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Final Cruise Report, Marine Species Monitoring & Lookout Effectiveness Study Submarine Commanders Course, February 2012, Hawaii Range Complex

Prepared for:
Commander, Pacific Fleet



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Table of Contents

Section 1	INTRODUCTION	4
Section 2	METHODS	5
Section 3	RESULTS	6
Section 4	CONCLUSION.....	12
4.1.	MARINE MAMMAL MONITORING	12
4.2.	RECOMMENDATIONS	12

List of Tables

Table 1.	Effort Hours and Environmental Conditions.....	7
Table 2.	Number of Sightings	7
Table 3.	Effort hours, sighting rates, and trial rates	9
Table 4.	Unique Marine Mammal Sightings	10

List of Figures

Figure 1.	Total percentage of effort (<i>left</i>) and sightings (<i>right</i>) at various Beaufort Sea States (BSS).....	6
Figure 2.	Marine Mammal Sighting Locations	8
Figure 3.	Pilot whales from sighting 8 on 15 Feb 2012.....	9

List of Acronyms and Abbreviations

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
km	kilometer(s)
LMMO	liaison marine mammal observer
LO	Navy Lookout
m	meter(s)
min	minute(s)
mm	millimeter(s)
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
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 (HRC) Monitoring Plan, implemented in January 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, 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 (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 (Dr. Stephanie Watwood, Dr. Robert Uyeyama, and Ms. Andrea Balla-Holden) and one contractor (Dr. Thomas Jefferson) embarked from 12-18 February 2012 during a training event in the HRC called Submarine

Commanders Course. These MMOs were stationed aboard a U.S. Navy guided missile destroyer, hereafter referred to as DDG-G. 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 or maneuvers, and would remove themselves from the bridge wing if necessary for DDG-G 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 prior surveys. Additional changes were made as necessary during these events. The MMO survey on DDG-G 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 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.

If an animal was visually detected by the SMMOs, information would be collected on both the marine mammal 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 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 DDG-G 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 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 28 hours and 23 minutes searching for marine species during the Submarine Commanders Course event (Table 1). Time considered off-effort included some training activities of the DDG-G that precluded conducting observations from the bridge wings; however observations were still possible and sightings were made from inside the bridge during these activities. For whole days out at sea, approximately 7.76 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. Approximately 80 percent of the observations occurred in BSS of 3 or greater, which decreases the probability of detecting marine mammals visually. February 13-15 presented almost ideal environmental sighting conditions (Table 1).

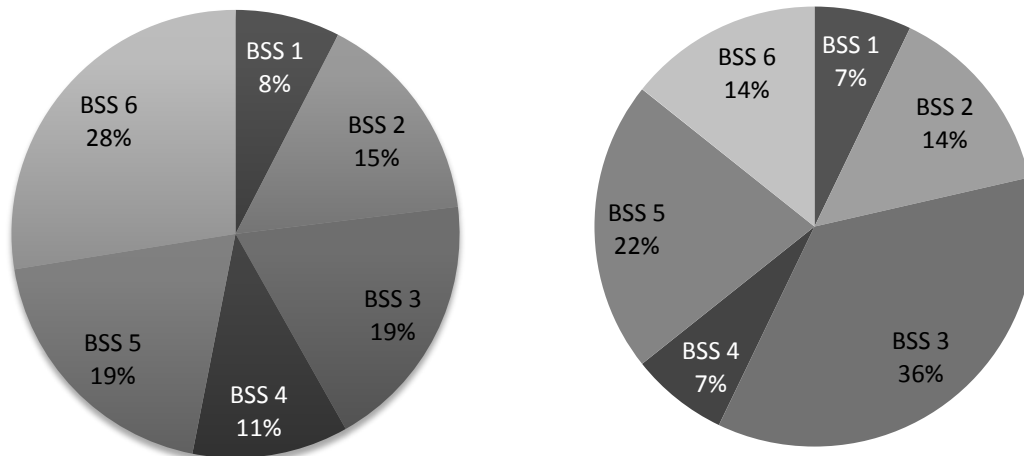


Figure 1. Total percentage of effort (*left*) and sightings (*right*) at various Beaufort Sea States (BSS)

Table 1. Effort Hours and Environmental Conditions

Date	Team Hours On-Effort	Time	Beaufort Sea State (range)	% Cloud Cover (range, conditions)	Visibility
13 Feb	1 hr 0 min	1644-1744	3	0	Excellent
14 Feb	4 hr 4 min	1306-1710	1 - 3	8 - 80	Excellent
15 Feb	7 hr 22 min	0741-1127, 1238-1539, 1625-1700	2 - 4	5 - 50	Good - Excellent
16 Feb	8 hr 35 min	0730-1126, 1300-1447, 1451-1703, 1756-1838	4 - 6	0 - 15	Good - Excellent
17 Feb	7 hr 20 min	0726-0958, 1151-1455, 1515-1700	4 - 6	2 - 80	Moderate - Excellent
Total	28 hr 23 min		1 - 6	0 - 100	Moderate - Excellent

In total, 14 unique sightings comprising at least 39 individual marine mammals were recorded during the five days of observation. The MMOs recorded seven independent sightings of marine mammals, that is, sightings not seen by the Navy lookout team (Table 2). None of these sightings were at distances less than 1000 yd (914 m), which is within the MFAS mitigation zone. Additionally, the Navy lookout team recorded one independent sighting (unconfirmed by the MMO team), and six sightings were seen by both the MMOs and the Navy lookout team (Table 2). A total of 266 photographs were taken, 66 of which were of cetaceans (Figure 3 for selected photograph) and 28 were of seabirds, with the remainder being of vessels, staff, and procedures.

Table 2. Number of Sightings

Date	Independent MMO Sightings	Independent Navy Lookout Team Sightings	Sightings by both Teams
13 Feb	0	0	0
14 Feb	5	0	2
15 Feb	0	0	1
16 Feb	0	1	2
17 Feb	2	0	1
Total	7	1	6

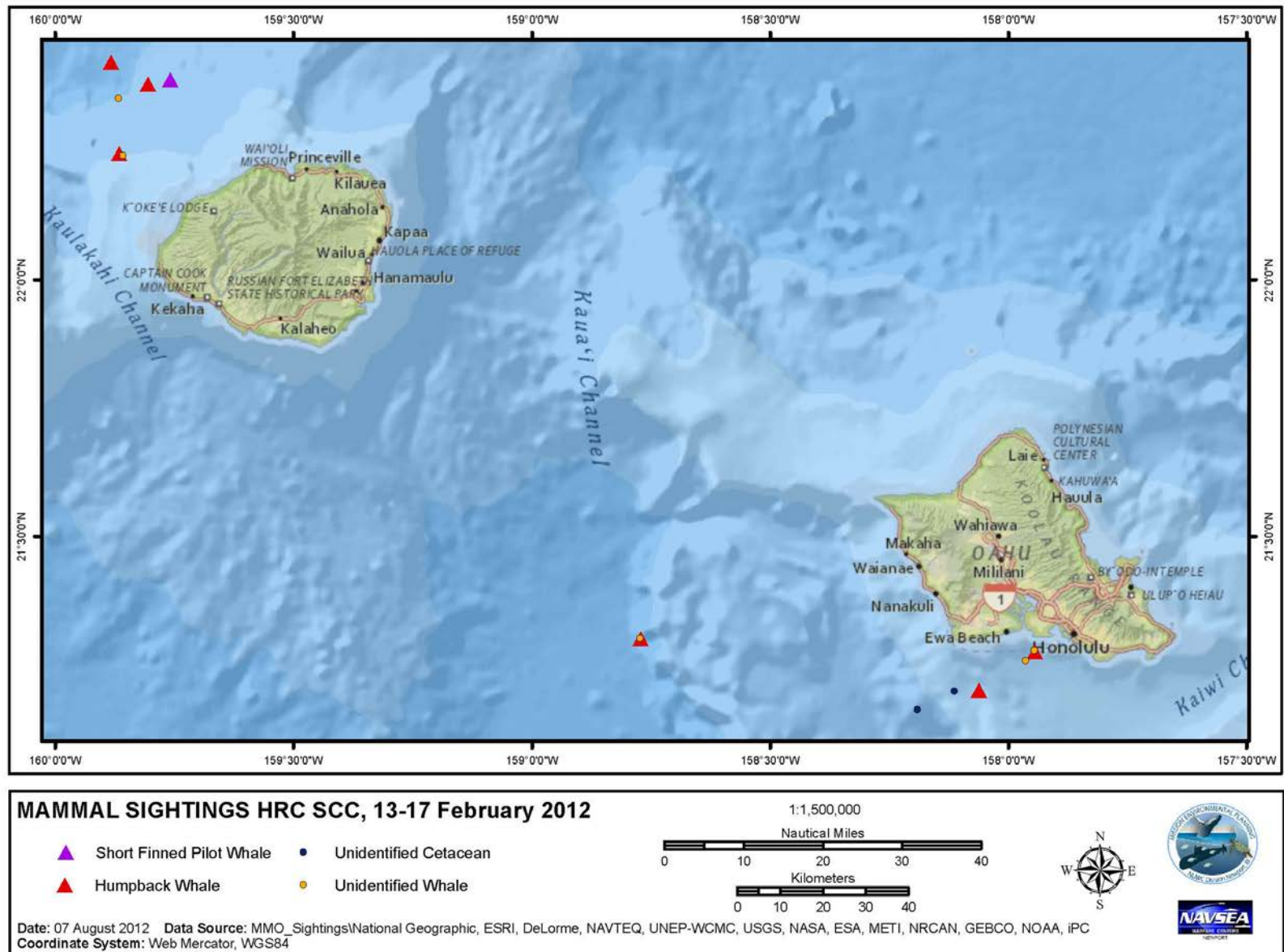


Figure 2. Marine Mammal Sighting Locations

Trials were successfully conducted on three days of the event, with ten of the fourteen sightings (71%) available for trials, or an average rate of 0.35 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
13 Feb	1 hr 0 min	0	0.00	0	0.00
14 Feb	4 hr 4 min	7	1.72	5	1.23
15 Feb	7 hr 22 min	1	0.14	0	0.00
16 Feb	8 hr 35 min	3	0.35	2	0.23
17 Feb	7 hr 20 min	3	0.41	3	0.41
Cumulative	28 hr 23 min	14	0.49	10	0.35



Figure 3. Pilot whales from sighting 8 on 15 Feb 2012.

Of the 14 sightings, two species were positively identified, the short-finned pilot whale (*Globicephala macrorhynchus*; Figure 3) and the humpback whale (*Megaptera novaeangliae*), and accounted for seven of the sightings (Table 4). The second day of the effort had the greatest frequency of unique sightings, 1.72 sightings/hour of effort. Seven of the sightings occurred on the second day which had the best sighting conditions (Feb 14; BSS 1-3).

Table 4. Unique Marine Mammal Sightings

Data Category	Sighting 1	Sighting 2	Sighting 3	Sighting 4	Sighting 5	Sighting 6	Sighting 7
Sighting Information							
Effort	On	On	On	On	On	On	On
Date	2/14/2012	2/14/2012	2/14/2012	2/14/2012	2/14/2012	2/14/2012	2/14/2012
Time (HST)	13:06:19	13:06:48	13:12:40	13:38:16	13:49:06	14:22:34	16:50:05
Location	21.27680 N 157.9457 W	21.27481 N 157.9455 W	21.257040 N 157.96391 W	21.200160 N 158.06253 W	21.197760 N 158.11316 W	21.161270 N 158.19084 W	21.30023 N 158.7720 W
Detection Sensor	BridgeMMO	MMO/Bridge	MMO	MMO	MMO	MMO	MMO
Species/Group	Unidentified Whale	Humpback Whale	Unidentified Whale	Humpback Whale	Unidentified Cetacean	Unidentified Cetacean	Humpback Whale
Group Size estimate (estimated range)	1 (1-2)	5 (4-5)	1 (1-2)	1 (1)	8 (5-10)	1 (1)	2 (2-3)
# Calves	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown
Bearing (relative)	310	5	305	78	322	0	0
Distance (m)	3210.23	4863.86	8590.34	8590.34	4862.86	1153.92	4297.88
Animal motion	Unknown	Closing	Unknown	Unknown	Parallel	None	None
Sighting Cue	Blow	Blow	Blow	Blow	Body and fins	Body	Blow
Behavior	Travel	Travel	Unknown	Unknown	Logging	Unknown	Travel
Environmental Information							
Wave height (ft)	< 3 ft	< 3 ft	< 3 ft	< 3 ft	< 3 ft	< 3 ft	< 3 ft
Visibility	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent
Beaufort Sea State	3	3	3	3	3	2	1
Cloud cover (%)	40	40	40	40	40	10	7
Glare (%)	10	10	10	10	10	3	2
Operational Information							
Sonar	Off	Off	Off	Off	Off	Off	Off
Ship bearing (true)	200	200	231	264	268	134	287
Mitigation implemented	None	None	None	None	None	None	None
Comments	Bridge saw animal first	Bridge saw at same time or first	Single blow	Not resighted	Probable Pilot Whales; Photos 1279-1280	No visible blow	Saw fluke, tall slender rorqual blow, not sperm blow, probable humpback

Table 4. (Cont) Unique Marine Mammal Sightings

Data Category	Sighting 8	Sighting 9	Sighting 10	Sighting 11	Sighting 12	Sighting 13	Sighting 14
Sighting Information							
Effort	On	On	On	On	On	On	On
Date	2/15/2012	2/16/2012	2/16/2012	2/16/2012	2/17/2012	2/17/2012	2/17/2012
Time	8:44:19	10:20:08	15:11:06	15:57:00	08:13:55	08:20:59	08:51:04
Location	22.389680 N 159.75891 W	22.35247 N 159.8660 W	22.422960 N 159.88362 W	22.381000 N 159.80557 W	22.245200 N 159.86639 W	22.241240 N 159.85684 W	21.30023 N 158.7720 W
Detection Sensor	Lookout	Lookout	MMO	MMO	MMO	MMO	MMO
Species/Group	Short Finned Pilot Whale	Unidentified Whale	Humpback Whale	Humpback Whale	Humpback Whale	Unidentified Rorqual	Unidentified Rorqual
Group Size estimate (estimated range)	8 (7-10)	1 (1)	3 (3-4)	2 (2)	3 (3)	1 (1)	2 (2)
# Calves	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown	Unknown
Bearing (relative)	315	255	8	280	311	11	300
Distance (m)	1623.26	1852.00	6731.20	6120.48	7515.65	8590.34	6120.48
Animal motion	Parallel	Unknown	None	Unknown	Unknown	None	Parallel
Sighting Cue	Fins	Tail	Blow	Blow	Blow	Blow	Blow
Behavior	Travel	Unknown	Unknown	Parallel	Unknown	Unknown	Unknown
Environmental Information							
Wave height (ft)	4-6 ft	> 6 ft	4 -6 ft	4 -6 ft	4 -6 ft	4 -6 ft	4 -6 ft
Visibility	Excellent	Good	Excellent	Excellent	Good	Good	Good
Beaufort Sea State	2	6	5	4	5	5	6
Cloud cover (%)	70	85	70	89	10	10	10
Glare (%)	10	20	10	10	10	10	10
Operational Information							
Sonar	Off	On	On	Off	On	On	Off
Ship bearing (true)	46	321	130	331	184	42	225
Mitigation implemented	Yes	Yes	None	None	None	None	None
Comments	LO mitigation turned to avoid animals	Ship mitigated by turning away from the whale	Mammal monitoring aircraft appeared to be departing for the day (over the whale but were going home)		Plane is on group	Probable humpback.	

SECTION 4 CONCLUSION

4.1. MARINE MAMMAL MONITORING

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 study occurred in waters with relatively low marine mammal density. Therefore, the opportunities for trials were few and far between. Collecting data more frequently or in a higher density season/location would improve sample size for analysis.

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

During the outbrief to the CO at the end of the SCC exercise, the MMOs recommended that LOs be given positive feedback and reminded that their job is important and valuable. During the SCC event, LOs were competing to be the first to locate the periscope of the participating sub to win a gift certificate for dinner from the CO and XO. We found the LOs during the SCC exercises to be highly motivated.

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

Data-entry on the same day after data collection, especially the first day, was a previous recommendation that is reiterated here, as it is especially valuable in the process of training of new Navy civilian biologists in the execution of the study.