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17 May 2007

Chief
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Re: File No. 1079–1828; Behavioral Response Study, Deep Diving Odontocetes

Dear Chief:

Thank you for the opportunity to comment on the Application for a Behavioral Response Study on Deep Diving Odontocetes. Cetacean Society International (CSI) is grateful for the application of this caliber of research to an issue of considerable concern to many, which we believe has population-level significance. CSI's comments are intended to be constructive, based on our commitment to help find solutions to anthropogenic acoustical impacts, and in particular the question of the moment: why do naval mid-frequency (MF) active sonars cause some marine animals to behave in ways that may jeopardize their survival?

However, this project bypasses this necessary objective and attempts a shotgun approach to the broader issue of potential impacts from anthropogenic MF sounds in general, and further, assumes that the target population on the AUTEC range will behave as would non-accommodated animals. Is there evidence that an equal or greater threat to marine mammal populations exists from some MF source other than naval active sonars? Is the potential for impact from seismic surveys or other sources caused by their MF component? CSI is not aware that any MF issue is as critical as naval MF active sonars.

This is recognized by the applicants, who state: "NOAA, Navy, and the marine biological research community in general, have not been able to gain a firm grasp on the acoustic mechanism of the observed effects on beaked whales from MF sonar sounds. This has hampered various efforts of the U.S. government to meet its mandated requirements for marine conservation while enabling military training activities that are critical to national security."

To support their approach the applicants state: "The proposed two-phase BRS research activity (2007-2008) is a study that examines the responses of deep-diving odontocetes (including beaked whales) to various underwater coherent/incoherent sounds. The purpose of the field research is to quantify the behavioral responses of deep-diving odontocetes to known acoustic exposure events." But they then interpret, and we believe misstate, the intent of the National Research Council's recommendations, saying : "This type of field research has been repeatedly identified by various reports by the National Research Council (1994; 2000; 2003; 2005) as a critical data need and was unanimously identified as the foremost data need regarding beaked whales and sonars at the Marine Mammal Commission (MMC) symposium on beaked whales two years ago

(see Cox et al., 2006). Also, the absence of direct behavioral information on the potential effects of active military sonar and offshore oil/gas exploration on odontocetes is clearly one of the most challenging issues facing the NOAA/NMFS Office of Protected Resources (OPR) in managing oceanic noise issues."

CSI believes that the beaked whale symposium "unanimously identified as the foremost data need regarding beaked whales and sonar" the specific characteristics of those sonars that appear to cause the problems. But this project will not use those sonars and cannot duplicate those sounds.

CSI has been one of the very few NGOs that has supported the need for a minimally invasive or harassing Controlled Exposure Experiment (CEE), but with caveats. The first caveat is to conduct all CEE research with the well-being of potentially affected animals and habitat as a priority; to do no harm in the process. We believe that the project's protocols can accomplish this.

A second caveat is that all research be conducted so that there can be no suggestion of a conflict of interest, and with all aspects openly available to the public in a timely manner. Unless the Navy intervenes we expect the project to be as publically open as is customary.

The third caveat is that the first major experiment like this should be conducted so that the results are specific to the most critical issue, which is the relationship between the normal operational use of naval MF active sonars and the resultant behavior of potentially affected marine animals. A third caveat does not seem to be the intent of the Applicants. Therefore CSI cannot support this CEE without a primary goal of addressing the fundamental question on everyone's mind, and the primary question that is assumed to stimulate the funding and support for this research: what is it about naval mid-frequency (MF) sonars that cause some marine animals, in particular some beaked whales, to behave in ways that can cause injury and death?

Instead, this project seems planned to address only more generic questions, using non-military sources. If this project will not use the naval mid-frequency active sonar types under controlled operational circumstances already implicated in events leading to mass strandings the project becomes limited to "nice-to-know" results, not what we all "need-to-know." Too much time has passed, too many events have occurred, and too many opportunities have been lost to waste resources on "nice-to-know" questions first.

CSI is an advocacy organization representing the public interest. We rely on science to address issues of public concern, and we hold science responsible for addressing these issues in a timely and appropriate manner. The issue at hand is not the potential behavioral impacts of all anthropogenic MF sounds. How can anyone refute that the priority need is to answer the very specific question about impacts resulting from military MF sonar use? The question has nothing to do with national security, but the answers may provide solutions that will ultimately lead to a "win-win" situation for all concerned, including the Navy. CSI believes it is the primary responsibility of all associated with this project to address first the apparent conflict between naval sonars and marine animals.

However, the experiment cannot address the immediate and necessary question if the Navy refuses to designate an appropriately equipped vessel or loan the researchers the sonars and support gear, of if the researchers do not require that the "real" equipment be used. We have a hard time believing that this could be true, and hope that we have just missed the Application's description of the use of appropriate naval sonars and situations.

We are also puzzled that such experienced and knowledgeable scientists would describe the noise characteristics they will research as "salient to the animals" as limited

to "features such as the loudness, frequency, duration, location, and distance or motion of the sound source." This truly is an inadequate, unsophisticated description of the acoustical characteristics of a sound that might cause adverse behaviors, much less the apparent startle or flight responses in some marine animals.

Are they ignoring the reality obvious to anyone with normal hearing, that several sources sharing identical characteristics from this list still would be easy to discriminate as having different sources or meaning; we can all hear the difference between a flute and a violin. It is logical to assume that beaked whales, for example, discriminate sounds by many other factors as well. It is also logical to assume that some characteristics not on this list signal predators or threats, while others do not. Something in the naval MF active sonars' noise triggers dangerous behaviors in some cetaceans. It is useless to search for that characteristic with non-military sources and artificial, contrived sounds.

The most serious flaw in this project is that it's most necessary purpose cannot be met using scientific or generic MF sources. It must include military sources working under operational conditions. Instead, as stated on page 32 of the Application: "Research Objective (Behavioral Response Study-BRS): Observe behavioral responses in several deep-diving cetacean species exposed to natural and artificial underwater sounds and quantify exposure conditions associated with various effects." Unfortunately, it appears that the researchers decided early on to investigate as much as they could, yet perhaps purposely excluded the essential need; to define beaked whale responses to the types of sonars and operations currently linked to their eventual problems.

Regarding objectives, the applicants' first hypothesis is inadequate. It asks: "Do beaked whales have a behavioral and/or physiological response to MF active sonars that can be associated with risk of stranding?" This dismisses other population-level impacts that may be more significant. The hypothesis should consider any physiological impact that may reduce the potential for the animal to contribute to the population. It is not logical to expect that only animals that strand were affected, or to deny the potential for most harmed individuals to die at sea or simply continue to survive in a debilitated state. That last category is meant to include animals that have been rendered incapable of contributing to the population, such as by not being able compete for reproductive opportunities, or to support a fetus of calf. This question cannot be ignored: Does naval MF sonar use have population level consequences?

CSI is grateful for the minimally invasive protocols to use "Skin samples collected from skin sloughed with suction cup tag.

The second significant flaw in this project is that it will cannot present novel stimuli to the subjects, while novelty must be assumed to have been a factor in events leading up to known strandings. This is assumed because, while some animals responded to the sonars, the actual population that heard it must be assumed to have been larger, so some did not respond; they were not startled or frightened.

By doing the research on the AUTEC range the project must assume that all possible subject animals are familiar with, and probably accommodated to a wide range of noise, especially similar anthropogenic acoustical sources as those that will be presented; the Navy uses this range to make and study their noise. The point is that there is little certainty that individuals that hear the project's sounds may be startled or frightened sufficiently to alter their behavior. What will we learn from the application of MF sounds to marine animals that are not startled or frightened by them?

This illuminates a third flaw in the Application, the failure to recognize that studies of previous events have concluded that significant behavioral changes must have occurred at received levels (RL) of MF sonar signals well below 160 SPL. The Bahamas event, for example, suggested that some stranded animals could not have been exposed to sonar signals much over 120 dB, as shown in some references included in the Application. Indeed, the most alarming aspect of the problem is that some stranded animals must have reacted to low levels

of noise at extreme distances requiring specific environmental conditions, complicating future solutions.

Because the Application ignores both accommodation and established reactions to low sound levels, it includes a provision to increase the source level sufficient to subject a target animal to an SPL of 180 dB, if lower levels are not sufficient to cause significant behavioral changes. This reduces the research to searching for the level of sound which even accommodated animals will tolerate or avoid. This level may have useful application to other issues, but it is useless to the necessary question. There is considerable evidence that some cetaceans tolerate very loud anthropogenic noise, perhaps because they must use or transit an ensonified area.

CSI requests that this project include some assessment of the following hypothesis: naval MF active sonar may have be perceived as a threat, and cause some cetaceans to flee, not just attempt to avoid the sound but actively run from it, perhaps upon first perceiving it at long distances. We want this hypothesis proven wrong! It is based on observations of mass strandings of healthy, well fed cetaceans not exposed to advers environmental conditions, and some observations of large groups traveling at high speed suggesting escape more than transit or foraging. The question relates to basic animal behavior; tight social units where one individual perceives a threat, which, in effect, causes a stampede of the group. Most animals in the group will follow the example of the panicked individual, not wait to find out what the threat is.

In the decades of modern active sonar use mass strandings have increased. CSI is aware that actual injury from sonars is limited to a small area around the source, but if such injuries have occurred, or for any other reason sonar noise has becomes associated with harm or fear, survivors and future generations within the social unit will perceive sonar noise as a threat. CSI wonders if some animals have learned to associate the sonars' sounds as a threat, perhaps from an earlier experience with a stampede noted above. Learning to identify threats is a necessity, but in this instance it may be counterproductive. If this hypothesis is correct there is potential for groups of animals within a large area to avoid or flee from necessary habitats or transit routes, or stop necessary behaviors, resulting in population-level impacts. Please prove us wrong.

Thank you for the opportunity to comment.

Sincerely,

William W. Rossiter
President, Cetacean Society International

NRDC
THE EARTH'S BEST DEFENSE

NATURAL RESOURCES DEFENSE COUNCIL

By Electronic and Regular Mail

May 17, 2007

P. Michael Payne
Chief, Permits
Conservation and Education Division
Office of Protected Resources
National Marine Fisheries Service
1315 East-West Highway, Room 13705
Silver Spring, MD 20910

Re: Scientific Research Permit for Behavioral Response Study (BRS) on Beaked Whales

Dear Mr. Payne:

On behalf of the Natural Resources Defense Council ("NRDC") and our more than 650,000 members, I am writing to comment on the proposed Behavioral Response Study ("BRS") on beaked whales in the Bahamas, whose application for a Scientific Research Permit is pending under the Marine Mammal Protection Act. 72 Fed. Reg. 19181 (Apr. 17, 2007).

NRDC appreciates the importance of research in ocean noise policy. We believe it is necessary both to fully understand the environmental impacts of noise sources and to improve our methods of mitigating them; and we strongly support the efforts of the National Marine Fisheries Service ("NMFS") in conducting and sponsoring research in this field. At the same time, we believe that any research with the potential to significantly harm marine mammals must receive careful evaluation, to weigh its benefits for conservation and management and to ensure that there are no less invasive means of meeting the same objectives.

Regretfully, in this instance, we have a number of reservations about the proposed study and, indeed, share the concerns about baseline information, data collection, and conservation benefit expressed by the Whale and Dolphin Conservation Society and others in their May 17 comments. It is the intention of this letter to encourage dialogue between the principal investigators and the NGO community before a decision on the permit is made.

We take this opportunity to highlight two of our concerns.

(1) Alternatives Analysis – In its draft environmental assessment, NMFS limits its analysis to two alternatives: the BRS as currently designed and the "No Action" item, which would result in the denial of a research permit and the abandonment of the study. EA at 91-92.[1] In fact, there remain a number of other alternatives for obtaining empirical data on the behavioral responses of cetaceans to mid-frequency sonar.

One such alternative would involve the use of existing data compiled during Navy training events. The AUTEC range has been capable of real-time detection and localization of some beaked whale species since at least 2005 – potentially a significant development for both mitigation and research.[2] To the extent that these acoustic data are preserved, the Navy and NMFS would have at their disposal a store of relevant information that could obviate the need for an additional sound source in the BRS, or could lead to substantial modifications of the study to target issues that existing data leave unresolved. Just as a matter of experimental design, it seems prudent to defer the BRS until beaked whale data from the AUTEC range have been analyzed. At the very least, such an alternative should be carefully considered in NMFS' environmental assessment.

(2) Data Interpretation – One of the primary justifications for the BRS, according to the environmental assessment, is its potential contribution to management: namely, that its results could be used, by NMFS, "for the formation of protective regulations." EA at 91, 95. We believe that is a worthy goal. Yet there are enough uncertainties and uncontrolled variables built into the experiment – significant differences between the BRS and actual sonar training; an unknown baseline of exposure; use of safe, short-term proxies for biologically significant effects; potentially low statistical power – to leave its ultimate value for management in doubt. The risk is amplified by the controversy that surrounds this issue, and, in particular, by past practice in which studies demonstrating strong behavioral effects at relatively low levels of sound exposure have not necessarily induced changes in policy.

It is essential, both to minimize exposures of target animals and to ensure management benefit, that NMFS and the researchers determine in advance which short-term responses constitute a biologically significant effect, including, but not limited to, a risk of injury or stranding. These markers should be conservative, particularly in light of the BRS' many uncertainties and its focus on pre-exposed populations. If agreement cannot be reached, management benefit cannot reasonably be cited as a justification for

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[1] Draft Environmental Assessment on the Effects of Scientific Research Activities Associated with a Behavioral Response Study on Deep Diving Odontocetes (Apr. 2007) (referenced in the text as "EA").

[2] D. Moretti, N. DiMarzio, R. Morrissey, J. Ward, and S. Jarvis, "Estimating the density of Blainville's beaked whales (Mesoplodon densirostris) in the Tongue of the Ocean (TOTO) using passive acoustics," paper contributed to MTS/IEEE Oceans 2006 conference, Sept. 18-21, 2006, Boston, Massachusetts (2006). See also S. Jarvis, N. DiMarzio, R. Morrissey, and D. Moretti, "Automated classification of beaked whales and other small odontocetes in the Tongue of the Ocean, Bahamas," paper contributed to MTS/IEEE Oceans 2006 conference (2006).

the study. In addition, it should be made clear that results from the AUTEC range cannot be extrapolated to naïve animals or be used to rule out the potential for long-term impacts in repeatedly exposed whales.

Given concerns about the BRS within the scientific, environmental, and animal welfare communities; uncertainties in the baseline data; the unprecedented application of the MMPA's scientific research provisions to mid-frequency sonar; and the extent of sonar use to be authorized under the permit, we strongly encourage NMFS to prepare an Environmental Impact Statement with a more thorough analysis of alternatives. More immediately, we urge the agency and the study's principal investigators to open a dialogue with the NGO community.

Very truly yours,

Michael Jasny
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17th May 2007

Comment on File No. 1079-1828: Behavioural Response Study of cetaceans in the Tongue of the Ocean, east of Andros Island in the Bahamas

Dear Sir,

The undersigned organisations acknowledge the expertise and knowledge of the principle investigators involved with the application for a permit to conduct the proposed Behavioural Response Study (BRS). However, we have several overarching concerns, particularly regarding the underlying lack of knowledge of the populations of all species in the proposed study area, and our ultimate conclusion is that an Environmental Impact Statement (EIS) is required before this research is undertaken.

As far as we are aware, this is the first BRS (previously known as a Controlled Exposure Experiment, or CEE (Tyack et al., 2004)) to be conducted on any beaked whale species. This is at least in part

because of concerns regarding the particular sensitivity of beaked whales to intense noise exposure. There are several well documented examples directly or indirectly linking beaked whale stranding and mortality to the use of military sonar (e.g., Simmonds and Lopez-Jurado, 1991; Frantzis, 1998; Balcomb and Claridge, 2001; Fernandez *et al.,* 2005), including strandings caused at moderate received levels (Anon, 2001; Gisiner, Hildebrand and Balcomb, 2004). Strandings induced by exposure to sound levels lower than those expected to cause auditory damage would appear to be the result of a behavioural/flight response (Tyack *et al.,* 2006), leading to tissue damage (Fernandez *et al.,* 2005) and causing injury and death. Whilst the mechanism of injury that leads to stranding and death remains unknown, increasing research is focused on this critical issue, and this factor is of prime importance when considering the development of BRSs on beaked whales.

It is possible that damage as a result of sound exposure might be internal and therefore unseen by observers. Should gas-bubble associated lesions (Fernandez *et al.,* 2005) begin to form/expand as a result of the experimental sound exposures, the animal(s) may continue to suffer beyond any assessment or monitoring period – i.e., the time that the tag remains on the body. As such, chronic pathologies that lead to potentially lethal impacts or impacts that reduce reproductive success or other vital parameters are likely to be undetectable by the proposed field study, unless the animal(s) strand or float within the vicinity of the BRS vessels.

Whilst we are generally concerned about the exposure of any of the species to SQS-53C and other sound sources proposed in the application, our primary concerns relate to beaked whales for the reasons outlined above and because of their particular vulnerability. These concerns are detailed below and can broadly be separated into the following categories, which we do not believe are covered in appropriate detail in the permit application or the draft Environmental Assessment. These concerns affect NMFS responsibility to prepare an EIS under NEPA:

1. Lack of knowledge of cetacean populations in the Tongue of the Ocean (TOTO)
2. Unknown history of sonar exposure of animals that regularly use the TOTO range
3. D-tags do not collect real-time data
4. Potential lack of observable behavioural response
5. Translation of results into management decisions for the use of active naval sonar

Lack of knowledge of cetacean populations in the Tongue of the Ocean

An appropriate level of knowledge, including basic biology, ecology, distribution and behaviour of the beaked whale population in question, is required in order to be able to correctly interpret the data collected during the BRS. These animals are very difficult to study and baseline monitoring has only been undertaken on a few discrete populations of less than a handful of beaked whale species around the world.

Existing studies have largely focused on apparently resident populations that inhabit areas adjacent to coastlines, with the exception of a study on northern bottlenose whales, *Hyperoodon ampullatus*, in the Gully, offshore Nova Scotia (the longest standing study of beaked whales in the world), and none of these studies are necessarily representative of any species as a whole. Nonetheless, long-term field studies incorporating photo-identification have proven practical in some instances and are underway in a number of field sites worldwide for both Cuvier's beaked whales, *Ziphius cavirostris,* and Blainville's beaked whales, *Mesoplodon densirostris* (for example, Canada - Hooker, 1999; Gowans and Whitehead, 2001; Bahamas - Claridge, 2006; Italy and the Canary Islands - Johnson and Tyack, 2005; Hawai'i – McSweeney *et al.,* 2007). In some cases these studies have identified site fidelity and residency. As a result of these studies and the recent application of tags attached by suction cups (known as 'D-tags') (Johnson *et al.,* 2004; Baird *et al*., 2004), our knowledge of some species of beaked whales is dramatically increasing. Field studies in TOTO are recent by comparison, only

beginning in 2005 (Moretti *et al.,* 2006). Almost nothing is known about Gervais' beaked whales, *Mesoplodon europaeus,* (Balcomb, 1981), which have stranded at TOTO (BMMRO, unpublished data).

'Within species, studies should be conducted preferentially on populations for which long-term data are already available' (Tyack *et al.,* 2004). However, nothing is known about the distribution, abundance, social structure or the dependence of beaked whales or other odontocetes upon TOTO, east of Andros Island.

Unknown history of active sonar exposure of animals that regularly use the TOTO range

We do not know how long the AUTEC (Atlantic Undersea Test and Evaluation Centre) range has been in operation, nor how many trials have taken place, although we understand that they occur multi-annually. This information is not provided in the permit application and is very important. It is possible, if not likely, that the animals that depend upon this habitat have been subjected to noise exposure from ongoing exercises and tests involving the use of active naval sonar during at least part of their lifetimes, if not their entire lives. Further, the level of exposure and potential impact of active naval sonar on animals and populations residing within the TOTO range, with ongoing and regular exercises, are currently unknown.

As far as we are aware, any history of strandings in this area is unknown. Collation of strandings records from the area and initiation of a strandings network would be a useful first stage in understanding the susceptibility of local animals to impacts from ongoing active sonar use.

In addition to this, animals whose home ranges include the AUTEC range have a history of being exposed to active sonar and therefore cannot be expected to provide a representative response to controlled exposures in other areas. Under such circumstances, extrapolation of reactions from animals in this area to another, where exposure is less frequent, must be carefully considered. We note that Phase II of this experiment is to occur in either the Gulf of Mexico or the Mediterranean, and that the results of this study are to be incorporated into future methodologies, yet no further details are supplied. Data collected from the Tongue of the Ocean cannot be applied to management decisions in other areas where animals are not exposed to the same level of active sonar on a regular basis.

Studies of short term responses of individuals during CEEs (BRSs) should be designed to allow the assessment of longer term impacts to the individual and cumulative impacts to all of the individuals in a population (Tyack *et al.,* 2004). To determine long-term effects of sonar exposure on cetaceans that reside in areas of regular exercise or training use requires long-term research. Yet, it is difficult and impractical to carry out a controlled experiment over larger scales of space (tens of kilometers) and time (many months or years). We might expect that some animals in the Tongue of the Ocean have habituated to regular naval sonar use, with unknown consequences for the population or individuals (including physiological or auditory damage).

Limitations of real-time data collection

A primary concern relates to the reliable detection of beaked whales during sound exposure. The advances in our understanding of beaked whales (and numerous other species) since the invention of the D-tag has been considerable. However, data from D-tags are not available in real time. The data are collected for analysis only once the tag has been retrieved from the animal. Therefore the proposed study is dependent upon the AUTEC seabed mounted hydrophones to detect vocalisations (and changes in vocalisations), and (more critically) to determine sound exposure level, in conjunction with visual tracking of beaked whales to determine visually observable behavioural changes during each experiment. This generates three significant concerns:

1. How effective are the seabed mounted AUTEC hydrophones at monitoring received levels (RL) at the focal animal during experimental sound exposures?

2. How reliable is visual detection of individuals that are elusive and deep diving and who provide limited visual cues of 'significant' behavioural responses during the few minutes that they spend at the surface?
3. Will it be possible to conduct appropriate in-the-field analysis of retrieved D-tags? These immediate analyses will be necessary to inform subsequent exposures, but will they be possible, given that 20 controlled exposures of beaked whales are anticipated during the study period, averaging one tag attachment every field day (assuming 42 experimental days minus bad weather days on at least half the days – see page 71 of the permit application).

Passive acoustic monitoring has limited utility, as cetaceans do not always vocalise and there is currently very limited 'baseline' data on normal vocalisation rates and frequencies, particularly for beaked whales around the Bahamas. 'The problems of locating marine mammals in three dimensions combined with inaccuracies in the predictions of propagation models mean that it is seldom possible to estimate exposure of an animal to better than 3-5 dB during an experiment' (Tyack *et al.,* 2004). It is our understanding that a previous trial was successful at visually detecting Blainville's beaked whales on nine occasions, whereas 90 'groups' of vocalisations were detected and verified acoustically (Moretti *et al.,* 2006).

Visual observations of beaked whales are widely reported as being challenging because of the animals' elusive behaviour, spending considerable time at depth, coming to the surface only for short periods to breathe, providing limited visual cues, the difficulty in re-locating and tracking the focal animal, as well as subjective interpretation of visual data. Such elusive and deep diving species provide a unique challenge to researchers.

Given the dependence on visual observations and AUTEC hydrophones to determine an identifiable behavioural response, we are not confident that it will be possible to determine 'safe and early indicators of responses that may be linked to a causal chain of events leading to stranding' (page 32 of the permit application). Tagged animals are unlikely to be in constant view of the boat during the experiment and so behavioural responses that are being monitored through the D-tag will not be known until the tag is retrieved and the data are down-loaded and analysed. This severe constraint means that any significant response, if not observed near the surface, may not be recognised during the study itself[1]. There will be difficulty monitoring and controlling the sound level that an animal receives when the sound source is on the boat and the animal and its conspecifics are moving in an unpredictable fashion below the water's surface. Monitoring is only likely to occur for a few hours after exposure, even though the current life of a D-tag is up to about 20 hours.

Beaked whales tend to swim in tight groups of 1-5 and 1-11 animals (Cuvier's beaked whales and Blainville's beaked whales respectively: Claridge, 2006) and so an entire group of whales could be exposed to the sound. Strong non-vocal responses from untagged whales will not be identified. As the groups may be fluid, changing members over periods of days, it will be very difficult to ensure that a given whale is 'naive', i.e., has not been previously exposed. Multiple exposures of the same whale will lead to biased results, and would also seem to increase the risk of physical harm to the whale. In addition, underwater movement of group members can not be effectively monitored and adverse responses by unmonitored conspecifics cannot therefore be adequately mitigated.

[1] A further complication might be that in the field, under research or mitigation conditions, detailed behavioural signals would be hard to interpret rapidly enough to serve a mitigation purpose even if they were available in real-time. The issue of a 'feedback' experiment is complex.

Responses may be non-linear and not graded, such that one would be unable to safely determine at what point the behavioural reactions become significant/damaging when scaling up the exposure. The responses may be threshold responses, occurring without warning. Given that responses obtained may be highly variable, it could be argued that large numbers of animals and species may need to be exposed during this BRS in order to acquire a suitable sample size for statistical testing.

A lack of observable behavioural response

A lack of observed response would likely lead the researchers to conduct additional controlled exposure experiments at higher received levels. The primary question will be: What RL will achieve a 'significant' response, requiring no additional animals to be exposed to higher RLs? How should a significant response be defined? With our cursory understanding of beaked whale biology and population status, this seems like a precarious task. The only precautionary approach would be to declare that any detectable response is significant. The lack of population level and life history information almost certainly predestines any but the strongest levels of response to be considered 'insignificant'. As this is the case, it seems important to question whether there is sufficient information available to suitably design beaked whale BRSs.

Beyond the acknowledgement of areas of ethical uncertainty that cannot be addressed at present, key issues surrounding the BRS include the identification of: 1) appropriate end-points (e.g., responses that are reliably detectable as well as scientifically meaningful); 2) 'safe' maximum exposure levels; and 3) effective mitigation measures, to include alternative technologies (benign, or less invasive, research alternatives including longer-term observational studies).

Translating results into management decisions surrounding the use of active naval sonar

The goal of conducting the BRS is to provide input for management decisions in order to devise appropriate mitigation measures, such as determining the safe radius from a sound source outside of which no serious reactions are thought to occur. However, a BRS will not mimic the circumstances of an actual exposure event – where there are unpredictable variables, such as multiple sound sources spread over several kilometers, rapid movement of the sound source or the animals, and changing seasons and oceanographic conditions. Therefore, at best the results of BRSs will have to be interpreted with care.

Setting mitigation measures that limit RLs may, in theory, protect the majority of cetacean species from severe impacts of noise, including injury and death. However, it would appear that beaked whales respond in a way that may be peculiar to them[2]. Some mechanism, which currently remains unknown to us, may make them especially susceptible to at least some forms of intense anthropogenic noise. Given the apparent sensitivity of these animals, it is essential to be precautionary when developing research designs as well as mitigation strategies that relate to them.

We would expect an observed lack of response during a BRS to translate into a management decision allowing RLs to be increased. The proposed BRS sets the maximum RL at 170 dB re 1µPa. We already know that the beaked whales that stranded and died as a result of exposure to military sonar in the Bahamas in 2000 likely were exposed to relatively low levels of sound – probably below 160 dB re 1µPa (Anon 2001), with Hildebrand *et al.*(2004) suggesting they could have been as low as 120-140 dB re 1µPa. The strandings of animals when exposed to relatively low levels of sound have so far had little impact on policy – they have not led to reduced source levels in wide-scale practical mitigation terms. How then will results from the proposed BRS lead to different policy decisions?

[2] Other species have also been involved in unusual stranding events that have been associated or coincided with exposure to intense anthropogenic noise.

In conclusion

It is clear that action is needed to protect beaked whales from the impacts of intense noise exposure. Assuming we can deal with the basic questions about biology, ecology and distribution of the population of interest, it might take several years (and possibly much longer) to acquire the appropriate data from BRSs. Even then, there would be no guarantees that these results would translate into policy and decisive management action.

There are some important measures that we can take now to protect cetaceans, and particularly beaked whale populations, from intense noise exposure without conducting BRSs. While the Beaked Whale Technical Workshop held in April 2004 in Baltimore recommended CEEs (BRSs), it also concluded that 1) gas bubble disease induced through a behavioural response is especially worthy of further consideration; 2) current monitoring and mitigation methods for beaked whales are ineffective; and 3) retrospective analyses of strandings need to be conducted (Cox *et al.* 2006). Some of these recommendations do not require putting whales at risk, but have yet to be acted upon.

Given the substantial concerns raised in this letter, we question the use of the data to be collected during the proposed study for management purposes. We therefore put forward the following recommendations:

1. All possible alternatives should be explored first, including opportunistic monitoring of tagged individuals during exercises, where animals will be subjected to realistic exposures.

2. If BRSs are to be pursued, the specific aims, timescales for the research and its outputs should be clearly and transparently stated, including future studies in other parts of the world.

3. Details of historic operations on the AUTEC range should be provided in order to understand potential history of exposure.

4. Collation of strandings records from the area and initiation of a strandings network should be undertaken.

5. Extrapolation of data from this region, where animals may have suffered previous and repeated exposure to naval sonar, should not be applied to species in other areas.

6. Details of success rates of previous passive acoustic and visual detection trials on the AUTEC range should be made available.

7. Specific management objectives should be clearly and transparently stated. BRSs should only be carried out if there is prior agreement between researchers and regulators as to which short-term reactions constitute a significant (e.g., population-level) effect. Particular *sizes* of effects that would be considered "biologically significant" should be delineated prior to the study, e.g., a 1% reduction in indications of feeding may not be considered enough to impact a population, whereas a 5% reduction may. If such an effect size (or at least a range of effect sizes) cannot be agreed upon between researchers and regulators, then the study will have little chance of contributing constructively to management and thus may not be worth pursuing.

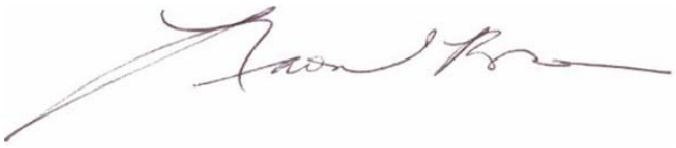
8. It is critical that BRSs be conducted as part of wider and longer-term population monitoring studies that investigate the health of populations involved over suitable timeframes and are capable of measuring potential impacts.

The concerns outlined in these comments are substantial and lead us to the conclusion that an EIS, to cover all these concerns explicitly, is required before such a novel research study can be conducted. We do not know enough about the populations that reside within TOTO to be conducting noise exposure studies at this time.

We are grateful for the opportunity to voice these concerns and would welcome the opportunity to discuss them more fully in person.

Yours sincerely

Sarah Dolman
International Science Team
Whale and Dolphin Conservation Society



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14 May 2007

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Permits, Conservation an Education Division F/PR1
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Comment on File No. 1079-1828: Behavioural Response Study of cetaceans in the Tongue of the Ocean, east of Andros Island in the Bahamas

Dear Dr. Payne:

It is my professional opinion, as a marine mammal scientist with 25 yrs. experience, specializing in whale vocal communication and undersea noise issues, that the BRS proposed above is ill-advised and premature, and presents an unacceptable risk to whales. As it is well-known and documented that naval sonar can cause lethal strandings and deaths at sea in whales (e.g. Fernandez et al. 2005; Jepson et al. 2003), especially beaked whales, any BRS exposing beaked whales to sonar must be considered to be potential Type A harassment, i.e. potentially resulting in injury and death. While this study could very well prove to be useful, there are more benign, realistic (representative of real-life naval maneuvers), cheaper, and scientifically more valid studies that should have been done first.

Animal Care Committees approve potentially harmful experiments based on the expected benefit along with the lack of more benign alternatives. This project does have a benign alternative, which does not require further sonar exposure. Naval exercises involving sonar have been occurring at the AUTEC range for decades, and take place over probably months each year. Moreover, archived acoustic recordings of these actual maneuvers are available. Beaked whale vocalizations could be detected from these recordings (the permit application states that such data from the AUTEC array will define the exposure range for the experiments), so that beaked whale vocalizations and even movements could be compared with sonar exposure. The AUTEC array is extensive, consisting of 31 bottom-mounted hydrophones, which have indeed already been used to track whales (Tiemann et al. 2006), and even fish (Mann and Jarvis 2004). This analysis would be vastly cheaper, would represent the real situation, would have a much greater sample size, and most importantly, would not put whales unnecessarily at greater risk, needlessly

exposing them to more sonar. National security considerations (classified information) must be respected, but random subsampling and other methods could be used to circumvent such issues.

I am also concerned that the whales still frequenting the AUTEC range, after decades of naval maneuvers, will not be representative of overall populations of whales. Beaked whales, in particular, appear to be found in small, local populations that are resident year-round (Wimmer and Whitehead 2004; Balcomb and Claridge 2001), rather than transitory to the area. If this is also the case at AUTEC, the individuals still present could not be considered to be "naïve" with respect to sonar exposure. In fact, other studies have shown that some individual dolphins leave the area permanently after being subjected to long-term human-caused disturbance, while others remain (Bejder et al. 2006). The remaining animals may in fact be the least sensitive individuals. The permit application states that: "it would not be conservative to develop a policy based upon data from less sensitive species and then apply it to more vulnerable ones" yet that is precisely what may be happening here, if future policies are based on the results of this experiment on what may be the least sensitive individuals (even if the more sensitive species are being used). Moreover, the maximum received levels that will be used (170 dB), are based, as cited in the permit application, on TTS studies on a few individual captive dolphins. It is not at all conservative to apply these results to beaked whales or indeed other species, which may be more sensitive. The best information we have on which exposure levels are lethal to beaked whales comes from the Bahamas stranding. By modeling the sound field (NOAA and U.S. Navy 2001) and by knowing the distribution of Cuvier's beaked whales in the area of the Bahamas based on previous studies, whales were thought to be exposed to relatively moderate levels of noise, on the order of 150–160 dB re 1 μPa for 50–150 s (Hildebrand 2005). It is also not valid or conservative to state, as the permit application does, that "experiments [are] only detectable over a tiny portion of the seasonal range" of species present. If indeed beaked whales are resident year-round, as would be likely, then this assumption does not hold. There may thus be an effect on stocks or at least local populations, as appeared to be the case for the Cuvier's beaked whale population after the Bahamas stranding, where most known individuals permanently disappeared (Balcomb and Claridge 2001).

In outlining the limitations of CEEs (or BRSs as they are now called), the Revised Report of the UK Beaked Whale Research, Planning Workshop (23-24 November 2004, Sea Mammal Research Unit, Table I, p. 15) states that: "Full level (realistic) source requires actual sonar, which is expensive; a lower level (200 dB) source likely to still require specifically outfitted vessel…Insufficient baseline data currently to quantify strength of different effects; no current techniques are available to measure physiological state; long-term effects require long-term research." All these limitations are still present in this proposed study. On the other hand, if archived AUTEC acoustical recordings of sonar trials and beaked whales were thoroughly analyzed, as I proposed above, the long-term effects of sonar exposure could be better studied (known identified individuals would be useful here—some acoustic cues of individual identity may be discovered, e.g.). If such archived recordings exist from the very beginning of sonar trials at AUTEC, then one could address another major limitation of this study, namely that animals are likely not naïve in terms of sonar exposure. One could additionally avoid the worrisome problem of incidental takes, where animals that are not being studied are unintentionally exposed, without any attendant benefit.

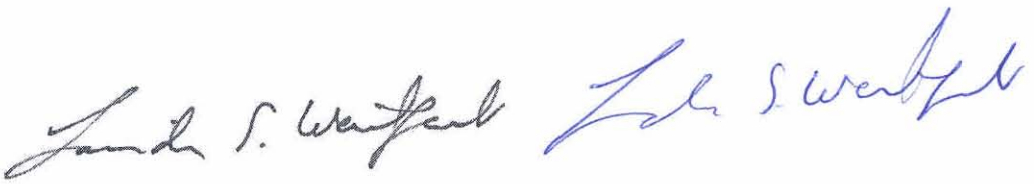
The permit application states that: "any potential behavioral reaction by the animal would not be caused by detecting any aspect of the source other than the playback acoustic stimulus." However, context may indeed be important. We *should* be concerned about how the multiple noise sources that commonly occur in naval maneuvers, interact. Eventually, it may be important to tease apart the exact stimulus causing a reaction in whales, but this may be impossible and moreover, comparatively irrelevant. We should simply want to understand how actual naval maneuvers involving noise, especially sonar, affect whales. Since there is a huge amount of archived acoustical information on AUTEC already available awaiting analysis, it seems incomprehensible that we should begin with the most invasive, least scientifically rigorous study. If the passive acoustic monitoring data from AUTEC will be used by this study anyway to define exposure ranges, why not carry out a full, detailed analysis of these data first?

I am also not confident that, should harmful effects occur in exposed animals, these would be detectable under the proposed study design. Important short-term reactions (e.g. physiological responses) can easily escape detection, even in tagged animals, but certainly long-term studies are needed to relate disturbance reactions to population impacts. Thus, this study is of very dubious worth for management purposes.

In general, it should be noted that statistical hypothesis testing, as this proposed study represents, has been steadily falling out of favor in the larger scientific community, as the following quotes depict: "During the past twenty years, modern statistical science has been moving away from formal methodologies based on statistical hypothesis testing…the historic emphasis on hypothesis testing will continue to diminish in the years ahead with increasing emphasis on estimation of effects or effect sizes and associated confidence intervals." (Burnham and Anderson 2002). "Most researchers recognize that we do not conduct experiments merely to reject null hypotheses or claim statistical significances; we want deeper insights than this" (Burnham and Anderson 2002). "Traditional testing-based thinking is uninformative" (Burnham and Anderson 2002). Burnham and Anderson (2002) also cite nine primary journal references to support their claim. Approaches such as model fitting, Bayesian inference, or meta-analysis are increasingly replacing hypothesis testing. By using hypothesis testing in studies of the effects of sound on whales, there is a good chance of incorrectly accepting the null hypothesis of no effect, i.e. you will more likely miss real effects, as sample sizes tend to be small in studies of whales. Statistical hypothesis testing has the additional major drawback for management purposes in that it is weighted toward not "crying wolf" (concluding an erroneous effect) rather than being precautionary (missing an effect with disastrous consequences). This of course represents the opposite of what responsible, conservative management should be.

For this and the reasons mentioned above, I am particularly disturbed that NMFS would not only consider granting this research permit, but moreover that NMFS chose to be the permit holder for this study. If NMFS is to be respected as a taxpayer-supported agency in charge of the protection of whales, it should not be supporting research of this nature, which is hard to rationalize due to its needless endangering of wildlife, its lack of scientific rigor, its inapplicability to real-world situations, its dubious worth for management purposes, and its imprudent use of funding resources. NMFS, as a regulator, should be providing a better example, and not be abdicating its primary responsibilities of the protection of our marine environment.

Sincerely,



Linda S. Weilgart, Ph.D.
Research Associate

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World Society for the Protection of Animals

P. Michael Payne
Chief, Permits, Conservation and Education Division
F/PR1, Office of Protected Resources, NMFS
1315 East-West Highway, Room 13705
Silver Spring, MD 20910

May 16, 2007

Dear Mr. Payne,

I am writing to you on behalf of the U.S. office of the World Society for the Protection of Animals (WSPA), an alliance of nearly 800 animal welfare organizations in over 140 countries, to express our concern for the experiments proposed by the National Marine Fisheries Service Office of Science and Technology which would expose several deep diving marine mammals to anthropogenic underwater mid-frequency sounds (to a maximum received level of 170dB) in the Tongue of the Ocean (east of Andros Island, Bahamas) and primarily on the U.S. Atlantic Undersea Test and Evaluation Center (AUTEC) range, Bahamas (as announced in the Federal Register April 17, 2007; Volume 72, Number 73, Page 19181). The species to be exposed would include beaked whales, pilot whales, melon-headed whales, sperm whales, and Risso's dolphins.

Whilst WSPA appreciates the need to improve our understanding of deep diving species in order to better protect individuals and populations from intense noise pollution, we are very concerned that the proposed experiments will cause stress, fear, pain, discomfort, injury and behavioral distress to these sensitive, sentient animals. With regard to undersea sound exposure experiments, WSPA would like to reiterate:

1. The lack of baseline data on any species in the vicinity of the experimental site;
2. The unknown history of exposure of animals in an area where active SONAR is regularly used; and,
3. The level of accuracy with which the exposed individuals can be monitored in real time.

In the case of this particular application we also note the following:

1. WSPA disagrees with the applicant's statement that the attachment of the DTAGs will not be stressful to the animal (Permit Application Page 81; Environmental Assessment Page 97). The action of pursuit and tag

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application will cause stress to the target animal. Also, tagging success rate is estimated at best to be 20-40% (Environmental Assessment Page 28 Table 3) and therefore multiple pursuits would be unavoidable. The permit application suggests that up to three pursuits per day would be allowed for the same individual. WSPA believes that this would cause unnecessary stress to the target individual. Furthermore, given that most of the target species are social, even if only one member of the group of animals is the target, harassment of multiple non-target individuals in the group would be unavoidable.

2. The permit application suggests that the sound levels administered to the target species would not be loud enough to cause hearing damage (Permit Application Page 81). However, other physiological stress conditions could be prompted by this experiment including reduction in vocalizations, alteration of swimming (speed and direction), breathing, and diving behaviors. It remains unknown when and how these changes translate into biologically significant effects that have repercussions for the animal beyond the time of disturbance, effects on the animal's ability to engage in essential activities, and effects that have potential consequences at the population level (Environmental Assessment Page 19). WSPA believes that physiological stress to these sentient animals is unnecessary and should not be permitted.

3. WSPA notes that the target animals will be observed only for a short time after exposure to these sounds. Long-term effects of exposure (however short the duration of exposure) would not be documented. Even in the short-term observation of exposed animals, only those with DTAGs can be monitored for physiological changes (such as heart rate), and the monitoring would only occur when the animal is at the surface of the water. If any physiological changes occur during the dive cycle they will remain unrecorded (Environmental Assessment Page 86).

4. In addition to the target species a wide variety of marine species can be found within the exposure area, including other marine mammals, sea turtles, invertebrates, teleost and elasmobranch fish, and sea birds (Environmental Assessment Page 43). The proposed experiment is not designed to expose just one target species. WSPA notes that the sounds to be administered to the target species will have unknown (and unmonitored) effects on other animals that may occur in the experimental area thereby exposing the target species to additional indirect effects.

5. WSPA is concerned that the impacts of the proposed experiments could have a more damaging effect on younger animals in the exposed groups. The Permit Application (Page 72) notes that the sensitivity and responsiveness of animals is likely to vary within a population. The Environmental Assessment (Page 68-82) also clearly states that "There is no direct measurement of auditory threshold for the hearing sensitivity" in the target species. The long-term effect of exposure to such sound sources at a young age is unknown.

6. The Environmental Assessment (Page 84) states: "The appropriate maximum level for Play Backs may need to go higher if no disturbance is detected within the regulated range, assuming that there is minimal potential for physiological effects, or permanent effects on hearing. However, for this Phase I SRP application, we propose to not expose animals to levels above those treated as safe by regulatory agencies (in this case, 170 dB SPL)." WSPA is concerned that future permit applications may seek to increase the maximum exposure level without adequately studying the long-term effects of present levels of exposure.

Given the numerous uncertainties in this experiment and the lack of precise control over the variables in an open ocean environment, WSPA requests that the permit be denied. WSPA also recommends that NMFS work towards completing baseline data surveys before proposing such experiments in the future.

Sincerely,

Sharanya K Prasad

Sharanya Krishna Prasad
Program Officer
WSPA USA