DEPARTMENT OF COMMERCE

National Oceanic and Atmospheric Administration

50 CFR Part 218

[Docket No. 260304–0065]

RIN 0648–BN61

Takes of Marine Mammals Incidental to Specified Activities; Taking Marine Mammals Incidental to U.S. Navy Operations of Surveillance Towed Array Sensor System Low Frequency Active Sonar in the Western and Central North Pacific Ocean and Eastern Indian Ocean

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

ACTION: Proposed rule; proposed letter of authorization; request for comments.

SUMMARY: NMFS has received a request from the U.S. Department of the Navy (Navy) for Incidental Take Regulations (ITR) and an associated Letter of Authorization (LOA) pursuant to the Marine Mammal Protection Act (MMPA). The requested regulations would govern the authorization of take of marine mammals incidental to training and testing activities using Surveillance Towed Array Sensor System (SURTASS) Low Frequency Active (LFA) sonar systems in the western and central North Pacific and eastern Indian oceans over the course of 7 years from August 2026 through August 2033. NMFS requests comments on this proposed rule. NMFS will consider public comments prior to making any final decision on the promulgation of the requested ITR and issuance of the LOA; agency responses to public comments will be summarized in the final rule, if issued. The Navy's activities are considered military readiness activities pursuant to the MMPA, as amended by the National Defense Authorization Act for Fiscal Year 2004 (2004 NDAA) and the NDAA for Fiscal Year 2019 (2019 NDAA).

DATES: Comments and information must be received no later than April 9, 2026.

ADDRESSES: A plain language summary of this proposed rule is available at: *https://www.regulations.gov/docket/NOAA-NMFS-2025-0999.* You may submit comments on this document, identified by NOAA–NMFS–2025–0999, by any of the following methods:

- *Electronic Submission:* Submit all electronic public comments via the Federal e-Rulemaking Portal. Visit *https://www.regulations.gov* and type NOAA–NMFS–2025–0999 in the Search box. Click on the ''Comment'' icon, complete the required fields, and enter or attach your comments.
- *Mail:* Submit written comments to Ben Laws, Incidental Take Program Supervisor, Permits and Conservation Division, Office of Protected Resources, National Marine Fisheries Service, 1315 East-West Highway, Silver Spring, MD 20910–3225.
- *Fax:* (301) 713–0376; Attn: Ben Laws.

Instructions: Comments sent by any other method, to any other address or individual, or received after the end of the comment period, may not be considered by NMFS. All comments received are a part of the public record and will generally be posted for public viewing at: *https://www.regulations.gov* without change. All personal identifying information (*e.g.,* name, address, *etc.*), confidential business information, or otherwise sensitive information submitted voluntarily by the sender will be publicly accessible. NMFS will accept anonymous comments (enter ''N/A'' in the required fields if you wish to remain anonymous). Attachments to electronic comments will be accepted in Microsoft Word, Excel, or Adobe PDF file formats only.

A copy of the Navy's Incidental Take Authorization (ITA) 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/national/marine-mammal-protection/incidental-take-authorizations-military-readiness-activities.* In case of problems accessing these documents, please call the contact listed below (see **FOR FURTHER INFORMATION CONTACT**).

FOR FURTHER INFORMATION CONTACT: Alyssa Clevenstine, Office of Protected Resources, NMFS, (301) 427–8401.

SUPPLEMENTARY INFORMATION:

Purpose and Need for Regulatory Action

This proposed rule, if promulgated, would provide a framework under the authority of the MMPA (16 U.S.C. 1361 *et seq.*) to allow for the authorization of take of marine mammals incidental to the Navy's training and testing activities (which qualify as military readiness activities) using SURTASS LFA sonar in the western and central North Pacific Ocean and eastern Indian Ocean (see figure 2–1 of the rulemaking and LOA application (hereafter referred to as the application)). Please see the Legal Authority for the Proposed Action section for relevant definitions.

Legal Authority for the Proposed Action

The MMPA prohibits the ''take'' of marine mammals, with certain exceptions. Section 101(a)(5)(A) and (D) of the MMPA (16 U.S.C. 1361 *et seq.*) directs 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 proposed or, if the taking is limited to harassment, a notice of a proposed authorization is provided to the public for review and the opportunity to submit comment.

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; 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 (collectively referred to as ''mitigation''); and requirements pertaining to the monitoring and reporting of the takings. The MMPA defines ''take'' to mean to harass, hunt, capture, or kill, or attempt to harass, hunt, capture, or kill any marine mammal (16 U.S.C. 1362). The Preliminary Analysis and Negligible Impact Determination section discusses the definition of ''negligible impact.''

The 2004 NDAA (Pub. L. 108–136) amended section 101(a)(5) of the MMPA to remove the ''small numbers'' and ''specified geographical region'' provisions (16 U.S.C. 1371(a)(5)(F)) and amended the definition of ''harassment'' in section 3(18)(B) of the MMPA as applied to a ''military readiness activity'' to read as follows: (1) Any act that injures or has the significant potential to injure a marine mammal or marine mammal stock in the wild (Level A Harassment); or (2) Any act that disturbs or is likely to disturb a marine mammal or marine mammal stock in the wild by causing disruption of natural behavioral patterns, including, but not limited to, migration, surfacing, nursing, breeding, feeding, or sheltering, to a point where such behavioral patterns are abandoned or significantly altered (Level B Harassment) (16 U.S.C.

1362(18)(B)). The 2004 NDAA also amended the MMPA to establish in section 101(a)(5)(A)(iii) that ''[f]or a military readiness activity . . . , a determination of 'least practicable adverse impact' . . . shall include consideration of personnel safety, practicality of implementation, and impact on the effectiveness of the military readiness activity'' (16 U.S.C. 1371(a)(5)(A)(iii)). On August 13, 2018, the 2019 NDAA (Pub. L. 115–232) amended the MMPA to allow ITRs for military readiness activities to be issued for up to 7 years (16 U.S.C. 1371(a)(5)(A)(ii)).

Summary of Major Provisions Within the Proposed Rule

The major provisions of this proposed rule are as follows:

- The proposed authorization of take of marine mammals by Level A harassment and Level B harassment;
- The proposed use of visual, passive acoustic, and active acoustic monitoring mitigation;
- The proposed implementation of geographic activity limitations including within 22 kilometers (km) (12 nautical miles (nmi)) of any emergent land and in certain offshore areas and times that are biologically important (*i.e.,* for foraging, migration, reproduction) for marine mammals;
- The proposed implementation of a Notification and Reporting Plan (for dead, live stranded, or marine mammals struck by any vessel engaged in military readiness activities); and
- The proposed implementation of a robust monitoring plan to improve our understanding of the environmental effects resulting from the Navy's training and testing activities.

This proposed rule includes an adaptive management component that allows for timely modification of mitigation, monitoring, and/or reporting measures based on new information, when appropriate.

Summary of Request

On April 6, 2025, NMFS received an application from the Navy requesting authorization to take marine mammals, by Level A and Level B harassment, incidental to training and testing activities (characterized as military readiness activities) using SURTASS LFA sonar in the western and central North Pacific Ocean and eastern Indian Ocean. The Navy is requesting one 7-year LOA for training and testing activities. In response to our comments and following an information exchange, the Navy submitted a revised application, deemed adequate and complete on July 1, 2025. The Navy's request is for take of 44 species of marine mammals by Level B harassment and a subset of those species by Level A harassment (9 species). On July 11, 2025, we published a notice of receipt (NOR) of application in the **Federal Register** (90 FR 30877), requesting comments and information related to the Navy's request for 30 days. During the 30-day public comment period on the NOR, we received one public comment from Turtle Island Restoration Network requesting that NMFS deny the Navy's ITA request and consider alternatives that prioritize avoiding critical habitats, reducing sonar intensity, or limiting operational time frames. NMFS reviewed and considered all submitted material during the drafting of this proposed rule.

NMFS has previously promulgated ITRs pursuant to the MMPA relating to similar military readiness activities using SURTASS LFA sonar. NMFS published the first rule effective August 15, 2002 through August 15, 2007 (67 FR 46712, July 16, 2002), the second rule effective from August 16, 2007 through August 15, 2012 (72 FR 46846, August 21, 2007), the third rule effective from August 15, 2012 through August 15, 2017 (77 FR 50290, August 20, 2012), and the fourth rule effective from August 12, 2019 through August 11, 2026 (84 FR 40132, August 13, 2019). Of note, on August 10, 2017, the Secretary of Defense,[1] after conferring with the Secretary of Commerce, determined that it was necessary for the national defense to exempt all military readiness activities that use SURTASS LFA sonar from compliance with the requirements of the MMPA for 2 years from August 13, 2017, through August 12, 2019, or until such time when NMFS issues regulations and a LOA under title 16, section 1371 for military readiness activities associated with the use of SURTASS LFA sonar, whichever is earlier. For this proposed rulemaking, the Navy proposes to conduct substantially similar training and testing activities using SURTASS LFA sonar that were conducted under previous rules.

The Navy's application reflects the most up-to-date compilation of training and testing activities deemed necessary to accomplish military readiness requirements. The types and numbers of activities included in the proposed rule account for interannual variability in training and testing to meet evolving or emergent military readiness requirements. In this proposed rule, we have undertaken a comprehensive assessment of the impacts of all SURTASS LFA sonar training and testing activities on marine mammals likely to be present within the western and central North Pacific Ocean and eastern Indian Ocean in the area described below.

Description of Proposed Activity

Overview

The Navy requests authorization to take marine mammals incidental to conducting military readiness activities. The Navy has determined that acoustic stressors are likely to result in take of marine mammals in the form of Level A and Level B harassment. Descriptions of these activities are provided in the Navy's application (*https://www.fisheries.noaa.gov/action/incidental-take-authorization-united-states-navys-surveillance-towed-array-sensor-system-low*), with additional detail provided in chapter 2 and appendix F of the 2025 SURTASS Draft Supplemental Environmental Impact Statement/Overseas Environmental Impact Statement (2025 SURTASS Draft SEIS/OEIS) (*https://www.nepa.navy.mil/surtass-lfa/*) which are summarized here.

The Navy's statutory mission is to organize, train, equip, and maintain combat-ready naval forces for the peacetime promotion of the national security interests and prosperity of the United States, including deterring maritime aggression and maintaining freedom of navigation in ocean areas. This mission is mandated by Federal law (10 U.S.C. 8062), which requires the readiness of the naval forces of the United States. Due to the advancements and use of quieting technologies in diesel-electric and nuclear submarines, undersea submarine threats have become increasingly difficult to locate solely using passive acoustic technologies. At the same time, the distance at which submarine threats can be detected has been decreasing due to these quieting technologies, and improvements in torpedo and missile design have extended the effective range of these weapons. To meet the requirement for improved capability to detect quieter and harder-to-find foreign submarines at greater distances, the Navy developed and uses SURTASS LFA sonar.

Dates and Duration

The specified activities would occur at any time during the 7-year period of validity of the regulations, from August 12, 2026 through August 11, 2033. The

[1] Pursuant to Executive Order 14347, ''*Restoring the United States Department of War,*'' (90 FR 43893), as of September 5, 2025, the ''Secretary of Defense'' is authorized to use the additional secondary title of ''Secretary of War.''

proposed number of military readiness activities are described in the Detailed Description of the Specified Activity section.

Geographic Region

The Pacific SURTASS LFA Sonar Study Area includes the western and central North Pacific Ocean and Eastern Indian Ocean, not including the Western Indian Ocean or Sea of Okhotsk (figure 1). Please refer to figure 2–1 of the application for a color map of the Study Area. The Study Area remains unchanged from the previous rulemaking (84 FR 40132, August 13, 2019) (see also the 2019 SURTASS SEIS/OEIS (U.S. Department of the Navy, 2019)).

Importantly and as described in greater detail in the Proposed Mitigation section, in areas within 22 km from any emergent land (coastal standoff range (CSR)) and in areas outside of the CSR identified as offshore biologically important areas (OBIAs), SURTASS LFA sonar training and testing would be conducted such that received levels of LFA sonar are below 180 decibels referenced to 1 microPascal (dB re 1 μPa) root-mean-square (RMS) sound pressure level (SPL). This restriction would be observed year-round for the CSR and during known periods of biological importance for OBIAs.

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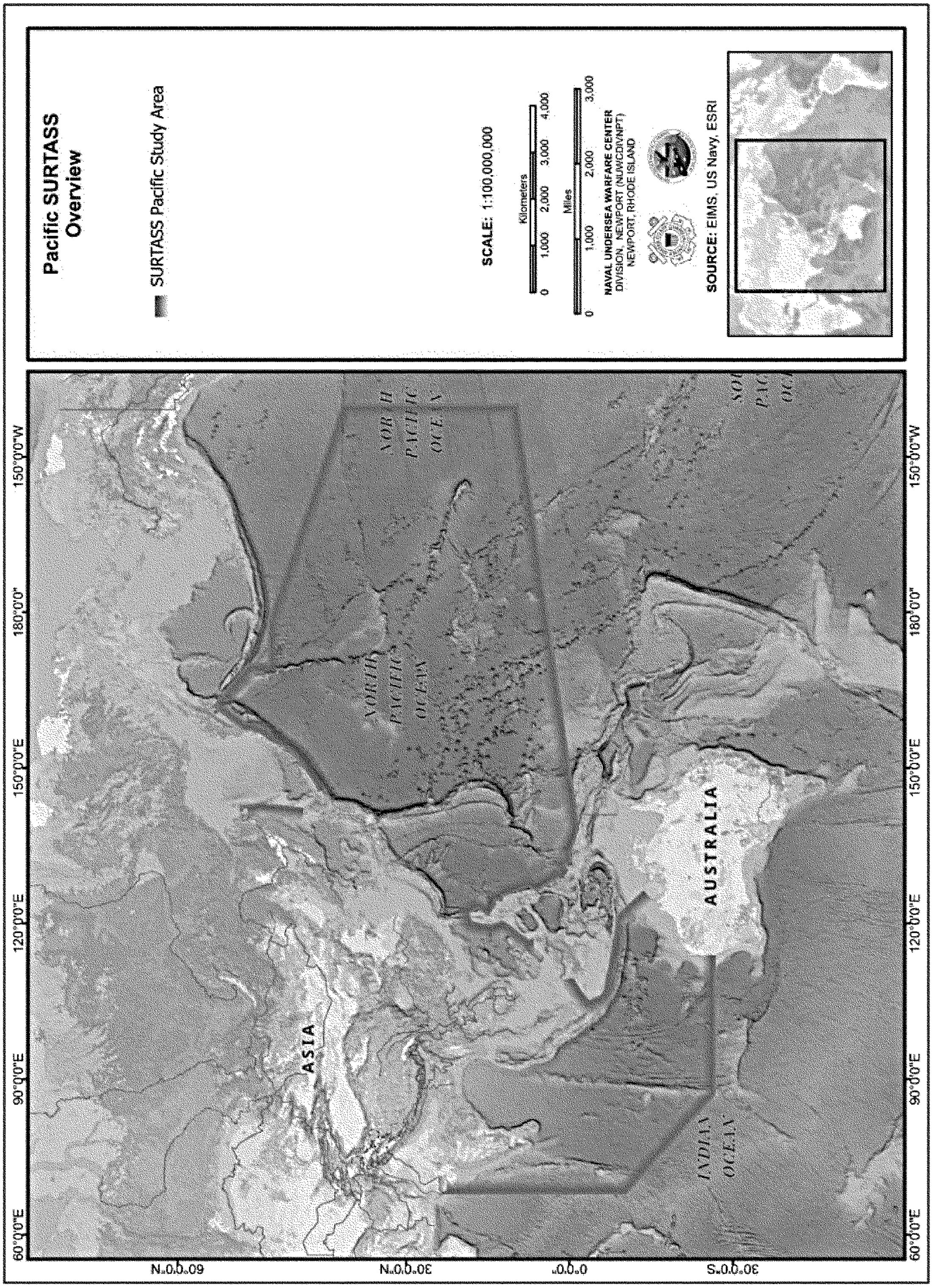

Figure 1 -- Map of the Pacific SURTASS LFA Sonar Study Area

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Detailed Description of the Specified Activity

The Navy proposes to use 1,100 hours of SURTASS LFA sonar per year. The analysis for the current SURTASS LFA incidental take regulations (84 FR 40132, August 13, 2019) analyzed the use of 592 hours. The change from 592 to 1,100 hours does not reflect new or additional training requirements. Instead, it is the result of a change in how the Navy counts an ''hour'' of transmission. Previously, SURTASS LFA sonar hours were calculated by adding the portions of time a sonar emits sound during its duty cycle (ratio of time the signal is on compared to off), whereas other Navy sonar systems, such as mid-frequency and high-frequency active sonar (MFAS and HFAS, respectively), report hours based on ''duration'' time (total time the source is active, including silent periods between pings). To bring SURTASS LFA sonar in line with these other systems, the Navy developed a conversion method that considers various factors including LFA sonar pings, wave trains, and other classified considerations. As a result, the 1,100 hours of annual SURTASS LFA training proposed are equivalent to the 592 hours under the previous counting method. The SURTASS LFA sonar transmission hours, which are classified as military readiness activities pursuant to the section 315(f) of Public Law 101–314 (16 U.S.C. 703), represent a distribution across three activities that include:

• Training (*i.e.,* contractor crew proficiency training, military crew proficiency training, active training);

• Maintenance and upgrade (*i.e.,* equipment maintenance checks and performance evaluations); and

• Exercises (*e.g.,* Valiant Shield, Rim of the Pacific (RIMPAC)).

Compared to the 2019 final rule (84 FR 40132, August 13, 2019), the geographic bounds of the Study Area and geographic mitigations remain the same, as do the operating characteristics of SURTASS LFA sonar system, which remains the only stressor with the potential to cause take during SURTASS training and testing activities. Although the sonar hours are calculated differently between the 2019 final rule and current proposed rulemaking (592 hours and 1,100 hours, respectively), the active sonar duration remains the same as analyzed for the 2019 rule. All of the acoustic thresholds and take calculation methods used here are referred to as ''Phase IV'' and described in the technical report ''Criteria and Thresholds for U.S. Navy Acoustic and Explosive Effects Analysis (Phase 4)'' (U.S. Department of the Navy, 2025) (hereafter referred to as the Criteria and Thresholds Technical Report) mirroring those used in analyses supporting the Phase IV AFTT (90 FR 50504, November 7, 2025) and HCTT (90 FR 58810, December 17, 2025) training and testing regulations. Alternatively, in the previous SURTASS LFA sonar rule (84 FR 40132, August 13, 2019), Phase III thresholds were used for acoustic injury prediction, a SURTASS-specific threshold was used to predict behavioral disturbance, and different SURTASS-specific methods and modeling were used in the calculation of take. This proposed rulemaking proposes to authorize take of marine mammals by Level A harassment that was not previously requested or authorized in the 2019 final rule. This change is due to updated marine mammal hearing thresholds, the criteria for estimating impacts to marine mammals, and the Navy's reliance on their Navy Acoustics Effects Model (NAEMO) rather than the Acoustic Integration Model (AIM), which was used to model and quantify estimated take for the 2019 rulemaking. These changes are described in the *Marine Mammal Hearing Groups* section, the Estimated Take of Marine Mammals section, and the *Navy Acoustic Effects Model* section. This proposed rule also includes five new marine mammal OBIAs for SURTASS LFA sonar, as described in the *Geographic Mitigation* section of this proposed rule.

The Navy describes and analyzes the effects of their activities within the application and provides additional details in the 2025 SURTASS Draft SEIS/OEIS. In their assessment, the Navy concluded that the transmission of acoustic signals was the only stressor likely to result in impacts on marine mammals that qualify as harassment as defined under the MMPA. Therefore, the Navy's application provides their assessment of potential effects from this stressor.

SURTASS LFA Sonar System

Sonar is an acronym for ''sound navigation and ranging'' and its definition includes any system that uses underwater sound or acoustics for observations and communications. The two basic types of sonar used in the SURTASS LFA sonar system are passive sonar and active sonar. Passive sonar detects sound created by a source. This is a one-way transmission of sound waves through water from the source to the receiver. Very simply, passive sonar ''listens'' without transmitting any sound signals. Active sonar is the transmission of sound energy for the purpose of sensing the environment by interpreting features of received signals. Active sonar detects objects by creating a sound pulse or ''ping'' that is transmitted from the sonar system through the water, reflects off a target object, and returns in the form of an echo to be detected by a receiver. Active sonar is a two-way transmission of sound waves through water (sound source to reflector to receiver).

SURTASS LFA sonar is a system with three components: low-frequency (less than 1,000 hertz (Hz)) active sonar system, passive sonar system, and active high-frequency/marine mammal monitoring (HF/M3) sonar (see figure 1–1 of the application). The passive component is the SURTASS receiver array while the active component includes the LFA sonar source array and HF/M3 sonar.

Although SURTASS LFA sonar vessels usually operate independently from one another, SURTASS LFA sonar vessels may operate in conjunction with other naval air, surface, or submarine assets as part of naval exercises. SURTASS LFA sonar vessels generally travel in straight lines or racetrack patterns depending on the scenario. When the SURTASS or LFA sonar arrays are deployed, a SURTASS LFA sonar vessel must maintain a speed of at least 5.6 kilometers per hour (km/hr) (3 knots), with a typical speed of 7.4 km/hr. When not towing the SURTASS or LFA sonar arrays, Tactical-Auxiliary General Ocean Surveillance (T–AGOS) vessels travel at maximum speeds of approximately 22.2 km/hr. Movements of SURTASS LFA sonar vessels are not unusual or extraordinary and are in line with routine operations of seagoing vessels.

Low-Frequency Active (LFA) Sonar

LFA sonar is employed when active sound signals are needed to detect and track underwater targets of interest. LFA sonar complements SURTASS passive activities by actively acquiring and tracking submarines when they are in quiet operating modes, measuring accurate target range, and re-acquiring lost contacts. LFA sonar consists of a vertical source array of sound-producing elements that are suspended by cable under one of the T–AGOS vessels. These elements, called projectors, are devices that produce the active sonar sound pulses or pings. To produce a ping, the projectors transform electrical energy into mechanical energy (*i.e.,* vibrations), which travel as pressure disturbances in water.

The LFA sonar source is a vertical line array consisting of up to 18 projectors. Each LFA projector transmits sonar beams that are omnidirectional (360 degrees) in the horizontal, with a narrow vertical beamwidth that can be steered above or below the horizontal. The operating features of the LFA sonar are as follows:

• The source level (SL) of an individual projector on the LFA sonar array is approximately 215 dB re 1 μPa RMS SPL or less;

• For the array SL, the effective SL of the system design was used; effective SL is a theoretical value, hypothetically measured at 1 meter (m) from the array on its horizontal axis, calculated from the formula: SEL + 20 Log10(N), where sound exposure level (SEL) = SL of an individual projector and N = number of projectors;

• The source frequency ranges from 100 to 500 Hz;

• The typical LFA sonar signal is not a constant tone but consists of various waveforms that vary in frequency and duration. A complete sequence of sound transmissions (waveforms) is referred to as a wavetrain (also known as a ping). These wavetrains last between 6 and 100 seconds, with an average length of 60 seconds. Within each wavetrain, a variety of signal types can be used, including continuous wave and frequency-modulated signals. The duration of each continuous frequency sound transmission within the wavetrain is no longer than 10 seconds;

• The maximum duty cycle (ratio of sound ''on'' time to total time) is 20 percent. The typical duty cycle, based on historical SURTASS LFA sonar operational parameters (from 2003 to 2017), is 7.5–10 percent; and

• The time between wavetrain transmissions typically ranges from 6 to 15 minutes.

Compact LFA Active Component

In addition to the LFA sonar system currently deployed on the T–AGOS vessel United States Naval Ship (USNS) IMPECCABLE, the Navy developed a compact LFA (CLFA) sonar system, which is now deployed on its three smaller T–AGOS vessels (USNS ABLE, USNS EFFECTIVE, and USNS VICTORIOUS). The operational characteristics of the active component for the CLFA sonar system are comparable to the LFA sonar system and the potential impacts from the CLFA sonar system will be similar to the effects from the LFA sonar system. The CLFA sonar system consists of smaller projectors that weigh 64,410 kilograms (kg), which is 82,554 kg less than the weight of the LFA projectors on the USNS IMPECCABLE. The CLFA sonar system also consists of up to 18 projectors suspended beneath the surveillance vessel in a vertical line array, and the CLFA sonar system projectors transmit in the low-frequency band (also between 100 and 500 Hz) with the same duty cycle as described for LFA sonar. Similar to the active component of the LFA sonar system, the source level of an individual projector in the CLFA sonar array is approximately 215 dB re 1 μPa or less.

For the analysis in this rulemaking, NMFS will use the term LFA to refer to both the LFA sonar system and/or the CLFA sonar system, unless otherwise specified.

Passive Acoustic System

SURTASS is the passive, or listening, component of the system that detects returning sounds from submerged objects, such as threat submarines, through the use of hydrophones. Hydrophones transform mechanical energy (*i.e.,* received acoustic sound waves) into an electrical signal that can be analyzed by the sonar processing system. The return (received) signals, which are usually below background or ambient noise level, are processed and evaluated to identify and classify potential underwater threats. SURTASS consists of a twin-line (TL–29A), ''Y'' shaped horizontal line array of hydrophones with two apertures that is approximately 305 m (1,000 feet) long. The SURTASS horizontal line array can be towed in shallow, littoral environments; can provide significant directional noise rejection; and can resolve bearing ambiguities without the vessel's course having to be changed.

High-Frequency/Marine Mammal Monitoring Active (HF/M3) Sonar

The HF/M3 sonar is a Navy-developed, enhanced high-frequency (HF) commercial sonar used as a mitigation and monitoring asset to detect, locate, and track marine mammals that may pass close enough to the SURTASS LFA sonar's transmit array to enter the LFA mitigation zone (1.8 km (2,000 yards)). This intermittent source has a low-duty cycle and would operate at a SL of 220 dB re 1 μPa at 1 m RMS SPL and source frequencies between 30 and 40 kHz, with maximum pulse length of 40 milliseconds and a variable duty cycle that is nominally 3–4 percent.

Vessel Movement

The Navy currently deploys SURTASS LFA sonar on four T–AGOS vessels that are 72–86 m in length, with twin-shafted diesel electric engines capable of providing 3,200–5,000 horsepower. T–AGOS vessels have a catamaran-type split-hull shape and an enclosed propeller system, and the bridge of T–AGOS vessels are positioned forward of the centerline, offering good visibility ahead of the bow and good visibility aft to visually monitor for marine mammals. Each vessel has an observation area on the bridge that is more than 9.1 m above sea level from where Lookouts will monitor for marine mammals whenever SURTASS LFA sonar is transmitting.

NMFS considered the likelihood that vessel movement during military readiness activities could result in an incidental, but not intentional, strike of a marine mammal in the Study Area, which has the potential to result in serious injury or mortality. Vessel strikes are not specific to any specific military readiness activity but rather, a limited, sporadic, and incidental result of the Navy's vessel movement during military readiness activities within the Study Area. Vessel strikes from commercial, recreational, and military vessels are known to seriously injure and occasionally kill cetaceans (Abramson *et al.,* 2011; Berman-Kowalewski *et al.,* 2010; Calambokidis, 2012; Crum *et al.,* 2019; Douglas *et al.,* 2008; Laggner 2009; Van der Hoop *et al.,* 2012; Van der Hoop *et al.,* 2013), although reviews of the literature on vessel strikes mainly involve collisions between commercial vessels and whales (Jensen and Silber, 2003, Laist *et al.,* 2001). Vessel speed, size, and mass are all important factors in determining both the potential likelihood and impacts of a vessel strike to marine mammals (Blondin *et al.* 2025; Conn and Silber, 2013; Garrison *et al.* 2025; Gende *et al.,* 2011; Redfern *et al.,* 2019; Silber *et al.,* 2010; Szesciorka *et al.,* 2019; Vanderlaan and Taggart, 2007; Wiley *et al.,* 2016). For large vessels, speed and angle of approach can influence the severity of a strike.

Here, the limited number of Navy vessels operating within the Study Area, the design and operation of the T–AGOS vessels, the monitoring and mitigation utilized, and the fact that no strikes of marine mammals from vessels conducting SURTASS training and testing have occurred in the past support the conclusion that Navy vessel strikes are not expected to result from the activities covered by this proposed rule. The number of vessels used in the Navy's SURTASS testing and training activities is minimal (especially as compared to the number of commercial ships transiting in the same areas on an annual basis), rendering the base probability of a vessel strike very low. The design of the T–AGOS vessels further reduces the risk of a vessel strike, with the catamaran-type split hull shape and enclosed propeller system, a propeller system design that has been suggested as effectively reducing sharp force injuries to marine species, particularly when combined with reduced speeds (*i.e.,* 5.6–7.4 km/hr) (Schoeman *et al.,* 2020). Both detection and avoidance of marine mammals are more effective at slower speeds and the T–AGOS vessel's slow operational speed (averaging 7.4 km/hr), as well as the relatively slow vessel cruising speed when SURTASS LFA sonar is not in use (a maximum of approximately 22.2 km/hr), are generally below the speed at which, records suggest, that marine mammal injury or death is more common (Laist *et al.,* 2001).

Surface ships operated by the Navy have multiple personnel assigned to stand watch at all times when moving through the water (underway). A primary duty of personnel standing watch on surface ships is to detect and report all objects and disturbances sighted in the water that may indicate a threat to the vessel and its crew, such as debris, a periscope, surfaced submarine, or surface disturbance. Per vessel safety requirements, personnel standing watch also report any marine mammals sighted in the path of the vessel as a standard collision avoidance procedure. All vessels proceed at a safe speed so they can take proper and effective action to avoid a collision with any sighted object or disturbance and can stop within a distance appropriate to the prevailing circumstances and conditions. The Navy utilizes Lookouts to avoid collisions, and Lookouts are trained to spot marine mammals so that vessels may change course or take other appropriate action to avoid collisions (for more information, see section 2.1.2 of the application).

Further, the use of HF/M3 sonar to monitor for marine mammals in tandem with Lookouts would support detection of cetaceans well in advance of any potential vessel strike during SURTASS LFA sonar training and testing activities. Proposed mitigation, monitoring, and reporting measures are described in detail later in this document (please see Proposed Mitigation Measures section, Proposed Monitoring section, and Proposed Reporting section).

Due to the reasons described above (*i.e.,* low probability of Navy vessel and marine mammal interactions, vessel design, relatively slow vessel speeds, high probability of detection and avoidance due to applied monitoring and mitigation measures), and the fact that there have been no known Navy vessel strikes in the 22-year history of SURTASS LFA sonar activities, the Navy has determined, and NMFS preliminarily concurs, that take of marine mammals by vessel strike is highly unlikely. Therefore, the Navy has not requested any take of marine mammals by vessel strike, and NMFS is not proposing to authorize take by serious injury or mortality by vessel strike.

Standard Operating Procedures

For training and testing to be effective, Navy personnel must be able to safely use their sensors, platforms, weapons, and other devices to their optimum capabilities and as intended for use in missions and combat operations. The Navy has developed standard operating procedures through decades of experience to provide for safety and mission success. Because they are essential to safety and mission success, standard operating procedures are part of the proposed activities and are considered in the environmental analysis for applicable resources (see chapter 3 (Affected Environment and Environmental Consequences) of the 2025 SURTASS Draft SEIS/OEIS). While standard operating procedures are designed for the safety of personnel and equipment and to ensure the success of training and testing activities, their implementation often yields additional benefits for environmental (*e.g.,* marine mammals), socioeconomic, public health and safety, and cultural resources.

Because standard operating procedures are essential to safety and mission success, the Navy considers them to be part of the proposed activities and has included them in the environmental analysis. Standard operating procedures that are recognized as providing a potential secondary benefit on marine mammals that apply to SURTASS LFA sonar training and testing activities include those related to the following, described in more detail in section 2.1.2 of the application:

- Vessel safety; and
- Towed in-water device safety.

Standard operating procedures (which are implemented regardless of their secondary benefits) are different from mitigation measures (which are designed entirely for the purpose of avoiding or reducing impacts). Information on mitigation measures is provided in the *Proposed Mitigation Measures* section.

Description of Marine Mammals and Their Habitat in the Area of Specified Activities

Marine mammal species and their associated stocks that have the potential to occur in the Study Area are presented in table 1 along with each stock's Endangered Species Act (ESA) and MMPA statuses, abundance estimate and associated coefficient of variation (CV) value, minimum abundance estimate, potential biological removal (PBR), annual M/SI, as applicable, and potential occurrence in the Study Area. The Navy requests authorization to take individuals of 44 species by Level B harassment and, for a subset of those species, Level A harassment (9 species), incidental to military readiness activities from the use of SURTASS LFA sonar in the Study Area. Of note, based on improvements to the Navy's density research since the 2019 SURTASS LFA Final Rule (84 FR 40132, August 13, 2019), seven more species were modeled for this proposed rulemaking than the 2019 rulemaking. Of those seven, the Navy's application includes estimated take of four species from the proposed activity that were not included in the 2019 final rule: (1) bearded seal; (2) ringed seal; (3) harbor seal; and (4) Steller sea lion. Multiple stocks of some species are affected, and independent assessments are conducted to make the necessary findings and determinations for each of these.

There are 34 stocks under NMFS' jurisdiction with confirmed or possible occurrence in the Study Area, of which 11 are listed as endangered or threatened under the ESA (16 U.S.C. 1531 *et seq.*). Currently, the false killer whale (Main Hawaiian Islands Insular DPS) and Hawaiian monk seal have critical habitat designated under the ESA in the Study Area (see *Critical Habitat* section below).

The remaining species in the Central and Western Pacific (CWP) and Eastern Indian Oceans (EIO) have no stock designation (NSD) under the MMPA.

Sections 3 and 4 and appendix A (Marine Mammal Species Supplemental Information) of the application summarize available information regarding status and trends, distribution and habitat preferences, and behavior and life history of the potentially affected species. NMFS fully considered all of this information, and we refer the reader to these descriptions, instead of reprinting the information. Additional information regarding population trends and threats may be found in NMFS' 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' website at: *https://www.fisheries.noaa.gov/find-species.* Additional information on the general biology and ecology of marine mammals is included in the 2025 SURTASS Draft SEIS/OEIS. Table 1 incorporates the best available science, including data from the 2023 Pacific and Alaska Marine Mammal Stock Assessment Reports (Carretta *et al.,* 2024; Young *et al.,* 2024) (see *https://www.fisheries.noaa.gov/national/marine-mammal-protection/marine-mammal-stock-assessments),* and 2024 draft SARs, as well as monitoring data from the Navy's marine mammal research efforts.

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Table 1 -- Marine Mammal Occurrence within the Pacific SURTASS LFA Sonar Study Area[1]

Common name	Scientific name	Stock	ESA/MMPA status; Strategic (Y/N)[2]	Stock abundance (CV, N_{min}, most recent abundance survey)[3]	PBR	Annual M/SI[4]
Order Artiodactyla – Cetacea – Mysticeti (baleen whales)						
Family Balaenidae						
North Pacific right whale	*Eubalaena japonica*	NSD	E, N/A, N/A		UNK	UNK
Family Balaenopteridae (rorquals)						
Blue whale	*Balaenoptera musculus*	NSD	E, N/A, N/A		UNK	UNK
Blue whale	*Balaenoptera musculus*	Central North Pacific	E, D, Y	133 (1.09, 63, 2010)	0.1	0
Bryde's whale	*Balaenoptera edeni*	NSD	-, N/A, N/A		UNK	UNK
Bryde's whale	*Balaenoptera edeni*	Hawaii	-, -, N	791 (0.29, 623, 2020)	6.2	0
Fin whale	*Balaenoptera physalus*	NSD	E, N/A, N/A		UNK	UNK
Fin whale	*Balaenoptera physalus*	Hawaii	E, D, Y	203 (0.99, 101, 2017)	0.2	0
Humpback whale	*Megaptera novaeangliae*	NSD	-[5], N/A, N/A		UNK	UNK
Humpback whale	*Megaptera novaeangliae*	Hawaii	-, -, N	11,278 (0.56, 7,265, 2020)	127	27.09
Humpback whale	*Megaptera novaeangliae*	Western North Pacific	E, D, Y	1,084 (0.088, 1,007, 2006)	3.4	5.82
Antarctic minke whale	*Balaenoptera bonaerensis*	NSD	-, N/A, N/A		UNK	UNK
Minke whale	*Balaenoptera acutorostrata*	NSD	-, N/A, N/A		UNK	UNK
Minke whale	*Balaenoptera acutorostrata*	Hawaii	-, -, N	438 (1.05, 212, 2017)	2.1	0
Omura's whale	*Balaenoptera omurai*	NSD	-, N/A, N/A		UNK	UNK

Common name	Scientific name	Stock	ESA/MMPA status; Strategic (Y/N)[2]	Stock abundance (CV, N_{min}, most recent abundance survey)[3]	PBR	Annual M/SI[4]
Sei whale	*Balaenoptera borealis*	NSD	E, N/A, N/A		UNK	UNK
Sei whale	*Balaenoptera borealis*	Hawaii	E, D, Y	391 (0.9, 204, 2010)	0.4	0.2
Odontoceti (toothed whales, dolphins, and porpoises)						
Family Physeteridae						
Sperm whale	*Physeter macrocephalus*	NSD	E, N/A, N/A		UNK	UNK
Sperm whale	*Physeter macrocephalus*	North Pacific	E, D, Y	UND (UND, UND, 2015)	UND	3.5
Sperm whale	*Physeter macrocephalus*	Hawaii	E, D, Y	5,707 (0.23, 4,486, 2017)	18	0
Family Kogiidae						
Dwarf sperm whale	*Kogia sima*	NSD	-, N/A, N/A		UNK	UNK
Dwarf sperm whale	*Kogia sima*	Hawaii	-, -, N	UNK (UNK, UNK, 2017)	UND	0
Pygmy sperm whale	*Kogia breviceps*	NSD	-, N/A, N/A		UNK	UNK
Pygmy sperm whale	*Kogia breviceps*	Hawaii	-, -, N	42,083 (0.64, 25,695, 2017)	257	0
Family Ziphiidae (beaked whales)						
Baird’s beaked whale	*Berardius bairdii*	NSD	-, N/A, N/A		UNK	UNK
Blainville’s beaked whale	*Mesoplodon densirostris*	NSD	-, N/A, N/A		UNK	UNK
Blainville’s beaked whale	*Mesoplodon densirostris*	Hawaii	-, -, N	1,132 (0.99, 564, 2017)	5.6	0
Deraniyagala’s beaked whale	*Mesoplodon hotaula*	NSD	-, N/A, N/A		UNK	UNK
Ginkgo-toothed beaked whale	*Mesoplodon ginkgodens*	NSD	-, N/A, N/A		UNK	UNK

Common name	Scientific name	Stock	ESA/MMPA status; Strategic (Y/N) [2]	Stock abundance (CV, N_{min}, most recent abundance survey) [3]	PBR	Annual M/SI [4]
Goose-beaked whale	*Ziphius cavirostris*	NSD	-, N/A, N/A		UNK	UNK
Goose-beaked whale	*Ziphius cavirostris*	Hawaii	-, -, N	4,431 (0.41, 3,180, 2017)	32	0
Hubbs' beaked whale	*Mesoplodon carlshubbi*	NSD	-, N/A, N/A		UNK	UNK
Longman's beaked whale	*Indopacetus pacificus*	NSD	-, N/A, N/A		UNK	UNK
Longman's beaked whale	*Indopacetus pacificus*	Hawaii	-, -, N	2,550 (0.67, 1,527, 2017)	15	0
Stejneger's beaked whale	*Mesoplodon stejnegeri*	NSD	-, N/A, N/A		UNK	UNK
Family Delphinidae						
False killer whale	*Pseudorca crassidens*	NSD	-, N/A, N/A		UNK	UNK
False killer whale	*Pseudorca crassidens*	Main Hawaiian Islands Insular	E, D, Y	138 (0.08, 129, 2015)	0.26	0.3
False killer whale	*Pseudorca crassidens*	Hawaii Pelagic	-, -, Y	5,528 (0.35, 4,152, 2017)	33	47
Killer whale	*Orcinus orca*	NSD	-, N/A, N/A		UNK	UNK
Killer whale	*Orcinus orca*	Hawaii	-, -, N	161 (1.06, 78, 2017)	0.8	0
Melon-headed whale	*Peponocephala electra*	NSD	-, N/A, N/A		UNK	UNK
Melon-headed whale	*Peponocephala electra*	Hawaiian Islands	-, -, N	40,647 (0.74, 23,301 2017)	233	0
Pygmy killer whale	*Feresa attenuata*	NSD	-, N/A, N/A		UNK	UNK
Pygmy killer whale	*Feresa attenuata*	Hawaii	-, -, N	10,328 (0.75, 5,885, 2017)	59	0
Short-finned pilot whale	*Globicephala macrorhynchus*	NSD	-, N/A, N/A		UNK	UNK
Short-finned pilot whale	*Globicephala macrorhynchus*	Hawaii	-, -, N	19,242 (0.23, 15,894, 2020)	159	0.2

Common name	Scientific name	Stock	ESA/MMPA status; Strategic (Y/N) [2]	Stock abundance (CV, N_{min}, most recent abundance survey) [3]	PBR	Annual M/SI [4]
Bottlenose dolphin	*Tursiops truncatus*	NSD	-, N/A, N/A		UNK	UNK
Bottlenose dolphin	*Tursiops truncatus*	Hawaii Pelagic	-, -, N	24,669 (0.57, 15,783, 2020)	158	0
Common dolphin	*Delphinus delphis*	NSD	-, N/A, N/A		UNK	UNK
Fraser's dolphin	*Lagenodelphis hosei*	NSD	-, N/A, N/A		UNK	UNK
Fraser's dolphin	*Lagenodelphis hosei*	Hawaii	-, -, N	40,960 (0.7, 24,068, 2017)	241	0
Northern right whale dolphin	*Lissodelphis borealis*	NSD	-, N/A, N/A		UNK	UNK
Pacific white-sided dolphin	*Aethalodelphis obliquidens*	North Pacific	-, -, N	26,880 (N/A, N/A, 1990)	UND	0
Pantropical spotted dolphin	*Stenella attenuata*	NSD	-, N/A, N/A		UNK	UNK
Pantropical spotted dolphin	*Stenella attenuata*	Hawaii Pelagic	-, -, N	67,313 (0.27, 53,839, 2020)	538	0
Risso's dolphin	*Grampus griseus*	NSD	-, N/A, N/A		UNK	UNK
Risso's dolphin	*Grampus griseus*	Hawaii	-, -, N	6,979 (0.29, 5,283, 2020)	53	0
Rough-toothed dolphin	*Steno bredanensis*	NSD	-, N/A, N/A		UNK	UNK
Rough-toothed dolphin	*Steno bredanensis*	Hawaii	-, -, N	83,915 (0.49, 56,782, 2017)	511	3.2
Spinner dolphin	*Stenella longirostris*	NSD	-, N/A, N/A		UNK	UNK
Spinner dolphin	*Stenella longirostris*	Hawaii Pelagic	-, -, N	UNK (UNK, UNK, 2010)	UND	0
Striped dolphin	*Stenella coeruleoalba*	NSD	-, N/A, N/A		UNK	UNK
Striped dolphin	*Stenella coeruleoalba*	Hawaii Pelagic	-, -, N	64,343 (0.28, 51,055, 2020)	511	0
Family Phocoenidae (porpoises)						
Dall's porpoise	*Phocoenoides dalli*	NSD	-, N/A, N/A		UNK	UNK

Common name	Scientific name	Stock	ESA/MMPA status; Strategic (Y/N) [2]	Stock abundance (CV, N_{min}, most recent abundance survey) [3]	PBR	Annual M/SI [4]
Order Carnivora – Pinnipedia						
Family Otariidae (eared seals and sea lions)						
Northern fur seal	*Callorhinus ursinus*	NSD	-, N/A, N/A		UNK	UNK
Steller sea lion	*Eumetopias jubatus*	Western	E, D, Y	49,837 (N/A, 49,837, 2022)	299	267
Family Phocidae (earless seals)						
Bearded seal	*Erignathus barbatus*	Beringia	T, D, Y	UND (UND, UND, 2013)	UND	6,709
Harbor seal	*Phoca vitulina*	California	-, -, N	30,968 (N/A, 27,348, 2012)	1,641	43
Ribbon seal	*Histriophoca fasciata*	NSD	-, N/A, N/A		UNK	UNK
Hawaiian monk seal	*Neomonachus schauinslandi*	Hawaii	E, D, Y	1,605 (0.05, 1,508, 2022)	5.3	≥4.8
Ringed seal	*Pusa hispida*	NSD	-[5], N/A, N/A		UNK	UNK
Spotted seal	*Phoca largha*	Bering	-, -, N	461,625 (N/A, 423,237, 2013)	25,394	5,254

Note: NSD = No Stock Designation, N/A = Not Applicable, UND = Undetermined, UNK = Unknown. A species or stock listed as 'NSD' is not a designated stock under the MMPA and, therefore, does not have a SAR or any SAR-specific information.

[1] Information on the classification of marine mammal species can be found on the web page for The Society for Marine Mammalogy's Committee on Taxonomy (*https://marinemammalscience.org/science-and-publications/list-marine-mammal-species-subspecies/*).

[2] 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. MMPA status information is N/A to a species for which no stock is designated.

[3] NMFS marine mammal stock assessment reports online at: *https://www.fisheries.noaa.gov/national/marine-mammal-protection/marine-mammal-stock-assessment-reports-region*. CV is coefficient of variation; N_{min} is the minimum estimate of stock abundance.

[4] 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, vessel 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.

[5] Only designated DPSs are ESA-listed.

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Species Not Included in the Analysis

The species carried forward for analysis (and described in table 1) are those likely to be found in the Study Area based on the most recent data available, and do not include species that may have once inhabited or transited the area but have not been sighted in recent years (*e.g.,* species which were extirpated from factors such as 19th and 20th century commercial exploitation). The following species were not included in the analysis.

The North Pacific right whale (NPRW) is one of the rarest marine mammals worldwide. Their historical range spanned the entire North Pacific Ocean from approximately 35 degrees north, with feeding grounds in the Bering Sea, Gulf of Alaska, Okhotsk Sea, and northwestern North Pacific, the latter of which overlaps a portion of the Study Area. Two transboundary stocks of NPRW are currently recognized: a Western North Pacific stock feeding primarily in the Sea of Okhotsk and an Eastern North Pacific (ENP) stock feeding primarily in the southeastern Bering Sea (Rosenbaum *et al.,* 2000; Brownell *et al.,* 2001; LeDuc *et al.,* 2012; Pastene *et al.,* 2022). The summer range of the ENP stock includes the Gulf of Alaska and Bering Sea but the winter calving grounds for both stocks are unknown, as they likely migrate out of the Bering Sea during winter months (Wright, 2017). Recent sightings of NPRW have occurred in the eastern Bering Sea, southeastern Bering Sea, northern Bering Sea, and British Columbia (Little, 2021). Acoustic detections of NPRW have also occurred in the southeastern Bering Sea, Gulf of Alaska, and the eastern Aleutian Islands. Young *et al.* (2024) indicate the N_{min} of the ENP stock is 26 individuals based on the 20th percentile of the photo-identification estimate of 31 whales (CV = 0.226) (Wade *et al.,* 2011). Despite the uncertainty in the current extent of the range of the ENP stock, and because the abundance of the ENP stock is so low and recent sightings data does not overlap the Study Area, it is considered unlikely the ENP stock would be impacted by the proposed activities.

Bowhead whales (*Balaena mysticetus*) are limited to the Arctic and sub-Arctic regions in the Northern Hemisphere, with shorter migrations than most baleen whales; the Okhotsk Sea and Bering Chukchi-Beaufort Seas stocks are confined to the Okhotsk and Bering Seas, respectively (Citta *et al.,* 2023; Citta *et al.,* 2015; Ivashchenko and Clapham, 2010). There has been one record of a calf in lower latitudes in Canadian waters; however, it is the only sighting of a bowhead within the eastern North Pacific (Towers *et al.,* 2022). There are no known or documented sightings of this species within the Study Area.

Beluga whales (*Delphinapterus leucas*) of the Beaufort Sea, Eastern Chukchi Sea, and Cook Inlet stocks of beluga whales do not overlap the Study Area. The Sakhalin-Amur, Ulbansky, Tugursky, Udskaya, and Shelikhov populations are all found in the northern part of the Okhotsk Sea, whereas the Anadyr population and the Bristol Bay and Eastern Bering Sea stocks are all found within the northern parts of the Bering Sea (Hobbs *et al.,* 2019). While both of these seas border the Study Area, both seas occur outside the Study Area, and there have been no documented sightings of belugas within the Study Area.

The distribution of shallow-water porpoise species, such as the Indo-Pacific finless porpoise (*Neophocaena phocaenoides*) and narrow-ridged finless porpoise (*N. asiaeorientalis*) are in shallow nearshore waters, where SURTASS LFA sonar is highly unlikely to be detectable.

Freshwater dolphin species, such as the Ganges River dolphin (*Platanista gangetica gangetica*), the Indus River dolphin (*P. gangetica minor*), and the baiji/Chinese river dolphin (*Lipotes vexillifer*), are restricted to riverine waters of the Ganges, Indus, and Yangtze Rivers, respectively. These river dolphins occur only in the main channels of these rivers, well inshore of where SURTASS LFA sonar would be detectable.

Inshore and coastal delphinid species, such as the Irrawaddy dolphin (*Orcaella brevirostris*), Australian snubfin dolphin (*O. heinsohni*), Indian Ocean humpback dolphin (*Sousa plumbea*), Indo-Pacific humpbacked dolphin (*S. chinensis*), Australian humpback dolphin (*S. sahulensis*), and Taiwanese humpbacked dolphin (*S. chinensis taiwanensis*), all occur in shallow, coastal waters near shore, where SURTASS LFA sonar is unlikely to be detectable.

Two species of marine mammal, sea otters (*Enhydra lutris*) and dugongs (*Dugong dugon*), occur in the Study Area but are managed by the U.S. Fish and Wildlife Service (U.S. FWS) and thus are not considered further in this analysis.

NMFS standardly considers additional information about the marine mammals in the area of the specified activities that informs our analysis, such as identifying known areas of important habitat or behaviors, or where unusual mortality events have been designated. For SURTASS LFA sonar training and testing activities, the Navy coordinated with NMFS to develop a comprehensive method for consideration of these types of important areas globally and specifically within the Study Area (for the purposes of identifying OBIAs, discussed further in the Offshore Biologically Important Areas for SURTASS LFA Sonar section). This method and these areas are summarized in the Proposed Mitigation Measures section and described in detail in appendix F of the 2025 SURTASS Draft SEIS/OEIS. Further, we note here that the OBIA identification criteria include consideration of the hearing sensitivity of the affected species, given the low frequency (100–500 Hz) of the LFA sonar signal, which most odontocetes and pinnipeds hear with significantly reduced sensitivity (9–65 dB lower, or more). Additional details regarding marine mammal hearing sensitivity are included in the *Marine Mammal Hearing Groups* section.

Below, we describe the critical habitat for the two species in the Study Area for which it has been designated under the ESA, as well two National Marine Sanctuaries that include marine mammal resources, although both critical habitat and Sanctuaries are considered through the referenced OBIA process. Further, we briefly describe biologically important areas (BIAs) for cetaceans identified and scored in Kratofil *et al.* (2023), which are not explicitly addressed through the OBIA process, but which NMFS addresses in the context of mitigation in the *Geographic Mitigation* section.

Critical Habitat

Currently, the false killer whale (Main Hawaiian Islands Insular DPS) and Hawaiian monk seal have ESA-designated critical habitat in the Study Area.

False Killer Whale (Main Hawaiian Island Insular DPS)

Critical habitat for the ESA-listed Main Hawaiian Islands insular false killer whale DPS was finalized in July 2018 (83 FR 35062, July 24, 2018) designating waters from the 45 m depth contour to the 3,200 m depth contour around the main Hawaiian Islands from Niihau east to Hawaii. This designation does not include most bays, harbors, or coastal in-water structures. NMFS excluded 14 areas. The total area designated was approximately 45,504 square kilometers (km^2) (13,267 nmi^2) of marine habitat. Critical habitat for the main Hawaiian Islands insular DPS of false killer whale overlaps the Study Area.

Main Hawaiian Islands insular false killer whales are island-associated whales that rely entirely on the productive submerged habitat of the main Hawaiian Islands to support all of their life-history stages. Island-associated marine habitat for Main Hawaiian Islands insular false killer whale is the only essential feature of the critical habitat. The following characteristics of this habitat support insular false killer whales' ability to travel, forage, communicate, and move freely around and among the waters surrounding the main Hawaiian Islands: (1) adequate space for movement and use within shelf and slope habitat; (2) prey species of sufficient quantity, quality, and availability to support individual growth, reproduction, and development, as well as overall population growth; (3) waters free of pollutants of a type and amount harmful to Main Hawaiian Islands insular false killer whales; and (4) sound levels that would not significantly impair false killer whales' use or occupancy.

Hawaiian Monk Seal

Critical habitat for Hawaiian monk seals was designated in 1986 (51 FR 16047, April 30, 1986) and later revised in 1988 (53 FR 18988, May 26, 1988) and in 2015 (80 FR 50925, August 21, 2015). In the Northwestern Hawaiian Islands Hawaiian monk seal critical habitat includes all beach areas, sand spits and islets, including all beach crest vegetation to its deepest extent inland as well as the seafloor and marine habitat 10 m in height above the seafloor from the shoreline out to the 200 m depth contour around Kure Atoll (Hōlanikū), Midway Atoll (Kuaihelani), Pearl and Hermes Reef (Manawai), Lisianski Island (Kapou), Laysan Island (Kamole), Maro Reef (Kamokuokamohoaliʻi), Gardner Pinnacles (ʻŌnūnui), French Frigate Shoals (Lalo), Necker Island (Mokumanamana) and Nihoa Island. In the main Hawaiian Islands, Hawaiian monk seal critical habitat includes the seafloor and marine habitat to 10 m above the seafloor from the 200 m depth contour through the shoreline and extending into terrestrial habitat 5 m inland from the shoreline between identified boundary points around Kaula Island (includes marine habitat only), Niʻihau (includes marine habitat from 10 to 200 m in depth), Kauaʻi, Ōahu, Maui Nui (including Kahoʻolawe, Lānaʻi, Maui, and Molokaʻi), and Hawaii Island. Critical habitat for the Hawaiian monk seal overlaps the Study Area.

The essential features of Hawaiian monk seal critical habitat are: (1) terrestrial areas and adjacent shallow, sheltered aquatic areas with characteristics preferred by monk seals for pupping and nursing; (2) marine areas from 0 to 200 m in depth that support adequate prey quality and quantity for juvenile and adult monk seal foraging; and (3) significant areas used by monk seals for hauling out, resting or molting.

Biologically Important Areas

Ferguson *et al.* (2015) identified BIAs within U.S. waters, which represent areas and times in which cetaceans are known to concentrate for reproduction, feeding, and migration, or areas where small and resident populations are known to occur. Harrison *et al.* (2023) identified a new scoring system, described below, and the BIAs in Hawaiian waters were updated (Kratofil *et al.,* 2023). Unlike ESA critical habitat, these areas are not formally designated pursuant to any statute or law but are a compilation of the best available science intended to inform impact and mitigation analyses. An interactive map of the BIAs is available at: *https://oceannoise.noaa.gov/biologically-important-areas.* A summary of all of the BIAs in the Study Area is included below.

Kratofil *et al.* (2023) delineates and scores BIAs for cetaceans in the Hawaii region following standardized protocols. Experts identified an overall Importance Score for each BIA that considers: (1) ''Intensity,'' meaning the intensity and characteristics underlying an area's identification as a BIA; and (2) ''Data Support,'' meaning the quantity, quality, and type of information, and associated uncertainties, upon which the BIA delineation and scoring depend. Importance Scores range from 1 to 3, with a higher score representing an area of higher intensity and data support. Each BIA is also scored for boundary uncertainty and spatiotemporal variability (dynamic, ephemeral, or static). Additionally, hierarchical BIAs are identified for some species and stocks where a higher intensity score is appropriate for a smaller core area(s) (child BIA) within a larger BIA unit (parent BIA).

The Study Area overlaps BIAs in Hawaii for small and resident populations of the following species: spinner dolphin, short-finned pilot whale, rough-toothed dolphin, pygmy killer whale, pantropical spotted dolphin, melon-headed whale, false killer whale, dwarf sperm whale, goose-beaked whale, common bottlenose dolphin, and Blainville's beaked whale, and the updated BIAs for humpback whale reproduction (Kratofil *et al.,* 2023). Table 2 describes each BIA that overlaps the Study Area and the scores for the above criteria. We note that the BIAs for small and resident populations of spinner dolphin, melon-headed whale, and dwarf sperm whale are all fully contained within OBIAs. The BIAs for small and resident populations of short-finned pilot whale, rough-toothed dolphin, pygmy killer whale, goose-beaked whale, and common bottlenose dolphin, and the reproductive BIA for humpback whale, are mostly contained within the OBIAs. The BIAs for small and resident populations of pantropical spotted dolphin, false killer whale, and Blainville's beaked whale are partially contained within the OBIAs described in the *Geographic Mitigation* section and proposed for implementation in this rule.

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Table 2 -- BIAs Overlapping the Pacific SURTASS LFA Sonar Study Area

Species	BIA Type	Parent/Child/Non-hierarchical	BIA Name	Effective Months	BIA Area (km2)	Importance Score	Intensity Score	Data Support Score	Boundary Certainty	Spatiotemporal Variability	Transboundary Across
Hawaii Study Area (Kratofil *et al.*, 2023)											
Humpback whale	Reproductive	Parent	Main Hawaiian Islands - Parent	December through May	23,041	2	2	2	2	Static	None
Humpback whale	Reproductive	Child	Main Hawaiian Islands - Child	December through May	6,676	3	3	3	3	Static	None
False killer whale	Small and Resident Population	Parent	Main Hawaiian Islands Insular Stock - Parent	Year-round	94,217	1	1	3	3	Static	None
False killer whale	Small and Resident Population	Child	Main Hawaiian Islands Insular Stock - Child	Year-round	7,775	3	3	3	3	Static	None
False killer whale	Small and Resident Population	Non-hierarchical	Northwestern Hawaiian Islands Insular Stock	Year-round	138,001	1	1	2	2	Static	None
Dwarf sperm whale	Small and Resident Population	Parent	Hawaii Island - Parent	Year-round	1,341	3	3	2	2	Static	None
Dwarf sperm whale	Small and Resident Population	Child	Hawaii Island - Child	Year-round	457	3	3	2	2	Static	None
Pygmy killer whale	Small and Resident Population	Non-hierarchical	O'ahu-Maui Nui	Year-round	7,416	3	3	2	2	Static	None
Pygmy killer whale	Small and Resident Population	Non-hierarchical	Hawaii Island	Year-round	5,201	2	2	2	2	Static	None
Short-finned pilot whale	Small and Resident Population	Parent	Main Hawaiian Islands - Parent	Year-round	51,280	1	1	3	3	Static	None
Short-finned	Small and Resident Population	Child	Main Hawaiian Islands - Child (Western	Year-round	4,040	3	3	3	3	Static	None

Species	BIA Type	Parent/Child/Non-hierarchical	BIA Name	Effective Months	BIA Area (km2)	Importance Score	Intensity Score	Data Support Score	Boundary Certainty	Spatiotemporal Variability	Transboundary Across
pilot whale			Community Core Range)								
Short-finned pilot whale	Small and Resident Population	Child	Main Hawaiian Islands - Child (Central Community Core Range)	Year-round	2,427	3	3	3	3	Static	None
Short-finned pilot whale	Small and Resident Population	Child	Main Hawaiian Islands - Child (Eastern Community Core Range)	Year-round	2,461	3	3	3	3	Static	None
Common bottlenose dolphin	Small and Resident Population	Parent	Kaua‘i/Ni‘ihau-O‘ahu-Maui Nui	Year-round	36,634	1	1	3	2	Static	None
Common bottlenose dolphin	Small and Resident Population	Child	Kaua‘i/Ni‘ihau-O‘ahu-Maui Nui-Kaua‘i/Ni‘ihau)	Year-round	2,772	3	3	3	3	Static	None
Common bottlenose dolphin	Small and Resident Population	Child	Kaua‘i/Ni‘ihau-O‘ahu-Maui Nui - O‘ahu	Year-round	8,486	3	3	2	2	Static	None
Common bottlenose dolphin	Small and Resident Population	Child	Kaua‘i/Ni‘ihau-O‘ahu-Maui Nui - Maui Nui	Year-round	10,622	2	2	2	2	Static	None
Common bottlenose dolphin	Small and Resident Population	Non-hierarchical	Hawaii Island	Year-round	8,299	2	2	3	3	Static	None
Pantropical spotted dolphin	Small and Resident Population	Parent	O‘ahu-Maui Nui-Hawaii Island - Parent	Year-round	57,711	1	1	2	2	Static	None
Pantropical spotted dolphin	Small and Resident Population	Child	O‘ahu-Maui Nui-Hawaii Island - Child (O‘ahu)	Year-round	12,952	1	1	2	2	Static	None
Pantropical spotted dolphin	Small and Resident Population	Child	O‘ahu-Maui Nui-Hawaii Island - Child (Maui Nui)	Year-round	6,743	1	1	2	2	Static	None

Species	BIA Type	Parent/Child/Non-hierarchical	BIA Name	Effective Months	BIA Area (km2)	Importance Score	Intensity Score	Data Support Score	Boundary Certainty	Spatiotemporal Variability	Transboundary Across
Pantropical spotted dolphin	Small and Resident Population	Child	O'ahu-Maui Nui-Hawaii Island - Hawaii Island-Child (Hawaii Island)	Year-round	10,768	1	1	2	2	Static	None
Rough-toothed dolphin	Small and Resident Population	Non-hierarchical	Maui Nui-Hawaii Island	Year-round	15,112	1	1	2	2	Static	None
Rough-toothed dolphin	Small and Resident Population	Parent	Kaua'i/Ni'ihau-O'ahu - Parent	Year-round	24,233	1	1	2	2	Static	None
Rough-toothed dolphin	Small and Resident Population	Child	Kaua'i/Ni'ihau-O'ahu - Child (Kaua'i/Ni'ihau)	Year-round	1,149	2	2	2	2	Static	None
Melon-headed whale	Small and Resident Population	Non-hierarchical	Kohala Residents - Hawaii Island	Year-round	3,816	2	2	3	3	Static	None
Spinner dolphin	Small and Resident Population	Non-hierarchical	Manawai (Pearl and Hermes Reef)	Year-round	2,094	1	2	1	2	Static	None
Spinner dolphin	Small and Resident Population	Non-hierarchical	Kuaihelani/Hōlanikū (Midway/Kure Atolls)	Year-round	4,841	1	2	1	2	Static	None
Spinner dolphin	Small and Resident Population	Non-hierarchical	Kaua'i and Ni'ihau	Year-round	7,233	1	1	2	3	Static	None
Spinner dolphin	Small and Resident Population	Non-hierarchical	O'ahu and Maui Nui	Year-round	14,651	1	1	2	3	Static	None
Spinner dolphin	Small and Resident Population	Non-hierarchical	Hawaii Island	Year-round	9,477	1	1	3	3	Static	None
Goose-beaked whale	Small and Resident Population	Parent	Hawaii Island	Year-round	37,157	2	2	3	2	Static	None

Species	BIA Type	Parent/Child/Non-hierarchical	BIA Name	Effective Months	BIA Area (km2)	Importance Score	Intensity Score	Data Support Score	Boundary Certainty	Spatiotemporal Variability	Transboundary Across
Goose-beaked whale	Small and Resident Population	Child	Hawaii Island	Year-round	5,400	3	3	3	3	Static	None
Blainville's beaked whale	Small and Resident Population	Parent	O‘ahu-Maui Nui-Hawaii Island - Parent	Year-round	78,714	1	1	3	2	Static	None
Blainville's beaked whale	Small and Resident Population	Child	O‘ahu-Maui Nui-Hawaii Island - Child (Hawaii Island)	Year-round	4,214	3	3	3	3	Static	None

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National Marine Sanctuaries

Under Title III of the Marine Protection, Research, and Sanctuaries Act of 1972 (also known as the National Marine Sanctuaries Act (NMSA)), NOAA has authority to establish as national marine sanctuaries (NMS) areas of the marine environment with special conservation, recreational, ecological, historical, cultural, archaeological, scientific, educational, or aesthetic qualities. Sanctuary regulations prohibit destroying, causing the loss of, or injuring any sanctuary resource managed under the law or regulations for that sanctuary (15 CFR part 922).

NMS are managed on a site-specific basis, and each sanctuary has site-specific regulations. Most, but not all sanctuaries have site-specific regulatory exemptions from the prohibitions for certain military activities. Separately, section 304(d) of the NMSA requires Federal agencies to consult with the Office of National Marine Sanctuaries (ONMS) whenever their Proposed Activities are likely to destroy, cause the loss of, or injure a sanctuary resource. There are two designated NMSs within the Study Area that contain areas or resources important to marine mammals (see chapter 3 of the 2025 SURTASS Draft SEIS/OEIS):

- Hawaiian Islands Humpback Whale NMS; and
- Papahānaumokuākea NMS.

Hawaiian Islands Humpback Whale NMS is a single-species managed sanctuary, composed of 3,540 km² of the submerged lands and waters off the coast of Maui, Lānaʻi, and Molokaʻi; and smaller areas off the north shore of Kauaʻi, off Hawaii's west coast, and off the north and southeast coasts of Oahu. Hawaiian Islands Humpback Whale NMS is entirely within the Study Area and constitutes one of the world's most important Hawaii humpback whale DPS habitats (81 FR 62259, September 8, 2016) and is a primary region for humpback reproduction in the U.S. (National Marine Sanctuaries Program, 2002). Scientists estimate that more than 50 percent of the entire North Pacific humpback whale population migrates to Hawaiian waters each winter to mate, calve, and nurse their young. The North Pacific humpback whale population has been split into two DPSs. The Hawaii humpback whale DPS migrates to Hawaiian waters each winter and is not listed under the ESA. In addition to protection under the MMPA, the Hawaii humpback whale DPS is protected in sanctuary waters by the Hawaiian Islands Humpback Whale NMS. The sanctuary was created to protect humpback whales and shallow, protected waters important for calving and nursing (Office of National Marine Sanctuaries, 2010).

Papahānaumokuākea NMS, the largest NMS, consists of approximately 1,508,849 km² of Pacific Ocean waters surrounding the Northwestern Hawaiian Islands and the submerged lands thereunder. The sanctuary comprises several interconnected ecosystems, such as coral islands surrounded by shallow reefs, low-light mesophotic reefs with extensive algal beds, open ocean waters connected to the greater North Pacific Ocean, deep-water habitats such as abyssal plains 4,999 m below sea level, and deep reef habitat characterized by seamounts, banks, and shoals. The 2,172 km stretch of coral islands, seamounts, banks, and shoals supports a diversity of coral, fish, birds, and marine mammals, many of which are unique to the Hawaiian Island chain. Many of the islands and shallow water environments are important habitats for rare species such as the endangered Hawaiian monk seal, while the waters are also important for humpback whale breeding and calving.

Unusual Mortality Events

An unusual mortality event (UME) is defined under section 410(9) of the MMPA as a stranding that is unexpected; involves a significant die-off of any marine mammal population; and demands immediate response (16 U.S.C. 1421h(9)). There are no active UMEs in the Study Area.

Marine Mammal Hearing Groups

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. Not all marine mammal species have equal hearing capabilities (*e.g.,* Richardson *et al.,* 1995, Wartzok and Ketten, 1999, Au and Hastings, 2008; Erbe *et al.,* 2025). To reflect this, Southall *et al.* (2007) and Southall *et al.* (2019c) recommended that marine mammals be divided into hearing groups based on directly measured (behavioral or auditory evoked potential techniques) or estimated hearing ranges (*e.g.,* behavioral response data, anatomical modeling). NMFS (2024) generalized hearing ranges were chosen based on the approximately 65-dB threshold from the composite audiograms, previous analysis in NMFS (2018), and/or data from Southall *et al.* (2007) and Southall *et al.* (2019c). We note that the names of two hearing groups and the generalized hearing ranges of all marine mammal hearing groups have been recently updated (NMFS, 2024) as reflected below in table 3.

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Table 3 -- Marine Mammal Hearing Groups (NMFS, 2024)

Hearing Group	Generalized Hearing Range*
Low-frequency (LF) cetaceans (baleen whales)	7 Hz to 36** kHz
High-frequency (HF) cetaceans (dolphins, toothed whales, beaked whales, bottlenose whales)	150 Hz to 160 kHz
Very High-frequency (VHF) cetaceans (true porpoises, *Kogia,* river dolphins, Cephalorhynchid, *Lagenorhynchus cruciger* and *L. australis*)	200 Hz to 165 kHz
Phocid pinnipeds (PW) (underwater) (true seals)	40 Hz to 90 kHz
Otariid pinnipeds (OW) (underwater) (sea lions and fur seals)	60 Hz to 68 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 the ~65-dB threshold from composite audiogram, previous analysis in NMFS (2018), and/or data from Southall *et al.* (2007) and Southall *et al.* (2019). Additionally, animals are able to detect very loud sounds above and below that "generalized" hearing range.

** The Navy split the LF functional hearing group into LF and VLF based on Houser *et al.*, (2024) while NMFS Updated Technical Guidance (NMFS, 2024) does not include these data. NMFS is aware of these data and data collected during a final field season by Houser *et al.* (in prep) have implications for the generalized hearing range for low-frequency cetaceans and their weighting function; however, as described in the 2024 Updated Technical Guidance, it is premature for us to propose any changes to our current Updated Technical Guidance. Mysticete hearing data is identified as a special circumstance that could merit reevaluating the acoustic criteria for low-frequency cetaceans in the 2024 Updated Technical Guidance once the data from the final field season is published. Therefore, we anticipate that once the data are published, it will likely necessitate updating this document (*i.e.*, likely after the data gathered in the summer 2024 field season and associated analysis are published).

Of particular relevance to the assessment of the impacts of the Navy's SURTASS LFA sonar training and testing are the auditory weighting functions shown in figure 2 and figure 3 (NMFS, 2024), which illustrate the significantly reduced sensitivity of most marine mammal taxa to frequencies in the 100–500 Hz range (*i.e.,* 0.1–0.5 kHz as indicated on the x-axis of these figures in NMFS (2024)), such as SURTASS LFA sonar. Specifically, the HF cetacean weighting function curve shows approximately 17–40 dB reduced sensitivity in that frequency range (*i.e.,* the sound would be perceived as that much lower level than a sound in the most noise susceptible portion of their hearing range) (figure 2), the underwater pinniped weighting function curves (PW, OW) show 9–30 dB reductions (figure 3), and the VHF cetacean weighting function curve shows a 47–65 dB reduction at frequencies from 200 to 500 Hz (*i.e.,* generalized hearing range for this hearing group starts at 200 Hz) and suggest even further reduced sensitivity (figure 2). Even the LF cetacean species have somewhat reduced sensitivity in the 100 to 500 Hz range (0.5–6 dB) (figure 2).

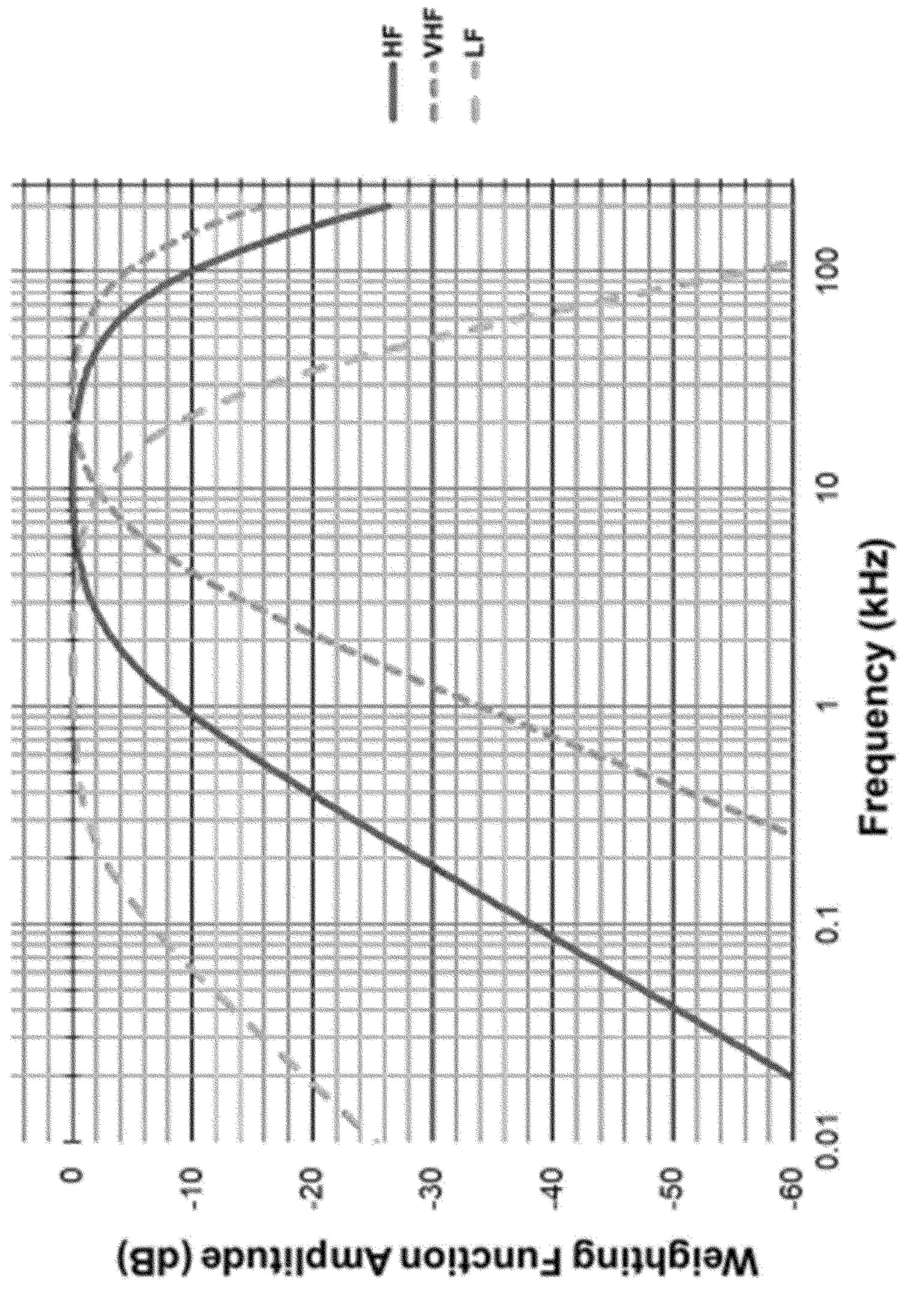

Figure 2 -- Auditory Weighting Functions for Low-Frequency (LF; dashed line), High-Frequency (HF; solid line), and Very High-Frequency (VHF; dotted line) Cetaceans

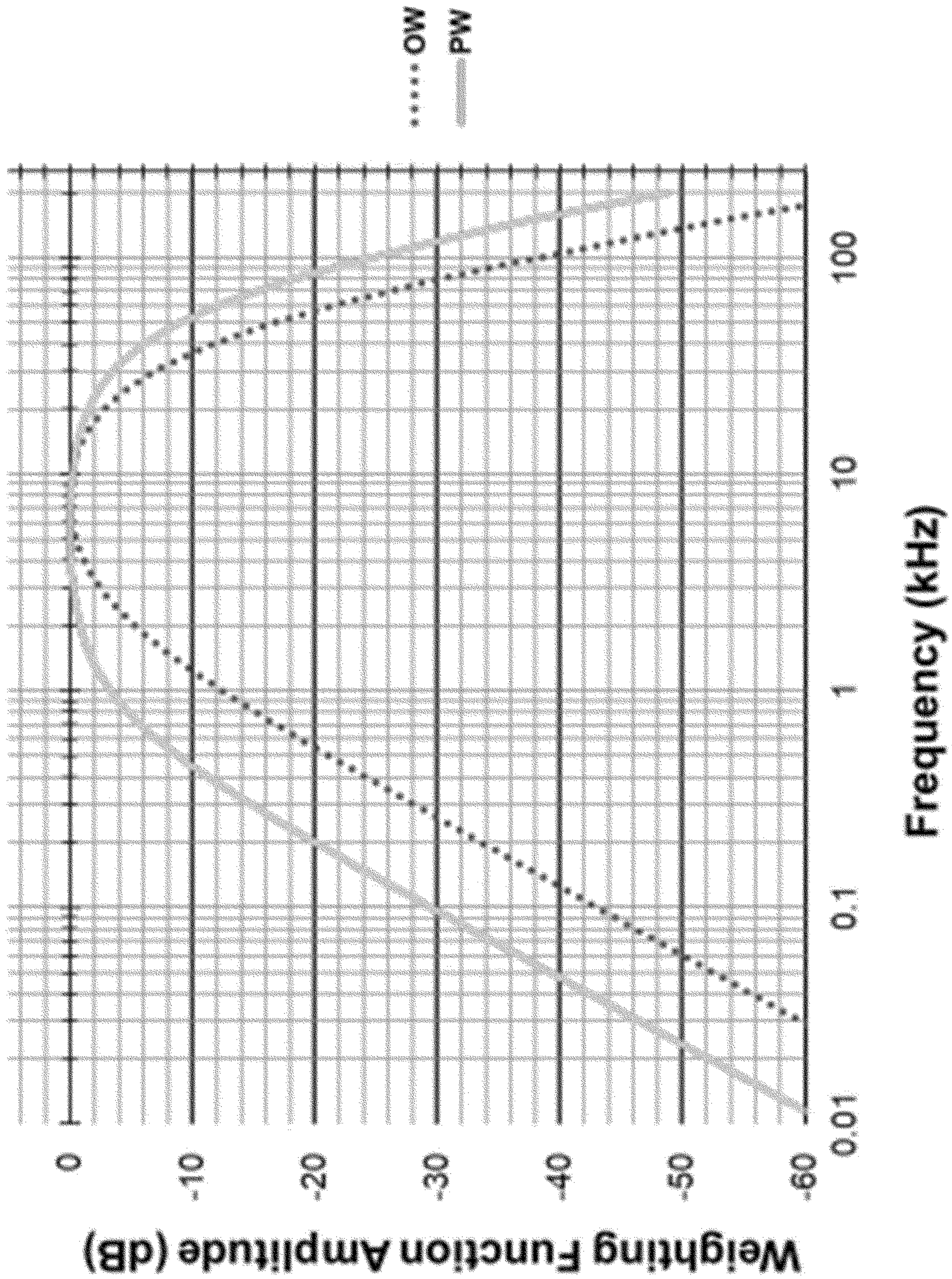

Figure 3 -- Underwater Auditory Weighting Functions for Otariid (OW; dotted line) and Phocid (PW; solid line) Pinnipeds

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For more detail concerning these hearing groups and associated frequency ranges and weighting functions, please see NMFS (2024) for a review of available information.

Of note, the Navy adjusted the LF cetacean hearing group using data from recent hearing measurements in minke whales (Houser *et al.,* 2024). These data support separating mysticetes (the LF cetaceans marine mammal hearing group in table 3) into two hearing groups, which the Navy designates as ‘‘very low-frequency (VLF) cetaceans’’ and ‘‘low-frequency (LF) cetaceans,’’ which follows the recommendations of Southall *et al.,* (2019c). Within the Navy's adjusted hearing groups, the VLF cetacean group contains the larger mysticetes (*i.e.,* blue, pygmy blue, fin, right, and bowhead whales) and the LF cetacean group contains the mysticete species not included in the VLF group (*e.g.,* minke, humpback, gray, pygmy right whales). Although there have been no direct measurements of hearing sensitivity in the larger mysticetes included in Navy's VLF hearing group, an audible frequency range of approximately 10 Hz to 30 kHz has been estimated from measured vocalization frequencies, observed responses to playback of sounds, and anatomical analyses of the auditory system. The upper frequency limit of hearing in Navy's LF hearing group has been estimated as 64 kHz, based on direct measurements of auditory evoked potentials in minke whales (Houser *et al.,* 2024).

Potential Effects of Specified Activities on Marine Mammals and Their Habitat

This section provides a discussion of the ways in which components of the specified activity may impact marine mammals and their habitat. The Estimated Take of Marine Mammals section later in this document includes a quantitative analysis of the number of individuals that are expected to be taken by this activity. The Preliminary Analysis and Negligible Impact Determination section considers the content of this section, the Estimated Take of Marine Mammals section, and the Proposed Mitigation Measures section to draw conclusions regarding the likely impacts of these activities on the reproductive success or survivorship of individuals and whether those impacts on individuals are likely to adversely affect the species or stock through effects on annual rates of recruitment or survival.

The Navy has requested authorization for the take of marine mammals that may occur incidental to training and testing activities in the Study Area. The Navy analyzed potential impacts to marine mammals from acoustic sources in the application. NMFS carefully reviewed the information provided by the Navy and concurs with their synthesis of science, along with independently reviewing applicable scientific research and literature and other information to evaluate the potential effects of the Navy's activities on marine mammals, which are presented in this section (see appendix D in the 2025 SURTASS Draft SEIS/OEIS for additional information).

Potential impacts to marine mammals from training and testing activities in the Study Area were analyzed in the 2025 SURTASS Draft SEIS/OEIS, in consultation with NMFS as a cooperating agency, and stressors other than acoustic sources were determined to be unlikely to result in marine mammal take. Therefore, the Navy has not requested authorization for take of marine mammals incidental to other components of their proposed Specified Activities, and we agree that incidental take is unlikely to occur from those components. In this proposed rule, NMFS analyzes the potential effects on marine mammals from the activity components that may result in take of marine mammals: exposure to acoustic stressors (*i.e.,* sonar).

For the purpose of MMPA ITAs, NMFS' effects assessments serve four primary purposes: (1) to determine whether the specified activities would have a negligible impact on the affected species or stocks of marine mammals (based on whether it is likely that the activities would adversely affect the species or stocks through effects on annual rates of recruitment or survival); (2) to determine whether the specified activities would have an unmitigable adverse impact on the availability of the species or stocks for subsistence uses; (3) to prescribe the permissible methods of taking (*i.e.,* Level B harassment (behavioral harassment and temporary threshold shift (TTS)), Level A harassment (auditory injury (AUD INJ), non-auditory injury), serious injury, or mortality), including identification of the number and types of take that could occur by harassment, serious injury, or mortality, and to prescribe other means of effecting the least practicable adverse impact on the species or stocks and their habitat (*i.e.,* mitigation measures); and (4) to prescribe requirements pertaining to monitoring and reporting.

In this section, NMFS provides a description of the ways marine mammals may generally be affected by acoustic stressors in the form of mortality, physical injury, sensory impairment (permanent and temporary threshold shifts and acoustic masking), physiological responses (particular stress responses), behavioral disturbance, or habitat effects. The Estimated Take of Marine Mammals section discusses how the potential effects on marine mammals from non-impulsive sources relate to the MMPA definitions of Level A Harassment and Level B Harassment and quantifies those effects that do not qualify as a take under the MMPA. The Preliminary Analysis and Negligible Impact Determination section assesses whether the proposed authorized take would have a negligible impact on the affected species and stocks.

Potential Effects of Underwater Sound on Marine Mammals

The marine soundscape is composed of both ambient and anthropogenic sounds. Ambient sound is defined as the all-encompassing sound in a given place and is usually a composite of sound from many sources both near and far (American National Standards Institute, 1995). The sound level of an area is defined by the total acoustical energy being generated by known and unknown sources, which may include physical (*e.g.,* waves, wind, precipitation, earthquakes, ice, atmospheric sound), biological (*e.g.,* sounds produced by marine mammals, fish, and invertebrates), and anthropogenic sound (*e.g.,* vessels, dredging, aircraft, construction).

The sum of the various natural and anthropogenic sound sources at any given location and time—which comprise ''ambient'' or ''background'' sound—depends not only on the source levels (as determined by current weather conditions and levels of biological and shipping activity) but also on the ability of sound to propagate through the environment. In turn, sound propagation is dependent on the spatially and temporally varying properties of the water column and sea floor and is frequency-dependent. As a result of the dependence on a large number of varying factors, ambient sound levels can be expected to vary widely over both coarse and fine spatial and temporal scales. Sound levels at a given frequency and location can vary by 10–20 dB from day to day (Richardson *et al.,* 1995). The result is that, depending on the source type and its intensity, sound from the specified activities may be a negligible addition to the local environment or could form a distinctive signal that may affect marine mammals.

Anthropogenic sounds cover a broad range of frequencies and sound levels and can have a range of highly variable impacts on marine life, from none or minor to potentially severe responses, depending on received levels, duration of exposure, behavioral context, and various other factors. The potential effects of underwater sound from active acoustic sources can possibly result in one or more of the following: temporary or permanent hearing impairment, other auditory injury, non-auditory physical or physiological effects, behavioral disturbance, stress, and masking (Richardson *et al.,* 1995; Gordon *et al.,* 2003; Nowacek *et al.,* 2007; Southall *et* *al.,* 2007; Götz *et al.,* 2009, Southall *et al.,* 2019a; Erbe *et al.,* 2025). The degree of effect is intrinsically related to the signal characteristics, received level, distance from the source, and duration of the sound exposure. In general, sudden, high-level sounds can cause auditory injury, as can longer exposures to lower level sounds. Temporary or permanent loss of hearing can occur after exposure to noise and occur almost exclusively for noise within an animal's hearing range.

Richardson *et al.* (1995) described zones of increasing intensity of effect that might be expected to occur, in relation to distance from a source and assuming that the signal is within an animal's hearing range. First is the area within which the acoustic signal would be audible (potentially perceived) to the animal, but not strong enough to elicit any overt behavioral or physiological response. The next zone corresponds with the area where the signal is audible to the animal and of sufficient intensity to elicit behavioral or physiological responsiveness. Third is a zone within which, for signals of high intensity, the received level is sufficient to potentially cause discomfort or tissue damage to auditory systems. Overlaying these zones to a certain extent is the area within which masking (*i.e.,* when a sound interferes with or masks the ability of an animal to detect a signal of interest that is above the absolute hearing threshold) may occur. The masking zone may be highly variable in size.

We also describe more severe potential effects (*i.e.,* certain non-auditory physical or physiological effects). Potential effects from high-level sound sources can range in severity from effects such as behavioral disturbance or tactile perception to physical discomfort, physiological damage, and injury of the auditory system (Yelverton *et al.,* 1973). Non-auditory physiological effects or injuries that theoretically might occur in marine mammals exposed to high levels of underwater sound or as a secondary effect of extreme behavioral responses (*e.g.,* change in dive profile as a result of an avoidance response) caused by exposure to sound include neurological effects, bubble formation, resonance effects, and other types of organ or tissue damage (Cox *et al.,* 2006; Southall *et al.,* 2007; Zimmer and Tyack, 2007; Tal *et al.,* 2015).

Hearing

Marine mammals have adapted hearing based on their biology and habitat. Amphibious marine mammals (*e.g.,* pinnipeds that spend time on land and underwater) have modified ears that allow them to hear both in-air and in-water, while fully aquatic marine mammals (*e.g.,* cetaceans that are always underwater) have specialized ear adaptations for in-water hearing (Wartzok and Ketten, 1999). These adaptations explain the variation in hearing ability and sensitivity among marine mammals and have led to the characterization of marine mammal functional hearing groups based on those sensitivities (see *Marine Mammal Hearing Groups* section).

The hearing sensitivity of marine mammals is also directional, meaning the angle between an animal's position and the location of a sound source impacts the animal's hearing threshold, thereby impacting an animal's ability to perceive the sound emanating from that source. This directionality is likely useful for determining the general location of a sound, whether for detection of prey, predators, or members of the same species, and can be dependent upon the frequency of the sound (Accomando *et al.,* 2020; Au and Moore, 1984; Byl *et al.,* 2016; Byl *et al.* 2019; Kastelein *et al.,* 2005; Kastelein *et al.,* 2019; Popov and Supin, 2009).

Acoustic Signaling

An acoustic signal refers to the sound waves used to communicate underwater, and marine mammals use a variety of acoustic signals for socially important functions, such as communicating, as well as biologically important functions, such as echolocating (Richardson *et al.,* 1995; Wartzok and Ketten, 1999; Erbe *et al.,* 2025). Acoustic signals used for communication are lower frequency (*i.e.,* 20 Hz to 30 kHz) than those signals used for echolocation, which are high-frequency (approximately 10–200 kHz peak frequency) signals used by odontocetes to sense their underwater environment. Lower frequency vocalizations used for communication may have a specific, prominent fundamental frequency (Brady *et al.,* 2021) or have a wide frequency range, depending on the functional hearing group and whether the marine mammal is vocalizing in-water or in-air. Acoustic signals used for echolocation are high-frequency, high-energy sounds with patterns and peak frequencies that are often species-specific (Baumann-Pickering *et al.,* 2013).

Marine mammal species typically produce sounds at frequencies within their own hearing range, though auditory and vocal ranges do not perfectly align (*e.g.,* odontocetes may hear only a portion of the frequencies of an echolocation click). Because determining a species vocal range is easier than determining a species' hearing range, vocal ranges are often used to infer a species' hearing range when species-specific hearing data are not available (*e.g.,* large whale species). Table 3, figure 2, and figure 3 in the *Marine Mammal Hearing Groups* section summarize the available data on marine mammal hearing groups, which is relevant given the significantly reduced sensitivity of most marine mammal taxa (9–65 dB and above for all but LF species) to the SURTASS LFA sonar source.

Hearing Loss and Auditory Injury

Marine mammals, like all mammals, lose their ability to hear over time due to age-related degeneration of auditory pathways and sensory cells of the inner ear. This natural, age-related hearing loss is distinct from acute noise-induced hearing loss (Møller, 2013). Noise-induced hearing loss can be temporary (*i.e.,* TTS) or result in a permanent (permanent threshold shift (PTS)), with higher-level sound exposures more likely to cause PTS or other AUD INJ. For marine mammals, AUD INJ is considered to be possible when sound exposures are sufficient to produce 40 dB of TTS measured approximately 4 minutes after exposure (NMFS, 2024; U.S. Department of the Navy, 2025). Numerous studies have directly examined noise-induced hearing loss in marine mammals by measuring an animal's hearing threshold before and after exposure to intense or long duration sounds. The difference between the post-exposure and pre-exposure hearing thresholds is then used to determine the amount of TTS (in dB) that was produced as a result of the sound exposure (see appendix D of the 2025 SURTASS Draft SEIS/OEIS for additional details). The Navy used these studies to generate exposure functions, which are predictions of the onset of TTS or PTS or other AUD INJ based on sound frequency, level, and type (non-impulsive or impulsive), for each marine mammal hearing group (NMFS, 2024; U.S. Department of the Navy, 2025).

TTS can last from minutes or hours to days (*i.e.,* however, there is complete recovery back to baseline/pre-exposure hearing threshold), can occur within a specific frequency range (*i.e.,* an animal might have a temporary loss of hearing sensitivity within only a limited frequency band of its auditory range), and can be of varying amounts (*e.g.,* an animal's hearing sensitivity might be reduced by only 6 dB or reduced by 30 dB). While there is no simple functional relationship between TTS and PTS or other AUD INJ (*e.g.,* neural degeneration), as TTS increases, the likelihood that additional exposure to increased SPL or duration will result in PTS or other injury also increases (see appendix D of the 2025 SURTASS Draft SEIS/OEIS for additional discussion). Exposure thresholds for the occurrence of AUD INJ, which include the potential for PTS, as well as situations when AUD INJ occurs without PTS, can therefore be defined based on a specific amount of TTS; that is, although an exposure has been shown to produce only TTS, we assume that any additional TTS exposure may result in some AUD INJ. The specific upper limit of TTS is based on experimental data showing amounts of TTS that have not resulted in AUD INJ. In other words, we do not need to know the exact functional relationship between TTS and AUD INJ, we need to know only the upper limit for TTS to determine when some AUD INJ is possible. In most cases of AUD INJ, the animal has an impaired ability to hear sounds in specific frequency ranges (Kryter, 1985; Finneran, 2015).

The following physiological mechanisms are thought to play a role in inducing auditory threshold shift: (1) effects to sensory hair cells in the inner ear that reduce their sensitivity; (2) modification of the chemical environment within the sensory cells; (3) displacement of certain inner ear membranes; (4) increased blood flow; and (5) post-stimulatory reduction in both efferent and sensory neural output (Southall *et al.,* 2007). The amplitude, duration, frequency, temporal pattern, and energy distribution of sound exposure all can affect the amount of associated threshold shift and the frequency range in which it occurs. Generally, the amount of threshold shift, and the time needed to recover from the effect, increase as amplitude and/or duration of sound exposure increases. Human non-impulsive noise exposure guidelines are based on the assumption that exposures of equal energy (the same cumulative SEL) produce equal amounts of hearing impairment regardless of how the sound energy is distributed in time (NIOSH, 1998). Previous marine mammal TTS studies have also generally supported this equal energy relationship (Southall *et al.,* 2007; Finneran, 2015; Southall *et al.,* 2019). Cumulative SEL is used to predict TTS in marine mammals and is considered a good predictor of TTS for shorter duration exposures than longer duration exposures. The amount of TTS increases with exposure SPL and duration, and is correlated with cumulative SEL, but duration of the exposure has a more significant effect on TTS than would be predicted based on cumulative SEL alone (*e.g.,* Finneran *et al.,* 2010b; Kastak *et al.,* 2007; Kastak *et al.,* 2005; Kastelein *et al.,* 2014a; Mooney *et al.,* 2009a; Popov *et al.,* 2014; Gransier and Kastelein, 2024). These studies highlight the inherent complexity of predicting TTS onset in marine mammals, as well as the importance of considering exposure duration when assessing potential impacts.

Generally, TTS increases with cumulative SEL in a non-linear fashion, where lower SEL exposures will elicit a steady rate of TTS increase while higher SEL exposures will either increase TTS more rapidly or plateau (Finneran, 2015; U.S. Department of the Navy, 2025). Additionally, with sound exposures of equal energy, those that had lower SPL with longer duration were found to induce TTS onset at lower levels than those of higher SPL and shorter duration. Less threshold shift will occur from intermittent sounds than from a continuous exposure with the same energy (some recovery can occur between intermittent exposures) (Kryter *et al.,* 1966; Ward, 1997; Mooney *et al.,* 2009a, 2009b; Finneran *et al.,* 2010; Kastelein *et al.,* 2014; Kastelein *et al.,* 2015). For example, one short, higher SPL sound exposure may induce the same impairment as one longer lower SPL sound, which in turn may cause more impairment than a series of several intermittent softer sounds with the same total energy (Ward, 1997). Additionally, though TTS is temporary, very prolonged or repeated exposure to sound loud enough to elicit TTS, or shorter-term exposure to sound levels well above the TTS threshold, can cause AUD INJ, at least in terrestrial mammals (Kryter, 1985; Lonsbury-Martin *et al.,* 1987).

Although TTS increases non-linearly in marine mammals, recovery from TTS typically occurs in a linear fashion with the logarithm of time (Finneran, 2015; Finneran *et al.,* 2010a; Finneran *et al.,* 2010b; Finneran and Schlundt, 2013; Kastelein *et al.,* 2012a; Kastelein *et al.,* 2012b; Kastelein *et al.,* 2013a; Kastelein *et al.,* 2014a; Kastelein *et al.,* 2014b; Kastelein *et al.,* 2014c; Popov *et al.,* 2014; Popov *et al.,* 2013; Popov *et al.,* 2011; Muslow *et al.,* 2023; Finneran *et al.,* 2023). Considerable variation has been measured in individuals of the same species in both the amount of TTS incurred from similar cumulative SELs (Kastelein *et al.,* 2012a; Popov *et al.,* 2013) and the time-to-recovery from TTS (Finneran, 2015; Kastelein *et al.,* 2019e). Many of these studies relied on continuous sound exposures, but intermittent, impulsive sound exposures have also been tested. Few studies (Finneran *et al.,* 2002; Lucke *et al.,* 2009; Sills *et al.,* 2020; Muslow *et al.,* 2023) using impulsive sounds have produced enough TTS to make predictions about hearing loss due to this source type (see U.S. Department of the Navy, 2025). In general, predictions of TTS based on cumulative SEL for this type of sound exposure are likely to overestimate TTS because some recovery from TTS may occur in the quiet periods between impulsive or intermittent sounds, especially when the duty cycle is low. Peak SPL (unweighted) is also used to predict TTS due to impulsive sounds (Southall *et al.,* 2007; Southall *et al.,* 2019c; U.S. Department of the Navy, 2025).

In some cases, associated with terrestrial mammal noise studies, intense noise exposures have caused AUD INJ (*e.g.,* loss of cochlear neuron synapses), despite thresholds eventually returning to normal (*i.e.,* it is possible to have AUD INJ without a resulting PTS (*e.g.,* Kujawa and Liberman, 2006, 2009; Fernandez *et al.,* 2015; Ryan *et al.,* 2016; Houser, 2021). In these situations, however, threshold shifts were 30–50 dB measured 24 hours after the exposure (*i.e.,* there is no evidence that an exposure resulting in less than 40 dB TTS measured a few minutes after exposure can produce AUD INJ). Therefore, an exposure producing 40 dB of TTS, measured a few minutes after exposure, can also be used as an upper limit to prevent AUD INJ (*i.e.,* it is assumed that exposures beyond those capable of causing 40 dB of TTS have the potential to result in INJ (which may or may not result in PTS)).

Irreparable damage to the inner or outer cochlear hair cells may cause PTS; however, other mechanisms are also involved, such as exceeding the elastic limits of certain tissues and membranes in the inner ears and resultant changes in the chemical composition of the inner ear fluids (Southall *et al.,* 2007). When AUD INJ occurs, there is physical damage (*i.e.,* typically mechanical) to the sound receptors in the ear, whereas TTS represents primarily tissue fatigue (*i.e.,* typically metabolic) and is fully reversible (Southall *et al.,* 2007). AUD INJ is permanent (*i.e.,* there is incomplete recovery back to baseline/pre-exposure levels) but also can occur in a specific frequency range and amount as mentioned above for TTS. In addition, other investigators have suggested that TTS is within the normal bounds of physiological variability and tolerance and does not represent physical injury (*e.g.,* Ward, 1997). Therefore, NMFS does not consider less than 40 dB of TTS to constitute AUD

INJ. The NMFS Acoustic Updated Technical Guidance (NMFS, 2024), which was used in the assessment of effects for this proposed rule, compiled, interpreted, and synthesized the best available scientific information for noise-induced hearing effects for marine mammals to derive updated thresholds for assessing the impacts of noise on marine mammal hearing.

While many studies have examined noise-induced hearing loss in marine mammals (see Finneran (2015) and Southall *et al.* (2019a) for summaries), published data on the onset of TTS for cetaceans are limited to the captive bottlenose dolphin, beluga, harbor porpoise, and Yangtze finless porpoise, and for pinnipeds in water, measurements of TTS are limited to harbor seals, elephant seals (*Mirounga* species), California sea lions (*Zalophus californianus*), and bearded seals. These studies examine hearing thresholds measured in marine mammals before and after exposure to intense sounds, which can then be used to determine the amount of threshold shift at various post-exposure times. NMFS has reviewed the available studies, which are summarized below (see also the 2025 SURTASS Draft SEIS/OEIS which includes additional discussion on TTS studies related to sonar and other transducers).

• The method used to test hearing may affect the resulting amount of measured TTS, with neurophysiological measures producing larger amounts of TTS compared to psychophysical measures (Finneran *et al.,* 2007; Finneran, 2015).

• The amount of TTS varies with the hearing test frequency. As the exposure SPL increases, the frequency at which the maximum TTS occurs also increases (Kastelein *et al.,* 2014b). For high-level exposures, the maximum TTS typically occurs one-half to one octave above the exposure frequency (Finneran *et al.,* 2007; Mooney *et al.,* 2009a; Nachtigall *et al.,* 2004; Popov *et al.,* 2011; Popov *et al.,* 2013; Schlundt *et al.,* 2000). The overall spread of TTS from tonal exposures can therefore extend over a large frequency range (*i.e.,* narrowband exposures can produce broadband (greater than one octave) TTS).

• The amount of TTS increases with exposure SPL and duration and is correlated with cumulative SEL, especially if the range of exposure durations is relatively small (Kastak *et al.,* 2007; Kastelein *et al.,* 2014b; Popov *et al.,* 2014). As the exposure duration increases, however, the relationship between TTS and cumulative SEL begins to break down. Specifically, duration has a more significant effect on TTS than would be predicted on the basis of cumulative SEL alone (Finneran *et al.,* 2010a; Kastak *et al.,* 2005; Mooney *et al.,* 2009a). This means if two exposures have the same cumulative SEL but different durations, the exposure with the longer duration (thus lower SPL) will tend to produce more TTS than the exposure with the higher SPL and shorter duration. In most acoustic impact assessments, the scenarios of interest involve shorter duration exposures than the marine mammal experimental data from which impact thresholds are derived; therefore, use of cumulative SEL tends to over-estimate the amount of TTS. Despite this, cumulative SEL continues to be used in many situations because it is relatively simple, more accurate than SPL alone, and lends itself easily to scenarios involving multiple exposures with different SPL (Finneran, 2015).

• Gradual increases of TTS over multiple exposures may not be directly observable with increasing exposure levels, before the onset of PTS (Reichmuth *et al.,* 2019). Similarly, PTS can occur without measurable behavioral modifications (Reichmuth *et al.,* 2019).

• The amount of TTS depends on the exposure frequency. Sounds at low frequencies, well below the region of highest susceptibility, are less hazardous than those at higher frequencies, near the region of highest susceptibility (Finneran and Schlundt, 2013). The onset of TTS—defined as the exposure level necessary to produce 6 dB of TTS (*i.e.,* clearly above the typical variation in threshold measurements)—also varies with exposure frequency. At the low frequency end of a species' hearing curve (*i.e.,* audiogram), onset-TTS exposure levels are higher compared to those in the region of best sensitivity.

• TTS can accumulate across multiple intermittent exposures, but the resulting TTS will be less than the TTS from a single, continuous exposure with the same cumulative SEL (Finneran *et al.,* 2010a; Kastelein *et al.,* 2014b; Kastelein *et al.,* 2015b; Mooney *et al.,* 2009b). This means that TTS predictions based on the total, cumulative SEL will overestimate the amount of TTS from intermittent exposures such as sonars and impulsive sources.

• The amount of observed TTS tends to decrease with increasing time following the exposure; however, the relationship is not monotonic (*i.e.,* increasing exposure does not always increase TTS). The time required for complete recovery of hearing depends on the magnitude of the initial shift; for relatively small shifts recovery may be complete in a few minutes, while large shifts (*e.g.,* approximately 40 dB or greater) may require several days for recovery. Under many circumstances TTS recovers linearly with the logarithm of time (Finneran *et al.,* 2010a, 2010b; Finneran and Schlundt, 2013; Kastelein *et al.,* 2012a; Kastelein *et al.,* 2012b; Kastelein *et al.,* 2013a; Kastelein *et al.,* 2014b; Kastelein *et al.,* 2014c; Popov *et al.,* 2011; Popov *et al.,* 2013; Popov *et al.,* 2014). This means that for each doubling of recovery time, the amount of TTS will decrease by the same amount (*e.g.,* 6 dB recovery per doubling of time).

Nachtigall *et al.* (2018) and Finneran (2018) describe the measurements of hearing sensitivity of multiple odontocete species (*i.e.,* bottlenose dolphin, harbor porpoise, beluga, and false killer whale) when a relatively loud sound was preceded by a warning sound. These captive animals were shown to reduce hearing sensitivity when warned of an impending intense sound. Based on these experimental observations of captive animals, the authors suggest that wild animals may dampen their hearing during prolonged exposures or if conditioned to anticipate intense sounds. Finneran (2018) recommends further investigation of the mechanisms of hearing sensitivity reduction in order to understand the implications for interpretation of existing TTS data obtained from captive animals, notably for considering TTS due to short duration, unpredictable exposures.

Marine mammal hearing plays a critical role in communication with conspecifics and in interpretation of environmental cues for purposes such as predator avoidance and prey capture. Depending on the degree (elevation of threshold in dB), duration (*i.e.,* recovery time), and frequency range of TTS, and the context in which it is experienced, TTS can have effects on marine mammals, ranging from discountable to serious, similar to those discussed in auditory masking below. For example, a marine mammal may be able to readily compensate for a brief, relatively small amount of TTS in a non-critical frequency range that takes place during a time where ambient noise is lower and there are not as many competing sounds present. Alternatively, a larger amount and longer duration of TTS sustained during a time when communication is critical for successful mother/calf interactions could have more serious impacts if it were in the same frequency band as the necessary vocalizations and of a severity that impeded communication. The fact that animals exposed to high levels of sound that would be expected to result in this physiological response would also be expected to have behavioral responses of a comparatively more severe or sustained nature is potentially more significant than the simple existence of a TTS. However, it is important to note that TTS could occur due to longer exposures to sound at lower levels so that a behavioral response may not be elicited.

Depending on the degree and frequency range, the effects of AUD INJ on an animal could also range in severity, although it is considered generally more serious than TTS because it is a permanent condition (Reichmuth *et al.,* 2019). Of note, reduced hearing sensitivity as a simple function of aging has been observed in marine mammals as well as in humans and other taxa (Southall *et al.,* 2007). We can infer that strategies exist for coping with this condition to some degree, though likely not without some cost to the animal.

As the amount of research on hearing sensitivity has grown, so, too, has the understanding that marine mammals may be able to self-mitigate or protect against noise-induced hearing loss. An animal may learn to reduce or suppress their hearing sensitivity when warned of an impending intense sound exposure, or if the duty cycle of the sound source is predictable, as has been demonstrated in some odontocete species (Finneran, 2018; Finneran *et al.,* 2024; Nachtigall and Supin, 2013, 2014, 2015; Nachtigall *et al.,* 2016a, 2016b, 2016c, 2018). This has been shown with several species, including the false killer whale (Nachtigall and Supin, 2013), bottlenose dolphin (Finneran, 2018; Nachtigall and Supin, 2014, 2015; Nachtigall *et al.,* 2016c), beluga whale (Nachtigall *et al.,* 2016a), and harbor porpoise (Nachtigall *et al.,* 2016b; Kastelein *et al.,* 2020). Additionally, Finneran *et al.* (2023) and Finneran *et al.* (2024) found that odontocetes that had participated in TTS experiments in the past could have learned from that experience and subsequently protected their hearing during new sound exposure experiments.

Behavioral Responses

Behavioral responses to sound are highly variable and context-specific (Nowacek *et al.,* 2007; Southall *et al.,* 2007; Southall *et al.,* 2019). Many different variables can influence an animal's perception of and response to (nature and magnitude) an acoustic event. An animal's prior experience with a sound or sound source affects whether it is less likely (habituation, self-mitigation) or more likely (sensitization) to respond to certain sounds in the future (animals can also be innately predisposed to respond to certain sounds in certain ways) (Southall *et al.,* 2007; Southall *et al.,* 2016; Finneran, 2018; Finneran *et al.,* 2024; Nachtigall and Supin, 2013, 2014, 2015; Nachtigall *et al.,* 2015, 2016a, 2016b, 2018). Related to the sound itself, the perceived proximity of the sound, bearing of the sound (approaching vs. retreating), the similarity of a sound to biologically relevant sounds in the animal's environment (*i.e.,* calls of predators, prey, or conspecifics), familiarity of the sound, and navigational constraints may affect the way an animal responds to the sound (Ellison *et al.,* 2012; Southall *et al.,* 2007; DeRuiter *et al.,* 2013a; Southall *et al.,* 2021; Wartzok *et al.,* 2003). Individuals (of different age, sex, reproductive status, *etc.*) among most populations will have variable hearing capabilities, and differing behavioral sensitivities to sounds that will be affected by prior conditioning, experience, and current activities of those individuals. Southall *et al.,* (2007) and Southall *et al.* (2021) have developed and subsequently refined methods developed to categorize and assess the severity of acute behavioral responses, considering impacts to individuals that may consequently impact populations. Often, specific acoustic features of the sound and contextual variables (*i.e.,* proximity, duration, or recurrence of the sound or the current behavior that the marine mammal is engaged in or its prior experience), as well as entirely separate factors such as the physical presence of a nearby vessel, may be more relevant to the animal's response than the received level alone.

Studies by DeRuiter *et al.,* (2013a) indicate that variability of responses to acoustic stimuli depends not only on the species receiving the sound and the sound source, but also on the social, behavioral, or environmental contexts of exposure. Another study by DeRuiter *et al.,* (2013b) examined behavioral responses of goose-beaked whales to MF sonar and found that whales responded strongly at low received levels (89–127 dB re 1 μPa) by ceasing normal fluking and echolocation, swimming rapidly away, and extending both dive duration and subsequent non-foraging intervals when the sound source was 3.4–9.5 km away. Importantly, this study also showed that whales exposed to a similar range of received levels (78–106 dB re 1 μPa) from distant sonar exercises 118 km away did not elicit such responses, suggesting that context may moderate responses.

Ellison *et al.* (2012) outlined an approach to assessing the effects of sound on marine mammals that incorporates contextual-based factors. The authors recommend considering not just the received level of sound, but also the activity the animal is engaged in at the time the sound is received, the nature and novelty of the sound (*i.e.,* whether this a new sound from the animal's perspective), and the distance between the sound source and the animal. They submit that this ''exposure context,'' as described, greatly influences the type of behavioral response exhibited by the animal. Forney *et al.,* (2017) also point out that an apparent lack of response (*e.g.,* no displacement or avoidance of a sound source) may not necessarily mean there is no cost to the individual or population, as some resources or habitats may be of such high value that animals may choose to stay, even when experiencing stress or hearing loss. Forney *et al.,* (2017) recommend considering both the costs of remaining in an area of noise exposure such as TTS, PTS, or masking, which could lead to an increased risk of predation or other threats or a decreased capability to forage, and the costs of displacement, including potential increased risk of vessel strike, increased risks of predation or competition for resources, or decreased habitat suitable for foraging, resting, or socializing. This sort of contextual information is challenging to predict with accuracy for ongoing activities that occur over large spatial and temporal expanses. However, distance is one contextual factor for which data exist to quantitatively inform a take estimate, and the method for predicting Level B harassment in this proposed rule does consider distance to the source. Other factors are often considered qualitatively in the analysis of the likely consequences of sound exposure, where supporting information is available.

Friedlaender *et al.,* (2016) provided the first integration of direct measures of prey distribution and density variables incorporated into across-individual analyses of behavior responses of blue whales to sonar and demonstrated a five-fold increase in the ability to quantify variability in blue whale diving behavior. These results illustrate that responses evaluated without such measurements for foraging animals may be misleading, which again illustrates the context-dependent nature of the probability of response.

Exposure of marine mammals to sound sources can result in, but is not limited to, no response or any of the following observable responses: (1) increased alertness; (2) orientation or attraction to a sound source; (3) vocal modifications; (4) cessation of feeding; (5) cessation of social interaction; (6) alteration of movement or diving behavior; habitat abandonment (temporary or permanent); and (in severe cases) (7) panic, flight, stampede, or stranding, potentially resulting in death (Southall *et al.,* 2007). A review of marine mammal responses to anthropogenic sound was first conducted by Richardson (1995). More recent reviews (Nowacek *et al.,* 2007; DeRuiter *et al.,* 2013a and 2013b; Ellison *et al.,* 2012; Gomez *et al.,* 2016; Erbe *et al.,* 2025) address studies conducted since 1995 and focused on observations where the received sound level of the exposed marine mammal(s) was known or could be estimated. Gomez *et al.,* (2016) conducted a review of the literature considering the contextual information of exposure in addition to received level and found that higher received levels were not always associated with more severe behavioral responses and vice versa. Southall *et al.,* (2016) states that results demonstrate that some individuals of different species display clear yet varied responses, some of which have negative implications, while others appear to tolerate high levels, and that responses may not be fully predictable with simple acoustic exposure metrics (*e.g.,* received sound level). Rather, the authors state that differences among species and individuals along with contextual aspects of exposure (*e.g.,* behavioral state) appear to affect response probability (Southall *et al.,* 2019). The following parts provide examples of behavioral responses to stressors that provide an idea of the variability in responses that would be expected given the differential sensitivities of marine mammal species to sound and the wide range of potential acoustic sources to which a marine mammal may be exposed. Behavioral responses that could occur for a given sound exposure should be determined from the literature that is available for each species (see appendix B of the 2025 SURTASS Draft SEIS/OEIS for a comprehensive list of behavioral studies and species-specific findings) or extrapolated from closely related species when no information exists, along with contextual factors.

Responses Due to Sonar and Other Transducers

Baleen whales are hypothesized to react more strongly to LF sounds that overlap with their vocalization range. One series of behavioral response studies (BRSs) was undertaken in 1997–1998 pursuant to the Navy's Low-Frequency Sound Scientific Research Program (LFS SRP). The frequency bands of LF sonars used were between 100 and 500 Hz, with received levels between 115 and 150 dB re 1 µPa. Exposures occurred on fin whale and blue whale foraging grounds, on humpback whale breeding grounds, and along gray whale (*Eschrichtius robustus*) migratory routes. These studies found short-term responses to LF sound by some individual fin and humpback whales, including changes in vocal activity and avoidance of the source vessel, while other fin, humpback, and blue whale individuals did not respond at all. When the source was in the path of migrating gray whales, they changed course up to 2 km to avoid the sound, but when the source was outside their path, little response was observed (Clark and Fristrup, 2001; Croll *et al.,* 2001; Fristrup *et al.,* 2003; Miller *et al.,* 2000; Nowacek *et al.,* 2007). These responses were short-lived across all individuals, and animals returned to their normal activities within tens of minutes after initial exposure (Clark and Fristrup, 2001). The context of an exposure scenario is important for determining the probability, magnitude, and duration of a response (Ellison *et al.,* 2012; Southall *et al.,* 2021).

At this time, no other BRSs have used an LFA (less than 1 kHz) sound source, so the applicability of all BRSs discussed herein to determining potential behavioral responses to the specified activities is limited. Specifically, while there are several studies illustrating the responses of LF species to MF sources (which are still in or near the most sensitive part of their predicted hearing range), many of the studies discussed below relate to the responses of HF hearing specialists to MF sources, which are essentially sources with frequencies in or near the most sensitive area of the species hearing, whereas (as noted above), all but LF species have significantly reduced sensitivity (9–65 dB and above) in the range of SURTASS LFA sonar. However, these data can generally inform the analysis of marine mammal response to sonar.

Mysticetes responses to sonar and other duty-cycled tonal sounds are dependent upon the characteristics of the signal, behavioral state of the animal, sensitivity and previous experience of an individual, and other contextual factors including distance of the source, movement of the source, physical presence of vessels, time of year, and geographic location (Goldbogen *et al.,* 2013; Harris *et al.,* 2019a; Harris *et al.,* 2015; Martin *et al.,* 2015; Sivle *et al.,* 2015b). For example, a BRS in Southern California demonstrated that individual behavioral state was critically important in determining response of blue whales to Navy sonar. In this BRS, some blue whales engaged in deep (greater than 50 m) feeding behavior had greater dive responses than those in shallow feeding or non-feeding conditions, while some blue whales that were engaged in shallow feeding behavior demonstrated no clear changes in diving or movement even when received levels were high (approximately 160 dB re 1 µPa) from exposures to 3–4 kHz sonar signals, while others showed a clear response at exposures at lower received level of sonar and pseudorandom noise (Goldbogen *et al.,* 2013). Generally, behavioral responses were brief and of low to moderate severity, and the whales returned to baseline behavior shortly after the end of the acoustic exposure (DeRuiter *et al.,* 2017; Goldbogen *et al.,* 2013; Southall *et al.,* 2019c). To better understand the context of these behavioral responses, Friedlaender *et al.,* (2016) mapped the prey field of the deep-diving blue whales and found that the response to sound was more apparent for individuals engaged in feeding than those that were not. The probability of a moderate behavioral response increased when the source was closer for these foraging blue whales, although there was a high degree of uncertainty in that relationship (Southall *et al.,* 2019b). In the same BRS, none of the tagged fin whales demonstrated more than a brief or minor response regardless of their behavioral state (Harris *et al.,* 2019a). The fin whales were exposed to both mid-frequency simulated sonar and pseudorandom noise of similar frequency, duration, and source level. They were less sensitive to disturbance than blue whales, with no significant differences in response between behavioral states or signal types. The authors rated responses as low-to-moderate severity with no negative impact to foraging success (Southall *et al.,* 2023).

Similarly, while the rates of foraging lunges decrease in humpback whales due to sonar exposure, there was variability in the response across individuals, with one animal ceasing to forage completely and another animal starting to forage during the exposure (Sivle *et al.,* 2016). In addition, almost half of the animals that exhibited avoidance behavior were foraging before the exposure, but the others were not;

the animals that exhibited avoidance behavior while not feeding responded at a slightly lower received level and greater distance than those that were feeding (Wensveen *et al.,* 2017). These findings indicate that the behavioral state of the animal plays a role in the type and severity of a behavioral response. Henderson *et al.* (2019) examined tagged humpback whale dive and movement behavior, including individuals incidentally exposed to Navy sonar during training activities, at the Pacific Missile Range Facility (PMRF) off Kauaʻi, Hawaii. Tracking data showed that, regardless of exposure to sonar, individual humpbacks spent limited time, no more than a few days, in the vicinity of Kauaʻi. Potential behavioral responses due to sonar exposure were limited and may have been influenced by breeding and social behaviors. Martin *et al.,* (2015) found that the density of calling minke whales was reduced during periods of Navy training involving sonar relative to the periods before training began and increased again in the days following the completion of training activities. The responses of individual whales could not be assessed, so in this case it is unknown whether the decrease in calling animals indicated that the animals left the range or simply ceased calling. Harris *et al.,* (2019b) utilized acoustically generated minke whale tracks to statistically demonstrate changes in the spatial distribution of minke whale acoustic presence before, during, and after surface ship MFAS training. The spatial distribution of probability of acoustic presence was different in the ''during'' phase compared to the ''before'' phase, and the probability of presence at the center of ship activity during MFAS training was close to zero for both years. The ''after'' phases for both years retained lower probabilities of presence suggesting the return to baseline conditions may take more than 5 days. The results show a clear spatial redistribution of calling minke whales during surface ship MFAS training; however, a limitation of passive acoustic monitoring is that one cannot conclude if the whales moved away, went silent, or a combination of the two.

Building on this work, Durbach *et al.,* (2021) used the same data and determined that individual minke whales tended to be in either a fast or slow movement behavioral state while on the missile range, whereas the whales tended to be in the slow state in baseline or before periods but transitioned into the fast state with more directed movement during sonar exposures. They also moved away from the area of sonar activity on the range, either to the north or east depending on where the activity was located; this explains the spatial redistribution found by Harris *et al.,* (2019b). Minke whales were also more likely to stop calling when in the fast movement behavioral state regardless of whether there was sonar activity and stop calling when in the slow movement behavioral state during sonar activity (Durbach *et al.,* 2021). Similarly, minke whale detections were reduced or ceased altogether during periods of sonar use off Jacksonville, Florida, (Norris *et al.,* 2012; Simeone *et al.,* 2015; U.S. Department of the Navy, 2013), especially with an increased ping rate (Charif *et al.,* 2015).

Odontocetes have varied, context-dependent behavioral responses to sonar and other transducers. Much of the research on odontocetes has been focused on understanding the impacts of sonar and other transducers on beaked whales because they were hypothesized to be more susceptible to behavioral disturbance after several strandings of beaked whales in which military MFAS was identified as a contributing factor (see *Stranding and Mortality* section). Subsequent BRSs have shown that beaked whales are likely more sensitive to disturbance than most other cetaceans. Many species of odontocetes have been studied during BRSs (though not for low frequency sources), including Blainville's beaked whale, goose-beaked whale, Baird's beaked whale, northern bottlenose whale, harbor porpoise, pilot whale, killer whale, sperm whale, false killer whale, melon-headed whale, bottlenose dolphin, rough-toothed dolphin, Risso's dolphin, Pacific white-sided dolphin, and Commerson's dolphin. Observed responses by Blainville's beaked whales, goose-beaked whales, Baird's beaked whales, and northern bottlenose whales (the largest of the beaked whales), to mid-frequency sonar sounds include cessation of clicking, decline in group vocal periods, termination of foraging dives, changes in direction to avoid the sound source, slower ascent rates to the surface, longer deep and shallow dive durations, and other unusual dive behaviors (DeRuiter *et al.,* 2013b; Hewitt *et al.,* 2022; Jacobson *et al.,* 2022; McCarthy *et al.,* 2011; Miller *et al.,* 2015; Moretti *et al.,* 2014; Southall *et al.,* 2011; Stimpert *et al.,* 2014; Tyack *et al.,* 2011).

During a BRS in Southern California, a tagged Baird's beaked whale exposed to simulated MFA sonar within 3 km increased swim speed and modified its dive behavior (Stimpert *et al.,* 2014). One goose-beaked whale was also incidentally exposed to real Navy sonar located over 100 km away in addition to the source used in the controlled exposure study, and the authors did not detect similar responses at comparable received levels. Received levels from the MFA sonar signals from the controlled (3.4 to 9.5 km) exposures were calculated as 84–144 dB re 1 µPa, and incidental (118 km) exposures were calculated as 78–106 dB re 1 µPa, indicating that context of the exposures (*e.g.,* source proximity, controlled source ramp-up) may have been a significant factor in the responses to the simulated sonars (DeRuiter *et al.,* 2013b).

Long-term tagging work during the same BRS demonstrated that the longer duration dives considered a behavioral response by DeRuiter *et al.* (2013b) fell within the normal range of dive durations found for eight tagged goose-beaked whales on the Southern California Offshore Range (Schorr *et al.,* 2014). However, the longer inter-deep dive intervals found by DeRuiter *et al.,* (2013b), which were among the longest found by Schorr *et al.,* (2014) and Falcone *et al.,* (2017), may indicate a response to sonar. Williams *et al.,* (2017) note that during normal deep dives or during fast swim speeds, beaked whales and other marine mammals use strategies to reduce their stroke rates (*e.g.,* leaping, wave surfing when swimming, interspersing glides between bouts of stroking when diving). The authors determined that in the post-exposure dives by the tagged goose-beaked whales described in DeRuiter *et al.,* (2013b), the whales ceased gliding and swam with almost continuous strokes. This change in swim behavior was calculated to increase metabolic costs by about 30.5 percent and increase the amount of energy expending on fast swim speeds from 27 to 59 percent of their overall energy budget. This repartitioning of energy was detected in the model up to 1.7 hours after the single sonar exposure. Therefore, while the overall post-exposure dive durations were similar, the metabolic energy calculated by Williams *et al.,* (2017) was higher. However, Southall *et al.,* (2019a) found that prey availability was higher in the western area of the Southern California Offshore Range where goose-beaked whales preferentially occurred, while prey resources were lower in the eastern area and moderate in the area just north of the Range. This high prey availability may indicate that goose-beaked whales need fewer foraging dives to meet energy requirements than would be needed in another area with fewer resources.

During a BRS in Norway, northern bottlenose whales avoided a sonar sound source over a wide range of distances (0.8 to 28 km) and estimated avoidance thresholds ranging from received SPLs of 117 to 126 dB re 1 µPa. The behavioral response characteristics and avoidance thresholds were comparable to those previously observed in beaked whale studies; however, researchers did not observe an effect of distance on behavioral response and found that onset and intensity of behavioral response were better predicted by received SPL. There was one instance where an individual northern bottlenose whale approached the vessel, circled the sound source (source level was only 122 dB re 1 µPa), and resumed foraging after the exposure. Conversely, one northern bottlenose whale exposed to a sonar source was documented performing the longest and deepest dive on record for the species, and continued swimming away from the source for more than 7 hours (Miller *et al.,* 2015; Siegal *et al.,* 2022; Wensveen *et al.,* 2019).

Research on Blainville's beaked whales at the Atlantic Undersea Test and Evaluation Center (AUTEC) range has shown that individuals move off-range during sonar use, only returning after the cessation of sonar transmission (Boyd *et al.,* 2009; Henderson *et al.,* 2015; Jones-Todd *et al.,* 2021; Manzano-Roth *et al.,* 2022; Manzano-Roth *et al.,* 2016; McCarthy *et al.,* 2011; Tyack *et al.,* 2011). Five Blainville's beaked whales estimated to be within 2 to 29 km of the AUTEC range at the onset of active sonar were displaced a maximum of 28 to 68 km after moving away from the range, although one individual did approach the range during active sonar use. Researchers found a decline in deep dives at the onset of the training and an increase in time spent on foraging dives as whales moved away from the range. Predicted received levels at which presumed responses were observed were comparable to those previously observed in beaked whale studies. Acoustic data indicated that vocal periods were detected on the range within 72 hours after training ended (Joyce *et al.,* 2019). However, Blainville's beaked whales have been documented to remain on-range to forage throughout the year (Henderson *et al.,* 2016), indicating the AUTEC range may be a preferred foraging habitat regardless of the effects of active sonar noise, or it could be that there are no long-term consequences of the sonar activity. In the SOCAL Range Complex, researchers conducting photo-identification studies have identified approximately 100 individual goose-beaked whales, with 40 percent having been seen in one or more prior years, with re-sightings up to 7 years apart, indicating a possible on-range resident population (Falcone and Schorr, 2014; Falcone *et al.,* 2009).

The probability of Blainville's beaked whale group vocal periods on the PMRF were modeled during periods of: (1) no naval activity; (2) naval activity without hull-mounted MFA sonar; and (3) naval activity with hull-mounted MFA sonar (Jacobson *et al.,* 2022). At a received level of 150 dB re 1 µPa RMS SPL, the probability of detecting a group vocal period during MFA sonar use decreased by 77 percent compared to periods when general training activity was ongoing, and by 87 percent compared to baseline (no naval activity) conditions. Jacobsen *et al.,* (2022) found a greater reduction in probability of a group vocal period with MFA sonar than observed in a prior study of the same species at the AUTEC range (Moretti *et al.,* 2014), which may be due to the baseline period in the AUTEC study including naval activity without MFA sonar, potentially lowering the baseline group vocal period activity in that study, or due to differences in the residency of the populations at each range.

Stanistreet *et al.* (2022) used passive acoustic recordings during a multinational naval activity to assess marine mammal acoustic presence and behavioral response to especially long bouts of sonar lasting up to 13 consecutive hours, occurring repeatedly over 8 days (median and maximum SPL = 120 dB and 164 dB). Goose-beaked whales and sperm whales substantially reduced how often they produced clicks during sonar activity, indicating a decrease or cessation in foraging behavior. Few previous studies have shown sustained changes in foraging or displacement of sperm whales, but there was an absence of sperm whale clicks for 6 consecutive days of sonar activity. Sperm whales returned to baseline levels of clicks within days after the activity, but beaked whale click detection rates remained low even 7 days after the exercise. In addition, there were no click detections from a Mesoplodon beaked whale species within the area during, and at least 7 days after, the sonar activity. Clicks from northern bottlenose whales and Sowerby's beaked whales were also detected but were not frequent enough at the recording site used to compare clicks between baseline and sonar conditions.

Goose-beaked whale behavioral responses (*i.e.,* deep and shallow dive durations, surface interval durations, inter-deep dive intervals) on the Southern California Anti-Submarine Warfare Range were modeled against predictor values that included helicopter dipping sonar, mid-power MFA sonar and hull-mounted, high-power MFA sonar along with other non-MFA sonar predictors (Falcone *et al.,* 2017). Falcone *et al.* (2017) found both shallow and deep dive durations increased as the proximity to both mid- and high-powered sources decreased and found that surface intervals and inter-deep dive intervals increased in the presence of both types of sonars (helicopter dipping and hull-mounted), although surface intervals shortened during periods without MFA sonar. Proximity of source and receiver were important considerations, as the responses to the mid-power MFA sonar at closer ranges were comparable to the responses to the higher source level vessel sonar, as was the context of the exposure. Helicopter dipping sonars are shorter duration and randomly located, therefore more difficult to predict or track by beaked whales and potentially more likely to elicit a response, especially at closer distances (6 to 25 km) (Falcone *et al.,* 2017).

Sea floor depths and quantity of light (*i.e.,* lunar cycle) are also important variables to consider in BRSs, as goose-beaked whale foraging dive depth increased with sea floor depth (maximum 2,000 m) and the amount of time spent at foraging depths (and likely foraging) was greater at night (likely avoiding predation by staying deeper during periods of bright lunar illumination), although they spent more time near the surface during the night, as well, particularly on dark nights with little moonlight (Barlow *et al.,* 2020). Sonar occurred during 10 percent of the dives studied and had little effect on the resulting dive metrics. Watwood *et al.,* (2017) found that the longer the duration of a sonar event, the greater reduction in detected goose-beaked whale group dives and, as helicopter dipping events occurred more frequently but with shorter durations than periods of hull-mounted sonar, when looking at the number of detected group dives there was a greater reduction during periods of hull-mounted sonar than during helicopter dipping sonar. DiMarzio *et al.* (2019) also found that group vocal periods (*i.e.,* clusters of foraging pulses), on average, decreased during sonar events on the Southern California Anti-Submarine Warfare Range, though the decline from before the event to during the event was significantly less for helicopter dipping events than hull-mounted events, and there was no difference in the magnitude of the decline between vessel-only events and events with both vessels and helicopters. Manzano-Roth *et al.* (2022) analyzed long-term passive acoustic monitoring data from the PMRF in Kauaʻi, Hawaii, and found beaked whales reduced group vocal periods during submarine command course events and remained low for a minimum of 3 days after the MFA sonar activity.

Harbor porpoise behavioral responses have been researched extensively using acoustic deterrent and acoustic harassment devices; however, BRSs using sonar are limited. Kastelein *et al.* (2018b) found harbor porpoises did not respond to low-duty cycle mid-frequency sonar tones (3.5–4.1 kHz at 2.7 percent duty cycle; *e.g.,* one tone per minute) at any received level, but one individual did respond (*i.e.,* increased jumping, increased respiration rates) to high-duty cycle sonar tones (3.5–4.1 kHz at 96 percent duty cycle; *e.g.,* continuous tone for almost a minute).

Behavioral responses by odontocetes (other than beaked whales and harbor porpoises) to sonar and other transducers include horizontal avoidance, reduced breathing rates, changes in behavioral state, changes in dive behavior (Antunes *et al.,* 2014; Isojunno *et al.,* 2018; Isojunno *et al.,* 2017; Isojunno *et al.,* 2020; Miller, 2012; Miller *et al.,* 2011; Miller *et al.,* 2014; Southall *et al.,* 2024), and, in one study, separation of a killer whale calf from its group (Miller *et al.,* 2011). Some species of dolphin (*e.g.,* bottlenose, spotted, spinner, Clymene, Pacific white-sided, rough-toothed) are frequently documented bowriding with vessels and the drive to engage in bowriding, whether for pleasure or energetic savings (Fiori *et al.,* 2024) may supersede the impact of associated sonar noise (Würsig *et al.,* 1998).

In controlled exposure experiments on captive odontocetes, Houser *et al.* (2013a) recorded behavioral responses from bottlenose dolphins with 3 kHz sonar-like tones between 115 and 185 dB re 1 μPa, and individuals across 10 trials demonstrated a 50 percent probability of response at 172 dB re 1 μPa. Multiple studies have been conducted on bottlenose dolphins and beluga whales to measure TTS (Finneran *et al.,* 2003a; Finneran *et al.,* 2001; Finneran *et al.,* 2005; Finneran and Schlundt, 2004; Schlundt *et al.,* 2000). During these studies, when individuals were presented with 1-second tones up to 203 dB re 1 μPa, responses included changes in respiration rate, fluke slaps, and a refusal to participate or return to the location of the sound stimulus, including what appeared to be deliberate attempts by animals to avoid a sound exposure (Finneran *et al.,* 2002; Schlundt *et al.,* 2000). Bottlenose dolphins exposed to more intense 1-second tones exhibited short-term changes in behavior above received levels of 178–193 dB re 1 μPa, and beluga whales did so at received levels of 180–196 dB re 1 μPa and above.

While several opportunistic observations of odontocete (other than beaked whales and harbor porpoises) responses have been recorded during previous Navy activities and BRSs that employed sonar and sonar-like sources, it is difficult to definitively attribute responses of non-focal species to sonar exposure. Responses range from no response to potential highlight-impactful responses, such as the separation of a killer whale calf from its group (Miller *et al.,* 2011). This may be due, in part, to the variety of species and sensitivities of the odontocete taxonomic group, as well as the breadth of study types conducted and field observations, leading to the assessment of both contextually driven and dose-based responses. The available data indicate exposures to sonar in close proximity and with multiple vessels approaching an animal likely lead to higher-level responses by most odontocete species, regardless of received level or behavioral state. However, when sources are further away and moving in variable directions, behavioral responses are likely driven by behavioral state, individual experience, or species-level sensitivities, as well as exposure duration and received level, with the likelihood of response increasing with increased received levels. As such, it is expected odontocete behavioral responses to sonar and other transducers will vary by species, populations, and individuals, and long-term consequences or population-level effects are likely dependent upon the frequency and duration of the exposure and resulting behavioral response.

Pinniped behavioral response to sonar and other transducers is context-dependent (*e.g.,* Hastie *et al.,* 2014; Southall *et al.,* 2019). All studies on pinniped response to sonar thus far have been limited to captive animals, though, based on exposures of wild pinnipeds to vessel noise and impulsive sounds (see Responses Due to Vessel Noise section), pinnipeds may only respond strongly to military sonar that is in close proximity or approaching an animal. Kvadsheim *et al.* (2010b) found that captive hooded seals exhibited avoidance response to sonar signals between 1 and 7 kHz (160–170 dB re 1 μPa RMS SPL) by reducing diving activity, rapid surface swimming away from the source, and eventually moving to areas of least SPL. However, the authors noted a rapid adaptation in behavior (passive surface floating) during the second and subsequent exposures, indicating a level of habituation within a short amount of time. Kastelein *et al.* (2015c) exposed captive harbor seals to three different sonar signals at 25 kHz with variable waveform characteristics and duty cycles and found individuals responded to a frequency modulated signal at received levels over 137 dB re 1 μPa by hauling out more, swimming faster, and raising their heads or jumping out of the water. However, seals did not respond to a continuous wave or combination signals at any received level (up to 156 dB re 1 μPa). Houser *et al.* (2013a) conducted a study to determine behavioral responses of captive California sea lions to MFA sonar at various received levels (125–185 dB re 1 μPa). They found younger animals (less than 2 years old) were more likely to respond than older animals and responses included increased respiration rate, increased time spent submerged, refusal to participate in a repetitive task, and hauling out. Most responses below 155 dB re 1 μPa were changes in respiration, while more severe responses (*i.e.,* refusing to participate, hauling out) began to occur over 170 dB re 1 μPa, and many of the most severe responses came from the young sea lions.

Responses Due to Vessel Noise

Mysticetes have varied responses to vessel noise and presence, from having no response to approaching vessels to exhibiting an avoidance response by both horizontal (swimming away) and vertical (increased diving) movement (Baker *et al.,* 1983; Fiori *et al.,* 2019; Gende *et al.,* 2011; Watkins, 1981). Avoidance responses include changing swim patterns, speed, or direction (Jahoda *et al.,* 2003), remaining submerged for longer periods of time (Au and Green, 2000), and performing shallower dives with more frequent surfacing. Behavioral responses to vessels range from smaller-scale changes, such as altered breathing patterns (*e.g.,* Baker *et al.,* 1983; Jahoda *et al.,* 2003), to larger-scale changes such as a decrease in apparent presence (Anderwald *et al.,* 2013). Other common behavioral responses include changes in vocalizations, surface time, feeding and social behaviors (Au and Green, 2000; Dunlop, 2019; Fournet *et al.,* 2018;

Machernis *et al.,* 2018; Richter *et al.,* 2003; Williams *et al.,* 2002a). For example, North Atlantic right whales (NARWs) have been reported to increase the amplitude or frequency of their vocalizations or call at a lower rate in the presence of increased vessel noise (Parks *et al.,* 2007; Parks *et al.,* 2011) but generally demonstrate little to no response to vessels or sounds from approaching vessels and often continue to use habitats in high vessel traffic areas (Nowacek *et al.* 2004a). This lack of response may be due to habituation to the presence and associated noise of vessels in NARW habitat or may be due to propagation effects that may attenuate vessel noise near the surface (Nowacek *et al.,* 2004a; Terhune and Verboom, 1999).

Mysticete behavioral responses to vessels may also be affected by vessel behavior (Di Clemente *et al.,* 2018; Fiori *et al.,* 2019). Avoidance responses occurred most often after ''J'' type vessel approaches (*i.e.,* traveling parallel to the whales' direction of travel, then overtaking the whales by turning in front of the group) compared to parallel or direct approaches. Mother humpbacks were particularly sensitive to direct and J type approaches and spent significantly more time diving in response (Fiori *et al.,* 2019). The presence of a passing vessel did not change the behavior of resting humpback whale mother-calf pairs, but fast vessels with louder low-frequency weighted source levels (173 dB re 1 μPa, equating to weighted received levels of 133 dB re 1 μPa) at an average distance of 100 m resulted in a decreased resting behavior and increases in dives, swim speeds, and respiration rates (Sprogis *et al.,* 2020).

Overall, mysticete responses to vessel noise and traffic are varied, and habituation or changes to vocalization are predominant long-term responses. When baleen whales do avoid vessels, they seem to do so by altering their swim and dive patterns to move away from the vessel. Although a lack of response in the presence of a vessel may minimize potential disturbance from passing vessels, it does increase the whales' vulnerability to vessel strike, which may be of greater concern for mysticetes than vessel noise.

Odontocete responses due to vessel noise are varied and context-dependent, and it is difficult to separate the impacts of vessel noise from the impacts of vessel presence. Vessel presence has been shown to interrupt feeding behavior in delphinids in some studies (Meissner *et al.,* 2015; Pirotta *et al.,* 2015b) while a recent study by Mills *et al.* (2023) found that, in an important foraging area, bottlenose dolphins may continue to forage and socialize even while constantly exposed to high vessel traffic. Ng and Leung (2003) found that the type of vessel, approach, and speed of approach can all affect the probability of a negative behavioral response and, similarly, Guerra *et al.* (2014) documented varied responses in group structure and vocal behavior.

While most odontocetes have documented neutral responses to vessels, avoidance (Bejder *et al.,* 2006a; Würsig *et al.,* 1998) and attraction (Norris and Prescott, 1961; Ritter, 2002; Shane *et al.,* 1986; Westdal *et al.,* 2023; Würsig *et al.,* 1998) behaviors have also been observed (Hewitt, 1985).

Information is limited on beaked whale responses to vessel noise, but Würsig *et al.* (1998) noted that most beaked whales seem to exhibit avoidance behaviors when exposed to vessels and beaked whales may respond to all anthropogenic noise (*i.e.,* sonar, vessel) at similar sound levels (Aguilar de Soto *et al.,* 2006; Tyack *et al.,* 2011; Tyack, 2009). The information available includes a disruption of foraging by a vocalizing goose-beaked whale in the presence of a passing vessel (Aguilar de Soto *et al.,* 2006) and restriction of group movement, or possibly reduction in the number of individuals clicking within the group, after exposure to broadband (received level of 135 dB re 1 μPa) vessel noise up to at least 5.2 km away from the source, though no change in duration of Blainville's beaked whale foraging dives was observed (Pirotta *et al.,* 2012).

Porpoises and small delphinids are known to be sensitive to vessel noise, as well. It should be noted that fewer responses in populations of odontocetes regularly subjected to high levels of vessel traffic could be a sign of habituation, or a sign that the more sensitive individuals in the population have abandoned that area of higher human activity.

Lusseau and Bejder (2007) have reported some long-term consequences of vessel noise on odontocetes but, overall, there is little information on the long-term and cumulative impacts of vessel noise (National Academies of Sciences Engineering and Medicine, 2017; NMFS, 2007). Many researchers speculate that long-term impacts may occur on odontocete populations that experience repeated interruption of foraging behaviors (Stockin *et al.,* 2008), and Southall *et al.* (2021) indicates that, in many contexts, the localized and coastal home ranges typical of many species make them less resilient to sustained or repeated vessel noise than mysticetes.

Context and experience likely play a role in pinnipeds response to vessel noise, which vary from negative responses including increased vigilance and alerting to avoidance to reduced time spent doing biologically important activities (*e.g.,* resting, feeding, and nursing) (Martin *et al.,* 2023a; Martin *et al.,* 2022; Mikkelsen *et al.,* 2019; Richardson *et al.,* 1995) to attraction or lack of observable response (Richardson *et al.,* 1995). More severe responses, like flushing, could be more detrimental to individuals during biologically important activities and times, such as during pupping season. Blundell and Pendleton (2015) found that vessel presence reduces haul out time of Alaskan harbor seals during pupping season and larger vessels elicit stronger responses. Cates and Acevedo-Gutiérrez (2017) modeled harbor seal responses to passing vessels at haul out sites in less trafficked areas and found the model best predicting flushing behavior included the number of boats, type of boats, and distance of seals to boats. The authors noted flushing occurred more in response to non-motorized vessels (*e.g.,* kayaks), likely because they tended to pass closer (25 to 184 m) to haul out sites than motorized vessels (55 to 591 m) and tended to occur in groups rather than as a single vessel.

Cape fur seals were also more responsive to vessel noise at sites with a large breeding colony than at sites with lower abundances of conspecifics (Martin *et al.,* 2023a). A field study of harbor and gray seals showed that seal responses to vessels included interruption of resting and foraging during times when vessel noise was increasing or at its peak (Mikkelsen *et al.,* 2019). And, although no behavioral differences were observed in hauled out wild cape fur seals exposed to low (60–64 dB re 20 μPa RMS SPL), medium (64–70 dB) and high-level (70–80 dB) vessel noise playbacks, mother-pup pairs spent less time nursing (15–31 percent) and more time awake (13–26 percent), vigilant (7–31 percent), and mobile (2–4 percent) during vessel noise conditions compared to control conditions (Martin *et al.,* 2022). Of note, the T–AGOS vessels engaged in SURTASS LFA sonar activities would remain at least 22 km from emergent land and islands, thereby avoiding pinniped colonies and haulouts.

Masking

Sound can disrupt behavior through masking, or interfering with, an animal's ability to produce, detect, recognize, interpret, or discriminate between acoustic signals of interest (*e.g.,* those used for intraspecific communication and social interactions, prey detection, predator avoidance, or navigation) (Clark *et al.,* 2009; Richardson *et al.,* 1995; Erbe and Farmer, 2000; Tyack, 2000; Erbe *et al.,* 2016; Branstetter and Sills, 2022; Erbe *et al.,* 2025). Masking occurs when the production or receipt of a sound is interfered with by another coincident sound at similar frequencies and at similar or higher intensity and may occur whether the coincident sound is natural (*e.g.,* snapping shrimp, wind, waves, precipitation) or anthropogenic (*e.g.,* shipping, sonar, seismic exploration) in origin.

The ability of a noise source to mask biologically important sounds depends on the characteristics of both the noise source and the signal of interest (*e.g.,* signal-to-noise ratio, temporal variability, direction), in relation to each other and to an animal's hearing abilities (*e.g.,* sensitivity, frequency range, critical ratios, frequency discrimination, directional discrimination, age, or TTS hearing loss) and/or ability to produce a signal (communication masking), and existing ambient noise and propagation conditions. Masking these acoustic signals can disturb the behavior of individual animals, groups of animals, or entire populations. Masking can lead to behavioral changes including vocal changes (*e.g.,* Lombard effect, increasing amplitude, or changing frequency or timing of vocalizations), cessation of foraging, and leaving an area, to both signalers and receivers, in an attempt to compensate for noise levels (Erbe *et al.,* 2016).

Most research on auditory masking is focused on energetic masking, or the ability of the receiver (*i.e.,* listener) to detect a signal in noise. However, from a fitness perspective, both signal detection and signal interpretation are necessary for success. This type of masking is called informational masking and occurs when a signal is detected by an animal but the meaning of that signal has been lost. Few data exist on informational masking in marine mammals, but studies have shown that some recognition of predator cues might be missed by species that are preyed upon by killer whales if killer whale vocalizations are masked (Curé *et al.,* 2016; Curé *et al.,* 2015; Deecke *et al.,* 2002; Isojunno *et al.,* 2016; Visser *et al.,* 2016).

Under certain circumstances, marine mammals experiencing significant masking could also be impaired from maximizing their performance fitness in survival and reproduction. Therefore, when the coincident (*i.e.,* masking) sound is man-made, it may be considered harassment when, in the case of military readiness activities, disrupting natural behavioral patterns to the point where the behavior is abandoned or significantly altered. It is important to distinguish TTS and PTS, which persist after the sound exposure, from masking, which occurs only during the sound exposure. Because masking (without resulting in threshold shift) is not associated with abnormal physiological function, it is not considered a physiological effect, but rather a potential behavioral effect.

Richardson *et al.* (1995) argued that the maximum radius of influence of anthropogenic noise (including broadband low-frequency sound transmission) on a marine mammal is the distance from the source to the point at which the noise can barely be heard. This range is determined by either the hearing sensitivity (including critical ratios, or the lowest signal-to-noise ratio in which animals can detect a signal) of the animal (Finneran and Branstetter, 2013; Johnson *et al.,* 1989; Southall *et al.,* 2000) or the background noise level present (Hatch *et al.,* 2016). Masking is most likely to affect some species' ability to detect communication calls and natural sounds (*i.e.,* surf noise, prey noise, *etc.*) (Clark *et al.,* 2009; Erbe *et al.,* 2025; Richardson *et al.,* 1995).

The frequency range of the potentially masking sound is important in determining any potential behavioral impacts. For example, low-frequency signals, like SURTASS LFA sonar, may have less effect on high-frequency echolocation sounds produced by odontocetes but are more likely to affect detection of mysticete communication calls and other potentially important natural sounds such as those produced by surf and some prey species. The masking of communication signals by anthropogenic noise may be considered as a reduction in the communication space of animals (*e.g.,* Clark *et al.,* 2009; Matthews *et al.,* 2016; Erbe *et al.,* 2016) and may result in energetic or other costs as animals change their vocalization behavior (*e.g.,* Miller *et al.,* 2000; Foote *et al.,* 2004; Parks *et al.,* 2007; Di Iorio and Clark, 2010; Holt *et al.,* 2009; Tennessen *et al.,* 2024). Masking can be reduced in situations where the signal and noise come from different directions (Richardson *et al.,* 1995; Erbe *et al.,* 2025), through amplitude modulation of the signal, or through other compensatory behaviors (Houser and Moore, 2014; Erbe *et al.,* 2016; Branstetter and Sills, 2022). Masking can be tested directly in captive species, but in wild populations it must be either modeled or inferred from evidence of masking compensation. There are few studies addressing real-world masking sounds likely to be experienced by marine mammals in the wild (*e.g.,* Cholewiak *et al.,* 2018; Branstetter and Sills, 2022; Branstetter *et al.,* 2024; Tennessen *et al.,* 2024).

Impacts on signal detection, measured by masked detection thresholds, are not the only important factors to address when considering the potential effects of masking. As marine mammals use sound to recognize conspecifics, prey, predators, or other biologically significant sources (Branstetter *et al.,* 2016), it is also important to understand the impacts of masked recognition thresholds (*i.e.,* informational masking). Branstetter *et al.* (2016) measured masked recognition thresholds for whistle-like sounds of bottlenose dolphins and observed that they are approximately 4 dB above detection thresholds (energetic masking) for the same signals. Reduced ability to recognize a conspecific call or the acoustic signature of a predator could have severe negative impacts. Branstetter *et al.* (2016) observed that if ''quality communication'' is set at 90 percent recognition the output of communication space models (which are based on 50 percent detection) would likely result in a significant decrease in communication range.

As marine mammals use sound to recognize predators (Allen *et al.,* 2014; Cummings and Thompson, 1971; Curé *et al.,* 2015; Fish and Vania, 1971), the presence of masking noise may also prevent marine mammals from responding to acoustic cues produced by their predators, particularly if it occurs in the same frequency band. For example, harbor seals that reside in the coastal waters of British Columbia are frequently targeted by mammal-eating killer whales. The seals acoustically discriminate between the calls of mammal-eating and fish-eating killer whales (Deecke *et al.,* 2002), a capability that should increase survivorship while reducing the energy required to identify all killer whale calls. Similarly, sperm whales (Curé *et al,* 2016; Isojunno *et al.,* 2016), long-finned pilot whales (Visser *et al.,* 2016), and humpback whales (Cureé *et al.,* 2015) changed their behavior in response to killer whale vocalization playbacks. The potential effects of masked predator acoustic cues depend on the duration of the masking noise and the likelihood of a marine mammal encountering a predator during the time that detection and recognition of predator cues are impeded. Given its low frequency, the SURTASS LFA sonar signal would be expected to interfere little, if at all, with marine mammal predator vocalization.

Redundancy and context can also facilitate detection of weak signals. These phenomena may help marine mammals detect weak sounds in the presence of natural or anthropogenic noise. Most masking studies in marine mammals present the test signal and the masking noise from the same direction. The dominant background noise may be highly directional if it comes from a particular anthropogenic source such as a vessel or industrial site. Directional hearing may significantly reduce the masking effects of these sounds by improving the effective signal-to-noise ratio (Erbe *et al.,* 2016).

Masking affects both senders and receivers of acoustic signals and, when present at large scales (*e.g.,* spatial and/or temporal), can potentially have long-term chronic effects on marine mammals at the population level as well as at the individual level. Low-frequency ambient sound levels have increased by as much as 20 dB (more than three times in terms of SPL) in some of the world's ocean from pre-industrial periods, with most of the increase from distant commercial shipping (Hildebrand, 2009; Cholewiak *et al.,* 2018). All anthropogenic sound sources, but especially chronic, continuous, and lower-frequency signals (*e.g.,* from commercial vessel traffic), contribute to elevated ambient sound levels, thus intensifying masking for marine mammals.

Masking Due to Sonar and Other Transducers

Masking can reduce the ranges over which marine mammals can detect biologically relevant sounds in the presence of high-duty cycle sources. Lower-duty cycle sonars have less of a masking effect as sonar tones occur over a relatively short duration, thus the listener can detect signals of interest during the quiet periods between cycles. The LFA sonar duty cycle averages 7.5–10 percent with a maximum of 20 percent; however, single pulses range from 6 to 100 seconds with an average of 60 seconds. Additionally, sonar tones occur over a relatively narrow bandwidth, which means the signal is unlikely to overlap more than a small portion of the vocalizations for most species. LFA sonar signals are limited to the 100–500 Hz range. For large mysticetes, the range of best hearing is estimated between 0.1 and 10 kHz, which overlaps with SURTASS LFA sonar sources. Additionally, many of their vocalizations are below 1 kHz, which overlaps with low-frequency sources. Any auditory impacts (TTS and AUD INJ) or masking may affect communication due to low-frequency sonars.

As noted previously in the *Marine Mammal Hearing Groups* section (table 3, figure 2, and figure 3, specifically), most marine mammal taxa (with the exception of LF hearing specialists) have significantly reduced hearing sensitivity in the 100–500 Hz range of SURTASS LFA sonar. Specifically, the HF cetacean species weighting function curve shows 17–40 dB reduced sensitivity in that frequency range (*i.e.,* the sound would be perceived as that much lower level than a sound in the most susceptible portion of their hearing range), the underwater pinniped weighting function curves show from 9–30-dB reductions, and the VHF cetacean weighting function curve shows a 47–65 dB reduction at frequencies from 200 to 500 Hz (*i.e.,* generalized hearing range for this hearing group starts at 200 Hz) and suggest even further reduced sensitivity. Even the LF cetacean species have somewhat reduced sensitivity in the 100 to 500 Hz range (0.5–6 dB). Any masking by LFA sonar would be expected to coincide with the time they are in the vicinity of a transmitting vessel (vessels would be transmitting, at most, 8 hours per day) and overlapping with only a small portion of the hearing range (given the narrow bandwidth). LFA sonar could overlap in frequency with mysticete vocalizations; however, LFA sonar overlaps little or not at all with vocalizations for most other marine mammal species, and especially not with high-frequency echolocation calls of odontocetes. For example, in the presence of LFA sonar, humpback whales were observed to increase the length of their songs (Fristrup *et al.,* 2003; Miller *et al.,* 2000), potentially due to the overlap in frequencies between the whale song and the LFA sonar.

High-frequency (10–100 kHz) sonars, including the HF/M3 source (frequency range of 30–40 kHz), fall within the best hearing and vocalization ranges of most odontocetes; however, the HF/M3 source is an intermittent source with a low duty cycle, thus less likely to overlap both hearing and vocalizations, and high frequency sounds attenuate more rapidly in the water due to absorption than do lower frequency sounds, thus producing a smaller zone of potential masking than mid- and low-frequency sounds. While high-frequency sonar has the potential to mask marine mammal vocalizations under certain conditions, reduction in available communication space or ability to locate prey is unlikely because of the small zone of effect.

For other mysticetes, the range of best hearing and vocalizations is typically between 1 and 30 kHz, which overlaps with mid- and high-frequency sonar sources. Masking from high-frequency sonar sources would be less likely to affect communication for these mysticetes than impacts due to low-frequency sonars. Odontocetes that use echolocation to hunt may experience masking of the echoes needed to find their prey when foraging near low-frequency and mid-frequency sonar sources. Communication sounds could also be masked by these sources. This effect is likely to be temporary in offshore areas where these sources would operate. Odontocetes with very high frequency hearing, such as harbor porpoises, may experience masking of echolocation and communication calls from close-proximity very-high-frequency sources, but these effects are likely to be transient and temporary in the case of the HF/M3, given the small impact zone. Pinnipeds may also experience masking due to low- and mid-frequency sources because their communication calls range from approximately 0.1–30 kHz. Some species of pinnipeds communicate primarily in air and would not experience masking due to underwater sonar use. Any impacts from masking would generally be expected to occur within the same areas for which direct behavioral disturbance from the SURTASS sources is quantified in the Estimated Take of Marine Mammals section.

Masking Due to Vessel Noise

Masking is more likely to occur in the presence of broadband, relatively continuous noise sources such as vessels; however, we note that this rule contemplates no more than four vessels traversing an ocean basin at greater than 22 km from shore (away from where marine mammal densities are higher), resulting in a very low likelihood of any meaningful masking resulting from the noise of the vessels themselves. Several studies have shown decreases in marine mammal communication space and changes in behavior as a result of the presence of vessel noise. For example, NARWs were observed to shift the frequency content of their calls upward while reducing the rate of calling in areas of increased anthropogenic noise (Parks *et al.,* 2007) as well as increasing the amplitude (intensity) of their calls (Parks, 2009; Parks *et al.,* 2011). Fournet *et al.* (2018) observed that humpback whales in Alaska responded to increasing ambient sound levels (natural and anthropogenic) by increasing the source levels of their calls (non-song vocalizations). Clark *et al.* (2009) also observed that right whales' communication space decreased by up to 84 percent in the presence of vessels. Cholewiak *et al.* (2018) also observed loss in communication space in Stellwagen National Marine Sanctuary for NARWs, fin whales, and humpback whales with increased ambient noise and shipping noise. Gabriele *et al.* (2018) modeled the effects of vessel traffic sound on communication space in Glacier Bay National Park in Alaska and found that typical summer vessel traffic in Glacier Bay National Park causes losses of communication space to singing whales (reduced by 13–28 percent), calling whales (18–51 percent), and roaring seals (32–61 percent), particularly during daylight hours and even in the absence of cruise ships. Dunlop (2019) observed that an increase in vessel noise reduced modeled communication space and resulted in significant reduction in group social interactions in Australian humpback whales. However, communication signal masking did not fully explain this change in social behavior in the model, indicating there may also be an additional effect of the physical presence of the vessel on social behavior (Dunlop, 2019). Although humpback whales off Australia did not change the frequency or duration of their vocalizations in the presence of ship noise, their source levels were lower than expected based on source level changes to wind noise, potentially indicating some signal masking (Dunlop, 2016). Multiple delphinid species have also been shown to increase the minimum or maximum frequencies of their whistles in the presence of anthropogenic noise and reduced communication space (*e.g.,* Holt *et al.,* 2009; Holt *et al.,* 2011; Gervaise *et al.,* 2012; Williams *et al.,* 2014; Hermannsen *et al.,* 2014; Papale *et al.,* 2015; Liu *et al.,* 2017).

Other Physiological Responses

Physiological stress is a natural and adaptive process that helps an animal survive changing conditions. When an animal perceives a potential threat, whether or not the stimulus actually poses a threat, a stress response is triggered (Selye, 1950; Moberg, 2000; Sapolsky, 2005). Once an animal's central nervous system perceives a threat, it mounts a biological response or defense that consists of a combination of behavioral responses, autonomic nervous system responses, neuroendocrine responses, or immune responses.

The primary distinction between stress (which is adaptive and does not normally place an animal at risk) and distress is the biotic cost of the response. During a stress response, an animal uses glycogen stores that can be quickly replenished once the stress is alleviated. In such circumstances, the cost of the stress response would not pose serious fitness consequences. However, when an animal does not have sufficient energy reserves to satisfy the energetic costs of a stress response, energy resources must be diverted from other biotic functions. For example, when a stress response diverts energy away from growth in young animals, those animals may experience stunted growth. When a stress response diverts energy from a fetus, an animal's reproductive success and its fitness will suffer. In these cases, the animals will have entered a pre-pathological or pathological state which is called "distress" or "allostatic loading" (McEwen and Wingfield, 2003). This pathological state of distress will last until the animal replenishes its energetic reserves sufficiently to restore normal function.

According to Moberg (2000), in the case of many stressors, an animal's first and sometimes most economical (in terms of biotic costs) response is behavioral avoidance of the potential stressor or avoidance of continued exposure to a stressor. An animal's second line of defense to stressors involves the sympathetic part of the autonomic nervous system and the classical "fight or flight" response, which includes the cardiovascular system, the gastrointestinal system, the exocrine glands, and the adrenal medulla to produce changes in heart rate, blood pressure, and gastrointestinal activity that humans commonly associate with "stress." These responses have a relatively short duration and may or may not have significant long-term effect on an animal's welfare.

An animal's third line of defense to stressors involves its neuroendocrine systems or sympathetic nervous systems; the system that has received the most study has been the hypothalamus-pituitary-adrenal (HPA) system (also known as the HPA axis in mammals or the hypothalamus-pituitary-interrenal axis in fish and some reptiles). Unlike stress responses associated with the autonomic nervous system, virtually all neuro-endocrine functions that are affected by stress, including immune competence, reproduction, metabolism, and behavior, are regulated by pituitary hormones. Stress-induced changes in the secretion of pituitary hormones have been implicated in failed reproduction (Moberg, 1987; Rivier and Rivest, 1991), altered metabolism (Elasser *et al.,* 2000), reduced immune competence (Blecha, 2000), and behavioral disturbance (Moberg, 1987; Blecha, 2000). Increases in the circulation of glucocorticosteroids (cortisol, corticosterone, and aldosterone in marine mammals; see Romano *et al.* (2004)) have been equated with stress for many years.

Marine mammals naturally experience stressors within their environment and as part of their life histories. Changing weather and ocean conditions, exposure to disease and naturally occurring toxins, lack of prey availability, and interactions with predators all contribute to the stress a marine mammal experiences (Atkinson *et al.,* 2015). Breeding cycles, periods of fasting, social interactions with members of the same species, and molting (for pinnipeds) are also stressors, although they are natural components of an animal's life history. Anthropogenic activities have the potential to provide additional stressors beyond those that occur naturally (*e.g.,* fishery interactions, pollution, tourism, ocean noise) (Fair *et al.,* 2014; Meissner *et al.,* 2015; Rolland *et al.,* 2012).

Relationships between these physiological mechanisms, animal behavior, and the costs of stress responses are well-studied through controlled experiments for both laboratory and free-ranging animals (*e.g.,* Holberton *et al.,* 1996; Hood *et al.,* 1998; Jessop *et al.,* 2003; Krausman *et al.,* 2004; Lankford *et al.,* 2005; Reneerkens *et al.,* 2002; Thompson and Hamer, 2000). However, it should be noted that our understanding of the functions of various stress hormones (*e.g.,* cortisol), is based largely upon observations of the stress response in terrestrial mammals. Atkinson *et al.,* (2015) note that the endocrine response of marine mammals to stress may not be the same as that of terrestrial mammals because of the selective pressures marine mammals faced during their evolution in an ocean environment. For example, due to the necessity of breath-holding while diving and foraging at depth, the physiological role of epinephrine and norepinephrine (the catecholamines) in marine mammals might be different than in other mammals. Relatively little information exists on the linkage between anthropogenic sound exposure and stress in marine mammals, and even less information exists on the ultimate consequences of sound-induced stress responses (either acute or chronic). Most studies to date have focused on acute responses to sound either by measuring catecholamines, a neurohormone, or heart rate as a proxy for an acute stress response.

The ability to make predictions from stress hormones about impacts on individuals and populations exposed to various forms of natural and anthropogenic stressors relies on understanding the linkages between changes in stress hormones and resulting physiological impacts. Currently, the sound characteristics that correlate with specific stress responses in marine mammals are poorly understood, as are the ultimate consequences of these changes. Several research efforts have improved the understanding of, and the ability to predict, how stressors ultimately affect marine mammal populations (*e.g.,* King *et al.,* 2015; New *et al.,* 2013a; Pirotta *et al.,* 2015a; Pirotta *et al.,* 2022b). This includes determining how and to what degree various types of anthropogenic sound cause stress in marine mammals and understanding what factors may mitigate those physiological stress responses. Factors potentially affecting an animal's response to a stressor include life history, sex, age, reproductive status, overall physiological and behavioral adaptability, and whether they are naïve or experienced with the sound (*e.g.,* prior experience with a stressor may result in a reduced response due to habituation) (Finneran and Branstetter, 2013; St. Aubin and Dierauf, 2001). Because there are many unknowns regarding the occurrence of acoustically induced stress responses in marine mammals, any physiological response (*e.g.,* hearing loss or injury) or significant behavioral response is assumed to be associated with a stress response.

Non-impulsive sources of sound can cause direct physiological effects including noise-induced loss of hearing sensitivity (or ''threshold shift'') or other auditory injury, nitrogen decompression, acoustically-induced bubble growth, and injury due to sound-induced acoustic resonance. Separately, an animal's behavioral response to an acoustic exposure might lead to physiological effects that might ultimately lead to injury or death, which is discussed later in the *Stranding and Mortality* section.

Heart Rate Response

Several experimental studies have measured the heart rate response of a variety of marine mammals. For example, Miksis *et al.* (2001) observed increases in heart rates of captive bottlenose dolphins to which known calls of other dolphins were played, although no increase in heart rate was observed when background tank noise was played back. However, it cannot be determined whether the increase in heart rate was due to stress or social factors, such as expectation of an encounter with a known conspecific. Similarly, a young captive beluga's heart rate increased during exposure to noise, with increases dependent upon the frequency band of noise and duration of exposure, and with a sharp decrease to normal or below normal levels upon cessation of the exposure (Lyamin *et al.,* 2011). Spectral analysis of heart rate variability corroborated direct measures of heart rate (Bakhchina *et al.,* 2017). This response might have been in part due to the conditions during testing, the young age of the animal, and the novelty of the exposure. A year later the exposure was repeated at a slightly higher received level and there was no heart rate response, indicating the beluga whale had potentially habituated to the noise exposure.

Kvadsheim *et al.* (2010a) measured the heart rate of captive hooded seals during exposure to sonar signals and found an increase in the heart rate of the seals during exposure periods versus control periods when the animals were at the surface. When the animals dove, the normal dive-related heart rate decrease was not impacted by the sonar exposure. Similarly, Thompson *et al.* (1998) observed a rapid, short-lived decrease in heart rates in wild harbor and grey seals exposed to seismic air guns (cited in Gordon *et al.* (2003)).

Two captive harbor porpoises showed significant bradycardia (reduced heart rate), below that which occurs with diving, when they were exposed to pinger-like sounds with frequencies between 100–140 kHz (Teilmann *et al.,* 2006). The bradycardia was found only in the early noise exposures and the porpoises acclimated quickly across successive noise exposures. Elmegaard *et al.* (2021) also found that initial exposures to sonar sweeps produced bradycardia but did not elicit a startle response in captive harbor porpoises. As with Teilmann *et al.* (2006), the cardiac response disappeared over several repeat exposures suggesting rapid acclimation to the noise. In the same animals, 40-kHz noise pulses induced startle responses but without a change in heart rate. Bakkeren *et al.* (2023) found no change in the heart rate of a harbor porpoise during exposure to masking noise (⅓ octave band noise, centered frequency of 125 kHz, maximum received level of 125 dB re 1 µPa) during an echolocation task but showed significant bradycardia while blindfolded for the same task. The authors attributed the change in heart rate to sensory deprivation, although no strong conclusions about acoustic masking could be made since the animal was still able to perform the echolocation task in the presence of the masking noise. Williams *et al.* (2022) observed periods of increased heart rate variability in narwhals during seismic air gun impulse exposure, but profound bradycardia was not noted. Conversely, Williams *et al.* (2017) found that a profound bradycardia persisted in narwhals, even though exercise effort increased dramatically as part of their escape response following release from capture and handling.

Limited evidence across several different species suggests that increased heart rate might occur as part of the acute stress response of marine mammals that are at the surface. However, the decreased heart rate typical of diving marine mammals can be enhanced in response to an acute stressor, suggesting that the context of the exposure is critical to understanding the cardiac response. Furthermore, in instances where a cardiac response was noted, there appears to be rapid habituation when repeat exposures occur. Additional research is required to understand the interaction of dive bradycardia, noise-induced cardiac responses, and the role of habituation in marine mammals.

Stress Hormone and Immune Response

What is known about the function of the various stress hormones is based largely upon observations of the stress response in terrestrial mammals. The endocrine response of marine mammals to stress may not be the same as that of terrestrial mammals because of the selective pressures marine mammals faced during their evolution in an ocean environment (Atkinson *et al.,* 2015). For example, due to the necessity of breath-holding while diving and foraging at depth, the physiological role of epinephrine and norepinephrine (the catecholamines) might be different in marine versus other mammals.

Catecholamines increase during breath-hold diving in seals, co-occurring with a reduction in heart rate, peripheral vasoconstriction (*i.e.,* constriction of blood vessels), and an increased reliance on anaerobic metabolism during extended dives (Hance *et al.,* 1982; Hochachka *et al.,* 1995; Hurford *et al.,* 1996); the catecholamine increase is not associated with increased heart rate, glycemic release, and increased oxygen consumption typical of terrestrial mammals. Captive belugas demonstrated no catecholamine response to the playback of oil drilling sounds (Thomas *et al.,* 1990b) but showed a small but statistically significant increase in catecholamines following exposure to impulsive sounds produced from a seismic water gun (Romano *et al.,* 2004). A captive bottlenose dolphin exposed to the same sounds did not demonstrate a catecholamine response but did demonstrate a statistically significant elevation in aldosterone (Romano *et al.,* 2004); however, the increase was within the normal daily variation observed in this species (St. Aubin *et al.,* 1996) and was likely of little biological significance. Aldosterone has been speculated to not only contribute to electrolyte balance, but possibly also the maintenance of blood pressure during periods of vasoconstriction (Houser *et al.,* 2011). In marine mammals, aldosterone is thought to play a role in mediating stress (St. Aubin and Dierauf, 2001; St. Aubin and Geraci, 1989).

Yang *et al.* (2021) measured cortisol concentrations in two captive bottlenose dolphins and found significantly higher concentrations after exposure to 140 dB re 1 µPa impulsive noise playbacks. Two out of six tested indicators of immune system function underwent acoustic dose-dependent changes, suggesting that repeated exposures or sustained stress response to impulsive sounds may increase an affected individual's susceptibility to pathogens. Unfortunately, absolute values of cortisol were not provided, and it is not possible from the study to tell if cortisol rose to problematic levels (*e.g.,* see normal variation and changes due to handling in Houser *et al.* (2021) and Champagne *et al.* (2018)). Exposing dolphins to a different acoustic stressor yielded contrasting results. Houser *et al.* (2020) measured cortisol and epinephrine obtained from 30 captive bottlenose dolphins exposed to simulated Navy MFAS and found no correlation between SPL and stress hormone levels, even though sound exposures were as high as 185 dB re 1 µPa. In the same experiment (Houser *et al.,* 2013b), behavioral responses were shown to increase in severity with increasing received SPLs. These results suggest that behavioral responses to sonar signals are not necessarily indicative of a hormonal stress response.

Whereas a limited amount of work has addressed the potential for acute sound exposures to produce a stress response, almost nothing is known about how chronic exposure to acoustic stressors affects stress hormones in marine mammals, particularly as it relates to survival or reproduction. In what is probably the only study of chronic noise exposure in marine mammals associating changes in a stress hormone with changes in anthropogenic noise, Rolland *et al.* (2012) compared the levels of cortisol metabolites in NARW feces collected before and after September 11, 2001. Following the events of September 11, 2001, shipping was significantly reduced in the region where fecal collections were made, and regional ocean background noise declined. Fecal cortisol metabolites significantly decreased during the period of reduced ship traffic and ocean noise (Rolland *et al.,* 2012). Rolland *et al.* (2017) also compared acute (death by vessel strike) to chronic (entanglement or live stranding) stressors in NARW and found that whales subject to chronic stressors had higher levels of glucocorticoid stress hormones (cortisol and corticosterone) than either healthy whales or those killed by ships. It was presumed that whales subjected to acute stress may have died too quickly for increases in fecal glucocorticoids to be detected.

Considerably more work has been conducted in an attempt to determine the potential effect of vessel disturbance on smaller cetaceans, particularly killer whales (Bain, 2002; Erbe, 2002; Lusseau, 2006; Noren *et al.,* 2009; Pirotta *et al.,* 2015b; Read *et al.,* 2014; Rolland *et al.,* 2012; Williams *et al.,* 2009; Williams *et al.,* 2014a; Williams *et al.,* 2014b; Williams *et al.,* 2006b). Most of these efforts focused primarily on estimates of metabolic costs associated with altered behavior or inferred consequences of boat presence and noise but did not directly measure stress hormones. However, Ayres *et al.* (2012) investigated Southern Resident killer whale fecal thyroid hormone and cortisol metabolites to assess two potential threats to the species' recovery: lack of prey (salmon) and impacts from exposure to the physical presence of vessel traffic (but without measuring vessel traffic noise). Ayres *et al.* (2012) concluded from these stress hormone measures that the lack of prey overshadowed any population-level physiological impacts on Southern Resident killer whales due to vessel traffic. Lemos *et al.* (2022) investigated the potential for vessel traffic to affect gray whales. By assessing gray whale fecal cortisol metabolites across years in which vessel traffic was variable, Lemos *et al.* (2022) found a direct relationship between the presence/density of vessel traffic and fecal cortisol metabolite levels. Unfortunately, no direct noise exposure measurements were made on any individual making it impossible to tell if other natural and anthropogenic factors could also be related to the results. Collectively, these studies indicate the difficulty in determining which factors primarily influence the secretion of stress hormones, including the separate and additive effects of vessel presence and vessel noise. While vessel presence could contribute to the variation in fecal cortisol metabolites in NARWs and gray whales, there are other potential influences on fecal hormone metabolites, so it is difficult to establish a direct link between ocean noise and fecal hormone metabolites.

Non-Auditory Injury

Non-auditory injury, or direct injury, is considered unlikely to occur in the context of the Navy's proposed activities. Here, we discuss less direct non-auditory injury impacts, including acoustically induced bubble formation, and injury from sonar-induced acoustic resonance. Neither the Navy, nor NMFS expects physical or non-auditory injury or mortality to any of the marine mammal species in the Study Area due to the proposed activities.

One theoretical cause of injury to marine mammals is rectified diffusion (Crum and Mao, 1996), the process of increasing the size of a bubble by exposing it to a sound field. This process could be facilitated if the environment in which the ensonified bubbles exist is supersaturated with gas. Repetitive diving by marine mammals can cause the blood and some tissues to accumulate gas to a greater degree than is supported by the surrounding environmental pressure (Ridgway and Howard, 1979). The deeper and longer dives of some marine mammals (for example, beaked whales) are theoretically predicted to induce greater supersaturation (Houser *et al.,* 2001b). If rectified diffusion were possible in marine mammals exposed to high-level sound, conditions of tissue supersaturation could theoretically speed the rate and increase the size of bubble growth. Subsequent effects due to tissue trauma and emboli would presumably mirror those observed in humans suffering from decompression sickness. Acoustically-induced (or mediated) bubble growth and other pressure-related physiological impacts are addressed below but are not expected to result from the Navy's proposed activities.

It is unlikely that the short duration (in combination with the source levels) of sonar pings would be long enough to drive bubble growth to any substantial size, if such a phenomenon occurs. However, an alternative but related hypothesis has also been suggested: stable bubbles could be destabilized by high-level sound exposures such that bubble growth then occurs through static diffusion of gas out of the tissues. In such a scenario the marine mammal would need to be in a gas-supersaturated state for a long enough period of time for bubbles to become of a problematic size. Recent research with ex vivo supersaturated bovine tissues suggested that, for a 37 kHz signal, a sound exposure of approximately 215 dB re 1 μPa would be required before microbubbles became destabilized and grew (Crum *et al.,* 2005). Assuming spherical spreading loss and a nominal sonar source level of 235 dB re 1 μPa at 1 m, a whale would need to be within 10 m of the sonar dome to be exposed to such sound levels. Furthermore, tissues in the study were supersaturated by exposing them to pressures of 400–700 kilopascals for periods of hours and then releasing them to ambient pressures. Assuming the equilibration of gases with the tissues occurred when the tissues were exposed to the high pressures, levels of supersaturation in the tissues could have been as high as 400–700 percent. These levels of tissue supersaturation are substantially higher than model predictions for marine mammals (Fahlman *et al.,* 2009; Fahlman *et al.,* 2014; Houser *et al.,* 2001; Saunders *et al.,* 2008). It is improbable that this mechanism is responsible for stranding events or traumas associated with beaked whale strandings because both the degree of supersaturation and exposure levels observed to cause microbubble destabilization are unlikely to occur, either alone or in concert.

Yet another hypothesis has speculated that rapid ascent to the surface following exposure to a startling sound might produce tissue gas saturation sufficient for the evolution of nitrogen bubbles (*i.e.,* decompression sickness) (Jepson *et al.,* 2003; Fernandez *et al.,* 2005). In this scenario, the rate of ascent would need to be sufficiently rapid to compromise behavioral or physiological protections against nitrogen bubble formation. Alternatively, Tyack *et al.* (2006) studied the deep diving behavior of beaked whales and concluded that: ''Using current models of breath-hold diving, we infer that their natural diving behavior is inconsistent with known problems of acute nitrogen supersaturation and embolism.'' Collectively, these hypotheses can be referred to as ''hypotheses of acoustically mediated bubble growth.''

Although theoretical predictions suggest the possibility for acoustically mediated bubble growth, there is considerable disagreement among scientists as to its likelihood (Piantadosi and Thalmann, 2004; Evans and Miller, 2003; Cox *et al.,* 2006; Rommel *et al.,* 2006). Crum and Mao (1996) hypothesized that received levels would have to exceed 190 dB in order for there to be the possibility of significant bubble growth due to supersaturation of gases in the blood (*i.e.,* rectified diffusion). Work conducted by Crum *et al.* (2005) demonstrated the possibility of rectified diffusion for short duration signals, but at SELs and tissue saturation levels that are highly improbable to occur in diving marine mammals. To date, energy levels predicted to cause in vivo bubble formation within diving cetaceans have not been evaluated (NOAA, 2002b). Jepson *et al.* (2003, 2005) and Fernandez *et al.* (2004, 2005) concluded that in vivo bubble formation, which may be exacerbated by deep, long-duration, repetitive dives may explain why beaked whales appear to be relatively vulnerable to MFAS/HFAS exposures. It has also been argued that traumas from some beaked whale strandings are consistent with gas emboli and bubble-induced tissue separations (Jepson *et al.,* 2003); however, there is no conclusive evidence of this (Rommel *et al.,* 2006). Based on examination of sonar-associated strandings, Bernaldo de Quiros *et al.* (2019) list diagnostic features, the presence of all of which suggest gas and fat embolic syndrome for beaked whales stranded in association with sonar exposure.

As described in additional detail in appendix D the 2025 SURTASS Draft SEIS/OEIS, marine mammals generally are thought to deal with nitrogen loads in their blood and other tissues, caused by gas exchange from the lungs under conditions of high ambient pressure during diving, through anatomical, behavioral, and physiological adaptations (Hooker *et al.,* 2012). Although not a direct injury, variations in marine mammal diving behavior or avoidance responses have been hypothesized to result in nitrogen off-gassing in super-saturated tissues, possibly to the point of deleterious vascular and tissue bubble formation (Hooker *et al.,* 2012; Jepson *et al.,* 2003; Saunders *et al.,* 2008) with resulting symptoms similar to decompression sickness; however, the process is still not well understood.

In 2009, Hooker *et al.* tested two mathematical models to predict blood and tissue tension N2 (P_{N2}) using field data from three beaked whale species: northern bottlenose whales, goose-beaked whales, and Blainville's beaked whales. The researchers aimed to determine if physiology (body mass, diving lung volume, and dive response) or dive behavior (dive depth and duration, changes in ascent rate, and diel behavior) would lead to differences in P_{N2} levels and thereby decompression sickness risk between species. In their study, they compared results for previously published time depth recorder data (Hooker and Baird, 1999; Baird *et al.,* 2006, 2008) from goose-beaked whale, Blainville's beaked whale, and northern bottlenose whale. They reported that diving lung volume and extent of the dive response had a large effect on end-dive P_{N2}. Also, results showed that dive profiles had a larger influence on end-dive P_{N2} than body mass differences between species. Despite diel changes (*i.e.,* variation that occurs regularly every day or most days) in dive behavior, P_{N2} levels showed no consistent trend. Model output suggested that all three species live with tissue P_{N2} levels that would cause a significant proportion of decompression sickness cases in terrestrial mammals. The authors concluded that the dive behavior of goose-beaked whale was different from both Blainville's beaked whale and northern bottlenose whale and resulted in higher predicted tissue and blood N2 levels (Hooker *et al.,* 2009). They also suggested that the prevalence of goose-beaked whales stranding after naval sonar exercises could be explained by either a higher abundance of this species in the affected areas or by possible species differences in behavior and/or physiology related to MF active sonar (Hooker *et al.,* 2009).

Bernaldo de Quiros *et al.* (2012) showed that, among stranded whales, deep diving species of whales had higher abundances of gas bubbles compared to shallow diving species. Kvadsheim *et al.* (2012) estimated blood and tissue P_{N2} levels in species representing shallow, intermediate, and deep diving cetaceans following behavioral responses to sonar and their comparisons found that deep diving species had higher end-dive blood and tissue N2 levels, indicating a higher risk of developing gas bubble emboli compared with shallow diving species. Fahlmann *et al.* (2014) evaluated dive data recorded from sperm, killer, long-finned pilot, Blainville's, and goose-beaked whales before and during exposure to low-frequency (1–2 kHz), as defined by the authors, and mid-frequency (2–7 kHz) active sonar in an attempt to determine if either differences in dive behavior or physiological responses to sonar are plausible risk factors for bubble formation. The authors suggested that CO_2 may initiate bubble formation and growth, while elevated levels of N2 may be important for continued bubble growth. The authors also suggest that if CO_2 plays an important role in bubble formation, a cetacean escaping a sound source may experience increased metabolic rate, CO_2 production, and alteration in cardiac output, which could increase risk of gas bubble emboli. However, as discussed in Kvadsheim *et al.* (2012), the actual observed behavioral responses to sonar from the species in their study (sperm, killer, long-finned pilot, Blainville's beaked, and goose-beaked whales) did not imply any significantly increased risk of decompression sickness due to high levels of N2. Therefore, further information is needed to understand the relationship between exposure to stimuli, behavioral response (discussed in more detail below), elevated N2 levels, and gas bubble emboli in marine mammals. The hypotheses for gas bubble formation related to beaked whale strandings is that beaked whales potentially have strong avoidance responses to MFAS because they sound similar to their main predator, the killer whale (Cox *et al.,* 2006; Southall *et al.,* 2007; Zimmer and Tyack, 2007; Baird *et al.,* 2008; Hooker *et al.,* 2009). Further investigation is needed to assess the potential validity of these hypotheses.

To summarize, while there are several hypotheses, there is little data directly connecting intense, anthropogenic underwater sounds with non-auditory physical effects in marine mammals. The available data do not support identification of a specific exposure level above which non-auditory effects can be expected (Southall *et al.,* 2007) or any meaningful quantitative predictions of the numbers (if any) of marine mammals that might be affected in these ways. In addition, such effects, if they occur at all, would be expected to be limited to situations where marine mammals were exposed to high powered sounds at very close range over a prolonged period of time, which is not expected to occur based on the speed of the vessels operating sonar in combination with the speed and behavior of marine mammals in the vicinity of sonar.

An object exposed to its resonant frequency will tend to amplify its vibration at that frequency, a phenomenon called acoustic resonance. Acoustic resonance has been proposed as a potential mechanism by which a sonar or sources with similar operating characteristics could damage tissues of marine mammals. In 2002, NMFS convened a panel of government and private scientists to investigate the potential for acoustic resonance to occur in marine mammals (NOAA, 2002). They modeled and evaluated the likelihood that Navy MFAS (2–10 kHz) caused resonance effects in beaked whales that eventually led to their stranding. The workshop participants concluded that resonance in air-filled structures was not likely to have played a primary role in the Bahamas stranding in 2000. They listed several reasons supporting this finding including (among others): (1) tissue displacements at resonance are estimated to be too small to cause tissue damage; (2) tissue-lined air spaces most susceptible to resonance are too large in marine mammals to have resonant frequencies in the ranges used by MFAS or LFA sonar; (3) lung resonant frequencies increase with depth, and tissue displacements decrease with depth so if resonance is more likely to be caused at depth it is also less likely to have an affect there; and (4) lung tissue damage has not been observed in any mass, multi-species stranding of beaked whales. The frequency at which resonance was predicted to occur in the animals' lungs was 50 Hz, well below the frequencies used by the MFAS systems associated with the Bahamas event. The workshop participants focused on the March 2000 stranding of beaked whales in the Bahamas as high-quality data were available, but the workshop report notes that the results apply to other sonar-related stranding events. For the reasons given by the 2002 workshop participants, we do not anticipate injury due to sonar-induced acoustic resonance from the Navy's proposed activity.

Further Potential Effects of Behavioral Disturbance on Marine Mammal Fitness

The different ways in which marine mammals respond to sound are sometimes indicators of the ultimate effect that exposure to a given stimulus will have on the well-being (survival, reproduction, *etc.*) of an animal. The long-term consequences of disturbance, hearing loss, chronic masking, and acute or chronic physiological stress are difficult to predict because of the different factors experienced by individual animals, such as context of stressor exposure, underlying health conditions, and other environmental or anthropogenic stressors. Linking these non-lethal effects on individuals to changes in population growth rates requires long-term data, which is lacking for many populations. We summarize several studies below, but there are few quantitative marine mammal data relating the exposure of marine mammals to sound to effects on reproduction or survival, though data exists for terrestrial species to which we can draw comparisons for marine mammals. Several authors have reported that disturbance stimuli may cause animals to abandon nesting and foraging sites (Sutherland and Crockford, 1993), may cause animals to increase their activity levels and suffer premature deaths or reduced reproductive success when their energy expenditures exceed their energy budgets (Daan *et al.,* 1996; Feare, 1976; Mullner *et al.,* 2004), or may cause animals to experience higher predation rates when they adopt risk-prone foraging or migratory strategies (Frid and Dill, 2002). Each of these studies addressed the consequences of animals shifting from one behavioral state (*e.g.,* resting or foraging) to another behavioral state (*e.g.,* avoidance or escape behavior) because of human disturbance or disturbance stimuli.

Lusseau and Bejder (2007) present data from three long-term studies illustrating the connections between disturbance from whale-watching boats and population-level effects in cetaceans. In Shark Bay Australia, the abundance of bottlenose dolphins was compared within adjacent control and tourism sites over three consecutive 4.5-year periods of increasing tourism levels. Between the second and third time periods, in which tourism doubled, dolphin abundance decreased by 15 percent in the tourism area and did not change significantly in the control area. In Fiordland, New Zealand, two populations (Milford and Doubtful Sounds) of bottlenose dolphins with tourism levels that differed by a factor of seven were observed and significant increases in travelling time and decreases in resting time were documented for both. Consistent short-term avoidance strategies were observed in response to tour boats until a threshold of disturbance was reached (average 68 minutes between interactions), after which the response switched to a longer-term habitat displacement strategy. For one population, tourism occurred only in a part of the home range. However, tourism occurred throughout the home range of the Doubtful Sound population and once boat traffic increased beyond the 68-minute threshold (resulting in abandonment of their home range/ preferred habitat), reproductive success drastically decreased (*i.e.,* increased stillbirths) and abundance decreased significantly (from 67 to 56 individuals in a short period). Last, in a study of Northern Resident killer whales off Vancouver Island, exposure to boat traffic was shown to reduce foraging opportunities and increase traveling time. A simple bioenergetics model was applied to show that the reduced foraging opportunities equated to a decreased energy intake of 18 percent, while the increased traveling incurred an increased energy output of 3–4 percent, which suggests that a management action based on avoiding interference with foraging might be particularly effective.

An important variable to consider is duration of disturbance. Severity scales used to assess behavioral responses of marine mammals to acute sound exposures are not appropriate to apply to sustained or chronic exposures, which requires considering the health of a population over time rather than a focus on immediate impacts to individuals (Southall *et al.,* 2021). For example, short-term costs experienced over the course of a week by an otherwise healthy individual may be recouped over time after exposure to the stressor ends. These short-term costs would be unlikely to result in long-term consequences to that individual or to that individual's population. Comparatively, long-term costs accumulated by otherwise healthy individuals over an entire season, year, or throughout a life stage (*e.g.,* pup, juvenile, adult) would be less easily recouped and more likely to result in long-term consequences to that individual or population.

Marine mammals exposed to frequent or intense anthropogenic activities may leave the area, habituate to the activity, or tolerate the disturbance and remain in the area (Wartzok *et al.,* 2003). Highly resident or localized populations may also stay in an area of disturbance because the cost of displacement is higher than the cost of remaining in the area (Forney *et al.,* 2017). As such, an apparent lack of response (*e.g.,* no displacement or avoidance of a sound source) does not necessarily indicate there is no cost to the individual or population, as some resources or habitats may be of such high value that animals may choose to stay, even when experiencing the consequences of stress, masking, or hearing loss (Forney *et al.,* 2017).

Longer term displacement can lead to changes in abundance or distribution patterns of the species in the affected region (Bejder *et al.,* 2006b; Blackwell *et al.,* 2004; Teilmann *et al.,* 2006). For example, gray whales in Baja California, Mexico, abandoned a historical breeding lagoon in the mid-1960s due to an increase in dredging and commercial shipping operations, and only repopulated the lagoon after shipping activities had ceased for several years (Bryant *et al.,* 1984). Mysticetes in the northeast tended to adjust to vessel traffic over several years, trending towards more neutral behavioral responses to passing vessels (Watkins, 1986), indicating that some animals may habituate to high levels of human activity. A study on bottlenose dolphin responses to vessel approaches found that lesser responses in populations of dolphins regularly subjected to high levels of vessel traffic could be a sign of habituation, or it could be that the more sensitive animals in this population previously abandoned the area of higher human activity (Bejder *et al.,* 2006a).

Population characteristics (*e.g.,* whether a population is open or closed to immigration and emigration) can influence sensitivity to disturbance as well; closed populations could not withstand a higher probability of disturbance compared to open populations with no limitation on food (New *et al.,* 2020). Predicting population trends or long-term displacement patterns due to anthropogenic disturbance is challenging due to limited information and survey data for many species over sufficient spatiotemporal scales, as well as a full understanding of how other factors, such as oceanographic oscillations, affect marine mammal presence (Moore and Barlow, 2013; Barlow, 2016; Moore and Barlow, 2017).

Population models are necessary to understand and link short-term effects to individuals from disturbance (anthropogenic impacts or environmental change) to long-term population consequences. Population models require inputs for the population size and changes in vital rates of the population (*e.g.,* the mean values for survival age, lifetime reproductive success, recruitment of new individuals into the population), to predict changes in population dynamics (*e.g.,* population growth rate). These efforts often rely on bioenergetic models, or energy budget models, which analyze energy intake from food and energy costs for life functions, such as maintenance, growth, and reproduction, either at the individual or population level (Pirotta, 2022), and model sensitivity analyses have identified the most consequential parameters, including prey characteristics, feeding processes, energy expenditure, body size, energy storage, and lactation capability (Pirotta, 2022). However, there is a high level of uncertainty around many parameters in these models (Hütt *et al.,* 2023).

The U.S. National Research Council (NRC) committee on Characterizing Biologically Significant Marine Mammal Behavior developed an initial conceptual model to link acoustic disturbance to population effects and inform data and research needs (NRC, 2005). This Population Consequences of Acoustic Disturbance, or PCAD, conceptual model linked the parameters of sound exposure, behavior change, life function immediately affected, vital rates, and population effects. In its report, the committee found that the relationships between vital rates and population effects were relatively well understood, but that the relationships between the other components of the model were not well-known or easily observed.

Following the PCAD framework (NRC, 2005), an Office of Naval Research (ONR) working group developed the Population Consequences of Disturbance (PCoD), outlining an updated conceptual model of the relationships linking disturbance to changes in behavior and physiology, health, vital rates, and population dynamics. The PCoD model considers all types of disturbance, not solely anthropogenic or acoustic, and incorporates physiological changes, such as stress or injury, along with behavioral changes as a direct result of disturbance (National Academies of Sciences Engineering and Medicine, 2017). In this framework, behavioral and physiological changes can have direct (acute) effects on vital rates, such as when changes in habitat use or increased stress levels raise the probability of mother-calf separation or predation; they can have indirect and long-term (chronic) effects on vital rates, such as when changes in time/energy budgets or increased disease susceptibility affect health, which then affects vital rates; or they can have no effect to vital rates (New *et al.,* 2014; Pirotta *et al.,* 2018a). In addition to outlining this general framework and compiling the relevant literature that supports it, the authors chose four example species for which extensive long-term monitoring data exist (southern elephant seals, NARW, *Ziphiidae* beaked whales, and bottlenose dolphins) and developed state-space energetic models that can be used to forecast longer-term, population-level impacts from behavioral changes. While these models cannot yet be applied broadly to project-specific risk assessments for the majority of species, as well as requiring significant resources and time to conduct (more than is typically available to support regulatory compliance for one project), they are a critical first step towards being able to quantify the likelihood of a population level effect. Since New *et al.* (2014), several publications have described models developed to examine the long-term effects of environmental or anthropogenic disturbance of foraging on various life stages of selected species (sperm whale, Farmer *et al.* (2018); California sea lion, McHuron *et al.* (2018); and blue whale, Pirotta, *et al.* (2018a)).

The PCoD model identifies the types of data that would be needed to assess population-level impacts. These data are lacking for many marine mammal species (Booth *et al.,* 2020). Southall *et al.* (2021) states that future modeling and population simulation studies can help determine population-wide long-term consequences and impact analysis. However, the method to do so is still developing, as there are gaps in the literature, possible sampling biases, and results are rarely ground-truthed, with a few exceptions (Booth *et al.,* 2022; Schwarz *et al.,* 2022). Nowacek *et al.* (2016) reviewed technologies such as passive acoustic monitoring, tagging, and the use of unmanned aerial vehicles which can improve scientists' abilities to study these model inputs and link behavioral changes to individual life functions and ultimately population-level effects. Relevant data needed for improving analyses of population-level consequences resulting from disturbances will continue to be collected during the 7-year period of the LOAs through projects funded by the Navy's Marine Species Monitoring Program. Multiple case studies across marine mammal taxonomic groups have been conducted following the PCoD framework. From these studies, Keen *et al.* (2021) identified themes and contextual factors relevant to assessing impacts to populations due to disturbance, which have been considered in the context of the impacts of the Navy's activities.

A population's movement ecology determines the potential for spatiotemporal overlap with a disturbance. Resident populations or populations that rely on spatially limited habitats for critical life functions (*i.e.,* foraging, breeding) would be at greater risk of repeated or chronic exposure to disturbances than populations that are wide-ranging relative to the footprint of a disturbance (Keen *et al.,* 2021). Even for the same species, differences in habitat use between populations can result in different potential for repeated exposure to individuals for a similar stressor (Costa *et al.,* 2016a). The location and radius of disturbance can impact how many animals are exposed and for how long (Costa *et al.,* 2016b). While some models have shown the advantages of populations with larger ranges, namely the decreased chance of being exposed (Costa *et al.,* 2016b), it is important to consider that for some species, the energetic cost of a longer migration could make a population more sensitive to energy lost through disturbance (Villegas-Amtmann *et al.,* 2017). In addition to ranging patterns, a species' activity budgets and lunging rates can cause variability in their predicted cost of disturbance as well (Pirotta *et al.,* 2021).

Bioenergetics frameworks that examine the impact of foraging disruption on body reserves of individual whales found that rates of daily foraging disruption can predict the number of days to terminal starvation for various life stages (Farmer *et al.,* 2018b). Similarly, when a population is displaced by a stressor, and has access to only areas of poor habitat quality (*i.e.,* low prey abundance) for relocation, bioenergetic models may be more likely to predict starvation, longer recovery times, or extinction (Hin *et al.,* 2023). There is some debate over the use of blubber thickness as a metric of cetacean energy stores and health, as marine mammals may not use their fat stores in a similar manner to terrestrial mammals (Derous *et al.,* 2020).

Resource limitation can impact marine mammal population growth rate regardless of additional anthropogenic disturbance. Stochastic Dynamic Programming models have been used to explore the impact declining prey species has on focal marine mammal predators (McHuron *et al.,* 2023a; McHuron *et al.,* 2023b). A Stochastic Dynamic Programming model determined that a decrease in walleye pollock (*Gadus chalcogrammus*) availability increased the time and distance northern fur seal mothers had to travel offshore, which negatively impacted pup growth rate and wean mass, despite attempts to compensate with longer recovery time on land (McHuron *et al.,* 2023b). Prey is an important factor in long-term consequence models for many species of marine mammals. In disturbance models that predict habitat displacement or otherwise reduced foraging opportunities, populations are being deprived of energy dense prey or ''high quality'' areas which can lead to long-term impacts on fecundity and survival (Czapanskiy *et al.,* 2021; Hin *et al.,* 2019; McHuron *et al.,* 2023a; New *et al.,* 2013b). Prey density limits the energy available for growth, reproduction, and survival. Some disturbance models indicate that the immediate decrease in a portion of the population (*e.g.,* young lactating mothers) is not necessarily detrimental to a population, since as a result, prey availability increases and the population's overall improved body condition reduces the age at first calf (Hin *et al.,* 2021). The timing of a disturbance with seasonally available resources is also important. If a disturbance occurs during periods of low resource availability, the population-level consequences are greater and occur faster than if the disturbance occurs during periods when resource levels are high (Hin *et al.,* 2019). Further, when resources are not evenly distributed, populations with cautious strategies and knowledge of resource variation have an advantage (Pirotta *et al.,* 2020).

Even when modeled alongside several anthropogenic sources of disturbance (*e.g.,* vessel strike, vessel noise, chemical contaminants, sonar), several species of marine mammals are most influenced by lack of prey (Czapanskiy *et al.,* 2021; Murray *et al.,* 2021). Some species like killer whales are especially sensitive to prey abundance due to their limited diet (Murray *et al.,* 2021). The short-term energetic cost of eleven species of cetaceans and mysticetes exposed to MFAS was influenced more by lost foraging opportunities than increased locomotor effort during avoidance (Czapanskiy *et al.,* 2021). Additionally, the model found that mysticetes incurred more energetic cost than odontocetes, even during mild behavioral responses to sonar. These results may be useful in the development of future Population Consequences of Multiple Stressors and PCoD models since they should seek to qualify cetacean health in a more ecologically relevant manner.

PCoD models have been used to assess the impacts of multiple and recurring stressors. A marine mammal population that is already subject to chronic stressors will likely be more vulnerable to acute disturbances. Models that have looked at populations of cetaceans who are exposed to multiple stressors over several years have found that even one major chronic stressor (*e.g.,* epizootic disease, oil spill) has severe impacts on population size. A layer of one or more stressor (*e.g.,* seismic surveys) in addition to a chronic stressor (*e.g.,* an oil spill) can yield devastating impacts on a population. These results may vary based on species and location, as one population may be more impacted by chronic shipping noise, while another population may not. However, just because a population does not appear to be impacted by one chronic stressor (*e.g.,* shipping noise), does not mean they are not affected by others (*e.g.,* disease) (Reed *et al.,* 2020). Recurring or chronic stressors can impact population abundance even when instances of disturbance are short and have minimal behavioral impact on an individual (Farmer *et al.,* 2018a; McHuron *et al.,* 2018b; Pirotta *et al.,* 2019). Some changes to response variables like pup recruitment (survival to age one) are not noticeable for several years, as the impacts on pup survival does not affect the population until those pups are mature but impacts to young animals will ultimately lead to population-wide declines. The severity of the repeated disturbance can also impact a population's long-term reproductive success. Scenarios with severe repeated disturbance (*e.g.,* 95 percent probability of exposure, with 95 percent reduction in feeding efficiency) can severely reduce fecundity and calf survival, while a weaker disturbance (25 percent probability of exposure, with 25 percent reduction in feeding efficiency) had no population-wide effect on vital rates (Pirotta *et al.,* 2019).

Farmer *et al.* (2018a) modeled how an oil spill led to chronic declines in a sperm whale population over 10 years, and if models included even one more stressor (*i.e.,* behavioral responses to air guns), the population declined even further. However, the amount of additional population decline due to acoustic disturbance depended on the way the dose-response of the noise levels were modeled. A single step-function led to higher impacts than a function with multiple steps and frequency weighting. In addition, the amount of impact from both disturbances was mediated when the metric in the model that described animal resilience was changed to increase resilience to disturbance (*e.g.,* able to make up reserves through increased foraging).

Not all stressors have the same impact for all species and all locations. Another model analyzed the effect of a number of chronic disturbances on two bottlenose dolphin populations in Australia over 5 years (Reed *et al.,* 2020). Results indicated that disturbance from fisheries interactions and shipping noise had little overall impact on population abundances in either location, even in the most extreme impact scenarios modeled. At least in this area, other factors (*e.g.,* epizootic scenarios) had the largest impact on population size and fecundity.

Recurring stressors can impact population abundance even when individual instances of disturbance are short and have minimal behavioral impact on an individual. A model on California sea lions introduced a generalized disturbance at different times throughout the breeding cycle, with their behavior response being an increase in the duration of a foraging trip by the female (McHuron *et al.,* 2018b). Very short duration disturbances or responses led to little change, particularly if the disturbance was a single event, and changes in the timing of the event in the year had little effect. However, with even relatively short disturbances or mild responses, when a disturbance was modeled as recurring there were resulting reductions in population size and pup recruitment (survival to age one). Often, the effects weren't noticeable for several years, as the impacts on pup survival did not affect the population until those pups were mature.

Stranding and Mortality

The definition for a stranding under title IV of the MMPA is an event in the wild in which (A) a marine mammal is dead and is (i) on a beach or shore of the United States; or (ii) in waters under the jurisdiction of the United States (including any navigable waters); or (B) a marine mammal is alive and is (i) on a beach or shore of the United States and is unable to return to the water; (ii) on a beach or shore of the United States and, although able to return to the water, is in need of apparent medical attention; or (iii) in the waters under the jurisdiction of the United States (including any navigable waters), but is unable to return to its natural habitat under its own power or without assistance (see 16 U.S.C. 1421h(6)). This definition is useful for considering stranding events even when they occur beyond lands and waters under the jurisdiction of the United States.

Marine mammal strandings have been linked to a variety of causes, such as: (1) illness from exposure to infectious agents, biotoxins, or parasites; (2) starvation; (3) unusual oceanographic or weather events; or (4) anthropogenic causes including fishery interaction, vessel strike, entrainment, entrapment, sound exposure, or combinations of these stressors sustained concurrently or in series. Historically, the cause or causes of most strandings have remained unknown (*e.g.,* Odell *et al.,* 1980), but the development of trained, professional stranding response networks and improved analyses have led to a greater understanding of marine mammal stranding causes (Simeone and Moore, 2018).

Numerous studies suggest that the physiology, behavior, habitat, social relationships, age, or condition of cetaceans may cause them to strand or might predispose them to strand when exposed to another phenomenon. These suggestions are consistent with the conclusions of numerous other studies that have demonstrated that combinations of dissimilar stressors commonly combine to kill an animal or dramatically reduce its fitness, even though one exposure without the other does not produce the same result (Bernaldo de Quiros *et al.,* 2019; Chroussos, 2000; Creel, 2005 Fair and Becker, 2000; Moberg, 2000; Relyea, 2005a; 2005b, Romero, 2004; Sih *et al.,* 2004).

Historically, stranding reporting and response efforts have been inconsistent, although significant improvements have occurred over the last 25 years. Reporting forms for basic (''Level A'') information, rehabilitation disposition, and human interaction have been standardized nationally are available at: *https://www.fisheries.noaa.gov/national/marine-mammal-protection/level-data-collection-marine-mammal-stranding-events.* However, data collected beyond basic information varies by region (and may vary from case to case) and are not standardized across the United States. Logistical conditions such as weather, time, location, and decomposition state may also affect the ability of the stranding network to thoroughly examine a specimen (Carretta *et al.,* 2023; Moore *et al.,* 2013). While the investigation of stranded animals provides insight into the types of threats marine mammal populations face, full investigations are possible and conducted only on a small fraction of the total number of strandings that occur, limiting our understanding of the causes of strandings (Carretta *et al.,* 2016a). Additionally, and due to the variability in effort and data collected, the ability to interpret long-term trends in stranded marine mammals is complicated.

In the United States from 2006 to 2022, there were 27,781 cetacean strandings and 79,572 pinniped strandings (107,353 total) (P. Onens, NMFS, *pers comm.,* 2024). Several mass strandings (strandings that involve two or more individuals of the same species, excluding a single mother-calf pair) that have occurred over the past two decades have been associated with anthropogenic activities that introduced sound into the marine environment such as naval operations and seismic surveys. An in-depth discussion of strandings can be found in the Navy's Technical Report on Marine Mammal Strandings Associated with U.S. Navy Sonar Activities (U.S. Navy Marine Mammal Program and Space and Naval

Warfare Systems Command Center Pacific, 2017b).

Worldwide, there have been several efforts to identify relationships between cetacean mass stranding events and military active sonar (Cox *et al.,* 2006; Hildebrand, 2004; Taylor *et al.,* 2004). D'Amico *et al.* (2009) reviewed beaked whale stranding data compiled primarily from the published literature, which provides an incomplete record of stranding events, as many are not written up for publication, along with unpublished information from some regions of the world.

Most of the stranding events reviewed by the International Whaling Commission involved beaked whales. A mass stranding of goose-beaked whales in the eastern Mediterranean Sea occurred in 1996 (Frantzis, 1998), and mass stranding events involving Gervais' beaked whales, Blainville's beaked whales, and goose-beaked whales occurred off the coast of the Canary Islands in the late 1980s (Simmonds and Lopez-Jurado, 1991). The stranding events that occurred in the Canary Islands and Kyparissiakos Gulf in the late 1990s and the Bahamas in 2000 have been the most intensively-studied mass stranding events and have been associated with naval maneuvers involving the use of tactical sonar. Other cetacean species with naval sonar implicated in stranding events include harbor porpoise (Norman *et al.,* 2004, Wright *et al.,* 2013) and common dolphin (Jepson *et al.,* 2013).

Strandings Associated With Active Sonar

Over the past 21 years, there have been 5 stranding events coincident with naval MFAS use in which exposure to sonar is believed to have been a contributing factor: (1) Greece (1996); (2) the Bahamas (2000); (3) Madeira (2000); (4) Canary Islands (2002); and (5) Spain (2006) (Cox *et al.,* 2006; Fernandez, 2006; U.S. Navy Marine Mammal Program and Space and Naval Warfare Systems Command Center Pacific, 2017). These 5 mass strandings have resulted in about 40 known cetacean deaths consisting mostly of beaked whales and with close linkages to MFAS activity. In these circumstances, exposure to non-impulsive acoustic energy was considered a potential indirect cause of death of the marine mammals (Cox *et al.,* 2006). Only one of these stranding events, the Bahamas (2000), was associated with exercises conducted by the U.S. Navy. Additionally, in 2004, during the RIMPAC exercises, between 150 and 200 usually pelagic melon-headed whales occupied the shallow waters of Hanalei Bay, Kauaʻi, Hawaii for over 28 hours. NMFS determined that MFAS was a plausible, if not likely, contributing factor in what may have been a confluence of events that led to the Hanalei Bay stranding. A number of other stranding events coincident with the operation of MFAS, including the death of beaked whales or other species (*i.e.,* minke whales, dwarf sperm whales, pilot whales), have been reported; however, the majority have not been investigated to the degree necessary to determine the cause of the stranding. Most recently, the Independent Scientific Review Panel investigating potential contributing factors to a 2008 mass stranding of melon-headed whales in Antsohihy, Madagascar released its final report suggesting that the stranding was likely initially triggered by an industry seismic survey (Southall *et al.,* 2013). This report suggests that the operation of a commercial high-powered 12 kHz multibeam echosounder during an industry seismic survey was a plausible and likely initial trigger that caused a large group of melon-headed whales to leave their typical habitat and then ultimately strand as a result of secondary factors such as malnourishment and dehydration. The report indicates that the risk of this particular convergence of factors and ultimate outcome is likely very low but recommends that the potential be considered in environmental planning. Because of the association between tactical MFAS use and a limited number of marine mammal strandings, the Navy and NMFS have been considering and addressing the potential for strandings in association with Navy activities for years. In addition to the proposed mitigation measures intended to more broadly minimize impacts to marine mammals, the Navy will abide by the Notification and Reporting Plan, which sets out notification, reporting, and other requirements when dead, injured, or stranded marine mammals are detected in certain circumstances.

Potential for Stranding From LFA Sonar

Although the confluence of Navy MFAS with the other contributory factors noted in the 2001 NMFS/Navy joint report was identified as the cause of the 2000 Bahamas stranding event, the specific mechanisms that led to that stranding (or the others) are not well understood, and there is uncertainty regarding the ordering of effects that led to the stranding. It is unclear whether beaked whales were directly injured by sound (*e.g.,* acoustically mediated bubble growth, as addressed above) prior to stranding or whether a behavioral response to sound occurred that ultimately caused the beaked whales to be injured and strand.

There is no empirical evidence of strandings of marine mammals associated with the employment of SURTASS LFA sonar since its use began in the early 2000s. Moreover, both the system acoustic characteristics and the operational parameters of SURTASS LFA sonar differ from MFAS. SURTASS LFA sonars use frequencies generally below 1,000 Hz with relatively long signals (pulses) on the order of 60 seconds, while MFAS use frequencies greater than 1,000 Hz with relatively short signals on the order of 1 second. SURTASS LFA sonars involve use of one slower-moving vessel operating far from shore, as opposed to the faster-moving, multi-vessel MFAS training scenarios operating in closer proximity to shore that have coincided with strandings.

Cox *et al.* (2006) provided a summary of common features shared by the stranding events related to MFAS in Greece (1996), Bahamas (2000), and Canary Islands (2002). These included deep water close to land (such as offshore canyons), presence of an acoustic waveguide (surface duct conditions), and periodic sequences of transient pulses (*i.e.,* rapid onset and decay times) generated at depths less than 10 m by sound sources moving at speeds of 2.6 m/second or more during sonar operations (D'Spain *et al.,* 2006). These features are not similar to SURTASS LFA sonar activities. First, the Navy will not test and train with SURTASS LFA sonar such that received levels are greater than 180 dB within 22 km of any coastline, ensuring that sound levels are at reduced levels at a sufficient distance from land. Second, when transmitting, the ship's typical speed is 7.4 km/hr, which is less than those found in Cox *et al.* (2006). Finally, the center of the vertical line array (source) is at a depth of approximately 121.9 m, reducing the sounds that are transmitted at depths above 10 m. Also, the LFA sonar signal is transmitted at depths well below 10 m. While there was an LF component in the Greek stranding in 1996, only MF components were present in the strandings in the Bahamas in 2000, Madeira in 2000, and the Canary Islands in 2002. The International Council for the Exploration of the Sea (ICES) in its ''Report of the Ad-Hoc Group on the Impacts of Sonar on Cetaceans and Fish'' raised the same issues as Cox *et al.* (2006), stating that the consistent association of MF sonar in the Bahamas, Madeira, and Canary Islands strandings suggest that it was the MF component, not the LF component, in the NATO sonar that triggered the Greek stranding of 1996 (ICES, 2005). The ICES (2005) report concluded that no strandings, injury, or major behavioral change have been associated with the exclusive use of LF sonar.

From the commencement of SURTASS LFA sonar use in 2002 through the present, neither LFA sonar nor operation of the T–AGOS vessels has been associated with any known mass or individual strandings of marine mammals. In addition, the Navy's required monitoring reports indicate that there have been no apparent avoidance reactions observed.

Potential Effects of Vessel Strike

Vessel strikes of marine mammals can result in death or serious injury of the animal. Wounds resulting from vessel strike may include massive trauma, hemorrhaging, broken bones, or propeller lacerations (Knowlton and Kraus, 2001). An animal at the surface could be struck directly by a vessel, a surfacing animal could hit the bottom of a vessel, or an animal just below the surface could be cut by a vessel's propeller. Superficial strikes may not kill or result in the death of the animal. Lethal interactions are typically associated with large whales, which are occasionally found draped across the bulbous bow of large commercial ships upon arrival in port. Although smaller cetaceans are more maneuverable in relation to large vessels than large whales, they may also be susceptible to strike. The severity of injuries typically depends on the size and speed of the vessel (Knowlton and Kraus, 2001; Laist *et al.,* 2001; Vanderlaan and Taggart, 2007; Conn and Silber, 2013). Impact forces increase with speed, as does the probability of a strike at a given distance (Silber *et al.,* 2010; Gende *et al.,* 2011).

The most vulnerable marine mammals are those that spend extended periods of time at the surface in order to restore oxygen levels within their tissues after deep dives (*e.g.,* the sperm whale; Jaquet and Whitehead, 1996; Watkins *et al.,* 1999). In addition, some baleen whales seem generally unresponsive to vessel sound, making them more susceptible to vessel strikes (Nowacek *et al.,* 2004). These species are primarily large, slow moving whales. Marine mammal responses to vessels may include avoidance and changes in dive pattern (NRC, 2003).

Wounds resulting from vessel strike may include massive trauma, hemorrhaging, broken bones, or propeller lacerations (Knowlton and Kraus, 2001). Impact forces increase with speed as does the probability of a strike at a given distance (Silber *et al.,* 2010; Gende *et al.,* 2011). An examination of all known vessel strikes from all shipping sources (civilian and military) indicates vessel speed is a principal factor in whether a vessel strike results in death or serious injury (Knowlton and Kraus, 2001; Laist *et al.,* 2001; Jensen and Silber, 2003; Pace and Silber, 2005; Vanderlaan and Taggart, 2007). In assessing records in which vessel speed was known, Laist *et al.* (2001) found a direct relationship between the occurrence of a whale strike and the speed of the vessel involved in the collision. The authors concluded that most deaths occurred when a vessel was traveling in excess of 24 km/hr.

Jensen and Silber (2003) detailed 292 records of known or probable vessel strikes of all large whale species from 1975 to 2002. Of these, vessel speed at the time of collision was reported for 58 cases. Of these 58 cases, 39 (or 67 percent) resulted in serious injury or death (19 of those resulted in serious injury as determined by blood in the water, propeller gashes, or severed tailstock, and fractured skull, jaw, vertebrae, hemorrhaging, massive bruising or other injuries noted during necropsy; 20 resulted in death). Operating speeds of vessels that struck various species of large whales ranged from 3.7 to 94.5 km/hr. The majority (79 percent) of these strikes occurred at speeds of 24 km/hr or greater. The average speed that resulted in serious injury or death was 34.4 km/hr. Pace and Silber (2005) found that the probability of death or serious injury increased rapidly with increasing vessel speed. Specifically, the predicted probability of serious injury or death increased from 45 to 75 percent as vessel speed increased from 18.5 to 25.9 km/hr and exceeded 90 percent at 31.5 km/hr. Higher speeds during strikes result in greater force of impact and also appear to increase the chance of severe injuries or death. While modeling studies have suggested that hydrodynamic forces pulling whales toward the vessel hull increase with increasing speed (Clyne, 1999; Knowlton *et al.,* 1995), this is inconsistent with Silber *et al.* (2010), which demonstrated that there is no such relationship (*i.e.,* hydrodynamic forces are independent of speed).

In a separate study, Vanderlaan and Taggart (2007) analyzed the probability of lethal mortality of large whales at a given speed, showing that the greatest rate of change in the probability of a lethal injury to a large whale as a function of vessel speed occurs between 15.9 and 27.8 km/hr. The chances of a lethal injury decline from approximately 80 percent at 27.8 km/hr to approximately 20 percent at 15.9 km/hr. At speeds below 21.9 km/hr, the chances of lethal injury drop below 50 percent, while the probability asymptotically increases toward 100 percent above 27.8 km/hr. Garrison *et al.* (2025) reviewed and updated available data on whale-vessel interactions in U.S. waters to determine the effects of vessel speed and size on lethality of strikes of large whales and found vessel size class had a significant effect on the probability of lethality. Decreasing vessel speeds reduced the likelihood of a lethal outcome for all vessel size classes modeled, with the strongest effect for vessels less than 108 m long. Notably, the probability that a strike by a very large (*i.e.,* in length) vessel will be lethal exceeded 0.80 at speeds greater than 9.26 km/hr (Garrison *et al.,* 2025). As described previously, T–AGOS vessels are 72–86 m long, have a catamaran-type split-hull shape, an enclosed propeller system, operate at a typical speed of 7.4 km/hr, and transit at a maximum speed of approximately 22.2 km/hr. Further, they operate at distances beyond 22 km from shore (where marine mammals are less dense) and outside of OBIAs where large whales are known to concentrate.

The Jensen and Silber (2003) report notes that the database represents a minimum number of strikes, because the vast majority probably goes undetected or unreported. In contrast, Navy vessels are likely to detect any strike that does occur because of the required personnel training and Lookouts (as described in the Proposed Mitigation Measures section), and they are required to report all vessel strikes involving marine mammals. The Navy has never reported any marine mammals being struck by SURTASS LFA sonar vessels (T–AGOS).

Between 2007 and 2009, the Navy developed and distributed additional training, mitigation, and reporting tools to Navy operators to improve marine mammal protection and to ensure compliance with permit requirements. In 2009, the Navy implemented Marine Species Awareness Training designed to improve effectiveness of visual observation for marine mammals and other marine resources. In subsequent years, the Navy issued refined policy guidance on vessel strikes in order to collect the most accurate and detailed data possible in response to a possible incident (also see the Notification and Reporting Plan for this proposed rule). In 2021, the Navy created a new SURTASS-specific Marine Species Awareness Training module, developed by civilian marine biologists and approved by NMFS. This video-based training provides information on marine species sighting cues, visual observation tools and techniques for SURTASS vessels, and sighting notification procedures. It is designed as a complement to the U.S. Navy Lookout Training Handbook adapted to SURTASS vessel training and testing. The module is required for ship masters, bridge watchstanders, and lookout personnel. For over a decade, the Navy has implemented the Protective Measures Assessment Protocol (PMAP) software tool, which provides operators with notification of the required mitigation and a visual display of the planned training or testing activity location overlaid with relevant environmental data.

Marine Mammal Habitat

The proposed training and testing activities could potentially affect marine mammal habitat through the introduction of impacts to the prey species of marine mammals, acoustic habitat (sound in the water column), water quality, and biologically important habitat for marine mammals. Each of these potential effects was considered in the 2025 SURTASS Draft SEIS/OEIS and was determined not to have adverse effects on marine mammal habitat. Based on the information below and the supporting information included in the 2025 SURTASS Draft SEIS/OEIS, NMFS has determined that the proposed training and testing activities would not have adverse or long-term impacts on marine mammal habitat.

Effects on Prey

Sound may affect marine mammals through impacts on the abundance, behavior, or distribution of prey species (*e.g.,* crustaceans, cephalopods, fishes, zooplankton). Marine mammal prey varies by species, season, and location and, for some species, is not well-documented. Here, we describe studies regarding the effects of noise on known marine mammal prey.

Fishes utilize the soundscape and components of sound in their environment to perform important functions such as foraging, predator avoidance, mating, and spawning (Zelick *et al.,* 1999; Fay, 2009). The most likely effects on fishes exposed to loud, intermittent, low-frequency sounds are behavioral responses (*i.e.,* flight or avoidance). Short duration, impulsive sounds (such as impact pile driving or seismic air guns) can cause overt or subtle changes in fish behavior and local distribution (*e.g.,* van der Knapp *et al.,* 2021; van der Knaap *et al.,* 2022; Jarriel *et al.,* 2025). The response of fishes to acoustic sources depends on the physiological state of the fish, past exposures, motivation (*e.g.,* feeding, spawning, migration), and other environmental factors. Key impacts to fishes from exposure to underwater noise may include behavioral responses, hearing damage, barotrauma (*i.e.,* pressure-related injuries), and, in some cases, mortality. While it is clear that the behavioral responses of individual prey, such as displacement or other changes in distribution, can have direct impacts on the foraging success of marine mammals, the effects on marine mammals of individual prey that experience hearing damage, barotrauma, or mortality is less clear, though obviously population scale impacts that meaningfully reduce the amount of prey available could have more serious impacts.

Fishes, like other vertebrates, have a variety of different sensory systems to glean information from ocean around them (Astrup and Mohl, 1993; Astrup, 1999; Braun and Grande, 2008; Carroll *et al.,* 2017; Hawkins and Johnstone, 1978; Ladich and Popper, 2004; Ladich and Schulz-Mirbach, 2016; Mann, 2016; Nedwell *et al.,* 2004; Popper *et al.,* 2003; Popper *et al.,* 2005). Depending on their hearing anatomy and peripheral sensory structures, which vary among species, fishes hear sounds using pressure and particle motion sensitivity capabilities and detect the motion of surrounding water (Fay *et al.,* 2008; Popper *et al.,* 2022), while terrestrial vertebrates generally detect only pressure. Most marine fishes primarily detect particle motion using the inner ear and lateral line system, while some fishes possess additional morphological adaptations or specializations that can enhance their sensitivity to sound pressure, such as a gas-filled swim bladder (Braun and Grande, 2008; Popper and Fay, 2011; Popper *et al.,* 2022).

Hearing capabilities vary considerably between different fish species with data available for only just over 100 species out of the 34,000 marine and freshwater fish species (Eschmeyer and Fong, 2016). In order to better understand acoustic impacts on fishes, fish hearing groups are defined by species that possess a similar continuum of anatomical features which result in varying degrees of hearing sensitivity (Popper and Hastings, 2009a; Popper *et al.,* 2022). There are four hearing groups defined for all fish species (modified by the Navy from Popper *et al.,* 2014) within this analysis and they include: (1) fishes without a swim bladder (*e.g.,* flatfish, sharks, rays, *etc.*); (2) fishes with a swim bladder not involved in hearing (*e.g.,* salmon, cod, pollock, *etc.*); (3) fishes with a swim bladder involved in hearing (*e.g.,* sardines, anchovy, herring, *etc.*); and (4) fishes with a swim bladder involved in hearing and high-frequency hearing (*e.g.,* shad and menhaden). While hearing studies have not been done on sardines and northern anchovies, it would not be unexpected for them to possess hearing similarities to Pacific herring (up to 2–5 kHz) (Mann *et al.,* 2005). Currently, less data are available to estimate the range of best sensitivity for fishes without a swim bladder. Because most fish species can hear low-frequency sounds (Popper, 2003), they would be expected to be able to hear the low-frequency sonar associated with the proposed activities.

In terms of physiology, multiple scientific studies have documented a lack of mortality or physiological effects to fishes from exposure to low-frequency sonar and other sounds (Cox *et al.,* 2018; Jørgensen *et al.,* 2005; Kane *et al.,* 2010; Kvadsheim and Sevaldsen, 2005; Popper *et al.,* 2007). Techer *et al.* (2017) exposed carp (Cyprinidae family) in floating cages for up to 30 days to low-power 23 and 46 kHz sources without any significant physiological response. Other studies have documented either a lack of TTS in species whose hearing range cannot perceive higher frequency military sonar, or for those species that could perceive sonar-like signals, any TTS experienced would be recoverable (Halvorsen *et al.,* 2012; Ladich and Fay, 2013; Popper and Hastings, 2009a, 2009b; Popper *et al.,* 2014; Smith, 2016). In addition, any sonar-induced TTS to fishes whose hearing range could perceive sonar would occur only in the narrow spectrum of the mid-frequency source (*e.g.,* 3.5 kHz) compared to the species' total hearing range (*e.g.,* 0.01–5 kHz). Overall, military sonar sources are much narrower in terms of source frequency compared to a given fish species' full hearing range (Halvorsen *et al.,* 2012; Jørgensen *et al.,* 2005; Juanes *et al.,* 2017; Kane *et al.,* 2010; Kvadsheim and Sevaldsen, 2005; Popper *et al.,* 2007; Popper and Hawkins, 2016; Watwood *et al.,* 2016).

In terms of behavioral responses, Juanes *et al.* (2017) discuss the potential for negative impacts from anthropogenic soundscapes on fishes, but the author's focus was on broader based sounds such as vessel noise sources. Based on results from Doksaeter *et al.* (2009), Doksaeter *et al.* (2012) and Sivle *et al.* (2012), Sivle *et al.* (2015) created a model in order to report on the possible population-level effects on Atlantic herring from active naval sonar. The authors concluded that the use of naval sonar poses little risk to populations of herring regardless of season, even when the herring populations are aggregated and directly exposed to sonar. Finally, Bruintjes *et al.* (2016) commented that fishes exposed to any short-term noise within their hearing range might initially startle but would quickly return to normal behavior.

For fishes exposed to military sonar, there would be limited sonar use spread out in time and space across large offshore areas such that only small areas are actually ensonified (tens of miles) compared to the total life history distribution of fish prey species. While there would be no probability of mortality or physical injury from low-frequency sonar exposure, there is the potential for minor, temporary changes in behavior among fishes, including increased swimming rate, avoidance of the sound source, or changes in orientation to the sound source. If behavioral effects were to occur, they would be localized and infrequent due to the transient nature of the vessels transmitting LFA sonar. Most acoustic effects, if any, are expected to be short-term and localized (a few seconds or minutes). Long-term consequences for fish populations, including key prey species within the Study Area, would not be expected based on the minor nature and short duration of the behavioral effects; and the low level and short duration (at most, 8 hours per day) of potential exposure to SURTASS LFA sonar.

Vessels and in-water devices do not normally collide with adult fishes, particularly those that are common marine mammal prey, most of which can detect and avoid them. Exposure of fishes to vessel strike stressors is limited to those fish groups that are large, slow-moving, and may occur near the surface, such as ocean sunfish, whale sharks, basking sharks, and manta rays. These species are distributed widely in the Study Area. Any isolated cases of a military vessel striking an individual could injure that individual, impacting the fitness of an individual fish. Vessel strikes would not pose a risk to most of the other marine fish groups, because many fish can detect and avoid vessel movements, making strikes rare and allowing the fish to return to their normal behavior after the ship or device passes. As a vessel approaches a fish, they could have a detectable behavioral or physiological response (*e.g.,* swimming away and increased heart rate) as the passing vessel displaces them. However, such responses are not expected to have lasting effects on the survival, growth, recruitment, or reproduction of these marine fish groups at the population level and therefore would not have an impact on marine mammal species as prey items.

In addition to fishes, prey sources such as marine invertebrates could potentially be impacted by sound stressors as a result of the proposed activities. However, most marine invertebrates' ability to sense sounds is very limited. In most cases, marine invertebrates would not respond to non-impulsive sounds, although they may detect and briefly respond to nearby low-frequency sounds. These short-term responses would likely be inconsequential to invertebrate populations.

Invertebrates appear to be able to detect sounds (Pumphrey, 1950; Frings and Frings, 1967) and are most sensitive to low-frequency sounds (Packard *et al.,* 1990; Budelmann and Williamson, 1994; Lovell *et al.,* 2005; Mooney *et al.,* 2010). Data on response of invertebrates such as squid, another marine mammal prey species, to anthropogenic sound is more limited (de Soto, 2016; Solé *et al.,* 2017; Solé *et al.,* 2023). Solé *et al.* (2017) reported physiological injuries to cuttlefish in cages placed at-sea when exposed during a controlled exposure experiment to low-frequency sources (315 Hz, received levels ranged from 139 to 142 dB re 1 μPa^2 and 400 Hz, 139 to 141 dB re 1 μPa^2). However, Solé *et al.* (2017) deployed 1-second sweeps with a 100 percent duty cycle for 1 hour (dissimilar to SURTASS sources), and the animals were caged, and therefore unable to move away from the sound. The studies do not address the issue of individual displacement outside of a zone of impact when exposed to sound.

Cephalopods have a specialized sensory organ inside the head called a statocyst that may help an animal determine its position in space (orientation) and maintain balance (Budelmann, 1992). Packard *et al.* (1990) showed that cephalopods were sensitive to particle motion, not sound pressure, and Mooney *et al.* (2010) demonstrated that squid statocysts act as an accelerometer through which particle motion of the sound field can be detected. Auditory injuries (lesions occurring on the statocyst sensory hair cells) have been reported upon controlled exposure to low-frequency sounds, suggesting that cephalopods are particularly sensitive to low-frequency sound (Andre *et al.,* 2011; Sole *et al.,* 2013; Leedham *et al.,* 2026). Behavioral responses, such as inking and jetting, have also been reported upon exposure to low-frequency sound (McCauley *et al.,* 2000b; Samson *et al.,* 2014; Solé *et al.,* 2023). Squids, like most fishes species, are likely more sensitive to low frequency sounds (Mooney *et al.,* 2010). Cumulatively for squid as a prey species, individual and population impacts from exposure to Navy sonar, like fishes, are not likely to be significant.

Vessels have the potential to impact marine invertebrates by disturbing the water column or sediments, or directly striking organisms (Bishop, 2008). The propeller wash (water displaced by propellers used for propulsion) from vessel movement and water displaced from vessel hulls can potentially disturb marine invertebrates in the water column and is a likely cause of zooplankton mortality (Bickel *et al.,* 2011). The localized and short-term exposure to vessels could displace, injure, or kill zooplankton, invertebrate eggs or larvae, and macro-invertebrates. However, mortality or long-term consequences for a few animals are unlikely to have measurable effects on overall populations. Long-term consequences to marine invertebrate populations would not be expected as a result of exposure to sounds of vessels in the Study Area.

Overall, the combined impacts of sound exposure and vessel movement resulting from the proposed activities would not be expected to have measurable effects on populations of marine mammal prey species. 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 an impulsive source (air gun noise) exposure are available (Fields *et al.,* 2019, Hawkins *et al.,* 2014, McCauley *et al.,* 2017) and not applicable as the proposed activities involve only a non-impulsive source. The most likely impacts for most prey species in a given area would be temporary avoidance of the area. 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. Long-term consequences to marine invertebrate populations would not be expected as a result of exposure to sounds or vessels in the Study Area.

Acoustic Habitat

Acoustic habitat is the soundscape which encompasses all of the sound present in a particular location and at a particular time, as a whole when considered from the perspective of the animals experiencing it. Animals produce sound for, or listen for sounds produced by, conspecifics (*e.g.,* communication during feeding, mating, and other social activities), other animals (*e.g.,* finding prey or avoiding predators), and the physical environment (*e.g.,* finding suitable habitats, navigating). Together, sounds made by animals and the geophysical environment (*e.g.,* produced by earthquakes, lightning, wind, rain, waves) make up the natural contributions to the total acoustics of a place. These acoustic conditions, termed acoustic habitat, are one attribute of an animal's total habitat.

Soundscapes are also defined by, and acoustic habitat influenced by, the total contribution of anthropogenic sound. This may include incidental emissions from sources such as vessel traffic or may be intentionally introduced to the marine environment for data acquisition purposes (*e.g.,* the use of air gun arrays) or for military training and testing purposes (*e.g.,* the use of sonar and other acoustic sources). Anthropogenic noise varies widely in its frequency, content, duration, and SPL, and these characteristics greatly influence the potential habitat-mediated effects to marine mammals (please also see the previous discussion in the Masking section), which may range from local effects for brief periods of time to chronic effects over large areas and for long durations. Depending on the extent of effects to habitat, animals may alter their communications signals (thereby potentially expending additional energy) or miss acoustic cues (either conspecific or adventitious). Problems arising from a failure to detect cues are more likely to occur when noise stimuli are chronic and overlap with biologically relevant cues used for communication, orientation, and predator/prey detection (Francis and Barber, 2013). For more detail on these concepts see Barber *et al.,* 2009; Pijanowski *et al.,* 2011; Lillis *et al.,* 2014.

The term ''listening area'' refers to the region of ocean over which sources of sound can be detected by an animal at the center of the space. Loss of communication space concerns the area over which a specific animal signal (used to communicate with conspecifics in biologically important contexts such as foraging or mating) can be heard, in noisier relative to quieter conditions (Clark *et al.,* 2009). Lost listening area concerns the more generalized contraction of the range over which animals would be able to detect a variety of signals of biological importance, including eavesdropping on predators and prey (Barber *et al.,* 2009). Such metrics do not, in and of themselves, document fitness consequences for the marine animals that live in chronically noisy environments. Long-term population-level consequences mediated through changes in the ultimate survival and reproductive success of individuals are difficult to study, and particularly so underwater. However, it is increasingly well documented that aquatic species rely on qualities of natural acoustic habitats, with researchers quantifying reduced detection of important ecological cues (*e.g.,* Francis and Barber, 2013; Slabbekoorn *et al.,* 2010) as well as survivorship consequences in several species (*e.g.,* Simpson *et al.,* 2015; Nedelec *et al.,* 2015).

Any anthropogenic noise attributed to SURTASS LFA sonar training and testing activities in the Study Area would be temporary and the affected area would be expected to immediately return to its original state when these activities cease.

Water Quality

Training and testing activities of SURTASS LFA sonar would have no effect on marine sediments as all equipment would only be deployed in the marine water column. No part of the proposed activities would affect seafloor sediments. The execution of the proposed activities would add sound to the ambient ocean environment, and water quality may potentially be affected should pollutants be discharged from T–AGOS vessels into oceanic waters. All equipment is properly maintained in accordance with applicable Navy and legal requirements. All such operating equipment meets Federal water quality standards, where applicable.

Estimated Take of Marine Mammals

This section indicates the number of takes that NMFS is proposing to authorize, which is based on the amount of take that NMFS anticipates is reasonably likely to occur. NMFS coordinated closely with the Navy in the development of their incidental take application and preliminarily agrees that: (1) the methods the Navy has put forth described herein to estimate take (including the model, thresholds, and density estimates); and (2) the resulting numbers are based on the best available science and appropriate for authorization.

Takes would be in the form of harassment only. For this military readiness activity, the MMPA defines ''harassment'' as (1) any act that injures or has the significant potential to injure a marine mammal or marine mammal stock in the wild (Level A harassment); or (2) any act that disturbs or is likely to disturb a marine mammal or marine mammal stock in the wild by causing disruption of natural behavioral patterns, including, but not limited to, migration, surfacing, nursing, breeding, feeding, or sheltering, to a point where the behavioral patterns are abandoned or significantly altered (Level B harassment) (16 U.S.C. 1362(18)(B)).

Proposed authorized takes would primarily be in the form of Level B harassment, as use of the acoustic sources is most likely to result in disruption of natural behavioral patterns to a point where they are abandoned or significantly altered (as defined specifically at the beginning of this section, but referred to generally as behavioral disturbance) for marine mammals, either via direct behavioral disturbance or TTS. There is also the potential for Level A harassment, in the form of auditory injury to result from exposure to SURTASS LFA sonar. Although we analyze the impacts of the potential harassment takes that are proposed for authorization, the proposed mitigation and monitoring measures are expected to minimize the severity of these takes.

Generally speaking, for acoustic impacts NMFS estimates the amount and type of harassment by considering: (1) acoustic thresholds above which NMFS believes the best available science indicates marine mammals would experience behavioral disturbance or incur some degree of temporary or permanent hearing impairment; (2) the area or volume of water that would be ensonified above these levels in a day or event; (3) the density or occurrence of marine mammals within these ensonified areas; and (4) the number of days of activities.

It is important to note that for this SURTASS LFA sonar proposed rule, the Navy, in coordination with NMFS, has elected to change both the acoustic thresholds and the take estimation methodology used to better reflect the best available science and also better align with the analytical methods used in other Navy training and testing rules. Specifically, all of the acoustic thresholds and take calculation methods used here are referred to as ''Phase IV'' and described in the Criteria and Thresholds Technical Report, mirroring those used in analyses supporting the Phase IV AFTT (90 FR 50504, November 7, 2025) and HCTT (90 FR 58810, December 17, 2025) training and testing regulations. Alternatively, in the previous SURTASS LFA sonar rule (84 FR 40132, August 13, 2019), Phase III thresholds were used for acoustic injury prediction, a SURTASS-specific threshold was used to predict behavioral disturbance, and different SURTASS-specific methods and modeling were used in the calculation of take.

Acoustic Thresholds

Using the best available science, NMFS, in coordination with the Navy, has established acoustic thresholds that identify the most appropriate received level of underwater sound above which marine mammals exposed to these sound sources could be reasonably expected to directly incur a disruption in behavior patterns to a point where they are abandoned or significantly altered (equated to onset of Level B harassment), or to incur TTS onset (equated to Level B harassment via the indirect disruptions of behavioral patterns) or AUD INJ onset (equated to Level A harassment).

Hearing Impairment (TTS/AUD INJ)

NMFS' 2024 Technical Guidance (NMFS, 2024) identifies dual criteria to assess AUD INJ (Level A harassment) to five different marine mammal groups (based on hearing sensitivity) as a result of exposure to noise from two different types of sources (impulsive or non-impulsive). The Updated Technical Guidance also identifies criteria to predict TTS, which is not considered injury and falls into the Level B harassment category. The Navy's specified activities include the use of non-impulsive (*i.e.,* sonar) sources.

For the consideration of impacts on hearing in Phase IV of the Navy's at-sea training and testing program (which SURTASS LFA sonar is considered a part of), marine mammals were divided into nine groups for analysis: VLF, LF, HF, VHF, SI, PCW and PCA, and OCW and OCA. For each group, a frequency-dependent weighting function and numeric thresholds for the onset of TTS and the onset of AUD INJ were estimated. The onset of TTS is defined as a TTS of 6 dB measured approximately 2–5 minutes after exposure. A TTS of 40 dB is used as a proxy for the onset of AUD INJ (*i.e.,* it is assumed that exposures beyond those capable of causing 40 dB of TTS have the potential to result in PTS or other auditory injury (*e.g.,* loss of cochlear neuron synapses)). Exposures just sufficient to cause TTS or AUD INJ are denoted as ''TTS onset'' or ''AUD INJ onset'' exposures. Onset levels are treated as step functions or ''all-or-nothing'' thresholds: exposures above the TTS or AUD INJ onset level are assumed to always result in TTS or AUD INJ, while exposures below the TTS or AUD INJ onset level are assumed to not cause TTS or AUD INJ. For non-impulsive exposures, onset levels are specified in frequency-weighted cumulative SEL.

To compare Phase IV weighting functions and TTS/AUD INJ SEL thresholds to those used in Phase III (which are the same as those included in NMFS (2018), which were used to predict TTS and AUD INJ in the previous SURTASS LFA sonar rule (84 FR 40132, August 13, 2019)), both the weighting function shape and the weighted threshold values were considered; the weighted thresholds by themselves indicate the TTS/AUD INJ threshold at only the most susceptible frequency (based on the relevant weighting function). In contrast, the TTS/AUD INJ exposure functions incorporate both the shape of the weighting function and the weighted threshold value and provide the best means of comparing the frequency-dependent TTS/AUD INJ thresholds for Phase III and Phase IV.

The most significant differences between the Phase III functions used in the previous SURTASS LFA sonar rule and the Phase IV functions and thresholds used here include the following:

• Mysticetes were divided into two groups (VLF and LF cetaceans), with the upper hearing limit for the LF cetacean group increased from Phase III to match recent hearing measurements in minke whales (Houser *et al.,* 2024);

• Group names were changed from Phase III to be consistent with Southall *et al.* (2019). Specifically, the Phase III mid-frequency (MF) cetacean group is now designated as the high-frequency (HF) cetacean group, and the group previously designated as high-frequency (HF) cetaceans is now the very-high frequency (VHF) cetacean group;

• For the HF group, Phase IV onset TTS/AUD INJ thresholds are lower compared to Phase III at frequencies below approximately 10 kHz. This is a result of new TTS onset data for dolphins at low frequencies (Finneran *et al.,* 2023);

• For the PCW group, new TTS data for harbor seals (Kastelein *et al.,* 2020a; Kastelein *et al.,* 2020b) resulted in slightly lower TTS/AUD INJ thresholds at high frequencies compared to Phase III; and

• For group OCW, new TTS data for California sea lions (Kastelein *et al.,* 2021b; Kastelein *et al.,* 2022a, 2022b) resulted in significantly lower TTS/AUD INJ thresholds compared to Phase III.

Of note, the thresholds and weighting function for the LF cetacean hearing group in NMFS' 2024 Technical Guidance (NMFS, 2024) match the Navy's VLF cetacean hearing group. However, the weighting function for those hearing groups differs between the two documents (*i.e.,* the Navy's LF cetacean group has a different weighting function from NMFS) due to the Houser *et al.* (2024) minke whale data incorporated into Navy 2024, but not NMFS (2024). While NMFS' 2024 Technical Guidance differs from the criteria that the Navy used to assess AUD INJ and TTS for low-frequency cetaceans, NMFS concurs that the criteria the Navy applied are appropriate for assessing the impacts of their proposed action. The criteria used by the Navy are conservative in that those criteria show greater sensitivity at higher frequencies (*i.e.,* application of those criteria result in a higher amount of estimated take by higher frequency sonars than would result from application of NMFS' 2024 Technical Guidance) which is where more of the take is expected. Of note, the Navy did not request, and NMFS did not authorize, take by Level A harassment in the 2019 SURTASS LFA sonar rule (84 FR 40132, August 13, 2019).

These thresholds (table 4) were developed by compiling and synthesizing the best available science and soliciting input multiple times from both public and peer reviewers. The references, analysis, and methodology used in the development of the thresholds are described in Updated Technical Guidance, which may be accessed at: *https://www.fisheries.noaa.gov/national/marine-mammal-protection/marine-mammal-acoustic-technical-guidance.*

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Table 4 -- Acoustic Thresholds Identifying the Onset of TTS

Group	TTS threshold SEL (weighted)	AUD INJ threshold SEL (weighted)
Very low-frequency (VLF)	177	197
Low-frequency (LF)	177	197
High-frequency (HF)	181	201
Very high-frequency (VHF)	161	181
Phocid carnivores in water (PW)	175	195
Otariid carnivores in water (OW)	179	199

Note: SEL thresholds in dB re 1 μPa^2 s underwater.

Level B Harassment by Behavioral Disturbance

Though significantly driven by received level and distance, the onset of Level B harassment by behavioral disturbance from anthropogenic noise exposure is also informed to varying degrees by other factors and can be difficult to predict (Southall *et al.,* 2007; Ellison *et al.,* 2012). As discussed in the Potential Effects of Specified Activities on Marine Mammals and Their Habitat section, marine mammal responses to sound (some of which are considered disturbances that qualify as take under the MMPA) are highly variable and context specific (*i.e.,* they are affected by differences in acoustic conditions; differences between species and populations; differences in sex, age, reproductive status, or social behavior; and other prior experience of the individuals). This means there is support for considering alternative approaches for estimating Level B behavioral harassment. As noted above, for this proposed rule, the Navy coordinated with NMFS and adopted the acoustic thresholds and take estimation methodology used to predict behavioral harassment used in other Phase 4 Navy rules (described in the Criteria and Thresholds Technical Report), as opposed to the SURTASS-specific thresholds and methodology used in the previous rule (84 FR 40132, August 13, 2019). Specifically, the previous thresholds used were based on a Low Frequency Sonar Scientific Research Project conducted in 1998 and used a ‘‘single ping equivalent’’ metric to predict responses, and a different model, the AIM, was used to model and quantify exposures. As described in the Criteria and Thresholds Technical Report, the Phase IV thresholds and methods used in this proposed rule utilize the best available science.

Despite the rapidly evolving science, there are still challenges in quantifying expected behavioral responses that qualify as take by Level B harassment, especially where the goal is to use one or two predictable indicators (*e.g.,* received level and distance) to predict responses that are also driven by additional factors that cannot be easily incorporated into the thresholds (*e.g.,* context). So, while the criteria used here to identify Level B harassment by behavioral disturbance (referred to *as* ‘‘behavioral harassment thresholds’’) consider the best available science (*e.g.,* incorporating both received level and distance), they also have some built-in factors to address the challenge noted. For example, while duration of observed responses in the data are considered in the thresholds, some of the responses that are informing take thresholds are of a very short duration, such that it is possible some of these responses might not always rise to the level of disrupting behavior patterns to a point where they are abandoned or significantly altered. We describe the application of this behavioral harassment threshold as identifying the maximum number of instances in which marine mammals could be reasonably expected to experience a disruption in behavior patterns to a point where they are abandoned or significantly altered. In summary, we believe these behavioral harassment criteria are the most appropriate method for predicting Level B harassment by behavioral disturbance given the best available science and the associated uncertainty.

In its analysis of impacts associated with sonar acoustic sources (which was coordinated with NMFS), the Navy used an updated approach, as described below. Many of the behavioral responses identified using the Navy’s quantitative analysis are most likely to be of moderate severity as described in the Southall *et al.* (2021) behavioral response severity scale. These ‘‘moderate’’ severity responses were considered significant if they were sustained for the duration of the exposure or longer. Within the Navy’s quantitative analysis, many responses are predicted from exposure to sound that may exceed an animal’s Level B behavioral harassment threshold for only a single exposure (lasting a few seconds) to several minutes, and it is likely that some of the resulting estimated behavioral responses that are counted as Level B harassment would not constitute ‘‘significantly altering or abandoning natural behavioral patterns’’ (*i.e.,* the estimated number of takes by Level B harassment due to behavioral disturbance and response is likely somewhat of an overestimate).

As noted above, the Navy coordinated with NMFS to develop behavioral harassment thresholds specific to their military readiness activities utilizing active sonar that identify at what received level and distance Level B harassment by behavioral disturbance would be expected to result. These behavioral harassment thresholds consist of behavioral response functions (BRFs) and associated distance cut-off conditions, and are also referred to, together, as ‘‘the criteria.’’ These criteria are used to estimate the number of animals that may exhibit a behavioral response that qualifies as take under the MMPA when exposed to sonar and other transducers. The way the criteria were derived is discussed in detail in the Criteria and Thresholds Technical Report. Developing these behavioral harassment criteria involved multiple steps. All peer-reviewed published BRSs conducted both in the field and on captive animals were examined in order to understand the breadth of behavioral responses of marine mammals to sonar and other transducers. Marine mammals were divided into four groups for analysis: (1) mysticetes (all baleen whales); (2) odontocetes (most toothed whales, dolphins, and porpoises); (3) sensitive species (beaked whales and harbor porpoise); and (4) pinnipeds and other marine carnivores (true seals, sea lions, walruses, sea otters, polar bears). For each group, a biphasic BRF was developed using the best available data and Bayesian dose response models developed at the University of St. Andrews. The BRF-based probability of response on the highest SPL (RMS) received level.

The BRFs relate only the highest received level of sound to the probability that an animal will have a behavioral response. The BRFs do not account for the duration or pattern of use of any individual sound source or of the activity as a whole, the number of sound sources that may be operating simultaneously, or how loud the animal may perceive the sonar signal to be based on the frequency of the sonar versus the animal's hearing range.

Criteria for assessing marine mammal behavioral responses to sonars use the metric of highest received sound level (RMS SPL) to evaluate the risk of immediate responses by exposed animals. Currently, there are limited data to develop criteria that include the context of an exposure, characteristics of individual animals, behavioral state, duration of an exposure, sound source duty cycle, and the number of individual sources in an activity (although these factors certainly influence the severity of a behavioral response) and, further, even where certain contextual factors may be predictive where known, it is difficult to reliably predict when such factors will be present.

The BRFs also do not account for distance. At moderate to low received levels the correlation between probability of response and received level is very poor and it appears that other variables mediate behavioral responses (*e.g.,* Ellison *et al.,* 2012) such as the distance between the animal and the sound source. For this analysis, distance between the animal and the sound source (*i.e.,* range) was initially included; however, range was too confounded with received level and therefore did not provide additional information about the possibility of response.

Data suggest that beyond a certain distance, significant behavioral responses are unlikely. At shorter ranges (less than 10 km) some behavioral responses have been observed at received levels below 140 dB re 1 μPa. Thus, proximity may mediate behavioral responses at lower received levels. Since most data used to derive the BRFs are within 10 km of the source, probability of response at farther ranges is not well-represented. Therefore, the source-receiver range must be considered separately to estimate likely significant behavioral responses.

This analysis applies behavioral cut-off conditions to responses predicted using the BRFs. Animals within a specified distance and above a minimum probability of response are assumed to have a significant behavioral response. The cut-off distance is based on the farthest source-animal distance across all known studies where animals exhibited a significant behavioral response. Animals beyond the cut-off distance but with received levels above the sound pressure level associated with a probability of response of 0.50 on the BRF are also assumed to have a significant behavioral response. The actual likelihood of significant behavioral responses occurring beyond the distance cut-off is unknown. Significant behavioral responses beyond 100 km are unlikely based on source-animal distance and attenuated received levels. The behavioral cut-off conditions and additional information on the derivation of the cut-off conditions can be found in table 2.2–3 of the Criteria and Thresholds Technical Report.

The Navy used cutoff distances beyond which the potential of significant behavioral responses (and therefore Level B harassment) is considered to be unlikely (table 5). These distances were determined by examining all available published field observations of behavioral responses to sonar or sonar-like signals that included the distance between the sound source and the marine mammal. Behavioral effects calculations are based on the maximum SPL to which a modeled marine mammal is exposed. There is empirical evidence to suggest that animals are more likely to exhibit significant behavioral responses to moderate levels sounds that are closer and less likely to exhibit behavioral responses when exposed to moderate levels of sound from a source that is far away. To account for this, the Navy has implemented behavioral cutoffs that consider both received sound level and distance from the source. These updated cutoffs conditions are unique to each behavioral hearing group and are outlined in table 5.

Table 5 -- Behavioral Cut-off Conditions for each Behavioral Hearing Group

Behavioral group	Received level associated with p(0.50) on the behavioral response function	Cut-off range
Sensitive Species	133 dB RMS SPL	40 km
Odontocetes	168 dB RMS SPL	15 km
Mysticetes	185 dB RMS SPL	10 km
Pinnipeds	156 dB RMS SPL	5 km

Note: Sensitive Species includes beaked whales and harbor porpoises. The Sensitive Species cut-off range for SURTASS LFA sonar activities is beyond 500 km regardless of received level based on the lowered sensation level of low-frequency sound to these cetaceans and the reduced sensitivity at long distances (*i.e.*, 500 km) as proximity has been shown to be a contextual factor driving behavioral reactions.

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The Navy and NMFS have used the best available science to address the challenging differentiation between significant and non-significant behavioral responses (*i.e.,* whether the behavior has been abandoned or significantly altered such that it qualifies as harassment), but have erred on the cautious side where uncertainty exists (*e.g.,* counting these lower duration responses as take), which likely results in some degree of overestimation of Level B harassment by behavioral disturbance. Therefore, we consider application of these behavioral harassment criteria as identifying the maximum number of instances in which marine mammals could be reasonably expected to experience a disruption in behavior patterns to a point where they are abandoned or significantly altered (*i.e.,* Level B harassment). NMFS has carefully reviewed the criteria (*i.e.,* BRFs and cutoff distances for the species) and agrees that it is the best available science and is the appropriate method to use at this time for determining impacts to marine mammals from military sonar and other transducers and for calculating take and to support the determinations made in this proposed rule. Because this is the most appropriate method for estimating Level B harassment given the best available science and uncertainty on the topic, these numbers of Level B harassment by behavioral disturbance are analyzed in the Preliminary Analysis and Negligible Impact Determination section and would be authorized.

Navy Acoustic Effects Model

NAEMO is the Navy's current standard model for assessing acoustic effects on marine mammals. As noted above, NAEMO includes differences from the AIM model previously used for the SURTASS LFA sonar that support a more accurate acoustic effects analysis based on the best available science. These factors are summarized below.

NAEMO calculates sound energy propagation from sonar and other transducers during military readiness activities and the sound received by animat dosimeters. Animat dosimeters are virtual representations of marine mammals distributed in the area around the modeled activity and each dosimeter records its individual sound ''dose.'' The model bases the distribution of animats over the Study Area on the density values in the Navy Marine Species Density Database (NMSDD) and distributes animats in the water column proportional to the known time that species spend at varying depths. It should be noted that the dive profile research included in the technical report ''Dive Distribution and Group Size Parameters for Marine Species Occurring in the U.S. Navy's Pacific Surveillance Towed Array Sensor System Low Frequency Active Sonar Training and Testing Study Area'' (U.S. Department of the Navy, 2025a/b/c), had to be completed by the fall of 2022 for the majority of marine mammals, before modeling began for the specified activities. As a result, although the technical report was not published until 2025, research for it largely stopped in 2022. Some dive profiles were researched after 2022 (*e.g.,* Indo-Pacific finless porpoise) and include data from 2022 onwards.

The model accounts for environmental variability of sound propagation in both distance and depth when computing the sound level received by the animats in accordance with the process described in the ''Quantifying Acoustic Impacts on Marine Mammals and Sea Turtles: Methods and Analytical Approach for Phase IV Training and Testing'' report.

As described in the *Marine Mammal Density* section, below, the Navy selected 15 representative modeling sites covering the spatial extent of the Study Area to provide representative regional coverage (see figure 1.1–1 of the Density Technical Report). The Navy assumed that use of SURTASS LFA sonar was equally likely at each site, and therefore, it split the total number of SURTASS LFA sonar hours evenly across the 15 modeling sites. The model conducts a statistical analysis based on multiple runs to compute the estimated effects on animals. The number of animats that exceed the thresholds for effects is tallied to provide an estimate of the number of marine mammals that could be affected.

Assumptions in NAEMO intentionally err on the side of overestimation when there are unknowns. The specified activities are modeled as though they would occur regardless of proximity to marine mammals, meaning that the implementation of shutdowns is not modeled or, thereby, considered in the take estimates. For more information on this process, see the discussion in the *Estimated Take from Acoustic Stressors* section below.

The model estimates the acoustic impacts caused by the SURTASS LFA sonar system during individual military readiness activities, with active SURTASS LFA sonar use modeled at 8 hours per day. During any individual modeled event, impacts to individual animats are considered over 24-hour periods. The animats do not represent actual animals, but rather they represent a distribution of animals based on density and abundance data, which allows for a statistical analysis of the number of instances that marine mammals may be exposed to sound levels resulting in an effect. Therefore, the model estimates the number of instances in which an effect threshold was exceeded over the course of a year but does not estimate the number of individual marine mammals that may be impacted over a year (*i.e.,* some marine mammals could be impacted several times, while others would not experience any impact). A detailed explanation of NAEMO is provided in the technical report ''Quantifying Acoustic Impacts on Marine Mammals and Sea Turtles: Methods and Analytical Approach for Phase IV Training and Testing'' (U.S. Department of the Navy, 2024b), hereafter referred to as the Acoustic Impacts Technical Report.

All previous iterations of SURTASS LFA sonar modeling were done using the Marine Acoustics, Inc. software AIM. The Navy elected to transition modeling for SURTASS to NAEMO, as it is the Navy-wide approved acoustic effect model for all at-sea projects. For this proposed action, NAEMO was used to quantify estimated acoustic exposures to marine mammals. AIM, as described in the 2019 SURTASS SEIS/OEIS, and NAEMO are similar in many ways (both models represent each marine species as independent virtual animals called ''animats''), but there are differences:

• Source parameters modeled in NAEMO accurately reflect operational parameters, based on validation from system subject matter experts, and the SL and duty cycle are higher than those used in AIM;

• NAEMO uses the range-dependent Comprehensive Acoustic Simulation System/Gaussian Ray Bundle (CASS–GRAB) for propagation modeling while AIM uses the range-dependent Navy standard parabolic equation (PE);

• NAEMO models propagation at 5-degree bearing resolution, AIM uses a 90-degree resolution;

• NAEMO models to a maximum 500 km distance extent for SURTASS LFA sonar modeling, while AIM models to a 100 dB transmission loss cutoff;

• NAEMO distributes animats and runs simulations for all unique species-stock density layers while AIM used three representative densities for modeling and scales simulation output based on species-stock density for final results;

• Animats are horizontally stationary in NAEMO, while AIM simulates animat movement;

• NAEMO mathematically approximates animal avoidance to sound, while AIM's animal movement did not factor avoidance;

• NAEMO calculates behavioral effect using the maximum SPL an animat is exposed to, while AIM uses a single ping equivalent metric.

Animat avoidance of high SLs was incorporated into NAEMO, with marine mammal avoidance thresholds based on their sensitivity to behavioral response. This process reduces the SEL, defined as the accumulation for a given animat, by reducing the received SPLs of individual exposures based on a spherical spreading calculation from sources on each unique platform in an event. The onset of avoidance was based on the behavioral response functions. Some species that are less sensitive to behavioral response (*i.e.,* most odontocetes and mysticetes) had less reduction in AUD INJ due to avoidance than in the prior analysis, leading to higher AUD INJ estimates. A detailed explanation of animat avoidance in NAEMO is provided in the Acoustic Impacts Technical Report.

As NAEMO interrogates the simulation data in the animat processor, exposures that are both outside the distance cutoff and below the received level cutoff are omitted when determining the maximum SPL for each animat.

The presence of the two cutoff criteria in Phase IV of the Navy's at-sea training and testing program provides an accurate and conservative estimation of behavioral effects, while the estimation of behavioral effects still omits exposures at distances and received levels that would be unlikely to produce a significant behavioral response. NAEMO retains the capability of calculating behavioral effects without the cutoffs applied, depending on user preference.

The modeling methods outlined in the Acoustic Impacts Technical Report are applied to SURTASS LFA with two exceptions: (1) NAEMO methods are applied to 500 km instead of 100 km; and (2) propagation of the array is calculated based on the individual transducers and combined rather than as a point source.

For Phase IV at-sea program modeling efforts for other non-SURTASS LFA acoustic sources, NAEMO modeled out to 100 km for all sources. However, a 2022 analysis of the SURTASS LFA sonar system by the Marine Species Modeling Team at the Naval Undersea Warfare Center determined, based on Phase IV criteria, the standard 100 km modeling extent would be insufficient to capture all behavioral effects on marine species. Both distance and the received level cutoff conditions are considered in determining which exposures are included in the behavioral effects calculation. While the specified distance condition (*i.e.,* the farthest source animal distance across all known studies) for all behavioral hearing groups is within 100 km, sound exposures above the received level cutoff condition (based on the 50 percent value along the behavioral response function) extended outside of 100 km for the SURTASS LFA sonar source for some behavioral hearing groups. Contributing factors to the long propagation distance for the LFA sonar system include the high source level and decreased loss of energy to low-frequency waves from absorption of sound in the ocean in some locations and under some environmental conditions. For SURTASS LFA modeling, NAEMO propagates out to 500 km, regardless of transmission loss, to capture the long transmission range given the low frequency and high apparent source level of the system and ensure that the appropriate received level cutoff condition can be applied for all groups.

SURTASS LFA is a towed array with multiple projectors located at different depths. The sound fields of the individual projectors are independent within a range from the source called the ''near-field.'' Past that range is considered the ''far-field,'' where transmissions from the individual projectors constructively interfere and the sound field behaves like that of a point source at the center point of the array depth. The received level of the array in the far-field is greater than what the received level would be from an individual projector in the far field. Therefore, the array is modeled in the far-field with a source level based on the cumulative energy of the projectors acting together. For the array source level, the effective source level of the system design was used. Effective source level is a theoretical value, hypothetically measured at 1 m from the array on its horizontal axis, calculated from the formula:

$$SL_{array} = SLE + 20\log_{10}N$$

Where:

- SLE = source level of an individual projector
- N = number of projectors

The near-field range was estimated based on the Fresnel distance (Guo *et al.,* 2024), which is dependent on the source frequency and size of the array. The analysis indicated that the near-field range would be within the SURTASS LFA mitigation zone, a small value relative to the 500 km propagation range NAEMO extends to for this source. Because the estimated near-field range is relatively small, NAEMO models SURTASS LFA at all ranges using the effective source level of the array, including within the near field.

Propagation modeling in NAEMO does not apply source level and uses only the frequency, depth, vertical beam width, and relative beam angle (*i.e.,* the vertical directionality of the beam) to create the transmission loss table (see section 4.1 of the Acoustic Impacts Technical Report). For each coordinate point where propagation is modeled for the SURTASS LFA system, NAEMO calculates the transmission loss for each individual projector within the array and combines them into a single transmission loss table. That transmission loss is then applied to a source level in the simulator (see section 4.3 of the Acoustic Impacts Technical Report). The source level, that was applied in NAEMO in both the near- and far-field, was the effective source level of the array, which likely results in an over-estimate of the received level in the near-field.

Range to Effects for Sonar

This section provides range (distance) to effects for sonar (active acoustic sources) to specific acoustic thresholds determined using NAEMO. Ranges are determined by modeling the distance that noise from a source will need to propagate to reach exposure level thresholds specific to a hearing group that will cause behavioral response, TTS, AUD INJ, non-auditory injury, and mortality, as described in the Acoustic Impacts Technical Report. Of note, neither non-auditory injury nor mortality were estimated for SURTASS LFA sonar activities, so they are not discussed further. Ranges to effects (table 6) are utilized to help predict impacts from acoustic sources and assess the benefit of mitigation zones. The ranges-to-effect calculations are bound by a species' maximum dive depth, and only the data for effects at less than or equal to the maximum dive depth of the species is used to estimate impact ranges. Marine mammals exposed within these ranges for the duration shown are predicted to experience the associated effect. Range to effects is important information in not only predicting acoustic impacts, but also in verifying the accuracy of model results against real-world situations and determining adequate mitigation ranges to avoid higher level effects, especially physiological effects to marine mammals.

Ranges to effects for sonar were determined by modeling the distance that sound would need to propagate to reach exposure level thresholds specific to a hearing group that would cause behavioral response, TTS, and AUD INJ, as described in the Criteria and Thresholds Technical Report. The ranges do not account for an animal avoiding a source nor for the movement of the platform, both of which would influence the actual range to onset of auditory effects during an actual exposure.

Table 6 provides the ranges to TTS and AUD INJ for marine mammals from exposure to the sonar system proposed for use (see also appendix B of the application). Due to the lower acoustic thresholds for TTS versus AUD INJ, ranges to TTS are larger. Successive pings can be expected to add together, further increasing the range to the onset of TTS and AUD INJ.

Table 6 -- Ranges to Effects for SURTASS LFA Sonar

Hearing group	Range to TTS	Range to AUD INJ
VLF	65,097 m (21,323 m)	1,000 m (393 m)
LF	3,500 m (14,373 m)	10 m (247 m)
HF	0 m (70 m)	0 m (0 m)
VHF	0 m (0 m)	0 m (0 m)
OW	0 m (0 m)	0 m (0 m)
PW	2,500 m (5,755 m)	0 m (95 m)

Note: Median ranges for an exposure duration of 60 seconds are shown with standard deviation ranges in parentheses. The Navy split the LF functional hearing group into LF and VLF based on Houser *et al.*, (2024); however, NMFS updated acoustic technical guidance (NMFS, 2024) does not include these data, but we have included the VLF group here for reference.

As described in the Level B Harassment by Behavioral Disturbance section, the BRFs relate only the highest received level of sound during an event to the probability that an animal will have a behavioral response. The Navy's analysis applies behavioral cut-off conditions to responses predicted using the BRFs. Animals within a specified distance and above a minimum probability of response are assumed to have a significant behavioral response. The cut-off distance is based on the farthest source animal distance across all known scientific studies where animals exhibited a significant behavioral response. Animals beyond the cut-off distance but with received levels above the sound pressure level associated with a probability of response of 0.50 (denoted p(0.5)) on the BRF are also assumed to have a significant behavioral response. The actual likelihood of significant behavioral reactions occurring beyond the distance cut-off is unknown.

As opposed to defining a specific cut-off distance, previous modeling using AIM propagated SURTASS LFA sonar to wherever there was 100 dB of transmission loss. NAEMO uses the maximum unweighted SPL value of exposures received by an animat to determine the behavioral effects. Cutoff conditions are applied in both distance and received level in NAEMO to determine which exposures are included in the behavioral effects calculation (see appendix C of the application for more information).

The mean, 5th, and 95th percentile behavioral response curves (see figures 2–17 through 2–20 of appendix B to the application) provide the probability of behavioral response as a function of range for the sensitive species (beaked whales), mysticete (all baleen whales), odontocete (most toothed whales, most porpoises, and dolphins), and pinniped (true seals and sea lions) behavioral response groups.

Marine Mammal Density

A quantitative analysis of impacts on a species or stock requires data on their abundance and distribution that may be affected by anthropogenic activities in the potentially impacted area. The most appropriate metric for this type of analysis is density, which is the number of animals present per unit area. Marine species density estimation requires a significant amount of effort to both collect and analyze data to produce a reasonable estimate. Unlike the species observed during surveys for terrestrial wildlife, many marine species spend much of their time submerged and are not easily observed. In order to collect enough sighting data to make reasonable density estimates, multiple observations are required, often in areas that are not easily accessible (*e.g.,* far offshore). Ideally, marine mammal species sighting data would be collected for the specific area and time period (*e.g.,* season) of interest and density estimates derived accordingly. However, in many places, poor weather conditions and high sea states prohibit the completion of comprehensive visual surveys.

For most cetacean species, abundance is estimated using line-transect surveys or mark-recapture studies (*e.g.,* Barlow, 2010; Barlow and Forney, 2007; Bradford *et al.,* 2021; Calambokidis *et al.,* 2008). This is the general approach applied in estimating cetacean abundance in NMFS SARs. Although the single value provides a good average estimate of abundance (*i.e.,* total number of individuals) for a specified area, it does not provide information on the species distribution or concentrations within that area, and it does not estimate density for other timeframes or seasons that were not surveyed. More recently, spatial habitat modeling has been used to estimate cetacean densities (*e.g.,* Becker *et al.,* 2022a, Becker *et al.,* 2022b, Kaschner *et al.,* 2006, Kaschner *et al.,* 2012). These models estimate cetacean density as a continuous function of habitat variables (*e.g.,* sea surface temperature, seafloor depth, *etc.*) and thus allow predictions of cetacean densities on finer spatial scales than traditional line-transect or mark recapture analyses, and for areas that have not been surveyed. Within the geographic area that was modeled, densities can be predicted wherever these habitat variables can be measured or estimated.

Ideally, density data would be available for all species throughout the Study Area year-round, in order to best estimate the impacts of specified activities on marine species. However, in many places, vessel availability, lack of funding, inclement weather conditions, and high sea states prevent the completion of comprehensive year-round surveys. Even with surveys that are completed, poor conditions may result in lower sighting rates for species that would typically be sighted with greater frequency under favorable conditions. Lower sighting rates preclude having an acceptably low uncertainty in the density estimates. A high level of uncertainty, indicating a low level of confidence in the density estimate, is typical for species that are rare or difficult to sight. In areas where survey data are limited or non-existent, known or inferred associations between marine habitat features and the likely presence of specific species are sometimes used to predict densities in the absence of actual animal sightings. Consequently, there is no single source of density data for every area, species, and season because of the fiscal costs, resources, and effort involved in providing enough survey coverage to sufficiently estimate density.

To characterize the marine species density for large oceanic regions, the Navy reviewed, critically assessed, and prioritized existing density estimates from multiple sources, requiring the development of a systematic method for selecting the most appropriate density estimate for each combination of species/stock, area, and season. The Navy obtained published and unpublished marine mammal data from NMFS Science Centers, foreign experts, NMFS-affiliated subject matter experts, and references from across the Pacific and Eastern Indian Oceans, where available. The selection and compilation of the best available marine species density data resulted in the Navy's Marine Species Density Database (NMSDD). The purpose of the Navy's NMSDD is to document the best available sources of density data for marine mammal species occurring in the western and central North Pacific and eastern Indian ocean areas where the SURTASS LFA systems are operated, and to provide a summary of species-specific and area-specific density estimates incorporated into the NMSDD. This database is described in the ''U.S. Navy Marine Species Density Database for the Surveillance Towed Array Sensor System (SURTASS) Low Frequency Active (LFA) Sonar Systems'' technical report (U.S. Department of the Navy, 2024), hereafter referred to as the Density Technical Report. NMFS reviewed all marine mammal densities provided by the Navy prior to use in their acoustic analysis for the current rulemaking process.

To accurately assess the potential effects of SURTASS LFA sonar activities, the Navy selected 15 representative modeling sites covering the spatial extent of the Study Area to provide representative regional coverage (see figure 1.1–1 of the Density Technical Report). Three of the SURTASS modeling sites overlap other Navy study areas: Two of the SURTASS modeling sites (10 and 11) overlap the Hawaii portion of the Hawaii-California Training and Testing (HCTT) Phase IV Study Area and one modeling site (4) is encompassed within the Mariana Islands Training and Testing (MITT) Phase IV Study Area. Marine mammal density estimates used for the recent Phase IV HCTT (U.S. Department of the Navy, 2025a/b/c) and MITT (U.S. Department of the Navy, *in prep.*) environmental planning analyses were also used by the Navy for these three SURTASS modeling sites as they represent the best available density data for these regions.

A variety of density data and density models are needed to develop a density database that encompasses the entirety of the Study Area. Because these data are collected using different methods with varying amounts of accuracy and uncertainty, the Navy has developed a hierarchy to ensure the most accurate data are used when available. The Density Technical Report describes these models in detail and provides detailed explanations of the best available density estimate for each species. The list below describes possible sources of density data in order of preference for cetaceans in the Study Area:

1. Density spatial models are preferred and used when available because they provide spatially-explicit density estimates (typically at 10 km by 10 km spatial resolution) throughout the study area with the least amount of uncertainty. These models (see Becker *et al.,* 2022a, Becker *et al.,* 2022b, Becker *et al.,* 2021, Bradford *et al.,* 2021) predict spatial variability of animal density based on habitat variables (*e.g.,* sea surface temperature, seafloor depth, *etc.*). Density spatial models are developed for areas, species, and, when available, specific timeframes (*e.g.,* months or seasons) with sufficient survey data; therefore, these models cannot be used for species with low numbers of sightings.

2. Stratified design-based density estimates use line-transect survey data with the sampling area divided (*i.e.,* stratified) into sub-regions, and a density is derived for each sub-region (see Barlow, 2016; Barlow and Forney, 2007; Bradford *et al.,* 2021). While geographically stratified density estimates provide a better indication of a species' distribution within the study area, the uncertainty is typically high because each sub-region estimate is based on a smaller stratified segment of the overall survey effort.

3. Design-based density estimations use line-transect survey data collected from ship or aerial surveys designed to cover a specific geographic area (see Carretta *et al.,* 2024). These estimates use the same survey data as stratified design-based estimates but are not segmented into sub-regions, instead providing one estimate for a large, surveyed area.

When interpreting the results of the quantitative analysis, the description provided in a previous technical report, the Density Technical Report for the Phase III Atlantic Fleet Training and Testing Study Area (U.S. Department of the Navy, 2017a), includes a useful reminder: ''It is important to consider that even the best estimate of marine species density is really a model representation of the values of concentration where these animals might occur. Each model is limited to the variables and assumptions considered by the original data source provider. No mathematical model representation of any biological population is perfect and with regards to marine species biodiversity, any single model method will not completely explain the actual distribution and abundance of marine mammal species. It is expected that there would be anomalies in the results that need to be evaluated, with independent information for each case, to support if we might accept or reject a model or portions of the model.''

For pinnipeds, density estimates are not model based and are essentially calculated as an in-water abundance divided by an area. Densities for pinnipeds relied on published data on the abundance, occurrence, and distribution of the species, including data from telemetry studies when available, that enabled the Navy to define spatial strata with greater precision and to better represent species' distribution than in previous analyses.

Except for Hawaiian monk seal, pinniped occurrence in the Study Area is likely only at or near the more northerly sites (1, 2, 5, 8, and 15).

Furthermore, the offshore distribution of several pinniped species with potential occurrence at the northern sites is limited to areas over the continental shelf or is closely tied to the sea ice front and its seasonal progression in the Bering Sea and Sea of Okhotsk. As such, occurrence inside the 250-km buffer defining each site is unlikely or considered extralimital for some species that may occur at the same latitude but inshore of a particular site. For example, spotted seals have a range that extends as far south as Japan (Boveng *et al.,* 2009) and approaches the latitude of site 2; however, their distribution is limited to waters over the continental shelf closer to shore and they are not expected to occur inside the 250 km buffer defining site 2.

Chernook *et al.* (2018) derived spatially explicit densities and estimated abundances for four ice-associated seals off the Kamchatka Peninsula, Russia located west of site 15. The seals (ringed, ribbon, spotted, and bearded) haulout on sea ice in winter and spring when the ice extent is farthest south for pupping, breeding, and molting, depending on the species. Once the ice breaks up and recedes northward, some species haulout on land, others become pelagic in the Bering Sea and Aleutian Islands, and some follow the ice north and remain in the northern Bering Sea and Arctic region. The distribution of seals occupying the Kamchatka Peninsula and nearshore waters in winter and spring remain over the shelf and slope extending from shore to about the 1,000 m depth contour, which is shoreward of the 250 km buffer at site 15. While the densities derived by Chernook *et al.* (2018) are informative, they are not applicable to site 15. Once the sea ice recedes northward in summer, only ribbon seals are expected to be pelagic and occurring within site 15.

Temporal variations in species-specific distribution patterns were incorporated into density estimates to more accurately match pinniped migration and haul-out behaviors that are unique to each species. This resulted in some species' in-water distributions varying by breeding and non-breeding seasons instead of the traditional winter, spring, summer, and fall seasons. Spatial strata to represent the species' seasonal distribution in the density calculation were developed for each species based on published data on habitat preferences and species range maps. The primary factors used to define spatial strata were bathymetry and distance from shore.

The Navy's estimates of abundance (based on density estimates used in the Study Area) are limited to those species or stocks with a stock designation under NMFS' SARs. For some species, the stock assessment for a given species may exceed the Navy's density prediction because those species' home range extends beyond the study area boundaries. For most species in the Study Area, the stock assessment abundance may be much less than the number of animals in the Navy's modeling given that the Study Area extends beyond the U.S. waters covered by the SAR abundance estimate. The primary source of density estimates are geographically specific survey data and either peer-reviewed line-transect estimates or habitat-based density models that have been extensively validated to provide the most accurate estimates possible.

Table 7 through 50 summarize the seasonal density estimates of the marine mammal species and stocks that have confirmed or possible occurrence within the 15 SURTASS LFA sonar modeling areas in the central and western North Pacific Ocean and eastern Indian Ocean. Given that substantial acoustic effects (PTS or auditory injury) would occur closest to the SURTASS LFA sound source, the Navy applied a 250 km buffer around the center of each modeling site to focus on the areas where the most serious impacts and likely the majority of less serious impacts (*e.g.,* behavioral disturbance, including TTS) would occur. This assumption is based on the 1.8 km LFA mitigation zone presented in the 2019 SURTASS SEIS/OEIS (U.S. Department of the Navy, 2019), which is intended to encompass the range to effects for Level A harassment (PTS and AUD INJ) for all species.

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Table 7 -- Summary of Density Values for North Pacific Right Whale in Each of the SURTASS LFA Modeling Sites

Location	Spring	Summer	Fall	Winter
Modeling Site 1	0.00014	0.00004	0.00004	0.00014
Modeling Site 2	0	0	0	0
Modeling Site 3	0	0	0	0
Modeling Site 4	0	0	0	0
Modeling Site 5	0	0	0	0
Modeling Site 6	0	0	0	0
Modeling Site 7	0	0	0	0
Modeling Site 8	0	0	0	0
Modeling Site 9	0	0	0	0
Modeling Site 10	0	0	0	0
Modeling Site 11	0	0	0	0
Modeling Site 12	0	0	0	0
Modeling Site 13	0	0	0	0
Modeling Site 14	0	0	0	0
Modeling Site 15	0.00014	0.00004	0.00004	0.00014

Notes: The units for numerical values are animals/km^2. Spring = March through May, Summer = June through August, Fall = September through November, Winter = December through February, regardless of hemisphere.

Table 8 -- Summary of Density Values for Blue Whale in Each of the SURTASS LFA Modeling Sites

Location	Spring	Summer	Fall	Winter
Modeling Site 1	0.00006	0.00034	0.00034	0.00006
Modeling Site 2	0.00006	0.00034	0.00034	0.00006
Modeling Site 3	0.00006	0.00006	0.00006	0.00006
Modeling Site 4	0.00006	0	0.00006	0.00006
Modeling Site 5	0	0	0	0
Modeling Site 6	0.00006	0.00006	0.00006	0.00006
Modeling Site 7	S	S	S	S
Modeling Site 8	0.00006	0.00034	0.00034	0.00006
Modeling Site 9	0.00006	0	0.00006	0.00006
Modeling Site 10	0.00006	0	0.00006	0.00006
Modeling Site 11	0.00006	0	0.00006	0.00006
Modeling Site 12	S	S	S	S
Modeling Site 13	S	S	S	S
Modeling Site 14	S	S	S	S
Modeling Site 15	0.00006	0.00034	0.00034	0.00006

Notes: The units for numerical values are animals/km^2. S = spatial model with various density values throughout the range. Spring = March through May, Summer = June through August, Fall = September through November, Winter = December through February, regardless of hemisphere.

Table 9 -- Summary of Density Values for Bryde's Whale in Each of the SURTASS LFA Modeling Sites

Location	Spring	Summer	Fall	Winter
Modeling Site 1	0.00065	0.00468	0.00468	0.00065
Modeling Site 2	0.00065	0.00468	0.00468	0.00065
Modeling Site 3	0.0003	0.0003	0.0003	0.0003
Modeling Site 4	0.00041	0.00041	0.00041	0.00041
Modeling Site 5	0.00065	0.00468	0.00468	0.00065
Modeling Site 6	0.0003	0.0003	0.0003	0.0003
Modeling Site 7	S	S	S	S
Modeling Site 8	0.00065	0.00468	0.00468	0.00065
Modeling Site 9	0.00041	0.00041	0.00041	0.00041
Modeling Site 10	S	S	S	S
Modeling Site 11	S	S	S	S
Modeling Site 12	S	S	S	S
Modeling Site 13	S	S	S	S
Modeling Site 14	S	S	S	S
Modeling Site 15	0	0	0	0

Notes: The units for numerical values are animals/km^2. S = spatial model with various density values throughout the range. Spring = March through May, Summer = June through August, Fall = September through November, Winter = December through February, regardless of hemisphere.

Table 10 -- Summary of Density Values for Fin Whale in each of the SURTASS LFA Modeling Sites

Location	Spring	Summer	Fall	Winter
Modeling Site 1	0.00048	0.00139	0.00139	0.00048
Modeling Site 2	0.00048	0.00139	0.00139	0.00048
Modeling Site 3	0.00008	0.00008	0.00008	0.00008
Modeling Site 4	0.00008	0	0.00008	0.00008
Modeling Site 5	0.00048	0.00139	0.00139	0.00048
Modeling Site 6	0.00008	0.00008	0.00008	0.00008
Modeling Site 7	S	0	0	S
Modeling Site 8	0.00048	0.00139	0.00139	0.00048
Modeling Site 9	0.00008	0	0.00008	0.00008
Modeling Site 10	0.00008	0	0.00008	0.00008
Modeling Site 11	0.00008	0	0.00008	0.00008
Modeling Site 12	0	0	0	0
Modeling Site 13	0	0	0	0
Modeling Site 14	0	S	S	0
Modeling Site 15	0.00048	0.00139	0.00139	0.00048

Notes: The units for numerical values are animals/km^2. S = spatial model with various density values throughout the range. Spring = March through May, Summer = June through August, Fall = September through November, Winter = December through February, regardless of hemisphere.

Table 11 -- Summary of Density Values for Humpback Whale in each of the SURTASS LFA Modeling Sites

Location	Spring	Summer	Fall	Winter
Modeling Site 1	0.00068	0.00014	0.00014	0.00068
Modeling Site 2	0.00068	0.00014	0.00014	0.00068
Modeling Site 3	0.00089	0.00089	0.00089	0.00089
Modeling Site 4	S	0	S	S
Modeling Site 5	0	0	0	0
Modeling Site 6	0.00089	0.00089	0.00089	0.00089
Modeling Site 7	S	S	S	S
Modeling Site 8	0.00068	0.00014	0.00014	0.00068
Modeling Site 9	0.00089	0	0.00089	0.00089
Modeling Site 10	S	0	S	S
Modeling Site 11	S	0	S	S
Modeling Site 12	0	0	0	0
Modeling Site 13	0	0	0	0
Modeling Site 14	S	S	S	S
Modeling Site 15	0.00068	0.00014	0.00014	0.00068

Notes: The units for numerical values are animals/km^2. S = spatial model or stratified estimates with various density values throughout the range. Spring = March through May, Summer = June through August, Fall = September through November, Winter = December through February, regardless of hemisphere.

Table 12 -- Summary of Density Values for Antarctic Minke Whale in Each of the SURTASS LFA Modeling Sites

Location	Spring	Summer	Fall	Winter
Modeling Site 1	0	0	0	0
Modeling Site 2	0	0	0	0
Modeling Site 3	0	0	0	0
Modeling Site 4	0	0	0	0
Modeling Site 5	0	0	0	0
Modeling Site 6	0	0	0	0
Modeling Site 7	0	0	0	0
Modeling Site 8	0	0	0	0
Modeling Site 9	0	0	0	0
Modeling Site 10	0	0	0	0
Modeling Site 11	0	0	0	0
Modeling Site 12	0	0	0	0
Modeling Site 13	0	0	0	0
Modeling Site 14	S	S	S	S
Modeling Site 15	0	0	0	0

Notes: The units for numerical values are animals/km^2. S = spatial model with various density values throughout the range. Spring = March through May, Summer = June through August, Fall = September through November, Winter = December through February, regardless of hemisphere.

Table 13 -- Summary of Density Values for Common Minke Whale in each of the SURTASS LFA Modeling Sites

Location	Spring	Summer	Fall	Winter
Modeling Site 1	0.00075	0.00108	0.00108	0.00075
Modeling Site 2	0.00075	0.00108	0.00108	0.00075
Modeling Site 3	0.00663	0.00663	0.00663	0.00663
Modeling Site 4	0.00015	0	0.00015	0.00015
Modeling Site 5	0.00663	0.00663	0.00663	0.00663
Modeling Site 6	0.00663	0.00663	0.00663	0.00663
Modeling Site 7	S	0	0	S
Modeling Site 8	0.00075	0.00108	0.00108	0.00075
Modeling Site 9	0.00015	0	0.00015	0.00015
Modeling Site 10	0.00018	0	0.00018	0.00018
Modeling Site 11	0.00018	0	0.00018	0.00018
Modeling Site 12	S	0	0	S
Modeling Site 13	S	0	0	S
Modeling Site 14	S	S	S	S
Modeling Site 15	0.00075	0.00108	0.00108	0.00075

Notes: The units for numerical values are animals/km^2. S = spatial model with various density values throughout the range. Spring = March through May, Summer = June through August, Fall = September through November, Winter = December through February, regardless of hemisphere.

Table 14 -- Summary of Density Values for Omura's Whale in Each of the SURTASS LFA Modeling Sites

Location	Spring	Summer	Fall	Winter
Modeling Site 1	0	0	0	0
Modeling Site 2	0.00027	0.00027	0.00027	0.00027
Modeling Site 3	0.00003	0.00003	0.00003	0.00003
Modeling Site 4	0.00004	0.00004	0.00004	0.00004
Modeling Site 5	0.00027	0.00027	0.00027	0.00027
Modeling Site 6	0.00003	0.00003	0.00003	0.00003
Modeling Site 7	S	S	S	S
Modeling Site 8	0	0	0	0
Modeling Site 9	0.00004	0.00004	0.00004	0.00004
Modeling Site 10	0	0	0	0
Modeling Site 11	0	0	0	0
Modeling Site 12	S	S	S	S
Modeling Site 13	S	S	S	S
Modeling Site 14	S	S	S	S
Modeling Site 15	0	0	0	0

Notes: The units for numerical values are animals/km^2. S = spatial model with various density values throughout the range. Spring = March through May, Summer = June through August, Fall = September through November, Winter = December through February, regardless of hemisphere.

Table 15 -- Summary of Density Values for Sei Whale in Each of the SURTASS LFA Modeling Sites

Location	Spring	Summer	Fall	Winter
Modeling Site 1	0.00105	0.00179	0.00179	0.00105
Modeling Site 2	0	0	0	0
Modeling Site 3	0	0	0	0
Modeling Site 4	0.00029	0	0.00029	0.00029
Modeling Site 5	0	0	0	0
Modeling Site 6	0	0	0	0
Modeling Site 7	0	0	0	0
Modeling Site 8	0.00105	0.00179	0.00179	0.00105
Modeling Site 9	0.00029	0	0.00029	0.00029
Modeling Site 10	0.00016	0	0.00016	0.00016
Modeling Site 11	0.00016	0	0.00016	0.00016
Modeling Site 12	0	0	0	0
Modeling Site 13	0	0	0	0
Modeling Site 14	S	S	S	S
Modeling Site 15	0.00105	0.00179	0.00179	0.00105

Notes: The units for numerical values are animals/km^2. S = spatial model with various density values throughout the range. Spring = March through May, Summer = June through August, Fall = September through November, Winter = December through February, regardless of hemisphere.

Table 16 -- Summary of Density Values for Sperm Whale in each of the SURTASS LFA Modeling Sites

Location	Spring	Summer	Fall	Winter
Modeling Site 1	0.00174	0.00174	0.00174	0.00174
Modeling Site 2	0.00174	0.00174	0.00174	0.00174
Modeling Site 3	0.00174	0.00174	0.00174	0.00174
Modeling Site 4	0.0162	0.0162	0.0162	0.0162
Modeling Site 5	0.00174	0.00174	0.00174	0.00174
Modeling Site 6	0.00174	0.00174	0.00174	0.00174
Modeling Site 7	S	S	S	S
Modeling Site 8	0.00174	0.00174	0.00174	0.00174
Modeling Site 9	0.0162	0.0162	0.0162	0.0162
Modeling Site 10	S	S	S	S
Modeling Site 11	S	S	S	S
Modeling Site 12	S	S	S	S
Modeling Site 13	S	S	S	S
Modeling Site 14	0.00236	0.00236	0.00236	0.00236
Modeling Site 15	0.00174	0.00174	0.00174	0.00174

Notes: The units for numerical values are animals/km^2. S = spatial model with various density values throughout the range. Spring = March through May, Summer = June through August, Fall = September through November, Winter = December through February, regardless of hemisphere.

Table 17 -- Summary of Density Values for Dwarf Sperm Whale in Each of the SURTASS LFA Modeling Sites

Location	Spring	Summer	Fall	Winter
Modeling Site 1	0.0153	0.0153	0.0153	0.0153
Modeling Site 2	0.0153	0.0153	0.0153	0.0153
Modeling Site 3	0.0153	0.0153	0.0153	0.0153
Modeling Site 4	0.0153	0.0153	0.0153	0.0153
Modeling Site 5	0.0153	0.0153	0.0153	0.0153
Modeling Site 6	0.0153	0.0153	0.0153	0.0153
Modeling Site 7	S	S	S	S
Modeling Site 8	0.0153	0.0153	0.0153	0.0153
Modeling Site 9	0.0153	0.0153	0.0153	0.0153
Modeling Site 10	0.0153	0.0153	0.0153	0.0153
Modeling Site 11	0.0153	0.0153	0.0153	0.0153
Modeling Site 12	S	S	S	S
Modeling Site 13	S	S	S	S
Modeling Site 14	S	S	S	S
Modeling Site 15	0	0	0	0

Notes: The units for numerical values are animals/km^2. S = spatial model with various density values throughout the range. Spring = March through May, Summer = June through August, Fall = September through November, Winter = December through February, regardless of hemisphere.

Table 18 -- Summary of Density Values for Pygmy Sperm Whale in each of the SURTASS LFA Modeling Sites

Location	Spring	Summer	Fall	Winter
Modeling Site 1	0.01719	0.01719	0.01719	0.01719
Modeling Site 2	0.01719	0.01719	0.01719	0.01719
Modeling Site 3	0.01719	0.01719	0.01719	0.01719
Modeling Site 4	0.01719	0.01719	0.01719	0.01719
Modeling Site 5	0.01719	0.01719	0.01719	0.01719
Modeling Site 6	0.01719	0.01719	0.01719	0.01719
Modeling Site 7	S	S	S	S
Modeling Site 8	0.01719	0.01719	0.01719	0.01719
Modeling Site 9	0.01719	0.01719	0.01719	0.01719
Modeling Site 10	0.01719	0.01719	0.01719	0.01719
Modeling Site 11	0.01719	0.01719	0.01719	0.01719
Modeling Site 12	S	S	S	S
Modeling Site 13	S	S	S	S
Modeling Site 14	S	S	S	S
Modeling Site 15	0	0	0	0

Notes: The units for numerical values are animals/km^2. S = spatial model with various density values throughout the range. Spring = March through May, Summer = June through August, Fall = September through November, Winter = December through February, regardless of hemisphere.

Table 19 -- Summary of Density Values for Baird's Beaked Whale in Each of the SURTASS LFA Modeling Sites

Location	Spring	Summer	Fall	Winter
Modeling Site 1	0.02338	0.02338	0.02338	0.02338
Modeling Site 2	0	0	0	0
Modeling Site 3	0	0	0	0
Modeling Site 4	0	0	0	0
Modeling Site 5	0.0178	0.0178	0.0178	0.0178
Modeling Site 6	0	0	0	0
Modeling Site 7	0	0	0	0
Modeling Site 8	0.02338	0.02338	0.02338	0.02338
Modeling Site 9	0	0	0	0
Modeling Site 10	0	0	0	0
Modeling Site 11	0	0	0	0
Modeling Site 12	0	0	0	0
Modeling Site 13	0	0	0	0
Modeling Site 14	0	0	0	0
Modeling Site 15	0.02338	0.02338	0.02338	0.02338

Notes: The units for numerical values are animals/km^2. Spring = March through May, Summer = June through August, Fall = September through November, Winter = December through February, regardless of hemisphere.

Table 20 -- Summary of Density Values for Blainville's Beaked Whale in Each of the SURTASS LFA Modeling Sites

Location	Spring	Summer	Fall	Winter
Modeling Site 1	0	0	0	0
Modeling Site 2	0.00046	0.00046	0.00046	0.00046
Modeling Site 3	0.00046	0.00046	0.00046	0.00046
Modeling Site 4 (north of 15.5 °N)	0.0285	0.0285	0.0285	0.0285
Modeling Site 4 (south of 15.5 °N)	0.00415	0.00415	0.00415	0.00415
Modeling Site 5	0	0	0	0
Modeling Site 6	0.00046	0.00046	0.00046	0.00046
Modeling Site 7	0	S	S	S
Modeling Site 8	0.00046	0.00046	0.00046	0.00046
Modeling Site 9 (north of 15.5 °N)	0.0285	0.0285	0.0285	0.0285
Modeling Site 9 (south of 15.5 °N)	0.00415	0.00415	0.00415	0.00415
Modeling Site 10	0.00046	0.00046	0.00046	0.00046
Modeling Site 11	0.00046	0.00046	0.00046	0.00046
Modeling Site 12	0	S	S	S
Modeling Site 13	0	S	S	S
Modeling Site 14	0	S	S	S
Modeling Site 15	0	0	0	0

Notes: The units for numerical values are animals/km^2. S = spatial model with various density values throughout the range. Spring = March through May, Summer = June through August, Fall = September through November, Winter = December through February, regardless of hemisphere.

Table 21 -- Summary of Density Values for Deraniyagala's Beaked Whale in Each of the SURTASS LFA Modeling Sites

Location	Spring	Summer	Fall	Winter
Modeling Site 1	0	0	0	0
Modeling Site 2	0	0	0	0
Modeling Site 3	0.00119	0.00119	0.00119	0.00119
Modeling Site 4	0.00119	0.00119	0.00119	0.00119
Modeling Site 5	0	0	0	0
Modeling Site 6	0	0	0	0
Modeling Site 7	S	S	S	S
Modeling Site 8	0	0	0	0
Modeling Site 9	0.00119	0.00119	0.00119	0.00119
Modeling Site 10	0	0	0	0
Modeling Site 11	0	0	0	0
Modeling Site 12	S	S	S	S
Modeling Site 13	S	S	S	S
Modeling Site 14	0	0	0	0
Modeling Site 15	0	0	0	0

Notes: The units for numerical values are animals/km^2. S = spatial model with various density values throughout the range. Spring = March through May, Summer = June through August, Fall = September through November, Winter = December through February, regardless of hemisphere.

Table 22 -- Summary of Density Values for Ginkgo-Toothed Beaked Whale in Each of the SURTASS LFA Modeling Sites

Location	Spring	Summer	Fall	Winter
Modeling Site 1	0.00119	0.00119	0.00119	0.00119
Modeling Site 2	0.00119	0.00119	0.00119	0.00119
Modeling Site 3	0.00119	0.00119	0.00119	0.00119
Modeling Site 4	0.00119	0.00119	0.00119	0.00119
Modeling Site 5	0	0	0	0
Modeling Site 6	0.00119	0.00119	0.00119	0.00119
Modeling Site 7	S	S	S	S
Modeling Site 8	0.00119	0.00119	0.00119	0.00119
Modeling Site 9	0.00119	0.00119	0.00119	0.00119
Modeling Site 10	0	0	0	0
Modeling Site 11	0	0	0	0
Modeling Site 12	S	S	S	S
Modeling Site 13	S	S	S	S
Modeling Site 14	0	0	0	0
Modeling Site 15	0	0	0	0

Notes: The units for numerical values are animals/km^2. S = spatial model with various density values throughout the range. Spring = March through May, Summer = June through August, Fall = September through November, Winter = December through February, regardless of hemisphere.

Table 23 -- Summary of Density Values for Goose-Beaked Whale in Each of the SURTASS LFA Modeling Sites

Location	Spring	Summer	Fall	Winter
Modeling Site 1	0.00181	0.00181	0.00181	0.00181
Modeling Site 2	0.00181	0.00181	0.00181	0.00181
Modeling Site 3	0.00181	0.00181	0.00181	0.00181
Modeling Site 4 (north of 15.5 °N)	0.00872	0.00872	0.00872	0.00872
Modeling Site 4 (south of 15.5 °N)	0.00478	0.00478	0.00478	0.00478
Modeling Site 5	0.00181	0.00181	0.00181	0.00181
Modeling Site 6	0.00181	0.00181	0.00181	0.00181
Modeling Site 7	S	S	S	S
Modeling Site 8	0.00181	0.00181	0.00181	0.00181
Modeling Site 9 (north of 15.5 °N)	0.00872	0.00872	0.00872	0.00872
Modeling Site 9 (south of 15.5 °N)	0.00478	0.00478	0.00478	0.00478
Modeling Site 10	0.00181	0.00181	0.00181	0.00181
Modeling Site 11	0.00181	0.00181	0.00181	0.00181
Modeling Site 12	S	S	S	S
Modeling Site 13	S	S	S	S
Modeling Site 14	S	S	S	S
Modeling Site 15	0.0021	0.0021	0.0021	0.0021

Notes: The units for numerical values are animals/km^2. S = spatial model with various density values throughout the range. Spring = March through May, Summer = June through August, Fall = September through November, Winter = December through February, regardless of hemisphere.

Table 24 -- Summary of Density Values for Hubbs' Beaked Whale in Each of the SURTASS LFA Modeling Sites

Location	Spring	Summer	Fall	Winter
Modeling Site 1	0.00267	0.00267	0.00267	0.00267
Modeling Site 2	0	0	0	0
Modeling Site 3	0	0	0	0
Modeling Site 4	0	0	0	0
Modeling Site 5	0	0	0	0
Modeling Site 6	0	0	0	0
Modeling Site 7	0	0	0	0
Modeling Site 8	0.00267	0.00267	0.00267	0.00267
Modeling Site 9	0	0	0	0
Modeling Site 10	0	0	0	0
Modeling Site 11	0	0	0	0
Modeling Site 12	0	0	0	0
Modeling Site 13	0	0	0	0
Modeling Site 14	0	0	0	0
Modeling Site 15	0	0	0	0

Notes: The units for numerical values are animals/km^2. Spring = March through May, Summer = June through August, Fall = September through November, Winter = December through February, regardless of hemisphere.

Table 25 -- Summary of Density Values for Longman's Beaked Whale in Each of the SURTASS LFA Modeling Sites

Location	Spring	Summer	Fall	Winter
Modeling Site 1	0	0	0	0
Modeling Site 2	0.00104	0.00104	0.00104	0.00104
Modeling Site 3	0.00104	0.00104	0.00104	0.00104
Modeling Site 4	0.0075	0.0075	0.0075	0.0075
Modeling Site 5	0	0	0	0
Modeling Site 6	0.00104	0.00104	0.00104	0.00104
Modeling Site 7	S	S	S	S
Modeling Site 8	0.00104	0.00104	0.00104	0.00104
Modeling Site 9	0.0075	0.0075	0.0075	0.0075
Modeling Site 10	0.00104	0.00104	0.00104	0.00104
Modeling Site 11	0.00104	0.00104	0.00104	0.00104
Modeling Site 12	S	S	S	S
Modeling Site 13	S	S	S	S
Modeling Site 14	S	S	S	S
Modeling Site 15	0	0	0	0

Notes: The units for numerical values are animals/km^2. S = spatial model with various density values throughout the range. Spring = March through May, Summer = June through August, Fall = September through November, Winter = December through February, regardless of hemisphere.

Table 26 -- Summary of Density Values for Stejneger's Beaked Whale in Each of the SURTASS LFA Modeling Sites

Location	Spring	Summer	Fall	Winter
Modeling Site 1	0.00267	0.00267	0.00267	0.00267
Modeling Site 2	0	0	0	0
Modeling Site 3	0	0	0	0
Modeling Site 4	0	0	0	0
Modeling Site 5	0.00267	0.00267	0.00267	0.00267
Modeling Site 6	0	0	0	0
Modeling Site 7	0	0	0	0
Modeling Site 8	0.00267	0.00267	0.00267	0.00267
Modeling Site 9	0	0	0	0
Modeling Site 10	0	0	0	0
Modeling Site 11	0	0	0	0
Modeling Site 12	0	0	0	0
Modeling Site 13	0	0	0	0
Modeling Site 14	0	0	0	0
Modeling Site 15	0.00118	0.00118	0.00118	0.00118

Notes: The units for numerical values are animals/km^2. Spring = March through May, Summer = June through August, Fall = September through November, Winter = December through February, regardless of hemisphere.

Table 27 -- Summary of Density Values for False Killer Whale in Each of the SURTASS LFA Modeling Sites

Location	Spring	Summer	Fall	Winter
Modeling Site 1	S	S	S	S
Modeling Site 2	S	S	S	S
Modeling Site 3	S	S	S	S
Modeling Site 4	0.00109	0.00109	0.00109	0.00109
Modeling Site 5	S	S	S	S
Modeling Site 6	S	S	S	S
Modeling Site 7	S	S	S	S
Modeling Site 8	S	S	S	S
Modeling Site 9	S	S	S	S
Modeling Site 10	S	S	S	S
Modeling Site 11 Hawaii Pelagic Stock	S	S	S	S
Modeling Site 11 Main Hawaiian Islands Insular Stock (range specific)	0.00057	0.00057	0.00057	0.00057
Modeling Site 11 Northwestern Hawaiian Islands Stock (range specific)	0.00106	0.00106	0.00106	0.00106
Modeling Site 12	S	S	S	S
Modeling Site 13	S	S	S	S
Modeling Site 14	S	S	S	S
Modeling Site 15	0	0	0	0

Notes: The units for numerical values are animals/km^2. S = spatial model with various density values throughout the range. Spring = March through May, Summer = June through August, Fall = September through November, Winter = December through February, regardless of hemisphere.

Table 28 -- Summary of Density Values for Killer Whale in Each of the SURTASS LFA Modeling Sites

Location	Spring	Summer	Fall	Winter
Modeling Site 1	S	S	S	S
Modeling Site 2	S	S	S	S
Modeling Site 3	S	S	S	S
Modeling Site 4	0.00007	0.00007	0.00007	0.00007
Modeling Site 5	S	S	S	S
Modeling Site 6	S	S	S	S
Modeling Site 7	S	S	S	S
Modeling Site 8	S	S	S	S
Modeling Site 9	S	S	S	S
Modeling Site 10	0.00007	0.00007	0.00007	0.00007
Modeling Site 11	0.00007	0.00007	0.00007	0.00007
Modeling Site 12	S	S	S	S
Modeling Site 13	S	S	S	S
Modeling Site 14	0.001	0.001	0.001	0.001
Modeling Site 15	S	S	S	S

Notes: The units for numerical values are animals/km^2. S = spatial model with various density values throughout the range. Spring = March through May, Summer = June through August, Fall = September through November, Winter = December through February, regardless of hemisphere.

Table 29 -- Summary of Density Values for Melon-Headed Whale in Each of the SURTASS LFA Modeling Sites

Location	Spring	Summer	Fall	Winter
Modeling Site 1	S	S	S	S
Modeling Site 2	S	S	S	S
Modeling Site 3	S	S	S	S
Modeling Site 4	0.00428	0.00428	0.00428	0.00428
Modeling Site 5	S	S	S	S
Modeling Site 6	S	S	S	S
Modeling Site 7	S	S	S	S
Modeling Site 8	S	S	S	S
Modeling Site 9	S	S	S	S
Modeling Site 10	0.01661	0.01661	0.01661	0.01661
Modeling Site 11	0.01661	0.01661	0.01661	0.01661
Modeling Site 12	S	S	S	S
Modeling Site 13	S	S	S	S
Modeling Site 14	S	S	S	S
Modeling Site 15	0	0	0	0

Notes: The units for numerical values are animals/km^2. S = spatial model with various density values throughout the range. Spring = March through May, Summer = June through August, Fall = September through November, Winter = December through February, regardless of hemisphere.

Table 30 -- Summary of Density Values for Pygmy Killer Whale in Each of the SURTASS LFA Modeling Sites

Location	Spring	Summer	Fall	Winter
Modeling Site 1	0.00255	0.00255	0.00255	0.00255
Modeling Site 2	0.00255	0.00255	0.00255	0.00255
Modeling Site 3	0.00255	0.00255	0.00255	0.00255
Modeling Site 4	0.0448	0.0448	0.0448	0.0448
Modeling Site 5	0	0	0	0
Modeling Site 6	0.00255	0.00255	0.00255	0.00255
Modeling Site 7	S	S	S	S
Modeling Site 8	0.00255	0.00255	0.00255	0.00255
Modeling Site 9	0.0448	0.0448	0.0448	0.0448
Modeling Site 10	0.00422	0.00422	0.00422	0.00422
Modeling Site 11	0.00422	0.00422	0.00422	0.00422
Modeling Site 12	S	S	S	S
Modeling Site 13	S	S	S	S
Modeling Site 14	S	S	S	S
Modeling Site 15	0	0	0	0

Notes: The units for numerical values are animals/km^2. S = spatial model with various density values throughout the range. Spring = March through May, Summer = June through August, Fall = September through November, Winter = December through February, regardless of hemisphere.

Table 31 -- Summary of Density Values for Short-Finned Pilot Whale in Each of the SURTASS LFA Modeling Sites

Location	Spring	Summer	Fall	Winter
Modeling Site 1	S	S	S	S
Modeling Site 2	S	S	S	S
Modeling Site 3	S	S	S	S
Modeling Site 4	0.0123	0.0123	0.0123	0.0123
Modeling Site 5	S	S	S	S
Modeling Site 6	S	S	S	S
Modeling Site 7	S	S	S	S
Modeling Site 8	S	S	S	S
Modeling Site 9	S	S	S	S
Modeling Site 10	S	S	S	S
Modeling Site 11	S	S	S	S
Modeling Site 12	S	S	S	S
Modeling Site 13	S	S	S	S
Modeling Site 14	S	S	S	S
Modeling Site 15	0	0	0	0

Notes: The units for numerical values are animals/km^2. S = spatial model with various density values throughout the range. Spring = March through May, Summer = June through August, Fall = September through November, Winter = December through February, regardless of hemisphere.

Table 32 -- Summary of Density Values for Bottlenose Dolphin in Each of the SURTASS LFA Modeling Sites

Location	Spring	Summer	Fall	Winter
Modeling Site 1	S	S	S	S
Modeling Site 2	S	S	S	S
Modeling Site 3	S	S	S	S
Modeling Site 4	0.0185	0.0185	0.0185	0.0185
Modeling Site 5	S	S	S	S
Modeling Site 6	S	S	S	S
Modeling Site 7	S	S	S	S
Modeling Site 8	S	S	S	S
Modeling Site 9	S	S	S	S
Modeling Site 10	S	S	S	S
Modeling Site 11 Oahu Stock (range specific)	0.0282	0.0282	0.0282	0.0282
Modeling Site 11 Maui Nui Stock (range specific)	0.0058	0.0058	0.0058	0.0058
Modeling Site 11 Kauai/Niihau Stock (range specific)	0.0397	0.0397	0.0397	0.0397
Modeling Site 11 Hawaii Island Stock (range specific)	0.0292	0.0292	0.0292	0.0292
Modeling Site 11 Hawaii Pelagic Stock (range specific)	S	S	S	S
Modeling Site 12	S	S	S	S
Modeling Site 13	S	S	S	S
Modeling Site 14	S	S	S	S
Modeling Site 15	0	0	0	0

Notes: The units for numerical values are animals/km^2. S = spatial model with various density values throughout the range. Spring = March through May, Summer = June through August, Fall = September through November, Winter = December through February, regardless of hemisphere.

Table 33 -- Summary of Density Values for Common Dolphin in Each of the SURTASS LFA Modeling Sites

Location	Spring	Summer	Fall	Winter
Modeling Site 1	S	S	S	S
Modeling Site 2	S	S	S	S
Modeling Site 3	S	S	S	S
Modeling Site 4	0	0	0	0
Modeling Site 5	S	S	S	S
Modeling Site 6	S	S	S	S
Modeling Site 7	0	0	0	0
Modeling Site 8	S	S	S	S
Modeling Site 9	0	0	0	0
Modeling Site 10	0	0	0	0
Modeling Site 11	0	0	0	0
Modeling Site 12	0	0	0	0
Modeling Site 13	0	0	0	0
Modeling Site 14	0	0	0	0
Modeling Site 15	0	0	0	0

Notes: The units for numerical values are animals/km^2. S = spatial model with various density values throughout the range. Spring = March through May, Summer = June through August, Fall = September through November, Winter = December through February, regardless of hemisphere.

Table 34 -- Summary of Density Values for Fraser's Dolphin in Each of the SURTASS LFA Modeling Sites

Location	Spring	Summer	Fall	Winter
Modeling Site 1	0	0	0	0
Modeling Site 2	0.01233	0.01233	0.01233	0.01233
Modeling Site 3	0.01233	0.01233	0.01233	0.01233
Modeling Site 4	0.01673	0.01673	0.01673	0.01673
Modeling Site 5	0	0	0	0
Modeling Site 6	0.01233	0.01233	0.01233	0.01233
Modeling Site 7	S	S	S	S
Modeling Site 8	0	0	0	0
Modeling Site 9	0.01233	0.01233	0.01233	0.01233
Modeling Site 10	0.01673	0.01673	0.01673	0.01673
Modeling Site 11	0.01673	0.01673	0.01673	0.01673
Modeling Site 12	S	S	S	S
Modeling Site 13	S	S	S	S
Modeling Site 14	S	S	S	S
Modeling Site 15	0	0	0	0

Notes: The units for numerical values are animals/km^2. S = spatial model with various density values throughout the range. Spring = March through May, Summer = June through August, Fall = September through November, Winter = December through February, regardless of hemisphere.

Table 35 -- Summary of Density Values for Northern Right Whale Dolphin in Each of the SURTASS LFA Modeling Sites

Location	Spring	Summer	Fall	Winter
Modeling Site 1	S	S	S	S
Modeling Site 2	0	0	0	0
Modeling Site 3	0	0	0	0
Modeling Site 4	0	0	0	0
Modeling Site 5	0	0	0	0
Modeling Site 6	0	0	0	0
Modeling Site 7	0	0	0	0
Modeling Site 8	S	S	S	S
Modeling Site 9	0	0	0	0
Modeling Site 10	0	0	0	0
Modeling Site 11	0	0	0	0
Modeling Site 12	0	0	0	0
Modeling Site 13	0	0	0	0
Modeling Site 14	0	0	0	0
Modeling Site 15	S	S	S	S

Notes: The units for numerical values are animals/km^2. S = spatial model with various density values throughout the range. Spring = March through May, Summer = June through August, Fall = September through November, Winter = December through February, regardless of hemisphere.

Table 36 -- Summary of Density Values for Pacific White-Sided Dolphin in Each of the SURTASS LFA Modeling Sites

Location	Spring	Summer	Fall	Winter
Modeling Site 1	S	S	S	S
Modeling Site 2	S	S	S	S
Modeling Site 3	0	0	0	0
Modeling Site 4	0	0	0	0
Modeling Site 5	S	S	S	S
Modeling Site 6	S	S	S	S
Modeling Site 7	0	0	0	0
Modeling Site 8	S	S	S	S
Modeling Site 9	0	0	0	0
Modeling Site 10	0	0	0	0
Modeling Site 11	0	0	0	0
Modeling Site 12	0	0	0	0
Modeling Site 13	0	0	0	0
Modeling Site 14	0	0	0	0
Modeling Site 15	S	S	S	S

Notes: The units for numerical values are animals/km^2. S = spatial model with various density values throughout the range. Spring = March through May, Summer = June through August, Fall = September through November, Winter = December through February, regardless of hemisphere.

Table 37 -- Summary of Density Values for Pantropical Spotted Dolphin in Each of the SURTASS LFA Modeling Sites

Location	Spring	Summer	Fall	Winter
Modeling Site 1	S	S	S	S
Modeling Site 2	S	S	S	S
Modeling Site 3	S	S	S	S
Modeling Site 4	S	S	S	S
Modeling Site 5	S	S	S	S
Modeling Site 6	S	S	S	S
Modeling Site 7	S	S	S	S
Modeling Site 8	S	S	S	S
Modeling Site 9	S	S	S	S
Modeling Site 10	S	S	S	S
Modeling Site 11 Insular Stocks (range specific)	S	S	S	S
Modeling Site 11 Hawaii Pelagic Stock	S	S	S	S
Modeling Site 12	S	S	S	S
Modeling Site 13	S	S	S	S
Modeling Site 14	S	S	S	S
Modeling Site 15	0	0	0	0

Notes: The units for numerical values are animals/km^2. S = spatial model with various density values throughout the range. Spring = March through May, Summer = June through August, Fall = September through November, Winter = December through February, regardless of hemisphere.

Table 38 -- Summary of Density Values for Risso's Dolphin in Each of the SURTASS LFA Modeling Sites

Location	Spring	Summer	Fall	Winter
Modeling Site 1	S	S	S	S
Modeling Site 2	S	S	S	S
Modeling Site 3	S	S	S	S
Modeling Site 4	0.0025	0.0025	0.0025	0.0025
Modeling Site 5	S	S	S	S
Modeling Site 6	S	S	S	S
Modeling Site 7	S	S	S	S
Modeling Site 8	S	S	S	S
Modeling Site 9	S	S	S	S
Modeling Site 10	S	S	S	S
Modeling Site 11	S	S	S	S
Modeling Site 12	S	S	S	S
Modeling Site 13	S	S	S	S
Modeling Site 14	S	S	S	S
Modeling Site 15	0	0	0	0

Notes: The units for numerical values are animals/km^2. S = spatial model with various density values throughout the range. Spring = March through May, Summer = June through August, Fall = September through November, Winter = December through February, regardless of hemisphere.

Table 39 -- Summary of Density Values for Rough-Toothed Dolphin in Each of the SURTASS LFA Modeling Sites

Location	Spring	Summer	Fall	Winter
Modeling Site 1	S	S	S	S
Modeling Site 2	S	S	S	S
Modeling Site 3	S	S	S	S
Modeling Site 4	0.0954	0.0954	0.0954	0.0954
Modeling Site 5	S	S	S	S
Modeling Site 6	S	S	S	S
Modeling Site 7	S	S	S	S
Modeling Site 8	S	S	S	S
Modeling Site 9	S	S	S	S
Modeling Site 10	S	S	S	S
Modeling Site 11	S	S	S	S
Modeling Site 12	S	S	S	S
Modeling Site 13	S	S	S	S
Modeling Site 14	S	S	S	S
Modeling Site 15	0	0	0	0

Notes: The units for numerical values are animals/km^2. S = spatial model with various density values throughout the range. Spring = March through May, Summer = June through August, Fall = September through November, Winter = December through February, regardless of hemisphere.

Table 40 -- Summary of Density Values for Spinner Dolphin in Each of the SURTASS LFA Modeling Sites

Location	Spring	Summer	Fall	Winter
Modeling Site 1	S	S	S	S
Modeling Site 2	S	S	S	S
Modeling Site 3	S	S	S	S
Modeling Site 4	S	S	S	S
Modeling Site 5	S	S	S	S
Modeling Site 6	S	S	S	S
Modeling Site 7	S	S	S	S
Modeling Site 8	S	S	S	S
Modeling Site 9	S	S	S	S
Modeling Site 10	S	S	S	S
Modeling Site 11 Hawaii Island Stock (range specific)	0.07	0.07	0.07	0.07
Modeling Site 11 Oahu/Maui Nui Stock (range specific)	0.023	0.023	0.023	0.023
Modeling Site 11 Kauai/Niihau Stock (range specific)	0.097	0.097	0.097	0.097
Modeling Site 11 Hawaii Pelagic Stock	S	S	S	S
Modeling Site 12	S	S	S	S
Modeling Site 13	S	S	S	S
Modeling Site 14	S	S	S	S
Modeling Site 15	0	0	0	0

Notes: The units for numerical values are animals/km^2. S = spatial model with various density values throughout the range. Spring = March through May, Summer = June through August, Fall = September through November, Winter = December through February, regardless of hemisphere.

Table 41 -- Summary of Density Values for Striped Dolphin in Each of the SURTASS LFA Modeling Sites

Location	Spring	Summer	Fall	Winter
Modeling Site 1	S	S	S	S
Modeling Site 2	S	S	S	S
Modeling Site 3	S	S	S	S
Modeling Site 4	S	S	S	S
Modeling Site 5	S	S	S	S
Modeling Site 6	S	S	S	S
Modeling Site 7	S	S	S	S
Modeling Site 8	S	S	S	S
Modeling Site 9	S	S	S	S
Modeling Site 10	S	S	S	S
Modeling Site 11	S	S	S	S
Modeling Site 12	S	S	S	S
Modeling Site 13	S	S	S	S
Modeling Site 14	S	S	S	S
Modeling Site 15	0	0	0	0

Notes: The units for numerical values are animals/km^2. S = spatial model with various density values throughout the range. Spring = March through May, Summer = June through August, Fall = September through November, Winter = December through February, regardless of hemisphere.

Table 42 -- Summary of Density Values for Dall's Porpoise in Each of the SURTASS LFA Modeling Sites

Location	Spring	Summer	Fall	Winter
Modeling Site 1	S	S	S	S
Modeling Site 2	0	0	0	0
Modeling Site 3	0	0	0	0
Modeling Site 4	0	0	0	0
Modeling Site 5	S	S	S	S
Modeling Site 6	0	0	0	0
Modeling Site 7	0	0	0	0
Modeling Site 8	S	S	S	S
Modeling Site 9	0	0	0	0
Modeling Site 10	0	0	0	0
Modeling Site 11	0	0	0	0
Modeling Site 12	0	0	0	0
Modeling Site 13	0	0	0	0
Modeling Site 14	0	0	0	0
Modeling Site 15	S	S	S	S

Notes: The units for numerical values are animals/km^2. S = spatial model with various density values throughout the range. Spring = March through May, Summer = June through August, Fall = September through November, Winter = December through February, regardless of hemisphere.

Table 43 -- Summary of Density Values for Northern Fur Seal in Each of the SURTASS LFA Modeling Sites

Location	Spring	Summer	Fall	Winter
Modeling Site 1	0.01525	0	0	0.01525
Modeling Site 2	0	0	0	0
Modeling Site 3	0	0	0	0
Modeling Site 4	0	0	0	0
Modeling Site 5	0.1577	0	0	0.368
Modeling Site 6	0	0	0	0
Modeling Site 7	0	0	0	0
Modeling Site 8	0	0	0	0
Modeling Site 9	0	0	0	0
Modeling Site 10	0	0	0	0
Modeling Site 11	0	0	0	0
Modeling Site 12	0	0	0	0
Modeling Site 13	0	0	0	0
Modeling Site 14	0	0	0	0
Modeling Site 15	0.01525	0	0	0.01525

Notes: The units for numerical values are animals/km^2. Spring = March through May, Summer = June through August, Fall = September through November, Winter = December through February, regardless of hemisphere.

Table 44 -- Summary of Density Values for Steller Sea Lion in Each of the SURTASS LFA Modeling Sites

Location	Spring	Summer	Fall	Winter
Modeling Site 1	0	0	0	0
Modeling Site 2	0	0	0	0
Modeling Site 3	0	0	0	0
Modeling Site 4	0	0	0	0
Modeling Site 5	0	0	0	0
Modeling Site 6	0	0	0	0
Modeling Site 7	0	0	0	0
Modeling Site 8	0	0	0	0
Modeling Site 9	0	0	0	0
Modeling Site 10	0	0	0	0
Modeling Site 11	0	0	0	0
Modeling Site 12	0	0	0	0
Modeling Site 13	0	0	0	0
Modeling Site 14	0	0	0	0
Modeling Site 15	S	S	S	S

Notes: The units for numerical values are animals/km^2. S = spatial model with various density values throughout the range. Spring = March through May, Summer = June through August, Fall = September through November, Winter = December through February, regardless of hemisphere. See Burkanov and Loughlin (2005), Holmes *et al.* (2007), and Trites (2021) for more information.

Table 45 -- Summary of Density Values for Bearded Seal in Each of the SURTASS LFA Modeling Sites

Location	Spring	Summer	Fall	Winter
Modeling Site 1	0	0	0	0
Modeling Site 2	0	0	0	0
Modeling Site 3	0	0	0	0
Modeling Site 4	0	0	0	0
Modeling Site 5	0	0	0	0
Modeling Site 6	0	0	0	0
Modeling Site 7	0	0	0	0
Modeling Site 8	0	0	0	0
Modeling Site 9	0	0	0	0
Modeling Site 10	0	0	0	0
Modeling Site 11	0	0	0	0
Modeling Site 12	0	0	0	0
Modeling Site 13	0	0	0	0
Modeling Site 14	0	0	0	0
Modeling Site 15	S	0	0	S

Notes: The units for numerical values are animals/km^2. S = spatial model with various density values throughout the range. Spring = March through May, Summer = June through August, Fall = September through November, Winter = December through February, regardless of hemisphere. See Chernook *et al.* (2018) for more information.

Table 46 -- Summary of Density Values for Harbor Seal in Each of the SURTASS LFA Modeling Sites

Location	Spring	Summer	Fall	Winter
Modeling Site 1	0	0	0	0
Modeling Site 2	0	0	0	0
Modeling Site 3	0	0	0	0
Modeling Site 4	0	0	0	0
Modeling Site 5	0	0	0	0
Modeling Site 6	0	0	0	0
Modeling Site 7	0	0	0	0
Modeling Site 8	0	0	0	0
Modeling Site 9	0	0	0	0
Modeling Site 10	0	0	0	0
Modeling Site 11	0	0	0	0
Modeling Site 12	0	0	0	0
Modeling Site 13	0	0	0	0
Modeling Site 14	0	0	0	0
Modeling Site 15	S	S	S	S

Notes: The units for numerical values are animals/km^2. S = spatial model with various density values throughout the range. Spring = March through May, Summer = June through August, Fall = September through November, Winter = December through February, regardless of hemisphere. See Blanchet *et al.* (2021) and Jefferson *et al.* (2015) for more information.

Table 47 -- Summary of Density Values for Ribbon Seal in Each of the SURTASS LFA Modeling Sites

Location	Spring	Summer	Fall	Winter
Modeling Site 1	0	0	0	0
Modeling Site 2	0	0	0	0
Modeling Site 3	0	0	0	0
Modeling Site 4	0	0	0	0
Modeling Site 5	0	0	0	0
Modeling Site 6	0	0	0	0
Modeling Site 7	0	0	0	0
Modeling Site 8	0	0	0	0
Modeling Site 9	0	0	0	0
Modeling Site 10	0	0	0	0
Modeling Site 11	0	0	0	0
Modeling Site 12	0	0	0	0
Modeling Site 13	0	0	0	0
Modeling Site 14	0	0	0	0
Modeling Site 15	0	0.0871	0.0871	0.0871

Notes: The units for numerical values are animals/km^2. Spring = March through May, Summer = June through August, Fall = September through November, Winter = December through February, regardless of hemisphere.

Table 48 -- Summary of Density Values for Hawaiian Monk Seal in Each of the SURTASS LFA Modeling Sites

Location	Spring	Summer	Fall	Winter
Modeling Site 1	0	0	0	0
Modeling Site 2	0	0	0	0
Modeling Site 3	0	0	0	0
Modeling Site 4	0	0	0	0
Modeling Site 5	0	0	0	0
Modeling Site 6	0	0	0	0
Modeling Site 7	0	0	0	0
Modeling Site 8	0	0	0	0
Modeling Site 9	0	0	0	0
Modeling Site 10	0.00003	0.00003	0.00003	0.00003
Modeling Site 11	S	S	S	S
Modeling Site 12	0	0	0	0
Modeling Site 13	0	0	0	0
Modeling Site 14	0	0	0	0
Modeling Site 15	0	0	0	0

Notes: The units for numerical values are animals/km^2. S = multiple density values throughout the site. Spring = March through May, Summer = June through August, Fall = September through November, Winter = December through February, regardless of hemisphere.

Table 49 -- Summary of Density Values for Ringed Seal in Each of the SURTASS LFA Modeling Sites

Location	Spring	Summer	Fall	Winter
Modeling Site 1	0	0	0	0
Modeling Site 2	0	0	0	0
Modeling Site 3	0	0	0	0
Modeling Site 4	0	0	0	0
Modeling Site 5	0	0	0	0
Modeling Site 6	0	0	0	0
Modeling Site 7	0	0	0	0
Modeling Site 8	0	0	0	0
Modeling Site 9	0	0	0	0
Modeling Site 10	0	0	0	0
Modeling Site 11	0	0	0	0
Modeling Site 12	0	0	0	0
Modeling Site 13	0	0	0	0
Modeling Site 14	0	0	0	0
Modeling Site 15	S	0	0	S

Notes: The units for numerical values are animals/km^2. S = spatial model with various density values throughout the range. Spring = March through May, Summer = June through August, Fall = September through November, Winter = December through February, regardless of hemisphere. See Chernook *et al.* (2018) for more information.

Table 50 -- Summary of Density Values for Spotted Seal in Each of the SURTASS LFA Modeling Sites

Location	Spring	Summer	Fall	Winter
Modeling Site 1	0	0	0	0
Modeling Site 2	0	0	0	0
Modeling Site 3	0	0	0	0
Modeling Site 4	0	0	0	0
Modeling Site 5	0.134	0.0447	0.134	0.134
Modeling Site 6	0	0	0	0
Modeling Site 7	0	0	0	0
Modeling Site 8	0	0	0	0
Modeling Site 9	0	0	0	0
Modeling Site 10	0	0	0	0
Modeling Site 11	0	0	0	0
Modeling Site 12	0	0	0	0
Modeling Site 13	0	0	0	0
Modeling Site 14	0	0	0	0
Modeling Site 15	0	0	0	0

Notes: The units for numerical values are animals/km^2. Spring = March through May, Summer = June through August, Fall = September through November, Winter = December through February, regardless of hemisphere.

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NMFS coordinated with the Navy in the development of its take estimates and concurs that the Navy's approach for density appropriately utilizes the best available science. Later, in the Preliminary Analysis and Negligible Impact Determination section, we assess how the estimated take numbers compare to stock abundance in order to better understand the potential number of individuals impacted, and the rationale for which abundance estimate is used is included there.

Estimated Take From Acoustic Stressors

The 2025 SURTASS Draft SEIS/OEIS considered all SURTASS LFA sonar activities proposed to occur in the Study Area that have the potential to result in the MMPA defined take of marine mammals. The Navy determined that the only stressors that could result in the incidental taking of marine mammals are acoustic (*i.e.,* sonars). NMFS has reviewed the Navy's data and analysis and determined that it is complete and accurate and agrees that acoustic stressors have the potential to result in take by harassment of marine mammals from the specified activities. The estimated take discussed herein would result primarily from marine mammal exposure to SURTASS LFA sonar given the slower attenuation and long distance that the sound would propagate in comparison to the HF/M3 sonar that would operate simultaneously.

The Navy is seeking authorization to take marine mammals incidental to 1,100 hours of SURTASS LFA sonar training per year, which is an increase from the 592 hours estimated for the 2019 regulations; however, this increase does not reflect new or additional training requirements. Instead, it is the result of a change in how the Navy counts an ''hour'' of transmission. Previously, SURTASS LFA sonar hours were calculated by adding the portions of time a sonar emits sound during its ''duty cycle'' (ratio of time the signal is on compared to off). Other Navy sonar systems, such as mid-frequency and high-frequency active sonar, calculate hours based on total ''duration'' time (total time the source is active, including silent periods between pings). To bring SURTASS LFA sonar in line with these other sonar systems, the Navy developed a conversion method that considers various factors including LFA sonar pings, wave trains, and other classified considerations. As a result, the 1,100 hours of annual SURTASS LFA training requested are equivalent to the 592 hours authorized under the previous counting method.

The quantitative analysis process used for the 2025 SURTASS Draft SEIS/OEIS and the application to estimate potential exposures to marine mammals resulting from acoustic stressors is detailed in the Acoustic Impacts Technical Report.

Regarding how avoidance of loud sources is considered in the take estimation, NAEMO does not simulate horizontal animat (*i.e.,* a virtual animal) movement during an event. However, NAEMO approximates marine mammal avoidance of high sound levels due to exposure to sonars in a one-dimensional calculation that scales how far an animat would be from a sound source based on sensitivity to disturbance, swim speed, and avoidance duration. This process reduces the SEL, defined as the accumulation for a given animat, by reducing the received SPL of individual exposures based on a spherical spreading calculation from sources on each unique platform in an event. The onset of avoidance was based on the behavioral response functions. Avoidance speeds and durations were informed by a review of available exposure and baseline data. This method captures a more accurate representation of avoidance by using the received sound levels, distance to platform, and species-specific criteria to calculate potential avoidance for each animat than the previous approach for SURTASS LFA sonar modeling using

AIM. However, this avoidance method may underestimate avoidance of long-duration sources with lower sound levels because it triggers avoidance calculations based on the highest modeled SPL received level exceeding p(0.5) on the BRF, rather than on cumulative exposure. This is because initiation of the avoidance calculation is based on the highest modeled SPL received level over p(0.5) on the BRF. Please see section 4.4.2.2 of the Acoustic Impacts Technical Report.

The ability to reduce cumulative SEL depends on susceptibility to auditory effects, sensitivity to behavioral disturbance, and characteristics of the sonar source, including duty cycle, source level, and frequency. Table 2–2 of appendix B to the application shows the percentage reduction of AUD INJ across the modeled activities in this analysis due to avoidance. The reduction in AUD INJ due to avoidance differs across the proposed action and between auditory and behavioral groups. Groups that are relatively less sensitive to behavioral disturbance compared to susceptibility to auditory effects are less likely to avoid AUD INJ, which include the mysticete and odontocete behavioral groups. Groups that are relatively more sensitive to behavioral disturbance compared to susceptibility to auditory effects are more likely to avoid AUD INJ, which include the Sensitive Species and Pinniped behavioral groups. The reduction in AUD INJ for most groups is less than assumed in prior analyses. Avoidance was able to be applied only for pinnipeds. It is likely that no reduction of AUD INJ could be applied to any other hearing group due to the high source level and low frequency of the SURTASS LFA.

Regarding the consideration of mitigation effectiveness in the take estimation, this quantitative analysis does not reduce model-estimated impacts to account for activity-based mitigation. While the activity-based mitigation is not quantitatively included in the take estimates (which, of note, would result in a reduction in the number of takes), section 2.3.2 of appendix B of the application indicates the percentage of the instances of take where an animal's closest point of approach was within a mitigation zone and, therefore, AUD INJ could potentially be mitigated. Only mysticetes in the VLF and LF hearing groups have at least one model-predicted AUD INJ. The potential mitigation opportunities for VLF and LF hearing groups during SURTASS LFA training and testing activities are 5 percent and 8 percent, respectively. Note that these percentages do not account for other factors, such as the sightability of a given species or viewing conditions.

For additional information on the quantitative analysis process, refer to the Acoustic Impacts Technical Report and appendices B and C of the application.

As a general matter, NMFS does not prescribe the methods for estimating take for any applicant, but we review and ensure that applicants use the best available science, and methodologies that are logical and technically sound. Applicants may use different methods of calculating take (especially when using models) and still get to a result that is representative of the best available science and that allows for a rigorous and accurate evaluation of the effects on the affected populations. There are multiple pieces of the Navy's take estimation methods (*e.g.,* propagation models, animat movement models, and behavioral thresholds). NMFS evaluates the acceptability of these pieces as they evolve and are used in different rules and impact analyses. Some of the pieces of the Navy's take estimation process have been used in Navy incidental take rules since 2009 and have undergone multiple public comment processes. All of them have undergone extensive internal Navy review and comprehensive review by NMFS, which has sometimes resulted in modifications to methods or models.

The Navy uses rigorous review processes (*i.e.,* verification, validation, and accreditation processes; peer and public review) to ensure the data and methodology it uses represent the best available science. For instance, NAEMO is the result of a NMFS-led Center for Independent Experts review of the components used in earlier models. The acoustic propagation component of NAEMO (titled CASS/GRAB) is accredited by the Oceanographic and Atmospheric Master Library (OAML), and many of the environmental variables used in NAEMO come from approved OAML databases and are based on in-situ data collection. The animal density components of NAEMO are base products of the NMSDD, which include animal density components that have been validated and reviewed by a variety of scientists from NMFS Science Centers and academic institutions. Several components of the model, for example, habitat-based density model results for species off Hawaii and California, have been published in several peer-reviewed journals (Becker *et al.,* 2020; Becker *et al.,* 2021; Becker *et al.,* 2022a; Becker *et al.,* 2022b). Additionally, NAEMO simulation components underwent quality assurance and quality control (QA/QC) review and validation for model parts (the scenario builder, acoustic builder, scenario simulator, *etc.*), conducted by qualified statisticians and modelers to ensure accuracy. Other models and methodologies have gone through similar review processes.

In summary, we believe the Navy's methods, including the method for incorporating avoidance, are the most appropriate methods for predicting AUD INJ, non-auditory injury, TTS, and behavioral disturbance. But even with the consideration of avoidance, given some of the more conservative components of the methodology (*e.g.,* the thresholds do not consider ear recovery between pulses), we would describe the application of these methods as identifying the maximum number of instances in which marine mammals would be reasonably expected to be taken through AUD INJ, non-auditory injury, TTS, or behavioral disturbance.

The Navy does not expect physical or non-auditory injury or mortality to any of the marine mammal species in the Study Area due to the proposed activities; therefore, it is not further discussed. Additionally, masking effects from vessel noise during the operation of T–AGOS vessels are not expected to qualify as take.

Based on the methods discussed in the previous sections and NAEMO, the Navy provided their take estimate and request for authorization of takes incidental to the use of acoustic sources for military readiness activities annually (based on the maximum number of activities that could occur per 12-month period) and over the 7-year period, covered by the application. NMFS agrees that the estimates for incidental takes by harassment from SURTASS LFA sonar sources requested for authorization are the maximum number of instances in which marine mammals are reasonably expected to be taken.

Table 51 summarizes the maximum annual and 7-year total amount and type of Level A harassment and Level B harassment that NMFS concurs is reasonably expected to occur by species or stock for SURTASS training and testing activities.

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Table 51 -- Total Annual and 7-year Incidental Take Proposed by Species or Stock by Harassment Type

Species	Stock	Maximum annual Level B harassment	Maximum annual Level A harassment	7-year total Level B harassment	7-year total Level A harassment
North Pacific right whale	NSD	325	2	2,271	11
Blue whale	NSD	1,062	3	7,426	21
Blue whale	Central North Pacific	13	-	83	-
Bryde's whale	NSD	816	1	5,708	5
Bryde's whale	Hawaii	7	-	41	-
Fin whale	NSD	5,738	32	40,165	218
Fin whale	Hawaii	16	-	111	-
Humpback whale	NSD	3	-	13	-
Humpback whale	Hawaii	13	-	79	-
Humpback whale	Western North Pacific	1,133	4	7,926	24
Antarctic minke whale	NSD	48	-	327	-
Minke whale	NSD	3,020	6	21,135	42
Minke whale	Hawaii	3	-	15	-
Omura's whale	NSD	217	1	1,513	3
Sei whale	NSD	2,021	9	14,140	58
Sei whale	Hawaii	5	1	30	1
Sperm whale	NSD	37	-	253	-
Sperm whale	North Pacific	225	-	1,569	-
Sperm whale	Hawaii	15	-	101	-
Dwarf sperm whale	NSD	719	-	5,025	-
Dwarf sperm whale	Hawaii	151	-	1,056	
Pygmy sperm whale	NSD	864	-	6,039	-

Species	Stock	Maximum annual Level B harassment	Maximum annual Level A harassment	7-year total Level B harassment	7-year total Level A harassment
Pygmy sperm whale	Hawaii	152	-	1,058	-
Baird's beaked whale	NSD	64,875	-	454,121	-
Blainville's beaked whale	NSD	61,964	-	433,748	-
Blainville's beaked whale	Hawaii	2,073	-	14,511	-
Deraniyagala's beaked whale	NSD	9,448	-	66,130	-
Ginkgo-toothed beaked whale	NSD	30,342	-	212,384	-
Goose-beaked whale	NSD	111,485	-	780,389	-
Goose-beaked whale	Hawaii	9,185	-	64,291	-
Hubbs' beaked whale	CWP/EIO NSD	25,289	-	177,021	-
Longman's beaked whale	CWP/EIO NSD	69,988	-	489,908	-
Longman's beaked whale	Hawaii	5,017	-	35,116	-
Stejneger's beaked whale	NSD	37,258	-	260,803	-
False killer whale	NSD	60	-	420	-
False killer whale	Main Hawaiian Islands Insular	1	-	1	-
False killer whale	Hawaii Pelagic	7	-	49	-
Killer whale	NSD	173	-	1,206	-
Killer whale	Hawaii	1	-	4	-
Melon-headed whale	NSD	537	-	3,749	-
Melon-headed whale	Hawaiian Islands	107	-	749	-
Pygmy killer whale	NSD	318	-	2,214	-
Pygmy killer whale	Hawaii	32	-	218	-
Short-finned pilot whale	NSD	1,083	-	7,579	-
Short-finned pilot whale	Hawaii	76	-	528	-

Species	Stock	Maximum annual Level B harassment	Maximum annual Level A harassment	7-year total Level B harassment	7-year total Level A harassment
Bottlenose dolphin	NSD	1,901	-	13,299	-
Bottlenose dolphin	Hawaii Pelagic	32	-	215	-
Common dolphin	NSD	1,713	-	11,987	-
Fraser's dolphin	NSD	465	-	3,247	-
Fraser's dolphin	Hawaii	152	-	1,056	-
Northern right whale dolphin	NSD	10	-	67	-
Pacific white-sided dolphin	North Pacific	49	-	342	-
Pantropical spotted dolphin	NSD	2,785	-	19,490	-
Pantropical spotted dolphin	Hawaii Pelagic	233	-	1,626	-
Risso's dolphin	NSD	1,575	-	11,015	-
Risso's dolphin	Hawaii	38	-	262	-
Rough-toothed dolphin	NSD	508	-	3,555	-
Rough-toothed dolphin	Hawaii	299	-	2,092	-
Spinner dolphin	NSD	276	-	1,924	-
Spinner dolphin	Hawaii Pelagic	15	-	98	-
Striped dolphin	NSD	4,327	-	30,277	-
Striped dolphin	Hawaii Pelagic	200	-	1,393	-
Dall's porpoise	NSD	3,020	-	21,130	-
Northern fur seal	NSD	1,296	-	9,067	-
Steller sea lion	Western	1	-	2	-
Bearded seal	Beringia	1	-	1	-
Harbor seal	California	1	-	1	-
Ribbon seal	NSD	37,650	1	263,550	2

Species	Stock	Maximum annual Level B harassment	Maximum annual Level A harassment	7-year total Level B harassment	7-year total Level A harassment
Hawaiian monk seal	Hawaii	1	-	7	-
Ringed seal	NSD	25	-	165	-
Spotted seal	Bering	71	-	487	-

Note: A stock or population listed as NSD is not a designated stock under the MMPA. Zero (0) impacts indicate total less than 0.5 and a dash (-) is a true zero. In some cases where the estimated take within a cell is equal to 1, that value has been rounded up from a value that is less than 0.5 to avoid underestimating potential impacts to a species or stock based on the 7-year rounding rules discussed in section 2.4 of appendix B (PAC SURTASS LFA Acoustic Analysis Report) of the application.

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Table 52 provides estimated take by effect type from sonar (with most take from LFA sonar), including the comparative amounts of TTS and behavioral disturbance for each species or stock annually, noting that if a modeled marine mammal was ''taken'' through exposure to both TTS and behavioral disturbance in the model, it was recorded as a TTS. Of note, a higher proportion of the takes by Level B harassment of mysticetes include the potential for TTS (as compared to other taxa and prior rules) due to a combination of the fact that mysticetes are relatively less sensitive to direct behavioral disturbance and the number of auditory impacts from sonar (both TTS and AUD INJ) have increased for some species since the previous analysis (84 FR 40132, August 13, 2019) largely due to changes in both the acoustic criteria and the modeling approach. We reiterate here that predicted exposures above TTS thresholds, characterized as TTS takes, could also include direct behavioral disturbance and, accordingly, the discussion of behavioral impacts in the Preliminary Analysis and Negligible Impact Determination section considers the total quantified TTS and direct behavioral disturbance takes.

Additionally, the updated Phase IV HF cetacean criteria reflect greater susceptibility to auditory effects at low and mid-frequencies than previously analyzed for the 2019 SURTASS final rule. Consequently, the predicted auditory effects due to sources under 10 kHz, including SURTASS LFA sonar, are substantially higher for this auditory group than in prior analyses of the same activities. Thus, some modeled exposures that would previously have been categorized as significant behavioral responses may now instead be counted as auditory effects (TTS and AUD INJ). For VHF cetaceans, susceptibility to auditory effects has not changed substantially since the prior analysis.

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Table 52 -- Annual and 7-Year Estimated Take of Marine Mammal Species or Stock by Effect Type

Species	Stock	Maximum annual behavioral	Maximum annual TTS	Maximum annual AUD INJ	Maximum 7-year behavioral	Maximum 7-year TTS	Maximum 7-year AUD INJ
North Pacific right whale	NSD	0	325	2	0	2,271	11
Blue whale	NSD	1	1,061	3	4	7,422	21
Blue whale	Central North Pacific	1	12	-	1	82	-
Bryde's whale	NSD	17	799	1	115	5.593	5
Bryde's whale	Hawaii	1	6	-	5	36	-
Fin whale	NSD	2	5,736	32	13	40,152	218
Fin whale	Hawaii	0	16	-	0	111	-
Humpback whale	NSD	1	2	-	1	12	-
Humpback whale	Hawaii	2	11	-	8	71	-
Humpback whale	Western North Pacific	5	1,128	4	34	7,892	24
Antarctic minke whale	NSD	4	44	-	22	305	-
Minke whale	NSD	53	2,967	6	371	20,764	42
Minke whale	Hawaii	1	2	-	3	12	-
Omura's whale	NSD	1	216	1	7	1,506	3
Sei whale	NSD	5	2,016	9	34	14,106	58
Sei whale	Hawaii	1	4	1	2	28	1
Sperm whale	NSD	37	-	-	253	-	-
Sperm whale	North Pacific	224	1	-	1,568	1	-
Sperm whale	Hawaii	15	-	-	101	-	-
Dwarf sperm whale	NSD	718	1	-	5,024	1	-
Dwarf sperm whale	Hawaii	151	-	-	1,056	-	-
Pygmy sperm whale	NSD	863	1	-	6,037	2	-

Species	Stock	Maximum annual behavioral	Maximum annual TTS	Maximum annual AUD INJ	Maximum 7-year behavioral	Maximum 7-year TTS	Maximum 7-year AUD INJ
Pygmy sperm whale	Hawaii	151	1	-	1,057	1	-
Baird's beaked whale	NSD	64,875	0	-	454,121	0	-
Blainville's beaked whale	NSD	61,964	-	-	433,748	-	-
Blainville's beaked whale	Hawaii	2,073	-	-	14,511	-	-
Deraniyagala's beaked whale	NSD	9,448	-	-	66,130	-	-
Ginkgo-toothed beaked whale	NSD	30,341	1	-	212,383	1	-
Goose-beaked whale	NSD	111,484	1	-	780,388	1	-
Goose-beaked whale	Hawaii	9,185	-	-	64,291	-	-
Hubbs' beaked whale	NSD	25,289	-	-	177,021	-	-
Longman's beaked whale	NSD	69,987	1	-	489,906	2	-
Longman's beaked whale	Hawaii	5,017	-	-	35,116	-	-
Stejneger's beaked whale	NSD	37,258	-	-	260,803	-	-
False killer whale	NSD	60	-	-	420	-	-
False killer whale	Main Hawaiian Islands Insular	1	-	-	1	-	-
False killer whale	Hawaii Pelagic	7	-	-	49	-	-
Killer whale	NSD	172	1	-	1,200	6	-
Killer whale	Hawaii	1	-	-	4	-	-
Melon-headed whale	NSD	536	1	-	3,747	2	-
Melon-headed whale	Hawaiian Islands	107	-	-	749	-	-
Pygmy killer whale	NSD	317	1	-	2,213	1	-
Pygmy killer whale	Hawaii	32	-	-	218	-	-
Short-finned pilot whale	NSD	1,081	2	-	7,567	12	-

Species	Stock	Maximum annual behavioral	Maximum annual TTS	Maximum annual AUD INJ	Maximum 7-year behavioral	Maximum 7-year TTS	Maximum 7-year AUD INJ
Short-finned pilot whale	Hawaii	76	-	-	528	-	-
Bottlenose dolphin	NSD	1,897	4	-	13,276	23	-
Bottlenose dolphin	Hawaii Pelagic	31	1	-	213	2	-
Common dolphin	NSD	1,712	1	-	11,984	3	-
Fraser's dolphin	NSD	464	1	-	3,244	3	-
Fraser's dolphin	Hawaii	151	1	-	1,054	2	-
Northern right whale dolphin	NSD	10	-	-	67	-	-
Pacific white-sided dolphin	North Pacific	49	-	-	342	-	-
Pantropical spotted dolphin	NSD	2,784	1	-	19,485	5	-
Pantropical spotted dolphin	Hawaii Pelagic	233	-	-	1,626	-	-
Risso's dolphin	NSD	1,574	1	-	11,013	2	-
Risso's dolphin	Hawaii	38	-	-	262	-	-
Rough-toothed dolphin	NSD	508	-	-	3,555	-	-
Rough-toothed dolphin	Hawaii	299	-	-	2,092	-	-
Spinner dolphin	NSD	275	1	-	1,923	1	-
Spinner dolphin	Hawaii Pelagic	14	1	-	97	1	-
Striped dolphin	NSD	4,325	2	-	30,269	8	-
Striped dolphin	Hawaii Pelagic	199	1	-	1,391	2	-
Dall's porpoise	NSD	3,019	1	-	21,128	2	-
Northern fur seal	NSD	1,296	0	-	9,067	0	-
Steller sea lion	Western	1	-	-	2	-	-
Bearded seal	Beringia	1	-	-	1	-	-

Species	Stock	Maximum annual behavioral	Maximum annual TTS	Maximum annual AUD INJ	Maximum 7-year behavioral	Maximum 7-year TTS	Maximum 7-year AUD INJ
Harbor seal	California	1	-	-	1	-	-
Ribbon seal	NSD	3,376	34,274	1	23,632	239,918	2
Hawaiian monk seal	Hawaii	1	-	-	7	-	-
Ringed seal	NSD	24	1	-	164	1	-
Spotted seal	Bering	70	1	-	486	1	-

Note: A stock or population listed as NSD is not a designated stock under the MMPA. Zero (0) impacts indicate total less than 0.5 and a dash (-) is a true zero. In some cases where the estimated take within a cell is equal to 1, that value has been rounded up from a value that is less than 0.5 to avoid underestimating potential impacts to a species or stock based on the 7-year rounding rules discussed in section 2.4 of appendix B (PAC SURTASS LFA Acoustic Analysis Report) of the application.

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Proposed Mitigation Measures

Under section 101(a)(5)(A) of the MMPA, NMFS must set forth the permissible methods of taking pursuant to the activity, and other means of effecting the least practicable adverse impact on the 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 subsistence uses (''least practicable adverse impact''). NMFS does not have a regulatory definition for least practicable adverse impact. The 2004 NDAA amended the MMPA as it relates to military readiness activities and the ITA process such that a determination of ''least practicable adverse impact'' shall include consideration of personnel safety, practicality of implementation, and impact on the effectiveness of the military readiness activity. For additional discussion of NMFS' interpretation of the least practicable adverse impact standard, see the Mitigation Measures section of the Gulf of Alaska Study Area final rule (88 FR 604, January 4, 2023).

Implementation of Least Practicable Adverse Impact Standard

Here, we discuss how we determine whether a measure or set of measures meets the ''least practicable adverse impact'' standard. Our separate analysis of whether the take anticipated to result from the Navy's activities meets the ''negligible impact'' standard appears in the Preliminary Analysis and Negligible Impact Determination section below.

Our 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, or their availability for subsistence uses (where relevant). This analysis considers such things as the nature of the potential adverse impact (*e.g.,* 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 measure(s) for applicant implementation. Practicability of implementation may consider such things as cost, impact on activities, and, in the case of a military readiness activity, specifically considers personnel safety, practicality of implementation, and impact on the effectiveness of the military readiness activity.

While the language of the least practicable adverse impact standard calls for minimizing impacts to affected species or stocks, we recognize 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 more 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—and the best available science has been used here. 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. We also acknowledge that there is always the potential that new information, or a new recommendation, could become available in the future and necessitate reevaluation of mitigation measures (which may be addressed through adaptive management) 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, consideration of personnel safety, practicality of implementation, and consideration of the impact on effectiveness of military readiness activities 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 in terms of these considerations, can vary widely. For example, a time/area restriction could be of very high value for decreasing 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 biological importance). Regarding practicability, for example, a measure might involve restrictions in an area or time that impede the Navy's ability to certify a strike group (higher impact on mission effectiveness), or it could mean delaying a small in-port training event by 30 minutes to avoid exposure of a marine mammal to injurious levels of sound (*i.e.,* lower impact). A responsible evaluation of ''least practicable adverse impact'' will consider the factors along these realistic scales. 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 its 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. We discuss consideration of these factors in greater detail below.

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: (1) avoiding or minimizing injury or mortality; (2) limiting interruption of known feeding, breeding, mother/young, or resting behaviors; (3) minimizing the abandonment of important habitat (temporally and spatially); (4) minimizing the number of individuals subjected to these types of disruptions; and (5) 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 is 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 for 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, alone or in combination, result in greater emphasis on the importance of a mitigation measure in reducing impacts on a species or stock: (1) the stock is known to be decreasing or status is unknown, but believed to be declining; (2) the known annual mortality (from any source) is approaching or exceeding the PBR level (as defined in MMPA section 3(20)); (3) the affected species or stock is a small, resident population; or (4) the stock is involved in a UME or has other known vulnerabilities (*e.g.,* 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.

We consider 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.

Practicability

Factors considered may include cost, impact on activities, and, in the case of a military readiness activity, will include personnel safety, practicality of implementation, and impact on the effectiveness of the military readiness activity (see 16 U.S.C. 1371(a)(5)(A)(iii)).

Assessment of Mitigation Measures for the Study Area

NMFS has fully reviewed the specified activities and the mitigation measures included in the application and the 2025 SURTASS Draft SEIS/OEIS to determine if the mitigation measures would result in the least practicable adverse impact on marine mammals and their habitat. NMFS worked with the Navy in the development of their initially proposed measures, which are informed by years of implementation and monitoring. A complete discussion of the Navy's evaluation process used to develop, assess, and select mitigation measures, which was informed by input from NMFS, can be found in chapter 4 (Mitigation, Monitoring, and Reporting) and appendix F (Marine Mammal Offshore Biologically Important Area (OBIA) Analysis) of the 2025 SURTASS Draft SEIS/OEIS. The process described in these sections of the 2025 SURTASS Draft SEIS/OEIS robustly supported NMFS' independent evaluation of whether the mitigation measures would meet the least practicable adverse impact standard. The Navy would be required to implement the mitigation measures identified in this proposed rule for the full 7 years to avoid or reduce potential impacts from acoustic stressors.

As a general matter, where an applicant proposes measures that are likely to reduce impacts to marine mammals, the fact that they are included in the application indicates that the measures are practicable, and it is not necessary for NMFS to conduct a detailed analysis of the measures the applicant proposed (rather, they are simply included). However, it is still necessary for NMFS to consider whether there are additional practicable measures that would meaningfully reduce the probability or severity of impacts that could affect reproductive success or survivorship.

The Navy has agreed to mitigation measures that would reduce the probability and/or severity of impacts expected to result from acute exposure to acoustic sources and impacts to marine mammal habitat. Specifically, the Navy would use a combination of delayed starts, sonar ramp-ups, and shutdowns to minimize the likelihood or severity of AUD INJ and reduce instances of TTS or more severe behavioral disturbance typically caused by exposure to higher received sound levels from acoustic sources. The Navy would implement the following primary mitigation measures, which are described in more detail below:

- Mitigation Monitoring: Use of a comprehensive suite of mitigation monitoring methods to support activity-based mitigation, including the use of visual monitoring, passive acoustic monitoring, and active acoustic monitoring using the HF/M3 system described below:
- Activity-Based Measures: Use of a combination of real-time measures to minimize the likelihood or severity of AUD INJ and reduce instances of TTS or more severe behavioral disturbance typically caused by exposure to higher received sound levels from acoustic sources, including delayed starts and shutdowns of the LFA sonar source, as well as ramp-ups of the HF/M3 system.
- Geographic Measures: Application of multiple time/area restrictions, including a year-round, 22-km CSR and avoiding identified OBIAs for marine mammals in areas or at times where they are known to engage in important behaviors (*e.g.,* calving), to reduce impacts on reproduction or survival of individuals that could lead to population-level impacts.

The Navy assessed the practicability of the proposed measures in the context of personnel safety, practicality of implementation, and their impacts on the Navy's ability to meet their congressionally mandated requirements and found that the measures are supportable. As described in more detail below, NMFS has independently evaluated the measures the Navy proposed in the manner described earlier in this section (*i.e.,* in consideration of their ability to reduce adverse impacts on marine mammal species and their habitat and their practicability for implementation). We have determined that the measures would significantly reduce impacts on the affected marine mammal species and stocks and their habitat and, further, be practicable for implementation by the Navy. We have preliminarily determined that the mitigation measures ensure that the Navy's activities would have the least practicable adverse impact on the species or stocks and their habitat.

The Navy also evaluated numerous measures in the 2025 SURTASS Draft SEIS/OEIS that were not included in the application, and NMFS independently reviewed and preliminarily concurs with the Navy's analysis that their inclusion was not appropriate under the least practicable adverse impact standard based on our assessment. The Navy considered these additional potential mitigation measures in the context of the potential benefits to marine mammals and whether they are practical or impractical.

Section 4.6 (Mitigation and Monitoring Measures Considered but Eliminated) of chapter 4 of the 2025 SURTASS Draft SEIS/OEIS, includes an analysis of an array of different types of mitigation that have been recommended over the years by non-governmental organizations or the public, through scoping or public comment on environmental compliance documents. These recommendations generally fall into three categories, discussed below: (1) reduction of activity; (2) activity-based operational measures; and (3) time/area limitations.

As described in section 4.6 of the 2025 SURTASS Draft SEIS/OEIS, the Navy considered reducing the overall amount of training and testing activities, longer suspension or delay period (clearance time), restricting transmission to daylight hours, increased CSR, and expanded geographic sound field operational constraints. Many of these mitigation measures could potentially reduce the number of marine mammals taken via direct reduction of the activities or amount of sound energy put in the water. However, as described in chapter 4 of the 2025 SURTASS Draft SEIS/OEIS, the Navy needs to train in the conditions in which they fight. These types of modifications fundamentally change the activity in a manner that would not support the purpose and need for the training (*i.e.,* are entirely impracticable) and therefore are not considered further. NMFS finds the Navy's explanation of why adoption of these recommendations would unacceptably undermine the purpose of the training persuasive. After independent review, NMFS finds the Navy's judgment on the impacts of these potential mitigation measures to personnel safety, practicality of implementation, and the effectiveness of training persuasive, and for these reasons, NMFS finds that these measures do not meet the least practicable adverse impact standard because they are not practicable.

Lastly, chapter 4 and appendix F of the 2025 SURTASS Draft SEIS/OEIS also describe a comprehensive analysis of potential geographic mitigation that includes consideration of both a biological assessment of how the potential time/area limitation would benefit the species and its habitat (*e.g.,* is a key area of biological importance or would result in avoidance or reduction of impacts) in the context of the stressors of concern in the specific area and an operational assessment of the practicability of implementation (*e.g.,* including an assessment of the specific importance of an area for training, considering proximity to training ranges and emergency landing fields and other issues). In some cases, potential benefits to marine mammals were non-existent, while in others the consequences on mission effectiveness were too great.

NMFS has reviewed the Navy's analyses in the application and chapter 4 and appendix F of the 2025 SURTASS Draft SEIS/OEIS, which considers the same factors that NMFS considers to satisfy the least practicable adverse impact standard, and concurs with the analysis and conclusions. Therefore, NMFS is not proposing to include any of the measures that the Navy ruled out in the 2025 SURTASS Draft SEIS/OEIS. Below are the mitigation measures that NMFS has preliminarily determined would ensure the least practicable adverse impact on all affected species and their habitat, including the specific considerations for military readiness activities.

The following sections describe the mitigation measures that would be implemented in association with the activities analyzed in this document. The mitigation measures are discussed in three sections: (1) mitigation monitoring methods; (2) activity-based mitigation; and (3) geographic mitigation. Additionally, table 53 describes the information designed to aid Lookouts and other applicable personnel with their observation, environmental compliance, and reporting responsibilities.

Table 53 -- Environmental Awareness and Education

Stressor or Activity: All training and testing activities, as applicable.
Requirements: Navy personnel (including civilian personnel) involved in mitigation and training or testing activity reporting under the specified activities must complete one or more modules of the U.S. Navy Afloat Environmental Compliance Training Series, as identified in their career path training plan. Modules include: • Introduction to Afloat Environmental Compliance Training Series. The introductory module provides information on environmental laws (*e.g.*, ESA, MMPA) and the corresponding responsibilities that are relevant to military readiness activities. The material explains why environmental compliance is important in supporting the Navy's commitment to environmental stewardship. • Marine Species Awareness Training. In 2021, the Navy developed a new SURTASS-specific Marine Species Awareness Training module. The module was developed by civilian marine biologists and approved by NMFS. This video-based training provides information on marine species sighting cues, visual observation tools and techniques for SURTASS vessels, and sighting notification procedures. It is designed as a complement to the U.S. Navy Lookout Training Handbook adapted to SURTASS vessel training and testing. The module is required for ship masters, bridge watchstanders, and lookout personnel.

Note: T-AGOS vessels have an onboard computer system that the Navy must use to implement CSR and OBIA mitigation measures, including real-time acoustic propagation prediction mapping. Similar mitigation is implemented using Protective Measures Assessment Protocol (PMAP) and Sonar Positional Reporting System (SPORTS) onboard vessels in other Study Areas. The Navy intends for future T-AGOS vessels to use PMAP and SPORTS; however, use of these specific programs is not proposed herein to provide flexibility for existing T-AGOS vessels that may not be able to operate those systems at this time.

Additionally, in the event of a live stranding (or near-shore atypical milling) event within the Study Area or within 50 km of the boundary of the Study Area, where the stranding network is engaged in herding or other interventions to return animals to the water, NMFS OPR will advise the Navy of the need to implement shutdown procedures for SURTASS LFA sonar within 50 km of the stranding or near-shore atypical milling event. Following this initial shutdown, NMFS will communicate with the Navy to determine if circumstances support any modification of the shutdown zone. The Navy may decline to implement all or part of the shutdown if it determines that continuation of the military readiness activities is necessary for national security. Shutdown procedures for live stranding or milling cetaceans include the following:

• If at any time, the marine mammal(s) die or are euthanized, or if herding/intervention efforts are stopped, NMFS will immediately advise that the shutdown around the animals' location is no longer needed;

• Otherwise, shutdown procedures will remain in effect until NMFS determines and advises that all live animals involved have left the area (either of their own volition or following an intervention); and

• If further observations of the marine mammals indicate the potential for re-stranding, additional coordination 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.

Mitigation Monitoring

The Navy would use a comprehensive three-part monitoring program to support the implementation of real-time, activity-based mitigation measures described in the next section. The combined use of all three types of monitoring (*i.e.,* visual monitoring, passive acoustic monitoring, and active acoustic monitoring) increases the likelihood of marine mammal detection and, thereby, the effectiveness of the mitigation measures. The mitigation monitoring measures are provided in table 54.

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Table 54 -- Mitigation Monitoring

Monitoring Method	Requirements
Visual Monitoring	Visual observations must be conducted by trained Lookouts on the vessel's bridge using standard binoculars (7x) and the naked eye. Pedestal-mounted 'Big Eye' (20x110) binoculars (if installed) must be used to assist in the detection of marine mammals in the vicinity of the vessel. Lookouts must conduct visual monitoring from the vessel's bridge during all daylight hours (30 minutes before sunrise until 30 minutes after sunset). During training and testing activities that employ SURTASS LFA sonar in the active mode, Lookouts must conduct visual monitoring beginning 30 minutes before sunrise or 30 minutes before SURTASS LFA sonar begins to transmit and continue until 30 minutes after sunset or until the SURTASS LFA sonar transmissions cease. Lookouts must log all detections of marine mammals during SURTASS LFA sonar transmissions. Lookouts must record the number, identification, bearing, and range of observed marine mammals and must identify marine mammals to the lowest taxonomic level possible. Lookouts must continue visual observations until 15 minutes have passed since the last detection of the marine mammal.
Passive Acoustic Monitoring	Navy passive acoustic sonar technicians must conduct passive acoustic monitoring using the SURTASS towed horizontal line array to detect vocalizing marine mammals. Passive acoustic sonar technicians are trained to identify detected vocalizations to marine mammal species whenever possible. Passive acoustic monitoring must begin 30 minutes before the SURTASS LFA sonar begins to transmit and continue until 15 minutes after SURTASS LFA sonar transmissions cease. If a detected sound is estimated to be from a vocalizing marine mammal, the sonar technician will notify the senior military member-in-charge, who must alert the HF/M3 sonar operator and Lookouts (during daylight).
Active Acoustic (HF/M3) Monitoring	Active acoustic mitigation uses the HF/M3 sonar to detect, locate, and track marine mammals in relation to the SURTASS LFA sonar array and the LFA mitigation zone. HF/M3 sonar monitoring must begin 30 minutes before the SURTASS LFA sonar begins to transmit and continue until 15 minutes after SURTASS LFA sonar transmissions cease. If a marine mammal is detected during HF/M3 monitoring within the SURTASS LFA mitigation zone, the sonar operator must notify the senior military member-in-charge.

Note: Effectiveness of the HF/M3 sonar system as a mitigation tool to detect marine mammals has been described in the Navy's 2001 Final Overseas Environmental Impact Statement/Environmental Impact Statement (OEIS/EIS) (section 2 and section 4) for SURTASS LFA sonar (U.S. Department of the Navy, 2001) in addition to the technical report by Ellison and Stein (1999). To summarize the effectiveness of the HF/M3 sonar system, the Navy's testing and analysis of the HF/M3 sonar system's capabilities indicated the system: (1) substantially increased probability of detecting marine mammals within the LFA mitigation zone; (2) provided a superior mitigation capability, especially for medium- to large-sized marine mammals to a distance of 2-2.5 km from the system; (3) would result in detections of a marine mammal before it even entered the LFA mitigation zone—based on the scan rate of the HF/M3 sonar system, most animals would receive at least eight pings from the sonar (*i.e.*, eight sonar returns or detections) before entering the LFA mitigation zone; (4) based on scan rate, probability of any marine mammal being detected prior to entering the LFA mitigation zone approached 100 percent (Ellison and Stein, 1999); (5) the probability of HF/M3 sonar system detecting a medium- to large-sized (approximately 10-30 m) marine mammal (humpback to blue whale) swimming towards the system in the LFA mitigation zone with only one HF/M3 ping would be near 100 percent (Ellison and Stein, 1999); (6) for small (approximately 2.5 m) marine mammals such as a dolphin, detection probability is 55 percent from one HF/M3 ping when the sonar is located at a distance of

800-930 m from the marine mammal, while detection probability increased to 90 percent for four HF/M3 pings; and (7) may result in higher detection probabilities in a typical at-sea operating environment—during HF/M3 testing, analysts noted that in expected at-sea conditions of reduced clutter interference in the open ocean and small marine mammals traveling in their typical group configurations (*i.e.*, in pods), the detection rate would be higher (Ellison and Stein, 1999). Also, we note that the underwater conditions during which the HF/M3 data on detection distances were collected were extremely challenging (*i.e.*, poor sea state and weather conditions).

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Activity-Based Mitigation

The primary objective of activity-based mitigation is to reduce overlap of marine mammals with stressors that have the potential to cause injury or mortality in real time. The Navy customizes mitigation for each applicable activity category or stressor. Activity-based mitigation generally involves: (1) the use of one or more trained Lookouts to diligently observe for marine mammals within a mitigation zone; (2) requirements for Lookouts to immediately communicate sightings of marine mammals to the appropriate watch station for information dissemination; and (3) requirements for the watch station to implement mitigation (*e.g.,* halt an activity) until certain recommencement conditions have been met.

For SURTASS LFA sonar, the Navy must implement the proposed activity-based mitigation measures described below (manned surface vessel mitigation (table 55), ramp up of HF/M3 sonar (table 56), and the SURTASS LFA mitigation zone and suspension/delay (table 57)), as appropriate, in response to an applicable detection within, or entering into, the relevant mitigation zone.

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Table 55 -- Manned Surface Vessel Mitigation

Mitigation Requirements	Mitigation Benefits
Manned surface vessel mitigation, which applies to T-AGOS vessels underway, will be implemented to the maximum extent practical based on the prevailing circumstances, including consideration of safety of vessels, towing platforms, and crews, as well as maneuverability restrictions. Immediately prior to getting underway and while underway, the Lookouts will observe for marine mammals. While underway Navy personnel must maneuver the manned surface vessels (which may include reducing speed) to maintain a distance of at least 457.2 m around observed whales and 182.9 m around all other marine mammals (except bow- or wake-riding dolphins), providing it is safe to do so. No further action is necessary if a dolphin continues to approach the vessel after it has made one course and/or speed change. Pedestal-mounted 'Big Eye' (20 x 110) binoculars (if installed) shall be used to assist in the detection of marine mammals in the vicinity of the vessel. If the presence of marine mammals is detected acoustically, Lookouts posted on the vessel shall increase the vigilance of their visual observation. Manned surface vessel mitigation will not be implemented (1) when dolphins are determined to be intentionally swimming at the bow, alongside the vessel or vehicle, or directly behind the vessel or vehicle (*e.g.*, to bow-ride or wake-ride), (2) when the vessel's safety is threatened, or (3) when impractical based on mission requirements (*e.g.*, restricted ability to maneuver during towing activities).	This mitigation is intended to minimize the already low likelihood of vessel strike of a marine mammal.

Table 56 -- Ramp-up of High Frequency Marine Mammal Monitoring (HF/M3) Sonar

Mitigation Requirements	Mitigation Benefits
Prior to full-power use, Navy personnel must ramp up the HF/M3 sonar power level beginning at a maximum SL of 180 dB re 1 µPa at 1 m RMS SPL in 10 dB increments to full operating level (if required) over a period of no less than 5 minutes. Navy personnel must implement this ramp-up procedure at least 30 minutes prior to any SURTASS LFA sonar transmissions and any time after the HF/M3 sonar has been powered down for more than 2 minutes. Navy personnel must not increase the HF/M3 active sonar system's SPL once a marine mammal is detected. The ramp-up may recommence once marine mammals are no longer detected by all of the monitoring methods.	A ramp-up procedure for the HF/M3 sonar system is intended to prevent inadvertent exposures of marine mammals to higher received levels more likely to result in AUD INJ or more severe behavioral responses if an animal were to occur in close proximity to the HF/M3 sonar system when it is turned on.

Table 57 -- SURTASS LFA Mitigation Zone and Suspension/Delay

Mitigation Requirements	Mitigation Benefits
The Navy has established a single, fixed mitigation zone of 1.8 km for use with the suspension and delay measures described below. At 1.8 km, modeling shows that the sound field would be about 174.75 dB. Utilizing a single, fixed mitigation zone for SURTASS LFA sonar training and testing activities standardizes and thus simplifies mitigation implementation while continuing to ensure protection of marine mammals in real time by limiting the potential for marine mammals to be exposed to received levels more likely to result in AUD INJ or more severe behavioral responses. If a marine mammal is detected during visual or acoustic monitoring within the LFA mitigation zone, the sonar operator must notify the senior military member-in-charge, who must order the immediate delay or suspension of LFA sonar transmissions. During the delay/suspension, active acoustic, visual, and passive acoustic monitoring for marine mammals would continue. If visual monitoring detects a marine mammal outside the LFA mitigation zone, the bridge officer will notify the senior military member-in-charge of the estimated range and bearing of the observed marine mammal. For possible visual or acoustic marine mammal observations outside of the zone, the sonar operator must verify (in the case of a visual observation) or determine (in the case of an acoustic detection) the range and projected track of the marine mammal and notify the senior military member-in-charge that a detected animal is likely to pass within the LFA mitigation zone. The senior military member-in-charge must notify the bridge and passive sonar operator of the potential presence of a marine animal projected to enter the mitigation zone. The senior military member-in-charge must order the delay or suspension of LFA sonar transmissions only when the marine mammal enters the LFA mitigation zone. Navy personnel must not commence or recommence SURTASS LFA sonar transmissions earlier than 15 minutes after all marine mammals have left the LFA mitigation zone and there is no further detection of marine mammals within the LFA mitigation zone by visual, active acoustic (HF/M3 sonar), or passive acoustic mitigation.	This mitigation is designed to reduce exposure of marine mammals to levels of sound that have the potential to cause AUD INJ or more severe behavioral impacts.

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Geographic Mitigation

In addition to activity-based mitigation, the Navy would implement geographic mitigation measures to avoid or minimize potential impacts on marine mammals (see figure 11–1 of the application), including a CSR and activity limitations around OBIAs. A full technical analysis of the geographic mitigation that the Navy considered for marine mammals is provided in section 4.6 and appendix F of the 2025 SURTASS Draft SEIS/OEIS. The Navy took into account public comments received on the 2019 SURTASS Supplemental EIS/OEIS, the best available science, and the practicability of implementing additional mitigation measures.

NMFS conducted an independent analysis of the geographic mitigation measures that the Navy proposed, which are described below. NMFS preliminarily concurs with the Navy's analysis, which indicates that the measures in these mitigation areas are both practicable and will reduce the likelihood, magnitude, or severity of adverse impacts to marine mammals or their habitat in the manner described in the Navy's analysis and this proposed rule. NMFS is heavily reliant on the Navy's description of operational practicability, since the Navy is best equipped to describe the degree to which a given mitigation measure affects personnel safety or mission effectiveness, and how practical it is to implement. The Navy considers the measures in this proposed rule to be practicable, and NMFS concurs. We further discuss the manner in which the Geographic Mitigation in the proposed rule will reduce the likelihood, magnitude, or severity of adverse impacts to marine mammal species or their habitat in the Preliminary Analysis and Negligible Impact Determination section.

Table 58 details geographic mitigation related to the implementation of a CSR.

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Table 58 -- Coastal Standoff Range

Mitigation Requirements	Mitigation Benefits
The received level of SURTASS LFA sonar transmissions will not exceed 180 dB re 1 µPa RMS SPL within 22 km (12 nmi) from any emergent land, including offshore islands. SURTASS LFA sonar activities will not occur within the territorial seas of foreign nations, which are areas from 0-22 km (0-12 nmi) from shore.	Many areas of biological importance to, and higher density of, marine mammals occur in coastal waters. The CSR would lower the risk to many marine mammals which aggregate in coastal waters. In a review of existing and proposed marine protected areas, approximately 80 percent were found to be located in the CSR. Coastal waters are heavily used seasonally for biologically important behaviors such as calving, foraging, and migrating.

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Offshore Biologically Important Areas for SURTASS LFA Sonar

Given the unique transmission characteristics of SURTASS LFA sonar and recognizing that certain areas of biological importance lie outside of the CSR (*i.e.,* 22 km from any emergent land) for SURTASS LFA sonar, Navy and NMFS developed the concept of marine mammal OBIAs for SURTASS LFA sonar. OBIAs for SURTASS LFA sonar are not intended to apply to any other Navy activities and were established solely as a mitigation measure to reduce incidental harassment of marine mammals associated with the use of SURTASS LFA sonar (77 FR 50290, August 20, 2012). OBIAs pertain to only species considered more sensitive to SURTASS LFA sonar, including marine mammals in the VLF and LF groups, as well as sperm whales and elephant seals, since the potential for impacts to other protected marine species from exposure to SURTASS LFA sonar transmissions would be low to moderate, necessitating no additional preventative measures for these taxa beyond those already established for SURTASS LFA sonar. Table 59 lists the identified OBIAs (figure 4 herein, and table 11–1 and figure 11–1 in the application) within the Study Area, and table 60 describes the mitigation requirements within OBIAs.

Appendix F of the 2025 SURTASS Draft SEIS/OEIS describes the selection criteria and stepwise analysis used to identify OBIAs. In summary, the comprehensive assessment of marine areas as OBIA candidates included a thorough review of the Important Marine Mammal Areas (IMMAs), Ecologically or Biologically Significant Marine Areas (EBSAs), areas listed in the World Database of Protected Areas (WDPA), Mission Blue Hope Spots, Pew Bertarelli Ocean Legacy Sites, High Seas Alliance Hot Spots, NOAA NMSs, NMFS ESA Critical Habitat, and areas previously included on the OBIA Watch List or that otherwise previously received full assessment for potential OBIA designation. The OBIA Watch List includes potential marine areas already identified and reviewed by the Navy and NMFS but for which documentation on the importance of the area to marine mammals has not been established or is lacking in detail. A total of 413 candidate marine areas in the Pacific and Indian Oceans were identified and added to a database for recordkeeping and analysis.

While the BIAs identified by Kratofil *et al.* (2023) and discussed in the *Biologically Important Areas* section of this proposed rule were not considered in the OBIA selection criteria, NMFS has considered these BIAs herein. Humpback whale is the only LF cetacean species for which Kratofil *et al.* (2023) identified a BIA, and this BIA fully overlaps identified OBIAs or the CSR, and therefore, mitigation will be implemented within the BIA. All other BIAs identified in the Pacific SURTASS LFA Study Area fully or partially overlap identified OBIAs or the CSR, as described in the *Biologically Important Areas* section.

The process for selection of OBIAs for SURTASS LFA sonar, from the candidate list, includes a stepwise analysis based on four criteria: (1) Geographic; (2) LF-Hearing Cetaceans; (3) Biological Importance, and (4) Navy Practicability:

Criterion 1: Geographic

A marine area must be located at least partly in the Study Area (figure 1) and partly outside of the CSR (*i.e.,* the area within 22 km of any emergent land including islands or island systems) for OBIA consideration. The CSR already receives the same protection as OBIAs, and therefore marine areas entirely within the CSR are not considered for further OBIA analysis.

Criterion 2: LF-Hearing Cetaceans

A marine area must have evidence of the presence of cetaceans that specialize in LF-hearing, such as all baleen whales, or marine mammals that have demonstrated sensitivity to LF sounds, such as sperm whales and elephant seals. SURTASS LFA sonar transmissions are well below the range of best hearing sensitivity for most other odontocetes and pinnipeds based on the measured hearing thresholds (U.S. Department of the Navy, 2025; Houser *et al.,* 2008; Houser *et al.,* 2024; Kastelein *et al.,* 2009; NMFS, 2024). The intent of

OBIAs is to protect those marine mammal species most likely to hear and be affected by SURTASS LFA sonar transmissions and to provide the animals additional protections during periods when they are conducting biologically significant activities. Thus, the primary focus of the OBIA mitigation measure is on LF-hearing sensitive species.

Criterion 3: Biological Importance

If a marine area meets Criteria 1 and 2, it must also have known biological importance to the relevant species present. As such, the marine area must meet at least one of the following biological sub-criteria to be considered as an OBIA: (1) have a presence of small, distinct populations with limited distributions; (2) have a presence of particularly high densities; (3) be a known breeding/calving ground(s); be a known foraging ground(s); (4) known migration routes; or (5) be a Critical Habitat as designated under the ESA. When direct data relevant to one of the biological subcriteria are limited, other available data and information may be used if those data and information, either alone or in combination with the limited direct data, are sufficient to establish that the biological criteria are met.

Criterion 4: Navy Practicability

If an area meets the (1) geographic, (2) presence of LF cetaceans, and (3) biological importance criteria, it is considered a candidate OBIA, and the Navy conducts a practicability assessment (*e.g.,* consideration of personnel safety, practicality of implementation, and impacts on the effectiveness of SURTASS LFA sonar testing and training activities). If the candidate area passes the practicability assessment, then the marine area is considered to meet all criteria for designation as a SURTASS LFA sonar OBIA for marine mammals. If the Navy determines that it is not practicable to designate the area as an OBIA, the Navy will identify the concerns that lead to this conclusion and discuss with NMFS whether modifications could be made to the proposed OBIA to alleviate the Navy's practicability concerns.

Of the 38 marine areas assessed, the Navy and NMFS' analysis resulted in the recommendation of 5 new marine areas for identification as OBIAs, pending Navy fleet review for practicability. One OBIA is an expansion of an existing OBIA (OBIA 35, Western Australia—Blue Whale), to include the entirety of the Indian Ocean Blue Whale Migratory Route Important Marine Mammal Area (a designation by the International Union for Conservation of Nature). A second OBIA (OBIA 43, South of Lombok and Sumbawa Islands) represents an area that connects an existing OBIA (OBIA 37, Southern Bali) to the newly expanded OBIA 35, Western Australia-Blue Whale. The remaining three OBIAs are standalone areas (OBIA 40, 41, 42), disconnected from any existing OBIAs in the Study Area.

The five candidate OBIAs underwent Navy fleet practicability review. The Navy fleet determined that the identification of the five candidate OBIAs in the Study Area and the relevant seasonal effectiveness periods would not impede the effectiveness of SURTASS LFA sonar training and testing activities, would be practicable to implement as a geographic mitigation measure, and would not impact personnel safety. As a result, five new marine mammal OBIAs for SURTASS LFA sonar have been identified: OBIA 35 (expansion), 40, 41, 42, and 43 (table 59).

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Table 59 -- Identified OBIAs in the Study Area

OBIA Number	Name	Location/water body	Relevant marine mammal species	Effective period
26	Main Hawaiian Islands	Central North Pacific Ocean	Humpback whale	November to April
27	Northwestern Hawaiian Islands	Central North Pacific Ocean	Humpback whale	December to April
28	Mariana Islands	Western North Pacific Ocean	Humpback whale	February to April
29	Ryukyu-Philippines	Western North Pacific Ocean	Humpback whale	January to April
30	Ogasawara - Sperm whale	Western North Pacific Ocean	Sperm whale	June to September
31	Ogasawara-Kazin - Humpback whale	Western North Pacific Ocean	Humpback whale	December to May
32	Honshu	Western North Pacific Ocean	Gray whale	January to May
33	Southeast Kamchatka	Western North Pacific Ocean	Fin, gray (Western North Pacific stock), humpback, and North Pacific right whale	June to September
34	Gulf of Thailand	Eastern Indian Ocean	Bryde's whale	April to November
35*	Western Australia - Blue whale	Eastern Indian Ocean	Blue (pygmy) whale	May to November
36	Western Australia - Humpback whale	Eastern Indian Ocean	Humpback whale	May to December
37	Southern Bali	Eastern Indian Ocean	Bryde's, humpback, Omura's, sei, and sperm whale	October to November
38	Swatch-of-No-Ground (SoNG)	Northern Bay of Bengal	Bryde's whale	Year-round
39	Sri Lanka	Eastern Indian Ocean	Blue (pygmy) and sperm whale	October to April
40*	Maldives Archipelago	Central Indian Ocean	Blue (pygmy), Bryde's, humpback, and sperm whale	October to May
41*	Northeast Arabian Sea	Arabian Sea	Blue, Bryde's, and humpback (Arabian Sea stock) whale	Year-round
42*	South of Java Island	East Indian Ocean	Blue (pygmy) whale	October to November

OBIA Number	Name	Location/water body	Relevant marine mammal species	Effective period
43*	South of Lombok Sumbawa Islands	East Indian Ocean	Blue (pygmy) whale	October to November

Note: Existing OBIA 35 (Western Australia - Blue whale) was expanded to include the entirety of the Eastern Indian Ocean blue whale migratory route.
*New or expanded OBIAs since the 2019 SURTASS final rule (84 FR 40132, August 13, 2019)

Table 60 -- OBIA Mitigation Requirements

Mitigation Requirements	Mitigation Benefits
The received level of SURTASS LFA sonar transmissions will not exceed 180 dB re 1 µPa RMS SPL at a distance of 1 km (0.5 nmi) seaward of the outer perimeter of any OBIA in the SURTASS LFA Study Area during the effective period[1] specified. OBIAs and the related effective periods are listed in (table 59) or may be subsequently identified through the adaptive management process.[2] No more than 25 percent of the sound source amount analyzed (*i.e.*, no more than 275 hours in a given year) of SURTASS LFA sonar for training and testing will be conducted within 18.5 km of any single OBIA during any year.[3]	OBIAs would protect species considered more sensitive to SURTASS LFA sonar (including marine mammals in the VLF and LF groups, as well as sperm whales and elephant seals) from receiving injurious effects (*i.e.*, AUD INJ) from SURTASS LFA transmissions.

[1] OBIAs are active only during the specific time of year when biologically significant activities are potentially being carried out within that area.
[2] Although it is difficult to compare SPL and SEL based metrics since SEL accumulates with increasing exposure time, auditory injury thresholds are well above 180 dB, even without considering frequency weighting of the received sound levels, except for VHF cetaceans. However, VHF cetaceans do not hear well at the low frequencies associated with SURTASS LFA, so it is expected that the received level at these frequencies would be greatly reduced.
[3] Should national security present a requirement to conduct more than 25 percent of the analyzed hours of SURTASS LFA sonar within 18.5 km of any single OBIA during any year, personnel conducting the activity would be required to obtain approval through the chain of command prior to commencement of the activity. The Navy must provide NMFS with notification as soon as is practicable and include the information (*e.g.*, sonar hours in exceedance of 25 percent) in its annual activity reports submitted to NMFS.

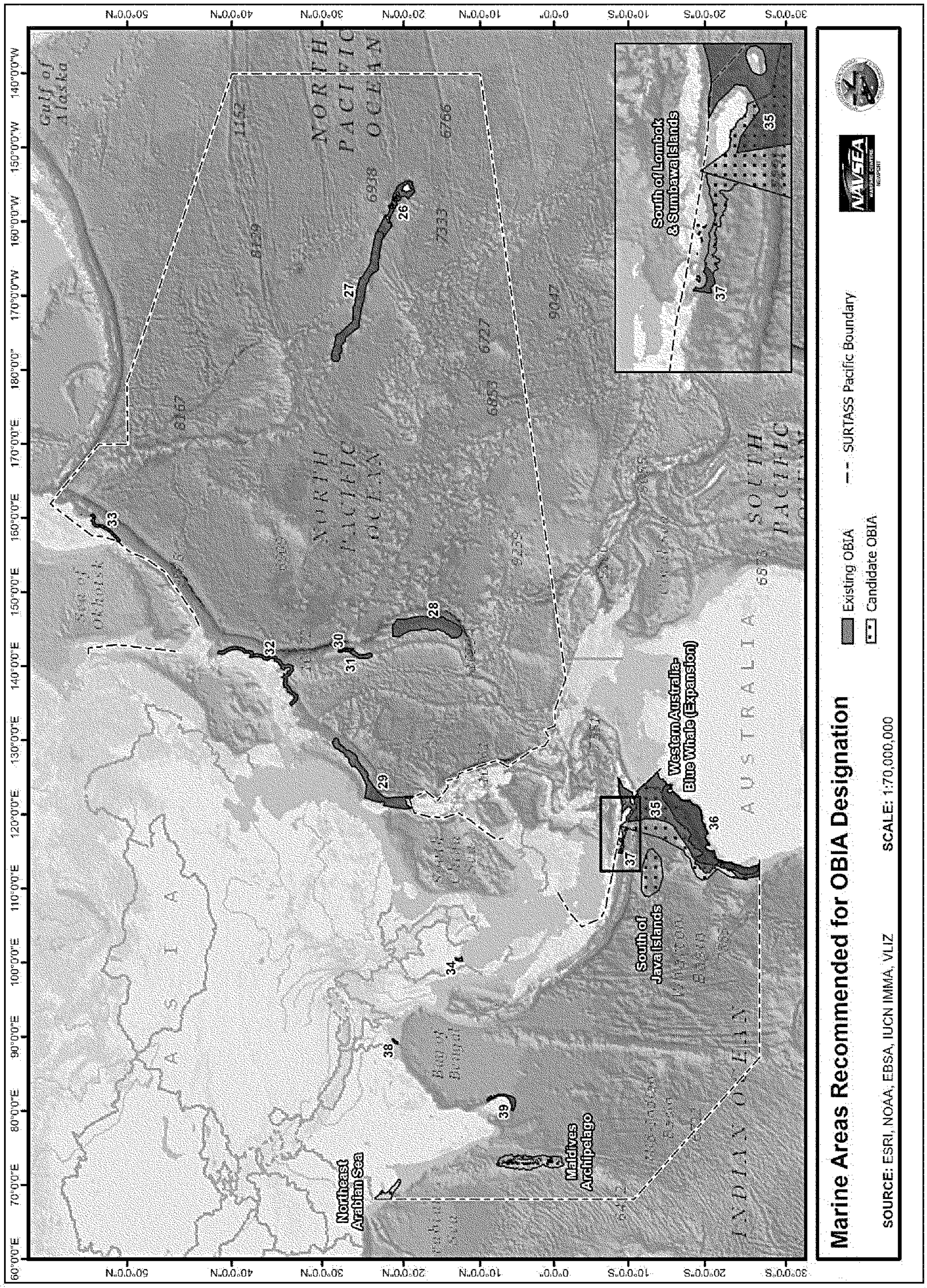

Figure 4 -- OBIAs for Marine Mammals in the Pacific SURTASS LFA Sonar Study Area.

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Mitigation Conclusions

NMFS has carefully evaluated the Navy's proposed mitigation measures—many of which were developed with NMFS' input during the previous phases of SURTASS LFA sonar activities—and considered a range of other measures (*i.e.,* the measures considered but eliminated in the 2025 SURTASS Draft SEIS/OEIS, which reflect many of the comments that have arisen from public input or through discussion with NMFS in past years) in the context of ensuring that NMFS prescribes the means of effecting the least practicable adverse impact on the affected marine mammal species and their habitat. Our evaluation of potential measures included consideration of the following factors in relation to one another: (1) the manner in which, and the degree to which, the successful implementation of the mitigation measures is expected to reduce the likelihood and/or magnitude of adverse impacts to marine mammal species and their habitat; (2) the proven or likely efficacy of the measures; and (3) the practicability of the measures for applicant implementation, including consideration of personnel safety, practicality of implementation, and impact on the effectiveness of the military readiness activity.

Based on our evaluation of the Navy's proposed measures, as well as other measures considered by the Navy and NMFS (see section 4.6 of the 2025 SURTASS Draft SEIS/OEIS), NMFS has preliminarily determined that these proposed mitigation measures are appropriate means of effecting the least practicable adverse impact on marine mammal species and their habitat, paying particular attention to rookeries, mating grounds, and areas of similar significance, and considering specifically personnel safety, practicality of implementation, and impact on the effectiveness of the military readiness activity. Additionally, an adaptive management component helps further ensure that mitigation is regularly assessed and provides a mechanism to improve the mitigation, based on the factors above, through modification as appropriate.

The proposed rule comment period provides the public with an opportunity to submit recommendations, views, and/or concerns regarding the Navy's activities and the proposed mitigation measures. While NMFS has preliminarily determined that the Navy's proposed mitigation measures would effect the least practicable adverse impact on the affected species and their habitat, NMFS will consider all public comments to help inform our final determination. Consequently, proposed mitigation measures may be refined, modified, removed, or added prior to the issuance of the final rule based on public comments received and, as appropriate, analysis of additional potential mitigation measures.

Proposed Monitoring

Section 101(a)(5)(A) of the MMPA states that in order to authorize incidental take for an activity, 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 ITAs 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.

A Marine Mammal Monitoring program became part of the research, monitoring, and reporting program for SURTASS LFA sonar's environmental compliance in 2001. A monitoring and research provision was included in the 2012 final rule (77 FR 50290, August 20, 2012) and subsequent LOAs for SURTASS LFA sonar that required the Navy to consider research or monitoring strategies that would increase the understanding of the potential effects of SURTASS LFA sonar transmissions.

The Navy would continue collecting monitoring data to inform our understanding of the occurrence of marine mammals in the Study Area, the likely exposure of marine mammals to stressors in the Study Area, the response of marine mammals to exposures to stressors, the consequences of a particular marine mammal response to their individual fitness and, ultimately, populations, and the effectiveness of implemented mitigation measures. Taken together, mitigation and monitoring comprise the Navy's integrated approach for reducing environmental impacts from the specified activities. The Navy's overall monitoring approach seeks to leverage and build on existing research efforts whenever possible.

As agreed upon between the Navy and NMFS, the monitoring measures presented here, as well as the mitigation measures described above, focus on the protection and management of potentially affected marine mammals. A well-designed monitoring program can provide important feedback for validating assumptions made in analyses and allow for adaptive management of marine mammals and their habitat, and other marine resources. Monitoring is required under the MMPA, and details of the monitoring program for the specified activities have been developed through coordination between NMFS and the Navy through the regulatory process for previous SURTASS training and testing activities.

Marine Mammal Monitoring Program

The SURTASS LFA sonar Marine Mammal Monitoring (M3) Program uses the Navy's fixed and mobile passive acoustic monitoring systems to enhance the Navy's collection of long-term data on individual and population levels of acoustically active marine mammals, principally baleen and sperm whales. Work using these sensors began under Navy funding in 1993.

The data that the M3 program collects are classified; however, analysts are working to develop reports that can be declassified and result in scientific papers that are peer-reviewed publications in scientific journals (Clark *et al.,* 2019; Guazzo *et al.,* 2024). Technical reports on accomplishments from the SURTASS Marine Mammal Monitoring Program are provided annually to NMFS. In addition, information on detections of western gray whale vocalizations has been shared with the International Union for the Conservation of Nature on possible wintering areas for this highly-endangered marine mammal. The Navy continues to assess and analyze program data collected from Navy passive acoustic monitoring systems and is working toward making some portion of that data, after appropriate security reviews, available to scientists with appropriate clearances and ultimately made publicly available. For example, from 2024 unclassified reporting for one of several species, analysts reported 630 acoustic tracks and 6,704 geographic positions of blue whales in the North Atlantic Ocean. In the North Pacific Ocean, 32 tracks and 119 associated positions were documented for North Pacific blue whales. During 2024, 559 geographic positions were used to develop four acoustic tracks of presumed hybrid blue/fin whales in the North Atlantic Ocean. The vocalizations of these assumed hybrid whales have individually distinct acoustic signals with characteristics of both typical fin and blue whale vocalizations, which enable individual hybrid whales to be differentiated and identified over years. Figure 13–1 of the application illustrates some of the information analyzed for annual reporting.

Regarding the suggested means of coordinating research opportunities and activities, collaboration between the monitoring program and the Navy's research and development (*e.g.,* the ONR) and demonstration-validation (*e.g.,* Living Marine Resources (LMR)) programs has been strengthened, leading to research tools and products that have already transitioned to the monitoring program. These include Marine Mammal Monitoring on Ranges, controlled exposure experiment BRSs, acoustic sea glider surveys, and global positioning system-enabled satellite tags. Recent progress has been made with better integration with monitoring across all Navy at-sea study areas. Publications from the LMR and ONR programs have also resulted in significant contributions to hearing, acoustic criteria used in effects modeling, exposure, and response, as well as in developing tools to assess biological significance (*e.g.,* consequences).

Specifically, the Navy's LMR Program is funding a two-phase SURTASS LFA sonar BRS. The BRS is intended to update previous LFAS studies completed during the 1990s. The Phase I feasibility study (conducted 2021–2022) investigated the best approach to designing a scientific study to assess behavioral response to LFA sonar. After the Phase I feasibility study, Navy determined that an adequate LFAS amplifier was not available within the Navy or commercially. Therefore, for Phase II, LMR is funding the construction of a new amplifier specific to the LFS source. Construction of the amplifier began in FY 2025 and will continue through FY 2026. The BRS field research is expected to begin in FY 2028 and will incorporate lessons learned and best practices from controlled and observational BRSs using other sonar sources conducted over the last 10 years and will aim to supplement understanding of how SURTASS LFA sonar may affect marine resources, including mysticetes and beaked whales.

Adaptive Management

The proposed regulations governing the take of marine mammals incidental to military readiness activities in the Study Area contain an adaptive management component. Our understanding of the effects of military readiness activities (*e.g.,* acoustic stressors) on marine mammals continues to evolve, which makes the inclusion of an adaptive management component both valuable and necessary within the context of 7-year regulations.

The reporting requirements associated with this proposed rule are designed to provide NMFS with monitoring data from the previous year to allow NMFS to consider whether any changes to existing mitigation and monitoring requirements are appropriate. The use of adaptive management allows NMFS to consider new information from different sources to determine (with input from the Navy regarding practicability) on an annual or biennial basis if mitigation or monitoring measures should be modified (including additions or deletions). Mitigation measures could be modified if new data suggests that such modifications would have a reasonable likelihood of more effectively accomplishing the goals of the mitigation and monitoring and if the measures are practicable. If the modifications to the mitigation, monitoring, or reporting measures are substantial, NMFS would publish a notice of the planned LOA in the **Federal Register** and solicit public comment.

The following are some of the possible sources of applicable data to be considered through the adaptive management process: (1) results from monitoring and exercise reports, as required by MMPA authorizations; (2) compiled results of Navy-funded research and development studies; (3) results from specific stranding investigations; (4) results from general marine mammal and sound research; and (5) any information which reveals that marine mammals may have been taken in a manner, extent, or number not authorized by these regulations or subsequent LOA. The results from monitoring reports and other studies may be viewed at: *https://www.navymarinespeciesmonitoring.us.*

Proposed Reporting

In order to issue an ITA for an activity, section 101(a)(5)(A) of the MMPA states that NMFS must set forth requirements pertaining to the monitoring and reporting of such taking. Effective reporting is critical both to compliance as well as ensuring that the most value is obtained from the required monitoring.

Notification of Injured, Live Stranded, or Dead Marine Mammals

The Navy would consult the Notification and Reporting Plan, which sets out notification, reporting, and other requirements when injured, live stranded, or dead marine mammals are detected. The Notification and Reporting Plan is available for review at: *https://www.fisheries.noaa.gov/national/marine-mammal-protection/incidental-take-authorizations-military-readiness-activities.*

Annual Study Area Marine Species Monitoring Report

The Navy would submit an unclassified annual report of the Study Area marine species monitoring, describing the implementation and results from the previous calendar year. Data collection will adhere to methods that allow for comparison to other range complexes and Study Areas in different geographic regions. The draft report must be submitted to the Director of OPR of NMFS annually as specified in the LOA. NMFS will submit comments or questions on the report, if any, within 3 months of receipt. The report will be considered final after the Navy has addressed NMFS' comments, or 3 months after submittal of the draft if NMFS does not provide comments on the draft report. The report would describe progress of knowledge made with respect to new or continuing scientific knowledge of marine mammals.

Annual SURTASS LFA Training and Testing Report

In the event that the analyzed sound levels were exceeded, the Navy would submit a preliminary report detailing the exceedance within 21 days after the anniversary date of issuance of the LOA. Regardless of whether analyzed sound levels were exceeded, the Navy would submit a detailed report (SURTASS LFA Annual Training and Testing Report) to NMFS annually within 3 months of the 1-year anniversary of the date of the issuance of the LOA. NMFS will submit comments or questions on the report, if any, within 1 month of receipt. The report will be considered final after the Navy has addressed NMFS' comments, or 1 month after submittal of the draft if NMFS does not provide comments on the draft report. For the final reporting year, Navy must submit a final/close out (year 7) SURTASS LFA Annual Training and Testing Report.

The SURTASS LFA Annual Training and Testing Report must include the following: (1) dates, times, and locations of each vessel during each training and testing activity; (2) information on sonar transmissions during each training and testing activity, including total annual hours or quantity of each bin of sonar used in all training and testing events, cumulative sonar use quantity from previous years' reports through the current year, and records of any sonar delays or suspensions due to the presence of marine mammals; and (3) marine mammal sighting information for each sighting in each exercise where mitigation was implemented. Marine mammal sighting information would include: (1) date, time, and location of sighting; (2) species (if not possible, indication of whale/dolphin/pinniped), number of individuals, and the initial detection sensor (*e.g.,* visual, passive acoustic, HF/M3 sonar); (3) indication of specific type of platform observation was made from (*e.g.,* the type of surface vessel or testing platform); (4) length of time observers maintained visual contact with marine mammal; (5) sea state; (6) visibility; (7) sound source in use at the time of sighting; (8) indication of whether animal was less than 182.9 m, 182.9 to 457.2 m, 457.2 to 914.4 m, 914.4 m to 1.8 km, or greater than 1.8 km from sonar source; (9) whether operation of sonar sensor was delayed, or sonar was powered or shut down, and the length of delay; (10) bearing and range from the vessel; and (11) for visual observations, Lookouts must report the observed behavior of the animal(s) in plain language and without trying to categorize in any way (animal closing to bow ride, paralleling course/speed, floating on surface and not swimming, *etc.*) and if any calves were present. The report must also include an evaluation (based on data gathered during the reporting year) of the effectiveness of mitigation measures designed to minimize the received level to which marine mammals may be exposed. This evaluation must identify the specific observations that support any conclusions the Navy reaches about the effectiveness of the mitigation. The analysis in the report must be based on the data from the current year's report and data collected from previous annual reports.

The final/close-out (year 7) SURTASS LFA Annual Training and Testing Report will also serve as the comprehensive close-out report and provide the annual totals for each sound source bin with a comparison to the annual amount analyzed and the 7-year total for each sound source bin with a comparison to the 7-year amount analyzed. NMFS must submit comments on the draft final/close-out report, if any, within 3 months of receipt. The reports will be considered final after the Navy has addressed NMFS' comments, or 3 months after submittal of the drafts if NMFS does not provide comments.

Other Reporting and Coordination

The Navy would continue to report and coordinate with NMFS for the following:

- Annual marine species monitoring technical review meetings that also include researchers and the Marine Mammal Commission; and
- Annual Adaptive Management meetings that also include the Marine Mammal Commission (and could occur in conjunction with the annual marine species monitoring technical review meetings).

Preliminary Analysis and Negligible Impact Determination

Introduction

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 by Level A harassment or Level B harassment (as presented in table 51), NMFS considers other factors, such as the likely nature of any responses (*e.g.,* intensity, duration) and the context of any responses (*e.g.,* critical reproductive time or location, migration), as well as effects on habitat and the likely effectiveness of the mitigation. We also assess the number, intensity, and context of estimated takes by evaluating this information relative to population status. Consistent with the 1989 preamble for NMFS' implementing regulations (54 FR 40338, September 29, 1989), the impacts from other past and ongoing anthropogenic activities are incorporated into this analysis via their impacts on the environmental baseline (*e.g.,* as reflected in the regulatory status of the species, population size and growth rate where known, other ongoing sources of human-caused mortality, and ambient noise levels).

In the Estimated Take of Marine Mammals section, we identified the subset of potential effects that would be expected to qualify as take under the MMPA both annually and over the 7-year period covered by this proposed rule and then identified the maximum number of takes we believe are reasonably expected to occur (harassment) based on the methods described. The impact that any given take will have is dependent on many case-specific factors that need to be considered in the negligible impact analysis (*e.g.,* the context of behavioral exposures such as duration or intensity of a disturbance, the health of impacted animals, the status of a species that incurs fitness-level impacts on individuals). For this proposed rule we evaluated the likely impacts of the enumerated maximum number of harassment takes that are proposed for authorization and reasonably expected to occur, in the context of the specific circumstances surrounding these predicted takes. Last, we collectively evaluated this information, as well as other more taxa-specific information and mitigation measure effectiveness, that support our negligible impact conclusions for each stock or species.

Analysis

In this section, we discuss multiple factors in the context of the Navy's activity, including the calculation of take by harassment, direct behavioral disturbance, the diel cycle, assessing the number of individuals taken and the likelihood of repeated takes, physiological stress responses, TTS, masking, AUD INJ, impacts on marine mammal habitat, and the proposed mitigation measures, and how they are considered in the negligible impact analysis.

Harassment

The specified activities reflect best estimates of the number of hours the Navy will conduct SURTASS LFA training and testing activities. The Description of the Proposed Activity section describes annual activities. There may be some flexibility in the exact number of transmission hours from year to year, but it will not exceed the annual total of 1,100 transmission hours for all vessels and take totals would not exceed the maximum annual total and 7-year total indicated in table 51. We base our analysis and negligible impact determination on the maximum number of takes that would be reasonably expected to occur annually and are proposed to be authorized, although, as stated before, the number of takes is only one part of the analysis, which includes qualitative consideration of other contextual factors that influence the degree of impact of the takes on the affected individuals.

The Navy's harassment take request was calculated using a model (NAEMO) for acoustic stressors, which NMFS reviewed and concurs appropriately estimates the maximum amount of harassment that is reasonably likely to occur based on the maximum number of hours and equal distribution of hours across the 15 geographic modeling areas. As described in more detail in the *Navy Acoustic Effects Model* section, NAEMO calculates: (1) sound energy propagation from SURTASS LFA sonar during military readiness activities; (2) the sound received by animat dosimeters representing marine mammals distributed in the area around the modeled activity); and (3) whether the sound received by a marine mammal exceeds the thresholds for effects. Assumptions in the Navy models intentionally err on the side of overestimation when there are unknowns. The effects of the specified activities are modeled as though they would occur regardless of proximity to marine mammals, meaning that no activity-based mitigation is considered (*e.g.,* no power down or shut down). However, the modeling does quantitatively consider the possibility that marine mammals would avoid continued or repeated sound exposures to some degree, based on a species' sensitivity to behavioral disturbance. NMFS provided input to, independently reviewed, and concurred with the Navy on this process. The Navy's analysis, which is described in detail in appendix B of the application, was used to quantify harassment takes for this proposed rule.

The Navy and NMFS anticipate more severe effects from takes resulting from exposure to higher received levels (though this is in no way a strictly linear relationship for behavioral effects throughout species, individuals, or circumstances) and less severe effects from takes resulting from exposure to lower received levels. However, there is also growing evidence of the importance of distance in predicting marine mammal behavioral response to sound, (*i.e.,* sounds of a similar level emanating from a more distant source have been shown to be less likely to elicit a response of equal magnitude) (DeRuiter *et al.,* 2013b). The estimated number of takes by Level A harassment and Level B harassment does not always equate to the number of individual animals the Navy expects to harass (which is lower for some species), but rather represents the instances of take (*i.e.,* exposures above the Level A harassment and Level B harassment threshold) that are anticipated to occur over the 7-year period. These instances may represent either brief exposures (*i.e.,* seconds or minutes) or, in some cases, longer durations of exposure within a day (though no more than 8 hours, which is the maximum amount Navy proposes to transmit in 1 day). In some cases, an animal that incurs a single take by AUD INJ or TTS may also experience a direct behavioral harassment from the same exposure.

Direct Behavioral Disturbance

The estimates calculated using the BRF do not differentiate between the different types of behavioral responses that qualify as Level B harassment. As described in the application, the Navy identified, with NMFS' input, that moderate behavioral responses, as characterized in Southall *et al.* (2021), would be considered a take. The behavioral responses predicted by the BRFs are assumed to be moderate severity exposures (*e.g.,* altered migration paths or dive profiles, interrupted nursing, breeding or feeding, or avoidance) that may last for the duration of an exposure. The Navy then compiled the available data indicating at what received levels and distances those responses have occurred and used the indicated literature to build biphasic behavioral response curves and cut-off conditions that are used to predict how many instances of Level B behavioral harassment occur in a day (see the Criteria and Thresholds Technical Report). Take estimates alone do not provide information regarding the potential fitness or other biological consequences of the responses on the affected individuals. We therefore consider the available activity-specific, environmental, and species-specific information to determine the likely nature of the modeled behavioral responses and the potential fitness consequences for affected individuals.

The use of SURTASS LFA sonar in a given region would generally be considered transient and temporary; however, we note the comparatively large ensonified areas generated by the higher-power LF source. In the range of potential behavioral effects that might be expected as part of a response that qualifies as an instance of Level B harassment (which, by nature of the way it is modeled/counted, occurs within 1 day), the less severe end might include exposure to comparatively lower levels of a sound, at a detectably greater distance from the animal, for a few or several minutes to multiple hours within the day of the exposure (though not more than 8 hours, which is the maximum transmission time proposed for any single day), which could result in a behavioral response such as avoiding an area that an animal would otherwise have chosen to move through or feed in for some amount of time or breaking off one or a few feeding bouts. More severe effects could occur when the animal gets close enough to the SURTASS LFA sonar source to receive a comparatively higher level or is exposed continuously to one source for a longer time. Such effects might result in an animal having a more severe flight response and leaving a larger area for a day or more or potentially losing feeding opportunities for a day. However, such severe behavioral effects are expected to occur infrequently. Of note, required monitoring reports indicate that there have been no apparent avoidance responses observed since use of SURTASS LFA sonar training and testing activities began in the Study Area in 2002.

To help assess this, for SURTASS LFA sonar used in the Study Area, the Navy provided information estimating the instances of take by Level B harassment by behavioral disturbance under each BRF that would occur within 6-dB increments, and by distance in 5-km bins in section 2.3.3 of appendix A of the application. As mentioned above, all else being equal, an animal's exposure to a higher received level is more likely to result in a behavioral disturbance that could more likely accumulate to impacts on reproductive success or survivorship of the animal, but other contextual factors (*e.g.,* distance, duration of exposure, and behavioral state of the animals) are also important (Di Clemente *et al.,* 2018; Ellison *et al.,* 2012; Moore and Barlow, 2013; Southall *et al.,* 2019c; Wensveen *et al.,* 2017, *etc.*). The majority of takes by Level B harassment are expected to be comparatively milder responses (*i.e.,* lower-level exposures that still qualify as take under the MMPA but would likely be less severe along the continuum of responses that qualify as take). We anticipate more severe effects from takes when animals are exposed to higher received levels of sound or at closer proximity to the source, or for longer durations. As noted previously in this proposed rule, behavioral response is likely variable between species (especially considering the reduced sensitivity of HF and VHF species to the SURTASS LFA sonar signal), individuals within a species, and context of the exposure. Specifically, given a range of behavioral responses that may be classified as Level B harassment, to the degree that higher received levels of sound are expected to result in more severe behavioral responses, only a smaller percentage of the anticipated Level B harassment from the specified activities might result in more severe responses. Further, the mitigation measures (described in detail in the Proposed Mitigation Measures section) are anticipated to reduce the exposure of marine mammals to received levels of SURTASS LFA sonar or HF/M3 sonar that would result in more severe behavioral responses.

Diel Cycle

Many animals perform vital functions, such as feeding, resting, traveling, and socializing on a diel cycle (24-hour cycle). Behavioral responses to noise exposure, when taking place in a biologically important context (*e.g.,* disruption of critical life functions, displacement, or avoidance of important habitat) are more likely to be significant if they last more than one diel cycle or recur on subsequent days (Southall *et al.,* 2007). Henderson *et al.* (2016) found that ongoing smaller scale MFAS events, for example, had little to no impact on foraging dives for Blainville's beaked whale, while multi-day training events may decrease foraging behavior for Blainville's beaked whale (Manzano-Roth *et al.,* 2016). Consequently, a behavioral response lasting less than 1 day and not recurring on subsequent days is not considered severe unless it could directly affect reproduction or survival (Southall *et al.,* 2007). Note that there is a difference between multiple-day substantive behavioral responses and multiple-day anthropogenic activities. SURTASS LFA sonar activities generally cover large areas that are relatively far from shore (typically more than 22 km from shore) and in generally deep waters. Marine mammals are moving as well, which would make it unlikely that the same animal could remain in the immediate vicinity of the ship for the entire duration of the activity. Further, as noted previously, SURTASS LFA sonar are not proposed to be conducted for more than 8 hours in a single day.

Assessing the Number of Individuals Taken and the Likelihood of Repeated Takes

As described previously, Navy modeling uses the best available science to predict the instances of exposure above certain acoustic thresholds, which are equated, as appropriate, to harassment takes. As further noted, for active acoustics it is typically more challenging to parse out the number of individuals taken by Level B harassment and the number of times those individuals are taken from this larger number of instances, though factors such as movement ecology (*e.g.,* is the species resident and more likely to remain in closer proximity to ongoing activities, versus nomadic or migratory; Keen *et al.* (2021)) or whether there are known areas where animals are known to congregate and overlap with activities can help inform this. One method that NMFS uses to help better understand the overall scope of the impacts is to compare these total instances of take against the abundance of that species (or stock if applicable). For example, if there are 100 harassment takes in a population of 100, the possibilities include either that every individual was exposed above acoustic thresholds once per year, or that some smaller number were exposed a few times per year while a few were not exposed at all. Where the instances of take exceed 100 percent of the population, multiple takes of some individuals are predicted and expected to occur within a year. Generally speaking, the higher the number of takes as compared to the population abundance, the more multiple takes of individuals are likely, and the higher the actual percentage of individuals in the population that are likely taken at least once in a year. We look at this comparative metric to give us a relative sense of where larger portions of the species are being taken by the Navy's SURTASS LFA sonar activities and where there is a higher likelihood that the same individuals are being taken across multiple days and where that number of days might be higher. It also provides a relative picture of the scale of impacts on each species.

For SURTASS LFA sonar, given the limited maximum annual number of hours of sonar spread across four vessels and a large geographic area, the fact that the training and testing occurs far from shore (>22 km) and outside of known areas of concentration of LFA sonar-sensitive species (OBIAs), and considering the predicted take numbers as compared to known stock abundances (with the exception of beaked whales and the Western North Pacific stock of humpback whales (take as a percentage of stock abundance ranges from 104–207 percent), it is unlikely that the individuals of most species or stocks are taken on multiple days (<1 percent for most, 1–10 percent for three stocks). Further, takes of single stocks are expected across multiple regions. All beaked whale stocks and species have comparatively higher numbers of takes and percentages as compared to known abundances. These higher numbers are driven by the BRF for sensitive species, which appropriately reflects the known higher sensitivity of beaked whales to acoustic stressors. However, we note that the BRFs used to predict takes from active acoustic sources do not take into account how loud the animal may perceive the sonar signal to be based on the frequency of the sonar versus the animal's hearing range and, as noted previously, HF hearing specialists (*e.g.,* beaked whales) have significantly reduced hearing sensitivity in the 100–500-Hz range of SURTASS LFA sonar (17–40-dB reduced sensitivity), which means that the effects of these exposures may be comparatively less severe than those from higher-frequency active sonar. For these stocks, and for all beaked whale species, we expect the total anticipated takes represent exposures of a smaller number of individuals of which some could be exposed multiple times. However, based on the nature of the Navy's SURTASS LFA sonar activities and the movement patterns of marine mammals, it is highly unlikely that any particular subset would be taken over more than several sequential days (with a few possible exceptions discussed in the *Negligible Impact Summary and Determinations* section).

When calculating the proportion of a population taken (*e.g.,* the number of takes divided by population abundance), which can also be helpful in estimating the number of days over which some individuals may be taken, it is important to choose an appropriate population estimate against which to make the comparison. Herein, NMFS considers the abundance estimates from the SARs where available and applicable. The SARs, where available and applicable, provide the official population estimate for a given species or stock in U.S. waters in a given year. These estimates are typically generated from the most recent shipboard and/or aerial surveys conducted, and in some cases, the estimates show substantial year-to-year variability. When the stock is known to range well outside of U.S. Exclusive Economic Zone (EEZ) boundaries, population estimates based on surveys conducted only within the U.S. EEZ are known to be underestimates. The SAR abundance estimate is included in table 1 for U.S. stocks. This proposed rule would authorize take of populations of the following species where there is no U.S. stock designated, as indicated in table 51: NPRW, blue whale, Bryde's whale, fin whale, humpback whale, Antarctic minke whale, minke whale, Omura's whale, sei whale, sperm whale, dwarf sperm whale, pygmy sperm whale, Baird's beaked whale, Blainville's beaked whale, Deraniyagala's beaked whale, ginkgo-toothed beaked whale, goose-beaked whale, Hubbs' beaked whale, Longman's beaked whale, Stejneger's beaked whale, false killer whale, killer whale, melon-headed whale, pygmy killer whale, short-finned pilot whale, bottlenose dolphin, common dolphin, Fraser's dolphin, Northern right whale dolphin, pantropical spotted dolphin, Risso's dolphin, rough-toothed dolphin, spinner dolphin, striped dolphin, Dall's porpoise, northern fur seal, ribbon seal, and ringed seal. For species for which no stock is designated, and no abundance estimate is available, it is not possible to calculate the proportion of the species taken. However, there is no reason to expect that these percentages would be higher than the U.S. stock percentages.

Physiological Stress Response

Some of the lower level physiological stress responses (*e.g.,* orientation or startle response, change in respiration, change in heart rate) discussed earlier would likely co-occur with the predicted harassments, although these responses are more difficult to detect and fewer data exist relating these responses to specific received levels of sound. Level B harassment takes, then, may have a stress-related physiological component as well; however, given the limited maximum number of total SURTASS LFA sonar hours in a year (1,100) and the fact that they are shared across four vessels and spread across an ocean basin, we would not expect SURTASS LFA sonar to create conditions of long-term continuous noise leading to long-term physiological stress responses in marine mammals that could affect reproduction or survival.

Temporary Threshold Shift (TTS)

NMFS and the Navy have estimated that 30 species of marine mammals may incur some level of TTS from SURTASS LFA sonar. As mentioned previously, in general, TTS can last from a few minutes to days, be of varying degree, and occur across various frequency bandwidths, all of which determine the severity of the impacts on the affected individual, which can range from minor to more severe. Table 52 indicates the number of takes by TTS that may be incurred by different species from exposure to active sonar. The TTS incurred by an animal is primarily characterized by three characteristics:

1. *Frequency*. Available data suggest that most TTS occurs in the frequency range of the source up to one octave higher than the source (with the maximum TTS at one-half octave above) (Finneran, 2015; Southall *et al.,* 2019). TTS from SURTASS LFA sonar would occur below 2 kHz, which is in the range where many mysticetes communicate and also where other auditory cues are located (*e.g.,* waves, snapping shrimp, fish prey), although it is out of the range of the majority of most odontocete communication and all echolocation. Pinnipeds communicate across a broad range, generally including low frequency grunts (in the tens of Hz), but sometimes ranging to high frequency whistles (above 20 kHz), depending on the species and context. Also of note, SURTASS LFA sonar from which TTS may incur occupy a narrow frequency band (between 100 and 500 Hz), meaning that the TTS incurred would also be across a narrower band (*i.e.,* not affecting more than a small portion of any marine mammal's hearing range).

2. *Degree of the shift (i.e., by how many dB the sensitivity of the hearing is reduced)*. Generally, both the degree of TTS and the duration of TTS will be greater if the marine mammal is exposed to a higher level of energy (which would occur when the peak SPL is higher or the duration is longer). The threshold for the onset of TTS was discussed previously in this proposed rule. Animals would have to approach closer to the source or remain in the vicinity of the sound source appreciably longer to increase the received SEL, which would be unlikely for most taxa considering the Lookouts and the relative motion between the sonar vessel and the animal but, given the large ensonified zone, could happen for some mysticetes, which is reflected in their higher TTS numbers. In the TTS studies discussed in the Potential Effects of Specified Activities on Marine Mammals and Their Habitat section, some using exposures of almost an hour in duration or up to 217 SEL, most of the TTS induced was 15 dB or less, though Finneran *et al.* (2007) induced 43 dB of TTS with a 64-second exposure to a 20 kHz source measured via auditory steady-state response (auditory evoked potential measurement). In general, there is a higher potential for TTS associated with sources with higher duty cycles, like continuous hull-mounted sonars, compared to those sources that are intermittent or have lower duty cycles (Kastelein *et al.,* 2015a).

In short, given the anticipated duration and levels of sound exposure, we would not expect marine mammals to incur more than low levels of TTS in most cases for sonar exposure, with potentially occasional moderate levels for some mysticete individuals. To add context to this degree of TTS, individual marine mammals may regularly experience variations of 6 dB differences in hearing sensitivity in their lifetime (Finneran *et al.,* 2000; Finneran *et al.,* 2002; Schlundt *et al.,* 2000).

3. *Duration of TTS (recovery time)*. As discussed in the Potential Effects of Specified Activities on Marine Mammals and Their Habitat section, TTS laboratory studies using exposures of up to an hour in duration or up to 217 dB SEL, most individuals recovered within 1 day (or less, often in minutes) (Kastelein, 2020b). One study resulted in a recovery that took 4 days (Finneran *et al.,* 2015; Southall *et al.,* 2019). However, there is evidence that repeated exposures resulting in TTS could potentially lead to residual threshold shifts that persist for longer durations and can result in PTS (Reichmuth *et al.,* 2019).

Compared to laboratory studies, marine mammals are likely to experience lower SELs from SURTASS LFA sonar in the Study Area due to movement of the source and animals and the duty cycle of SURTASS LFA sonar, though the larger ensonified area may result in longer exposures than some other sonar sources. Also, for the same reasons discussed in the Diel Cycle section of the Preliminary Analysis and Negligible Impact Determination section, and because of the short distance between the source and animals needed to reach high SELs, it is unlikely that marine mammals would be exposed to the levels necessary to induce TTS in subsequent time periods such that hearing recovery is impeded. Additionally, though the frequency range of TTS that marine mammals might incur would overlap with some of the frequency ranges of their vocalization types, the frequency range of TTS from SURTASS LFA sonar does not span the entire frequency range of one vocalization type, much less span all types of vocalizations or other critical auditory cues.

As described above, we expect the majority of TTS takes to be in the form of milder, relatively short-term (minutes to hours), narrower band (only affecting a portion of the animal's hearing range) TTS. This means that for one to several times per year, for several minutes, maybe a few hours, or at most in limited circumstances a few days, a taken individual will have diminished hearing sensitivity (*i.e.,* more than natural variation, but nowhere near total deafness). Any such exposure would occur within a narrower low-frequency band that may overlap part (but not all) of the communication range of some mysticetes or pinnipeds, little odontocete communication, and no echolocation or predator sounds, or overlap some low frequency environmental sounds, such as those that marine mammals use to navigate or find prey. The significance of TTS is also related to the auditory cues that are germane within the time period that the animal incurs the TTS. For example, if a mysticete has TTS at frequencies that inhibits its detection of prey but incurs it at night when it is resting and not feeding, it may not be as impactful. In short, the expected results of any one of these limited number of mild TTS occurrences could be that: (1) it does not overlap signals that are pertinent to that animal in the given time period; (2) it overlaps parts of signals that are important to the animal, but not in a manner that impairs interpretation; or (3) it reduces detectability of an important signal to a small degree for a short amount of time—in which case the animal may be aware and be able to compensate (but there may be slight energetic cost), or the animal may have some reduced opportunities (*e.g.,* to detect prey) or reduced capabilities to react with maximum effectiveness (*e.g.,* to detect a predator or navigate optimally). However, it is unlikely that individuals would experience repeated or high degree TTS overlapping in frequency and time with signals critical for behaviors in a manner that would impact overall fitness.

Auditory Masking or Communication Impairment

The ultimate potential impacts of masking on an individual (if it were to occur) are similar to those discussed for TTS, but an important difference is that masking occurs only during the time of the signal, versus TTS, which continues beyond the duration of the signal. Fundamentally, masking is referred to as a chronic effect because one of the key harmful components of masking is its duration—the fact that an animal would have reduced ability to hear or interpret critical cues becomes much more likely to cause a problem the longer it occurs. Also inherent in the concept of masking is the fact that the potential for the effect is present only during the times that the animal and the source are in close enough proximity for the effect to occur (and further, this time period would need to coincide with a time that the animal was utilizing sounds at the masked frequency). As our analysis has indicated, because of the relative movement of vessels and the sound sources primarily involved in this proposed rule, as well as the fact that the Navy proposes a maximum of 8 hours of SURTASS LFA sonar transmission per day, we do not expect the exposures with the potential for masking to be of a long duration.

Masking is fundamentally more of a concern at lower frequencies because low-frequency signals propagate significantly farther than higher frequencies and because they are more likely to overlap both the narrower LF calls of mysticetes and pinnipeds and many non-communication cues (*e.g.,* fish and invertebrate prey), and geologic sounds that inform navigation. Masking is more of a concern from continuous sources where there is no quiet time between pulses and detection and interpretation of auditory signals is likely more challenging. While SURTASS LFA sonar has comparatively long pings or wavetrains (6–100 seconds) and there are opportunities for reflection and reverberation in the deep ocean, there are also between 6- and 15-minute periods between each ping and, further, the limited hours of total annual LFA sonar transmission further reduces the likelihood of long exposure for any given individual. For these reasons, short-term exposure to the SURTASS LFA sonar is not expected to result in a meaningful amount of masking, and it is not in the contemporaneous aggregate amounts that would be expected to accrue to degrees that would have the potential to affect reproductive success or survival.

In conclusion, the bandwidth of a given SURTASS LFA sonar transmitted signal is limited (100 to 500 Hz), the average pulse length 60 seconds, the signals do not remain at a single frequency for more than 10 seconds, and the system is silent nominally 90–92.5 percent of the time during at-sea training activities. With the nominal duty cycle of 7.5–10 percent, masking by SURTASS LFA sonar would occur only over a very small temporal scale. Masking is more likely to occur in the presence of broadband, relatively continuous noise sources such as from vessels; however, masking effects from vessel noise during the operation of T–AGOS vessels are not expected to rise to the level of take. The duration of temporal and spatial overlap with any individual marine mammal and the SURTASS LFA sonar would not be expected to result in more than short-term, low impact masking that would neither have a reasonably foreseeable significant adverse impact on marine mammals nor affect reproduction or survival.

Auditory Injury

Table 52 indicates the number of takes of each species by Level A harassment in the form of auditory injury resulting from exposure to active sonar is estimated to occur, and table 51 indicates the totals across all SURTASS LFA sonar activities. The number of takes estimated to result from auditory injury annually from sonar for each species or stock ranges from 0 (for 35 species) to 32 (1–9 AUD INJ takes for 9 species or stocks, and 32 for fin whales with NSD). As described previously, the Navy's model likely overestimates the number of injurious takes. Nonetheless, these Level A harassment take numbers represent the maximum number of instances in which marine mammals would be reasonably expected to incur auditory injury, and we have analyzed them accordingly.

As discussed previously in relation to TTS, the likely consequences to the health of an individual that incurs auditory injury can range from mild to more serious and is dependent upon the degree of auditory injury and the frequency band associated with auditory injury. The majority of any auditory injury incurred as a result of exposure to SURTASS LFA sonar would be expected to be in the 100–500 Hz range and could overlap a small portion of the hearing and communication frequency range of mysticetes and some pinnipeds. The SURTASS frequency range is higher than the typically pelagic large whale main foraging and communication range (*e.g.,* blue, fin, sei whales in the 20–40 Hz range). SURTASS frequency range is also lower than the most sensitive (*i.e.,* ability to perceive without significant loudness) range of many odontocetes and pinnipeds. Permanent loss of some degree of hearing is a normal occurrence for older animals, and many animals are able to compensate for the shift, both in old age or at younger ages as the result of stressor exposure. While a small loss of hearing sensitivity may include some degree of energetic costs for compensating or may mean some small loss of opportunities or detection capabilities, at the expected scale it would be unlikely to impact behaviors, opportunities, or detection capabilities to a degree that would interfere with reproductive success or survival.

The Navy implements mitigation measures during SURTASS LFA sonar activities that are expected to minimize the severity of any AUD INJ accrued. This includes visual, active acoustic, and passive acoustic monitoring (the combination of which has been shown to be over 98 percent effective at detecting marine mammals) to support delaying initial sonar transmissions and suspending ongoing transmission when a marine mammal is observed in the shutdown zone (1.8 km around the LFA sonar array and T–AGOS vessel). These measures are described further in the Proposed Mitigation Measures section. Monitoring for marine mammals during the SURTASS LFA sonar activities would also include active (HF/M3) and passive acoustic detection methods before the activity begins and continue until 15 minutes after LFA sonar transmissions are terminated, in order to cover the mitigation zone. These mitigation measures are considered near 100 percent effective in avoiding exposures within the 1.8 km mitigation zone and reduce the severity of any auditory injury exposures (if incurred).

It is unlikely that any of the limited number of auditory injuries accrued to any one species would result in reduced reproductive success of any individuals, and auditory injury of the low severity anticipated here is not expected to affect the survival of any individual marine mammals.

Impacts to Marine Mammal Habitat

As described in the *Marine Mammal Habitat* section, the proposed training and testing activities have the potential to affect marine mammal habitat through impacts on the prey species of marine mammals, as well as the acoustic habitat of marine mammals (see masking discussion above). Impacts to habitat would be expected to be localized around the T–AGOS vessel transmitting sonar, and long-term consequences to fish or invertebrate populations would not be expected based on the low level and short duration (at most, 8 hours per day) of potential exposure to SURTASS LFA sonar. Most fish species can hear low-frequency sounds and would be expected to be able to hear the LF sonar associated with the proposed activities. The most likely effects on fishes exposed to low-frequency sounds are behavioral responses. While there would be no probability for mortality or physical injury from low-frequency sonar, there is the potential for minor, temporary changes in behavior among fish, including increased swimming rate, avoidance of the sound source, or changes in orientation to the sound source. Marine invertebrate prey would be expected to detect nearby low-frequency sounds in most cases, which could, in some cases, cause behavioral effects. The most likely impacts for most prey species in a given area would be temporary avoidance of the area and long-term consequences to marine invertebrate populations would not be expected as a result of exposure to sounds or vessels in the Study Area.

Any anthropogenic noise attributed to SURTASS LFA sonar training and testing activities in the Study Area would be temporary and the acoustic habitat of the affected area would be expected to immediately return to its original state when these activities cease. The proposed activities would add sound to the ambient ocean environment, and water quality may potentially be affected should pollutants be discharged from T–AGOS vessels into oceanic waters. However, no impacts to the sediment or benthic environment would be expected because all equipment would be deployed in the marine water column.

The proposed SURTASS LFA sonar activities would not affect the physical characteristics of marine mammal habitats. Unless the sound source is stationary and/or continuous over a long duration in one area (noting the 8-hour daily maximum for SURTASS LFA sonar), the effects of the introduction of sound into the environment are generally considered to have a less severe impact on marine mammal habitat than actions involving physical alteration of the habitat. Marine mammals may be temporarily displaced from areas where SURTASS LFA training and testing activities are occurring to avoid noise exposure (*i.e.,* due to impacts on acoustic habitat), but the habitat will not be physically altered and will likely be available for use again after the activities have ceased or moved out of the area. In addition, pings from SURTASS LFA sonar are very sporadic and are not generally repeated in the exact same area. SURTASS LFA training and testing activities would not result in the deposition of materials, change bathymetry, strike or modify features, or cause any physical alterations to marine mammal habitat.

NMFS does not expect any short- or long-term effects to marine mammal food resources from SURTASS LFA sonar training and testing activities. It is unlikely that the activities of the T–AGOS vessels transmitting LFA sonar at any place in the Study Area over the course of a year would implicate all of the areas for a given species or stock in any year. It is anticipated that ample similar nearby habitat areas are available for species/stocks in the event that portions of preferred areas are ensonified. Implementation of the 1.8 km LFA shutdown zone would ensure that most marine mammal takes are limited to lower-level Level B harassment. Further, in areas of known or likely biological importance for marine mammal functions (feeding, reproduction, *etc.*), effects are mitigated by the coastal standoff and OBIAs.

Mitigation

As described in the Proposed Mitigation Measures section, this proposed rule includes mitigation measures that would reduce the probability and/or severity of impacts expected to result from acute exposure to acoustic sources and impacts to marine mammal habitat. Specifically, the Navy would use a comprehensive suite of mitigation monitoring methods to support activity-specific mitigation, including the use of visual monitoring, passive acoustic monitoring, and active acoustic monitoring using the HF/M3 system. Real-time activity specific measures would include a combination of delayed starts, sonar ramp-ups, and shutdowns to minimize the likelihood or severity of AUD INJ and reduce instances of TTS or more severe behavioral disturbance caused by acoustic sources. Navy would also apply time/area restrictions, including a 22-km CSR and avoiding identified OBIAs for marine mammals. The CSR and OBIA geographic restrictions on SURTASS LFA sonar training and testing activities are expected to minimize the likelihood of disruption of marine mammals in areas where important behavior patterns (*e.g.,* migration, calving, breeding, feeding, or sheltering) occur or in areas with small resident populations or higher densities of marine mammals. As a result, the takes that occur are less likely to result in energetic effects or disturbances of other important behaviors that would reduce reproductive success or survivorship.

In examining the results of the mitigation monitoring procedures over the previous 22 years of SURTASS LFA sonar activities, NMFS has concluded that the mitigation and monitoring measures for initiating shutdowns of the LFA sonar system have been implemented properly and have successfully minimized the potential adverse effects of SURTASS LFA sonar to marine mammals in the 1.8 km LFA sonar mitigation zone around the vessel.

Negligible Impact Summary and Determinations

As described above and in detail in table 61, NMFS has estimated and proposed to authorize the take, by harassment only, of 44 species of marine mammals, including 34 stocks identified pursuant to the MMPA. A subset of nine of those species could also be taken by Level A harassment over the course of the 7-year period. For reasons stated previously, no mortalities or serious injuries are anticipated to occur as a result of the Navy's proposed SURTASS LFA sonar training and testing activities, and none are proposed to be authorized by NMFS.

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Table 61 -- Annual Estimated Take by Level B harassment and Level A harassment and Related Information for Marine Mammals in the Study Area

Marine Mammal Species	Stock	SAR Abundance	Maximum Annual Level B Harassment (BEH + TTS)	Maximum Annual Level A Harassment (AUD INJ)	Maximum Annual Take	Maximum Annual Take as Percentage of SAR Abundance (Level A and Level B only)
North Pacific right whale	NSD	N/A	325	2	327	N/A
Blue whale	NSD	N/A	1,062	3	1,065	N/A
Blue whale	Central North Pacific	133	13	0	13	9.77
Bryde's whale	NSD	N/A	816	1	817	N/A
Bryde's whale	Hawaii	791	7	0	7	0.88
Fin whale	NSD	N/A	5,738	32	5,770	N/A
Fin whale	Hawaii	203	16	0	16	7.88
Humpback whale	NSD	N/A	3	0	3	N/A
Humpback whale	Hawaii	11,278	13	0	13	0.12
Humpback whale	Western North Pacific	1,084	1,133	4	1,137	104.89
Antarctic minke whale	NSD	N/A	48	0	48	N/A
Minke whale	NSD	N/A	3,020	6	3,026	N/A
Minke whale	Hawaii	438	3	0	3	0.68
Omura's whale	NSD	N/A	217	1	218	N/A
Sei whale	NSD	N/A	2,021	9	2,030	N/A
Sei whale	Hawaii	391	5	1	6	1.53
Sperm whale	NSD	N/A	37	0	37	N/A
Sperm whale	North Pacific	UNK	225	0	225	UND
Sperm whale	Hawaii	5,707	15	0	15	0.26
Dwarf sperm whale	NSD	N/A	719	0	719	N/A

Marine Mammal Species	Stock	SAR Abundance	Maximum Annual Level B Harassment (BEH + TTS)	Maximum Annual Level A Harassment (AUD INJ)	Maximum Annual Take	Maximum Annual Take as Percentage of SAR Abundance (Level A and Level B only)
Dwarf sperm whale	Hawaii	UNK	151	0	151	N/A
Pygmy sperm whale	NSD	N/A	864	0	864	N/A
Pygmy sperm whale	Hawaii	42,083	152	0	152	0.36
Baird's beaked whale	NSD	N/A	64,875	0	64,875	N/A
Blainville's beaked whale	NSD	N/A	61,964	0	61,964	N/A
Blainville's beaked whale	Hawaii	1,132	2,073	0	2,073	183.13
Deraniyagala's beaked whale	NSD	N/A	9,448	0	9,448	N/A
Ginkgo-toothed beaked whale	NSD	N/A	30,342	0	30,342	N/A
Goose-beaked whale	NSD	N/A	111,485	0	111,485	N/A
Goose-beaked whale	Hawaii	4,431	9,185	0	9,185	207.29
Hubbs' beaked whale	NSD	N/A	25,289	0	25,289	N/A
Longman's beaked whale	NSD	N/A	69,988	0	69,988	N/A
Longman's beaked whale	Hawaii	2,550	5,017	0	5,017	196.75
Stejneger's beaked whale	NSD	N/A	37,258	0	37,258	N/A
False killer whale	NSD	N/A	60	0	60	N/A
False killer whale	Main Hawaiian Islands Insular	138	1	0	1	0.72
False killer whale	Hawaii Pelagic	5,528	7	0	7	0.13
Killer whale	NSD	N/A	173	0	173	N/A
Killer whale	Hawaii	161	1	0	1	0.62
Melon-headed whale	NSD	N/A	537	0	537	N/A

Marine Mammal Species	Stock	SAR Abundance	Maximum Annual Level B Harassment (BEH + TTS)	Maximum Annual Level A Harassment (AUD INJ)	Maximum Annual Take	Maximum Annual Take as Percentage of SAR Abundance (Level A and Level B only)
Melon-headed whale	Hawaiian Islands	40,647	107	0	107	0.26
Pygmy killer whale	NSD	N/A	318	0	318	N/A
Pygmy killer whale	Hawaii	10,328	32	0	32	0.31
Short-finned pilot whale	NSD	N/A	1,083	0	1,083	N/A
Short-finned pilot whale	Hawaii	19,242	76	0	76	0.39
Bottlenose dolphin	NSD	N/A	1,901	0	1,901	N/A
Bottlenose dolphin	Hawaii Pelagic	24,669	32	0	32	0.13
Common dolphin	NSD	N/A	1,713	0	1,713	N/A
Fraser's dolphin	NSD	N/A	465	0	465	N/A
Fraser's dolphin	Hawaii	40,960	152	0	152	0.37
Northern right whale dolphin	NSD	N/A	10	0	10	N/A
Pacific white-sided dolphin	North Pacific	26,880	49	0	49	0.18
Pantropical spotted dolphin	NSD	N/A	2,785	0	2,785	N/A
Pantropical spotted dolphin	Hawaii Pelagic	67,313	233	0	233	0.35
Risso's dolphin	CWP/EIO NSD	N/A	1,575	0	1,575	N/A
Risso's dolphin	Hawaii	6,979	38	0	38	0.54
Rough-toothed dolphin	NSD	N/A	508	0	508	N/A
Rough-toothed dolphin	Hawaii	83,915	299	0	299	0.36
Spinner dolphin	NSD	N/A	276	0	276	N/A
Spinner dolphin	Hawaii Pelagic	N/A	15	0	15	N/A
Striped dolphin	NSD	N/A	4,327	0	4,327	N/A

Marine Mammal Species	Stock	SAR Abundance	Maximum Annual Level B Harassment (BEH + TTS)	Maximum Annual Level A Harassment (AUD INJ)	Maximum Annual Take	Maximum Annual Take as Percentage of SAR Abundance (Level A and Level B only)
Striped dolphin	Hawaii Pelagic	64,343	200	0	200	0.31
Dall's porpoise	NSD	N/A	3,020	0	3,020	N/A
Northern fur seal	NSD	N/A	1,296	0	1,296	N/A
Steller sea lion	Western	49,837	1	0	1	0.00
Bearded seal	Beringia	UND	1	0	1	UND
Harbor seal	California	30,968	1	0	1	0.00
Ribbon seal	NSD	N/A	37,650	1	37,651	N/A
Hawaiian monk seal	Hawaii	1,605	1	0	1	0.06
Ringed seal	NSD	N/A	25	0	25	N/A
Spotted seal	Bering	461,625	71	0	71	0.02

Note: A stock or population listed as 'NSD' is not a designated stock under the MMPA. N/A = Not Applicable, UND = Undetermined, UNK = Unknown.

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For the following summarized reasons, based on the analysis and information in this proposed rule, as well as the referenced supporting documentation, NMFS preliminary finds that the total take proposed for authorization from SURTASS LFA sonar training and testing activities will have a negligible impact on all affected marine mammal species or stocks based on the following:

- No mortality is anticipated or proposed for authorization, nor is any non-auditory injury. Neither acoustic impacts resulting in stranding nor vessel strikes are expected to result from SURTASS LFA sonar training and testing. There is no empirical evidence of strandings or vessel strikes of marine mammals associated spatially or temporally with the use of SURTASS LFA sonar. Moreover, the sonar system acoustic characteristics differ between LFA sonar and MFA sonars that have been associated with strandings.
- The maximum annual allowable instances of take under this proposed rule by Level A harassment (AUD INJ only) range from 0 to 32 (fin whales with NSD).
- Regarding potential takes associated with auditory impairment, as described in the Temporary Threshold Shift section, any takes in the form of TTS are expected to be lower-level and of short duration. Any associated lost opportunities or capabilities that individuals might experience as a result of TTS would not be at a level or duration that would be expected to impact reproductive success or survival. For similar reasons, as discussed in the Auditory Injury section, while auditory injury impacts last longer, the low anticipated levels of AUD INJ that could be reasonably expected to result from these activities, should they occur, are unlikely to have any effect on fitness.
- The operational characteristics of the specified activities, including the limited maximum annual number of hours of SURTASS LFA sonar (1,100) shared across multiple vessels (likely not in close proximity to one another) and spread over the entire western and central North Pacific Ocean and eastern Indian Ocean (including multiple smaller and separated seas for some species), as well as the 8-hour maximum daily transmission, thus minimize the likelihood of multi-day or long-duration exposures for any individual marine mammals. Further, and as noted above, the context of exposures is important in evaluating the ultimate impacts of Level B harassment on individuals, and in the case of SURTASS LFA sonar, the approaching sound source would be moving through the open ocean at low speeds, so concerns of noise exposure are somewhat lessened in this context compared to situations where animals may not be as able to avoid strong or rapidly approaching sound sources.
- Regarding the potential takes associated with behavioral harassment, as described in the Potential Effects of Specified Activities on Marine Mammals and Their Habitat section, behavioral disturbance from SURTASS LFA sonar activities in a given region would generally be considered transient and temporary, though the ensonified area generated by the higher-power LF source is comparatively large. Behavioral disturbance is likely variable between species, individuals within a species, and context of the exposure, and responses are likely to range from less severe (*e.g.,* an animal avoiding an area that it would otherwise have chosen to move through or feed in for some amount of time) to more severe (*e.g.,* an animal having a more severe flight response and leaving a larger area for a day or more). Such severe behavioral effects are expected to occur infrequently due to the implementation of the proposed mitigation measures (*e.g.,* the SURTASS LFA mitigation zone, which is designed to ensure that most marine mammal takes are limited to lower-level Level B harassment, CSR, and OBIAs).
- Previous reports indicate that the HF/M3 active sonar system has proven to be the most effective of the mitigation monitoring measures to detect possible marine mammals in proximity to the transmitting LFA sonar array, and the use of this system substantially increases the probability of detecting marine mammals within the mitigation zone. Because the HF/M3 system is able to monitor marine mammals out to an effective range of 2–2.5 km from the vessel, it is unlikely that the SURTASS LFA sonar operations would expose marine mammals to an SPL greater than about 174 dB re 1 µPa. Past results of the HF/M3 system tests provide confirmation that the system has a demonstrated probability of single-ping detection of 95 percent or greater for single marine mammals that are 10 m in length or larger, and a probability approaching 100 percent for multiple pings of any sized marine mammal (see chapter 4 of the 2025 SURTASS Draft SEIS/OEIS).
- In areas of known or likely biological importance for functions such as feeding, reproduction, *etc.,* effects are mitigated by the CSR and mitigation in the OBIAs for species sensitive to LF sound. The sound field generated by SURTASS LFA sonar during training activities would not exceed 180 dB re 1 µPa RMS SPL within 22 km from any emergent land. Further, no more than 25 percent (275 hours) of SURTASS LFA sonar will be used for training activities within 18.5 km of any single OBIA during any year. These measures are expected to minimize the likelihood of disruption of marine mammals in areas where important behavior patterns (*e.g.,* migration, calving, breeding, feeding, or sheltering) occur, or in areas with small resident populations or higher densities of marine mammals. As a result, any takes that occur are less likely to result in energetic effects or disturbances of other important behaviors that would be more likely to reduce reproductive success or survivorship.
- Based on the information in the *Marine Mammal Habitat* section of this proposed rule, and the supporting information included in the 2025 SURTASS Draft SEIS/OEIS, NMFS has determined that the proposed training and testing activities would not have adverse or long-term impacts on marine mammal habitat.
- As noted above, there is a higher likelihood that some number of individual beaked whales (of all species and stocks) or humpback whales (Western North Pacific stock) may be taken on up to several days within a year, considering annual take maxima and the total across 7 years. However, as described, given the magnitude and severity of the potential take (especially noting the reduced sensitivity of beaked whales to SURTASS LFA sonar signal), and in consideration of the required mitigation measures and other information presented, the Navy's activities are not expected to result in impacts on the reproduction or survival of any individuals, much less affect annual rates of recruitment or survival.

Preliminary Determination

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

Unmitigable Adverse Impact Analysis and Determination

The Navy will not operate SURTASS LFA sonar in Arctic waters nor in the Gulf of Alaska, or off the Aleutian Island chain where subsistence uses of marine mammals protected through sections 101(a)(5)(A) of the MMPA occur. Therefore, there are no relevant subsistence uses of the affected marine mammal stocks or species implicated by this action. As such, there would be no impact on subsistence hunting, nor would SURTASS LFA sonar cause abandonment of any harvest/hunting locations, displace any subsistence users, or place physical barriers between marine mammals and the hunters. NMFS has preliminarily determined that the total taking of affected species or stocks would not have an unmitigable adverse impact on the availability of such species or stocks for taking for subsistence purposes.

Classification

Endangered Species Act (ESA)

There are 10 marine mammal species under NMFS jurisdiction that are listed as endangered or threatened under the ESA with confirmed or possible occurrence in the Study Area: (1) blue whale; (2) fin whale; (3) humpback whale; (4) NPRW; (5) sei whale; (6) sperm whale; (7) false killer whale; (8) bearded seal; (9) Hawaiian monk seal; and (10) Steller sea lion. The humpback whale (86 FR 21082, April 21, 2021), false killer whale (83 FR 35062, July 24, 2018), and Hawaiian monk seal (51 FR 16047, April 30, 1986; revised in 1988 (53 FR 18988, May 26, 1988) and in 2015 (80 FR 50925, August 21, 2015)) have critical habitat designated under the ESA in the Study Area.

The Navy will consult with NMFS pursuant to section 7 of the ESA for the Study Area activities. NMFS will also consult internally on the issuance of the regulations and an LOA under section 101(a)(5)(A) of the MMPA.

National Marine Sanctuaries Act

The Navy and NMFS will work with NOAA's Office of National Marine Sanctuaries to fulfill our responsibilities under the National Marine Sanctuaries Act as warranted and will complete any NMSA requirements prior to a determination on the issuance of the final rule and LOA.

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 its proposed actions with respect to potential impacts on the human environment. Accordingly, NMFS plans to rely on the 2025 SURTASS Draft SEIS/OEIS for the Study Area, provided our independent evaluation of the document finds that it includes adequate information analyzing the effects on the human environment of issuing regulations and LOAs under the MMPA. NMFS is a cooperating agency on the 2025 SURTASS Draft SEIS/OEIS and has worked extensively with the Navy in developing the document. The 2025 SURTASS Draft SEIS/OEIS was made available for public comment at: *https://www.nepa.navy.mil/surtass-lfa/,* which also provides additional information about the NEPA process, from June 13, 2025, through July 28, 2025. We will review all comments prior to concluding our NEPA process and making a final decision on the MMPA rulemaking and request for LOA.

We will review all comments submitted in response to this notice prior to concluding our NEPA process or making a final decision on the MMPA rule and request for LOA.

Regulatory Flexibility Act

Pursuant to the Regulatory Flexibility Act (RFA), the Chief Counsel for Regulation of the Department of Commerce has certified to the Chief Counsel for Advocacy of the Small Business Administration that this proposed rule, if adopted, would not have a significant economic impact on a substantial number of small entities. The RFA requires Federal agencies to prepare an analysis of a rule's impact on small entities whenever the agency is required to publish a notice of proposed rulemaking. However, a Federal agency may certify, pursuant to 5 U.S.C. 605(b), that the action will not have a significant economic impact on a substantial number of small entities. The Navy is the only entity that would be affected by this proposed rulemaking and is not a small governmental jurisdiction, small organization, or small business, as defined by the RFA. Any requirements imposed by an LOA issued pursuant to these regulations, and any monitoring or reporting requirements imposed by these regulations, would be applicable only to the Navy. NMFS does not expect the issuance of these regulations or the associated LOA to result in any impacts to small entities pursuant to the RFA. Because this action, if adopted, would directly affect only the Navy and not any small entities, NMFS concludes that the action would not result in a significant economic impact on a substantial number of small entities. As a result, an initial regulatory flexibility analysis is not required and none has been prepared.

Paperwork Reduction Act

This action does not contain any collection of information requirements for purposes of the Paperwork Reduction Act of 1980 (44 U.S.C. 3501 *et seq.*).

Executive Order 12866

This proposed rule has been determined to be not significant for purposes of Executive Order 12866.

Executive Order 14192

This proposed rule is not an Executive Order 14192 regulatory action because this rule is not significant under Executive Order 12866.

List of Subjects in 50 CFR Part 218

Administrative practice and procedure, Endangered and threatened species, Fish, Fisheries, Marine mammals, Penalties, Reporting and recordkeeping requirements, Transportation, Wildlife.

Dated: March 5, 2026.

Samuel D. Rauch III,

Deputy Assistant Administrator for Regulatory Programs, National Marine Fisheries Service.

For the reasons set forth in the preamble, NMFS proposes to amend 50 CFR part 218 as follows:

PART 218–REGULATIONS GOVERNING THE TAKING AND IMPORTING OF MARINE MAMMALS

■ 1. The authority citation for part 218 continues to read as follows:

Authority: 16 U.S.C. 1361 *et seq.*

■ 2. Revise subpart X to read as follows:

Subpart X—Taking and Importing Marine Mammals; U.S. Navy Surveillance Towed Array Sensor System Low Frequency Active (SURTASS LFA) Sonar Training and Testing in the Central and Western North Pacific and Eastern Indian Oceans

Sec.

§ 218.230 Specified activity and geographical region.

(a) Regulations in this subpart apply only to the U.S. Navy (Navy) for the taking of marine mammals that occurs in the area described in paragraph (b) of this section and that occurs incidental to the activities listed in paragraph (c) of this section. Requirements imposed on the Navy must be implemented by those persons they authorize or fund to conduct activities on their behalf.

(b) The taking of marine mammals by the Navy under this subpart may be authorized in a letter of authorization (LOA) only if it occurs within the Pacific Surveillance Towed Array Sensor System Low Frequency Active (SURTASS LFA) Sonar Study Area. The Pacific SURTASS LFA Sonar Study Area is delineated in Figure 1 to this paragraph (b) and includes the western and central North Pacific Ocean and eastern Indian Ocean, not including the western Indian Ocean or Sea of Okhotsk.

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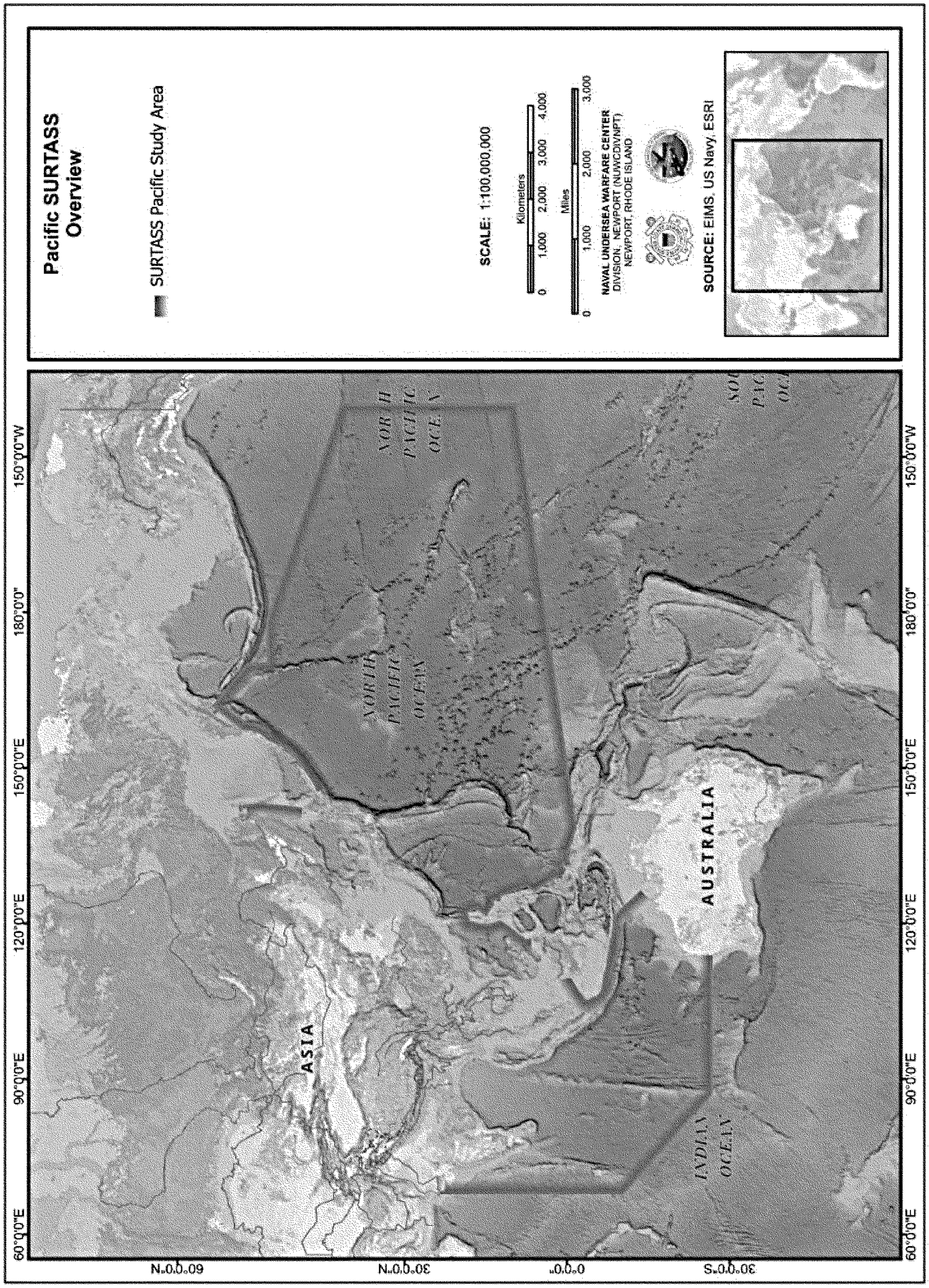

Figure 1 to paragraph (b) -- Map of the Pacific SURTASS LFA Sonar Study Area

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(c) The taking of marine mammals by the Navy is authorized only if it occurs incidental to the Navy conducting military readiness activities, including those in the following categories:

(1) Training;

(2) Maintenance and upgrades; and

(3) Exercises.

§ 218.231 Effective dates.

Regulations in this subpart are effective from August 13, 2026, through August 12, 2033.

§ 218.232 Permissible methods of taking.

(a) Under LOAs issued pursuant to § 216.106 of this chapter and this subpart, the Navy may incidentally, but not intentionally, take marine mammals within the area described in § 218.230(b) by Level A harassment and Level B harassment associated with the use of SURTASS LFA sonar, provided the activity is in compliance with all terms, conditions, and requirements of this subpart and the applicable LOA.

(b) The incidental take of marine mammals by the activities listed in § 218.230(c) is limited to the following species:

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Table 1 to paragraph (b)

Species	Stock
North Pacific right whale	No stock designation (NSD)
Blue whale	NSD
Blue whale	Central North Pacific
Bryde's whale	NSD
Bryde's whale	Hawaii
Fin whale	NSD
Fin whale	Hawaii
Humpback whale	NSD
Humpback whale	Hawaii
Humpback whale	Western North Pacific
Antarctic minke whale	NSD
Minke whale	NSD
Minke whale	Hawaii
Omura's whale	NSD
Sei whale	NSD
Sei whale	Hawaii
Sperm whale	NSD
Sperm whale	North Pacific
Sperm whale	Hawaii
Dwarf sperm whale	NSD
Dwarf sperm whale	Hawaii
Pygmy sperm whale	NSD
Pygmy sperm whale	Hawaii
Baird's beaked whale	NSD
Blainville's beaked whale	NSD
Blainville's beaked whale	Hawaii
Deraniyagala's beaked whale	NSD
Ginkgo-toothed beaked whale	NSD
Goose-beaked whale	NSD
Goose-beaked whale	Hawaii
Hubbs' beaked whale	NSD

Longman's beaked whale	NSD
Longman's beaked whale	Hawaii
Stejneger's beaked whale	NSD
False killer whale	NSD
False killer whale	Main Hawaiian Islands Insular
False killer whale	Hawaii Pelagic
Killer whale	NSD
Killer whale	Hawaii
Melon-headed whale	NSD
Melon-headed whale	Hawaiian Islands
Pygmy killer whale	NSD
Pygmy killer whale	Hawaii
Short-finned pilot whale	NSD
Short-finned pilot whale	Hawaii
Bottlenose dolphin	NSD
Bottlenose dolphin	Hawaii Pelagic
Common dolphin	NSD
Fraser's dolphin	NSD
Fraser's dolphin	Hawaii
Northern right whale dolphin	NSD
Pacific white-sided dolphin	North Pacific
Pantropical spotted dolphin	NSD
Pantropical spotted dolphin	Hawaii Pelagic
Risso's dolphin	NSD
Risso's dolphin	Hawaii
Rough-toothed dolphin	NSD
Rough-toothed dolphin	Hawaii
Spinner dolphin	NSD
Spinner dolphin	Hawaii Pelagic
Striped dolphin	NSD
Striped dolphin	Hawaii Pelagic
Dall's porpoise	NSD
Northern fur seal	NSD

Steller sea lion	Western
Bearded seal	Beringia
Harbor seal	California
Ribbon seal	NSD
Hawaiian monk seal	Hawaii
Ringed seal	NSD
Spotted seal	Bering

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§ 218.233 Prohibitions.

Except incidental take described in § 218.232 and authorized by a LOA issued under this subpart, it shall be unlawful for any person to do the following in connection with the activities described in this subpart:

(a) Violate, or fail to comply with, the terms, conditions, and requirements of this subpart or a LOA issued under § 216.106 of this chapter and this subpart;

(b) Take any marine mammal not specified in § 218.232(b);

(c) Take any marine mammal specified in § 218.232(b) in any manner other than as specified in the LOA;

(d) Take a marine mammal specified in § 218.232(b) after NMFS determines such taking results in more than a negligible impact on the species or stock of such marine mammal; or

(e) Take a marine mammal specified in § 218.232(b) after NMFS determines such taking is having, or may have, an unmitigable adverse impact on the availability of the species or stock for taking for subsistence uses.

§ 218.234 Mitigation requirements.

When conducting the activities identified in § 218.230(c), the mitigation measures contained in this section and any LOA issued under this subpart must be implemented by Navy personnel or contractors who are trained according to the requirements in the LOA. If Navy contractors are serving on behalf of Navy personnel, Navy contractors must follow the mitigation applicable to Navy personnel. These mitigation measures include, but are not limited to:

(a) General operating procedures. The following general operating procedures are required:

(1) Prior to SURTASS LFA sonar activities, the Navy must promulgate executive guidance for the administration, execution, and compliance with the environmental regulations under these regulations and LOA.

(c) *Manned surface vessel mitigatio*n. Manned surface vessel mitigation applies to Tactical-Auxiliary General Ocean Surveillance (T–AGOS) vessels underway and must be implemented to the maximum extent practical based on the prevailing circumstances, including consideration of safety of vessels, towing platforms, and crews, as well as maneuverability restrictions, consistent with the following:

(1) Immediately prior to getting underway and while underway, Lookouts will observe for marine mammals;

(2) While underway, Navy personnel must maneuver the manned surface vessels (which may include reducing speed) to maintain a distance of at least 457.2 meters (m) (500 yards (yd)) around observed whales and 182.9 m (200 yd) around all other marine mammals (except bow- or wake-riding dolphins), providing it is safe to do so. No further action is necessary if a dolphin continues to approach the vessel after the vessel has made one course and/or speed change.

(3) Pedestal-mounted 'Big Eye' (20 x 110) binoculars (if installed) shall be used to assist in the detection of marine mammals in the vicinity of the vessel. If the presence of marine mammals is detected acoustically, Lookouts posted on the vessel shall increase the vigilance of their visual observation.

(4) Manned surface vessel mitigation will not be implemented if one of the following conditions applies:

(i) Dolphins are determined to be intentionally swimming at the bow, alongside the vessel or vehicle, or directly behind the vessel or vehicle (*e.g.,* to bow-ride or wake-ride),

(ii) The vessel's safety is threatened, or

(iii) Doing so is impractical based on mission requirements (*e.g.,* restricted ability to maneuver during towing activities).

(d) *SURTASS LFA sonar mitigation zone; suspension and delay.* If a marine mammal is detected, through monitoring required under § 218.235, within or about to enter within 2,000 yd (1.8 kilometers (km)) of the SURTASS LFA source (*i.e.,* the LFA mitigation zone), the Navy must immediately delay or suspend SURTASS LFA sonar transmissions.

(e) *Recommencement of SURTASS LFA sonar transmissions.* The following requirements for commencement or recommencement of SURTASS LFA sonar transmissions apply:

(1) Navy personnel must not commence or recommence SURTASS LFA sonar transmissions earlier than 15 minutes after:

(i) All marine mammals have left the area of the 2,000-yd (1.8 km) LFA sonar mitigation zone; and

(ii) There is no further detection of any marine mammal within the 2,000-yd (1.8 km) LFA sonar mitigation zone as determined by the visual, passive acoustic, and active acoustic high frequency monitoring described in § 218.235.

(2) [Reserved]

(f) *Ramp-up of the high-frequency/marine mammal monitoring (HF/M3) active sonar.* The following requirements for ramp-up procedures for the HF/M3 active sonar apply:

(1) Prior to full-power use, Navy personnel must ramp up the HF/M3 active sonar power level beginning at a maximum source sound pressure level of 180 decibels referenced to 1 microPascal (dB re 1 μPa) root-mean-square (RMS) sound pressure level (SPL) in 10-dB increments to full operating levels over a period of no less than 5 minutes. Navy personnel must implement this ramp-up procedure:

(i) At least 30 minutes prior to any SURTASS LFA sonar transmissions; and

(ii) Any time after the HF/M3 source has been powered down for more than 2 minutes.

(2) Navy personnel must not increase the HF/M3 SPL once a marine mammal is detected; and

(3) Ramp-up may recommence once marine mammals are no longer detected.

(g) *Geographic mitigation.* The Navy must implement the geographic mitigation requirements as follows:

(1) LFA sonar training and testing activities must be conducted such that:

(i) The received level of SURTASS LFA sonar transmissions will not exceed 180 dB re 1 μPa RMS SPL within 22 km (12 nautical miles (nmi)) from any emergent land, including offshore islands;

(ii) The received level of SURTASS LFA sonar transmissions will not exceed 180 dB re 1 μPa RMS SPL at a distance of 1 km (0.5 nmi) seaward of the outer perimeter of any Offshore Biologically Important Area (OBIA) in the SURTASS LFA Study Area during the effective period specified. OBIAs and the related effective periods are listed in paragraph (g)(2) of this section or may be subsequently identified through the adaptive management process specified in § 218.237(c)(1). The boundaries and effective periods of the OBIAs will be kept on file in NMFS' Office of Protected Resources (OPR) and on its website.

(iii) No more than 25 percent of the sound source amount analyzed (no more than 275 hours in a given year) of SURTASS LFA sonar for training and testing will be conducted within 18.5 km (10 nmi) of any single OBIA during any year; and

(iv) SURTASS LFA sonar activities will not occur within territorial seas of foreign nations, which are areas from 0–22 km (0–12 nmi) from shore.

(2) Figure 1 to this paragraph (g)(1) shows the location of the OBIAs. Table 1 to paragraph (g)(1) shows the specified timeframes when the requirements from paragraph (g)(1) apply.

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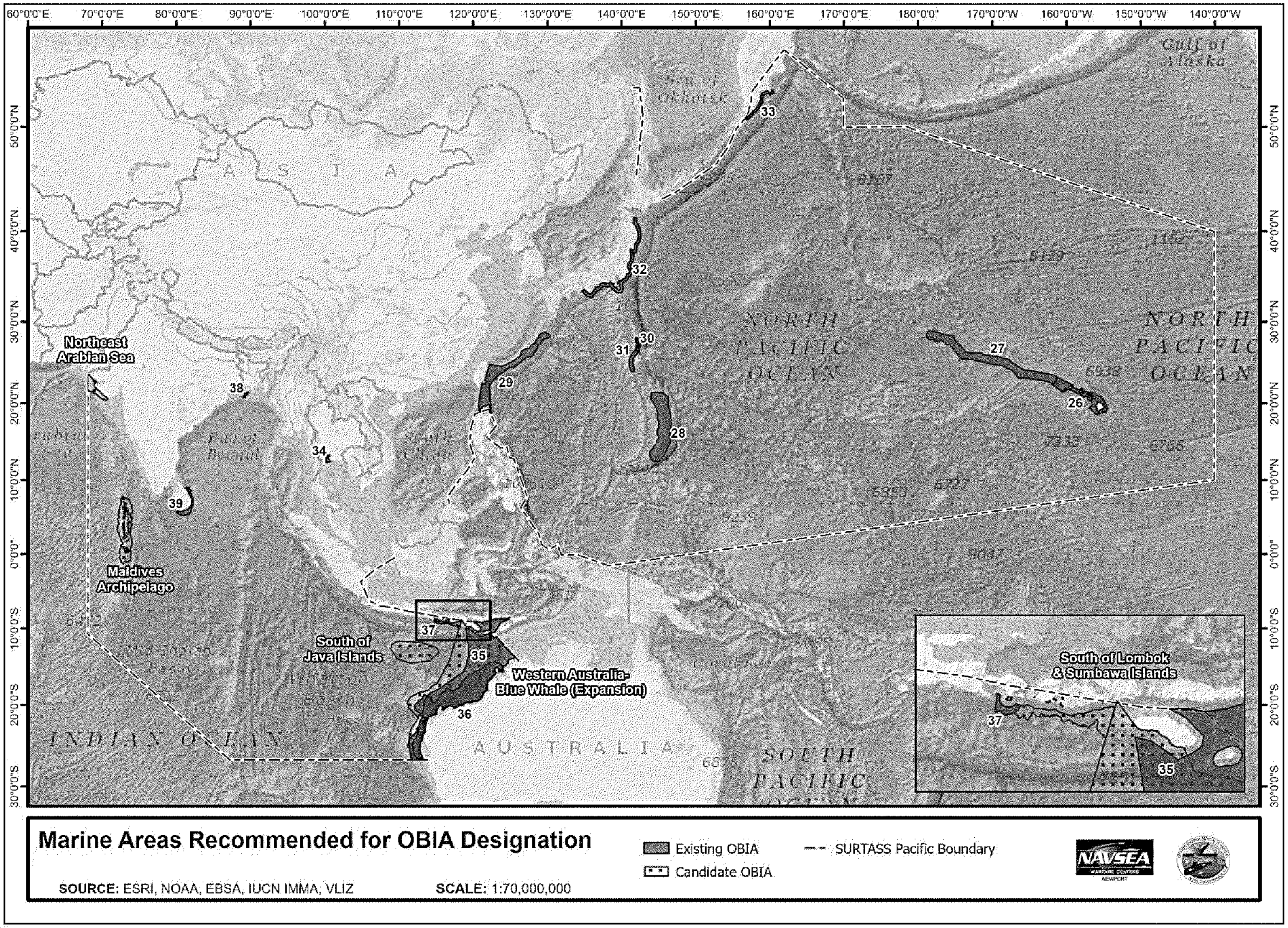

Figure 1 to paragraph (g)(1)—OBIAs for Marine Mammals in the Pacific SURTASS LFA Sonar Study Area

Table 1 to paragraph (g)(1)—OBIAs for Marine Mammals in the Pacific SURTASS LFA Sonar Study Area

OBIA Number	Name	Location/water body	Relevant marine mammal species	Effective period
26	Main Hawaiian Islands	Central North Pacific Ocean	Humpback whale	November to April
27	Northwestern Hawaiian Islands	Central North Pacific Ocean	Humpback whale	December to April
28	Mariana Islands	Western North Pacific Ocean	Humpback whale	February to April
29	Ryukyu-Philippines	Western North Pacific Ocean	Humpback whale	January to April
30	Ogasawara - Sperm whale	Western North Pacific Ocean	Sperm whale	June to September
31	Ogasawara-Kazin - Humpback whale	Western North Pacific Ocean	Humpback whale	December to May
32	Honshu	Western North Pacific Ocean	Gray whale	January to May
33	Southeast Kamchatka	Western North Pacific Ocean	Fin, gray (Western North Pacific stock), humpback, and North Pacific right whale	June to September
34	Gulf of Thailand	Eastern Indian Ocean	Bryde's whale	April to November
35	Western Australia - Blue whale	Eastern Indian Ocean	Blue (pygmy) whale	May to November
36	Western Australia - Humpback whale	Eastern Indian Ocean	Humpback whale	May to December
37	Southern Bali	Eastern Indian Ocean	Bryde's, humpback, Omura's, sei, and sperm whale	October to November
38	Swatch-of-No-Ground (SoNG)	Northern Bay of Bengal	Bryde's whale	Year-round
39	Sri Lanka	Eastern Indian Ocean	Blue (pygmy) and sperm whale	October to April
40	Maldives Archipelago	Central Indian Ocean	Blue (pygmy), Bryde's, humpback, and sperm whale	October to May
41	Northeast Arabian Sea	Arabian Sea	Blue, Bryde's, and humpback (Arabian Sea stock) whale	Year-round

42	South of Java Island	East Indian Ocean	Blue (pygmy) whale	October to November
43	South of Lombok Sumbawa Islands	East Indian Ocean	Blue (pygmy) whale	October to November

Note: Existing OBIA 35 (Western Australia - Blue whale) was expanded to include the entirety of the Eastern Indian Ocean blue whale migratory route.

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(3) Should national security require the Navy to exceed a requirement in paragraph (g)(1) of this section, personnel conducting the activity are required to obtain approval through the chain of command prior to commencement of the activity. The Navy must provide NMFS with notification as soon as is practicable and include the information (*e.g.,* sonar hours in exceedance of 25 percent) in its annual activity reports submitted to NMFS.

(h) *Cetacean live stranding.* In the event of a cetacean live stranding (or near-shore atypical milling) event within the Study Area or within 50 km (27 nmi) of the boundary of the Study Area, where the NMFS Marine Mammal Stranding Network is engaged in herding or other interventions to return animals to the water, NMFS OPR will advise the Navy of the need to implement shutdown procedures for all active acoustic sources or explosive devices within 50 km of the stranding. Following this initial shutdown, NMFS will communicate with the Navy to determine whether circumstances support modification of the shutdown zone. The Navy may decline to implement all or part of the shutdown if the holder of the LOA, or his/her designee, determines that it is necessary for national security. Shutdown procedures for live stranding or milling cetaceans include the following:

(1) *Shutdown no longer needed.* If at any time, the marine mammal(s) die or are euthanized, or if herding/intervention efforts are stopped, NMFS will immediately advise that the shutdown around the animals' location is no longer needed;

(2) *Shutdown procedures remain in effect.* Otherwise, shutdown procedures will remain in effect until NMFS determines and advises that all live animals involved have left the area (either of their own volition or following an intervention); and

(3) *Further observations.* If further observations of the marine mammals indicate the potential for re-stranding, additional coordination 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.

§ 218.235 Requirements for monitoring and reporting.

The Navy must implement the following monitoring and reporting requirements when conducting the specified activities:

(a) *Notification of take.* If the Navy reasonably believes that the specified activity identified in § 218.230 resulted in the mortality or serious injury of any marine mammals, or in any Level A harassment or Level B harassment of marine mammals not identified in this subpart, then the Navy shall notify NMFS immediately or as soon as operational security considerations allow.

(b) *Monitoring and reporting under the LOA.* The Navy must conduct all monitoring and reporting required under the LOA.

(c) *Notification of injured, live stranded, or dead marine mammals.* Navy personnel must abide by the Notification and Reporting Plan, which sets out notification, reporting, and other requirements when dead, injured, or live stranded marine mammals are detected. The Notification and Reporting Plan is available at: *https://www.fisheries.noaa.gov/national/marine-mammal-protection/incidental-take-authorizations-military-readiness-activities.*

(d) *Mitigation monitoring.* The Navy must conduct all monitoring required under the LOA, including:

(1) *Visual Observations.* Visual observations must be conducted by trained Lookouts on the vessel's bridge using standard binoculars (7x) and the naked eye. Pedestal-mounted 'Big Eye' (20x110) binoculars (if installed) must be used to assist in the detection of marine mammals in the vicinity of the vessel.

(i) Lookouts must conduct visual monitoring from the vessel's bridge during all daylight hours (30 minutes before sunrise until 30 minutes after sunset);

(ii) During training and testing activities that employ SURTASS LFA sonar in the active mode, Lookouts must conduct visual monitoring beginning 30 minutes before sunrise or 30 minutes before SURTASS LFA sonar begins to transmit and continue until 30 minutes after sunset or until 15 minutes after the SURTASS LFA sonar transmissions cease.

(iii) Lookouts must log all detections of marine mammals during SURTASS LFA sonar transmissions during training and testing activities;

(iv) Lookouts must record the number, identification, bearing, and range of observed marine mammals during training and testing activities, and must identify marine mammals to the lowest taxonomic level possible; and

(v) Lookouts must continue visual observations until 15 minutes have passed since the last detection of the marine mammal.

(2) *Passive Acoustic Monitoring.* During training and testing activities that employ SURTASS LFA sonar in the active mode, Navy personnel must conduct passive acoustic monitoring using the SURTASS towed horizontal line array to detect vocalizing marine mammals.

(i) Passive acoustic monitoring must begin 30 minutes before the SURTASS LFA sonar begins to transmit and continue until 15 minutes after SURTASS LFA sonar transmissions cease.

(ii) If a detected sound is estimated to be from a vocalizing marine mammal, the sonar technician will notify the senior military member-in-charge, who must alert the HF/M3 sonar operator and Lookouts (during daylight).

(3) *Active Acoustic (HF/M3) Monitoring.* During training and testing activities that employ SURTASS LFA sonar in the active mode, Navy personnel must use the HF/M3 sonar to detect, locate, and track marine mammals in relation to the SURTASS LFA sonar array and the LFA mitigation zone, subject to the ramp-up requirements in § 218.234(e);

(i) HF/M3 sonar monitoring must begin 30 minutes before the SURTASS

LFA sonar begins to transmit and continue until 15 minutes after SURTASS LFA sonar transmissions cease.

(ii) If a marine mammal is detected during HF/M3 monitoring within the SURTASS LFA mitigation zone, the sonar operator must notify the senior military member-in-charge.

(4) *Cessation of Monitoring.* Navy personnel must continue monitoring either for at least 15 minutes after completion of the SURTASS LFA sonar training and testing transmission or, if marine mammals are exhibiting unusual changes in behavioral patterns, until behavior patterns return to normal or conditions prevent continued observations.

(e) *Designation of qualified* individuals. The Navy must designate qualified on-site individuals to conduct the mitigation, monitoring, and reporting activities specified in these regulations and LOA issued under §§ 216.106 of this chapter and 218.237.

(f) *Marine Mammal Monitoring Program.* The Navy must continue to assess data from the Marine Mammal Monitoring Program and work toward making some portion of that data, after appropriate security reviews, available to scientists with appropriate clearances. Any portions of the analyses conducted by these scientists based on these data that are determined to be unclassified after appropriate security reviews will be made publicly available.

(g) *Annual Study Area marine species monitoring report.* The Navy must submit an unclassified annual report of the Study Area marine species monitoring describing the implementation and results from the previous calendar year. Data collection will adhere to methods that allow for comparison to other range complexes and Study Areas in other geographic regions. The draft report must be submitted to the Director, Office of Protected Resources, NMFS, annually. NMFS will submit comments or questions on the report, if any, within 3 months of receipt. The report will be considered final after the Navy has addressed NMFS' comments, or 3 months after submittal of the draft if NMFS does not provide comments on the draft report. The report must describe progress of knowledge made with respect to new or continuing scientific knowledge of marine mammals.

(h) *Quick look reports.* In the event that the sound source amount analyzed in the preambles of the Marine Mammal Protection Act (MMPA) proposed rule (Citation, when available) and final rule (Citation, when available) were exceeded within a given reporting year, the Navy must submit a preliminary report detailing the exceedance within 21 days after the anniversary date of issuance of the LOA.

(i) *Annual Pacific SURTASS LFA training and testing report.* The Navy must submit a classified and unclassified report (SURTASS LFA Annual Training and Testing Report) to the Director, Office of Protected Resources, NMFS, annually within 3 months of the one-year anniversary of the date of the issuance of the LOA. For the final reporting year, the Navy must submit a final/close-out (year 7) SURTASS LFA Annual Training and Testing Report. NMFS will submit comments or questions on the report, if any, within 1 month of receipt. The report will be considered final after the Navy has addressed NMFS' comments, or 1 month after submittal of the drafts if NMFS does not provide comments on the draft report.

(1) *Annual Reports.* The SURTASS LFA Annual Training and Testing Report must include elements listed below. The analysis in the report must be based on the data from the current year's report and data collected from previous annual reports.

(i) Dates, times, and locations of each vessel during each training and testing activity;

(ii) Information on sonar transmissions during each training and testing activity, including:

(A) Total annual hours or quantity of each bin of sonar used in all training and testing events,

(B) Cumulative sonar use quantity from previous years' reports through the current year, and

(C) Records of any sonar delays or suspensions due to the presence of marine mammals.

(iii) Marine mammal sighting information for each sighting in each exercise where mitigation was implemented:

(A) Date, time, and location of sighting;

(B) Species (if not possible, indication of whale/dolphin/pinniped);

(C) Number of individuals;

(D) Initial Detection Sensor (*e.g.,* visual, passive acoustic, HF/M3 sonar);

(E) Indication of specific type of platform observation was made from (including, for example, what type of surface vessel or testing platform);

(F) Length of time observers maintained visual contact with marine mammal;

(G) Sea state;

(H) Visibility;

(I) Sound source in use at the time of sighting;

(J) Indication of whether animal was less than 200 yd (182.9 m), 200 to 500 yd (182.9 to 457.2 m), 500 to 1,000 yd (457.2 to 914.4 m), 1,000 to 2,000 yd (914.4 m to 1.8 km), or greater than 2,000 yd (1.8 km) from sonar source;

(K) Whether operation of sonar sensor was delayed, or sonar was powered or shut down, and the length of delay;

(L) Bearing and range from the vessel; and

(M) For visual observations, Lookouts must report the observed behavior of the animal(s) in plain language and without trying to categorize in any way (such as animal closing to bow ride, paralleling course/speed, floating on surface and not swimming, *etc.*) and if any calves were present.

(iv) An evaluation (based on data gathered during the reporting year) of the effectiveness of mitigation measures designed to minimize the received level to which marine mammals may be exposed. This evaluation must identify the specific observations that support any conclusions the Navy reaches about the effectiveness of the mitigation.

(2) *Final/close-out Report.* The final/close-out report at the conclusion of the authorization period (year 7) will also serve as the comprehensive close-out report and provide the annual totals for each sound source bin with a comparison to the annual amount analyzed and the 7-year total for each sound source bin with a comparison to the 7-year amount analyzed.

§ 218.236 Letter of Authorization.

(a) To incidentally take marine mammals pursuant to this subpart, the Navy must apply for and obtain an LOA.

(b) An LOA, unless suspended or revoked, may be effective for a period of time not to exceed the expiration date of this subpart.

(c) In the event of projected changes to the activity or to mitigation, monitoring, or reporting measures (excluding changes made pursuant to the adaptive management provision of § 218.237(c)(1)) required by an LOA, the Navy must apply for and obtain a modification of the LOA as described in § 218.237.

(d) The LOA will set forth:

(1) Permissible methods of incidental taking;

(2) Geographic areas for incidental taking;

(3) Means of effecting the least practicable adverse impact (*i.e.,* mitigation) on the species and stocks of marine mammals and their habitat; and

(4) Requirements for monitoring and reporting.

(e) Issuance of the LOA must be based on a determination that the level of taking is consistent with the findings made for the total taking allowable under the regulations of this subpart.

(f) Notice of issuance or denial of the LOA will be published in the **Federal Register** within 30 days of a determination.

§ 218.237 Modifications of Letter of Authorization.

(a) An LOA issued under §§ 216.106 of this chapter and 218.236 for the activity identified in § 218.230(c) shall be modified, upon request by the Navy, provided that:

(1) The specified activity and mitigation, monitoring, and reporting measures, as well as the anticipated impacts, are the same as those described and analyzed for the regulations in this subpart (excluding changes made pursuant to the adaptive management provision in paragraph (c)(1) of this section); and

(2) NMFS determines that the mitigation, monitoring, and reporting measures required by the previous LOA under this subpart were implemented.

(b) For LOA modification requests by the applicant that include changes to the activity or to the mitigation, monitoring, or reporting measures (excluding changes made pursuant to the adaptive management provision in paragraph (c)(1) of this section), the LOA should be modified provided that:

(1) NMFS determines that the change(s) to the activity or the mitigation, monitoring, or reporting do not change the findings made for this subpart and do not result in more than a minor change in the total estimated number of takes (or distribution by species or stock or years); and

(2) NMFS may publish a notice of proposed modified LOA in the **Federal Register**, including the associated analysis of the change, and solicit public comment before issuing the LOA.

(c) An LOA issued under §§ 216.106 of this chapter and 218.236 for the activities identified in § 218.230(c) may be modified by NMFS OPR under the following circumstances:

(1) After consulting with the Navy regarding the practicability of the modifications, through adaptive management, NMFS may modify (including remove, revise, or add to) the existing mitigation, monitoring, or reporting measures if doing so creates a reasonable likelihood of more effectively accomplishing the goals of the mitigation and monitoring measures set forth in this subpart.

(i) Possible sources of data that could contribute to the decision to modify the mitigation, monitoring, or reporting measures in an LOA include, but are not limited to:

(A) Results from the Navy's monitoring report and annual exercise reports from the previous year(s);

(B) Results from other marine mammal and/or sound research or studies; or

(C) Any information that reveals marine mammals may have been taken in a manner, extent, or number not authorized by this subpart or a subsequent LOA.

(ii) If, through adaptive management, the modifications to the mitigation, monitoring, or reporting measures are substantial, NMFS shall publish a notice of proposed LOA(s) in the **Federal Register** and solicit public comment.

(2) If NMFS OPR determines that an emergency exists that poses a significant risk to the well-being of the species or stocks of marine mammals specified in LOAs issued pursuant to §§ 216.106 of this chapter and 218.236, a LOA may be modified without prior notice or opportunity for public comment. Notice would be published in the **Federal Register** within 30 days of the action.

§§ 218.238–218.239 [Reserved]

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