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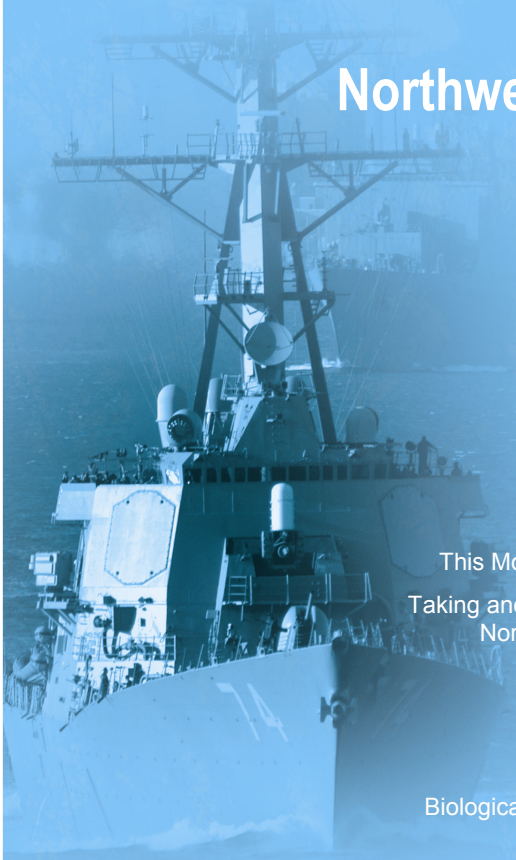
National Marine Fisheries Service

Office of Protected Resources

Prepared by

Department of the Navy



Northwest Training Range Complex Monitoring Plan

FINAL

JUNE 2010

This Monitoring Plan is submitted to NMFS in support of the

Taking and Importing Marine Mammals; U.S. Navy Training in the Northwest Training Range Complex; Proposed Rule

AND

Biological Opinion on the U.S. Navy's training in the Northwest Training Range Complex

Commander
United States Pacific Fleet
c/o Pacific Fleet Environmental Office
1101 Tautog Circle
Silverdale, WA 98315

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ICMP	Integrated Comprehensive Monitoring Program
NMFS	National Marine Fisheries Service
NWTRC	Northwest Training Range Complex

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INTRODUCTION

The U.S. Navy has developed this Northwest Training Range Complex (NWTRC) (Figure 1) Monitoring Plan to provide marine mammal and sea turtle monitoring as required under the Marine Mammal Protection Act of 1972 and the Endangered Species Act of 1973. Appendix A lists potential marine mammal species within the NWTRC. Appendix B lists details of the Navy-wide Integrated Comprehensive Monitoring Program (ICMP). Appendix C details other Navy funded marine mammal science being conducted in the Pacific Northwest. In order to issue an Incidental Take Authorization for an activity, Section 101(a) (5) (a) of the MMPA states that National Marine Fisheries Service (NMFS) must set forth "*requirements pertaining to the monitoring and reporting of such taking*". The Marine Mammal Protection Act implementing regulations at 50 Code of Federal Regulations Section 216.104 (a) (13) note that requests for Letters of Authorization must include the suggested means of accomplishing the necessary monitoring and reporting that will result in increased knowledge of the species and of the level of taking or impacts on populations of marine mammals that are expected to be present (NOAA/NMFS 2005). While the Endangered Species Act does not have specific monitoring requirements, recent Biological Opinions issued by the NMFS have included terms and conditions requiring the Navy to develop a monitoring program. Additional Navy funded research and development studies and ancillary research collaborations with academia and other institutions will be integrated as possible to enhance the available data, and will be used in part to address objectives of a larger Navy-wide initiative discussed in this Plan (Appendix B and C). As an adaptive management strategy, the NWTRC Monitoring Plan will integrate elements from Navy-wide marine mammal research into the regional monitoring and data analysis proposed in this Plan when new technologies and techniques become available. Results from the NWTRC Monitoring Plan will be published annual in a NWTRC Marine Mammal Monitoring Report.

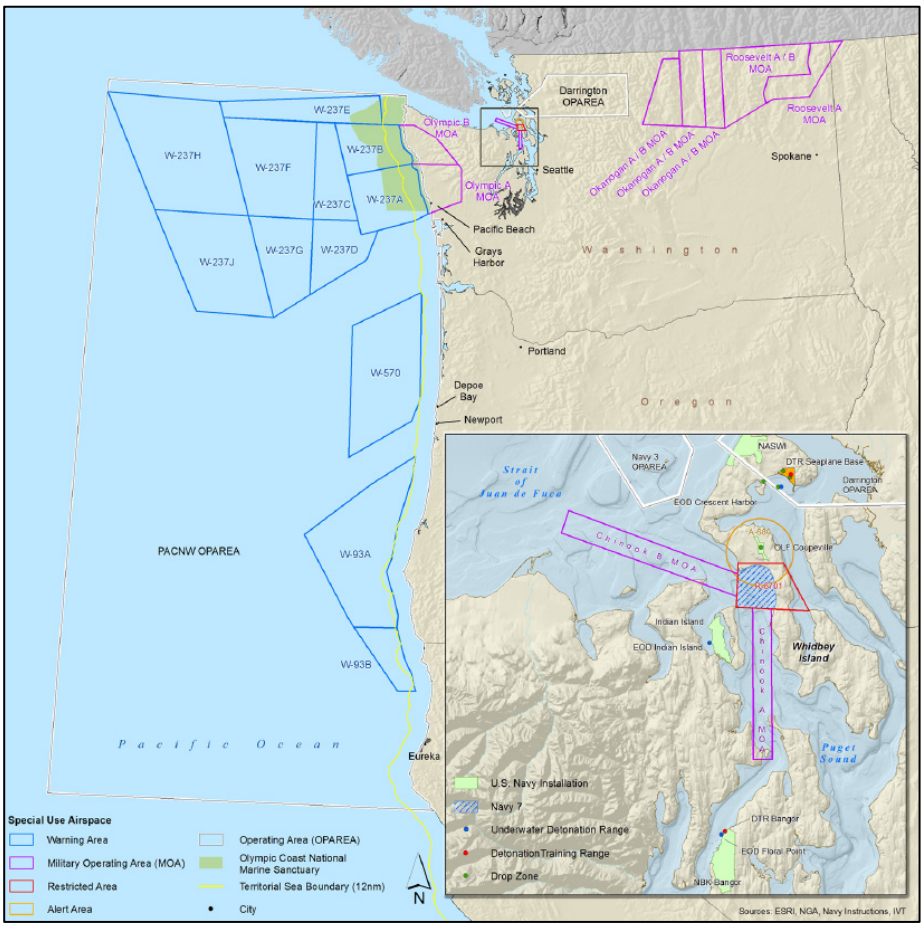


Figure 1. Northwest Training Range Complex (From DoN 2008).

NWTRC MONITORING PLAN

Monitoring Plan Objectives

To accomplish these monitoring goals, the Navy will use similar methods of implementation and data analysis which have demonstrated success in comparable monitoring programs studying the effects of anthropogenic sound on marine animals. The Navy in consultation with the NMFS designed a series of focused "study questions" to gather data in various combinations within the Navy's range complexes to address:

Question 1. Are marine mammals and sea turtles exposed to mid-frequency active sonar, especially at levels associated with adverse effects (i.e., based on NMFS' criteria for behavioral harassment, Temporary Threshold Shift, or Permanent Threshold Shift)? If so, at what levels are they exposed?

Question 2. If marine mammals and sea turtles are exposed to mid-frequency active sonar in NWTRC, do they redistribute geographically as a result of continued exposure? If so, how long does the redistribution last?

Question 3. If marine mammals and sea turtles are exposed to mid-frequency active sonar, what are their behavioral responses to various levels?

Question 4. What are the behavioral responses of marine mammals and sea turtles that are exposed to explosives at specific levels?

Question 5. Is the Navy's suite of mitigation measures for mid-frequency active sonar and explosives (e.g., Protective Measures Assessment Protocol), major exercise measures agreed to by the Navy through permitting effective at avoiding Temporary Threshold Shift, injury, and mortality of marine mammals and sea turtles?

Given the larger scope of training events within other Navy range complexes as compared to the Northwest Training Range Complex (NWTRC), not every one of these original five study questions will be addressed within NWTRC (Table 1). Rather, data collected from NWTRC monitoring will be used to supplement range complex marine mammal monitoring reports incorporating data from the Navy's Hawaii Range Complex, Marianas Islands Range Complex, NWTRC, and Southern California Range Complex. For instance, in the Southern California Range Complex based on the Fleet concentration in that area and needed training, 45 times more hours of the most powerful sonar system (AN/SQS-53) were authorized annually by NMFS as compared to the hours authorized annually in the NWTRC. Therefore, more monitoring techniques are used and more monitoring time spent in Southern California. Annual monitoring reports to NMFS will summarized all monitoring conducted at each range complex.

Monitoring methods proposed for beginning in June 2010 in the NWTRC include a combination of two research elements designed to support both Range Complex specific monitoring, and contribute information to a larger Pacific-wide program.

Table 1 shows the techniques and levels of effort for this period. Research elements include passive acoustic monitoring, and marine mammal tagging. The techniques selected for the NWTRC will be primarily focused on providing additional data for study questions 1 and 2.

The Navy's Integrated Comprehensive Monitoring Program (ICMP) and report to NMFS contains further details on the background of Navy-wide marine mammal monitoring and is include in this Plan as Appendix B (DoN 2009).

Monitoring Plan Proposed Initial June 2010 to June 2015 Commitment

Table 1. Summary of proposed initial June 2010 to June 2015 monitoring studies and level of effort in support of the NWTRC Monitoring Plan subject to annual adaptive management review adjustment.

Monitoring Technique	Implementation	
Marine Mammal Tagging STUDIES 1,2	Conduct opportunistic marine mammal or sea turtle tagging	Adaptive Management Review for 2011
Passive Acoustics Monitoring STUDIES 1,2	Continue data collection and analysis from two US Navy funded passive acoustic monitoring devices	

TOTAL Navy 2010 Goal:

PASSIVE ACOUSTIC MONITORING: Deploy a minimum of two passive acoustic devices between June to December 2010: 1) one Navy funded passive acoustic monitoring device is already in-water and has been collecting data for several years (see Appendix C); 2) The second passive acoustic recording device will be deployed prior to December 2010 to start data collection at a different site.

TAGGING: Scope, plan and purchase tags, with tag placement dependent on at-sea schedules and tagging success for species of interest. Tagging will be coordinated with NMFS and other regional tagging efforts.

Study 1= Are marine mammals and sea turtles exposed to mid-frequency active sonar (MFAS), especially at levels associated with adverse effects (i.e., based on NMFS' criteria for behavioral harassment, Temporary Threshold Shift, or Permanent Threshold Shift)? If so, at what levels are they exposed?
Study 2= If marine mammals and sea turtles are exposed to sonar, do they redistribute geographically as a result of continued exposure? If so, how long does the redistribution last?

NAVY-WIDE INTEGRATED COMPREHENSIVE MONITORING PROGRAM (ICMP)

The Integrated Comprehensive Monitoring Program (ICMP) is Navy-wide and will provide an overarching structure and coordination that compiles data from all Navy range specific monitoring plans (DoN 2009). Specific details of the ICMP are contained in Appendix B.

In addition to the NWTRC monitoring plan, a number of other Navy range complex monitoring plans are being developed for protected marine species, primarily marine mammals and sea turtles, as part of the environmental planning and regulatory compliance process associated with a variety of training actions in those regions. Goals of these monitoring plans are to assess the impacts of training activities on marine species and effectiveness of the Navy's current mitigation practices. Ranges with the largest amount of operations will be prioritized for monitoring based on availability of both funding and scientific resources. These include the Atlantic Fleet Active Sonar Training Range, Hawaii Range Complex, Marianas Island Range Complex, and Southern California Range Complex.

The NWTRC plan is one component of the ICMP and the studies outlined here will also be implemented in various combinations within other range complexes (Appendix B). The overall objective of the ICMP is to assimilate relevant data collected across Navy range complexes in order to answer questions pertaining to the impact of mid-frequency active sonar and underwater explosive detonation on marine mammals and sea turtles.

Monitoring measures prescribed in range/project-specific monitoring plans and Navy-funded research relating to the effects of anthropogenic sound on protected marine species should be designed to accomplish one or more of the following top-level goals:

- An increase in the probability of detecting marine mammals and other threatened or endangered marine species, both within the safety zone (thus allowing for more effective implementation of the mitigation) and in general to generate more data to contribute to the effects analyses.
- An increase in our understanding of how many marine mammals and other threatened or endangered marine species are likely to be exposed to levels of mid-frequency active sonar, high-frequency active sonar, underwater detonations, or other stimuli that are associated with specific adverse effects, such as behavioral harassment, Temporary Threshold Shift, or Permanent Threshold Shift.
- An increase in our understanding of how marine mammals and other threatened or endangered marine species respond (behaviorally or physiologically) to sonar, underwater detonations, or other stimuli at specific received levels that result in the anticipated take of individual animals.
- An increase in our understanding of how anticipated adverse effects on individual animals may impact the population, species, or stock (specifically through effects on annual rates of recruitment or survival).
- An increase in our understanding of the effectiveness of certain mitigation and monitoring measures.
- A better understanding and record of the manner in which the authorized entity complies with the incidental take authorization.

Under the ICMP and given the larger scope of training events within other Navy range complexes as compared to NWTRC, not every one of these original five study questions will be addressed within NWTRC (Table 1). Rather, data collected from NWTRC monitoring will be used to supplement a consolidated range complex marine mammal monitoring report incorporating data from the Atlantic Fleet Active Sonar Training Range, Hawaii Range Complex, NWTRC, and Southern California Range Complex.

Monitoring techniques for the NWTRC will be focused to contribute information to studies question 1 and 2 above.

OVERVIEW OF MONITORING PLAN RESEARCH ELEMENTS

Worldwide, a suite of visual and acoustic monitoring techniques has been used to assess the effects of anthropogenic sound on marine mammals (Barlow and Gisiner 2006). The NWTRC Monitoring Plan proposes monitoring goals that are unique with regard to their breadth as well as their focus on potential impacts of MFAS and underwater explosions on marine mammals and sea turtles. To accomplish these goals, the Navy will use similar methods of implementation and data analysis which have demonstrated success in comparable monitoring programs studying the effects of anthropogenic sound on marine animals.

In addition to the U.S. Pacific Fleet funded initiative described in this Plan, the Chief of Naval Operations Environmental Readiness Division and the Office of Naval Research have developed a coordinated Research & Development program focused on marine mammals and sound. Total investment in this program from 2004-2008 was $100 million. Fiscal year 2009 funding was $22 million. Continued funding at levels greater than $14 million is foreseen in subsequent years (>2010). Results from Navy Research and Development funded monitoring within the NWTRC for 2009, the most recent reporting year, are presented in Appendix C.

Each monitoring technique has advantages and disadvantages that vary temporally and spatially, as well as support one particular study objective better than another. The Navy intends to use a combination of techniques so that detection of marine animals is maximized, and meaningful information can be derived to answer the research objectives described previously.

Monitoring methods initially proposed for the NWTRC scheduled to begin between June 2010 to June 2011 include a combination of the following research elements designed to support both Range Complex specific monitoring, and contribute information to the ICMP. These research elements include:

- Passive Acoustic Monitoring
- Marine mammal tagging (opportunistically as available)

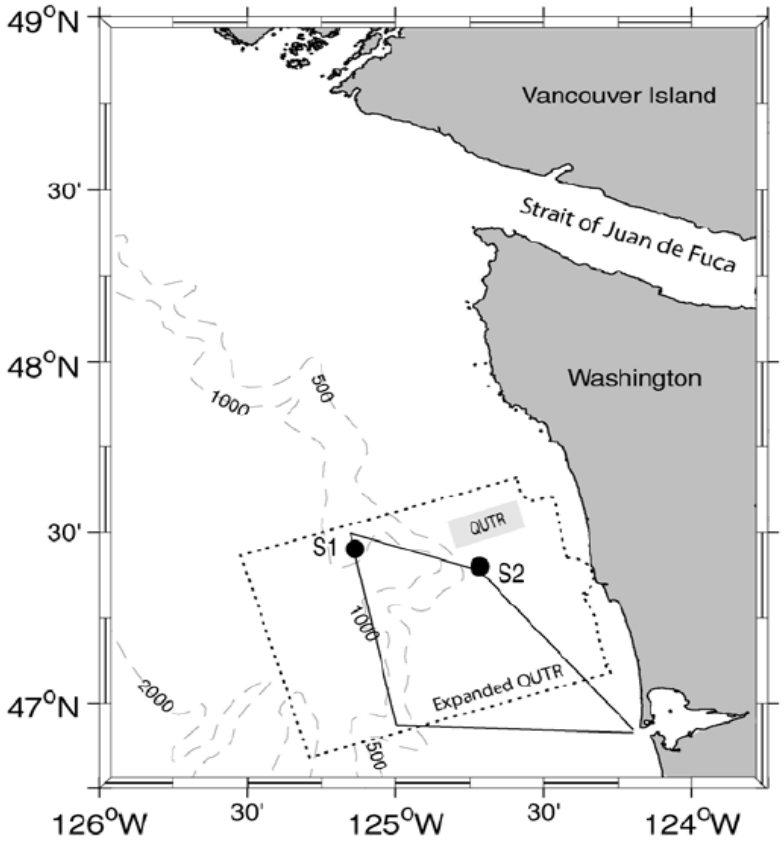
Passive Acoustic Monitoring

There are both benefits and limitations to passive acoustic monitoring as discussed in Mellinger and Barlow (2003) and Mellinger et al. (2007). Passive acoustic monitoring allows detection of marine mammals that may not be seen during a visual survey, and monitoring of vocalization/echolocation rates before, during, and after Navy training events. When interpreting data collected from passive acoustic monitoring, it should be noted that species specific results must be viewed with caution because not all animals within a given population may be vocalizing, or may only vocalize only under certain conditions (Mellinger et al. 2007, Oleson et al. 2007a, 2007b, ONR 2007, NMFS 2008, Oleson et al. 2008, Mouy et al. 2009, Oleson et al. 2009, Southall and Nowacek 2009).

Deployable acoustic recording packages may offer the first immediately available tools (see Newcomb et al. 2002, Hildebrand 2005, Hildebrand 2007, Wiggins and Hildebrand 2007, Lammers et al. 2008, Oleson et al. 2008). Other acoustic monitoring buoy types will also be considered for deployment as well (Lammers et al. 2005). The entire suite of passive acoustic monitoring tools, both bottom-mounted Acoustic Recording Packages, stationary surface sonobuoys, towed passive acoustic arrays, and other technology if available, will be investigated for applicability and affordability within the NWTRC Monitoring Plan in subsequent years. As discussed in more detail in Appendix C, the Navy has funded the deployment of previous passive acoustic monitoring in the Pacific Northwest from 2004-2009 (Oleson et al. 2008, 2009).

As the Plan progresses within the first year (2010-2011) and experience gained within NWTRC, either through direct measurement of results, review of technical passive acoustic monitoring specifications, and from guidance of subject matter experts within the field, future NWTRC monitoring may include a smaller sub-set of passive acoustic monitoring devices.

passive acoustic monitoring in the NWTRC will be used to detect, locate, and potentially track vocalizing marine mammals, as well as provide seasonal estimates of presence/absence. A minimum of two passive acoustic monitoring will be deployed within the NWTRC. Buoys will be set on a duty cycle that maximizes battery power, data storage space, and provides adequate sampling. If Navy funding is available and additional buoys deemed necessary after consultation with NMFS and regional scientists, then potentially additional buoys may be considered. Autonomous acoustic recording buoys will provide long term, daily information on the presence and absence of marine mammals and their movements through an area (Mellinger and Barlow 2003, Oswald et al. 2003, Melliger et al. 2007, Oleson et al. 2008, 2009, Whitehead 2009). Acoustic data will be collected according to standard and accepted passive acoustic monitoring protocols (NMFS 2008).



Locations of two High-frequency Acoustic Recording Packages, S1 and S2, and the primary track for monthly visual surveys (solid line) from Westport Harbor, WA from 2004 to 2008 (from Oleson et al. 2009).

Marine Mammal Tagging

Technological advancements in recent years now provide opportunity for data collection by deploying tags on individual marine mammals (Mate et al. 1999, Baird et al. 2006, Tyack 2007, Baird et al. 2008, Baumgartner et al. 2008, Calambokidis et al. 2008). Individuals can be tracked using VHF radio or satellite tags. These types of tags, as well as acoustic recording tags that provide more discreet information about pitch, roll, vertical and horizontal movement, can provide significant new information about animal movement and habitat use. This tool is especially useful when deployed on medium-sized, difficult-to-observe and deep-diving target species such as beaked whales (Zimmer et al. 2005, Tyack 2007, Johnson et al. 2008). To date, some tag attachments are lasting in excess of 60 days (Baird pers. comm. 2008). A variety of long and short term tags will be used to obtain a broad-scale data set. Effort will also be given to coordinate with ongoing marine mammal tagging efforts in the NWTRC study area for baleen whale species (i.e., Tagging of Pacific Predators available at: http://www.topp.org). Tagging of Pacific Predators began in 2000 as one of 17 projects of the Census of Marine Life, a 10-year, 80-nation endeavor to assess and explain the diversity and abundance of life in the oceans. National Oceanographic and Atmospheric Administration's Pacific Fisheries Ecosystems Lab, Stanford's Hopkins Marine Lab, and University of California, Santa Cruz's Long Marine Laboratory manage the program. The Navy's Office of Naval Research already provides funding for marine mammal tag development and improvement.

In addition to baleen whale tagging already being conducted in Central and Southern California, the Navy will directly fund researchers in a program to tag whale species of interest recommended by researchers within NWTRC. This program is in an initial planning phase and will be integrated as the NWTRC monitoring plan matures. As was the case for passive acoustic monitoring, a toolkit of applicable tag types will be reviewed. Examples of tags include retrievable Digital Acoustic Recording Tag which is a short-term tag (hours-to-days) that can record short term animal movement (diving profiles, swimming

speed, depth), exposure to underwater sound, and potential behavioral reactions; or one of a series of satellite position tags that can provide medium to longer term indication of animal movement over time. Another tag successfully used in NWTRC by academic and Navy researchers has been satellite Argos tags. The Argos program is administered under a joint agreement between the National Oceanographic And Atmospheric Administration and the French space agency, Centre National d'Etudes Spatiales. The system consists of in-situ data collection platforms equipped with sensors and transmitters and the Argos instrument aboard the National Oceanographic And Atmospheric Administration's Polar-orbiting Operational Environmental Satellites (http://noaasis.noaa.gov/ARGOS/). Argos tags can be attached by a dorsal fin dart and can remain attached for over 30 days (Schorr et al. 2007). Another example of a long term tags, discussed on the Tagging of Pacific Predators web site, is the Smart Position or Temperature Transmitting Tag which has a potential lifespan of two years. Species will be tagged opportunistically; however the focus will be on cryptic and deep diving species such as beaked, or sperm whales that have the lowest rates of detectability in visual surveys (Barlow and Gisiner 2006). Other tag types will be considered as more information becomes available.

Results from tagging will be examined annually to assess the effectiveness of this technique.

Marine Species Under Consideration

There are 41 potential marine mammal species or separate stocks with possible or confirmed occurrence in the marine waters off Southern California and within the NWTRC. There are 34 cetacean species (whales, dolphins, and porpoises), six pinnipeds (sea lions, fur seals and true seals) and one sea otter species. Appendix A Table A-1 lists marine mammal species with possible occurrence within the NWTRC. For additional background, there are several sources of information on Pacific Northwest marine mammals and sea turtles, including the NMFS Stock Assessment Reports for marine mammals, and the Navy's Northwest Training Range Complex Draft Environmental Impact Statement\Draft Overseas Environmental Impact Statement (DoN 2008).

The NMFS U.S. Pacific Stock Assessment Reports are prepared annually and available online at:
http://www.nmfs.noaa.gov/pr/sars/

The NWTRC Environmental Impact Statement\Draft Overseas Environmental Impact Statement also contains a summary of the scientific literature on animal distribution and likely occurrence within the Pacific Northwest marine waters (DoN 2008). This NWTRC Monitoring Plan has been designed in an attempt to gather data on all species of marine mammals and sea turtles observed in the NWTRC study area. However, the Navy will prioritize monitoring efforts for species based on regulatory requirement due to Endangered Species Act-listing, and on beaked whale species where mid-frequency active sonar use and strandings have been linked at certain locations and under certain circumstances. Of note, all of the beaked whale strandings and association with mid-frequency active sonar have been in specific geographic locations of the Atlantic Ocean (Bahamas, Canary Islands) and Mediterranean Sea (Greece). There have been no beaked whale atypical mass strandings associated with mid-frequency active sonar use on United States Navy Range Complexes within the Atlantic or Pacific. A detailed discussion on the science known about marine mammal stranding is contained in the NWTRC Environmental Impact Statement\Draft Overseas Environmental Impact Statement (DoN 2008).

Prioritization of Species

Therefore, based on the requirements listed above, species for study within the NWTRC Monitoring Plan that regularly occur within NWTRC will be prioritized for research as follows:

- **Beaked whale species** (Cuvier's beaked whale, Baird's beaked whale, other Mesoplodon species)
- **ESA-listed species** (blue whale, fin whale, humpback whale, sei whale, sperm whale, Southern Resident killer whale, and Stellar sea lion)
- **Killer whale** (Eastern North Pacific Offshore stock)
- **Other Species**

The Plan recognizes that deep diving and cryptic species of marine mammals such as beaked whales, and sperm whales, may have low probability of visual detection (Barlow and Gisiner 2006). Therefore, methods will be utilized to address this issue (e.g., passive acoustic monitoring, animal tagging).

Other Potential Monitoring Elements For Future Consideration

There may be a number of potential additional marine mammal monitoring techniques, or variations of those already described, that could be attempted under this Plan. Future modifications to the NWTRC Monitoring Plan may include integration of additional marine mammal monitoring techniques and research as either new technology or new information becomes available. The previously discussed list of elements is based on initial identification of the research questions promulgated by NMFS and subsequent dialog on best immediate techniques to attempt at the outset of this Plan starting in June 2010 based on past non-integrated monitoring, and regional availability.

As part of future dialog to begin in the summer and fall of 2010 with Northwest Pacific NMFS marine mammal scientists, academic scientists, and other subject matter experts with extensive field monitoring experience, the Navy will continually solicit input and recommendations to this Plan. An annual formal review with NMFS is being proposed at the end of each year's monitoring to capture lessons learned, and seek concurrence as to the best mix of monitoring techniques to employ in the next year's sampling based on scientific merit, applicability to the direct research questions posed in this Plan, and logistic and economic feasibility (Table 1). As additional recommendations are made from the Navy's ICMP as it develops, these too will be integrated into future NWTRC monitoring.

Previous Navy Funded Marine Mammal Research in the Pacific Northwest

Total investment in this program by Chief of Naval Operations N45 and Office of Naval Research has totaled $100 million Navy-wide from 2004-2008, and $22 million for fiscal year 2009. Continued funding at levels greater than $14 million is foreseen in subsequent years. The Chief of Naval Operations N45 and Office of Naval Research coordinated Science & Technology and Research & Development program currently is focused in the following areas through the end of 2010:

• Comprises four interrelated areas: determining marine mammal demographics; establishing accepted criteria and thresholds to measure the effects of naval activities; developing effective protective methods to lessen those effects; and further understanding the effects of man-made sound fields on marine life.

• Provides better biological data and tools to enable the Fleet to train prior to deployments at a minimal risk to marine mammals.

• Seeks to make monitoring and mitigation as compatible as possible with Fleet sensors, data displays and personnel training.

The NWTRC Environmental Impact Statement\Draft Overseas Environmental Impact Statement summarized some of the general science on past studies of anthropogenic (i.e., human generated) noise on marine mammals (DoN 2008). Other related references also include Cox et al. 2006, Deeck 2006, Nowacek et al. 2007, and Southall et al. 2008). In light of continued discoveries and identification of knowledge gaps from scientific references cite above, continuing adjustments and prioritization to the Research and Development program will be achieved via consensus with the ICMP in order to advance the knowledge of marine mammal science. It should be noted, the N45 and ONR marine mammal program is a separately funded and administered program from the proposed NWTRC Monitoring Plan to be funded by U.S. Pacific Fleet. Both programs can be complementary in many instances and data from one can be leveraged and used within the other. In support of this complementary nature, several significant projects funded by the Navy Science & Technology and Research & Development program are funded through fiscal year 2011 and currently ongoing within NWTRC.

The NWTRC Monitoring Plan will integrate elements and data from these region specific studies into this Plan as appropriate. Included as an example of this effort, Appendix C has a report summarizing visual and passive acoustic monitoring from Navy funded research in the offshore waters of Washington State (Oleson et al. 2008, 2009).

Proposed Initial Monitoring Area

Specific areas within NWTRC have been deemed focus areas based on either past marine mammal surveys within that area, or lack of marine mammal survey information. Figure 2 shows the preliminary areas of monitoring interest within the NWTRC and represent areas accessible enough for the various research elements discussed in this Plan. These nominated research areas, however, do not preclude monitoring in other areas of the NWTRC, but are intended to designation sub-regions within NWTRC that will have initial prioritization.

The designation of the most appropriate monitoring sub-areas will be reviewed at the end of each monitoring year as part of an adaptive management approach based on results for that year's monitoring. As described later in this Plan, at the end of each monitoring and reporting year, a review of monitoring results, expectations, and fit in answering the Plan's overall objectives will be conducted, termed an Adaptive Management Review.

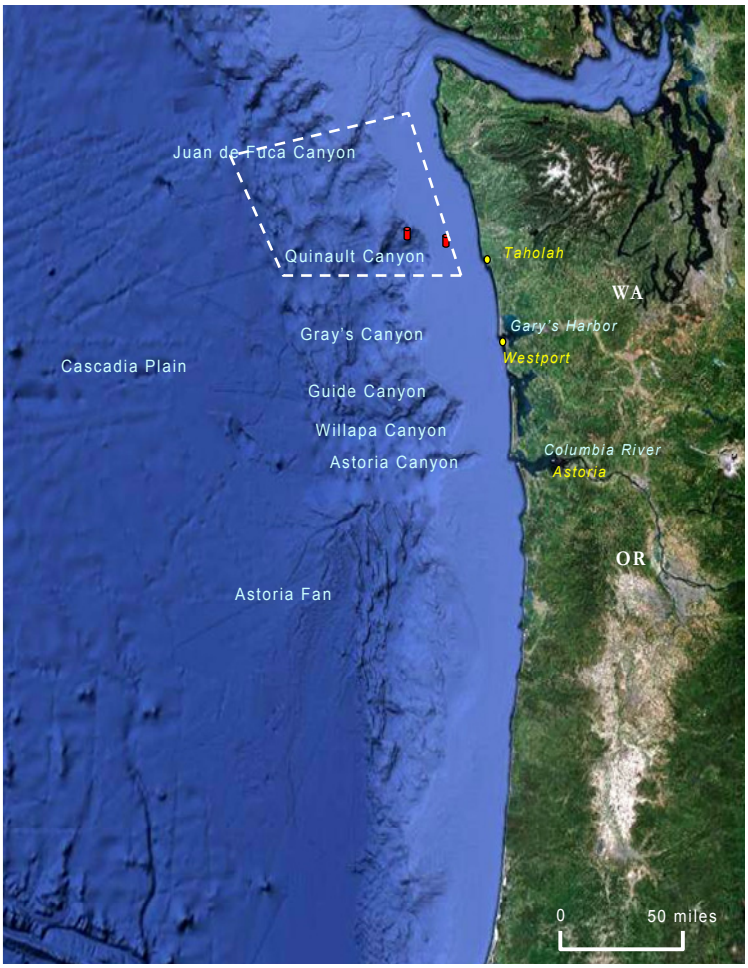


Figure 2. Region (dotted line) within the Pacific Northwest proposed as initial focus area for the NWTRC Monitoring Plan.
Red cylinders are approximate locations of previous Navy funded passive acoustic monitoring devices. Monitoring could occur in any part of the NWTRC if deemed needed in support of the monitoring plan goals.

MONITORING PLAN STUDY DESCRIPTIONS

STUDY 1: Are marine mammals and sea turtles exposed to mid-frequency active sonar (MFAS), especially at levels associated with adverse effects (i.e., based on NMFS' criteria for behavioral harassment, TTS, or PTS)? If so, at what levels are they exposed?

STUDY 2: If marine mammals and sea turtles are exposed to MFAS in the NWTRC, do they redistribute geographically as a result of continued exposure? If so, how long does the redistribution last?

Methods- Documenting known at-sea behavioral reactions of marine mammal to military sonar and explosives is complicated by lack of information and direct observations of cause-and-effects. Any particular reaction is likely to be conditional on the species in question, and a host of other factors such as feeding status, breeding status, time of day, overall health, and other issues. In order to address this question, there is a need to assess whether marine mammals and sea turtles are not only at the surface, but in the water column where they could be potentially exposed to sonar. If animals are not present, then there would be no exposure and no possibility of behavioral reaction, or lack of reaction. Within the NWTRC, therefore, a combination of passive acoustic monitoring and tagging will be used to contribute data to address Questions 1 and 2.

Passive acoustic monitoring- Opportunistic data collected as part of passive acoustic monitoring in the NWTRC (described in Study 2) may offer insights to animal vocalization rates, potential dive pattern, and possible movement in relation to Navy training events. This field is relatively new in terms of defining behavioral context of vocalization and is dependent of knowing marine mammal vocalization patterns when no Navy operations are present. Temporary passive acoustic monitoring buoys can be used to track the presence and absence of vocalizing marine mammals over both short (hours-days) and long time scales (weeks-months). The exact number of buoys above two needed to adequately characterize an area is under review. Depending on passive acoustic monitoring location in relation to training events, data from monitoring buoys might be used to assess potential sound exposure levels based on receive levels recorded by the buoys. The extent of actual exposure is an extrapolation of potential exposure between the source and the buoy, but is not an exact measure of the actual sound level to which an individual marine mammal was actually exposed.

Marine mammal tagging (Beaked whale, killer whale, Endangered Species Act-listed sperm whale, Endangered Species Act-listed baleen whale, or surrogate species animal tagging)- Attempts to tag suitable animals will be conducted prior to a given Navy event, allowing animals the opportunity to distribute naturally prior to any potential immediate exposure to training activities. Tags shall be applied in a geographical area within NWTRC that is likely to be transited by Navy vessels during the training event. The goal of the tagging effort is to examine spatial distribution of animals before, during and after a training event; as well as potential long-term habitat associations and distributions independent of Navy training events. It should be cautioned that finding, approaching, and tagging these rather cryptic species is a very difficult process, and successful tag attachment can not be guaranteed.

ANALYSIS AND REPORTING

Data Collection and Analysis

Contracted third party data collection will be collected by qualified, professional marine mammal and sea turtle biologists that are experts in their field. Researchers will provide annual reports to the Navy, however, this is expected to be an ongoing process with data collected, analyzed and interpreted over many years. It is not likely that firm conclusions can be drawn on most questions within a single year of monitoring effort due to the difficulty in achieving sufficient sample sizes for statistical analysis. The Navy will provide annual reports to NMFS in fulfillment of the Marine Mammal Protection Act and Endangered Species Act requirements. The report will provide information on the amount and spatial/temporal distribution of monitoring effort as well as summaries of data collected and any preliminary results that may be available from analysis.

While the monitoring described in this plan represent the best estimate of availability, there may be instances within any given year where exercise schedules shift, survey crew availability becomes limited, or extreme weather precludes effective sampling. In case of monitoring delay based on these conditions, monitoring effort will be re-scheduled at the next available opportunity. In the event that a particular target exercise is not available within the remainder of a particular year, monitoring may have to be made up in a following year.

Table 1 provides the exact detail about how the initial NWTRC Monitoring Plan will be implemented starting in 2010.

Data collection will begin between June and December 2010.

The Navy will be investing significant funding and personnel towards this monitoring program and intends to conduct the research in a scientifically sound and robust manner. The Navy is committed to conducting research until the original program objectives have been answered to the satisfaction of both NMFS and Navy. Therefore, it is in the best interest of the Navy to choose studies wisely in each range complex that are the most likely to collect large data sets, and will enable the Navy and NMFS to answer required questions. Some field methods may be applied throughout Navy ranges, while other methodologies may be specially selected for one or two ranges that are most likely to produce the best quality data.

For the NWTRC Monitoring Plan, therefore, it is premature to dictate before data collection begins what sample size will be required from each species in each study. This is particularly true given that research will be conducted on a diversity of species. The NWTRC Plan, as written, covers research on the effects from mid-frequency active sonar and explosives on a diversity of mysticete and odonotocete species found in the NWTRC. This range of species will make each study unique in the sense of knowing when enough data have been collected. As a result, it may be prudent to initially focus some of the studies on prioritized species that are likely to provide more data collection opportunities and use those as representative species.

Using other large ocean monitoring programs as an example and guideline, one thing becomes clear - the key to the success of the plan's execution and analysis is using scientific professionals that are the top of their field (Aburto et al. 1997, Au et al. 1997, Frankel and Clark 1998, 2000, NRC 2000, 2003, 2005, Croll et al. 2001, ONR 2001, Costa et al. 2003, Fristrup et al. 2003, Clark and Altman 2006, Mobley 2001, 2006, Oleson et al. 2008, 2009). It's the Navy's intention that the NWTRC Monitoring Plan be implemented by a team of qualified, professional marine mammal and sea turtle biologists that are experts in their field. This team of experts will include statistical analysts to analyze data and make recommendations as to when they are beginning to see a pattern in the data and/or when the study designs need to be slightly altered for more robust data collection. This adaptive management process will provide a critical feedback loop to allow for adapting to new methods and evolving methodology. The process will be transparent to the public in the sense of yearly reporting to NMFS under the NMFS authorization as well as encouraging the scientific team to publish results in peer-reviewed literature as they become available.

New technology and techniques will be incorporated as part of the Navy's adaptive management strategy. Adaptive measures and feedback from the experts will allow flexibility within a given year and/or within

years so as to best achieve monitoring plan goals and take into consideration shifting demands, inclement weather and other unforeseen events. For example, flexibility is built in to monitor an alternate but equal training exercise within the year and/or in a following year in the instance an operational schedule changes, is delayed or cancelled. This flexibility ensures monitoring will occur under the best of circumstances and conditions.

In addition to the studies conducted under the NWTRC Monitoring Plan, the Navy intends to collaborate with other researchers in the Washington, Oregon, and California that are conducting complimentary research on this topic. Those studies will not replace the Navy's obligation under the Marine Mammal Protection Act and Endangered Species Act monitoring requirements, but will augment the resources provided to the Plan's specific questions.

Reporting

The Navy is currently working on the overarching structure and coordination via the ICMP that will, over time, compile data from both range-specific monitoring plans (e.g., NWTRC monitoring plan) as well as Navy funded research and development studies. The analysis protocols are still in development phase at this time. However, data collection methods will be standardized to allow for comparison from ranges in different geographic locations. The sampling scheme for the program will be developed so that the results are scientifically defensible. For example, since all data will be collected using a behavioral program like Noldus, data collection will be standardized between the different geographical regions. A data management system will be developed to assure standardized, quality data are collected towards meeting of the goals. The data management plan shall provide standard marine species sighting forms for Navy lookouts and biologists to use to standardize data collection. Annual reports summarizing effort, analysis and results will be compiled and submitted to NMFS. These reports will allow the Navy and NMFS to assess and adaptively manage the Navy's monitoring effort to more effectively answer the questions outlined above.

Data collected from the NWTRC monitoring plan will be added to a Navy wide analysis of monitoring from other permitted Navy range complexes via the ICMP. All available data will be included in the Navy's NWTRC Monitoring Annual Report. The Navy's reports will provide information on the amount and spatial/temporal distribution of monitoring effort as well as summaries of data collected and any preliminary results that may be available from analysis. This also includes an evaluation of the effectiveness of any given element within the NWTRC monitoring program. All subsequent analysis shall be completed in time for Navy's five year report to NMFS.

ADAPTIVE MANAGEMENT

Background

NMFS acknowledges that the NWTRC Monitoring Plan plan will enhance the understanding of how sonar or underwater detonations (as well as other environmental conditions) may, or may not, be associated with marine mammal injury or strandings. Additionally, NMFS also points out that information gained from the investigations associated with this Plan may be used in the adaptive management of mitigation or monitoring measures in subsequent NMFS authorizations, if appropriate.

Adaptive management is an iterative process of optimal decision making in the face of uncertainty, with an aim to reducing uncertainty over time via system monitoring. Within the natural resource management community, adaptive management involves ongoing, real-time learning and knowledge creation, both in a substantive sense and in terms of the adaptive process itself. Adaptive management focuses on learning and adapting, through partnerships of managers, scientists, and other stakeholders who learn together how to create and maintain sustainable ecosystems (Williams el at. 2007). Adaptive management helps science managers maintain FLEXIBILTY in their decisions, knowing that uncertainties exist and provides managers the latitude to change direction; will improve UNDERSTANDING of ecological systems to achieve management objectives; and is about taking ACTION to improve progress towards desired outcomes (Williams et al. 2007). Further discussion of adaptive management in the natural resource community is available from the U.S. Department of Interior's Adaptive Management Guidelines: http://www.doi.gov/initiatives/AdaptiveManagement/index.html

Adaptive Management Implementation

There are annual reporting requirements contained in NMFS Marine Mammal Protection Act authorization associated with the NWTRC. Following the Navy's Annual Monitoring Report to NMFS, the Navy will request specific written discussion from NMFS of NMFS's assessment of the Plan's past year results. The goal of this consultation and collaboration would be to determine if these research elements and associated results continue to meet the overall objectives of the Plan specific to the NWTRC. For instance, if one particilar research element does not provide direct or indirect support to one of the objectives listed above, then resources for future instances of that element could be re-directed to other research elements that do provide more support.

The actual Adaptive Management Review will be a multipart review. Initial accomplishments will be tabulated by Navy subject matter experts familiar with marine mammal monitoring. If available, collaberation with regional NMFS scientists, academic scientists, and other non-Navy subject matter experts will be informally sought. As of this time, there is no formal mechanism in which to compensate a non-Navy "expert team", but this is one goal for the ICMP to designated, structure, and potentially fund. The Navy will then consult with the NMFS Office of Protected Resources in discussion of lessons learned and recommended way forward for the next year's sampling effort.

Until at least one or two years worth of monitoring data are collected and analyzed both within the NWTRC and in context of the ICMP, it is premature to guess which, if any of the proposed elements contained in this Plan will provide the most scientifically valid information to address the objectives. Most likely it will be a combination of elements that will provide the best data in addressing MFAS and explosive effects or lack of effects on the marine mammals within the NWTRC. The original intent of this Monitoring Plan is to integrated into both the text discussions on research elements, and Table 1 allocation of effort, what is anticipated as being the best allocation of resources to address the Plan's objectives.

Proper application of the adaptive management concept will allow future adjustments to be made to the NWTRC Monitoring Plan that will enhance overall scientific conclusions, lead to better statistical approaches, integrate new technologices in marine mammal monitoring and detection, and provide a stronger foundation upon which to base mitigation and policy decisions. In addition, as part of the annual review, a more complete cost-benefit analysis can be presented based on actual monitoring cost by research element within NWTRC.

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APPENDIX A- COMMON MARINE MAMMAL SPECIES IN NWTRC

Table A-1. Summary of Marine Mammal Species in the Pacific Northwest.

Common Name	Stock	ESA/ MMPA Status	Population Trend	Occurrence	Designated Critical Habitat in NWTRC	Primary occurrence Warm Season May-Oct	Primary occurrence Cold Season Nov-Apr
ESA Listed							
Blue whale	Eastern North Pacific	E,D,S	May be increasing	Rare, all year	None	Yes	No
Fin whale	CA, OR, WA	E,D,S	May be increasing	Rare, all year	None	Yes	No
Humpback whale	Eastern North Pacific	E,D,S	Increasing	Rare, warm season	None	Yes	No
Killer whale	Eastern North Pacific-Southern Resident	E,D	Increasing	Infrequent	Puget Sound and vicinity	Yes	Yes
North Pacific right whale	Eastern North Pacific	E,D,S	Unknown	Very rare, warm season	None	Possible	No
Sei whale	Eastern North Pacific	E,D,S	May be increasing	Very rare, all season	None	Yes	No
Sperm whale	CA, OR, WA	E,D,S	Unknown	Uncommon, but expected	None	Yes	Yes
Stellar sea lion	Eastern North Pacific	T,D	Increasing	Uncommon	Rookeries in OR and CA	Yes	Yes
Sea otter	Washington	T, D	Increasing	Common, all year	None	Yes	Yes
Sea otter	California	T,D	Increasing	Common, all year	None	Yes	Yes

Common Name	Stock	ESA/ MMPA Status	Population Trend	Occurrence	Designated Critical Habitat in NWTRC	Primary occurrence Warm Season May-Oct	Primary occurrence Cold Season Nov-Apr
Non-ESA Listed							
Baird's beaked whale	CA, OR, WA	-	Unknown	Very rare, warm season	-	Yes	Yes
Bottlenose dolphin	CA, OR, WA Offshore	-	Stable	Very rare, extralimital	-	Yes	Yes
California sea lion	U.S.	-	Increasing	Common	-	Yes	Yes
Cuvier's beaked whale	CA, OR, WA	-	Unknown	Uncommon, but expected	-	Yes	Unknown
Dall's porpoise	CA, OR, WA	-	Unknown	Abundant	-	No	Yes
Dwarf sperm whale	CA, OR, WA	-	Unknown	Uncommon, warm season	-	Yes	Unknown
Gray whale	Eastern North Pacific	-	Increasing	Common, warm season	-	Yes	No
Harbor porpoise	WA inland waters	-	Stable	Common	-	Yes	Yes
Harbor porpoise	OR, WA Coast	-	Stable	Common	-	Yes	Yes
Harbor porpoise	Northern CA, Southern OR	-	Stable	Common	-	Yes	Yes
Harbor seal	Washington Inland waters	-	Increasing, approaching stable	Abundant year round	-	Yes	Yes
Harbor seal	OR and WA Coast	-	Increasing, approaching stable	Abundant year round	-	Yes	Yes
Hubb's beaked whale	CA, OR, WA	-	Unknown	Rage	-	Unknown	Unknown
Killer whale	Eastern North Pacific Offshore	-	Unknown	Uncommon, all year	-	Yes	Unknown
Killer whale	West Coast transient	-	Unknown	Uncommon, all year	-	Yes	Unknown
Minke whale	CA, OR, WA	-	No trends	Rare, all year	-	No	Yes
Northern elephant seal	CA Breeding	-	Increasing	Uncommon	-	Yes	Yes
Northern fur seal	San Miguel Island		Increasing	Common cold, uncommon warm	-	No	Yes
Northern right whale dolphin	CA, OR, WA	-	No trend	Common	-	Yes	Yes
Pacific white-sided dolphin	CA, OR, WA	-	No trend	Common, warm season	-	Yes	Yes
Risso's dolphin	CA, OR, WA	-	No trend	Uncommon	-	Yes	Yes
Short-beaked common dolphin	CA, OR, WA	-	No trend	Uncommon, warm season off CA	-	Yes	No
Short-finned pilot whale	CA, OR, WA	-	Unknown	Rare	-	Unknown	Unknown
Stejneger's beaked whale	CA, OR, WA	-	Unknown	Rare	-	Unknown	Unknown
Striped dolphin	CA, OR, WA	-	No trend	Very rare, off N. CA	-	Possible	No

ESA = Endangered Species Act; MMPA = Marine Mammal Protection Act; E= Endangered; D= Depleted; S= strategic stock under MMPS; T= Threatened
CA= California; OR= Oregon; WA= Washington

APPENDIX B- INTEGRATED COMPREHENSIVE MONITORING PROGRAM

UNITED STATES NAVY

INTEGRATED COMPREHENSIVE MONITORING PROGRAM

23 December 2009

Point of Contact: OPNAV N45
Dr. V. Frank Stone
703-604-1424

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EXECUTIVE SUMMARY

The Navy is responsible for compliance with a suite of Federal environmental laws and regulations that apply to marine mammals and other marine protected species, including the Endangered Species Act (ESA) and the Marine Mammal Protection Act (MMPA). As part of the regulatory compliance process associated with these Acts, the Navy is responsible for meeting specific requirements for monitoring and reporting on activities involving active sonar and/or detonations from underwater explosives.

This Integrated Comprehensive Monitoring Program (ICMP) provides the overarching framework for coordination of the United States Navy monitoring program. It has been developed in direct response to Navy Range permitting requirements established in the various MMPA Final Rules, ESA Consultations, Biological Opinions, and applicable regulations. As a framework document, the ICMP applies by regulation to those activities on ranges and operating areas for which the Navy sought and received incidental take authorizations.

The ICMP is intended for use as a planning tool to focus Navy monitoring priorities pursuant to ESA and MMPA requirements. Top priority will always be given to satisfying the mandated legal requirements across all ranges. Once legal requirements are met, any additional monitoring-related research will be planned and prioritized using guidelines provided by the ICMP, consistent with availability of both funding and scientific resources. As a planning tool, the ICMP is a "living document". It will be routinely updated as the Program matures. Initial areas of focus for maturing the document in 2010 include further refinement of monitoring goals, adding a characterization of the unique attributes associated with each range complex / study area to aid in shaping future monitoring projects, as well as a broader description of the data management organization and access procedures.

The ICMP will be evaluated annually through the adaptive management process to assess progress, provide a matrix of goals for the following year, and make recommendations for refinement and analysis of the monitoring and mitigation techniques. This process includes conducting an annual Adaptive Management Review (AMR) at which the Navy and National Marine Fisheries Service (NMFS) jointly consider the prior year goals, monitoring results, and related science advances to determine if modifications are needed to more effectively address monitoring program goals. Modifications to the ICMP that result from AMR decisions will be incorporated by an addendum or revision to the ICMP. The ICMP updates will be provided to NMFS by 31 December annually beginning in 2010. This adaptive management process recurs annually, with some modifications to the process in 2011, when the Navy, with guidance and support from NMFS, is to host a Monitoring Workshop that incorporates outside experts and expanded participation.

Section 1 introduces the ICMP, including purpose, objectives, specific ranges and geographic areas included, and additional background material. Section 2 describes overall monitoring goals and prioritization guidelines. Section 3 discusses standard data collection and management procedures. Section 4 addresses the coordination of reporting requirements, including a specific timeline for coordination of the current year's reporting requirements, and the recordkeeping system that documents how each Range Complex contributes to ongoing monitoring objectives. Section 5 outlines the adaptive management process, including provisions for annual reviews as well as a monitoring workshop in 2011. Section 6 discusses near-term plans for continued maturation of the Monitoring Program.

Section 7 provides roles and responsibilities among the various Navy components. References are listed in Section 8.

OPNAV (N45) is responsible for maintaining and updating this ICMP as required to reflect the results of future regulatory agency final rulemaking, adaptive management reviews, best available science, improved assessment methodologies, or more effective protective measures. This will be done in consultation with Navy technical experts, Fleet Commanders, and Echelon II Commands as appropriate as part of the adaptive management process.

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1. INTRODUCTION

The Navy is responsible for compliance with a suite of Federal environmental laws and regulations that apply to marine mammals and other marine protected species, including the Endangered Species Act (ESA) and the Marine Mammal Protection Act (MMPA). As part of the regulatory compliance process associated with these Acts, the Navy is responsible for meeting specific requirements for monitoring and reporting on military readiness activities involving active sonar and underwater detonations from explosives and explosive munitions. These military readiness activities include both Fleet training events and Navy-funded research, development, test and evaluation (RDT&E) activities.

This Integrated Comprehensive Monitoring Program (ICMP) plan provides the overarching framework for coordination of the United States Navy monitoring program. It is intended for use as a planning tool to focus Navy monitoring priorities pursuant to ESA and MMPA requirements and as an adaptive management tool to analyze and refine monitoring and mitigation techniques over time. It has been developed in direct response to Navy Range permitting requirements established in the various MMPA Final Rules, ESA Consultations, Biological Opinions, and applicable regulations. As a framework document, the ICMP applies by regulation to those activities on ranges and operating areas for which the Navy sought and received incidental take authorizations.

The ICMP currently includes specific monitoring plans that have been or are being developed for the Southern California (SOCAL) Range Complex, Atlantic Fleet Active Sonar Training (AFAST) Study Area, Hawaii Range Complex (HRC), Mariana Islands Range Complex (MIRC), Northwest Training Range Complex (NWTRC), Gulf of Alaska (GOA), Virginia Capes (VACAPES) Range Complex, Cherry Point Range Complex, Jacksonville (JAX) Range Complex[1], Gulf of Mexico (GOMEX) Range Complex, Naval Sea Systems Command Naval Undersea Warfare Center Keyport (NUWC Keyport) Range Complex, and Naval Sea Systems Command Naval Surface Warfare Center Panama City Division (NSWC PCD) Study Area. These range complexes and study areas are depicted in Figure 1. Note that the AFAST study area encompasses multiple smaller ranges. Additional ranges or study areas may be added to the ICMP consistent with future Navy range permitting requirements.

Table 1 provides a status listing of the MMPA Final Rules for ranges and study areas presently included in the ICMP, and the applicable dates for those Final Rules that are in effect. This table is current as of 27 November 2009. Unless otherwise specified, references to "MMPA Final Rules" throughout this document include all of the rules listed by Table 1 that have a status of "In Effect". A listing of the corresponding Letters of Authorization and Monitoring Plans in effect as of the data date is provided in the Reference section. While the ICMP also applies to range-specific monitoring plans that are still being developed, modifications to the ICMP may be required to appropriately reflect requirements established by future Rules.

[1] Note, the Jacksonville Range Complex includes operating areas for both Jacksonville, FL and Charleston, SC and is sometimes referred to as the Charleston / Jacksonville (CHASJAX) Range Complex. For purposes of this document, references to this Range Complex will simply be as Jacksonville Range Complex, which is consistent with the nomenclature used in the MMPA Final Rule.

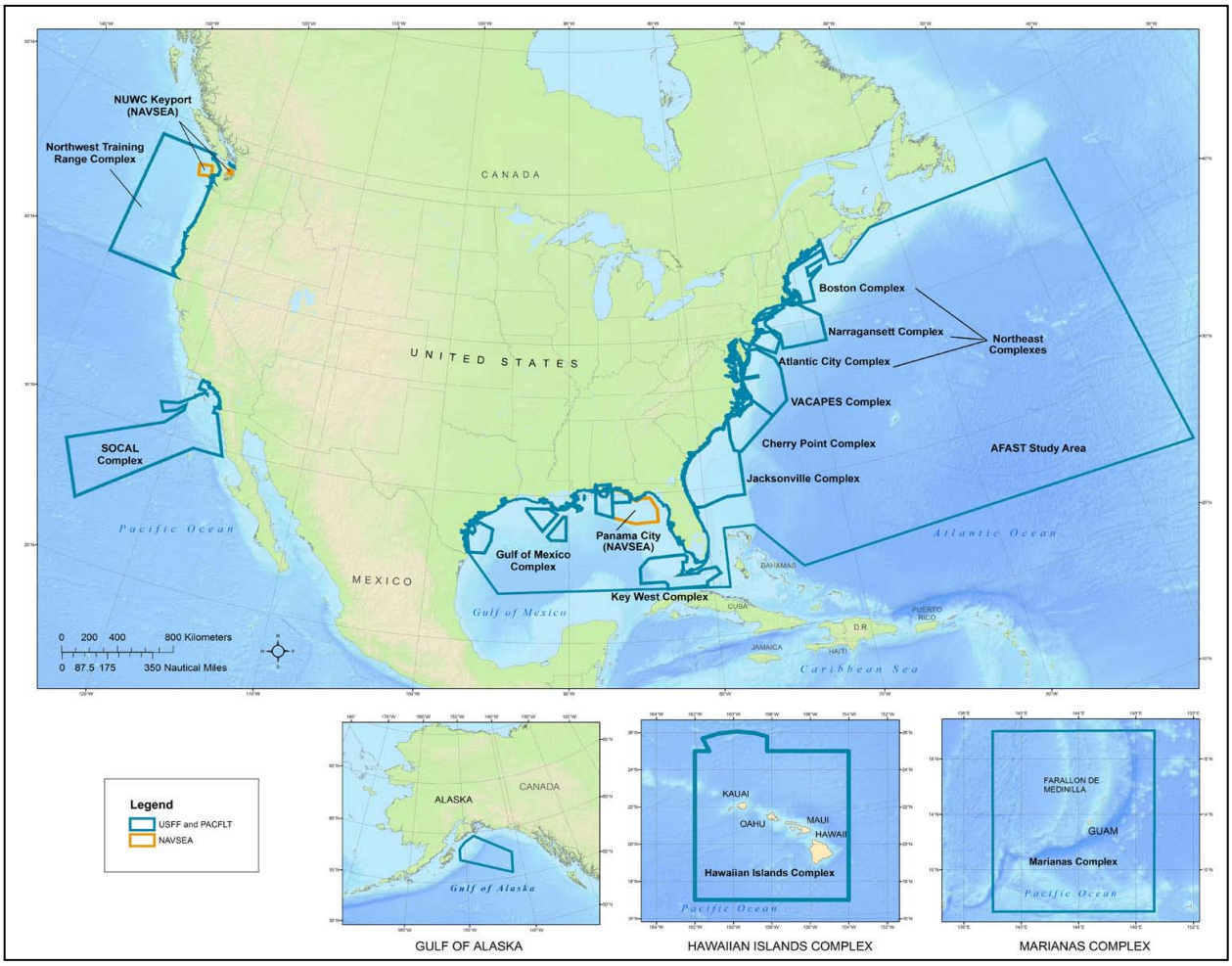

Figure 1: Navy Range Complexes and Study Areas included under the ICMP

Table 1: Status of MMPA Final Rules for Navy Range Complexes included in the ICMP
(Data date: 27 November 2009)

RANGE	MMPA Final Rule Reference (or status)	Dates Applicable
Hawaii Range Complex (HRC)	**IN EFFECT**: Taking and Importing Marine Mammals; U.S. Navy Training in the Hawaii Range Complex; Final Rule, 74 Fed. Reg. 1456 (January 12, 2009) (to be codified at 50 C.F.R. § 216).	5 Jan 2009 – 5 Jan 2014
Southern California (SOCAL) Range Complex	**IN EFFECT**: Taking and Importing Marine Mammals; U.S. Navy Training in the Southern California Range Complex; Final Rule, 74 Fed. Reg. 3883 (January 21, 2009) (to be codified at 50 C.F.R. § 216).	14 Jan 2009 - 14 Jan 2014
Atlantic Fleet Active Sonar Training (AFAST) Study Area	**IN EFFECT**: Taking and Importing Marine Mammals; U.S. Navy's Atlantic Fleet Active Sonar Training (AFAST); Final Rule, 74 Fed. Reg. 4844 (January 27, 2009) (to be codified at 50 C.F.R. § 216).	22 Jan 2009 - 22 Jan 2014
Cherry Point Range Complex	**IN EFFECT:** Taking and Importing Marine Mammals; U.S. Navy Training in the Cherry Point Range Complex; Final Rule, 74 Fed. Reg. 28370 (June 15, 2009) (to be codified at 50 C.F.R. § 218).	5 Jun 2009 – 4 Jun 2014
Jacksonville (JAX) Range Complex	**IN EFFECT**: Taking and Importing Marine Mammals; U.S. Navy Training in the Jacksonville Range Complex; Final Rule, 74 Fed. Reg. 28349 (June 15, 2009) (to be codified at 50 C.F.R. § 218).	5 Jun 2009 – 4 Jun 2014
Virginia Capes (VACAPES) Range Complex	**IN EFFECT**: Taking and Importing Marine Mammals; U.S. Navy Training in the Virginia Capes Range Complex; Final Rule, 74 Fed. Reg. 28328 (June 15, 2009) (to be codified at 50 C.F.R. § 218).	5 Jun 2009 – 4 Jun 2014
Naval Sea Systems Command Naval Surface Warfare Center Panama City Division (NSWC PCD) Study Area	**PROPOSED:** Taking and Importing Marine Mammals; U.S. Naval Surface Warfare Center Panama City Division Mission Activities; Proposed Rule, 74 Fed. Reg. 20156 (April 30, 2009) (to be codified at 50 C.F.R. § 218).	TBD. Proposed Rules closed to public comments on 1 Jun 2009.
Naval Sea Systems Command Naval Undersea Warfare Center Keyport (NUWC Keyport) Range Complex	**PROPOSED**: Taking and Importing of Marine Mammals; U.S. Navy's Research, Development, Test, and Evaluation Activities Within the Naval Sea Systems Command Naval Undersea Warfare Center Keyport Range Complex; Proposed Rules, 74 Fed. Reg. 32264 (July 7, 2009) (to be codified at 50 C.F.R. § 218).	TBD. Proposed Rules closed to public comments on 6 Aug 2009.
Northwest Training Range Complex (NWTRC)	**PROPOSED**: Taking and Importing Marine Mammals; Navy Training Activities Conducted Within the Northwest Training Range Complex; Proposed Rules, 74 Fed. Reg. 33828 (July 13, 2009) (to be codified at 50 C.F.R. § 218).	TBD. Proposed Rules closed to public comments on 19 Aug 2009.
Gulf of Mexico (GOMEX) Range Complex	**PROPOSED**: Taking of Marine Mammals Incidental to Specified Activities; Taking Marine Mammals Incidental to Training Operations Conducted Within the Gulf of Mexico Range Complex; Proposed Rules, 74 Fed. Reg. 33960 (July 14, 2009) (to be codified at 50 C.F.R. § 218).	TBD. Proposed Rules closed to public comments on 13 Aug 2009.
Mariana Islands Range Complex (MIRC)	**PROPOSED**: Taking and Importing Marine Mammals; Military Training Activities and Research, Development, Testing and Evaluation Conducted Within the Mariana Islands Range Complex (MIRC); Proposed Rule, 74 Fed. Reg. 53796 (October 20, 2009) (to be codified at 50 C.F.R. § 218).	TBD. Proposed Rules closed to public comments on 19 Nov 2009.
Gulf of Alaska (GOA) Range Complex	**STATUS:** Letter of Authorization (LOA) application submitted to NMFS on March 20, 2009 and revised/resubmitted on November 20, 2009.	TBD

There are two broad categories of authorized activities covered by the ICMP. These include:

1) Authorized Fleet activities carried out on Fleet-permitted ranges in support of military readiness, and
2) Authorized Navy Acquisition Community RDT&E activities carried out on NAVSEA-permitted ranges in support of military readiness.

There are variations in the monitoring and mitigation requirements between Fleet and Acquisition Community activities. This is in part due to the significant differences in the nature of activities conducted by these two communities relative to factors such as the types of sound sources, numbers and size of platforms (boats, ships, aircraft), as well as numbers of individuals involved. Monitoring and mitigation measures are tailored to the specific authorized activities consistent with permitting requirements. For the Fleet-permitted ranges, the associated monitoring plans are generally "range-specific" and apply across all authorized activities on that range. For the NAVSEA-permitted ranges, their monitoring plans tend to be "project-specific", that is, specifically tailored to each individual authorized activity.

Appendices A and B provides a listing by range complex / study area of specific sound sources and activities included in the associated MMPA Final Rules / Proposed Rules for the Fleet and Naval Sea Systems Command (NAVSEA) action proponents respectively. Note that for Atlantic ranges in the AFAST study area, monitoring and mitigation requirements for mid-frequency active sonar (MFAS), high-frequency active sonar (HFAS), and underwater detonations from explosive sonobuoy (specifically IEER) Fleet military readiness activities are addressed in the AFAST MMPA Final Rule. Monitoring requirements associated with Fleet military readiness activities involving other types of underwater detonations are established in the MMPA Final Rules for the individual range complexes (e.g., VACAPES, JAX, Cherry Point, and GOMEX) where these activities will be conducted.

The MMPA Final Rules detail specific requirements for this document. The following quote is from the Final Rule for the SOCAL Range Complex[2]. Similar language is found in each of the other MMPA Final Rules listed by Table 1.

> "The Navy shall complete an Integrated Comprehensive Monitoring Plan (ICMP) in 2009. This planning and adaptive management tool shall include:
> (1) A method for prioritizing monitoring projects that clearly describes the characteristics of a proposal that factor into its priority.
> (2) A method for annually reviewing, with NMFS, monitoring results, Navy R&D, and current science to use for potential modification of mitigation or monitoring methods.
> (3) A detailed description of the Monitoring Workshop to be convened in 2011 and how and when Navy/NMFS will subsequently utilize the findings of the Monitoring Workshop to potentially modify subsequent monitoring and mitigation.
> (4) An adaptive management plan.
> (5) A method for standardizing data collection across Range Complexes."

[2] See 74 Fed. Reg. 3915 (January 21, 2009) (50 C.F.R.§216.175(c)).

The MMPA Final Rules further provide that the primary objectives of the ICMP are to:

- Monitor and assess the effects of Navy activities on protected marine species;
- Ensure that data collected at multiple locations is collected in a manner that allows comparison between and among different geographic locations;
- Assess the efficacy and practicality of the monitoring and mitigation techniques;
- Add to the overall knowledge base of protected marine species and the effects of Navy activities on these species.

The ICMP meets these requirements and objectives by:

- Identifying top-level goals for the monitoring program, as well as guidelines for use in prioritizing monitoring projects and related RDT&E activities;
- Defining standard procedures for the compilation and management of data from range/project-specific monitoring plans;
- Establishing an adaptive management process that includes annual reviews with NMFS;
- Making provisions to review relevant monitoring-related research and, where appropriate, incorporate findings as updates to the range/project-specific monitoring plans and mitigation measures through adaptive management; and
- Providing an unclassified recordkeeping system that will allow interested parties to see how each Range Complex is contributing to ongoing monitoring.

As the overarching framework, the ICMP focuses Navy monitoring priorities pursuant to ESA and MMPA requirements. However, the ICMP does not include or specify the actual monitoring fieldwork components, nor does it commit to fund specific monitoring-related activities. Individual Navy permit-holders and research sponsors are responsible for defining the range/project-specific fieldwork components and research activities for their respective range monitoring plans and research programs. Top priority will always be given to satisfying the mandated legal requirements across all ranges. Once legal requirements are met, any additional monitoring-related activities will be planned and prioritized using guidelines provided by the ICMP, consistent with availability of both funding and scientific resources.

The ICMP will be evaluated annually through the adaptive management process to assess progress, provide a matrix of goals for the following year, and make recommendations for refinement and analysis of the monitoring and mitigation techniques. This process includes conducting an Adaptive Management Review (AMR) at which Navy and National Marine Fisheries Service (NMFS) will jointly consider the prior year goals, monitoring results, and related science advances to determine if modifications are needed to more effectively address monitoring program goals. Modifications to the ICMP that result from AMR decisions will be incorporated by an addendum or revision to the ICMP. These ICMP updates will be provided to NMFS by 31 December annually beginning in 2010. This adaptive management process recurs annually, with some modifications to the process in 2011, when the Navy, with guidance and support from NMFS, is to host a Monitoring Workshop that incorporates outside experts and expanded participation.

The ICMP is organized in the following way. Section 2 describes overall monitoring goals and prioritization guidelines. Section 3 discusses standard data collection and management procedures. Section 4 addresses the coordination of reporting requirements and the recordkeeping system that documents how each Range Complex contributes to ongoing

monitoring objectives. Section 5 outlines the adaptive management review process, including provisions for a monitoring workshop in 2011. Section 6 discusses near-term plans for continued maturation of the Monitoring Program. Section 7 provides roles and responsibilities among the various Navy components. References are listed in Section 8.

2. MONITORING GOALS AND PRIORITIZATION GUIDELINES

Research relating to the effects of anthropogenic sound on marine species is an evolving science. The Navy is committed to utilizing the best available science in developing and implementing the monitoring programs required pursuant to ESA and MMPA. The Navy demonstrated this commitment by funding approximately $26 million annually in marine mammal-related research projects for fiscal years 2007-2009[3] to better understand how marine mammals hear and how they are affected by sound. Researchers at Navy laboratories and warfare centers are investigating marine-mammal bioacoustics, marine mammal distribution and abundance, and passive acoustic detection of marine mammals. The Navy also collaborates with universities, institutes, conservation agencies, private industries, and independent researchers around the world to better understand what combinations of ocean conditions, bathymetry, and sonar usage patterns may lead to marine species disturbances. The Navy intends to continue this level of annual investment in protected marine species research over the next five years.[4]

As the overarching framework for coordination of the Navy's monitoring efforts, the ICMP guides the research investment by establishing top-level goals and guidelines for use in prioritizing monitoring projects and related RDT&E activities. The guidelines are not intended to supersede the specific legal requirements that each range complex must meet for monitoring and mitigation of ongoing Navy military readiness activities as detailed by its governing Letter of Authorization (LOA). Top priority will continue to be given to satisfying the mandated legal requirements across all ranges.

To meet requirements in the MMPA Final Rules for Navy Range Complexes[5], this section provides a method for prioritizing monitoring projects that clearly describes the characteristics of a proposal that factor into its priority. However, as noted previously, the ICMP does not specify or commit to fund specific monitoring-related research; that remains the responsibility of individual research sponsors. The ICMP also makes provisions for maintaining an unclassified record of Navy-sponsored monitoring projects and research using the procedures described in Section 4.

The adaptive management process described in Section 5 will be used to review and, when appropriate, incorporate findings from relevant research as updates to the range/project-specific monitoring plans. Adaptive management will also be used to evaluate and update the goals and priorities presented here on an annual basis. ICMP updates resulting from the adaptive management process will be documented and provided to NMFS by 31 December annually beginning in 2010.

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[3] Research funding level from http://www.navy.mil/oceans/environmental.html on 14 April 2009.

[4] Projected investment level from http://www.navy.mil/oceans/science.html on 15 July 2009.

[5] *E.g.*, 50 C.F.R. § 216.175(c).

2.1 MONITORING GOALS

Monitoring measures prescribed in range/project-specific monitoring plans and Navy-funded research relating to the effects of anthropogenic sound on protected marine species should be designed to accomplish one or more of the following top-level goals:

- An increase in the probability of detecting marine mammals and other threatened or endangered marine species, both within the safety zone (thus allowing for more effective implementation of the mitigation) and in general to generate more data to contribute to the effects analyses.

- An increase in our understanding of how many marine mammals and other threatened or endangered marine species are likely to be exposed to levels of Mid-Frequency Active Sonar (MFAS), High-Frequency Active Sonar (HFAS), underwater detonations, or other stimuli that are associated with specific adverse effects, such as behavioral harassment, Temporary Threshold Shift (TTS), or Permanent Threshold Shift (PTS).

- An increase in our understanding of how marine mammals and other threatened or endangered marine species respond (behaviorally or physiologically) to MFAS/HFAS, underwater detonations, or other stimuli at specific received levels that result in the anticipated take of individual animals.

- An increase in our understanding of how anticipated adverse effects on individual animals may impact the population, species, or stock (specifically through effects on annual rates of recruitment or survival).

- An increase in our understanding of the effectiveness of certain mitigation and monitoring measures.

- A better understanding and record of the manner in which the authorized entity complies with the incidental take authorization.

As the overall ICMP continues to develop, these top-level goals will be further refined through the development of a series of subquestions associated with each goal. The combination of top-level goals and associated subquestions will then be used to shape future monitoring efforts. This goal refinement effort will be an important area of focus for the Program during 2010.

Several of the top-level goals listed above focus on understanding the short-term effects to individual animals from naval anthropogenic sound. For the purposes of the ICMP, short-term is defined as the period during which the behavioral response is empirically determined or presumed to be directly attributable to exposure to naval anthropogenic sound.

To begin to address these top-level goals, the current set of range-specific Monitoring Plans have been designed as a collection of focused ‘‘studies’’ to gather data that will allow the Navy to address the following questions (not all questions apply to each range):

- Are marine mammals (and sea turtles) exposed to mid-frequency active sonar (MFAS), especially at levels associated with adverse effects (i.e., based on NMFS’ criteria for behavioral harassment, temporary threshold shift (TTS), or permanent threshold shift (PTS))? If so, at what levels are they exposed?

- If marine mammals (and sea turtles) are exposed to MFAS, do they redistribute geographically as a result of continued exposure? If so, how long does the redistribution last?

- If marine mammals (and sea turtles) are exposed to MFAS, what are their behavioral responses to various received levels?

- What are the behavioral responses of marine mammals and sea turtles that are exposed to explosives?

- Is the Navy's suite of mitigation measures for MFAS (e.g., measures agreed to by the Navy through permitting) effective at avoiding TTS, injury, and mortality of marine mammals?

Monitoring measures that are put in place to meet the above goals and focused studies will produce data sets that include short-term individual observations. These observations, in combination with parallel monitoring and data analysis efforts by others, support research efforts directed towards identifying biologically significant behavioral responses that may have either cumulative or population-level effects. These data sets will also support the assessment of population trends, including species composition, distribution, and abundance, to determine the efficacy of mitigation and monitoring measures, and increase knowledge regarding the response of marine mammals and other threatened or endangered marine species to Navy sound sources. These data sets may also help to provide important information on the geographic and temporal extent of key habitats and provide baseline information to account for natural perturbations such as El Niño or La Niña events. Additionally, the data sets will provide observational data and baseline information to determine the spatial and temporal extent of reactions to Navy operations, or indirect effects from changes in prey availability and distribution. These data sets will be managed and made available for use by the procedures outlined in Section 3.

In developing range/project-specific monitoring plans or research programs to address these top-level goals and focused studies, sponsors should strive to prevent creating situations that leave the Navy "data rich but information poor." That is, it is often easier to collect some types of information than it is to analyze and draw meaningful conclusions from it. One example of this potential situation is the collection of marine mammal vocalizations using passive acoustic monitoring, where terabytes of acoustic data can be collected over the course of a given monitored event. To fully benefit from this type of monitoring and data collection investment, it is critical that sufficient funding for data analysis be factored into the program plans.

2.2 PRIORITIZATION GUIDELINES

In establishing prioritization guidelines, it is important to "begin with the end in mind." The desired end-result from Navy monitoring and mitigation conducted pursuant to ESA and MMPA requirements is a comprehensive and accurate assessment of applicable Navy military readiness and scientific research activities that involve active sonar and/or underwater detonations, performed in a manner that enables Fleet Commands, Program Executive Offices (PEOs), and other Echelon II Commands to meet their requisite operational, training, acquisition, research, development, testing, and evaluation requirements.

The guidelines presented here maximize marine resource protection by focusing Navy efforts and resources on those geographic areas where potential effects to marine mammals and other threatened or endangered marine species are most likely to occur due to concentrated and repetitive Navy activities. However, the guidelines are not intended to preclude monitoring activities in other areas of moderate or low Navy use when there might be special biological circumstances or other overriding considerations. The guidelines are intended for use when developing or modifying range/project-specific monitoring plans and monitoring-related research programs that will be considered as part of the adaptive management process described in Section 5. The guidelines are not intended to supersede the specific legal requirements that each range complex must meet for monitoring and mitigation of ongoing Navy military readiness activities as detailed in its governing LOA. Top priority will continue to be given to satisfying the mandated legal requirements across all ranges. Once legal requirements are met, additional monitoring activities will be prioritized using the guidelines that follow, consistent with availability of both funding and scientific resources.

In shaping, designing or evaluating prospective monitoring projects, sponsors should consider the following factors for each proposal:

a. Number of monitoring goals that the project addresses,

b. Relative density of marine mammals and other protected marine species in the proposed area,

c. Relative occurrence of concentrated and repetitive Navy active sonar activities in the proposed area,

d. Level of anticipated impacts to marine mammals in the area,

e. Presence of unique biological and /or physical attributes that better allow monitoring goals to be addressed,

f. Degree to which the proposed activity might provide unique contributions or additional diversity to the data set collection that will assist in meeting the top-level goals,

g. Ability to leverage and/or augment existing efforts by Navy monitoring to positive effect,

h. Availability of specialized Navy assets within a specific area to support monitoring efforts, e.g. instrumented ranges,

i. Return on investment as measured by confidence level in the likelihood of obtaining meaningful monitoring data based on factors such as prior success with the specific method itself, anticipated sea states, seasonal weather patterns, local animal densities and migration patterns, and anticipated success rate for integrating the monitoring method with training events, and

j. Degree to which the proposed activity might affect the ability of Navy Commands to meet their requisite operational, training, acquisition, research, development, testing, and evaluation requirements.

Many of the factors listed above are highly dependent on the specific location at which the proposed activity is to be conducted. To better assist planning efforts within the ICMP, a characterization of the unique attributes associated with each range complex / study area will be developed and added as an update to this document during 2010.

The monitoring requirements established in the MMPA Final Rules listed by Table 1 are currently in effect for five-year periods beginning in 2009. To fully evaluate and respond to the effects of naval anthropogenic sound on living marine resources, it is anticipated that monitoring time frames extending beyond the initial five years will be needed.

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3. DATA COLLECTION AND MANAGEMENT

This section discusses standardized data collection and management methods in support of Navy monitoring activities, and is a required element of the ICMP under the MMPA Final Rules for Navy ranges and operating areas. The Navy makes substantial investments in monitoring programs to ensure compliance with terms of ESA consultations and MMPA authorizations, and to provide for adaptive program management. Standardized procedures are essential to make the most of this investment. The objective for this standardization is to collect data in a manner that will enable comparison between and among different geographic locations to the extent that is scientifically justifiable. These standardized approaches apply to both range/project-specific monitoring plans as well as Navy-funded R&D studies.

Improved monitoring and assessment methodologies are likely to be developed as the science surrounding marine species monitoring continues to evolve. These improvements will be reviewed and assessed annually as part of the adaptive management process conducted jointly by Navy and NMFS. This process will determine whether modifications to the standardized collection and management methods are appropriate for the upcoming year. If so, updates to the ICMP will be made to reflect the results of Navy-NMFS adaptive management decisions to incorporate the improved monitoring and assessment methodologies as standard procedures and provided to NMFS by 31 December annually. As discussed in Section 5, adaptive management reviews will be done in consultation with Navy technical experts, Fleet Commanders, and Echelon II Commands as appropriate.

3.1 DATA COLLECTION

There is a large suite of monitoring methods that may be used to detect, locate, identify, and study the behaviors and responses of individual marine animals *in situ*. Some of the more prevalent categories of monitoring techniques and tools include:

- Visual Observations made using Navy lookouts, Civilian Marine Species Observers, vessel-based surveys, aerial surveys, shore surveys, and photo-identification,
- Acoustic Monitoring using both passive and active methods, and
- Behavioral Monitoring through tag attachments.

This suite of methods is continually evolving in step with advances in research. Each monitoring technique has advantages and disadvantages that vary temporally and spatially. Therefore, a combination of techniques is generally recommended so that the detection and observation of marine animals is maximized. The optimal choice of monitoring approach will vary depending on the purpose for the monitoring, the type of data to be collected, and a number of other factors such as the species of concern (whether frequently on surface, deep-diving, or cryptic), animal density, geographical location, weather, visibility, expected sea state conditions, type of Navy activities conducted in the area, and the total size of the area to be monitored. The particular choice of monitoring approaches will also be influenced by duration of monitoring period, effectiveness, practicality, impact to training, and cost.

It is beyond the scope of this framework document to fully describe this suite of monitoring methods or to prescribe "best practices" for the implementation of these independent techniques for monitoring purposes. Instead, the focus here is on prescribing both essential as well as desired data elements to be collected and recorded as "standard data" to support future data comparisons to the extent that is scientifically appropriate.

This section prescribes the data elements that are to be collected as standard practice for both range/project-specific monitoring as well as Navy-funded R&D studies. While it may not be scientifically valid to directly combine data sets from varied platforms such as shipboard and aerial surveys, the use of standardized sampling and survey protocols will be critical to meeting the overall monitoring goals, as well as assisting better data comparison between years and across different sets of observations. While detailed sampling and survey protocols are specific to independent monitoring techniques and outside the scope of this document, some overall guidelines on sample size and statistical analysis are provided by Appendix C.

Each range/operating area LOA designates particular types and quantities of military readiness activities that require mitigation, monitoring, and reporting pursuant to MMPA and ESA. The LOA details the specific mitigation measures that must be implemented when conducting these activities, and the data that is to be recorded and documented for the various compliance reports. While the information presented here is intended to highlight common data collection requirements from the LOAs, requirements imposed in the range/project-specific LOA take precedence over the information listed here.

The MMPA Final Rules pertaining to Fleet military readiness activities prescribe essential data elements that are to be recorded for individual marine mammal sightings during MFAS/HFAS Major Training Exercises (MTEs) and SINK Exercises (SINKEXs). Table 2 highlights these essential data elements. As one step towards collecting this data in a standardized manner, formatted marine species sighting forms are used by Navy lookouts during monitored military readiness activities. Appendix D provides the current Fleet version of this form. Note, while the LOAs prescribe the collection of these data elements specifically during Fleet MTEs and SINKEXs, the marine species sighting form may also be used to document sightings during other monitored military readiness activities. Its use is not strictly limited to MTEs or SINKEXs.

The MMPA Proposed Rules pertaining to RDT&E activities also prescribe the reporting of individual marine mammal sightings. For purposes of standardized data collection, Marine Species Observers monitoring RDT&E activities, as well as third-party biologists under contract to the Navy for marine species monitoring, should be tasked to collect (at minimum) the essential data elements highlighted by Table 2. They may elect to use a different format than that presented in Appendix D as long as these essential data elements are included. In addition, the governing LOA, once issued, should be verified in event additional essential data elements are prescribed for marine species sightings associated with RDT&E activities. To the extent possible, data will be collected from all distinct habitats in the region to avoid potential sampling bias.

Table 2 also lists additional oceanographic data elements that are highly desirable to fully support analysis of the observations and associated acoustic propagation conditions. Distribution and abundance of marine species are highly dependent on oceanographic

DATA ELEMENTS TO BE RECORDED FOR INDIVIDUAL MARINE ANIMAL SIGHTINGS ASSOCIATED WITH MONITORED MILITARY READINESS ACTIVITIES	
COMMON DATA ELEMENTS	
1)	Location of sighting (lat / long)
2)	Species (if species not possible— indication of whale/dolphin/pinniped/turtle)
3)	Number of individuals
4)	Calves observed (y/n)
5)	Initial Detection Sensor
6)	Indication of specific type of platform observation made from (including, for example, type of surface vessel, i.e., FFG, DDG, or CG)
7)	Length of time observers maintained visual contact with marine animal(s)
8)	Wave height (in feet)
9)	Visibility
10)	Sonar source in use (y/n). If impulsive or explosive source in use, skip to line 15.
IF ACTIVE SONAR SOURCE IN USE:	
11)	Indication of whether animal is <200yd, 200–500yd, 500–1000yd, 1000– 2000yd, or >2000yd from sonar source in (10) above
12)	Mitigation Implementation— Whether operation of sonar sensor was delayed, or sonar was powered or shut down, and how long the delay was.
13)	If source in use (from 10 above)) is hull-mounted, true bearing of animal from ship, true direction of ship's travel, and estimation of animal's motion relative to ship (opening, closing, parallel)
14)	Observed behavior— Watchstanders shall report, in plain language and without trying to categorize in any way, the observed behavior of the animals (such as animal closing to bow ride, paralleling course/ speed, floating on surface and not swimming, etc.) [END for active source essential data elements]
IF IMPULSIVE/EXPLOSIVE SOURCES ARE BEING USED:	
15)	Whether sighting was before, during, or after detonations/exercise, and how many minutes before or after.
16)	Distance of individual/group from actual detonations—or target spot if not yet detonated—use four categories to define distance: (a) The modeled injury threshold radius (MITR) for the largest explosive used in that exercise type in that OPAREA; (b) the required exclusion zone (e.g., 1 nm for SINKEX); (c) the required observation distance (if different than the exclusion zone) (e.g., 2 nm for SINKEX); and (d) greater than the required observed distance. In this example, the observer would indicate if < MITR, from MITR — 1 nm, from 1 nm—2 nm, and > 2 nm.
17)	Observed behavior— Watchstanders will report, in plain language and without trying to categorize in any way, the observed behavior of the animals (such as animal closing to bow ride, paralleling course/ speed, floating on surface and not swimming etc.), including speed and direction.
18)	Resulting mitigation implementation—Indicate whether explosive detonations were delayed, ceased, modified, or not modified due to marine mammal presence and for how long.
19)	If observation occurs while explosives are detonating in the water, indicate munition type in use at time of marine mammal detection. [END for explosive source essential data elements]
OPTIONAL DATA ELEMENTS, PROVIDE AS AVAILABLE or KNOWN	
20)	Sound Velocity Profile for location
21)	Sea surface temperature
22)	Presence of strong gulf stream currents, fronts, and/or mesoscale eddies (y/n)
23)	Other prominent oceanographic features

Table 2: Data Elements to be recorded for individual marine animal sightings associated with monitored military readiness activities

conditions and other environmental factors. Some scientific literature suggests that animals often limit their range to certain habitat areas or broad ocean regions based on sea surface temperature, bathymetric features, and prey abundance. Thus, it is desirable to include data from additional oceanographic and environmental monitoring, predictive forecasts of oceanographic conditions, or some mix of both to account for ambient conditions. The Navy's meteorological and oceanographic community has an extensive array of ocean data gathered by satellite sensing, direct measurements, and predictive models that may be used to support this. Oceanographic conditions can be monitored by a variety of different platforms including satellites, *in situ* observation systems such as buoys, and vessel surveys. For more extensive monitoring efforts, UAVs or gliders might be utilized to obtain oceanographic data. In addition, the recent distribution of joint civilian-government agency Ocean Observing Systems, ocean monitoring satellites, and in-situ buoys offer multiple information sources that could support the Navy's protected marine species monitoring program. Whenever possible, these optional data elements should be recorded for individual marine mammal sightings or relevant groups of individual sightings when made in close proximity to each other. Note that these optional data elements, if available, are typically recorded pre- or post-monitoring by personnel other than the Navy lookouts assigned to sight for marine animals.

3.2 DATA MANAGEMENT

As previously discussed, results from Navy-funded monitoring activities will establish time-series data sets that may be used to research trends in species abundance, behavioral reactions and mitigation effectiveness. The data collected through protected marine species monitoring and mitigation activities across all permitted Navy range complexes and relevant Navy-funded RDT&E activities will be incorporated into an electronic centralized data repository established under the guidance of OPNAV N45. These data will be used to support a Navy-wide analysis of monitoring and produce required reports for NMFS on behalf of the Navy Action Proponent. The electronic central repository will include data that are the result of activities conducted under the MMPA authorizations, such as monitoring data from sonar activities and underwater detonations from designated ranges and OPAREAS, marine species sighting observations, and exercise reports pertaining to protected marine species monitoring. The repository will also include annual results from Navy-funded R&D programs such as technical and professional journal articles. Due to the potential for inclusion of classified data, distribution of raw acoustic time series data from monitoring activities is subject to the written consent of the Secretary of the Navy or appointed designee. Unclassified NMFS-required monitoring reports, as specified by the MMPA Final Rules, will be made publicly available by posting on the internet.

As the ICMP matures, and greater amounts of monitoring data are recorded and available for analysis, ways of efficiently organizing this data to support discovery and access within the bounds of existing regulations will become increasingly important. Navy and NMFS will continue to work together to develop a data-sharing process that best supports the regulatory process in a transparent manner. Procedures will be developed in a structured manner to meet specific access requirements for the various Fleet, Scientific, and General Public user groups. Unclassified NMFS-required monitoring reports as specified by the

MMPA Final Rules are currently available on the NMFS website. These reports along with unclassified results from monitoring-related Navy R&D programs will also be publicly available from the Navy repository by the end of calendar year 2010. A more complete description of the data management organization and access procedures will be provided in the next ICMP update.

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4. REPORTING

This section addresses the overarching structure and coordination that will be used to coordinate reporting requirements from range/project-specific monitoring plans, and the recordkeeping system that tracks and documents how each Range Complex or Operating Area contributes to ongoing monitoring.

4.1 REPORT COORDINATION

The Navy is required to monitor and report on the effects of Navy actions on protected marine species. The MMPA Final Rules and LOAs specify the compilation of reports that summarize range/project-specific monitoring activities, analyses and results. These reports are submitted to the NMFS Office of Protected Resources (NMFS OPR) and provide critical inputs to the adaptive management process that allows the Navy and NMFS to assess and refine the Navy's overall monitoring effort. If there is a conflict between the reporting information described here and the requirements specified in the NMFS MMPA LOA, the LOA requirements take precedence.

Navy range action proponents are responsible for report development and submittal. The action proponents include Commander United States Fleet Forces Command (USFF), Commander Pacific Fleet (CPF), and Commander Naval Sea Systems Command (NAVSEA). Note, while Commander NAVSEA is the Action Proponent, he has designated Commander NUWC Keyport Division and Commander NSWC Panama City Division as the responsible individuals for report development and submittal. It is recognized that some information provided in the annual reports may be classified and not releasable to the public.

For the Fleet range complexes and study areas, there are two recurring reports required annually: an Annual Exercise Report and an Annual Monitoring Plan Report.

The primary purpose of the Annual Exercise Report is to report on authorized military readiness activities conducted within each range complex or study area, as well as the monitoring and mitigation performed in association with those activities. Table 3 provides a summary of contents for this multi-part report. As noted in Section 1, Anti-Submarine Warfare (ASW) military readiness activities that take place within the AFAST Study Area are covered in entirety under the AFAST MMPA Final Rules and LOA. Subsequently, only the explosives summary section is required in the Annual Exercise Report for the Cherry Point, Jacksonville, Virginia Capes, and Gulf of Mexico Range Complexes.

The Annual Monitoring Plan Report describes the implementation and results from the associated range/project-specific monitoring plan. It relies on standardized data collection methods across the Navy range complexes to allow for comparison of different geographic locations. The individual range reports may be provided to NMFS within a consolidated report that includes the required Monitoring Plan Reports from multiple Range Complexes.

For the NAVSEA ranges, there is a single recurring annual report required on RDT&E military readiness activities authorized under their permit. This report includes an estimated number of hours of sonar operation broken down by source type as well as a report of all marine mammal sightings.

Summary Sections contained in the Annual Exercise Report
Summary of MFAS/HFAS Major Training Exercises
a) Exercise info for Integrated Coordinated, and Major Training Exercises (MTEs)
– (i) Exercise designator. – (ii) Date that exercise began and ended. – (iii) Location. – (iv) Number and types of active sources used in the exercise. – (v) Number and types of passive acoustic sources [*sic*] used in exercise. – (vi) Number and types of vessels, aircraft, etc., participating in exercise. – (vii) Total hours of observation by lookouts. – (viii) Total hours of all active sonar source operation. – (ix) Total hours of each active sonar source (along with explanation of how hours are calculated for sources typically quantified in alternate way (buoys, torpedoes, etc.)). – (x) Wave height (high, low, and average during exercise).
b) Individual marine mammal sighting info (for each sighting in each MTE).
– See list of data elements described in Section 3.1
c) An evaluation (based on data gathered during all of the MTEs) of the effectiveness of mitigation measures designed to avoid exposing marine mammals to mid-frequency sonar. This evaluation shall identify the specific observations that support any conclusions the Navy reaches about the effectiveness of the mitigation.
ASW Summary
a) Summarized information For MTEs & non-major training exercises Include total annual hours of each type of sonar source (along with explanation of how hours are calculated for sources typically quantified in alternate way (buoys, torpedoes, etc.)), plus other range-specific information.
b) Cumulative Impact Report
c) Annual (and seasonal, where practicable) depiction of non-major training exercises geographically across the Study Area.
SINKEX Summary
a) Exercise info for each SINKEX completed that year
– (i) Location. – (ii) Date and time exercise began and ended. – (iii) Total hours of observation by lookouts before, during, and after exercise. – (iv) Total number and types of rounds expended/explosives detonated. – (v) Number and types of passive acoustic sources used in exercise. – (vi) Total hours of passive acoustic search time. – (vii) Number and types of vessels, aircraft, etc., participating in exercise. – (viii) Wave height in feet (high, low, and average during exercise). – (ix) Narrative description of sensors and platforms utilized for marine mammal detection and timeline illustrating how marine mammal detection was conducted.
b) Individual marine mammal sighting info (for each sighting in each MTE).
– See list of data elements described in Section 3.1
IEER / AEER Summary
– (i) Total number of IEER and AEER events conducted. – (ii) Total expended/detonated rounds (buoys). – (iii) Total number of self-scuttled IEER rounds.
Explosives Summary
– (i) Total annual number of each type of explosive exercise (of those identified as part of the ''specified activity'' in this MMPA Final Rule) conducted in the action area – (ii) Total annual expended/detonated rounds (missiles, bombs, etc.) for each explosive type.

Table 3: Summary Sections contained in the Annual Exercise Report
Each range complex submits annual summaries as applicable for authorized military readiness activities.

The annual reporting requirements associated with the MMPA Final Rules are designed to provide NMFS with monitoring data from the previous year to allow NMFS to consider the data and issue annual LOAs. As part of the adaptive management process described in Section 5, NMFS and the Navy will meet yearly, prior to LOA issuance, to discuss these annual reports and to determine whether mitigation or monitoring modifications are appropriate. Range/project-specific monitoring plans are then updated and submitted as part of the LOA Renewal Application. If substantial modification, as determined by NMFS, to the described mitigation or monitoring will occur during the upcoming season, the NMFS will provide the public a period of 30 days for review and comment on the request.

There are also non-recurring reporting requirements. For both Fleet and NAVSEA ranges and study areas, these requirements include a draft "Range Complex 5-year Comprehensive Report" that analyzes and summarizes all multi-year marine mammal information gathered during authorized activities for which annual reports are required. This report is submitted at the end of the fourth year of the rule, covering activities that occurred through a specified data cutoff date.

For the Fleet ranges only, the non-recurring requirements also include a draft "Comprehensive National ASW Report" that analyzes, compares, and summarizes the active sonar data gathered from Navy lookouts pursuant to the implementation of range-specific monitoring plans. This National ASW Report is not required for the Cherry Point, Jacksonville, Virginia Capes, and Gulf of Mexico Range Complexes, as active sonar data from these OPAREAS is included in the AFAST reporting requirements. Further guidance to support the preparation of these two comprehensive reports will be promulgated by OPNAV N45 in conjunction with the Adaptive Management Process.

Table 4 provides an overall summary listing of report dates under the current MMPA Final Rules, current as of 27 November 2009. Similar reporting requirements are anticipated for Navy range complexes that have yet to receive MMPA authorizations. NMFS is responsible for establishing the specific timeline for each year's report submittals. It should be noted that, as part of adaptive management, there might be a potential total overhaul of the report submission dates to better streamline the overall process.

The Navy shall respond to NMFS comments and requests for additional information or clarification on the individual annual or comprehensive reports if submitted within three months of receipt. These reports will be considered final after the Navy has addressed NMFS' comments or provided the requested information, or three months after the submittal of the draft if NMFS does not comment by then.

It is anticipated that reporting requirements will be added pursuant to the implementation of monitoring plans and MMPA Final Rules for the Naval Surface Warfare Center Panama City Division Study Area, Naval Undersea Warfare Center Keyport Range Complex, Mariana Islands Range Complex, the Northwest Training Range Complex, and the Gulf of Alaska Range Complex. The ICMP plan will be updated as appropriate to reflect these requirements through the adaptive management process.

Table 4: Common reporting requirements for range complexes/study areas covered by ICMP
(Data date: 27 November 2009)

RANGE	Annual Exercise Report	Annual Monitoring Plan Report	5-Year Comprehensive Monitoring Report	Comprehensive National ASW Report
Hawaii Range Complex (HRC)	1 Aug cutoff / 1 Oct submit	1 Aug cutoff / 1 Oct submit	1 June 2012 cutoff / 30 Nov 2012 submit	1 Jan 2014 cutoff / June 2014 submit
Southern California (SOCAL) Range Complex	1 Aug cutoff / 1 Oct submit	1 Aug cutoff / 1 Oct submit	1 June 2012 cutoff / 30 Nov 2012 submit	1 Jan 2014 cutoff / June 2014 submit
Atlantic Fleet Active Sonar Training (AFAST) Study Area	1 Aug cutoff / 1 Oct submit	1 Aug cutoff / 1 Oct submit	1 June 2012 cutoff / 30 Nov 2012 submit	1 Jan 2014 cutoff / June 2014 submit
Cherry Point Range Complex	Annual report required, but submittal date not specified.	1 Jan cutoff / 1 Mar submit	1 Dec 2012 cutoff / 31 May 2013 submit	Not Applicable
Jacksonville (JAX) Range Complex	Annual report required, but submittal date not specified.	1 Jan cutoff / 1 Mar submit	1 Dec 2012 cutoff / 31 May 2013 submit	Not Applicable
Virginia Capes (VACAPES) Range Complex	Annual report required, but submittal date not specified.	1 Jan cutoff / 1 Mar submit	1 Dec 2012 cutoff / 31 May 2013 submit	Not Applicable
Naval Surface Warfare Center Panama City Division (NSWC PCD) Study Area	Not Applicable	PROPOSED: 1 Jun cutoff / 1 Sep submit	PROPOSED: 1 June 2012 cutoff / 30 Nov 2012 submit	Not Applicable
Naval Undersea Warfare Center Keyport (NUWC Keyport) Range Complex	Not Applicable	PROPOSED: 1 Sep cutoff / 1 Dec submit	PROPOSED: 1 Sep 2013 [*sic*] cutoff / 30 Jun 2013 submit	Not Applicable
Northwest Training Range Complex (NWTRC)	PROPOSED: 1 Aug cutoff / 1 Oct submit	PROPOSED: 1 Jun cutoff / 1 Sep submit	PROPOSED: 1 June 2013 cutoff / 30 Nov 2013 submit	PROPOSED: 1 Jan 2014 cutoff / June 2014 submit
Gulf of Mexico (GOMEX) Range Complex	Annual report required, but submittal date not specified.	PROPOSED: 1 Sep cutoff / 1 Nov submit	PROPOSED: 1 Sep 2013 cutoff / 30 Mar 2014 submit	Not Applicable
Mariana Islands Range Complex (MIRC)	PROPOSED: 1 Jun cutoff / 15 Nov submit	PROPOSED: 15 Sep cutoff / 15 Nov submit	PROPOSED: 15 Jul 2014 [*sic*] cutoff / 30 Nov 2013 submit	PROPOSED: 1 Jan 2014 cutoff / June 2014 submit
Gulf of Alaska (GOA) Range Complex	TBD	TBD	TBD	Other MMPA Final Rules indicate that GOA will be included in this report, but GOA MMPA Final Rule not yet published.

4.2 RECORDKEEPING SYSTEM

OPNAV (N45) is responsible for coordinating the development, funding, and assessment of Navy marine research, and ensuring prioritization of research monitoring projects consistent with the top-level goals and priorities established by the ICMP or other applicable legal requirements. Monitoring activities will be allocated and resourced based on the strength of particular and specific monitoring proposals. With NMFS concurrence, they will not be allocated based on maintaining an equal (or commensurate to effects) distribution of monitoring effort across the Range complexes. For example, if careful prioritization and planning through the ICMP (which would include a review of both past monitoring results and current scientific developments) were to show that a large, intense monitoring effort in on one range complex would likely provide extensive, robust and much-needed data that could be used to understand the effects of sonar on the marine environment throughout different geographical areas, it may be appropriate to have other Range Complexes dedicate money, resources, or staff to the specific monitoring proposal identified as ‘‘high priority’’ by the Navy and NMFS, in lieu of focusing on smaller, lower priority projects divided throughout their home Range Complexes. In the event that monitoring is allocated in this fashion, clear recordkeeping is needed to demonstrate how each Range Complex / project is contributing to all of the ongoing monitoring. This will be done by maintaining a record of these resource allocation decisions in the electronic central data repository previously discussed in Section 3.

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5. ADAPTIVE MANAGEMENT

The MMPA Final Rules for Navy Range Complexes[6] require an adaptive management process to be established. Section 5.1 describes the process that will be used to annually review, with NMFS, monitoring results, Navy RDT&E, and current science to use for potential modification of mitigation or monitoring methods. The MMPA Final Rules also prescribe a Monitoring Workshop to be held in 2011 to review cumulative monitoring results from 2009 and 2010. Section 5.2 discusses this Monitoring Workshop, as well as how and when Navy/NMFS will subsequently utilize the findings of the Monitoring Workshop to potentially modify subsequent monitoring and mitigation.

5.1 ANNUAL REVIEWS

The reporting requirements associated with the MMPA Final Rules are designed to provide NMFS with monitoring data from the previous year in sufficient time to allow NMFS to consider the data before reissuing subsequent LOAs. Using the data collection and reporting procedures previously described in Sections 3 and 4, the Navy's monitoring data and marine species sighting observations will be consolidated and made available for analysis. NMFS and Navy will then meet to conduct an annual Adaptive Management Review (AMR). The AMR is a multipart review at which NMFS and the Navy jointly consider prior year goals, monitoring results and advancing science to assess overall progress. The review will determine if modifications are needed in mitigation or monitoring measures to more effectively address monitoring program goals. The AMR will consider data as available from across all of the range complexes included within the ICMP. At present, only one AMR per year is planned, and it will be applicable to all range complexes covered by the ICMP. The AMR will also consider an updated matrix of goals and prioritization guidelines proposed for the following year.

OPNAV N45 is responsible for the overall AMR meeting coordination and agenda. Navy action proponents will be asked to assign staff familiar with range/project-specific monitoring results to participate in this review and present an overview of the past year's monitoring activities. Additionally, sponsors of Navy-funded monitoring-related research will be asked to participate and provide a summary of their activities and accomplishments. Other potential presentation and discussion topics for the AMR include:

- Lessons learned from previous year's monitoring efforts,
- Other (outside of Navy-funded) monitoring-related science advances,
- Effectiveness of existing monitoring and mitigation tools,
- Operational feasibility of new tools and technologies,
- Recommendations for refinement and analysis of monitoring and mitigation methods, and
- Recommendations for the next year's monitoring activities.

[6] *E.g.*, 50 C.F.R. § 216.175(c).

If available, collaboration with regional NMFS scientists, academic scientists, and other non-Navy subject matter experts will be informally sought.

Products of the AMR include a determination as to whether mitigation or monitoring modifications are appropriate for the upcoming year, and an updated matrix of monitoring goals and prioritization guidelines. Adaptations and refinements to monitoring programs that result from the AMR will be incorporated into the range/project-specific monitoring plans as they come up for renewal in the normal course of events.

Adaptive Management will also lead to updates and improvements to the overall ICMP. The updated matrix of goals and prioritization guidelines resulting from the AMR will be incorporated by an annual addendum or revision to the ICMP. Additionally, expanded descriptions of the data repository, details for data standardization protocols, expanded information on range-specific characteristics, and planning information for the 2011 Monitoring Workshop are among the candidate information to be included in future updates. Annual ICMP updates will be provided to NMFS by 31 December beginning in 2010.

With the annual Adaptive Management Review, NMFS and Navy will have the ability to consider new data from different sources for purposes of making minor modifications to improve the effectiveness of range/project-specific monitoring plans, or to potentially identify substantial changes for subsequent 5-year regulations. This could result in mitigation or monitoring measures being added, modified, or deleted for subsequent annual LOAs. If a request to renew a Letter of Authorization indicates that a substantial modification as determined by NMFS to the described activity, mitigation, or monitoring during the upcoming season will occur, NMFS will provide the public a period of 30 days for review and comment on the request.

AMRs potentially could lead to significant restructuring of the monitoring plans put forward by individual ranges. In order to obtain robust, much-needed data that addresses high priority monitoring goals, monitoring activities may be prioritized and resourced based on the likely contribution of specific monitoring proposals to stated monitoring goals, as well as the likely technical success of the proposed monitoring approach based on a review of past monitoring results. This is in contrast to allocating monitoring resources based on maintaining an equal (or commensurate to effects) distribution of monitoring effort across Range complexes. For example, if careful prioritization and planning were to suggest that a large, intense monitoring effort in one Range Complex could be used to understand the effects of sonar throughout different geographical areas, it may be appropriate to have other Range Complexes dedicate money, resources, or staff to the specific monitoring proposal identified as ‘‘high priority’’ by the Navy and NMFS, in lieu of focusing on smaller, lower priority projects divided throughout their home Range Complexes.

A record of decisions and monitoring resource allocations made as a result of the AMR will be documented and maintained in the electronic central data depository previously discussed in Section 3. This will allow NMFS and other interested parties to see how each Range Complex is contributing to all of the ongoing monitoring (funding, staffing, and level of effort).

This adaptive management process recurs annually. However, there will be modifications to the process in 2011, when the Navy, with guidance and support from NMFS, is to host a Monitoring Workshop that incorporates outside experts and expanded participation.

5.2 MONITORING WORKSHOP IN 2011

As part of the Adaptive Management process in 2011, the Navy, with guidance and support from NMFS, will convene a Monitoring Workshop, including marine mammal and acoustic experts as well as other interested parties. This Monitoring Workshop, tentatively scheduled for April 2011 at a location yet to be determined, will present a consolidated overview of monitoring activities accomplished in 2009 and 2010 pursuant to the regulations in place to govern the unintentional taking of marine mammals incidental to authorized activities conducted on Navy ranges and operating areas. It will also include outcomes of selected monitoring-related research activities. One possible outcome of this workshop is the potential identification of substantial changes in monitoring approaches for subsequent 5-year regulations.

Participation in this jointly sponsored NMFS / Navy Workshop will be by invitation only. Participants will include, among others, recognized experts in marine species monitoring from across Government, academia, and the private sector. After considering the current science and working within the framework of available resources and feasibility of implementation, Monitoring Workshop participants will be asked to submit their individual recommendations to the Navy and NMFS. Navy and NMFS will then analyze the input from the Monitoring Workshop participants and determine the best way forward from a national perspective.

The workshop will not be used to seek or achieve consensus on a way forward for the monitoring program. NMFS has statutory responsibility to prescribe regulations pertaining to monitoring and reporting, and will develop in coordination with the Navy the most effective and appropriate monitoring and reporting protocols for future authorizations. As necessary, NMFS will incorporate any changes into future LOAs and future rules. If the modification to the described activity, mitigation, or monitoring is determined by NMFS to be substantial, NMFS will provide the public a period of 30 days for review and comment.

OPNAV N45 will take the lead for Navy in coordinating this Monitoring Workshop with NMFS. There will be a series of detailed planning meetings for this 2011 workshop starting with the 2010 Adaptive Management Review.

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6. ICMP NEAR-TERM DEVELOPMENT FOCUS AREAS

To be an effective planning tool, the ICMP must continue to develop and evolve over time. Specific recommendations for near-term development of the ICMP have been suggested throughout the document, and are compiled here for ease in tracking. A progress report covering each of the focus areas listed below will be included with the Adaptive Management Review. Updated information will also be included in the next annual revision of this document, which will be provided to NMFS by December 31, 2010.

There are three specific areas that have been identified for the initial ICMP near-term development.

1. **Top-level Goal Refinement**. The Navy, in consultation with NMFS, will refine the top-level goals provided by section 2 through the development of a series of subquestions associated with each goal. The combination of top-level goals and associated subquestions will then be used to identify, in advance, at the ICMP level, the types of monitoring projects that would achieve these goals. For example, the series of subquestions in combination with a review of existing data might lead to proposing a density survey in a data-poor area, or proposing to tag an animal and record its responses to a nearby exercise.

2. **Characterization of Navy Range Complexes / Study Areas**. Many of the prioritization guideline factors provided by section 2 are highly dependent on the specific location at which the proposed monitoring activity is to be conducted. To better assist planning efforts within the ICMP, one would like to predict a confidence level for the likelihood of obtaining meaningful monitoring data in any given location based on factors such as prior success with the specific monitoring method itself, anticipated sea states, seasonal weather patterns, local animal densities and migration patterns, and anticipated success rate for integrating the monitoring method with training events at that location. For this framework document to support that level of comparative analysis, it needs to include reference information that allows the user a top-level view of attributes across the various Navy range complexes. This characterization of the unique attributes associated with each range complex / study area will be developed and results added with the next update.

3. **Data Management Organization and Access Procedures Development**. Section 3 provided a preliminary description of the centralized electronic repository for data associated with the ICMP, and the types of data that might be made available, as appropriate, to various categories of users. At present, there is a mix of classified and unclassified data that falls under the ICMP umbrella. As the ICMP matures, and greater amounts of monitoring data are recorded and available for analysis, ways of efficiently organizing this data to support discovery and access within the bounds of existing regulations will become increasingly important. Navy and NMFS will continue to work together to develop a data-sharing process that best supports the regulatory process in a transparent manner. Procedures will be developed in a structured manner to meet specific access requirements for the various Fleet, Scientific, and General Public user groups. Unclassified NMFS-required monitoring reports as specified by the MMPA Final Rules are currently available on the NMFS website. These reports along with unclassified results from monitoring-related Navy R&D programs will also be publicly available from the Navy repository by the end of calendar year 2010. A more complete description of the data management organization and access procedures will be provided in the next ICMP update.

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7. ROLES AND RESPONSIBILITIES

OPNAV (N45) is responsible for maintaining and updating this ICMP as appropriate to reflect future regulatory agency final rulemaking, adaptive management reviews, best available science, improved assessment methodologies, or more effective protective measures. This will be done in consultation with Navy technical experts, Fleet Commanders, and Echelon II Commands as appropriate.

OPNAV (N45) shall

- Coordinate the development, funding, and assessment of Navy marine research, ensuring prioritization of monitoring projects consistent with the top-level goals established by the ICMP or other applicable legal requirements.
- Establish an electronic central repository that includes both monitoring data from activities conducted under the MMPA authorizations and annual results from Navy-funded R&D programs.
- Review annual ESA and MMPA reports prepared by Echelon II Commands to ensure a standardized approach is maintained that will enable appropriate consolidation and comparison of data.
- Chair an annual Adaptive Management Review (AMR) with NMFS on a schedule that supports the reissuance of LOA and annual Biological Opinions (BO) to maintain uninterrupted Fleet training and operations as well as Acquisition Community RDT&E activities. Attendees should include representatives from OPNAV, Office of the Assistant Secretary of the Navy for Installations and Environment (OASN I&E), Office of Naval Research (ONR), and Echelon II commands. OPNAV (N45) may approve additional attendees.
- In conjunction with the Adaptive Management Review, submit an annual evaluation of monitoring-related goals and priorities to NMFS.
- Co-chair planning sessions with NMFS to address detailed planning for the April 2011 Monitoring Workshop.

USFF, CPF, NAVSEA, and other permit holders shall

- Coordinate completion of environmental planning, permitting, consultations, and reports to support uninterrupted Fleet training and research, development, testing, and evaluation requirements,
- Conduct monitoring measures consistent with applicable NMFS MMPA Final Rules, Biological Opinions, and other governing legal requirements,
- Monitor changes in ESA species, critical habitats, Habitat Areas of Particular Concern (HAPC), sanctuaries and protected marine species regulations as it may effect Navy military readiness activities authorized under their permits, and
- Assign staff to participate in the Adaptive Management Review.

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8. REFERENCES

MMPA FINAL RULES / PROPOSED RULES:

Taking and Importing Marine Mammals; U.S. Navy Training in the Hawaii Range Complex; Final Rule, 74 Fed. Reg. 1456 (January 12, 2009) (to be codified at 50 C.F.R. pt. 216).

Taking and Importing Marine Mammals; U.S. Navy Training in the Southern California Range Complex; Final Rule, 74 Fed. Reg. 3883 (January 21, 2009) (to be codified at 50 C.F.R. pt. 216).

Taking and Importing Marine Mammals; U.S. Navy's Atlantic Fleet Active Sonar Training (AFAST); Final Rule, 74 Fed. Reg. 4844 (January 27, 2009) (to be codified at 50 C.F.R. pt. 216).

Taking and Importing Marine Mammals; U.S. Navy Training in the Cherry Point Range Complex; Final Rule, 74 Fed. Reg. 28370 (June 15, 2009) (to be codified at 50 C.F.R. pt. 218).

Taking and Importing Marine Mammals; U.S. Navy Training in the Jacksonville Range Complex; Final Rule, 74 Fed. Reg. 28349 (June 15, 2009) (to be codified at 50 C.F.R. pt. 218).

Taking and Importing Marine Mammals; U.S. Navy Training in the Virginia Capes Range Complex; Final Rule, 74 Fed. Reg. 28328 (June 15, 2009) (to be codified at 50 C.F.R. pt. 218).

Taking and Importing Marine Mammals; U.S. Naval Surface Warfare Center Panama City Division Mission Activities; Proposed Rule, 74 Fed. Reg. 20156 (April 30, 2009) (to be codified at 50 C.F.R. pt. 218).

Taking and Importing of Marine Mammals; U.S. Navy's Research, Development, Test, and Evaluation Activities Within the Naval Sea Systems Command Naval Undersea Warfare Center Keyport Range Complex; Proposed Rules, 74 Fed. Reg. 32264 (July 7, 2009) (to be codified at 50 C.F.R. pt. 218).

Taking and Importing Marine Mammals; Navy Training Activities Conducted Within the Northwest Training Range Complex; Proposed Rules, 74 Fed. Reg. 33828 (July 13, 2009) (to be codified at 50 C.F.R. pt. 218).

Taking of Marine Mammals Incidental to Specified Activities; Taking Marine Mammals Incidental to Training Operations Conducted Within the Gulf of Mexico Range Complex; Proposed Rules, 74 Fed. Reg. 33960 (July 14, 2009) (to be codified at 50 C.F.R. pt. 218).

Taking and Importing Marine Mammals; Military Training Activities and Research, Development, Testing and Evaluation Conducted Within the Mariana Islands Range Complex (MIRC); Proposed Rule, 74 Fed. Reg. 53796 (October 20, 2009) (to be codified at 50 C.F.R. pt. 218).

LETTERS OF AUTHORIZATION / REQUESTS FOR LETTER OF AUTHORIZATION:

Commander, Naval Surface Warfare Center Panama City Division. Request for Letter of Authorization for the incidental harassment of marine mammals resulting from the Naval Surface Warfare Center Panama City Division Mission Activities. Submitted to National Marine Fisheries Service March 2008.

Commander, Naval Undersea Warfare Command Division Keyport. Request for Letter of Authorization for the incidental harassment of marine mammals resulting from Navy Research, Development, Test, and Evaluation Activities conducted within the NAVSEA NUWC Keyport Range Complex Extension. Submitted to National Marine Fisheries Service April 2008.

Commander, U.S. Fleet Forces Command. Request for Letter of Authorization for the incidental harassment of marine mammals resulting from Navy Training Operations conducted within the Gulf of Mexico Study Area. Submitted to National Marine Fisheries Service October 2008.

Commander, U.S. Fleet Forces Command. Request for Letter of Authorization for the incidental harassment of marine mammals resulting from Training and Research, Development, Testing and Evaluation Activities conducted within the Mariana Islands Range Complex. Submitted to National Marine Fisheries Service August 2008.

Commander, U.S. Fleet Forces Command. Request for Letter of Authorization for the incidental harassment of marine mammals resulting from Training and Research, Development, Testing and Evaluation Activities conducted within the Mariana Islands Range Complex, Update #1. Submitted to National Marine Fisheries Service February 2009.

Commander, U.S. Pacific Fleet. Request for Letter of Authorization for the incidental harassment of marine mammals resulting from Navy Training Activities conducted within the Northwest Training Range Complex. Submitted to National Marine Fisheries Service September 2008.

Commander, U.S. Pacific Fleet. Request for Letter of Authorization for the incidental harassment of marine mammals resulting from Navy Training Activities conducted within the Gulf of Alaska Range Complex. Submitted to National Marine Fisheries Service November 2009.

Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service Letter of Authorization signed 8 January 2009 for Commander, U.S. Pacific Fleet incidental to take marine mammals incidental to Navy exercises conducted in the Hawaii Range Complex (HRC).

Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service Letter of Authorization signed 22 January 2009 for Commander, U.S. Fleet Forces Command to take marine mammals incidental to Navy activities conducted in the Atlantic Fleet Active Sonar Training (AFAST) in the Atlantic Ocean and Gulf of Mexico.

Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service Letter of Authorization signed 22 January 2009 for Commander, U.S. Pacific Fleet incidental to take marine mammals incidental to Navy exercises conducted in the Southern California (SOCAL) Range Complex.

Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service Letter of Authorization signed 5 June 2009 for Commander, U.S. Fleet Forces Command to take marine mammals incidental to U.S. Navy training activities conducted in the Cherry Point Range Complex in the Atlantic Ocean.

Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service Letter of Authorization signed 5 June 2009 for Commander, U.S. Fleet Forces Command to take marine mammals incidental to U.S. Navy training activities conducted in the Jacksonville (JAX) Range Complex in the Atlantic Ocean.

Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service Letter of Authorization signed 5 June 2009 for Commander, U.S. Fleet Forces Command to take marine mammals incidental to U.S. Navy training activities conducted in the Virginia Capes (VACAPES) Range Complex in the Atlantic Ocean.

RANGE-SPECIFIC MONITORING PLANS

Hawaii Range Complex Monitoring Plan dated December 2008.

Atlantic Fleet Active Sonar Training Range Complex Monitoring Plan dated January 2009.

Southern California Range Complex Monitoring Plan dated 9 January 2009.

Jacksonville Range Complex Monitoring Plan (draft) dated February 2009.

VACAPES Range Complex Monitoring Plan (draft) dated February 2009.

Cherry Point Range Complex Monitoring Plan dated April 2009.

Northwest Training Range Complex Monitoring Plan (draft) dated 20 April 2009.

OTHER REFERENCES:

CNO Memo dated 6 Mar 2006, “Mid-Frequency Active Sonar Effects Analysis Interim Policy”.

DRAFT United States Navy Comprehensive Marine Species Monitoring Program dated October 2007. Naval Facilities Engineering Command Pacific, Pearl Harbor, HI. Prepared by: ManTech SRS Technologies, Inc., 3865 Wilson Boulevard, Suite 800, Arlington, VA 22203 under Contract No. N68711-02-D-8043; Task Order No. 0035 in collaboration with: Cascadia Research Collective; Centre for Research into Ecological and Environmental Modeling, University of St. Andrews; Greeneridge Sciences, Inc.; LGL Limited; Kim Holland, Ph.D. University of Hawaii; and U. S. Navy Marine Resources Support Group.

Endangered Species Act (ESA), 16 U.S.C. §1531, *et seq*.

Executive Order 12114, “Environmental Effects Abroad of Major Federal Actions”.

Marine Mammal Protection Act (MMPA), 16 U.S.C. §1361, *et seq*., as amended by the 2004 National Defense Authorization Act, Pub. L. No. 108-136, 319, 117, Stat. 1433.

National Environmental Policy Act (NEPA), 42 U.S.C. §4321, *et seq.*

OPNAVINST 5090.1C, Environmental Readiness Program Manual dated 30 October 2007.

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APPENDIX A:

Sound Sources and Activities authorized or anticipated to be authorized under the MMPA Final Rules for Fleet Training Range Complexes / Study Areas

Range Green: Proposed Rules Yellow: TBD Sound Source / Activity	AFAST	SOCAL	HRC	VACAPES	Cherry Pt	JAX	NWTRC	GOMEX	MIRC	GOA
Use of mid-frequency active sonar (MFAS) and high frequency active sonar (HFAS) sources for Fleet Training:										
AN/AQS–22 or 13 (helicopter dipping sonar)	X	X	X						X	
AN/BQQ–10 or 5 (submarine mounted sonar)	X	X	X						X	
AN/BQS–15 (submarine navigation)	X	X					X		X	
AN/SLQ–25 (NIXIE—towed countermeasure)	X	X								
AN/SQQ–32 (over the side mine-hunting sonar)	X									
AN/SQS–53 (hull-mounted sonar)	X	X	X				X		X	
AN/SQS–56 (hull-mounted sonar)	X	X	X				X		X	
AN/SSQ–125 (AEER sonar sonobuoys)	X	X					X		X	
MK–1 or 2 or 3 or 4 (Submarine-fired Acoustic Device Countermeasure (ADC))	X									
MK–46 or 54 (lightweight torpedoes)	X	X							X	
MK–48 (heavyweight torpedoes)	X	X	X				X		X	
Noise Acoustic Emitters (NAE - Sub-fired countermeasure)	X									
SSQ–62 DICASS (sonobuoys)	X	X	X				X		X	
MK-84 range tracking pingers for ASW tracking							X		X	
Portable Undersea Tracking Range Uplink							X		X	
Detonation of underwater explosives for Fleet Training:										
AN/SSQ–110A (IEER explosive sonobuoy) (5 lbs)	X	X	X				X		X	
MK–48 Heavyweight Torpedo (851 lbs)		X	X				X		X	
Airborne Mine Neutralization System (AMNS)				X						
Demolition Charges (20 lbs)		X	X	X	X	X	X		X	
AGM–65 E/F Maverick missile (78.5 lbs)		X	X	X		X	X		X	
Harpoon missile (448 lbs)		X	X				X		X	
AGM–114 Hellfire missile				X	X	X	X		X	
AGM–88 High-speed anti-radiation missile (HARM)				X			X		X	
Tube-launched Optically tracked Wire-guided (TOW) missile					X					
SLAM missile							X		X	
MK–82 Bomb / GBU-12		X	X				X		X	
MK–83 Bomb / GBU-16 / GBU -32		X	X	X			X	X	X	
MK–84 Bomb / GBU-10		X	X				X		X	
5” Naval Gunfire (9.5 lbs)		X	X	X	X	X	X		X	
76 mm rounds (1.6 lbs)		X	X				X		X	
MK3A2 anti-swimmer concussion grenades (0.5 lbs)						X		X	X	
Training Events or Activity:										
ASW Exercise	X	X	X				X		X	
MINEX (Neutralization, Avoidance, Countermeasures)	X	X	X	X	X	X	X		X	
MISSILEX (Air-to-Surface)		X	X	X	X	X	X		X	
MISSILEX (Surface-to-Surface)			X							
BOMBEX (Air-to-Surface)		X	X	X			X	X	X	
SINKEX		X	X				X		X	
GUNEX (Surface-to-Surface)		X	X				X		X	
Naval Surface Fire Support			X							
FIREX with Integrated Maritime Portable Acoustic Scoring System (IMPASS)				X	X	X				
Small Arms Training with grenades						X		X	X	
Maintenance	X	X								
RDT&E (unspecified)	X	X							X	

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APPENDIX B:

Sound Sources and Activities anticipated to be authorized under the MMPA Final Rules for NAVSEA RDT&E Ranges / Study Areas

Green: Proposed Rules **Sound Source / Activity**	**Range** NUWC Keyport	NSWC PCD
Use of mid-frequency and high frequency active sound sources for NAVSEA RDT&E:		
Acoustic communication modems, HF	X	X
Acoustic devices for general range and UUV tracking (HF)	X	
Aids to navigation (range equipment)	X	
AN/AQS-22 (helicopter dipping sonar)	X	
AN/AQS–20 (helicopter towed mine-hunting sonar)		X
AN/SQQ–32 (over the side mine-hunting sonar)		X
AN/SQS–53/56 (hull-mounted sonar, Kingfisher)		X
AN/WLD–11 RMS Navigation (HF)	X	X
F84Y (Tower-mounted parametric sonar used to simulate mine-like objects, HF)		X
Object detection and navigation sonars (multiple HF)	X	X
Range Targets with active acoustic devices (MF, HF)	X	
Sidescan Sonars (multiple HF frequencies)	X	X
Sonobuoys, active	X	
Special Test Systems with active acoustic devices (MF, HF)	X	
Sub-bottom profilers (MF, HF)	X	X
Torpedo Sonars (HF)	X	
TVSS (Toroidal Volume Search Sonar, HF)		X
Detonation of underwater explosives for NAVSEA RDT&E:		
Live Ordnance (1 – 10 lb net explosive weight)		X
Live Ordnance (11 – 75 lb net explosive weight)		X
Live Ordnance (76 – 600 lb net explosive weight)		X
Line Charges (1750 lb net explosive in 5 lb increments)		X
Projectiles (5in, 40mm, 30mm, 20mm, 76mm, 25mm, and small arms)		X
NAVSEA RDT&E Activity:		
Acoustic and non-acoustic sensor testing	X	
Countermeasure testing	X	
Impact testing	X	
Inert mine detection, classification, and localization	X	
Ordnance Live T&E		X
Projectile Firing T&E		X
Sonar T&E		X
Surf zone clearing T&E with line charges		X
Surface Operations – equipment deployment and recovery	X	X
Surface Operations – system development	X	X
Surface Operations – test support	X	X
Surface Operations – tows	X	X
UUV and UAS testing	X	
Vehicle propulsion testing	X	

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APPENDIX C:
Sample size and Statistical analysis

Specific guidelines for sample size and statistical analysis are under development. This is a PLACEHOLDER for a FUTURE UPDATE.

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APPENDIX D:
Marine Mammal Sighting Form for Navy Lookouts

Version 3.0N - 19 MAR 09

USS________________DAILY MARINE MAMMAL LOG

A. DTG: Z	B. Species/Type of Mammal:	C. Number of Mammals:	D. Calves: YES/NO
E. Initial Detection Source: VISUAL / AURAL	F. Initial Brg/Rng: T / Yds	G. Unit Position: LAT: LONG:	
H. Unit Course/Speed: T / Kts	I. Last Known Brg/Rng: T / Yds	J. Total Time Visually Observed: MIN	
K. Wave Height: FT	L. Visibility: NM	M. MFAS Active:	N. MFAS Action Taken:
IF MFAS WAS TRANSMITTING WHEN MAMMAL WAS SIGHTED AND SUBSEQUENTLY POWERED DOWN/SHUT DOWN, OR COURSE CHANGED:			
O. Duration of Action: MIN	P. Maneuver Conducted:	Q. Degrees of Course Chg: DEG	R. Range Action Taken: YDS
S. Action impact (note 1):			
T. Narrative of observation (note 2) :			

A. DTG: Z	B. Species/Type of Mammal:	C. Number of Mammals:	D. Calves: YES/NO
E. Initial Detection Source: VISUAL / AURAL	F. Initial Brg/Rng: T / Yds	G. Unit Position: LAT: LONG:	
H. Unit Course/Speed: T / Kts	I. Last Known Brg/Rng: T / Yds	J. Total Time Visually Observed: MIN	
K. Wave Height: FT	L. Visibility: NM	M. MFAS Active:	N. MFAS Action Taken:
IF MFAS WAS TRANSMITTING WHEN MAMMAL WAS SIGHTED AND SUBSEQUENTLY POWERED DOWN/SHUT DOWN, OR COURSE CHANGED:			
O. Duration of Action: MIN	P. Maneuver Conducted:	Q. Degrees of Course Chg: DEG	R. Range Action Taken: YDS
S. Action impact (note 1):			
T. Narrative of observation (note 2) :			

A. DTG: Z	B. Species/Type of Mammal:	C. Number of Mammals:	D. Calves: YES/NO
E. Initial Detection Source: VISUAL / AURAL	F. Initial Brg/Rng: T / Yds	G. Unit Position: LAT: LONG:	
H. Unit Course/Speed: T / Kts	I. Last Known Brg/Rng: T / Yds	J. Total Time Visually Observed: MIN	
K. Wave Height: FT	L. Visibility: NM	M. MFAS Active:	N. MFAS Action Taken:
IF MFAS WAS TRANSMITTING WHEN MAMMAL WAS SIGHTED AND SUBSEQUENTLY POWERED DOWN/SHUT DOWN, OR COURSE CHANGED:			
O. Duration of Action: MIN	P. Maneuver Conducted:	Q. Degrees of Course Chg: DEG	R. Range Action Taken: YDS
S. Action impact (note 1):			
T. Narrative of observation (note 2) :			

A. DTG: Z	B. Species/Type of Mammal:	C. Number of Mammals:	D. Calves: YES/NO
E. Initial Detection Source: VISUAL / AURAL	F. Initial Brg/Rng: T / Yds	G. Unit Position: LAT: LONG:	
H. Unit Course/Speed: T / Kts	I. Last Known Brg/Rng: T / Yds	J. Total Time Visually Observed: MIN	
K. Wave Height: FT	L. Visibility: NM	M. MFAS Active:	N. MFAS Action Taken:
IF MFAS WAS TRANSMITTING WHEN MAMMAL WAS SIGHTED AND SUBSEQUENTLY POWERED DOWN/SHUT DOWN, OR COURSE CHANGED:			
O. Duration of Action: MIN	P. Maneuver Conducted:	Q. Degrees of Course Chg: DEG	R. Range Action Taken: YDS
S. Action impact (note 1):			
T. Narrative of observation (note 2) :			

Note 1: Tactical Degradation Assessment. Impact examples: None. Slight - Degraded ASW screen when ship maneuvered to open whales. Moderate: Lost Contact when power reduced. Significant: Engagement interrupted when MFAS was Shutdown.
Note 2: Describe actions of marine mammals and ship's reactions. Aircraft include altitude. Narrative examples: Dolphins sighted at 1200 YDS off Port bow, closing the ship, CPA of 600 YDS. Powered down MFAS for 35 min until lost sight of whales.
Porpoises sighted by Lookouts using NVGs, range 550 YDS, opening the ship. Powered down MFAS -6dB for 10 min until outside of 1000 YDS.
LoneWolf 42, flying SW at 60kts, 1200 FT, sighted pod of dolphins within 100 YDS DICASS 12. Buoy was not active at the time.

Example:

A. DTG: **061234 Z JAN 09**	B. Species/Type of Mammal: **Whale**	C. Number of Mammals: **2**	Q. Calves: YES/NO
E. Initial Detection Source: VISUAL / AURAL	F. Initial Brg/Rng: **215** T / **1400** Yds	G. Unit Position: LAT: **123456N** LONG: **1234555E**	
H. Unit Course/Speed: **265** T / **12** Kts	I. Last Known Brg/Rng: **095** T / **900** Yds	J. Total Time Visually Observed: **14** MIN	
K. Wave Height: **4** FT	L. Visibility: **12** NM	M. MFAS Status: **ON**	N. MFAS Action Taken: **Powerdown**
IF MFAS WAS TRANSMITTING WHEN MAMMAL WAS SIGHTED AND SUBSEQUENTLY POWERED DOWN/SHUT DOWN, OR COURSE CHANGED:			
O. Duration of Action: **14** MIN	P. Maneuver Conducted: **Turn Stbd**	Q. Degrees of Course Chg: **45** DEG	R. Range Action Taken: **800** YDS
S. Action impact (note 1): **slight - degraded integrity of ASW screen, as ship maneuvered to avoid whales**			
T. Narrative of observation (note 2): **two whales paralleled ship's course, CPA of 600 yds after maneuver. Powered down MFAS for 14 min until lost sight of whales.**			

Data Fields:

A. DDHHMM Z MMM YY
B. WHALE / DOLPHIN / PORPOISE / SEAL / SEAL LION / TURTLE /GENERIC (i.e unknown)
C. Number
D. YES / NO
E. VISUAL / AURAL
F. Bearing in Degrees True / Range in Yards
G. Position: DDMMSS N/S DDDMMSS E/W
H. Course in Degrees True / Speed in Knots
I. Bearing in Degrees True / Range in Yards
J. Minutes
K. Feet
L. Nautical Miles
M. NO / YES
N. Powerdown -6dB / Powerdown -10dB / Shutdown / None
O. Minutes
P. Turn STBD / Turn PORT / -
Q. Degrees
R. Range in Yards
S. Tactical Degradation Assessment examples:
   - None
   - Slight - Degraded ASW screen integrity when ship maneuvered to open whales.
   - Moderate - Lost Contact when power reduced.
   - Significant - Engagement interrupted when MFAS was Shutdown.
T. Observation examples:
   - Dolphins sighted at 1200 YDS off Port bow, closing the ship. Maneuvered to confirm Bow Riding and continued MFAS operations
   - Pod of whales sighted fin slapping 600 YDS off STBD bow, paralleling ships course. Ship maneuvered to Port to open range.
   - Porpoises sighted 250 YDS off STBD Beam, opening ship. Powered down MFAS by -6dB until they opened to 1000 YDS. Lost sight astern.
   - DragonSlayer 12, flying NW at 60 kts, 1200FT, spotted pod of dolphins within 150 YDS of DICASS Buoy 12. Buoy was passive at the time, and remained so until dolphins were seen leaving the area. 80% cloud layer at 3500 FT. Photos taken.

APPENDIX C- DATA REPORT FROM NAVY FUNDED MONITORING IN PACIFIC NORTHWEST

NPS-OC-09-001

NAVAL POSTGRADUATE SCHOOL

MONTEREY, CALIFORNIA

Acoustic and visual monitoring for cetaceans along the outer Washington coast

by

Erin M. Oleson, John Calambokidis, Erin Falcone, Greg Schorr,
and John A. Hildebrand

March 2009

Approved for public release; distribution is unlimited.

Prepared for: CNO(N45), Washington, D.C.

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NAVAL POSTGRADUATE SCHOOL
Monterey, California 93943-5000

Daniel T. Oliver
President

Leonard A. Ferrari
Executive Vice President and
Provost

This report was prepared for CNO(N45), Washington, D.C.
and funded by CNO(N45), Washington, D.C.

This report was prepared by:

Erin M. Oleson
Postdoctoral Investigator

John Calambokidis
Research Biologist

Erin Falcone
Research Biologist

Greg Schorr
Research Biologist

John A. Hildebrand
Professor of Oceanography

Reviewed by:

Jeffrey Paduan
Department of Oceanography

Released by:

Karl Van Bibber
Vice President and Dean of Research

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13. ABSTRACT ***(maximum 200 words)***

Since July 2004, visual and acoustic monitoring efforts for marine mammals have been conducted in waters off the outer Washington coast. These efforts have been specifically to determine the seasonal occurrence of marine mammal species and to estimate their relative abundances, particularly in the area of the proposed expansion of the U.S. Navy's Quinault Underwater Tracking Range (QUTR) of the Northwest Range Complex. This has resulted in the first multi-year, year-round effort in 20 years to document and understand the presence of marine mammal species in this region. This report summarizes all data so far collected, presenting analyses of seasonal occurrence, variation in sighting distribution, and evaluation of relative abundance for all species that can be consistently identified from the visual and acoustic data sets.

14. SUBJECT TERMS marine mammals, visual surveys, acoustic surveys, HARP, QUTR, baleen whales, odontocetes, pinnipeds, Humpback whales, Gray whales, Minke whales, Fin whales, Killer whales, Cuvier's beaked whales, Northern right whale dolphins, Pacific white-sided dolphins, Risso's dolphins, Harbor porpoises, Dall's porpoises, California sea lions, Stellar sea lions, Northern fur seals, Harbor seals, Elephant seals

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FY07 Grant Report:
Acoustic and Visual Monitoring for Cetaceans along the Outer Washington Coast

Erin M. Oleson[1], John Calambokidis[2], Erin Falcone[2], Greg Schorr[2], and John A. Hildebrand[1]

[1]UCSD Scripps Institution of Oceanography
[2]Cascadia Research Collective

Project Impact

In September 2003, the U.S. Navy proposed expansion of its Quinault Underwater Tracking Range (QUTR), part of the Northwest Range Complex (Federal Register, **Vol. 68**: 53599-53600, 11 September 2003), further west into offshore waters and south along the shelf. In July of 2004, we initiated an acoustic and visual monitoring effort for marine mammals within the boundaries of the proposed expansion area. This effort was designed to allow for: 1) characterization of the vocalizations of species present in the area, 2) determination of the year-round seasonal presence of all marine mammal species, and 3) evaluation of the distribution of marine mammals near the Navy range. Two High-frequency Acoustic Recording Packages (HARPs) were deployed near the QUTR, one in deep water within Quinault Canyon (Figure 1: S1) and a second in inshore waters on the shelf (S2). In conjunction with the acoustic monitoring, visual surveys have been conducted roughly monthly by Cascadia Research Collective since August 2004.

In July 2007 the Navy renewed its intent to issue an Environmental Impact Statement (EIS/OEIS) for the range expansion (Federal Register, **Vol. 72**: 41712. 31 July 2007). It is our intent, as part of this grant report, to provide the most up-to-date and complete information available from our monitoring efforts for inclusion in the EIS for the QUTR expansion. Our study provides the first multi-year and year-round effort to document and understand the presence of marine mammal species in this region in nearly 20 years. In addition, we present the first year-round visual and acoustic study for this region, a mode of surveying which provides greater opportunity to survey all marine mammal species, ranging form those that are commonly seen but rarely heard, such as gray whales, to those that are highly vocal but surface infrequently, such as sperm whales.

Project Background

The outer Washington coast of the United States is a highly productive marine ecosystem, home to many species of marine mammals, including beaked whales, killer whales, and several other odontocete, mysticete, and pinniped species. Expansion of the QUTR into deep-water habitats used by beaked and sperm whales and south along the shelf where coastal cetaceans forage could impact these marine mammal communities.

In the late 1980s, extensive year-round aerial surveys were conducted along the Oregon and Washington coasts (Green *et al.* 1992). Fourteen species of cetacean were observed during these surveys, with the most common being the Risso's dolphin, Pacific white-sided dolphin, northern right whale dolphin, harbor porpoise, Dall's porpoise, and gray whale. The study yielded estimates of seasonal distribution and abundance for the most common cetacean species.

Since that time, cetacean surveys in this region have generally been limited to the summer and fall, including broad-scale visual and acoustic ship surveys (Barlow 1994, 2003) conducted by NOAA Fisheries, and fine-scale ship-based surveys along the northern Washington coast (Calambokidis *et al.* 2004a) conducted by the Olympic Coast National Marine Sanctuary (OCNMS). Very few winter and spring surveys have been conducted, including winter aerial surveys along the northern Washington coast conducted by NOAA Fisheries (Shelden *et al.* 2000). Year-round acoustic monitoring from NAVY SOSUS arrays has provided information on the seasonal occurrence of blue, fin and humpback whales (Watkins *et al.* 2000, Stafford *et al.* 2001), although these arrays are located further offshore and provide only low frequency listening capabilities. No acoustic surveys for odontocetes have been conducted in this region, with the exception of occasional ship-based acoustic recordings from summer and fall NOAA surveys.

In July 2004 a visual and acoustic monitoring effort for marine mammals was initiated off the outer Washington coast. This effort was specifically designed to determine the seasonal occurrence of marine mammal species and estimate their relative abundances. Visual and acoustic data collection has continued since 2004, resulting in four full years of survey data in this region.

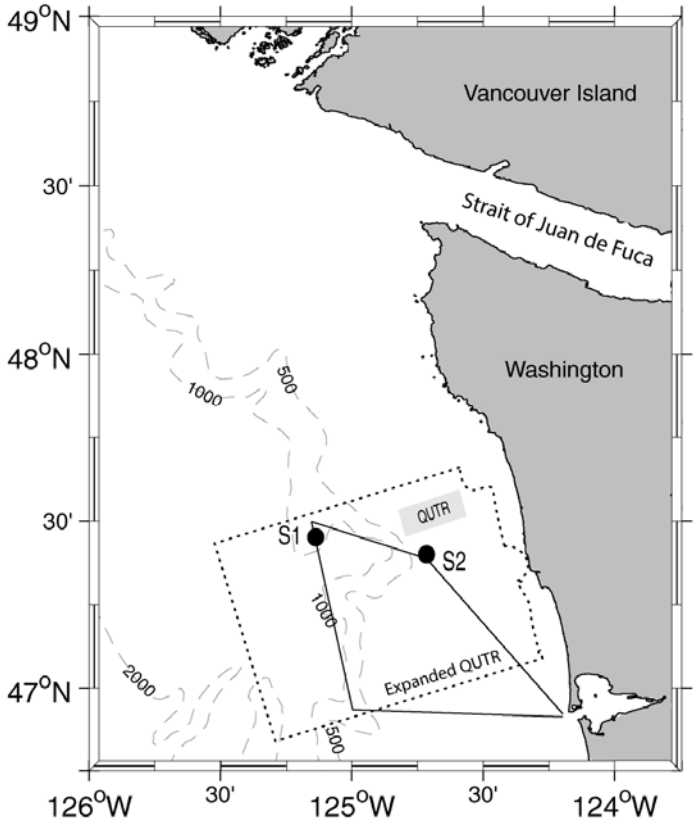

Figure 1. Locations of two High-frequency Acoustic Recording Packages, S1 and S2, and the monthly visual survey track (solid line) from Westport harbor.

Data Collected to Date

A total of 59 months of acoustic data have been collected at two sites using autonomous High-frequency Acoustic Recording Packages (HARPs). From July 2004 to July 2007, acoustic data were collected at an 80 kHz sample rate, either continuously or at 1/3 duty cycle (Table 1). A software bug resulting in an abandonment of the duty cycle on 1 January produced shorter recordings than expected. In order to sample the spring period in 2007, both HARPs were re-fitted with new batteries in April of that year. In July and October of 2007 the offshore and inshore HARPs, respectively, were redeployed with a higher sample rate (200 kHz) specifically targeting beaked whales and other very high-frequency odontocetes. Due to the increase in acoustic sampling rate, the duty-cycle was necessarily lengthened, resulting in year-round recordings, but with longer off periods between recording segments (Table 1). These data were retrieved in June 2008. Acoustic data collection continues at both sites.

A 5.3 to 5.9 m rigid hull inflatable was used to conduct surveys out of Grays Harbor, Washington. The goal was to conduct surveys during periods of good weather, with an emphasis on sampling as consistently as possible across different seasons through an entire year. Weather was monitored and surveys only attempted during periods of forecast good weather. Two to three people including the driver were aboard during each survey, and visual observations were maintained for marine mammals during the entire survey. Weather and time permitting, the surveys followed a similar route: 1) Grays Harbor to the Quinault Canyon, stopping at both of the HARP locations there; 2) Quinault Canyon south along deeper waters down to Grays Canyon; and 3) Grays Canyon back to Grays Harbor. Slight variations to this route were made as necessitated by weather and time constraints and in response to sightings.

Table 1. Acoustic data collection near QUTR since July 2004. Ongoing acoustic data collection is shown in italics.

Acoustic Monitoring Period	Sample Rate & Duty Cycle (on/off, min.)	S1: Offshore	S2: Inshore
OCNMS01: July – October 2004	80 kHz continuous	Yes	Instrument lost
OCNMS02: October 2004 – July 2005	80 kHz 10/20	Data ended 1/05	No recording
OCNMS03: July 2005 – August 2006	80 kHz 6/12	Data ended 2/06	No recording
OCNMS04: August 2006 – March 2007	80 kHz 6/12	Data ended 2/07	Yes
OCNMS05: April – July 2007	80 kHz continuous	Yes	Yes
OCNMS06: July 2007 – June 2008	200 kHz 5/35	Yes	
OCNMS07: October 2007 – June 2008	200 kHz 5/30		Yes
OCNMS08: June 2008 – June 2009	*200 kHz 5/35*	*Ongoing*	*Ongoing*

When marine mammals were encountered we recorded the time, position, species, number of animals, behavior, environmental conditions, and water depth. For large cetacean sightings, especially humpback, gray, and killer whales, photographs were taken to document

species and to allow photographic identification of individual animals. Photographic identification was conducted using methods established in past work along the west coast on gray whales (Calambokidis *et al.* 2004b) and humpback whales (Calambokidis *et al.* 2004a, Calambokidis and Barlow 2004). Biopsy samples were also collected from many of the humpback whales encountered using a small dart fired from a crossbow.

Joint visual-acoustic surveys were conducted in collaboration with the Olympic Coast National Marine Sanctuary during July 2007 and June 2008. These surveys were carried out aboard the NOAA Ship *MacArthur II*, and consisted of a team of three visual observers on watch from the flying bridge of the *MacArthur II* while two acousticians monitored a towed hydrophone array for marine mammal vocalizations. These surveys allowed for collection of acoustic data from visually identified species to aid in species-discrimination algorithms, and will serve to provide an opportunity to directly compare visual and acoustic detection rates for some species.

In FY07 the project goals included 1) analysis of the existing acoustic and visual data, 2) assessment of environmental datasets for development of a habitat model for cetaceans in the region, and 3) continued data collection for an additional year. This report will summarize all data collected to date and will present analyses of seasonal occurrence, variation in sighting distribution, and evaluation of relative abundance for all species that can be consistently identified from the visual and acoustic data sets.

Results

Visual Surveys

Table 2. Visual survey sighting summary for all surveys conducted from August 2004 through September 2008. Tables of sightings during each survey can be found in the appendix.

Species		Sightings	Animals
Baleen whales			
	Humpback Whale	80	147
	Gray Whale	55	116
	Minke Whale	1	1
	Fin whale	1	2
	UnID Whale	2	2
Odontocetes			
	Killer Whale	6	51
	Cuvier's beaked whale	1	3
	UnID beaked whale	2	3
	N. Right Whale Dolphin	3	59
	Pac. White-sided Dolphin	18	1681
	Risso's dolphins	2	38
	Harbor Porpoise	114	244
	Dall's Porpoise	44	206
Pinnipeds			
	California Sea Lion	25	187
	Steller Sea Lion	11	56
	Northern Fur Seal	60	157
	Harbor Seal	27	723
	Northern Elephant Seal	10	10
	UnID Pinniped	3	5
Total		**465**	**3691**

A total of 42 small boat surveys were conducted over a 4-year period between 16 August 2004 and 2 September 2008 representing 414 hours and 5,353 nmi of survey effort (see Appendix Table I). Surveys were conducted at roughly monthly intervals as weather allowed throughout the year. Maps indicating the location of each dolphin and porpoise (Figure 2), whale (Figure 11), and pinniped (Figure 20) sighting are included. A total of 465 sightings of 3,691 marine mammals were made during the small boat surveys (Table 2) representing 11 cetacean and 5 pinniped species. Harbor porpoise were the most frequently sighted marine mammals overall (114 sightings), although, due to their larger average group size, Pacific white-sided dolphin had the largest number of animals sighted (1,681). Among baleen whales, sightings were dominated by humpback and gray whales, with only single sightings of fin and minke whales.

Habitat Analysis from Visual Survey Data

There were significant differences in key habitat variables for different species, highlighting the differences in their occurrence within the study area (Table 3). Distance from shore was significantly different by species (ANOVA: F=55.5, df=18, p=0.000). Similar significant differences were also found by species for distance from the 200 m depth contour (ANOVA: F=42.2, df=18, p=0.000) and water depth (ANOVA: F=26.0, df=18, p=0.000).

Table 3. Key habitat variables by species, including distance from shore, distance from 200 m depth (shelf break), and water depth. N represents the total number of sightings of each species or species group.

		Dist. (km) from shore		Dist. (km) from 200 m		Water depth (m)	
Species	**N**	**Mean**	**SD**	**Mean**	**SD**	**Mean**	**SD**
Minke whale	1	14	-	38	-	-38	-
Fin whale	1	63	-	5	-	-968	-
Gray whale	55	13	11	37	11	-46	81
- S migration Dec.-Jan.	10	29	13	22	10	-126	171
- N migration Feb.-April	30	9	5	42	6	-26	16
- Summer feeding May-Oct.	15	12	9	39	9	-33	23
Humpback whale	80	35	14	17	10	-187	265
Killer whale	6	36	22	17	16	-342	407
Risso's dolphin	2	34	1	3	0	-129	5
Northern right whale dolphin	3	56	9	12	6	-964	377
Pacific white-sided dolphin	18	56	11	13	8	-801	534
Beaked whale	3	61	4	14	8	-906	415
Dall's porpoise	44	46	15	12	9	-501	526
Harbor porpoise	114	10	9	40	9	-31	26
Northern fur seal	60	55	14	11	7	-754	477
Steller sea lion	11	13	10	35	13	-42	37
Elephant seal	10	59	8	13	4	-905	334
Harbor seal	27	11	15	42	14	-56	165
California sea lion	25	21	14	28	15	-78	98

Acoustic Monitoring

To date, several species have been detected within the acoustic data set, including Pacific white-sided dolphins, Risso's dolphins, beaked whales, killer whales, sperm whales, humpback whales, blue whales, and fin whales. Also, a number of sounds have not yet been classified to species. Acoustic classification is carried out either from comparison to species-specific spectral characteristics or through analysis of the time and frequency characters of individual clicks. Other species are known to occur in this area, though species-specific information on their sounds has not yet been identified.

In general there are nearly twice as many detections of marine mammal sounds at the offshore acoustic monitoring site than at the inshore site. Some species have a distinct seasonal pattern, while others are present year-round. Species-specific trends in vocal activity are described below.

Findings by Species

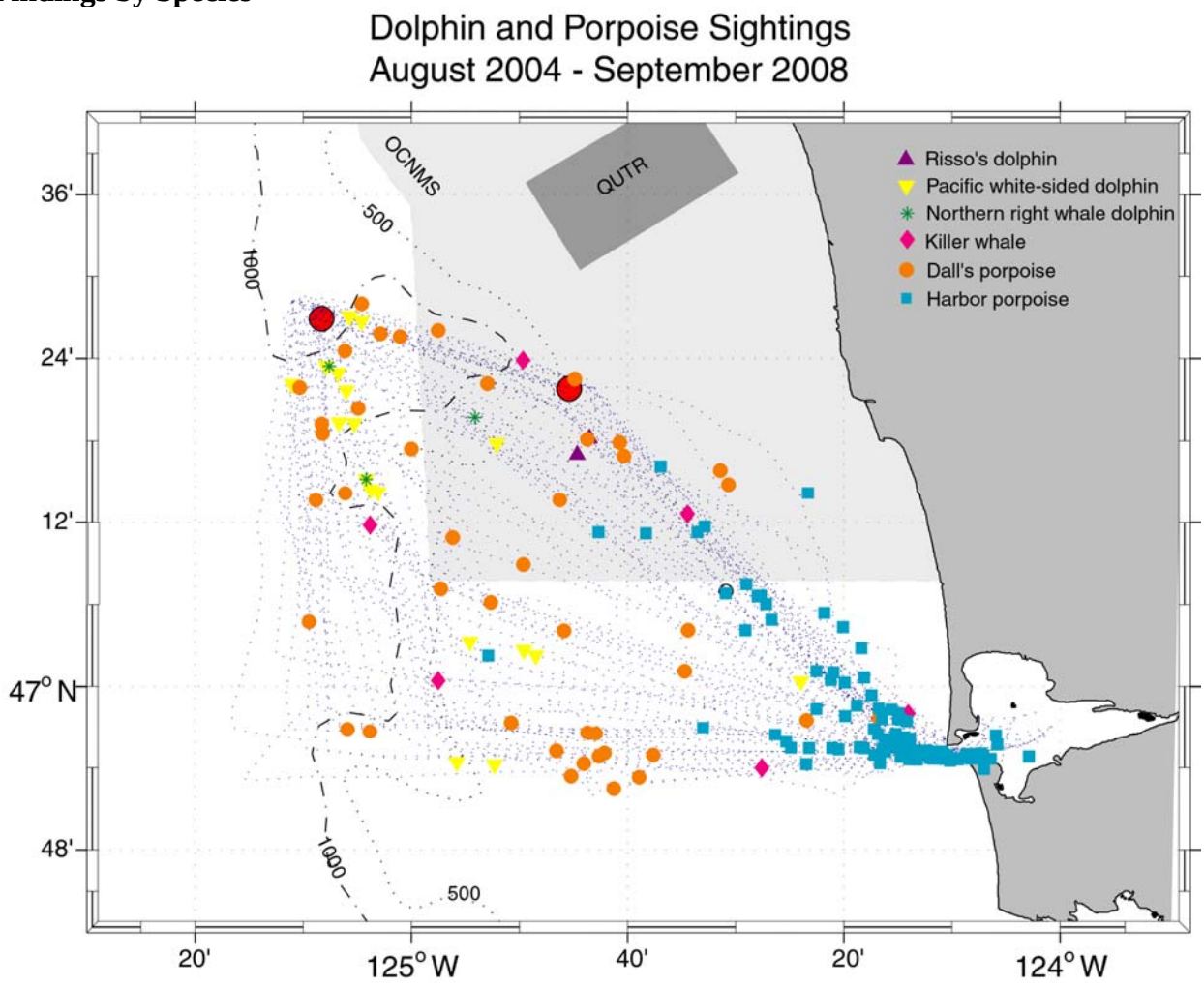

Figure 2. Dolphin and porpoise sightings during visual surveys since August 2004. Although sightings of Dall's and harbor porpoise are common in all months, the remaining delphinids have been seen on very few surveys, primarily during the summer.

Harbor and Dall's Porpoise

Harbor and Dall's porpoise were the most frequency sighted marine mammals during visual surveys, with 158 total combined sightings. The echolocation clicks of both of these species are thought to be higher in frequency than the HARP is currently able to record, such that no acoustic detection data are available for either of these species. Some unidentified high-frequency clicks-- lower in frequency than porpoise clicks are thought to be emitted, yet higher in frequency and lower in bandwidth than the clicks of many other odontocetes-- were recorded on the HARP. It is possible these clicks are those of either harbor or Dall's porpoise. The seasonal occurrence of these clicks is presented below for unidentified odontocetes.

Harbor porpoise sightings varied significantly by season for distance from shore (ANOVA: $F=5.3$, $p=0.002$), distance from the shelf edge ($F=5.6$, $p=0.001$), and water depth ($F=5.5$, $p=0.002$), with fall sightings closest to shore, farthest from the shelf edge, and in

shallower water versus summer sightings (farthest from shore, closest to the shelf edge, and in deeper water).

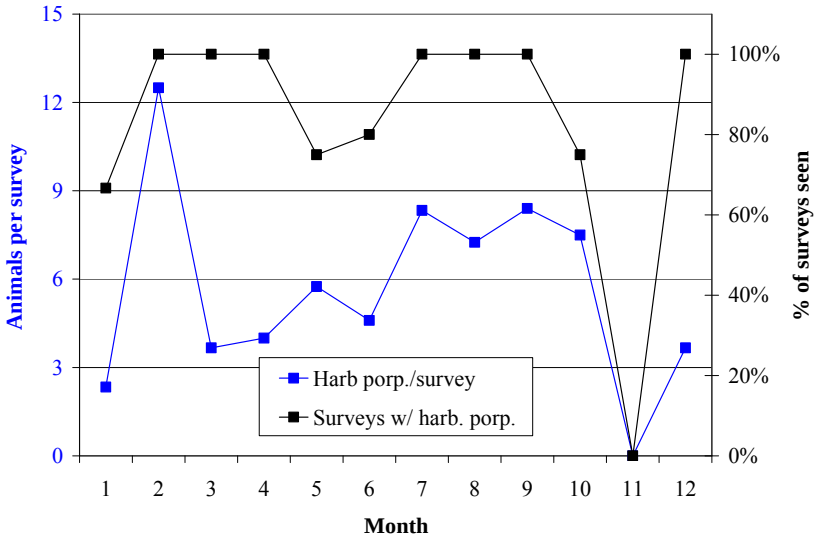

Figure 3. Seasonal occurrence of harbor porpoise based on visual survey sightings from August 2004 through September 2008. As an indicator of relative density, the average number of animals seen per survey per month is compared to the percent of surveys per month in which harbor porpoise were sighted.

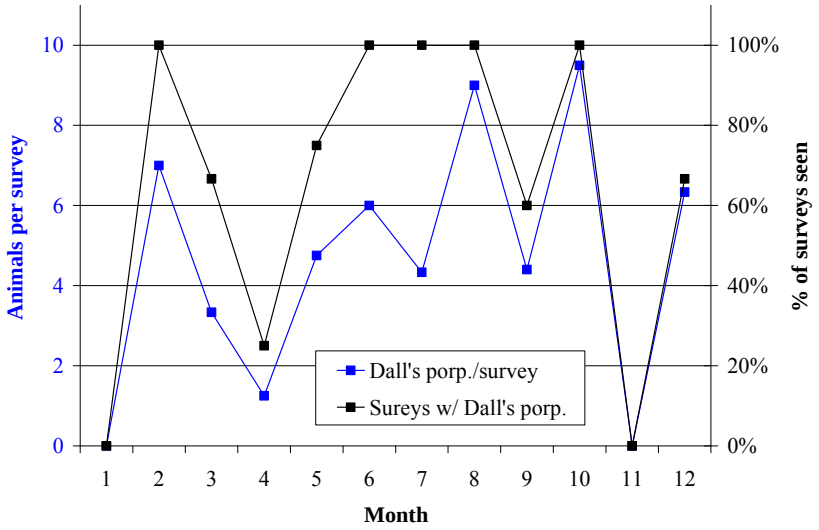

Figure 4. Seasonal occurrence of Dall's porpoise based on visual survey sightings from August 2004 through September 2008. As an indicator of relative density, the average number of animals seen per survey per month is compared to the percent of surveys per month in which Dall's porpoise were sighted.

Although Dall's and harbor porpoise occurrence appears to be tightly correlated (Figures 3 and 4), it is unclear whether this represents an actual coupling in the occurrence of these species or is more indicative of weather conditions during the surveys. Porpoises are difficult to see in moderate weather conditions. Harbor porpoise are much more common close to shore, while Dall's porpoise are sighted throughout the study area (Figure 2).

Pacific White-sided Dolphins

Pacific white-sided dolphins are the most commonly detected odontocete in the acoustic dataset. White-sided dolphins were heard for nine to ten months each year, with a distinct absence in April and May of most years (Figure 5). The specific timing of arrival and departure

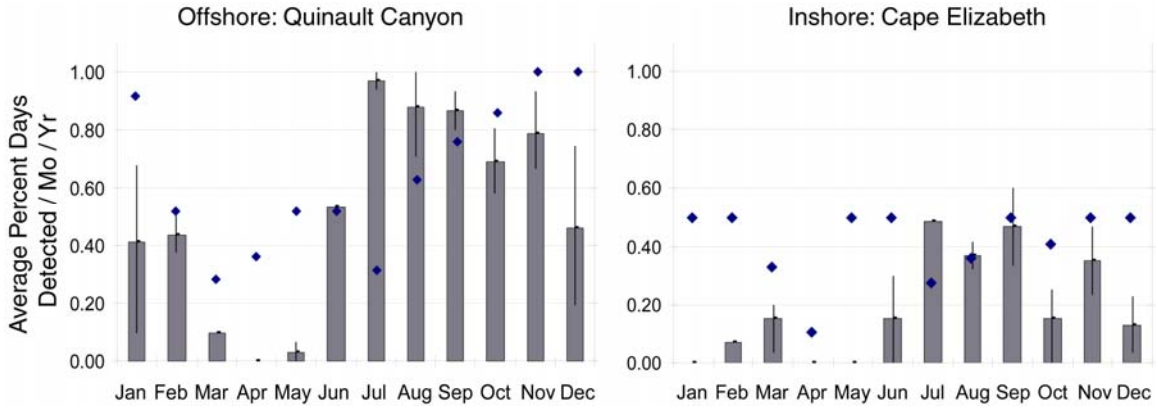

Figure 5. Average seasonal occurrence of Pacific white-sided dolphin echolocation clicks at the offshore and inshore acoustic monitoring locations. The gray bars represent the mean detection rate across all years of acoustic monitoring effort and error bars indicate minimum and maximum acoustic detection rates. Blue diamonds indicate the average acoustic monitoring effort for each month, with 100% (shown as 1.00 on the y-axis) effort indicating monitoring all month over all four years of data collection.

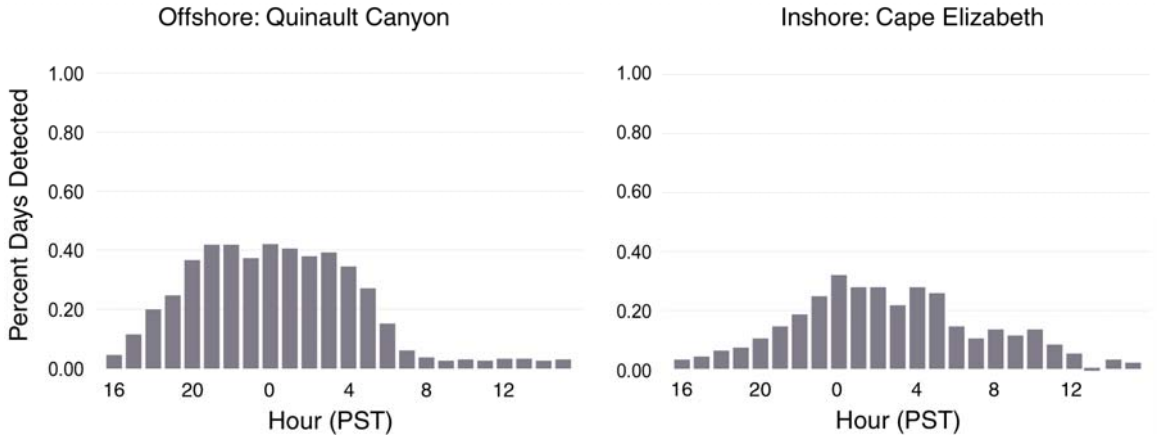

Figure 6. Occurrence of Pacific white-sided dolphin clicks by hour of the day. Pacific white-sided dolphins are significantly more common at night than during the day at both locations.

from the area fluctuated somewhat among years, though 2007-08 had particularly low rates of white-sided occurrence in the winter and spring. A peak in Pacific white-sided dolphin detection occurs in the summer at both acoustic monitoring sites, though high levels of detection continue at the offshore site through November.

A significant daily pattern of acoustic detection is evident at both the inshore and offshore monitoring locations for this species (Kruskal Wallis: inshore, χ^2=51.84, df=100, p<0.0001; offshore, χ^2=431.73, df=466, p<0.0001). At both sites Pacific white-sided dolphins are heard more commonly at night than during the day, with nighttime detection rates 8 times higher than daytime detection rates at the offshore location (Figure 6). These observations suggest nighttime monitoring will be required in order to reliably detect the presence of this species using its distinct echolocation clicks.

Pacific white-sided dolphins were observed 18 times over 7 surveys in the summer and fall. Though observed less commonly than several other species, the total number of individuals observed was highest for Pacific white-sided dolphins due to the large group sizes for this species in this region. The seasonality of Pacific white-sided dolphin sightings is consistent with the acoustic detection of this species; however, acoustic detections do indicate their presence over a much broader period than indicated by the visual sightings alone. This is likely due to marginal weather conditions during many fall and winter surveys. It is interesting to note that Pacific white-sided dolphins were among the most frequently sighted cetaceans during the OCNMS survey in this region in July 2007, though they were not seen at all in June 2008. It is not yet clear if the Pacific white-sided dolphins had not yet arrived in the region or if oceanographic factors may have led them to use alternative regions for feeding in 2008. Sightings during our visual surveys in summer were significantly farther offshore than those during fall (ANOVA: F=8.0, p=0.12).

Risso's Dolphins

Risso's dolphins were detected within the acoustic records an average of 5 to 6 days per year, but were sighted by visual observers only once in 4 years of surveying. Risso's dolphins also were not observed during the July 2007 and June 2008 OCNMS cetacean survey cruises. The low visual and acoustic detection rate in this region is in sharp contrast to the large number of Risso's dolphins observed during aerial visual surveys in the late 1980s (Green *et al.* 1992). During those surveys, Risso's dolphins were the most commonly sighted odontocete within the study area. Acoustic detections of Risso's dolphins during this study occurred throughout the year.

Unidentified Odontocetes

A large number of echolocation clicks, whistles, and burst-pulse sounds have been detected that cannot currently be identified to species. Several delphinid species are thought to occur here, including northern right whale dolphin and common dolphin, as well as pygmy and dwarf sperm whales, false killer whales, and several beaked whale species. We have catalogued those sounds that cannot yet be identified to species, and will compare them to new recordings of these species as they become available. Unidentified sounds are most common in the summer and fall, and are rarely heard in the spring (Figure 7). This pattern is quite similar to that of Pacific white-sided dolphin acoustic detections, suggesting a general summer and fall peak in occurrence for most delphinid species. It is also likely that many of the sounds within the

unidentified category, particularly burst-pulse sounds which have not been adequately described for this species as yet, are those of Pacific white-sided dolphin.

Although there is a statistically significant daily pattern in the occurrence of unidentified sounds (Figure 8), it is slight, likely because the sounds of several species and that represent several behavioral states are lumped together, obscuring patterns that might otherwise be quite distinct.

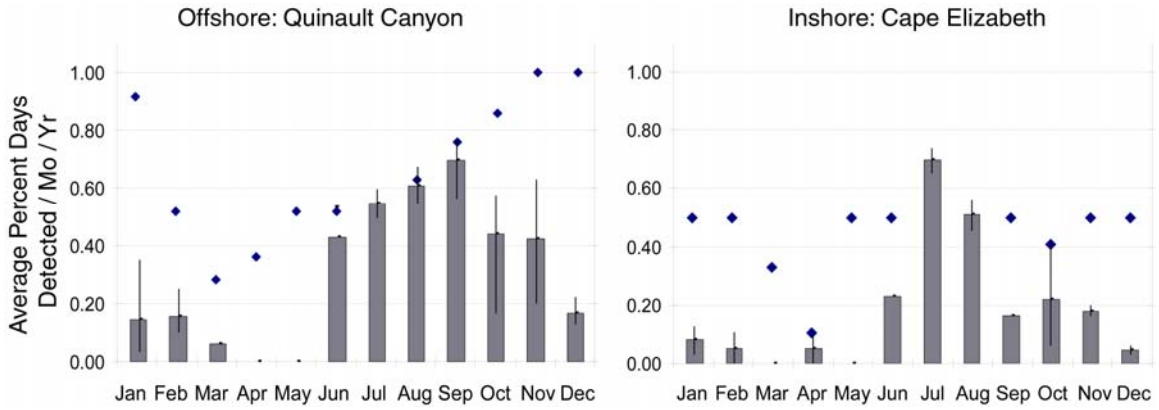

Figure 7. Average seasonal occurrence of whistles, burst-pulses, and echolocation clicks from unidentified odontocetes at the offshore and inshore acoustic monitoring locations. The gray bars represent the mean detection rate across all years of acoustic monitoring effort and error bars indicate minimum and maximum acoustic detection rates. Blue diamonds indicate the average acoustic monitoring effort for each month, with 100% (shown as 1.00 on the y-axis) effort indicating monitoring all month over all four years of data collection.

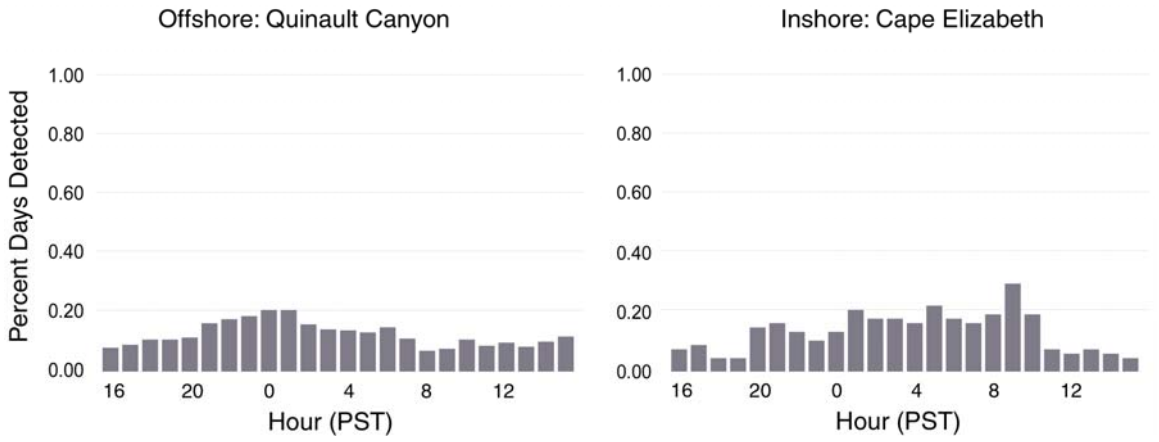

Figure 8. Occurrence of clicks, whistles, and burst-pulse sounds from unidentified odontocetes by hour of the day. Although the hourly pattern is significant, the inclusion of sounds from several species is likely muting patterns that would otherwise be more prevalent

In addition to the echolocation clicks, whistles, and burst-pulse sounds tallied above, we detected a new click type in 2007-08 due to the higher acoustic bandwidth available in this year.

Clicks series consisted of 8-10 clicks with -10 dB frequency from 57-75 kHz. The clicks were often quite faint and single series could be separated by long periods of absence. These clicks were heard at both acoustic monitoring locations, though the seasonal occurrence at the two sites does appear to be different (Figure 9). There is a clear peak in the occurrence of these high-frequency clicks in January at the offshore location, while the peak occurs somewhat earlier and later, in November and again in June, at the inshore location.

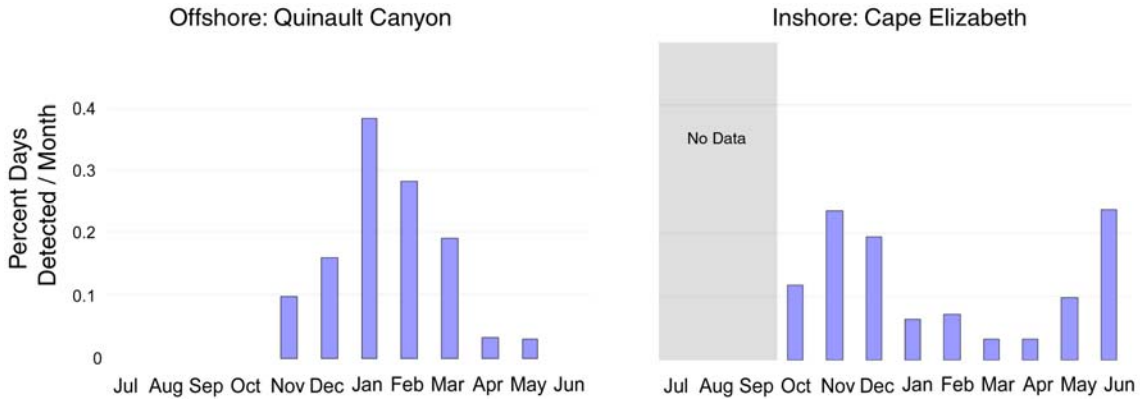

Figure 9. Seasonal occurrence of high-frequency clicks from an unidentified odontocete recorded from July 2007 through June 2008.

Killer Whales

Four killer whale communities have been detected at the acoustic monitoring sites, including Northern and Southern Residents, Offshores, and Transient ecotypes. Both the

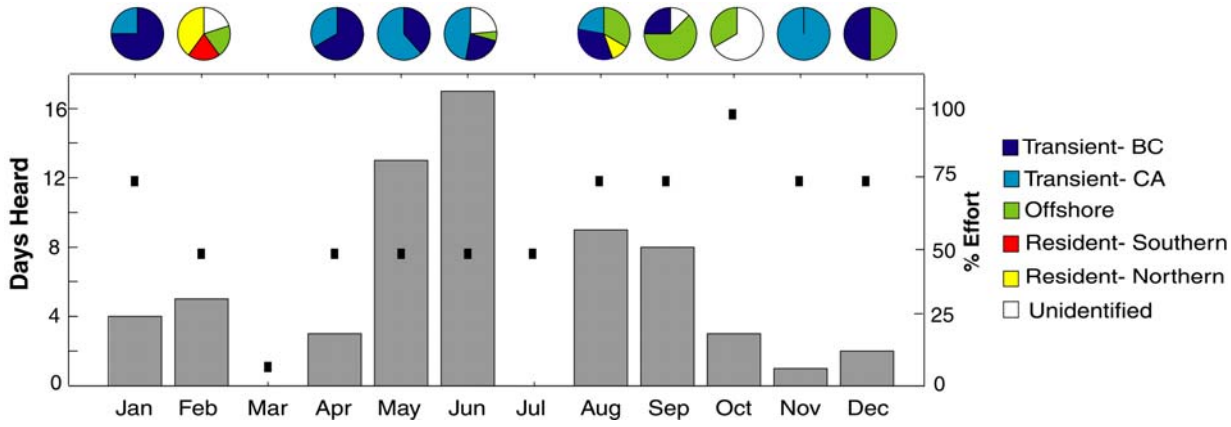

Figure 10. Seasonal occurrence through July 2007 of killer whale ecotypes recorded at both acoustic monitoring sites. Gray bars represent the average number of days that killer whales were heard per month from 2004 through 2007 and black dots represent the average number of days of effort per month in each year. The pie charts above the panel indicate the relative occurrence of each killer whale ecotype in each month. Killer whale calls detected from July 2007 through June 2008 have not yet been identified to ecotype and are not included in this figure.

California and British Columbia transient killer whale dialects of the West Coast Transient killer whale community have been recorded, occasionally within mixed groups. The seasonal and relative occurrence of the discrete calls of each killer whale ecotype is shown above for acoustic data collected through July 2007, with the grey bars of the histogram representing overall killer whale occurrence monthly, and the colored pie charts indicating the relative abundance occurrence of each ecotype. There were over 20 occurrences of killer whale calls within the July 2007-June 2008 data set. Identification of these calls to ecotype is ongoing.

There have been six sightings of killer whale groups during visual surveys (Figure 2). All but one of these encounters was of transient killer whales, with the remaining sighting being Southern Residents in April 2006 near Grays Harbor. Sightings of transient killer whales were spread across the study area and occurred throughout the year. When killer whales were seen, as many whales as possible were photographed for later identification in order to confirm their population identity and individual life history.

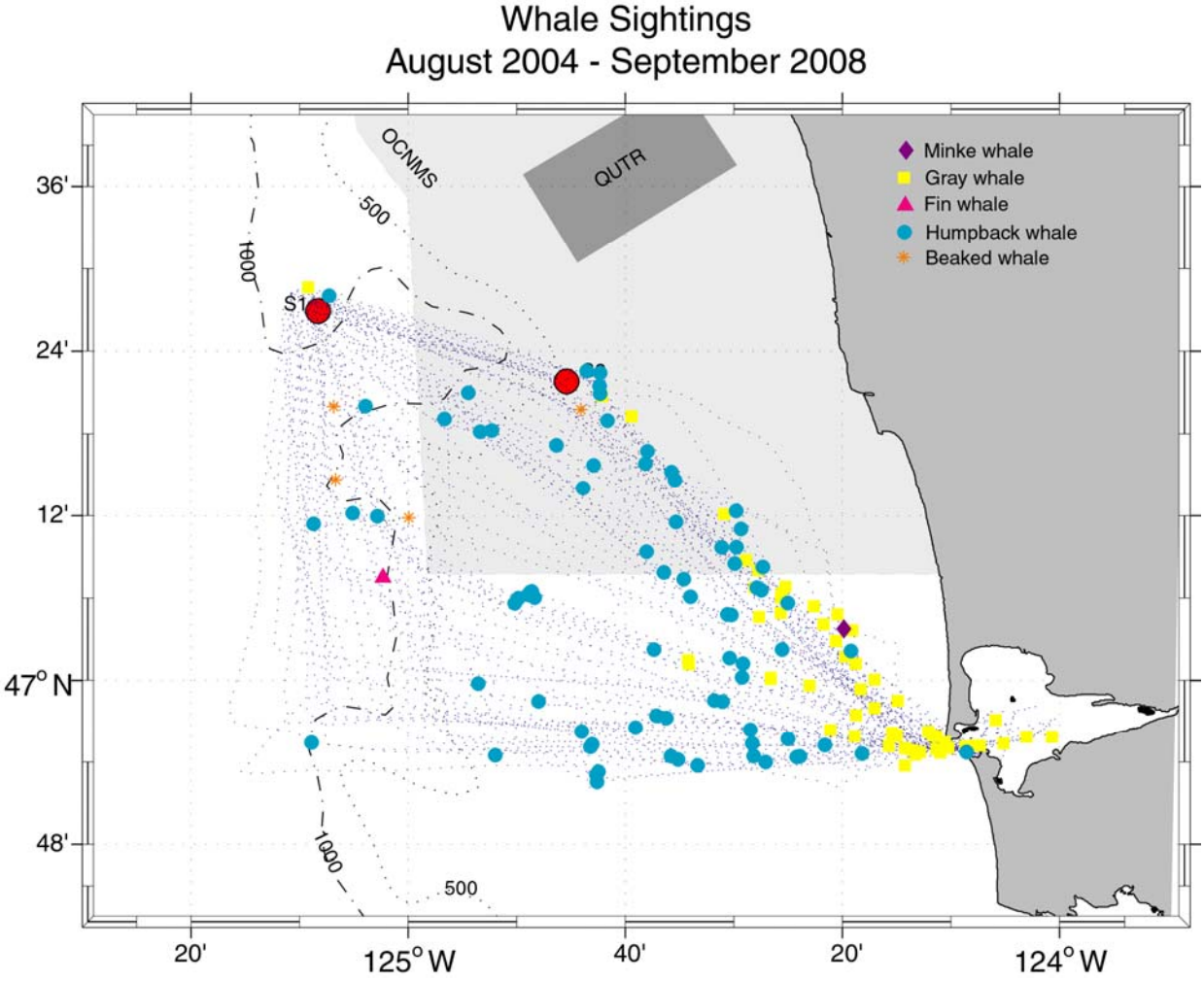

Figure 11. Large whale sightings during visual surveys since August 2004. Humpback whales are the most common large whale, though gray whales are also common in winter and spring. Beaked whales have been seen on three occasions along the shelf edge.

Beaked Whales

Upsweep clicks were detected twice, once in January and once in April 2008. Both bouts of upsweep clicks consisted of individual pulses 220 μs in duration with -10 dB bandwidth from 43 to 75 kHz, somewhat higher than clicks previously reported for either Cuvier's or Blainville's beaked whales. Although these clicks were likely produced by beaked whales, the species identity of the producer has not yet been determined. Cuvier's beaked whales have been observed once during visual surveys (Figure 11), with that sighting occurring near the offshore acoustic recording location prior to high-frequency data collection there. Two additional sightings of unidentified beaked whales have also occurred during visual surveys.

Sperm Whales

Although never seen during visual surveys conducted during this study, sperm whales are quite common within the acoustic dataset. Sperm whales are heard in all months of the year at the offshore site, with a peak in occurrence from April to August, and are heard from April to November, with one detection in January, at the inshore location (Figure 12). Not surprisingly, the detection rate at the inshore site is much lower than that at the offshore site, likely due to the shallow habitat surrounding the inshore site. Although there are periods of loud clicking at the inshore site suggesting that sperm whales are swimming nearby, most detections there of sperm whales are faint, potentially suggesting that the whales are offshore.

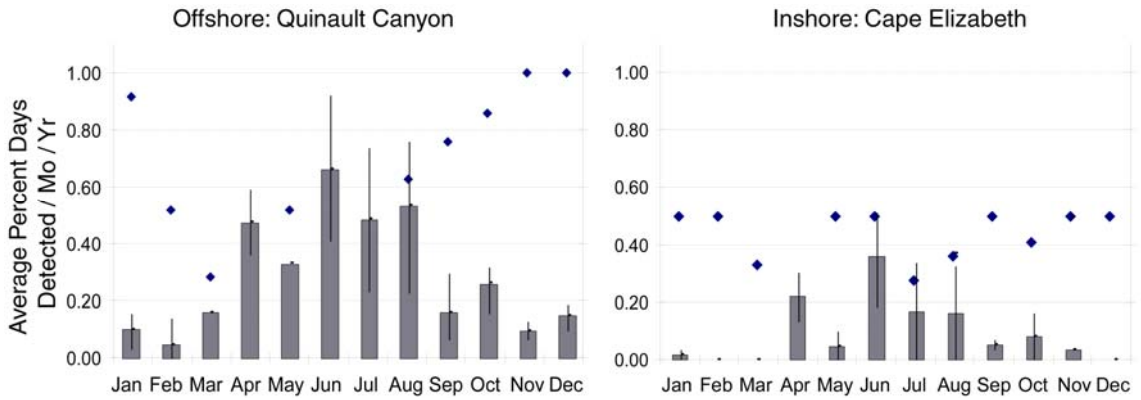

Figure 12. Average seasonal occurrence of sperm whale clicks at the offshore and inshore acoustic monitoring locations. The gray bars represent the mean detection rate across all years of acoustic monitoring effort and error bars indicate minimum and maximum acoustic detection rates. Blue diamonds indicate the average acoustic monitoring effort for each month, with 100% (shown as 1.00 on the y-axis) effort indicating monitoring all month over all four years of data collection.

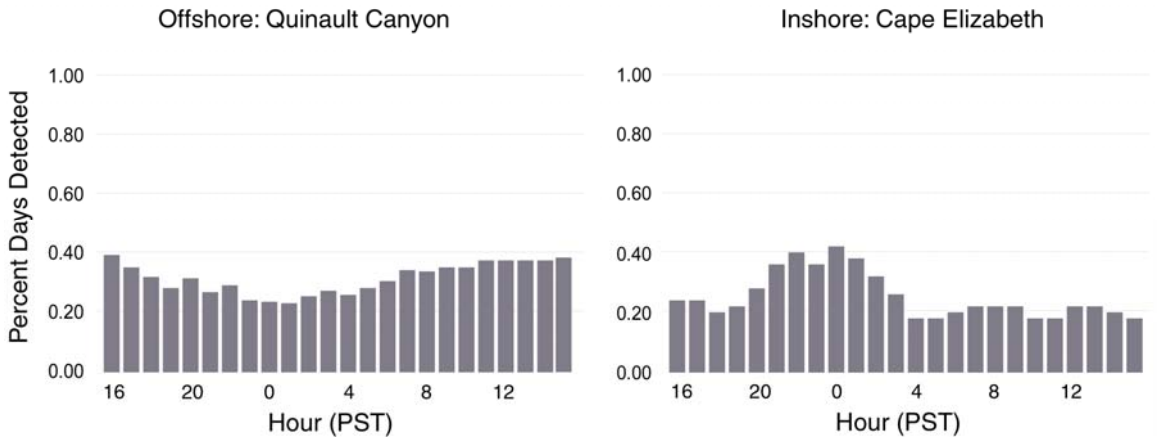

Figure 13. Occurrence of sperm whale clicks by hour of the day. The daily pattern of sperm whale clicks is significant at both sites, though barely so at the offshore site.

Although slight, there is a significant diel pattern in the occurrence of sperm whale clicks at each of the acoustic monitoring locations (Figure 13). At the offshore site, clicks are heard more commonly during the day (Kruskal Wallis: χ^2=14.48, df=223, p=0.0001), while they are more common at night at the inshore location (Kruskal Wallis: χ^2=7.16, df=51, p=0.0074). This difference in the day versus nighttime activity of sperm whales in these locations could be an indicator of diel movements up and down the slope in search of prey.

Humpback Whales

Sightings of humpback whales occurred widely throughout the survey area, but were most common in waters on the continental shelf deeper than 50 m. The high frequency of humpback whale sightings during the surveys was somewhat surprising and may represent a relatively recent development as humpback whales recover from commercial whaling. Close to 2,000 humpback whales were killed by up to four catcher boats operating out of Bay City in Grays Harbor generally in summer and fall between 1911 and 1925 (Scheffer and Slipp 1948). Sightings of humpback whales were rare offshore of Grays Harbor in the 1960s and 1970s. No sightings of humpback whales were reported between 1966 and 1976 from 47 day trips (similar to those we conducted) going offshore out of Grays Harbor and covering the continental shelf, slope, and sometimes deeper waters (Wahl 1977). During year-round aerial surveys in 1989 and 1990 off Oregon and Washington, sightings of humpback whales occurred primarily in May to September, but only a couple of sightings were reported from the area offshore of Grays Harbor to Quinault Canyon (Greene *et al.* 1992). From annual summer surveys from 1995 to 2002, Calambokidis *et al.* (2004a) reported frequent occurrences of humpback whales off northern Washington. Most of these sightings were concentrated near the Canadian border, and relatively few were sighted in the Quinault Canyon area and the portion of their survey area that overlapped with the area covered in this survey. While humpback whales are generally thought to occur primarily on low latitude breeding grounds in winter, sightings in other feeding areas in winter have been reported, including off northern Washington (Shelden *et al.* 2000).

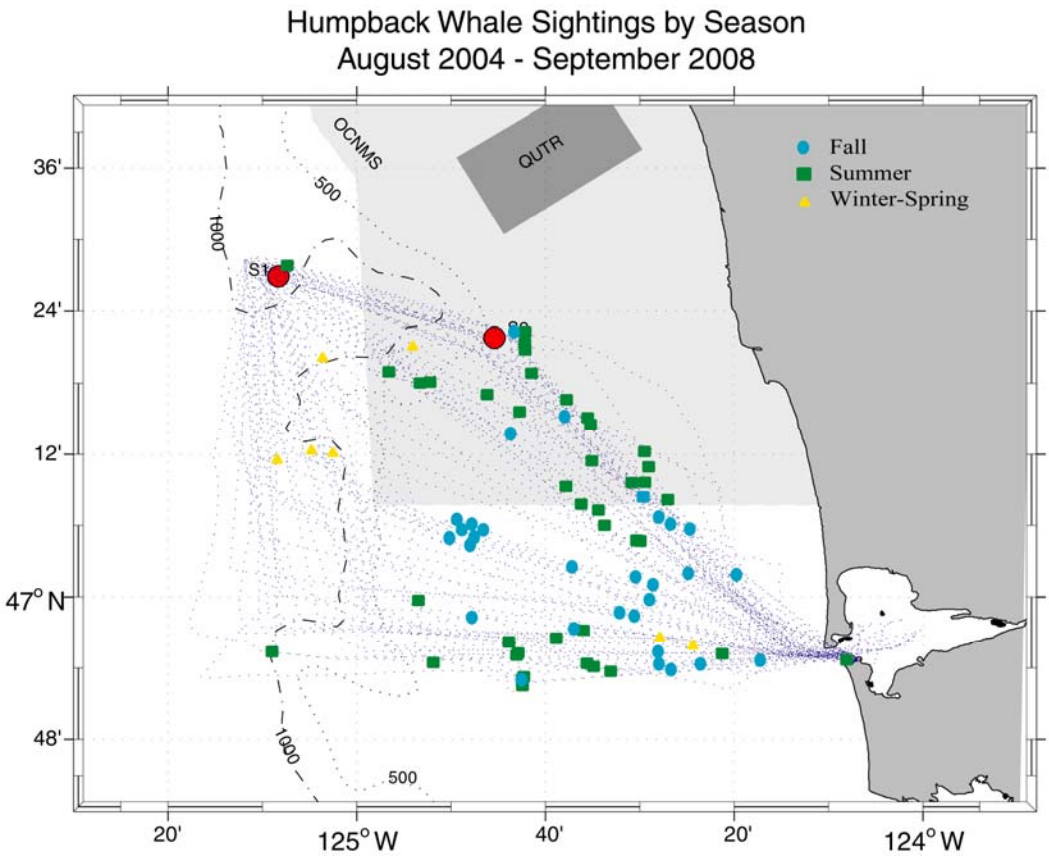

Figure 14. Seasonal distribution of humpback whale sightings over all surveys. Humpbacks were seen further offshore in winter and spring than during the remainder of year. This is also the period of lowest humpback occurrence in this region.

Sightings of humpback whales varied significantly throughout the year in distance offshore (ANOVA: $F=3.2$, $p=0.027$) and water depth ($F=29.4$, $p=0.000$), with winter-spring sightings being farther from shore and in deeper water compared to those from summer and fall. There was not a significant difference by season in distance from the shelf edge ($p>0.05$). One potential implication of this shift is that humpback whale sightings in winter were generally much closer to the offshore HARP site than in other seasons, potentially increasing the probability of detecting this species at the offshore HARP site. The mean of the distance of the humpback visual sightings to the offshore HARP did vary significantly by season (ANOVA: $F=4.5$, $p=0.006$), averaging less than 10 nmi in winter compared to more than 25 nmi in all other seasons. Mean distance to the inshore HARP did not vary significantly by season ($p>0.05$).

Humpback whale song or song components were commonly detected from later summer through early winter within the acoustic data at both the inshore and offshore monitoring locations (Figure 15). The peak in humpback acoustic detections occurred in October at both sites. While there was little humpback acoustic activity through the winter and spring, there were occasional detections of calls, especially from February through May at the inshore site.

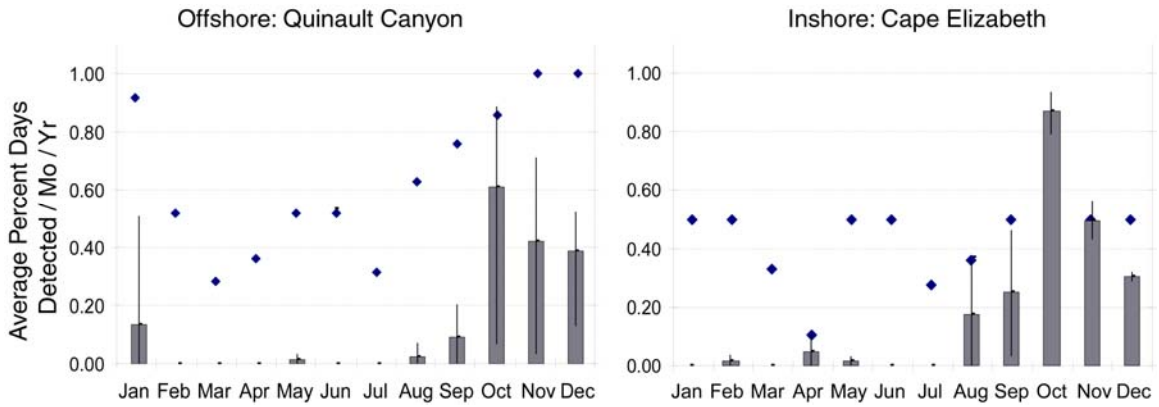

Figure 15. Average seasonal occurrence of humpback whale sounds (song and non-song) at the offshore and inshore acoustic monitoring locations. The gray bars represent the mean detection rate across all years of acoustic monitoring effort and error bars indicate minimum and maximum acoustic detection rates. Blue diamonds indicate the average acoustic monitoring effort for each month, with 100% (shown as 1.00 on the y-axis) effort indicating monitoring all month over all four years of data collection.

Humpback whale acoustic activity varied significantly throughout the day, with nearly 50% of nighttime hours containing song or song segments relative to a daytime low of near 1% of hours containing humpback sounds (Figure 16). These differences were statistically significant (Kruskal Wallis: inshore, χ^2=12.58, df=120, p=0.0004; offshore, χ^2=17.35, df=132, p<0.0001). The relative hourly occurrence of humpback sounds did vary between the sites, with a sharp onset of increased activity at both sites around 1800, but with a steady decline toward dawn at the offshore location versus a prolonged elevation of activity lasting until dawn at the inshore site. The level of daytime activity was also markedly lower offshore versus inshore.

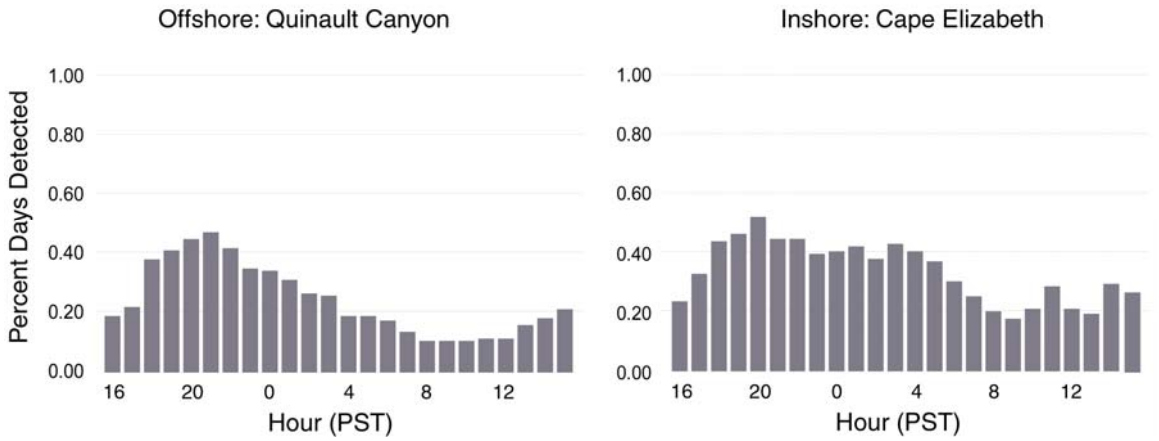

Figure 16. Occurrence of humpback whale sounds by hour of the day. Humpback whales sounds are significantly more common at night than during the day at both locations.

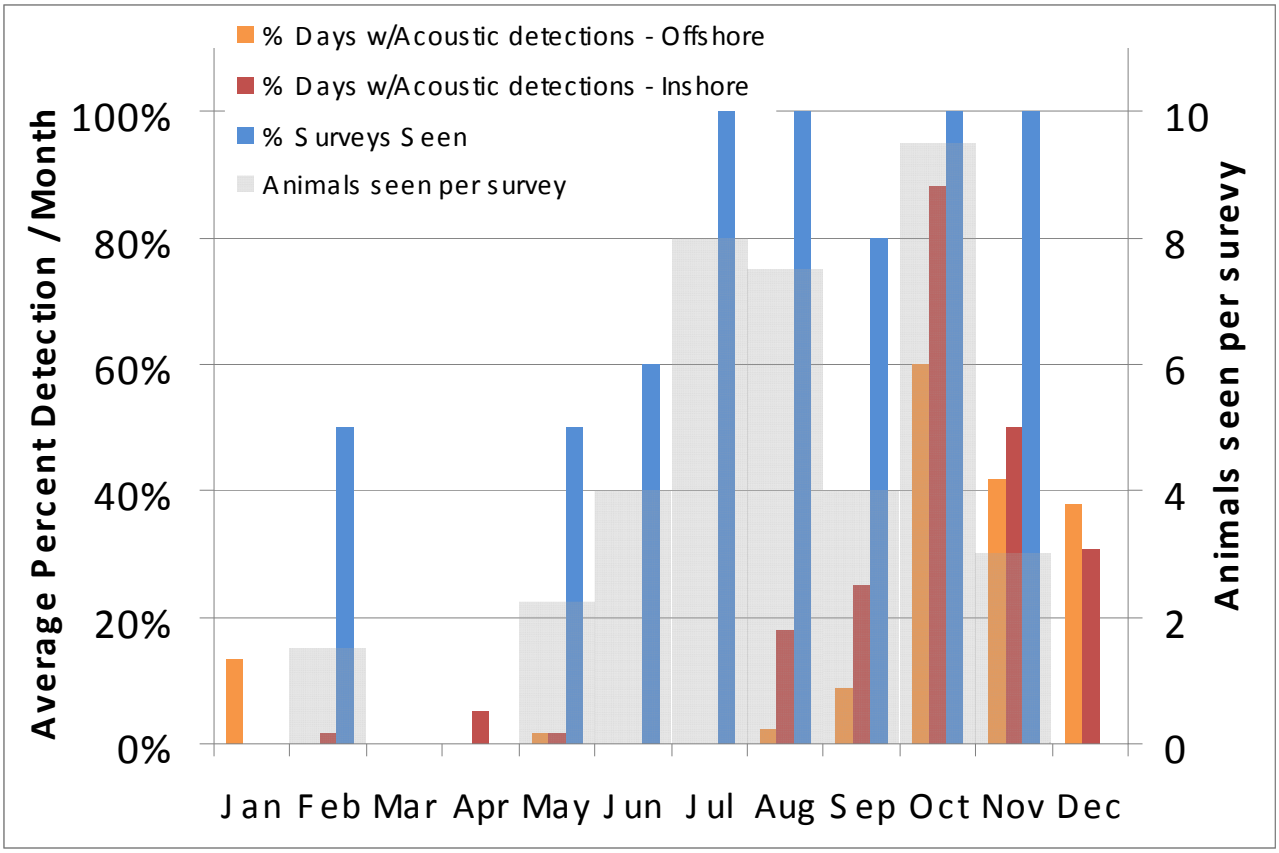

Figure 17. Seasonal occurrence of humpback whales based on visual survey sightings and acoustic detections from August 2004 through September 2008. As an indicator of relative density, the average number of animals seen per survey per month is compared to the percent of surveys per month in which humpback whales are seen.

The correlation between acoustic and visual detections of humpback whales by month was fairly weak. Acoustic detections as measured by percent of days monitored each month with acoustic detections showed a strong seasonal pattern, with highest detections in October to November and lowest in January to July. This contrasts and only slightly overlaps with the peak in visual detections in May to November. This may reflect in part the strong seasonal variation in singing behavior of humpback whales, that primarily sing on the winter breeding grounds but which are also known to vocalize on the feeding grounds, although most heavily nearer the time of winter breeding season (see, for example, Clark and Clapham 2004).

A total of 68 unique humpback whales were identified in the study area from 2004 through 2007. (Identifications from 2008 have not yet been compared.) Only two individuals were re-sighted within the study area, both within the same year: one seen in both June and October 2006 and the other in both June and September 2007. These results suggest that, while some animals do stay in the study area for longer periods within the season, many animals are using a broader feeding area than just our study area.

Matches of these humpback whale identifications to those in other areas within Cascadia Research Collective's catalog provide an important insight into the winter breeding area for these animals and the other areas that humpbacks go to feed. A total of 21 of the 68 whales identified

in these surveys has also been seen in northern Washington, while much smaller numbers have been seen in other feeding areas, including California, Oregon, and British Columbia (Table 4). This finding contradicts an earlier conclusion that humpback whales in southern Washington were more likely part of the feeding aggregation off California and Oregon than the one off northern Washington and southern British Columbia (Calambokidis *et al.* 2004a). The Structure of Populations, Levels of Abundance and Status of Humpback whales in the North Pacific (SPLASH; Calambokidis *et al.* 2008) study utilized some of the identifications collected as a part of this study in 2004 and 2005. These photographs were compared to those from all other areas of the North Pacific. The matches indicate that humpback whales from the Washington-southern British Columbia area are a relatively distinct feeding aggregation numbering 200-400 whales with a very diverse set of winter breeding areas, including all three subareas of Mexico, Central America, and Hawaii (Calambokidis *et al.* 2008). The one good identification of a humpback whale obtained in the current study in winter (25 February 2005) revealed that this was an individual that had been seen in previous years in the summer off Oregon and Washington.

Table 4. Matches of individuals between the study areas and other feeding areas. (This does not include SPLASH results.)

Region	# of individuals
California	8
Oregon	3
N Washington	21
British Columbia	1

Gray Whales

There were seasonal differences in the distribution and habitat of gray whales. These were examined corresponding to three time period matching stages in the life cycle of the gray whale:

1) Winter (December and January): corresponding to the timing of the southbound migration of gray whales from their primary feeding ground in Alaska to their breeding grounds in Mexico.
2) Spring (February to April): corresponding to the timing of the northbound migration past Washington as the main population heads back to Alaskan waters.
3) Summer-Fall (May to October): when the gray whales that are present are primarily those that feed in Pacific Northwest waters, sometimes referred to as Seasonal Residents or the Pacific Coast Feeding Aggregation.

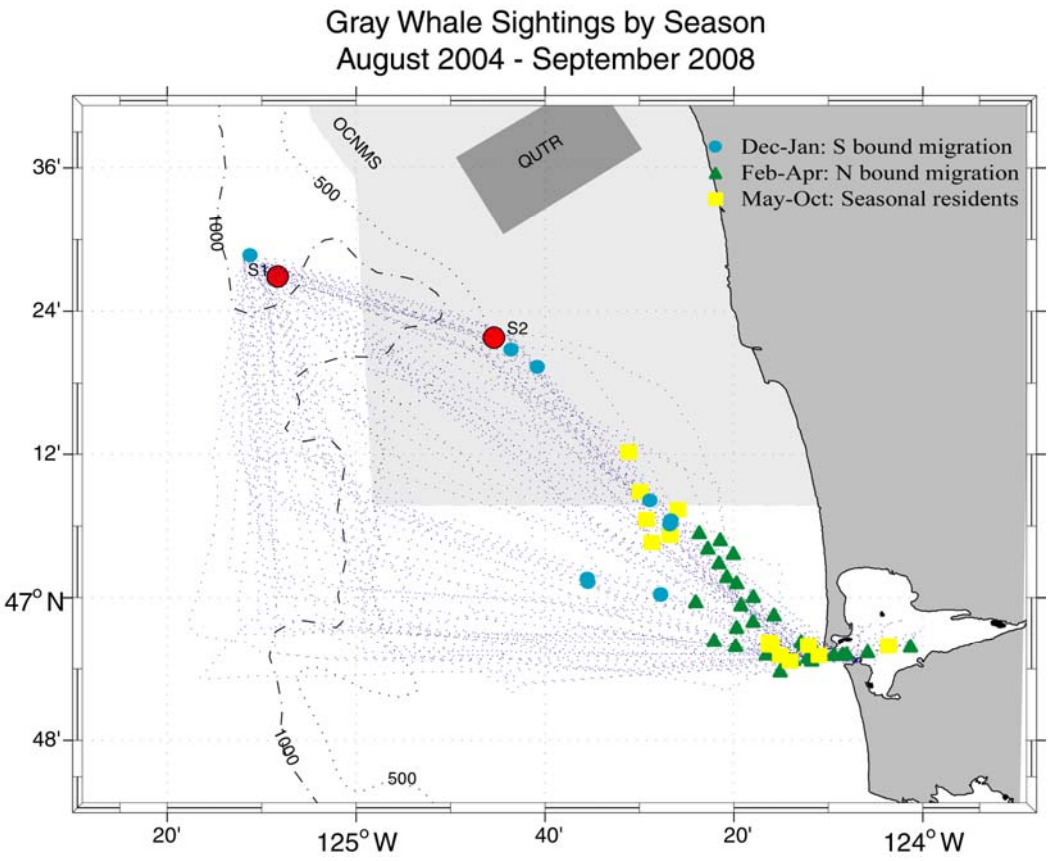

Figure 18. Seasonal distribution of gray whale sightings over all surveys. Gray whales were seen further offshore during the winter southbound migration than during the remainder of the year. Some gray whales also appear to remain in this region during summer and fall, when much of the greater eastern North Pacific population is found in the Bering and northern seas.

There were clear differences in the distribution of sightings during these periods, with highly significant differences (ANOVA) among these three time periods in distance from shore ($F=24.8$, $p=0.000$), distance from shelf break ($F=26.1$, $p=0.000$) and water depth ($F=7.3$, $p=0.002$). During the south-bound migration gray whales were sighted primarily offshore, including one sighting right at the offshore HARP (Figure 18). The average distance from shore (29 km) and water depth (126 m) for sightings in this period were more than twice that of the other two time periods. Sightings of gray whales during spring tended to be close to shore, mostly on a north-south distribution averaging about 10 km offshore. Sightings of gray whales during the summer and fall were clustered in two areas: in and around the entrance to Grays Harbor and then clustered in an offshore area 20-25 km offshore in about 60 m of water.

The offshore sightings of gray whales during the summer represented a surprising finding, given the typical pattern of gray whales feeding in the Pacific Northwest close to shore in shallow waters. These offshore sightings were all made between 8 June and 1 September 2007. While they were grouped into just 6 sightings, they totaled 42 whales, since each sighting represented a concentration of up to 14 whales in one area.

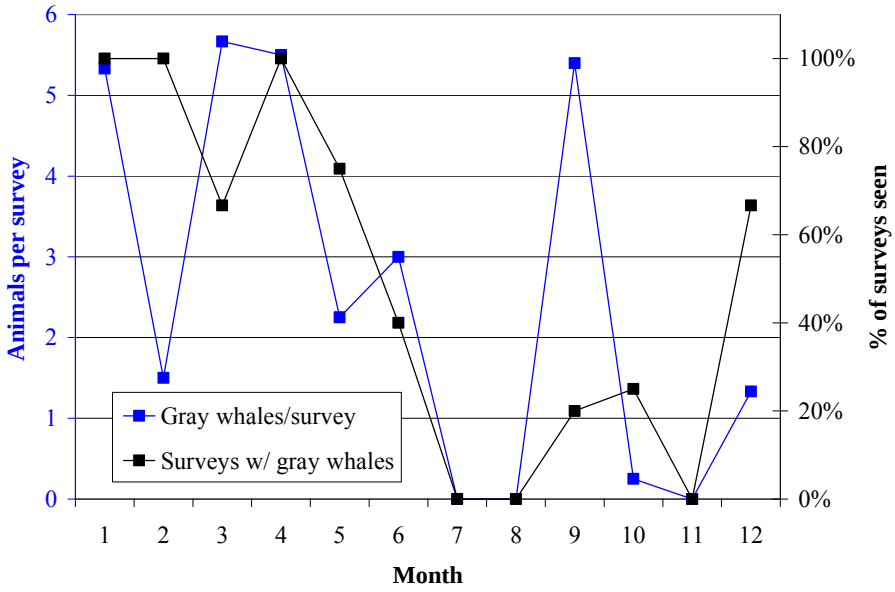

Figure 19. Seasonal occurrence of gray whales based on visual survey sightings from August 2004 through September 2008. As an indicator of relative density, the average number of animals seen per survey per month is compared to the percent of surveys per month in which gray whales were seen.

During the course of the surveys, individual identifications were made of 49 gray whales from 2004 to 2007. (Identifications from 2008 have not been matched yet.) Seven of these whales were seen on multiple surveys during the course of this study. Comparison of the identifications to the larger collection of identifications of "seasonal resident" gray whales that spend the spring through fall feeding in Pacific Northwest waters (see Calambokidis *et al.* 2002) indicated 33 of the 46 (71%) had been identified both in other areas of the Pacific Northwest and in other years from when they were seen on these surveys. Of the 13 whales that had not been seen in other areas, 10 were identified on the current surveys during the winter and spring, representing the time period when gray whales are on migration to and from their primary feeding area in Alaska.

Table 5. Gray whale identifications by year.

Year	IDs
2004	1
2005	3
2006	13
2007	37
Grand Total	54
Unique	49

Identifications from the concentration of gray whales found feeding almost 10 nmi offshore in summer and fall 2007 revealed this unusual offshore feeding concentration consisted almost completely of animals known as "seasonal residents" in other parts of the Pacific Northwest. All but one of the 28 individuals had been identified on other feeding areas in the Pacific Northwest.

Although some gray whale sound types have been characterized, no gray whale sounds have yet been detected within the acoustic datasets at either location. Gray whales are thought to be quiet during the northbound migration, presumably to avoid detection by killer whales, but are known to make sound on both the breeding areas and other feeding areas. Examination of the acoustic data for gray whale sounds continues, specifically during the period of gray whale feeding activity near the inshore HARP location in summer.

Pinnipeds

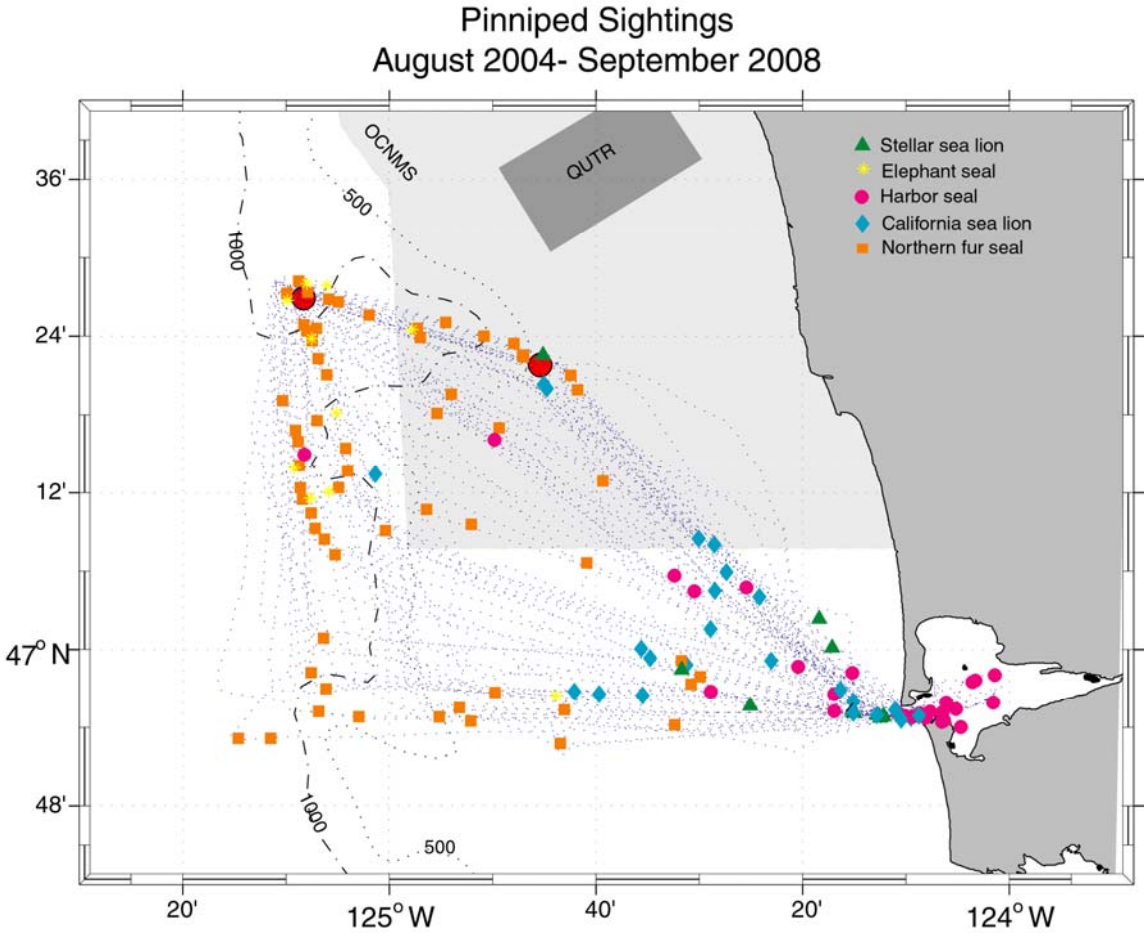

Figure 20. Pinniped sightings during visual surveys since August 2004. Northern fur seals are the most commonly observed pinniped.

Among the five pinniped species sighted during visual surveys, fur seals (thought to be northern fur seals, but which could include some Guadalupe fur seals) were the most common, although all species were seen at least 10 times. There were clear habitat differences in their distribution (Figure 20) and in their key habitat parameters (Table 3). Steller sea lion distance from the shelf edge varied significantly by season ($F=5.2$, $p=0.033$) as did water depth where the Steller sea lions were seen ($F=5.4$, $p=0.03$), primarily due to sightings close to the shelf edge and in deeper water in summer. Northern fur seals and elephant seals were both seen farthest offshore (>50 km) and in offshore deep water (> 500 m), while the other three species were sighted much closer to shore (< 25 km) and in water averaging less than 100 m. Even though harbor seals were primarily seen in coastal waters, there were a few sightings, especially in spring, in offshore waters out to 64 km, suggesting that harbor seals can range widely. These overall findings are consistent with the known feeding habitats of these species. Northern fur seals are known to feed in pelagic waters, elephant seals are known as deep diving specialists, and the other species are known to primarily feed in more coastal waters.

Although most species were seen year-round, there were some seasonal patterns worth noting in pinniped occurrence. California sea lions were seen primarily in spring and fall, coinciding with the period when males are known to migrate north from breeding areas in California and Mexico into Pacific Northwest waters. Harbor seals were seen in all seasons, although sightings were most common in spring during the pupping season. Northern fur seals were seen throughout the year, though large numbers of sightings occurred in summer months when most breeding animals are thought to have migrated to their breeding locations in the Pribilof Islands and San Miguel Island. All but one elephant seal sighting was made between January and June.

Publications and Presentations in FY08

Oleson, E.M., S.M. Wiggins, and J.A. Hildebrand. 2007. The impact of non-continuous recording on cetacean acoustic detection probability. *3rd Workshop on Detection and Classification of Marine Mammals using Passive Acoustics.* **24-26 July 2007**. Boston, MA

Calambokidis, J. Update on status of marine mammals in the Olympic Coast National Marine Sanctuary. 2008. *Presentation to the OCNMS Scientific Advisory Committee*. **30 May 2008**. Ocean Shores, WA.

Oleson, E.M., M.S. Soldevilla, J. Calambokidis, C. Collins, S.M. Wiggins, and J. A. Hildebrand. 2008. Distribution patterns of delphinids in the California Current ecosystem observed through acoustic monitoring of species-specific echolocation clicks. *Acoustics '08 Paris*. **29 June-4 July 2008**. Paris, France.

Several manuscripts are being prepared for submission to scientific journals. Two articles on the seasonal occurrence and distribution of Pacific white-sided and other delphinids in the Washington region and greater California Current are near completion, as well as an article on the relative occurrence of killer whales off the outer Washington coast detailed from the acoustic detection data. A fourth manuscript comparing the visual versus acoustic detection rates of humpback whales is also being prepared. Several other manuscripts are planned for the next year.

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Calambokidis, J. and J. Barlow. 2004. Abundance of blue and humpback whales in the eastern North Pacific estimated by capture-recapture and line-transect methods. *Mar. Mammal Sci.* **20**: 63-85.

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Calambokidis, J., E.A. Falcone, T.J. Quinn, A.M. Burdin, P.J. Clapham, J.K.B. Ford, C.M. Gabriele, R. LeDuc, D. Mattila, L. Rojas-Bracho, J.M. Straley, B.L. Taylor, J. Urbán R., D. Weller, B.H. Witteveen, M. Yamaguchi, A. Bendlin, D. Camacho, K. Flynn, A. Havron, J. Huggins, N. Maloney, J. Barlow, and P.R. Wade. 2008. SPLASH: Structure of Populations, Levels of Abundance and Status of Humpback whales in the North Pacific. *Final report for Contract AB133F-03-RP-00078*. *Prepared by:* Cascadia Research Collective *for* U.S. Dept of Commerce. May 2008.

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Appendix.

Table I. Visual survey effort from August 2004 through September 2008.

Date	Beg.	End	Hrs.	nmi
16-Aug-04	9:01	18:30	9.5	130
21-Sep-04	8:25	16:51	8.4	112
11-Oct-04	7:32	17:28	9.9	122
27-Oct-04	11:26	13:31	2.1	11
9-Nov-04	7:47	13:41	5.9	33
23-Dec-04	8:00	17:05	9.1	121
28-Dec-04	7:50	16:45	8.9	113
17-Feb-05	7:25	16:59	9.6	119
25-Feb-05	7:49	16:54	9.1	122
24-Mar-05	7:15	17:23	10.1	133
26-Apr-05	7:00	18:45	11.7	133
26-May-05	6:38	18:52	12.2	130
3-Jun-05	9:34	19:14	9.7	100
29-Jun-05	7:13	15:35	8.4	122
29-Jul-05	7:12	19:18	12.1	94
31-Aug-05	7:36	18:57	11.3	132
28-Sep-05	8:37	19:20	10.7	127
20-Oct-05	8:31	16:54	8.4	91
18-Nov-05	7:50	17:50	10.0	127
8-Dec-05	7:58	16:53	8.9	126
12-Mar-06	8:04	16:40	8.6	132
20-Mar-06	7:27	17:28	10.0	131
05-Apr-06	8:00	18:18	10.3	123
21-May-06	6:52	16:15	9.4	94
12-Jun-06	10:10	19:08	9.0	140
30-Jul-06	7:46	19:23	11.6	139
8-Sep-06	9:32	17:55	8.4	117
10-Oct-06	7:57	17:28	9.5	143
12-Jan-07	9:11	15:56	6.7	124
31-Jan-07	8:15	16:11	7.9	136
3-Apr-07	7:42	18:42	11.0	141
16-May-07	9:06	18:18	9.2	149
8-Jun-07	7:30	18:46	11.3	148
26-Jun-07	6:48	18:31	11.7	148
30-Aug-07	8:00	19:10	11.2	147
1-Sep-07	8:30	20:15	11.8	144
31-Oct-07	7:40	17:31	9.9	146
23-Jan-08	6:30	16:33	10.1	111
5-Mar-08	11:15	13:35	2.3	30
1-Apr-08	8:31	16:38	8.1	147
29-May-08	7:39	18:00	10.4	134
2-Jul-08	8:46	18:44	10.0	158
10-Aug-08	7:50	19:40	11.8	133
2-Sep-08	7:55	16:00	8.1	140
Totals			414.3	5353

Table II. Sightings of cetaceans during each survey conducted from August 2004 through September 2008. (S = number of sightings, An = number of animals)

Date	Humpback Whale		Gray Whale		Minke Whale		Fin Whale		Killer Whale		UnID Whale		UnID Beaked Whale		Cuvier's Beaked Whale		N. Right Whale Dolphin		Pac. White-Sided Dolphin		Risso's Dolphin		Harbor Porpoise		Dall's Porpoise	
	# S	# An	# S	# An	# S	# An	# S	# An	# S	# An	# S	# An	# S	# An	# S	# An	# S	# An	# S	# An	# S	# An	# S	# An	# S	# An
8/16/04	2	5																					5	12		
10/11/04	1	3	1	1																			1	2	2	12
11/09/04					1	1																	2	2	1	1
12/23/04			2	4																			3	7	1	9
12/28/04			1	1																			1	1	1	10
2/17/05			1	1									1	2									4	7		
2/25/05	2	3	1	2																			10	18	3	14
3/24/05			7	9																			3	4		
4/26/05			2	2							1	1											3	4	1	5
5/26/05	3	5	1	1																						
6/03/05	1	3							1	7							1	4	4	246					1	5
6/29/05																			7	242			5	14		
7/29/05	9	16															1	5	1	400			1	3		
8/31/05	6	12																					5	12	1	3
9/28/05	6	10																					5	12		
10/20/05	8	19							1	1													1	4	2	20
11/18/05	1	3																								
12/08/05							1	2	1	13			1	1									1	3		
3/12/06																							2	4	4	10
3/20/06			4	8																			1	3		
4/05/06			3	5					1	11													3	8		
5/21/06			6	6							1	1											2	2	1	5
6/12/06															1	3							2	6	1	8
7/30/06	6	7																			2	38	5	8	2	8
9/08/06	3	5																	2	306			5	20	3	9
10/10/06	5	8																							2	11
1/12/07			4	10																			4	5		
1/31/07			1	3																						

Date	Humpback Whale		Gray Whale		Minke Whale		Fin Whale		Killer Whale		UnID Whale		UnID Beaked Whale		Cuvier's Beaked Whale		N. Right Whale Dolphin		Pac. White-Sided Dolphin		Risso's Dolphin		Harbor Porpoise		Dall's Porpoise	
	# S	# An	# S	# An	# S	# An	# S	# An	# S	# An	# S	# An	# S	# An	# S	# An	# S	# An	# S	# An	# S	# An	# S	# An	# S	# An
4/03/07			6	9					1	13													1	2		
5/16/07																										
6/08/07	7	11	1	12																					3	8
6/26/07	4	6	2	3															2	52			2	3	2	9
8/30/07	3	8															1	50	1	400			1	1	5	25
9/01/07	2	4	3	27																			1	3		
10/31/07	5	8																					9	24	2	6
1/23/08			2	3					1	6													1	2		
3/05/08			1	1																			2	2		
4/01/08			5	6																			1	2		
5/29/08	2	4	1	2																			12	21	2	14
7/02/08	1	1																	1	35			4	14	2	5
8/10/08	2	5																					3	4	1	8
9/02/08	1	1																					3	5	1	1
Total	80	147	55	116	1	1	1	2	6	51	2	2	2	3	1	3	3	59	18	1681	2	38	114	244	44	206

Table III. Sightings of pinnipeds during each survey conducted from August 2004 through September 2008. (S = number of sightings, An = number of animals).

	California Sea Lion		Steller Sea Lion		Northern Fur Seal		Harbor Seal		Northern Elephant Seal		UnID Pinniped	
Date	# S	# An	# S	# An	# S	# An	# S	# An	# S	# An	# S	# An
8/16/04					4	4						
10/11/04	2	2										
11/09/04							1	1				
12/23/04					3	3	1	1				
12/28/04					1	6						
2/17/05	3	4			1	1						
2/25/05	1	1	1	1	2	2	3	3				
3/24/05	3	4	1	1			1	1				
4/26/05					1	1	6	699				
5/26/05	1	10			5	80						
6/03/05					7	9			1	1		
6/29/05	1	1			5	7	1	1			2	2
7/29/05												
8/31/05												
9/28/05	1	1	1	1	1	1	1	1			1	3
10/20/05			2	8	2	2	1	1				
11/18/05	2	3										
12/08/05	1	1										
3/12/06	1	2			1	1						
3/20/06			1	1			5	7				
4/05/06												
5/21/06	1	1			1	1			3	3		
6/12/06					3	3						
7/30/06							1	1				
9/08/06												
10/10/06	1	2										
1/12/07					2	4			1	1		
1/31/07					1	1			1	1		
4/03/07					1	1	1	1				
5/16/07					1	1	1	1	1	1		
6/08/07	1	1			9	14			1	1		
6/26/07	1	1	1	1	2	8						
8/30/07					4	4						
9/01/07					1	1						
10/31/07	4	152	1	30			1	1				
1/23/08	1	1					1	1				
3/05/08												
4/01/08									1	1		
5/29/08			3	13	2	2	1	1				
7/02/08												
8/10/08												
9/02/08							1	2	1	1		
Total	25	187	11	56	60	157	27	723	10	10	3	5

Initial Distribution List

1.	Defense Technical Information Center 8725 John J. Kingman Rd., STE 0944 Ft. Belvoir, VA 22060-6218	2
2.	Dudley Knox Library, Code 013 Naval Postgraduate School Monterey, CA 93943-5100	2
3.	Erin Oleson National Marine Fisheries Service Pacific Islands Fisheries Science Center Honolulu, HI	1
4.	John Hildebrand Scripps Institution of Oceanography University of California La Jolla, CA	1
5.	John Calambokidis Cascadia Research Collective Olympia, WA	1
6.	Greg Schorr Cascadia Research Collective Olympia, WA	1
7.	Erin Falcone Cascadia Research Collective Olympia, WA	1
8.	Ching-Sang Chiu Naval Postgraduate School Monterey, CA	1
9.	Curtis A. Collins Naval Postgraduate School Monterey, CA	1
10.	Thomas A. Rago Naval Postgraduate School Monterey, CA	1
11.	Tetyana Margolina Naval Postgraduate School Monterey, CA	1

12.	Chris Miller Naval Postgraduate School Monterey, CA	1
13.	John Joseph Naval Postgraduate School Monterey, CA	1
14.	Katherine Whitaker Pacific Grove, CA	1
15.	Frank Stone CNO(N45) Washington, D.C.	1
16.	Jay Barlow Southwest Fisheries Science Center, NOAA La Jolla, CA	1
17.	CAPT Ernie Young, USN (Ret.) CNO(N45) Washington, D.C.	1
18.	Dale Liechty CNO(N45) Washington, D.C.	1
19.	Dave Mellinger Oregon State University Newport, OR	1
20.	Kate Stafford Applied Physics Laboratory University of Washington Seattle, CA	1
21.	Sue Moore NOAA at Applied Physics Laboratory University of Washington Seattle, WA	1
22.	Petr Krysl University of California La Jolla, CA	1
23.	Mark McDonald Whale Acoustics Bellvue, CO	1

24.	Ted Cranford Quantitative Morphology Consulting, Inc. AND San Diego State University San Diego, CA	1
25.	Monique Fargues Naval Postgraduate School Monterey, CA	1
26.	Mary Ann Daher Woods Hole Oceanographic Institution Woods Hole, MA	1
27.	Heidi Nevitt NAS North Island San Diego, CA	1
28.	Rebecca Stone Naval Postgraduate School Monterey, CA	1
29.	Melissa Hock Scripps Institution of Oceanography University of California La Jolla, CA	1
30.	Sean M. Wiggins Scripps Institution of Oceanography University of California La Jolla, CA	1
31.	E. Elizabeth Henderson Scripps Institution of Oceanography University of California La Jolla, CA	1
32.	Gregory S. Campbell Scripps Institution of Oceanography University of California La Jolla, CA	1
33.	Marie A. Roch San Diego State University San Diego, CA	1

34.	Anne Douglas Cascadia Research Collective Olympia, WA	1
35.	Julie Rivers Naval Facilities Engineering Command, Pacific Pearl Harbor, HI	1
36.	Jenny Marshall Naval Facilities Engineering Command San Diego, CA	1
37.	Chip Johnson COMPACFLT Pearl Harbor, HI	1
38.	CDR Len Remias U.S. Pacific Fleet Pearl Harbor, HI	1
39.	LCDR Robert S. Thompson U.S. Pacific Fleet Pearl Harbor, HI	1
40.	Jene J. Nissen U. S. Fleet Forces Command Norfolk, VA	1
41.	W. David Noble U. S. Fleet Forces Command Norfolk, VA	1
42.	David T. MacDuffee U. S. Fleet Forces Command Norfolk, VA	1
43.	Keith A. Jenkins Naval Facilities Engineering Command, Atlantic Norfolk, VA	1
44.	Joel T. Bell Naval Facilities Engineering Command, Atlantic Norfolk, VA	1
45.	Mandy L. Shoemaker Naval Facilities Engineering Command, Atlantic Norfolk, VA	1

46.	Anurag Kumar Naval Facilities Engineering Command, Atlantic Norfolk, VA	1
47.	Merel Dalebout University of New South Wales Sydney, Australia	1
48.	Robin W. Baird Cascadia Research Collective Olympia, WA	1