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**DRAFT Cruise Report, Marine Species Monitoring &
Lookout Effectiveness Study
Unit Level Training, July 2010,
SOCAL 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
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
SOCAL	Southern California range complex
VHF	very high frequency
yd(s)	yard(s)

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 Southern California (SOCAL) Range Complex 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, especially at levels associated with adverse effects (i.e., based on NMFS' criteria for behavioral harassment, TTS, or PTS)? If so, at what levels are they exposed?
2. If marine mammals and sea turtles are exposed to MFAS in the Southern California Range Complex, 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 to various levels?
4. Are the Navy's suite of mitigation measures for MFAS (e.g., Protective Measures Assessment Protocol [PMAP], major exercise measures agreed to by the Navy through permitting) effective at avoiding TTS, injury, and mortality 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 fourth 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 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 (Dr. Sean Hanser, Ms. Mandy Shoemaker, Dr. Robert Uyeyama, and Dr. Stephanie Watwood) participated in a Unit Level Training (ULT) event on the SOCAL Range Complex on 22-29 July, 2010. These MMOs were stationed aboard a US Navy guided missile destroyer, hereafter referred to as DDG-C. The goals of the ULT 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.

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 DDG C 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 three prior surveys. Additional changes were made as necessary during this event. The MMO survey on DDG C 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.

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 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-C 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 or SMMOs reported sightings made by the Navy starboard lookout. 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 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, weather change) the DMMO recorded 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.

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 50 hours and 8 minutes searching for marine species during the ULT (Table 1). Three people were vigilant during virtually all of the on effort hours; therefore this study comprised a total of 150 hours and 24 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. Time considered off-effort included some training activities of the DDG-C that precluded conducting observations from the bridge wings; however observations were still possible and sightings were made during many training activities. Activities that required the team to vacate the bridge level entirely were not counted towards effort totals, and included radar exercises, ship officers' meetings on the bridge wings, and meals. For whole days out at sea, approximately 7.9 hours per day were spent on effort. The first two days presented almost ideal environmental sighting conditions (Table 1).

Table 2. Effort Hours and Environmental Conditions

Date	Team Hours On-Effort	Time	Beaufort Sea State (range)	% Cloud Cover (range, conditions)	Visibility
22 Jul	2 hr 45 min	1300-1341, 1607-1658, 1821-1934	1	0 – 100	Good-Excellent
23 Jul	7 hr 45 min	0728-1201, 1258-1631	1 – 2	70 – 100	Good – Excellent
24 Jul	6 hr 53 min	0741-0917, 1000-1202; 1316-1631	3 – 5	99 – 100	Moderate
25 Jul	8 hr 13 min	0736-1141, 1242-1650	4 – 5	92 – 100	Good
26 Jul	7 hr 05 min	1039-1146, 1254-1702, 1757-1947	2 – 3	20 – 100	Moderate – Excellent
27 Jul	9 hr 55 min	0731-1151, 1234-1701, 1749-1857	2 – 4	0 – 100	Good – Excellent
28 Jul	7 hr 32 min	0721-1158, 1342-1517, 1541-1701	2 – 5	5 – 100	Good
Total	50 hr 08 min (150 hr 24 min for three MMOs)		1 – 5	0 – 100	Moderate – Excellent

In total, 105 sightings comprising 680 individual marine mammals were recorded during the seven days of observation. The MMOs recorded 65 independent sightings of marine mammals, that is, sightings not seen by the Navy lookout team (Table 2). The great majority of these sightings were at distances much greater than the MFAS mitigation zone, as well as at more lateral bearings relative to the vessel's travel such that the animals would not eventually enter the mitigation zone. Additionally, the Navy lookout team recorded 8 independent sightings, and 32 sightings were seen by both the MMOs and the Navy lookout team, of which 5 were seen first by the Navy lookouts or bridge team, and 27 were seen first by the MMO team (Table 2). A total of 1049 photographs were taken, 899 of which were of animal sightings (see Fig. 1 for selected photographs), and the remainder being of the vessel, staff, and procedures.

Table 3. Number of Sightings

Date	Independent MMO Sightings	Independent Navy Lookout Team Sightings	Sightings by both Teams
22 Jul	14	0	2
23 Jul	19	5	16
24 Jul	3	0	0
25 Jul	3	2	2
26 Jul	12	1	3
27 Jul	4	0	3
28 Jul	10	0	6
Total	65	8	32

Trials were successfully conducted on all seven days of the event, with 92 of 105 sightings (88%) available for trials, or an average rate of 1.84 trials per hour of effort across all seven days (Table 3). This average trial rate was equivalent to that of the single best day of the six-day DDG B Lookout Effectiveness cruise in the Jacksonville Range Complex, where the other five days each resulted in no trials being performed. Of the 105 sightings, seven different species were positively identified, and three of the sightings were mixed-species groups (Table 4). The species identified were California sea lion (*Zalophus californianus*), bottlenose dolphin (*Tursiops truncatus*), long-beaked common dolphin (*Delphinus capensis*), short-beaked common dolphin (*Delphinus delphis*), Risso's dolphin (*Grampus griseus*), blue whale (*Balaenoptera musculus*), and minke whale (*Balaenoptera acutorostrata*). Among other unidentified sightings, one was judged to likely be either a fin whale (*Balaenoptera physalus*) or sei whale (*Balaenoptera borealis*). The three mixed-species groups were: 1) California sea lions with small rorquals, probably minke whales; 2) California sea lions with dolphins, probably bottlenosed dolphins; 3) Risso's dolphins with bottlenosed dolphins. The first two days of the effort had the greatest frequency of unique sightings, 5.82 sighting/hr on 22 July and 5.16 sightings/hr on 23 July. This sighting frequency is representative both of true animal density as well as exceptional seastate conditions (Beaufort 1-2) that were encountered on those days. Potentially unusual behavior was reported on one sighting while MFAS was active, a California sea lion sighted at a range of 364 - 400m at a bearing of 30° to starboard that was observed to be continuously leaping through more than a dozen leaps, in different directions with each leap, including often changing leap direction 180° between consecutive leaps.

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

Date	Hours MMO Team Effort	# of Unique Sightings*	Sightings/ Hour	# of Trials	Trials/ Hour
22 Jul	2 hr 45 min	16	5.82	16	5.82
23 Jul	7 hr 45 min	40	5.16	32	4.13
24 Jul	6 hr 53 min	3	0.44	3	0.44
25 Jul	8 hr 13 min	7	0.85	5	0.61
26 Jul	7 hr 05 min	16	2.26	14	1.98
27 Jul	9 hr 55 min	7	0.71	6	0.61
28 Jul	7 hr 32 min	16	2.12	16	2.12
Total	50 hr 08 min	105	2.09 (mean)	92	1.84 (mean)

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

Table 4. Unique sightings by species

Species	Unique animal group sightings ¹	Total number of animals (based on best group size estimate)
California sea lion	9 (11)	16
Bottlenosed dolphin	6 (7)	88
Long-beaked common dolphin	2	105
Short-beaked common dolphin	3	135
Risso's dolphin	2 (3)	14
Blue whale	3	6
Minke whale	3	3
Mixed species group	3	-
Unidentified common dolphin	2	105
Unidentified balaenopterid ²	12	13
Unidentified small balaenopterid	0 (1)	2
Unidentified otariid	6	6
Unidentified pinnipeds	18	24
Unidentified dolphin	18 (19)	142
Unidentified whale	13	16
Unidentified marine mammal	5	5
Total	105	680

¹Numbers in parentheses includes composition of the three mixed species groups

² One among these sightings was judged to be either a fin whale or sei whale

Additionally, three sightings of sea-lion carcasses in a state of decomposition were sighted on 22 July at 15:25, 23 July at 14:06, and 25 July at 13:53. GPS coordinates of the vessel at the time of sighting, as well as opportunistic photographs were taken of all three sightings (Fig. 2). These sightings are not tabulated in the sighting tables (Tables 3-4), nor were these considered for trials.



Figure 1. Selected photographs of marine mammal sightings – a. long beaked common dolphins; b. Risso's dolphins; c. California sea lions; d. blue whale; e. bottlenosed dolphins; f. unidentified large balaenopterid (likely fin whale or sei whale)



Figure 2. Sea lion carcasses, times and coordinates. Two photographs are shown for each sighting.

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.
 - a. The execution of this study in waters known to contain a high density of marine mammals produced a commensurately greater amount of useful data (i.e., trials) than in past cruises. However the high sighting rates experienced on some days resulted in some difficulties for the DMMO to efficiently record data, which included sightings and resightings for both sides of the vessel from both MMOs and Navy LOs where multiple groups of animals were simultaneously available. Therefore some changes will be recommended in the final report regarding both the construction of the data recording forms as well as contingencies in scanning protocol regarding effort expended toward searching for resights or following continuously-available animals, especially after seen by the Navy LO, or if the animals have passed abeam.

This event is the third 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.

Sightings information included the bearing and distance of the animal to DDG-C. This information can be used to determine, if MFAS was in use, and to 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 were made by the MMO team, and will be considered for implementation in future lookout effectiveness studies.

In particular, it was possible for the MMOs to conduct sightings and report them even when they were stationed in front of the Navy lookouts. The higher density of animals found in the waters of the SOCAL range (as compared to the Jacksonville range complex or Hawaii range complex) allowed for a significantly greater number of trials. Future lookout effectiveness studies in the same waters, or waters with similarly high estimated animal density, is recommended when possible. However, the higher frequency of sightings may necessitate slight adjustments to the data-entry forms, as well as the sighting protocol to facilitate accurate and efficient data collection as well as maximizing sighting effort. Data-entry on the same day after data collection, especially the first day, is a previous recommendation that is

reiterated here, as it is an especially valuable in the process of training of new Navy civilian biologists in the execution of the study. A portion of the study area was identified as being associated with a particularly high sighting frequency and probable true higher density of animals; this knowledge is useful for further application to MFAS mitigation issues including possibly directing effort for future vessel-based and aerial surveys.

