Prepared For and Submitted To
National Marine Fisheries Service
Office of Protected Resources

Prepared by
Department of the Navy
In accordance with Letter of Authorizations
12 January 2010 (HRC 2010 LOA renewal)
21 January 2010 (SOCAL 2010 LOA renewal)

Marine Mammal Monitoring
For The U.S. Navy's
Hawaii Range Complex
And
Southern California Range Complex-

ANNUAL REPORT 2010

01 October 2010

DRAFT version 01 October 2010
Submitted by the Navy to NMFS OPR for internal consultations
THIS VERSION REPLACES DRAFT SUBMISSION OF 15 SEP 2010

Citation for this report is as follows:

DoN. 2010. Marine Mammal Monitoring For The U.S. Navy's Hawaii Range Complex And Southern California Range Complex- Annual Report 2010. Department of the Navy, U.S. Pacific Fleet.

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EXECUTIVE SUMMARY

This report presents the U.S. Navy's Year 2 level of effort, regulatory compliance, scientific accomplishments, and preliminary data obtained from marine mammal monitoring in the Hawaii Range Complex and Southern California Range Complex.

Year 2 encompassed the period from 02 August 2009 to 01 August 2010. As outlined in the Hawaii and Southern California Range Complex sections within this report, significant accomplishments were achieved from visual surveys, deployments of passive acoustic monitoring devices, marine mammal satellite tagging, use of marine mammal observers, and leveraging of additional field efforts from several projects funded by multiple Department of the Navy organizations. Substantial data was collected, most of which is still undergoing analysis for use in a future 2012 or 2013 multi-year synthesis of results.

In generally, the U.S. Navy met or exceeded its monitoring goals as stated in the range complex specific Monitoring Plans modified through the 01 October 2009 Monitoring Report to the National Marine Fisheries Service.

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AMR	Adaptive Management Review
ASW	anti-submarine warfare
Bf	Beaufort
CalCOFI	California Cooperative Oceanic Fisheries Investigation
CRC	Cascadia Research Collective
CREEM	Centre for Research into Ecological and Environmental Modeling
dB	decibel
DoN	Department of the Navy
EAR	Ecological Acoustic Recorder
ft	feet
GPS	global positioning service
GUNEX	Gunnery Exercise, Surface-to-Surface
HARP	high-frequency acoustic recording package
HRC	Hawaii Range Complex
kHz	kilohertz
M3R	Marine Mammal Monitoring on Navy Ranges
MDSU	Mobile Diving and Salvage Unit
MFAS	mid-frequency active sonar
MISSILEX	Missile Exercise, Surface-to-Surface
MMO	marine mammal observer
MMRC	Marine Mammal Research Consultants
MTE	Major Training Event
nm	nautical mile
NMFS	National Marine Fisheries Service
NOAA	National Oceanographic and Atmospheric Administration
NUWC	Naval Undersea Warfare Center
PAM	passive acoustic monitoring
PIFSC	Pacific Islands Fisheries Science Center
PMAP	Protective Measures Assessment Protocol
PMRF	Pacific Missile Range Facility
R/V	research vessel
RIMPAC	Rim Of the Pacific Exercise
RHIB	Rigid hull inflatable boat
SCC	Submarine Commanders Course
SES	Smultea Environmental Sciences
SINKEX	Sinking Exercise
SOAR	Southern California Offshore Anti-submarine warfare Range
SSC PAC	Space and Naval Warfare Systems Center Pacific
SWFSC	Southwest Fisheries Science Center
USWEX	Undersea Warfare Exercise

INTRODUCTION

Background

The U.S. Navy developed Range Complex specific Monitoring Plans 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.

This report continues to provide range complex specific monitoring results for Year 2 (02 August 2009 to 01 August 2010) within the Navy's Hawaii Range Complex and Southern California Range Complex.

As a recap, Range Complex Monitoring Plans were designed as a collection of focused "studies" to gather data that will attempt to address the following National Marine Fisheries Service (NMFS) questions which are described more fully in the previous NMFS' Letters of Authorizations and Navy Monitoring Plans:

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?

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

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

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

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?

Monitoring methods proposed for the Range Complex Monitoring Plans include a combination of research elements designed to support both Range Complex specific monitoring, and contribute information to a larger Navy-wide science-based program. These research elements include visual surveys from vessel or airplanes, passive acoustic monitoring, marine mammal observers, and marine mammal tagging. Each monitoring technique has advantages and disadvantages that vary temporally and spatially, as well as support one particular study objective better than another (DoN 2009a,b). The Navy uses a combination of techniques so that detection and observation of marine animals is maximized, and meaningful information can be derived to answer the research questions proposed above. This also includes incorporation of new techniques (e.g. photo-ID).

In addition to Fleet funded Monitoring Plans described above, the Chief of Naval Operations Energy and Environmental Readiness Division and the Office of Naval Research have developed a coordinated Science & Technology and Research & Development program focused on marine mammals and sound. Total investment in this program for fiscal year 2010 was approximately $26

million. Several significant projects relative to Navy operational impact or lack of impact to marine mammals are currently funded and ongoing within the Hawaii Range Complex and Southern California Range Complex. For example, in the Southern California Range Complex, to leverage scientific expertise and funding availability, both U.S. Pacific Fleet and OPNAV N45 programs integrated certain elements of their programs to address the requirements as stated in the Southern California Range Complex Monitoring Plan (see Section Appendix A of Southern California Range Complex section).

Report Objective

Design of the Range Complex specific Monitoring Plans represented part of a new Navy-wide assessment, and as with any new program, there are many coordination, logistic, and technical details that continue to be refined. The scope of the original 2008 Range Complex Monitoring Plans was to discuss the background for monitoring as well as define initial procedures to be used in meeting study objectives derived from NMFS-Navy agreements. Monitoring results are presented each year to NMFS and the next year's monitoring goals established based on the adaptive management process.

Overall, and in support of the above statement, this report has two main objectives:

1) Under the Hawaii Range Complex and Southern California Range Complex 2010 Marine Mammal Protection Act Letters of Authorization, present data and results from the Navy-funded Range Complex marine mammal and sea turtle monitoring conducted in the Hawaii Range Complex and Southern California Range Complex during the Study Year 2 from 02 August 2009 to 01 August 2010.

Included in this assessment are reportable metrics of monitoring as requested by the NMFS. This Year 2 report will focus mostly on summarizing collected data, and providing a brief description of the major accomplishments from techniques used this year while referring to the more technical discussions in various Appendices provided by the scientists who performed the monitoring work on the two Range Complexes.

2) Set the foundation for adaptive management review with NMFS for incorporation of proposed revisions to the Navy's 2011 Monitoring Plans based on actual lessons learned from 2009 and 2010. This can include data quality in answering the original study questions, assessment of logistic feasibility, availability of monitoring resources, use of new techniques not originally incorporated in this year's Monitoring Plan, and any other pertinent information.

HAWAII RANGE COMPLEX

Monitoring in the Hawaii Range Complex

This section reports accomplishments from the Navy's marine species field monitoring efforts in the Hawaii Range Complex (HRC). The HRC consists of 235,000 square nautical miles (nm^2) of surface and subsurface ocean areas and special use airspace for military training and research, development, testing and evaluation (RDT&E) activities. The HRC includes the Pacific Missile Range Facility (PMRF) on Kauai which is both a Fleet training range and a Fleet and DoD RDT&E range. PMRF includes 1,020 nm^2 of instrumented ocean area at depths between 1,800 feet and 15,000 feet. Various subcomponents of the range complex are more fully described in the Final Hawaii Range Complex Overseas Environmental Impact Statement/Environmental Impact Statement (DoN 2008a). Of note and in regards to in-water unit-level training and major training events (MTE) using sonar and explosives, a much more limited subset of the range complex is used.

Monitoring efforts are divided into two major categories – those field efforts implemented by the U.S Pacific Fleet as part of the HRC compliance monitoring, and those funded by the Office of Naval Research and the Environmental Readiness Division of the Chief of Naval Operations. Reporting will primarily focus on the Pacific Fleet compliance monitoring required under the Fleets MMPA permit and ESA consultation, however, highlights from the Navy's research monitoring are presented in Part III of this Section.

In the HRC monitoring plan, the Navy proposed to implement a diversity of field methods to gather field data from marine mammals and sea turtles in conjunction with training events. Studies were specifically designed to meet the questions outlined in the Introduction section of this document. Metrics (e.g. hours or events) were agreed to by Navy and NMFS and used as a goal for implementation.

During study year two (02 August 2009 to 01 August 2010), U.S. Pacific Fleet implemented aerial and vessel surveys, embarked marine mammal observers on Navy platforms, tagged Hawaiian monk seals and deployed passive acoustic monitoring devices. This work builds upon U.S. Pacific Fleet -funded field work that has occurred in the Hawaiian Islands since the Rim of the Pacific (RIMPAC) exercise in 2006.

HRC YEAR 2 (02 AUG 2009 TO 01 AUGUST 2010 MONITORING OBJECTIVES

The goal of the HRC Monitoring Plan as revised (DoN 2009) is to implement field methods chosen to address the long term monitoring objectives outlined in the Introduction. **Table H-1** from the final HRC Monitoring Plan shows the FY 2010 monitoring objectives as initially agreed upon by the NMFS and Navy.

U.S. Pacific Fleet began conducting aerial and vessel surveys in conjunction with major exercises in 2006. Most aerial and vessel surveys from 2006-2008 were conducted only before and after, however some vessel surveys were conducted during the event as well. These early surveys not only provided data points that will be used in future analysis, but they also provided proof-of-concept data for determining the feasibility of using diverse field methods in the HRC. Based upon lessons learned from those surveys and input from NMFS, the Navy shaped the studies in the HRC monitoring plan with proven field methods that would provide visual and acoustic data to support scientific assessment on the potential effects from Navy training on marine species.

In the HRC monitoring plan, the Navy proposed to use visual surveys (aerial and vessel) and marine mammal observers aboard Navy vessels during ASW and explosive events to meet its goals in FY09. Navy also proposed to purchase passive acoustic monitoring devices in 2009 and lay groundwork for purchasing tagging devices in 2010.

Table H-1. FY10 monitoring commitments for the Hawaii Range Complex (DoN 2009)

Monitoring Technique	Implementation	
Visual Surveys (aerial or vessel) STUDIES 1,2,3,4,5	120-160 hours before, during and after ASW training events including major training exercises (MTE), SCC, Unit Level Training (ULT) and/or explosive events.	Adaptive Management Review (AMR) for FY11
Marine Mammal Observers (MMO) STUDIES 1,2,3,4,5	80 hours aboard Navy vessels during MTE, ULT, and/or explosive events	
Tagging STUDIES 1,2,3	Tag a goal of 15 individual marine mammals	
Passive Acoustics Monitoring (PAM) STUDIES 1,2,3	Deploy four autonomous devices; collaborate with data collection and analysis from other N45/ONR R&D-funded autonomous PAM devices (goal of 10 devices total). Analyze PIFSC acoustic data collected in 2009.	
Mitigation Effectiveness STUDY 5	Lookout effectiveness study by MMOs on Navy surface vessels during 3 ASW events and 6 explosive events	

HAWAII YEAR 2 MAJOR TRAINING EXERCISE SUMMARY

Given the focus on monitoring around Navy at-sea training events, a list of MTEs that occurred in the HRC between August 2009 and August 2010 is provided in **Table H-2**. Marine mammal sightings during MTEs are a form of compliance monitoring and represent substantial numbers of sightings. For HRC, MTEs may include Rim of the Pacific exercises (RIMPAC), Undersea Warfare Exercises (USWEX), and Multi Strike Group Exercises.

There were two MTEs in the HRC between 1 August 2009 and 1 August 2010 – one USWEX and RIMPAC. During transits and training events during those MTEs, Navy lookouts reported 47 marine mammal sightings for an estimated 286 marine mammals. There were zero marine mammal sightings reported at a range less than 1000 yards concurrent with MFAS use.

Ranges associated with potential NMFS criteria levels of PTS and TTS (215 and 195 dB re 1 µPa2-s) are much shorter than 200 yards. During the HRC MTEs this reporting period, there were no reported sightings of marine mammals or sea turtles at less than 200 yards concurrent with MFAS use.

Table H-2. Hawaii Range Complex major training events from 02 August 2009 to 01 August 2010.

MTE Type	Dates	# Of Days	# of Ships Involved	# of Sea Turtle Sightings	# of Sea Turtles	# Of Marine Mammal Sightings	# Of Marine Mammals
USWEX	11 - 18 Nov 2009	4	8	None reported	None reported	None reported	None reported
RIMPAC	6 - 31 July 2010	26	26	7	25	47	286
Totals:		30	34	7	25	47	286

Table H-3. Total number of marine mammal and sea turtle sightings observed from Navy platforms during Hawaii Range Complex major training events from 02 August 2009 to 01 August 2010.

Species Type	# of sightings	% of total sightings	# of sea turtles or marine mammals	% of total number of marine mammals
Dolphins	33	61%	256	82%
Whales	14	26%	30	10%
Pinniped	0	0%	00	0%
Sea Turtles	7	13%	25	8%
Totals:	54	100%	311	100%

Table H-4 Number of marine mammal sightings at ranges less than 1,000 yards observed from Navy platforms during major training events concurrent with MFAS mitigation from 02 August 2009 to 01 August 2010 in the SOCAL range Complex.

mitigation range	# of sightings	total # of marine mammals	Breakdown by species type		
			# of dolphins	# of whales	# of sea turtles
< 200 yards	0	0	0	0	0
200-500 yards	0	0	0	0	0
500-1000 yards	0	0	0	0	0
Totals:	0	0	0	0	0

* Note that many mitigation ranges were not reported by the ships, so these numbers may be an under-representation of the totals in each category.

The three categories of mitigation measures (Personnel Training, Lookout and Watchstander Responsibilities, and Operating Procedures) outlined in the HRC EIS/OEIS and approved by NMFS (DoN 2008, NMFS 2009a, 2009b) were effective in detecting and appropriately mitigating exposures of marine mammals to mid-frequency sonar. Fleet commanders and ship watch teams continue to improve individual awareness and enhance reporting practices. Additionally, a lookout effectiveness study has been initiated by the Navy which will provide data to demonstrate the effectiveness of the Navy's suite of mitigation measures.

HAWAII YEAR 2 MONITORING ACCOMPLISHMENTS

Marine species monitoring in conjunction with training events has been funded by U.S. Pacific Fleet since 2006. From 2006-2008, surveys focused on visual line transect surveys conducted before and after training events, collecting visual sighting data, photographs, video and behavioral observations. Aerial and vessel surveys were conducted during RIMPAC 2006 (Mobley 2006), USWEX (Cetos 2007, Mobley 2007, Mobley 2008a,b), RIMPAC 2008 (Mobley 2008c, Smultea and Mobley 2008).

Monitoring in 2009 and 2010 expanded after the finalization of the HRC monitoring plan in early 2009. Novel approaches for conducting aerial surveys in close proximity to Navy training events were successfully implemented in 2009 and 2010, providing valuable behavioral observations while ASW was occurring. Additionally, data is being collected by embarking marine mammal observers on Navy platforms, tagging Hawaiian monk seals, deploying passive acoustic monitoring devices and conducting visual surveys from research vessels.

Table H-5 presents a summary of Navy funded marine mammal monitoring within the Hawaii Range Complex during Year 2.

Major accomplishments from U.S. Pacific Fleet's Year 2 compliance monitoring in HRC:

- Visual (Aerial) Survey
  - Aerial surveys were conducted during two Submarine Commanders Courses (SCC) by a contracted aircraft in close-proximity (e.g. between 200 and 2,500 yards) to Navy surface vessels. Logistical challenges were overcome by close coordination with Pacific Missile Range Facility (PMRF) range and P-3 pilots to allow for survey aircraft to share airspace with P-3 and helicopters involved in several training scenarios. This success demonstrates that that during certain training events, contracted aircraft may be used as a method for conducting behavioral monitoring of submerged and at-surface marine mammals. (**Appendix G and H**)
  - Extended focal follows were obtained for several marine mammal species.
  - Aerial surveys were conducted in front of surface vessel with MMOs on board, providing an opportunity for coordination during sightings.
  - Coastline and pelagic surveys during and after training events in search of otherwise-undetected strandings.
- Visual (Vessel) Survey
  - A small vessel survey was conducted off Kauai and Niihau during the Rim of the Pacific (RIMPAC) Exercise. The survey was scheduled to gather data mid-exercise and in conjunction with scheduled "opposed-transit" events. (**Appendix E**)
  - A small vessel survey was conducted off Kaula Islet pre-RIMPAC. (**Appendix F**)
- Passive Acoustic Monitoring
  - Four PAM devices were deployed in areas of the HRC where underwater detonations and anti-submarine warfare exercises may occur nearby. (**Appendix E**)
  - Recordings of PMRF underwater range hydrophones continued at twice per month. Efforts focused on manual verification for presence of beaked whales in the acoustic data. Manual verification is done to confirm that selected automated beaked whale click detections are indicative of the presence of beaked whales (a

high percentage of automatically detected beaked whale clicks are false positives). The manual verification process matches observed characteristics with known beaked whale echolocation click details, and foraging dive vocal behavior. To date beaked whales have been confirmed via manual analysis. Analysis from data collected during SCC in February 2010 focused towards two marine mammal species for which automated classifiers are available, beaked whales and minke whales. (**Appendix J**)

- Groundwork for collaboration and acoustic data sharing between Navy and Hawaii Institute of Marine Biology (HIMB) was laid. Contract will be awarded this fall.
- Analysis of marine mammal acoustic and behavioral data from several data sets and sources (SIO, PIFSC and Cascadia) was conducted. (**Appendix I**)

- Marine mammal observers (MMO)
  - The Navy's lookout effectiveness study commenced when four Marine Mammal Observers (MMOs) embarked during the February 2010 Submarine Commanders Course (SCC) in the HRC. This study was collaboratively developed by Navy, NMFS Science Centers and University of St. Andrews. Study was also implemented in AFAST and SOCAL ranges this year. (**Appendix C**)
  - MMOs embarked on a Navy cruiser during the August 2009 SCC, gathering sighting and behavioral information. (**Appendix D**)
  - MMOs monitored two Sinking Exercises (SINKEX) and four underwater detonations while embarked on Navy platforms. (**Appendix B**)
- Tagging
  - Eleven Hawaiian monk seals were tagged with "cell phone tags" on Oahu, Molokai and Kauai by National Marine Fisheries Service, Pacific Islands Fisheries Science Center. Funds were provided to tag 15 animals and tagging efforts will continue into the next data year. At this writing, tracks from several animals have been finalized with several more still reporting after a couple of months. (**Appendix A**)

Table H-5. U.S. Navy funded marine mammal monitoring accomplishments within the Hawaii Range Complex from 01 August 2009 to 01 August 2010.

Study Type	U.S. Navy LOA monitoring	Associated event type	U.S. Navy R&D funded monitoring	Associated event type	MMPA/ESA requirement	Total accomplished
Visual surveys (Studies 1,2,3,4,5)	1) 31.3 hours - 26-30 Aug 2009 (aerial) 2) 33 hours – 15-19 Feb 2010 (aerial) 3) 21.5 hours 26-28 June 2010 (vessel) 4) 78 hours 17-25 July 2010 (vessel)	1) SCC (ASW) 2) SCC (ASW) 3) Pre-RIMPAC (ASW and explosives) 4) RIMPAC (ASW)	n/a	n/a	120-160 hours before, during and after ASW and/or explosive events	163.8 hours of aerial and vessel surveys
Marine Mammal Observers (Studies 1,2,3,4,5)	1) 42.5 hrs (21.25 hrs x 2 MMOs] – 26-30 Aug 2009 2) 197 hrs [49.2 hrs x 4 MMOs] - 15-19 Feb 2010	1) SCC (ASW) 2) SCC (ASW)	n/a	n/a	80 hours aboard Navy vessels during ASW and/or explosive events	239.3 hours
Tagging (Studies 1,2,3)	11 Hawaiian monk seals tagged off Kauai, Oahu and Molokai	Coverage overlaps ULT, SCC, RIMPAC	Navy funding supports Cascadia Research Collective cetacean tagging off Hawaii and Oahu	n/a	Tag 15 marine mammals	11 monk seals tagged
Passive Acoustic Monitoring (Studies 1,2,3)	1) Two Ecological Acoustic Recording (EAR) devices deployed on Pu`uloa 8 July 2010 2) Two EARS deployed off Ni`ihau 17 July 2010	RIMPAC	1) ONR-funded PAM acoustic methods and tracking (UH/SOEST); 2) ONR-funded Acoustic Ecology of Minke Whales (BioWaves) ; 3) ONR-funded hearing and echolocation of odontocetes (HIMB)	n/a	Deploy 4 devices and collaborate with data collection from other Navy-funded devices. Analyze PIFSC data collected in 2009.	4 EARs deployed, two off Oahu and two off Niihau Acoustic data collected and analyzed from PMRF instrumented range. Acoustic data from HRC analyzed by CPF funded post-doc Groundwork laid for early FY11 contract award to collaborate with HIMB data analysis.
Mitigation Effectiveness (Study 5)	1) 42 hours from 26-30 Aug 2009 2) 197 hours from 15-19 Feb 2010 3) 2 explosive events - 10 July and 17 July 4) 4 explosive events, 15 July	1) SCC (ASW) 2) SCC (ASW) 3) RIMPAC Sinking Exercise 4) RIMPAC Underwater Detonations	n/a		Lookout effectiveness study by MMOs during 3 ASW events and 6 explosive events	Lookout effectiveness during 2 ASW events and 6 explosive events

Metrics exceeded:

Visual surveys: visual surveys (four total) were conducted before, during and after all the multi-unit ASW events in the HRC, totaling significantly more than the targeted number of hours.

Marine mammal observers: hours were exceeded four-fold for marine mammal observer hours. This was in part, due to the lookout effectiveness study design which recommends four marine mammal observers participate in each embark.

Passive Acoustic Monitoring: continuation of acoustic recording and analysis from the PMRF instrumented range was not committed to in prior monitoring plans, however, it has been ongoing with ONR and CPF funding for many years. **Appendix J** contains full reports from this effort.

Metric shortfalls:

Tagging: the Navy's goal was to tag 15 marine mammals however, only eleven were successfully tagged by the 1 August 2010 data cutoff. NMFS is still striving to complete the necessary number of deployments and tagging will continue to complete all 15 deployments. Falling short of our goal is primarily a result of the unpredictability of field work. During multiple field trips, NMFS was presented with an unprecedented lack of seals on the beaches, particularly on Kauai. In three, week-long trips to Kauai, only 4 instruments were deployed. Of the seals that were encountered on those trips, most were pregnant females, young of the year, or animals that were not suitable candidates for instrumentation due to some sort of injury or molt status. During the first field trip to Kauai in February 2010 three cell phone tags were deployed. All of these tags fell off within a few weeks of deployment. This malfunction was due to a bad batch of epoxy that was used to secure the tags to a neoprene base. New epoxy was used on all subsequent deployments to prevent similar issues.

Mitigation effectiveness:

The HRC had fewer ASW events in 2010 than is typical. These fewer events translated to fewer opportunities to monitor. So, although the hours for MMOs well-exceeded the goal of hours, MMOs embarked during two ASW events instead of three.

OTHER NAVY FUNDED RESEARCH IN HAWAII

The Office of Naval Research funded several projects in the HRC that are related to the U.S. Pacific Fleet's monitoring goals which are summarized below.

1) *Passive Acoustic Methods/Tracking, (Eva Nosal, Dept. of Ocean & Resources Engineering, University of Hawaii). Funded in part by ONR.*

There are two project summarized here: 1) Passive Acoustic Methods for Tracking Marine Mammals Using Widely-Spaced Bottom-Mounted Hydrophones and 2) Passive Acoustic Tracking of Minke Whales, in support of ONR funded project, Tom Norris PI: The ecology and acoustic behavior of minke whales in the Hawaiian and Pacific Islands.

The long-term goals of these projects are to improve and apply passive acoustic methods for tracking marine mammals, with primary effort dedicated to methods that use bottom-mounted hydrophones (esp. U.S. Navy ranges of AUTEC and PMRF). When possible, tracking results are used to study marine mammal behavior and bioacoustics. Two specific challenges are tackled: (1) Multiple animals whose calls cannot be easily separated or associated, and (2) Insufficient receiver coverage, in which case standard time-of-arrival (TOA) tracking methods fail.

Project 1 results to date: (1) Implementation of model-based tracking methods that account for multi-path arrivals and depth-dependent sound speed profiles (particularly important as refraction becomes significant at long distances, such as on Navy ranges). (2) Development of an automated detection algorithm for unknown and unexpected transients in large and unexplored datasets (very useful as a "first sweep" for large volumes of data in which unknown or unpredictable sounds are present). (3) Implementation of several methods to separate and associate calls between hydrophones (for the case of multiple calling animals) – associating calls is a critical step for tracking work, and also benefits efforts aimed at counting animals.

Project 2 results: (1) Acoustic data collected with Fleet funds at PMRF by Steve Martin (SPAWAR) were post-processed using a 3D model-based tracking algorithm to verify the 2D minke whale tracks obtained. These acoustically derived positions were compared with concurrent visual sightings by a team led by BioWaves (Tom Norris) aboard the *R/V Dariabar*. (2) A minke whale boing detector was developed and implemented.

1) *The ecology and acoustic behavior of minke whales in the Hawaiian and Mariana Islands: localization, abundance estimation and characterization of minke whale 'boings' (Tom Norris, BioWaves). Funded in part by ONR.*

See **Appendix K** for full report

2) *The Acoustic Ecology and Behavior of Minke Whales (Balaenoptera acutorostrata) near Tropical and Subtropical North Pacific Islands: Localization, Abundance Estimation and Characterization of Minke Whale 'Boings' (Thomas Norris, Tina Yack, Stephen Martin, Julie N. Oswald, Amanda J. Cummins, Len Thomas). Funded in part by ONR.*

Passive acoustic monitoring, acoustic localization and acoustic/visual line-transect surveys of minke whales were conducted near the Hawaiian and Marianas islands between 2006 and 2010. Acoustic data were collected using: 1) towed hydrophone arrays deployed off Kauai and the Marianas Islands 2) seafloor hydrophones from the U.S. Navy's Pacific Missile Range Facility

(PMRF) northwest of Kauai, 3) the Aloha Cabled Observatory (ACO) seafloor hydrophone northwest of Oahu and, 4) HARP autonomous recorders deployed off the Northwest Hawaiian Island Chain. Significant differences were detected in the pulse repetition rates of boings recorded in Hawaiian versus the Marianas Islands. This information is being used to assess the population characteristics of North Pacific minke whales. Analysis of ACO recordings indicates seasonal patterns, but not diurnal patterns in the number of boings detected. We are in the process of estimating the abundance of vocalizing animals in the main Hawaiian and Northern Mariana Islands study sites using towed hydrophone array data. These results will be compared to estimates made with the PMRF hydrophone data using spatially-explicit capture-recapture methods. Results of these studies are providing a better understand the acoustic ecology and behavior of minke whales in low-latitude breeding areas of the North Pacific.

3) *Hearing and echolocation of odontocetes (Paul Nachtigall et al, Hawaii Institute of Marine Biology). Funded by ONR.*

Paul Nachtigall's team of researchers and students published results on the discrimination capability and click parameters of the false killer whale as a function of the development of presbycusis and examining the effects of disrupting echolocation with sound. They measured the audiograms of two new species: the long finned pilot whale (*Globicephala melas*) and the pygmy killer whale (*Feresa attenuata*) and continued the measurement of hearing during echolocation on the false killer whale.

The team began comparative measurements of hearing during echolocation on bottlenose dolphins and harbor porpoise and examined whether or not there were additional automatic gain control mechanisms in the hearing of the false killer whale during echolocation. They also tested the comparative hearing pathways of the bottlenose dolphin and the false killer whale.

Related publications: (Nachtigall et al in press, Mooney et al in press, Pacini et al in press, Muller et al in press, Kloepper et al in press, Ibsen et al 2010, Supin et al 2010)

HRC ADAPTIVE MANAGEMENT AND 2011 MONITORING PLAN

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. Adaptive management helps science managers maintain flexibility 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.

The Navy and NMFS convened meetings in 2009 (Raleigh Durham, NC) and July 2010 (Washington DC) in the interest of soliciting input on monitoring objectives and methods. Additionally, the Fleets will convene a monitoring plan review meeting in October 2010 prior to the 2011 Adaptive Management meeting. Results of these meetings as well as success and challenges in the field continue to feed Adaptive Management.

Significant progress was made during range complex compliance monitoring within the Hawaii Range Complex this year. This year's focus was expansion beyond monitoring techniques that are proven in the HRC, while targeting required metrics. We continued to successfully schedule monitoring using civilian aircraft and ships operating concurrently with multiple Navy aircraft and ships in the same area, which required extensive pre-survey coordination between multiple Navy commands. The U.S. Pacific Fleet operational community provided critical interface and coordination which was instrumental in using novel field methods to allow for researchers to conduct monitoring in close-proximity to Navy assets. They also provided berthing and vessels for MMOs on two types of surface vessels.

Cancellations or major date shifts in Navy training events based on logistics, fiscal, or operational needs were challenging to overcome. These kind of changes are difficult to predict and more importantly, more difficult to reschedule from a monitoring prospective when contracts have been awarded, survey equipment has been purchased, rented or relocated; personnel availability and transport arranged; and fixed date contracts put into place. Several planned Navy training events scheduled for monitoring had to be re-scheduled to cover the change in monitoring design.

In view of lessons learned during implementation of the 2010 HRC Monitoring Plan and as part of the Navy's adaptive management review for the Hawaii Range Complex, slight modification of the 2010 Plan is recommended and shown in Tables H-6 and H-7. A separate, stand alone HRC Year 3 Monitoring Plan is provided in Appendix A.

The main rational for restructuring the monitoring shown in Table H-6 is to:

- simplify the presentation of goals, and
- align the technique with the best promise of more accurately addressing the Monitoring Plan objectives

Specific revisions for elements of the proposed 2010 monitoring include:

Visual Surveys: Minor change in order to allow maximum flexibility of platform choice.

Marine Mammal Observers (MMOs): There are two changes to this section. Firstly, since the MMOs are the method being used for study 5, it was erroneous in the 2010 plan to separate out Mitigation Effectiveness in the table. Therefore, it has been combined for FY11. Secondly, there is a change from the metric of *hours* to a metric of *events*. This is to account for the variable time duration of ASW and explosive events as experienced in FY10. MMOs will continue to be used for gathering species and behavioral data as well as implementation of the Lookout Effectiveness developed in 2010 by Navy, University of St. Andrews and NMFS Science Centers.

Tagging: No change.

PAM: Other than editorial changes, the addition here is to include the hydrophones of the Pacific Missile Range Facility instrumented range as a tool for acoustic data gathering and analysis. This was not included in prior monitoring plans although the data collection has been funded since 2002. Adding this method of passive acoustic monitoring will expand our capabilities.

Table H-6. Adaptive management review showing updates to FY10 monitoring plan (strike through are deletions and red font are additions).

Monitoring Technique	Implementation	
Visual Surveys (aerial or vessel) STUDIES 1,2,3,4,5	120-160 hours before, during and after ASW and/or explosives training events ~~including major training exercises (MTE), SCC, Unit Level Training (ULT) and/or explosive events.. "During" will be targeted by aerial surveys when feasible.~~	Adaptive Management Review (AMR) for FY11
Marine Mammal Observers STUDIES 1,2,3,4,5	~~80 hours aboard Navy vessels during MTE, ULT, and/or explosive events~~ MMO team aboard Navy surface platforms during 2 ASW and 6 explosive events.	
Tagging STUDIES 1,2,3	Tag a goal of 15 individual marine mammals.	
Passive Acoustic Monitoring STUDIES 1,2,3	~~Install~~ four ~~HARPs~~ PAM devices deployed throughout the year. ~~; collaborate with~~ Continue collaboration of data collection and analysis from ~~other~~ additional N45/ONR R&D funded autonomous PAM devices ~~(goal of 10 devices total)~~. ~~Analyze PIFSC acoustic data collected in 2009.~~ - Continue use of the Pacific Missile Range Facility instrumented range hydrophones to gather and analyze marine mammal acoustic data.	
~~**Mitigation Effectiveness STUDY 5**~~	~~Lookout effectiveness study by MMOs on Navy surface vessels during 3 ASW events and 6 explosive events~~	

Legend:

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 sonar, do they redistribute geographically as a result of continued exposure? If so, how long does the redistribution last?

Study 3 - If marine mammals and sea turtles are exposed to MFAS, what are their behavioral responses to various levels?

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

Study 5 - Is Navy's suite of mitigation measures for sonar and explosives, and major exercise measures agreed to by Navy through permitting effective at avoiding TTS, injury, and mortality of marine mammals and sea turtles

Table H-7. Final 2011 monitoring commitments resulting from changes red-lined in Table H-6.

Monitoring Technique	Implementation	
Visual Surveys (aerial or vessel) STUDIES 1,2,3,4, 5	120-160 hours before, during and after ASW and/or explosives training events	Adaptive Management Review (AMR) for FY11
Marine Mammal Observers (MMO) STUDIES 1,2,3, 4, 5	MMO team aboard Navy surface platforms during 2 ASW and 6 explosive events	
Tagging STUDIES 1,2, 3	Tag a goal of 15 individual marine mammals	
Passive Acoustic Monitoring (PAM) STUDIES 1,2, 3	- 4 PAM devices deployed through the year. Begin data analysis. Continue collaboration of data collection and analysis from additional N45/ONR-funded autonomous PAM devices. - Continue use of the Pacific Missile Range Facility instrumented range hydrophones to gather and analyze marine mammal acoustic data.	

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END OF HRC SECTION

SOUTHERN CALIFORNIA RANGE COMPLEX

Monitoring in the Southern California Range Complex

This section reports results from the Navy's field monitoring efforts in the Southern California Range Complex from 02 August 2009 to 01 August 2010.

The Navy fully implemented the monitoring plan outlined in the Navy's 2009 Year 1 Monitoring Report to NMFS (DoN 2009) and specified in the Navy's subsequent 2010 Letter of Authorization renewal application for study year two (Year 2) from 02 August 2009 to 01 August 2010 within the Southern California Range Complex.

Monitoring efforts were funded by the Navy's U.S Pacific Fleet as required for compliance monitoring under the Navy's annual Letter of Authorization. Additional marine mammal monitoring within Southern California, part of a larger research program, was funded by the Energy and Environmental Readiness Division of the Chief of Naval Operations. Some results from this research monitoring with complementary objectives as Navy's compliance monitoring are presented in this report, where applicable.

Monitoring field work in the Southern California Range Complex was performed by civilian scientific organizations and companies with significant experience in ocean monitoring for marine species. These include Scripps Institute of Oceanography, Smultea Environmental Services, Cascadia Research Collective, and National Marine Fisheries Service's Southwest Fisheries Science Center. Experienced civilian field biologists from various Navy commands participated in the marine mammal observer event.

Monitoring accomplished in Year 2 within the offshore waters of Southern California included aerial and vessel visual marine mammals and sea turtles surveys, the first ever embarkation of marine mammal observers on a Navy surface ship in this region, and passive acoustic marine mammal monitoring from multiple bottom-mounted acoustic recording packages.

Report Organization

This report is organized to summarize the Navy's monitoring commitments and Year 2 accomplishments within the Southern California Range Complex.

Specific subsections include:

- Visual Survey Results
- Marine Mammal Observers (MMO)
- Passive Acoustic Monitoring (PAM)
- Southern California Range Complex Exercise Summary
- Other Navy Funded Research Results- Other visual surveys, Marine mammal tagging, Marine Mammal Mitigation on Navy Ranges (M3R), and photographic identification (PhotoID)

Year 2 Monitoring Locations

While all near shore and offshore ocean areas within Southern California Range Complex are acceptable for monitoring depending on the technique being used, certain portions of the range complex were designated as "focal areas" based on scientific merit for study in that location, logistics of being able to safely reach the site especially for shore-base airplane surveys, proximity to key Navy training areas, and previous field experience from past Navy monitoring in 2008 and 2009.

Figure S-1 shows the general Southern California focal areas surveyed the most during Year 2 (from 02 August 2009 to 01 August 2010). The Navy will soon add a fourth proposed focal area for Year 3 monitoring within the Southern California Range Complex as discussed in more detail in the 2011 Monitoring Plan (**Appendix A**).

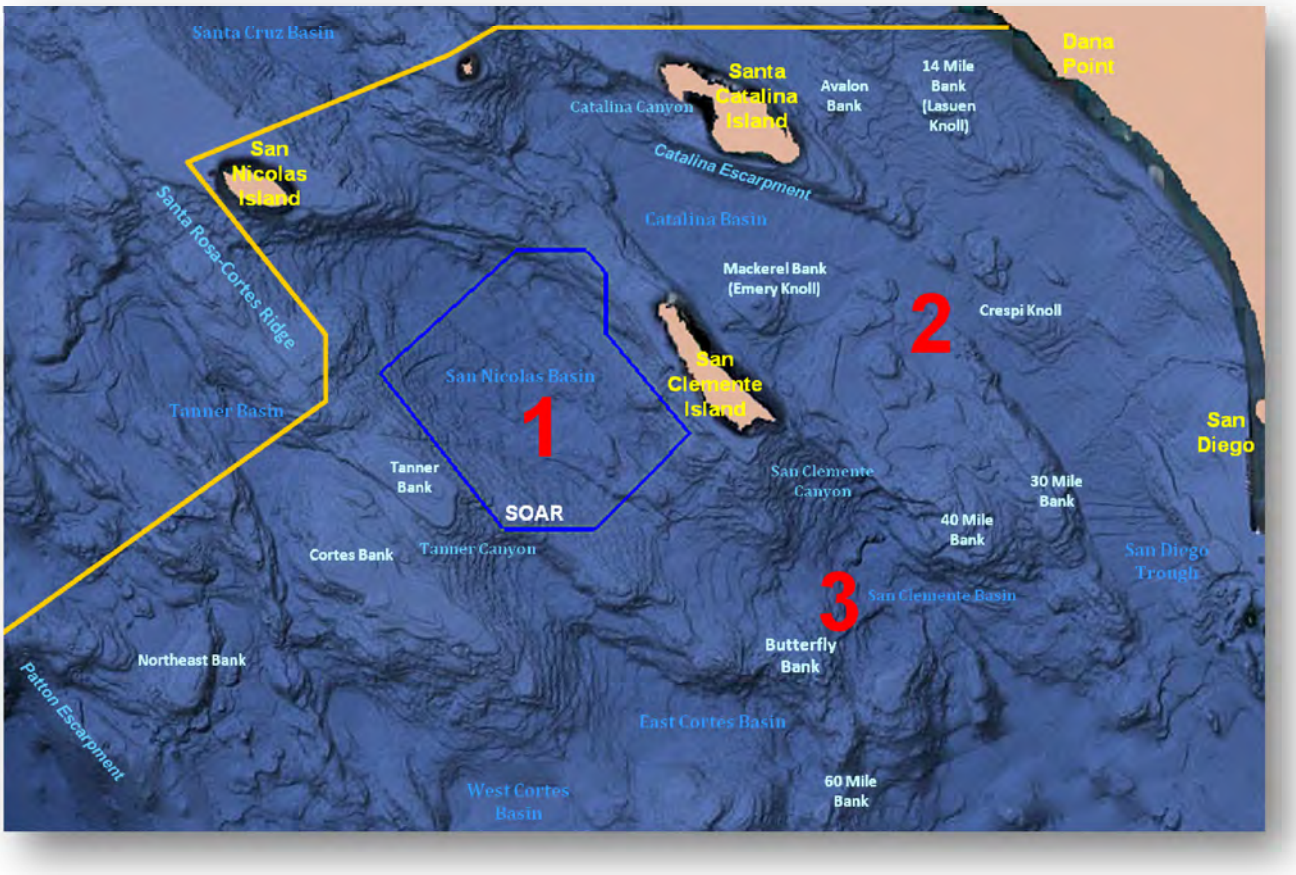


Figure S-1. Study focal areas for Year 2 monitoring within the Southern California Range Complex.

Oceanographic Conditions

The Navy's 2009 Pacific Monitoring Report (DoN 2009) discussed the importance of regional oceanographic conditions on potential marine mammal occurrence within Southern California.

These include the El Niño (warm water regimes) and La Niño (cold water regime) oscillations, the longer term Pacific Decadal Oscillation, and global climate change. While the Navy's 2009 Monitoring Report highlighted these changes from 1950 to 2009 (DoN 2009), **Figure S-2** instead shows an updated summary of Pacific sea surface temperatures as an indicator of oceanographic condition covering the period from 2008 through 2010, with the Navy's Year 2 range complex monitoring period indicated in Figure 2 by the dashed lines around the appropriate months.

During Year 2 monitoring, there were elevated sea surface temperatures from August 2009 through May 2010 indicative of a warm water regime El Nino condition. Current indications going into 2011 are that a switch to a cool water La Niño condition is occurring per the September 2009 update provide on the National Oceanic and Atmospheric Administration's El Niño Southern Oscillation (ENSO) Diagnostic Discussion Archive, which contains monthly descriptive narratives off El Niño and La Niño conditions within the Pacific.

http://www.cpc.noaa.gov/products/expert_assessment/ENSO_DD_archive.shtml

Figure S-2. Warm and cold ocean temperature episodes base on Oceanic Niño index as a predictor of El Niño and La Niño oceanographic conditions within SOCAL from 2008 to 2010.

Eastern Pacific Warm and Cold Water Periods 2008-2010
(Dashline line for monitoring from August 2009 until August 2010)

DESCRIPTION: Warm (red) and cold (blue) episodes based on a threshold of +/- 0.5°C for the Oceanic Niño Index (ONI) [3 month running mean of ERSST.v3b SST anomalies in the Niño 3.4 region (5°N-5°S, 120°-170°W)], based on the 1971-2000 base period. For historical purposes cold and warm episodes (blue and red colored numbers) are defined when the threshold is met for a minimum of 5 consecutive over-lapping seasons.
From: National Weather Service Climate Prediction Center
http://www.cpc.noaa.gov/products/analysis_monitoring/ensostuff/ensoyears.shtml

Year	DJF	JFM	FMA	MAM	AMJ	MJJ	JJA	JAS	ASO	SON	OND	NDJ
2008	-1.4	-1.4	-1.1	-0.8	-0.6	-0.4	-0.1	0.0	0.0	0.0	-0.3	-0.6
2009	-0.8	-0.7	-0.5	-0.1	0.2	0.6	0.7	0.8	0.9	1.2	1.5	1.8
2010	1.7	1.5	1.2	0.8	0.3	-0.2	-0.6					

warm period scale		cold period scale	
	+0.5 to 0.7°C (+0.9 to 1.3°F)		-0.5 to -0.7°C (-0.9 to -1.3°F)
	+0.8 to 1.0°C (+1.4 to 1.8°F)		-0.8 to 1.0°C (-1.4 to 1.8°F)
	≥ +1.1°C (≥ +2.0°F)		≥ -1.1°C (≥ -2.0°F)

(see DoN 2009 for similar plot of years 1950 to 2009)

SOUTHERN CALIFORNIA RANGE COMPLEX YEAR 2 MONITORING ACCOMPLISHMENTS

To assess the Year 2 SOCAL Range Complex monitoring, each monitoring objective in this year's effort is presented along with discussions of accomplishments, metrics of completion, scientific contribution, and overall value to the monitoring program.

Following a brief summary, individual subsections will discuss each monitoring subject. Longer field reports from various researchers are either included within these subsections, or placed in an accompanying appendix if lengthy.

Year 2 Monitoring Objectives include reporting annual results from:

- Visual Surveys
- Marine Mammal Observers
- Passive Acoustic Monitoring
- Southern California Range Complex Navy Exercise and Lookout Summary
- Other Navy Funded Research Results- visual surveys, marine mammal tagging, passive acoustic monitoring, photographic identification (PhotoID), and population assessments

Year 2 Overview

Tables S-1 and S-2 compares the Navy's Year 2 monitoring accomplishments in terms of regulatory commitments to the National Marine Fisheries Service contained in the Navy's 2010 Letter of Authorization renewal application and Year 1 (2008-2009) Monitoring Report.

As indicated in **Table S-1**, all Year 2 monitoring objectives were met, and in some cases significantly exceeded.

Table S-1. Overview of Navy compliance with monitoring requirements in the Southern California Range Complex.

Type of Monitoring	2010 Planned Monitoring as Committed To By The Navy	2010 Completed Year 2 Monitoring Accomplishment
Compliance Funded Monitoring Visual survey	120 hours effort	671 hours of effort completed
Marine Mammal Observers	120 hours of effort	144 hours of effort completed
Passive Acoustic Monitoring	Deploy 2 passive acoustic devices	2 devices deployed; preliminary analysis provided in this report
Navy Exercise Summary	Present results from Navy major training events	Provided in this report
Other Navy Funded Monitoring Marine Mammal Tagging	Present tagging results obtained from Navy Research monitoring	19 satellite tags deployed during Year 2; provided in this report
Photographic Identification (PhotoID)	Present PhotoID results from Navy Research monitoring	Summarized in this report
Other studies	No commitment	Provided in this report, as available

Table S-2. Summary of Navy funded monitoring accomplishments within the Southern California Range Complex from 02 August 2009 to 01 August 2010.

Monitoring Study Type	U.S. Navy Fleet funded Compliance monitoring	Associated Navy training event	U.S. Navy funded Research monitoring	Associated Navy training event	Total YEAR 2 (2009-2010) accomplished
Visual Surveys (VS) (studies 1,2,3,4,5) 120 hours	27 hrs (A) 18-23 Nov 09	After MTE	94 hrs (R) 02 Nov 09-30 Jul 10	Multiple	**1,061 hours visual survey**
	29 hrs (A) 13-18 May 10	During MTE	77 hrs (R) 11-24 Nov 09	During MTE	
	5 hrs (H) 27-28 Jul 10	During MTE	43 hrs (R) 19-25 Nov 09	During MTE	
	16 hrs (A) 29 Jul-03 Aug 10	During MTE	22 hrs (R) 9-11 Apr 10	No MTE	
	24 hrs (S) 20-23 Jul 10	During MTE	68 hrs (R) 15-30 Jun 10 119 hrs (R) 15-30 Jun 10 390 hrs (S) 14 Jul 09-24 Apr 10	No MTE No MTE Multiple	
Marine Mammal Observers (MMO) (studies 2, 5) up to 120 hrs	144 hrs 22-29 July 10	During ULT	Not applicable	Not applicable	**144 hours of MMO**
Marine Mammal Tagging (MMT) (studies 1, 2, 3)	Not applicable	Not applicable	12 LIMPET satellite tags 11-24 Nov 2009 8 fin whales, 3 blue whales, 1 Risso's dolphin	During MTE	**12 tags Nov 09**
			7 LIMPET satellite tags 2 fin whales, 2 Cuvier's beaked whales, 2 Risso's dolphins, 1 killer whale 15-30 Jun 2010	No MTE	**7 tags Jun 10**
Passive Acoustics Monitoring (PAM) (study 2)	2 Pacific Fleet Funded PAM devices (SIO's HARP) 11 Mar 09 to 26 Mar 10, and continued deployment 15,335 hrs recorded	Before\ During\ After MTEs and ULTs	M3R on Navy instrumented range west of San Clemente Island continued field validation 2009, 2010	Before\ During\ After MTEs and ULTs	**2 PAM devices deployed for total of 15,335 hours of HARP recording; plus 770 hrs from other passive**

Notes:
A= airplane platform, H= helicopter platform, S= ship platform, R= Rigid Hulled Inflatable Boat (RHIB)
MTE= major training event; ULT= unit level training;
SIO= Scripps Institute of Oceanography, HARP= high frequency acoustic recording package;
M3R= Marine Mammal Monitoring on Navy Ranges;
LIMPET= Low Impact Minimally Percutaneous External-electronics Transmitter satellite tag

Year 2 Objective Summary

The Navy met and vastly exceeded all of its Year 2 monitoring objectives within the Southern California Range Complex (**Table S-2**).

Year 2 Scientific Summary

The total field effort of Year 2 monitoring within the Southern California Range Complex is presented in **Table S-3**.

To date, the Navy's monitoring programs in Southern California have generated an extraordinary amount of data on marine mammal biology within the region, a significant amount of which is new to science. Some preliminary results will be presented in later subsections within this report, although data analysis continues with the goal of producing a more complete synthesis by the end of the National Marine Fisheries Service authorization under which this monitoring occurs.

Highlights for Year 2 monitoring include:

- **1,061 hours of survey effort**
- **15,870 nm of ocean surveyed**
- **1,181 sightings representing over 76,740 marine mammals**
- **Over 19,753 hours of passive acoustic recordings made**
- **15,858 digital photographs of marine mammals taken**
- **13 hours of digital video of marine mammals taken**
- **85 tissue biopsies taken**
- **19 medium term satellite tracking tags put on marine mammals**

Table S-3. Cumulative total effort and accomplishments from Year 2 Navy funded monitoring in within Southern California from 02 Aug 2009 to 01 Aug 2010.

Navy funding	Performing Organization	Survey Dates or Window	Participating Vessel \ Platform	# Days (days)	Total Survey Time (hrs)	Total Survey Distance (nm)	# Groups Sighted	# Individuals Sighted	# Species visually sighted	Digital Photo/ IDs taken (#)	Digital video taken (hrs)	# of Aerial Survey Behavioral Focal Follows	Total Behavioral Focal Follow Time (hrs)	Biopsies (#)	Satellite Tags (# tags)	# Passive recordings (#)	Total passive recording (hrs)	# Acoustic detection (#)	# Species acoustically detected (#)	# Passive sonobuoys (# buoys)
P	Si	11 Mar 09- 25 Mar 2010 +	HARP "M"	320	na	na	na	na	na	na	na	na	na	na	na	na	7,591	*	14	na
P	Si	14 Mar 09- 26 Mar 2010 +	HARP "N"	325	na	na	na	na	na	na	na	na	na	na	na	na	7,744	*	16	na
N	Si	14Jul 2009-24 Apr 2010 4 CalCOFI cruises	Vessel	92	390	4,030	339	17,632	na	258	na	na	na	na	na	253	747	308	8	166
N	Si	02 Nov 09-30 Jul 2010 SIO\SWFSC bimonthly small boat cruises	RHIB -SI	14	94.5	834	138	9,890	6	6,404	na	na	na	36	na	43	2.8	20	5	na
N	Nw	11 Nov 2009- 30 Jul 2010 M3R	SOAR	152	na	na	na	na	na	na	na	na	na	na	na	na	3,648	*	10	na
N	Si	19-25 Nov 2009	RHIB -SI	7	43.5	515	28	6,202	5	255	0	na	na	1	na	15	1.2	na	na	na
N	C	11-24 Nov 2009	RHIB- C	14	77.5	720	94	7,322	10	na	na	na	na	15	12	na	na	na	na	na
P	Sm	18-23 Nov 2009	Airplane	6	28	2,604	93	12,826	10	2,203	1.5	24	6.5	na	na	na	na	na	na	na
N	Si	9-11 April 2010	RHIB -Si	3	22.4	221	10	1,113	6	106	na	na	na	1	na	0	0	na	na	na
P	Sm	13-18 May 2010	Airplane	6	29	2,641	152	5,453	9	1,350	5.6	30	10.5	na	na	na	na	na	na	na
N	Si	15-30 Jun 2010	RHIB -Si	11	68.4	686	31	868	5	1,410	0	na	na	23	na	4	0.5	na	na	na
N	C	15-30 Jun 2010	RHIB- C	15	118.7	1,310	66	2,340	12	na	na	na	na	9	7	na	na	na	na	na
P	P	22-28 Jul 2010	MMOs	7	144.4	400	105	680	7	899	na	na	na	na	na	na	na	na	na	na
P	Sm	27-28 Jul 2010	Helicopter	2	5.3	242	16	1,971	4	500	1.8	5	3.3	na	na	na	na	na	na	na
P	Sm	29 Jul-03 Aug 2010	Airplane	5	15.7	1,446	70	9,119	5	2,400	4.5	14	6.0	na	na	na	na	na	na	na
N	Si	20-23 Jul 2010	Vessel	3	23.8	221	39	1,324	6	73	na	na	na	na	na	4	18.3	20	4	3
		HARP only summary		**645**	-	-	-	-	-	-	-	-	-	-	-	-	**15,335**	-	-	-
		aerial visual only summary		**19**	**78**	**6,933**	**331**	**29,369**	**28**	**6,453**	**13.3**	**73**	**26.3**	-	-	-	-	-	-	-
		ship\boat visual only summary		**159**	**839**	**8,537**	**745**	**46,691**	**50**	**8,506**	-	-	-	**85**	**19**	**319**	**770**	**348**	**17**	**169**
		ALL visual summary (EXCLUDING HARPs, MMO)		**330**	**917**	**15,470**	**1,076**	**76,060**	**78**	**14,959**	**13.3**	**73**	**26**	**85**	**19**	**319**	**770**	**348**	**27**	**169**
		Totals all efforts:		**982**	**1,061**	**15,870**	**1,181**	**76,740**	**85**	**15,858**	**13.3**	**73**	**26**	**85**	**19**	**319**	**19,753**	**348**	**57**	**169**

notes:
HARP= high-frequency acoustic recording package (i.e., bottom mounted passive acoustic monitoring device;
M3R= Marine Mammal Monitoring on Navy Ranges; Detection system being tested on Navy's underwater instrumented range west of San Clemente Island, the Southern California Offshore Anti-submarine warfare Range (SOAR); 11-24 Nov 2009 and 14-30 Jun 2010 validation testing, and continuous 24-hr recording from May 2010 through 30 July 2010
RHIB= rigid-hull inflatable boat; Airplane= Partenavia P-68-C (Nov, May), P-68-OBS (Jul); helicopter= Bell 206-L- III; vessel = R/V Sproul
MMO= 4 marine mammal observers (biologists) embarked on US Navy destroyer
P= U.S. Pacific Fleet; Si= Scripps Institute of Oceanography; Nu= Navy Undersea Warfare Center; N= OPNAV N45, C= Cascadia Research Collective, Sm= Smultea Environmental Services; Nw= Naval Undersea Warfare Center Newport
CalCOFI= California Cooperative Oceanic Fisheries Investigation, a joint agency 61-year old California survey series. Navy has been funding since 2004, marine mammal survey as part of 4 regularly scheduled cruises per year (14 Jul - 5 Aug 2009, 6 -22 Nov 2009, 12 Jan - 3 Feb 2010, 4 - 24 Apr 2010)
+ = Mar 2009 to Mar 2010 dates dictated by field deployment cycle
na= not applicable or summarized for this event type
*= In many cases, number of actual detections are large. For instance echolocating dolphins can be hundreds per minute. To make data more comparable, HARP summaries use fixed time window (one hour or one minute) and then detected presence or absence of animals in these windows

SOUTHERN CALIFORNIA YEAR 2 VISUAL SURVEYS (AERIAL SUMMARY)

Under terms and conditions of the Navy's Year 2 01 August 2009 to 02 August 2010 Monitoring Plan, the Navy completed 1,061 hours of visual surveys out of a planned total of 120 hours. Of the 1,061 hours of visual survey effort, aerial visual surveys accounted for 77 hours (**Table S-3**).

Aerial visual surveys provide the opportunity to rapidly survey large tracks of ocean in the fraction of time needed by ship based surveys, although on-station time is typically limited by the amount of fuel available aboard a given airplane or helicopter. Typical on-station survey times for a single flight was around five hours for a civilian airplane (Partenavia P-68-C or P-68-OBS) or 2-3 hours for a civilian helicopter (Bell 206-L- III).

Year 2 was the first time a helicopter was successfully used specifically for marine mammal focal follows, where the helicopter follows a group of marine to allow prolonged, detailed behavioral observations. While focal follows are also conducted during the airplane surveys, the helicopter proved to be a stable, excellent platform from which to both observe as well as shoot high resolution digital photographs and video.

While all visual survey effort is presented in **Table S-2** and **S-3**, specific aerial visual survey accomplishments in Year 2 include:

Completion of four aerial survey periods, a 27 hour airplane survey from 18-23 November 2009; a 29 hour airplane survey 13-18 May 2010; and a back to back helicopter and airplane survey from 27-28 July 2010 (helicopter- 5 hours) and 29 Jul-03 Aug 2010 (airplane- 16 hours)

- Over 6,933 nm surveyed
- 331 sighting of approximately 29,369 marine mammals
- 6,453 hi-resolution digital photos taken
- 13.3 hours of digital video taken
- Completion of 73 focal follows greater than 5 min each of various marine mammals for total of 26.3 hours of detailed behavioral focal follows

Bell 206-L-III helicopter used during aerial surveys 27-28 July 2010.
Photos by M. Smultea courtesy of Smultea Environmental Sciences.

Aerial surveys within the Southern California Range Complex have a distinct contribution they can make to the overall monitoring plan. These kinds of surveys:

1. Provide advantage of surveying key Navy areas of interest within one day, providing a "snapshot" of marine mammal numbers, presence, distribution and behavior before, during and after major training events,

2. Collect quantifiable behavioral data known to be indices of stress/disturbance,

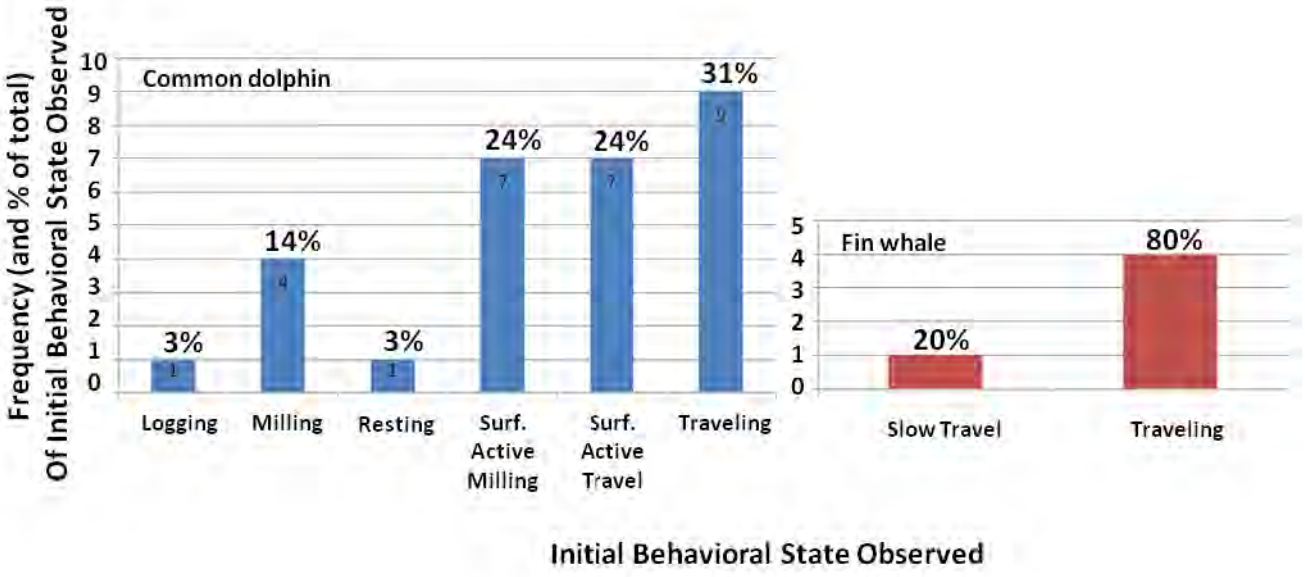
3. Conduct focal follows of priority cetacean species including video-documentation of underwater behavior,

4. Provide a platform from which behavior and potential reactions of cetaceans to Navy training may be studied without confounding results (vs. from vessels), and

5. Locate and identify dead floating or stranded marine mammals.

The Navy will continue to use aerial survey in next year's monitoring for both spatial coverage, but more importantly to continue gather baseline behavioral data on marine mammals at-sea. For instance, although compiled from just one survey (18-23 November 2009), **Figure S-3** shows some of the basic observations, in this case for common dolphins and fin whale, being obtained from aerial surveys in Southern California.

Figure S-3. Frequency of initially observed behavioral states for common dolphins and fin whales during November 2009 Southern California aerial survey.



The following photographs over the next few pages highlight some of the unique sightings within the Southern California Range Complex during Year 2.

Minke whale (Balaenoptera acutorostrata) breach sequence as observed from the aircraft on November 21, 2009 using a telephoto lens during the November 2009 aerial marine mammal monitoring survey off San Diego, California, demonstrating the ability to observe cetaceans and behavior sub-surface during an aerial survey. Photos by Mark Deakos courtesy of Smultea Environmental Sciences.

[The Navy verified that there was no active sonar used within the Southern California Range Complex on the day of this sighting, 21 Nov 2009, nor were any Navy vessels in the vicinity of the sighting location. The nearest sonar use was over three days previous on 18 November.]

Below are photos from a rare (for Southern California) sighting of killer whales (Orcinus orca) observed on November 21, 2009 from the aircraft during the November 2009 aerial marine mammal monitoring survey off San Diego, California. Photographs were taken (with a telephoto lens) of a calf apparently nursing from an adjacent adult lying on its side underwater while another juvenile approached the pair (right photo below). Photos by Mark Deakos courtesy of Smultea Environmental Sciences.

On May 16 from 13:54 to 14:17 at the northern portion of the Navy's underwater instrumented range west of San Clemente Island [northeast portion of San Nicolas Basic], an unusually behaving group of 14 Risso's dolphins was tracked from the airplane for a focal follow lasting approximately 23 minutes. The group consistently traveled fast and was surface-active with frequent porpoising and whitewater observed as the dolphins headed consistently to approximately 060 degrees magnetic. The observation was considered unusual because Risso's dolphins during our past surveys have most frequently been observed traveling slowly or milling with little to no surface-active behaviors. Approximately 18 minutes of video was taken while following this group.

The Navy had a major training event ongoing in the Southern California Range Complex on this day. However, in an analysis of ship positions and sonar use, the ships in the strike group involved with the training were 30-50 nautical miles to the southeast of the Risso's dolphin sighting location. San Clemente Island would have been between the two locations (the Risso's dolphin site and Navy ship concentration). The nearest Navy surface ship to the sighting was 30 nautical miles due south (i.e., not in the "shadow" of San Clemente Island), but was not using sonar at the time of the sighting or for the morning prior to the sighting time.

At this time, it is unknown if the Risso's behavioral observations was an as yet, unseen natural behavior in response to foraging, predator avoidance, or some other natural phenomena, or a reaction to or avoidance of an anthropogenic event. This sighting highlights the importance of continuing to collect baseline marine mammal behavioral information to build the science on what could constitute normal behavior for marine mammal species.

Photo on 16 May 2010 of a pod of 14 Risso's dolphins travelling rapidly (Photo by L. Mazzuca).

SOUTHERN CALIFORNIA YEAR 2 MARINE MAMMAL OBSERVERS

Under terms and conditions of the Navy's Year 2 01 August 2009 to 02 August 2010 Monitoring Plan, the Navy completed 144 hours of Marine Mammal Observers (MMO) out of a planned 80-120 hours of MMOs.

There was one MMO event in the Southern California Range Complex within Year 2. Four experienced Navy civilian marine science biologists embarked on a Navy destroyer from 22 to 28 July 2010. The ship then proceeded to sea within the Southern California Range Complex where it engaged in various sonar and non-sonar training events during a planned unit-level training.

Up until late in 2010, there had been significant logistical challenges in finding short-term training schedules, which change frequently, as well as getting formal approval for MMOs to board Navy ships within Southern California. This year, although not strictly a field monitoring achievement, one of the Year 2 accomplishments was finally establishing business rule for both requesting MMO access to Navy ships, and building the working relationship with the appropriate Navy command which could liaison directly with the ship for scheduling. This should lead to improved subsequent MMO opportunities within next year's range complex monitoring.

The following pages provide details for the July Southern California MMO event. Given the end of the monitoring year nature of this particular MMO event (22-28 July) as compared to the 02 August to 01 August monitoring period, only a preliminary MMO summary report has been prepared at the time of this report submission.

During the six day MMO underway period, the MMOs made 105 sightings of approximately 680 marine mammals. In fact, the frequency of sightings when compared to MMO events on other Navy range complexes was such that the MMO team identified several study protocol and data recording procedure modifications needed to account for the faster rate of sighting marine mammals within Southern California. These changes will be incorporated into future MMO events within California.

Some of the analysis from this event will be folded into a Navy-wide lookout effectiveness study using MMO events on Navy ships along the Atlantic Coast, Hawaii, and Southern California. This pooled data study will be reported in later submissions to the National Marine Fisheries Service in the 2012-2013 time frame.

August 2010

Marine Mammal Observer Report

- Cruise Report, Marine Species Monitoring & Lookout Effectiveness Study During Unit Level Training 22-28 July 2010 within the SOCAL Range Complex-

Prepared for:

Commander, U.S. Pacific Fleet

U.S. Navy photos by Robert Uyeyama of 22-28 July Southern California Range Complex MMO event

Prepared by:

Dr. Sean Hanser – Naval Facilities Engineering Command, Pacific
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INTRODUCTION

In a concerted effort to address monitoring questions posed in the Navy's range complex monitoring plans, marine mammal observers (MMO) are used in a two-part effort to observe marine mammal behaviors in the vicinity of Navy ships, and to compare Navy shipboard lookout effectiveness. These include comparing embarked MMO sightings at-sea to standard Navy lookout reports. Navy lookouts can be on the ship's bridge, on the bridge wings, and/or on the flying bridge. For the lookout effectiveness portions, civilian biologists were utilized to collect data that would characterize the likelihood of detecting marine species in the field of view aboard a U.S. Navy destroyer (DDG). The University Of St. Andrews, Scotland, under contract to the U.S. Navy, developed an initial protocol for use during this study. This protocol was reviewed by National Marine Fisheries Service personal from two regional science centers. Necessary changes to the protocol were identified and made during three prior field implementations and MMO events in 2009 and 2010. Data collected are intended to be combined with future monitoring efforts in order to determine the effectiveness of Navy lookout teams as a whole, rather than specific to each vessel. As such, this report describes basic observations with the remaining lookout effectiveness data to be pooled at a later date.

As part of this data collection effort, four U.S. Navy civilian MMOs (Dr. Sean Hanser, Ms. Mandy Shoemaker, Dr. Robert Uyeyama, and Dr. Stephanie Watwood) participated in a Unit Level Training (ULT) event on the Southern California Range Complex from 22-29 July 2010. These MMOs were stationed aboard an Arleigh Burke class Navy destroyer, referred to as "DDG C".

The goals of the MMO event during unit level training monitoring and this study were:

- Collect data to assess the effectiveness of the Navy lookout team.
- Obtain data to characterize possible exposure of marine species to ship mid-frequency active sonar and behavioral reactions or lack of reactions to this exposure

METHODS

Shipboard Monitoring- MMO surveys were conducted on a not-to-interfere basis, which means that the MMOs would not replace required Navy lookouts, would not dictate operational requirements/maneuvers, and would remove themselves from the bridge wing if necessary for DDG C to accomplish its mission objectives. The exceptions would be if a marine mammal was sighted by the MMO within the shut-down zone during mid-frequency active sonar training (within 200 yards) and the animal was not sighted by the Navy lookout team, or if the vessel was in danger of striking a marine species. In these cases, the MMO would report the sighting to the Navy lookout team for appropriate reporting and action. The initial protocol for data collection was provided by the University of St. Andrews; this protocol was modified by the MMOs on three prior surveys. Additional changes were made as necessary during this event. The MMO survey on DDG C was conducted on the bridge wings (elevated 60 feet above the waterline), with one MMO on each wing (called survey MMOs, or SMMOs. One MMO acted as a liaison to the starboard and port lookouts (called liaison MMO or LMMO). The fourth MMO was primarily responsible for recording data (data MMO or DMMO) reported by the two SMMOs and the LMMO. A rotation schedule was used, such that an MMO would be on effort for one hour on port, one hour as the LMMO, one hour as an SMMO on starboard, and one hour as DMMO. While on effort, MMOs used naked eye and 7 x 50 magnification binoculars to scan the area from dead ahead to just aft of the beam. If an animal was visually detected by the SMMOs, information would be collected on twenty-three sighting, environmental, and operational parameters. Sightings obtained first by the SMMOs before the Navy lookout were considered to be "trials." If applicable, photographs would

be taken using a Canon EOS 20D digital camera with a 100 – 300 millimeter zoom lens. No photographs would be taken until the Navy lookout had also made the sighting so as not to inappropriately call attention to the sighting. The track of the DDG-C was not altered as result of the MMO sightings, unless to avoid a collision. Therefore, the species identification level represents the best ability to recognize species specific characteristics at a distance from the ship, without approaching the animals for study. The LMMO or SMMOs reported sightings made by the Navy starboard lookout. The LMMO was also responsible for noting sightings made by the bridge team or watchstanders. After a sighting by the Navy lookout or bridge team, the LMMO would also query the personnel to clarify information on the sighting such as animals seen, bearing, distance, and time. All four MMOs were equipped with headset two-way radios in order to maintain communications without leaving post, as well as communicating sighting and effort data without cueing the Navy lookouts to sightings. The DMMO was responsible for recording all data and making initial determination as to whether sightings were considered a duplicate. The DMMO's recorded effort-related events (e.g., begin effort, end effort, observer rotation, weather change) the DMMOs recorded time, location, and weather information as per the protocol. At the time of events and sightings, a waypoint was immediately taken by the DMMO such that the accurate time and location would be recorded, with associated information to be appended. Effort and environmental information was collected when the MMOs began effort, at each rotation, as weather changes occurred, and when the MMOs went off effort. At the conclusion of each observation day, all photographs were reviewed to assist with species identification.

RESULTS

The MMO team was vigilant during virtually all of the on effort hours; therefore this study comprised a total of approximately 150.5 hours of on effort hours of marine mammal shipboard monitoring. Effort and environmental information was collected when the MMOs began effort, at each rotation, as weather changes occurred, and when the MMOs went off effort The DMMO was often observing when there were no data to record but this effort was not recorded and therefore not included, and the LMMO was generally vigilant through a majority of the rotation. Time considered off-effort included some training activities such as chaff exercises and refueling at-sea; however observations were still possible and sightings were made during other exercises such as man overboard, evasive maneuvering, helicopter operations, and torpedo launcher air shots. Activities that required the team to vacate the bridge level entirely were not counted towards effort totals, and included radar exercises, and meals. The refueling operation on 22 July, which did not require the MMO team to vacate the bridge entirely, was not included although observational efforts were still made from the starboard bridge wing.

The first two days presented almost ideal environmental sighting conditions (Table 1). In total, 105 sightings comprising 680 individual marine mammals were recorded during the seven days of observation. Trials were successfully conducted on all seven days of the event, with 92 of 105 sightings (88%) available for trials, or an average rate of 1.84 trials per hour of effort across all seven days. This average trial rate was equivalent to that of the single best day of the six-day DDG B Lookout Effectiveness cruise in the Jacksonville Range Complex, where the other five days each resulted in no trials being performed. For the July Southern California Range Complex MMO event, of the 105 sightings, seven different species were positively identified, and three of the sightings were mixed-species groups (Table 2). The species identified were California sea lion (*Zalophus californianus*), bottlenose dolphin (*Tursiops truncatus*), long-beaked common dolphin (*Delphinus capensis*), short-beaked common dolphin (*Delphinus delphis*), Risso's dolphin (*Grampus griseus*), blue whale (*Balaenoptera musculus*), and minke whale (*Balaenoptera*

acutorostrata) (Figure 1). Among other unidentified sightings, one was judged to likely be either a fin whale (*Balaenoptera physalus*) or sei whale (*Balaenoptera borealis*). The three mixed-species groups were: 1) California sea lions with small rorquals, likely\possibly minke whales; 2) California sea lions with dolphins, probably bottlenose dolphins; and 3) Risso's dolphins with bottlenose dolphins. The first two days of the effort had the greatest frequency of unique sightings with 5.82 sighting/hour on 22 July and 5.16 sightings/hour on 23 July. This sighting frequency is representative both of higher animal density in Southern California as well as exceptional seastate conditions (Beaufort 1-2) that were encountered on those days. Approximately 899 digital photographs of marine mammals were taken.

Potentially unusual behavior was observed for one pinniped sighting while MFAS was active. A California sea lion sighted at a range of 364 – 400 m at a bearing of 30º to starboard was observed to be continuously leaping through more than a dozen leaps, in different directions with each leap, including often changing leap direction 180º between consecutive leaps. The cause of this behavior cannot be conclusively determined. There are significant data unknowns about at-sea behavior for many marine mammals, pinnipeds included. For instance, although this could have been a reaction to the sonar use, or ship presence, it just as well could have been a reaction to other natural events. For instance, it is unknown if the leaping sea lion observed during this trip was reacting to unseen prey or subsurface predator. Southern California has a significant migratory population of white sharks and may represent a potential nursery for white shark juveniles[2]. White sharks are known to prey on marine mammal including sea lions.

CONCLUSIONS

The goals of the lookout effectiveness monitoring effort are provided below, with a conclusion regarding each of the goals:

1) Collect data to determine the effectiveness of the Navy lookout team.

The execution of this study in waters known to contain a high density of marine mammals produced a commensurately greater amount of useful data (i.e., trials) than in past cruises. However the high sighting rates experienced on some days resulted in some difficulties for the DMMO to efficiently record data, which included sightings and resightings for both sides of the vessel from both MMOs and Navy Lookouts where multiple groups of animals were simultaneously available. Therefore some changes will be recommended in the final report regarding both the construction of the data recording forms as well as contingencies in scanning protocol regarding effort expended toward searching for resights or following continuously-available animals, especially after seen by the Navy L or if the animals have passed abeam. This event is the third aboard a DDG in which data were collected to determine effectiveness; data will be combined with future monitoring efforts in order to determine the effectiveness of Navy lookouts as a whole, rather than specific to each vessel.

2) Obtain data to characterize the possible exposure of marine species to MFAS and behavioral reactions or lack of reactions.

[2] Jorgensen, S.J., Reeb, C.A., Chapple, T.K., Anderson, S., Perle, C., Van Sommeran, S.R., Fritz-Cope, C., Brown, A.C., Klimley, A.P., and Block, B.A. 2009. Philopatry and migration of Pacific white sharks. Proc. R. Soc. B. doi:10.1098/rspb.2009.1155

http://www.topp.org/sites/topp.org/files/topp/publications/Jorgensen_et_al_rspb200911551.pdf

Weng, K.C., O'Sullivan, J.B., Lowe, C.G., Winkler, C.E., Dewar, H., Block, B.A.2007. Movements, behavior and habitat preferences of juvenile white sharks *Carcharodon carcharias* in the eastern Pacific. Marine Ecology Progress Series 338: 211-224

Sightings information included the bearing and distance of the animal to DDG C. This information can be used to determine, if MFAS was in use and to what level the animal may have been exposed to MFAS. Reconstruction of the event and the determination of the possible exposures of marine species to MFAS will be completed under separate task. Obtaining the data needed to make these determinations was successful. There were no behavioral reactions noted during this period that indicated adverse response, although quantification of biological reaction is difficult and the data from this MMO event is still under review.

Minor changes to the data forms, protocols, and recommended equipment were made by the MMO team, and will be considered for implementation in future lookout effectiveness studies. In particular, it was possible for the MMOs to conduct sightings and report them even when they were stationed in front of the Navy lookouts. The higher density of animals found in the waters of the Southern California Range Complex (as compared to the Jacksonville range complex or Hawaii range complex) allowed for a significantly greater number of trials. Future lookout effectiveness studies in the Southern California Range Complex are recommended when possible. However, the higher frequency of sightings may necessitate slight adjustments to the data-entry forms, as well as the sighting protocol to facilitate accurate and efficient data collection as well as maximizing sighting effort.

Table 1. MMO survey times and environmental conditions from 22-28 July 2010 MMO event.

Date	Observation Time	Beaufort Sea State	% Cloud Cover	Visibility
22 Jul	1300-1341, 1607-1658, 1821-1934	1	0 – 100	Good-Excellent
23 Jul	0728-1201, 1258-1631	1 – 2	70 – 100	Good – Excellent
24 Jul	0741-0917, 1000-1202; 1316-1631	3 – 5	99 – 100	Moderate
25 Jul	0736-1141, 1242-1650	4 – 5	92 – 100	Good
26 Jul	1039-1146, 1254-1702, 1757-1947	2 – 3	20 – 100	Moderate – Excellent
27Jul	0731-1151, 1234-1701, 1749-1857	2 – 4	0 – 100	Good – Excellent
28 Jul	0721-1158, 1342-1517, 1541-1701	2 – 5	5 – 100	Good

Table 2. Summary of MMO marine mammal observations from 22-28 July 2010 MMO event.

Species	Unique animal group sightings [1]	Total number of animals (based on best group size estimate)
California sea lion	9 (11)	16
Bottlenose dolphin	6 (7)	88
Long-beaked common dolphin	2	105
Short-beaked common dolphin	3	135
Risso's dolphin	2 (3)	14
Blue whale	3	6
Minke whale	3	3
Mixed species group	3	-
Unidentified common dolphin	2	105
Unidentified balaenopterid	12	13
Unidentified small balaenopterid [2]	0 (1)	2
Unidentified otariid	6	6
Unidentified pinnipeds	18	24
Unidentified dolphin	18 (19)	142
Unidentified whale	13	16
Unidentified marine mammal	5	5
Totals:	**105**	**680**

[1] Numbers in parentheses includes composition of the three mixed species groups
[2] One among these sightings was judged to be either a fin whale, Bryde's whale, or sei whale
Additionally, three sightings of three sea-lion carcasses in a state of decomposition were sighted on 22 July at 15:25, 23 July at 14:06, and 25 July at 13:53. GPS coordinates of the vessel at the time of sighting, as well as opportunistic photographs were taken of all three sightings. These sightings are not tabulated in the sighting tables. Carcass sightings were relayed to NMFS Southwest Region Stranding Coordinator.

Figure 1. Selected photographs of marine mammal sightings – a. long beaked common dolphins; b. Risso's dolphins; c. California sea lions; d. blue whale; e. bottlenose dolphins; f. unidentified large balaenopterid (likely fin whale, Bryde's, or sei whale).

SOUTHERN CALIFORNIA YEAR2 PASSIVE ACOUSTIC MONITORING

Under terms and conditions of the Navy's Year 2 01 August 2009 to 02 August 2010 Monitoring Plan, the Navy continued deployment of two bottom mounted passive acoustic monitoring (PAM) devices within the Southern California Range Complex (**Figure S-4**).

Two high-frequency acoustic recording packages (HARP) were designed, manufactured, deployed, and analyzed by the Whale Acoustic Lab, Marine Physical Laboratory of Scripps Institute of Oceanography (Dr. John Hildebrand) (http://cetus.ucsd.edu/). The HARP records broadband acoustic data (10 Hz – 100 kHz), including both marine species sounds and anthropogenic sound including Navy sonar and broadband commercial and some military ship sounds. One HARP at a depth of 4,265 feet is located southwest of San Clemente Island near the eastern slope of the East Cortes Basin. The other HARP is located just north of the Southern California Range Complex northern boundary, northwest of San Clemente Island in the southern part of the Santa Cruz Basin (**Figure S-4**).

Preliminary analysis of these two HARPs for the time period 11 March 2009 to 26 March 2010 is contained in **Appendix C**. The reporting period of March-to-March is based on service time required for the HARPs (retrieve HARP, gather data, re-deploy HARP), and to allow analysis time for inclusion within Appendix C. The Navy and Scripps' initial goal was to have a full years worth of data for presentation within the Navy's 2010 monitoring report.

While Appendix C contains PAM results from the two Navy compliance monitoring funded PAM devices, it should be noted that substantial amounts of additional passive acoustic data was also collected this past year for Navy research funded HARPs both within and outside of the Southern California Range Complex (see Figure S-4). Analysis of data from these other HARPs, which are sometimes shifted in location within Southern California, are ongoing and not contained in this report.

Specific PAM highlights accomplished in Year 2 include:

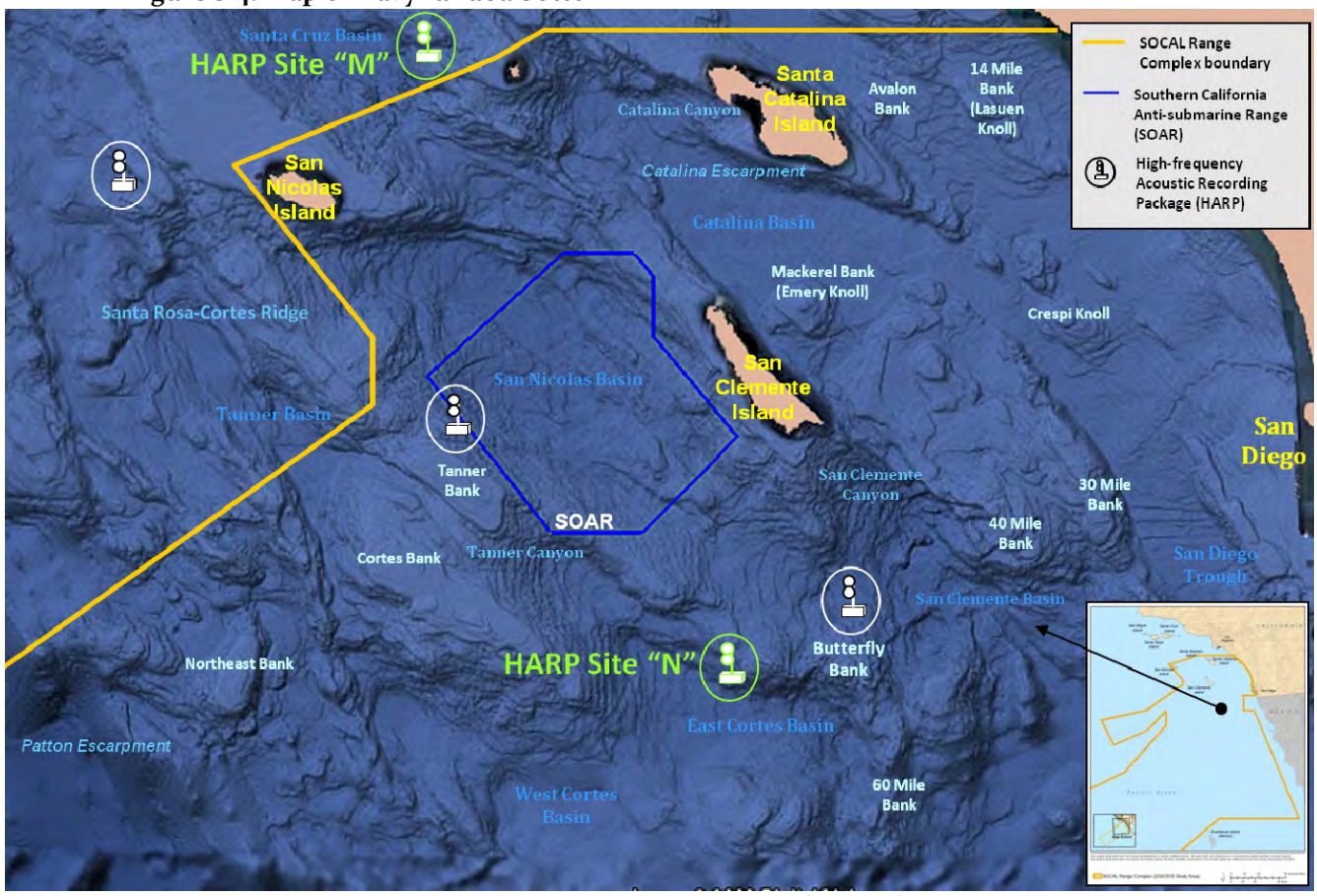
HARP M- 7,591 hours of passive acoustic recordings

- Detected marine mammals include: blue whale, fin whale, unidentified whale, Bryde's whale, minke whale, humpback whale, sperm whale, killer whale, unidentified beaked whale, Baird's beaked whale, Risso's dolphin, Pacific white-sided dolphin, unidentified odontocete, and pinniped. Anthropogenic sounds include mid-frequency active sonar, echosounders, ship noise, and explosions.

HARP N- 7,744 hours of passive acoustic recordings

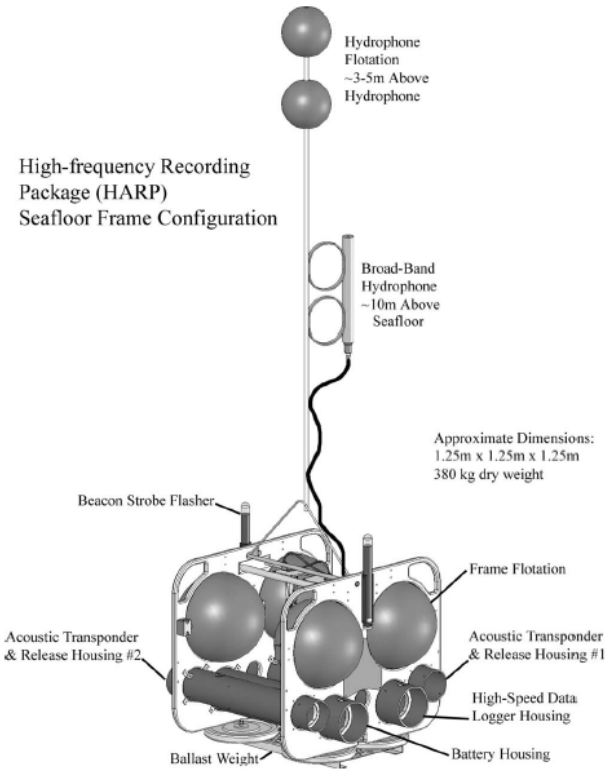
- Detected marine mammals include: blue whale, fin whale, unidentified whale, Bryde's whale, minke whale, humpback whale, sperm whale, killer whale, unidentified beaked whale, "43 kHz" beaked whale, "50 kHz" beaked whale, Baird's beaked whale, Risso's dolphin, Pacific white-sided dolphin, unidentified odontocete, and pinniped. Anthropogenic sounds include mid-frequency active sonar, echosounders, ship noise, and explosions.

Figure S-4. Map of Navy funded bottom



mounted high-frequency acoustic recording packages (HARPs) deployed within or adjacent to the Southern California Range Complex.

(HARP schematic is shown right. Buoys "M" and "N" are two HARPs funded by US Pacific Fleet compliance monitoring; remaining HARPs are funded by the Navy's research program; buoy locations as of July 2010)



Vessel noise- Discussions of anthropogenic ship sounds in terms of passive acoustic monitoring within the Southern California Range Complex must take into account both commercial as well as military ship traffic. While Navy major training events often have multiple ships at sea for period of up to two or three weeks, cumulatively over a year's time, from August 2009 to August 2010, this only resulted in 40 non-consecutive days of Navy multi-ship at-sea time (See following *Southern California Range Complex Exercise Summary Results* Section). In addition, most of the Navy combatant ships (cruisers, destroyers, and frigates) are engineered to be as quite as possible to enhance their warfighting capabilities, and are often difficult to detect at long ranges via passive acoustics.

In contrast to military ship traffic, Southern California including portions of the Southern California Range Complex lie along major shipping routes to and from South America, and from the port of San Diego to Japan and Hawaii. **Figure S-5**, provided by the Naval Postgraduate School in Monterey CA, shows average commercial ship density within Southern California for just a three month period from September to November 2009.

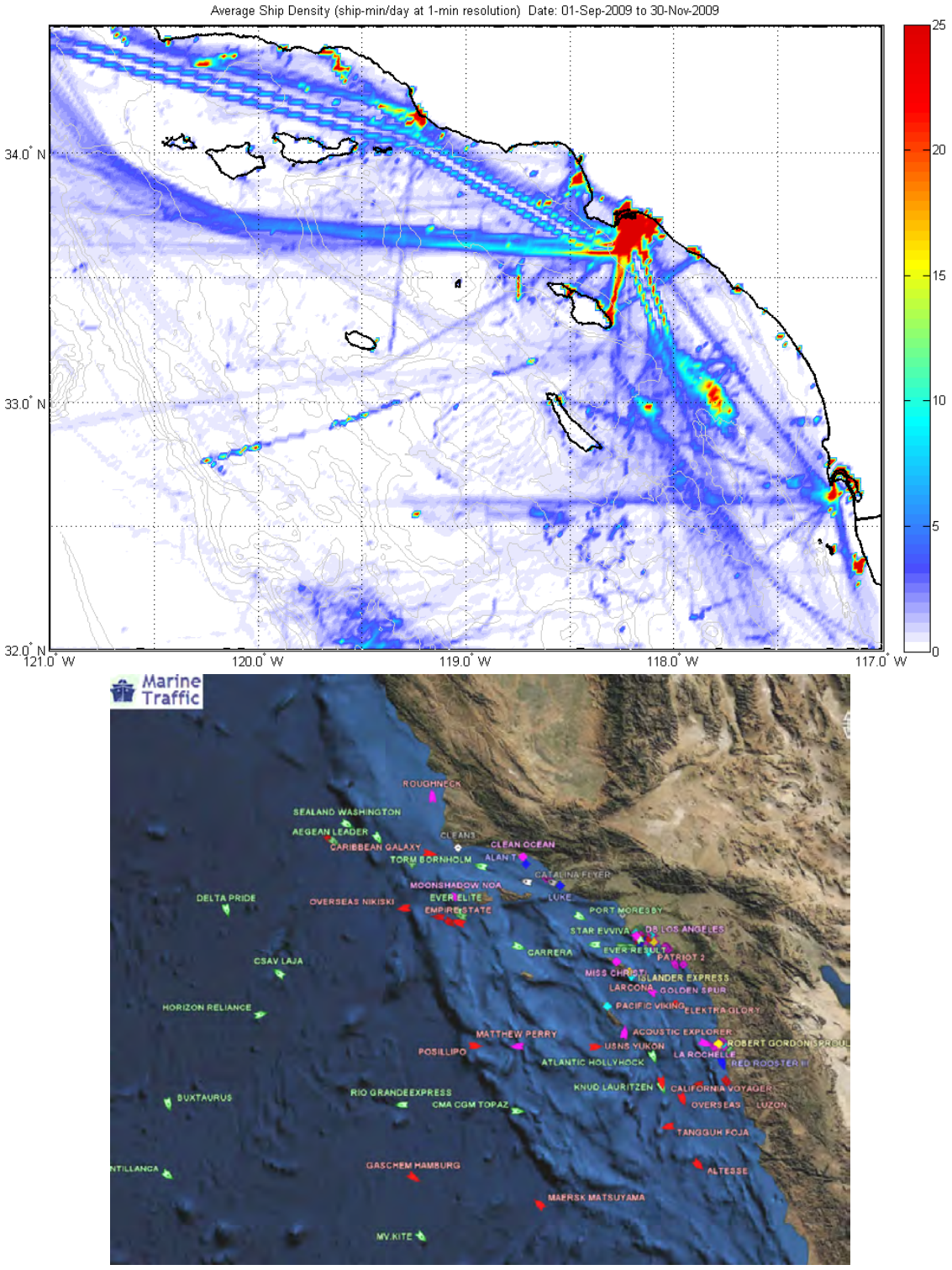


Figure S-5. Average commercial ship density in Southern California based on analysis on cumulative Automatic Identification System (AIS) data from September to November 2009.

(top graphic courtesy of J. Joseph, Naval Postgraduate School, Ocean Acoustics Lab; bottom panel shows representative individual ship traffic from AIS data at 2:00 PM on 15 September 2010)

SOUTHERN CALIFORNIA YEAR 2 MAJOR TRAINING EXERCISE SUMMARY

SUMMARY: The three categories of mitigation measures (Personnel Training, Lookout and Watchstander Responsibility, and Operating Procedures) outlined in the SOCAL Final Environmental Impact Statement/Overseas Environmental Impact Statement of December 2008 and approved by NMFS in subsequent Letters of Authorization in 2009 and 2010 were effective in appropriately mitigating exposure of marine mammals to mid-frequency sonar. For the most part, during this year's major exercise events, the proscribed NMFS safety zones were adhered to, and vessels and aircraft applied mitigation measures when marine mammals were visually observed within the requisite zone.

Fleet commanders and ship watch teams continue to improve individual awareness and enhance reporting practices. This improvement can be attributed to the various pre-exercise conferences, mandatory Marine Species Awareness Training, adherence to required MFAS mitigation zones, and application of lesson learned in marine mammal sighting and reporting.

For the five major training events conducted in the Southern California Range Complex this reporting period (02 Aug 2009 to 01 Aug 2010), the Navy conducted over 4,127 hours of Marine Species Awareness Training for 2,795 Navy personnel prior to getting underway. In addition, over the 40 non-consecutive major training event days in this same period (**Table S-4**), the Navy performed over 25,835 hours of visual observation (when counting the number of individual watchstanders engaged in lookout or navigation duties times the number of ships involved times the number of days at-sea)."

Table S-4. SOCAL Range Complex major training events from 02 August 2009 to 01 August 2010.

MTE Type	Dates	# Of Days	# of Ships Involved	# Of Marine Mammal Sightings	# Of Marine Mammals
SUSTEX	11-18 November 2009	8	8	13	136
IACII	08-10 March 2010	3	5	34	249
COMPTUEX	17 March to 02 April 2010	17	7	25	190
IACII	14-16 May 2010	3	8	56	319
COMPTUEX	23 Jul-14 Aug 2010 *	9 *	11	82	313
	Totals:	40 days	39 ships	210 sightings	1,207 marine mammals

Note: * A COMPTUEX occurred from 23 July 2010 until 14 August 2010. Given this exercise occurred between monitoring report periods which run from Aug to Aug, details from this event are summarized for the period 23-31 July. Data from 01-14 August will be included in the 2011 Monitoring Report (Aug 2010 to Aug 2011).

SUSTEX= Sustainment Exercise

COMPTUEX= Composite Training Unit Exercise

IACII = Integrated Anti-submarine Warfare Course Phase II

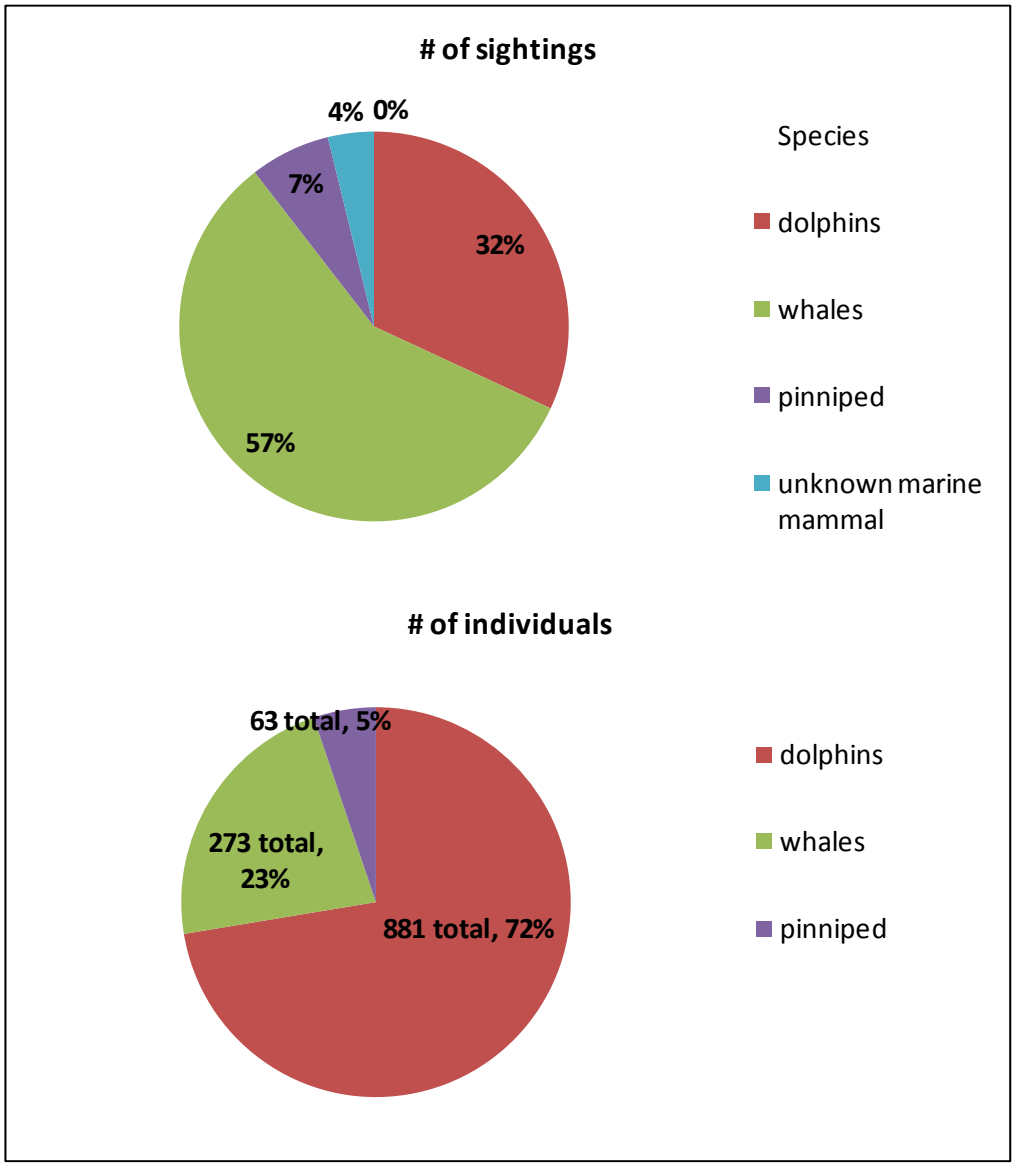


Figure S-6. Chart of marine mammal sightings (top panel) and sightings by species type (bottom panel) during SOCAL Range Complex major training events from 02 August 2010 to 01 August 2010.

SOCAL Major Training Event Marine Mammal Observations

There were approximately 210 sightings of an estimated 1,217 marine mammals over the course of five major training events in the Southern California Range Complex (**Table S-5, Figure S-6**). Breakdown of sightings by species type were:

-Dolphins: 67 sightings of 881 animals (32% of total sightings, 72% of total animals)
-Whales: 121 sightings of 273 animals (58% of total sightings, 22% of total animals)
-Pinniped: 14 sightings of 63 animals (7% of total sightings, 5% of total animals)

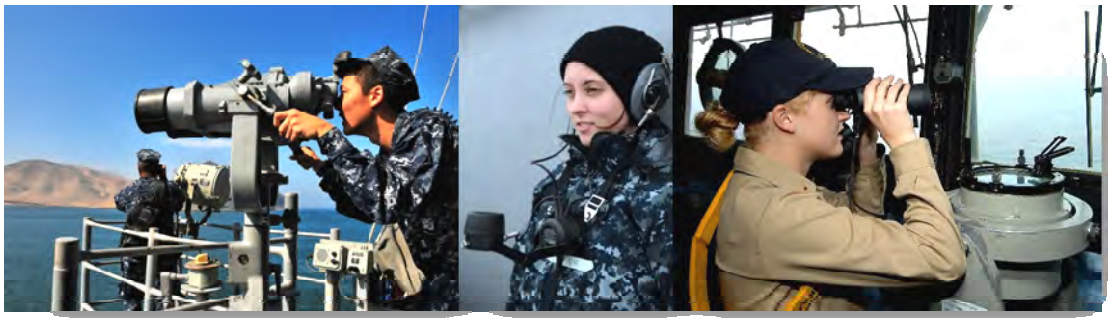
Dolphin species in Southern California typically occur in larger pods than whales, hence the higher number of dolphins and larger percentage of total numbers seen in these counts.

Table S-5. Total number of marine mammal sightings observed from Navy platforms during SOCAL Range Complex major training events from 02 August 2009 to 01 August 2010.

Species Type	# of sightings	% of total sightings	# of marine mammals	% of total number of marine mammals
Dolphins	67	32%	881	72%
Whales	121	57%	273	23%
Pinniped	14	7%	63	5%
Unidentified marine mammals	8	4%	not reported	not applicable
Totals:	210	1,207		

Note: Totals represent sum of observations during both MFAS\explosive events, and during non-MFAS\ non-explosives training periods.

Navy lookouts and bridge watchstanders on surface ships within the Southern California Range Complex during 2009-2010 (U.S. Navy photographs).



SOCAL Major Training Event Mitigations

Of the 210 Navy marine mammal sightings during major training events, there were 62 sightings within 1,000 yards that qualified as mitigation events (**Table S-5** and **Table S-6, Figure S-7**). In other, words mid-frequency active sonar surface ships had their sonar on, and followed the appropriate mitigation (secure or power down) depending on the range to the marine mammal.

These 62 mitigation events represented 29.5% of all marine mammal sightings for an estimated total of 306 marine mammals during this annual reporting period. As stated previously, with dolphins occurring either more frequently or in larger numbers within Southern California, of the 306 marine mammals observed during mitigation events, 218 were dolphins, 50 whales, and 38 pinnipeds (**Table S-5**).

Of the 62 mitigation events, there were 29 periods when sonar was turned off (i.e., secured) at ranges <200 yards from the ship, 27 periods when sonar power was turned down (i.e., powered down), and six periods when mitigation did not occur but with the explanations detailed below. There were also three reports of a Navy ship changing course in addition to applying sonar mitigation in order to open the range between the marine mammal and ship. The Navy lost a minimum of 20 hours of training time due to subsequent shut downs and power downs as a result of applying marine mammal mitigation during these sighting events at ranges less than 1,000 yards. There were no reports of any marine mammal behaving in any unusual manner during mitigation events.

Table S-6. Number of marine mammal sightings at ranges less than 1,000 yards observed from Navy platforms during major training events concurrent with MFAS mitigation from 02 August 2009 to 01 August 2010 in the Southern California range Complex.

			Breakdown by species type		
mitigation range	# of sightings	total # of marine mammals	# of dolphins	# of whales	# of pinnipeds
< 200 yards	15	75	33	21	21
200-500 yards	27	120	92	12	16
500-1000 yards	20	111	93	17	1
Totals:	62 *	306 *	218	50	38

* 62 sightings of 306 marine mammals is 29% of the total sightings and 25% of the total individuals observed during all major training events periods (MFAS\explosive and non-MFAS\non-explosive periods) (*see Table S-5*).

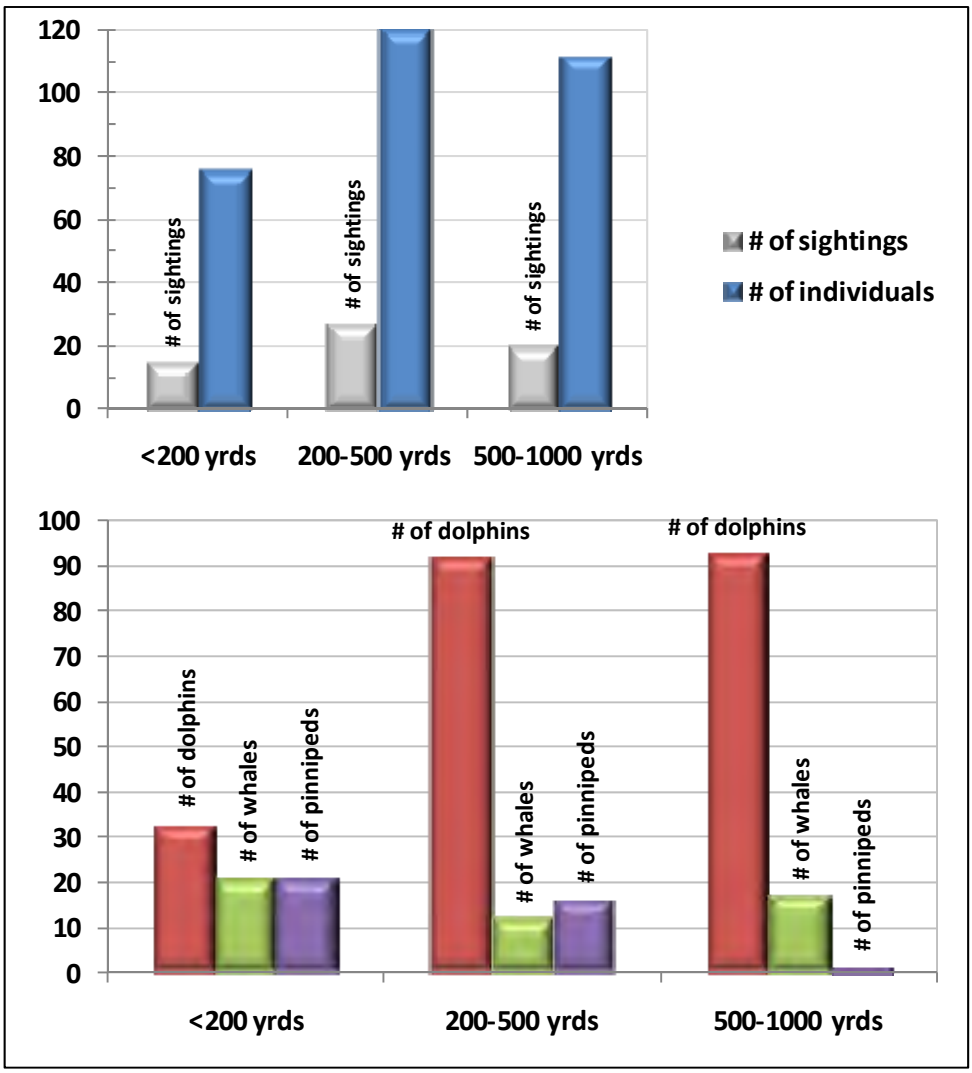


Figure S-7. Bar chart showing marine mammal sightings concurrent with MFAS mitigation (top panel) and breakdown of sightings by species type (bottom panel) from 02 August 2009 to 01 August 2010 in the SOCAL Range Complex.

Navy Safety Zone Adherence

For the most part, during this year's major exercise events, the proscribed NMFS safety zones were adhered to with the exceptions noted below. These six cases ranked by range between the marine mammal(s) and ship represent times when mitigation was not performed, although under the agreed to mitigation procedures with NMFS no mitigation is required in the case of bowriding dolphins, or if a marine mammal is leaving a mitigation zone.

Range	Ship Action	Analysis	Relative ship (circle-blue arrow) and marine mammal position (square-green arrow)
< 200 yards 1 pinniped	Ship did not shut down sonar	Ship was doing 144T @ 8 knots, and spotted seal at 050T, or slightly abaft the beam. By the time the seal sighting was received and understood by the bridge, it was already passed and opening (i.e., behind the ship), due in part to the confusion with 2 dolphins spotted at the same time at the same bearing, but beyond the mitigation zones (>1,000 yards). The ship's Officer of the Deck (OOD) realized the dolphins were not an issue, and disregarded other reports coming from the same bearing. By the time it was made clear to the OOD, the seal was outside of the safety zones. By happenstance, a Navy exercise representative was aboard this ship during the event. He conducted training with the ship's bridge team after the incident to explain what happened and provide guidance. **Assessment: erroneous initial reporting, then ship soon passed beyond mitigation range. Maximum exposure estimated to be << 189 dB given the orientation of the ship**	
9 pinnipeds	Ship did not shut down sonar	Ship was doing 211T when sea lions were spotted at 200T, or slighting abaft the starboard beam. **Assessment: Ship soon passed beyond mitigation range to the pinnipeds. Maximum exposure estimated to be <<189 dB given the orientation of the ship**	
2 whales	Ship powered down vice shut down sonar	Ship was doing 032T when whales were spotted 010T, or slightly to the left of the ship's bow. The ship powered down sonar for over an hour until the whales were well clear (>>1,000 yards) behind. **Assessment: Maximum exposure estimated to be <179 dB.**	
200-500 yards 1 dolphin	Ship did not power down sonar	Ship was doing 175T when dolphin spotted at 070T approaching the ship from the left rear. Dolphin continued to close and eventually ride the bow wave (bowride). **Assessment: dolphins were bowriding, no mitigation required**	
5 dolphins	Ship did not power down sonar	Ship was doing 175T when dolphins spotted at 070T approaching the ship from the rear. Dolphins continued to close and eventually ride the bow wave (bowride). **Assessment: dolphins were bowriding, no mitigation required**	
2 pinnipeds	Ship did not power down sonar	Ship was doing 210T when pinnipeds spotted at 220T, or slightly off the right bow. **Assessment: none. Maximum exposure estimated to be <189 dB**	
500-1000 yards 50 dolphins		Ship was doing 160T when dolphins spotted at 290T, or behind and to the right of the ship closer to the 1000 yard edge of the mitigation zone. Ship relative motion quickly put dolphins outside of mitigation range >1000 yards. **Assessment: minimum exposure, prior to no mitigation required**	

SOUTHERN CALIFORNIA YEAR 2 NAVY RESEARCH FUNDED MONITORING

Visual surveys, Marine Mammal Tagging, M3R, PhotoID Results

Navy research funded monitoring and marine mammal science within the Southern California Range Complex included several visual survey efforts, marine mammal tagging, and other relevant topics.

Specific field reports are included in **Appendix D** of this report, and include:

- Scripps Institute of Oceanography and National Marine Fisheries Service Southwest Fisheries Science Center small boat based marine mammal surveys in Southern California: Report of Results for August 2009 - July 2010

- Marine mammal surveys conducted during regularly scheduled California Cooperative Oceanic Fisheries Investigation (CalCOFI) field cruises within Southern California

- Cascadia Research Collective small vessel surveys and satellite tagging of marine mammal at SCORE[3] and surrounding areas of Southern California in 11-24 November* 2009 and 15-30 June 2010 **

  * Cacadia report combines July 2009 and November 2009 field efforts (**Appendix D**). Only November 2009 effort summarized in this report. The Navy's 2009 Monitoring Report (DoN 2009) contains the July 2009 field discussions.
  ** Data tabulation still ongoing for June event.

[3] SCORE is an older acronym for Southern California Offshore Range, and is the equivalent of the newer designation for the Southern California Range Complex

Scripps Institute of Oceanography and National Marine Fisheries Service, Southwest Fisheries Science Center small boat surveys in Southern California

Primary objectives of this research is to use sighting, photo-identification, biopsy and acoustical sampling techniques to assess the occurrence, distribution and population structure of small cetaceans in a region that is subject to frequent naval exercises. Surveys are conducted from a 6.8 m rigid-hulled inflatable boat (RHIB). Survey effort is focused on the Southern California Offshore Range (SCORE) near San Clemente Island as part of an ongoing collaborative study to assess cetacean populations occurring in this active Navy training area. Additional surveys were conducted at peripheral locations including Catalina Island and the San Diego coastline. This geographically broad approach was designed to increase the effectiveness of our Southern California monitoring efforts by collecting similar data at multiple sites across a large temporal scale, providing a regionally comprehensive assessment of small cetacean populations inhabiting the area. While the current small boat effort in Southern California incorporates data collection from all cetacean species encountered, bottlenose and Risso's dolphins were selected as initial focal species due to their accessibility, existing baseline data and varying life history patterns. Small vessel surveys were conducted at San Clemente and Catalina Island from 19-25 November 2009 and 14–24 June 2010. In addition, fourteen surveys were conducted along the San Diego coastline and three surveys were conducted in offshore waters during this same time period. Monitoring results are shown in **Table S-7** with specific study accomplishments for this year provided **Appendix D**.

Scripps small boat surveys accomplishments in parallel with Year 2 monitoring in the Southern California Range Complex include:

94 hours of visual survey effort over 834 nm
138 sightings of 9,890 marine mammals, and 6,404 digital photographs taken
Continuation of photoID catalogs for offshore stock of bottlenose dolphins
Continuation of photoID catalogs for Risso's dolphins

Table S-7. Cumulative total of Scripps Institute of Oceanography small boat surveys within the Southern California Range Complex from August 2009 to August 2010.

Species	# of Groups	# of Individuals	# of ID Images	# of Re-cordings	# of Biopsies
Coastal Bottlenose Dolphin	40	273	3,948	17	4
Offshore Bottlenose Dolphin	17	395	1,658	4	25
Risso's Dolphin	7	144	297	1	1
Pacific White-Sided Dolphin	26	260	4	11	2
Short-Beaked Common Dolphin	26	4,889	74	3	3
Long-Beaked Common Dolphin	10	3,484	280	4	0
Common Dolphin, species unknown	4	433	0	3	0
Fin Whale	5	9	53	0	1
Humpback Whale	1	1	17	0	0
Gray Whale	2	2	73	0	0
Totals:	**138**	**9,890**	**6,404**	**43**	**36**

Scripps Institute of Oceanography marine mammal surveys during California Cooperative Oceanic Fisheries Investigations (CalCOFI) surveys

The Navy's Research monitoring program funds marine mammal surveys during regularly occurring California Cooperative Oceanic Fisheries Investigation (CalCOFI) field cruises. Scripps Institute of Oceanography, Marine Physical Laboratory participates as marine mammal observers during these Southern California CalCOFI cruises.

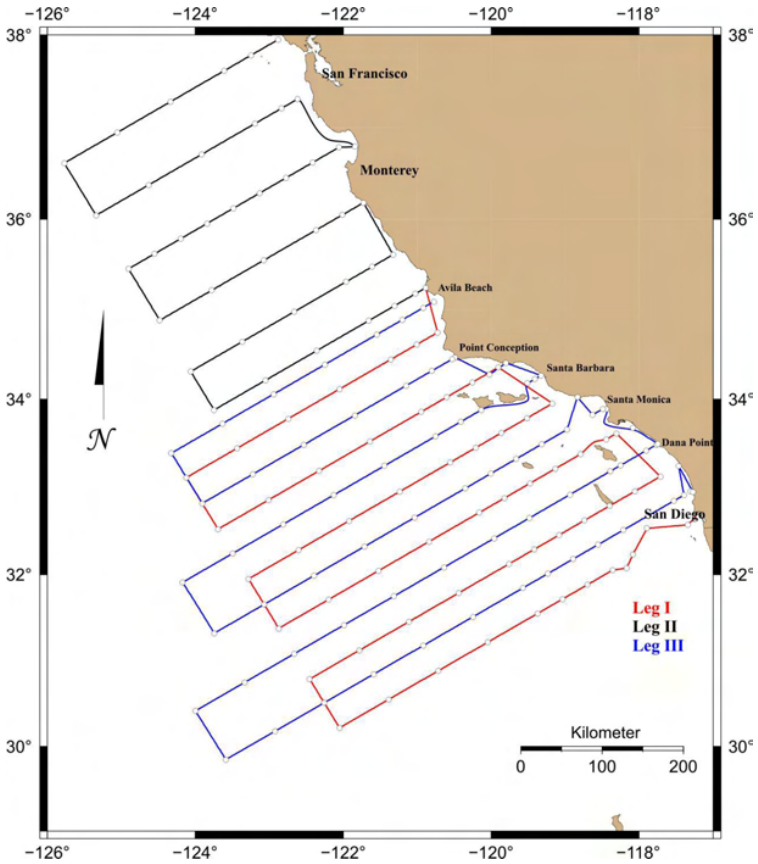
More information on the 61-year history of the CalCOFI program is available online at:

http://www.calcofi.net/

The CalCOFI marine mammal efforts represents some of the few winter vessel surveys within Southern California, consistent sampling of the same survey track lines, and coverage of a significant amount of offshore area.

Specific accomplishments for marine mammal surveys during CalCOFI cruises from 02 August 2009 to 01 August 2010 include:

- 390 hours of survey effort covering 4,030 nm
- 339 sightings of 17,632 marine mammals
- 258 digital photographs of marine mammals taken
- 747 hours of passive acoustic recording of marine mammal vocalizations
- **Appendix D** has a more complete discussion of CalCOFI results



CalCOFI station positions for standard transect (blue), trawling transect (red), and northern transect (black). Image courtesy of CalCOFI program.

Cascadia Research Collective small vessel surveys and satellite tagging of marine mammal at SCORE and surrounding areas of Southern California in 11-24 November 2009, and 15-30 June 2010

Cascadia Research participated in the fourth and fifth year of collaborative marine mammal surveys centered on the Southern California Offshore Range (SCORE)[i.e. the Southern California Range Complex]. The primary mission of these surveys since their inception has been to provide visual verification of passive acoustic detections on the Navy instrumented underwater passive acoustic monitoring range and array using the Navy's Marine Mammal Monitoring (M3R) system (Moretti et al. 2006)[4]. Over time, these surveys have evolved to include focal studies of several species of interest to the Navy, including beaked whales and ESA listed baleen whales, via photo-identification, tissue sampling, and the deployment of medium duration satellite tags.

This work has produced some of the first U.S. West Coast tagging of Cuvier's beaked whales (see **Appendix D**). Processing and analysis of photo-identification data for all species is underway. Cumulatively, including 2009 and 2010 field work, this effort has contributed to photoID of 68 fin whales and 58 Cuvier's beaked whales.

Cascadia survey, photoID, and tagging accomplishments in parallel with Year 2 monitoring in the Southern California Range Complex include:

196 hours of visual survey effort over >1,310 nm
160 sightings of 9,662 marine mammals
24 biopsies taken
19 medium duration Low Impact Minimally Percutaneous External-electronics Transmitter (LIMPET) satellite tracking tags deployed
- 8 fin whales, 3 blue whales, 1 Risso's dolphin- November 2009
- 2 fin whales, 2 Cuvier's beaked whales, 2 Risso's dolphins, 1 killer whale- June 2010

Tagging Highlights

Figure S-8 shows the long term movement of a tagged male Cuvier's beaked whale from the November 2009 survey. The beaked whale stayed a portion of its time along the western side of San Nicolas basin, before heading south past Baja when the tag was lost. This represents one of the first indications that Southern California beaked whales may engage in non-local, out of area movement, although the biological significance for this activity is not understood, nor is it known at this time if this is indicative for all beaked whales, just male beaked whales, or just this particular individual. **Figure S-9** shows 127 day track movement data for a fin whale tagged in the November 2009 survey. This whale was tagged on the middle of the Navy's instrumented range west of San Clemente Island, but spent time (presumably foraging) west and south of San Nicolas Island, before heading south down along the coast of Baja Mexico.
Figure S-10 shows a Cuvier's beaked whale with an attached satellite tag affixed during the June 2010 survey, while **Figure S-11** shows the track movement data for the two Cuvier's beaked whales tagged during that survey.

[4] Moretti D., Morissey R., DiMarzio N., and Ward J. 2006. Verified passive acoustic detection of beaked whales (*Mesoplodon densirostris*) using bottom-mounted hydrophones in the tongue of the ocean, Bahamas. Applied Acoustics 67:1091–1105.

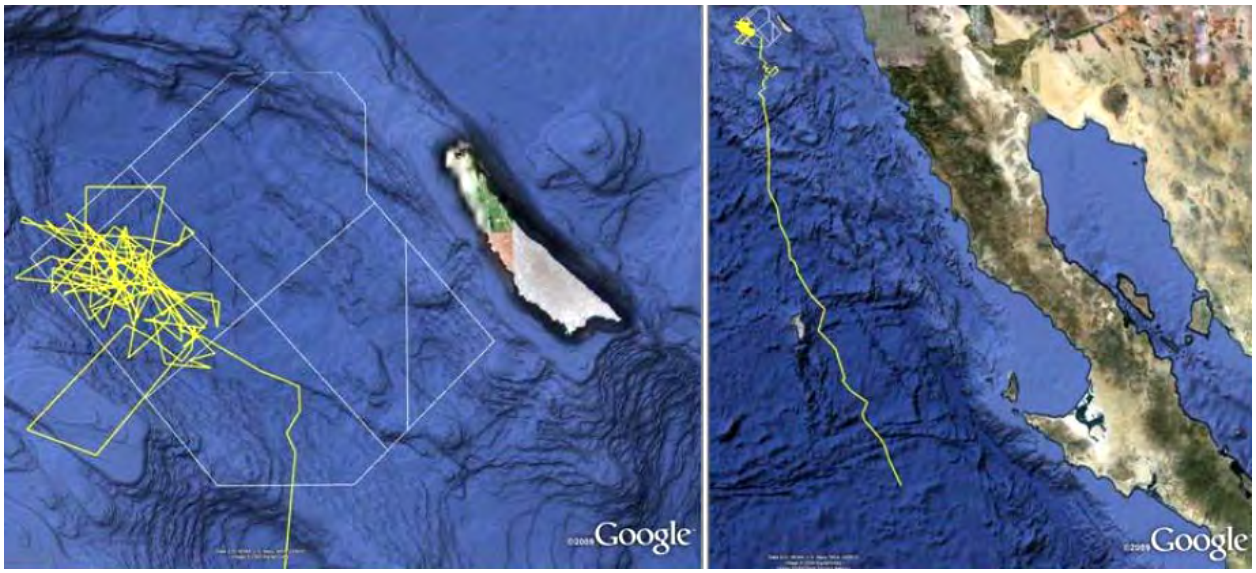


Figure S-8. Movements of a tagged adult male Cuvier's beaked whale showing the first month of movements after tagging in late July 2009 (3A) and the movement to the south (3B).

(Graphic courtesy of Cascadia Research Collective)

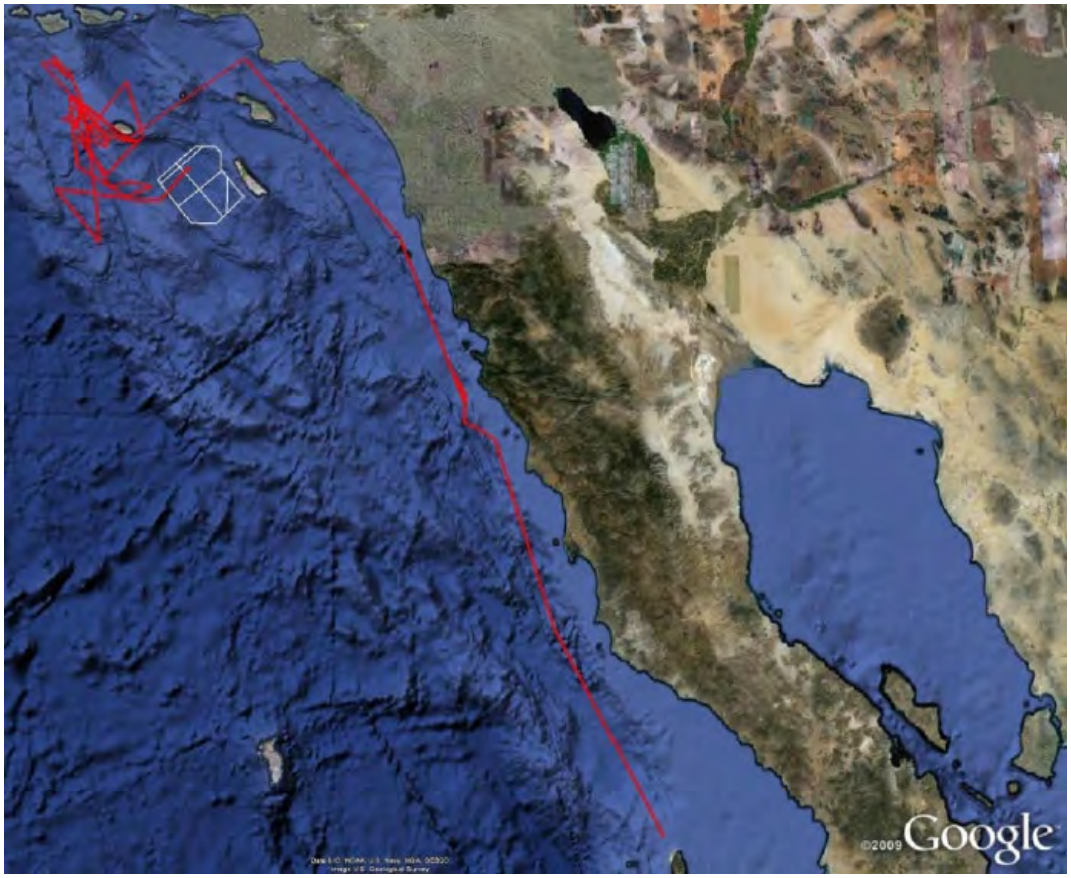


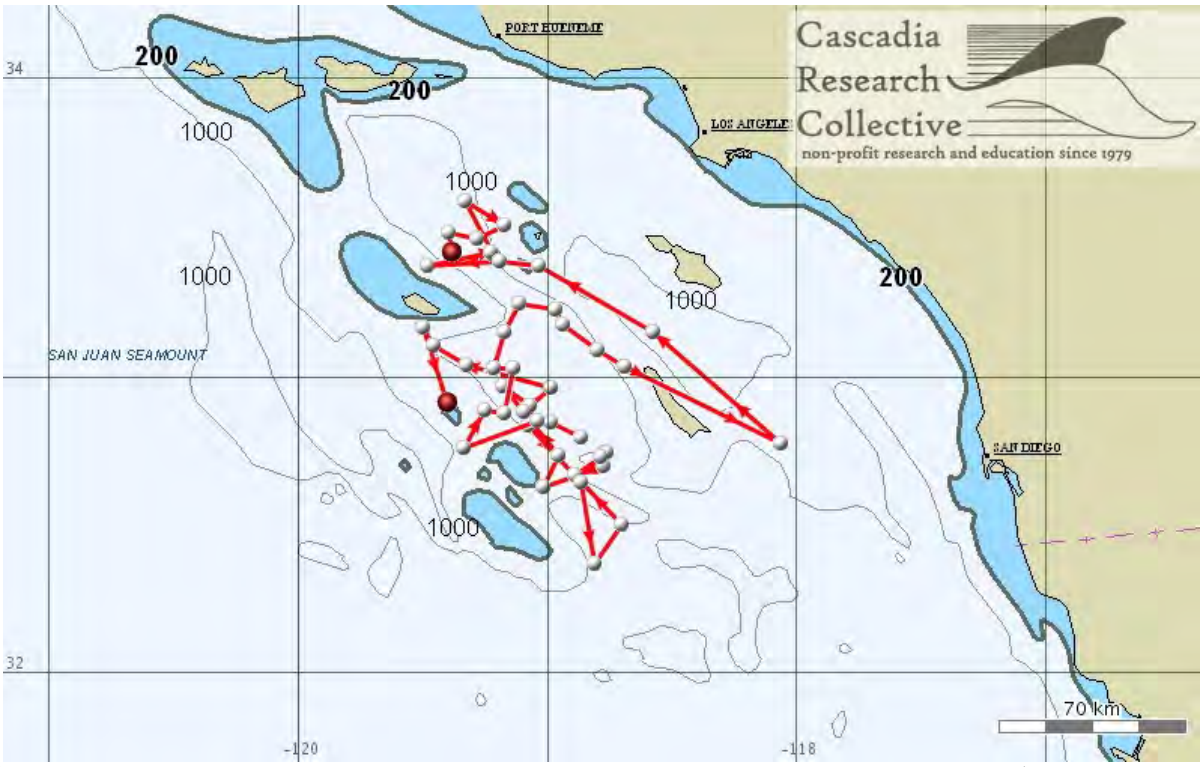
Figure S-9.Trackline representing the movements of a tagged fin whale over 127 days (total transmission duration for this whale was 160 days).

(Graphic courtesy of Cascadia Research Collective)

Figure S-10. Picture of Cuvier's beaked whale with satellite tag attached during 15-30 June 2010 visual survey and tagging field work in the Southern California Range Complex.

(Photograph courtesy of Erin Falcone, Cascadia Research Collective)

Figure S-11. Track movements of two satellite tagged Cuvier's beaked whales in the Southern California Range Complex.



(Unfiltered Argos satellite track log; Graphic courtesy of Erin Falcone, Cascadia Research Collective)

OTHER NAVY FUNDED RESEARCH IN CALIFORNIA

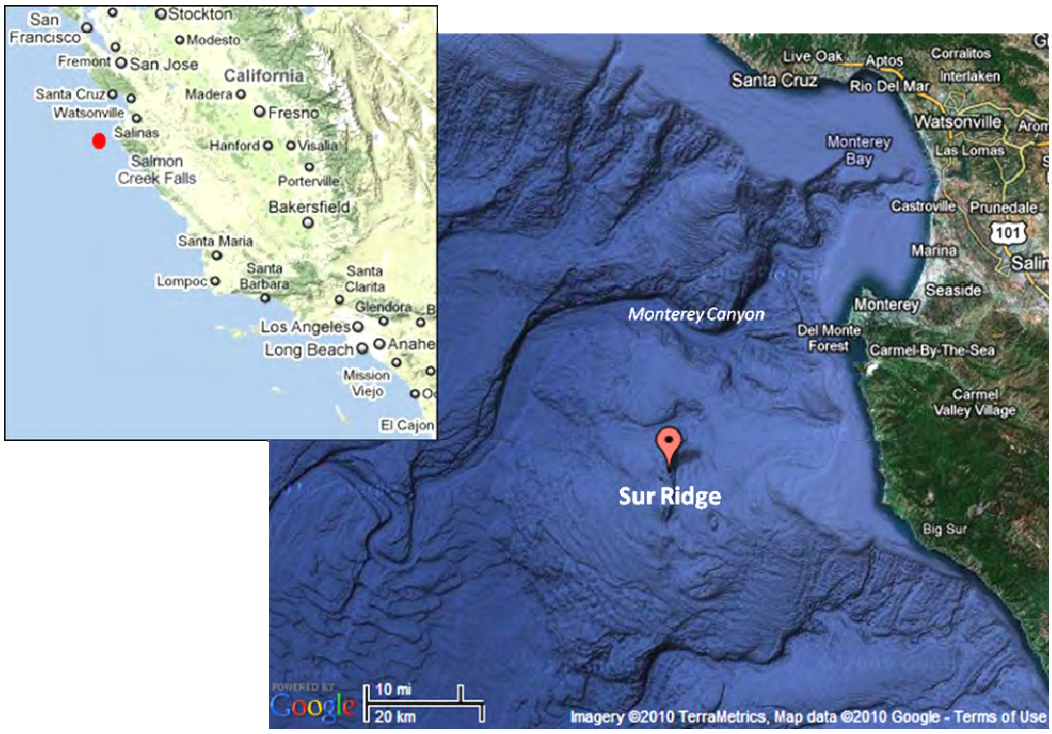
Naval Postgraduate School

The Naval Post-graduate school at Monterey, CA deployed a bottom-mounted HARP along the central California coast near the Sur Ridge to detect marine mammal vocalizations and seasonality in that region. The HARP has been in place since 23 September 2009.

Deployment details for this HARP are provided below. Approximate location for the HARP is along the Sur Ridge, south of Monterey Canyon.

Source	Start Date and Stop Date
Sur Ridge HARP (PS08)	23 September 2009 to 6 January 2010 @50% duty cycle (5 min/10 min)
Sur Ridge HARP (PS09)	22 February 2010 to ~ November 2010 @20% duty cycle (5 min/25 min)

The Naval Postgraduate School HARP data analysis is still ongoing for the September 2009 to January 2010 deployment. A technical report summarizing these results is in preparation and should be available at the end of 2010. Naval Postgraduate school also prepared the merchant ship automated information system plot for Southern California shown in **Figure S-5**.



Sur Ridge off central California

SOCAL-10

SOCAL-10 is the first phase of a multi-year effort (~2010-2015), notionally referred to as SOCAL-BRS (Behavioral Response Study). This research collaboration is designed to increase understanding of marine mammal behavior and reactions to sound. Direct, scientific information about these responses to different human sounds is very limited, but critically needed by both regulatory agencies to support informed conservation management decisions and requirements and militaries for effective operational planning to minimize environmental risk. This *project* extends previous BRS efforts conducted in the Bahamas and Mediterranean Sea in 2007-2009 and is being coordinated with related and successful field efforts (e.g., population surveys of Navy range areas, satellite tagging before active sonar operations) underway in southern California. SOCAL- 10 will use controlled exposure experiments to carefully measure behavioral responses of individual animals to sound exposure. It is part of an integrated, international effort using similar experimental approaches and observational tracking of animals during real activities. This project will take place during August and September 2010 in coastal areas from San Diego to Santa Barbara and the Channel Islands, as well as an offshore area on and around the U.S. Navy's training range near San Clemente Island. SOCAL-10 includes collaborations among scientists, acousticians, and engineers from National Oceanic and Atmospheric Administration, academic and private research laboratories, and U.S. Navy supported organizations.

Field work for BRS-10 to include marine mammal tagging began in August and September 2010. The Navy's next Monitoring Report in 2011 will contain more information on SOCAL-10 accomplishments.

Southern California marine mammal tagging efforts near Long Beach California under the SOCAL-10 project in September 2010.

Photo (left) M. Weiss, Office of Naval Research, (right) J. Calambokidis, Cascadia Research Collective.

CONCLUSIONS FOR SOUTHERN CALIFORNIA RANGE COMPLEX YEAR 2 MONITORING

The Navy achieved all of its planned annual monitoring objectives in Year 2 from 02 August 2009 to 01 August 2010. Most of the data collected will continue to be pooled with previous year's effort for continued scientific analysis over the full five year Southern California Range Complex authorization.

Significant contributions were made in Year 2 to learn more about baseline marine mammal occurrence, movement, and behavior within the Southern California Range Complex. To this end, over 11,900 nm of coastal and offshore waters within the Southern California were visually surveyed. These surveys occurred both during and without Navy major training events. Refinement on techniques and procedures continued for satellite tagging of ESA-listed baleen whales, Cuvier's beaked whales, and other species of interest. Passive acoustic monitoring provided the first long-term analysis of marine mammal vocalizations as an indicator of presence or absence across both warm and cold seasons. In the spirit of collaboration and information sharing within the marine science community, visual survey data from the Navy's Year 1 (2008-2009) and Year 2 (2009-2010) efforts will be made available online for download by the spring or early summer of 2011.

Finally, **Appendix A** contains the Navy's proposed Year 3 Southern California Range Complex Monitoring Plan for the period 02 August 2010 to 01 August 2011.

Most of the same techniques used as measures of accomplishments for Year 2 will also apply in Year 3.

discovered that even when the range was available and weather favorable, securing lodging on island on short notice was difficult or impossible at times. Also the need to install Intuicom tracking packages and range radios ahead of each survey costs up to a half day of time. One solution to these challenges would be to identify a permanent ongoing housing arrangement and purchase hardware that could be permanently installed on RHIBs so that staff could come and go from the island more flexibly.

Though temporal flexibility may always be limited by logistics as SCORE, geographic flexibility is much more feasible and provides a way to better use field days that can't be expended on the range, as seen this year. When the range was closed for a day and a half in July 2009, we were able to work back inshore, reposition further up the coast and cover waters from Dana Point to Long Beach, the inside shelf edge of Santa Catalina Island, and a wide swath of waters in the Santa Catalina Basin before returning to the range. This provided a substantial amount of sighting and photo-ID data from adjacent regions, which is very relevant baseline data for characterizing the SCORE populations within a broader regional context. We also feel that the many days spent tagging off-range in November were much better spent moving throughout the Southern California Bight as opposed to being restricted to SCORE when conditions and range restrictions prevented work there, and hope to continue to operate in this fashion in 2010.

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