

May 2014

# Final Cruise Report, Marine Species Monitoring & Lookout Effectiveness Study Koa Kai, January 2014 Hawaii Range Complex

Prepared for:  
U.S. Pacific Fleet



Prepared by:  
Ms. Mandy Shoemaker – Naval Facilities Engineering Command, Atlantic  
Ms. Tara Moll – Naval Undersea Warfare Center Division, Newport  
Dr. Kristen Ampela – HDR, Inc.  
Dr. Thomas Jefferson – HDR, Inc.

<b>REPORT DOCUMENTATION PAGE</b>		<i>Form Approved</i> <b>OMB No. 0704-0188</b>
<small>Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden to Washington Headquarters Service, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302, and to the Office of Management and Budget, Paperwork Reduction Project (0704-0188) Washington, DC 20503.</small> <b>PLEASE DO NOT RETURN YOUR FORM TO THE ABOVE ADDRESS.</b>		
<b>1. REPORT DATE (DD-MM-YYYY)</b> 05-2014	<b>2. REPORT TYPE</b> Monitoring report	<b>3. DATES COVERED (From - To)</b> 1 Jan 2014 - 31 Dec 2014
<b>4. TITLE AND SUBTITLE</b> Final Cruise Report, Marine Species Monitoring & Lookout Effectiveness Study Koa Kai, January 2014 Hawaii Range Complex	<b>5a. CONTRACT NUMBER</b>	
	<b>5b. GRANT NUMBER</b>	
	<b>5c. PROGRAM ELEMENT NUMBER</b>	
<b>6. AUTHOR(S)</b> Mandy Shoemaker Tara Moll Kristen Ampela Thomas Jefferson	<b>5d. PROJECT NUMBER</b>	
	<b>5e. TASK NUMBER</b>	
	<b>5f. WORK UNIT NUMBER</b>	
<b>7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)</b> Naval Facilities Engineering Command, Atlantic 6506 Hampton Blvd Norfolk VA Naval Undersea Warfare Center Division, Newport 1176 Howell Street Newport, RI HDR, Inc. 8690 Balboa Avenue Suite 200 San Diego, CA		<b>8. PERFORMING ORGANIZATION REPORT NUMBER</b>
<b>9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)</b> Commander, U.S.Pacific Fleet 250 Makalapa Dr. Pearl Harbor, HI	<b>10. SPONSOR/MONITOR'S ACRONYM(S)</b>	
	<b>11. SPONSORING/MONITORING AGENCY REPORT NUMBER</b>	
<b>12. DISTRIBUTION AVAILABILITY STATEMENT</b> Approved for public release; distribution is unlimited		
<b>13. SUPPLEMENTARY NOTES</b>		
<b>14. ABSTRACT</b> A study was initiated in 2010 (based upon the 2009 monitoring plan and continued into Phase 2) to determine the effectiveness of the Navy lookout team, including lookouts in the pilot house or on the bridge wings. In addition to the eighth scientific objective, data collected as part of this study also addresses the first and third scientific objectives. 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 initial embarks. Data collected are combined with prior and subsequent 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, two U.S. Navy civilian MMOs and two contractor MMOs embarked from 25 Jan - 01 Feb 2014 during a Koa Kai event in HRC. These MMOs were stationed aboard a U.S. Navy guided missile destroyer, hereafter referred to as DDG-K. 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.		
<b>15. SUBJECT TERMS</b> Monitoring, marine mammal, adaptive management review, Hawaii Range Complex		

<b>16. SECURITY CLASSIFICATION OF:</b>			<b>17. LIMITATION OF ABSTRACT</b> UU	<b>18. NUMBER OF PAGES</b> 26	<b>19a. NAME OF RESPONSIBLE PERSON</b> Department of the Navy
<b>a. REPORT</b> Unclassified	<b>b. ABSTRACT</b> Unclassified	<b>c. THIS PAGE</b> Unclassified			<b>19b. TELEPHONE NUMBER (Include area code)</b> 808-471-6391

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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
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 (MMPA) and a Biological Opinion under the Endangered Species Act (ESA). The Navy has developed Monitoring Plans for individual Navy Range Complexes, guided by the Integrated Comprehensive Monitoring Program (ICMP) to provide marine mammal and sea turtle monitoring guidelines as required under the MMPA and ESA (Department of the Navy 2010). The Hawaii Range Complex (HRC) Monitoring Plan, implemented in 2014, was developed with NMFS to comply with the requirements under the permits (Department of the Navy 2014).

The ICMP provides the overarching framework for coordination of the U.S. Navy Monitoring Program (Department of the Navy 2010). The ICMP outlines objectives for range/ project-specific Monitoring Plans and Navy-funded research relating to the effects of naval training and testing activities on protected marine species (Department of the Navy 2010). The Marine Species Monitoring Report for the Hawaii Range Complex includes the following scientific objectives (Department of the Navy 2014):

1. Determine what species and populations of marine mammals and sea turtles are present in Navy range complexes;
2. Continue development of passive acoustic monitoring techniques and tools for detecting, classifying, and localizing marine mammals;
3. Determine what populations of marine mammals are exposed to Navy training and testing activities;
4. Establish the baseline vocalization behavior of marine mammals where Navy training and testing activities occur;
5. Develop analytic methods to evaluate behavioral responses based on passive acoustic monitoring techniques;
6. Evaluate behavioral responses by marine mammals exposed to Navy training and testing activities;
7. Establish the baseline habitat uses and movement patterns of marine mammals where Navy training and testing activities occur;
8. Determine the effectiveness of Navy watch-standers/ lookouts;
9. Assess existing data sets which could be utilized to address the above objectives.

In order to address these objectives, 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 eighth scientific objective above, a study was initiated in 2010 (based upon the 2009 monitoring plan)

to determine the effectiveness of the Navy lookout team, including lookouts in the pilot house or on the bridge wings. In addition to the eighth scientific objective, data collected as part of this study also addresses the first and third scientific objectives. 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 initial embarks. Data collected are combined with prior and subsequent 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, two U.S. Navy civilian MMOs (Ms. Mandy Shoemaker and Ms. Tara Moll) and two contractor MMOs (Dr. Kristen Ampela and Dr. Thomas Jefferson) embarked from 25 Jan - 01 Feb 2014 during a Koa Kai event in HRC. These MMOs were stationed aboard a U.S. Navy guided missile destroyer, hereafter referred to as DDG-K. 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-K 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 [yd], 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. The MMO survey on DDG-K 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.

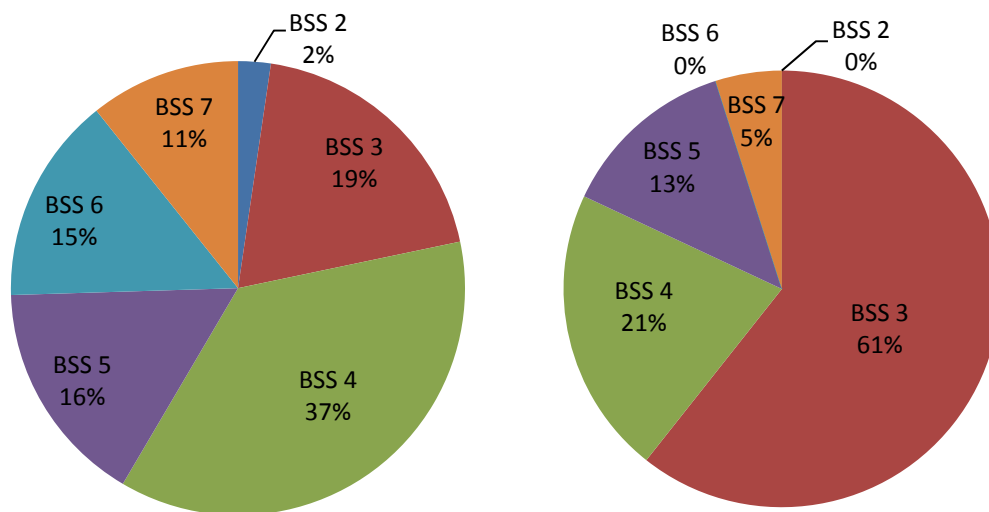
If a marine mammal or sea turtle was visually detected by the SMMOs, information was collected on both the sighting and concurrent operational parameters. Environmental data were collected routinely. Sightings obtained first by the SMMOs before the Navy lookout were considered to be “trials.” If applicable, photographs were 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-K 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 observation. 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 43 hours 4 minutes searching for marine species during the training event (Table 1). For whole days out at sea, approximately 7.2 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. The majority of observation time was spent in a BSS of 4 or greater (78%), although the majority of the sightings (61%) occurred in BSS 3 (Figure 1).

**Table 1. Effort Hours and Environmental Conditions**

Date	Team Hours On-Effort	Time	Beaufort Sea State (range)	% Cloud Cover (range)	Visibility
25 Jan	4 hr 4 min	1228-1632	4-5	90-93	Good-Excellent
26 Jan	6 hr 57 min	0720-1120, 1404-1701	3-5	40-93	Good-Excellent
27 Jan	7 hr 58 min	0721-1121, 1233-1631	2-5	75-100	Moderate- Excellent
28 Jan	5 hr 49 min	0723-1123, 1247-1334, 1418-1452, 1813-1841	5-7	10-85	Excellent
29 Jan	7 hr 48 min	0723-0906, 0909-0914, 0933-1133, 1235-1635	3-7	13-93	Moderate-Good
30 Jan	7 hr 57 min	0730-1130, 1237-1634	3-4	5-80	Poor-Excellent
31 Jan	7 hr 31 min	0747-1149, 1320-1649	3-5	15-100	Moderate-Excellent
<b>Total</b>	<b>48 hrs 4 min</b>		<b>2-7</b>	<b>5-100</b>	<b>Poor-Excellent</b>



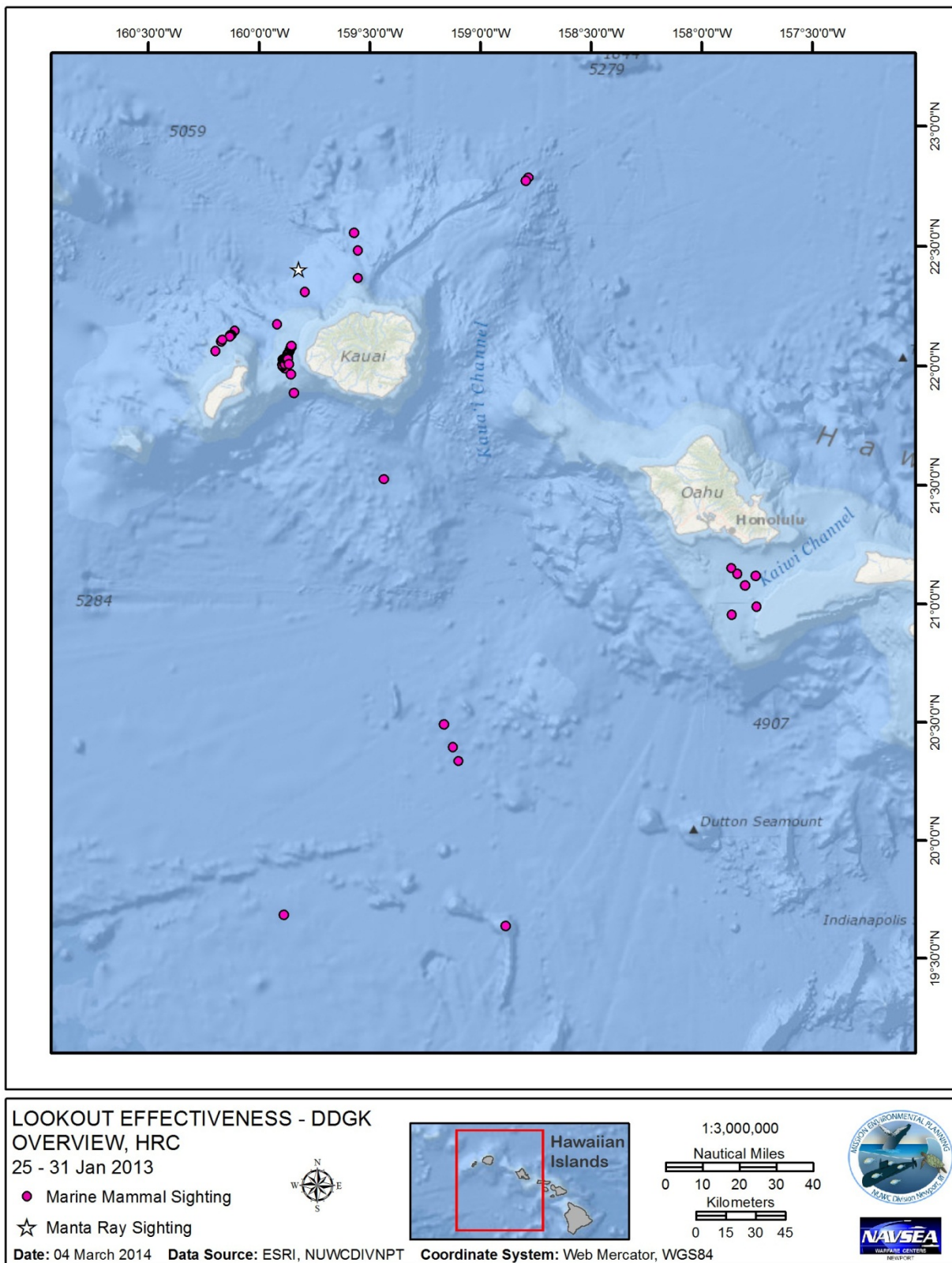
**Figure 1. Total Percentage of Effort (left) and Sightings (right) at Various Beaufort Sea States**

In total, 60 unique sightings comprising at least 107 individual marine mammals were recorded during the seven days of observation. MMOs made 51 sightings independent of the ship's watchstander team (Table 2; Figures 2 - 7). There were seven sightings made concurrently by both the MMO and watchstander team. There were two sightings by the watchstander team independent of the MMOs.

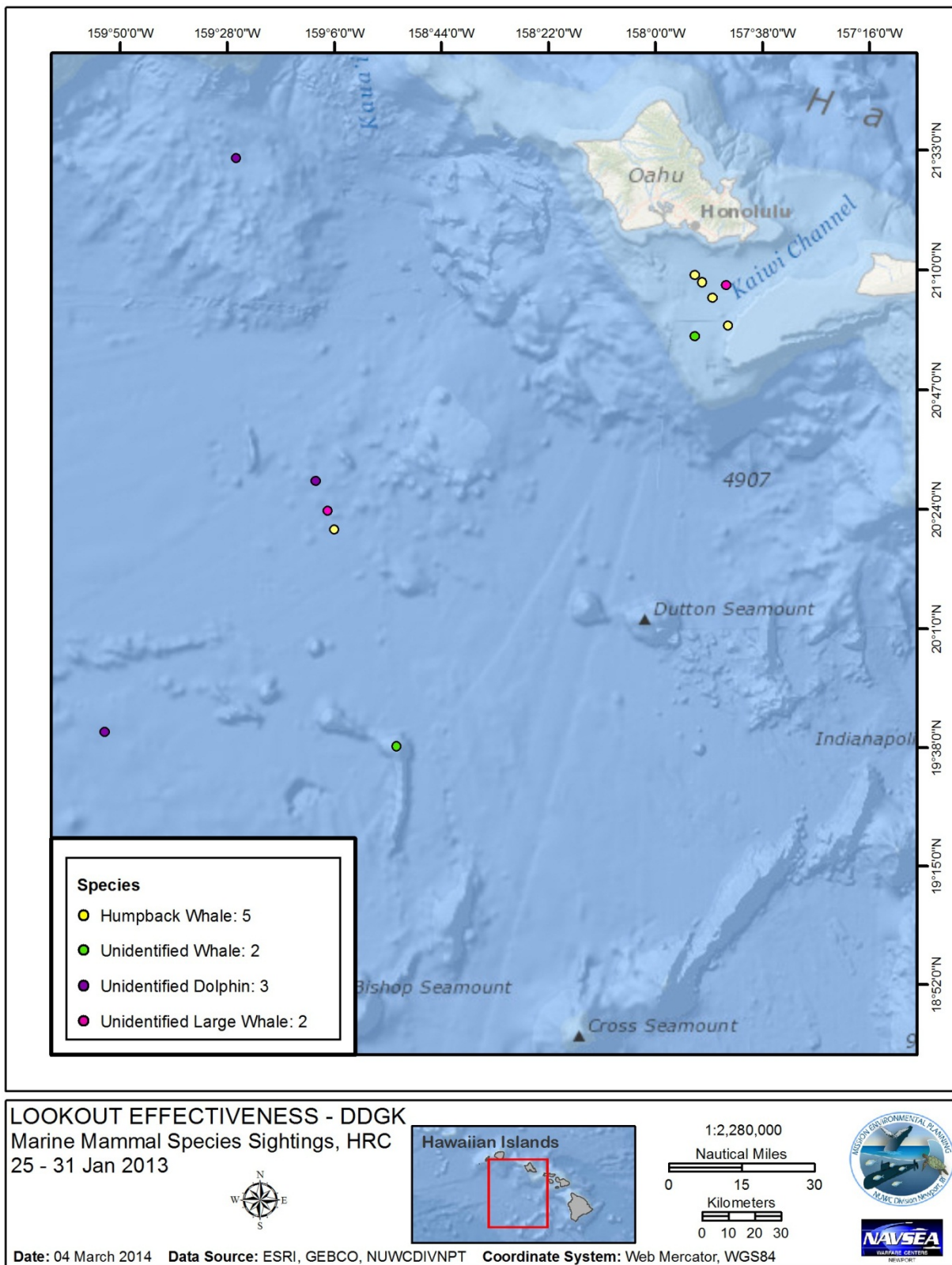
Seabird sightings were not recorded on this trip, however one manta ray sighting was recorded in the datasheet but not included in the sighting tallies in Table 2. A total of 120 photographs were taken, some of which include visible cetaceans. All other photos are of seabirds, vessels, airplanes, staff, and procedures.

**Table 2. Number of Sightings**

<b>Date</b>	<b>Independent MMO Sightings</b>	<b>Independent Navy Watchstander Team Sightings</b>	<b>Sightings by both Teams</b>
25 Jan	3	0	0
26 Jan	1	0	3
27 Jan	4	1	1
28 Jan	3	0	0
29 Jan	1	0	1
30 Jan	3	0	0
31 Jan	36	1	2
<b>Total</b>	<b>51</b>	<b>2</b>	<b>7</b>



**Figure 2. Locations of All Marine Mammal Sightings**



**Figure 3. Marine Mammal Sightings South of Oahu**



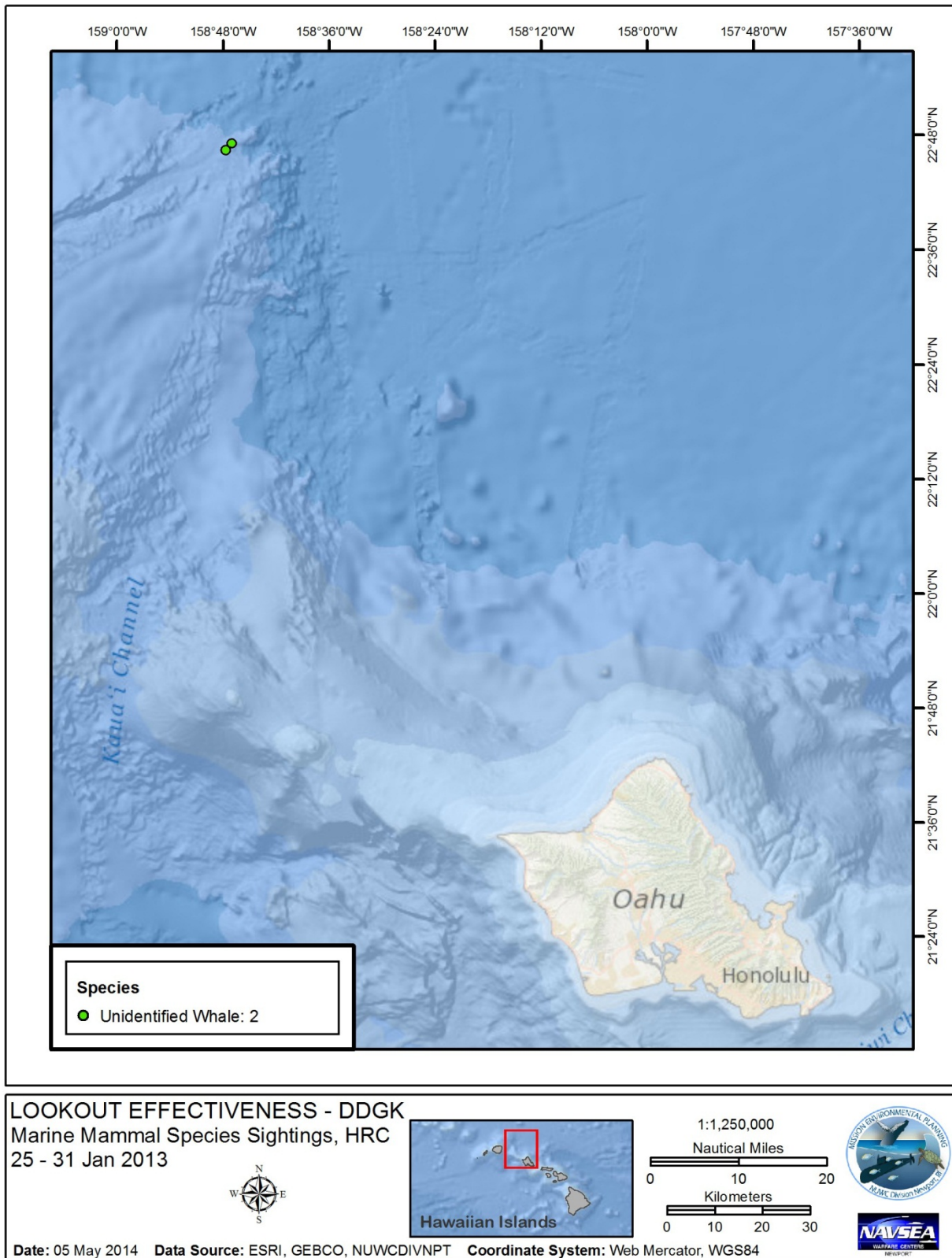
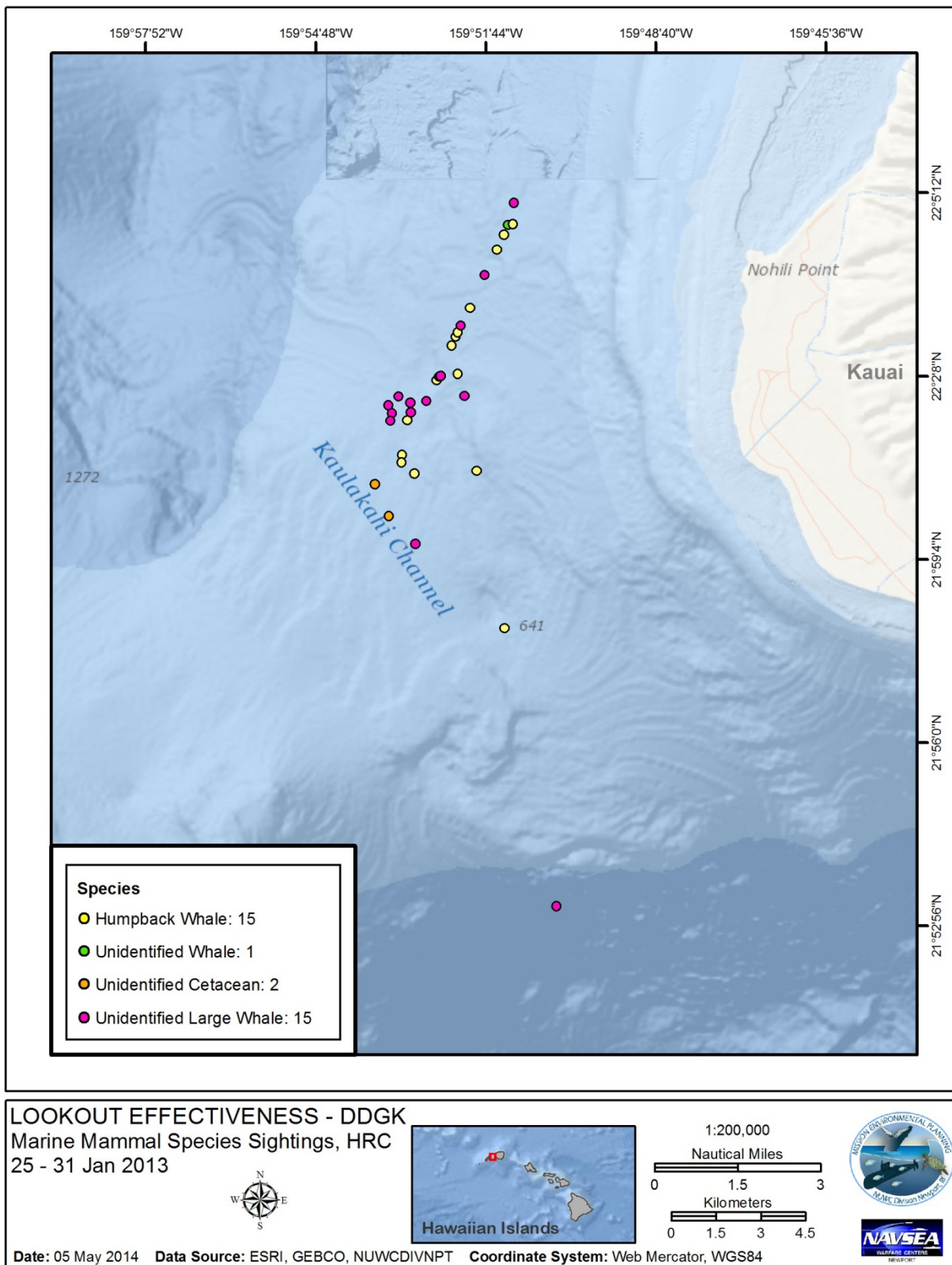
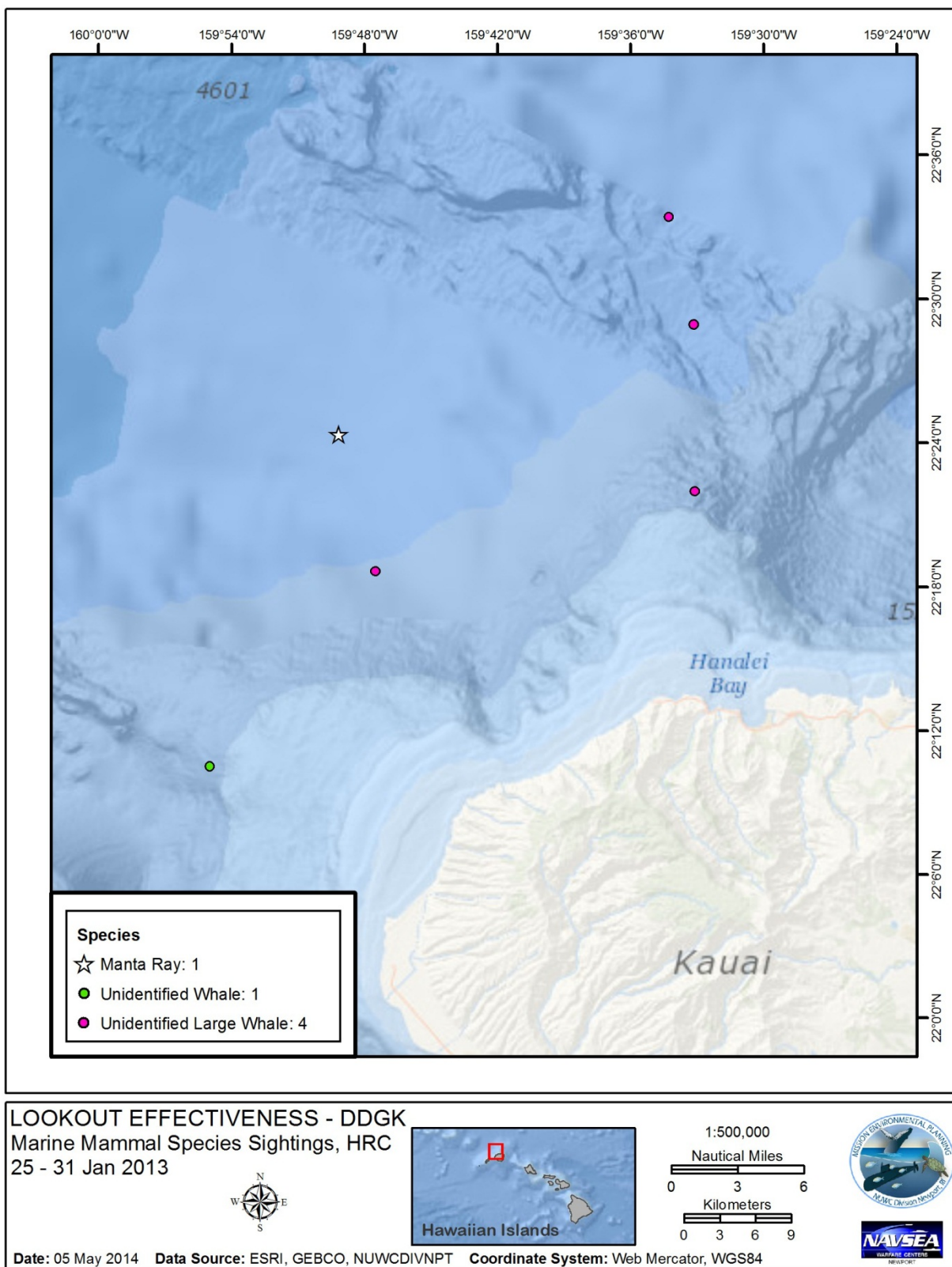


Figure 4. Marine Mammal Sightings Northwest of Oahu

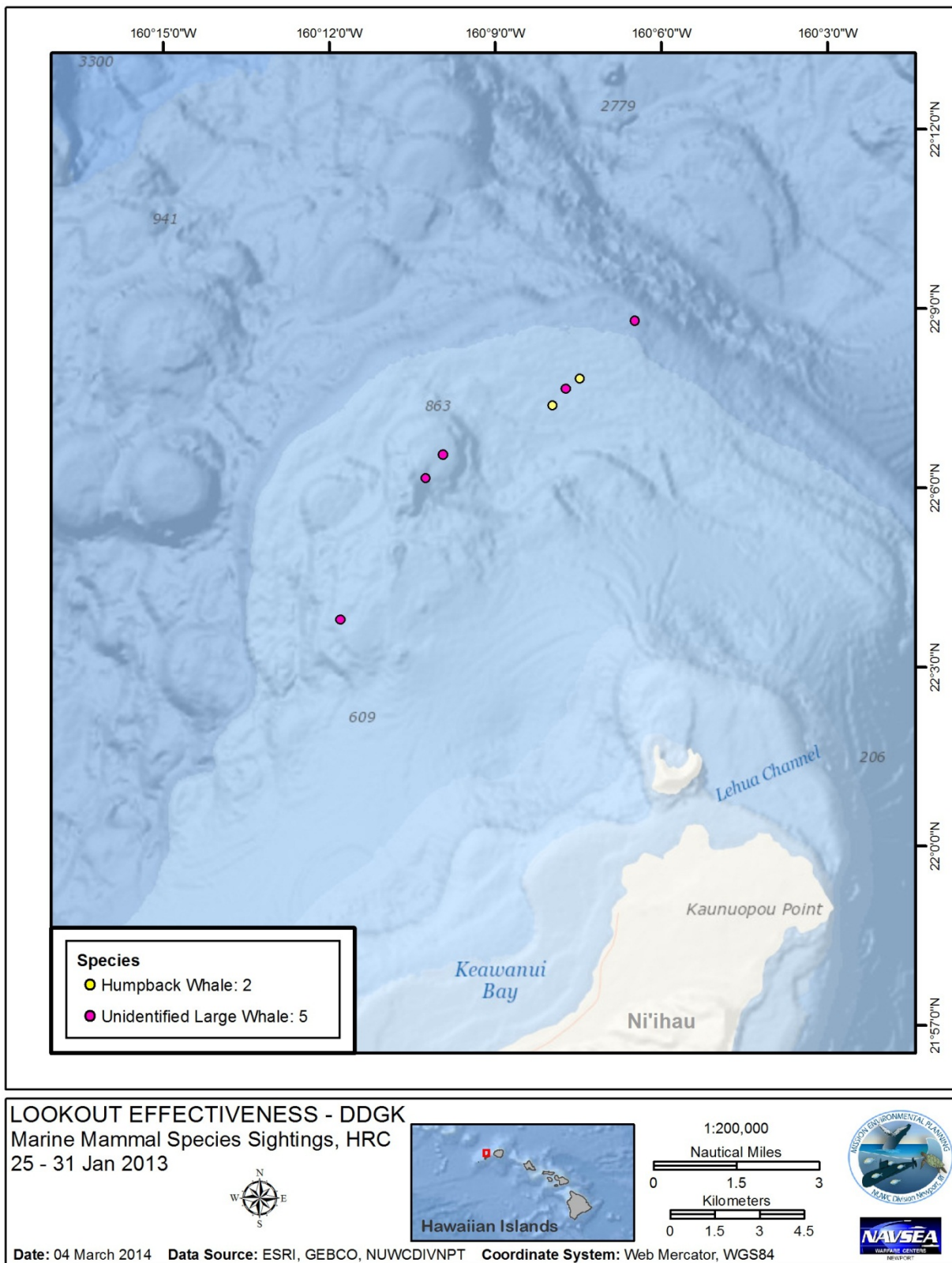


**Figure 5. Marine Mammal Sightings West of Kauai**



**Figure 6. Marine Mammal Sightings and a Manta Ray Sighting Northwest of Kauai**





**Figure 7. Marine Mammal Sightings Northwest of Ni’ihau**

Trials were successfully conducted on all days of the event, with 56 of the 60 sightings (93%) available for trials, or an average rate of 1.30 trials per hour of effort across all four days (Table 3). The average of trials per hour was skewed by the drastic increase of sightings on 31 January with 5.19 sightings per hour.

**Table 3. Effort Hours, Sighting Rates, and Trial Rates**

Date	Hours MMO Team Effort	# of Unique Sightings	Sightings/ Hour	# of Trials	Trials/Hour
25 Jan	4 hr 4 min	3	0.74	3	0.74
26 Jan	6 hr 57 min	4	0.58	3	0.43
27 Jan	7 hr 58 min	6	0.75	5	0.63
28 Jan	5 hr 49 min	3	0.52	3	0.52
29 Jan	6 hr 48 min	2	0.29	2	0.29
30 Jan	7 hr 57 min	3	0.38	3	0.38
31 Jan	7 hr 31 min	39	5.19	37	4.92
<b>Cumulative</b>	<b>43 hrs 4 min</b>	<b>60</b>	<b>1.39</b>	<b>56</b>	<b>1.30</b>

Of the 60 sightings, humpback whales (*Megaptera novaeangliae*) were the only species positively identified (Figure 8). Unidentified dolphins were sighted three times and the remainder of the sightings were unidentified cetaceans, the majority noted as large whales (Table 4).



**Figure 8. Humpback Whales Sighted from DDG-K**

**Table 4. Unique Marine Mammal Sightings**

Data Category	Sighting 1	Sighting 2	Sighting 3	Sighting 4	Sighting 5	Sighting 6
<b>Sighting Information</b>						
Effort	On	On	On	Off	On	On
Date	01/25/14	01/25/14	01/25/14	01/26/14	01/26/14	01/26/14
Time (HST)	13:08:01	15:34:00	16:09:04	0710 (approximate)	7:26:03	7:47:55
Location	21.11876 N 157.75722 W	21.12799 N 157.83987 W	21.15105 N 157.8658 W	Unknown	20.98881 N 157.75150 W	21.07878 N 157.80394 W
Detection Sensor	MMO	MMO	MMO	Lookout	MMO; Lookout	MMO
Species/Group	Unidentified Large Whale	Humpback Whale	Humpback Whale	Unknown	Humpback Whale	Humpback Whale
Group Size estimate (estimated range)	3	0	2	Unknown	2 (1-2)	1
# Calves	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown
Bearing (relative)	40	20	320	Unknown	300	90
Distance (m)	2754.81	6731.20	6120.48	Unknown	1348.68	2754.81
Animal motion	Parallel	Parallel	Opening	Unknown	Unknown	Parallel
Sighting Cue	Blow	Blow	Blow	Unknown	Blow, Body	Body
Behavior	Traveling	Fluke Slapping/ Milling	Traveling	Unknown	Traveling	Flipper Slap
<b>Environmental Information</b>						
Wave height (ft)	4-6	4-6	4-6	4-6	4-6	4-6
Visibility	Good	Good	Good	Excellent	Excellent	Excellent
Beaufort Sea State	5	5	5	4	4	4
Cloud cover (%)	90	93	93	40	40	40
Glare (%)	5	0	0	0	0	0
<b>Operational Information</b>						
Sonar	Off	Off	Off	Off	Off	Off
Ship bearing (true)	91	299	299	Unknown	331	329
Mitigation implemented	None	None	None	Ship maneuvered to avoid.	None	None
Comments	Ship turned at time of sighting. Further sightings on the port side unconfirmed.	Sighting coincided with RHIB deployment		3 groups of probable humpbacks sighted before we were on effort.	Only saw 1 blow on initial sighting. Confirmed sighting past beam.	Bridge team was tracking a HVA off the bow at the time of sighting.

**Table 4. Unique Marine Mammal Sightings (cont'd)**

Data Category	Sighting 7	Sighting 8	Sighting 9	Sighting 10	Sighting 11	Sighting 12
<b>Sighting Information</b>						
Effort	On	On	On	On	On	On
Date	01/26/14	01/27/14	01/27/14	01/27/14	01/27/14	01/27/14
Time (HST)	8:52:53	10:56:43	14:10:04	14:23:42	14:32:08	16:01:35
Location	20.95481 N 157.86473 W	21.52454 N 159.43681 W	20.49090 N 159.16357 W	20.39519 N 159.12299 W	20.33570 N 159.09924 W	19.68315 N 159.88739 W
Detection Sensor	MMO; Lookout	MMO	MMO	MMO	MMO	MMO; Lookout
Species/Group	Unidentified Whale	Unidentified Dolphin	Unidentified Dolphin	Unidentified Large Whale	Humpback Whale	Unidentified Dolphin
Group Size estimate (estimated range)	2	3	3 (2-5)	1	2	Unknown
# Calves	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown
Bearing (relative)	40	45	45	60	320	15
Distance (m)	3349.76	731.91	2343.24	5032.09	2754.81	91
Animal motion	Parallel	Parallel	Parallel	Unknown	Opening	Unknown
Sighting Cue	Blow	Dorsal Fin	Dorsal Fin	Blow	Blow	Body
Behavior	Traveling	Traveling	Porpoising	Unknown	Traveling	Porpoising
<b>Environmental Information</b>						
Wave height (ft)	4-6	4-6	4-6	4-6	4-6	4-6
Visibility	Excellent	Good	Moderate	Moderate	Good	Good
Beaufort Sea State	4	5	4	4	4	5
Cloud cover (%)	65	95	75	75	93	85
Glare (%)	3	10	20	20	3	15
<b>Operational Information</b>						
Sonar	Off	Off	Off	Off	Off	Off
Ship bearing (true)	210	193	157	161	160	178
Mitigation implemented	None	None	None	None	None	None
Comments		Lost at 10:58	Loose group formation.	Low bushy blow; passed beam at 14:28.		

**Table 4. Unique Marine Mammal Sightings (cont'd)**

Data Category	Sighting 13	Sighting 14	Sighting 15	Sighting 16	Sighting 17	Sighting 18
<b>Sighting Information</b>						
Effort	On	On	On	On	On	On
Date	01/27/14	01/28/14	01/28/14	01/28/14	01/29/14	01/29/14
Time (HST)	16:07:33	13:07:36	18:15:00	18:23:59	7:36:08	9:41:32
Location	19.63778 N 158.88589 W	22.17518 N 159.91634 W	GPS Malfunction	22.77355 N 158.79536 W	21.98875 N 159.88341 W	22.3109 N 159.79189 W
Detection Sensor	MMO; Lookout	MMO	MMO	MMO	MMO; Lookout	MMO
Species/Group	Unidentified Whale	Unidentified Whale	Unidentified Whale	Unidentified Whale	Unidentified Large Whale	Unidentified Large Whale
Group Size estimate (estimated range)	1	3 (3-5)	1	1	2 (2-3)	1
# Calves	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown
Bearing (relative)	20	315	0	20	36	90
Distance (m)	895.64	6120.48	6731.20	3022.22	1623.26	4297.88
Animal motion	Parallel	Unknown	Parallel	Unknown	Opening	Unknown
Sighting Cue	Blow	Splash	2 Blows	Blow	Blow	Blow
Behavior	Unknown	Breach	Traveling	Traveling	Traveling	Unknown
<b>Environmental Information</b>						
Wave height (ft)	4-6	>6	4-6	4-6	4-6	>6
Visibility	Good	Excellent	Excellent	Excellent	Good	Good
Beaufort Sea State	5	7	5	5	3	7
Cloud cover (%)	85	20	50	50	13	75
Glare (%)	15	5	5	5	0	10
<b>Operational Information</b>						
Sonar	Off	Off	Off	Off	Off	Off
Ship bearing (true)	161	273	219	220	345	345
Mitigation implemented	None	None	None	None	None	None
Comments	Blows seen by MMO's and Lookout simultaneously.					Passed beam one minute later.

**Table 4. Unique Marine Mammal Sightings (cont'd)**

Data Category	Sighting 19	Sighting 20	Sighting 21	Sighting 22	Sighting 23	Sighting 24
<b>Sighting Information</b>						
Effort	On	On	On	On	On	On
Date	01/30/14	01/30/14	01/30/14	01/31/14	01/31/14	01/31/14
Time (HST)	11:06:03	13:46:49	15:54:24	8:51:57	9:05:31	9:08:17
Location	22.48230 N 159.55257 W	22.55679 N 159.5712 W	22.36635 N 159.55203 W	22.14668 N 160.10797 W	22.13049 N 160.12453 W	22.12756 N 160.12874 W
Detection Sensor	MMO	MMO	MMO	MMO	MMO	MMO
Species/Group	Unidentified Large Whale	Unidentified Large Whale	Unidentified Large Whale	Unidentified Large Whale	Humpback Whale	Unidentified Large Whale
Group Size estimate (estimated range)	1	1	2	2 (2-3)	3	1
# Calves	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown
Bearing (relative)	5	275	45	355	305	80
Distance (m)	6120.48	8590.34	12964	6482	4074	6731.20
Animal motion	Unknown	Opening	Opening	Unknown	Closing	Opening
Sighting Cue	Blow	Blow	Blow	Blow	Blow/Body	Blow
Behavior	Traveling	Breach, Traveling	Traveling	Traveling	Traveling	Traveling
<b>Environmental Information</b>						
Wave height (ft)	4-6	4-6	4-6	4-6	4-6	4-6
Visibility	Excellent	Excellent	Good	Excellent	Good	Good
Beaufort Sea State	4	4	4	3	3	3
Cloud cover (%)	25	35	27	60	77	77
Glare (%)	10	15	5	0	5	5
<b>Operational Information</b>						
Sonar	Off	Off	Off	Off	On	Off
Ship bearing (true)	270	271	95	194	232	216
Mitigation implemented	None	None	None	None	None	None
Comments	Passed beam at 1114.					

**Table 4. Unique Marine Mammal Sightings (cont'd)**

Data Category	Sighting 25	Sighting 26	Sighting 27	Sighting 28	Sighting 29	Sighting 30
<b>Sighting Information</b>						
Effort	On	On	On	On	On	On
Date	01/31/14	01/31/14	01/31/14	01/31/14	01/31/14	01/31/14
Time (HST)	9:11:50	9:46:06	10:18:56	10:37:37	13:20:02	13:23:08
Location	22.123 N 160.13278 W	22.10267 N 160.17088 W	22.06321 N 160.19661 W	22.10935 N 160.16570 W	22.04415 N 159.87241 W	22.04651 N 159.8712 W
Detection Sensor	MMO	MMO	MMO	MMO	MMO	MMO
Species/Group	Humpback Whale	Unidentified Large Whale	Unidentified Large Whale	Unidentified Large Whale	Humpback Whale	Humpback Whale
Group Size estimate (estimated range)	4 (4-5)	1	0	1 (1-2)	2	2
# Calves	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown
Bearing (relative)	300	315	45	60	10	5
Distance (m)	4074	7408	8590.34	6120.48	6120.48	2343.24
Animal motion	Closing	Unknown	Unknown	Unknown	Unknown	Unknown
Sighting Cue	Blow, Fluke	Blow, Dorsal, Breach	Blow, Breach	Blow, Breach	Blow	Blow
Behavior	Traveling	Traveling	Breach	Traveling	Unknown	Unknown
<b>Environmental Information</b>						
Wave height (ft)	4-6	4-6	4-6	4-6	4-6	4-6
Visibility	Good	Excellent	Excellent	Excellent	Good	Good
Beaufort Sea State	3	4	4	4	3	3
Cloud cover (%)	77	55	50	50	100	100
Glare (%)	5	15	10	10	0	0
<b>Operational Information</b>						
Sonar	On	On	On	On	On	On
Ship bearing (true)	200	200	223	70	22	22
Mitigation implemented	None	None	None	None	None	None
Comments						



**Table 4. Unique Marine Mammal Sightings (cont'd)**

Data Category	Sighting 31	Sighting 32	Sighting 33	Sighting 34	Sighting 35	Sighting 36
<b>Sighting Information</b>						
Effort	On	On	On	On	On	On
Date	01/31/14	01/31/14	01/31/14	01/31/14	01/31/14	01/31/14
Time (HST)	13:24:41	13:26:54	13:33:48	13:45:29	13:54:39	14:00:11
Location	22.04778 N 159.87061 W	22.04953 N 159.86967 W	22.05457 N 159.86697 W	22.06367 N 159.86249 W	22.07073 N 159.85890 W	22.07502 N 159.85677 W
Detection Sensor	MMO	MMO; Lookout	MMO	MMO	MMO	MMO
Species/Group	Humpback Whale	Unidentified Large Whale	Humpback Whale	Unidentified Large Whale	Humpback Whale	Humpback Whale
Group Size estimate (estimated range)	2	3	2	1	1	3
# Calves	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown
Bearing (relative)	200	70	20	45	25	18
Distance (m)	2040.42	895.64	4297.88	4297.88	6120.48	6120.48
Animal motion	Opening	Parallel	Parallel	Unknown	Unknown	Unknown
Sighting Cue	Blow	Blow	Body, Blow	Blow	Blow	Blow, Breach
Behavior	Traveling	Traveling	Traveling, Milling	Unknown	Unknown	Unknown
<b>Environmental Information</b>						
Wave height (ft)	4-6	4-6	4-6	4-6	4-6	4-6
Visibility	Good	Good	Good	Good	Good	Good
Beaufort Sea State	3	3	3	3	3	3
Cloud cover (%)	100	100	100	100	100	100
Glare (%)	0	0	0	0	0	0
<b>Operational Information</b>						
Sonar	On	Off	Off	Off	Off	Off
Ship bearing (true)	22	23	23	23	23	23
Mitigation implemented	None	None	None	None	None	None
Comments		Passed beam at 1329. Bridge team was tracking the animals.	Off			



**Table 4. Unique Marine Mammal Sightings (cont'd)**

Data Category	Sighting 37	Sighting 38	Sighting 39	Sighting 40	Sighting 41	Sighting 42
<b>Sighting Information</b>						
Effort	On	On	On	On	On	On
Date	01/31/14	01/31/14	01/31/14	01/31/14	01/31/14	01/31/14
Time (HST)	14:03:28	14:05:45	14:08:00	14:21:25	14:32:08	14:35:28
Location	22.07759 N 159.85547 W	22.077935 N 159.85400 W	22.08383 N 159.85368 W	22.02521 N 159.89041 W	21.9966 N 159.89124 W	22.00545 N 159.89558 W
Detection Sensor	Lookout	MMO	MMO	MMO	MMO	MMO
Species/Group	Unidentified Whale	Humpback Whale	Unidentified Large Whale	Humpback Whale	Unidentified Whale	Unidentified Cetacean
Group Size estimate (estimated range)	2	2	1	1	3 (3-4)	2 (2-3)
# Calves	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown
Bearing (relative)	170	50	300	50	20	22
Distance (m)	Unknown	11,112	4297.88	4863.86	5625.74	7515.65
Animal motion	Unknown	Unknown	Unknown	Unknown	Unknown	Closing
Sighting Cue	Breach	Blow	Blow	Blow	Splash	Blow, Splash
Behavior	Unknown	Unk	Unknown	Traveling	Unknown	Traveling
<b>Environmental Information</b>						
Wave height (ft)	4-6	4-6	4-6	0-3	0-3	0-3
Visibility	Good	Good	Good	Good	Good	Good
Beaufort Sea State	3	3	3	3	3	3
Cloud cover (%)	100	100	100	73	73	73
Glare (%)	0	0	0	13	13	13
<b>Operational Information</b>						
Sonar	Off	Off	Off	Off	Off	Off
Ship bearing (true)	23	23	335	66	282	26
Mitigation implemented	None	None	None	None	None	None
Comments		Passed beam @1409.			Tall slender blow.	Low bushy blow, breach.

**Table 4. Unique Marine Mammal Sightings (cont'd)**

Data Category	Sighting 43	Sighting 44	Sighting 45	Sighting 46	Sighting 47	Sighting 48
<b>Sighting Information</b>						
Effort	On	On	On	On	On	On
Date	01/31/14	01/31/14	01/31/14	01/31/14	01/31/14	01/31/14
Time (HST)	14:54:24	14:57:32	15:00:45	15:06:14	15:10:50	15:15:40
Location	22.02318 N 159.88579 W	22.02545 N 159.88470 W	22.02812 N 159.88486 W	22.02987 N 159.88844 W	22.02741 N 159.89139 W	22.02311 N 159.89087 W
Detection Sensor	MMO	Lookout	MMO	MMO	MMO	MMO
Species/Group	Humpback Whale	Unidentified Large Whale	Unidentified Large Whale	Unidentified Large Whale	Unidentified Large Whale	Unidentified Large Whale
Group Size estimate (estimated range)	2	1	2 (2-3)	1 (1-2)	1	1
# Calves	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown
Bearing (relative)	40	1	69	285	35	290
Distance (m)	8334	3349.76	10266.91	4863.86	7515.65	6482
Animal motion	Closing	Unknown	Unknown	Unknown	Unknown	Unknown
Sighting Cue	Blow	Blow	Blow, Breach	Blow	Blow	Blow
Behavior	Traveling	Traveling	Traveling			
<b>Environmental Information</b>						
Wave height (ft)	0-3	0-3	0-3	0-3	0-3	0-3
Visibility	Good	Good	Good	Good	Good	Good
Beaufort Sea State	3	3	3	3	3	3
Cloud cover (%)	73	73	73	73	73	73
Glare (%)	13	13	13	13	13	13
<b>Operational Information</b>						
Sonar	Off	Off	Off	Off	Off	Off
Ship bearing (true)	25	346	323	253	195	161
Mitigation implemented	None	None	None	None	None	None
Comments						Passed beam at 1522.

**Table 4. Unique Marine Mammal Sightings (cont'd)**

Data Category	Sighting 49	Sighting 50	Sighting 51	Sighting 52	Sighting 53	Sighting 54
<b>Sighting Information</b>						
Effort	On	On	On	On	On	On
Date	01/31/14	01/31/14	01/31/14	01/31/14	01/31/14	01/31/14
Time (HST)	15:26:13	15:28:28	15:32:18	15:43:30	15:49:28	15:50:51
Location	22.01363 N 159.88725 W	22.01149 N 159.88744 W	22.00848 N 159.88365 W	22.02855 N 159.87997 W	22.03431 N 159.87703 W	22.03533 N 159.87622 W
Detection Sensor	MMO	MMO	MMO	MMO	MMO; Lookout	MMO
Species/Group	Humpback Whale	Humpback Whale	Humpback Whale	Unidentified Large Whale	Humpback Whale	Unidentified Large Whale
Group Size estimate (estimated range)	2 (2-3)	2	2	1 (1-2)	Unknown	1
# Calves	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown
Bearing (relative)	45	340	350	5	280	0
Distance (m)	4297.88	6731.20	9260	4297.88	1243.68	1348.68
Animal motion	None	Opening	Unknown	Opening	Unknown	Unknown
Sighting Cue	Blow	Blow	Breach	Blow	Body	Blow
Behavior	Milling	Traveling	Breach	Traveling	Traveling	Unknown
<b>Environmental Information</b>						
Wave height (ft)	0-3	0-3	0-3	0-3	0-3	0-3
Visibility	Good	Good	Good	Good	Good	Good
Beaufort Sea State	3	3	3	3	3	3
Cloud cover (%)	15	15	15	15	15	15
Glare (%)	7	7	7	7	7	7
<b>Operational Information</b>						
Sonar	Off	Off	Off	Off	Off	Off
Ship bearing (true)	186	173	35	25	40	72
Mitigation implemented	None	None	None	None	None	None
Comments	Passed beam at 1530, flipper slaps, spyhopping, breaching		Ship turned; passed beam at 1537.			

**Table 4. Unique Marine Mammal Sightings (cont'd)**

Data Category	Sighting 55	Sighting 56	Sighting 57	Sighting 58	Sighting 59	Sighting 60
<b>Sighting Information</b>						
Effort	On	On	On	On	On	On
Date	01/31/14	01/31/14	01/31/14	01/31/14	01/31/14	01/31/14
Time (HST)	15:51:20	15:53:57	15:56:42	16:01:44	16:08:45	16:21:07
Location	22.03560 N 159.87579 W	22.03614 N 159.87056 W	22.03004 N 159.86864 W	22.00912 N 159.86501 W	21.96529 N 159.85658 W	21.88776 N 159.84096 W
Detection Sensor	MMO	MMO	MMO	MMO	MMO	MMO
Species/Group	Unidentified Large Whale	Humpback Whale	Unidentified Large Whale	Humpback Whale	Humpback Whale	Unidentified Large Whale
Group Size estimate (estimated range)	1	3	2	1	1	3 (3-4)
# Calves	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown
Bearing (relative)	340	290	230	300	200	45
Distance (m)	8590.34	9260	6120.48	3349.76	2040.42	6120.48
Animal motion	Unknown	Unknown	Closing	Unknown	Opening	Unknown
Sighting Cue	Blow	Flipper Slap, Blow	Blow	Dorsal Fin	Blow	Blow
Behavior	Unknown	Flipper Slap	Unknown	Unknown	Traveling	Unknown
<b>Environmental Information</b>						
Wave height (ft)	0-3	0-3	0-3	0-3	0-3	0-3
Visibility	Good	Good	Good	Good	Good	Good
Beaufort Sea State	3	3	3	3	3	3
Cloud cover (%)	15	15	15	15	15	17
Glare (%)	7	7	7	7	7	17
<b>Operational Information</b>						
Sonar	Off	Off	Off	Off	Off	Off
Ship bearing (true)	72	127	170	171	171	169
Mitigation implemented	None	None	None	None	None	None
Comments					Coming towards us but we passed it, so wrote "opening"	Passed beam at 1632.

## **SECTION 4      CONCLUSIONS**

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

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

This event is the eleventh 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-K. This information can be used to determine the level of exposure a marine mammal may experience during an MFAS event.

## **SECTION 5      REFERENCES**

Department of the Navy (2010). United States Navy Integrated Comprehensive Monitoring Program 2010 Update, 20 December 2010.

Department of the Navy (2014). Marine Species Monitoring for the U.S. Navy's Hawaii Range Complex 2013 Annual Report. U.S. Pacific Fleet, Pearl Harbor, HI.