MARINE MAMMAL COMMISSION

5 November 2012

Mr. P. Michael Payne, Chief
Permits and Conservation Division
Office of Protected Resources
National Marine Fisheries Service
1315 East-West Highway
Silver Spring, MD 20910-3225

Dear Mr. Payne:

The Marine Mammal Commission, in consultation with its Committee of Scientific Advisors on Marine Mammals, has reviewed the National Marine Fisheries Service's 4 October 2012 notice (77 Fed. Reg. 60679) and the application submitted by the U.S. Department of the Navy seeking issuance of regulations under section 101(a)(5)(A) of the Marine Mammal Protection Act. The regulations would authorize the taking of marine mammals incidental training and research, development, test, and evaluation activities conducted from January 2014 to January 2019 within the Atlantic Fleet Training and Testing study area. The Commission has commented on previously proposed regulations for similar activities and, most recently, the Navy's Draft Environmental Impact Statement/Overseas Environmental Impact Statement (DEIS) regarding the proposed activities (see the enclosed 10 July 2012 letter).

RECOMMENDATIONS

The Marine Mammal Commission recommends that, prior to publishing proposed regulations, the National Marine Fisheries Service—

- require the Navy to adjust all acoustic and explosive thresholds for low-, mid-, and high-frequency cetaceans by the appropriate amplitude factor (e.g., 16.5 or 19.4 dB), if it intends to use the type II weighting functions as depicted in Figure 6 of Finneran and Jenkins (2012);
- require the Navy to explain why data from Kastak et al. (2005) were used as the basis for explosive thresholds in pinnipeds and, more importantly, to specify the extrapolation process and factors used as the basis for associated temporary threshold shift (TTS) thresholds;
- require the Navy to provide detailed information regarding how it determined marine mammal takes that occur when multiple types of sound-producing sources (i.e., acoustic, explosive, and non-explosive impulsive) of varying frequencies (i.e., low, mid, and high) are used simultaneously;
- require the Navy to use its spatially and temporally dynamic simulation models to estimate strike probabilities for specific activities (i.e., movements of vessels, torpedo, unmanned underwater vehicles and expended munitions, ordnance, and other devices);
- require the Navy to provide the predicted average and maximum ranges for all criteria (i.e., behavioral response, TTS, permanent threshold shift (PTS), onset slight lung injury, onset

slight gastrointestinal injury, and onset mortality), all activities (i.e., based on the activity category and representative source bins), and all functional hearing groups of marine mammals;

- require the Navy to use passive and active acoustics to supplement visual monitoring during the implementation of its mitigation measures for all activities that introduce sufficient levels of sound into the marine environment;
- require the Navy to cease the use of its sound sources and not reinitiate them for (1) at least 15 minutes if a small odontocete or pinniped enters the mitigation zone and is not observed to leave that zone and (2) relevant time periods based on the maximum dive times of mysticetes or large odontocetes if they enter the mitigation zone and are not observed to have left that zone;
- require the Navy to adjust the size of the mitigation zone for mine neutralization events using the average swim speed of the fastest swimming marine mammal occurring in the area where time-delay firing devices would be used to detonate explosives; and
- not allow the Navy to reduce its estimated numbers of Level A harassment and mortality takes based on its proposed post-model analysis and, instead, propose to authorize the total numbers of model-estimated Level A harassment and mortality takes.

RATIONALE

The Navy's proposed study area encompasses 8.9 million square kilometers from the east coast of the United States to near the mid-Atlantic ridge (45°W longitude) and throughout much of the Gulf of Mexico. It also includes Navy pierside locations, port transit channels, and the lower Chesapeake Bay. 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 (including ship shock trials), expended materials, vibratory and impact hammers, airguns, electromagnetic devices, high-energy lasers, vessels, underwater vehicles, and aircraft.

Criteria and thresholds

The Navy proposed to estimate the numbers of takes resulting from its activities by adjusting received sound levels at different frequencies based on the hearing sensitivity of various groups of marine mammals at those frequencies. The adjustments are based on "weighting" functions derived by Southall et al. (2007) and Finneran and Jenkins (2012; type I and type II weighting functions, respectively). Type I weighting functions (see Figure 1 in Southall et al. 2007) are flat over a wide range of frequencies and then decline at the extremes of the animal's hearing range. Type II weighting functions (Finneran and Jenkins 2012) are used only for cetaceans and combine the precautionary type I curves developed by Southall et al. (2007) with equal loudness weighting functions derived from empirical studies with bottlenose dolphins (Finneran and Schlundt 2011).

The Commission considers the theory behind those weighting functions to be sound. However, the amplitudes of the final type II weighting functions appear to have been shifted, lowering the sensitivity at all frequencies by roughly 16–20 dB (compare Figures 2 and 6 of Finneran and Jenkins (2012)). For sonar-related activities Finneran and Jenkins (2012) reduced the acoustic thresholds for low- and mid-frequency cetaceans by 16.5 dB (presumably to account for the amplitude decrease in the type II weighting functions), but it appears that they did not apply a similar adjustment of 19.4 dB for high-frequency cetaceans. Because data are lacking for temporary threshold shift (TTS) thresholds for high-frequency cetaceans exposed to acoustic (i.e., tonal) signals, they appear to add a 6-dB correction factor to the TTS threshold derived from non-explosive impulsive sources (i.e., airguns) based on the method outlined in Southall et al. (2007). However, the Commission's understanding is that Southall et al. (2007) did not use the 6-dB factor to extrapolate between impulsive and acoustic thresholds, but rather to estimate permanent threshold shift (PTS) thresholds from TTS thresholds based on peak pressure levels. In addition, it is unclear how the explosive thresholds (i.e., for underwater detonations) were adjusted downward to account for the amplitude decrease in the type II weighting functions. If those thresholds were not adjusted by the appropriate amplitude factor, the Navy may have underestimated takes of marine mammals. To address these concerns, the Marine Mammal Commission recommends that the National Marine Fisheries Service require the Navy to adjust all acoustic and explosive thresholds for low-, mid-, and high-frequency cetaceans by the appropriate amplitude factor (e.g., 16.5 or 19.4 dB), if it intends to use the type II weighting functions as depicted in Figure 6 of Finneran and Jenkins (2012).

For determining TTS thresholds for pinnipeds for underwater detonations, the Navy used data from Kastak et al. (2005) and extrapolation factors from Southall et al. (2007). Kastak et al. (2005) estimated the average sound exposure level for onset-TTS for pinnipeds exposed to octave-band underwater sound centered at 2.5 kHz (i.e., mid-frequency sound). However, underwater detonations produce broadband sound in the low-frequency range. The Commission recognizes that the data provided by Kastak et al. (2005) may be the only data available, but those data may not provide an appropriate basis for estimating the relevant thresholds. Furthermore, the extrapolation factors from Southall et al. (2007) were not stated specifically in the Navy's analysis for underwater detonations, but it appears that the Navy used 6 dB. As noted in the previous paragraph, Southall et al. (2007) seem to have used 6 dB as the extrapolation factor for determining PTS thresholds from TTS thresholds based on peak sound pressure levels, not for extrapolating from acoustic to explosive thresholds. Thus, the Commission is unsure why thresholds based on octave-band mid-frequency sound were used for underwater detonations and it is unsure what extrapolation factors were used and why. Therefore, the Marine Mammal Commission recommends that the National Marine Fisheries Service require the Navy to explain why data from Kastak et al. (2005) were used as the basis for explosive thresholds in pinnipeds and, more importantly, to specify the extrapolation process and factors used as the basis for associated TTS thresholds.

Modeling methods

Some of the Navy's activities involve the simultaneous use of multiple source types (i.e., acoustic, explosive, non-explosive impulsive) that generate sound within various frequency bands (i.e., low, mid, and high). To account for activities involving those sources, the Navy has proposed to sum all sound exposure levels received by an animal in each frequency band. However, the application did not describe how the Navy would sum the sound exposure levels from multiple source types (e.g., acoustic vs. explosive). It also did not explain how the various thresholds for those different source types would be prioritized and applied. In such cases with multiple source types, a simple summation of sound exposure levels may not necessarily estimate takes accurately.

In addition, the Navy used three different types of propagation models: the Comprehensive Acoustic System Simulation/Gaussian Ray Bundle model for acoustic sources, Reflection and Refraction in Multilayered Ocean/Ocean Bottoms with Shear Wave Effects model for explosive sources, and the Range-Dependent Acoustic Model for non-explosive impulsive sources. None of the Navy's documents (i.e., its application, DEIS, or supporting technical documents) provided (1) information regarding how the Navy integrated propagation of sound from those three models into its effects model and (2) details regarding how sound exposure levels would be summed. Again, it is not clear whether a basic summation of those sound exposure levels is appropriate. If the Navy used some other algorithm for this summation, it should explain that algorithm. For all of these reasons, the Marine Mammal Commission recommends that the National Marine Fisheries Service require the Navy to provide detailed information regarding how it determined marine mammal takes that occur when multiple types of sound-producing sources (i.e., acoustic, explosive, and non-explosive impulsive) of varying frequencies (i.e., low, mid, and high) are used simultaneously.

The Navy also estimated the probability of vessels, expended munitions, and non-explosive materials (e.g. sonobouys) striking a marine mammal. The Navy's method for determining those strike probabilities was based on simple probability calculations. For example, it used a Poisson model to estimate the probability of ship strikes based on the historical rate of ship strikes. Although the use of the Poisson model is not unreasonable for modeling the occurrence of rare events, such as a ship striking a marine mammal, the assumption that the encounter rate will remain the same is questionable because the Navy proposes to increase the number of training and testing activities and the abundance and distribution of marine mammals could change in the next five years. As such, the manner in which the Navy used the Poisson model is not appropriate.

In addition, the Navy estimated the probability of spent munitions or non-explosive materials striking marine mammals in Appendix G of its DEIS. However, that approach and associated number of takes were not included in its application for promulgation of regulations. The Commission believes it is important and scientifically sound to include such an analysis in the Navy's request for regulations and encourages the Service to require such analyses of impacts. In the Navy's DEIS, it simply compared the aggregated footprint of some specific marine mammal species with the footprint of all objects that might strike them. Both of those were based only on densities of marine mammals in the action area and expected amount of materials to be expended within a year in those areas. By combining marine mammal densities and those activities over space and time into a single calculation sequence, the Navy provided only a crude estimate of strike probabilities for the 'average' condition. Neither marine mammals nor Navy activities are distributed homogeneously in space or time. The Navy should incorporate spatial and temporal considerations to make its take estimation procedure more realistic biologically. The Navy's model for determining takes of marine mammals from sound-producing activities can account for moving sound sources and marine mammals. In that model, the Navy could adjust the data collected by the animal dosimeters from received sound level to a close approach distance and estimate strike probabilities more realistically. The Marine Mammal Commission recommends that the National Marine Fisheries Service require the Navy to use its spatially and temporally dynamic simulation models to estimate strike probabilities for specific activities (i.e., movements of vessels, torpedo, unmanned underwater vehicles and expended munitions, ordnance, and other devices).

Mitigation and monitoring measures

Many of the proposed activities involve mitigation measures that currently are being implemented in accordance with previous environmental planning documents, regulations, or consultations. Most of the current mitigation zones for activities involving acoustic (e.g., mid- and high-frequency active sonar) or explosive sources (e.g., underwater detonations, explosive sonobuoys, surface detonations) were designed to reduce the potential for onset of TTS. For the proposed regulations, the Navy revised its acoustic propagation models by updating hearing criteria and thresholds and marine mammal density and depth data. Based on the updated information, the models predict that certain activities may have adverse effects over greater distances than previously expected. Mitigation and monitoring measures generally are less effective at greater distances and the Navy considers the costs of improving those measures unacceptably high. That is, the Navy does not believe it is feasible to prevent or mitigate TTS for every activity. For that reason, it proposes to base its mitigation zones for each activity on avoiding or reducing PTS.

Table 11-1 in the application lists the Navy's predicted distances or ranges over which PTS might occur and recommended mitigation zones. The table categorizes sound sources by type (e.g., MF1:SQS-53 mid-frequency active hull-mounted sonar) and does not include all sources, but rather includes for each category (or bin) the average and maximum distances from the sound source at which PTS could be expected to occur. Chapter 6 of the application also includes tables listing such ranges. However, in Chapter 6, the tables include only a subset of the proposed activities (6 of the 13 explosive activities analyzed) and the average rather than maximum ranges (see Tables 6-19 to 6-22). In addition, the application does not provide the ranges to PTS for acoustic sources for more than one ping (Table 6-8), as it does for TTS (i.e., 1, 5, and 10 pings; Tables 6-9). Instead, the Navy simply assumed that marine mammals would not maintain a nominal speed of 10 knots parallel to a ship and thereby receive sound from more than a single ping. The same information is lacking in the Navy's DEIS. Absent that kind of information, neither the regulation nor the DEIS process is fully transparent and the Commission and public cannot comment on the appropriateness of the proposed mitigation zones. To address those shortcomings, the Marine Mammal Commission recommends that the National Marine Fisheries Service require the Navy to provide the predicted average and maximum ranges for all criteria (i.e., behavioral response, TTS, PTS, onset slight lung injury, onset slight gastrointestinal injury, and onset mortality), for all activities (i.e., based on the activity category and representative source bins), and all functional hearing groups of marine mammals.

Although not stated specifically within its application, the Navy indicated in its DEIS that the use of lookouts (i.e., observers) would increase the likelihood of detecting marine mammals at the surface, but it also noted that the value of visual monitoring is limited and could not be relied on to avoid all impacts to all species. The Commission agrees and has made numerous recommendations to the Navy to characterize the effectiveness of visual observation. Importantly, the Navy is now working with collaborators at the University of St. Andrews to study observer effectiveness. The Commission believes those studies will be very useful once completed.

However, until the results are available, the Commission also believes that the Navy should supplement its visual monitoring efforts with other measures rather than simply reducing the size of the zones it plans to monitor. The Navy did propose to supplement visual monitoring using passive acoustics during activities that generate impulsive sounds (i.e., primarily for explosives), but does not propose the same during the use of (non-impulsive) low-, mid-, and high-frequency active sonar. In contrast, the Navy uses visual, passive acoustic, and active acoustic monitoring during Surveillance Towed Array Sensor System Low Frequency Active (SURTASS LFA) sonar activities to augment its mitigation efforts over large areas. It is not clear why the Navy did not propose to use those same monitoring methods for the other activities described in its application. To ensure effective monitoring, the Marine Mammal Commission recommends that, whenever practicable, the National Marine Fisheries Service require the Navy to use passive and active acoustics to supplement visual monitoring during the implementation of its mitigation measures for all activities that introduce sufficient levels of sound into the marine environment.

In addition, the Navy proposed that it will cease acoustic activities (i.e., active sonar transmissions) when a marine mammal is detected within the mitigation zone. Those acoustic activities would resume when (1) the animal is observed exiting the mitigation zone, (2) the animal is thought to have exited the mitigation zone based on its course and speed, (3) the mitigation zone has been clear from any additional sightings for a period of 30 minutes, (4) the vessel has transited more than 1.8 km beyond the location of the last sighting, or (5) ship personnel conclude that dolphins are deliberately approaching the ship to ride the vessel's bow wave (and no other marine mammals are sighted within the mitigation zone). Similar requirements were proposed for explosive and non-explosive impulsive activities. In either case, the Commission must question some of those requirements when the position of the marine mammal is unknown. The key considerations driving those measures are the relative positions of the marine mammal and the sound source. Their relative positions over time are best estimated as a function of their positions when the marine mammal was first sighted, the speed and heading of the vessel, and the speed and heading of the marine mammal. If the vessel and marine mammal are moving in opposite directions, then the marine mammal may leave the mitigation zone relatively quickly. However, if they are moving in the same direction, then the marine mammal may remain in the mitigation zone for a prolonged period. Unless a sighted marine mammal is resighted leaving or outside the mitigation zone, the Navy should not resume its activity until it has had a reasonable chance of verifying that it can do so safely. The delay should take into account that (1) a marine mammal may remain underwater where it is not visible, (2) it may change its heading and speed in response to the vessel, and (3) visual observation alone may not be sufficient to determine a marine mammal's position relative to the vessel or sound source after the initial sighting, unless the marine mammal surfaces again and is observed.

The dive time of a sighted marine mammal is a central consideration whenever mitigation measures depend on visual observation. For small cetaceans (other than beaked whales) and pinnipeds, the Commission has recommended a delay of at least 15 minutes because their dive times are shorter and generally occur within that timeframe. For some mysticetes and large cetaceans, the proposed 30-minute pause may be inadequate, sometimes markedly so. Sperm whales and beaked whales, in particular, may remain submerged for periods far exceeding 30 minutes. Blainville's beaked whales dive to considerable depths (> 1,400 m) and can remain submerged for nearly an hour (Baird et al. 2006, Tyack et al. 2006). In addition, lookouts may not detect marine mammals each time they surface. Even under ideal conditions detection can be a problem, particularly for cryptic species such as beaked whales. Barlow (1999) found that "[a]ccounting for both submerged animals and animals that are otherwise missed by the lookouts in excellent survey conditions, only 23 percent of Cuvier's beaked whales and 45 percent of *Mesoplodon* beaked whales are estimated to be seen on ship surveys if they are located directly on the survey trackline." Thus, depending on the species involved, short-term visual monitoring may not be adequate to confirm that a sighted marine mammal has left the mitigation zone. To address this problem, <u>the Marine Mammal Commission again recommends</u> that, after the sighting of one or more marine mammals within or about to enter a mitigation zone, the National Marine Fisheries Service require the Navy to cease the use of its sound sources and not reinitiate them for (1) at least 15 minutes if a small odontocete or pinniped enters the mitigation zone and is not observed to leave that zone and (2) relevant time periods based on the maximum dive times of mysticetes or large odontocetes if they enter the mitigation zone and are not observed to have left that zone.

For explosive activities that involve time-delay firing devices, the Navy proposed to use a 915-m mitigation zone, which is smaller than the 1,326-m zone currently used. The current zone was based on a 20-lb net explosive weight charge, a time delay to detonation of 10 minutes, an average swim speed for dolphins of 3 knots, and an added buffer to account for marine mammals that may be transiting at speeds faster than the average. The Commission has commented on this matter in numerous letters and continues to believe that the use of 3 knots as an average swim speed is inaccurate and inadequate, even with an added buffer to account for animals swimming faster than 3 knots. A simple calculation indicates that if a marine mammal swims at just 4 knots for the duration of the time-delay (10 minutes), the size of the mitigation zone would be inadequate, whether at 1,326 or 915 m. Importantly, many marine mammals are capable of swimming, and regularly do swim, much faster than 4 knots, especially for short periods. The average swim speed for bottlenose dolphins, for example, ranges from 2.6 to 8 knots (Lockyer and Morris 1987, Mate et al. 1995, Ridoux et al. 1997). In addition, pelagic dolphins swim faster than coastal species. Au and Perryman (1982) reported a swim speed for wild pantropical spotted dolphins of 6.9 knots. Rohr et al. (1998) reported Wild long-beaked common dolphins swimming at an average of 8.1 knots and captive individuals of that species swimming at an average of 13.0 knots. Rohr and Fish (2004) reported an average swim speed for captive Atlantic spotted dolphins of 6.8 knots and for captive Pacific white-sided dolphins of 12.4 knots. Because many of the marine mammal species in the study area can and generally do swim faster than 3 knots, the mitigation zone proposed by the Navy is simply inadequate and poses a risk of additional injury and mortality, as was recently observed at the Silver Strand Training Complex. To address this concern, <u>the Marine Mammal Commission recommends</u>

that the National Marine Fisheries Service require the Navy to adjust the size of the mitigation zone for mine neutralization events using the average swim speed of the fastest swimming marine mammal occurring in the area where time-delay firing devices would be used to detonate explosives.

Request for Level A harassment and mortality takes

The Navy proposed additional post-model analysis of acoustic and explosive effects to include (1) animal avoidance of repeated sound exposures, (2) sensitive species avoidance of areas of activity before use of a sound source or explosive, and (3) implementation of mitigation measures—none of which were included in its DEIS. That analysis effectively reduced the model-estimated numbers of Level A harassment (i.e., PTS) and mortality takes.

The Navy assumed that marine mammals likely would avoid repeated high level exposures to a sound source that could result in injuries (i.e., PTS). It therefore adjusted its estimated numbers of takes to account for marine mammals swimming away from a sonar or other active source and away from multiple explosions to avoid repeated high-level sound exposures. The Navy did not provide a basis for this assumption or the details of its adjustment. The Navy also assumed that harbor porpoises and beaked whales would avoid certain training and testing activity areas because of high levels of vessel or aircraft traffic before the activity. It based that assumption on various publications indicating those species swim away from or avoid vessels (Barlow 1988, Polacheck and Thorpe 1990, Evans et al. 1994, Jaramillo-Legorreta et al.1999, Palka and Hammond 2001, Pirotta et al. 2012). But, again, it did not explain how it adjusted the take estimates to reflect the degree of avoidance by harbor porpoises and beaked whales. Depending on conditions, marine mammals may avoid areas of excessive sound or activity. Indeed, one of the concerns regarding sound-related disturbance is that it causes marine mammals to abandon important habitats on a long-term or even permanent basis. That being said, the Commission knows of no scientifically established basis for predicting the extent to which marine mammals will abandon their habitat, which would seem to be essential information for adjusting the estimated numbers of takes. Absent the relevant information, the Commission and public cannot comment on the appropriateness of such adjustments—in essence, the regulatory process would not be sufficiently transparent.

The Navy also indicated that its post-model analysis considered the potential for highly effective mitigation to prevent Level A harassment from exposure to sonar and other active acoustic sources and Level A harassment and mortalities from exposure to explosives. Clearly, the purpose of mitigation measures is to reduce the number and severity of takes. However, the effectiveness of the Navy's mitigation measures has not been demonstrated and remains uncertain. This is an issue that the Commission has raised many times in the past, and the Navy has recognized the need to assess the effectiveness of its mitigation measures in its Comprehensive Integrated Monitoring Plan and even in its recent DEIS, which states that although the use of lookouts is expected to increase the likelihood that marine species would be detected at the water's surface, it is unlikely that using those lookouts would help avoid impacts to all species because of the inherent limits of visual monitoring. The Navy has now proposed to adjust its take estimates based on both mitigation effectiveness scores and g(0)—the probability that an animal on a vessel's or aircraft's track line will be detected.

According to its proposed approach, for each species the Navy would multiply a mitigation effectiveness score and a g(0) to estimate the percentage of the subject species that would be observed by lookouts and for which mitigation would be implemented, thus reducing the estimated number of marine mammal takes for Level A harassment and mortality (explosives only). The Navy would then decrease the estimated numbers of Level A harassment and mortality takes for that species to Level B or Level A harassment takes, respectively.

To implement that approach, the Navy assigned mitigation effectiveness scores of—

1 if it expects to be able to monitor continuously the entire mitigation zone based on the surveillance platform(s), number of lookouts, and size of the range to effects zones

0.5 if it expects to be able to monitor continuously less than the full mitigation zone but more than half of it or if the mitigation zone within the activity type consists of more than one scenario, but the range to effects zone can be monitored continuously for the majority of those scenarios, or

N/A if it expects to be able to monitor continuously less than half of the mitigation zone or if the mitigation zone cannot be monitored continuously for most of the scenarios in an activity type.

The general idea behind this adjustment is reasonable, but the difficulty is in determining the appropriate adjustment factors. Again, the information needed to judge effectiveness has not been made available. In addition, the Navy did not provide the criteria (i.e., the number and types of surveillance platforms, number of lookouts, and sizes of the respective zones) needed to elicit the three mitigation effectiveness scores. Therefore, the use of those scores is unsubstantiated. Importantly, numbers of lookouts and surveillance platform(s) used for continuous monitoring of a zone are measures of effort, but they do not necessarily ensure effectiveness. The Navy has not yet demonstrated that such measures of effort are reliably linked to effectiveness.

In addition, this approach is confusing because the Navy is inconsistent in its use of the terms "range to effects zone" and "mitigation zone," which are not the same (see Table 11-1). More importantly, some of the mitigation zones are smaller than the estimated range to effects zones. For example, the Navy proposed a mitigation zone of 183 m after a 10 dB reduction in power for its most powerful active acoustic sources (e.g., source type MF1: AN/SQS-53C) and assumed that marine mammals would leave the area near the sound source after the first three to four pings. However, for a single ping, the predicted average range to PTS is 257 m and could be as high as 267 m. That distance would increase if the activity involves multiple pings, which most do. But even with a single ping, PTS may occur well outside of the mitigation zone. In such cases, mitigation based on those zones cannot be deemed effective, no matter how many observers or observer platforms are involved. That being the case, assigning mitigation effectiveness scores based on zones that do not cover the full range to which PTS may occur is inappropriate.

The Navy used numerous references to estimate species-specific g(0)s. Those sources were based on scientific surveys of marine mammals that used both vessels and aircraft. It also indicated that various factors are involved in estimating g(0), including sightability and detectability of the animal (e.g., species-specific behavior and appearance, school size, blow characteristics, dive characteristics, and dive interval), viewing conditions (e.g., sea state, wind speed, wind direction, sea swell, and glare), the observer's ability to detect animals (e.g., experience, fatigue, and concentration), and platform characteristics (e.g., pitch, roll, yaw, speed, and height above water). In the DEIS, the Navy noted that due to the various detection probabilities, levels of experience, and dependence on sighting conditions, lookouts will not always be effective at avoiding impacts to all species. Yet it based its g(0) estimates on seasoned researchers conducting the associated surveys, not Navy lookouts whose observer effectiveness has yet to be determined. The Commission recommended earlier in this letter that the Navy supplement its mitigation and monitoring measures because the observer effectiveness study has yet to be completed or reviewed. It therefore would be inappropriate for the Navy to reduce the numbers of takes based on the proposed post-analysis approach because, as the Navy has described it, it does not address the issue of observer effectiveness in developing mitigation effectiveness scores and g(0). Based on all these concerns, the Marine Mammal Commission recommends that the National Marine Fisheries Service not allow the Navy to reduce its estimated numbers of Level A harassment and mortality takes based on its proposed post-model analysis and, instead, propose to authorize the total numbers of model-estimated Level A harassment and mortality takes. The Navy's general approach has merit and warrants further investigation, but it cannot be deemed reliable at this point.

Please contact me if you have questions concerning the Commission's recommendations or rationale.

Sincerely,

Timothy J. Ragen

Timothy J. Ragen, Ph.D.
Executive Director

Enclosure

References

Au, D., and W. Perryman. 1982. Movement and speed of dolphin schools responding to an approaching ship. Fishery Bulletin 80(2):371–379.

Baird, R.W., D.L. Webster, D.J. McSweeney, A.D. Ligon, G.S. Schorr, and J. Barlow. 2006. Diving behavior and ecology of Cuvier's (*Ziphius cavirostris*) and Blainville's (*Mesoplodon densirostris*) beaked whales in Hawaii. Canadian Journal of Zoology 84(8):1120–1128.

Barlow, J. 1988. Harbor porpoise, *Phocoena phocoena*, abundance estimation for California, Oregon, and Washington: I. Ship surveys. Fishery Bulletin 86(3):417–432.

Barlow, J. 1999. Trackline detection probability for long-diving whales. Pages 209–221 *in* G.W. Garner, S.C. Amstrup, J.L. Laake, B.F.J. Manly, L.L. McDonald, and D.G. Robertson (eds.), Marine Mammal Survey and Assessment Methods. Balkema, Rotterdam, The Netherlands.

Evans, P.G.H., Q. Carson, P. Fisher, W. Jordan, R. Limer, and I. Rees. 1994. A study of the reactions of harbour porpoises to various boats in the coastal waters of southeast Shetland. European Research on Cetaceans 8:60–64.

Finneran, J.J., and C.E. Schlundt. 2011. Subjective loudness level measurements and equal loudness contours in a bottlenose dolphin (*Tursiops truncatus*). Journal of the Acoustical Society of America 130(5):3124–3136.

Finneran, J.J., and A.K. Jenkins. 2012. Criteria and thresholds for U.S. Navy acoustic and explosive effects analysis. SPAWAR Marine Mammal Program, San Diego, California, 64 pages.

Jaramillo-Legorreta, A.M., L. Rojas-Bracho, and T. Gerrodette. 1999. A new abundance estimate for vaquitas: First step for recovery. Marine Mammal Science 15(4):957–973.

Kastak, D., B.L., Southall, R.J. Schusterman, and C.R. Kastak. 2005. Underwater temporary threshold shift in pinnipeds:effects of noise level and duration. Journal of the Acoustical Society of America 118:3154–3163.

Kennedy, A.S., D.R. Salden, and P.J. Clapham. 2011. First high- to low-latitude match of an eastern North Pacific right whale (*Eubalaena japonica*). Marine Mammal Science.doi: 10.1111/j.1748-7692.2011.00539.x

Lockyer, C., and R. Morris. 1987. Observations on diving behavior and swimming speeds in a juvenile *Tursiops truncatus*. Aquatic Mammals 13:31–35.

Mate, B.R., K.A. Rossback, S.L. Nieukirk, R.S. Wells, A.B. Irvine, M.D. Scott, and A.J. Read. 1995. Satellite-monitored movements and dive behavior of a bottlenose dolphin (*Tursiops truncatus*) in Tampa Bay, Florida. Marine Mammal Science 11(4):452–463.

Palka, D.L. and P.S. Hammond. 2001. Accounting for responsive movement in line transect estimates of abundance. Canadian Journal of Fisheries and Aquatic Sciences 58:777–787.

Pirotta, E., R. Milor, N. Quick, D. Moretti, N. Di Marzio, and P. Tyack. 2012. Vessel noise affects beaked whale behavior: Results of a dedicated acoustic response study. PLoS ONE 7(8):e42535.

Polacheck, T. and L. Thorpe. 1990. The swimming direction of harbor porpoise in relationship to a survey vessel. Reports of the International Whaling Commission 40:463–470.

Ridoux, V., C. Guinet, C. Liret, P. Creton, R. Steenstrup, and G. Beauplet. 1997. A video sonar as a new tool to study marine mammals in the wild: Measurements of dolphin swimming speed. Marine Mammal Science 13:196–206.

Rohr, J.J., and F.E. Fish. 2004. Strouhal numbers and optimization of swimming by odontocete cetaceans. Journal of Experimental Biology 207:1633–1642.

Rohr, J.J., E.W. Hendricks, L. Quigley, F.E. Fish, J.W. Gilpatrick, and J. Scardina-Ludwig. 1998. Observations of dolphin swim speed and Stouhal number. Space and Naval Warfare Systems Center Technical Report 1769, San Diego, California. 56 pages.

Southall, B.L., A.E. Bowles, W.T. Ellison, J.J. Finneran, R.L. Gentry, C.R. Greene, Jr., D. Kastak, D.R. Ketten, J.H. Miller, P.E. Nachtigall, W.J. Richardson, J.A. Thomas, and P.L. Tyack. 2007. Marine Mammal Noise Exposure Criteria: Initial Scientific Recommendation. Aquatic Mammals 33(4):411–521.

Tyack, P.L., M. Johnson, N. Aguilar Soto, A. Sturlese, and P.T. Madsen. 2006. Extreme diving of beaked whales. Journal of Experimental Biology 209(21):4238–4253.

Wade, P. R., A. Kennedy, R. LeDuc, J. Barlow, J. Carretta, K. Shelden, W. Perryman, R. Pitman, K. Robertson, B. Rone, J. Carlos Salinas, A. Zerbini, R.L. Brownell, Jr., and P.J. Clapham. 2011. The world's smallest whale population. Biological Letters 7:83–85.