

Marine Species Monitoring For the U.S. Navy's Hawaii Range Complex 2013 Annual Report



1 March 2014



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The level of effort accomplished during this monitoring period was 130.05 visual survey hours, 12 tags deployed, one Lookout Effectiveness study embark, and two underwater detonations monitored. There was no specific metric for passive acoustic monitoring in Year Five, which resulted in an increase in the use of a unique and powerful asset—the Pacific Missile Range Facility instrumented hydrophone range. Data collection primarily focused on the Submarine Commanders’ Course, which was selected through Adaptive Management Review as an ideal exercise to monitor due to its proximity to Pacific Missile Range Facility, high level of monitoring opportunities, and ability to synergize with existing efforts from the Living Marine Resources (LMR) program. Marine mammal observers and U.S. Navy lookouts recorded all marine mammal sightings and observed mitigation measures, as required.

Among the monitoring accomplishments are an increased understanding of the spatial movement patterns and habitat use of species which may be exposed to mid-frequency active sonar, estimated received levels on odontocetes during naval training events, and detected behavioral response, or lack thereof, of monk seals and beaked whales to mid-frequency active sonar. For example, evidence points to a demographically isolated population of bottlenose dolphins off Kauai, an island-associated population of short-finned pilot whales which move over an area spanning Kauai, Niihau, Kaula, and Oahu and associate with shelf habitat, and site fidelity in rough-toothed dolphins to the Kauai and Niihau area and that these ranges substantially overlap with PMRF (Baird et al. 2013c). Progress was also made in furthering our understanding of exposure levels. It was estimated that the received levels for beaked whales at the Pacific Missile Range Facility varied from 52 to 137 decibels (dB) referenced to (re) 1 micropascal (µPa) (mean 109 dB, standard deviation 22 dB) while the animals were presumed to be at depth foraging during a naval training event (Monzano-Roth et al. 2013). Received levels were estimated assuming the animals were at/near the sea surface and averaged 40.1 dB higher than those estimated at foraging depth (Monzano-Roth et al. 2013). Lastly, progress was also made in understanding behavioral response. No abnormal behavior was detected in Hawaiian monk seals during periods in which cell phone tag data overlapped with periods of mid-frequency active sonar (D’Amico 2013). However, there were statistically significant differences in dive rates of beaked whales after the initiation of a naval training event, in addition to observed diel occurrence patterns and spatial distributions of dives (Monzano-Roth et al. 2013).

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Under The Marine Mammal Protection Act and Endangered Species Act
For Incidental Harassment of Marine Mammals Resulting From
U.S. Navy Training Activities in the Hawaii Range Complex**

Marine Species Monitoring For the U.S. Navy's Hawaii Range Complex

2013 Annual Report

**Prepared in Accordance With
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**Submitted By
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United States Pacific Fleet
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EXECUTIVE SUMMARY

This report presents the United States (U.S.) Department of the Navy's (Navy's) Year Five monitoring accomplishments in the Hawaii Range Complex from the monitoring period of 2 August 2012 to 31 December 2013 and the evolution of process as a result of Adaptive Management. The U.S. Pacific Fleet achieved the monitoring goals for metrics, with two exceptions, as stated in the Hawaii Range Complex Fiscal Year 2012-2014 (FY12-14) Monitoring Plan submitted to the National Marine Fisheries Service (DoN 2011, 2012).

The evolution of process in the Hawaii Range Complex Monitoring Program has been, and continues to be, concurrent with the evolution of the larger U.S. Navy Marine Species Monitoring Program. While systemic changes will be implemented in concert with the issuance of National Marine Fisheries Service (NMFS) Letter of Authorization (NMFS 2013) for Navy's Hawaii-Southern California Environmental Impact Statement (HSTT EIS) (DoN 2013b), marine species monitoring in the Hawaii Range Complex demonstrated specific incremental changes in Year Five, which are representative of some of the anticipated future directions for the Hawaii Range Complex Monitoring Program.

Adaptive Management discussions in 2012 and 2013 between the Navy and NMFS enabled the Navy's monitoring program to shift from rigid effort based-metrics to question-based reporting. Although the HRC Marine Species Monitoring Plan for 2012-2014 was not formally resubmitted, this flexibility was applied to HRC. This process change increased local scientific input at the planning stages, facilitated the generation of statistically powerful results, and fostered collaboration. It has generated enhanced results in this report, through demonstration of specific progress in furthering our understanding of the monitoring questions. The questions were developed to fit within the existing metric-based requirements, while in the future, questions are planned to be developed through the U.S. Navy Strategic Planning Process.

The level of effort accomplished during this monitoring period was 130.05 visual survey hours, 12 tags deployed, one Lookout Effectiveness study embark, and two underwater detonations monitored. There was no specific metric for passive acoustic monitoring in Year Five, which resulted in an increase in the use of a unique and powerful asset—the Pacific Missile Range Facility instrumented hydrophone range. Data collection primarily focused on the Submarine Commanders' Course, which was selected through Adaptive Management Review as an ideal exercise to monitor due to its proximity to Pacific Missile Range Facility, high level of monitoring opportunities, and ability to synergize with existing efforts from the Living Marine Resources (LMR) program. Marine mammal observers and U.S. Navy lookouts recorded all marine mammal sightings and observed mitigation measures, as required.

Among the monitoring accomplishments are an increased understanding of the spatial movement patterns and habitat use of species which may be exposed to mid-frequency active sonar, estimated received levels on odontocetes during naval training events, and detected behavioral response, or lack thereof, of monk seals and beaked whales to mid-frequency active sonar. For example, evidence points to a demographically isolated population of bottlenose dolphins off Kauai, an island-associated population of short-finned pilot whales which move over an area spanning Kauai, Niihau, Kaula, and Oahu and associate with shelf habitat, and site fidelity in rough-toothed dolphins to the Kauai and Niihau area and that these ranges substantially overlap with PMRF (Baird et al. 2013c). Progress was also made in furthering our understanding of exposure levels. It was estimated that the received levels for beaked whales at the Pacific Missile Range Facility varied from 52 to 137 decibels (dB) referenced to (re) 1 micropascal (μPa) (mean 109 dB, standard deviation 22 dB) while the animals were presumed to be at

**Marine Species Monitoring for the U.S. Navy's Hawaii Range Complex
2013 Annual Report**

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**Marine Species Monitoring for the U.S. Navy’s Hawaii Range Complex
2013 Annual Report**

TABLE OF CONTENTS

1	<u>INTRODUCTION</u>	1
1.1	BACKGROUND.....	1
1.2	INTEGRATED COMPREHENSIVE MONITORING PROGRAM	1
1.3	REPORT OBJECTIVES	2
2	<u>HAWAII RANGE COMPLEX MONITORING OVERVIEW</u>	2
2.1	HAWAII RANGE COMPLEX YEAR FIVE MONITORING OBJECTIVES	4
2.2	HAWAII YEAR FIVE MAJOR TRAINING EXERCISES SUMMARY	4
2.2.1	OVERVIEW OF MAJOR TRAINING EXERCISES.....	4
2.2.2	OVERVIEW OF SIGHTINGS DURING MAJOR TRAINING EXERCISES.....	5
2.2.3	DISCUSSION OF MITIGATIONS.....	5
2.3	HAWAII YEAR FIVE MONITORING ACCOMPLISHMENTS.....	6
2.3.1	SUMMARY OF METRICS	6
2.3.1.1	Metrics Met or Exceeded.....	6
2.3.1.2	Metrics Shortfalls	6
2.3.2	MONITORING TIMELINE	8
2.3.3	PROJECT UPDATES AND ABSTRACTS.....	15
2.4	OTHER NAVY-FUNDED RESEARCH IN HAWAII (OFFICE OF NAVAL RESEARCH, N45, LIVING MARINE RESOURCES) 23	
2.5	HAWAII RANGE COMPLEX ADAPTIVE MANAGEMENT AND 2013–2014 MONITORING PLAN.....	26
3	<u>LITERATURE CITED</u>	30
4	<u>LIST OF SUPPORTING TECHNICAL REPORTS</u>	32

LIST OF TABLES

TABLE 2-1:	2012-2014 HAWAII RANGE COMPLEX MONITORING COMMITMENTS.....	4
TABLE 2-2:	TOTAL NUMBER OF MARINE MAMMAL AND SEA TURTLE SIGHTINGS OBSERVED FROM U.S. NAVY PLATFORMS DURING HAWAII RANGE COMPLEX MAJOR TRAINING EXERCISES FROM 2 AUGUST 2012 TO 1 AUGUST 2013	5
TABLE 2-3:	TOTAL NUMBER OF DOLPHIN, WHALE, PINNIPED, AND UNIDENTIFIED SIGHTINGS AND ESTIMATED NUMBER OF INDIVIDUALS OBSERVED FROM U.S. NAVY PLATFORMS DURING HAWAII RANGE COMPLEX MAJOR TRAINING EXERCISES FROM 2 AUGUST 2012 TO 1 AUGUST 2013	5
TABLE 2-4:	SUMMARY OF METRICS IN HAWAII RANGE COMPLEX	7
TABLE 2-5:	SIGHTINGS AND NOTABLE OUTCOMES	10
TABLE 2-6:	PERIODS DURING WHICH THERE WAS AN OVERLAP BETWEEN SATELLITE TAGGING OPERATIONS AND ACOUSTIC ARCHIVES FOR EXAMINING MID-FREQUENCY ACTIVE SONAR USE ON THE PACIFIC MISSILE RANGE FACILITY.....	16
TABLE 2-7:	SUMMARY OF UNITED STATES NAVY RESEARCH AND DEVELOPMENT MONITORING IN HAWAII RANGE COMPLEX.....	23
TABLE 2-8:	HAWAII RANGE COMPLEX REGION-SPECIFIC RESEARCH STUDY QUESTIONS STARTING IN 2014 (MONITORING PLAN)	27

**Marine Species Monitoring for the U.S. Navy's Hawaii Range Complex
2013 Annual Report**

LIST OF FIGURES

FIGURE 2-1: HAWAII RANGE COMPLEX INCLUDING TEMPORARY OPERATING AREA AS ANALYZED IN THE HRC EIS/OEIS (DoN 2008)3
FIGURE 2-2: MONITORING TIMELINE FOR 2 AUGUST 2012 TO 1 AUGUST 2013.....9

**Marine Species Monitoring for the U.S. Navy's Hawaii Range Complex
2013 Annual Report**

ACRONYMS AND ABBREVIATIONS

μPa	micropascal(s)	nm ²	square nautical mile(s)
μPa ² -s	micropascal squared second	NMFS	National Marine Fisheries Service
AMR	Adaptive Management Review	NOAA	National Oceanic and Atmospheric Administration
ASW	Anti-Submarine Warfare		
BSS	Beaufort Sea State	NUWC	Naval Undersea Warfare Center
CZMA	Coastal Zone Management Act	NWFSC	Northwest Fisheries Science Center
dB	decibel(s)	OEIS	Overseas Environmental Impact Statement
dB re 1 μPa	decibels referenced to 1 micropascal	ONR	Office of Naval Research
DDG	Missile Destroyer	OPNAV N45	Office of the Chief of Naval Operations Energy and Environmental Readiness Division
DoN	Department of the Navy		
DURIP	Defense University Research Instrumentation Program	PAM	Passive Acoustic Monitoring
EAR	Ecological Acoustic Recorder	PMRF	Pacific Missile Range Facility
EIS	Environmental Impact Statement	RDT&E	Research, Development, Testing, and Evaluation
ESA	Endangered Species Act		
FY	Fiscal Year	R&D	Research and Development
GPS	Global Positioning System	re	referenced to
HMSRP	Hawaiian Monk Seal Research Program	RL	Received Levels
HRC	Hawaii Range Complex	rms	root mean square
HSTT	Hawaii-Southern California Training and Testing	s.d.	standard deviation
Hz	Hertz	SAG	Scientific Advisory Group
ICMP	Integrated Comprehensive Monitoring Program	SCC	Submarine Commanders' Course
ID	Identification	TBD	To Be Determined
km	kilometer(s)	TTS	Temporary Threshold Shift
LIMPET	Low-Impact Minimally Percutaneous External-Electronics Transmitter	U.S.	United States
LMR	Living Marine Resources	UNDET	Underwater Detonation
LOA	Letter of Authorization	USWEX	Undersea Warfare Exercise
M3R	Marine Mammal Monitoring on Navy Ranges	yd.	yard(s)
m	meter(s)		
MDSU-1	Mobile Diving and Salvage Unit 1		
MFA	Mid-Frequency Active		
MFAS	Mid-Frequency Active Sonar		
MM/ST	Marine Mammals and Sea Turtles		
MMO	Marine Mammal Observer		
MMPA	Marine Mammal Protection Act		
MSO	Marine Species Observer		
MTE	Major Training Exercise		
n/a	Not Applicable		
Navy	United States Department of the Navy		

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1 INTRODUCTION

1.1 BACKGROUND

The United States (U.S.) Department of the Navy (Navy) developed Range-Complex-specific Monitoring Plans, guided by the Integrated Comprehensive Monitoring Program (ICMP), to provide marine mammal and sea turtle monitoring as required under the Marine Mammal Protection Act (MMPA) of 1972 and the Endangered Species Act (ESA) of 1973. This report provides Range-Complex-specific monitoring results from 2 August 2012 to 31 December 2013 within the U.S. Navy's Hawaii Range Complex (HRC).

1.2 INTEGRATED COMPREHENSIVE MONITORING PROGRAM

The ICMP provides the overarching framework for coordination of the U.S. Navy Monitoring Program (Department of the Navy 2010). The ICMP has been developed in direct response to U.S. Navy Range monitoring requirements established in the various MMPA Final Rules, ESA Consultations, Biological Opinions, and applicable regulations. As a framework document, the ICMP applies by regulation to those activities on ranges and operating areas for which the U.S. Navy sought and received Letters of Authorization.

The ICMP is intended for use as a planning tool to focus U.S. Navy monitoring priorities pursuant to ESA and MMPA requirements. Top priority will always be given to satisfying the mandated legal requirements across all ranges. Any additional monitoring will be planned and prioritized using guidelines provided by the ICMP, consistent with availability of both funding and scientific resources. As a planning tool, the ICMP is a "living document." It will be routinely updated as the program matures. The program was advanced in 2013 and 2014 through the addition of the Strategic Planning Process.

The ICMP is evaluated annually through the Adaptive Management Review (AMR) process to: (1) assess progress, (2) provide a matrix of goals for the following year, and (3) make recommendations for refinement and analysis of the monitoring and mitigation techniques. This process includes conducting an annual AMR meeting at which the U.S. Navy and National Marine Fisheries Service (NMFS) jointly consider the prior-year goals, monitoring results, and related scientific advances to determine if modifications are needed to more effectively address monitoring program goals. Modifications to the ICMP that result from AMR discussions are incorporated by an addendum or revision to the ICMP.

Under the ICMP, monitoring measures outlined in range/project-specific Monitoring Plans and U.S. Navy-funded research relating to the effects of naval training and testing activities on protected marine species should be designed to accomplish one or more of the following top-level goals as currently prescribed in the 2010 ICMP update (Department of the Navy 2010). For more information on the ICMP, including the top-level goals, please visit:

http://www.navy-marine-species-monitoring.us/files/2813/4629/1071/Integrated_Comprehensive_Monitoring_Program_Charter_Dec_2010.pdf

For more information on the Strategic Planning Process, please visit:

http://www.nmfs.noaa.gov/pr/pdfs/permits/navy_planning_monitoring_draft2012.pdf

1.3 REPORT OBJECTIVES

The objectives of the report are to present NMFS with monitoring data, results and progress which furthers our understanding of monitoring questions. The Year Five report will focus mostly on summarizing collected data and providing a brief description of the 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.

Additional objectives are to continue the AMR process by providing an overview of meetings and initiatives over the past year that support proposed revisions to the U.S. Navy's 2013 HRC Monitoring Plan (Department of the Navy 2012b), as well as presenting progress made toward development of the Strategic Planning Process for U.S. Navy monitoring. Proposed changes primarily reflect input received from the scientific community and other stakeholders. An overview of the events that have prompted these most recent adaptive management actions is provided in the following sections.

2 HAWAII RANGE COMPLEX MONITORING OVERVIEW

The HRC (Figure 2-1) consists of 235,000 square nautical miles (nm²) 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) off Kauai, which includes an instrumented range covering 1,020 nm² of ocean area at depths between 1,800 and 15,000 feet (549 and 4,572 meters [m]). Various subcomponents of the Range Complex are more fully described in the *Hawaii Range Complex Environmental Impact Statement/Overseas Environmental Impact Statement (EIS/OEIS)* (Department of the Navy 2008b). Monitoring efforts are divided into two major categories—those field efforts implemented by the U.S. Pacific Fleet as part of HRC compliance monitoring, and those funded by the Office of Naval Research (ONR) and the Living Marine Resources (LMR) Program. Reporting will focus on the U.S. Pacific Fleet's compliance monitoring required under the Fleet's MMPA permit (Letter of Authorization [LOA]) and ESA Consultation.

In the 2012-2014 HRC Monitoring Plan (Department of the Navy 2011), the U.S. Navy proposed to implement a diversity of field methods to gather data on marine mammals and sea turtles (MM/ST). Studies were specifically designed to meet the goals outlined in the Introduction. Metrics (e.g., hours or events) were agreed to by the U.S. Navy and NMFS and used as goals for implementation.

**Marine Species Monitoring for the U.S. Navy's Hawaii Range Complex
2013 Annual Report**

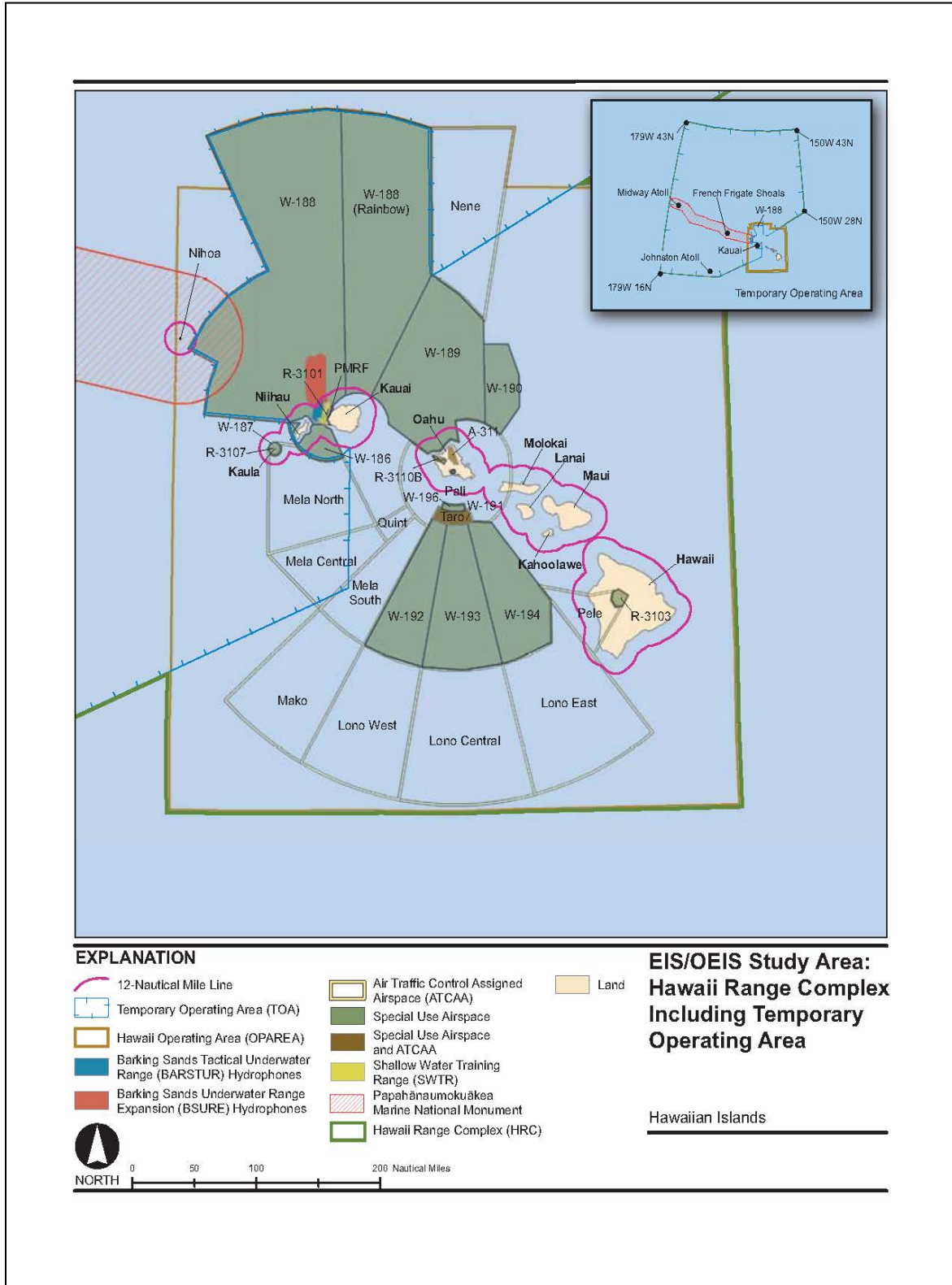


Figure 2-1: Hawaii Range Complex Including Temporary Operating Area as analyzed in the HRC EIS/OEIS (DoN 2008)

**Marine Species Monitoring for the U.S. Navy's Hawaii Range Complex
2013 Annual Report**

2.1 HAWAII RANGE COMPLEX YEAR FIVE MONITORING OBJECTIVES

The goal of the 2012-2013 HRC Monitoring Plan (DoN 2011), prepared in support of the two-year NMFS Letter of Authorization (NMFS 2012a), is to implement field methods chosen to address the long-term monitoring objectives outlined in the Introduction¹. Table 2-1 shows the monitoring commitments agreed upon by NMFS and the U.S. Navy. Numbers in brackets are consistent throughout this document and used to identify projects outlined in Figure 2-2. The assigned numbers are a continuation of numbered projects from the timeline in the Comprehensive Exercise and Marine Species Monitoring Report for the U.S. Navy's Hawaii Range Complex (Figure 3.2-1) (Department of the Navy 2013).

Table 2-1: 2012-2013 Hawaii Range Complex Monitoring Commitments

MONITORING TECHNIQUE	IMPLEMENTATION
Visual Surveys (aerial or vessel) STUDIES [61], [63], [65], [69]	120–160 hours before, during, and after ASW training events including major training exercises, SCC, Unit-Level Training and/or explosive events
Marine Mammal Observers (MMO) STUDIES [66], [68]	MMO team aboard U.S. Navy surface platforms during two ASW and six explosive events
Tagging STUDIES [61], [63], [69]	Tag a goal of 15 individual marine mammals
Passive Acoustic Monitoring (PAM) STUDIES [57], [60], [62], [64], [67], [70]	Utilize a combination of autonomous recording devices, and/or sonobuoys and/or towed arrays to gather acoustic data. Continue collaboration of data collection and analysis from additional N45/ONR-funded autonomous PAM devices. Continue data analysis. Continue use of the PMRF instrumented range hydrophones to gather and analyze marine mammal acoustic data

Notes: ASW = Anti-Submarine Warfare, FY = Fiscal Year, N45 = Energy and Environmental Readiness Division, ONR = Office of Naval Research, PMRF = Pacific Missile Range Facility, SCC = Submarine Commanders' Course, U.S. = United States

2.2 HAWAII YEAR FIVE MAJOR TRAINING EXERCISES SUMMARY

2.2.1 OVERVIEW OF MAJOR TRAINING EXERCISES

Marine mammal sightings made during Major Training Exercises (MTEs) comprise a form of compliance monitoring. There was one MTE in the HRC between 2 August 2012 and 31 December 2013. During the transits and training events during this MTE, U.S. Navy lookouts reported six marine species sightings for an estimated nine individual marine mammals and zero sea turtles (Table 2-2).

¹ The HRC monitoring plan, prepared in 2011 for the 2012-2014 Request for Letter of Authorization, is the last of the first generation of monitoring plans where metrics of hours or number of devices was used. Adaptive Management discussions between the Navy and NMFS in 2012 and 2013 enabled a shift from committing to and reporting metrics to the flexibility of question-based monitoring, which was incorporated into HRC monitoring while still maintaining adherence to the monitoring plan metrics. Therefore, this report will provide results both in terms of metrics and question based monitoring.

**Marine Species Monitoring for the U.S. Navy's Hawaii Range Complex
2013 Annual Report**

Table 2-2: Total Number of Marine Mammal and Sea Turtle Sightings Observed from U.S. Navy Platforms during Hawaii Range Complex Major Training Exercises from 2 August 2012 to 31 December 2013

MTE TYPE	DATES	NUMBER OF EXERCISE DAYS	NUMBER OF SEA TURTLE SIGHTINGS	ESTIMATED NUMBER OF SEA TURTLES	NUMBER OF MARINE MAMMAL SIGHTINGS	ESTIMATED NUMBER OF MARINE MAMMALS
USWEX	19–23 January 2013	5	0	0	6	9

Notes: MTE = Major Training Exercise, USWEX = Undersea Warfare Exercise

2.2.2 OVERVIEW OF SIGHTINGS DURING MAJOR TRAINING EXERCISES

Overview of Sightings during Major Training Exercises

Marine mammal sightings are reported at ranges of < 200 yards (yd.), 200–500 yd., 501–1,000 yd., 1,001–2,000 yd., and > 2,000 yd. (< 183 m, 183–458 m, 457–914 m, 915–1,829 m, and > 1,829 m, respectively) concurrent with mid-frequency active sonar (MFAS) use. Ranges associated with potential NMFS criteria levels of permanent threshold shift and temporary threshold shift (215 and 195 decibels [dB] referenced to [re] 1 micropascal squared second [$\mu\text{Pa}^2\text{-s}$], respectively) are much shorter than 200 yd. (183 m). There were three sightings of three large whales and three unidentified sightings of marine mammals (Table 2-3). One sighting of a large whale was made at 1,001–2,000 yd. range and two sightings of large whales were made at > 2000 yd. One sighting of two unidentified marine mammals was made at > 2000 yd. and another sighting of three unidentified marine mammals was made at > 2000 yd. Lastly, an unidentified sighting was made at an unknown distance.

Table 2-3: Total Number of Dolphin, Whale, Pinniped, and Unidentified Sightings and Estimated Number of Individuals Observed from U.S. Navy Platforms during Hawaii Range Complex Major Training Exercises from 2 August 2012 to 31 December 2013

MARINE MAMMAL TYPE	NUMBER OF SIGHTINGS	PERCENTAGE OF TOTAL SIGHTINGS	ESTIMATED NUMBER OF INDIVIDUALS	PERCENTAGE OF TOTAL NUMBER OF INDIVIDUALS
Dolphin	0	0%	0	0%
Whale	3	50%	3	33%
Pinniped	0	0%	0	0%
Unidentified	3	50%	6	67%

2.2.3 DISCUSSION OF MITIGATIONS

The three categories of mitigation measures (Personnel Training, Lookout and Watchstander Responsibilities, and Operating Procedures), outlined in the HRC EIS/OEIS (Department of the Navy 2008b) and approved by NMFS (NMFS 2012a, b), were effective in detecting MM/ST and appropriately mitigating their exposures to MFAS. Fleet commanders and ship watch teams continue to improve individual awareness and enhance reporting practices. Additionally, a Lookout Effectiveness study was conducted by the U.S. Navy in the HRC and provided data to demonstrate the effectiveness of the U.S. Navy's suite of mitigation measures (see Watwood et al. 2013).

2.3 HAWAII YEAR FIVE MONITORING ACCOMPLISHMENTS

Monitoring in HRC exceeded metrics in visual effort, met metrics for marine mammal observers (MMOs) aboard U.S. Navy Vessels during underwater detonations (UNDETs), and fell short of metrics for tagging and MMOs aboard U.S. Navy Vessels during anti-submarine warfare (ASW). For a detailed summary of metrics including references to project timelines and descriptions, please see Table 2-4.

2.3.1 SUMMARY OF METRICS

2.3.1.1 Metrics Met or Exceeded

Visual Surveys ([61], [63], [65], [69]): a total of 135.15 hours of visual surveys (vessel and aerial) were conducted, three of which were in conjunction with training events. This met the 120–160-hour metric of visual survey effort before, during, and after ASW and/or explosive events committed to in the HRC Monitoring Plan for Year Five.

Marine Mammal Observers [68]: MMO teams embarked on a total of two UNDET events. An excess of four UNDET events monitored in Year Four leads to a fulfillment of the metric for Year Five and a balance of zero. This met the requirement for MMO teams aboard U.S. Navy vessels during six explosive (UNDET) events.

Passive Acoustic Monitoring Studies ([57], [60], [62], [64], [67], [70]): Four Ecological Acoustic Recorders (EARs) were retrieved from Niihau and Kaula Islands on 17 October 2012 (Kaula) and 11 March 2013 (Niihau). Analysis on the EAR data is on-going. The PMRF hydrophone array was monitored by the Marine Mammal Monitoring on Navy Ranges (M3R) team during the tagging project before February and August 2013 Submarine Commanders' Courses (SCCs). Acoustic data was also obtained from 31 hydrophones in the PMRF hydrophone array on random days throughout the year as well as before, during and after training events for analysis during this reporting year and archived for future analysis. This fulfills the following Year Five goals: (1) utilization of a combination of autonomous recording devices, sonobuoys, and/or towed arrays to gather acoustic data; (2) continued collaboration of data collection and analysis from additional LMR/ONR-funded autonomous passive acoustic monitoring (PAM) devices; (3) continued analysis of PAM data; and (4) continued use of the PMRF instrumented range hydrophones to gather marine mammal acoustic data.

2.3.1.2 Metrics Shortfalls

Tagging ([61], [63], [69]): Twelve tags were successfully deployed in the field, with zero tag loss, during three separate field efforts: December 2012 in Lanai, January/February 2013 at PMRF; and July/August 2013 at PMRF. This is three tags short of the monitoring plan goal, however it did not result from lack of effort. The Navy contracted very experienced researchers who were in the field for 169.6 hours and covered 3,096 km. However, inclement weather conditions and lack of adequate tagging opportunities resulted in a fewer tags being deployed. This is typical for field efforts that are planned for a certain timeframe, where contractual obligations preclude researchers from being unable to work around challenging weather conditions or equipment breakage.

Marine Mammal Observers [66]: MMO teams embarked during one ASW event and two underwater detonations, resulting in a shortfall of one ASW event and four explosive events. MMOs were prepared to embark during more events however several training event cancellations resulted in a lack of opportunities.

**Marine Species Monitoring for the U.S. Navy's Hawaii Range Complex
2013 Annual Report**

Table 2-4: Summary of Metrics in Hawaii Range Complex

STUDY TYPE	U.S. NAVY EIS/LOA MONITORING	ASSOCIATED EVENT TYPE	U.S. NAVY R&D MONITORING	MONITORING GOAL	TOTAL ACCOMPLISHED
Visual Surveys (Studies [61], [63], [65], [69])	[61] 28.8 hours, 8–13 December, 2012 (vessel) [63] 55.9 hours, PMRF pre-SCC, 2–9 February, 2013 (vessel) [65] 17.25 hours, 19–21 February 2013 (aerial) [69] PMRF pre-SCC, 25 July–1 August, 2013 (vessel)	[61] n/a [63] SCC [65] SCC [69] SCC	[61] n/a [63] n/a [65] n/a [69] n/a	120–160 hours before, during, and after ASW and/or explosives training events	135.15 hours
Marine Mammal Observers (Studies [66], [68])	[66] 27.28 hours, 18–22 February [68] 6.0 hours, 2 April 2013; 4 April 2013	[66] SCC (ASW) [68] UNDET	[66] n/a [68] n/a	MMO team aboard U.S. Navy surface platforms during two ASW and six explosives events	1 ASW 2 explosive
Tagging (Studies [61], [63], [69])	[61] 3 tags successfully deployed on cetaceans at Lanai [63] 6 tags successfully deployed on cetaceans (in conjunction with M3R) [69] 3 tags successfully deployed on cetaceans (in conjunction with M3R)	[61] n/a [63] SCC [69] SCC	[61] n/a [63] n/a [69] n/a	Tag a goal of 15 marine mammals	12 animals tagged
Passive Acoustic Monitoring (Studies [57], [60], [62], [64], [67], [70])	[57] Continued data analysis [60] Continued data analysis [62] [64] [67] [70] Continued data analysis, continued use of the PMRF instrumented range hydrophones to gather and analyze marine mammal acoustic data	[60] n/a [62] SCC [64] SCC [67] SCC [70] SCC	[57] n/a [60] n/a [62] n/a [64] LMR funding of M3R program to record and analyze acoustic data from marine mammals using the PMRF instrumented range hydrophones [67] n/a [70] LMR funding of M3R program to record and analyze acoustic data from marine mammals using the PMRF instrumented range hydrophones	- Utilize a combination of autonomous recording devices, and/or sonobuoys and/or towed arrays to gather acoustic data. Continue collaboration of data collection and analysis from additional N45/ONR-funded autonomous PAM devices. Continue data analysis. - Continue use of the PMRF instrumented range hydrophones to gather and analyze marine mammal acoustic data.	Recorded acoustic data with EARs, recovered EARs, analyzed EAR data, continued use of the PMRF instrumented range hydrophones to gather and analyze marine mammal acoustic data, meta-analysis using multiple data sets including acoustic from EARs and PMRF.

Notes: ASW = Anti-Submarine Warfare, EAR = Ecological Acoustic Recorder, EIS = Environmental Impact Statement, ESA = Endangered Species Act, LOA = Letter of Authorization, M3R = Marine Mammal Monitoring on Navy Ranges, MMO = Marine Mammal Observer, MMPA = Marine Mammal Protection Act, n/a = Not Applicable, N45 = Energy and Environmental Readiness Division, ONR = Office of Naval Research, PAM = Passive Acoustic Monitoring, PMRF = Pacific Missile Range Facility, R&D = Research and Development, SCC = Submarine Commanders' Course, U.S. = United States, UNDET = Underwater Detonation

2.3.2 MONITORING TIMELINE

The timing of projects was primarily based on Naval training event schedules. Figure 2-2 illustrates the timing in which the analysis efforts and surveys were conducted and in some cases the connectivity when monitoring techniques are applied in coordination with others. The figure is a continuation of the timeline (Figure 3.2-1) in the 2013 Comprehensive Exercise and Marine Species Monitoring Report for the HRC 2009-2012 (DoN 2013a). Each analysis effort and survey, as organized by monitoring technique, is included in a green box. On-going analysis efforts and important meetings are also depicted, in addition to the field efforts. Notable sightings are called out in purple ovals. Table 2-5 includes additional details about the monitoring effort, including notable sightings and outcomes.

**Marine Species Monitoring for the U.S. Navy's Hawaii Range Complex
2013 Annual Report**

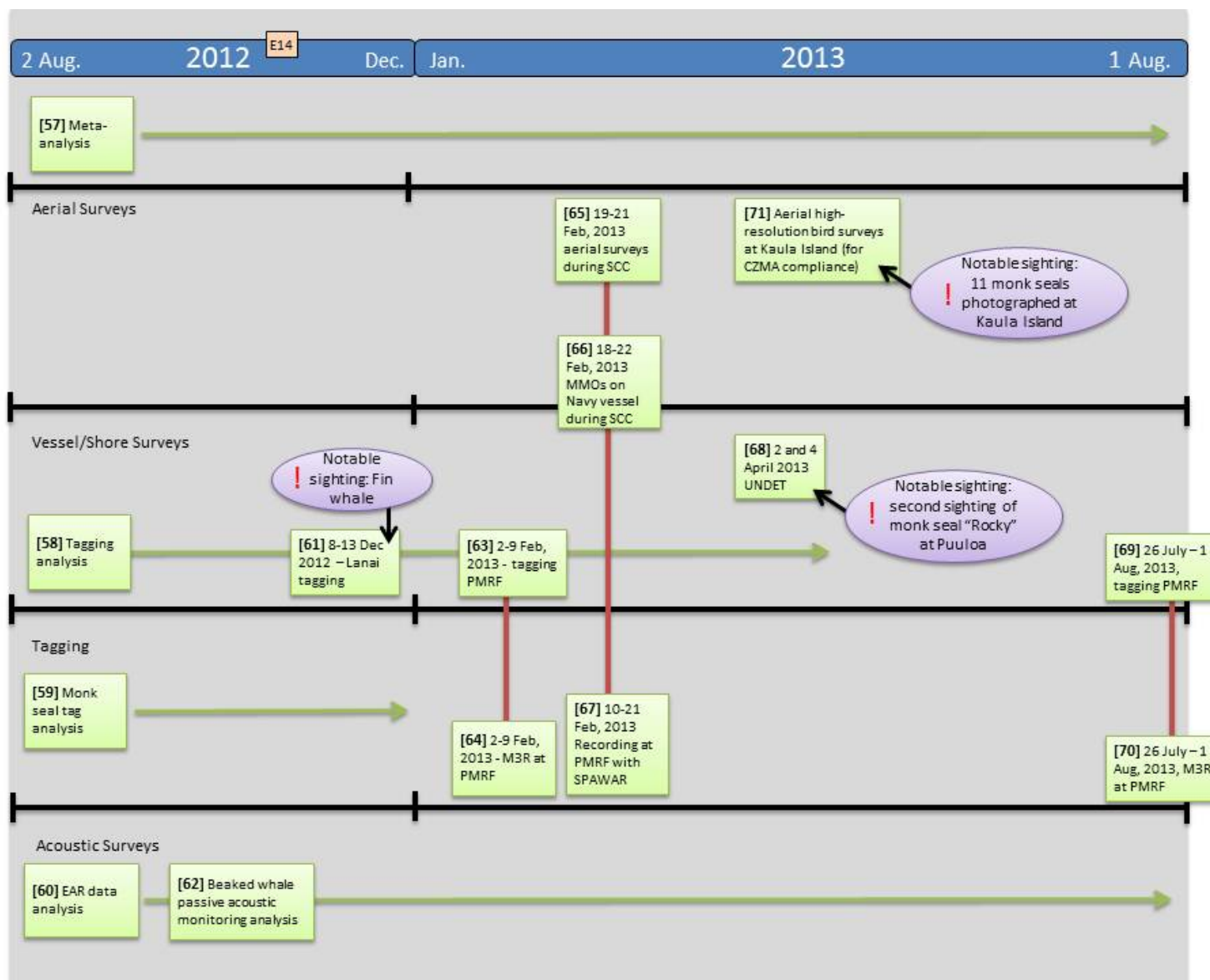


Figure 2-2: Monitoring Timeline for 2 August 2012 to 31 December 2013 (note: no monitoring was conducted after August)

**Marine Species Monitoring for the U.S. Navy's Hawaii Range Complex
2013 Annual Report**

Table 2-5: Sightings and Notable Outcomes

PROJECT NUMBER	DATES OF DATA COLLECTION IN FIELD	LOCATION	OBJECTIVES	METHODS USED	SPECIES DETECTED/OBSERVED	NOTABLE OUTCOMES/EVENTS/ CONCLUSIONS
[57]	Multiple	Multiple	Meta-analysis of multiple Fleet-funded (and other available) data sets	Multiple levels of analysis including satellite tagging, visual survey, and passive acoustics	Multiple	Estimated to be reported in FY15
[58]	2011–2013	PMRF, Kauai	Further our understanding of the questions: (1) What were the received levels of tagged animals in the vicinity of a naval training event? (2a) Were there any large scale movements away from the naval training event? OR (2b) What is the baseline short term and long term movement rates for tagged animals?	Tagging analysis Passive acoustic monitoring	Analysis on tagged short-finned pilot whales, bottlenose dolphins, and rough-toothed dolphins	Estimated to be reported in FY15
[59]	2010–2011	Main Hawaiian Islands	Determine if there was a correlation between abnormal behavior in Hawaiian monk seals and periods of MFAS within 36 miles	Tagging analysis	Monk seals	No detectable abnormal behavior during overlapping periods of MFAS within 36 miles
[60]	Deployment dates: 1/26/12–3/11/13 (three devices – Niihau) 4/25/12–10/17/12 (one device – Kaula)	Niihau, Kaula	Further our understanding of the questions: “What species occur in the area around Niihau and Kaula Islands? and “Do detection rates vary before, during and after MFAS events?”	Passive acoustic monitoring	TBD	Estimated to be reported in FY15
[61]	8–12 December 2012	Lanai	Further understanding of odontocete distribution, habitat use, and population structure in the four-island area of Molokai, Maui, Lanai, and Kahoolawe	Visual survey Tagging	Short-finned pilot whale Spinner dolphin Rough-toothed dolphin Bottlenose dolphin Pantropical spotted	Fin whale sighting and photographs/ biopsy sample obtained First satellite tag data from pilot whales, bottlenose dolphins and melon-headed whales in four-

**Marine Species Monitoring for the U.S. Navy's Hawaii Range Complex
2013 Annual Report**

PROJECT NUMBER	DATES OF DATA COLLECTION IN FIELD	LOCATION	OBJECTIVES	METHODS USED	SPECIES DETECTED/OBSERVED	NOTABLE OUTCOMES/EVENTS/ CONCLUSIONS
					dolphin Melon-headed whale Fin whale Humpback whale	island area Matches of two melon-headed whales with Hawaii Island and Kauai individuals 18 rough toothed dolphins matched to Hawaii population Bottlenose matched to individuals from four-island region and associated with shallow water Analysis on-going
[62]	February 2012	PMRF, Kauai	Estimate RLs on beaked whales Calculate dive rates after initiation of Naval training event	Passive acoustic monitoring	Blainville's beaked whales Unknown "Cross sea-mount" beaked whale	Statistical differences in dive rates of beaked whales after the initiation of the Navy training event. Differences observed in the diel occurrence patterns and spatial distribution of dives. Estimated RLs varying from 52 to 137 dB re 1 µPa (mean 109 dB, s.d. 22 dB) while the animals were presumed to be at depth foraging. RLs estimated assuming the animals were at/near the sea surface, average 40.1 dB higher than those estimated at foraging depth.

**Marine Species Monitoring for the U.S. Navy's Hawaii Range Complex
2013 Annual Report**

PROJECT NUMBER	DATES OF DATA COLLECTION IN FIELD	LOCATION	OBJECTIVES	METHODS USED	SPECIES DETECTED/OBSERVED	NOTABLE OUTCOMES/EVENTS/ CONCLUSIONS
[63]	29 February 2013	PMRF, Kauai	Contribute to our understanding of the monitoring question: “What are the spatial movement patterns and habitat use (e.g., island-associated or open-ocean, restricted ranges vs. large ranges) of species that are exposed to mid-frequency active (MFA) sonar, and how do these patterns influence exposure and potential responses?” and visually validate acoustic detections made by the M3R team	Visual survey Tagging	Bottlenose dolphins Short-finned pilot Whales Humpback whales Rough-toothed dolphin Spinner dolphins	Bottlenose dolphins may be demographically isolated from the other islands, and spend the majority of their time in near-shore, shallow water. Short-finned pilot whales may also be part of an island-associated resident population which move over an area covering Kauai, Niihau, Kaula, Oahu, and offshore north of the PMRF range boundaries and are associated with shelf habitat. Rough-toothed dolphins show a degree of site fidelity to Kauai/Niihau and appear to be demographically isolated from those found at the Island of Hawaii All three species' ranges overlap with PMRF, and are associated with different depths.
[64]	2–9 Feb 2013	PMRF, Kauai	Increase the encounter rate for the vessel based survey effort [63]	Passive acoustic monitoring	Short-finned pilot whale Blainville's beaked whale Humpback whale False killer whale Rough-toothed dolphin Spinner dolphin Bottlenose Cuvier's beaked whale Sperm whale	An indication of confidence in the species ID is included in the appendix report (Baird et al. 2013). This information should not be used to determine species occurrence.
[65]	19–21 February 2013	PMRF, Kauai	Conduct focal follows on cetaceans in the vicinity of MFAS in order to detect behavioral response	Visual survey	Unidentified dolphin Unidentified sea turtle Unidentified large whale Unidentified whales	TBD

**Marine Species Monitoring for the U.S. Navy's Hawaii Range Complex
2013 Annual Report**

PROJECT NUMBER	DATES OF DATA COLLECTION IN FIELD	LOCATION	OBJECTIVES	METHODS USED	SPECIES DETECTED/OBSERVED	NOTABLE OUTCOMES/EVENTS/ CONCLUSIONS
[66]	18–22 February 2013	PMRF, Kauai	Lookout effectiveness study	Visual survey	Unidentified blackfish Spinner dolphins Unidentified marine mammal Humpback whale Green turtle	Ninth event aboard a DDG
[67]	10–21 February 2013	PMRF, Kauai	Recording using hydrophone array at PMRF before, during and after Navy training event	Passive acoustic monitoring	TBD	Estimated to be reported in FY15
[68]	2 and 4 April 2013	Puuloa, Oahu	Monitor mitigation measures conducted by MDSU-1, opportunistic visual surveys	Visual survey	Unidentified sea turtle Hawaiian monk seal Spinner dolphins Humpback whale Green sea turtle	Hawaiian monk seal RH58, also known as “Rocky,” was sighted. This seal was also sighted on 19 October 2011 following an UNDET on the same range. Mitigation performed.
[69]	25 July–2 August 2013	PMRF, Kauai	Contribute to our understanding of the monitoring question: “ What are the spatial movement patterns and habitat use (e.g., island-associated or open-ocean, restricted ranges vs. large ranges) of species that are exposed to mid-frequency active (MFA) sonar, and how do these patterns influence exposure and potential responses? ” and visually validate acoustic detections made by the M3R team	Visual survey Tagging	False killer whale Rough-toothed dolphins Bottlenose dolphins Spinner dolphins	Estimated to be reported in FY15
[70]	25 July–2 August 2013	PMRF, Kauai	Increase the encounter rate for the vessel-based survey effort [69]	Passive acoustic monitoring	TBD	Estimated to be reported in FY15

**Marine Species Monitoring for the U.S. Navy's Hawaii Range Complex
2013 Annual Report**

PROJECT NUMBER	DATES OF DATA COLLECTION IN FIELD	LOCATION	OBJECTIVES	METHODS USED	SPECIES DETECTED/OBSERVED	NOTABLE OUTCOMES/EVENTS/ CONCLUSIONS
[71]	23–24 April 2013	Kaula Island	Avian survey for CZMA compliance (not part of MMPA compliance monitoring)	Aerial surveys using very high resolution digital photograph	Hawaiian monk seal	11 Hawaiian monk seals photographed on Kaula. Hawaiian monk seals photographed at locations not previously known as haul out sites.
E14	Adaptive management meeting					

Notes: μ Pa = micropascal, CZMA = Coastal Zone Management Act, dB = decibels, DDG = Missile Destroyer, FY = Fiscal Year, ID = Identification, M3R = Marine Mammal Monitoring on Navy Ranges, MDSU-1 = Mobile Diving and Salvage Unit 1, MFAS = Mid-Frequency Active Sonar, MMPA = Marine Mammal Protection Act, Navy = United States Department of the Navy, PMRF = Pacific Missile Range Facility, re = referenced to RL = Received Level, s.d. = standard deviation, TBD = To Be Determined, UNDET = Underwater Detonation

2.3.3 PROJECT UPDATES AND ABSTRACTS²

[57] UPDATE: Meta-analysis of multiple data sets

A working group of experts (i.e., biologists, acousticians, and other researchers with extensive experience working in HRC) was convened in San Diego, CA for an HRC Data Analysis Planning Meeting on 10 and 11 September 2012 in order to assess how existing HRC monitoring data could be used to support the U.S. Pacific Fleet's regulatory requirements. The group was asked to review the existing data sets in the context of regulatory requirements and the Scientific Advisory Group (SAG) report and propose answerable monitoring questions and specific data analyses which could be undertaken to address some of the revised questions (HDR 2013). The proposed questions, in which the likelihood of making a significant contribution to our understanding using the existing data sets, within budget limitations are:

- How well is baseline occurrence (distribution, density, and habitat use) known/defined (short to medium term) across species/species groups?
- How does our ability to address questions of exposure (integrating propagation models and animal occurrence) vary with species/species groups?
- What are the short-term behavioral responses of MM/ST when exposed to MFAS/explosions at different levels and conditions?

The execution planning is still in progress for this project.

[58] UPDATE: Assessment of Received Sound Levels and Movements of Satellite-tagged Odontocetes Exposed to Mid-frequency Active Sonar at the Pacific Missile Range Facility: February 2011 through February 2013

By Robin W. Baird,¹ Stephen W. Martin,² Daniel L. Webster,¹ and Brandon L. Southall³

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The PMRF off of Kaua'i is the site of regular U.S. Navy training, some of which involve MFAS use. The PMRF range is instrumented with 219 bottom-mounted hydrophones, which allows for real-time PAM as well as recording capabilities to detect and localize some species of vocalizing marine mammals or other sources of sound on the range. In recent years, vessel-based studies involving deployment of Low-Impact Minimally Percutaneous External-electronics Transmitter (LIMPET) satellite tags on odontocete cetaceans on and around the PMRF range, combined with real-time PAM to increase vessel-based encounter rates, have allowed for an assessment of habitat use and range of several different odontocete species. Two types of LIMPET tags are used: location-only tags, and location-dive tags, which also transmit dive depths and durations. Some of these vessel-based tagging efforts were timed to occur associated with SCCs occurring on PMRF, and archived acoustic data were recorded from a number of hydrophones on the PMRF range during some of these periods (31 phones in 2011 and 2012, 62 phones in 2013). We are assessing overlap between these two data sources, i.e., location data from satellite tags deployed on odontocetes and acoustic archives from the PMRF range. The objective is twofold: (1) to

² Abstracts are from appendix reports and were submitted by the primary authors. Updates are for on-going projects for which there is not yet a report.

**Marine Species Monitoring for the U.S. Navy's Hawaii Range Complex
2013 Annual Report**

determine whether MFAS was used and recorded in the acoustic archive during instances when animal positions were known, and (2) to estimate received sound levels for animals at known positions given available information on sonar transmissions. This integrated information will also be used to assess whether any large-scale movements of animals may have occurred in response to received sounds, as has been demonstrated elsewhere. During efforts from January 2011 through February 2013, LIMPET satellite tags have been deployed on 23 individuals of four species of odontocetes off of Kaua'i: rough-toothed dolphins, bottlenose dolphins, false killer whales, and short-finned pilot whales. Satellite tags were deployed on five different occasions off Kaua'i between February 2011 and February 2013. Four of the five efforts were timed to coincide with SCCs, with the first effort starting at the end of the February 2011 SCC, efforts starting before the August 2011, February 2012, and February 2013 SCCs, and the remaining field effort occurring prior to the July 2012 Rim of the Pacific exercise. Of the 23 tags, preliminary analysis of tag and archived acoustic data revealed temporal and spatial overlap in the two data sets for 10 tagged individuals of three species (Table 2-6). Analyses to estimate received levels (RLs) and assess whether large-scale movements were associated are ongoing.

Table 2-6: Periods During Which There Was an Overlap between Satellite Tagging Operations and Acoustic Archives for Examining Mid-Frequency Active Sonar Use on the Pacific Missile Range Facility

PERIOD	MFA SONAR IN ACOUSTIC RECORD	# DAYS ACOUSTIC DATA BEFORE	# DAYS DURING	# DAYS AFTER	SPECIES (#) WITH OVERLAPPING SATELLITE TAG DATA
February 2013	Yes	3	4	<1	<i>Gm</i> (1), <i>Tt</i> (1)
June/July 2012	5 June only	0	1	0	<i>Sb</i> (2), <i>Tt</i> (1)
January/February 2012	Yes	n/a	n/a	n/a	n/a
July/August 2011	Yes	0	2	2	<i>Sb</i> (2), <i>Tt</i> (1)
February 2011	Yes	0	2	3	<i>Gm</i> (2)

Notes: MFA = Mid-Frequency Active, n/a = Not Applicable

[59] ABSTRACT: Analysis of Monk Seal Behavior Relative to Navy Activities

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NOAA Fisheries' Hawaiian Monk Seal Research Program (HMSRP) and U.S. Navy Pacific Fleet Environmental initiated a collaborative research effort to investigate potential impacts of naval activities in the HRC. To accomplish this goal, positional data was collected by 13 global positioning system (GPS) telemetry tags deployed over a 2-year period (2010–2011) on 11 individual Hawaiian monk seals, for a total of 38,232 hours (1,593 days). By using geo-spatial data bases, it was determined that four of the eight seals were exposed to a total of 14.48 hours (less than 1 day) of mid-frequency sonar activity while the seal was within 36 km of a hull mounted sonar ship. Independently, the tag data were analyzed by HMSRP to identify specific dates where seal behaviors differed from "normal" for each individual. The time periods determined by HMSRP to be outside the "normal" range were compared to those time periods when a monk seal was in the vicinity of a hull-mounted sonar ship while it was transmitting. The available data suggest there were no significant impacts from MFAS on the Hawaiian monk seals tagged in HRC during the 2010–2011 time period, as no outlier days occurred on the day of active transmissions.

[60] UPDATE: On-going PAM data analysis

The analysis of Ecological Acoustic Recorder (EAR) data from the final two deployments will further our understanding of the following monitoring questions: What species of beaked whales (Ziphius/Mesoplodon) are heard in and around the Niihau area of the HRC? Do beaked whale (Ziphius/Mesoplodon) detection rates vary before, during, and after MFAS detections? What is the seasonal occurrence of baleen whales (minke, fin, possibly sei³) heard in the HRC around the Niihau area? Do baleen whale (minke, fin, possibly sei) detection rates vary before, during, and after MFAS detections? What is the occurrence of sperm whales heard in the HRC around the Niihau area? Do sperm whale detection rates vary before, during, and after MFAS detections? What species of delphinids occur in the HRC around the Niihau area? Do delphinid detection rates vary before, during, and after MFAS detections? It is estimated that the reports from the analysis will be included in the annual report in 2015.

[61] UPDATE: Multi-species odontocete research off Lanai, Hawaii: a summary of results from a December 2012 small-boat field effort

*By Robin W. Baird,¹ Daniel L. Webster,¹ Annie B. Douglas,¹ Katy A. Reid,¹ Sabre D. Mahaffy¹
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Multi-species vessel-based studies of odontocetes involving photo-identification and biopsy sampling for genetic studies were undertaken in the four-island area (Moloka'i, Maui, Lāna'i, Kaho'olawe) annually from 2000 through 2003. During those years, there were 8,178 km (682 hours) of survey effort, with six species of odontocetes documented: bottlenose, spinner, and spotted dolphins, false killer and short-finned pilot whales, and dwarf sperm whales. Results from this work provided evidence of demographically isolated populations of both bottlenose dolphins and pantropical spotted dolphins in the four-island area (Baird et al. 2009; Courbis 2011; Martien et al. 2011). Information on spinner dolphins from those efforts also contributed to a study to examine movements and estimate abundance of spinner dolphins in the main Hawaiian Islands (Hill et al. 2011) and examine resting areas for spinner dolphins among the islands (Thorne et al. 2012). Photos and genetic samples from false killer whales during those efforts were used in a larger study of false killer whale population structure and movements (Chivers et al. 2007; Baird et al. 2008a). Information on odontocetes in the four-island area since the 2003 field effort has primarily come from opportunistic sightings by other researchers working with humpback whales in the area (e.g., Baird et al. 2008a); directed satellite tagging efforts with odontocetes had not been undertaken in the four-island area, as they have been off other areas in the main Hawaiian Islands.

In December 2012, using funding from Commander, Pacific Fleet, and NMFS's Pacific Islands Fisheries Science Center, a 15-day field effort was undertaken in the four-island area based off the island of Lāna'i. The purpose of this effort was to gain a better understanding of odontocete distribution, habitat use, and population structure in the area, combining analyses of sightings and effort data, individual photo-identification, genetic analyses of biopsy samples, and satellite tagging.

³ The structure of sei whale calls in Hawaii is still under scientific debate.

Marine Species Monitoring for the U.S. Navy's Hawaii Range Complex 2013 Annual Report

Over 15 days, there were 77.1 hours of survey effort covering 1,415 km of trackline, with 34 encounters with six species of odontocetes (short-finned pilot whales, spinner dolphins, rough-toothed dolphins, bottlenose dolphins, pantropical spotted dolphins, and melon-headed whale), as well as three encounters with humpback whales and a single encounter with a fin whale. This was the first fin whale recorded in surveys we have undertaken in the main Hawaiian Islands since 2000. Only three previous genetic samples were available from fin whales around the Hawaiian archipelago, and a biopsy sample obtained was sent to the Southwest Fisheries Science Center confirming species identification, and to be used as part of a large-scale study of fin whale population structure in the North Pacific. Identification photographs of this individual are also being compared to a Cascadia Research Collective photo-identification catalog of fin whales from the eastern North Pacific. Overall we deployed seven satellite tags (on three species of odontocetes), collected 23 biopsy samples (all six species of odontocetes and from the fin whale), and took 16,011 photos. Data from effort and sightings has been incorporated into an examination of habitat use and differences in species composition among the main Hawaiian Islands (Baird et al. 2013a). Sub-samples from biopsies of six of the seven species were sent to Woods Hole Oceanographic Institution for incorporation into a study of the microbial community associated with marine mammals, as well as contributed to the genetics tissue archive at the Southwest Fisheries Science Center. Photographs from three encounters with spinner dolphins (~3,400 images) were contributed to the Pacific Islands Fisheries Science Center and to Murdoch University, for movement studies.

One group of melon-headed whales (estimated at 150 individuals) was the first sighting of this species in our efforts in the four-island area. Although photographs of approximately 100 melon-headed whales were taken for individual identification, at this point only a small number of individuals have been compared with our photo-identification catalog for this species. From these photos there were matches of two individuals from the main Hawaiian Islands population (Aschettino et al. 2011), with previous sightings of both individuals off Kaua'i in 2008. One individual was satellite tagged and data were obtained over an 8-day span, with the individual remaining within 37.4 km from land (median distance from shore = 14.3 km), at a median depth of 845 m, with locations closest to Moloka'i, Lānai, and Kaho'olawe. A group of rough-toothed dolphins encountered was also the first encounter of this species in the four-island effort in our studies. Thirty individuals were photo-identified, 18 of which were also photo-identified together in a group off Hawai'i Island in 2008. Further analyses of photos from Hawai'i Island, to determine whether individuals from this group had ever been seen in association with the resident population of rough-toothed dolphins off the island (Baird et al. 2008b), is ongoing. One biopsy sample from this group is being used as part of a study of rough-toothed dolphin population structure in Hawai'i through Oregon State University. There were seven encounters with bottlenose dolphins, and two satellite tags were deployed on individuals in separate groups. While the tagged individuals had not been previously photo-identified, individuals in both groups had been previously photo-identified in the four-island area (as early as 2000 and 2001 for the two groups). Both tagged individuals remained in the area, moving from Lānai to Maui and Moloka'i. Median depths of locations from the two individuals were 64 and 86 m, while the median distance from shore was 4.01 and 2.59 km, indicating both individuals remained strongly associated with shallow-water near-shore areas. Results from photo-identification and satellite tagging of bottlenose dolphins during this period are being incorporated into a larger study of bottlenose dolphin population structure among the islands (Gorgone et al. 2013). There were eight encounters with short-finned pilot whales, and satellite tags were deployed on four individuals in three different groups, with location data obtained over spans from 4 to 71 days. All four individuals remained in the area from southern Penguin Bank to southwest of Lānai, using slope waters with median depths ranging from 569 to 1,216 m and median distance from shore ranging from 9.49 to 20.07 km. Results from pilot whale satellite tagging are being incorporated into a

larger assessment of pilot whale movements in the main Hawaiian Islands (Baird et al. 2013b), and five biopsy samples obtained have been contributed to a study of pilot whale population genetics being undertaken as part of a Ph.D. project at Scripps Institution of Oceanography. Identification photographs from short-finned pilot whales are still being compared to our catalog, but matches to individuals seen in 2000 off Lānaʻi and 2010 off Oʻahu have been found.

This field effort was the first in the four-island area involving satellite tag deployments on odontocetes. While the sample sizes are small, this information significantly increases what is known about the movement patterns and habitat use of three species of odontocetes in the area, as well as contributing genetic samples and photos for studies of population structure and residency. Given the small sample sizes available, additional field efforts in the four-island area involving satellite tagging is needed to assess residency and movement patterns of odontocetes in the area.

[62] ABSTRACT: The impact of mid-frequency active sonar on beaked whale dives in Hawaiian waters

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Beaked whales (family Ziphiidae) were automatically detected post exercise in recorded acoustic data collected before, during and after a February 2012 U.S. Naval training event at the PMRF, Kauai, Hawaii. Manual validation of the detections was performed to ensure they fit known characteristics of beaked whale foraging echolocation clicks, including waveform, spectrum, inter-click-intervals, and dive vocal period durations. Received levels, being the received sound pressure level in dB per 1 micropascal (μPa) rms, are estimated utilizing the U.S. Navy's standard personal computer interactive multi-sensor analysis tool for dive groups detected during MFAS transmissions.

A total of 289 beaked-whale-like dives were detected over the study period. Two hundred fifty-eight of these were composed of clicks that resemble Blainville's foraging clicks, while 31 dives were composed of clicks more similar to those observed near Cross Seamount. Statistical differences in dive rates of both type occurred after the initiation of the Navy training event. Differences are also observed in the diel occurrence patterns and spatial distribution of the dives. Receive levels for the 10 beaked whale dives detected during MFAS activity at distances from potentially as close as 13 km to over 52 km have estimated RLs varying from 52 to 137 dB re 1 μPa (mean 109 dB, standard deviation [s.d.] 22 dB) while the animals were presumed to be at depth foraging. RLs that are estimated assuming the animals were at/near the sea surface, average 40.1 dB higher than those estimated at foraging depth due to ducted propagation varying from 134 to 162 dB re 1 μPa (mean 151 dB, s.d. 9 dB).

[63, 64] ABSTRACT: Odontocete studies off the Pacific Missile Range Facility in February 2013: Satellite-Tagging, Photo-identification, and Passive Acoustic Monitoring for Species Verification

By Robin W. Baird,¹ Jessica A. Shaffer,² Daniel L. Webster,¹ Scott D. Fisher,² Jessica M. Aschettino,¹ Antoinette M. Gorgone,¹ Brenda K. Rone,¹ Sabre D. Mahaffy,¹ and David J. Moretti²

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**Marine Species Monitoring for the U.S. Navy's Hawaii Range Complex
2013 Annual Report**

A joint project in February 2013 off the Pacific Missile Range Facility (PMRF) combined passive acoustic monitoring and boat-based field efforts. There were 1,010 kilometers (km) (55.9 hours [hr]) of small-vessel field effort over the course of the 8-day project. Of the 55.9 hr of survey effort, 64.2 percent of time was spent within the PMRF instrumented hydrophone range boundaries, and 14.8 percent of the effort was in depths greater than 1,000 meters (m). A total of 50.4 hr of acoustic monitoring coincided with the small-vessel field effort. There were 20 sightings of four species of odontocetes, 14 of which were directed by acoustic detections from the Marine Mammal Monitoring on Navy Ranges (M3R) system. Bottlenose dolphins were encountered on 12 occasions, spinner dolphins on four occasions, rough-toothed dolphins on three occasions, and short-finned pilot whales on one occasion. Recordings on the M3R system for species verification were made for three of the four species (all but spinner dolphins). During the encounters 3,875 photos were taken for individual identification, seven biopsy samples were obtained for genetic studies, and six satellite tags were deployed on three species (three on bottlenose dolphins, one on a rough-toothed dolphin, and two on short-finned pilot whales). Data from the tagged species show that all appear to have island-associated populations with restricted ranges, and the ranges of all three populations substantially overlap with the PMRF range. Based on preliminary sound propagation analyses and the locations of animals tracked during this study, all of these populations are likely exposed to mid-frequency active (MFA) sonar on the PMRF range, but appear to use the overall area in different ways, thus the likelihood of exposure to different sound levels also probably varies by species. Continued collection of movement and habitat use data from all species should allow for a better understanding of the use of the range as well as provide datasets that can be used to estimate received sound levels at animal locations and examine potential responses to exposure.

[65] ABSTRACT: Aerial Survey Monitoring for Marine Mammals and Sea Turtles in the Hawaii Range Complex in Conjunction with a Navy Training Event

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Aerial surveys of marine mammals and sea turtles (MM/ST) were conducted in the waters off the Pacific Missile Range Facility (PMRF), Kauai, Hawaii, during the periods Feb 19-21 and Aug 12-13, 2013 in conjunction with Submarine Commander Course (SCC) training events. The February event corresponded with the time of peak residency of humpback whales on the Hawaiian wintering grounds, whereas during the August event, humpback whales are not normally present. Surveys during both months involved flying elliptical orbits ahead of a missile destroyer (DDG) to detect and monitor any MM/ST within approximately 5 km of the ship. Upon detection, a focal follow procedure was initiated, whereby the survey plane increased altitude from 244 to 305 m to reduce potential for reaction to the plane. Survey effort comprised a total of 15.3 and 8.1 hours and approximately 2,834 and 1,500 km for the February and August events, respectively, with the majority of effort occurring in poor sea state conditions (Bf = 6) in both cases. For the February event, a total of 40 sightings were recorded, including 37 confirmed humpback whales, one unidentified large whale (likely humpback), an unidentified species of sea turtle, and one unidentified dolphin species. Of these, six sightings occurred while orbiting the DDG, including five pods of humpback whales and one unidentified sea turtle. One focal follow was performed on a pod of two humpback whales, which resulted in a 19-minute video. The latter will be added to the focal follow videos obtained during previous SCC events for subsequent analysis of behavioral response. For the August event, three unidentified dolphin groups were seen, all within 5 km of the DDG. Focal follows were not possible in these cases due to poor sea state conditions. Additionally, three sightings of an unidentified turtle species were recorded during transits along the Kauai coastline.

**[66] ABSTRACT: Final Cruise Report, Marine Species Monitoring & Lookout Effectiveness Study
Submarine Commanders Course, February 2013, Hawaii Range Complex**

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In accordance with the HRC Monitoring Plan, implemented in January 2009, data were collected 18–22 February 2013 during a SCC event, with the following stated goals: (1) collect data to assess the effectiveness of the Navy lookout team, and (2) obtain data to characterize the possible exposure of marine species to MFAS. Three U.S. Navy civilian MMOs (MMOs and one contractor MMO) were stationed aboard a U.S. Navy-guided DDG for observation of marine species. MMO surveys were conducted on a not-to-interfere basis, which means that the MMOs did not replace required Navy lookouts and did not dictate operational requirements or maneuvers. If a marine mammal or sea turtle was visually detected by the MMOs or by Navy watchstanders, information was collected on the sighting and concurrent operational and environmental parameters. For the duration of the embark, the MMO team spent 27 hours and 17 minutes searching for marine species during the training event. For whole days out at sea, approximately 6.8 hours per day were spent on effort. The majority of the on-effort time (64 percent) was in Beaufort Sea State (BSS) 6, with the range being BSS 4–7. Sightings occurred in all BSS, with the majority (55 percent) occurring in BSS 7. In total, 13 unique sightings comprising at least 28 individual MM/ST were recorded during the 4 days of observation. Visual sightings included one unidentified blackfish, four unidentified whales, two unidentified marine mammals, one spinner dolphin (*Stenella longirostris*), two humpback whales (*Megaptera novaeangliae*), and two green sea turtles (*Chelonia mydas*). MMOs made seven sightings independent of the ship's watchstander team. There were two sightings made concurrently by both the MMO and watchstander team. The ship's passive acoustic detection team detected three marine mammal groups independent of the MMOs and one marine mammal group visually confirmed by a MMO sighting. Forty-three visual observations made of birds were also reported during the observation period.

**[68] ABSTRACT: Hawaii Range Complex Marine Mammal and Sea Turtle Underwater Detonation
Monitoring Report for 2 and 4 April, 2013**

By Jessica M. Aschettino,¹ Morgan W. Richie,¹ and Robert K. Uyeyama¹

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Navy Marine Species Observers (MSOs) monitored UNDET training exercises at the Pu'uloa Underwater Range, located west of the Pearl Harbor entrance channel, on 2 and 4 April 2013. The intent of the exercises was to provide training in precision cutting for harbor clearance or salvage. The primary purpose of the MSO presence was to monitor mitigation measures conducted by Mobile Diving and Salvage Unit 1 (MDSU-1); however, visual surveys were also conducted opportunistically. The UNDET on 2 April 2013 contained a net explosive weight of 12.6 pounds and occurred at approximately N21°17'29", W157°59'14" at 10:02:03 HST. The detonation portions of the 4 April 2013 exercise were cancelled after multiple sightings of marine species in the area. No marine species sightings occurred prior to the scheduled UNDET on 2 April 2013. Approximately 25–30 fish were seen dead or stunned floating at the surface following the detonation. A green sea turtle was seen 21 minutes after the detonation ~370 m from the UNDET site. Following the 30-minute post-UNDET monitoring, two

unidentified species of sea turtles were seen in transit to the harbor. During the pre-detonation survey on 4 April 2013, a group of 40–80 spinner dolphins (best = 60) were seen travelling near the 640 m mitigation boundary. At the same time, a humpback whale was observed breaching outside the mitigation zone, ~915 m away. The 30-minute pre-detonation visual survey re-started following these sightings. A Hawaiian monk seal was then seen surfacing ~235 m from the intended UNDET site. After the seal dove, the 30-minute pre-detonation visual survey re-started. The surfacing of a green sea turtle ~410 m from the intended UNDET site re-started the clock on the pre-detonation survey again. Another Hawaiian monk seal sighting, 330 m from the intended UNDET site, occurred, and at this time, instead of re-starting the mitigation clock for the fourth time, MDSU-1 cancelled the scheduled detonation for the day. Two unidentified species of sea turtles were observed during the transit to the harbor.

[71] UPDATE: Aerial Survey of Seabirds and Marine Mammals at Kaula Island

Aerial surveys were conducted, primarily for seabirds, at Kaula Island on 23–24 April 2013. High-resolution digital still images were collected using a Piper PA-31 Navajo N3949W twin-engine survey aircraft and a GPS-linked custom flight management camera system, the APEM SeeBird01, specifically designed by APEM to target high resolution surveys for birds and marine mammals. Approximately 1,500 digital photographs were collected from all three surveys and spatially joined to create one large mosaic image covering the whole island. Specially trained APEM staff were responsible for identifying species, behavior, count, and position. During the course of the survey, 11 Hawaiian monk seals were recorded on ledges on the eastern side of the island. Two were in the northeastern section and nine were resting on the larger ledges towards the southeastern section. These areas have not been previously documented as haul out sites for Hawaiian monk seals (Normandeau Associates Inc. and APEM Joint Venture 2013).

**Marine Species Monitoring for the U.S. Navy's Hawaii Range Complex
2013 Annual Report**

2.4 OTHER NAVY-FUNDED RESEARCH IN HAWAII (OFFICE OF NAVAL RESEARCH, LIVING MARINE RESOURCES)

The Navy is one of the world's leading organizations in assessing the effects of human activities on the marine environment, while also providing a significant amount of funding and support to marine research. There are three levels in the conceptual pathway for timeline and focus of Navy-funded research: ONR, LMR, and operational navy monitoring programs (represented in this report).

The ONR Marine Mammals and Biology program supports basic and applied research and technology development related to understanding the effects of sound on marine mammals, including physiological, behavioral, ecological effects, and population-level effects. The mission of the LMR program is to develop, demonstrate, and assess information and technology solutions to protect living marine resources by minimizing the environmental risks of Navy at-sea training and testing activities while preserving core Navy readiness capabilities. ONR- and LMR-funded projects relevant to the HRC are found in Table 2-7.

Table 2-7: Summary of United States Navy Research and Development Monitoring in Hawaii Range Complex

TITLE	ORGANIZATION	PRIMARY INVESTIGATOR	DURATION	DESCRIPTION	FUNDER
Passive autonomous acoustic monitoring of marine mammals: Proof-of-concept demonstration	OASIS	Phillip Abbot	8/07–3/13	Monitor Pacific humpback whales using gliders.	ONR
Improving attachments of remotely-deployed dorsal fin-mounted tags: Tissue structure, hydrodynamics, in situ performance, and tagged animal follow-up	Alaska Sealife Center	Russ Andrews	4/10–12/13	Tag development for short-finned pilot whales and false killer whales in Hawaii	ONR
Development and testing of a datalogging device for physiological measurements of deep-diving odontocetes	Alaska Sealife Center	Russ Andrews	3/11–9/13	Tag development for short-finned pilot whales and false killer whales in Hawaii	ONR
Conduct research on the foraging behavior of beaked whales in Hawaiian waters	University of Hawaii	Whitlow Au	10/11–3/13	Ecosystem research on whales and dolphins in Hawaii	ONR
Remote monitoring of dolphins and whales in the high naval activity areas in Hawaiian waters	University of Hawaii	Whitlow Au	1/12–8/13	Passive acoustic monitoring of beaked whales and sperm whales in Hawaii	ONR
Utilizing pro-bono	University of	Whitlow Au	1/12–6/13	Passive acoustic monitoring	ONR

**Marine Species Monitoring for the U.S. Navy's Hawaii Range Complex
2013 Annual Report**

TITLE	ORGANIZATION	PRIMARY INVESTIGATOR	DURATION	DESCRIPTION	FUNDER
commercial assets for marine mammal surveys in a high naval activity area in Hawaiian waters	Hawaii			of whales and dolphins in Hawaii	
Movements and habitat use of dwarf and pygmy sperm whales using remotely deployed LIMPET satellite tags	Cascadia Research Collective	Robin Baird	6/12–9/15	Ecosystem research on dwarf and pygmy sperm whales in Hawaii	ONR
Acoustic Behavior, Baseline Ecology and Habitat Use of Pelagic Odontocete Species of Concern	Cascadia Research Collective	Robin Baird	6/11-9/13	Assess the acoustic signals of Hawaiian insular false killer whales and melon-headed whales, determine baseline acoustic behavior, and pair data on the acoustic characteristics with behavioral ecology information to evaluate the potential for species classification, passive acoustic detection and density estimates.	ONR
Improving the Navy's passive underwater acoustic monitoring of marine mammal populations	Scripps Institution of Oceanography	Gerald D'Spain	5/13–5/15	Passive acoustic monitoring of humpback whales in Hawaii	ONR
Dorsal fin structure analysis	NOAA-NWFSC	Brad Hanson	2/11–12/13	Tag development for short-finned pilot whales and false killer whales in Hawaii	ONR
Remote release device for marine mammal electronic tags – N2-3320-STTR	Wildlife Computers, Inc.	Roger Hill	11/10–12/13	Tag development for false killer whales and melon-headed whales in Hawaii	ONR
Acoustic behavior, baseline ecology and habitat use of pelagic odontocete species of concern	Woods Hole Oceanographic Institution	Aran Mooney	7/11–9/13	Ecosystem research on false killer whales and melon-headed whales in Hawaii	ONR
Portable multi hydrophone array for field and laboratory measurements of odontocete acoustic signals (DURIP)	University of Hawaii	Paul Nachtigall	6/13–9/14	Effects of sound on a captive false killer whale and bottlenose dolphins	ONR
Improvements to passive acoustic	University of	Eva-Marie	1/12–12/14	Passive acoustic monitoring of sperm whales, beaked	ONR

**Marine Species Monitoring for the U.S. Navy's Hawaii Range Complex
2013 Annual Report**

TITLE	ORGANIZATION	PRIMARY INVESTIGATOR	DURATION	DESCRIPTION	FUNDER
tracking methods for marine mammal monitoring	Hawaii	Nosal		whales, minke whales, and humpback whales in Hawaii	
Cetacean density estimation from novel acoustic dataset by acoustic propagation modeling	Portland State University	Martin Siderius	1/12–9/13	Passive acoustic monitoring of false killer whales	ONR
Advanced methods for Passive Acoustic Detection Classification and Localization of Marine Mammals	OSU, SDSU, NUWC, SSC PAC	Steve Martin	4/11 - 4/14	Develop advanced real-time passive acoustic D,C,L methods. SSC PAC focus on baleen species	ONR
Measuring the hearing of stranded whales and dolphins	University of Hawaii	Paul Nachtigall	10/12–10/13	Measure the hearing of odontocetes and mysticetes that strand around Hawaii. Measure animals prior to Navy exercises to determine baseline levels of new species and during or directly after exercises to determine the effects of sound.	LMR
Measuring Low Frequency Hearing Shifts in the Bottlenose Dolphin	University of Hawaii	Paul Nachtigall	10/12–10/13	Derive a new technique for measuring low frequency Evoked Auditory Potential hearing thresholds in the bottlenose dolphin. Establish low-frequency thresholds and compare/validate them to behaviorally measured thresholds. Re-establish NOAA endangered species permit to measure TTS. Expose the dolphin to low frequency (500–5,000 Hz) loud sounds and measure TTS to sounds as loud as 180 dB for 1 hour if necessary to produce a 5 dB shift if possible.	LMR
Marine Mammal Monitoring on Navy Ranges	NUWC	Dave Moretti	10/11-TBD	Provide real-time marine mammal monitoring capabilities in support of range operations	LMR

Notes: dB = decibels, DURIP = Defense University Research Instrumentation Program, Hz = Hertz, LIMPET = Low-Impact Minimally Percutaneous External-Electronics Transmitter, LMR = Living Marine Resources, Navy = United States Department of the Navy, NOAA = National Oceanic and Atmospheric Administration, NUWC = Naval Undersea Warfare Center, NWFSC = Northwest Fisheries Science Center, ONR = Office of Naval Research, TBD = To Be Determined, TTS = Temporary Threshold Shift

2.5 HAWAII RANGE COMPLEX ADAPTIVE MANAGEMENT AND 2014 MONITORING PLAN

Adaptive Management Review is an iterative process of optimal decision making in the face of uncertainty, with an aim to reducing uncertainty over time via systematic monitoring. AMR has been conducted on an annual basis with NMFS, and also engaged the Marine Mammal Commission and non-governmental organizations. Revisions to the Compliance Monitoring structure as a result of AMR are described in full in the HSTT Final Rule 50 CFR Parts 216 and 218.

Table 2-8 lists 2014 HRC Compliance Monitoring study objectives that are described in 50 CFR Parts 216 and 218 and will be applied under the HSTT EIS/OEIS LOA (NMFS 2013). Longer-term goals will be a complete transition to the Strategic Planning Process for methodology selections with no legacy projects which have not been assessed under the Strategic Planning Process criteria, as well as moving toward integration across all Navy range complexes of their monitoring plans, and the respective scientific question objectives that drive them.

**Marine Species Monitoring for the U.S. Navy's Hawaii Range Complex
2013 Annual Report**

Table 2-8: Hawaii Range Complex Region-Specific Research Study Questions Starting in 2014 (Monitoring Plan)

INTERMEDIATE SCIENTIFIC OBJECTIVE	PROJECT DESCRIPTION	STATUS
<p>Determine what species and populations of marine mammals and sea turtles are present in Navy range complexes</p> <p>Continue development of passive acoustic monitoring techniques and tools for detecting, classifying, and localizing marine mammals</p> <p>Determine what populations of marine mammals are exposed to Navy training and testing activities</p> <p>Establish the baseline vocalization behavior of marine mammals where Navy training and testing activities occur</p> <p>Develop analytic methods to evaluate behavioral responses based on passive acoustic monitoring techniques</p> <p>Evaluate behavioral responses by marine mammals exposed to Navy training and testing activities</p>	<p>Title: Analysis of existing passive acoustic data</p> <p>Location: Niihau and Kaula Islands</p> <p>Objectives: Further our understanding of the following monitoring questions –</p> <p>What species of beaked whales (<i>Ziphius/Mesoplodon</i>) are heard in and around the Niihau area of the HRC?</p> <p>What is the seasonal occurrence of baleen whales (minke, fin, possibly sei) heard in the HRC around the Niihau area?</p> <p>What is the occurrence of sperm whales heard in the HRC around the Niihau area?</p> <p>What species of delphinids occur in the HRC around the Niihau area?</p> <p>Do beaked whale (<i>Ziphius/Mesoplodon</i>), baleen whale (minke, fin, possibly sei), sperm whale, and delphinid detection rates vary before, during, and after MFAS detections?</p> <p>Methods: PAM analysis</p> <p>Performing organization: HDR, Inc.</p> <p>Timeline: Estimated 2013–2015</p>	<p>Continuation from FY12. Analysis expected to continue through 2015.</p>
<p>Determine which species and populations of marine mammals and sea turtles are present in Navy range complexes</p> <p>Determine which species and populations of marine mammals are exposed to Navy training and testing activities</p> <p>Establish the baseline habitat uses and movement patterns of marine mammals where Navy training and testing activities occur</p>	<p>Title: Marine species monitoring prior to Navy training events</p> <p>Location: Kauai, Niihau, Kaula Islands</p> <p>Objectives: Further our understanding of the monitoring question –</p> <p>What are spatial movement patterns and habitat use (e.g., island-associated or open ocean, restricted ranges v. large ranges) of species that are exposed to MFAS and how do these patterns influence exposure and potentially response?</p> <p>Methods: Visual survey, satellite tagging, PAM</p> <p>Performing Organization: U.S. Navy and HDR, Inc.</p> <p>Timeline: 2013-2014 (with option to extend)</p>	<p>Continuation from FY12 – Field work occurred in 2013 and will commence following another HRC Navy training event in 2014.</p>
<p>Continue development of passive acoustic monitoring techniques and tools for detecting, classifying, and localizing marine mammals.</p> <p>Determine what populations of marine</p>	<p>Title: Marine species monitoring at PMRF during Navy training events</p> <p>Location: Kauai</p> <p>Objectives: Further our understanding of the following monitoring question –</p> <p>What are the estimated received levels of MFAS which marine mammals are exposed to during anti-submarine warfare training, and what, if any, behavioral effects result at</p>	<p>Continuation from FY07 – Field work occurred in 2013 and will commence following another HRC Navy training</p>

**Marine Species Monitoring for the U.S. Navy's Hawaii Range Complex
2013 Annual Report**

INTERMEDIATE SCIENTIFIC OBJECTIVE	PROJECT DESCRIPTION	STATUS
<p>mammals are exposed to Navy training and testing activities</p> <p>Develop analytic methods to evaluate behavioral responses based on passive acoustic monitoring techniques</p> <p>Evaluate behavioral responses by marine mammals exposed to Navy training and testing activities</p>	<p>various levels?</p> <p>Methods: PAM, visual survey</p> <p>Performing organization: U.S. Navy and HDR, Inc.</p> <p>Timeline: 2013-2014 (with option to extend)</p>	<p>event in 2014.</p>
<p>Evaluate behavioral responses by marine mammals exposed to Navy training and testing activities</p>	<p>Title: Marine species monitoring following Navy training events</p> <p>Location: Islands near training event</p> <p>Objectives: Further our understanding of the monitoring question – Do marine mammals strand along shorelines of the Main Hawaiian Islands within one week following a Navy training event?</p> <p>Methods: Visual survey</p> <p>Performing Organization: U.S. Navy and HDR, Inc.</p> <p>Timeline: 2013-2014 (with option to extend)</p>	<p>Continuation from FY10 – Field work occurred in 2013 and will commence following another HRC Navy training event in 2014.</p>
<p>Determine which species and populations of marine mammals are exposed to Navy training and testing activities</p> <p>Determine the effectiveness of Navy watch-standers/lookouts</p>	<p>Title: Marine Species Observers embarked on Navy assets during anti-submarine warfare training and underwater detonation training and testing</p> <p>Location: Hawaii Range Complex</p> <p>Objectives: Further our understanding of the monitoring questions – What is the effectiveness of Navy lookouts when implementing protective measures? Which marine mammals are observed in the vicinity of ASW and UNDET training that could be exposed to Navy sound sources?</p> <p>Methods: Visual survey</p> <p>Performing Organization: U.S. Navy and HDR, Inc.</p> <p>Timeline: 2014-2018</p>	<p>Continuation from FY10</p>
<p>Assess existing data sets which could be utilized to address the above objectives</p>	<p>Title: Meta-analysis of HRC monitoring and other existing data sets – possible inclusion of other existing data in on-going analysis</p> <p>Location: HRC</p> <p>Objectives: Further our understanding of the monitoring questions – How well is baseline occurrence (distribution, density and habitat use) known/defined (short to medium term) across species groups? How does our ability to address question of exposure (integrating propagation models and animal occurrence) vary with species/species groups?</p> <p>Methods: Meta-analysis of multiple data sets</p>	<p>Continuation from FY12</p>

**Marine Species Monitoring for the U.S. Navy's Hawaii Range Complex
2013 Annual Report**

INTERMEDIATE SCIENTIFIC OBJECTIVE	PROJECT DESCRIPTION	STATUS
	<p>Performing Organization: HDR, Inc. Timeline: 2013-2014</p>	

Notes: FY = Fiscal Year, HRC = Hawaii Range Complex, MFAS = Mid-Frequency Active Sonar, Navy = United States Department of the Navy, PAM = Passive Acoustic Monitoring, PMRF = Pacific Missile Range Facility, TBD = To Be Determined, U.S. = United States

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2013 Annual Report**

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