic aircraft- and ship-based surveys have been conducted for marine mammals in offshore waters of Oregon and Washington (e.g., Bonnell *et al.*, 1992; Green *et al.*, 1992, 1993; Barlow 1997, 2003; Barlow and Taylor 2001; Calambokidis and Barlow 2004; Barlow and Forney 2007; Forney 2007; Barlow 2010). Ship surveys for cetaceans in slope and offshore waters of Oregon and Washington were conducted by NMFS' Southwest Fisheries Science Center (SWFSC) in 1991, 1993, 1996, 2001, 2005, 2008, and 2014 and synthesized by Barlow (2016); these surveys were conducted from the coastline up to ~556 km from shore from June or August to November or December. These data were used by the SWFSC to develop spatial models of cetacean densities for the California Current Ecosystem (CCE). Systematic, offshore, at-sea survey data for pinnipeds are more limited (e.g., Bonnell *et al.*, 1992; Adams *et al.*, 2014). In British Columbia, several systematic surveys have been conducted in coastal waters (e.g., Williams and Thomas 2007; Ford *et al.*, 2010a; Best *et al.*, 2015; Harvey *et al.*, 2017). Surveys in coastal as well as offshore waters were conducted by DFO during 2002 to 2008; however, little effort occurred off the west coast of Vancouver Island during late spring/summer (Ford *et al.*, 2010). Density estimates for the survey areas outside the U.S. EEZ, *i.e.*, in the Canadian EEZ, were not readily available, so density estimates for U.S. waters were applied to the entire survey area.

The U.S. Navy primarily used SWFSC habitat-based cetacean density models to develop a marine species density database (MSDD) for the Northwest Training and Testing (NWTT) Study Area for NWTT Phase III activities (U.S. Navy 2019a), which encompasses the U.S. portion of the survey area. For several cetacean species, the Navy updated densities estimated by line-transect surveys or mark-recapture studies (e.g., Barlow 2016). These methods usually produce a single value for density that is an averaged estimate across very large geographical areas, such as waters within the U.S. EEZ off California, Oregon, and Washington (referred to as a "uniform" density estimate). This is the general approach applied in estimating cetacean abundance in the NMFS stock assessment reports. The disadvantage of these methods is that they do not provide spatially- or temporally-explicit density information. More recently, a

newer method called spatial habitat modeling has been used to estimate cetacean densities that address some of these shortcomings (e.g., Barlow *et al.*, 2009; Becker *et al.*, 2010; 2012a; 2014; Becker *et al.*, 2016; Ferguson *et al.*, 2006; Forney *et al.*, 2012; 2015; Redfern *et al.*, 2006). (Note that spatial habitat models are also referred to as "species distribution models" or "habitat-based density models.") These models estimate density as a continuous function of habitat variables (e.g., sea surface temperature, seafloor depth) and thus, within the study area that was modeled, densities can be predicted at all locations where these habitat variables can be measured or estimated. Spatial habitat models therefore allow estimates of cetacean densities on finer scales (spatially and temporally) than traditional line-transect or mark-recapture analyses.

The methods used to estimate pinniped at-sea densities are typically different than those used for cetaceans, because pinnipeds are not limited to the water and spend a significant amount of time on land (e.g., at rookeries). Pinniped abundance is generally estimated via shore counts of animals on land at known haulout sites or by counting number of pups weaned at rookeries and applying a correction factor to estimate the abundance of the population (for example Harvey *et al.*, 1990; Jeffries *et al.*, 2003; Lowry, 2002; Sepulveda *et al.*, 2009). Estimating in-water densities from land-based counts is difficult given the variability in foraging ranges, migration, and haulout behavior between species and within each species, and is driven by factors such as age class, sex class, breeding cycles, and seasonal variation. Data such as age class, sex class, and seasonal variation are often used in conjunction with abundance estimates from known haulout sites to assign an in-water abundance estimate for a given area. The total abundance divided by the area of the region provides a representative in-water density estimate for each species in a different location. In addition to using shore counts to estimate pinniped density, traditional line-transect derived estimates are also used, particularly in open ocean areas.

The Navy's MSDD is currently the most comprehensive compendium for density data available for the CCE. However, data products are currently not publically available for the database; thus, in this analysis the Navy's data products were used only for species for which density data were not available from an alternative spatially-explicit model (e.g., pinnipeds, *Kogia* spp., minke whales, sei whales, gray whales,

short-finned pilot whales, and Northern Resident, transient, and offshore killer whales). For these species, a geographic information system (GIS) was used to determine the areas expected to be ensonified in each density category (*i.e.*, distance from shore). For pinnipeds, the densities from the Navy's MSDD were corrected by projecting the most recent population growth and updated population estimates to 2020, when available. Where available, the appropriate seasonal density estimate from the MSDD was used in the estimation here (*i.e.*, summer).

NMFS obtained data products from the Navy for densities of Southern Resident killer whales in the NWTT Offshore Study Area. The modeled density estimates were available on the scale of 1 km by 1 km grid cells. The densities from grid cells overlapping the ensonified area in each depth category were multiplied by the corresponding area to estimate potential exposures (Table 9).

For most other species, (*i.e.*, humpback, blue, fin, sperm, Baird's beaked, and other small beaked whales; bottlenose, striped, common, Pacific white-sided, Risso's and northern right whale dolphins; and Dall's porpoise), habitat-based density models from Becker *et al.* (2016) were used. Becker *et al.* (2016) used seven years of SWFSC cetacean line-transect survey data collected between 1991 and 2009 to develop predictive habitat-based models of cetacean densities in the CCE. The modeled density estimates were available on the scale of 7 km by 10 km grid cells. The densities from all grid cells overlapping the ensonified areas within each water depth category were averaged to calculate a zone-specific density for each species.

Becker *et al.* (2016) did not develop a density model for the harbor porpoise, so densities from Forney *et al.* (2014) were used for that species. Forney *et al.* (2014) presented estimates of harbor porpoise abundance and density along the Pacific coast of California, Oregon, and Washington based on aerial line-transect surveys conducted between 2007 and 2012. Separate density estimates were provided for harbor porpoises in Oregon south of 45° N and Oregon/Washington north of 45° N (*i.e.*, within the boundaries of the Northern California/Southern Oregon and Northern Oregon/Washington Coast stocks), so stock-specific take estimates were generated (Forney *et al.*, 2014).

Background information on the density calculations for each species/guild (if different from the general methods from the Navy's MSDD, Becker *et al.* (2016), or Forney *et al.* (2014)

described above) are reported here. Density estimates for each species/guild (aside from Southern Resident killer whales, which are discussed separately) are found in Table 7.

Gray Whale

DeAngelis *et al.* (2011) developed a migration model that provides monthly, spatially explicit predictions of gray whale abundance along the U.S. West Coast from December through June. These monthly density estimates apply to a “main migration corridor” that extends from the coast to 10 km offshore. A zone from the main migration corridor out to 47 km offshore is designated as an area of “potential presence”. To derive a density estimate for this area the Navy assumed that 1 percent of the population could be within the 47-km “potential presence” area during migration. Given the 2014 stock assessment population estimate of 20,990 animals (Carretta *et al.*, 2017b), approximately 210 gray whales may use this corridor. Assuming the migration wave lasts 30 days, then 7 whales on average on any one day could occur in the “potential presence” area. The area from the main migration route offshore to 47 km within the NWTT study area = 45,722.06 km², so density within this zone = 0.00015 whales/km². From July–November, gray whale occurrence off the coast is expected to consist primarily of whales belonging to the Pacific Coast Feeding Group (PCFG). Calambokidis *et al.* (2012) provided an updated analysis of the abundance of the PCFG whales in the Pacific Northwest and recognized that this group forms a distinct feeding aggregation. For the purposes of establishing density, the Navy assumed that from July 1 to November 30 all the 209 PCFG whales could be present off the coast in the Northern California/Oregon/Washington region (this accounts for the potential that some PCFG whales may be outside of the area but that there also may be some non-PCFG whales in the region as noted by Calambokidis *et al.* (2012)). Given that the PCFG whales are found largely nearshore, it was assumed that all the whales could be within 10 km of the coast. To capture the potential presence of whales further offshore (*e.g.*, Oleson *et al.*, 2009), it was assumed that a percentage of the whales could be present from 10 km out to 47 km off the coast; the 47 km outer limit is consistent with the DeAngelis *et al.* (2011) migration model. Since 77 percent of the PCFG sightings were within the nearshore BIAs (Calambokidis *et al.*, 2015), it was assumed that 23 percent (48 whales) could potentially be found

further offshore. Two strata were thus developed for the July–November gray whale density layers: (1) From the coast to 10 km offshore, and (2) from 10 km to 47 km offshore. The density was assumed to be 0 animals/km² for areas offshore of 47 km.

Small Beaked Whale Guild

NMFS has developed habitat-based density models for a small beaked whale guild in the CCE (Becker *et al.*, 2012b; Forney *et al.*, 2012). The small beaked whale guild includes Cuvier’s beaked whale and beaked whales of the genus *Mesoplodon*, including Blainville’s beaked whale, Hubbs’ beaked whale, and Stejneger’s beaked whale. NMFS SWFSC developed a CCE habitat-based density model for the small beaked whale guild which provides spatially explicit density estimates off the U.S. West Coast for summer and fall based on survey data collected between 1991 and 2009 (Becker *et al.*, 2016).

False Killer Whale

False killer whales were not included in the Navy’s MSDD, as they are very rarely encountered in the northeast Pacific. Density estimates for false killer whales were also not presented in Barlow (2016) or Becker *et al.* (2016), as no sightings occurred during surveys conducted between 1986 and 2008 (Ferguson and Barlow 2001, 2003; Forney 2007; Barlow 2003, 2010). One sighting was made off of southern California during 2014 (Barlow 2016). One pod of false killer whales occurred in Puget Sound for several months during the 1990s (Navy 2015). Based on the available information, NMFS does not believe false killer whales are expected to be taken, but L–DEO has requested take of this species so we are acting on that request.

Killer Whale

A combination of movement data (from both visual observations and satellite-linked tags) and detections from stationary acoustic recorders have provided information on the offshore distribution of the Southern Resident stock (Hanson *et al.*, 2018). These data have been used to develop state space movement models that provide estimates of the probability of occurrence (or relative density) of Southern Residents in the offshore study area in winter and spring (Hanson *et al.*, 2018). Since the total number of animals that comprise each pod is known, the relative density estimates were used in association with the total abundance estimates to derive absolute density estimates (*i.e.*, number of animals/km²) within the offshore study

area. Given that the K and L pods were together during all but one of the satellite tag deployments, Hanson *et al.* (2018) developed two separate state space models, one for the combined K and L pods and one for the J pod. The absolute density estimates were thus derived based on a total of 53 animals for the K and L pods (K pod = 18 animals, L pod = 35 animals) and 22 animals for the J pod (Center for Whale Research, 2019). Of the three pods, the K and L pods appear to have a more extensive and seasonally variable offshore coastal distribution, with rare sightings as far south as Monterey Bay, California (Carretta *et al.*, 2019; Ford *et al.*, 2000; Hanson *et al.*, 2018). Two seasonal density maps were thus developed for the K and L pods, one representing their distribution from January to May (the duration of the tag deployments), and another representing their distribution from June to December. Based on stationary acoustic recording data, their excursions offshore from June to December are more limited and typically do not extend south of the Columbia River (Emmons 2019). To provide more conservative density estimates, the Navy extended the June to December distribution to just south of the Columbia River and redistributed the total K and L populations (53 animals) within the more limited range boundaries. A conservative approach was also adopted for the J pod since the January to May density estimates were assumed to represent annual occurrence patterns, despite information that this pod typically spends more time in the inland waters during the summer and fall (Carretta *et al.*, 2019; Ford *et al.*, 2000; Hanson *et al.*, 2018). Further, for all seasons the Navy assumed that all members of the three pods of Southern Residents could occur either offshore or in the inland waters, so the total number of animals in the stock was used to derive density estimates for both study areas.

Due to the difficulties associated with reliably distinguishing the different stocks of killer whales from at sea sightings, and anticipated equal likelihood of occurrence among the stocks, density estimates for the rest of the stocks are presented as a whole (*i.e.*, includes the Offshore, West Coast Transient, and Northern Resident stocks). Barlow (2016) presents density values for killer whales in the CCE, with separate densities for waters off Oregon/Washington (*i.e.*, north of the California border) and Northern California for summer/fall. Density data are not available for the NWTT Offshore area northwest of the CCE study area, so data

from the SWFSC Oregon/Washington area were used as representative estimates. These values were used to represent density year-round.

Short-Finned Pilot Whale

Along the U.S. West Coast, short-finned pilot whales were once common south of Point Conception, California (Carretta *et al.*, 2017b; Reilly & Shane, 1986), but now sightings off the U.S. West Coast are infrequent and typically occur during warm water years (Carretta *et al.*, 2017b). Stranding records for this species from Oregon and Washington waters are considered to be beyond the normal range of this species rather than an extension of its range (Norman *et al.*, 2004). Density values for short-finned pilot whales are available for the SWFSC Oregon/Washington and Northern California strata for summer/fall (Barlow, 2016). Density data are not available for the NWT Offshore area northwest of the SWFSC strata, so data from the SWFSC Oregon/Washington stratum were used as representative estimates. These values were used to represent density year-round.

Guadalupe Fur Seal

Adult male Guadalupe fur seals are expected to be ashore at breeding areas over the summer, and are not expected to be present during the planned geophysical survey (Caretta *et al.*, 2017b; Norris 2017b). Additionally, breeding females are unlikely to be present within the Offshore Study Area as they remain ashore to nurse their pups through the fall and winter, making only short foraging trips from rookeries (Gallo-Reynoso *et al.*, 2008; Norris 2017b; Yochem *et al.*, 1987). To estimate the total abundance of Guadalupe fur seals, the Navy adjusted the population reported in the 2016 SAR (Caretta *et al.*, 2017b) of 20,000 seals by applying the average annual growth rate of 7.64 percent over the seven years between 2010 and 2017. The resulting 2017 projected abundance was 33,485 fur seals. Using the reported composition of the breeding population of Guadalupe fur seals (Gallo-Reynoso 1994) and satellite telemetry data (Norris 2017b), the Navy established seasonal and demographic abundances of Guadalupe fur seals expected to occur within the Offshore Study Area.

The distribution of Guadalupe fur seals in the Offshore Study Area was stratified by distance from shore (or water depth) to reflect their preferred pelagic habitat (Norris, 2017a). Ten percent of fur seals in the Study Area are expected to use waters over the continental shelf (approximated as waters with depths between 10 and 200

m). A depth of 10 m is used as the shoreward extent of the shelf (rather than extending to shore), because Guadalupe fur seals in the Offshore Study Area are not expected to haul out and would not be likely to come close to shore. All fur seals (*i.e.*, 100 percent) would use waters off the shelf (beyond the 200-m isobath) out to 300 km from shore, and 25 percent of fur seals would be expected to use waters between 300 and 700 km from shore (including the planned geophysical survey area). The second stratum (200 m to 300 km from shore) is the preferred habitat where Guadalupe fur seals are most likely to occur most of the time. Individuals may spend a portion of their time over the continental shelf or farther than 300 km from shore, necessitating a density estimate for those areas, but all Guadalupe fur seals would be expected to be in the central stratum most of the time, which is the reason 100 percent is used in the density estimate for the central stratum (Norris, 2017a). Spatial areas for the three strata were estimated in a GIS and used to calculate the densities.

The Navy's density estimate for Guadalupe fur seals projected the abundance through 2017, while L-DEO's survey was initially planned to occur in 2020. Therefore, we have projected the abundance estimate in 2020 using the abundance estimate (34,187 animals) and population growth rate (5.9 percent) presented in the 2019 draft SARs (Caretta *et al.*, 2019). This calculation yielded an increased density estimate of Guadalupe fur seals than what was presented in the Navy's MSDD.

Northern Fur Seal

The Navy estimated the abundance of northern fur seals from the Eastern Pacific stock and the California breeding stock that could occur in the NWT Offshore Study Area by determining the percentage of time tagged animals spent within the Study Area and applying that percentage to the population to calculate an abundance for adult females, juveniles, and pups independently on a monthly basis. Adult males are not expected to occur within the Offshore Study Area and the planned survey area during the planned geophysical survey as they spend the summer ashore at breeding areas in the Bering Sea and San Miguel Island (Caretta *et al.*, 2017b). Using the monthly abundances of fur seals within the Offshore Study Area, the Navy created strata to estimate the density of fur seals within three strata: 22 km to 70 km from shore, 70 km to 130 km from shore, and 130 km to 463 km from shore

(the western Study Area boundary). L-DEO's planned survey is 423 km from shore at the closest point. Based on satellite tag data and historic sealing records (Olesiuk 2012; Kajimura 1984), the Navy assumed 25 percent of the population present within the overall Offshore Study Area may be within the 130 km to 463 km stratum.

The Navy's density estimates for northern fur seals did not include the latest abundance data collected from Bogoslof Island or the Pribilof Islands in 2015 and 2016. Incorporating the latest pup counts yielded a slight decrease in the population abundance estimate, which resulted in a slight decrease in the estimated densities of northern fur seals in each depth stratum.

Steller Sea Lion

The Eastern stock of Steller sea lions has established rookeries and breeding sites along the coasts of California, Oregon, British Columbia, and southeast Alaska. A new rookery was recently discovered along the coast of Washington at the Carroll Island and Sea Lion Rock complex, where more than 100 pups were born in 2015 (Muto *et al.*, 2017; Wiles 2015). The 2017 SAR did not factor in pups born at sites along the Washington coast (Muto *et al.*, 2017). Considering that pups have been observed at multiple breeding sites since 2013, specifically at the Carroll Island and Sea Lion Rock complex (Wiles 2015), the 2017 SAR abundance of 1,407 Steller sea lions (non-pups only) for Washington underestimates the total population. Wiles (2015) estimates that up to 2,500 Steller sea lions are present along the Washington coast, which is the abundance estimate used by the Navy to calculate densities. Approximately 30,000 Steller sea lions occur along the coast of British Columbia, but these animals were not included in the Navy's calculations. The Navy applied the annual growth rate for each regional population (California, Oregon, Washington, and southeast Alaska), reported in Muto *et al.* (2017), to each population to estimate the stock abundance in 2017, and we further projected the population estimate in 2020. The Commission noted that we had used the non-pup population growth rate to project the population of both non-pups and pups. Additionally, the Commission suggested we include the British Columbia population in our projections. We have revised the population projections and resulting density estimates accordingly.

Sea lions from northern California and southern Oregon rookeries migrate north in September following the breeding season and winter in northern

Oregon, Washington, and British Columbia waters. They disperse widely following the breeding season, which extends from May through July, likely in search of different types of prey, which may be concentrated in areas where oceanic fronts and eddies persist (Fritz *et al.*, 2016; Jemison *et al.*, 2013; Lander *et al.*, 2010; Muto *et al.*, 2017; NMFS 2013; Raum-Suryan *et al.*, 2004; Sigler *et al.*, 2017). Adults depart rookeries in August. Females with pups remain within 500 km of their rookery during the non-breeding season and juveniles of both sexes and adult males disperse more widely but remain primarily over the continental shelf (Wiles 2015).

Based on 11 sightings along the Washington coast, Steller sea lions were observed at an average distance of 13 km from shore and 35 km from the shelf break (defined as the 200-m isobath) (Oleson *et al.*, 2009). The mean water depth in the area of occurrence was 42 m, and surveys were conducted out to approximately 60 km from shore. Wiles (2015) estimated that Steller sea lions off the Washington coast primarily occurred within 60 km of shore, favoring habitats over the continental shelf. However, a few individuals may travel several hundred km offshore (Merrick & Loughlin 1997; Wiles 2015). Based on these occurrence and distribution data, two strata were used to estimate densities for Steller sea lions. The spatial area extending from shore to the 200-m isobath (*i.e.*, over the continental shelf) was defined as one stratum, and the second stratum extended from the 200-m isobath to 300 km from shore to account for reports of Steller sea lions occurring several hundred km offshore. Ninety-five percent of the population of Steller sea lions occurring in the NWT Study Area were distributed over the continental shelf stratum and the remaining five percent were assumed to occur between the 200-m isobath and 300 km from shore.

The percentage of time Steller sea lions spend hauled out varies by season, life stage, and geographic location. To calculate densities in the Study Area, the projected population abundance was adjusted to account for time spent hauled out. In spring and winter, sea lions were estimated to be in the water 64 percent of the time. In summer, when sea lions are more likely to be in the water, the percent of animals estimated to be in the water was increased to 76 percent, and in fall, sea lions were anticipated to be in the water 53 percent of the time (U.S. Navy 2019). Densities were calculated for each depth stratum off Washington and off Oregon.

California Sea Lion

Seasonal at-sea abundance of California sea lions is estimated from strip transect survey data collected offshore along the California coastline (Lowry & Forney 2005). The survey area was divided into seven strata, labeled A through G. Abundance estimates from the two northernmost strata (A and B) were used to estimate the abundance of California sea lions occurring in the NWT Study Area. While the northernmost stratum (A) only partially overlaps with the Study Area, this approach conservatively assumes that all sea lions from the two strata would continue north into the Study Area.

The majority of male sea lions would be expected in the NWT Study Area from August to mid-June (Wright *et al.*, 2010). In summer, males are expected to be at breeding sites off of Southern California. In-water abundance estimates of adult and sub-adult males in strata A and B were extrapolated to estimate seasonal densities in the Study Area. Approximately 3,000 male California sea lions are known to pass through the NWT Study Area in August as they migrate northward to the Washington coast and inland waters (DeLong 2018a; Wright *et al.*, 2010). Nearly all male sea lions are expected to be on or near breeding sites off California in July (DeLong *et al.*, 2017; Wright *et al.*, 2010). An estimate of 3,000 male sea lions is used for the month of August. Projected 2017 seasonal abundance estimates were derived by applying an annual growth rate of 5.4 percent (Caretta *et al.*, 2017b) between 1999 and 2017 to the abundance estimates from Lowry & Forney (2005).

The strata used to calculate densities in the NWT Study Area were based on distribution data from Wright *et al.* (2010) and Lowry & Forney (2005) indicating that approximately 90 percent of California sea lions occurred within 40 km of shore and 100 percent of sea lions were within 70 km of shore. A third stratum was added that extends from shore to 450 km offshore to account for anomalous conditions, such as changes in sea surface temperature and upwelling associated with El Niño, during which California sea lions have been encountered farther from shore, presumably seeking prey (DeLong & Jeffries 2017; Weise *et al.*, 2010). The Navy calculated densities for each stratum (0 to 40 km, 40 to 70 km, and 0 to 450 km) for each season, spring, summer, fall, and winter, but noted that the density of California sea lions in all strata for June and July was 0 animals/km². The Navy's calculated densities for

August were conservatively used here, as sightings of California sea lions have been reported on the continental shelf in June and July (Adams *et al.*, 2014).

Northern Elephant Seal

The most recent surveys supporting the abundance estimate for northern elephant seals were conducted in 2010 (Caretta *et al.*, 2017b). By applying the average growth rate of 3.8 percent per year for the California breeding stock over the 7 years from 2010 to 2017, the Navy calculated a projected 2017 abundance estimate of 232,399 elephant seals (Caretta *et al.*, 2017b; Lowry *et al.*, 2014). Male and female distributions at sea differ both seasonally and spatially. Pup counts reported by Lowry *et al.*, (2014) and life tables compiled by Condit *et al.*, (2014) were used to determine the proportion of males and females in the population, which was estimated to be 56 percent female and 44 percent male. Females are assumed to be at sea 100 percent of the time within their seasonal distribution area in fall and summer (Robinson *et al.*, 2012). Males are at sea approximately 90 percent of the time in fall and spring, remain ashore through the entire winter, and spend one month ashore to molt in the summer (*i.e.*, are at sea 66 percent of the summer). Monthly distribution maps produced by Robinson *et al.* (2012) showing the extent of foraging areas used by satellite tagged female elephant seals were used to estimate the spatial areas to calculate densities. Although the distributions were based on tagged female seals, Le Boeuf *et al.* (2000) and Simmons *et al.* (2007) reported similar tracks by males over broad spatial scales. The spatial areas representing each monthly distribution were calculating using GIS and then averaged to produce seasonally variable areas and resulting densities.

As with other pinniped species above, NMFS used the population growth rate reported by Caretta *et al.* (2017b) to project the estimated abundance in 2020. The resulting population estimate and estimated densities increased from those presented in the Navy's MSDD (U.S. Navy 2019).

Harbor Seal

Only harbor seals from the Washington and Oregon Coast stock would be expected to occur in the survey area. The most recent abundance estimate for the Washington and Oregon Coast stock is 24,732 harbor seals (Caretta *et al.*, 2017b). Survey data supporting this abundance estimate are from 1999, which exceeds the 8 year limit beyond which NMFS will not confirm abundance in a SAR (Caretta *et*

al., 2017b). However, based on logistical growth curves for the Washington and Oregon Coast stock that leveled off in the early 1990s (Caretta *et al.*, 2017b) and unpublished data from the Washington Department of Fish and Wildlife (DeLong & Jeffries 2017), an annual growth rate of 0 percent (*i.e.*, the population has remained stable) was applied such that the 2017 abundance estimate used by the Navy, and 2020 estimate used here, was still 24,732 harbor seals. A haulout factor of 33 percent was used to account for hauled-

out seals (*i.e.*, seals are estimated to be in the water 33 percent of the time) (Huber *et al.*, 2001). A single stratum extending from shore to 30 km offshore was used to define the spatial area used by the Navy for calculating densities off Washington and Oregon (Bailey *et al.*, 2014; Oleson *et al.*, 2009).

No significant new information is available since we published the notice of proposed IHA, and no changes have been made, other than those described in the Changes from the Proposed IHA

section, provided previously in this document.

Marine Mammal Densities

Densities for most species are presented by depth stratum (shallow, intermediate, and deep water) in Table 7. For species where densities are available based on other categories (gray whale, harbor porpoise, northern fur seal, Guadalupe fur seal, California sea lion, Steller sea lion), category definitions are provided in the footnotes of Table 7.

TABLE 7—MARINE MAMMAL DENSITY VALUES IN THE SURVEY AREA

Species	Estimated density (#/km ²)			Reference
	Shallow <100 m/Category 1	Intermediate 100–1,000 m/Category 2	Deep >1,000 m/Category 3	
LF Cetaceans:				
Humpback whale	0.0052405	0.0040200	0.0004830	Becker <i>et al.</i> (2016)
Blue whale	0.0020235	0.0010518	0.0003576	Becker <i>et al.</i> (2016)
Fin whale	0.0002016	0.0009306	0.0013810	Becker <i>et al.</i> (2016)
Sei whale	0.0004000	0.0004000	0.0004000	U.S. Navy (2019)
Minke whale	0.0013000	0.0013000	0.0013000	U.S. Navy (2019)
Gray whale ^a	0.0155000	0.0010000	N.A.	U.S. Navy (2019)
MF Cetaceans:				
Sperm whale	0.0000586	0.0001560	0.0013023	Becker <i>et al.</i> (2016)
Baird's beaked whale	0.0001142	0.0002998	0.0014680	Becker <i>et al.</i> (2016)
Small beaked whale	0.0007878	0.0013562	0.0039516	Becker <i>et al.</i> (2016)
Bottlenose dolphin	0.0000007	0.0000011	0.0000108	Becker <i>et al.</i> (2016)
Striped dolphin	0.0000000	0.0000025	0.0001332	Becker <i>et al.</i> (2016)
Short-beaked common dolphin	0.0005075	0.0010287	0.0016437	Becker <i>et al.</i> (2016)
Pacific white-sided dolphin	0.0515230	0.0948355	0.0700595	Becker <i>et al.</i> (2016)
Northern right-whale dolphin	0.0101779	0.0435350	0.0621242	Becker <i>et al.</i> (2016)
Risso's dolphin	0.0306137	0.0308426	0.0158850	Becker <i>et al.</i> (2016)
False killer whale ^b	N.A.	N.A.	N.A.	
Killer whale (all stocks except Southern Residents)	0.0009200	0.0009200	0.0009200	U.S. Navy (2019)
Short-finned pilot whale	0.0002500	0.0002500	0.0002500	U.S. Navy (2019)
HF Cetaceans:				
Pygmy/dwarf sperm whale	0.0016300	0.0016300	0.0016300	U.S. Navy (2019)
Dall's porpoise	0.1450767	0.1610605	0.1131827	Becker <i>et al.</i> (2016)
Harbor porpoise ^c	0.6240000	0.4670000	N.A.	Forney <i>et al.</i> (2014)
Otariids:				
Northern fur seal ^d	0.0113247	0.1346441	0.0103424	U.S. Navy (2019)
Guadalupe fur seal ^e	0.0234772	0.0262595	N.A.	U.S. Navy (2019)
California sea lion ^f	0.0288000	0.0037000	0.0065000	U.S. Navy (2019)
Steller sea lion ^g	0.4804893	0.0035811	N.A.	U.S. Navy (2019)
Phocids:				
Northern elephant seal	0.0345997	0.0345997	0.0345997	U.S. Navy (2019)
Harbor seal ^h	0.3424000	N.A.	N.A.	U.S. Navy (2019)

^a Category 1 = 0–10 km offshore, Category 2 = 10–47 km offshore (U.S. Navy 2019).

^b No density estimates available for false killer whales in the survey area, take is based on mean group size from Mobley *et al.* (2000).

^c Category 1 = South of 45° N, Category 2 = North of 45° N (Forney *et al.*, 2014).

^d Category 1 = 22–70 km offshore, Category 2 = 70–130 km offshore, Category 3 = 130–463 km offshore (U.S. Navy 2019).

^e Category 1 = 10–200 m depth, Category 2 = 200 m depth–300 km offshore; No stock-specific densities are available so these densities were applied to northern fur seals as a species (U.S. Navy 2019).

^f Category 1 = 0–40 km offshore, Category 2 = 40–70 km offshore, Category 3 = 0–450 km offshore (U.S. Navy 2019).

^g Category 1 = shore–200 m depth, Category 2 = 200 m depth–300 m offshore (U.S. Navy 2019).

^h Category 1 = 0–30 km offshore (U.S. Navy 2019).

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 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 and Level B harassment thresholds. The distance for the 160-dB threshold (based on L–DEO model results) was used to draw a buffer

around every transect line in GIS to determine the total ensonified area in each depth category (Table 8). The areas presented in Table 8 do not include areas ensonified within Canadian territorial waters (from 0–12 nmi (22.2 km) from shore). As discussed above, NMFS cannot authorize the incidental take of marine mammals in the territorial seas of foreign nations, as the MMPA does not apply in those waters. However, NMFS has still calculated the level of incidental take in the entire activity area (including Canadian territorial waters) as part of the analysis supporting our determination under the MMPA that the activity will have a negligible impact on the affected

species. The total estimated take in U.S. and Canadian waters is presented in Table 11.

In past applications, to account for unanticipated delays in operations, L-DEO has added 25 percent in the form of operational days, which is equivalent to adding 25 percent to the proposed line km to be surveyed. In this application, however, due to the strict operational timelines and availability of the R/V *Langseth*, no additional time or distance has been added to the survey calculations. 37 days is the absolute maximum amount of time the R/V *Langseth* is available to conduct seismic operations.

The ensonified areas in Table 8 were used to estimate take of marine mammal

species with densities available for the three depth strata (shallow, intermediate, and deep waters). For other species where densities are available based on other categories (*i.e.*, gray whale, harbor porpoise, northern fur seal, Guadalupe fur seal, California sea lion, Steller sea lion; see Table 7), GIS was used to determine the areas expected to be ensonified in each density category (see L-DEO's EA for the ensonified areas in each category). The areas provided in Tables 8 and 9 here have been updated from those provided in Tables 8 and 9 of the notice of proposed IHA (85 FR 19580; April 7, 2020) based on the revised planned survey tracklines.

TABLE 8—AREAS (KM²) ESTIMATED TO BE ENSONIFIED TO LEVEL A AND LEVEL B HARASSMENT THRESHOLDS

Survey zone	Criteria	Relevant isopleth (m)	Total ensonified area (km ²)
Level B Harassment:			
Shallow <100 m	160 dB	^a 12,650	3,580.73
Intermediate 100–1,000 m	160 dB	^b 9,468	23,562.43
Deep >1,000 m	160 dB	^b 6,733	52,438.71
Overall			79,581.85
Level A Harassment:			
All depth zones	LF Cetacean	426.9	5,334.55
	MF Cetacean	13.6	171.42
	HF Cetacean	268.3	3,363.99
	Otariid	10.6	133.61
	Phocid	43.7	550.53

^aBased on L-DEO model results

^bBased on data from Crone *et al.* (2014)

Density estimates for Southern Resident killer whales from the U.S. Navy's MSDD were overlaid with GIS

layers of the Level B harassment zones in each depth category to determine the

areas expected to be ensonified in each density category (Table 9).

TABLE 9—SOUTHERN RESIDENT KILLER WHALE DENSITIES AND CORRESPONDING ENSONIFIED AREAS

Pod	Density (animals/km ²)	Ensonified area (km ²)
K/L	0.000000	5,888
	0.000001–0.002803	15,470
	0.002804–0.005615	342
	0.005616–0.009366	0
	0.009367–0.015185	0
J	0.000000	6,427
	0.000001–0.001991	5,556
	0.001992–0.005010	0
	0.005011–0.009602	0
	0.009603–0.018822	20

The marine mammals predicted to occur within these respective areas, based on estimated densities or other occurrence records, are assumed to be incidentally taken. For species where NMFS expects take by Level A

harassment to potentially occur, the calculated Level A harassment takes have been subtracted from the total within the Level B harassment zone. Estimated exposures for the survey outside of Canadian territorial waters

are shown in Table 10. These numbers have changed from those provided in Table 10 of the notice of proposed IHA (85 FR 19580; April 7, 2020) because of the revised planned survey tracklines.

TABLE 10—ESTIMATED TAKING BY LEVEL A AND LEVEL B HARASSMENT, AND PERCENTAGE OF POPULATION

Species	MMPA stock ^a	Stock abundance	Estimated take		Total authorized take	Percent of MMPA stock
			Level 1B	Level 1A		
LF Cetaceans:						
	Central North Pacific	10,103	112	29	^b 141	1.40
Humpback whale	California/Oregon/Washington.	2,900	.....	.....	.....	4.86
Blue whale	Eastern North Pacific	1,647	40	11	51	3.10
Fin whale	California/Oregon/Washington.	9,029	94	1	95	1.05
	Northeast Pacific	3,168	.....	.....	.....	3.00
Sei whale	Eastern North Pacific	27,197	30	2	32	0.12
Minke whale	California/Oregon/Washington.	25,000	96	7	103	0.41
	Eastern North Pacific	26,960	43	1	44	0.16
MF Cetaceans:						
Sperm whale	California/Oregon/Washington.	26,300	72	0	72	0.27
Baird's beaked whale ..	California/Oregon/Washington.	2,697	84	0	84	3.12
Small beaked whale	California/Oregon/Washington.	6,318	242	0	^c 242	3.83
Bottlenose dolphin	California/Oregon/Washington (offshore).	1,924	1	0	^d 13	0.68
Striped dolphin	California/Oregon/Washington.	29,211	7	0	^d 46	0.16
Short-beaked common dolphin.	California/Oregon/Washington.	969,861	112	0	^d 179	0.02
Pacific white-sided dolphin.	California/Oregon/Washington.	26,814	6,084	0	6,084	22.69
Northern right-whale dolphin.	California/Oregon/Washington.	26,556	4,318	0	4,318	16.26
Risso's dolphin	California/Oregon/Washington.	6,336	1,664	0	1,664	26.26
False killer whale	n/a	Unknown	n/a	n/a	^e 5	^f n/a
Killer whale	Southern Resident	73	10	0	10	13.70
	Northern Resident	302	73	0	73	24.17
	West Coast Transient	349	.....	.....	.....	20.92
	Offshore	300	.....	.....	.....	24.33
Short-finned pilot whale	California/Oregon/Washington.	836	20	0	^d 29	3.47
HF Cetaceans:						
Pygmy/dwarf sperm whale.	California/Oregon/Washington.	4,111	125	5	130	3.16
Dall's porpoise	California/Oregon/Washington.	27,750	9,762	488	10,250	^g 36.94
Harbor porpoise	Northern Oregon/Washington Coast.	21,487	7,958	283	8,241	^g 38.35
	Northern California/Southern Oregon.	35,769	.....	.....	.....	23.04
Otariid Seals:						
Northern fur seal	Eastern Pacific	608,143	4,592	0	4,592	0.76
	California	14,050	.....	.....	.....	32.68
Guadalupe fur seal	Mexico to California	34,187	2,048	0	2,048	5.99
California sea lion	U.S.	257,606	889	0	889	0.35
Steller sea lion	Eastern U.S.	43,201	7,504	0	7,504	17.37
Phocid Seals:						
Northern elephant seal	California Breeding	179,000	2,754	0	2,754	1.54
Harbor seal	Oregon/Washington Coast	^h 24,732	3,887	0	3,887	15.72

^a In most cases, where multiple stocks are being affected, for the purposes of calculating the percentage of the stock impacted, the take is being analyzed as if all authorized takes occurred within each stock.

^b Takes are allocated among the three DPSs in the area based on Wade et al. (2017) (Oregon: 32.7% Mexico DPS, 67.2% Central America DPS; Washington/British Columbia: 27.9% Mexico DPS, 8.7% Central America DPS, 63.5% Hawaii DPS).

^c Total for small beaked whale guild (Appendix B of L-DEO's application describes potential take estimates of each species represented in the guild, but we present the authorized take of small beaked whales as a whole).

^d Authorized take increased to mean group size from Barlow (2016).

^e Authorized take increased to mean group size from Mobley et al. (2000).

^f False killer whales that may be taken during this survey are not likely to belong to any designated stock. Therefore we cannot determine the percent of stock that may be taken, but we assume that five individuals would be considered small relative to the abundance of the population they belong to.

^g The percentage of these stocks expected to experience take is discussed further in the Small Numbers section later in the document.

^h As noted in Table 1, there is no current estimate of abundance available for the Oregon/Washington Coast stock of harbor seal. The abundance estimate from 1999, included here, is the best available.

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 takes by Level A harassment. 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. Also, note that in consideration of the near-field soundscape of the airgun array, we have authorized a different number of takes of mid-frequency cetaceans and pinnipeds by Level A harassment than the number estimated by L-DEO (see Appendix B in L-DEO's IHA application).

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 the activity, and other means of effecting the least practicable impact on the species or stock and its habitat, paying particular attention to rookeries, mating grounds, and areas of similar significance, and on the availability of the 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 the 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 and impact on operations.

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 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 will implement mitigation measures for marine mammals. Mitigation measures that will be adopted during the planned surveys include (1) Vessel-based visual mitigation monitoring; (2) Vessel-based passive acoustic monitoring; (3) Establishment of an exclusion zone; (4) Shutdown procedures; (5) Ramp-up procedures; and (6) Vessel strike avoidance measures.

Vessel-Based Visual Mitigation Monitoring

Visual monitoring requires the use of trained observers (herein referred to as visual PSOs) to scan the ocean surface visually for the presence of marine mammals. The area to be scanned visually includes primarily the exclusion zone, within which observation of certain marine mammals requires shutdown of the acoustic source, but also the buffer zone. The buffer zone means an area beyond the exclusion zone to be monitored for the presence of marine mammals that may enter the exclusion zone. During pre-clearance monitoring (*i.e.*, before ramp-up begins), the buffer zone also acts as an extension of the exclusion zone in that observations of marine mammals within the buffer zone would also prevent airgun operations from beginning (*i.e.*, ramp-up). The buffer zone encompasses the area at and below the sea surface from the edge of the 0–500 m exclusion zone, out to a radius of 1,000 m from the edges of the airgun array (500–1,000 m). Visual monitoring of the exclusion zone and adjacent waters is intended to establish and, when visual conditions allow, maintain zones around the sound source that are clear of marine mammals, thereby reducing or eliminating the potential for injury and minimizing the potential for more severe behavioral reactions for animals occurring closer to the vessel. Visual monitoring of the buffer zone is intended to (1) provide additional protection to naïve marine mammals

that may be in the area during pre-clearance, and (2) during airgun use, aid in establishing and maintaining the exclusion zone by alerting the visual observer and crew of marine mammals that are outside of, but may approach and enter, the exclusion zone.

L-DEO must use dedicated, trained, NMFS-approved Protected Species Observers (PSOs). 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 must be provided to NMFS for approval.

At least one of the visual and two of the acoustic PSOs (discussed below) aboard the vessel must have a minimum of 90 days at-sea experience working in those roles, respectively, during a deep penetration (*i.e.*, “high energy”) seismic survey, with no more than 18 months elapsed since the conclusion of the at-sea experience. One visual PSO with such experience must be designated as the lead for the entire protected species observation team. The lead PSO must serve as primary point of contact for the vessel operator and ensure all PSO requirements per the IHA are met. To the maximum extent practicable, the experienced PSOs should be scheduled to be on duty with those PSOs with appropriate training but who have not yet gained relevant experience.

During survey operations (*e.g.*, any day on which use of the acoustic source is planned to occur, and whenever the acoustic source is in the water, whether activated or not), a minimum of two visual PSOs must be on duty and conducting visual observations at all times during daylight hours (*i.e.*, from 30 minutes prior to sunrise through 30 minutes following sunset). Visual monitoring of the exclusion and buffer zones must begin no less than 30 minutes prior to ramp-up and must continue until one hour after use of the acoustic source ceases or until 30 minutes past sunset. Visual PSOs must coordinate to ensure 360° visual coverage around the vessel from the most appropriate observation posts, and must conduct visual observations using binoculars and the naked eye while free from distractions and in a consistent, systematic, and diligent manner.

PSOs must establish and monitor the exclusion and buffer zones. These zones must be based upon the radial distance from the edges of the acoustic source (rather than being based on the center of the array or around the vessel itself). During use of the acoustic source (*i.e.*, anytime airguns are active, including

ramp-up), detections of marine mammals within the buffer zone (but outside the exclusion zone) must be communicated to the operator to prepare for the potential shutdown of the acoustic source.

During use of the airgun (*i.e.*, anytime the acoustic source is active, including ramp-up), detections of marine mammals within the buffer zone (but outside the exclusion zone) should be communicated to the operator to prepare for the potential shutdown of the acoustic source. Visual PSOs must immediately communicate all observations to the on duty acoustic PSO(s), including any determination by the PSO regarding species identification, distance, and bearing and the degree of confidence in the determination. Any observations of marine mammals by crew members must be relayed to the PSO team. During good conditions (*e.g.*, daylight hours; Beaufort sea state (BSS) 3 or less), visual PSOs must conduct observations when the acoustic source is not operating for comparison of sighting rates and behavior with and without use of the acoustic source and between acquisition periods, to the maximum extent practicable.

While the R/V *Langseth* is surveying in water depths of 200 m or less along the coast between Tillamook Head, Oregon and Barkley Sound, British Columbia (between latitudes 45.9460903° N and 48.780291° N), and within the boundaries of Olympic Coast National Marine Sanctuary, a second vessel with additional PSOs must travel approximately 5 km ahead of the R/V *Langseth*. Two PSOs must be on watch on the second vessel during all such survey operations and must alert PSOs on the R/V *Langseth* of any marine mammal observations so that they may be prepared to initiate shutdowns. This requirement has been modified from what was included in the proposed IHA, which proposed using the second vessel through the entire survey area in waters under 200 m. This requirement was primarily intended to increase the likelihood of PSOs detecting Southern Resident killer whales. However, L-DEO has described practicability concerns with the second vessel, including high cost and limited availability for the time period specified. NMFS carefully considered the area in which the second vessel would effect the most reduction in impacts to Southern Resident killer whales and, accordingly, the area requiring the second vessel has been revised to reflect the areas of highest occurrence (based on Navy, 2019), between Tillamook Head and Barkley

Sound and within the boundaries of Olympic Coast National Marine Sanctuary.

Visual PSOs on both vessels may be on watch for a maximum of four consecutive hours followed by a break of at least one hour between watches and may conduct a maximum of 12 hours of observation per 24-hour period. Combined observational duties (visual and acoustic but not at same time) may not exceed 12 hours per 24-hour period for any individual PSO.

Passive Acoustic Monitoring

Acoustic monitoring means the use of trained personnel (sometimes referred to as passive acoustic monitoring (PAM) operators), herein referred to as acoustic PSOs) to operate PAM equipment to acoustically detect the presence of marine mammals. Acoustic monitoring involves acoustically detecting marine mammals regardless of distance from the source, as localization of animals may not always be possible. Acoustic monitoring is intended to further support visual monitoring (during daylight hours) in maintaining an exclusion zone around the sound source that is clear of marine mammals. In cases where visual monitoring is not effective (*e.g.*, due to weather, nighttime), acoustic monitoring may be used to allow certain activities to occur, as further detailed below.

Passive acoustic monitoring will take place in addition to the visual monitoring program. 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. Acoustical monitoring can be used in addition to visual observations to improve detection, identification, and localization of cetaceans. The acoustic monitoring will serve to alert visual PSOs (if on duty) when vocalizing cetaceans are detected. It is only useful when marine mammals call, but it can be effective either by day or by night, and does not depend on good visibility. It will be monitored in real time so that the visual observers can be advised when cetaceans are detected.

The R/V *Langseth* must use a towed PAM system, which must be monitored by at a minimum one on duty acoustic PSO beginning at least 30 minutes prior to ramp-up and at all times during use of the acoustic source. Acoustic PSOs may be on watch for a maximum of 4 consecutive hours followed by a break of at least 1 hour between watches and may conduct a maximum of 12 hours of observation per 24-hour period. Combined observational duties (acoustic

and visual but not at same time) may not exceed 12 hours per 24-hour period for any individual PSO.

Survey activity may continue for 30 minutes when the PAM system malfunctions or is damaged, while the PAM operator diagnoses the issue. If the diagnosis indicates that the PAM system must be repaired to solve the problem, operations may continue for an additional five hours without acoustic monitoring during daylight hours only under the following conditions:

- Sea state is less than or equal to BSS 4;
- No marine mammals (excluding delphinids, other than killer whales) detected solely by PAM in the applicable exclusion zone in the previous 2 hours;
- NMFS is notified via email as soon as practicable with the time and location in which operations began occurring without an active PAM system; and
- Operations with an active acoustic source, but without an operating PAM system, do not exceed a cumulative total of five hours in any 24-hour period.

Establishment of Exclusion and Buffer Zones

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 must establish a minimum EZ with a 500-m radius. The 500-m EZ must be based on radial distance from the edge 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 or enters this zone, the acoustic source must be shut down.

The 500-m EZ is intended to be precautionary in the sense that it would be expected to contain sound exceeding the injury criteria for all cetacean hearing groups, (based on the dual criteria of SEL_{cum} and peak SPL), 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 extended EZ of 1,500 m must be enforced for all beaked whales, and dwarf and pygmy sperm whales. No buffer zone is required.

Pre-Clearance and Ramp-Up

Ramp-up (sometimes referred to as “soft start”) means the gradual and systematic increase of emitted sound levels from an airgun array. Ramp-up begins by first activating a single airgun of the smallest volume, followed by doubling the number of active elements in stages until the full complement of an array’s airguns are active. Each stage should be approximately the same duration, and the total duration should not be less than approximately 20 minutes. The intent of pre-clearance observation (30 minutes) is to ensure no protected species are observed within the buffer zone prior to the beginning of ramp-up. During pre-clearance is the only time observations of protected species in the buffer zone would prevent operations (*i.e.*, the beginning of ramp-up). The intent of ramp-up is to warn protected species of pending seismic operations and to allow sufficient time for those animals to leave the immediate vicinity. A ramp-up procedure, involving 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, is required at all times as part of the activation of the acoustic source. All operators must adhere to the following pre-clearance and ramp-up requirements:

- The operator must notify a designated PSO of the planned start of ramp-up as agreed upon with the lead PSO; the notification time should not be less than 60 minutes prior to the planned ramp-up in order to allow the PSOs time to monitor the exclusion and buffer zones for 30 minutes prior to the initiation of ramp-up (pre-clearance);
- Ramp-ups must be scheduled so as to minimize the time spent with the source activated prior to reaching the designated run-in;
- One of the PSOs conducting pre-clearance observations must be notified again immediately prior to initiating ramp-up procedures and the operator must receive confirmation from the PSO to proceed;
- Ramp-up may not be initiated if any marine mammal is within the applicable exclusion or buffer zone. If a marine mammal is observed within the applicable exclusion zone or the buffer zone during the 30 minute pre-clearance period, ramp-up may not begin until the animal(s) has been observed exiting the zones or until an additional time period has elapsed with no further sightings

(15 minutes for small odontocetes and pinnipeds, and 30 minutes for all mysticetes and all other odontocetes, including sperm whales, pygmy sperm whales, dwarf sperm whales, beaked whales, pilot whales, false killer whales, and Risso’s dolphins);

- Ramp-up must begin by activating a single airgun of the smallest volume in the array and must continue in stages by doubling the number of active elements at the commencement of each stage, with each stage of approximately the same duration. Duration must not be less than 20 minutes. The operator must provide information to the PSO documenting that appropriate procedures were followed;

- PSOs must monitor the exclusion and buffer zones during ramp-up, and ramp-up must cease and the source must be shut down upon detection of a marine mammal within the applicable exclusion zone. Once ramp-up has begun, detections of marine mammals within the buffer zone do not require shutdown, but such observation must be communicated to the operator to prepare for the potential shutdown;

- Ramp-up may occur at times of poor visibility, including nighttime, if appropriate acoustic monitoring has occurred with no detections in the 30 minutes prior to beginning ramp-up. Acoustic source activation may only occur at times of poor visibility where operational planning cannot reasonably avoid such circumstances;

- If the acoustic source is shut down for brief periods (*i.e.*, less than 30 minutes) for reasons other than that described for shutdown (*e.g.*, mechanical difficulty), it may be activated again without ramp-up if PSOs have maintained constant visual and/or acoustic observation and no visual or acoustic detections of marine mammals have occurred within the applicable exclusion zone. For any longer shutdown, pre-clearance observation and ramp-up are required. For any shutdown at night or in periods of poor visibility (*e.g.*, BSS 4 or greater), ramp-up is required, but if the shutdown period was brief and constant observation was maintained, pre-clearance watch of 30 minutes is not required; and

- Testing of the acoustic source involving all elements requires ramp-up. Testing limited to individual source elements or strings does not require ramp-up but does require pre-clearance of 30 min.

Shutdown

The shutdown of an airgun array requires the immediate de-activation of all individual airgun elements of the

array. Any PSO on duty has the authority to delay the start of survey operations or to call for shutdown of the acoustic source if a marine mammal is detected within the applicable EZ. The operator must also establish and maintain clear lines of communication directly between PSOs on duty and crew controlling the acoustic source to ensure that shutdown commands are conveyed swiftly while allowing PSOs to maintain watch. When both visual and acoustic PSOs are on duty, all detections must be immediately communicated to the remainder of the on-duty PSO team for potential verification of visual observations by the acoustic PSO or of acoustic detections by visual PSOs. When the airgun array is active (*i.e.*, anytime one or more airguns is active, including during ramp-up) and (1) a marine mammal appears within or enters the applicable exclusion zone and/or (2) a marine mammal (other than delphinids, see below) is detected acoustically and localized within the applicable exclusion zone, the acoustic source must be shut down. When shutdown is called for by a PSO, the acoustic source must be immediately deactivated and any dispute resolved only following deactivation. Additionally, shutdown must occur whenever PAM alone (without visual sighting), confirms presence of marine mammal(s) in the EZ. If the acoustic PSO cannot confirm presence within the EZ, visual PSOs must be notified but shutdown is not required. L-DEO must also implement shutdown of the airgun array if killer whale vocalizations are detected, regardless of localization.

Following a shutdown, airgun activity must not resume until the marine mammal has cleared the 500-m EZ. The animal would be considered to have cleared the 500-m EZ if 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 30 min in the case of mysticetes and large odontocetes, including sperm whales, pygmy sperm whales, dwarf sperm whales, pilot whales, beaked whales, killer whales, false killer whales, and Risso’s dolphins.

The shutdown requirement can be waived for small dolphins if an individual is visually detected within the exclusion zone. As defined here, the small dolphin 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 shutdown requirement

applies solely to specific genera of small dolphins—*Tursiops*, *Delphinus*, *Stenella*, *Lagenorhynchus*, and *Lissodelphis*.

We include this small dolphin exception because shutdown requirements for small dolphins under all circumstances represent practicability concerns without likely commensurate benefits for the animals in question. Small dolphins 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 above, 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).

A large body of anecdotal evidence indicates that small dolphins 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 R/V *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 dolphins, they are much less likely to approach vessels. Therefore, retaining a 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 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.

Visual PSOs must use best professional judgment in making the decision to call for a shutdown if there is uncertainty regarding identification (i.e., whether the observed marine mammal(s) belongs to one of the delphinid genera for which shutdown is

waived or one of the species with a larger exclusion zone).

Upon implementation of shutdown, the source may be reactivated after the marine mammal(s) has been observed exiting the applicable exclusion zone (i.e., animal is not required to fully exit the buffer zone where applicable) or following 15 minutes for small odontocetes and pinnipeds, and 30 minutes for mysticetes and all other odontocetes, including sperm whales, pygmy sperm whales, dwarf sperm whales, beaked whales, pilot whales, and Risso's dolphins, with no further observation of the marine mammal(s).

L-DEO must implement shutdown if a marine mammal species for which take was not authorized, or a species for which authorization was granted but the takes have been met, approaches the Level A or Level B harassment zones. L-DEO must also implement shutdown if any of the following are observed at any distance:

- Any large whale (defined as a sperm whale or any mysticete species) with a calf (defined as an animal less than two-thirds the body size of an adult observed to be in close association with an adult);
- An aggregation of six or more large whales;
- A North Pacific right whale; and/or
- A killer whale of any ecotype.

Vessel Strike Avoidance

These measures apply to all vessels associated with the planned survey activity; however, 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. These measures include the following:

1. Vessel operators and crews must maintain a vigilant watch for all marine mammals and slow down, stop their vessel, or alter course, as appropriate and regardless of vessel size, to avoid striking any marine mammal. A single marine mammal at the surface may indicate the presence of submerged animals in the vicinity of the vessel; therefore, precautionary measures should be exercised when an animal is observed. A visual observer aboard the vessel must monitor a vessel strike avoidance zone around the vessel (specific distances detailed below), to ensure the potential for strike is minimized. Visual observers monitoring the vessel strike avoidance zone can be either third-party observers or crew members, but crew members responsible for these duties must be

provided sufficient training to distinguish marine mammals from other phenomena and broadly to identify a marine mammal to broad taxonomic group (i.e., as a large whale or other marine mammal);

2. Vessel speeds must be reduced to 10 knots or less when mother/calf pairs, pods, or large assemblages of any marine mammal are observed near a vessel;

3. All vessels must maintain a minimum separation distance of 100 m from large whales (i.e., sperm whales and all mysticetes);

4. All vessels must attempt to maintain a minimum separation distance of 50 m from all other marine mammals, with an exception made for those animals that approach the vessel; and

5. When marine mammals are sighted while a vessel is underway, the vessel should take action as necessary to avoid violating the relevant separation distance (e.g., attempt to remain parallel to the animal's course, avoid excessive speed or abrupt changes in direction until the animal has left the area). If marine mammals are sighted within the relevant separation distance, the vessel should reduce speed and shift the engine to neutral, not engaging the engines until animals are clear of the area. This recommendation does not apply to any vessel towing gear.

Operational Restrictions

While the R/V *Langseth* is surveying in waters 200 m deep or less along the coast between Tillamook Head, Oregon and Barkley Sound, British Columbia (between latitudes 45.9460903° N and 48.780291° N), and within the boundaries of Olympic Coast National Marine Sanctuary, survey operations must occur in daylight hours only (i.e., from 30 minutes prior to sunrise through 30 minutes following sunset) to ensure the ability to use visual observation as a detection-based mitigation tool and to implement shutdown procedures for species or situations with additional shutdown requirements outlined above (e.g., killer whale of any ecotype, North Pacific right whale, aggregation of six or more large whales, large whale with a calf). The proposed IHA included this requirement to operate only during daylight hours in waters 200 m deep or less throughout the entire survey area. We have revised that requirement to apply only between Tillamook Head and Barkley Sound and within the boundaries of Olympic Coast National Marine Sanctuary because those are the areas with the highest expected Southern Resident killer whale

occurrence, and we determined that requiring this operational restriction throughout the entire survey area was not practicable, in consideration of cost and vessel availability concerns.

Communication

Each day of survey operations, L-DEO must contact NMFS Northwest Fisheries Science Center, NMFS West Coast Region, The Whale Museum, Orca Network, Canada's DFO, Olympic Coast National Marine Sanctuary, and/or other sources to obtain near real-time reporting for the whereabouts of Southern Resident killer whales.

Mitigation Measures in Canadian Waters

As stated above, NMFS cannot authorize the incidental take of marine mammals in the territorial seas of foreign nations, as the MMPA does not apply in those waters. Therefore, the mitigation requirements described above do not apply within Canadian territorial waters. The MMPA is applicable in the EEZs of foreign nations, and therefore, the mitigation measures above apply within the Canadian EEZ. However, L-DEO also consulted with Canada's DFO under the Canada Species at Risk Act and must also comply with DFO's mitigation requirements within the Canadian EEZ in order to avoid causing the death of fish or marine mammals and/or the harmful alteration, disruption, or destruction of fish habitat, or causing prohibited effects to aquatic species at risk. Within the Canadian EEZ, L-DEO must:

- Conduct seismic survey activities outside of designated Killer Whale Critical Habitat (KWCH) with a setback that ensures that the estimated sound pressure level has diminished to ≤ 160 dB rms re: $1 \mu\text{Pa}$ at the boundary of KWCH;
- Initiate an immediate and complete shutdown of the airgun array if a killer whale (all ecotypes), North Pacific right whale, whale with calf (any species) or aggregation of whales (any species) is observed;
- Initiate an immediate and complete shutdown of the airgun array if a sperm whale or a beaked whale (any species) is sighted within 1,500 m of the airgun array;
- For other observations of marine mammals, initiate an immediate and complete shutdown of the airgun array if these animals are observed within an established EZ with a radius of 1,000 m;
- Refrain from conducting seismic surveys in waters less than 100 m in depth;

- Conduct seismic surveys in waters 100 to 200 m deep during daylight hours only, with a second vessel having two marine mammal observers on watch, positioned 5 km ahead of the R/V *Langseth*;

- Combine enhanced visual observations (e.g., reticle and big-eye binoculars, night vision devices and digital cameras) with non-visual detection methods (e.g., infrared technology (FLIR) and passive acoustic monitoring) to increase the likelihood of detecting marine mammals during ramp up, Beaufort sea states >3 , and nighttime survey operations; and
- Monitor the established EZ with a radius of 1,000 m for 60 minutes prior to initial start-up of the airgun array or resumption of operations following a complete shutdown to allow for the detection of deep diving animals.

While operating within the Canadian EEZ but outside Canadian territorial waters, if mitigation requirements in the IHA differ from the requirements established by DFO, L-DEO must adhere to the most protective measure (e.g., larger EZ, visual monitoring procedures).

Mitigation Measures Considered But Eliminated

As stated above, in determining appropriate mitigation measures, NMFS considers the practicability of the measures for applicant implementation, which may include such things as cost or impact on operations. NMFS has proposed expanding critical habitat for Southern Resident killer whales to include marine waters between the 6.1-m depth contour and the 200-m depth contour from the U.S. international border with Canada south to Point Sur, California (84 FR 49214; September 19, 2019). Though the proposed expansion has not been finalized, due to the habitat features of the area and the higher likelihood of occurrence within the area, NMFS considered implementing a closure area and prohibiting L-DEO from conducting survey operations between the 200-m isobath and the coastline. However, this measure was eliminated from consideration because the closure would not be practicable for L-DEO, as the primary purpose of their survey is to investigate the geologic features that occur within that area. Therefore, NMFS has not prohibited L-DEO from operating in waters within the 200-m isobath for this survey.

We have carefully evaluated the suite of mitigation measures described here and considered a range of other measures in the context of ensuring that we prescribe the means of effecting the

least practicable adverse impact on the affected marine mammal species and stocks and their habitat. Based on our evaluation of the proposed measures, as well as other measures considered by NMFS described above, NMFS has determined that the mitigation measures provide the means 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.

Vessel-Based Visual Monitoring

As described above, PSO observations must take place during daytime airgun operations. During seismic operations, at least five visual PSOs must be based aboard the R/V *Langseth*. Two visual PSOs must be on duty at all time during daytime hours, with an additional two PSOs on duty aboard a second scout vessel at all times during daylight hours when operating in waters shallower than 200 m. Monitoring must be conducted in accordance with the following requirements:

- The operator must provide PSOs with bigeye binoculars (*e.g.*, 25 x 150; 2.7 view angle; individual ocular focus; height control) of appropriate quality (*i.e.*, Fujinon or equivalent) solely for PSO use. These must be pedestal-mounted on the deck at the most appropriate vantage point that provides for optimal sea surface observation, PSO safety, and safe operation of the vessel; and
- The operator must work with the selected third-party observer provider to ensure PSOs have all equipment (including backup equipment) needed to adequately perform necessary tasks, including accurate determination of distance and bearing to observed marine mammals.

PSOs must have the following requirements and qualifications:

- PSOs must be independent, dedicated, trained visual and acoustic PSOs and must be employed by a third-party observer provider;
- PSOs must have no tasks other than to conduct observational effort (visual or acoustic), collect data, and communicate with and instruct relevant vessel crew with regard to the presence of protected species and mitigation requirements (including brief alerts regarding maritime hazards);
- PSOs must have successfully completed an approved PSO training course appropriate for their designated task (visual or acoustic). Acoustic PSOs are required to complete specialized training for operating PAM systems and are encouraged to have familiarity with the vessel with which they will be working;
- PSOs can act as acoustic or visual observers (but not at the same time) as long as they demonstrate that their training and experience are sufficient to perform the task at hand;
- NMFS must review and approve PSO resumes accompanied by a relevant

training course information packet that includes the name and qualifications (*i.e.*, experience, training completed, or educational background) of the instructor(s), the course outline or syllabus, and course reference material as well as a document stating successful completion of the course;

- NMFS shall have one week to approve PSOs from the time that the necessary information is submitted, after which PSOs meeting the minimum requirements shall automatically be considered approved;
- PSOs must successfully complete relevant training, including completion of all required coursework and passing (80 percent or greater) a written and/or oral examination developed for the training program;
- PSOs must have successfully attained a bachelor's degree from an accredited college or university with a major in one of the natural sciences, a minimum of 30 semester hours or equivalent in the biological sciences, and at least one undergraduate course in math or statistics; and
- The educational requirements may be waived if the PSO has acquired the relevant skills through alternate experience. Requests for such a waiver must be submitted to NMFS and must include written justification. Requests shall be granted or denied (with justification) by NMFS within one week of receipt of submitted information. Alternate experience that may be considered includes, but is not limited to (1) secondary education and/or experience comparable to PSO duties; (2) previous work experience conducting academic, commercial, or government-sponsored protected species surveys; or (3) previous work experience as a PSO; the PSO should demonstrate good standing and consistently good performance of PSO duties.

For data collection purposes, PSOs must use standardized data collection forms, whether hard copy or electronic. PSOs must record detailed information about any implementation of mitigation requirements, including the distance of animals to the acoustic source and description of specific actions that ensued, the behavior of the animal(s), any observed changes in behavior before and after implementation of mitigation, and if shutdown was implemented, the length of time before any subsequent ramp-up of the acoustic source. If required mitigation was not implemented, PSOs should record a description of the circumstances. At a minimum, the following information must be recorded:

- Vessel names (source vessel and other vessels associated with survey) and call signs;
 - PSO names and affiliations;
 - Dates of departures and returns to port with port name;
 - Date and participants of PSO briefings;
 - Dates and times (Greenwich Mean Time) of survey effort and times corresponding with PSO effort;
 - Vessel location (latitude/longitude) when survey effort began and ended and vessel location at beginning and end of visual PSO duty shifts;
 - Vessel heading and speed at beginning and end of visual PSO duty shifts and upon any line change;
 - Environmental conditions while on visual survey (at beginning and end of PSO shift and whenever conditions changed significantly), including BSS and any other relevant weather conditions including cloud cover, fog, sun glare, and overall visibility to the horizon;
 - Factors that may have contributed to impaired observations during each PSO shift change or as needed as environmental conditions changed (*e.g.*, vessel traffic, equipment malfunctions); and
 - Survey activity information, such as acoustic source power output while in operation, number and volume of airguns operating in the array, tow depth of the array, and any other notes of significance (*i.e.*, pre-clearance, ramp-up, shutdown, testing, shooting, ramp-up completion, end of operations, streamers, etc.).
- The following information should be recorded upon visual observation of any protected species:
- Watch status (sighting made by PSO on/off effort, opportunistic, crew, alternate vessel/platform);
 - PSO who sighted the animal;
 - Time of sighting;
 - Vessel location at time of sighting;
 - Water depth;
 - Direction of vessel's travel (compass direction);
 - Direction of animal's travel relative to the vessel;
 - Pace of the animal;
 - Estimated distance to the animal and its heading relative to vessel at initial sighting;
 - Identification of the animal (*e.g.*, genus/species, lowest possible taxonomic level, or unidentified) and the composition of the group if there is a mix of species;
 - Estimated number of animals (high/low/best);
 - Estimated number of animals by cohort (adults, yearlings, juveniles, calves, group composition, etc.);

- Description (as many distinguishing features as possible of each individual seen, including length, shape, color, pattern, scars or markings, shape and size of dorsal fin, shape of head, and blow characteristics);

- Detailed behavior observations (e.g., number of blows/breaths, number of surfaces, breaching, spyhopping, diving, feeding, traveling; as explicit and detailed as possible; note any observed changes in behavior);

- Animal's closest point of approach (CPA) and/or closest distance from any element of the acoustic source;

- Platform activity at time of sighting (e.g., deploying, recovering, testing, shooting, data acquisition, other); and

- Description of any actions implemented in response to the sighting (e.g., delays, shutdown, ramp-up) and time and location of the action.

If a marine mammal is detected while using the PAM system, the following information should be recorded:

- An acoustic encounter identification number, and whether the detection was linked with a visual sighting;

- Date and time when first and last heard;

- Types and nature of sounds heard (e.g., clicks, whistles, creaks, burst pulses, continuous, sporadic, strength of signal); and

- Any additional information recorded such as water depth of the hydrophone array, bearing of the animal to the vessel (if determinable), species or taxonomic group (if determinable), spectrogram screenshot, and any other notable information.

Reporting

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

The draft report must also include geo-referenced time-stamped vessel tracklines for all time periods during which airguns were operating. Tracklines should include points recording any change in airgun status (e.g., when the airguns began operating, when they were turned off, or when they changed from full array to single gun or vice versa). GIS files must be provided in ESRI shapefile format and include the UTC date and time, latitude in decimal degrees, and longitude in decimal degrees. All coordinates must be referenced to the WGS84 geographic coordinate system. In addition to the report, all raw observational data must be made available to NMFS. The report must summarize the information submitted in interim monthly reports as well as additional data collected as described above and in the IHA. A final report must be submitted within 30 days following resolution of any comments on the draft report.

Reporting Injured or Dead Marine Mammals

Discovery of injured or dead marine mammals—In the event that personnel involved in survey activities covered by the authorization discover an injured or dead marine mammal, the L-DEO must report the incident to the Office of Protected Resources (OPR), NMFS and to the NMFS West Coast Regional Stranding Coordinator as soon as feasible. The report must include the following information:

- Time, date, and location (latitude/longitude) of the first discovery (and updated location information if known and applicable);

- Species identification (if known) or description of the animal(s) involved;

- Condition of the animal(s) (including carcass condition if the animal is dead);

- Observed behaviors of the animal(s), if alive;

- If available, photographs or video footage of the animal(s); and

- General circumstances under which the animal was discovered.

Vessel strike—In the event of a ship strike of a marine mammal by any vessel involved in the activities covered by the authorization, L-DEO must report the incident to OPR, NMFS and to the NMFS West Coast Regional Stranding Coordinator as soon as feasible. The report must include the following information:

- Time, date, and location (latitude/longitude) of the incident;

- Vessel's speed during and leading up to the incident;

- Vessel's course/heading and what operations were being conducted (if applicable);

- Status of all sound sources in use;
- Description of avoidance measures/requirements that were in place at the time of the strike and what additional measures were taken, if any, to avoid strike;

- Environmental conditions (e.g., wind speed and direction, Beaufort sea state, cloud cover, visibility) immediately preceding the strike;

- Species identification (if known) or description of the animal(s) involved;

- Estimated size and length of the animal that was struck

- Description of the behavior of the animal immediately preceding and following the strike;

- If available, description of the presence and behavior of any other marine mammals present immediately preceding the strike;

- Estimated fate of the animal (e.g., dead, injured but alive, injured and moving, blood or tissue observed in the water, status unknown, disappeared); and

- To the extent practicable, photographs or video footage of the animal(s).

Actions To Minimize Additional Harm to Live-Stranded (or Milling) Marine Mammals

In the event of a live stranding (or near-shore atypical milling) event within 50 km of the survey operations, where the NMFS stranding network is engaged in herding or other interventions to return animals to the water, the Director of OPR, NMFS (or designee) will advise L-DEO of the need to implement shutdown procedures for all active acoustic sources operating within 50 km of the stranding. Shutdown procedures for live stranding or milling marine mammals include the following: If at any time, the marine mammal the marine mammal(s) die or are euthanized, or if herding/intervention efforts are stopped, the Director of OPR, NMFS (or designee) will advise the IHA-holder that the shutdown around the animals' location is no longer needed. Otherwise, shutdown procedures must remain in effect until the Director of OPR, NMFS (or designee) determines and advises L-DEO that all live animals involved have left the area (either of their own volition or following an intervention).

If further observations of the marine mammals indicate the potential for re-stranding, additional coordination with the IHA-holder will be required to determine what measures are necessary to minimize that likelihood (e.g.,

extending the shutdown or moving operations farther away) and to implement those measures as appropriate.

Additional Information Requests—If NMFS determines that the circumstances of any marine mammal stranding found in the vicinity of the activity suggest investigation of the association with survey activities is warranted, and an investigation into the stranding is being pursued, NMFS will submit a written request to L-DEO indicating that the following initial available information must be provided as soon as possible, but no later than 7 business days after the request for information:

- Status of all sound source use in the 48 hours preceding the estimated time of stranding and within 50 km of the discovery/notification of the stranding by NMFS; and
- If available, description of the behavior of any marine mammal(s) observed preceding (*i.e.*, within 48 hours and 50 km) and immediately after the discovery of the stranding.

In the event that the investigation is still inconclusive, the investigation of the association of the survey activities is still warranted, and the investigation is still being pursued, NMFS may provide additional information requests, in writing, regarding the nature and location of survey operations prior to the time period above.

Reporting Species of Concern

To support NMFS’s goal of improving our understanding of occurrence of

marine mammal species or stocks in the area (*e.g.*, presence, abundance, distribution, density), L-DEO must immediately report observations of Southern Resident killer whales and North Pacific right whales to OPR, NMFS. L-DEO must also immediately report all sightings of Southern Resident killer whales and North Pacific right whales within Olympic Coast National Marine Sanctuary to the Sanctuary.

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’s 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 species listed in Tables 10 and 11, given that NMFS expects the anticipated effects of the planned geophysical survey 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 have authorized only the takes estimated to occur outside of Canadian territorial waters (Table 10); however, for the purposes of our negligible impact analysis and determination, we consider the total number of takes that are anticipated to occur as a result of the entire survey (including the portion of the survey that would occur within the Canadian territorial waters (approximately six percent of the survey) (Table 11).

TABLE 11—TOTAL ESTIMATED TAKE INCLUDING CANADIAN TERRITORIAL WATERS

Species	Estimated take (excluding Canadian territorial waters)		Estimated take (within Canadian territorial waters)		Total estimated take	
	Level B	Level A	Level B	Level A	Level B	Level A
LF Cetaceans:						
Humpback whale	112	29	21	1	133	30
Blue whale	40	11	7	1	47	11
Fin whale	94	1	2	0	96	1
Sei whale	30	2	2	0	31	2
Minke whale	96	7	6	0	101	7
Gray whale	43	1	23	1	66	2
MF Cetaceans:						
Sperm whale	72	0	1	0	73	0
Baird’s beaked whale	84	0	1	0	85	0
Small beaked whale	242	0	5	0	247	0
Bottlenose dolphin	1	0	0	0	1	0
Striped dolphin	7	0	0	0	7	0
Short-beaked common dolphin	112	0	4	0	116	0
Pacific white-sided dolphin	6093	0	333	0	6426	0
Northern right-whale dolphin	4320	0	118	0	4438	0
Risso’s dolphin	1669	0	145	0	1814	0
False killer whale	5	0	0	0	5	0
Killer whale (Southern Resident)	10	0	1	0	11	0
Killer whale (Northern Resident)						
Killer whale (West Coast Transient)						
Killer whale (Offshore)	73	0	4	0	77	0

TABLE 11—TOTAL ESTIMATED TAKE INCLUDING CANADIAN TERRITORIAL WATERS—Continued

Species	Estimated take (excluding Canadian territorial waters)		Estimated take (within Canadian territorial waters)		Total estimated take	
	Level B	Level A	Level B	Level A	Level B	Level A
Short-finned pilot whale	20	0	1	0	21	0
HF Cetaceans:						
Pygmy/dwarf sperm whale	125	5	8	0	134	6
Dall's porpoise	9762	488	696	23	10457	511
Harbor porpoise	7958	283	2403	87	10361	369
Otariid Pinnipeds:						
Northern fur seal	4424	0	54	0	4478	0
Guadalupe fur seal	2048	0	113	0	2161	0
California sea lion	889	0	137	0	1026	0
Steller sea lion	7504	0	1920	0	9424	0
Phocid Pinnipeds:						
Northern elephant seal	2754	0	164	0	2918	0
Harbor seal	3887	0	1623	0	5510	0

NMFS does not anticipate that serious injury or mortality will occur as a result of L-DEO's planned survey, even in the absence of mitigation, and none are authorized. As discussed in the *Potential Effects* section of the notice of proposed IHA (85 FR 19580; April 7, 2020), non-auditory physical effects, stranding, and vessel strike are not expected to occur.

We have authorized a limited number of instances of Level A harassment of nine species (low- and high-frequency cetacean hearing groups only) and Level B harassment of 31 marine mammal species. 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 total deafness, because of the constant movement relative to each other of both the R/V *Langseth* and of the marine mammals in the project areas, 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) and, further, would be unlikely to affect the fitness of any individuals. 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 R/V *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, Ellison *et al.*, 2012).

Potential impacts to marine mammal habitat were discussed in detail in the *Potential Effects of the Specified Activity on Marine Mammals and their Habitat* section of the notice of proposed IHA (85 FR 19580; April 7, 2020). Marine mammal habitat may be impacted by elevated sound levels, but these impacts would be temporary. Prey species are mobile and are broadly distributed throughout the project areas; 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 relatively short duration (37 days) and temporary nature of the disturbance, the availability of similar habitat and resources in the surrounding area, 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.

The tracklines of this survey either traverse or are proximal to BIAs for humpback and gray whales (Ferguson *et al.*, 2015). The entire U.S. West Coast within 47 km of the coast is a BIA for migrating gray whale potential presence from January to July and October to December. The BIA for northbound gray whale migration is broken into two phases, Phase A (within 8 km of shore) and Phase B (within 5 km of shore), which are active from January to July and March to July, respectively. The BIA for southbound migration includes waters within 10 km of shore and is active from October to March. There are four gray whale feeding BIAs within the survey area: The Grays Harbor gray

whale feeding BIA is used between April and November; the Northwest Washington gray whale feeding BIA is used between May and November; and the Depoe Bay and Cape Blanco and Orford Reef gray whale feeding BIAs off Oregon are each used between June and November. There are also two humpback whale feeding BIAs within the survey area: The Stonewall and Heceta Bank humpback whale feeding BIA off central Oregon and the northern Washington BIA off the Washington Olympic Peninsula are each used between May and November.

For the humpback whale feeding and gray whale feeding and northbound migration BIAs, L-DEO's survey beginning in June 2021 could overlap with a period where BIAs represent an important habitat. However, only a portion of seismic survey days would actually occur in or near these BIAs, and all survey efforts would be completed by mid-July, still in the early window of primary use for these BIAs. Gray whales are most commonly seen migrating northward between March and May and southward between November and January. As planned, there is no possibility that L-DEO's survey impacts the southern migration, and presence of northern migrating individuals should be below peak during survey operations beginning in June 2021.

Although migrating gray whales may slightly alter their course in response to the survey, the exposure would not substantially impact their migratory behavior (Malme *et al.*, 1984; Malme and Miles 1985; Richardson *et al.*, 1995), and Yazvenko *et al.* (2007b) reported no apparent changes in the frequency of feeding activity in Western gray whales exposed to airgun sounds in their feeding grounds near Sakhalin Island. Goldbogen *et al.* (2013) found

blue whales feeding on highly concentrated prey in shallow depths (such as the conditions expected within humpback feeding BIAs) were less likely to respond and cease foraging than whales feeding on deep, dispersed prey when exposed to simulated sonar sources, suggesting that the benefits of feeding for humpbacks foraging on high-density prey may outweigh perceived harm from the acoustic stimulus, such as the seismic survey (Southall *et al.*, 2016). Additionally, L-DEO must shut down the airgun array upon observation of an aggregation of six or more large whales, which would reduce impacts to cooperatively foraging animals. For all habitats, no physical impacts to BIA habitat are anticipated from seismic activities. While SPLs of sufficient strength have been known to cause injury to fish and fish and invertebrate mortality, in feeding habitats, the most likely impact to prey species from survey activities would be temporary avoidance of the affected area and any injury or mortality of prey species would be localized around the survey and not of a degree that would adversely impact marine mammal foraging. The duration of fish avoidance of a given area after survey effort stops is unknown, but a rapid return to normal recruitment, distribution and behavior is expected. Given the short operational seismic time near or traversing BIAs, as well as the ability of cetaceans and prey species to move away from acoustic sources, NMFS expects that there would be, at worst, minimal impacts to animals and habitat within the designated BIAs.

Critical habitat has been established on the U.S. West Coast for the eastern DPS of Steller sea lions (58 FR 45269; August 27, 1993) and in inland waters of Washington for Southern Resident killer whales (71 FR 69054; November 29, 2006). Critical habitat for the Mexico and Central America DPSs of humpback whales has been established along the U.S. West Coast (86 FR 21082; April 21, 2021), and NMFS has proposed expanding Southern Resident killer whale critical habitat to include coastal waters of Washington, Oregon, and California (84 FR 49214; September 19, 2019). Only a small portion of L-DEO's seismic survey will occur in or near these established or proposed critical habitats.

Critical habitat for Steller sea lions has been established at two rookeries on the Oregon coast, at Rogue Reef (Pyramid Rock) and Orford Reef (Long Brown Rock and Seal Rock). The critical habitat area includes aquatic zones that extend 0.9 km seaward and air zones extending 0.9 km above these rookeries (NMFS 1993). Steller sea lions occupy

rookeries and pup from late-May through early-July (NMFS 2008), which coincides with L-DEO's survey. The Orford Reef and Rogue Reef critical habitats are located 7 km and 9 km from the nearest planned seismic transect line, respectively. Impacts to Steller sea lions within these areas, and throughout the survey area, are expected to be limited to short-term behavioral disturbance, with no lasting biological consequences.

Critical habitat for the threatened Mexico DPS and endangered Central America DPS humpback whales has been established along the U.S. West Coast (86 FR 21082; April 21, 2021). The critical habitat encompasses the humpback whale feeding BIAs described above and generally includes waters between the 50-m isobath and the 1,200-m isobath, though some areas extend further offshore. NMFS determined that prey within humpback whale feeding areas are essential to the conservation of each of the three DPSs of humpback whales for which critical habitat was established (Mexico, Central America, and Western North Pacific DPSs). Critical habitat was therefore designated in consideration of importance that the whales not only have reliable access to prey within their feeding areas, but that prey are of a sufficient density to support feeding and the build-up of energy reserves. Although humpback whales are generalist predators and prey availability can vary seasonally and spatially, substantial data indicate that the humpback whales' diet is consistently dominated by euphausiid species (of genus *Euphausia*, *Thysanoessa*, *Nyctiphanes*, and *Nematoscelis*) and small pelagic fishes, such as northern anchovy (*Engraulis mordax*), Pacific herring (*Clupea pallasii*), Pacific sardine (*Sardinops sagax*), and capelin (*Mallotus villosus*) (Nemoto 1957, 1959; Klumov 1963; Rice Krieger and Wing 1984; Baker 1985; Kieckhefer 1992; Clapham *et al.*, 1997; Neilson *et al.*, 2015). While there are possible impacts of seismic activity on plankton and fish species (e.g., McCauley *et al.*, 2017; Hastings and Popper 2005), the areas expected to be affected by L-DEO's activities are small relative to the greater habitat areas available. Additionally, humpback whales feeding on high-density prey may be less likely to cease foraging when the benefit of energy intake outweighs the perceived harm from acoustic stimulus (Southall *et al.*, 2016). Therefore, this seismic activity is not expected to have a lasting physical impact on humpback whale critical

habitat, prey within it, or overall humpback whale fitness. Any impact would be a temporary increase in sound levels when the survey is occurring in or near the critical habitat and resulting temporary avoidance of prey or marine mammals themselves due these elevated sound levels. As stated above, L-DEO must shut down the airgun array upon observation of an aggregation of six or more large whales, which would reduce direct impacts to groups of humpback whales that may be cooperatively feeding in the area.

As discussed earlier, in response to comments from the ENGOs, we acknowledge ongoing concern over the health and growth of the California/Oregon/Washington stock of humpback whales, due to vessel strikes and other factors. As described above, though, impacts from this seismic survey are not expected to impact the fitness of any individuals and thereby will not alone, or incrementally in combination with other baseline stressors, adversely affect the stock through impacts on rates of recruitment or survival.

Southern Resident Killer Whales

In acknowledgment of our concern regarding the status of Southern Resident killer whales, including low abundance and a decreasing trend, we address impacts to this stock separately in this section.

L-DEO's planned tracklines do not overlap with existing Southern Resident killer whale habitat, but NMFS has proposed expanding Southern Resident critical habitat to include waters between the 6.1-m and 200-m depth contours from the U.S. international border with Canada south to Point Sur, California (84 FR 49214; September 19, 2019). The proposed expanded critical habitat areas were identified in consideration of physical and biological features essential to conservation of Southern Resident killer whales (essential features): (1) Water quality to support growth and development; (2) Prey species of sufficient quantity, quality, and availability to support individual growth, reproduction, and development, as well as overall population growth; and (3) Passage conditions to allow for migration, resting, and foraging. NMFS did not identify in-water sound levels as a separate essential feature of existing or proposed expanded critical habitat areas, though anthropogenic sound is recognized as one of the primary threats to Southern Resident killer whales (NMFS 2019). Exposure to vessel noise and presence of whale watching boats can significantly affect the foraging behavior of Southern Resident killer

whales (Williams *et al.*, 2006; Lusseau *et al.*, 2009; Giles and Cendak 2010; Senigaglia *et al.*, 2016). Nutritional stress has also been identified as a primary cause of Southern Resident killer whale decline (Ayres *et al.*, 2012; Wasser *et al.*, 2017), suggesting that reduced foraging effort may have a greater impact than behavioral disturbance alone. However, these studies have primarily focused on effects of whale watch vessels operating in close proximity to Southern Resident killer whales, and commercial shipping traffic in the Salish Sea (*i.e.*, the inland waters of Washington and British Columbia). Commercial whale watch and private recreational vessels operating in the waters around the San Juan Islands in summer months number in the dozens (Erbe 2002), and at least 400 piloted vessels (commercial vessels over 350 gross tons and pleasure craft over 500 gross tons that are required to be guided in and out of the Port of Vancouver by British Columbia Coast Pilots) transit through Haro Strait each month (Joy *et al.*, 2002). Concentration of vessel traffic on the outer coast, where the survey area occurs, is much lower than in the inland waters (Cominelli *et al.*, 2018), suggesting that effects from vessel noise may be lower than in inland waters. Increased noise levels from the survey in any specific area would be short-term due to the mobile nature of the survey, unlike the near-constant vessel presence in inland waters.

Approximately 30 percent of L-DEO's total tracklines occur within the 200-m isobath along the coast of Oregon, Washington, and British Columbia. L-DEO is required to shut down seismic airguns immediately upon visual observation or acoustic detection of killer whales of any ecotype at any distance to minimize potential exposures of Southern Resident killer whales, and must operate within the 200-m isobath in daylight hours only, to increase the ability to visually detect killer whales and implement shutdowns. Southern Resident killer whales exposed to elevated sound levels from the R/V *Langseth* and the airgun array may reduce foraging time, but no survey tracklines or ensonified area overlap with the areas of highest estimated densities of Southern Resident killer whales (see Table 9 of this notice and Figures 7-9 and 7-11 in the U.S. Navy's MSDD (U.S. Navy 2019)). While Southern Resident killer whales may be encountered outside of these areas of highest density, the likelihood is significantly decreased and the relatively small amount of time of

altered behavior would not likely affect their overall foraging ability. Short-term impacts to foraging ability are not likely to result in significant or lasting consequences for individual Southern Resident killer whales or the population as a whole (Ayres *et al.*, 2012). Due to the mobile nature of the survey, animals would not be exposed to elevated sounds for an extended period, and the proposed critical habitat contains a large area of suitable habitat that would allow Southern Resident killer whales to forage away from the survey. Noren *et al.* (2016) reported that although resident killer whales increase energy expenditure in response to vessel presence, the increase is considered to be negligible.

No permanent hearing impairment (Level A harassment) is anticipated or authorized. Authorized takes of Southern Resident killer whales would be limited to Level B harassment in the form of behavioral disturbance. We anticipate 11 instances of Level B harassment of Southern Resident killer whales (10 takes by Level B harassment authorized in this IHA and one take by Level B harassment within Canadian territorial waters), which we expect would likely occur to a smaller subset of the population on only a few days. Limited, short term behavioral disturbance of the nature expected here would not be expected to result in fitness-level effects to individual Southern Resident killer whales or the population as a whole.

Negligible Impact Conclusions

The survey will be of short duration (37 days of seismic operations), and the acoustic "footprint" of the survey is small relative to the ranges of the marine mammals that will potentially be affected. Sound levels will increase in the marine environment in a relatively small area surrounding the vessel compared to the range of the marine mammals within the survey area. Short term exposures to survey operations are not likely to significantly disrupt marine mammal behavior, and the potential for longer-term avoidance of important areas is limited.

The prescribed 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 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 required mitigation will be effective in

preventing, at least to some extent, potential PTS in marine mammals that may otherwise occur in the absence of the mitigation (although all authorized PTS has been accounted for in this analysis). Further, for Southern Resident Killer Whales (as described above), additional mitigation (*e.g.*, second monitoring vessel, daylight only surveys) is expected to increase the ability of PSOs to detect killer whales and shut down the airgun array to reduce the instances and severity of behavioral disturbance.

While operating within the Canadian EEZ, L-DEO will implement certain measures prescribed by Canada's DFO that are more protective than those prescribed by NMFS under the MMPA. These include a requirement to avoid operating within or nearby designated Southern Resident or Northern Resident killer whale critical habitat such that the ensonified area above the 160 dB rms threshold does not extend inside critical habitat, shutting down the airgun array if a sperm whale or a beaked whale (any species) is observed within 1,500 m, and shutting down the airgun array if any species of marine mammal is observed within 1,000 m of the array.

Additionally, throughout the entire survey area within the Canadian EEZ, L-DEO will not conduct survey operations in waters 100 m or less and will conduct seismic surveys in waters 100 to 200 m deep during daylight hours only, with a second vessel having two marine mammal observers on watch, positioned 5 km ahead of the R/V *Langseth*. L-DEO must also combine enhanced visual observations (*e.g.*, reticle and big-eye binoculars, night vision devices and digital cameras) with non-visual detection methods (*e.g.*, infrared technology (FLIR) and PAM) to increase the likelihood of detecting marine mammals during ramp up, Beaufort sea states >3, and night time survey operations. Finally, L-DEO must monitor the established exclusion zone with a radius of 1,000 m for 60 minutes prior to initial start-up of the airgun array or resumption of operations following a complete shutdown to allow for the detection of deep diving animals.

NMFS concludes that exposures to marine mammal species and stocks due to L-DEO's planned survey will result in only short-term (temporary and short in duration) effects to individuals exposed, over relatively small areas of the affected animals' ranges. 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. NMFS does not anticipate the

authorized take to impact annual rates of recruitment or survival.

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 species or stock through effects on annual rates of recruitment or survival:

- No serious injury or mortality is anticipated or authorized;
- The planned activity is temporary and of relatively short duration (37 days);
- The anticipated impacts of the activity on marine mammals will primarily be temporary behavioral changes due to avoidance of the area around the survey vessel;
- The number of instances of potential PTS that may occur are expected to be very small in number. Instances of potential PTS that are incurred in marine mammals are expected to 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 survey to avoid exposure to sounds from the activity;
- The potential adverse effects on fish or invertebrate species that serve as prey species for marine mammals from the survey will be temporary and spatially limited, and impacts to marine mammal foraging will be minimal; and
- The mitigation requirements, including visual and acoustic monitoring, shutdowns, and enhanced measures for areas of biological importance (e.g., additional monitoring vessel, daylight operations only) are expected to minimize potential impacts to marine mammals (both amount and severity).
- Additionally as described above for Southern Resident killer whales specifically, anticipated impacts are limited to few days of behavioral disturbance for any one individual and additional mitigation (e.g., additional monitoring vessel, survey timing, shutdowns) are expected to ensure that both the numbers and severity of impacts to this stock are minimized, and, therefore the authorization of Southern Resident killer whale take is not expected to impact the fitness of any individuals, much less rates of recruitment or survival.

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 prescribed mitigation and monitoring 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 Sections 101(a)(5)(A) and (D) of the MMPA for specified activities other than military readiness activities. The MMPA does not define small numbers and 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.

There are two stocks for which the estimated instances of take appear high when compared to the stock abundance (Table 10)—the California/Oregon/Washington Dall's porpoise stock and the Northern Oregon/Washington Coast harbor porpoise stock. However, when other qualitative factors are used to inform an assessment of the likely number of individual marine mammals taken, the resulting numbers are appropriately considered small. We discuss these in further detail below.

For all other stocks (aside from the two referenced above and described below), the authorized take is less than one-third of the best available stock abundance (recognizing that some of those takes may be repeats of the same individual, thus rendering the actual percentage even lower). Additionally, we note that the authorized take is compared to the stock abundance for MMPA designated stocks, which for many species are limited to U.S. waters and do not include animals within the Canadian EEZ. Therefore, for species with transboundary populations, the actual percentage of the population affected is lower than that shown in Table 10.

The expected take of the California/Oregon/Washington stock of Dall's porpoises, as a proportion of the population abundance, is 36.94 percent, if all takes are assumed to occur for unique individuals. In reality, it is unlikely that all takes would occur to different individuals. L-DEO's survey area represents a small portion of the stock's overall range (Caretta *et al.*,

2017), and it is more likely that there will be multiple takes of a smaller number of individuals within the action area. In addition, Best *et al.* (2015) estimated the population of Dall's porpoise in British Columbia to be 5,303 porpoises based on systematic line-transect surveys of the Strait of Georgia, Johnstone Strait, Queen Charlotte Sound, Hecate Strait, and Dixon Entrance between 2004 and 2007. In consideration of the greater abundance estimate combining the U.S. stock and animals in British Columbia, and the likelihood of repeated takes of individuals, it is unlikely that more than one-third of the stock will be exposed to the seismic survey.

When assuming all estimated takes of harbor porpoise (8,241 total takes by Level A and B harassment) will occur to the Northern Oregon/Washington Coast stock, the take appears high relative to stock abundance (38.35 percent). In reality, takes will occur to both the Northern Oregon/Washington Coast and Northern California/Southern Oregon stocks, and therefore, the number of takes of each stock will be much lower. NMFS has no commonly used method to estimate the relative proportion of each stock that will experience take, but here we propose to apportion the takes between the two stocks based on the stock boundary (Lincoln City, Oregon) and the approximate proportion of the survey area that will occur on either side of the stock boundary. North of Lincoln City, Oregon, harbor porpoises belong to the Northern Oregon/Washington Coast stock, and south of Lincoln City, harbor porpoises belong to the Northern California/Southern Oregon stock. Approximately one-third of the planned survey occurs south of Lincoln City, therefore one-third of the total estimated takes are assumed to be from the Northern California/Southern Oregon stock. The remaining two-thirds of the estimated takes are assumed to be from the Northern Oregon/Washington Coast stock. The estimated one-third of total takes assigned to the Northern California/Southern Oregon stock (2,747 total Level A and Level B takes) represent 7.68 percent of the stock abundance, which NMFS considers to be small relative to the stock abundance. In addition, the survey area represents a small portion of the stock's range, and it is likely that there will be multiple takes of a small portion of individuals, further reducing the number of individuals exposed. The estimated two-thirds of total takes assigned to the Northern Oregon/Washington Coast stock (5,494 takes) represent 25.57 percent of the stock abundance, which

NMFS considers to be small relative to the stock abundance. Additionally, the Northern Oregon/Washington Coast stock abundance estimate does not include animals in Canadian waters (Caretta *et al.*, 2017). Best *et al.* (2015) estimated a population abundance of 8,091 harbor porpoises in British Columbia. The estimated takes of animals in the northern portion of the survey area (north of Lincoln City) represent 18.57 percent of the combined British Columbia and Northern Oregon/Washington Coast abundance estimates, which NMFS considers to be small relative to the stock abundance.

Based on the analysis contained herein of the planned activity (including the required 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 or stocks.

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.

National Environmental Policy Act

To comply with the National Environmental Policy Act of 1969 (NEPA; 42 U.S.C. 4321 *et seq.*) and NOAA Administrative Order (NAO) 216–6A, NMFS must review our proposed action (*i.e.*, the issuance of an incidental harassment authorization) with respect to potential impacts on the human environment.

Accordingly, NMFS has adopted the NSF's EA, as we have determined that it includes adequate information analyzing the effects on the human environment of issuing the IHA, and prepared a FONSI. NSF's EA is available at <https://www.nsf.gov/geo/oce/envcomp/>, and NMFS' FONSI is available at <https://www.fisheries.noaa.gov/national/marine-mammal-protection/incidental-take-authorizations-research-and-other-activities>.

Endangered Species Act (ESA)

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

whenever we propose to authorize take for endangered or threatened species.

The NMFS Office of Protected Resources ESA Interagency Cooperation Division issued a Biological Opinion under section 7 of the ESA, on the issuance of an IHA to L-DEO under section 101(a)(5)(D) of the MMPA by the NMFS OPR Permits and Conservation Division. The Biological Opinion concluded that the proposed action is not likely to jeopardize the continued existence of ESA-listed blue whales, fin whales, sei whales, sperm whales, Central America DPS humpback whales, Mexico DPS humpback whales, Southern Resident killer whale DPS, and Guadalupe fur seals, and is not likely to destroy or adversely modify designated Steller sea lion or humpback whale critical habitat. There is no designated critical habitat in the action area for the other ESA-listed species.

Authorization

As a result of these determinations, NMFS has issued an IHA to L-DEO for conducting a marine geophysical survey in the northeast Pacific Ocean beginning in June 2021, provided the previously mentioned mitigation, monitoring, and reporting requirements are incorporated.

Dated: May 24, 2021.

Catherine Marzin,

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

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