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Cruise Report, Marine Species Monitoring & Lookout Effectiveness Study

Fleet Exercise, March 2019, Virginia Capes Range Complex

Prepared for:
Commander, United States Fleet Forces Command

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List of Acronyms and Abbreviations

°	degrees
%	percent
BSS	Beaufort Sea State
CG	United States Navy guided missile cruiser
DDG	United States Navy guided missile destroyer
DMMO	data marine mammal observer
EDT	Eastern Daylight Time
ESA	Endangered Species Act
ft	foot (feet)
ICMP	Integrated Comprehensive Monitoring Program
LMMO	liaison marine mammal observer
LO	Lookout
m	meter (s)
MFAS	mid-frequency active sonar
MMO	marine mammal observer
MMPA	Marine Mammal Protection Act
NMFS	National Marine Fisheries Service
SMMO	survey marine mammal observer
U.S.	United States
VACAPES	Virginia Capes Range Complex

SECTION 1 INTRODUCTION

In order to train with mid-frequency active sonar (MFAS), the United States (U.S.) Navy has obtained a Letter of Authorization from the National Marine Fisheries Service under the Marine Mammal Protection Act (MMPA) and a Biological Opinion under the Endangered Species Act (ESA). The Navy conducts monitoring within Navy Range Complexes and testing ranges, guided by the Integrated Comprehensive Monitoring Program (ICMP), as required under the MMPA and the ESA (Department of the Navy 2010).

The ICMP provides the overarching framework for coordination of the U.S. Navy Marine Species Monitoring Program (Department of the Navy 2010). The ICMP outlines objectives for marine species monitoring and U.S. Navy-funded research relating to the effects of Naval training and testing activities on protected marine species (Department of the Navy 2010). The ICMP includes the following scientific objectives (Department of the Navy 2010):

1. monitor and assess the effects of Navy activities on protected marine species;
2. ensure that data collected at multiple locations is collected in a manner that allows comparison between and among different geographic locations;
3. assess the efficacy and practicality of the monitoring and mitigation techniques; and
4. add to the overall knowledge base of protected marine species and the effects of Navy activities on these species.

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 accordance with objective 3 above, a study was initiated to determine the effectiveness of the Navy lookout (LO) team, including lookouts in the pilot house or on the bridge wings. Trained biologists are utilized for the study to collect data that would characterize the likelihood of detecting marine species in the field from a U.S. Navy guided missile destroyer (DDG) or guided missile cruiser (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 prior cruises. Data collected are intended to be combined with current and future data 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 (Mrs. Jacqueline Bort Thornton, Ms. Danielle Jones, Mr. Benjamin Bartley, and Ms. Erica Felins) embarked from 19-22 March 2019 during a Fleet Exercise event in the Virginia Capes Range Complex (VACAPES). These MMOs were stationed aboard a U.S. Navy guided missile cruiser, hereafter referred to as CG-D. The goals of the monitoring and this study were to:

1. collect data to assess the effectiveness of the Navy lookout team; and
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 wings if necessary for CG-D 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, 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 prior surveys.

The MMO survey on CG-D was conducted on the bridge wings (elevated 61.6 feet [ft]; 18.79 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 SMMO would generally 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, SMMOs 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° field in front of the ship that was covered by the MMOs, with a 20° 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 would be collected on both the sighting and concurrent operational parameters. Environmental data, such as sea state and cloud cover, were routinely collected. The goal of the survey was to set up “trials” for the Navy LO team such that the SMMO observed an animal before the Navy LO, and determined if the Navy LO subsequently detected that animal or not, and at what distance. Sightings that were between 270° and 90° relative to the ship and obtained first by the SMMOs and before the Navy LO or at the same time as the Navy LO were considered to be “trials”. If applicable, photographs would be taken using a Nikon D90 digital camera with a 100–400 millimeter zoom lens. No photographs would be taken immediately after an animal was sighted or until the Navy LO had also made the sighting (when applicable) so as not to call attention to the sighting.

The track of CG-D would not be 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 would report sightings made by the Navy bridge wing LOs. The LMMO would also be responsible for noting sightings made by the bridge team or watchstanders. After a sighting was made by the Navy LO or bridge team, the LMMO would query the personnel to clarify information on the sighting such as animals seen, bearing, distance, and time. All four MMOs would be equipped with a headset two-way radio setup 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 would record all data and make initial determination as to whether sightings were considered a duplicate, e.g., the same animal seen by two observers. The DMMO would also record 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, the DMMO would immediately take a waypoint using a global

positioning system such that the accurate time and location of the event/sighting would be recorded, with associated information to be appended. Effort and environmental information would be collected when the MMOs began effort, at each rotation, and as weather changes occurred. At the conclusion of each observation day, if any photographs were taken, they would be reviewed to assist with species identification.

SECTION 3 RESULTS

The MMO team spent 17 hours and 3 minutes searching for marine species during the training event (Table 1). During whole days at sea (20-21 March), an average of 4.7 hours per day was spent on effort. Technical issues with the ship, a few training evolutions, and adverse weather conditions precluded full days of observing. 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. During the event, BSS ranged from 2 to 7 (Table 1). The majority of observation time was spent in a BSS of 2 or 3 (28 percent [%] and 58.9%, respectively), which amounts to moderate/favorable environmental sighting conditions, with the most sightings occurring in a BSS of 2 (46.7%, Figure 1).

Table 1. Effort Hours and Environmental Conditions

Date	Team Hours On-Effort	Time	Beaufort Sea State (range)	% Cloud Cover (range)	Visibility
19 March	4 hours 35 minutes	13:32-17:27 18:39-19:19	3	22-55	Excellent
20 March	7 hours 44 minutes	08:18-11:32 12:58-17:20 18:41-18:49	2-4	96-100	Good to Excellent
21 March	1 hour 40 minutes	08:51-10:31	6-7	100	Moderate to Good
22 March	3 hours 4 minutes	07:41-07:56 08:51-11:40	3-4	0-5	Excellent
Total	**17 hours 3 minutes**		**2-7**	**0-100**	**Moderate to Excellent**

Visibility: Bad (0.5km); Poor (0.5-1.5km); Moderate (1.5-10km); Good (10-15km); Excellent (>15km)

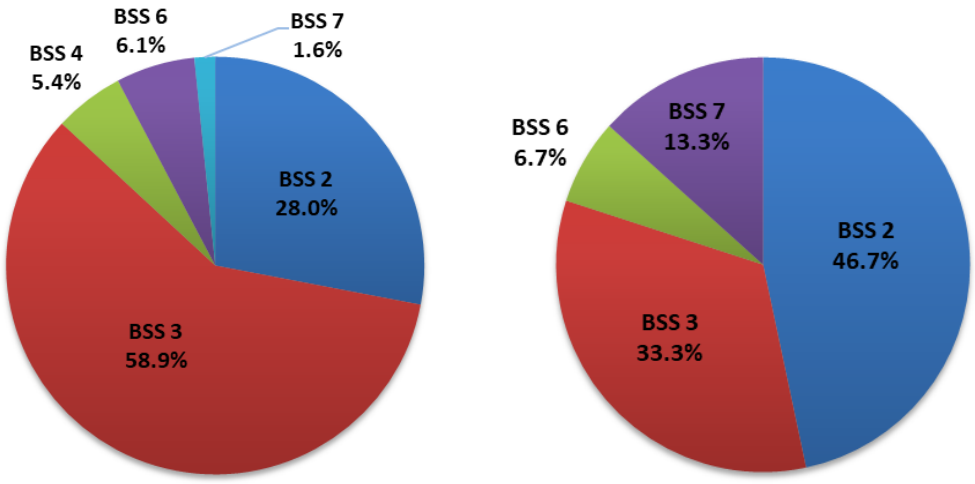

Figure 1. Total percentage of effort (left) and sightings (right) at various Beaufort Sea States (BSS)

In total, 15 unique sightings (in which each sighting does not include subsequent re-sightings/surfacings or separate sightings of the same animal(s) made by the MMOs and LOs) comprising at least 37 individual marine animals were recorded during the four days of observation (Figure 2). MMOs made 10 sightings independent of the Navy's LO team (Table 2). The LO team had one sighting independent of the MMOs. There were 4 sightings made by both teams. The ship log was not obtained at the end of the cruise as an officer from the Navigation team informed us that the log did not contain any new marine mammal or sea turtle sighting information.

Seabird sightings were not recorded on this trip. A total of 62 photographs were taken of dolphins, vessels, training exercises, and environmental conditions**.**

Table 2. Number of Sightings

Date	Independent MMO Sightings	Independent Navy LO Team Sightings	Sightings by both Teams	Total Number of Sightings
19 March	2	0	2	4
20 March	7	0	1	8
21 March	1	1	1	3
22 March	0	0	0	0
Total	**10**	**1**	**4**	**15**

Trials, or sightings in which the MMOs detected animals before or at the same time as the Navy LOs, were successfully conducted on three of the four days of the event, with 12 of the 15 sightings (80%) available for trials. There were more trials than sightings due to surfacing series for some of the whale sightings. There was an average rate of 0.88 sightings per hour of effort and an average rate of 1 trial per hour of effort across all four days (Table 3). The second day of effort (20 March) had the greatest frequency of trials, with 1.42 trials per hour of effort. The greatest frequency of unique sightings occurred on 21 March, with 1.80 sightings per hour of effort (Table 3), however, this rate is biased due to the low amount of survey effort that was conducted that day due to adverse environmental conditions.

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

Date	Hours MMO Team Effort	# of Unique Sightings	Sightings/ Hour	# of Trials	Trials/Hour
19 March	4 hours 35 minutes	4	0.87	4	0.87
20 March	7 hours 44 minutes	8	1.03	11	1.42
21 March	1 hours 40 minutes	3	1.80	2	1.20
22 March	3 hours 4 minutes	0	0.00	0	0.00
Cumulative	**17 hours 3 minutes**	**15**	**0.88**	**17**	**1.00**

Of the 15 unique marine animal sightings, 7 were identified to the species level. Visual sightings included 6 sightings of unidentified large whales, 1 fin whale (*Balaenoptera physalus*), 1 sperm whale (*Physeter macrocephalus*), 2 sightings of common dolphins (*Delphinus delphis*), 1 sighting of bottlenose dolphins (*Tursiops truncatus)*, 1 mixed-species sighting of Atlantic spotted (*Stenella frontalis)* and common dolphins, 1 sighting of unidentified dolphins, and 1 loggerhead sea turtle (*Caretta caretta)* (Table 4, Figure 2). A photograph of one of the sightings is provided in Figure 3.

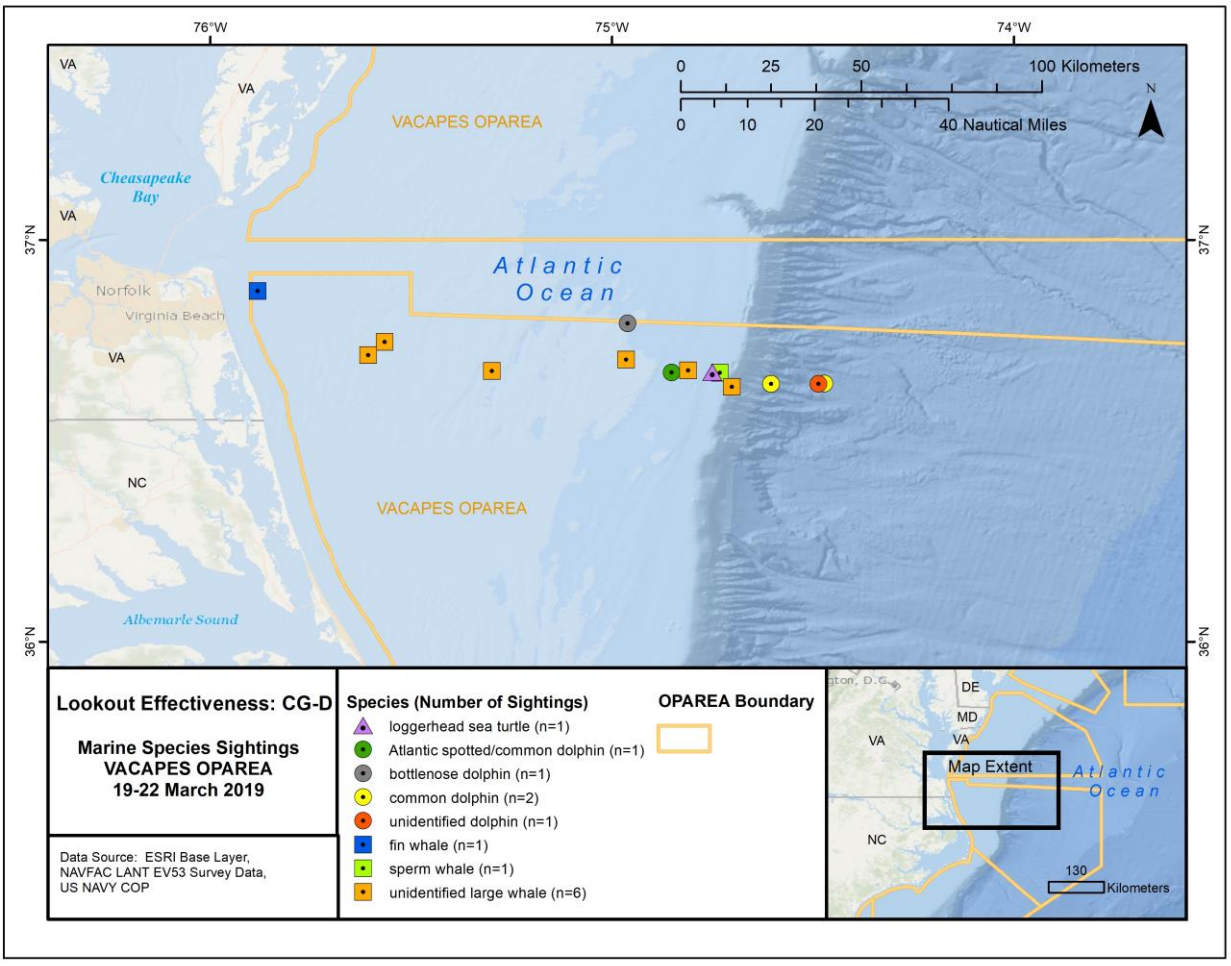

Figure 2. Marine animal sightings in the Virginia Capes Range Complex

Figure 3. Common dolphins surfacing from Sighting 13 on 21 March 2019

Table 4. Unique Marine Mammal and Sea Turtle Sightings

Data Category	Sighting 1	Sighting 2	Sighting 3	Sighting 4	Sighting 5
Sighting Information					
Effort	On	On	On	On	On
Date	03/19/19	03/19/19	03/19/19	03/19/19	03/20/19
Time (EDT)	13:40	14:36	14:50	17:21	10:20
Location	36.8728	36.7464	36.7132	36.6739	36.7925
	-75.8821	-75.5659	-75.6065	-75.2988	-74.9614
Detection Sensor	LO/MMO	MMO	MMO/LO	MMO	MMO/LO
Species/Group	Fin whale	Unidentified large whale	Unidentified large whale	Unidentified large whale	Bottlenose dolphin
Group Size Estimate (estimated range)	1	1	1	1	4
# Calves	0	0	0	0	0
Animal Bearing (relative degrees)	80	340	275	80	90
Distance (m)	274	3758	417.5	1879	9
Animal Motion	Parallel	None	None	Parallel	Parallel
Sighting Cue	Dorsal fin	Blow	Blow	Blow	Body
Behavior	Traveling	Traveling	Traveling	Traveling	Bowriding
Environmental Information					
Beaufort Sea State	3	3	3	3	3
Wave Height (ft)	0-3	0-3	0-3	0-3	0-3
Visibility	Excellent	Excellent	Excellent	Excellent	Excellent
Glare (%)	10	40	40	0	0
Cloud Cover (%)	40	55	55	55	98
Operational Information					
Sonar	Off	Off	Off	Off	Off
Ship Bearing (true degrees)	122	140	138	88	227
Mitigation Implemented	Yes	No	No	No	No
Comments	Bridge sighted animal first and told LOs to stay vigilant	LO present, but did not see animal	LO saw at same time. Sighting consisted of 1 additional surfacing series at 14:50; LO sighted at same time as MMO	LO present, but did not see animal. Sighting consisted of 1 additional surfacing series at 17:22	Animals moved from stern to bow. Bridge team sighted at same time. Phalanx CIWS fired at 10:23

Visibility: Bad (0.5km); Poor (0.5-1.5km); Moderate (1.5-10km); Good (10-15km); Excellent (>15km)

Table 5. Unique Marine Mammal and Sea Turtle Sightings (cont'd)

Data Category	Sighting 6	Sighting 7	Sighting 8	Sighting 9	Sighting 10
Sighting Information					
Effort	On	On	On	On	On
Date	03/20/19	03/20/19	03/20/19	03/20/19	03/20/19
Time (EDT)	13:36	14:07	15:21	15:23	15:26
Location	36.7024	36.6699	36.6710	36.6750	36.6790
	-74.9655	-74.8518	-74.7503	-74.8109	-74.7114
Detection Sensor	MMO	MMO	MMO	MMO	MMO
Species/Group	Unidentified large whale	Atlantic spotted and Common dolphins	Loggerhead sea turtle	Unidentified large whale	Unidentified large whale
Group Size Estimate (estimated range)	1 (1-2)	16 (13-20)	1	1	1
# Calves	0	2	0	0	0
Animal Bearing (relative degrees)	10	7	20	325	20
Distance (m)	940	10	69	3758	1879
Animal Motion	Parallel	Closing	Opening	None	None
Sighting Cue	Blow	Body	Body	Blow	Blow
Behavior	Traveling	Traveling	Traveling	Traveling	Traveling
Environmental Information					
Beaufort Sea State	2	2	2	2	2
Wave Height (ft)	0-3	0-3	0-3	0-3	0-3
Visibility	Good	Good	Good	Good	Good
Glare (%)	0	0	0	0	0
Cloud Cover (%)	100	98	100	100	100
Operational Information					
Sonar	Off	Off	Off	Off	Off
Ship Bearing (true degrees)	101	91	82	82	81
Mitigation Implemented	No	No	No	No	No
Comments	LO present, but did not see animal. Possible fin whale	LO present, but did not see animals	LO present, but did not see animal	LO present, but did not see animal	LO present, but did not see animal. Sighting consisted of 3 additional surfacing series from 15:29-15:31

Visibility: Bad (0.5km); Poor (0.5-1.5km); Moderate (1.5-10km); Good (10-15km); Excellent (>15km)

Table 6. Unique Marine Mammal and Sea Turtle Sightings (cont'd)

Data Category	Sighting 11	Sighting 12	Sighting 13	Sighting 14	Sighting 15
Sighting Information					
Effort	On	On	On	On	On
Date	03/20/19	03/20/19	03/21/19	03/21/19	03/21/19
Time (EDT)	16:10	16:11	9:14	10:23	10:28
Location	36.6342	36.6694	36.6416	36.6419	36.6424
	-74.7019	-74.7317	-74.6042	-74.4866	-74.4714
Detection Sensor	MMO	MMO	MMO	LO	MMO/LO
Species/Group	Unidentified large whale	Sperm whale	Common dolphin	Unidentified dolphin	Common dolphin
Group Size Estimate (estimated range)	1	1	6 (2-8)	2	10 (9-15)
# Calves	0	0	2	0	1
Animal Bearing (relative degrees)	90	290	330	270	270
Distance (m)	3758	275	18	45.6	416
Animal Motion	None	None	Closing		Closing
Sighting Cue	Blow	Blow	Body		Body
Behavior	Traveling	Traveling	Bowriding		Bowriding
Environmental Information					
Beaufort Sea State	2	2	6	7	7
Wave Height (ft)	0-3	0-3	>6	>6	>6
Visibility	Good	Good	Good	Moderate	Moderate
Glare (%)	0	0	0	0	0
Cloud Cover (%)	100	100	100	100	100
Operational Information					
Sonar	Off	Off	Off	Off	Off
Ship Bearing (true degrees)	275	217	122	96	96
Mitigation Implemented	No	No	No	No	No
Comments	LO present, but did not see animal	LO present, but did not see animal. Sighting consisted of 1 additional surfacing series at 16:12			Bridge team sighted animals (porpoising) at same time

Visibility: Bad (0.5km); Poor (0.5-1.5km); Moderate (1.5-10km); Good (10-15km); Excellent (>15km)

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 was the fourth aboard a CG in which data were collected to determine effectiveness; data will be combined with current and future data sets 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 the CG-D. This information can be used to determine the level of exposure a marine mammal or sea turtle may experience if the ship was using sonar during an MFAS event.

SECTION 5 REFERENCES

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