Cruise Report, Marine Species Monitoring & Lookout Effectiveness Study
Submarine Commanders Course, February 2016
Hawaii Range Complex

Prepared for:
U.S. Pacific Fleet

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BSS	Beaufort Sea State
DDG	United States Navy guided missile destroyer
DMMO	data marine mammal observer
ft	foot (feet)
hr	hour(s)
HRC	Hawaii Range Complex
HST	Hawaii Standard Time
LMMO	liaison marine mammal observer
LO	lookout
m	meter(s)
min	minute(s)
MFAS	mid-frequency active sonar
MMO	marine mammal observer
SCC	submarine command course
SMMO	survey marine mammal observer
yd	yard(s)

SECTION 1   INTRODUCTION

As part of the regulatory compliance process associated with the Marine Mammal Protection Act and the Endangered Species Act, the United States Navy is responsible for meeting specific monitoring and reporting requirements for military training and testing activities.

In support of these monitoring requirements, marine mammal monitoring was conducted in the Hawaii Range Complex during 12 Feb - 19 Feb 2016. This report provides findings from this monitoring effort that was conducted in order to further our understanding of the following monitoring questions:

1. Determine what species and populations of marine mammals and sea turtles are present in Navy range complexes;

2. Determine what populations of marine mammals are exposed to Navy training and testing activities;

3. Develop analytic methods to evaluate behavioral responses based on passive acoustic monitoring techniques;

4. Evaluate behavioral responses by marine mammals exposed to Navy training and testing activities;

5. Establish the baseline habitat uses and movement patterns of marine mammals where Navy training and testing activities occur;

6. Determine the effectiveness of Navy watch-standers/ lookouts (LOs);

7. Assess existing data sets which could be utilized to address the above objectives.

To help answer this question, the monitoring effort was structured around two objectives

1. Collect data to assess the effectiveness of the Navy lookout team.
2. Obtain data to characterize the possible exposure of marine species to mid-frequency active sonar (MFAS).

SECTION 2   METHODS

Marine mammal observer (MMO) surveys were conducted on a not-to-interfere basis, which means that the MMOs would not replace required Navy LOs, would not dictate operational requirements or maneuvers, and would remove themselves from the bridge wing if necessary for the guided missile destroyer (DDG-N) 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 LO 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 LO team for appropriate reporting and action. The initial protocol for data collection was developed by the University of St. Andrews which was refined by the MMOs on the first few embarks and solidified in 2010. The MMO survey on DDG-N 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 LO 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-N 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. 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 LOs. After a sighting by the Navy LO 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 LOs 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 global positioning system 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 were 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, if any photographs were taken, they were to be reviewed to assist with species identification.

SECTION 3   RESULTS

The MMO team spent 36 hours 41 minutes searching for marine species during the training event over 6 days (Table 1). For whole days out at sea, an average of approximately 7 hours per day was spent on effort. Figure 1 shows the breakdown of Beaufort Sea State (BSS) as a total of the on-effort observation period and Figure 2 shows the percentage of sightings that occurred at each BSS. The majority of observation time was spent in a BSS of 4, 5, 6, or 7 (92%) (Figure 1), while sightings were mostly distributed among BSS of 4 and 6 (Figure 2). No sightings occurred in BSS 7 or 8.

Table 1. Effort Hours and Environmental Conditions

Date	Team Hours On-Effort	Time	Beaufort Sea State (range)	% Cloud Cover (range)	Visibility
13 Feb	8 hr 4 min	0804-1205, 1308-1711	3-5	7.5-42.5	Excellent
14 Feb	3 hr 28 min	0738-0832, 1316-1450, 1539-1636	2-4	5-20	Excellent
15 Feb	3 hr 55 min	0716-1007, 1008-1122	3-7	22.5-100	Poor-Excellent
16 Feb	6 hr 7 min	0734-1044, 1225-1522	6-8	30-99.25	Moderate-Good
17 Feb	7 hr 57 min	0715-1120, 1235-1627	6-7	22.5-90	Good-Excellent
18 Feb	8 hr 12 min	0720-1125, 1235-1642	5-6	15-82.5	Poor-Excellent
Total	**37 hrs 43 min**		**2-8**	**5-100**	**Poor-Excellent**
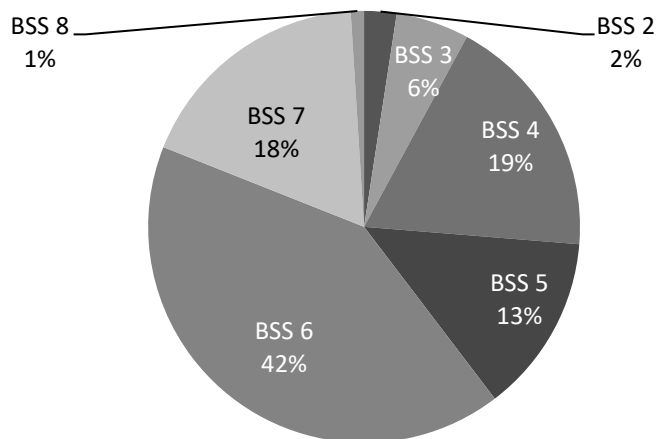
Figure 1. Total Percentage of Effort at Various Beaufort Sea States
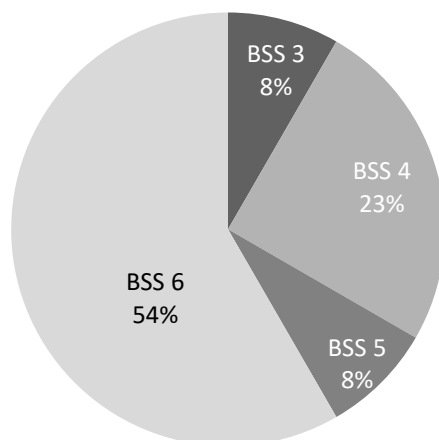
Figure 2. Total Percentage of Sightings at Various Beaufort Sea States

In total, 13 unique sightings, comprising at least 20 individual marine mammals, were recorded during the six days of observation. MMOs made 12 sightings independent of the ship's LO team (Table 2). There were four sightings made concurrently by both the MMO and LO team. While on effort, there was one sighting by the LO team independent of the MMOs.

Table 2. Number of Sightings Made by MMO and LO Teams

Date	Independent MMO Sightings	Independent Navy LO Team Sightings	Sightings by both Teams
13 Feb	2	0	0
14 Feb	2	0	0
15 Feb	8	1	4
Total	**12**	**1**	**4**
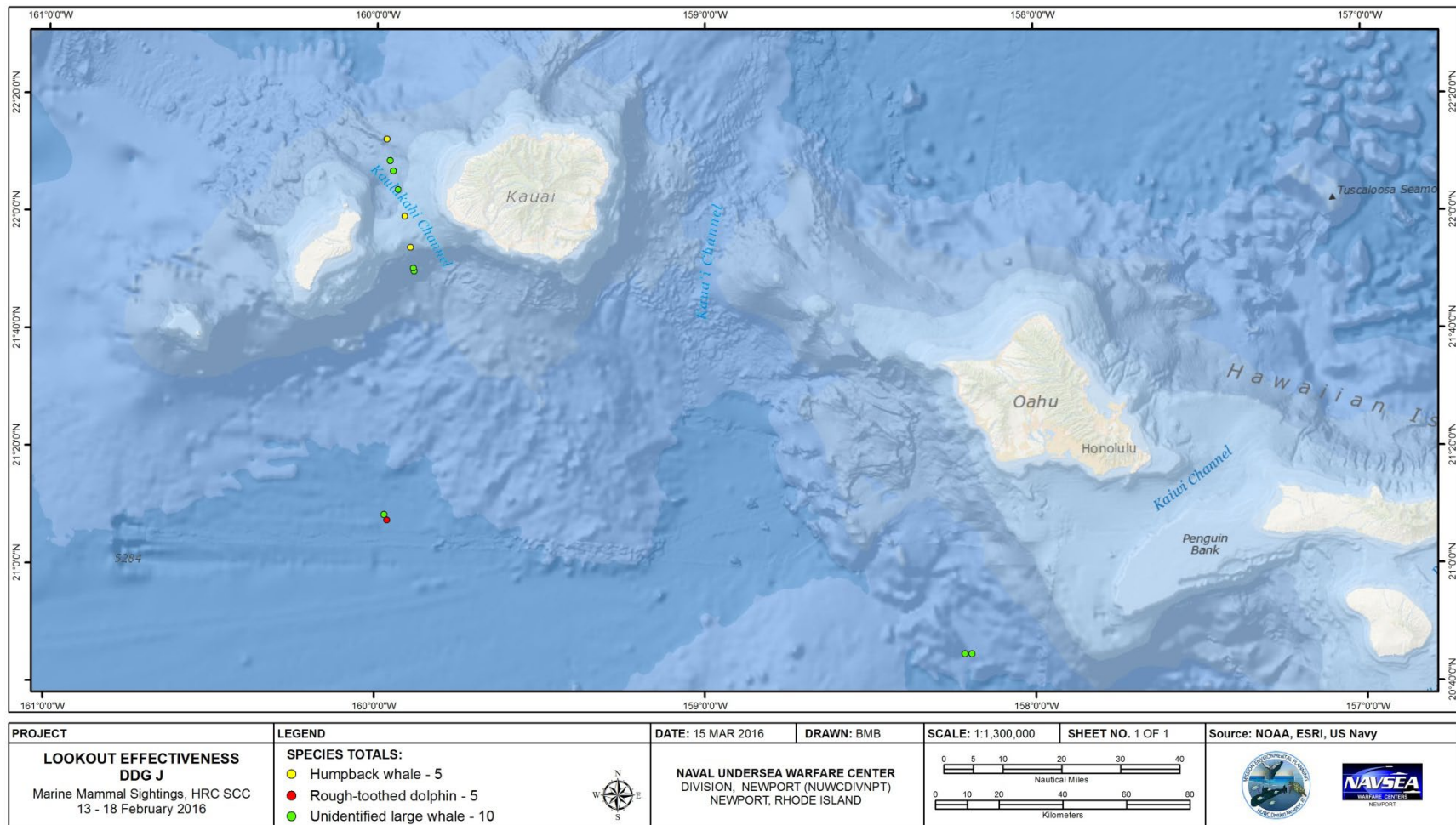
Figure 3. Marine Mammal Sightings February 13-18, 2016

The cruise was 6 days in length. Trials were successfully conducted on three days prior to Submarine Command Course (SCC); February 13 through February 15. The SCC event was in progress from February 16 through February 18. No sightings, and thus, no trials, occurred over the days of the SCC event. All 13 sightings occurred prior to arrival at the Pacific Missile Range Facility. The rate of trials averaged 0.30 trials per hour of effort across six days of effort (Table 3). The sighting rate was highest on the third day (February 15), when there was a very wide range of conditions including Beaufort Sea States of 3 through 6 and good to excellent visibility. The highest rate of sightings occurred in the channel between Kauai and Niihau (Figure 3).

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

Date	Hours MMO Team Effort	# of Unique Sightings	Sightings/ Hour	# of Trials	Trials/Hour
13 Feb	8 hrs 4 min	2	0.25	2	0.25
14 Feb	3 hrs 28 min	2	0.58	2	0.58
15 Feb	3 hrs 55 min	9	2.30	7	1.79
16 Feb	6 hrs 7 min	0	0	0	0
17 Feb	7 hrs 57 min	0	0	0	0
18 Feb	8 hrs 12 min	0	0	0	0
Cumulative	**37 hrs 43 min**	**13**	**0.34**	**11**	**0.29**

Of the 13 sightings, humpback whales (*Megaptera novaeangliae*) and rough-toothed dolphins (*Steno bredanensis*) were the only species positively identified, accounting for 50% of individuals sighted. Unidentified large whales (which were also most likely humpback whales) accounted for the remaining 50% of individuals sighted (Table 4). Because the ship's sonar was not operating at the time, none of the 13 sightings occurred when sonar was active. Ship's sonar was active for only a few hours on February 16.

Table 4. Unique Marine Mammal Sightings

Data Category	Sighting 1	Sighting 2	Sighting 3	Sighting 4	Sighting 5
Sighting Information					
Effort	ON	ON	ON	ON	ON
Date	2/13/2016	2/13/2016	2/14/2016	2/14/2016	2/15/2016
Time (HST)	13:58:09	16:47:49	14:07:49	14:226:04	08:13:32
Location	20.75096 °N 158.21513 °W	20.75119 °N 158.19429 °W	21.14486 °N 1159.97301 °W	21.14 °N 159.97 °W	21.837 °N 159.88574 °W
Detection Sensor	MMO	MMO	MMO	MMO	MMO
Species/Group	Unidentified Large Whale	Unidentified Large Whale	Unidentified Large Whale	Rough-toothed dolphin	Unidentified large whale
Group Size (estimated range)	1	2	1	3-6	1
# Calves	0	0	0	0	0
Bearing (relative degrees)	+5°	-15°	0°	0°	320°
Distance (m)	1667 m	800 m	1000 m	286 m	1333 m
Animal motion	Unknown	Unknown	Unknown	Closing	Unknown
Sighting Cue	Blow	Blow	Blow	Body	Blow
Behavior	Unknown	Unknown	Traveling	Fast travel	Splash
Environmental Information					
Wave height (ft)	4-6 ft	4-6 ft	4-6 ft	4-6 ft	4-6 ft
Visibility	Excellent	Excellent	Excellent	Excellent	Excellent
Beaufort Sea State	4	3	4	4	6
Cloud cover (%)	10%	10%	5%	5%	50%
Glare (%)	40%	15%	20%	20%	5%
Sonar	OFF	OFF	OFF	OFF	OFF
Ship bearing (true)	341.2°	275°	050°	050°	350.8°
Mitigation implemented	N	N	N	N	N
Comments	Only blows seen; possible movement from stbd to port	Seen only once		Dolphins bow-riding	

Table 4. (cont.) Unique Marine Mammal Sightings

Data Category	Sighting 6	Sighting 7	Sighting 8	Sighting 9	Sighting 10
Sighting Information					
Effort	ON	ON	ON	ON	ON
Date	2/15/2016	2/15/2016	2/15/2016	2/15/2016	2/15/2016
Time (HST)	08:16:27	08:30:08	08:53:08	09:13:15	09:32:00
Location	21.845 °N 159.88751 °W	21.90307 °N 159.89629 °W	21.99155 °N 159.91435 °W	22.06678 °N 159.93559 °W	22.12 °N 159.95 °W
Detection Sensor	LO	MMO	MMO	MMO	MMO
Species/Group	Unidentified large whale	Humpback whale	Humpback whale	Unidentified large whale	Unidentified large whale
Group Size (estimated range)	1	1	3	1	1
# Calves	0	0	0	0	0
Bearing (relative)	070°	083°	240°	090°	355°
Distance (m)	457 m	667 m	667 m	571 m	400 m
Animal motion	Unknown	Unknown	Unknown	Unknown	Unknown
Sighting Cue	Blow	Blow	Blow, tail	Blow	Blow
Behavior	Unknown	Diving	Unknown	Blow	Blow
Environmental Information					
Wave height (ft)	4-6 ft	4-6 ft	4-6 ft	4-6 ft	4-6 ft
Visibility	Excellent	Excellent	Excellent	Excellent	Excellent
Beaufort Sea State	6	3-6	5	5-6	6
Cloud cover (%)	50%	50%	22.5%	22.5-30%	30%
Glare (%)	5%	5-7.5%	15%	15-20%	20%
Sonar	OFF	OFF	OFF	OFF	OFF
Ship bearing (true)	351.6°	348°	348°	349°	347°
Mitigation implemented	N	N	N	N	N
Comments		2 bridge 1000 yds			TJ and LO spotted whale for second time on stbd side simultaneously

Table 4. (cont.) Unique Marine Mammal Sightings

Data Category	Sighting 11	Sighting 12	Sighting 13
Sighting Information			
Effort	ON	ON	ON
Date	2/15/2016	2/15/2016	2/15/6
Time (HST)	09:40:00	09:40:00	09:55:40
Location	22.15 °N 159.96 °W	22.15 °N 159.96 °W	22.21 °N 159.97 °W
Detection Sensor	MMO	MMO	MMO
Species/Group	Unidentified large whale	Unidentified large whale	Humpback whale
Group Size (estimated range)	1	1	1
# Calves	0	0	0
Bearing (relative)	045°	352°	020°
Distance (m)	667 m	1667 m	1000 m
Animal motion	Unknown	Unknown	Unknown
Sighting Cue	Blow	Blow	Big splash
Behavior	Blow	Blow	Breach
Environmental Information			
Wave height (ft)	4-6+ ft	4-6+ ft	>6 ft
Visibility	Good-Excellent	Good-Excellent	Excellent
Beaufort Sea State	6	6	6
Cloud cover (%)	30-42.5% (36%)	30-42.5%	42.5%
Glare (%)	20%	20%	20%
Sonar	OFF	OFF	OFF
Ship bearing (true)	350°	350°	349°
Mitigation implemented	N	N	N
Comments			

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 twelfth 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-N. This information can be used to determine the level of exposure a marine mammal may experience during an MFAS event; however, active sonar on DDG-N was operational for only a few hours on the first day of this particular SCC event before it failed and was non-operational for the remainder of the event. Another surface ship participating in this SCC event was operating its active sonar during the event.