May 2014

Final Cruise Report, Marine Species Monitoring & Lookout Effectiveness Study Submarine Commanders Course, August 2013, Hawaii Range Complex

Prepared for:
U.S. Pacific Fleet

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REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

1. REPORT DATE *(DD-MM-YYYY)*	2. REPORT TYPE	3. DATES COVERED *(From - To)*
05-2014	Monitoring report	1 Jan 2013 - 31 Dec 2014

4. TITLE AND SUBTITLE
Final Cruise Report, Marine Species Monitoring & Lookout Effectiveness Study Submarine Commanders Course, August 2013, Hawaii Range Complex

5a. CONTRACT NUMBER

5b. GRANT NUMBER

5c. PROGRAM ELEMENT NUMBER

6. AUTHOR(S)
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5d. PROJECT NUMBER

5e. TASK NUMBER

5f. WORK UNIT NUMBER

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)
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8. PERFORMING ORGANIZATION REPORT NUMBER

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)
Commander, U.S.Pacific Fleet 250 Makalapa Dr. Pearl Harbor, HI

10. SPONSOR/MONITOR'S ACRONYM(S)

11. SPONSORING/MONITORING AGENCY REPORT NUMBER

12. DISTRIBUTION AVAILABILITY STATEMENT
Approved for public release; distribution is unlimited

13. SUPPLEMENTARY NOTES

14. ABSTRACT

In order to train with mid-frequency active sonar (MFAS), the United States (U.S.) Navy has obtained a permit from the National Marine Fisheries Service (NMFS) under the Marine Mammal Protection Act and a Biological Opinion under the Endangered Species Act. The Hawaii Range Complex Monitoring Plan, implemented starting in November 2009, was developed with NMFS to comply with the requirements under the permits. The monitoring plan and reporting requirements provide science-based answers to questions regarding whether or not marine mammals are exposed and react to Navy MFAS. The objectives of the monitoring plan address the following questions:
1. Are marine mammals and sea turtles exposed to MFAS at regulatory thresholds of harm or harassment? If so, at what levels and how frequently are they exposed?
2. If marine mammals and sea turtles are exposed to MFAS in the HRC, 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 MFAS, what are their behavioral responses? Are they different at various levels?
4. What are the behavioral responses of marine mammals and sea turtles that are exposed to various levels and distances from explosives?
5. Are the Navy's suite of mitigation measures for MFAS and explosives (e. g. Protective Measures Assessment Protocol [PMAP], measures agreed to by the Navy through permitting and consultation) effective at avoiding harm and harassment of marine mammals and sea turtles?

In order to address these questions, data would be collected through various means, including contracted vessel and aerial surveys, tagging, passive acoustic monitoring, and placing marine mammal observers (MMOs) aboard Navy warships. In a concerted effort to address the fifth question above, a study was initiated to determine the effectiveness of the Navy lookout team, including lookouts in the pilot house or on the bridge wings. Trained biologists were utilized for the study to collect data that would characterize the likelihood of detecting marine species in the field from 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. Necessary changes to the protocol were identified and made during prior cruises. 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 part of this data collection effort, three U.S. Navy civilian MMOs (Mr. Thomas Vars, Ms. Meredith Fagan, and Ms. Jessica Aschettino) and one contractor MMO (Dr. Thomas Jefferson) embarked from 10-14 August 2013 during a Submarine Commanders Course event in HRC. These MMOs were stationed aboard a U.S. Navy guided missile destroyer, hereafter referred to as DDG-J. The goals of the monitoring and this study were to:

1. Collect data to assess the effectiveness of the Navy lookout team.
2. Obtain data to characterize the possible exposure of marine species to MFAS.

15. SUBJECT TERMS
Monitoring, marine mammal, adaptive management review, Hawaii Range Complex

16. SECURITY CLASSIFICATION OF:			**17. LIMITATION OF ABSTRACT**	**18. NUMBER OF PAGES**	**19a. NAME OF RESPONSIBLE PERSON**
			UU	15	Department of the Navy
a. REPORT Unclassified	**b. ABSTRACT** Unclassified	**c. THIS PAGE** Unclassified			**19b. TELEPONE NUMBER (*Include area code)*** 808-471-6391

1. REPORT DATE. Full publication date, including day, month, if available. Must cite at lest the year and be Year 2000 compliant, e.g., 30-06-1998; xx-08-1998; xx-xx-1998.

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4. TITLE. Enter title and subtitle with volume number and part number, if applicable. On classified documents, enter the title classification in parentheses.

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5b. GRANT NUMBER. Enter all grant numbers as they appear in the report, e.g. 1F665702D1257.

5c. PROGRAM ELEMENT NUMBER. Enter all program element numbers as they appear in the report, e.g. AFOSR-82-1234.

5d. PROJECT NUMBER. Enter al project numbers as they appear in the report, e.g. 1F665702D1257; ILIR.

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8. PERFORMING ORGANIZATION REPORT NUMBER. Enter all unique alphanumeric report numbers assigned by the performing organization, e.g. BRL-1234; AFWL-TR-85-4017-Vol-21-PT-2.

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10. SPONSOR/MONITOR'S ACRONYM(S). Enter, if available, e.g. BRL, ARDEC, NADC.

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List of Acronyms and Abbreviations

BSS	Beaufort Sea State
DDG	United States Navy guided missile destroyer
DMMO	data marine mammal observer
ft	foot (feet)
GPS	global positioning system
hr	hour(s)
HRC	Hawaii Range Complex
HST	Hawaii Standard Time
LMMO	liaison marine mammal observer
m	meter(s)
min	minute(s)
MFAS	mid-frequency active sonar
MMO	marine mammal observer
NMFS	National Marine Fisheries Service
PMAP	Protective Measures Assessment Protocol
SMMO	survey marine mammal observer
U.S.	United States
yd	yard(s)

SECTION 1 INTRODUCTION

In order to train with mid-frequency active sonar (MFAS), the United States (U.S.) Navy has obtained a permit from the National Marine Fisheries Service (NMFS) under the Marine Mammal Protection Act and a Biological Opinion under the Endangered Species Act. The Hawaii Range Complex Monitoring Plan, implemented starting in November 2009, was developed with NMFS to comply with the requirements under the permits. The monitoring plan and reporting requirements provide science-based answers to questions regarding whether or not marine mammals are exposed and react to Navy MFAS. The objectives of the monitoring plan address the following questions:

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In order to address these questions, data would be collected through various means, including contracted vessel and aerial surveys, tagging, passive acoustic monitoring, and placing marine mammal observers (MMOs) aboard Navy warships. In a concerted effort to address the fifth question above, a study was initiated to determine the effectiveness of the Navy lookout team, including lookouts in the pilot house or on the bridge wings. Trained biologists were utilized for the study to collect data that would characterize the likelihood of detecting marine species in the field from 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. Necessary changes to the protocol were identified and made during prior cruises. 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 part of this data collection effort, three U.S. Navy civilian MMOs (Mr. Thomas Vars, Ms. Meredith Fagan, and Ms. Jessica Aschettino) and one contractor MMO (Dr. Thomas Jefferson) embarked from 10-14 August 2013 during a Submarine Commanders Course event in HRC. These MMOs were stationed aboard a U.S. Navy guided missile destroyer, hereafter referred to as DDG-J. The goals of the monitoring and this study were to:

1. Collect data to assess the effectiveness of the Navy lookout team.
2. Obtain data to characterize the possible exposure of marine species to MFAS.

SECTION 2 METHODS

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 or maneuvers, and would remove themselves from the bridge wing if necessary for DDG-J to accomplish its mission objectives. The exceptions would be if a marine mammal was sighted by the MMO within the shut-down zone during MFAS operations (200 yards [yds], 183 meters [m]) and was not sighted by the Navy lookout team, or if the vessel was in danger of striking the 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 developed by the University of St. Andrews which was modified by the MMOs on initial embarks. Additional changes were made as necessary during these events. The MMO survey on DDG-J was conducted on the bridge wings (elevated 60 feet [ft; 20 m] 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 10 degrees on the opposite side of dead ahead to just aft of the beam. This equates to a 180 degree field in front of the ship that was covered by the MMOs, with a 20 degree overlap in the area forward of the trackline covered by both observers.

If a marine mammal or sea turtle was visually detected by the SMMOs, information would be collected on both the sighting and concurrent operational parameters. Environmental data were collected routinely. 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 7D 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-J was not altered as result of the sightings. 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. Seabirds are not the focus of this study, however, as they represent a white cue against a dark background, they were often observed during routine searches for marine mammals. The LMMO or SMMOs reported sightings made by the Navy bridge wing lookouts. 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 their 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, e. g., the same animal seen by two observers. The DMMO recorded effort-related events (e.g., begin effort, end effort, observer rotation, weather change) in addition to 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.

SECTION 3 RESULTS

The MMO team spent 36 hours and 16 minutes searching for marine species during the training event (Table 1). For whole days out at sea, approximately 8.2 hours per day were spent on effort. Figure 1 shows the breakdown of Beaufort Sea State (BSS) as a total of the on-effort observation period and the percentage of sightings that occurred at each BSS. Except for the last hour of the last day, each observation day was spent in a BSS of 4 or greater, which amounts to inferior environmental sighting conditions (Table 1).

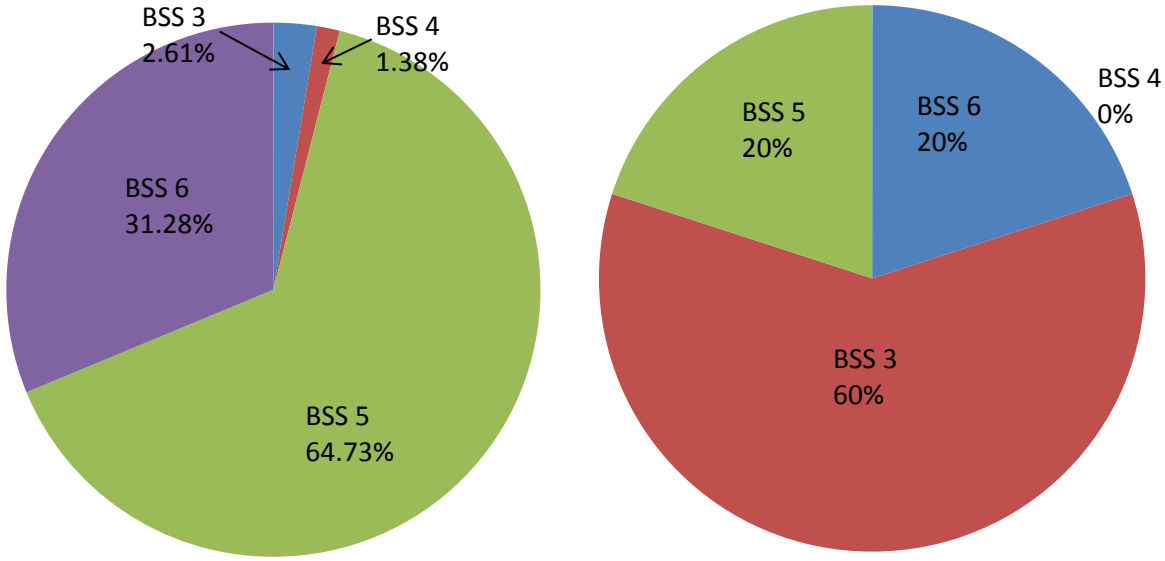

Figure 1. Total percentage of effort (left) and sightings (right) at various Beaufort Sea States (BSS)

In total, 5 unique sightings comprising at least 17 individual marine mammals and sea turtles were recorded during the five days of observation. MMOs made five sightings independent of the ship's watchstander team (Table 2). There were no sightings made concurrently by both the MMO and watchstander team. There was one sighting made by the watchstander team that followed an initial sighting made by the MMO.

Table 1. Effort Hours and Environmental Conditions

Date	Team Hours On-Effort	Time	Beaufort Sea State (range)	% Cloud Cover (range)	Visibility
10 Aug	8 hr 2 min	0728-1130, 1300-1700	5	1-92.5	Good-Excellent
11 Aug	7 hr 58 min	0709-1109, 1232-1630	5 - 6	5 – 67.5	Good-Excellent
12 Aug	7 hr 54 min	0704-1101, 1233-1630	5 - 6	15 - 83	Good-Excellent
13 Aug	8 hr 57 min	0703–1101, 1231-1730	5 - 6	7 - 25	Excellent
14 Aug	3 hr 25 min	0711-1036	3 - 6	4-12	Good-Excellent
Total	**36 hr 16 min**		**3– 6**	**4 – 92.5**	**Good-Excellent**

A total of 768 photographs were taken, 28 of which include images of pilot whales sighted on 14 August (Figure 5). There are no photographs of sea turtles. All of the remaining photos are of seabirds, vessels, airplanes, staff, and procedures.

Table 2. Number of Sightings

Date	Independent MMO Sightings	Independent Navy Watchstander Team Sightings	Sightings by both Teams
10 Aug	0	0	0
11 Aug	0	0	0
12 Aug	0	0	0
13 Aug	1	0	0
14 Aug	3	0	1
Total	**4**	**0**	**1**

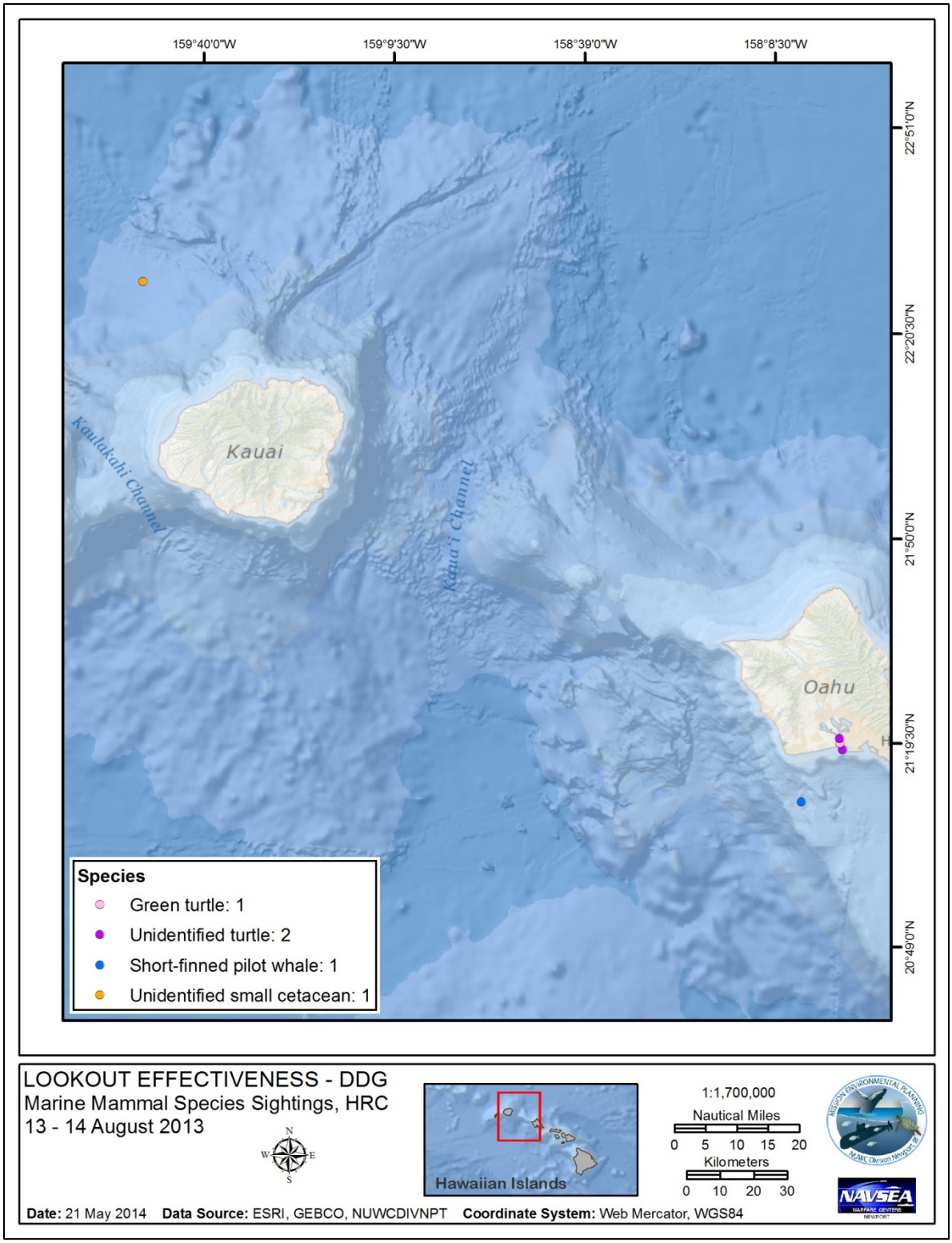

Figure 2. Locations of all marine mammal sightings

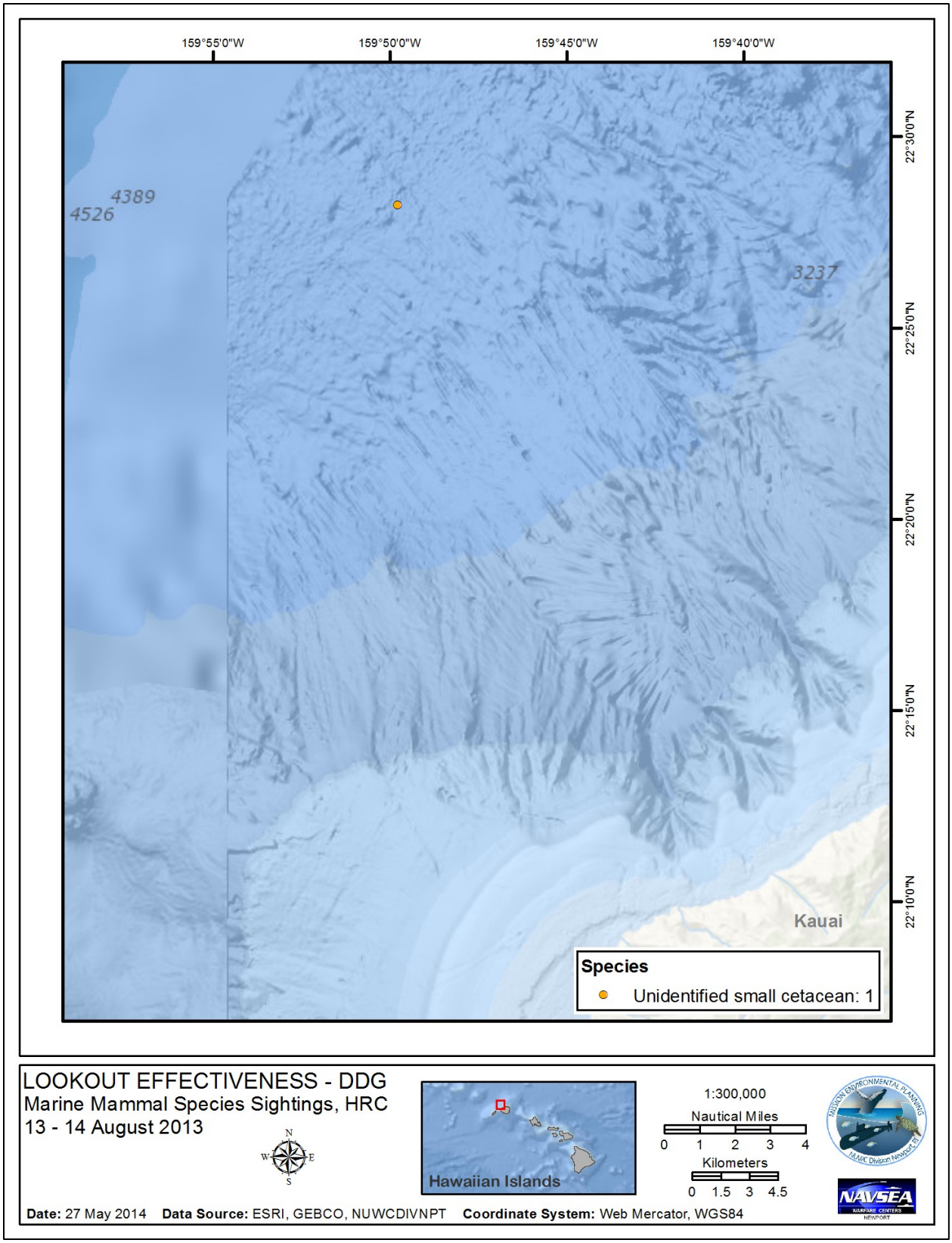

Figure 3. Marine mammal sightings near Kauai

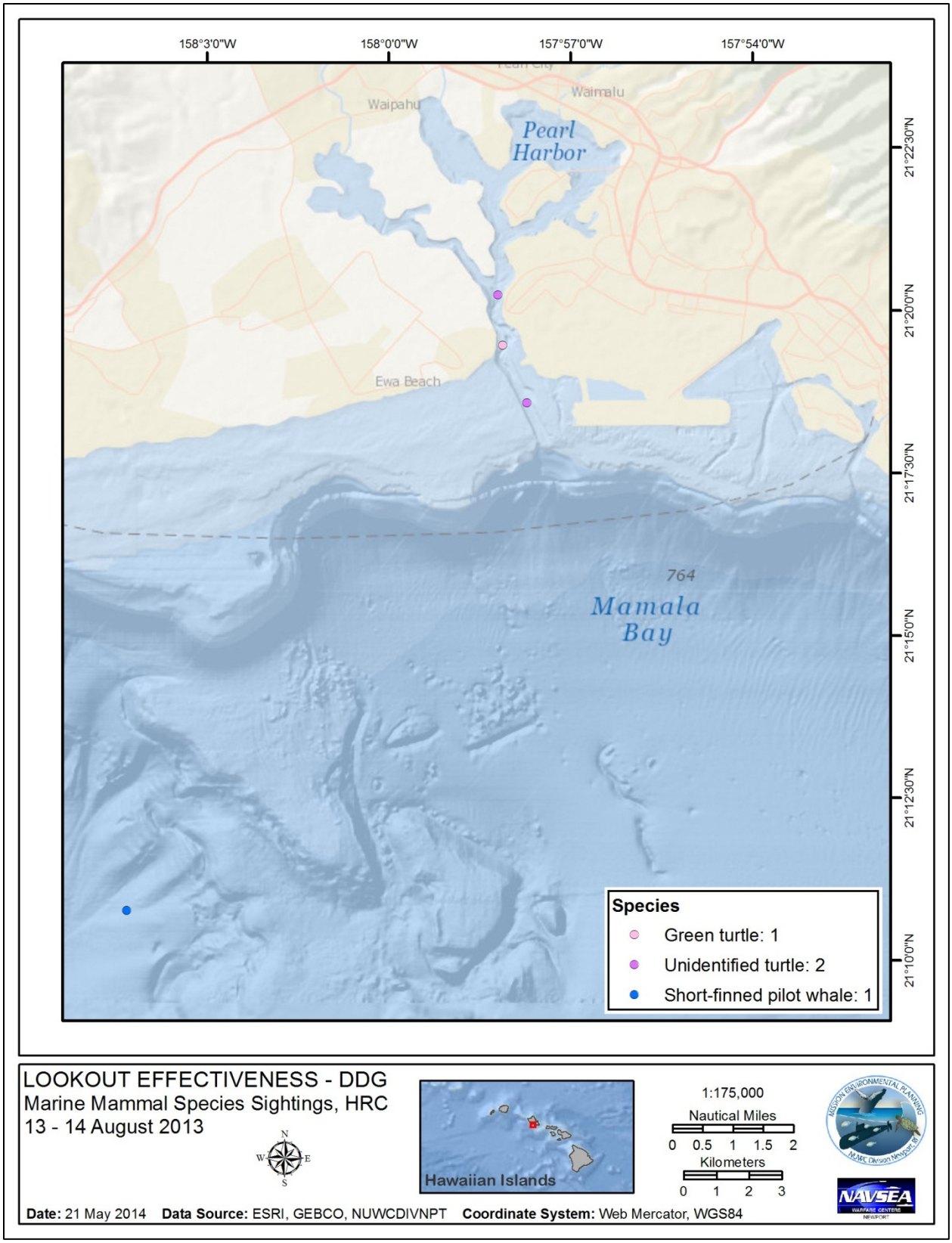

Figure 4. Marine mammal and sea turtle sightings near Oahu

Only one trial was successfully conducted during the event, with 1 of the 5 sightings (20%) available for trials, or an average rate of 0.28 trials per hour of effort across all five days (Table 3).

Table 3. Effort hours, sighting rates, and trial rates

Date	Hours MMO Team Effort	# of Unique Sightings	Sightings/ Hour	# of Trials	Trials/Hour
10 Aug	8 hr 2 min	0	0.0	0	0
11 Aug	7 hr 58 min	0	0.0	0	0
12 Aug	7 hr 54 min	0	0.0	0	0.0
13 Aug	8 hr 57 min	1	0.11	0	0
14 Aug	3 hr 25 min	4	1.17	1	0.29
Cumulative	**36 hr 16 min**	**5**	**0.14**	**1**	**0.028**

Of the 5 sightings, two species were positively identified. Visual sightings included one unidentified small marine mammal, a group of up to 10 pilot whales (*Globicephala macrorhynchus*), two unidentified sea turtles, and one green sea turtle (*Chelonia mydas*). The fifth day of the effort had the greatest frequency of unique sightings, 1.17 sightings/hour of effort.

Table 4. Unique Marine Mammal and Sea Turtle Sightings

Data Category	Sighting 1	Sighting 2	Sighting 3	Sighting 4	Sighting 5
Effort	On	On	On	On	On
Date	8/13/2013	8/14/2013	8/14/2013	8/14/2013	8/14/2013
Time (HST)	09:15:19	09:00:48	10:10:56	10:16:19	10:21:00
Location	22.47003 N 159.82971-W	21.17943 N 21.17943 W	21.30966 N 157.96198 W	21.32439 N 157.96869 W	21.33724 N 157.96999 W
Detection Sensor	MMO	MMO	MMO	MMO	MMO
Species/Group	Small Marine Mammal	Pilot Whales	Unidentified Turtle	Green Turtle	Unidentified Turtle
Group Size estimate (estimated range)	Unknown	9 (9-10)	1(1)	1 (1)	1 (1)
# Calves	Unknown	Unknown	NA	NA	NA
Bearing (relative)	120	290	230	296	291
Distance (m)	733	383	91	182	136.5
Animal motion	Unknown	Opening	None	None	None
Sighting Cue	Birds	Dorsal Fin	Body	Body	Body
Behavior	Unknown	Travelling	Travelling	Travelling	Travelling
Wave height (ft)	3-5	3-5	0-3	0-3	0-3
Visibility	Good	Good	Good	Good	Good
Beaufort Sea State	5	6	3	3	3
Cloud cover (%)	12.5	12.5	9	9	9
Glare (%)	10	10	0	0	0
Sonar	Off	Off	Off	Off	Off
Ship bearing (true)	221	23	293	292	291
Mitigation implemented	None	None	None	None	None
Comments	Sighting quickly lost in glare		.		

Figure 5. Pilot whale sighting (Sighting 2) on August 14, 2014

SECTION 4 CONCLUSION

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.

   This event is the tenth 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.

   Sighting information included the bearing and distance of the animal to DDG-J. This information can be used to determine the level of exposure a marine mammal or sea turtles may experience during an MFAS event.