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Takes of Marine Mammals Incidental to Specified Activities; U.S. Navy Civilian Port Defense Activities at the Ports of Los Angeles/Long Beach, California; Notice

DEPARTMENT OF COMMERCE

National Oceanic and Atmospheric Administration

RIN 0648–XE131

Takes of Marine Mammals Incidental to Specified Activities; U.S. Navy Civilian Port Defense Activities at the Ports of Los Angeles/Long Beach, California

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

ACTION: Notice; proposed incidental harassment authorization; request for comments.

SUMMARY: NMFS has received a request from the U.S. Navy (Navy) for an Incidental Harassment Authorization (IHA) to take marine mammals, by harassment, incidental to Civilian Port defense activities within and near the Ports of Los Angeles and Long Beach from October through November 2015. Pursuant to the Marine Mammal Protection Act (MMPA), NMFS is requesting comments on its proposal to issue an IHA to the Navy to incidentally take, by Level B harassment only, marine mammals during the specified activity.

DATES: Comments and information must be received no later than October 5, 2015.

ADDRESSES: Comments on the Navy's IHA application (the application) should be addressed to Jolie Harrison, Chief, Permits and Conservation Division, Office of Protected Resources, National Marine Fisheries Service, 1315 East-West Highway, Silver Spring, MD 20910. The mailbox address for providing email comments is *itp.fiorentino@noaa.gov.* Comments sent via email, including all attachments, must not exceed a 25-megabyte file size. NMFS is not responsible for comments sent to addresses other than those provided here.

Instructions: All comments received are a part of the public record and will generally be posted to *http://www.nmfs.noaa.gov/pr/permits/incidental/* without change. All Personal Identifying Information (for example, name, address, etc.) voluntarily submitted by the commenter may be publicly accessible. Do not submit Confidential Business Information or otherwise sensitive or protected information.

An electronic copy of the application may be obtained by writing to the address specified above, telephoning the contact listed below (see **FOR FURTHER INFORMATION CONTACT**), or visiting the Internet at: *http://www.nmfs.noaa.gov/pr/permits/incidental/.* Documents cited in this notice may also be viewed, by appointment, during regular business hours, at the aforementioned address.

The Navy is also preparing an Environmental Assessment (EA) in accordance with the National Environmental Policy Act (NEPA), to evaluate all components of the proposed Civilian Port Defense training activities. NMFS intends to adopt the Navy's EA, if adequate and appropriate. Currently, we believe that the adoption of the Navy's EA will allow NMFS to meet its responsibilities under NEPA for the issuance of an IHA to the Navy for Civilian Port Defense activities at the Ports of Los Angeles and Long Beach Harbor. If necessary, however, NMFS will supplement the existing analysis to ensure that we comply with NEPA prior to the issuance of the final IHA.

FOR FURTHER INFORMATION CONTACT: John Fiorentino, Office of Protected Resources, NMFS, (301) 427–8477.

SUPPLEMENTARY INFORMATION:

Background

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

An authorization for incidental takings shall be granted if NMFS finds that the taking will have a negligible impact on the species or stock(s), will not have an unmitigable adverse impact on the availability of the species or stock(s) for subsistence uses (where relevant), and if the permissible methods of taking and requirements pertaining to the mitigation, monitoring and reporting of such takings are set forth. NMFS has defined ''negligible impact'' in 50 CFR 216.103 as ''an impact resulting from the specified activity that cannot be reasonably expected to, and is not reasonably likely to, adversely affect the species or stock through effects on annual rates of recruitment or survival.''

The National Defense Authorization Act of 2004 (NDAA) (Pub. L. 108–136) removed the ''small numbers'' and ''specified geographical region'' limitations indicated above and amended the definition of ''harassment'' as it applies to a ''military readiness activity'' to read as follows (Section 3(18)(B) of the MMPA): (i) 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 (ii) 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, to a point where such behavioral patterns are abandoned or significantly altered [Level B Harassment].

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

Summary of Request

On April 16, 2015, NMFS received an application from the Navy requesting an IHA for the taking of marine mammals incidental to Civilian Port Defense activities at the Ports of Los Angeles and Long Beach, California from October through November, 2015.

The Study Area includes the waters within and near the Ports of Los Angeles and Long Beach, California. Since the Ports of Los Angeles and Long Beach are adjacent and are both encompassed within the larger proposed action area (Study Area) they will be described collectively as Los Angeles/Long Beach (see Figure 2–1 of the application for a map of the Study Area). These activities are classified as military readiness activities. Marine mammals present in the Study Area may be exposed to sound from active acoustic sources (sonar). The Navy is requesting authorization to take 7 marine mammal species by Level B harassment (behavioral). No injurious takes (Level A harassment) of marine mammals are predicted and, therefore, none are being authorized.

Description of the Specified Activity

Civilian Port Defense activities are naval mine warfare exercises conducted in support of maritime homeland defense, per the Maritime Operational Threat Response Plan. These activities are conducted in conjunction with other federal agencies, principally the Department of Homeland Security. The three pillars of Mine Warfare include airborne (helicopter), surface (ship and unmanned vehicles), and undersea (divers, marine mammal systems, and unmanned vehicles), all of which are used in order to ensure that strategic U.S. ports are cleared of mine threats. Civilian Port Defense events are conducted in ports or major surrounding waterways, within the shipping lanes, and seaward to the 300 feet (ft, 91 meters [m]) depth contour. The events employ the use of various mine detection sensors, some of which utilize active acoustics for detection of mines and mine-like objects in and around various ports. Assets used during Civilian Port Defense training include up to four unmanned underwater vehicles, marine mammal systems, up to two helicopters operating (two to four hours) at altitudes as low as 75 to 100 ft (23 to 31 m), explosive ordnance disposal platoons, a Littoral Combat Ship or Landing Dock Platform and AVENGER class ships. The AVENGER is a surface mine countermeasure vessel specifically outfitted for mine countermeasure capability. The proposed Civilian Port Defense activities for Los Angeles/Long Beach include the use of up to 20 bottom placed non explosive mine training shapes. Mine shapes may be retrieved by Navy divers, typically explosive ordnance disposal personnel, and may be brought to beach side locations to ensure that the neutralization measures are effective and the shapes are secured. The final step to the beach side activity is the intelligence gathering and identifying how the mine works, disassembling it or neutralizing it. The entire training event takes place over multiple weeks utilizing a variety of assets and scenarios. The following descriptions detail the possible range of activities which could take place during a Civilian Port Defense training event. This is all inclusive and many of these activities are not included within the analysis of this specific event. Mine detection including towed or hull mounted sources would be the only portion of this event which we are proposing authorization.

Mine Detection Systems

Mine detection systems are used to locate, classify, and map suspected mines (Figure 1–1 of the application). Once located, the mines can either be neutralized or avoided. These systems are specialized to either locate mines on the surface, in the water column, or on the sea floor.

• Towed or Hull-Mounted Mine Detection Systems. These detection systems use acoustic and laser or video sensors to locate and classify suspect mines. Helicopters, ships, and unmanned vehicles are used with towed systems, which can rapidly assess large areas.

• Unmanned/Remotely Operated Vehicles. These vehicles use acoustic and video or lasers systems to locate and classify mines. Unmanned/remotely operated vehicles provide mine warfare capabilities in nearshore littoral areas, surf zones, ports, and channels.

• Airborne Laser Mine Detection Systems. Airborne laser detection systems work in concert with neutralization systems. The detection system initially locates mines and a neutralization system is then used to relocate and neutralize the mine.

• Marine Mammal Systems. Navy personnel and Navy marine mammals work together to detect specified underwater objects. The Navy deploys trained bottlenose dolphins and California sea lions as part of the marine mammal mine-hunting and object-recovery system.

Sonar systems to be used during Civilian Port Defense Mine Detection training would include AN/SQQ–32, AN/SLQ–48, AN/AQS–24, and handheld sonars (*e.g.,* AN/PQS–2A). Of these sonar sources, only the AN/SQQ–32 would require quantitative acoustic effects analysis, given its source parameters. The AN/SQQ–32 is a high frequency (between 10 and 200 kilohertz [kHz]) sonar system; the specific source parameters of the AN/SQQ–32 are classified. The AN/AQS–24, AN/SLQ–48 and handheld sonars are considered *de minimis* sources, which are defined as sources with low source levels, narrow beams, downward directed transmission, short pulse lengths, frequencies above known hearing ranges, or some combination of these factors (Department of the Navy 2013). *De minimis* sources have been determined to not have potential impact to marine mammals.

Mine Neutralization

Mine neutralization systems disrupt, disable, or detonate mines to clear ports and shipping lanes. Mine neutralization systems can clear individual mines or a large number of mines quickly. Two types of mine neutralization could be conducted, mechanical minesweeping and influence system minesweeping. Mechanical minesweeping consists of cutting the tether of mines moored in the water column or other means of physically releasing the mine. Moored mines cut loose by mechanical sweeping must then be neutralized or rendered safe for subsequent analysis. Influence minesweeping consists of simulating the magnetic, electric, acoustic, seismic, or pressure signature of a ship so that the mine detonates (no detonations would occur as part of the proposed training activities). Mine neutralization is included here to present the full spectrum of Civilian Port Defense Mine Warfare activities. The mine neutralization component of the proposed Civilian Port Defense training activities will not result in the incidental taking of marine mammals.

Dates, Duration, and Geographic Region

Civilian Port Defense training activities are scheduled every year, typically alternating between the east and west coasts of the United States. Civilian Port Defense activities in 2015 are proposed to occur on the U.S. west coast near Los Angeles/Long Beach, California. Civilian Port Defense events are typically conducted in areas of ports or major surrounding waterways and within the shipping lanes and seaward to the 300 ft (91 m) depth contour.

Civilian Port Defense activities would occur at the Ports of Los Angeles/Long Beach during October through November 2015 (Figure 2–1 of the application). The training exercise would occur for a period of two weeks in which active sonar would be utilized for two separate periods of four day long events. The AN/SQQ–32 sonar could be active for up to 24 hours a day during these training events; however, the use of the AN/SQQ–32 would not be continuously active during the four day long period. Additional activities would occur during this time and are analyzed within the Navy's Environmental Assessment for Civilian Port Defense training activities. The Navy has determined there is potential for take as defined under MMPA for military readiness activities. Specifically take has potential to occur from utilization of active sonar sources. This stressor is the only aspect of the proposed training activities for which this IHA is being requested.

The Ports of Los Angeles and Long Beach combined represent the busiest port along the U.S. West Coast and second busiest in the United States. In 2012 and 2013, approximately 4,550 and 4,500 vessel calls, respectively, for ships over 10,000 deadweight tons arrived at the Ports of Los Angeles and Long Beach (Louttit and Chavez 2014; U.S. Department of Transportation). This level of shipping would mean approximately 9,000 large ship transits to and from these ports and through the Study Area. By comparison, the next nearest large regional port, Port of San Diego, only had 318 vessel calls in 2012.

Description of Marine Mammals in the Area of the Specified Activity

Nineteen marine mammal species are known to occur in the study area, including five mysticetes (baleen whales), nine odontocetes (dolphins and toothed whales), and five pinnipeds (seals and sea lions). Among these species are 31 stocks managed by NMFS. All species were quantitatively analyzed in the Navy Acoustic Effects Model (NAEMO; see Chapter 6.4 of the application for additional information on the modeling process). After completing the modeling simulations, seven species (each with a single stock) are estimated to potentially be taken by harassment as defined by the MMPA, as it applies to military readiness, during the proposed Civilian Port Defense activities due to use of active sonar sources. Based on a variety of factors, including source characterization, species presence, species hearing range, duration of exposure, and impact thresholds for species that may be present, the remainder of the species were not quantitatively predicted to be exposed to or affected by active acoustic transmissions related to the proposed activities that would result in harassment under the MMPA and, therefore, are not discussed further. Other potential stressors related to the proposed Civilian Port Defense activities (*e.g.,* vessel movement/noise, in water device use) would not result in disruption or alteration of breeding, feeding, or nursing patterns that that would rise to a level of significance under the MMPA. The seven species with the potential to be taken by harassment during the proposed training activities are presented in Table 1 and relevant information on their status, behavior, life history, distribution, abundance, and hearing and vocalization is presented in Chapter 4 of the application. Further information on the general biology and ecology of marine mammals is included in the Navy's EA. In addition, NMFS publishes annual SARs for marine mammals, including stocks that occur within the Study Area (*http://www.nmfs.noaa.gov/pr/species/mammals;* Carretta *et al.,* 2014; Allen and Angliss, 2014).

TABLE 1—MARINE MAMMAL SPECIES WITH ESTIMATED EXPOSURES ABOVE HARASSMENT THRESHOLDS IN THE STUDY AREA

Species	Stock	Stock abundance [1] (coefficient of variance)	Occurrence, seasonality, and duration in study area
Odontocetes			
Long-beaked common dolphin (*Delphinus capensis*).	California	107,016 (0.42)	Common inshore of 820 ft (250 m) isobath. Species may be more abundant in study area from May to October.
Short-beaked common dolphin (*Delphinus delphis*).	California, Oregon, Washington	411,211 (0.21)	Primary occurrence between the coast and 300 nautical miles (nm) from shore. Prefers water depths between 650 and 6,500 ft (200 and 2,000 m).
Risso's dolphin (*Grampus griseus*).	California, Oregon, Washington	6,272 (0.30)	Frequently observed in waters surrounding San Clemente Island, California. Occurs on the shelf in the Southern California Bight. Highest abundance is in the cold season.
Pacific white-sided dolphin (*Lagenorhynchus obilquidens*).	California, Oregon, Washington	26,930 (0.28)	Occurs primarily in shelf and slope waters of California; spends more time in California waters in colder water months.
Bottlenose dolphin coastal (*Tursiops truncatus*).	Coastal California	323 (0.13)	Small, limited population; found within 1,640 ft (500 m) of the shoreline 99 percent of the time and within 820 ft (250 m) 90 percent of the time.
Pinnipeds			
Harbor seal (*Phoca vitulina*)	California	[2] 30,196 (0.157)	Found in moderate numbers. Concentrate around haul-outs in the Channel Islands.
California sea lion (*Zalophus californianus*).	U.S.	296,750	Most common pinniped. Primarily congregate around the Channel Islands. Peak abundance is from May to August.

[1] From: Carretta et al. (2014). U.S. Pacific Marine Mammal Stock Assessments, 2013.
[2] NMFS' draft U.S. Pacific Marine Mammal Stock Assessments, 2014 is proposing a small revision to the California stock of harbor seals from 30,196 to 30,968. No other proposed revisions are anticipated for these species.

Marine Mammal Hearing and Vocalizations

Cetaceans have an auditory anatomy that follows the basic mammalian pattern, with some changes to adapt to the demands of hearing underwater. The typical mammalian ear is divided into an outer ear, middle ear, and inner ear. The outer ear is separated from the inner ear by a tympanic membrane, or eardrum. In terrestrial mammals, the outer ear, eardrum, and middle ear transmit airborne sound to the inner ear, where the sound waves are propagated through the cochlear fluid. Since the impedance of water is close to that of the tissues of a cetacean, the outer ear is not required to transduce sound energy as it does when sound waves travel from air to fluid (inner ear). Sound waves traveling through the inner ear cause the basilar membrane to vibrate. Specialized cells, called hair cells, respond to the vibration and produce nerve pulses that are transmitted to the central nervous system. Acoustic energy causes the basilar membrane in the cochlea to vibrate. Sensory cells at different positions along the basilar membrane are excited by different frequencies of sound (Pickles, 1998).

Marine mammal vocalizations often extend both above and below the range of human hearing; vocalizations with frequencies lower than 20 Hz are labeled as infrasonic and those higher than 20 kHz as ultrasonic (National

Research Council (NRC), 2003; Figure 4–1). Measured data on the hearing abilities of cetaceans are sparse, particularly for the larger cetaceans such as the baleen whales. The auditory thresholds of some of the smaller odontocetes have been determined in captivity. It is generally believed that cetaceans should at least be sensitive to the frequencies of their own vocalizations. Comparisons of the anatomy of cetacean inner ears and models of the structural properties and the response to vibrations of the ear's components in different species provide an indication of likely sensitivity to various sound frequencies. The ears of small toothed whales are optimized for receiving high-frequency sound, while baleen whale inner ears are best in low to infrasonic frequencies (Ketten, 1992; 1997; 1998).

Baleen whale vocalizations are composed primarily of frequencies below 1 kHz, and some contain fundamental frequencies as low as 16 Hz (Watkins *et al.,* 1987; Richardson *et al.,* 1995; Rivers, 1997; Moore *et al.,* 1998; Stafford *et al.,* 1999; Wartzok and Ketten, 1999) but can be as high as 24 kHz (humpback whale; Au *et al.,* 2006). Clark and Ellison (2004) suggested that baleen whales use low-frequency sounds not only for long-range communication, but also as a simple form of echo ranging, using echoes to navigate and orient relative to physical features of the ocean. Information on auditory function in baleen whales is extremely lacking. Sensitivity to low-frequency sound by baleen whales has been inferred from observed vocalization frequencies, observed reactions to playback of sounds, and anatomical analyses of the auditory system. Although there is apparently much variation, the source levels of most baleen whale vocalizations lie in the range of 150–190 dB re 1 microPascal (μPa) at 1 m. Low-frequency vocalizations made by baleen whales and their corresponding auditory anatomy suggest that they have good low-frequency hearing (Ketten, 2000), although specific data on sensitivity, frequency or intensity discrimination, or localization abilities are lacking. Marine mammals, like all mammals, have typical U-shaped audiograms that begin with relatively low sensitivity (high threshold) at some specified low frequency with increased sensitivity (low threshold) to a species specific optimum followed by a generally steep rise at higher frequencies (high threshold) (Fay, 1988).

The toothed whales produce a wide variety of sounds, which include species-specific broadband ''clicks'' with peak energy between 10 and 200 kHz, individually variable ''burst pulse'' click trains, and constant frequency or frequency-modulated (FM) whistles ranging from 4 to 16 kHz (Wartzok and Ketten, 1999). The general consensus is that the tonal vocalizations (whistles) produced by toothed whales play an important role in maintaining contact between dispersed individuals, while broadband clicks are used during echolocation (Wartzok and Ketten, 1999). Burst pulses have also been strongly implicated in communication, with some scientists suggesting that they play an important role in agonistic encounters (McCowan and Reiss, 1995), while others have proposed that they represent ''emotive'' signals in a broader sense, possibly representing graded communication signals (Herzing, 1996). Sperm whales, however, are known to produce only clicks, which are used for both communication and echolocation (Whitehead, 2003). Most of the energy of toothed whale social vocalizations is concentrated near 10 kHz, with source levels for whistles as high as 100 to 180 dB re 1 μPa at 1 m (Richardson *et al.,* 1995). No odontocete has been shown audiometrically to have acute hearing (<80 dB re 1 μPa) below 500 Hz (DoN, 2001). Sperm whales produce clicks, which may be used to echolocate (Mullins *et al.,* 1988), with a frequency range from less than 100 Hz to 30 kHz and source levels up to 230 dB re 1 μPa 1 m or greater (Mohl *et al.,* 2000).

Brief Background on Sound

An understanding of the basic properties of underwater sound is necessary to comprehend many of the concepts and analyses presented in this document. A summary is included below.

Sound is a wave of pressure variations propagating through a medium (*e.g.,* water). Pressure variations are created by compressing and relaxing the medium. Sound measurements can be expressed in two forms: intensity and pressure. Acoustic intensity is the average rate of energy transmitted through a unit area in a specified direction and is expressed in watts per square meter (W/m^2). Acoustic intensity is rarely measured directly, but rather from ratios of pressures; the standard reference pressure for underwater sound is 1 μPa; for airborne sound, the standard reference pressure is 20 μPa (Richardson *et al.,* 1995).

Acousticians have adopted a logarithmic scale for sound intensities, which is denoted in decibels (dB). Decibel measurements represent the ratio between a measured pressure value and a reference pressure value (in this case 1 μPa or, for airborne sound, 20 μPa). The logarithmic nature of the scale means that each 10-dB increase is a ten-fold increase in acoustic power (and a 20-dB increase is then a 100-fold increase in power; and a 30-dB increase is a 1,000-fold increase in power). A ten-fold increase in acoustic power does not mean that the sound is perceived as being ten times louder, however. Humans perceive a 10-dB increase in sound level as a doubling of loudness, and a 10-dB decrease in sound level as a halving of loudness. The term ''sound pressure level'' implies a decibel measure and a reference pressure that is used as the denominator of the ratio. Throughout this document, NMFS uses 1 μPa (denoted re: 1μPa) as a standard reference pressure unless noted otherwise.

It is important to note that decibel values underwater and decibel values in air are not the same (different reference pressures and densities/sound speeds between media) and should not be directly compared. Because of the different densities of air and water and the different decibel standards (*i.e.,* reference pressures) in air and water, a sound with the same level in air and in water would be approximately 62 dB lower in air. Thus, a sound that measures 160 dB (re 1 μPa) underwater would have the same approximate effective level as a sound that is 98 dB (re 20 μPa) in air.

Sound frequency is measured in cycles per second, or Hertz (abbreviated Hz), and is analogous to musical pitch; high-pitched sounds contain high frequencies and low-pitched sounds contain low frequencies. Natural sounds in the ocean span a huge range of frequencies: from earthquake noise at 5 Hz to harbor porpoise clicks at 150,000 Hz (150 kHz). These sounds are so low or so high in pitch that humans cannot even hear them; acousticians call these infrasonic (typically below 20 Hz) and ultrasonic (typically above 20,000 Hz) sounds, respectively. A single sound may be made up of many different frequencies together. Sounds made up of only a small range of frequencies are called ''narrowband'', and sounds with a broad range of frequencies are called ''broadband''; explosives are an example of a broadband sound source and active tactical sonars are an example of a narrowband sound source.

When considering the influence of various kinds of sound on the marine environment, it is necessary to understand that different kinds of marine life are sensitive to different frequencies of sound. Current data indicate that not all marine mammal species have equal hearing capabilities

(Richardson *et al.,* 1995; Southall *et al.,* 1997; Wartzok and Ketten, 1999; Au and Hastings, 2008).

Southall *et al.* (2007) designated ''functional hearing groups'' for marine mammals based on available behavioral data; audiograms derived from auditory evoked potentials; anatomical modeling; and other data. Southall *et al.* (2007) also estimated the lower and upper frequencies of functional hearing for each group. However, animals are less sensitive to sounds at the outer edges of their functional hearing range and are more sensitive to a range of frequencies within the middle of their functional hearing range. Note that direct measurements of hearing sensitivity do not exist for all species of marine mammals, including low-frequency cetaceans. The functional hearing groups and the associated frequencies developed by Southall *et al.* (2007) were revised by Finneran and Jenkins (2012) and have been further modified by NOAA. Table 2 provides a summary of sound production and general hearing capabilities for marine mammal species (note that values in this table are not meant to reflect absolute possible maximum ranges, rather they represent the best known ranges of each functional hearing group). For purposes of the analysis in this document, marine mammals are arranged into the following functional hearing groups based on their generalized hearing sensitivities: High-frequency cetaceans, mid-frequency cetaceans, low-frequency cetaceans (mysticetes), phocids (true seals), otariids (sea lion and fur seals), and mustelids (sea otters). A detailed discussion of the functional hearing groups can be found in Southall et al. (2007) and Finneran and Jenkins (2012).

TABLE 2—MARINE MAMMAL FUNCTIONAL HEARING GROUPS

Functional hearing group	Functional hearing range *
Low-frequency (LF) cetaceans (baleen whales)	7 Hz to 25 kHz.
Mid-frequency (MF) cetaceans (dolphins, toothed whales, beaked whales, bottlenose whales)	150 Hz to 160 kHz.
High-frequency (HF) cetaceans (true porpoises, *Kogia,* river dolphins, cephalorhynchid, *Lagenorhynchus cruciger* & *L. australis*).	200 Hz to 180 kHz.
Phocid pinnipeds (underwater) (true seals)	75 Hz to 100 kHz.
Otariid pinnipeds (underwater) (sea lions and fur seals)	100 Hz to 48 kHz.

Adapted and derived from Southall *et al.* (2007).

* Represents frequency band of hearing for entire group as a composite (*i.e.,* all species within the group), where individual species' hearing ranges are typically not as broad. Functional hearing is defined as the range of frequencies a group hears without incorporating non-acoustic mechanisms (Wartzok and Ketten, 1999). This is ~60 to ~70 dB above best hearing sensitivity (Southall *et al.,* 2007) for all functional hearing groups except LF cetaceans, where no direct measurements on hearing are available. For LF cetaceans, the lower range is based on recommendations from Southall *et al.,* 2007 and the upper range is based on information on inner ear anatomy and vocalizations.

When sound travels (propagates) from its source, its loudness decreases as the distance traveled by the sound increases. Thus, the loudness of a sound at its source is higher than the loudness of that same sound a kilometer away. Acousticians often refer to the loudness of a sound at its source (typically referenced to one meter from the source) as the source level and the loudness of sound elsewhere as the received level (*i.e.,* typically the receiver). For example, a humpback whale 3 km from a device that has a source level of 230 dB may only be exposed to sound that is 160 dB loud, depending on how the sound travels through water (*e.g.,* spherical spreading [3 dB reduction with doubling of distance] was used in this example). As a result, it is important to understand the difference between source levels and received levels when discussing the loudness of sound in the ocean or its impacts on the marine environment.

As sound travels from a source, its propagation in water is influenced by various physical characteristics, including water temperature, depth, salinity, and surface and bottom properties that cause refraction, reflection, absorption, and scattering of sound waves. Oceans are not homogeneous and the contribution of each of these individual factors is extremely complex and interrelated. The physical characteristics that determine the sound's speed through the water will change with depth, season, geographic location, and with time of day (as a result, in actual active sonar operations, crews will measure oceanic conditions, such as sea water temperature and depth, to calibrate models that determine the path the sonar signal will take as it travels through the ocean and how strong the sound signal will be at a given range along a particular transmission path). As sound travels through the ocean, the intensity associated with the wavefront diminishes, or attenuates. This decrease in intensity is referred to as propagation loss, also commonly called transmission loss.

Metrics Used in This Document

This section includes a brief explanation of the two sound measurements (sound pressure level (SPL) and sound exposure level (SEL)) frequently used to describe sound levels in the discussions of acoustic effects in this document.

Sound pressure level (SPL)—Sound pressure is the sound force per unit area, and is usually measured in micropascals (μPa), where 1 Pa is the pressure resulting from a force of one newton exerted over an area of one square meter. SPL is expressed as the ratio of a measured sound pressure and a reference level.

SPL (in dB) = 20 log (pressure/reference pressure)

The commonly used reference pressure level in underwater acoustics is 1 μPa, and the units for SPLs are dB re: 1 μPa. SPL is an instantaneous pressure measurement and can be expressed as the peak, the peak-peak, or the root mean square (rms). Root mean square pressure, which is the square root of the arithmetic average of the squared instantaneous pressure values, is typically used in discussions of the effects of sounds on vertebrates and all references to SPL in this document refer to the root mean square. SPL does not take the duration of exposure into account. SPL is the applicable metric used in the risk continuum, which is used to estimate behavioral harassment takes (see Level B Harassment Risk Function (Behavioral Harassment) Section).

Sound exposure level (SEL)—SEL is an energy metric that integrates the squared instantaneous sound pressure over a stated time interval. The units for SEL are dB re: 1 μPa^2-s. Below is a simplified formula for SEL.

SEL = SPL + 10 log (duration in seconds)

As applied to active sonar, the SEL includes both the SPL of a sonar ping and the total duration. Longer duration pings and/or pings with higher SPLs will have a higher SEL. If an animal is exposed to multiple pings, the SEL in each individual ping is summed to calculate the cumulative SEL. The cumulative SEL depends on the SPL, duration, and number of pings received. The thresholds that NMFS uses to indicate at what received level the onset of temporary threshold shift (TTS) and permanent threshold shift (PTS) in hearing are likely to occur are expressed as cumulative SEL.

Potential Effects of the Specified Activity on Marine Mammals

The Navy has requested authorization for the take of marine mammals that may occur incidental to Civilian Port Defense training activities in the Study Area. The Navy has analyzed potential impacts to marine mammals from non-impulsive sound sources.

Other potential impacts to marine mammals from training activities in the Study Area were analyzed in the Navy's EA, and determined to be unlikely to result in marine mammal harassment. Therefore, the Navy has not requested authorization for take of marine mammals that might occur incidental to other components of its proposed activities. In this document, NMFS analyzes the potential effects on marine mammals from exposure to non-impulsive sound sources (active sonar).

For the purpose of MMPA authorizations, NMFS' effects assessments serve four primary purposes: (1) To prescribe the permissible methods of taking (*i.e.,* Level B harassment (behavioral harassment), Level A harassment (injury), or mortality, including an identification of the number and types of take that could occur by harassment or mortality) and to prescribe other means of effecting the least practicable adverse impact on such species or stock and its habitat (*i.e.,* mitigation); (2) to determine whether the specified activity would have a negligible impact on the affected species or stocks of marine mammals (based on the likelihood that the activity would adversely affect the species or stock through effects on annual rates of recruitment or survival); (3) to determine whether the specified activity would have an unmitigable adverse impact on the availability of the species or stock(s) for subsistence uses; and (4) to prescribe requirements pertaining to monitoring and reporting.

More specifically, for activities involving non-impulsive sources (active sonar), NMFS' analysis will identify the probability of lethal responses, physical trauma, sensory impairment (permanent and temporary threshold shifts and acoustic masking), physiological responses (particular stress responses), behavioral disturbance (that rises to the level of harassment), and social responses (effects to social relationships) that would be classified as a take and whether such take would have a negligible impact on such species or stocks. This section focuses qualitatively on the different ways that non-impulsive sources may affect marine mammals (some of which NMFS would not classify as harassment). Then, in the Estimated Take of Marine Mammals section, the potential effects to marine mammals from non-impulsive sources will be related to the MMPA definitions of Level B harassment, and we will attempt to quantify those effects.

Non-Impulsive Sources

Direct Physiological Effects

Based on the literature, there are two basic ways that non-impulsive sources might directly result in physical trauma or damage: Noise-induced loss of hearing sensitivity (more commonly-called "threshold shift") and acoustically mediated bubble growth.

Threshold Shift (noise-induced loss of hearing)—When animals exhibit reduced hearing sensitivity (*i.e.,* sounds must be louder for an animal to detect them) following exposure to an intense sound or sound for long duration, it is referred to as a noise-induced threshold shift (TS). An animal can experience temporary threshold shift (TTS) or permanent threshold shift (PTS). TTS can last from minutes or hours to days (*i.e.,* there is complete recovery), can occur in specific frequency ranges (*i.e.,* an animal might only have a temporary loss of hearing sensitivity between the frequencies of 1 and 10 kHz), and can be of varying amounts (for example, an animal's hearing sensitivity might be reduced initially by only 6 dB or reduced by 30 dB). PTS is permanent, but some recovery is possible. PTS can also occur in a specific frequency range and amount as mentioned above for TTS.

The following physiological mechanisms are thought to play a role in inducing auditory TS: Effects to sensory hair cells in the inner ear that reduce their sensitivity, modification of the chemical environment within the sensory cells, residual muscular activity in the middle ear, displacement of certain inner ear membranes, increased blood flow, and 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 TS and the frequency range in which it occurs. As amplitude and duration of sound exposure increase, so, generally, does the amount of TS, along with the recovery time. For intermittent sounds, less TS could occur than compared to a continuous exposure with the same energy (some recovery could occur between intermittent exposures depending on the duty cycle between sounds) (Kryter *et al.,* 1966; Ward, 1997). For example, one short but loud (higher SPL) sound exposure may induce the same impairment as one longer but softer 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, prolonged exposure to sounds strong enough to elicit TTS, or shorter-term exposure to sound levels well above the TTS threshold, can cause PTS, at least in terrestrial mammals (Kryter, 1985). Although in the case of mid- and high-frequency active sonar (MFAS/HFAS), animals are not expected to be exposed to levels high enough or durations long enough to result in PTS.

PTS is considered auditory injury (Southall *et al.,* 2007). 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 middle and inner ears and resultant changes in the chemical composition of the inner ear fluids (Southall *et al.,* 2007).

Although the published body of scientific literature contains numerous theoretical studies and discussion papers on hearing impairments that can occur with exposure to a loud sound, only a few studies provide empirical information on the levels at which noise-induced loss in hearing sensitivity occurs in nonhuman animals. For marine mammals, published data are limited to the captive bottlenose dolphin, beluga, harbor porpoise, and Yangtze finless porpoise (Finneran *et al.,* 2000, 2002b, 2003, 2005a, 2007, 2010a, 2010b; Finneran and Schlundt, 2010; Lucke *et al.,* 2009; Mooney *et al.,* 2009a, 2009b; Popov *et al.,* 2011a, 2011b; Kastelein *et al.,* 2012a; Schlundt *et al.,* 2000; Nachtigall *et al.,* 2003, 2004). For pinnipeds in water, data are limited to measurements of TTS in harbor seals, an elephant seal, and California sea lions (Kastak *et al.,* 1999, 2005; Kastelein *et al.,* 2012b).

Marine mammal hearing plays a critical role in communication with conspecifics, and 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 occurs 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 time when communication is critical for successful mother/calf interactions could have more serious impacts. Also, depending on the degree and frequency range, the effects of PTS on an animal could range in severity, although it is considered generally more serious because it is a permanent condition. Of note, reduced hearing sensitivity as a simple function of aging has been observed in marine mammals, as well as humans and other taxa (Southall *et al.,* 2007), so one can infer that strategies exist for coping with this condition to some degree, though likely not without cost.

Acoustically Mediated Bubble Growth—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.

It is unlikely that the short duration 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 referenced to (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 (33 ft.) 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 (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. 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 (decompression sickness) 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 (Jepson *et al.,* 2003; Fernandez *et al.,* 2005; Fernández *et al.,* 2012). 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). 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). More recent 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 (ELs) predicted to cause in vivo bubble formation within diving cetaceans have not been evaluated (NOAA, 2002b). Although it has been argued that traumas from some recent beaked whale strandings are consistent with gas emboli and bubble-induced tissue separations (Jepson *et al.,* 2003), there is no conclusive evidence of this. However, Jepson *et al.* (2003, 2005) and Fernandez *et al.* (2004, 2005, 2012) concluded that in vivo bubble formation, which may be exacerbated by deep, long-duration, repetitive dives may explain why beaked whales appear to be particularly vulnerable to sonar exposures. Further investigation is needed to further assess the potential validity of these hypotheses.

Acoustic Masking

Marine mammals use acoustic signals for a variety of purposes, which differ among species, but include communication between individuals, navigation, foraging, reproduction, and learning about their environment (Erbe and Farmer, 2000; Tyack, 2000). Masking, or auditory interference, generally occurs when sounds in the environment are louder than and of a similar frequency to, auditory signals an animal is trying to receive. Masking is a phenomenon that affects animals that are trying to receive acoustic information about their environment, including sounds from other members of their species, predators, prey, and sounds that allow them to orient in their environment. Masking these acoustic signals can disturb the behavior of individual animals, groups of animals, or entire populations.

The extent of the masking interference depends on the spectral, temporal, and spatial relationships between the signals an animal is trying to receive and the masking noise, in addition to other factors. In humans, significant masking of tonal signals occurs as a result of exposure to noise in a narrow band of similar frequencies. As the sound level increases, though, the detection of frequencies above those of the masking stimulus decreases also. This principle is expected to apply to marine mammals as well because of common biomechanical cochlear properties across taxa.

Richardson *et al.* (1995b) argued that the maximum radius of influence of an industrial 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 of the animal or the background noise level present. Industrial masking is most likely to affect some species' ability to detect communication calls and natural sounds (*i.e.,* surf noise, prey noise, etc.; Richardson *et al.,* 1995).

The echolocation calls of toothed whales are subject to masking by high frequency sound. Human data indicate low-frequency sound can mask high-frequency sounds (*i.e.,* upward masking). Studies on captive odontocetes by Au *et al.* (1974, 1985, 1993) indicate that some species may use various processes to reduce masking effects (*e.g.,* adjustments in echolocation call intensity or frequency as a function of background noise conditions). There is also evidence that the directional hearing abilities of odontocetes are useful in reducing masking at the high-frequencies these cetaceans use to echolocate, but not at the low-to-moderate frequencies they use to communicate (Zaitseva *et al.,* 1980). A recent study by Nachtigall and Supin (2008) showed that false killer whales adjust their hearing to compensate for ambient sounds and the intensity of returning echolocation signals.

As mentioned previously, the functional hearing ranges of odontocetes and pinnipeds underwater overlap the frequencies of the high-frequency sonar source (*i.e.,* AN/SQQ–32) used in the Navy's training exercises. Additionally, species' vocal repertoires span across the frequencies of the sonar source used by the Navy. The closer the characteristics of the masking signal to the signal of interest, the more likely masking is to occur. For hull-mounted and towed sonar the pulse length and low duty cycle of the HFAS signal makes it less likely that masking would occur as a result. Further, the frequency band of the sonar is narrow, limiting the likelihood of auditory masking.

Impaired Communication

In addition to making it more difficult for animals to perceive acoustic cues in their environment, anthropogenic sound presents separate challenges for animals that are vocalizing. When they vocalize, animals are aware of environmental conditions that affect the ''active space'' of their vocalizations, which is the maximum area within which their vocalizations can be detected before it drops to the level of ambient noise (Brenowitz, 2004; Brumm *et al.,* 2004; Lohr *et al.,* 2003). Animals are also aware of environmental conditions that affect whether listeners can discriminate and recognize their vocalizations from other sounds, which is more important than simply detecting that a vocalization is occurring (Brenowitz, 1982; Brumm *et al.,* 2004; Dooling, 2004, Marten and Marler, 1977; Patricelli *et al.,* 2006). Most animals that vocalize have evolved with an ability to make adjustments to their vocalizations to increase the signal-to-noise ratio, active space, and recognizability/distinguishability of their vocalizations in the face of temporary changes in background noise (Brumm *et al.,* 2004; Patricelli *et al.,* 2006). Vocalizing animals can make adjustments to vocalization characteristics such as the frequency structure, amplitude, temporal structure, and temporal delivery.

Many animals will combine several of these strategies to compensate for high levels of background noise. Anthropogenic sounds that reduce the signal-to-noise ratio of animal vocalizations, increase the masked auditory thresholds of animals listening for such vocalizations, or reduce the active space of an animal's vocalizations impair communication between animals. Most animals that vocalize have evolved strategies to compensate for the effects of short-term or temporary increases in background or ambient noise on their songs or calls. Although the fitness consequences of these vocal adjustments remain unknown, like most other trade-offs animals must make, some of these strategies probably come at a cost (Patricelli *et al.,* 2006). For example, vocalizing more loudly in noisy environments may have energetic costs that decrease the net benefits of vocal adjustment and alter a bird's energy budget (Brumm, 2004; Wood and Yezerinac, 2006). Shifting songs and calls to higher frequencies may also impose energetic costs (Lambrechts, 1996).

Stress Responses

Classic stress responses begin when an animal's central nervous system perceives a potential threat to its homeostasis. That perception triggers stress responses regardless of whether a stimulus actually threatens the animal; the mere perception of a threat is sufficient to trigger a stress response (Moberg, 2000; Sapolsky *et al.,* 2005; Seyle, 1950). Once an animal's central nervous system perceives a threat, it mounts a biological response or defense that consists of a combination of the four general biological defense responses: behavioral responses, autonomic nervous system responses, neuroendocrine responses, or immune responses.

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; the system that has received the most study has been the hypothalamus-pituitary-adrenal 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, 1995), altered metabolism (Elasser *et al.,* 2000), reduced immune competence (Blecha, 2000), and behavioral disturbance. 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.

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 a risk to the animal's welfare. 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 function, which impairs those functions that experience the diversion. For example, when mounting a stress response diverts energy away from growth in young animals, those animals may experience stunted growth. When mounting 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'' (Seyle, 1950) or ''allostatic loading'' (McEwen and Wingfield, 2003). This pathological state will last until the animal replenishes its biotic reserves sufficient to restore normal function. Note that these examples involved a long-term (days or weeks) stress response exposure to stimuli.

Relationships between these physiological mechanisms, animal behavior, and the costs of stress responses have also been documented fairly well through controlled experiments; because this physiology exists in every vertebrate that has been studied, it is not surprising that stress responses and their costs have been documented in both laboratory and free-living animals (for examples see, 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). Information has also been collected on the physiological responses of marine mammals to exposure to anthropogenic sounds (Fair and Becker, 2000; Romano *et al.,* 2002; Wright *et al.,* 2008). For example, Rolland *et al.* (2012) found that noise reduction from reduced ship traffic in the Bay of Fundy was associated with decreased stress in North Atlantic right whales. In a conceptual model developed by the Population Consequences of Acoustic Disturbance (PCAD) working group, serum hormones were identified as possible indicators of behavioral effects that are translated into altered rates of reproduction and mortality. The Office of Naval Research hosted a workshop (Effects of Stress on Marine Mammals Exposed to Sound) in 2009 that focused on this very topic (ONR, 2009).

Studies of other marine animals and terrestrial animals would also lead us to expect some marine mammals to experience physiological stress responses and, perhaps, physiological responses that would be classified as ''distress'' upon exposure to high frequency, mid-frequency and low-frequency sounds. For example, Jansen (1998) reported on the relationship between acoustic exposures and physiological responses that are indicative of stress responses in humans (for example, elevated respiration and increased heart rates). Jones (1998) reported on reductions in human performance when faced with acute, repetitive exposures to acoustic disturbance. Trimper *et al.* (1998) reported on the physiological stress responses of osprey to low-level aircraft noise while Krausman *et al.* (2004) reported on the auditory and physiology stress responses of endangered Sonoran pronghorn to military overflights. Smith *et al.* (2004a, 2004b), for example, identified noise-induced physiological transient stress responses in hearing-specialist fish (*i.e.,* goldfish) that accompanied short- and long-term hearing losses. Welch and Welch (1970) reported physiological and behavioral stress responses that accompanied damage to the inner ears of fish and several mammals.

Hearing is one of the primary senses marine mammals use to gather information about their environment and to communicate with conspecifics. Although empirical information on the relationship between sensory impairment (TTS, PTS, and acoustic masking) on marine mammals remains limited, it seems reasonable to assume that reducing an animal's ability to gather information about its environment and to communicate with other members of its species would be stressful for animals that use hearing as their primary sensory mechanism. Therefore, we assume that acoustic exposures sufficient to trigger onset PTS or TTS would be accompanied by physiological stress responses because terrestrial animals exhibit those responses under similar conditions (NRC, 2003). More importantly, marine mammals might experience stress responses at received levels lower than those necessary to trigger onset TTS. Based on empirical studies of the time required to recover from stress responses (Moberg, 2000), we also assume that stress responses are likely to persist beyond the time interval required for animals to recover from TTS and might result in pathological and pre-pathological states that would be as significant as behavioral responses to TTS.

Behavioral Disturbance

Behavioral responses to sound are highly variable and context-specific. 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 effects whether it is less likely (habituation) or more likely (sensitization) to respond to certain sounds in the future (animals can also be innately pre-disposed to respond to certain sounds in certain ways) (Southall *et al.,* 2007). Related to the sound itself, the perceived nearness of the sound, bearing of the sound (approaching vs. retreating), similarity of a sound to biologically relevant sounds in the animal's environment (*i.e.,* calls of predators, prey, or conspecifics), and familiarity of the sound may affect the way an animal responds to the sound (Southall *et al.,* 2007). Individuals (of different age, gender, 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. 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.

Exposure of marine mammals to sound sources can result in no response or responses including, but not limited to: Increased alertness; orientation or attraction to a sound source; vocal modifications; cessation of feeding; cessation of social interaction; alteration of movement or diving behavior; habitat abandonment (temporary or permanent); and, in severe cases, 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 and others in 1995. A more recent review (Nowacek *et al.,* 2007) addresses studies conducted since 1995 and focuses on observations where the received sound level of the exposed marine mammal(s) was known or could be estimated. The following sub-sections provide examples of behavioral responses that provide an idea of the variability in behavioral 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. Estimates of the types of behavioral responses that could occur for a given sound exposure should be determined from the literature that is available for each species, or extrapolated from closely related species when no information exists.

Flight Response—A flight response is a dramatic change in normal movement to a directed and rapid movement away from the perceived location of a sound source. Relatively little information on flight responses of marine mammals to anthropogenic signals exist, although observations of flight responses to the presence of predators have occurred (Connor and Heithaus, 1996). Flight responses have been speculated as being a component of marine mammal strandings associated with sonar activities (Evans and England, 2001).

Response to Predator—Evidence suggests that at least some marine mammals have the ability to acoustically identify potential predators. For example, harbor seals that reside in the coastal waters off British Columbia are frequently targeted by certain groups of killer whales, but not others. The seals discriminate between the calls of threatening and non-threatening killer whales (Deecke *et al.,* 2002), a capability that should increase survivorship while reducing the energy required for attending to and responding to all killer whale calls. The occurrence of masking or hearing impairment provides a means by which marine mammals may be prevented from responding to the acoustic cues produced by their predators. Whether or not this is a possibility depends on the duration of the masking/hearing impairment and the likelihood of encountering a predator during the time that predator cues are impeded.

Diving—Changes in dive behavior can vary widely. They may consist of increased or decreased dive times and surface intervals as well as changes in the rates of ascent and descent during a dive. Variations in dive behavior may reflect interruptions in biologically significant activities (*e.g.,* foraging) or they may be of little biological significance. Variations in dive behavior may also expose an animal to potentially harmful conditions (*e.g.,* increasing the chance of ship-strike) or may serve as an avoidance response that enhances survivorship. The impact of a variation in diving resulting from an acoustic exposure depends on what the animal is doing at the time of the exposure and the type and magnitude of the response.

Nowacek *et al.* (2004) reported disruptions of dive behaviors in foraging North Atlantic right whales when exposed to an alerting stimulus, an action, they noted, that could lead to an increased likelihood of ship strike. However, the whales did not respond to playbacks of either right whale social sounds or vessel noise, highlighting the importance of the sound characteristics in producing a behavioral reaction. Conversely, Indo-Pacific humpback dolphins have been observed to dive for longer periods of time in areas where vessels were present and/or approaching (Ng and Leung, 2003). In both of these studies, the influence of the sound exposure cannot be decoupled from the physical presence of a surface vessel, thus complicating interpretations of the relative contribution of each stimulus to the response. Indeed, the presence of surface vessels, their approach, and speed of approach, seemed to be significant factors in the response of the Indo-Pacific humpback dolphins (Ng and Leung, 2003). Low frequency signals of the Acoustic Thermometry of Ocean Climate (ATOC) sound source were not found to affect dive times of humpback whales in Hawaiian waters (Frankel and Clark, 2000) or to overtly affect elephant seal dives (Costa *et al.,* 2003). They did, however, produce subtle effects that varied in direction and degree among the individual seals, illustrating the equivocal nature of behavioral effects and consequent difficulty in defining and predicting them.

Due to past incidents of beaked whale strandings associated with sonar operations, feedback paths are provided between avoidance and diving and indirect tissue effects. This feedback accounts for the hypothesis that variations in diving behavior and/or avoidance responses can possibly result in nitrogen tissue supersaturation and nitrogen off-gassing, possibly to the point of deleterious vascular bubble formation (Jepson *et al.,* 2003). Although hypothetical, discussions surrounding this potential process are controversial.

Foraging—Disruption of feeding behavior can be difficult to correlate with anthropogenic sound exposure, so it is usually inferred by observed displacement from known foraging areas, the appearance of secondary indicators (*e.g.,* bubble nets or sediment plumes), or changes in dive behavior. Noise from seismic surveys was not found to impact the feeding behavior in western grey whales off the coast of Russia (Yazvenko *et al.,* 2007) and sperm whales engaged in foraging dives did not abandon dives when exposed to distant signatures of seismic airguns (Madsen *et al.,* 2006). However, Miller *et al.* (2009) reported buzz rates (a proxy for feeding) 19 percent lower during exposure to distant signatures of seismic airguns. Balaenopterid whales exposed to moderate low-frequency signals similar to the ATOC sound source demonstrated no variation in foraging activity (Croll *et al.,* 2001), whereas five out of six North Atlantic right whales exposed to an acoustic alarm interrupted their foraging dives (Nowacek *et al.,* 2004). Although the received sound pressure levels were similar in the latter two studies, the frequency, duration, and temporal pattern of signal presentation were different. These factors, as well as differences in species sensitivity, are likely contributing factors to the differential response. Blue whales exposed to simulated mid-frequency sonar in the Southern California Bight were less likely to produce low frequency calls usually associated with feeding behavior (Melcón *et al.,* 2012). It is not known whether the lower rates of calling actually indicated a reduction in feeding behavior or social contact since the study used data from remotely deployed, passive acoustic monitoring buoys. In contrast, blue whales increased their likelihood of calling when ship noise was present, and decreased their likelihood of calling in the presence of explosive noise, although this result was not statistically significant (Melcón *et al.,* 2012). Additionally, the likelihood of an animal calling decreased with the increased received level of mid-frequency sonar, beginning at a SPL of approximately 110–120 dB re 1 μPa (Melcón *et al.,* 2012). Preliminary results from the 2010–2011 field season of an ongoing behavioral response study in Southern California waters indicated that, in some cases and at low received levels, tagged blue whales responded to mid-frequency sonar but that those responses were mild and there was a quick return to their baseline activity (Southall *et al.,* 2011). A determination of whether foraging disruptions incur fitness consequences will require information on or estimates of the energetic requirements of the individuals and the relationship between prey availability, foraging effort and success, and the life history stage of the animal. Goldbogen *et al.,* (2013) monitored behavioral responses of tagged blue whales located in feeding areas when exposed simulated MFA sonar. Responses varied depending on behavioral context, with deep feeding whales being more significantly affected (*i.e.,* generalized avoidance; cessation of feeding; increased swimming speeds; or directed travel away from the source) compared to surface feeding individuals that typically showed no change in behavior. Non-feeding whales also seemed to be affected by exposure. The authors indicate that disruption of feeding and displacement could impact individual fitness and health. However, for this to be true, we would have to assume that an individual whale could not compensate for this lost feeding opportunity by either immediately feeding at another location, by feeding shortly after cessation of acoustic exposure, or by feeding at a later time. There is no indication this is the case, particularly since unconsumed prey would likely still be available in the environment in most cases following the cessation of acoustic exposure.

Breathing—Variations in respiration naturally vary with different behaviors and variations in respiration rate as a function of acoustic exposure can be expected to co-occur with other behavioral reactions, such as a flight response or an alteration in diving. However, respiration rates in and of themselves may be representative of annoyance or an acute stress response. Mean exhalation rates of gray whales at rest and while diving were found to be unaffected by seismic surveys conducted adjacent to the whale feeding grounds (Gailey *et al.,* 2007). Studies with captive harbor porpoises showed increased respiration rates upon introduction of acoustic alarms (Kastelein *et al.,* 2001; Kastelein *et al.,* 2006a) and emissions for underwater data transmission (Kastelein *et al.,* 2005). However, exposure of the same acoustic alarm to a striped dolphin under the same conditions did not elicit a response (Kastelein *et al.,* 2006a), again highlighting the importance in understanding species differences in the tolerance of underwater noise when determining the potential for impacts resulting from anthropogenic sound exposure (Southall *et al.,* 2007; Henderson *et al.,* 2014).

Social Relationships—Social interactions between mammals can be affected by noise via the disruption of communication signals or by the displacement of individuals. Disruption of social relationships therefore depends on the disruption of other behaviors (*e.g.,* caused avoidance, masking, etc.) and no specific overview is provided here. However, social disruptions must be considered in context of the relationships that are affected. Long-term disruptions of mother/calf pairs or mating displays have the potential to affect the growth and survival or reproductive effort/success of individuals, respectively.

Vocalizations (also see Masking Section)—Vocal changes in response to anthropogenic noise can occur across the repertoire of sound production modes used by marine mammals, such as whistling, echolocation click production, calling, and singing. Changes may result in response to a need to compete with an increase in background noise or may reflect an increased vigilance or startle response. For example, in the presence of low-frequency active sonar, humpback whales have been observed to increase the length of their ''songs'' (Miller *et al.,* 2000; Fristrup *et al.,* 2003), possibly due to the overlap in frequencies between the whale song and the low-frequency active sonar. A similar compensatory effect for the presence of low-frequency vessel noise has been suggested for right whales; right whales have been 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). Killer whales off the northwestern coast of the U.S. have been observed to increase the duration of primary calls once a threshold in observing vessel density (*e.g.,* whale watching) was reached, which has been suggested as a response to increased masking noise produced by the vessels (Foote *et al.,* 2004; NOAA, 2014b). In contrast, both sperm and pilot whales potentially ceased sound production during the Heard Island feasibility test (Bowles *et al.,* 1994), although it cannot be absolutely determined whether the inability to acoustically detect the animals was due to the cessation of sound production or the displacement of animals from the area.

Avoidance—Avoidance is the displacement of an individual from an area as a result of the presence of a sound. Richardson *et al.,* (1995) noted that avoidance reactions are the most obvious manifestations of disturbance in marine mammals. It is qualitatively different from the flight response, but also differs in the magnitude of the response (*i.e.,* directed movement, rate of travel, etc.). Oftentimes avoidance is temporary, and animals return to the area once the noise has ceased. Longer term displacement is possible, however, which can lead to changes in abundance or distribution patterns of the species in the affected region if they do not become acclimated to the presence of the sound (Blackwell *et al.,* 2004; Bejder *et al.,* 2006; Teilmann *et al.,* 2006). Acute avoidance responses have been observed in captive porpoises and pinnipeds exposed to a number of different sound sources (Kastelein *et al.,* 2001; Finneran *et al.,* 2003; Kastelein *et al.,* 2006a; Kastelein *et al.,* 2006b). Short-term avoidance of seismic surveys, low frequency emissions, and acoustic deterrents have also been noted in wild populations of odontocetes (Bowles *et al.,* 1994; Goold, 1996; 1998; Stone *et al.,* 2000; Morton and Symonds, 2002) and to some extent in mysticetes (Gailey *et al.,* 2007), while longer term or repetitive/chronic displacement for some dolphin groups and for manatees has been suggested to be due to the presence of chronic vessel noise (Haviland-Howell *et al.,* 2007; Miksis-Olds *et al.,* 2007).

Maybaum (1993) conducted sound playback experiments to assess the effects of MFAS on humpback whales in Hawaiian waters. Specifically, she exposed focal pods to sounds of a 3.3-kHz sonar pulse, a sonar frequency sweep from 3.1 to 3.6 kHz, and a control (blank) tape while monitoring behavior, movement, and underwater vocalizations. The two types of sonar signals (which both contained mid- and low-frequency components) differed in their effects on the humpback whales, but both resulted in avoidance behavior. The whales responded to the pulse by increasing their distance from the sound source and responded to the frequency sweep by increasing their swimming speeds and track linearity. In the Caribbean, sperm whales avoided exposure to mid-frequency submarine sonar pulses, in the range of 1000 Hz to 10,000 Hz (IWC 2005).

Kvadsheim *et al.,* (2007) conducted a controlled exposure experiment in which killer whales fitted with D-tags were exposed to mid-frequency active sonar (Source A: a 1.0 second upsweep 209 dB @1–2 kHz every 10 seconds for 10 minutes; Source B: with a 1.0 second upsweep 197 dB @6–7 kHz every 10 seconds for 10 minutes). When exposed to Source A, a tagged whale and the group it was traveling with did not appear to avoid the source. When exposed to Source B, the tagged whales along with other whales that had been carousel feeding, ceased feeding during the approach of the sonar and moved rapidly away from the source. When exposed to Source B, Kvadsheim and his co-workers reported that a tagged killer whale seemed to try to avoid further exposure to the sound field by the following behaviors: immediately swimming away (horizontally) from the source of the sound; engaging in a series of erratic and frequently deep dives that seemed to take it below the sound field;

or swimming away while engaged in a series of erratic and frequently deep dives. Although the sample sizes in this study are too small to support statistical analysis, the behavioral responses of the orcas were consistent with the results of other studies.

In 2007, the first in a series of behavioral response studies, a collaboration by the Navy, NMFS, and other scientists showed one beaked whale (*Mesoplodon densirostris*) responding to an MFAS playback. Tyack *et al.* (2011) indicates that the playback began when the tagged beaked whale was vocalizing at depth (at the deepest part of a typical feeding dive), following a previous control with no sound exposure. The whale appeared to stop clicking significantly earlier than usual, when exposed to mid-frequency signals in the 130–140 dB (rms) received level range. After a few more minutes of the playback, when the received level reached a maximum of 140–150 dB, the whale ascended on the slow side of normal ascent rates with a longer than normal ascent, at which point the exposure was terminated. The results are from a single experiment and a greater sample size is needed before robust and definitive conclusions can be drawn.

Tyack *et al.* (2011) also indicates that Blainville's beaked whales appear to be sensitive to noise at levels well below expected TTS (~160 dB re 1 μPa). This sensitivity is manifest by an adaptive movement away from a sound source. This response was observed irrespective of whether the signal transmitted was within the band width of MFAS, which suggests that beaked whales may not respond to the specific sound signatures. Instead, they may be sensitive to any pulsed sound from a point source in this frequency range. The response to such stimuli appears to involve maximizing the distance from the sound source.

Stimpert *et al.* (2014) tagged a Baird's beaked whale, which was subsequently exposed to simulated mid-frequency sonar. Changes in the animal's dive behavior and locomotion were observed when received level reached 127 dB re 1 μPa.

Results from a 2007–2008 study conducted near the Bahamas showed a change in diving behavior of an adult Blainville's beaked whale to playback of mid-frequency source and predator sounds (Boyd *et al.,* 2008; Southall *et al.* 2009; Tyack *et al.,* 2011). Reaction to mid-frequency sounds included premature cessation of clicking and termination of a foraging dive, and a slower ascent rate to the surface. Results from a similar behavioral response study in southern California waters have been presented for the 2010–2011 field season (Southall *et al.* 2011; DeRuiter *et al.,* 2013b). DeRuiter *et al.* (2013b) presented results from two Cuvier's beaked whales that were tagged and exposed to simulated mid-frequency active sonar during the 2010 and 2011 field seasons of the southern California behavioral response study. The 2011 whale was also incidentally exposed to mid-frequency active sonar from a distant naval exercise. Received levels from the mid-frequency active sonar signals from the controlled and incidental exposures were calculated as 84–144 and 78–106 dB re 1 μPa root mean square (rms), respectively. Both whales showed responses to the controlled exposures, ranging from initial orientation changes to avoidance responses characterized by energetic fluking and swimming away from the source. However, the authors did not detect similar responses to incidental exposure to distant naval sonar exercises at comparable received levels, indicating that context of the exposures (*e.g.,* source proximity, controlled source ramp-up) may have been a significant factor. Cuvier's beaked whale responses suggested particular sensitivity to sound exposure as consistent with results for Blainville's beaked whale. Similarly, beaked whales exposed to sonar during British training exercises stopped foraging (DSTL, 2007), and preliminary results of controlled playback of sonar may indicate feeding/foraging disruption of killer whales and sperm whales (Miller *et al.,* 2011).

In the 2007–2008 Bahamas study, playback sounds of a potential predator—a killer whale—resulted in a similar but more pronounced reaction, which included longer inter-dive intervals and a sustained straight-line departure of more than 20 km from the area. The authors noted, however, that the magnified reaction to the predator sounds could represent a cumulative effect of exposure to the two sound types since killer whale playback began approximately 2 hours after mid-frequency source playback. Pilot whales and killer whales off Norway also exhibited horizontal avoidance of a transducer with outputs in the mid-frequency range (signals in the 1–2 kHz and 6–7 kHz ranges) (Miller *et al.,* 2011). Additionally, separation of a calf from its group during exposure to mid-frequency sonar playback was observed on one occasion (Miller *et al.,* 2011). In contrast, preliminary analyses suggest that none of the pilot whales or false killer whales in the Bahamas showed an avoidance response to controlled exposure playbacks (Southall *et al.,* 2009).

Through analysis of the behavioral response studies, a preliminary overarching effect of greater sensitivity to all anthropogenic exposures was seen in beaked whales compared to the other odontocetes studied (Southall *et al.,* 2009). Therefore, recent studies have focused specifically on beaked whale responses to active sonar transmissions or controlled exposure playback of simulated sonar on various military ranges (Defence Science and Technology Laboratory, 2007; Claridge and Durban, 2009; Moretti *et al.,* 2009; McCarthy *et al.,* 2011; Tyack *et al.,* 2011). In the Bahamas, Blainville's beaked whales located on the range will move off-range during sonar use and return only after the sonar transmissions have stopped, sometimes taking several days to do so (Claridge and Durban 2009; Moretti *et al.,* 2009; McCarthy *et al.,* 2011; Tyack *et al.,* 2011). Moretti *et al.* (2014) used recordings from seafloor-mounted hydrophones at the Atlantic Undersea Test and Evaluation Center (AUTEC) to analyze the probability of Blainsville's beaked whale dives before, during, and after Navy sonar exercises.

Orientation—A shift in an animal's resting state or an attentional change via an orienting response represent behaviors that would be considered mild disruptions if occurring alone. As previously mentioned, the responses may co-occur with other behaviors; for instance, an animal may initially orient toward a sound source, and then move away from it. Thus, any orienting response should be considered in context of other reactions that may occur.

Behavioral Responses

Southall *et al.* (2007) reports the results of the efforts of a panel of experts in acoustic research from behavioral, physiological, and physical disciplines that convened and reviewed the available literature on marine mammal hearing and physiological and behavioral responses to human-made sound with the goal of proposing exposure criteria for certain effects. This peer-reviewed compilation of literature is very valuable, though Southall *et al.* (2007) note that not all data are equal, some have poor statistical power, insufficient controls, and/or limited information on received levels, background noise, and other potentially important contextual variables—such data were reviewed and sometimes used for qualitative illustration but were not included in the quantitative analysis for the criteria recommendations. All of the studies considered, however, contain an estimate of the received sound level when the animal exhibited the indicated response.

In the Southall *et al.* (2007) publication, for the purposes of analyzing responses of marine mammals to anthropogenic sound and developing criteria, the authors differentiate between single pulse sounds, multiple pulse sounds, and non-pulse sounds. MFAS/HFAS sonar is considered a non-pulse sound. Southall *et al.* (2007) summarize the studies associated with low-frequency, mid-frequency, and high-frequency cetacean and pinniped responses to non-pulse sounds, based strictly on received level, in Appendix C of their article (incorporated by reference and summarized in the three paragraphs below).

The studies that address responses of low-frequency cetaceans to non-pulse sounds include data gathered in the field and related to several types of sound sources (of varying similarity to MFAS/HFAS) including: Vessel noise, drilling and machinery playback, low-frequency M-sequences (sine wave with multiple phase reversals) playback, tactical low-frequency active sonar playback, drill ships, Acoustic Thermometry of Ocean Climate (ATOC) source, and non-pulse playbacks. These studies generally indicate no (or very limited) responses to received levels in the 90 to 120 dB re: 1 µPa range and an increasing likelihood of avoidance and other behavioral effects in the 120 to 160 dB range. As mentioned earlier, though, contextual variables play a very important role in the reported responses and the severity of effects are not linear when compared to received level. Also, few of the laboratory or field datasets had common conditions, behavioral contexts or sound sources, so it is not surprising that responses differ.

The studies that address responses of mid-frequency cetaceans to non-pulse sounds include data gathered both in the field and the laboratory and related to several different sound sources (of varying similarity to MFAS/HFAS) including: pingers, drilling playbacks, ship and ice-breaking noise, vessel noise, Acoustic Harassment Devices (AHDs), Acoustic Deterrent Devices (ADDs), MFAS, and non-pulse bands and tones. Southall *et al.* (2007) were unable to come to a clear conclusion regarding the results of these studies. In some cases, animals in the field showed significant responses to received levels between 90 and 120 dB, while in other cases these responses were not seen in the 120 to 150 dB range. The disparity in results was likely due to contextual variation and the differences between the results in the field and laboratory data (animals typically responded at lower levels in the field).

The studies that address responses of high frequency cetaceans to non-pulse sounds include data gathered both in the field and the laboratory and related to several different sound sources (of varying similarity to MFAS/HFAS) including: pingers, AHDs, and various laboratory non-pulse sounds. All of these data were collected from harbor porpoises. Southall *et al.* (2007) concluded that the existing data indicate that harbor porpoises are likely sensitive to a wide range of anthropogenic sounds at low received levels (~ 90 to 120 dB), at least for initial exposures. All recorded exposures above 140 dB induced profound and sustained avoidance behavior in wild harbor porpoises (Southall *et al.,* 2007). Rapid habituation was noted in some but not all studies. There is no data to indicate whether other high frequency cetaceans are as sensitive to anthropogenic sound as harbor porpoises are.

The studies that address the responses of pinnipeds in water to non-pulse sounds include data gathered both in the field and the laboratory and related to several different sound sources (of varying similarity to MFAS/HFAS) including: AHDs, ATOC, various non-pulse sounds used in underwater data communication; underwater drilling, and construction noise. Few studies exist with enough information to include them in the analysis. The limited data suggested that exposures to non-pulse sounds between 90 and 140 dB generally do not result in strong behavioral responses in pinnipeds in water, but no data exist at higher received levels.

Potential Effects of Behavioral Disturbance

The different ways that 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. There is limited marine mammal data quantitatively 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.

Attention is the cognitive process of selectively concentrating on one aspect of an animal's environment while ignoring other things (Posner, 1994). Because animals (including humans) have limited cognitive resources, there is a limit to how much sensory information they can process at any time. The phenomenon called ''attentional capture'' occurs when a stimulus (usually a stimulus that an animal is not concentrating on or attending to) ''captures'' an animal's attention. This shift in attention can occur consciously or subconsciously (for example, when an animal hears sounds that it associates with the approach of a predator) and the shift in attention can be sudden (Dukas, 2002; van Rij, 2007). Once a stimulus has captured an animal's attention, the animal can respond by ignoring the stimulus, assuming a ''watch and wait'' posture, or treat the stimulus as a disturbance and respond accordingly, which includes scanning for the source of the stimulus or ''vigilance'' (Cowlishaw *et al.,* 2004).

Vigilance is normally an adaptive behavior that helps animals determine the presence or absence of predators, assess their distance from conspecifics, or to attend cues from prey (Bednekoff and Lima, 1998; Treves, 2000). Despite those benefits, however, vigilance has a cost of time; when animals focus their attention on specific environmental cues, they are not attending to other activities such as foraging. These costs have been documented best in foraging animals, where vigilance has been shown to substantially reduce feeding rates (Saino, 1994; Beauchamp and Livoreil, 1997; Fritz *et al.,* 2002). Animals will spend more time being vigilant, which may translate to less time foraging or resting, when disturbance stimuli approach them more directly, remain at closer distances, have a greater group size (for example, multiple surface vessels), or when they co-occur with times that an animal perceives increased risk (for example, when they are giving birth or accompanied by a calf). Most of the published literature, however, suggests that direct approaches will increase the amount of time animals will dedicate to being vigilant. For example, bighorn sheep and Dall's sheep dedicated more time being vigilant, and less time resting or foraging, when aircraft made direct approaches over them (Frid, 2001; Stockwell *et al.,* 1991).

Several authors have established that long-term and intense disturbance stimuli can cause population declines by reducing the body condition of individuals that have been disturbed, followed by reduced reproductive success, reduced survival, or both (Daan *et al.,* 1996; Madsen, 1994; White, 1983). For example, Madsen (1994) reported that pink-footed geese in undisturbed habitat gained body mass and had about a 46-percent reproductive success rate compared with geese in disturbed habitat (being consistently scared off the fields on which they were foraging) which did not gain mass and had a 17-percent reproductive success rate. Similar reductions in reproductive success have been reported for mule deer disturbed by all-terrain vehicles (Yarmoloy *et al.,* 1988), caribou disturbed by seismic exploration blasts (Bradshaw *et al.,* 1998), caribou disturbed by low-elevation military jet-fights (Luick *et al.,* 1996), and caribou disturbed by low-elevation jet flights (Harrington and Veitch, 1992). Similarly, a study of elk that were disturbed experimentally by pedestrians concluded that the ratio of young to mothers was inversely related to disturbance rate (Phillips and Alldredge, 2000).

The primary mechanism by which increased vigilance and disturbance appear to affect the fitness of individual animals is by disrupting an animal's time budget and, as a result, reducing the time they might spend foraging and resting (which increases an animal's activity rate and energy demand). For example, a study of grizzly bears reported that bears disturbed by hikers reduced their energy intake by an average of 12 kcal/minute (50.2×10^3kJ/minute), and spent energy fleeing or acting aggressively toward hikers (White *et al.,* 1999). Alternately, Ridgway *et al.* (2006) reported that increased vigilance in bottlenose dolphins exposed to sound over a 5-day period did not cause any sleep deprivation or stress effects such as changes in cortisol or epinephrine levels.

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 Sharks 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 only occurred 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 (increased stillbirths) and abundance decreased significantly (from 67 to 56 individuals in 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.

On a related note, many animals perform vital functions, such as feeding, resting, traveling, and socializing, on a diel cycle (24-hour cycle). Substantive behavioral reactions to noise exposure (such as 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). Consequently, a behavioral response lasting less than 1 day and not recurring on subsequent days is not considered particularly severe unless it could directly affect reproduction or survival (Southall *et al.,* 2007). Note that there is a difference between multiple-day substantive behavioral reactions and multiple-day anthropogenic activities. For example, just because an at-sea exercise lasts for multiple days does not necessarily mean that individual animals are either exposed to that exercise for multiple days or, further, exposed in a manner resulting in a sustained multiple day substantive behavioral responses.

In order to understand how the effects of activities may or may not impact stocks and populations of marine mammals, it is necessary to understand not only what the likely disturbances are going to be, but how those disturbances may affect the reproductive success and survivorship of individuals, and then how those impacts to individuals translate to population changes. Following on the earlier work of a committee of the U.S. National Research Council (NRC, 2005), New *et al.* (2014), in an effort termed the Potential Consequences of Disturbance (PCoD), outline an updated conceptual model of the relationships linking disturbance to changes in behavior and physiology, health, vital rates, and population dynamics (below). As depicted, behavioral and physiological changes can either 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, or 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 (New *et al.,* 2014).

In addition to outlining this general framework and compiling the relevant literature that supports it, New *et al.* (2014) have chosen four example species for which extensive long-term monitoring data exist (southern elephant seals, North Atlantic right whales, Ziphidae beaked whales, and bottlenose dolphins) and developed state-space energetic models that can be used to effectively forecast longer-term, population-level impacts from behavioral changes. While these are very specific models with very specific data requirements that cannot yet be applied broadly to project-specific risk assessments, they are a critical first step.

Vessels

Commercial and Navy ship strikes of cetaceans can cause major wounds, which may lead to the death of the animal. 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. 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).

Marine mammals react to vessels in a variety of ways. Some respond negatively by retreating or engaging in antagonistic responses while other animals ignore the stimulus altogether (Terhune and Verboom, 1999; Watkins, 1986). Silber *et al.* (2010) concludes that large whales that are in close proximity to a vessel may not regard the vessel as a threat, or may be involved in a vital activity (*i.e.,* mating or feeding) which may not allow them to have a proper avoidance response. Cetacean species generally pay little attention to transiting vessel traffic as it approaches, although they may engage in last minute avoidance maneuvers (Laist *et al.,* 2001). Baleen whale responses to vessel traffic range from avoidance maneuvers to disinterest in the presence of vessels (Nowacek *et al.,* 2007; Scheidat *et al.,* 2004). Species of delphinids can vary widely in their reaction to vessels. Many exhibit mostly neutral behavior, but there are frequent instances of observed avoidance behaviors (Hewitt, 1985; Würsig *et al.,* 1998). Many species of odontocetes (*e.g.,* bottlenose dolphin) are frequently observed bow riding or jumping in the wake of a vessel (Norris and Prescott, 1961; Ritter, 2002; Shane *et al.,* 1986; Würsig *et al.,* 1998).

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). In addition, some baleen whales, such as the North Atlantic right whale, seem generally unresponsive to vessel sound, making them more susceptible to vessel collisions (Nowacek *et al.,* 2004). These species are primarily large, slow moving whales. Smaller marine mammals (*e.g.,* bottlenose dolphin) move quickly through the water column.

An examination of all known ship strikes from all shipping sources (civilian and military) indicates vessel speed is a principal factor in whether a vessel strike results in death (Knowlton and Kraus, 2001; Laist *et al.,* 2001; Jensen and Silber, 2003; 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 13 knots.

Jensen and Silber (2003) detailed 292 records of known or probable ship 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 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 and 20 resulted in death). Operating speeds of vessels that struck various species of large whales ranged from 2 to 51 knots. The majority (79 percent) of these strikes occurred at speeds of 13 knots or greater. The average speed that resulted in serious injury or death was 18.6 knots. 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 10 to 14 knots, and exceeded 90 percent at 17 knots. Higher speeds during collisions 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).

The Jensen and Silber (2003) report notes that the database represents a minimum number of collisions, because the vast majority probably goes undetected or unreported. In contrast, Navy vessels are likely to detect any strike that does occur, and they are required to report all ship strikes involving marine mammals. Overall, the percentages of Navy traffic relative to overall large shipping traffic are very small (on the order of 2 percent).

Other efforts have been undertaken to investigate the impact from vessels (both whale-watching and general vessel traffic noise) and demonstrated impacts do occur (Bain, 2002; Erbe, 2002; Lusseau, 2009; Williams *et al.,* 2006, 2009, 2011b, 2013, 2014a, 2014b; Noren *et al.,* 2009; Read *et al.,* 2014; Rolland *et al.,* 2012; Pirotta *et al.,* 2015). This body of research for the most part has investigated impacts associated with the presence of chronic stressors, which differ significantly from generally intermittent Navy training and testing activities. For example, in an analysis of energy costs to killer whales, Williams *et al.* (2009) suggested that whale-watching in the Johnstone Strait resulted in lost feeding opportunities due to vessel disturbance, which could carry higher costs than other measures of behavioral change might suggest. Ayres *et al.* (2012) recently reported on research in the Salish Sea involving the measurement of southern resident killer whale fecal hormones to assess two potential threats to the species recovery: Lack of prey (salmon) and impacts to behavior from vessel traffic. Ayres *et al.* (2012) suggested that the lack of prey overshadowed any population-level physiological impacts on southern resident killer whales from vessel traffic.

The Navy's Draft EA for 2015 West Coast Civilian Port Defense training activities fully addressed the potential impacts of vessel movement on marine mammals in the Study Area. The Navy does not anticipate vessel strikes to marine mammals within the Study Area, nor were takes by injury or mortality resulting from vessel strike predicted in the Navy's analysis. Vessel strikes within the Study Area are highly unlikely due to the size, maneuverability, and speed of the surface mine countermeasure vessel (the AVENGER class ship would typically operate at speeds less than 10 knots (18 km/hour); the generally low likelihood of occurrence of large whales within the Study Area; the effectiveness of Navy lookouts; and the implementation of mitigation measures described below. Therefore, takes by injury or mortality resulting from vessel strikes are not authorized by NMFS in this proposed incidental harassment authorization. However, the Navy has proposed measures (see Proposed Mitigation) to mitigate potential impacts to marine mammals from vessel strike and other physical disturbance (towed in-water devices) during training activities in the Study Area.

Marine Mammal Habitat

The primary source of potential marine mammal habitat impact is acoustic exposures resulting from mine detection and mine neutralization activities. However, the exposures do not constitute a long-term physical alteration of the water column or bottom topography, as the occurrences are of limited duration and intermittent in time.

Marine mammal habitat and prey species may be temporarily impacted by acoustic sources associated with the proposed activities. The potential for acoustic sources to impact marine mammal habitat or prey species is discussed below.

Expected Effects on Habitat

The effects of the introduction of sound into the environment are generally considered to have a lesser impact on marine mammal habitat than the physical alteration of the habitat. Acoustic exposures are not expected to result in long-term physical alteration of the water column or bottom topography, as the occurrences are of limited duration and intermittent in time. The proposed training activities will only occur during a two week period, and no military expended material would be left as a result of this event.

The ambient underwater noise level within active shipping areas of Los Angeles/Long Beach has been estimated around 140 dB re 1 µPa (Tetra Tech Inc., 2011). Existing ambient acoustic levels in non-shipping areas around Terminal Island in the Port of Long Beach ranged between 120 dB and 132 dB re 1 µPa (Tetra Tech Inc., 2011). Additional vessel noise, aircraft noise, and underwater acoustics associated with the proposed training activities have the potential to temporarily increase the noise levels of the Study Area. However, with ambient levels of noise being elevated, the additional vessel noise would likely be masked by the existing environmental noise and marine species would not be impacted by the sound of the vessels or aircraft, but perhaps by the sight of an approaching vessel or the shadow of a helicopter.

Noise generated from helicopters is transient in nature and variable in intensity. Helicopter sounds contain dominant tones from the rotors that are generally below 500 Hz. Helicopters often radiate more sound forward than aft. The underwater noise produced is generally brief when compared with the duration of audibility in the air. The sound pressure level from an H–60 helicopter hovering at a 50 ft (15 m) altitude would be approximately 125 dB re 1 μPa at 1 m below the water surface, which is lower than the ambient sound that has been estimated in and around the Ports of Los Angeles/Long Beach. Helicopter flights associated with the proposed activities could occur at altitudes as low as 75 to 100 ft (23 to 31 m), and typically last two to four hours.

Mine warfare sonar employs high frequencies (above 10 kHz) that attenuate rapidly in the water, thus producing only a small area of potential auditory masking. Odontocetes and pinnipeds may experience some limited masking at closer ranges as the frequency band of many mine warfare sonar overlaps the hearing and vocalization abilities of some odontocetes and pinnipeds; however, the frequency band of the sonar is narrow, limiting the likelihood of auditory masking.

The proposed training activities are of limited duration and dispersion of the activities in space and time reduce the potential for disturbance from ship-generated noise, helicopter noise, and acoustic transmissions from the proposed activities on marine mammals. The relatively high level of ambient noise in and near the busy shipping channels also reduces the potential for any impact on habitat from the addition of the platforms associated with the proposed activities.

Effects on Marine Mammal Prey

Invertebrates—Marine invertebrates in the Study Area inhabit coastal waters and benthic habitats, including salt marshes, kelp forests, and soft sediments, canyons, and the continental shelf. The diverse range of species include oysters, crabs, worms, ghost shrimp, snails, sponges, sea fans, isopods, and stony corals (Chess and Hobson 1997; Dugan *et al.* 2000; Proctor *et al.* 1980).

Very little is known about sound detection and use of sound by aquatic invertebrates (Montgomery *et al.* 2006; Popper *et al.* 2001). Organisms may detect sound by sensing either the particle motion or pressure component of sound, or both. Aquatic invertebrates probably do not detect pressure since many are generally the same density as water and few, if any, have air cavities that would function like the fish swim bladder in responding to pressure (Popper *et al.* 2001). Many marine invertebrates, however, have ciliated ''hair'' cells that may be sensitive to water movements, such as those caused by currents or water particle motion very close to a sound source (Mackie and Singla 2003). These cilia may allow invertebrates to sense nearby prey or predators or help with local navigation. Marine invertebrates may produce and use sound in territorial behavior, to deter predators, to find a mate, and to pursue courtship (Popper *et al.* 2001).

Both behavioral and auditory brainstem response studies suggest that crustaceans may sense sounds up to 3 kHz, but best sensitivity is likely below 200 Hz (Goodall *et al.* 1990; Lovell *et al.* 2005; Lovell *et al.* 2006). Most cephalopods (*e.g.,* octopus and squid) likely sense low-frequency sound below 1,000 Hz, with best sensitivities at lower frequencies (Mooney *et al.* 2010; Packard *et al.* 1990). A few cephalopods may sense higher frequencies up to 1,500 Hz (Hu *et al.* 2009). Squid did not respond to toothed whale ultrasonic echolocation clicks at sound pressure levels ranging from 199 to 226 dB re 1 microPascal peak-to-peak, likely because these clicks were outside of squid hearing range (Wilson *et al.* 2007). However, squid exhibited alarm responses when exposed to broadband sound from an approaching seismic airgun with received levels exceeding 145 to 150 dB re 1 microPascal root mean square (McCauley *et al.* 2000).

It is expected that most marine invertebrates would not sense high-frequency sonar associated with the proposed activities. Most marine invertebrates would not be close enough to active sonar systems to potentially experience impacts to sensory structures. Any marine invertebrate capable of sensing sound may alter its behavior if exposed to sonar. Although acoustic transmissions produced during the proposed activities may briefly impact individuals, intermittent exposures to sonar are not expected to impact survival, growth, recruitment, or reproduction of widespread marine invertebrate populations.

Fish—The portion of the California Bight in the vicinity of the Study Area is a transitional zone between cold and warm water masses, geographically separated by Point Conception, and is highly productive (Leet *et al.* 2001). The cold-water of the California Bight is rich in microscopic plankton (diatoms, krill, and other organisms), which form the base of the food chain in the Study Area. Small coastal pelagic fishes depend on this plankton and in turn are fed on by larger species (such as highly migratory species). The high fish diversity found in the Study Area occurs for several reasons: (1) The ranges of many temperate and tropical species extend into Southern California, (2) the area has complex bottom features and physical oceanographic features that include several water masses and a changeable marine climate offshore (Allen *et al.* 2006; Horn and Allen 1978), and (3) the islands and coastal areas provide a diversity of habitats that include soft bottom, rocky reefs, kelp beds, and estuaries, bays, and lagoons.

All fish have two sensory systems to detect sound in the water: The inner ear, which functions very much like the inner ear in other vertebrates, and the lateral line, which consists of a series of receptors along the fish's body (Popper 2008). The inner ear generally detects relatively higher-frequency sounds, while the lateral line detects water motion at low frequencies (below a few hundred Hz) (Hastings and Popper 2005). Although hearing capability data only exist for fewer than 100 of the 32,000 fish species, current data suggest that most species of fish detect sounds from 50 to 1,000 Hz, with few fish hearing sounds above 4 kHz (Popper 2008). It is believed that most fish have their best hearing sensitivity from 100 to 400 Hz (Popper 2003). Additionally, some clupeids (shad in the subfamily Alosinae) possess ultrasonic hearing (*i.e.,* able to detect sounds above 100 kHz) (Astrup 1999). Permanent hearing loss, or PTS, has not been documented in fish. The sensory hair cells of the inner ear in fish can regenerate after they are damaged, unlike in mammals where sensory hair cells loss is permanent (Lombarte *et al.* 1993; Smith *et al.* 2006). As a consequence, any hearing loss in fish may be as temporary as the timeframe required to repair or replace the sensory cells that were damaged or destroyed (Smith *et al.* 2006).

Potential direct injuries from acoustic transmissions are unlikely because of the relatively lower peak pressures and slower rise times than potentially injurious sources such as explosives. Acoustic sources also lack the strong shock waves associated with an explosion. Therefore, direct injury is not likely to occur from exposure to sonar. Only a few fish species are able to detect high-frequency sonar and could have behavioral reactions or experience auditory masking during these activities. These effects are expected to be transient and long-term consequences for the population are not expected. Hearing specialists are not expected to be within the Study Area. If hearing specialists were present, they would have to in close vicinity to the source to experience effects from the acoustic transmission. While a large number of fish species may be able to detect low-frequency sonar, some mid-frequency sonar and other active acoustic sources, low-frequency and mid-frequency acoustic sources are not planned as part of the proposed activities. Overall effects to fish from active sonar sources would be localized, temporary and infrequent.

Based on the detailed review within the Navy's EA for 2015 Civilian Port Defense training activities and the discussion above, there would be no effects to marine mammals resulting from loss or modification of marine mammal habitat or prey species related to the proposed activities.

Marine Mammal Avoidance

Marine mammals may be temporarily displaced from areas where Navy Civilian Port Defense training occurring, but the area should be utilized again after the activities have ceased. Avoidance of an area can help the animal avoid further acoustic effects by avoiding or reducing further exposure. The intermittent or short duration of training activities should prevent animals from being exposed to stressors on a continuous basis. In areas of repeated and frequent acoustic disturbance, some animals may habituate or learn to tolerate the new baseline or fluctuations in noise level. While some animals may not return to an area, or may begin using an area differently due to training and testing activities, most animals are expected to return to their usual locations and behavior.

Effects of Habitat Impacts on Marine Mammals

The proposed Civilian Port Defense training activities are not expected to have any habitat-related effects that cause significant or long-term consequences for individual marine mammals, their populations, or prey species. Based on the discussions above, there will be no loss or modification of marine mammal habitat and as a result no impacts to marine mammal populations.

Proposed Mitigation

In order to issue an incidental take authorization under section 101(a)(5)(A) and (D) of the MMPA, NMFS must set forth the ''permissible methods of taking pursuant to such activity, and other means of effecting the least practicable adverse impact on such species or stock and its habitat, paying particular attention to rookeries, mating grounds, and areas of similar significance.'' NMFS' duty under this ''least practicable adverse impact'' standard is to prescribe mitigation reasonably designed to minimize, to the extent practicable, any adverse population-level impacts, as well as habitat impacts. While population-level impacts can be minimized by reducing impacts on individual marine mammals, not all takes translate to population-level impacts. NMFS' primary objective under the ''least practicable adverse impact'' standard is to design mitigation targeting those impacts on individual marine mammals that are most likely to lead to adverse population-level effects.

The NDAA of 2004 amended the MMPA as it relates to military-readiness activities and the ITA process such that ''least practicable adverse impact'' shall include consideration of personnel safety, practicality of implementation, and impact on the effectiveness of the ''military readiness activity.'' The training activities described in the Navy's application are considered military readiness activities.

NMFS reviewed the proposed activities and the proposed mitigation measures as described in the application to determine if they would result in the least practicable adverse effect on marine mammals, which includes a careful balancing of the likely benefit of any particular measure to the marine mammals with the likely effect of that measure on personnel safety, practicality of implementation, and impact on the effectiveness of the ''military-readiness activity.'' Included below are the mitigation measures the Navy proposed in their application. NMFS worked with the Navy to develop these proposed measures, and they are informed by years of experience and monitoring.

The Navy's proposed mitigation measures are modifications to the proposed activities that are implemented for the sole purpose of reducing a specific potential environmental impact on a particular resource. These do not include standard operating procedures, which are established for reasons other than environmental benefit. Most of the following proposed mitigation measures are currently, or were previously, implemented as a result of past environmental compliance documents. The Navy's overall approach to assessing potential mitigation measures is based on two principles: (1) Mitigation measures will be effective at reducing potential impacts on the resource, and (2) from a military perspective, the mitigation measures are practicable, executable, and safety and readiness will not be impacted.

The mitigation measures applicable to the proposed Civilian Port Defense training activities are the same as those identified in the Mariana Islands Training and Testing Environmental Impact Statement/Overseas Environmental Impact Statement (MITT EIS/OEIS), Chapter 5. All mitigation measures which could be applicable to the proposed activities are provided below. For the mitigation measures described below, the Lookout Procedures and Mitigation Zone Procedure sections from the MITT EIS/OEIS have been combined. For details regarding the methodology for analyzing each measure, see the MITT EIS/OEIS, Chapter 5.

Lookout Procedure Measures

The Navy will have two types of lookouts for the purposes of conducting visual observations: (1) Those positioned on surface ships, and (2) those positioned in aircraft or on boats. Lookouts positioned on surface ships will be dedicated solely to diligent observation of the air and surface of the water. They will have multiple observation objectives, which include but are not limited to detecting the presence of biological resources and recreational or fishing boats, observing mitigation zones, and monitoring for vessel and personnel safety concerns. Lookouts positioned on surface ships will typically be personnel already standing watch or existing members of the bridge watch team who become temporarily relieved of job responsibilities that would divert their attention from observing the air or surface of the water (such as navigation of a vessel).

Due to aircraft and boat manning and space restrictions, Lookouts positioned in aircraft or on boats will consist of the aircraft crew, pilot, or boat crew. Lookouts positioned in aircraft and boats may necessarily be responsible for tasks in addition to observing the air or surface of the water (for example, navigation of a helicopter or rigid hull inflatable boat). However, aircraft and boat lookouts will, to the maximum extent practicable and consistent with aircraft and boat safety and training requirements, comply with the observation objectives described above for Lookouts positioned on surface ships.

Mitigation Measures

High-Frequency Active Sonar

The Navy will have one Lookout on ships or aircraft conducting high-frequency active sonar activities associated with mine warfare activities at sea.

Mitigation will include visual observation from a vessel or aircraft (with the exception of platforms operating at high altitudes) immediately before and during active transmission within a mitigation zone of 200 yards (yds. [183 m]) from the active sonar source. If the source can be turned off during the activity, active transmission will cease if a marine mammal is sighted within the mitigation zone. Active transmission will recommence if any one of the following conditions is met: (1) The animal is observed exiting the mitigation zone, (2) the animal is thought to have exited the mitigation zone based on a determination of its course and speed and the relative motion between the animal and the source, (3) the mitigation zone has been clear from any additional sightings for a period of 10 minutes for an aircraft-deployed source, (4) the mitigation zone has been clear from any additional sightings for a period of 30 minutes for a vessel-deployed source, (5) the vessel or aircraft has repositioned itself more than 400 yds (366 m) away from the location of the last sighting, or (6) the vessel concludes that dolphins are deliberately closing in to ride the vessel's bow wave (and there are no other marine mammal sightings within the mitigation zone).

Physical Disturbance and Strike

Although the Navy does not anticipate that any marine mammals would be struck during the conduct of Civilian Port Defense training activities, the mitigation measures below will be implemented and adhered to.

Vessels—While underway, vessels will have a minimum of one Lookout. Vessels will avoid approaching marine mammals head on and will maneuver to maintain a mitigation zone of 500 yds (457 m) around observed whales, and 200 yds (183 m) around all other marine mammals (except bow riding dolphins), providing it is safe to do so.

Towed In-Water Devices—The Navy will have one Lookout during activities using towed in-water devices when towed from a manned platform.

The Navy will ensure that towed in-water devices being towed from manned platforms avoid coming within a mitigation zone of 250 yds (229 m) around any observed marine mammal, providing it is safe to do so.

Mitigation Conclusions

NMFS has carefully evaluated the Navy's proposed mitigation measures—many of which were developed with NMFS' input during previous Navy Training and Testing authorizations—and considered a range of other measures in the context of ensuring that NMFS prescribes the means of effecting the least practicable adverse impact on the affected marine mammal species and stocks and their habitat. Our evaluation of potential measures included consideration of the following factors in relation to one another: 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 stocks and their habitat; the proven or likely efficacy of the measures; and the practicability of the suite of measures for applicant implementation, including consideration of personnel safety, practicality of implementation, and impact on the effectiveness of the military readiness activity.

Any mitigation measure(s) prescribed by NMFS should be able to accomplish, have a reasonable likelihood of accomplishing (based on current science), or contribute to accomplishing one or more of the general goals listed below:

a. Avoid or minimize injury or death of marine mammals wherever possible (goals b, c, and d may contribute to this goal).

b. Reduce the number of marine mammals (total number or number at biologically important time or location) exposed to received levels of MFAS/HFAS, underwater detonations, or other activities expected to result in the take of marine mammals (this goal may contribute to a, above, or to reducing harassment takes only).

c. Reduce the number of times (total number or number at biologically important time or location) individuals would be exposed to received levels of MFAS/HFAS, underwater detonations, or other activities expected to result in the take of marine mammals (this goal may contribute to a, above, or to reducing harassment takes only).

d. Reduce the intensity of exposures (either total number or number at biologically important time or location) to received levels of MFAS/HFAS, underwater detonations, or other activities expected to result in the take of marine mammals (this goal may contribute to a, above, or to reducing the severity of harassment takes only).

e. Avoid or minimize adverse effects to marine mammal habitat, paying special attention to the food base, activities that block or limit passage to or from biologically important areas, permanent destruction of habitat, or temporary destruction/disturbance of habitat during a biologically important time.

f. For monitoring directly related to mitigation—increase the probability of detecting marine mammals, thus allowing for more effective implementation of the mitigation (shut-down zone, etc.).

Based on our evaluation of the Navy's proposed measures, as well as other measures considered by NMFS, NMFS has determined preliminarily that the Navy's proposed mitigation measures are adequate means of effecting the least practicable adverse impacts on marine mammals species or stocks and their habitat, paying particular attention to rookeries, mating grounds, and areas of similar significance, while also considering personnel safety, practicality of implementation, and impact on the effectiveness of the military readiness activity.

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

Proposed Monitoring and Reporting

Section 101(a)(5)(A) of the MMPA states that in order to issue an ITA 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 LOAs 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.

Integrated Comprehensive Monitoring Program

The U.S. Navy has coordinated with NMFS to develop an overarching program plan in which specific monitoring would occur. This plan is called the Integrated Comprehensive Monitoring Program (ICMP) (U.S. Department of the Navy, 2011). The ICMP has been developed in direct response to Navy permitting requirements established in various MMPA Final Rules, Endangered Species Act consultations, Biological Opinions, and applicable regulations. As a framework document, the ICMP applies by regulation to those activities on ranges and operating areas for which the Navy is seeking or has sought incidental take authorizations. The ICMP is intended to coordinate monitoring efforts across all regions and to allocate the most appropriate level and type of effort based on set of standardized research goals, and in acknowledgement of regional scientific value and resource availability.

The ICMP is designed to be a flexible, scalable, and adjustable plan. The ICMP is evaluated annually through the adaptive management process to assess progress, provide a matrix of goals for the following year, and make recommendations for refinement. Future monitoring will address the following ICMP top-level goals through a series of regional and ocean basin study questions with a priority study and funding focus on species of interest as identified for each range complex.

- An increase in our understanding of the likely occurrence of marine mammals and/or ESA-listed marine species in the vicinity of the action (*i.e.,* presence, abundance, distribution, and/or density of species);
- An increase in our understanding of the nature, scope, or context of the likely exposure of marine mammals and/or ESA-listed species to any of the potential stressor(s) associated with the action (*e.g.,* tonal and impulsive sound), through better understanding of one or more of the following: (1) The action and the environment in which it occurs (*e.g.,* sound source characterization, propagation, and ambient noise levels); (2) the affected species (*e.g.,* life history or dive patterns); (3) the likely co-occurrence of marine mammals and/or ESA-listed marine species with the action (in whole or part) associated with specific adverse effects, and/or; (4) the likely biological or behavioral context of exposure to the stressor for the marine mammal and/or ESA-listed marine species (*e.g.,* age class of exposed animals or known pupping, calving or feeding areas);
- An increase in our understanding of how individual marine mammals or ESA-listed marine species respond (behaviorally or physiologically) to the specific stressors associated with the action (in specific contexts, where possible, *e.g.,* at what distance or received level);
- An increase in our understanding of how anticipated individual responses, to individual stressors or anticipated combinations of stressors, may impact either: (1) The long-term fitness and survival of an individual; or (2) the population, species, or stock (*e.g.,* through effects on annual rates of recruitment or survival);
- An increase in our understanding of the effectiveness of mitigation and monitoring measures;
- A better understanding and record of the manner in which the authorized entity complies with the ITA and Incidental Take Statement;
- An increase in the probability of detecting marine mammals (through improved technology or methods), both specifically within the safety zone (thus allowing for more effective implementation of the mitigation) and in general, to better achieve the above goals; and
- A reduction in the adverse impact of activities to the least practicable level, as defined in the MMPA.

The ICMP will also address relative investments to different range complexes based on goals across all range complexes, and monitoring will leverage multiple techniques for data acquisition and analysis whenever possible. Because the ICMP does not specify actual monitoring field work or projects in a given area, it allows the Navy to coordinate its monitoring to gather the best scientific data possible across all areas in which the Navy operates. Details of the ICMP are available online (*http://www.navymarinespeciesmonitoring.us/*).

Strategic Planning Process for Marine Species Monitoring

The Navy also developed the Strategic Planning Process for Marine Species Monitoring, which establishes the guidelines and processes necessary to develop, evaluate, and fund individual projects based on objective scientific study questions. The process uses an underlying framework designed around top-level goals, a conceptual framework incorporating a progression of knowledge, and in consultation with a Scientific Advisory Group and other regional experts. The Strategic Planning Process for Marine Species Monitoring would be used to set intermediate scientific objectives, identify potential species of interest at a regional scale, and evaluate and select specific monitoring projects to fund or continue supporting for a given fiscal year. This process would also address relative investments to different range complexes based on goals across all range complexes, and monitoring would leverage multiple techniques for data acquisition and analysis whenever possible. The Strategic Planning Process for Marine Species Monitoring is also available online (*http://www.navymarinespeciesmonitoring.us/*).

Reporting

In order to issue an incidental take authorization for an activity, section 101(a)(5)(A) and (D) 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. Some of the reporting requirements are still in development and the final authorization may contain additional details not contained here. Additionally, proposed reporting requirements may be modified, removed, or added based on information or comments received during the public comment period. Reports from individual monitoring events, results of analyses, publications, and periodic progress reports for specific monitoring projects would be posted to the Navy's Marine Species Monitoring Web portal: *http://www.navymarinespeciesmonitoring.us.*

General Notification of Injured or Dead Marine Mammals—If any injury or death of a marine mammal is observed during the Civilian Port Defense training activities, the Navy will immediately halt the activity and report the incident to NMFS following the standard monitoring and reporting measures consistent with the MITT EIS/OEIS. The reporting measures include the following procedures:

Navy personnel shall ensure that NMFS (regional stranding coordinator) is notified immediately (or as soon as clearance procedures allow) if an injured or dead marine mammal is found during or shortly after, and in the vicinity of, any Navy training activity utilizing high-frequency active sonar. The Navy shall provide NMFS with species or description of the animal(s), the condition of the animal(s) (including carcass condition if the animal is dead), location, time of first discovery, observed behaviors (if alive), and photo or video (if available). The Navy shall consult the Stranding Response and Communication Plan to obtain more specific reporting requirements for specific circumstances.

Vessel Strike—Vessel strike during Navy Civilian Port Defense activities in the Study Area is not anticipated; however, in the event that a Navy vessel strikes a whale, the Navy shall do the following:

Immediately report to NMFS (pursuant to the established Communication Protocol) the:

- Species identification (if known);
- Location (latitude/longitude) of the animal (or location of the strike if the animal has disappeared);
- Whether the animal is alive or dead (or unknown); and
- The time of the strike.

As soon as feasible, the Navy shall report to or provide to NMFS, the:

- Size, length, and description (critical if species is not known) of animal;
- An estimate of the injury status (*e.g.,* dead, injured but alive, injured and moving, blood or tissue observed in the water, status unknown, disappeared, etc.);
- Description of the behavior of the whale during event, immediately after the strike, and following the strike (until the report is made or the animal is no longer sighted);
- Vessel class/type and operational status;
- Vessel length;
- Vessel speed and heading; and
- To the best extent possible, obtain a photo or video of the struck animal, if the animal is still in view.

Within 2 weeks of the strike, provide NMFS:

- A detailed description of the specific actions of the vessel in the 30-minute timeframe immediately preceding the strike, during the event, and immediately after the strike (*e.g.,* the speed and changes in speed, the direction and changes in direction, other maneuvers, sonar use, etc., if not classified);
- A narrative description of marine mammal sightings during the event and immediately after, and any information as to sightings prior to the strike, if available; and use established Navy shipboard procedures to make a camera available to attempt to capture photographs following a ship strike.

NMFS and the Navy will coordinate to determine the services the Navy may provide to assist NMFS with the investigation of the strike. The response and support activities to be provided by the Navy are dependent on resource availability, must be consistent with military security, and must be logistically feasible without compromising Navy personnel safety. Assistance requested and provided may vary based on distance of strike from shore, the nature of the vessel that hit the whale, available nearby Navy resources, operational and installation commitments, or other factors.

Estimated Take by Incidental Harassment

In the Potential Effects section, NMFS' analysis identified the lethal responses, physical trauma, sensory impairment (PTS, TTS, and acoustic masking), physiological responses (particular stress responses), and behavioral responses that could potentially result from exposure to active sonar (MFAS/HFAS). In this section, the potential effects to marine mammals from active sonar will be related to the MMPA regulatory definitions of Level A and Level B harassment and attempt to quantify the effects that might occur from the proposed activities in the Study Area.

As mentioned previously, behavioral responses are context-dependent, complex, and influenced to varying degrees by a number of factors other than just received level. For example, an animal may respond differently to a sound emanating from a ship that is moving towards the animal than it would to an identical received level coming from a vessel that is moving away, or to a ship traveling at a different speed or at a different distance from the animal. At greater distances, though, the nature of vessel movements could also potentially not have any effect on the animal's response to the sound. In any case, a full description of the suite of factors that elicited a behavioral response would require a mention of the vicinity, speed and movement of the vessel, or other factors. So, while sound sources and the received levels are the primary focus of the analysis and those that are laid out quantitatively in the regulatory text, it is with the understanding that other factors related to the training are sometimes contributing to the behavioral responses of marine mammals, although they cannot be quantified.

Definition of Harassment

As mentioned previously, with respect to military readiness activities, section 3(18)(B) of the MMPA defines ''harassment'' as: ''(i) 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 (ii) 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].'' It is important to note that, as Level B harassment is interpreted here and quantified by the behavioral thresholds described below, the fact that a single behavioral pattern (of unspecified duration) is abandoned or significantly altered and classified as a Level B take does not mean, necessarily, that the fitness of the harassed individual is affected either at all or significantly, or that, for example, a preferred habitat area is abandoned. Further analysis of context and duration of likely exposures and effects is necessary to determine the impacts of the estimated effects on individuals and how those may translate to population level impacts, and is included in the Analysis and Negligible Impact Determination.

Level B Harassment

Of the potential effects that were described earlier in this document, the following are the types of effects that fall into the Level B harassment category:

Behavioral Harassment—Behavioral disturbance that rises to the level described in the definition above, when resulting from exposures to non-impulsive or impulsive sound, is considered Level B harassment. Some of the lower level physiological stress responses discussed earlier would also 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. When Level B harassment is predicted based on estimated behavioral responses, those takes may have a stress-related physiological component as well.

As the statutory definition is currently applied, a wide range of behavioral reactions may qualify as Level B harassment under the MMPA, including but not limited to avoidance of the sound source, temporary changes in vocalizations or dive patters, temporary avoidance of an area, or temporary disruption of feeding, migrating, or reproductive behaviors. The estimates calculated by the Navy using the acoustic thresholds do not differentiate between the different types of potential behavioral reactions. Nor do the estimates provide information regarding the potential fitness or other biological consequences of the reactions on the affected individuals. We therefore consider the available scientific evidence to determine the likely nature of the modeled behavioral responses and the potential fitness consequences for affected individuals.

Temporary Threshold Shift (TTS)—As discussed previously, TTS can affect how an animal behaves in response to the environment, including conspecifics, predators, and prey. The following physiological mechanisms are thought to play a role in inducing auditory fatigue: Effects to sensory hair cells in the inner ear that reduce their sensitivity, modification of the chemical environment within the sensory cells; residual muscular activity in the middle ear, displacement of certain inner ear membranes; increased blood flow; and post-stimulatory reduction in both efferent and sensory neural output. Ward (1997) suggested that when these effects result in TTS rather than PTS, they are within the normal bounds of physiological variability and tolerance and do not represent a physical injury. Additionally, Southall *et al.* (2007) indicate that although PTS is a tissue injury, TTS is not because the reduced hearing sensitivity following exposure to intense sound results primarily from fatigue, not loss, of cochlear hair cells and supporting structures and is reversible. Accordingly, NMFS classifies TTS (when resulting from exposure to sonar and other active acoustic sources and explosives and other impulsive sources) as Level B harassment, not Level A harassment (injury).

Level A Harassment

Of the potential effects that were described earlier, the types of effects that can fall into the Level A harassment category (unless they further rise to the level of serious injury or mortality) include permanent threshold shift (PTS), tissue damage due to acoustically mediated bubble growth, tissue damage due to behaviorally mediated bubble growth, physical disruption of tissues resulting from explosive shock wave, and vessel strike and other physical disturbance (strike from towed in-water devices). Level A harassment and mortality are not anticipated to result from any of the proposed Civilian Port Defense activities; therefore, these effects will not be discussed further. Although the Navy does not anticipate that any marine mammals would be struck during proposed Civilian Port Defense activities, the mitigation measures described above in Proposed Mitigation will be implemented and adhered to.

Criteria and Thresholds for Predicting Acoustic Impacts

Criteria and thresholds used for determining the potential effects from the Civilian Port Defense activities are consistent with those used in the Navy's Phase II Training and Testing EISs (*e.g.,* HSTT, MITT). Table 3 below provides the criteria and thresholds used in this analysis for estimating quantitative acoustic exposures of marine mammals from the proposed training activities. Weighting criteria are shown in the table below. Southall *et al.* (2007) proposed frequency-weighting to account for the frequency bandwidth of hearing in marine mammals. Frequency-weighting functions are used to adjust the received sound level based on the sensitivity of the animal to the frequency of the sound. Details regarding these criteria and thresholds can be found in Finneran and Jenkins (2012).

TABLE 3—INJURY (PTS) AND DISTURBANCE (TTS, BEHAVIORAL) THRESHOLDS FOR UNDERWATER SOUNDS

Group	Species	Behavioral criteria	Physiological criteria	
			Onset TTS	Onset PTS
Low-Frequency Cetaceans.	All mysticetes	Mysticete Dose Function (Type I weighted).	178 dB Sound Exposure Level (SEL) [1] (Type II weighted).	198 dB SEL (Type II weighted).
Mid-Frequency Cetaceans.	Most delphinids, beaked whales, medium and large toothed whales.	Odontocete Dose Function (Type I weighted).	178 dB SEL (Type II weighted).	198 dB SEL (Type II weighted).
High-Frequency Cetaceans.	Porpoises, River dolphins, *Cephalorynchus* spp., *Kogia* sp.	Odontocete Dose Function (Type I weighted).	152 dB SEL (Type II weighted).	172 dB SEL (Type II weighted).
Harbor Porpoises	Harbor porpoises	120 dB SPL, unweighted	152 dB SEL (Type II weighted).	172 dB SEL (Type II weighted).
Beaked Whales	All Ziphiidae	140 dB SPL, unweighted	178 dB SEL (Type II weighted).	198 dB SEL (Type II weighted).
Phocidae (in water)	Harbor, Bearded, Hooded, Common, Spotted, Ringed, Baikal, Caspian, Harp, Ribbon, Gray seals, Monk, Elephant, Ross, Crabeater, Leopard, and Weddell seals.	Odontocete Dose Function (Type I weighted).	183 dB SEL (Type I weighted).	197 dB SEL (Type I weighted).
Otariidae (in water)	Guadalupe fur seal, Northern fur seal, California sea lion, Steller sea lion.	Odontocete Dose Function (Type I weighted).	206 dB SEL (Type I weighted).	220 dB SEL (Type I weighted).

As discussed earlier, factors other than received level (such as distance from or bearing to the sound source, context of animal at time of exposure) can affect the way that marine mammals respond; however, data to support a quantitative analysis of those (and other factors) do not currently exist. It is also worth specifically noting that while context is very important in marine mammal response, given otherwise equivalent context, the severity of a marine mammal behavioral response is also expected to increase with received level (Houser and Moore, 2014). NMFS will continue to modify these criteria as new data become available and can be appropriately and effectively incorporated.

Marine Mammal Density Estimates

A quantitative analysis of impacts on a species requires data on the abundance and distribution of the species population in the potentially impacted area. The most appropriate unit of metric for this type of analysis is density, which is described as the number of animals present per unit area.

There is no single source of density data for every area, species, and season because of the fiscal costs, resources, and effort involved in NMFS providing enough survey coverage to sufficiently estimate density. Therefore, to characterize the marine species density for large areas such as the Study Area, the Navy needed to compile data from multiple sources. Each data source may use different methods to estimate density, of which, uncertainty in the estimate can be directly related to the method applied. To develop a database of marine species density estimates, the Navy, in consultation with NMFS experts, adopted a protocol to select the best available data sources (including habitat-based density models, line-transect analyses, and peer-reviewed published studies) based on species, area, and season (see the Navy's Pacific Marine Species Density Database Technical Report; U.S. Department of the Navy, 2012, 2014). The resulting Geographic Information System (GIS) database includes one single spatial and seasonal density value for every marine mammal present within the Study Area.

The Navy Marine Species Density Database includes a compilation of the best available density data from several primary sources and published works including survey data from NMFS within the U.S. EEZ. NMFS is the primary agency responsible for estimating marine mammal and sea turtle density within the U.S. EEZ. NMFS publishes annual SARs for various regions of U.S. waters and covers all stocks of marine mammals within those waters. The majority of species that occur in the Study Area are covered by the Pacific Region Stock Assessment Report (Carretta *et al.,* 2014). Other independent researchers often publish density data or research covering a particular marine mammal species, which is integrated into the NMFS SARs.

For most cetacean species, abundance is estimated using line-transect methods that employ a standard equation to derive densities based on sighting data collected from systematic ship or aerial surveys. More recently, habitat-based density models have been used effectively to model cetacean density as a function of environmental variables (*e.g.,* Redfern *et al.,* 2006; Barlow *et al.,* 2009; Becker *et al.,* 2010; Becker *et al.,* 2012a; Becker *et al.,* 2012b; Becker, 2012c; Forney *et al.,* 2012). Where the data supports habitat based density modeling, the Navy's database uses those density predictions. Habitat-based density models allow predictions of cetacean densities on a finer spatial scale than traditional line-transect analyses because cetacean densities are estimated as a continuous function of habitat variables (*e.g.,* sea surface temperature, water depth). Within most of the world's oceans, however there have not been enough systematic surveys to allow for line-transect density estimation or the development of habitat models. To get an approximation of the cetacean species distribution and abundance for unsurveyed areas, in some cases it is appropriate to extrapolate data from areas with similar oceanic conditions where extensive survey data exist. Habitat Suitability Indexes or Relative Environmental Suitability have also been used in data-limited areas to estimate occurrence based on existing observations about a given species' presence and relationships between basic environmental conditions (Kaschner *et al.,* 2006).

Methods used to estimate pinniped at-sea density are generally quite different than those described above for cetaceans. Pinniped abundance is generally estimated via shore counts of animals at known rookeries and haulout sites. For example, for species such as the California sea lion, population estimates are based on counts of pups at the breeding sites (Carretta *et al.,* 2014). However, this method is not appropriate for other species such as harbor seals, whose pups enter the water shortly after birth. Population estimates for these species are typically made by counting the number of seals ashore and applying correction factors based on the proportion of animals estimated to be in the water (Carretta *et al.,* 2014). Population estimates for pinniped species that occur in the Study Area are provided in the Pacific Region Stock Assessment Report (Carretta *et al.,* 2014). Translating these population estimates to in-water densities presents challenges because the percentage of seals or sea lions at sea compared to those on shore is species-specific and depends on gender, age class, time of year (molt and breeding/pupping seasons), foraging range, and for species such as harbor seal, time of day and tide level. These parameters were identified from the literature and used to establish correction factors which were then applied to estimate the proportion of pinnipeds that would be at sea within the Study Area for a given season.

Density estimates for each species in the Study Area, and the sources for these estimates, are provided in Chapter 4 of the application and in the Navy's Pacific Marine Species Density Database Technical Report.

Quantitative Modeling To Estimate Take

The Navy performed a quantitative analysis to estimate the number of mammals that could be exposed to the acoustic transmissions during the proposed Civilian Port Defense activities. Inputs to the quantitative analysis included marine mammal density estimates, marine mammal depth occurrence distributions (Watwood and Buonantony 2012), oceanographic and environmental data, marine mammal hearing data, and criteria and thresholds for levels of potential effects. The quantitative analysis consists of computer modeled estimates and a post-model analysis to determine the number of potential mortalities and harassments. The model calculates sound energy propagation from the proposed sonars, the sound received by animat (virtual animal) dosimeters representing marine mammals distributed in the area around the modeled activity, and whether the sound received by a marine mammal exceeds the thresholds for effects. The model estimates are then further analyzed to consider animal avoidance and implementation of mitigation measures, resulting in final estimates of effects due to the proposed training activities.

The Navy developed a set of software tools and compiled data for estimating acoustic effects on marine mammals without consideration of behavioral avoidance or Navy's standard mitigations. These databases and tools collectively form the Navy Acoustic Effects Model (NAEMO). In NAEMO, animats (virtual animals) are distributed non-uniformly based on species-specific density, depth distribution, and group size information. Animats record energy received at their location in the water column. A fully three-dimensional environment is used for calculating sound propagation and animat exposure in NAEMO. Site-specific bathymetry, sound speed profiles, wind speed, and bottom properties are incorporated into the propagation modeling process. NAEMO calculates the likely propagation for various levels of energy (sound or pressure) resulting from each source used during the training event.

NAEMO then records the energy received by each animat within the energy footprint of the event and calculates the number of animats having received levels of energy exposures that fall within defined impact thresholds. Predicted effects on the animats within a scenario are then tallied and the highest order effect (based on severity of criteria; *e.g.,* PTS over TTS) predicted for a given animat is assumed. Each scenario or each 24-hour period for scenarios lasting greater than 24 hours is independent of all others, and therefore, the same individual marine animal could be impacted during each independent scenario or 24-hour period. In few instances, although the activities themselves all occur within the Study Area, sound may propagate beyond the boundary of the Study Area. Any exposures occurring outside the boundary of the Study Area are counted as if they occurred within the Study Area boundary. NAEMO provides the initial estimated impacts on marine species with a static horizontal distribution. These model-estimated results are then further analyzed to account for pre-activity avoidance by sensitive species, mitigation (considering sound source and platform), and avoidance of repeated sound exposures by marine mammals, producing the final predictions of effects used in this request for an IHA.

There are limitations to the data used in the acoustic effects model, and the results must be interpreted within these context. While the most accurate data and input assumptions have been used in the modeling, when there is a lack of definitive data to support an aspect of the modeling, modeling assumptions believed to overestimate the number of exposures have been chosen:

- Animats are modeled as being underwater, stationary, and facing the source and therefore always predicted to receive the maximum sound level (*i.e.,* no porpoising or pinnipeds' heads above water). Some odontocetes have been shown to have directional hearing, with best hearing sensitivity facing a sound source and higher hearing thresholds for sounds propagating towards the rear or side of an animal (Kastelein et al. 2005; Mooney et al. 2008; Popov and Supin 2009).
- Animats do not move horizontally (but change their position vertically within the water column), which may overestimate physiological effects such as hearing loss, especially for slow moving or stationary sound sources in the model.
- Animats are stationary horizontally and therefore do not avoid the sound source, unlike in the wild where animals would most often avoid exposures at higher sound levels, especially those exposures that may result in PTS.
- Multiple exposures within any 24-hour period are considered one continuous exposure for the purposes of calculating the temporary or permanent hearing loss, because there are not sufficient data to estimate a hearing recovery function for the time between exposures.
- Mitigation measures that are implemented were not considered in the model. In reality, sound-producing activities would be reduced, stopped, or delayed if marine mammals are detected within the mitigation zones around sound sources.

Because of these inherent model limitations and simplifications, model-estimated results must be further analyzed, considering such factors as the range to specific effects, avoidance, and the likelihood of successfully implementing mitigation measures, in order to determine the final estimate of potential takes.

Impacts on Marine Mammals

Range to Effects—Table 4 provides range to effects for active acoustic sources to specific criteria determined using NAEMO. Marine mammals within these ranges would be predicted to receive 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. Therefore, the ranges in Table 4 provide realistic maximum distances over which the specific effects from the use of the AN/SQQ–32 high frequency sonar, the only acoustic source to be used in the proposed activities that requires quantitative analysis, would be possible.

TABLE 4—MAXIMUM RANGE TO TEMPORARY THRESHOLD SHIFT AND BEHAVIORAL EFFECTS FROM THE AN/SQQ–32 IN THE LOS ANGELES/LONG BEACH STUDY AREA

Hearing group	Range to effects cold season (m)		Range to effects warm season (m)	
	Behavioral	TTS	Behavioral	TTS
Low Frequency Cetacean	2,800	<50	1,900	<50
Mid-Frequency Cetacean	3,550	<50	2,550	<50
High Frequency Cetacean	3,550	95	2,550	195
Phocidae water	3,450	<50	2,500	<50
Otariidae Odobenidae water	3,350	<50	2,200	<50

Avoidance Behavior and Mitigation Measures—When sonar is active, exposure to increased sound pressure levels would likely involve individuals that are moving through the area during foraging trips. Pinnipeds may also be exposed enroute to haul-out sites. As discussed further in Chapter 7 of the application and in Analysis and Negligible Impact Determination below, if exposure were to occur, both pinnipeds and cetaceans could exhibit behavioral changes such as increased swimming speeds, increased surfacing time, or decreased foraging. Most likely, individuals affected by elevated underwater noise would move away from the sound source and be temporarily displaced from the proposed Study Area. Any effects experienced by individual marine mammals are anticipated to be limited to short-term disturbance of normal behavior, temporary displacement or disruption of animals which may occur near the proposed training activities. Therefore, the exposures requested are expected to have no more than a minor effect on individual animals and no adverse effect on the populations of these species.

Results from the quantitative analysis should be regarded as conservative estimates that are strongly influenced by limited marine mammal population data. While the numbers generated from the quantitative analysis provide conservative overestimates of marine mammal exposures, the short duration, limited geographic extent of Civilian Port Defense training activities, and mitigation measures would further limit actual exposures.

Incidental Take Request

The Navy's Draft EA for 2015 West Coast Civilian Port Defense training activities analyzed the following stressors for potential impacts to marine mammals:

- Acoustic (sonar sources, vessel noise, aircraft noise)
- Energy (electromagnetic devices and lasers)
- Physical disturbance and strikes (vessels, in-water devices, seafloor objects)

NMFS and the Navy determined the only stressor that could potentially result in the incidental taking of marine mammals per the definition of MMPA harassment from the Civilian Port Defense activities within the Study Area is from acoustic transmissions related to high-frequency sonar.

The methods of incidental take associated with the acoustic transmissions from the proposed Civilian Port Defense are described within Chapter 2 of the application. Acoustic transmissions have the potential to temporarily disturb or displace marine mammals. Specifically, only underwater active transmissions may result in the ''take'' in the form of Level B harassment.

Level A harassment and mortality are not anticipated to result from any of the proposed Civilian Port Defense activities. Furthermore, Navy mitigation and monitoring measures will be implemented to further minimize the potential for Level B takes of marine mammals.

A detailed analysis of effects due to marine mammal exposures to non-impulsive sources (*i.e.,* active sonar) in the Study Area is presented in Chapter 6 of the application and in the Estimated Take by Incidental Harassment section of this proposed IHA. Based on the quantitative acoustic modeling and analysis described in Chapter 6 of the application, Table 5 summarizes the Navy's final take request the Civilian Port Defense training activities from October through November 2015.

TABLE 5—TOTAL NUMBER OF EXPOSURES MODELED AND REQUESTED PER SPECIES FOR CIVILIAN PORT DEFENSE TRAINING ACTIVITIES

Common name	Level B takes requested	Percentage of stock taken (%)
Long-beaked common dolphin	8	0.007
Short-beaked common dolphin	727	0.177
Risso's dolphin	21	0.330
Pacific white-sided dolphin	40	0.149
Bottlenose dolphin coastal	48	14.985
Harbor seal	8	0.026
California sea lion	46	0.015
Total	898	

Analysis and Negligible Impact Determination

Negligible impact is ''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, as the severity of harassment may vary greatly depending on the context and duration of the behavioral response, many of which would not be expected to have deleterious impacts on the fitness of any individuals. In determining whether the expected takes will have a negligible impact, in addition to considering estimates of the number of marine mammals that might be ''taken'', NMFS must consider other factors, such as the likely nature of any responses (their intensity, duration, etc.), the context of any responses (critical reproductive time or location, migration, etc.), as well as the number and nature (*e.g.,* severity) of estimated Level A harassment takes, the number of estimated mortalities, and the status of the species.

To avoid repetition, we provide some general analysis immediately below that applies to all the species listed in Table 5, given that some of the anticipated effects (or lack thereof) of the Navy's training activities on marine mammals are expected to be relatively similar in nature. However, below that, we break our analysis into species to provide more specific information related to the anticipated effects on individuals or where there is information about the status or structure of any species that would lead to a differing assessment of the effects on the population.

Behavioral Harassment

As discussed previously in this document, marine mammals can respond to MFAS/HFAS in many different ways, a subset of which qualifies as harassment (see Behavioral Harassment). One thing that the Level B harassment take estimates do not take into account is the fact that most marine mammals will likely avoid strong sound sources to one extent or another. Although an animal that avoids the sound source will likely still be taken in some instances (such as if the avoidance results in a missed opportunity to feed, interruption of reproductive behaviors, etc.), in other cases avoidance may result in fewer instances of take than were estimated or in the takes resulting from exposure to a lower received level than was estimated, which could result in a less severe response. An animal's exposure to a higher received level is more likely to result in a behavioral response that is more likely to adversely affect the health of the animal.

Specifically, given a range of behavioral responses that may be classified as Level B harassment, to the degree that higher received levels are expected to result in more severe behavioral responses, only a small percentage of the anticipated Level B harassment from Navy activities might necessarily be expected to potentially result in more severe responses, especially when the distance from the source at which the levels below are received is considered. Marine mammals are able to discern the distance of a given sound source, and given other equal factors (including received level), they have been reported to respond more to sounds that are closer (DeRuiter *et al.,* 2013). Further, the estimated number of responses do not reflect either the duration or context of those anticipated responses, some of which will be of very short duration, and other factors should be considered when predicting how the estimated takes may affect individual fitness.

Although the Navy has been monitoring the effects of MFAS/HFAS on marine mammals since 2006, and research on the effects of active sonar is advancing, our understanding of exactly how marine mammals in the Study Area will respond to MFAS/HFAS is still growing. The Navy has submitted reports from more than 60 major exercises across Navy range complexes that indicate no behavioral disturbance was observed. One cannot conclude from these results that marine mammals were not harassed from MFAS/HFAS, as a portion of animals within the area of concern were not seen, the full series of behaviors that would more accurately show an important change is not typically seen (*i.e.,* only the surface behaviors are observed), and some of the non-biologist watchstanders might not be well-qualified to characterize behaviors. However, one can say that the animals that were observed did not respond in any of the obviously more severe ways, such as panic, aggression, or anti-predator response.

Diel Cycle

As noted previously, many animals perform vital functions, such as feeding, resting, traveling, and socializing on a diel cycle (24-hour cycle). Behavioral reactions to noise exposure (when taking place in a biologically important context, such as 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). Consequently, a behavioral response lasting less than one 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 reactions and multiple-day anthropogenic activities. For example, just because at-sea exercises last for multiple days does not necessarily mean that individual animals are either exposed to those exercises for multiple days or, further, exposed in a manner resulting in a sustained multiple day substantive behavioral response. Additionally, the Navy does not necessarily operate active sonar the entire time during an exercise. While it is certainly possible that these sorts of exercises could overlap with individual marine mammals multiple days in a row at levels above those anticipated to result in a take, because of the factors mentioned above, it is considered not to be likely for the majority of takes, does not mean that a behavioral response is necessarily sustained for multiple days, and still necessitates the consideration of likely duration and context to assess any effects on the individual's fitness.

TTS

As mentioned previously, 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. The TTS sustained by an animal is primarily classified by three characteristics:

1. Frequency—Available data (of mid-frequency hearing specialists exposed to mid- or high-frequency sounds; Southall *et al.,* 2007) 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 ½ octave above). The more powerful MF sources used have center frequencies between 3.5 and 8 kHz and the other unidentified MF sources are, by definition, less than 10 kHz, which suggests that TTS induced by any of these MF sources would be in a frequency band somewhere between approximately 2 and 20 kHz. There are fewer hours of HF source use and the sounds would attenuate more quickly, plus they have lower source levels, but if an animal were to incur TTS from these sources, it would cover a higher frequency range (sources are between 20 and 100 kHz, which means that TTS could range up to 200 kHz; however, HF systems are typically used less frequently and for shorter time periods than surface ship and aircraft MF systems, so TTS from these sources is even less likely).

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 dB level is higher or the duration is longer). The threshold for the onset of TTS was discussed previously in this document. An animal 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 difficult considering the Lookouts and the nominal speed of an active sonar vessel (10–15 knots). In the TTS studies, 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. However, MFAS emits a nominal ping every 50 seconds, and incurring those levels of TTS is highly unlikely.

3. Duration of TTS (recovery time)—In the TTS laboratory studies, some using exposures of almost an hour in duration or up to 217 SEL, almost all individuals recovered within 1 day (or less, often in minutes), although in one study (Finneran *et al.,* 2007), recovery took 4 days.

Based on the range of degree and duration of TTS reportedly induced by exposures to non-pulse sounds of energy higher than that to which free-swimming marine mammals in the field are likely to be exposed during MFAS/HFAS training exercises in the Study Area, it is unlikely that marine mammals would ever sustain a TTS from active sonar that alters their sensitivity by more than 20 dB for more than a few days (and any incident of TTS would likely be far less severe due to the short duration of the majority of the exercises and the speed of a typical vessel). Also, for the same reasons discussed in the Diel Cycle section, and because of the short distance within which animals would need to approach the sound source, it is unlikely that animals would be exposed to the levels necessary to induce TTS in subsequent time periods such that their recovery is impeded. Additionally, though the frequency range of TTS that marine mammals might sustain would overlap with some of the frequency ranges of their vocalization types, the frequency range of TTS from MFAS/HFAS (the source from which TTS would most likely be sustained because the higher source level and slower attenuation make it more likely that an animal would be exposed to a higher received level) would not usually span the entire frequency range of one vocalization type, much less span all types of vocalizations or other critical auditory cues. If impaired, marine mammals would typically be aware of their impairment and are sometimes able to implement behaviors to compensate (see Acoustic Masking or Communication Impairment section), though these compensations may incur energetic costs.

Acoustic Masking or Communication Impairment

Masking only occurs during the time of the signal (and potential secondary arrivals of indirect rays), versus TTS, which continues beyond the duration of the signal. Standard MFAS/HFAS nominally pings every 50 seconds for hull-mounted sources. For the sources for which we know the pulse length, most are significantly shorter than hull-mounted active sonar, on the order of several microseconds to tens of microseconds. For hull-mounted active sonar, though some of the vocalizations that marine mammals make are less than one second long, there is only a 1 in 50 chance that they would occur exactly when the ping was received, and when vocalizations are longer than one second, only parts of them are masked. Alternately, when the pulses are only several microseconds long, the majority of most animals' vocalizations would not be masked. Masking effects from MFAS/HFAS are expected to be minimal. If masking or communication impairment were to occur briefly, it would be in the frequency range of MFAS/HFAS, which overlaps with some marine mammal vocalizations; however, it would likely not mask the entirety of any particular vocalization, communication series, or other critical auditory cue, because the signal length, frequency, and duty cycle of the MFAS/HFAS signal does not perfectly mimic the characteristics of any marine mammal's vocalizations.

Important Marine Mammal Habitat

No critical habitat for marine mammals species protected under the ESA has been designated in the Study Area. There are also no known specific breeding or calving areas for marine mammals within the Study Area.

Species-Specific Analysis

Long-beaked Common Dolphin—Long-beaked common dolphins that may be found in the Study Area belong to the California stock (Carretta *et al.,* 2014). The Navy's acoustic analysis (quantitative modeling) predicts that 8 instances of Level B harassment of long-beaked common dolphin may occur from active sonar in the Study Area during Civilian Port Defense training activities. These Level B takes are anticipated to be in the form of behavioral reactions (3) and TTS (5) and no injurious takes of long-beaked common dolphin are requested or proposed for authorization. Relative to population size, these activities are anticipated to result only in a limited number of level B harassment takes. When the numbers of behavioral takes are compared to the estimated stock abundance (stock abundance estimates are shown in Table 1) and if one assumes that each take happens to a separate animal, less than 0.01 percent of the California stock of long-beaked common dolphin would be behaviorally harassed during proposed training activities.

Behavioral reactions of marine mammals to sound are known to occur but are difficult to predict. Recent behavioral studies indicate that reactions to sounds, if any, are highly contextual and vary between species and individuals within a species (Moretti *et al.,* 2010; Southall *et al.,* 2011; Thompson *et al.,* 2010; Tyack, 2009; Tyack *et al.,* 2011). Behavioral responses can range from alerting, to changing their behavior or vocalizations, to avoiding the sound source by swimming away or diving (Richardson, 1995; Nowacek, 2007; Southall *et al.,* 2007; Finneran and Jenkins, 2012). Long-beaked common dolphins generally travel in large pods and should be visible from a distance in order to implement mitigation measures and reduce potential impacts. Many of the recorded long-beaked common dolphin vocalizations overlap with the MFAS/HFAS TTS frequency range (2–20 kHz) (Moore and Ridgway, 1995; Ketten, 1998); however, NMFS does not anticipate TTS of a serious degree or extended duration to occur as a result of exposure to MFAS/HFAS. Recovery from a threshold shift (TTS) can take a few minutes to a few days, depending on the exposure duration, sound exposure level, and the magnitude of the initial shift, with larger threshold shifts and longer exposure durations requiring longer recovery times (Finneran *et al.,* 2005; Mooney *et al.,* 2009a; Mooney *et al.,* 2009b; Finneran and Schlundt, 2010). Large threshold shifts are not anticipated for these activities because of the unlikelihood that animals will remain within the ensonified area at high levels for the duration necessary to induce larger threshold shifts. Threshold shifts do not necessarily affect all hearing frequencies equally, so some threshold shifts may not interfere with an animal's hearing of biologically relevant sounds.

Overall, the number of predicted behavioral reactions is low and temporary behavioral reactions in long-beaked common dolphins are unlikely to cause long-term consequences for individual animals or the population. The Civilian Port Defense activities are not expected to occur in an area/time of specific importance for reproductive, feeding, or other known critical behaviors for long-beaked common dolphin. No evidence suggests any major reproductive differences in comparison to short-beaked common dolphins (Reeves *et al.,* 2002). Short-beaked common dolphin gestation is approximately 11 to 11.5 months in duration (Danil, 2004; Murphy and Rogan, 2006) with most calves born from May to September (Murphy and Rogan, 2006). Therefore, calving would not occur during the Civilian Port Defense training timeframe. The California stock of long-beaked common dolphin is not depleted under the MMPA. Although there is no formal statistical trend analysis, over the last 30 years sighting and stranding data shows an increasing trend of long-beaked common dolphins in California waters (Carretta *et al.,* 2014). Consequently, the activities are not expected to adversely impact annual rates of recruitment or survival of long-beaked common dolphin.

Short-beaked Common Dolphin—Short-beaked common dolphins that may be found in the Study Area belong to the California/Washington/Oregon stock (Carretta *et al.,* 2014). The Navy's acoustic analysis (quantitative modeling) predicts that 727 instances of Level B harassment of short-beaked common dolphin may occur from active sonar in the Study Area during Civilian Port Defense training activities. These Level B takes are anticipated to be in the form of behavioral reactions (422) and TTS (305) and no injurious takes of short-beaked common dolphin are requested or proposed for authorization. Relative to population size, these activities are anticipated to result only in a limited number of level B harassment takes. When the numbers of behavioral takes are compared to the estimated stock abundance (stock abundance estimates are shown in Table 1) and if one assumes that each take happens to a separate animal, less than 0.18 percent of the California/Washington/Oregon stock of short-beaked common dolphin would be behaviorally harassed during proposed training activities.

Behavioral reactions of marine mammals to sound are known to occur but are difficult to predict. Recent behavioral studies indicate that reactions to sounds, if any, are highly contextual and vary between species and individuals within a species (Moretti *et al.,* 2010; Southall *et al.,* 2011; Thompson *et al.,* 2010; Tyack, 2009; Tyack *et al.,* 2011). Behavioral responses can range from alerting, to changing their behavior or vocalizations, to avoiding the sound source by swimming away or diving (Richardson, 1995; Nowacek, 2007; Southall *et al.,* 2007; Finneran and Jenkins, 2012). Short-beaked common dolphins generally travel in large pods and should be visible from a distance in order to implement mitigation measures and reduce potential impacts. Many of the recorded short-beaked common dolphin vocalizations overlap with the MFAS/HFAS TTS frequency range (2–20 kHz) (Moore and Ridgway, 1995;

Ketten, 1998); however, NMFS does not anticipate TTS of a serious degree or extended duration to occur as a result of exposure to MFAS/HFAS. Recovery from a threshold shift (TTS) can take a few minutes to a few days, depending on the exposure duration, sound exposure level, and the magnitude of the initial shift, with larger threshold shifts and longer exposure durations requiring longer recovery times (Finneran *et al.,* 2005; Mooney *et al.,* 2009a; Mooney *et al.,* 2009b; Finneran and Schlundt, 2010). Large threshold shifts are not anticipated for these activities because of the unlikelihood that animals will remain within the ensonified area at high levels for the duration necessary to induce larger threshold shifts. Threshold shifts do not necessarily affect all hearing frequencies equally, so some threshold shifts may not interfere with an animal's hearing of biologically relevant sounds.

Overall, the number of predicted behavioral reactions is low and temporary behavioral reactions in short-beaked common dolphins are unlikely to cause long-term consequences for individual animals or the population. The Civilian Port Defense activities are not expected to occur in an area/time of specific importance for reproductive, feeding, or other known critical behaviors for long-beaked common dolphin. Short-beaked common dolphin gestation is approximately 11 to 11.5 months in duration (Danil, 2004; Murphy and Rogan, 2006) with most calves born from May to September (Murphy and Rogan, 2006). Therefore, calving would not occur during the Civilian Port Defense training timeframe. The California/Washington/Oregon stock of short-beaked common dolphin is not depleted under the MMPA. Abundance off California has increased dramatically since the late 1970s, along with a smaller decrease in abundance in the eastern tropical Pacific, suggesting a large-scale northward shift in the distribution of this species in the eastern north Pacific (Forney and Barlow, 1998; Forney *et al.,* 1995). Consequently, the activities are not expected to adversely impact annual rates of recruitment or survival of short-beaked common dolphin.

Risso's Dolphin—Risso's dolphins that may be found in the Study Area belong to the California/Washington/Oregon stock (Carretta *et al.,* 2014). The Navy's acoustic analysis (quantitative modeling) predicts that 21 instances of Level B harassment of Risso's dolphin may occur from active sonar in the Study Area during Civilian Port Defense training activities. These Level B takes are anticipated to be in the form of behavioral reactions (16) and TTS (5) and no injurious takes of Risso's dolphin are requested or proposed for authorization. Relative to population size, these activities are anticipated to result only in a limited number of level B harassment takes. When the numbers of behavioral takes are compared to the estimated stock abundance (stock abundance estimates are shown in Table 1) and if one assumes that each take happens to a separate animal, approximately 0.33 percent of the California/Washington/Oregon stock of Risso's dolphin would be behaviorally harassed during proposed training activities.

Behavioral reactions of marine mammals to sound are known to occur but are difficult to predict. Recent behavioral studies indicate that reactions to sounds, if any, are highly contextual and vary between species and individuals within a species (Moretti *et al.,* 2010; Southall *et al.,* 2011; Thompson *et al.,* 2010; Tyack, 2009; Tyack *et al.,* 2011). Behavioral responses can range from alerting, to changing their behavior or vocalizations, to avoiding the sound source by swimming away or diving (Richardson, 1995; Nowacek, 2007; Southall *et al.,* 2007; Finneran and Jenkins, 2012). Risso's dolphins generally travel in large pods and should be visible from a distance in order to implement mitigation measures and reduce potential impacts. Many of the recorded Risso's dolphin vocalizations overlap with the MFAS/HFAS TTS frequency range (2–20 kHz) (Corkeron and Van Parijs 2001); however, NMFS does not anticipate TTS of a serious degree or extended duration to occur as a result of exposure to MFAS/HFAS. Recovery from a threshold shift (TTS) can take a few minutes to a few days, depending on the exposure duration, sound exposure level, and the magnitude of the initial shift, with larger threshold shifts and longer exposure durations requiring longer recovery times (Finneran *et al.,* 2005; Mooney *et al.,* 2009a; Mooney *et al.,* 2009b; Finneran and Schlundt, 2010). Large threshold shifts are not anticipated for these activities because of the unlikelihood that animals will remain within the ensonified area at high levels for the duration necessary to induce larger threshold shifts. Threshold shifts do not necessarily affect all hearing frequencies equally, so some threshold shifts may not interfere with an animal's hearing of biologically relevant sounds.

Overall, the number of predicted behavioral reactions is low and temporary behavioral reactions in Risso's dolphins are unlikely to cause long-term consequences for individual animals or the population. The Civilian Port Defense activities are not expected to occur in an area/time of specific importance for reproductive, feeding, or other known critical behaviors for Risso's dolphin. The California/Washington/Oregon stock of Risso's dolphin is not depleted under the MMPA. The distribution of Risso's dolphins throughout the region is highly variable, apparently in response to oceanographic changes (Forney and Barlow, 1998). The status of Risso's dolphins off California, Oregon and Washington relative to optimum sustainable population is not known, and there are insufficient data to evaluate potential trends in abundance. However, Civilian Port Defense training activities are not expected to adversely impact annual rates of recruitment or survival of Risso's dolphin for the reasons stated above.

Pacific White-Sided Dolphin—Pacific white-sided dolphins that may be found in the Study Area belong to the California/Washington/Oregon stock (Carretta *et al.,* 2014). The Navy's acoustic analysis (quantitative modeling) predicts that 40 instances of Level B harassment of Pacific white-sided dolphin may occur from active sonar in the Study Area during Civilian Port Defense training activities. These Level B takes are anticipated to be in the form of behavioral reactions (21) and TTS (19) and no injurious takes of Pacific white-sided dolphin are requested or proposed for authorization. Relative to population size, these activities are anticipated to result only in a limited number of level B harassment takes. When the numbers of behavioral takes are compared to the estimated stock abundance (stock abundance estimates are shown in Table 1) and if one assumes that each take happens to a separate animal, less than 0.15 percent of the California/Washington/Oregon stock of Pacific white-sided dolphin would be behaviorally harassed during proposed training activities.

Behavioral reactions of marine mammals to sound are known to occur but are difficult to predict. Recent behavioral studies indicate that reactions to sounds, if any, are highly contextual and vary between species and individuals within a species (Moretti *et al.,* 2010; Southall *et al.,* 2011; Thompson *et al.,* 2010; Tyack, 2009; Tyack *et al.,* 2011). Behavioral responses can range from alerting, to changing their behavior or vocalizations, to avoiding the sound source by swimming away or diving

(Richardson, 1995; Nowacek, 2007; Southall *et al.,* 2007; Finneran and Jenkins, 2012). Pacific white-sided dolphins generally travel in large pods and should be visible from a distance in order to implement mitigation measures and reduce potential impacts. Many of the recorded Pacific white-sided dolphin vocalizations overlap with the MFAS/HFAS TTS frequency range (2–20 kHz); however, NMFS does not anticipate TTS of a serious degree or extended duration to occur as a result of exposure to MFAS/HFAS. Recovery from a threshold shift (TTS) can take a few minutes to a few days, depending on the exposure duration, sound exposure level, and the magnitude of the initial shift, with larger threshold shifts and longer exposure durations requiring longer recovery times (Finneran *et al.,* 2005; Mooney *et al.,* 2009a; Mooney *et al.,* 2009b; Finneran and Schlundt, 2010). Large threshold shifts are not anticipated for these activities because of the unlikelihood that animals will remain within the ensonified area at high levels for the duration necessary to induce larger threshold shifts. Threshold shifts do not necessarily affect all hearing frequencies equally, so some threshold shifts may not interfere with an animal's hearing of biologically relevant sounds.

Overall, the number of predicted behavioral reactions is low and temporary behavioral reactions in Pacific white-sided dolphins are unlikely to cause long-term consequences for individual animals or the population. The Civilian Port Defense activities are not expected to occur in an area/time of specific importance for reproductive, feeding, or other known critical behaviors for long-beaked common dolphin. Pacific white-sided dolphin calves are typically born in the summer months between April and early September (Black, 1994; NOAA, 2012; Reidenberg and Laitman, 2002). This species is predominantly located around the proposed Study Area in the colder winter months when neither mating nor calving is expected, as both occur off the coast of Oregon and Washington outside of the timeframe for the proposed activities (October through November). The California/Washington/Oregon stock of Pacific white-sided dolphin is not depleted under the MMPA. The stock is considered stable, with no indications of any positive or negative trends in abundance (NOAA, 2014). Consequently, the activities are not expected to adversely impact annual rates of recruitment or survival of Pacific white-sided dolphin.

Bottlenose Dolphin—Bottlenose dolphins that may be found in the Study Area belong to the California Coastal stock (Carretta *et al.,* 2014). The Navy's acoustic analysis (quantitative modeling) predicts that 48 instances of Level B harassment of bottlenose dolphin may occur from active sonar in the Study Area during Civilian Port Defense training activities. These Level B takes are anticipated to be in the form of behavioral reactions (29) and TTS (19) and no injurious takes of bottlenose dolphin are requested or proposed for authorization. Relative to population size, these activities are anticipated to result only in a limited number of level B harassment takes. When the numbers of behavioral takes are compared to the estimated stock abundance (stock abundance estimates are shown in Table 1) and if one assumes that each take happens to a separate animal, less than 15 percent of the Coastal stock of bottlenose dolphin would be behaviorally harassed during proposed training activities.

Behavioral reactions of marine mammals to sound are known to occur but are difficult to predict. Recent behavioral studies indicate that reactions to sounds, if any, are highly contextual and vary between species and individuals within a species (Moretti *et al.,* 2010; Southall *et al.,* 2011; Thompson *et al.,* 2010; Tyack, 2009; Tyack *et al.,* 2011). Behavioral responses can range from alerting, to changing their behavior or vocalizations, to avoiding the sound source by swimming away or diving (Richardson, 1995; Nowacek, 2007; Southall *et al.,* 2007; Finneran and Jenkins, 2012). Bottlenose dolphins generally travel in large pods and should be visible from a distance in order to implement mitigation measures and reduce potential impacts. Many of the recorded bottlenose dolphin vocalizations overlap with the MFAS/HFAS TTS frequency range (2–20 kHz); however, NMFS does not anticipate TTS of a serious degree or extended duration to occur as a result of exposure to MFAS/HFAS. Recovery from a threshold shift (TTS) can take a few minutes to a few days, depending on the exposure duration, sound exposure level, and the magnitude of the initial shift, with larger threshold shifts and longer exposure durations requiring longer recovery times (Finneran *et al.,* 2005; Mooney *et al.,* 2009a; Mooney *et al.,* 2009b; Finneran and Schlundt, 2010). Large threshold shifts are not anticipated for these activities because of the unlikelihood that animals will remain within the ensonified area at high levels for the duration necessary to induce larger threshold shifts. Threshold shifts do not necessarily affect all hearing frequencies equally, so some threshold shifts may not interfere with an animal's hearing of biologically relevant sounds.

Overall, the number of predicted behavioral reactions is low and temporary behavioral reactions in bottlenose dolphins are unlikely to cause long-term consequences for individual animals or the population. The Civilian Port Defense activities are not expected to occur in an area/time of specific importance for reproductive, feeding, or other known critical behaviors for bottlenose dolphin. The California/Washington/Oregon stock of bottlenose dolphin is not depleted under the MMPA. In a comparison of abundance estimates from 1987–89 (n = 354), 1996–98 (n = 356), and 2004–05 (n = 323), Dudzik *et al.* (2006) found that the population size has remained stable over this period of approximately 20 years. Consequently, the activities are not expected to adversely impact annual rates of recruitment or survival of bottlenose dolphin.

Harbor Seal—Harbor seals that may be found in the Study Area belong to the California stock (Carretta *et al.,* 2014). Harbor seals have not been observed on the mainland coast of Los Angeles, Orange, and northern San Diego Counties (Henkel and Harvey, 2008; Lowry *et al.,* 2008). Thus, no harbor seal haul-outs are located within the proposed Study Area. The Navy's acoustic analysis (quantitative modeling) predicts that 8 instances of Level B harassment of harbor seal may occur from active sonar in the Study Area during Civilian Port Defense training activities. These Level B takes are anticipated to be in the form of non-TTS behavioral reactions only and no injurious takes of harbor seal are requested or proposed for authorization. Relative to population size, these activities are anticipated to result only in a limited number of level B harassment takes. When the numbers of behavioral takes are compared to the estimated stock abundance (stock abundance estimates are shown in Table 1) and if one assumes that each take happens to a separate animal, less than 0.03 percent of the California stock of harbor seal would be behaviorally harassed during proposed training activities.

Research and observations show that pinnipeds in the water may be tolerant of anthropogenic noise and activity (a review of behavioral reactions by pinnipeds to impulsive and non-impulsive noise can be found in

Richardson *et al.,* 1995 and Southall *et al.,* 2007). Available data, though limited, suggest that exposures between approximately 90 and 140 dB SPL do not appear to induce strong behavioral responses in pinnipeds exposed to nonpulse sounds in water (Jacobs and Terhune, 2002; Costa *et al.,* 2003; Kastelein *et al.,* 2006c). Based on the limited data on pinnipeds in the water exposed to multiple pulses (small explosives, impact pile driving, and seismic sources), exposures in the approximately 150 to 180 dB SPL range generally have limited potential to induce avoidance behavior in pinnipeds (Harris *et al.,* 2001; Blackwell *et al.,* 2004; Miller *et al.,* 2004). If pinnipeds are exposed to sonar or other active acoustic sources they may react in a number of ways depending on their experience with the sound source and what activity they are engaged in at the time of the acoustic exposure. Pinnipeds may not react at all until the sound source is approaching within a few hundred meters and then may alert, ignore the stimulus, change their behaviors, or avoid the immediate area by swimming away or diving. Effects on pinnipeds in the Study Area that are taken by Level B harassment, on the basis of reports in the literature as well as Navy monitoring from past activities, will likely be limited to reactions such as increased swimming speeds, increased surfacing time, or decreased foraging (if such activity were occurring). Most likely, individuals will simply move away from the sound source and be temporarily displaced from those areas, or not respond at all. In areas of repeated and frequent acoustic disturbance, some animals may habituate or learn to tolerate the new baseline or fluctuations in noise level. Habituation can occur when an animal's response to a stimulus wanes with repeated exposure, usually in the absence of unpleasant associated events (Wartzok *et al.,* 2003). While some animals may not return to an area, or may begin using an area differently due to training activities, most animals are expected to return to their usual locations and behavior. Given their documented tolerance of anthropogenic sound (Richardson *et al.,* 1995 and Southall *et al.,* 2007), repeated exposures of harbor seals to levels of sound that may cause Level B harassment are unlikely to result in hearing impairment or to significantly disrupt foraging behavior.

Overall, the number of predicted behavioral reactions is low and temporary behavioral reactions in harbor seals are unlikely to cause long-term consequences for individual animals or the population. The Civilian Port Defense activities are not expected to occur in an area/time of specific importance for reproductive, feeding, or other known critical behaviors for harbor seal. In California, harbor seals breed from March to May and pupping occurs between April and May (Alden *et al.,* 2002; Reeves *et al.,* 2002), neither of which occur within the timeframe of the proposed activities. The California stock of harbor seal is not depleted under the MMPA. Counts of harbor seals in California increased from 1981 to 2004, although a review of harbor seal dynamics through 1991 concluded that their status could not be determined with certainty (Hanan, 1996). The population appears to be stabilizing at what may be its carrying capacity. Consequently, the activities are not expected to adversely impact annual rates of recruitment or survival of harbor seal.

California Sea Lion—California sea lions that may be found in the Study Area belong to the U.S. stock (Carretta *et al.,* 2014). The Navy's acoustic analysis (quantitative modeling) predicts that 46 instances of Level B harassment of California sea lion may occur from active sonar in the Study Area during Civilian Port Defense training activities. These Level B takes are anticipated to be in the form of non-TTS behavioral reactions only and no injurious takes of California sea lions are requested or proposed for authorization. Relative to population size, these activities are anticipated to result only in a limited number of level B harassment takes. When the numbers of behavioral takes are compared to the estimated stock abundance (stock abundance estimates are shown in Table 1) and if one assumes that each take happens to a separate animal, less than 0.02 percent of the U.S. stock of California sea lions would be behaviorally harassed during proposed training activities.

Research and observations show that pinnipeds in the water may be tolerant of anthropogenic noise and activity (a review of behavioral reactions by pinnipeds to impulsive and non-impulsive noise can be found in Richardson *et al.,* 1995 and Southall *et al.,* 2007). Available data, though limited, suggest that exposures between approximately 90 and 140 dB SPL do not appear to induce strong behavioral responses in pinnipeds exposed to nonpulse sounds in water (Jacobs and Terhune, 2002; Costa *et al.,* 2003; Kastelein *et al.,* 2006c). Based on the limited data on pinnipeds in the water exposed to multiple pulses (small explosives, impact pile driving, and seismic sources), exposures in the approximately 150 to 180 dB SPL range generally have limited potential to induce avoidance behavior in pinnipeds (Harris *et al.,* 2001; Blackwell *et al.,* 2004; Miller *et al.,* 2004). If pinnipeds are exposed to sonar or other active acoustic sources they may react in a number of ways depending on their experience with the sound source and what activity they are engaged in at the time of the acoustic exposure. Pinnipeds may not react at all until the sound source is approaching within a few hundred meters and then may alert, ignore the stimulus, change their behaviors, or avoid the immediate area by swimming away or diving. Effects on pinnipeds in the Study Area that are taken by Level B harassment, on the basis of reports in the literature as well as Navy monitoring from past activities will likely be limited to reactions such as increased swimming speeds, increased surfacing time, or decreased foraging (if such activity were occurring). Most likely, individuals will simply move away from the sound source and be temporarily displaced from those areas, or not respond at all. In areas of repeated and frequent acoustic disturbance, some animals may habituate or learn to tolerate the new baseline or fluctuations in noise level. Habituation can occur when an animal's response to a stimulus wanes with repeated exposure, usually in the absence of unpleasant associated events (Wartzok *et al.,* 2003). While some animals may not return to an area, or may begin using an area differently due to training activities, most animals are expected to return to their usual locations and behavior. Given their documented tolerance of anthropogenic sound (Richardson *et al.,* 1995 and Southall *et al.,* 2007), repeated exposures of individuals to levels of sound that may cause Level B harassment are unlikely to result in hearing impairment or to significantly disrupt foraging behavior.

Overall, the number of predicted behavioral reactions is low and temporary behavioral reactions in California sea lions are unlikely to cause long-term consequences for individual animals or the population. The Civilian Port Defense activities are not expected to occur in an area/time of specific importance for reproductive, feeding, or other known critical behaviors for California sea lions. It is likely that male California sea lions will be primarily outside of the Study Area during the timeframe of the proposed activities, but females may be present. Typically during the summer, California sea lions congregate near rookery islands and specific open-water areas. The primary rookeries off the coast of California are on San Nicolas, San Miguel, Santa Barbara, and San Clemente Islands (Boeuf and Bonnell, 1980; Carretta *et al.,* 2000; Lowry *et al.,* 1992; Lowry and Forney, 2005). In May or June, female sea lions give birth, either on land or in water. Adult males establish breeding territories, both on land and in water, from May to July. In addition to the rookery sites, Santa Catalina Island is a major haul-out site within the Southern California Bight (Boeuf, 2002). Thus, breeding and pupping take place outside of the timeframe and location of the proposed training activities. The U.S. stock of California sea lions is not depleted under the MMPA. A regression of the natural logarithm of the pup counts against year indicates that the counts of pups increased at an annual rate of 5.4 percent between 1975 and 2008 (when pup counts for El Niño years were removed from the 1975–2005 time series). These records of pup counts from 1975 to 2008 were compiled from Lowry and Maravilla-Chavez (2005) and unpublished NMFS data. Consequently, the activities are not expected to adversely impact annual rates of recruitment or survival of California sea lion.

Preliminary Determination

Overall, the conclusions and predicted exposures in this analysis find that overall impacts on marine mammal species and stocks would be negligible for the following reasons:

- All estimated acoustic harassments for the proposed Civilian Port Defense training activities are within the non-injurious temporary threshold shift (TTS) or behavioral effects zones (Level B harassment), and these harassments (take numbers) represent only a small percentage (less than 15 percent of bottlenose dolphin coastal stock; less than 0.5 percent for all other species) of the respective stock abundance for each species taken.
- Marine mammal densities inputted into the model are also overly conservative, particularly when considering species where data is limited in portions of the proposed study area and seasonal migrations extend throughout the Study Area.
- The protective measures described in Proposed Mitigation are designed to reduce sound exposure on marine mammals to levels below those that may cause physiological effects (injury).
- Animals exposed to acoustics from this two week event are habituated to a bustling industrial port environment.

This proposed IHA assumes that short-term non-injurious SELs predicted to cause onset-TTS or predicted SPLs predicted to cause temporary behavioral disruptions (non-TTS) qualify as Level B harassment. This approach predominately overestimates disturbances from acoustic transmissions as qualifying as harassment under MMPA's definition for military readiness activities because there is no established scientific correlation between short term sonar use and long term abandonment or significant alteration of behavioral patterns in marine mammals.

Consideration of negligible impact is required for NMFS to authorize incidental take of marine mammals. By definition, an activity has a ''negligible impact'' on a species or stock when it is determined that the total taking is not likely to reduce annual rates of adult survival or recruitment (*i.e.,* offspring survival, birth rates).

Behavioral reactions of marine mammals to sound are known to occur but are difficult to predict. Recent behavioral studies indicate that reactions to sounds, if any, are highly contextual and vary between species and individuals within a species (Moretti *et al.,* 2010; Southall *et al.,* 2011; Thompson *et al.,* 2010; Tyack, 2009; Tyack *et al.,* 2011). Depending on the context, marine mammals often change their activity when exposed to disruptive levels of sound. When sound becomes potentially disruptive, cetaceans at rest become active, feeding or socializing cetaceans or pinnipeds often interrupt these events by diving or swimming away. If the sound disturbance occurs around a haul out site, pinnipeds may move back and forth between water and land or eventually abandon the haul out. When attempting to understand behavioral disruption by anthropogenic sound, a key question to ask is whether the exposures have biologically significant consequences for the individual or population (National Research Council of the National Academies, 2005).

If a marine mammal does react to an underwater sound by changing its behavior or moving a small distance, the impacts of the change may not be detrimental to the individual. For example, researchers have found during a study focusing on dolphins response to whale watching vessels in New Zealand, that when animals can cope with constraint and easily feed or move elsewhere, there's little effect on survival (Lusseau and Bejder, 2007). On the other hand, if a sound source displaces marine mammals from an important feeding or breeding area for a prolonged period and they do not have an alternate equally desirable area, impacts on the marine mammal could be negative because the disruption has biological consequences. Biological parameters or key elements having greatest importance to a marine mammal relate to its ability to mature, reproduce, and survive. For example, some elements that should be considered include the following:

- Growth: Adverse effects on ability to feed;
- Reproduction: The range at which reproductive displays can be heard and the quality of mating/calving grounds; and
- Survival: Sound exposure may directly affect survival, for example where sources of a certain type are deployed in a a manner that could lead to a stranding response.

The importance of the disruption and degree of consequence for individual marine mammals often has much to do with the frequency, intensity, and duration of the disturbance. Isolated acoustic disturbances such as acoustic transmissions usually have minimal consequences or no lasting effects for marine mammals. Marine mammals regularly cope with occasional disruption of their activities by predators, adverse weather, and other natural phenomena. It is also reasonable to assume that they can tolerate occasional or brief disturbances by anthropogenic sound without significant consequences.

The exposure estimates calculated by predictive models currently available reliably predict propagation of sound and received levels and measure a short-term, immediate response of an individual using applicable criteria. Consequences to populations are much more difficult to predict and empirical measurement of population effects from anthropogenic stressors is limited (National Research Council of the National Academies, 2005). To predict indirect, long-term, and cumulative effects, the processes must be well understood and the underlying data available for models. Based on each species' life history information, expected behavioral patterns in the Study Area, all of the modeled exposures resulting in temporary behavioral disturbance (Table 5), and the application of mitigation procedures proposed above, the proposed Civilian Port Defense activities are anticipated to have a negligible impact on marine mammal stocks within the Study Area.

NMFS concludes that Civilian Port Defense training activities within the Study Area would result in Level B takes only, as summarized in Table 5.

The effects of these military readiness activities will be limited to short-term, localized changes in behavior and possible temporary threshold shift in the hearing of marine mammal species. These effects are not likely to have a significant or long-term impact on feeding, breeding, or other important biological functions. No take by injury or mortality is anticipated, and the potential for permanent hearing impairment is unlikely. Based on best available science NMFS concludes that exposures to marine mammal species and stocks due to the proposed training activities would result in only short-term effects from those Level B takes to most individuals exposed and would likely not affect annual rates of recruitment or survival.

Based on the analysis contained herein of the likely effects of the specified activity on marine mammals and their habitat and dependent upon the implementation of the mitigation and monitoring measures, NMFS preliminarily finds that the total taking from Civilian Port Defense training activities in the Study Area will have a negligible impact on the affected species or stocks.

Subsistence Harvest of Marine Mammals

There are no relevant subsistence uses of marine mammals implicated by this action. Therefore, NMFS has 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.

NEPA

The Navy is preparing an EA in accordance with the National Environmental Policy Act (NEPA), to evaluate all components of the proposed Civilian Port Defense training activities. NMFS intends to adopt the Navy's EA, if adequate and appropriate. Currently, we believe that the adoption of the Navy's EA will allow NMFS to meet its responsibilities under NEPA for the issuance of an IHA to the Navy for Civilian Port Defense activities at the Ports of Los Angeles and Long Beach Harbor. If necessary, however, NMFS will supplement the existing analysis to ensure that we comply with NEPA prior to the issuance of the final IHA.

ESA

No species listed under the Endangered Species Act (ESA) are expected to be affected by the proposed Civilian Port Defense training activities and no takes of any ESA-listed species are requested or proposed for authorization under the MMPA. Therefore, NMFS has determined that a formal section 7 consultation under the ESA is not required.

Proposed Authorization

As a result of these preliminary determinations, NMFS proposes to issue an IHA to the Navy for conducting Civilian Port Defense activities from October to November 2015 on the U.S. west coast near Los Angeles/Long Beach, California, provided the previously mentioned mitigation, monitoring, and reporting requirements are incorporated. The proposed IHA language is provided next.

This section contains a draft of the IHA itself. The wording contained in this section is proposed for inclusion in the IHA (if issued).

The Commander, U.S. Pacific Fleet, 250 Makalapa Drive, Pearl Harbor, Hawaii 96860, and persons operating under his authority (*i.e.,* Navy), is hereby authorized under section 101(a)(5)(D) of the Marine Mammal Protection Act (16 U.S.C. 1371(a)(5)(D)) and 50 CFR 216.107, to harass marine mammals incidental to Civilian Port Defense training activities proposed to be conducted near the Ports of Los Angeles and Long Beach from October to November 2015.

1. This Authorization is valid from October 25, 2015 through November 25, 2015.

2. This Authorization is valid for the incidental taking of a specified number of marine mammals, incidental to Civilian Port Defense training activities proposed to be conducted near the Ports of Los Angeles and Long Beach from October to November 2015, as described in the Incidental Harassment Authorization (IHA) application.

3. The holder of this authorization (Holder) is hereby authorized to take, by Level B harassment only, 8 long-beaked common dolphins (*Delphinus capensis*), 727 short-beaked common dolphins (*Delphinus delphis*), 21 Risso's dolphins (*Grampus griseus*), 40 Pacific white-sided dolphins (*Lagenorhynchus obilquidens*), 48 bottlenose dolphins (*Tursiops truncates*), 8 harbor seals (*Phoca vitulina*), and 46 California sea lions (*Zalophus californianus*) incidental to Civilian Port Defense training activities proposed to be conducted near the Ports of Los Angeles and Long Beach, California.

4. The taking of any marine mammal in a manner prohibited under this IHA must be reported immediately to NMFS' Office of Protected Resources, 1315 East-West Highway, Silver Spring, MD 20910; phone 301–427–8401; fax 301–713–0376.

5. Mitigation Requirements

The Holder is required to abide by the following mitigation conditions listed in 5(a)–(b). Failure to comply with these conditions may result in the modification, suspension, or revocation of this IHA.

(a) Lookouts

The following are protective measures concerning the use of Lookouts:

Procedural Measures—The Navy will have two types of lookouts for the purposes of conducting visual observations: (1) Those positioned on surface ships, and (2) those positioned in aircraft or on boats. Lookouts positioned on surface ships will be dedicated solely to diligent observation of the air and surface of the water. Their observation objectives will include, but are not limited to, detecting the presence of biological resources and recreational or fishing boats, observing mitigation zones, and monitoring for vessel and personnel safety concerns. Lookouts positioned in aircraft or on boats will, to the maximum extent practicable and consistent with aircraft and boat safety and training requirements, comply with the observation objectives described above for Lookouts positioned on surface ships.

Active Sonar—The Navy will have one Lookout on ships or aircraft conducting high-frequency active sonar activities associated with mine warfare activities at sea.

Vessels—While underway, vessels will have a minimum of one Lookout.

Towed In-Water Devices—The Navy will have one Lookout during activities using towed in-water devices when towed from a manned platform.

(b) *Mitigation Zones*—The following are protective measures concerning the implementation of mitigation zones:

Active Sonar—Mitigation will include visual observation from a vessel or aircraft (with the exception of platforms operating at high altitudes) immediately before and during active transmission within a mitigation zone of 200 yards (yds. [183 m]) from the active sonar source. If the source can be turned off during the activity, active transmission will cease if a marine mammal is sighted within the mitigation zone. Active transmission will recommence if any one of the following conditions is met: (1) the animal is observed exiting the mitigation zone, (2) the animal is thought to have exited the mitigation zone based on a determination of its course and speed and the relative motion between the animal and the source, (3) the mitigation zone has been clear from any additional sightings for a period of 10 minutes for an aircraft-deployed source, (4) the mitigation zone has been clear from any additional sightings for a period of 30 minutes for a vessel-deployed source, (5) the vessel or aircraft has repositioned itself more than 400 yds (366 m) away from the location of the last sighting, or (6) the vessel concludes that dolphins are deliberately closing in to ride the vessel's bow wave (and there are no other marine mammal sightings within the mitigation zone).

Vessels—Vessels will avoid approaching marine mammals head on and will maneuver to maintain a mitigation zone of 500 yds (457 m) around observed whales, and 200 yds (183 m) around all other marine mammals (except bow riding dolphins), providing it is safe to do so.

Towed In-Water Devices—The Navy will ensure that towed in-water devices being towed from manned platforms avoid coming within a mitigation zone of 250 yds (229 m) around any observed marine mammal, providing it is safe to do so.

6. Monitoring and Reporting Requirements

The Holder is required to abide by the following monitoring and reporting conditions. Failure to comply with these conditions may result in the modification, suspension, or revocation of this IHA.

General Notification of Injured or Dead Marine Mammals—If any injury or death of a marine mammal is observed during the Civilian Port Defense training activity, the Navy will immediately halt the activity and report the incident to NMFS following the standard monitoring and reporting measures consistent with the MITT EIS/OEIS. The reporting measures include the following procedures:

Navy personnel shall ensure that NMFS (regional stranding coordinator) is notified immediately (or as soon as clearance procedures allow) if an injured or dead marine mammal is found during or shortly after, and in the vicinity of, any Navy training activity utilizing high-frequency active sonar. The Navy shall provide NMFS with species or description of the animal(s), the condition of the animal(s) (including carcass condition if the animal is dead), location, time of first discovery, observed behaviors (if alive), and photo or video (if available). The Navy shall consult the Stranding Response and Communication Plan to obtain more specific reporting requirements for specific circumstances.

Vessel Strike—Vessel strike during Navy Civilian Port Defense activities in the Study Area is not anticipated; however, in the event that a Navy vessel strikes a whale, the Navy shall do the following:

Immediately report to NMFS (pursuant to the established Communication Protocol) the:

- Species identification (if known);
- Location (latitude/longitude) of the animal (or location of the strike if the animal has disappeared);
- Whether the animal is alive or dead (or unknown); and
- The time of the strike.

As soon as feasible, the Navy shall report to or provide to NMFS, the:

- Size, length, and description (critical if species is not known) of animal;
- An estimate of the injury status (*e.g.,* dead, injured but alive, injured and moving, blood or tissue observed in the water, status unknown, disappeared, etc.);
- Description of the behavior of the whale during event, immediately after the strike, and following the strike (until the report is made or the animal is no longer sighted);
- Vessel class/type and operational status;
- Vessel length;
- Vessel speed and heading; and
- To the best extent possible, obtain a photo or video of the struck animal, if the animal is still in view.

Within 2 weeks of the strike, provide NMFS:

- A detailed description of the specific actions of the vessel in the 30-minute timeframe immediately preceding the strike, during the event, and immediately after the strike (*e.g.,* the speed and changes in speed, the direction and changes in direction, other maneuvers, sonar use, etc., if not classified);
- A narrative description of marine mammal sightings during the event and immediately after, and any information as to sightings prior to the strike, if available; and use established Navy shipboard procedures to make a camera available to attempt to capture photographs following a ship strike.

NMFS and the Navy will coordinate to determine the services the Navy may provide to assist NMFS with the investigation of the strike. The response and support activities to be provided by the Navy are dependent on resource availability, must be consistent with military security, and must be logistically feasible without compromising Navy personnel safety. Assistance requested and provided may vary based on distance of strike from shore, the nature of the vessel that hit the whale, available nearby Navy resources, operational and installation commitments, or other factors.

7. A copy of this Authorization must be in the possession of the on-site Commanding Officer in order to take marine mammals under the authority of this Incidental Harassment Authorization while conducting the specified activities.

8. This Authorization may be modified, suspended, or withdrawn if the Holder or any person operating under his authority fails to abide by the conditions prescribed herein or if the authorized taking is having more than a negligible impact on the species or stock of affected marine mammals.

Request for Public Comments

NMFS requests comment on our analysis, the draft authorization, and any other aspect of the Notice of Proposed IHA for the Navy's Civilian Port Defense training activities. Please include with your comments any supporting data or literature citations to help inform our final decision on the Navy's request for an MMPA authorization.

Dated: August 31, 2015.

Donna S. Wieting,

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

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