AN ANALYSIS OF THE UNITED STATES NAVY'S PROPOSED UNDERSEA WARFARE TRAINING RANGE

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Abstract

In October 2005, the United States Navy issued a Draft Environmental Impact Statement for the construction of an undersea warfare training range off the North Carolina coast. Exercises conducted in this proposed range will involve the use of mid-frequency sonar, the known cause of one mass whale stranding in the Bahamas, and the suspected cause of at least twelve other stranding events that have occurred in the past decade world-wide. In their statement, the Navy indicates the potential for limited harm to marine life. Fearing an increase in future strandings, scientists, environmentalists, and the general public have questioned the scope of the Navy's predictions for biological damage. My review suggests that the Navy does not fully acknowledge the negative effects the training range could have, and does not appropriately use the best available scientific information. In light of this, I conclude that the Navy has not fulfilled the requirements of the National Environmental Policy Act.

Introduction

In October 2005, the United States Navy issued a Draft Environmental Impact Statement (DEIS) in accordance with the National Environmental Policy Act (NEPA), describing a proposed Undersea Warfare Training Range (USWTR). The 500-square-nautical-mile (nm^2) range will be placed in a littoral area, so that the Navy can train effectively in a shallow-water environment. Training exercises will consist of surface vessels, aircraft, or submarines, or a combination thereof. The Navy proposes to employ short, but intense, pings of mid-frequency sonar to detect the presence of a submarine (or submarine target simulators).

The range itself will consist of no more than 300 transducer nodes on the ocean floor, connected by fiber-optic undersea cables to a buried trunk cable. The cable transmits acoustic data back to shore-based facilities, where it may be reviewed and used to enhance training. The preferred site is the Cherry Point Operating Area (OPAREA), south of Cape Lookout, NC, with alternative sites near Wallops Island, VA, and Jacksonville, FL. Straddling the continental shelf break, the range would be positioned so that the Gulf Stream sometimes meanders over it.

The Navy asserts that it requires a training range in shallow-water environments – that, as international concerns have shifted to littoral seas, such as the Arabian Sea, the South China Sea, and the Korean Sea, it must expand its training capabilities to include these environments.

Many problems may attend the siting of this range, but conservationists are most concerned about the effects of mid-frequency sonar on cetaceans (whales, dolphins, and porpoises). In the past sixteen years, at least twelve instances of mass whale strandings have coincided geographically and temporally with Navy or North Atlantic Treaty Organisation (NATO) sonar exercises (NRDC, 2005). After a mass stranding of beaked whales (family Ziphiidae) and other species in the Bahamas in March 2000, the Navy and the National Marine Fisheries Service (NMFS) issued a joint interim report (the final report has never been issued), concluding that the confluence of the Navy's mid-frequency sonar activities in the vicinity and a variety of contributing factors (such as unusual bathymetry, surface ducting, constricted channel with limited egress, and the use

of multiple sonar units over an extended period of time) was the most likely cause of the stranding event (DoC, 2001).

After giving a brief history of the Navy's use of sonar for anti-submarine warfare, as well as other activities of the Navy, I will briefly describe several pieces of legislation that have relevance for the proposed action. I will then summarize some of the effects that biologists have suggested could occur when marine mammals are exposed to intense sound or sonar. The remainder of this document will address the concerns I have with the draft EIS, as it stands. During the course of this project, I had access to the comments of five organizations and agencies: the National Resource Defense Council (NRDC), Sierra Club, the Southern Environmental Law Center (SELC), the Marine Mammal Commission (MMC), and the National Oceanic and Atmospheric Administration (NOAA). I based my critique on these published comments, but I did not include any commentary that I felt invalid or unsupportable. My objective is not to demonstrate that the USWTR should or should not be built. Instead, I intended this document to suggest how the Navy can improve its current draft impact statement, before it issues the final statement and settles on a course of action. I trust that the Navy has a legitimate need for the range for national defense. I also believe that the range could serve as an advantageous arena for long-term research about sound and sonar, and its potential effects on cetaceans and other marine life.

History

In May 1915, a German U-boat sank the RMS *Lusitania*, beginning an age of submarine warfare. In response to Germany's effective use of U-boats during the First World War, Britain and the United States began to develop sonar (**so**und **na**vigation **r**anging) technology to detect the presence of these destructive vessels. Sonar was invaluable during World War II, and the technology continued to advance through the Cold War, as Soviet submarines became quieter and more sophisticated. At its conception, sonar was purely passive, detecting the sound created by an object. Later sonar systems were improved: submarines could actively send out a signal, or "ping," and then listen for the echo. The lower the frequency of the signal, the farther it travels, and therefore information is gathered over a larger area. This means that submarines and

other approaching vessels could be detected at greater distances, giving a longer response time.

So that those responsible for using the sonar will be prepared in times of war, training must be conducted under a wide range of ocean conditions, including variable depth. According to a Navy website, "Currently, there are 224 submarines operated by non-allied nations, and the submarines prowling the world's oceans today are much quieter and more deadly than ever before. An undetected enemy submarine is an underwater terrorist, threatening any surface ship or coastline within its range" (DoN, undated).

The environmental consequences of sonar rose to the public's attention as early as 1994, when NRDC began investigating the use of low-frequency active (LFA) sonar off the coast of California. The low-frequency nature of this sonar allows the sound to travel with little attenuation (NRDC, 2005). Despite having used mid-frequency sonar for decades, in 2001 the Navy issued an EIS detailing the use of the new low-frequency technology. In the EIS, the Navy asserted that by restricting the received levels of sonar within twelve nautical miles of any coastlines and offshore biologically important areas, they could adequately mitigate any negative effects of the sonar on whale and other marine life. The Navy also requested a Letter of Authorization (LOA) from NMFS to allow the incidental takings of marine mammals, which was granted.

In 2002, NRDC sought a preliminary injunction to prevent the United States Navy's peacetime use of LFA sonar system for "training, testing and routine operations" (NRDC *et al.* v Evans, 2002). NRDC charged that NMFS should not have granted the Navy a permit to use LFA because of violations to MMPA, NEPA, the Endangered Species Act (ESA), and the Administrative Procedure Act (APA). Although the judge granted the preliminary injunction, she declined to make it a complete ban on peacetime use of LFAS, stating that the Navy and NMFS should tailor it to reduce risk to marine mammals and endangered species but still allow the Navy's use for training and testing purposes. In 2003, the judge again listened to the case (NRDC *et al.* v Evans, 2003), this time to determine if she would issue a permanent injunction against the defendants. She expressed the opinion that "the public interest in *both* military preparedness and protection of marine life can be reconciled through a carefully tailored injunction."

In November 2005 (a month after issuing the DEIS for the USWTR), the Navy issued a Draft Supplemental Environmental Impact Statement (SEIS) to employ up to four LFA sonar systems in the Pacific, Atlantic, and Indian Oceans, and the Mediterranean Sea. Although the supplement addresses some of the deficiencies that were found to exist during the 2002 and 2003 suits, some environmental groups, such as NRDC, continue to find fault with the Navy's analysis (NRDC, 2006b). However, further analysis of this SEIS is beyond the scope of this current project.

Both the LFA and the USWTR draft impact statements were issued at a time when residents of North Carolina, a state traditionally supportive of the military, have been battling the Navy's construction of an outlying landing field (OLF) in Beaufort and Washington Counties, less than five miles from the Pocosin National Wildlife Refuge. The Refuge is a wintering ground for over 100,000 snow geese and tundra swans. Of the birds that migrate along the Eastern flyway, 65 to 75% use northeastern North Carolina as a winter refuge. The Navy's use of "lethal and nonlethal" methods to remove these birds from the land designated for the OLF is only one of many concerns. It is likely that the increased noise levels and low-altitude flights will have a significant impact on the migratory bird populations. Conservation and civic organizations, including the Sierra Club, SELC, the Audubon Society, and the newly formed North Carolinians Opposing the Outlying Landing Field (NO OLF), have been leading the fight, with help from some unlikely sources, such as the National Rifle Association (Sierra Club, undated).

In my opinion, it is possible that some of the public criticism from North Carolina with regard to the USWTR (based on views expressed during the public hearing held in Morehead City, NC, November 17, 2005) is in part because of the strong feelings against the Navy that have formed during the dispute over the OLF. It is yet to be seen how North Carolinians will react, either in support or against, if the Navy does decide to build the USWTR just south of Cape Lookout, NC.

Legal requirements

To understand the restrictions that exist for the Navy in their issuance of the Draft Environmental Impact Statement, and their estimated takes, I have included a brief summary of three of the relevant acts, the National Environmental Policy Act, the Marine Mammal Protection Act, and the Endangered Species Act. I have also included a summary of the relevant section of the National Defense Authorization Act for Fiscal Year 2004, which amended the MMPA for the purposes of military readiness.

National Environmental Policy Act

The purpose of the National Environmental Policy Act (NEPA) of 1969 is to ensure that federal agencies assess the environmental impacts of any action before making decisions and beginning the action, and that they release this information to public officials and citizens. To comply with NEPA, the agency must prepare a draft EIS complete with reasonable alternatives to the proposal and appropriate mitigation measures for any impacts determined to be negative. The draft EIS is then subject to public hearings and a comment period, after which the final EIS may be issued. Comments made during the hearing or submitted in writing afterward must be answered within the final EIS, although the agency is not required to heed the advice of the public. Thirty days after the final EIS is released, during which time the public has another opportunity to submit comments, the agency issues a Record of Decision, and the action can be implemented.

Marine Mammal Protection Act

The Marine Mammal Protection Act (MMPA) was passed in 1972 because of rising concerns among scientists, environmentalists, and the general public that marine mammal stocks were being depleted as a result of anthropogenic activity. It was recognized that there was much to learn about the dynamics and ecology of marine mammals, and that measures should be taken to not allow the stocks to fall below their optimum sustainable population levels. The Act allows for certain exceptions to the take prohibitions, including subsistence hunting and scientific research. As amended in 1994,

the MMPA includes a mandate for stock assessments for all marine mammal stocks in US waters. (NMFS, undated(b))

The MMPA defines *take* as "to harass, hunt, capture, or kill, or attempt to harass, hunt, capture, or kill any marine mammal." *Harassment* was defined as "any act of pursuit, torment, or annoyance which —

> Level A Harassment - has the potential to injure a marine mammal or marine mammal stock in the wild; or
> Level B Harassment - has the potential to disturb a marine mammal or marine mammal stock in the wild by causing disruption or behavioral patterns, including, but not limited to, migration, breathing, nursing, breeding, feeding, or sheltering."

The MMPA has split jurisdiction: whales, dolphins, porpoises, seals, and sea lions fall under the control of NMFS, which is part of the National Oceanic and Atmospheric Administration (NOAA) under the Department of Commerce (DoC); walruses, sea otters, polar bears, and manatees are managed by the Fish and Wildlife Service (FWS), under the Department of Interior (DoI). Permits and authorizations are issued by the managing agency (either NOAA Fisheries or FWS), and are required for activities that may result in a taking of a marine mammal (NMFS, MMPA). In the case of the USWTR, the Navy will be submitting an MMPA letter of authorization (LOA) request for the estimated incidental harassments of marine mammals that are not listed under the Endangered Species Act, including beaked whales. Because of beaked whales' history with sonar and stranding, although the harassment is expected to cause only a behavioral disruption, all harassment of beaked whales is being considered as Level A (DEIS at 4.3-31).

Endangered Species Act (ESA)

The Endangered Species Act (ESA) of 1973 was written to protect species that are endangered or threatened with extinction. Like the MMPA, the ESA has joint jurisdiction between NMFS and FWS. The responsible agency can undertake a status review of a species to assess the applicability of listing the species as threatened or endangered, or an individual or an organization can petition for a species to be listed. The process for getting a species listed can be arduous and can create significant controversy, because of the legal implications of listing a species. Once listed, Federal

law prohibits the "take" (defined as harassing, harming, pursuing, hunting, shooting, wounding, killing, trapping, capturing, or collecting) of the species. The relevant agency is then required to create a recovery plan. Any non-federal action that has the potential to take a protected species must have an authorizing permit. Federal actions require consultation with NMFS or FWS. (NMFS, undated(a))

In the preferred site identified in the Navy's DEIS, only two ESA-listed species of marine mammals are identified as potentially affected by the activities of the USWTR: the humpback whale (*Megaptera novaeangliae)* and the sperm whale (*Physeter macrocephalus)*. According to the DEIS, the Navy has initiated consultation with NMFS, but no significant impacts on these species are expected to occur. Although there are North Atlantic right whale (*Eubalaena glacialis)* sightings in the area, the Navy estimates their density within the USWTR to be zero, and therefore the right whale is not being considered under the ESA.

National Defense Authorization Act for Fiscal Year 2004 (NDAA FY 2004)

In 2004, the National Defense bill reauthorization contained a rider, section 319 (NDAA, 2004), which changed the way the MMPA affects the Department of Defense (DoD). First, it amended the definition of harassment in cases of "military readiness activities," making the qualification for both Level A and Level B harassment more stringent. Instead of requiring only the "potential" to injure or disturb, military readiness acts are categorized as harassment only if they *do* injure or disturb, or have the "significant potential" to do so.

Second, the bill exempted actions "necessary for national defense" from the control of the regulating agencies. The Secretaries of Commerce and Interior previously had the final say over actions that would otherwise violate the MMPA, but now the Secretary of Defense can exempt any action (such as the use of Navy sonar) undertaken by any component of the DoD (such as the Navy), if it is determined by the Secretary of Defense that it is necessary for national defense. This exemption will not last more than two years, but it can be renewed by the Secretary of Defense without limit. The Secretary must submit to the Committees on Armed Services of both the House and the

Senate a notice explaining the exemption, but there is no authority on the part of these committees to support or deny the exemption.

Last, the bill amended the qualifications for issuance of permits for incidental taking and harassment in the case of military readiness. The determination of the "least practicable adverse impact" on the species should include consideration of "personnel safety, practicality of implementation, and impact on the effectiveness of the military readiness activity." In addition, it stated that military readiness activities should not be subject to the requirements that the authorization be "within a specified geographical region" and that the take or harassment be "of small numbers." This last amendment to the MMPA might have been included because it was one of the elements of the MMPA that led to an injunction against the use of the Navy's low-frequency active sonar (LFAS) in 2002 (NRDC *et al.* v Evans, 2002).

Effects of sound on cetaceans

Biologists are still attempting to understand what effects sonar and other sounds may have on marine life, and to understand the mechanisms that could cause mass strandings of whales. Based on experiments with trained bottlenose dolphins (*Tursiops truncatus)* and belugas (*Delphinapterus leucas)*, research on stranded cetaceans, and on observed responses from animals in the wild, marine mammal biologists have proposed a range of potential effects, from tissue damage to behavioral changes (Cox *et al.*, in press).

The inner ear of cetaceans is one of the most highly developed of any mammal. Fatty areas within the head of the whale transmit sound to the fluid-filled inner ear, which is the location of the cochlea, responsible for sound detection, and of the vestibular system, which dictates orientation and balance. The cochlea uses the basilar membrane to move cilia, causing the release of neurotransmitters, thereby converting sound waves to nerve signals (SOLMAR, undated). In the mammalian ear, exposure to high levels of sound can cause these hair cells to fatigue and lose their shape, resulting in reduced hearing sensitivity. This is known as a temporary threshold shift (TTS), after which the cells will eventually regain their original sensitivity. If the hair cells are damaged beyond recovery (so that they eventually die), permanent hearing loss will result, and this is known as a permanent threshold shift (PTS) (NRC, 2005). Historically, TTS and PTS

have been the metrics by which managers gauge the level of effect on cetaceans. However, recent research has revealed a more nuanced approach to assessing the levels of effects on cetaceans, ranging from behavioral response to tissue damage.

Changes in behavior of marine mammals after exposure to sound vary significantly, depending on factors such as species, age, sex, presence of dependent offspring, past noise exposure, and individual noise sensitivity. Responses can be as limited as a change in dive and breathing patterns, but exposure to sound can also cause changes in vocalizations (both reduced and increased levels of singing have been observed), cessation in activity, or flight. Studied effects have been mainly short term, but they could potentially be long term, such as abandoning feeding or mating grounds, or changing migration routes (NRC, 2003).

Although the oceans are naturally noisy, an increase in background noise can drown out biologically important sounds, masking the sounds whales use to attract mates, forage or hunt for food, and avoid predators. Masking is usually reported as a threshold past which signals can no longer be heard; it can also affect a cetacean's ability to detect a signal accurately. Assessing the effects of masking on an individual or a population basis is impeded not only by the paucity of studies but also by marine mammal biologists' limited understanding of how cetaceans communicate and use acoustic cues in the marine environment (NRC, 2003).

Responses to repeated or chronic sound, while more difficult to study than concrete, single, acute responses to sound, are more likely to have long-term population effects, such as pathological stress. Small disturbances can lead to temporary stress, and then homeostasis is restored. Continual disruption can cause chronic stress, altering immune responses, suppressing reproduction, inhibiting growth, and altering metabolism (NRC, 2003).

As described above, unusual mass strandings of cetaceans during or shortly after Naval sonar exercises led biologists to suspect a connection between the events. However, there is no clear mechanism by which the sonar might be causing the strandings, making it difficult not only to prove a causal relationship but to devise strategies for reducing the effects of sonar. Cox *et al.* (in press) summarize various hypothesized mechanisms (specifically for beaked whales) but refrain from concluding

that one is more likely than others, although they did highlight gas-bubble formation induced by a behavioral response (see below) as a particularly plausible mechanism in need of intensive study. The effects that could potentially lead to stranding can be broken into four groups: a behavioral response that directly leads to stranding; a behavioral response that leads to tissue damage; a physiological change; and tissue damage as a direct result of sonar (Cox *et al.*, in press).

Behavioral responses that could lead to stranding include whales attempting to avoid the sonar by moving into shallower water, where they are more likely to strand. An altering of diving behavior could also lead to tissue damage. Remaining at depth for too long could potentially cause hypoxia or the formation of gas bubbles. For example, if startled by sonar, a whale might rise to the surface too quickly, or dive too soon after surfacing, possibly resulting in elevated nitrogen supersaturation of tissues and the creation of gas bubbles. In turn, biologists have suggested that these gas bubbles could lead to the tissue damage observed in some of the animals involved in the stranding events. Gas emboli-associated lesions in the organs of stranded whales and dolphins support this hypothesis (Cox *et al.*, in press).

It is possible that whales could be subject to stress-induced hemorrhaging (hemorrhagic diathesis), causing disorientation, which would in turn lead to stranding. Alternatively, disorientation could also be a vestibular response after sound exposure. Tissue damage as a direct result of sound exposure could occur result from acoustically mediated bubble growth or tissue shear, or acoustic resonance of tissues. It is not clear whether any of these mechanisms lead directly to death or to the animals' stranding and subsequent death (Cox *et al.*, in press).

Analysis of Draft Environmental Impact Statement

What follows is an assessment of the Navy's 2005 Draft Environmental Impact Statement (DEIS) for the installation and operation of an Undersea Warfare Training Range (USWTR). I limit my focus to issues pertaining to cetaceans, for the Navy's preferred location, in the Cherry Point OPAREA, off the coast of North Carolina. Concerns about the effect of the installation and operation of the range for fish, sea turtles, and invertebrates were beyond the scope of this project.

Strandings

Over the past twenty years, there have been at least twelve mass stranding events of cetaceans that have been associated temporally and spatially with the operation of low- or mid-frequency sonar. However, it was not until 1996 that the connection was made between sonar activity and mass strandings, when Frantzis (1998) reported the stranding of twelve Cuvier's beaked whales on the coast of Greece. A stranding in the Bahamas in 2000 of seventeen cetaceans (four species of whales, including Cuvier's and Blainville's beaked whales [*Ziphius cavirostris* and *Mesplodon densirostris*]), drew additional concern, and the interim report, issued by NOAA and the Navy, indicated that the use of mid-frequency active sonar by four Navy ships (in concurrence with contributing environmental factors) was the most likely cause of the stranding. It is not known how many strandings have occurred and gone unnoticed, or if mortalities have occurred without resulting in a stranding (Sierra Club, 2006).

Beaked whales (family Ziphiidae) rarely mass strand. However, recent strandings have suggested that these species may be especially susceptible to the effects of sonar (Cox *et al.*, in press). Despite the paucity of information about the effects of sonar on beaked whales and the critical nature of this subject, there are several recent sources, including Cox *et al.* (in press) and Fernandez *et al.* (2005), that are not cited by the Navy (MMC, 2006).

The DEIS discusses only the strandings of beaked whales. However, some strandings or extreme behaviors associated with sonar activity have involved multiple species, not always including beaked whales. Minke whales (*Balaenoptera acutorostrata)* were among the stranded species in the Bahamas in 2000 (DoC, 2001).

Four years later, over 150 melon-headed whales (*Peponocephala electra*), which usually remain in deep waters, were observed crowding into shallow areas of Hanalei Bay, Kaui'i, Hawai'i during RIMPAC exercises conducted by the US and Japanese navies. A final report regarding this incident was issued by the NOAA Fisheries Service in late April 2006, and it states that the exact cause of this stranding is unknown, but that active sonar is "a plausible, if not likely, contributing factor in what may have been a confluence of events" (Southall *et al.*, 2006). Exercises conducted by the *USS Shoup* in Haro Strait, Washington, in 2003, were concurrent with observed abnormal behavior in killer whales (*Orcinus orca*) and the stranding of several harbor porpoises (*Phocoena phocoena*). The report issued by NMFS stated that the received exposure levels from the active sonar were likely to cause a behavioral reaction in the killer whales, but without more data, the cause of the harbor porpoise stranding would remain unknown (NMFS, 2005). Thirty-three short-finned pilot whales (*Globicephala macrorhynchus*), two dwarf sperm whales (*Kogia sima*), and one minke whale were stranded on the Outer Banks, NC, in January 2005, within the area and time-frame of tactical mid-frequency sonar activity conducted by the Navy (Hohn *et al.*, 2006).

The Outer Banks stranding of 2005 is not mentioned in the draft environmental impact statement, and the draft's comment period closed before the National Marine Fisheries Service (NMFS) issued the report in March 2006. Researchers did not find a specific cause for the multi-species stranding, but they noted the concurrence of Naval activity and specific environmental factors such as wind patterns, upwelling and downwelling, and bathymetry, which are consistent with conditions under which previous strandings occurred (Hohn *et al.*, 2006). The report states that it was not possible to determine a single cause for the stranding (and the authors suggest that the minke whale stranding may have been coincidental), but it was not possible to rule out the possibility that sonar was involved.

Acoustic Effects

As described earlier, under the Marine Mammal Protection Act, it is illegal to harass, hunt, capture, or kill any marine mammal, or attempt to do so. The definition of harassment is broken into two levels – levels A and B. Level A refers to acts that have the potential to injure an animal in the wild. Level B refers to acts that have the potential to disturb an animal by causing a disruption of behavioral patterns. The Navy set three thresholds in relation to these definitions. The Navy anticipates that at a received energy flux density level[1] (EL) of 190 dB re 1 μPa^2-s, the sonar will cause behavioral effects, which will be considered Level B harassment. At an EL of 195 dB re 1 μPa^2-s, the Navy anticipates that sonar will cause a temporary threshold shift (TTS) in hearing, which will also be considered Level B harassment. At an EL of 215 dB re 1 μPa^2-s, the Navy anticipates that sonar will cause a permanent threshold shift (PTS) in hearing, which will be considered Level A harassment. No whales are anticipated to experience Level A harassment, except for beaked whales. As explained earlier, all harassment of beaked whales will be considered Level A harassment because of their unique sensitivity to active sonar (DEIS at 4.3).

The Navy based these thresholds for harassment on a series of studies conducted by Finneran and Schlundt (Schlundt *et al.*, 2000; Finneran *et al.*, 2000, 2004). These studies used seven trained, captive odontocetes (five bottlenose dolphins [*Tursiops truncatus*] and two white whales [*Delphinapterus leucas*]). All these subjects had been repeatedly exposed to loud noise in the past (MMC, 2006). At least one dolphin already had significant mid-frequency hearing loss, and most had high-frequency hearing loss (SELC, 2006). In addition, the test subjects were food-reinforced (NOAA, 2006). The studies performed by Finneran and Schlundt consisted of exposing the captive cetaceans to one-second pulses at varying intensities and varying frequencies. The researchers determined if any resulting behaviors were distinct from the dolphins' and white whales' trained behaviors. There were instances where the mammals attacked the laboratory equipment in response to exposure to the sound (NOAA, 2006). It is questionable

[1] Energy flux density level (EL) is a "measure of the sound energy flow per unit area expressed in decibels." For underwater sound, EL is given in dB re 1 μPa^2-s. Sound pressure level (SPL) is a "measure of the root-mean square, or "effective," sound pressure in decibels." SPL is expressed in dB re 1 µPa for underwater sound. (DEIS at 4.3-12).

whether these animals are the most appropriate basis for the Navy's harassment thresholds.

The Navy cannot assume that all species of cetacean, in all classes of age and sex, will have the same thresholds as these seven individuals (MMC, 2006), and therefore should not extrapolate the data to other species. When performing a risk assessment, it is expected that the study will use the most sensitive species, to determine the most conservative threshold for harm. There is no evidence that bottlenose dolphins and white whales are the cetaceans most sensitive to mid-frequency sonar. Harbor porpoises, killer whales, and right whales have all displayed sensitivity to mid-frequency sounds, ceasing to feed or changing dive patterns (NMFS, 2005; Nowacek *et al.*, 2004). Beaked whales especially are known to be extremely and even fatally susceptible to mid-frequency active sonar. The test animals may have become habituated to intense sound, but without quantification of this effect, it is impossible to know how much this habituation could have affected the results (NOAA, 2006). In addition, it is not appropriate to apply odontocete harassment thresholds to mysticetes. Ideally, species-specific thresholds could be set to more accurately predict the harassment levels for the operation of the range (MMC, 2006; NOAA, 2006).

In addition, the sounds used in the studies are not necessarily comparable in quality and level to sonar (MMC, 2006), despite the benefit of having complete control over the sound conditions (NOAA, 2006). According to the National Oceanic and Atmospheric Administration (NOAA) (2006), the pure-tone exposures used in these experiments are not accurate representations of the "complex frequency modulation and multi-path propagation patterns of tactical sonars in operational environments."

The suitability of the threshold of 190 dB re 1 μPa^2-s for sub-TTS behavioral disturbance should be reconsidered. Finneran and Schlundt calculated the percentage of sessions in which behavioral alterations occurred as a function of the level of received noise, at 0.4, 3, 10, 20, and 75 kHz. The Navy chose an intensity threshold at which 50% of the exposures to 3, 10, and 20 kHz tones resulted in altered behaviors, using pooled data from all test subjects (DEIS at 4.3-23). This is not a conservative threshold, especially given the limitations of the laboratory studies enumerated above (NOAA, 2006). The National Research Council (NRC) 2005 report on marine mammal

populations and ocean noise recommended the use of a quartile level as a more conservative measure in the face of such uncertainty (MMC, 2006), which in this case would result in a lower threshold, 180 dB re 1 μPa^2-s (Finneran *et al.*, 2004). In addition, the Navy did not include the other frequencies tested by Finneran and Schlundt. Over the years of the range operation, there will be many acoustic sources at different frequencies, adding to the level of anthropogenic sound in the ocean. It would not be unreasonable, in the interest of conservation, for the Navy to include the 0.4 and 75 kHz frequencies tested by Finneran and Schlundt, and to set the sub-TTS behavioral disturbance threshold to 173 dB re 1 μPa^2-s (NOAA, 2006), the lowest threshold discussed in Finneran *et al.* (2004). And yet, even at 173 dB re 1 μPa^2-s, the Navy would still be disregarding the instances where Finneran *et al.* (2004) observed alterations in behavior at 160 dB re 1 μPa^2-s (NRDC, 2006a).

There are other concerns with the Navy's categorization of harassment and thresholds. For instance, TTS should not represent the lowest level of significant biological effects. Although the experiments of Finneran and Schlundt are the best available laboratory studies on the subject, they do not prove that any effect below TTS is not biologically significant (MMC, 2006). In addition, the Navy acknowledges in their draft EIS that "susceptibility to PTS cannot be reliably predicted from TTS measurements" (DEIS at 4.3-15). Yet, they base their PTS threshold entirely on the TTS threshold, assuming a linear relationship of an additional 20 dB (Sierra Club, 2006; NRDC, 2006a).

The Navy offers little explanation for their use of TTS and PTS as the most appropriate thresholds for harassment and injury (NRDC, 2006a). Effects that they considered and discarded include acoustically mediated bubble growth (beaked whales were considered separately), resonance, and long-term effects (DEIS at 4.3-31 to 32). As stated earlier, these effects are theoretical, and biologists have no thresholds past which these hypothetical effects will occur. However, given that biologists have not ruled out these hypotheses (Cox *et al.*, in press), and that the lesions have been found in species other than beaked whales (Jepson *et al.,* 2005), they should not be rejected. Even if threshold levels cannot be set based on the potential formation of gas bubbles, the Navy could consider more conservative thresholds.

Unmentioned in the draft environmental impact statement is a threshold for mortality – the highest threshold is for Level A harassment, at 215 dB re 1 μPa^2-s (the level the Navy predicts will cause PTS) – and so there are no estimates for the number of whales that could die as a result of the range operation. As was seen in the Bahamas, whales have stranded and died during or shortly after naval activity, with active sonar as the cause. The NRC (2005) stated that evidence of this relationship "suggests a possible risk of stranding for whales exposed to noise as low as 160 dB re 1 μPa" (p 45) (Sierra Club, 2006). In the case of the Bahamas, the modeled exposure levels based on observed beaked whale positions were no more than 160-170 dB re 1 μPa for 10-30 seconds, as reported in 2004 by the Scientific Committee of the International Whaling Commission (IWC, 2004). Further modeling, conducted in part by the Office of Naval Research, suggests that the received level was lower than 140 dB re 1 μPa (NRDC, 2006a). Although NMFS and the Navy have stated that the incident in the Bahamas was, in part, due to certain characteristics of the area and the sonar activity, a precautionary approach would dictate that the Navy set a threshold for mortality (NRDC, 2006a).

The Marine Mammal Commission noted that, unless the Navy's set thresholds are appropriate for only the three proposed USWTR sites, it is unclear how the hemorrhaging of beaked whales in the Bahamas would have occurred. Using the Navy's threshold for injury (215 dB re 1 μPa^2-s), and a source level of 230 dB re 1 μPa at 1 meter, the sound would reach the threshold at 5.6 meters (DEIS at 4.3-49). If this is how close the beaked whales would have had to be to experience injury, the Navy vessels would have been well within striking distance, and would have presumably mitigated against a potential ship strike, unless the injury to the whales was due to received levels below the Navy's threshold for injury. If the fatal stranding was not a result of immediate injury but was because the whales startled due to a lower exposure, it is possible that their deaths would not even be considered Level B harassment (MMC, 2006).

From the DEIS, it is clear that the Navy is already carrying out anti-submarine warfare (ASW) training exercises in East Coast OPAREAs. The Navy fails to give the full details of how many OPAREAs are being used for this purpose, and to what extent. Because this is the "no-action" baseline that they are comparing the alternatives to, it is essential to know what the baseline is. In addition, it is unclear if these non-range

associated exercises will continue after the establishment of the USWTR at the same capacity or at reduced levels (MMC, 2006). If exercises in the Atlantic are expected to continue outside the chosen USWTR site, the Navy should examine the cumulative effects of the sonar, and not simply state that "the Navy is implementing a comprehensive strategy to support training with active sonar in a manner protective of marine mammals" (DEIS at 4.8-5), without giving additional detail about what that strategy might entail.

There are no estimates of the number of takes that are already occurring as a result of the Navy's other active sonar activities, nor does the Navy estimate the number of marine mammals subject to acoustic harassment from non-Naval activities, such as shipping. This is an essential aspect of cumulative effects, which NEPA defines as:

> The impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions *regardless of what agency* (Federal or non-Federal) *or person undertakes such other actions*. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time. (40 C.F.R. § 1508.7) (Emphases added.)

If there is not sufficient data for a full analysis of the cumulative effects, it should be fully stated (MMC, 2006).

The calculation of estimated takes by harassment was done in a manner that disregarded cumulative effects. The process of calculating these effects was as follows: the acoustic "footprint" of the sonar was determined for 1 km; the portion of this footprint that modeled a received level exceeding threshold levels was calculated; and this area was multiplied by the density of marine mammals estimated to be present within the training range for a season or year, assuming even distribution of individuals. No effort was made to consider the impacts of repeated exposures, especially for species that might not abandon their year-round habitat or breeding grounds. Each take is considered to be a new whale, or else repeated takes of the same whale are assumed to be non-additive (NRDC, 2006a).

Modeling of sound

The Navy includes in their draft environmental impact statement an explanation of their approach to modeling the sound to determine the estimated level of harassment of marine mammal species. However, the models used by the Navy only map the sound 1 km from the sound source (DEIS at 4.3-40). At this range, the received level will have dropped by only about 55 dB (DEIS figure 4.3-10), and, if the thresholds were not sufficiently conservative, as I suggested earlier, the sound could still have an effect on whales. Any animals predicted to be outside this radius were not considered in the take estimates.

Several concerns were not considered in the modeling analysis, such as the effect of deep canyons in the region, and how these will affect and change the propagation of sound (SELC, 2006). In addition, the Navy did not include the effects of reverberation or reflection off the hardbottom seafloor (for which the data used by the Navy was out of date), which could potentially lengthen the duty cycle of the exercise and raise the received energy levels (NRDC, 2006a). Nor is there a discussion of the potential for surface ducting, which is the channeling of sounds in the upper portions of the water column, allowing the sound to travel further, an issue discussed in the Navy and NFMS report regarding the 2000 mass stranding in the Bahamas (DoC, 2001), and one of the contributing factors that led to that event, as stated by the Navy (NRDC, 2006a).

Cumulative impacts

The acoustic effects of the sonar range are of great concern, partially because there is still so much uncertainty. However, there are other concerns for which there is more information and these also need to be addressed, especially when considering the cumulative impacts. Even if individual impacts are minimal, the combined effects of repeated or multiple actions, or of actions unrelated to the USWTR, could have significant impacts on individuals and populations on and near the range (NRDC, 2006a).

The DEIS does identify ship strikes, ocean debris, commercial fishing, bioaccumulation of toxins, climate change, and other activities that play a role in the survival and success of marine mammal species. However, as noted above for acoustic effects, the Navy fails to quantify how these actions affect the recovery of the protected

species, and how much additional impact the operations of the USWTR will have on the species (Sierra Club, 2006; NRDC, 2006a). There is no assessment of the cumulative, long-term effects of toxic chemicals (such as hydrogen cyanide and lead), only an explanation of the single releases of the chemicals (NRDC, 2006a).

The DEIS mentions the possibility that the Navy will use the USWTR for mine warfare training, but it does not analyze the potential impacts of such activity, or the cumulative effects of both exercises (SELC, 2006). There is no indication that the Navy has considered the maintenance, expansion, or increased use of the range, although these are all foreseeable actions that deserve notice in the analysis of cumulative effect. Also, the Navy gives no indication of the lifespan of the range (Sierra Club, 2006).

As stated before, it is essential to have some quantitative estimates for the activities that are known to affect marine mammals, so that these can be added to the new predictions for effects of the USWTR, and the overall harm to populations in or near the USWTR can be assessed. The purpose of having a cumulative effects section in an environmental impact statement is to ensure that the additional actions will not tip the scale against the protection of the environment. In the case of marine mammals, the cumulative effects should be considered with regard to the potential biological removal (PBR) of each species, to ensure that the total number of takes will not prevent the recovery of the species (MMC, 2006).

Mitigation

In Chapter 6 of the draft environmental impact statement, the Navy outlines the mitigation measures it intends to take for the proposed action. The acoustic-related mitigation involves two elements: visual monitoring and sonar abatement. Navy personnel would be trained in visual monitoring, and their duties would include the detection-by-binocular of nearby, surfacing whales. Visual surveys would occur before and during exercises (DEIS at 6-1-2). When whales and dolphins are within 320 meters of the sonar, active transmissions would be reduced by 6 dB and would remain at this lowered level until the cetaceans were out of the 320-meter range. In the case of the sonar-dipping helicopter, the sonar would not be used at all if cetaceans are within 183 meters. As an exception, when dolphins bow-ride, the vessel does not have to employ

further mitigation measures (DEIS at 6-3). The Navy does not provide *any* assessment of the estimated effectiveness of these measures (SELC, 2006).

The Navy dismisses several measures that have been suggested as potentially mitigating the acoustic effects of sonar. Ramp-up, the slow increase in sound levels, to give marine mammals the chance to leave the area, is deemed infeasible because it is not a technique used in war-time operations. The use of dedicated third-party visual observers was rejected based on scheduling complications and prohibitive cost. Last, the possibility of using the transducer nodes as a method of passive acoustic monitoring was discarded because the effectiveness of the nodes for this purpose is unknown (DEIS at 6-5). Despite the Navy's rejection of this latter mitigation method, widely spaced, bottom-mounted hydrophones are currently being tested in the Navy's Atlantic Undersea Test and Evaluation Center (AUTEC) to determine their effectiveness in detecting vocalizing whales (Tyack, 2006). The DEIS does state that the Navy will continue to coordinate similar research within the USWTR.

The potential for passive acoustic monitoring should be explored more fully in the draft EIS. It is only recently that researchers have begun to record and explore the vocalizing patterns of beaked whales in the wild (Johnson *et al.*, 2004). Johnson's study shows that the beaked whales, which spend very little time at the surface and are therefore difficult to detect by on-board lookouts, begin to vocalize when foraging at depths below 200 meters (in the case of *Ziphius*) or 400 meters (in the case of *Mesoplodon*). If the transducer nodes could be useful for detecting these vocalizations, this option should be described in the DEIS, along with statements of the uncertainty of their effectiveness. Even though non-vocalizing whales would not be detected using this method, using this technique would still increase the Navy's awareness of beaked whales in the range.

To rely solely on non-dedicated personnel to visually spot whales, which spend a small fraction of their time at the surface (especially in the case of beaked whales), and to lower the source levels of the sonar only when in such close proximity to the marine mammals does not satisfy the responsibility of the Navy to limit the potential for harm to these protected species. The Navy does not discuss the limitations of using only observers from surface vessels and aircraft to detect the presence of whales (Sierra Club,

2006). At times of low light, sighting whales is difficult or impossible, and there is no indication how this limitation will be dealt with (NOAA, 2006). Under the best circumstances, a trained marine mammal observer will see 33% of North Atlantic right whales (one of the easier species of whale to detect) in an area. When the whales are more than 1.5 miles from the sighting platform, the probability drops to 11%[2] (NRDC, 2006a). Under ideal conditions (which include three highly trained observers, daytime, a Beaufort sea state of less than two, and high-powered binoculars), the probability of spotting a beaked whale directly on the survey track-line is estimated to be 23% for Cuvier's beaked whales and 45% for mesoplodont beaked whales (Barlow and Gisiner, in press). These probabilities decrease dramatically as sea conditions worsen, and the probability of experienced observers' sighting these elusive whales is twice that of less experienced observers (Barlow and Gisiner, in press).

There are also a number of measures that the Navy does not consider in the DEIS. For instance, it does not consider implementing seasonal restrictions on the exercises. The Navy could also consider a complete shutdown procedure (as opposed to their proposed 6-dB reduction in intensity) when whales are in a certain radius of *any* sonar, not just the sonar-dipping helicopter. The "safety zone" could also be larger than 320 meters, providing more protection for nearby whales. While the DEIS states that aerial surveys will be conducted before and during exercises, it specifies *when possible* (DEIS at 6-2). Aerial surveys should be conducted before and during every exercise, to lessen the chance of exposing local whales to the intense sonar (NRDC, 2006a).

These suggestions, when compared to the Navy's proposed measures, may seem extreme. However, these measures are being used by other forces using active sonar. For instance, the NATO Undersea Research Centre (NURC) uses many of the above suggested measures, including ramping up from a source level of 150 dB re 1 μPa at 1 meter and keeping the sonar at as low an intensity as possible for the mission requirements. They also suspend all operations if there are animals within a safety zone, which is the area ensonified to 160 dB re 1 μPa at 1 meter, or twice that area in the case

[2] J.W.W. Hain, S.L. Ellis, R.D. Kenney, and C.K. Slay, Sightability of Right Whales in Coastal Waters of the Southeastern United States with Implications for the Aerial Monitoring Program, in G.W. Garner, S.C. Amstrup, J.L. Laake, B.F.J. Manley, L.L. McDonald, and D.G. Robertson, Marine Mammal Survey and Assessment Methods 191 (1999). As referenced by NRDC, 2006a.

of endangered species and the Cuvier's beaked whale. Trained lookouts and aircraft keep watch for whales within this area, and NATO employs passive acoustic monitoring systems for further detection. NATO also requires that all sightings recorded be reported in standard form, and that a team be ready to respond to marine mammal incidents (NRDC, 2006a).

The Australian Navy likewise places restrictions on the geographic and seasonal use of active sonar. It uses a safety zone of 4000 yards, which is monitored before and during exercises, and within which there is a shutdown procedure in the presence of whales. In addition, in conditions that are likely to create surface ducting, the Australian Navy employs lower power levels (NRDC, 2006a).

All of the above mitigation measures relate to the operation of the range – when and where the sonar should be used. However, it might be possible to change the sonar itself to make it less harmful to marine mammals. The use of complex waveforms, which may retain the sensitivity of the mid-frequency sonar used now, but reach lower peak amplitudes, was suggested by an expert panel commissioned by the US Office of Naval Research (NRDC, 2006a).

Monitoring and reporting

Considering the level of uncertainty regarding the numbers and levels of harm that could occur as a result of USWTR operations, it is essential that the Navy institute a rigorous monitoring program, which is not described in detail in the draft EIS. Surveys should be conducted before and after events whenever possible, and they should cover the entire ensonified area (NOAA, 2006). The coastline should also be monitored to ensure that, if a stranding event does occur, either the involved whales will be put back to sea or, if there are mortalities, researchers can perform necropsies with expedience (MMC, 2006). It should be noted that even with strict monitoring of the waters and beaches, there is a possibility that some of the bodies may never be found onshore (SELC, 2006). It is likely that the Navy will question the feasibility of this suggestion; with 161 exercises each year, the range will be in operation almost half of the year. However, perhaps this is not a reason to forgo thorough monitoring but a reason to limit the number of exercises, especially during the early years of operation.

The Navy should also create and release a protocol for reporting to NMFS any sightings and behaviors (altered or not) of whales as observed by Navy vessels before, during, and after sonar use, and if possible, the estimated received levels of sound for the animals (SELC, 2006). These reports could then be used to confirm or correct density estimates and could serve as evidence for the effects of sonar on whales, and the duration of these effects.

From the DEIS, it is clear that the Navy has been conducting ASW training exercises in several of their OPAREAs already. The Navy also asserts that they currently employ trained observers to detect the presence of marine mammals. However, the Navy does not provide any data on the presence and behavior of marine mammals during sonar operation – data that is presumably being recorded by these observers. If these data exist, they could be used to confirm or update the given density estimates and the understanding of the whales' responses to exposure. It would also serve as evidence for the efficacy of the Navy's responses to cetacean presence. These data should have been included as a part of the base-line, no-action alternative, and used to compare the effects of action (MMC, 2006).

Release of information

For the public to have an adequate understanding of the methods that the Navy used to conduct their environmental analysis, it is essential that the Navy release information to this point. For instance, the Navy should release data for the specific activities they intend to conduct in the training range, including source levels, frequency ranges, duty cycles, and other technical parameters (NRDC, 2006a). Although the DEIS includes information on the operation of some sonar systems, others, such as the sonar-dipping helicopter, remain unexplained. In addition, the models used to assess the effects of the sonar systems were not released, and therefore the public is unable to determine the validity of the Navy's analysis (NRDC, 2006a). Although the Navy states that there will be a protocol for the monitoring and reporting of marine mammal sightings, received sound levels, and any incidents that could occur, this protocol is not explained in the DEIS.

Non-sonar sound

The only sound that the DEIS acknowledges will have an impact on marine mammals is the mid-frequency sonar. However, from numerous studies on the effects of ship-related noise on marine mammals (Nowacek *et al.*, 2004), it is clear that the Navy's activities will have additional effects. No information is provided on the nature and levels of sound that will be created by the Navy's vessels, nor is there any mention of the effects that these sounds could have on marine life. Perhaps the Navy has excluded these because they will most likely only marginally add to the existing noise from vessels (Navy or otherwise). However, it is their responsibility to fully explain the potential environmental impacts of the proposed action. Although these sounds alone may have little effect on marine mammals, when combined with already existing sounds and the additional noise from sonar systems, there may be cumulative effects. Additionally, the Navy gives no indication that they will attempt to limit this sound or assess the effects it will have on marine mammals (MMC, 2006). There will presumably be sounds associated with the installation of the USWTR, such as burying the cable, and which the Navy has not quantified these or explained their possible effects of in the DEIS (Sierra Club, 2006).

Density estimates of whales

Within the draft impact statement, the Navy provides density estimates for each of the three proposed OPAREAs, including the Cherry Point OPAREA off the coast of North Carolina. The bases for these estimates were internal abundance reports conducted for the Navy and unavailable to the public. Although the Navy states that "cetacean fauna were characterized using all available marine mammal survey and sighting data for all locations" (DEIS at 3.3-8), there is no indication that these data were used in formulating the quantitative distribution and abundance estimates. The Marine Mammal Commission noted that they were unfamiliar with the referenced Navy publications, and therefore they were unable to "judge the reliability of the data or the validity of the procedures used to generate the estimates" (MMC, 2006).

Beyond the use of internal reports and the exclusion of relevant data, the Navy bases their decision to stratify the density estimates between the on- and off-shelf depth

zones on the large-scale CETAP (Cetacean and Turtle Assessment Program) surveys conducted over 20 years ago (DEIS at 3.3-9) (NRDC, 2006a). To use this outdated information does not comply with the requirements of NEPA.

A number of whale species were listed as having zero-density within the Cherry Point OPAREA and have been recorded in NMFS and other surveys as being present. For instance, the Navy assigns the fin whale (*Balaenoptera musculus*) a "may occur" designation for off-shelf depths in the winter, and for other seasons states that there will be a zero density. However, fin whales have been seen in other seasons less than 70 km from the proposed range borders, based on a stock assessment published in 2003 (NRDC, 2006a). Humpback whales in the area are assumed by the Navy to be either feeding close inshore or migrating further offshore, and so will not be present within the training range (DEIS at 4.3-45). However, the studies cited by the Navy were conducted only a few miles from shore and do not support this assumption (NRDC, 2006a). Other species were completely excluded from consideration, including sei whales (*Balaenoptera borealis*), pygmy killer whales (*Feresa attenuata*), melon-headed whales, Fraser's dolphins (*Lagenodelphis hosei*), and striped dolphins (*Stenella coeruleoalba*). Surveys conducted by NMFS have placed these species near Cape Hatteras, and due to the tendency of these species to remain offshore and be missed by surveys, it would be appropriate for the Navy to take a more precautionary approach to the abundance of these species (NRDC, 2006a). When considering bottlenose dolphins, the Navy fails to consider the potential for three separate stocks, each of which could overlap in the vicinity of the training range (NRDC, 2006a).

Right whales

The North Atlantic right whale (*Eubalaena glacialis*) was excluded from the Navy's analysis of the potential biological effects of the installation and operation of the USWTR, based on the Navy's density estimates indicating a zero density of right whales in the Cherry Point OPAREA, although they do give the right whale a "may occur" designation. While the Marine Mammal Commission (MMC) agrees that the installation of the USWTR is "unlikely to have biologically significant effects" on cetaceans, it states that both the installation and the operation of the range pose a threat to the North Atlantic

right whale. The MMC adds that the DEIS does not include reference surveys conducted by NOAA, or stranding records, as evidence of the occurrence of right whales within the proposed training range (MMC, 2006).

Ship strike reports were similarly unmentioned, such as the injury of a pregnant right whale off the coast of Virginia, struck by a Navy vessel in November 2004 (NRDC, 2006a). Thirty-five percent of known North Atlantic right whale mortalities between 1970 and 1997 were due to ship strikes (Nowacek *et al.*, 2004; Caswell *et al.*, 1999). Despite right whales' ability to hear ships, and strategies employed by ships to avoid striking surfaced whales, these endangered cetaceans do not always respond predictably to the sound of approaching ships.

There have been recent observations of mother and calf pairs in the shelf waters off North Carolina (SELC, 2006), and whales have been sighted between 20 and 50 miles off the North Carolina shore (Sierra Club, 2006). With so much uncertainty about the migration patterns of this species (40% of known mother-calf pairs were unaccounted for in the summer of 2005 (Sierra Club, 2006)), the Navy should not assume that right whales will be absent in the training range, especially since the loss of just one right whale could affect the recovery of the species (SELC, 2006).

The Navy must not only consider the risk of ship strikes, a known threat for the right whale, but also the potential acoustic effects. Right whales were observed to abandon deep dives and surface rapidly, or remain at the surface or at depth for abnormally long periods when exposed to mid- and low-frequency alerts (which were not intended to mimic the active sonar used by the Navy) at received levels of 133-148 dB re 1 μPa for the duration of exposure. These surfacing behaviors could make them more vulnerable to ship strikes (Nowacek *et al.*, 2004). The Navy should consider studies such as this, to determine if the sonar could cause right whales to engage in endangering behavior (NRDC, 2006a).

Entanglements

One of the primary threats to cetaceans is the risk of entanglement in fishing gear, which has caused 5% of right whale mortality, at an estimated rate of 2.6 deaths per year. At least 70% of right whales in the western North Atlantic population have scars identified as caused by entanglement (Caswell *et al.*, 1999).

Several aspects of the sonar range could increase the risk of entanglement for cetaceans, including the parachutes, sonobuoys, cables, control wire, and other items that will remain in the ocean after the completion of the exercises. The parachutes and other expendable waste will be abandoned in the water column to sink to the floor (SELC, 2006). The Navy predicts they will use 7884 sonobuoys yearly, suspended for up to eight hours by a cable that extends 90 to 400 feet below the surface (MMC, 2006). The interconnecting cables between nodes will be exposed in the preferred site off the coast of North Carolina. If there is slack in these cables, bottom-feeding baleen whales could become entangled, an effect that is similar to that caused by lobster-pot lines (NRDC, 2006a). There is evidence of sperm whales being entangled in the trans-Atlantic cable (Sierra Club, 2006). All of these concerns remain unanswered in the draft impact statement and should be considered.

Conclusion

Based on the concerns I have raised here, I believe that the Navy should issue a supplement to their draft environmental impact statement for the undersea warfare training range, or perhaps issue a new draft, so that the public has more time to comment on the changes. To comply fully with the National Environmental Policy Act, the Navy must use the best available information and fully explain all of the potential impacts that the proposed range could have on the environment. The thresholds for harassment of marine mammals need to be adjusted to take into consideration the limitations of the Finneran and Schlundt studies, or should be based on more appropriate data. In addition, a threshold for mortality must be included. Other concerns, such as the incomplete modeling of the sonar, the lack of quantified cumulative effects, the mitigation methods (especially the potential for passive acoustic monitoring), and issues relating to right whales, must all be expanded or altered to incorporate all of the current and applicable data.

The Navy's proposed range could provide a unique opportunity to study the shallow-water effects of sonar on whales for an extended period of time. By restricting their actions to a limited area, the Navy has made it possible for monitoring to be more standardized, compared with exercises that currently occur in a variety of OPAREAs. To take advantage of this opportunity, the Navy must use the forum of the environmental impact statement to fully inform the public how these studies and monitoring will be conducted.

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