MARINE MAMMAL COMMISSION

13 November 2017

Naval Facilities Engineering Command, Pacific
HSTT EIS/OEIS Project Manager
258 Makalapa Drive, Suite 100
Pearl Harbor, HI 96860–3134

Dear Sir or Madam:

The Marine Mammal Commission (the Commission), in consultation with its Committee of Scientific Advisors on Marine Mammals, has reviewed the U.S. Navy's (the Navy) Draft Environmental Impact Statement/Overseas Environmental Impact Statement (DEIS) for training and research, development, test, and evaluation (testing) activities conducted within the Hawaii-Southern California Fleet Training and Testing (HSTT) study area (Phase III; 82 Fed. Reg. 47729). The DEIS addresses the impacts on marine mammals from conducting training and testing activities in the HSTT study area and is associated with the letter of authorization (LOA) application that the Navy submitted to the National Marine Fisheries Service (NMFS). The Navy previously analyzed the various impacts, first under the Tactical Training Theater Assessment and Planning DEISs (TAP I) and second under Phase II DEISs.

Background

The Navy's HSTT study area is in the Pacific Ocean and encompasses the waters along the coast of Southern California, around the Hawaiian Islands, and the associated transit corridor. The activities would involve the use of low-, mid-, high- and very high-frequency active sonar, weapons systems, explosive and non-explosive practice munitions and ordnance, high-explosive underwater detonations, expended materials, vibratory and impact hammers, airguns, electromagnetic devices, high-energy lasers, vessels, underwater vehicles, and aircraft. Under the No Action Alternative, the Navy would not conduct training or testing activities[1]. Alternative 1, the Preferred Alternative, includes a representative number of training and testing activities, and Alternative 2 includes the maximum number of training and testing activities. In addition to some time-area closures, mitigation measures would include visual monitoring[2] to implement delay and shut-down procedures.

Density estimates

The Commission had recommended in previous letters regarding Navy Phase II activities that the Navy incorporate more refined data in its extrapolated density estimates, primarily with

[1] The Commission appreciates that the Navy included this alternative consistent with DEISs for the Navy's Surveillance Towed Array Sensor System Low Frequency Active (SURTASS) sonar and the Commission's previous recommendations.
[2] Passive acoustic monitoring would be required only for sinking exercises, explosive sonobuoys, and explosive torpedoes.

4340 East-West Highway • Room 700 • Bethesda, MD 20814-4498 • T: 301.504.0087 • F: 301.504.0099
www.mmc.gov

regard to cetaceans in regions that have not been surveyed. For Phase III activities, the Navy used more refined density estimation methods for cetaceans and accounted for uncertainty in those densities and the group size estimates[3] that seeded its animat modeling. The Commission appreciates that the Navy incorporated those measures of uncertainty and expects that comparable methods will be used for the other Navy study areas. The Commission notes that 30 iterations or Monte Carlo simulations is low for general bootstrapping methods but understands that increasing the number of iterations in turn increases the computational time needed to run the models. Accordingly, the Commission suggests that, if the computation time is not overly burdensome, the Navy consider increasing the iterations from 30 to at least 200 for activities that have yet to be modeled for Phase III and for all activities in Phase IV.

The Commission still has concerns regarding the Navy's pinniped density estimates. Given that a single density was provided for the respective areas and pinnipeds were assumed to occur at sea as individual animals, uncertainty does not appear to have been incorporated in the Navy's animat modeling for pinnipeds. The Navy primarily used sightings or abundance data, assuming certain correction factors, divided by an area to estimate pinniped densities. Many, if not all, of the abundance estimates had associated measures of uncertainty (i.e., coefficients of variation (CV), standard deviation (SD), or standard error (SE)). Therefore, the Commission recommends that the Navy specify whether and how it incorporated uncertainty in the pinniped density estimates into its animat modeling and if it did not, use measures of uncertainty inherent in the abundance data (i.e., CV, SD, SE) similar to the methods used for cetaceans.

More specifically, the Commission has concerns regarding the various areas, abundance estimates, and correction factors that the Navy used for pinnipeds. In HSTT, the Navy used the following areas—

- for harbor seals and northern fur seals, the area was based on the NMFS Southern California (SoCal) stratum[4] for its vessel-based surveys (i.e., Barlow 2010);
- for elephant seals, California sea lions, and Guadalupe fur seals, the area was based on the Navy SoCal modeling area; and
- for monk seals, the area was based on the areas within the 200-m isobaths in both the Main and Northwest Hawaiian Islands (MHI and NWHI, respectively) and areas beyond the 200-m isobaths in the U.S. EEZ.

The only 'area' that is appropriate is that used for monk seals. Neither of the other two areas are based on the biology or ecology of the specific species. For example, the Navy indicated that, since harbor seals generally occur within 80 km of their haul-out sites, it applied the density estimates from the coast to 80-km offshore. It would have been more appropriate and logical for the Navy to take the approach it did for monk seals at HSTT and for harbor seals in the Northwest Training and Testing (NWTT) study area[5]—that is to use the area of occurrence to estimate the densities for harbor seals. For the other species, either the NMFS SoCal stratum or the Navy SoCal modeling

[3] Using means and standard deviations that varied based on a lognormal distribution for densities and either a Poisson or lognormal distribution for group sizes.
[4] Extending to the extent of the U.S. exclusive economic zone (EEZ), 370 km from the coast.
[5] The area was based on Calambokidis et al. (2004) reporting that seals occur within 40 km of the coastline for the offshore area.

area was used. However, none of the underlying abundance data are related to those areas, and it is unclear why two different areas were necessary. Both areas encompass approximately the same extent, with the Navy SoCal modeling area being approximately 13 percent larger than the NMFS SoCal stratum.

In addition, some of the abundances used were not based on best available science. The Navy noted that its monk seal abundance was less than that reported by Baker et al. (2016), but that those more recent data were not available when the Navy's modeling process began. Baker et al. (2016) data have been available for nearly a year and should have been incorporated accordingly, particularly since the data would yield greater densities[6] and the species is endangered. For harbor seals, the Navy assumed that 22 percent of the stock occurred in SoCal, citing Department of the Navy (2015). There are two concerns with this. First, one has to go to Department of the Navy (2015) to determine the original source of the information (Lowry et al. 2008) (see Commission's 20 February 2014 letter on this matter). Second, Lowry et al. (2008) indicated that 23.3 percent of the harbor seal population occurred in SoCal, not 22 percent[7] as used by the Navy.

For northern elephant seals in the California stock, the Navy assumed an annual growth rate of 1.7 percent for the last 10 years based on Lowry's (2002) field effort from 2001. Since it has been more than 15 years since those data were collected, the elephant seal abundance estimate for the California stock should have been based on 15 years of increasing trends. In addition, Lowry et al. (2014) indicated that the population was estimated to have grown 3.8 percent annually from 1988 to 2010. That growth rate is more applicable and should have been used. Further, it is unclear where the abundance estimate for elephant seals in Mexico originated. The Navy assumed that 68.5 percent of the seals[8] would occur in the SoCal range complex. There were between 31,000 and 60,000 elephant seals estimated to occur in the Mexican population (Lowry et al. 2014), which would yield 21,235 to 41,100 seals not 15,083 seals as proposed by the Navy. The elephant seal density for Mexico appears greatly underestimated based on the assumptions used. In turn, deciphering the appropriateness of the California sea lion abundance estimates is more difficult. The California population estimate was based on a personal communication and the Mexico population estimate was based on a Spanish-language document, which has not been translated. The use of both sources reduces transparency.

Further, the correction factors that were applied to the population estimates to account for seasonality are either unsubstantiated or incorrect. For Guadalupe fur seals, the references cited[9] refer to harbor seals and cetaceans, not Guadalupe fur seals. The references cited for seasonal correction factors for northern fur seals and northern elephant seals are applicable to the species, but none provided the seasonal at-sea correction factors. Thus, it is unclear what assumptions the Navy made and what the specific underlying data were for those correction factors. For California

[6] The 2015 abundance estimate is 19% greater than what the Navy used.
[7] Which was based on a single year of data, the lower of the two years (24.59 percent in 2002 and 21.98 percent in 2004) rather than the mean of both years.
[8] Based on 27 percent of the post-breeding and 9.5 percent of the post-molt migration for adult females and 15 percent of the post-breeding and 17 percent of the post-molt migration for adult males. It is unclear what justification the Navy has regarding movements of juveniles and pups.
[9] Barlow (2010) and Yochem et al. (1987).

sea lions, Lowry and Forney (2005) stipulated that 44[10] not 47 percent of the sea lions would be at sea during the cold season and 48[11] not 53 percent would be at sea during the warm season. Similarly for harbor seals, Yochem et al. (1987) indicated that 59[12] not 39 percent would be at sea during the warm season. However, Harvey and Goley (2011) used updated methods and provided more extensive data than Yochem et al. (1987). They found that harbor seals spend 35 percent[13] of the time hauled out and 65 percent in the water. The Navy indicated the cold season correction factor for harbor seals originated from Eguchi (2015), but that reference is about sea turtles. Eguchi and Harvey (2005) was noted in the harbor seal density section, but it did not include haul-out correction factors. Those authors provided dive data that are not comparable to haul-out correction factors[14]. It appears that the Navy, when it has haul-out correction factors, is using them incorrectly[15] or, when it doesn't, is using dive data inappropriately. Finally for monk seals, the issue of appropriate correction factors is related to the Navy's failure to use the best available science[16]. Baker et al. (2016) indicated that 63[17] not 61 percent would be at sea in the MHI and Harting et al. (2017) 69[18] not 61 percent would be at sea in the NWHI.

The Commission continues to believe that data regarding movements and dispersion of tagged pinnipeds could yield better approximations of densities than the methods the Navy currently uses. Furthermore, pinnipeds generally are found in greater densities closer to known haul-out sites and rookeries. This has not been addressed through the Navy's use of uniform densities. The Commission understands the difficulty of analyzing these data in time to be incorporated into the Navy's current estimates but that should not absolve the Navy from doing so in future analyses. Therefore, the Commission recommends that the Navy amend its pinniped density estimates[19] by—

(1) using the extent of the coastal range (e.g., from shore to 80 km offshore) of harbor seals as the applicable area, 23.3 percent of the California abundance estimate based on Lowry et al. (2008), and an at-sea correction factor of 65 percent based on Harvey and Goley (2011) for both seasons;
(2) using the 2015 monk seal abundance estimate from Baker et al. (2016) and an at-sea correction factor of 63 percent for the MHI based on Baker et al. (2016) and 69 percent for the NWHI based on Harting et al. (2017);
(3) using the same representative area for elephant seals, northern fur seals, Guadalupe fur seals, and California sea lions;

---

[10] Based on a haul-out correction factor of 1.77 for December 1998 data, 56 percent of the population would be hauled out and 44 percent would be in the water.
[11] Based on the average haul-out correction factor of 1.93 for May-June and September 1998 data and July 1999 data, 52 percent of the population would be hauled out and 48 percent would be in the water.
[12] Based on 41 percent hauled out each day, 59 percent would be in the water.
[13] Based on a haul-out correction factor of 2.86 for SoCal, 35 percent of the population would be hauled out and 65 percent would be in the water.
[14] Additionally, harbor seals do not exhibit such drastic at-sea differences between the warm and cold season as purported by the Navy (39 and 85.5 percent, respectively). Harbor seals haul out steadily throughout the year and leave their haul-out sites twice per day with the changing tides. They do not remain onshore throughout the breeding season or make extensive movements, as do otariids and other phocids.
[15] This has been discussed at length in previous Commission letters (see its 17 June 2017 letter).
[16] Wilson et al. was based on unpublished data at the time.
[17] Based on 37 percent of the population would be hauled out and 63 percent would be in the water.
[18] Based on 31 percent of the population would be hauled out and 69 percent would be in the water.
[19] Rather than remodeling, the take estimates could be scaled based on the revised density estimates.

(4) using an increasing trend of 3.8 percent annually for the last 15 years for elephant seals as part of the California population and at least 31,000 as representative of the Mexico population based on Lowry et al. (2014); and

(5) using an at-sea correction factor of 44 percent for the cold season and 48 percent for the warm season for California sea lions based on Lowry and Forney (2005).

In addition, the Commission recommends that the Navy (1) specify the assumptions made and the underlying data that were used for the at-sea correction factors for Guadalupe and northern fur seals and (2) for all future DEISs, consult with experts in academia and at the NMFS Science Centers to develop more refined pinniped density estimates that account for pinniped movements[20], distribution, at-sea correction factors, and density gradients associated with proximity to haul-out sites or rookeries.

Probability of strike

The Navy estimated the probabilities of expended munitions and non-explosive materials (e.g., missiles, bombs, other projectiles, sonobuoys, anchors, etc.) striking a marine mammal based on simple probability calculations (Appendix F of its DEIS). In doing so, the Navy compared the aggregated footprint of a subset of marine mammal species[21] with the footprint of all objects that might strike them. Both were based only on densities of marine mammals in the action area and the expected amount of materials to be expended within a year in those areas. That method, as the Commission had commented on for the Navy's Phase II DEISs, is coarse and unrealistic.

To provide a more realistic estimate of possible takes from munitions and other expended materials, the Navy should incorporate spatial and temporal considerations in its calculations. For example, the Navy's model for determining takes of marine mammals from sound-producing activities accounts for the movement of sound sources and marine mammals[22]. Using that model to estimate the probability of strike, the Navy could change the data collected by the animat dosimeters from a received sound level to a close approach distance, which would result in more realistic strike probabilities. The probability of direct strike is invariably quite low. However, if the Navy intends to estimate the numbers of marine mammals that could be struck by a munition or other expended material, it should do so using the best available method. Therefore, the Commission again recommends that the Navy use its spatially and temporally dynamic simulation models (e.g., randomly-generated munition trajectories and animat simulations) rather than simple probability calculations to estimate strike probabilities and numbers of takes from expended munitions and non-explosive materials.

Criteria and thresholds

As stated in letters related to "NMFS's Technical guidance for assessing the effects of anthropogenic sound on marine mammal hearing: Underwater acoustic thresholds for onset of permanent and temporary threshold shifts" (PTS and TTS, respectively; NMFS 2016), the Commission supports the weighting functions and associated thresholds as stipulated in Finneran

[20] Including using telemetry data and Markov process methods to estimate habitat-use probability densities.
[21] Seven marine mammal species (or populations or distinct population segments) from Hawaii and eight from Southern California.
[22] Sources move horizontally in the virtual space, while marine mammals move vertically.

(2016), which are the same as those used for Navy Phase III activities (Department of the Navy 2017a). Multiple recent studies provide additional information on behavioral audiograms (Branstetter et al. 2017, Kastelein et al. 2017b) and TTS (Kastelein et al. 2017a, 2017c). The Commission appreciates that developing weighting functions and associated thresholds is an extensive process[23] and that the Navy cannot amend them with each new published dataset. However, the Navy should discuss whether those new data corroborate the current weighting functions and associated thresholds.

To further define its behavior thresholds for non-impulsive sources[24], the Navy developed multiple[25] Bayesian biphasic dose response functions[26] (Bayesian BRFs) for Phase III activities. The Bayesian BRFs were a generalization of the monophasic functions previously developed[27] and applied to behavioral response data[28] (see Department of the Navy 2017a for specifics). The biphasic portions of the functions are intended to describe both level- and context-based responses as proposed in Ellison et al. (2011). At higher amplitudes, a level-based response relates the received sound level to the probability of a behavioral response; whereas, at lower amplitudes, sound can cue the presence, proximity, and approach of a sound source and stimulate a context-based response based on factors other than received sound level[29]. The Bayesian BRFs are reasonable and a much needed improvement on the Navy's two dose response functions (BRFs)[30] that it had used both for TAP I and Phase II activities.

However, the Navy then decided to implement various cut-off distances beyond which it considered the potential for significant behavioral responses to be unlikely (Table C.4 in Department of the Navy 2017a). The Navy indicated it was likely that the context of the exposure is more important than the amplitude at large distances[31]—that is, the context-based response dominates the level-based response. The Commission agrees and notes that, although an important contextual factor is the distance between the animal and the sound source, those factors already have been included in the Bayesian BRFs. Including additional cut-off distances contradicts the data underlying those functions and negates the intent of the functions themselves. The actual cut-off distances used by the Navy also appear to be unsubstantiated. For example, the Navy indicated there are limited data on pinniped behavioral responses in general, and a total lack of data beyond 3 km from the source. However, the Navy arbitrarily set the cut-off distance at 5 and 10 km depending on the source.

---

[23] More so then amending point density estimates.
[24] Acoustic sources (i.e., sonars and other transducers).
[25] For odontocetes, mysticetes, beaked whales, and pinnipeds. The Navy used the 120-dB re 1 μPa unweighted, step-function threshold for harbor porpoises as it had done for Phase II activities.
[26] Comprising two truncated cumulative normal distribution functions with separate mean and standard deviation values, as well as upper and lower bounds. The model was fitted to data using the Markov Chain Monte Carlo algorithm.
[27] By Antunes et al. (2014) and Miller et al. (2014).
[28] From both wild and captive animals.
[29] e.g., the animal's previous experience, separation distance between sound source and animal, and behavioral state including feeding, traveling, etc.
[30] One for odontocetes and pinnipeds and one for mysticetes.
[31] For example, the Navy indicated that the range to the basement level of 120 dB re 1 μPa for the BRFs from TAP I and Phase II sometimes extended to more than 150 km during activities involving the most powerful sonar sources (e.g., AN/SQS-53).

More concerning is the fact that, depending on the activity and species, the cut-off distances could effectively eliminate a large portion of the estimated numbers of takes. For sonar bin MF1 (the most powerful mid-frequency active sonars), the estimated numbers of takes would be reduced to zero for odontocetes beginning where the probability of response is 40 percent, for pinnipeds where the probability of response is 27 percent, and for beaked whales where the probability of response is 28 percent (Table 3.7-11 in the DEIS). A 40-percent probability of response is quite high to be assuming that all instances of take are negligible. On a related note, takes for mysticetes would be eliminated for MF1 sources at a received level of 154 dB re 1 μPa equating to a probability of response of 17 percent. That percentage may seem inconsequential but that received level is greater than the level at which actual context-based behavioral responses were observed for feeding blue whales (see Figure 3 in Goldbogen et al. 2013[32]). For all of these reasons, the Commission recommends that the Navy refrain from using cut-off distances in conjunction with the Bayesian BRFs and re-estimate the numbers of marine mammal takes based solely on the Bayesian BRFs. Use of cut-off distances could be perceived as an attempt to reduce the numbers of takes, which is discussed in a subsequent section of this letter.

For behavior thresholds for explosives, the Navy assumed a threshold 5 dB less than the TTS thresholds for each functional hearing group. That value was derived from observed onset behavioral responses by captive bottlenose dolphins during non-impulsive TTS testing[33] (Schlundt et al. 2000). The justification for that threshold itself is questionable but more concerning is the fact that the Navy continues to believe that marine mammals do not exhibit behavioral responses to single detonations (Department of the Navy 2017a)[34]. The Navy has asserted that the most likely behavioral response would be a brief alerting or orienting response and significant behavioral reactions would not be expected to occur if there were no further detonations following the initial detonation. Although there are no data to substantiate that assumption, the Navy notes that the same reasoning was used in previous ship shock trial final rules in 1998, 2001, and 2008. Without such data, there is no reason to continue to ascribe validity to assumptions made 10 to 20 years ago. Larger single detonations (such as mines or bombs[35]) would be expected to elicit 'significant behavioral responses'[36] as described in Department of the Navy (2017a) and used by the Navy to differentiate behavioral response severity. The Navy provided no justification for why it believes that an animal would exhibit a significant behavioral response to two 5-lb charges detonated within a few minutes of each other but would not exhibit a similar response for a single detonation of 50 lbs, let alone detonations of up to 2,000 lbs. Therefore, the Commission recommends that the Navy include behavior takes of marine mammals during *all* explosive activities, including those that involve single detonations.

Further on the topic of explosive thresholds, the Commission notes that the constants and exponents[37] for the impulse metrics regarding both onset mortality and onset slight lung injury for

---

[32] Data that were used to derive the Bayesian BRFs.
[33] Based on 1-sec tones.
[34] Including certain gunnery exercises that have several detonations of small munitions occurring within a few seconds.
[35] With net explosive weights of 500 to 650 lbs and 650 to 1,000 lbs (Bins E11:650-lb mine and E12:2,000-lb bomb, respectively).
[36] Including the animals (1) altering their migration path, speed and heading, diving behavior; (2) stopping or altering feeding, breeding, nursing, resting, or vocalization behavior; (3) avoiding the area near the source; or (4) displaying aggression or annoyance (e.g., tail slapping).
[37] The constants have increased and the exponents have decreased from 1/2 to 1/6.

Phase III activities have been amended from those used in TAP I and Phase II activities. The Navy did not indicate why the constants and exponents have changed while the underlying data[38] remain the same. The modifications yield smaller zones[39] in some instances and larger zones in other instances[40]. These results are counterintuitive since the Navy presumably amended the impulse metrics to account for lung compression with depth, thus the zones would be expected to be smaller rather than larger the deeper the animal dives. The Commission recommends that the Navy (1) explain why the constants and exponents for onset mortality and onset slight lung injury thresholds[41] for Phase III have been amended, (2) ensure that the modified equations are correct, and (3) specify whether any additional assumptions were made.

More importantly, the Navy only used the onset mortality and onset slight lung injury criteria to determine the range to effects[42], while it used the 50 percent mortality and 50 percent slight lung injury criteria to estimate the numbers of marine mammal takes[43]. That approach is inconsistent with the manner in which the Navy estimated the numbers of takes for PTS, TTS, and behavior for explosive activities. All of those takes have been and continue to be based on onset, not 50-percent values.

Although the effectiveness of the Navy's mitigation measures[44] has yet to be determined, the circumstances of the deaths of multiple common dolphins during one of the Navy's underwater detonation events within the HSTT study area in March 2011 (Danil and St. Leger 2011) indicate that the Navy's mitigation measures are not fully effective, especially for explosive activities. It would be more prudent for the Navy to estimate injuries and mortalities based on onset rather than a 50-percent incidence of occurrence. The Navy did indicate that it is reasonable to assume for impact analysis—thus its take estimation process—that extensive lung hemorrhage[45] is a level of injury that would result in wild animal mortality (Department of the Navy 2017a). Thus, it is unclear why the Navy did not follow through with that premise. The Commission recommends that the Navy use onset mortality, onset slight lung injury, and onset GI tract injury thresholds to estimate both the numbers of marine mammal takes *and* the respective ranges to effect.

Mitigation measures

The Navy's proposed mitigation zones are similar to the zones[46] previously used during Phase II activities and are intended, based on the Phase III DEIS, to avoid the potential for marine mammals to be exposed to levels of sound that could result in injury (i.e., PTS). However, the Phase III proposed mitigation zones would not protect various functional hearing groups[47] from PTS. For

---

[38] Based on Richmond et al. (1973), Yelverton et al. (1973), Yelverton and Richmond (1981), and Goertner (1982).
[39] When animals occur at a depth between the surface and 8 m, yielding greater absolute thresholds.
[40] When animals occur at depths deeper than 8 m, yielding lower absolute thresholds.
[41] Equations 11 and 12 in Department of the Navy (2017a).
[42] To inform the mitigation zones.
[43] A similar approach was taken for gastrointestinal (GI) tract injuries.
[44] Which is discussed further herein.
[45] i.e., onset mortality; see Table 4-1 in Department of the Navy (2017a).
[46] The Commission appreciates that the Navy has provided the estimated mean, minimum, and maximum distances for all impact criteria (i.e., behavior, TTS, PTS, onset slight lung injury, onset slight gastrointestinal injury, and onset mortality) for the various proposed activity types and for all functional hearing groups of marine mammals. That approach is consistent with the Commission's recommendations on Phase II activities.
[47] Primarily high- and low-frequency cetaceans (HF and LF, respectively) and phocids (PW).

example, the mitigation zone for an explosive sonobuoy is 549 m but the mean PTS zones range from 2,466–3,682 m for HF[48]. Similarly, the mitigation zone for an explosive torpedo is 1,920 m but the mean PTS zones range from 7,635–10,062 m for HF, 1,969–4,315 m for LF, and 3,053–3,311 for PW[49]. The appropriateness of such zones is further complicated by platforms firing munitions (e.g., for missiles and rockets) at targets that are 28 to 139 km away from the firing platform. An aircraft would clear the target area well before it positions itself at the launch location and launches the missile or rocket. Ships, on the other hand, do not clear the target area before launching the missile or rocket. In either case, marine mammals could be present in the target area at the time of the launch unbeknownst to the Navy.

In addition, the Navy indicated that lookouts would not be 100 percent effective at detecting all species of marine mammals for every activity because of the inherent limitations of observing marine species and because the likelihood of sighting individual animals is largely dependent on observation conditions (e.g., time of day, sea state, mitigation zone size, observation platform). The Commission agrees and has made numerous recommendations to the Navy in previous letters related to the effectiveness of visual monitoring. Since 2010, the Navy has been collaborating with researchers at the University of St. Andrews to study Navy lookout effectiveness. The Navy does not appear to have mentioned that study in its DEIS for Phase III. For its Phase II DEISs, the Navy noted that data that had been collected cannot be analyzed in a statistically significant manner. The Commission understands that point but continues to consider the basic information provided by the studies to be useful[50]. In one instance, the marine mammal observers (MMOs) sighted at least three marine mammals at distances of less than 914 m (i.e., within the mitigation zone for mid-frequency active sonar for cetaceans), which were not sighted by Navy lookouts (Department of the Navy 2012). In other instances, MMOs sighted a group of approximately three dolphins at a distance of 732 m (Department of the Navy 2014a), a group of approximately 20 dolphins at a distance of 759 m (Department of the Navy 2014c), a group of approximately 9 pilot whales at a distance of 383 m (Department of the Navy 2014b), and a small unidentified marine mammal at 733 m (Department of the Navy 2014b)—none of which were documented as having been sighted by the Navy lookouts. Further, MMOs have reported marine mammal sightings not observed by Navy lookouts to the Officer of the Deck, presumably to implement mitigation measures (Department of the Navy 2010). Neither the details regarding those reports nor the raw sightings data were provided to confirm this.

The Commission is not aware of any additional data that have been made available since 2014 but understands that any data that have been collected since then would not be sufficient to conduct a statistical analysis. The Commission recognizes that the study will be very informative once completed but notes that in the interim, the preliminary data do provide an adequate basis for taking a precautionary approach. Accordingly, the Commission continues to believe that rather than simply reducing the size of the zones it plans to monitor, the Navy should supplement its visual monitoring efforts with other monitoring measures. The Navy did propose to supplement visual monitoring with passive acoustic monitoring during three explosive activity types but not during the remaining explosive activities or during low-, mid- and high-frequency active sonar activities. The

[48] The maximum range extends to 7,025 m for HF (Table 9-44) based on varying propagation environments as presented in Navy (2017b).
[49] The maximum ranges extend to 31,025 m for HF (Table 9-44), 8,025 m for LF (Table 9-45), and 8,275 m for PW (Table 9-52) based on varying propagation environments as presented in Department of the Navy (2017b).
[50] The Commission notes that the Navy has been collecting data for nearly 10 years. The Navy should make it a priority to collect sufficient data in the near-term to fulfill this project.

Navy uses visual, passive acoustic, and active acoustic monitoring (via HF/M3) during SURTASS LFA sonar activities to augment its mitigation efforts over large areas. The Navy indicated in its Phase III DEIS that it is not able to use HF/M3 during training and testing activities due to limitations regarding space, personnel, and the resources needed to design, build, install, and maintain the devices.

The Navy also stated that it did not have sufficient resources to construct and maintain additional passive acoustic monitoring systems or platforms for each training and testing activity. The Commission points out that sonobuoys, which are deployed and utilized during many of the Navy's activities, could be deployed and utilized without having to construct or maintain additional systems. Specifically, sonobuoys could be deployed with the target prior to an activity to better determine whether the target area is clear and remains clear until the munition is launched. This is just one example of surmounting the stated difficulties. The Navy went on to indicate that passive acoustic detections would not provide range or bearing to detected animals and therefore cannot be used to determine an animal's location or confirm its presence in a mitigation zone. The Commission understands that the Navy's supposition is not the case.

In the DEIS, the Navy indicated that it had capabilities to monitor instrumented ranges in real time or through data recorded by hydrophones at both the Southern California Offshore Range and the Pacific Missile Range Facility (PMRF) off Kauai, both of which are within the HSTT study area. The Commission also understands that the Navy is quite adept at detecting, classifying, and localizing individual marine mammals on PMRF[51]. For example, Helble et al. (2015) were able to track multiple animals on PMRF hydrophones in real time, including humpback whales, a species that can be problematic to localize. Multiple animals were localized simultaneously with a localization error rate of 2 percent or less. Similar methods can be used for other species. Baird et al. (2015) also indicated that the PMRF hydrophones allow the PAM analyst to isolate animal vocalizations on the range, confirm species classification, and localize groups of animals in real time. Multiple detectors can be used for sperm whales, delphinids, beaked whales, and baleen whales. Similar to Helble et al. (2015), Baird et al. (2015) indicated that localization algorithms could determine an animal's position. In the case of bottlenose dolphins, that location was within approximately 100 m of the vocalizing animal. Similar localizations have been used to direct researchers to groups of vocalizing odonotocetes to deploy satellite-linked tags as well (Baird et al. 2014).

Although the Navy indicated that it was continuing to improve its capabilities for using range instrumentation to aid in the passive acoustic detection of marine mammals, it also stated that it didn't have the capability or resources to monitor instrumented ranges in real time for the purpose of mitigation. That capability clearly exists. While available resources could be a limiting factor, the Commission notes that personnel who monitor the hydrophones on the operational side do have the ability to monitor for marine mammals as well[52]. The Commission has supported the use of the instrumented ranges to fulfill mitigation implementation for quite some time (see the Commission's

[51] Via the Marine Mammal Monitoring on Navy Ranges (M3R) program.
[52] For example, the engineer monitoring the hydrophones during a U.S. Air Force (USAF) activity at PMRF also listened for any signs of marine mammal life post [aerial clearance] survey and leading up to weapon impact (USAF 2016).

most recent 16 May 2017 letter) and contends that localizing certain species (or genera) provides more effective mitigation than localizing none at all.

Given that the effectiveness of Navy lookouts conducting visual monitoring has yet to be determined, the Commission believes that passive or active acoustic monitoring should be used to supplement visual monitoring, especially for activities that could injure or kill marine mammals. Therefore, the Commission again recommends that NMFS require the Navy to use passive and active acoustic monitoring, whenever practicable, to supplement visual monitoring during the implementation of its mitigation measures for all activities that could cause injury or mortality beyond those explosive activities for which passive acoustic monitoring already was proposed.

Level A harassment and mortality takes

The Navy used various post-model analyses to estimate the numbers of marine mammal takes during acoustic and explosive activities that are similar to methods used in its Phase II DEISs. Those analyses effectively reduced the model-estimated numbers of Level A harassment (i.e., PTS and injury) and mortality takes. The analyses were based on (1) animal avoidance, (2) mitigation effectiveness, and (3) cut-off distances. The Commission has discussed the first two aspects at length in letters written for Phase II activities. That information is not repeated herein but should be reviewed in conjunction with this letter (see the Commission's most recent 15 September 2014 letter). The Commission has a few additional comments on those analyses.

For avoidance, the Navy assumed that animals present beyond the range to onset PTS for the first three to four pings would avoid any additional exposures at levels that could cause PTS. That equated to approximately 5 percent of the total pings or 5 percent of the overall time active; therefore, 95 percent of marine mammals predicted to experience PTS due to sonar and other transducers were instead assumed to experience TTS. The Navy should have been able to query the dosimeters of the animats to verify whether its 5-percent assumption was valid, but on its face that assumption has no scientific basis. Given that sound sources are moving, it may not be until later in an exercise that the animal is close enough to experience PTS and it is those few close pings that contribute to the potential to experience PTS. Since both sources and animals are moving during an exercise, whether an animal is initially beyond the PTS zone has no bearing on whether it will later come within close range. In addition, Navy vessels may move faster than the speed animals are capable of moving to evacuate the area.

Regarding mitigation effectiveness, the Commission notes that the specific mitigation effectiveness scores for the various activities were provided for the Phase II activities. The Navy included more detail regarding how the scores were determined (including species sightability, observation area extent, visibility factors, and whether sound sources were under positive control) but did not specify what the actual scores were for those four factors or the mitigation scores as a whole. In addition, the Navy apparently did not include model-estimated numbers of takes. That lack of information makes it difficult for the Commission and the public to assess the appropriateness of the mitigation scores or their effect on the overall numbers of marine mammal takes. Most importantly, however, the Navy has yet to determine the effectiveness of its mitigation measures, and it is premature to include any related assumptions to reduce the numbers of marine mammal takes.

Although the flaws of the cut-off distances were articulated in a previous section of this letter, it seems apparent that the post-analyses as a whole would underestimate the numbers of Level A and B harassment and mortality takes given the lack of a scientific basis for those reductions. Therefore, the Commission again recommends that the Navy (1) provide the total numbers of model-estimated Level A harassment (PTS and slight lung and GI injuries) and mortality takes rather than reduce the estimated numbers of takes based on the Navy's post-model analyses and (2) include the model-estimated Level A harassment and mortality takes in its LOA application to inform NMFS's negligible impact determination analyses.

Pile-driving activities

The Navy did not stipulate whether it estimated the numbers of marine mammal takes during pile-driving activities using the Navy Acoustic Effects Model (NAEMO) or NMFS's user spreadsheet. However, based on the estimated extents of the PTS zones[53], the Navy does not appear to have used NMFS's user spreadsheet. That tool would yield PTS zones[54] that range from 55 to 1,343 m for the various functional hearing groups. In addition, the PTS and TTS zones for LF and HF are estimated to be the same (Table 3.7-53 in the DEIS). Neither NAEMO (based on results for the other broadband sources) nor NMFS's user spreadsheet would yield the exact same ranges for LF and HF. That same trend does not exist for vibratory pile driving[55]. Therefore, the Commission recommends that the Navy (1) specify what modeling method and underlying assumptions were used to estimate the PTS and TTS zones for pile-driving activities and (2) clarify why those zones were estimated to be the same for LF and HF during impact pile driving.

Most, if not all, of the Commission's recommendations would apply to the Navy's LOA application as well, and should be considered as such. Please contact me if you have questions concerning the Commission's recommendations or rationale.

Sincerely,

Rebecca J. Lent

Rebecca J. Lent, Ph.D.,
Executive Director

cc: Jolie Harrison, NMFS

References

Antunes, R., P.H. Kvadsheim, F.P. Lam, P.L. Tyack, L. Thomas, P.J. Wensveen, and P.J. Miller. 2014. High thresholds for avoidance of sonar by free-ranging long-finned pilot whales (*Globicephala melas*). Marine Pollution Bulletin 83(1):165–180.

---

[53] Ranging from 2 to 65 m for the various functional hearing groups during impact pile-driving.
[54] Assuming six piles would be driven per day with 35 strikes per minute for a total of 15 minutes per pile, a source level of 182 dB re 1 μPa^2-sec, and transmission loss of 16.5 (Sections 3.0.3.3.1.3 and 3.7.3.1.4 of the DEIS).
[55] HF zones are much greater than LF for both PTS (7 vs 0 m, respectively) and TTS (3 vs 116 m, respectively) as depicted in Table 3.7-54.

Baird, R.W., S.W. Martin, D.L. Webster, and B.L. Southall. 2014. Assessment of modeled received sound pressure levels and movements of satellite-tagged odontocetes exposed to mid-frequency active sonar at the Pacific Missile Range Facility: February 2011 through February 2013. Prepared for U.S. Pacific Fleet. 26 pages.

Baird, R.W., A.N. Dilley, D.L. Webster, R. Morrissey, B.K. Rone, S.M. Jarvis, S.D. Mahaffy, A.M. Gorgone, and D.J. Moretti. 2015. Odontocete studies on the Pacific Missile Range Facility in February 2014: Satellite-tagging, photo-identification, and passive acoustic monitoring. Prepared for Commander, U.S. Pacific Fleet. 44 pages.

Baker, J.D., A.L. Harting, T.C. Johanos, and C.L. Littnan. 2016) Estimating Hawaiian monk seal range-wide abundance and associated uncertainty. Endangered Species Research 31:317–324.

Barlow, J. 2010. Cetacean abundance in the California Current estimated from a 2008 ship-based line-transect survey. NOAA Technical Memorandum NMFS-SWFSC-456. Southwest Fisheries Science Center, La Jolla, California. 24 pages.

Branstetter, B.K., J. St. Leger, D. Acton, J. Stewart, D. Houser, J.J. Finneran, and K. Jenkins. 2017. Killer whale (*Orcinus orca*) behavioral audiograms. The Journal of the Acoustical Society of America 141:2387–2398. http://dx.doi.org/10.1121/1.4979116.

Calambokidis, J., G.H. Steiger, D.K. Ellifrit, B.L. Troutman, and C.E. Bowlby. 2004. Distribution and abundance of humpback whales (*Megaptera novaeangliae*) and other marine mammals off the northern Washington coast. Fishery Bulletin 102:563–580.

Danil, K., and J.A. St. Ledger. 2011. Seabird and dolphin mortality associated with underwater detonation exercises. Marine Technology Society Journal 45(6):63–87.

Department of the Navy. 2010. Appendix C–Cruise report, marine species monitoring and lookout effectiveness study: Submarine Commanders Course, February 2010, Hawaii Range Complex. *in* Marine mammal monitoring for the U.S. Navy's Hawaii Range Complex and Southern California Range Complex Annual Report 2010. Department of the Navy, U.S. Pacific Fleet. 31 pages.

Department of the Navy. 2012. Cruise report, marine species monitoring and lookout effectiveness study: Koa Kai, November 2011, Hawaii Range Complex. *in* Marine species monitoring for the U.S. Navy's Hawaii Range Complex 2012 Annual Report. Department of the Navy, U.S. Pacific Fleet, Honolulu, Hawaii. 12 pages.

Department of the Navy. 2014a. Final cruise report, marine species monitoring and lookout effectiveness study: Koa Kai, January 2014, Hawaii Range Complex. Department of the Navy, U.S. Pacific Fleet, Honolulu, Hawaii. 29 pages.

Department of the Navy. 2014b. Final cruise report, marine species monitoring and lookout effectiveness study: Submarine Commanders Course, August 2013, Hawaii Range Complex. Department of the Navy, U.S. Pacific Fleet, Honolulu, Hawaii. 18 pages.

Department of the Navy. 2014c. Final cruise report, marine species monitoring and lookout effectiveness study: Submarine Commanders Course, February 2014, Hawaii Range Complex. Department of the Navy, U.S. Pacific Fleet, Honolulu, Hawaii. 12 pages.

Department of the Navy. 2015. Pacific Navy Marine Species Density Database: Revised Final Northwest Training and Testing Technical Report. Naval Facilities Engineering Command Pacific, Pearl Harbor, Hawaii. 488 pages.

Department of the Navy. 2017a. Technical report: Criteria and thresholds for U.S. Navy acoustic and explosive effects analysis (Phase III). SSC Pacific, San Diego, California. 194 pages.

Department of the Navy. 2017b. Quantifying acoustic impacts on marine mammals and sea turtles: Methods and analytical approach for Phase III Training and Testing. Space and Naval

Warfare Systems Center Pacific, San Diego and Naval Undersea Warfare Center, Newport. 91 pages.

Eguchi, T. 2015. SOCAL sea turtle abundance. Personal communication between Tomoharu Eguchi (NMFS SWFSC) and Mike Zickel (ManTech) via email.

Eguchi, T., and J.T. Harvey. 2005. Diving behavior of the Pacific harbor seal (*Phoca vitulina richardii*) in Monterey Bay, California. Marine Mammal Science 21(2):283–295.

Ellison, W.T., B.L. Southall, C.W. Clark, and A.S. Frankel. 2011. A new context-based approach to assess marine mammal behavioral responses to anthropogenic sounds. Conservation Biology 26(1):21–28.

Finneran, J.J. 2016. Auditory weighting functions and TTS/PTS exposure functions for cetaceans and marine carnivores. May 2016. SSC Pacific, San Diego, California. 73 pages.

Goertner, J.F. 1982. Prediction of underwater explosion safe ranges for sea mammals. Naval Surface Weapons Center, Dahlgren, Virginia. 31 pages.

Goldbogen, J.A., B.L. Southall, S.L. DeRuiter, J. Calambokidis, A.S. Friedlaender, E.L. Hazen, E.A. Falcone, G.S. Schorr, A. Douglas, D.J. Moretti, C. Kyburg, M.F. McKenna, and P.L. Tyack. 2013. Blue whales respond to simulated mid-frequency military sonar. Proceedings of the Royal Society B 280(1765):20130657.

Harting, A.L., J.D. Baker, and T.C. Johanos. 2017. Estimating population size for Hawaiian monk seals using haulout data. Journal of Wildlife Management 81:1202-1209.

Harvey, J.T., and D. Goley. 2011. Determining a correction factor for aerial surveys of harbor seals in California. Marine Mammal Science 27(4):719–735.

Helble, T.A., G.R. Ierley, G.L. D'Spain, and S.W. Martin. 2015. Automated acoustic localization and call associations for vocalizing humpback whales on the Navy's Pacific Missile Range Facility. Journal of the Acoustic Society of America 137:11–21.

Lowry, M.S. 2002. Counts of northern elephant seals at rookeries in the Southern California Bight: 1981–2001.NOAA Technical Memorandum NMFS-SWFSC-345. Southwest Fisheries Science Center, La Jolla, California. 68 pages.

Lowry, M.S., and K. A. Forney. 2005. Abundance and distribution of California sea lions (*Zalophus californianus*) in central and northern California during 1998 and summer 1999. Fishery Bulletin 103(2):331–343.

Lowry, M.S., J.V. Carretta, and K.A. Forney. 2008. Pacific harbor seal census in California during May–July 2002 and 2004. California Fish and Game 94(4):180–193.

Lowry, M.S., R. Condit, B. Hatfield, S.G. Allen, R. Berger, P.A. Morris, B.J. Le Boeuf, and J. Reiter. 2014. Abundance, distribution, and population growth of the northern elephant seal (*Mirounga angustirostris*) in the United States from 1991 to 2010. Aquatic Mammals 40(1):20–31.

Kastelein, R.A., L. Helder-Hoek, and S. Van de Voorde. 2017a. Effects of exposure to sonar playback sounds (3.5–4.1 kHz) on harbor porpoise (*Phocoena phocoena*) hearing. The Journal of the Acoustical Society of America 142(4):1965–1975. https://doi.org/10.1121/1.5005613.

Kastelein, R.A., L. Helder-Hoek, and S. Van de Voorde. 2017b. Hearing thresholds of a male and a female harbor porpoise (*Phocoena phocoena*). The Journal of the Acoustical Society of America 142(2):1006–1010. http://dx.doi.org/10.1121/1.4997907.

Kastelein, R.A., L. Helder-Hoek, S. Van de Voorde, A.M. von Benda-Beckmann, F.-P. A. Lam, E. Jansen, C.A.F. de Jong, and M.A. Ainslie. 2017c. Temporary hearing threshold shift in a harbor porpoise (*Phocoena phocoena*) after exposure to multiple airgun sounds. The Journal of the Acoustical Society of America 142(4):2430–2442. https://doi.org/10.1121/1.5007720.

Miller, P.J., R.N. Antunes, P.J. Wensveen, F.I. Samarra, A.C. Alves, P.L. Tyack, P.H. Kvadsheim, L. Kleivane, F.P. Lam, M.A. Ainslie, and L. Thomas. 2014. Dose-response relationships for the onset of avoidance of sonar by free-ranging killer whales. The Journal of Acoustical Society of America 135(2):975–993.

NMFS. 2016. Technical guidance for assessing the effects of anthropogenic sound on marine mammal hearing: Underwater acoustic thresholds for onset of permanent and temporary threshold shifts. Office of Protected Resources, NMFS, Silver Spring, Maryland. NOAA Technical Memorandum NMFS-OPR-55. 178 pages.

Richmond, D.R., J.T. Yelverton, and E.R. Fletcher. 1973. Far-field underwater-blast injuries produced by small charges. Lovelace Foundation for Medical Education and Research, Defense Nuclear Agency, Washington DC. 95 pages.

Schlundt, C.E., J.J. Finneran, D.A. Carder, and S.H. Ridgway. 2000. Temporary shift in masked hearing thresholds of bottlenose dolphins, *Tursiops truncatus*, and white whales, *Delphinapterus leucas*, after exposure to intense tones. The Journal of Acoustical Society of America 107(6):3496–3508.

USAF. 2016. Protected species monitoring and mitigation results for 2016 Long Range Strike Weapon System Evaluation Program operational testing: Pacific Missile Range Facility, Kaua'i, HI. Department of the Air Force, Eglin Air Force Base, Florida. 8 pages.

Yelverton, J.T., and D.R. Richmond. 1981. Underwater explosion damage risk criteria for fish, birds, and mammals. Paper presented at the 102nd Meeting of the Acoustical Society of America, Miami Beach, Florida. 35 pages.

Yelverton, J.T., D.R. Richmond, E.R. Fletcher, and R.K. Jones. 1973. Safe distances from underwater explosions for mammals and birds. Lovelace Foundation for Medical Education and Research, Albuquerque, New Mexico. 64 pages.

Yochem, P.K., B.S. Stewart, R.L. DeLong, and D.P. DeMaster. 1987. Diel haul-out patterns and site fidelity of harbor seals (*Phoca vitulina richardsi*) on San Miguel Island, California, in autumn. Marine Mammal Science 3(4):323–332.