

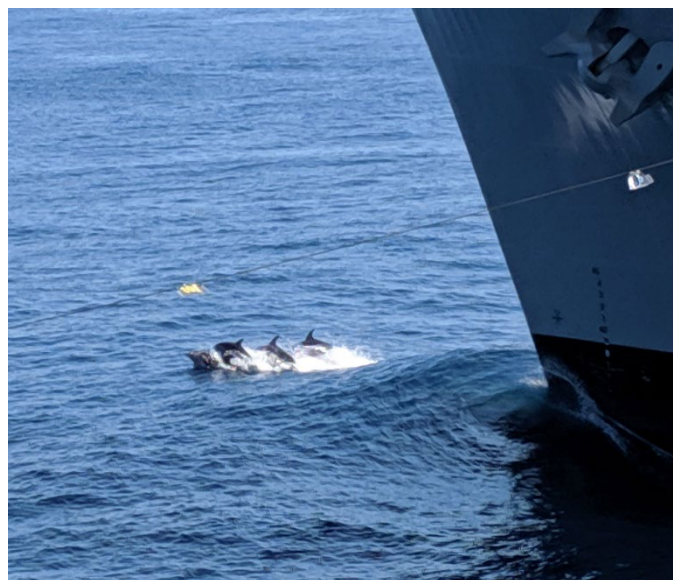
October 2019

Cruise Report, Marine Species Monitoring & Lookout Effectiveness Study

Fleet Exercise, September 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
yds	yard (s)

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. Angela Bostwick, Mrs. Deanna Rees, Mrs. Erica Felins, and Dr. Jason Krumholz) embarked from 9-12 September 2019 during a Fleet Exercise event in the Virginia Capes Range Complex (VACAPES). These MMOs were stationed aboard a U.S. Navy guided missile destroyer, hereafter referred to as DDG-U. 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 DDG-U 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 DDG-U was conducted on the bridge wings (elevated 65.6 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 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 DDG-U 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 22 hours and 41 minutes searching for marine species during the training event (Table 1). During whole days at sea (10-11 September), an average of 7.59 hours per day was spent on effort. A few training evolutions precluded full days of observing (e.g., man overboard drills, underway replenishment, etc.). 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 1 to 4 (Table 1). The majority of observation time was spent in a BSS of 1 or 3 (27.2 percent [%] and 50.7%, respectively), which amounts to moderate/favorable environmental sighting conditions, with the most sightings occurring in a BSS of 1 (53.6%, Figure 1).

Table 1. Effort Hours and Environmental Conditions

Date	Team Hours On-Effort	Time	Beaufort Sea State (range)	% Cloud Cover (range)	Visibility
9 September	2 hours 45 minutes	13:32-15:24 16:05-17:05 18:07-18:36 18:59-19:27	1-2	38.5-85	Good to Excellent
10 September	7 hours 34 minutes	6:59-7:35 9:28-11:25 12:59-16:59 18:06-19:07	3-4	0-12.5	Excellent
11 September	7 hours 36 minutes	6:55-10:58 11:18-11:58 15:56-16:56 17:38-19:31	1-2	5-12.5	Excellent
12 September	4 hours 45 minutes	7:05-10:50 11:58-12:58	2-3	0-35	Excellent
Total	22 hours 41 minutes		1-4	0-85	Good to Excellent

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

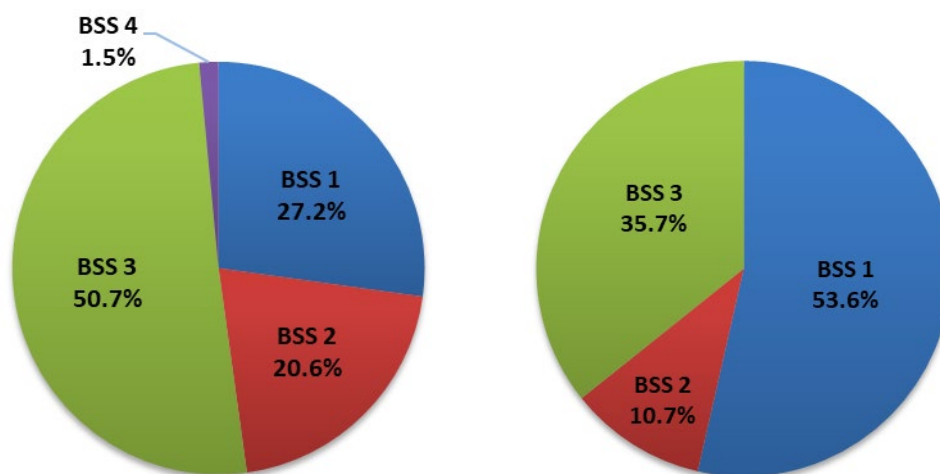


Figure 1. Total percentage of effort (left) and sightings (right) at various Beaufort Sea States (BSS)

In total, 28 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 75 individual marine animals were recorded during the four days of observation (Figure 2). MMOs made 18 sightings independent of the Navy's LO team (Table 2). The LO team had three sightings independent of the MMOs. There were seven sightings made by both teams. The ship log was obtained at the end of the cruise; it contained one entry for marine mammal sighting information that was not recorded by the MMO team while on effort.

Seabird sightings were not recorded on this trip. A total of 217 photographs were taken of birds, dolphins, vessels, 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
9 September	1	0	0	1
10 September	0	1	5	6
11 September	14	2	1	17
12 September	3	0	1	4
Total	18	3	7	28

The maximum distance for a mitigation zone that is applicable to the Lookout Effectiveness study is 1000 yards (yds). Out of the 28 unique sightings, 21 sightings (75 %) consisted of animals that were detected at less than or equal to 1000 yds from a given stressor (Table 3). For this embark, the stressor was the DDG, as gunnery exercises were not conducted and the ship did not go active on sonar while the MMO team was on effort. Within the 1000-yds mitigation zone, the MMOs had 13 independent sightings, the LO team had two independent sightings, and six of the sightings were made by both the MMO and LO teams.

Table 3. Number of Sightings within the Navy's Mitigation Zones*

Date	Independent MMO Sightings	Independent Navy LO Team Sightings	Sightings by both Teams	Total Number of Sightings
9 September	0	0	0	0
10 September	1	0	4	5
11 September	9	2	1	12
12 September	3	0	1	4
Total	13	2	6	21

*The maximum distance for a mitigation zone that is applicable to the Lookout Effectiveness study is 1000 yds. This table reports the number of animals detected less than or equal to 1000 yds from a given stressor.

Trials, or sightings in which the MMOs detected animals before or at the same time as the Navy LOs, were successfully conducted on all four days of the event, with 23 of the 28 sightings (82.1 %) available for trials. There were more trials than sightings due to a re-sighting of the same group of animals for one of the dolphin sightings. There was an average rate of 1.23 sightings per hour of effort and an average rate of 1.06 trials per hour of effort across all four days (Table 4). The third day of effort (11 September) had the greatest frequency of trials, with 2.1 trials per hour of effort. The greatest frequency of unique sightings also occurred on 11 September, with 2.24 sightings per hour of effort (Table 4).

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

Date	Hours MMO Team Effort	Number of Unique Sightings	Sightings/Hour	Number of Trials	Trials/Hour
9 September	2 hours 45 minutes	1	0.36	1	0.36
10 September	7 hours 34 minutes	6	0.79	3	0.40
11 September	7 hours 36 minutes	17	2.24	16	2.10
12 September	4 hours 45 minutes	4	0.84	4	0.84
Cumulative	17 hours 3 minutes	28	1.23	24	1.06

Of the 28 unique marine animal sightings, 11 were identified to the species level. Visual sightings included 8 sightings of unidentified dolphins, 3 sightings of unidentified large whales, 4 sightings of loggerhead sea turtles (*Caretta caretta*), 3 sightings of bottlenose dolphins (*Tursiops truncatus*), 3 sightings of unidentified cetaceans, 3 unidentified sea turtles, 1 green sea turtle (*Chelonia mydas*), 1 sighting of harbor porpoises (*Phocoena phocoena*), 1 sighting of Atlantic white-sided dolphins (*Lagenorhynchus acutus*), and 1 leatherback sea turtle (*Dermochelys coriacea*) (Table 5, Figure 2). A photograph of one of the sightings is provided in Figure 3.

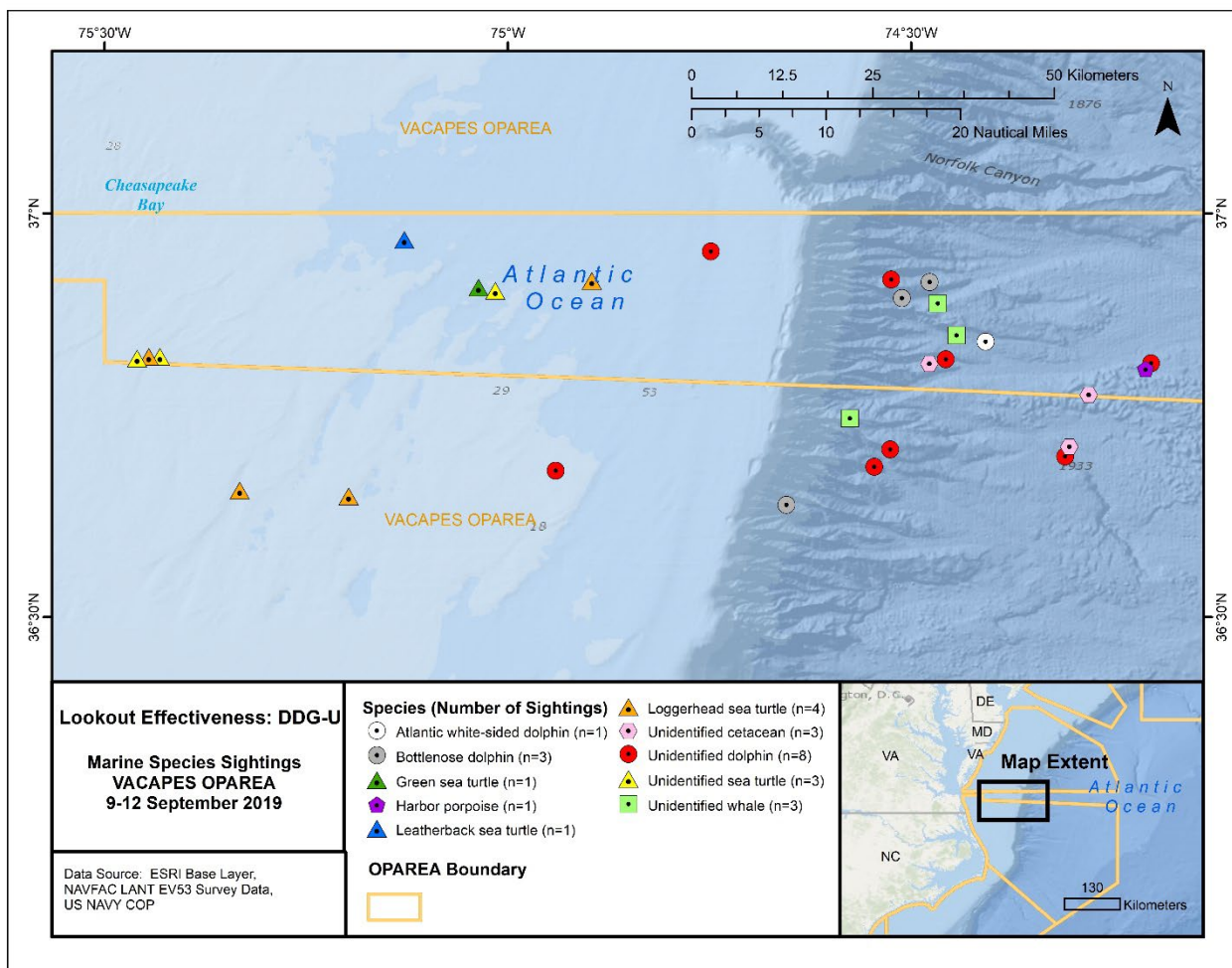


Figure 2. Marine animal sightings in the Virginia Capes Range Complex



Figure 3. Bottlenose dolphins surfacing from Sighting 12 on 11 September 2019

Table 5. 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	09/09/19	09/10/19	09/10/19	09/10/19	09/10/19
Time (EDT)	15:11	10:54	11:09	13:14	15:09
Location	36.6812	36.6566	36.6494	36.6390	36.6860
	74.9699	75.3297	75.1956	74.6873	74.5157
Detection Sensor	MMO	LO/MMO	MMO	MMO/LO	LO/MMO
Species/Group	Unidentified dolphin	Loggerhead sea turtle	Loggerhead sea turtle	Bottlenose dolphin	Unidentified dolphin
Group Size Estimate (estimated range)	1	1	1	5 (4-8)	1 (1-2)
# Calves	0	0	0	0	0
Animal Bearing (relative degrees)	350	300	270	30	274
Distance (m)	1333.33	80	110	1000	1142.86
Animal Motion	Opening	None	None	Closing	Closing
Sighting Cue	Breach	Body	Body	Breach	Blow
Behavior	Breaching	Diving	Diving	Bowriding	Traveling
Environmental Information					
Beaufort Sea State	2	3	3	3	3
Wave Height (ft)	0-3	0-3	0-3	4-6	4-6
Visibility	Good	Excellent	Excellent	Excellent	Excellent
Glare (%)	10	15	15	0	0
Cloud Cover (%)	85	5	5	5	0
Operational Information					
Sonar	Off	Off	Off	Off	Off
Ship Bearing (true degrees)	1	95	92	115	4
Mitigation Implemented	N/A	N/A	N/A	N/A	N/A
Comments	LO present, but did not see animal	LO sighted animal <5 seconds before MMO	LO present, but did not see animal	LO sighted animals 30 seconds after MMO	LO sighted animal 50 seconds before MMO

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	09/10/19	09/10/19	09/11/19	09/11/19	09/11/19
Time (EDT)	15:43	16:14	7:08	9:14	9:32
Location	36.7458	36.7076	36.8411	36.8488	36.8883
	74.4746	74.5220	74.4030	74.4263	74.4911
Detection Sensor	LO/MMO	MMO/LO	MMO	MMO	MMO
Species/Group	Unidentified whale	Unidentified dolphin	Atlantic white-sided dolphin	Unidentified whale	Unidentified whale
Group Size Estimate (estimated range)	3 (1-3)	2	8 (5-10)	1	1 (1-2)
# Calves	0	0	2	0	0
Animal Bearing (relative degrees)	270	290	15	30	310
Distance (m)	4000	120	200	2285.71	1000
Animal Motion	None	Parallel	Closing	None	Opening
Sighting Cue	Blow	Breach	Breach	Blow	Blow
Behavior	Traveling	Traveling	Traveling	Traveling	Traveling
Environmental Information					
Beaufort Sea State	3	3	1	1	1
Wave Height (ft)	4-6	0-3	0-3	0-3	0-3
Visibility	Excellent	Excellent	Excellent	Excellent	Excellent
Glare (%)	0	25	0	12.5	12.5
Cloud Cover (%)	0	5	10	2.5	2.5
Operational Information					
Sonar	Off	Off	Off	Off	Off
Ship Bearing (true degrees)	100	186	328	320	308
Mitigation Implemented	N/A	N/A	N/A	N/A	N/A
Comments	LO sighted animal 30 seconds before MMO	LO sighted animals 15 seconds after MMO	LO present, but did not see animals	LO present, but did not see animal	LO present, but did not see animal

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 11	Sighting 12	Sighting 13	Sighting 14	Sighting 15
Sighting Information					
Effort	On	On	On	On	On
Date	09/11/19	09/11/19	09/11/19	09/11/19	09/11/19
Time (EDT)	9:40	9:42	10:52	11:28	11:52
Location	36.9147	36.8949	36.9527	36.9162	36.9038
	74.5179	74.4992	74.7289	74.8965	75.0093
Detection Sensor	MMO	MMO/LO	MMO	MMO	MMO
Species/Group	Bottlenose dolphin	Bottlenose dolphin	Unidentified dolphin	Loggerhead sea turtle	Unidentified sea turtle
Group Size Estimate (estimated range)	2 (1-3)	8 (6-10)	2	1	1
# Calves	0	0	0	0	0
Animal Bearing (relative degrees)	280	0	40	10	20
Distance (m)	2666.67	500	1066.67	30	250
Animal Motion	Opening	Closing	Closing	None	None
Sighting Cue	Breach	Breach	Breach	Body	Body
Behavior	Traveling	Bowriding	Traveling	Traveling	Milling
Environmental Information					
Beaufort Sea State	1	1	2	1	1
Wave Height (ft)	0-3	0-3	0-3	0-3	0-3
Visibility	Excellent	Excellent	Excellent	Excellent	Excellent
Glare (%)	12.5	12.5	5	0	0
Cloud Cover (%)	2.5	2.5	10	10	10
Operational Information					
Sonar	Off	Off	Off	Off	Off
Ship Bearing (true degrees)	282	280	220	260	285
Mitigation Implemented	N/A	N/A	N/A	N/A	N/A
Comments	LO present, but did not see animals	LO sighted animals 15 seconds after MMO. MMO/LO resighted same group 10 minutes later	LO present, but did not see animals	LO present, but did not see animal	LO present, but did not see animal

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 16	Sighting 17	Sighting 18	Sighting 19	Sighting 20
Sighting Information					
Effort	On	On	On	On	On
Date	09/11/19	09/11/19	09/11/19	09/11/19	09/11/19
Time (EDT)	11:56	16:29	16:31	17:40	17:47
Location	36.9079	36.8143	36.8073	36.8192	36.8135
	75.0320	74.2136	74.2232	74.4369	74.4627
Detection Sensor	MMO	MMO	MMO	MMO	LO
Species/Group	Green sea turtle	Unidentified dolphin	Harbor porpoise	Unidentified dolphin	Unidentified cetacean
Group Size Estimate (estimated range)	1	18 (15-25)	1 (1-2)	4 (3-6)	1
# Calves	0	0	0	0	0
Animal Bearing (relative degrees)	15	310	45	300	30
Distance (m)	200	842.11	500	800	600
Animal Motion	None	Opening	Parallel	Closing	None
Sighting Cue	Body	Breach	Dorsal fin	Breach	Dorsal fin
Behavior	Traveling	Traveling	Traveling	Traveling	Other
Environmental Information					
Beaufort Sea State	1	1	1	1	1
Wave Height (ft)	0-3	0-3	0-3	0-3	0-3
Visibility	Excellent	Excellent	Excellent	Excellent	Excellent
Glare (%)	0	10	10	12.5	12.5
Cloud Cover (%)	10	5	5	5	5
Operational Information					
Sonar	Off	Off	Off	Off	Off
Ship Bearing (true degrees)	284	271	269	270	269
Mitigation Implemented	N/A	N/A	N/A	N/A	N/A
Comments	LO present, but did not see animal	LO not present	LO not present	LO not present	MMO did not see animal

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 21	Sighting 22	Sighting 23	Sighting 24	Sighting 25
Sighting Information					
Effort	On	On	On	On	On
Date	09/11/19	09/11/19	09/11/19	09/11/19	09/11/19
Time (EDT)	17:56	18:27	19:01	19:09	9:18
Location	36.8012	36.7751	36.6989	36.7108	36.9669
	-74.4702	74.5173	74.3049	74.2821	75.1276
Detection Sensor	LO	MMO	MMO	MMO	MMO/LO
Species/Group	Unidentified dolphin	Unidentified cetacean	Unidentified dolphin	Unidentified cetacean	Leatherback sea turtle
Group Size Estimate (estimated range)	1	2 (1-2)	5 (3-6)	1	1
# Calves	0	0	0	0	0
Animal Bearing (relative degrees)	300	80	0	80	15
Distance (m)	274.3	8000	1333.33	800	50
Animal Motion		Parallel	None	Parallel	Closing
Sighting Cue		Splash	Dorsal fin	Body	Body
Behavior		Traveling	Traveling	Traveling	Traveling
Environmental Information					
Beaufort Sea State	1	1	2	2	3
Wave Height (ft)	0-3	0-3	0-3	0-3	0-3
Visibility	Excellent	Excellent	Excellent	Excellent	Excellent
Glare (%)	12.5	12.5	0	0	0
Cloud Cover (%)	5	5	12.5	12.5	10
Operational Information					
Sonar	Off	Off	Off	Off	Off
Ship Bearing (true degrees)	270	115	124	155	270
Mitigation Implemented	N/A	N/A	N/A	N/A	N/A
Comments	Sighting recorded in ship's log. MMOs did not see animal	LO present, but did not see animals	LO present, but did not see animals	LO present, but did not see animal	LO sighted animal 10 seconds after MMO

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 26	Sighting 27	Sighting 28
Sighting Information			
Effort	On	On	On
Date	09/11/19	09/11/19	09/11/19
Time (EDT)	12:26	12:27	12:30
Location	36.8223	36.8224	36.8201
	75.4498	75.4501	75.4649
Detection Sensor	MMO	MMO	MMO
Species/Group	Unidentified sea turtle	Loggerhead sea turtle	Unidentified sea turtle
Group Size Estimate (estimated range)	1	1	1
# Calves	0	0	0
Animal Bearing (relative degrees)	80	30	35
Distance (m)	666.67	200	300
Animal Motion	None	Parallel	None
Sighting Cue	Body	Body	Body
Behavior	Resting	Traveling	Traveling
Environmental Information			
Beaufort Sea State	3	3	3
Wave Height (ft)	0-3	0-3	0-3
Visibility	Excellent	Excellent	Excellent
Glare (%)	0	0	0
Cloud Cover (%)	5.5	5.5	5.5
Operational Information			
Sonar	Off	Off	Off
Ship Bearing (true degrees)	272	272	272
Mitigation Implemented	N/A	N/A	N/A
Comments	LO not present	LO not present	LO not present

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 twentieth aboard a DDG 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 DDG-U. 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.