Cruise Report, Marine Species Monitoring & Lookout Effectiveness Study
Koa Kai, November 2010,
Hawaii Range Complex

Prepared for:
Commander, Pacific Fleet

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List of Acronyms and Abbreviations

DMMO	data marine mammal observer
ft	foot (feet)
GPS	global positioning system
HRC	Hawaii Range Complex
km	kilometer(s)
LMMO	liaison marine mammal observer
LO	Navy Lookout
m	meter(s)
mm	millimeter
MFAS	mid-frequency active sonar
MMO	marine mammal observer
nm	nautical mile(s)
NMFS	National Marine Fisheries Service
PMAP	Protective Measures Assessment Protocol
SMMO	survey marine mammal observer
VHF	very high frequency
yd(s)	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 Endangered Species Act. The Hawaii Range Complex (HRC) Monitoring Plan, implemented in January 2009, was developed with NMFS to comply with the requirements under the permit. The monitoring plan and reporting will provide science-based answers to questions regarding whether or not marine mammals are exposed and reacting to Navy MFAS. The objectives of the monitoring plan are to 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 in the HRC as a result of repeated 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 or 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 acoustics, 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, on the bridge wings, and/or the forward lookout on the flying bridge. 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 (CG). 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 three prior implementations. 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, four U.S. Navy civilian MMOs (Ms. Amy Farak, Ms. Morgan Richie, Ms. Julie Rivers, and Dr. Robert Uyeyama) participated in an event on the Hawaii Range Complex on 12-16 November, 2010. These MMOs were stationed aboard a US Navy cruiser, hereafter referred to as CG-A. The goals of the monitoring and this study were:

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/maneuvers, and would remove themselves from the bridge wing if necessary for CG-A 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 (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 provided by the University of St. Andrews; this protocol was modified by the MMOs on four prior surveys. Additional changes were made as necessary during this event. The MMO survey on CG-A 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 lookout team (called liaison MMO or LMMO), and was provided a headset to listen to the Navy lookout team conversation. The fourth MMO was primarily responsible for recording data (data MMO or DMMO) reported by the two SMMOs and the LMMO. A rotation schedule was used, such that an MMO would be on effort for one hour on port, one hour as the LMMO, one hour as an SMMO on starboard, and one hour as DMMO. While on effort, MMOs used naked eye and 7 X 50 magnification binoculars to scan the area from dead ahead to just aft of the beam.

If an animal was visually detected by the SMMOs, information would be collected on twenty-three sighting, environmental, and operational parameters. Sightings obtained first by the SMMOs (between 270° and 90°relative to the ship) before the Navy lookout were considered to be "trials." If applicable, photographs would be taken using a Canon EOS 20D digital camera with a 100 – 300 millimeter [mm] 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 CG-A was not altered as result of the sightings, unless to avoid a collision. Therefore, the species identification level represents the best ability to recognize species specific characteristics at a distance from the ship, without approaching the animals for study.

The LMMO reported sightings made by the Navy lookout team, including the bridge team and aft watchstander. After a sighting by the Navy lookout or bridge team, the LMMO would also query the personnel to clarify information on the sighting such as animals seen, bearing, distance, and time. All four MMOs were equipped with headset two-way radios in order to maintain communications without leaving post, as well as communicating sighting and effort data without cueing the Navy lookouts to sightings. The DMMO was responsible for recording all data and making initial determination as to whether sightings were considered a duplicate.

The DMMO recorded effort-related events (e.g., begin effort, end effort, observer rotation, and weather changes) 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 the cruise, photographs were reviewed to assist with species identification.

SECTION 3   RESULTS

Effort and environmental information was collected when the MMOs began effort, at each rotation, as weather changes occurred, and when the MMOs went off effort. The MMO team spent 35 hours and 7 minutes searching for marine species during the exercise (Table 1). Three people were vigilant during virtually all of the on effort hours; therefore this study comprised a total of 105 hours and 21 minutes of marine mammal shipboard monitoring. The DMMO was often observing when there were no data to record but this effort was not recorded and therefore not included, and the LMMO was vigilant through the majority of the rotation. A majority (56%) of time on effort was during Beaufort Sea States 4 and 5 (Figure 1).

Table 1. Effort Hours and Environmental Conditions

| Date	Team Hours On-Effort	Time	Beaufort Sea State (range)	% Cloud Cover (range, conditions)	Visibility
12 Nov	5 hr 26 min	1201-1727	3-5	60 – 85	Good
13 Nov	9 hr 37 min	0643-1144, 1254-1730	3 – 6	5 – 75	Good
14 Nov	8 hr 54 min	0724-1130, 1225-1631, 1708-1750	2 – 5	5 – 75	Good – Excellent
15 Nov	9 hr 19 min	0633-1128, 1237-1532, 1601-1730	4 – 7	10 – 100	Moderate – Good
16 Nov	1 hr 51 min	0633-0824	1 – 3	10	Good – Excellent
Total	**35 hr 07 min** (105 hr 21 min for three MMOs)		**1 – 7**	**0 – 100**	**Moderate – Excellent**
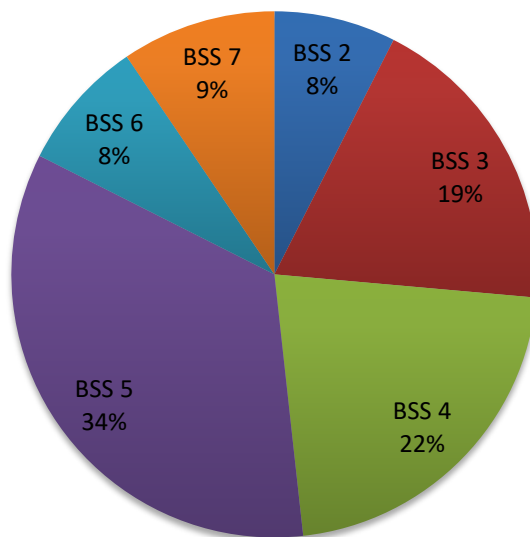
Figure 1. Percentage of Effort at each Beaufort Sea State (BSS)

In total, three sightings of marine mammals and five sea turtles were recorded during the five days of observation (Table 2). Two of the marine mammal sightings and four of the sea turtle sightings were made independently by the MMOs, that is, not seen by the Navy lookout team (

Table 3). One pod of dolphins was observed by the bridge and reported to the SMMOs. Additionally, the other pod of dolphins was observed by one of the officers standing on the bridge wing, but was not reported to the lookout team or recorded by the bridge, and therefore was not considered to be seen by the lookout team. The Navy lookout team recorded one independent sighting of a sea turtle.

Table 2. Marine Mammal and Sea Turtle Sightings

Date	Time	Latitude	Longitude	Species	Behavior/Notes
11/12/10	123645	21.30447	-157.959	Green turtle	At surface then dove at abeam.
11/13/10	072334	21.58836	-157.321	Unidentified Balaenopterid	Tall blow, probably humpback.
11/13/10	141735	21.077	-157.909	Unidentified sea turtle	Swimming at surface.
11/16/10	070331	21.10289	-157.94	Spinner dolphin	Bowriding.
11/16/10	075813	21.26614	-157.94	Spotted dolphin	Feeding in association with birds.
11/16/10	080858	21.30111	-157.624	Green turtle	Swimming at surface.
11/16/10	081401	21.31828	-157.967	Green turtle	Swimming at surface.
11/16/10	081536	21.32369	-157.968	Green turtle	Swimming at surface.

Table 3. Summary of Marine Mammal Sightings

Date	Independent MMO Sightings	Independent Navy Lookout Team Sightings	Sightings by both Teams
12 Nov	0	0	0
13 Nov	1	1	0
14 Nov	0	0	0
15 Nov	0	0	0
16 Nov	1	0	1
Total	**2**	**1**	**1**

All marine mammal sightings were considered trials for the lookout effectiveness study. However, given the low number of sightings (3), the average number of trials per hour over the duration of the exercise was 0.09 (Table 4). This trial rate was the lowest average obtained to date as part of the lookout effectiveness study. Two of the marine mammal sightings could be identified to species (Table 5): spinner dolphin (*Stenella longirostris*) and spotted dolphin (*Stenella attenuata*). The third sighting, unidentified balaenopterid, could not be identified to species. Photographs were obtained for the spinner dolphins (Figure 2).

The spinner dolphins were first observed by the starboard MMO as they rode the bow. They were soon observed by the port MMO and the bridge lookouts. The animals were in several small groups. They were observed bowriding and porpoising out of the water abeam of the port side. The last small group observed was of four animals and was riding the wave off the port beam. The entire period of observation was approximately 5 minutes. The ship did not implement any mitigation measures as the animals were bowriding. One calf was observed.

The spotted dolphins were observed at a distance of 2,055 ft (626 m) by the LMMO. The first cue was splashes and a bird flock. The dorsal fins were observed about 1 minute using binoculars about one minute after the bird flock and splashes were first observed. The subsequent observation of dorsal fins was the confirmation of marine mammals. The dolphins were observed swimming in a fairly tight group, weaving with frequent changes in direction. Given the presence of birds circling overhead and diving into the water and the back and forth swimming of the animals, the dolphins appeared to be feeding. At approximately the same time as the LMMO confirmation of dolphins with the birds, the LMMO heard the Chaplain point out the dolphins to the SMMO. The Chaplain was not on lookout duty and did not report the sighting to the bridge or lookouts. The lookout team did not see the animals during the entire sighting. The dolphins stayed in a fairly tight group, swimming back and forth and were associated with the birds for the entire sighting. They did not appear to change their behavior (e.g. to bowride) in response to the presence of the Navy vessel. The animals were lost off the starboard side after CG-A continued on course.

Table 4. Effort Hours, Sighting Rates, and Trial Rates

Date	Hours MMO Team Effort	# of Unique Sightings*	Sightings/ Hour	# of Trials	Trials/ Hour
12 Nov	5 hr 26 min	0	0	0	0
13 Nov	9 hr 37 min	1	0.10	1	0.10
14 Nov	8 hr 54 min	0	0	0	0
15 Nov	9 hr 19 min	0	0	0	0
16 Nov	1 hr 51 min	2	1.09	2	1.09
Total	**35 hr 07 min**	**3**	**0.09 (mean)**	**3**	**0.09 (mean)**

* Number of sightings includes both MMO and Navy lookout team sightings combined

Table 5. Unique sightings by species

Species	Unique animal group sightings	Total number of animals (based on best group size estimate)
Spinner dolphin	1	13
Spotted dolphin	1	35
Unidentified balaenopterid	1	1
Green sea turtle	4	4
Unidentified sea turtle	1	1
Total	**8**	**54**

Figure 2. Photographs of spinner dolphin sighting

In addition to marine mammal and sea turtle sightings, 61 seabirds were recorded during this effort. Seabird sightings and identification were not an objective of this study, but were recorded when appropriate. Species observed included wedge-tail shearwater, brown booby, red-footed booby, masked booby, white tern, frigatebird, red-tailed tropicbird, and brown noddy, and unidentified shearwaters, petrels, and birds.

SECTION 4   CONCLUSION

4.1. MARINE MAMMAL MODELING

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

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

    The small number of sightings resulted in very limited data (i.e., trials) that can be used in determining the effectiveness of the Navy lookout team. The lack of sightings data, however, provides insight into species presence and composition in the area, which can be used for later analyses. This event is the first aboard a CG 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.

    Sightings information included the bearing and distance of the animal to CG-A. This information can be used to determine, if MFAS was in use, what level the animal may have been exposed to MFAS. Reconstruction of the event and the determination of the possible exposures of marine species to MFAS will be completed under separate task. Obtaining the data needed to make these determinations was successful.

4.2. RECOMMENDATIONS

Minor changes to the data forms, protocols, and recommended equipment and logistics were made by the MMO team, and will be considered for implementation in future lookout effectiveness studies.

4.2.1. Data Forms

Specific data form recommendations include:

- Sightings form
  - Need to make more clear that the first "bearing" is the "Animal Bearing" not the ship bearing
- Effort form
  - A field for waypoint is needed.
  - Wind speed and direction was not recorded during this effort, as it is inherently included in sea state recordings. Wind speed and direction are not necessary for the Lookout Effectiveness Study. However, this information is necessary when providing sightings data to NMFS in support of the LOA annual reports. It is recommended to copy the bridge logbooks either each night or after the cruise to obtain hourly wind speed and direction information.
  - Need to clarify what type of waypoint should be provided for a change in the sonar status.
  - Visibility. Currently, "moderate" is defined as 1.5-10 km, which seems to be a very large range in visibility. Additionally, "excellent" conditions (> 15 km) are not physically possible on smaller vessels (e.g., frigates). Recommend the

visibility ranges be reviewed and updated as appropriate.

   o Swell height. Recommend determining if additional swell heights should be
     included for swells much greater than 6 ft.

4.2.2. Lookout Effectiveness Study Protocol

• The LMMO was provided with a headset connected to the ship's communication system
  so that the LMMO could listen to information passed between the lookouts and bridge
  team. This would potentially result in quicker notification to the DMMO of a sighting.
  However, have two headsets proved to be cumbersome (see photos below). It is
  recommended for future efforts that the LMMO not be listening to the Navy
  communications, but be either located in the pilot house or nearby the lookouts so that
  information can be readily passed along.

• A concern was raised regarding sightings during extenuating circumstances. Not all
  sightings may be reported and/or recorded if they are deemed insignificant at the time of
  the sighting. For example, during entry into the harbor, the focus of the bridge team is to
  ensure safe passage, and therefore sightings not in the immediate vicinity of the ship
  could be deemed insignificant. Would like to discuss further with St. Andrews how these
  data are being accounted for in the analysis.

• If non-lookout/bridge team personnel are on the bridge and sight an animal, is it
  considered a successful trial (i.e., an animal first sighted by the MMOs and then sighted
  by the lookout team)? For example, one of the officers sighted one of the pods of
  dolphins, but was not part of the lookout/bridge team and did not report it to anyone.
  Therefore it was not recorded by the bridge as a sighting. We assume that the sighting
  would not be considered a successful trial, but need verification.

4.2.3. Equipment and Logistics

• The officers recommended that our equipment not be left on the bridge overnight if it was
  not locked up. Recommend bringing bicycle locks (or similar) on future embarks so that
  equipment can be secured while off effort (e.g., overnight).

• One MMO recommended that laminated datasheets or notebooks be brought so that notes
  can be obtained by the SMMO if the DMMO is busy taking information on a different
  sighting.

• Need to verify the observation protocol used by the bridge-wing lookouts. Many seemed
  to focus their efforts outward from the ship (e.g., 60-90° relative) rather than in front,

although the bridge team appeared to be focusing forward. The bridge-wing lookout's protocol may affect the analysis in determining how likely they are to observe an animal at different bearings from the ship.