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Cruise Report, Marine Species Monitoring & Lookout Effectiveness Study

Fleet Exercise, June 2018, 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
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). 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, two U.S. Navy civilian MMOs (Ms. Gwendolyn Lockhart and Ms. Christiana Salles) and two MMOs from McLaughlin Research Corporation (Dr. Jason Krumholz and Ms. Erin Oliveira), embarked from 4–8 June 2018 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-S. 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-S 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-S 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 100–300 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-S 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 31 hours and 21 minutes searching for marine species during the training event (Table 1). During whole days at sea (5-7 June), an average of 8.2 hours per day was spent on effort. Several training evolutions occurred that precluded full days of observing (gunnery exercises, 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 2 to 5 (Table 1). The majority of observation time was spent in a BSS of 2 or 3 (59.2 percent [%] and 29.4%, respectively), which amounts to favorable environmental sighting conditions, with the most sightings occurring in a BSS of 2 (50%, Figure 1).

Table 1. Effort Hours and Environmental Conditions

Date	Team Hours On-Effort	Time	Beaufort Sea State (range)	% Cloud Cover (range)	Visibility
4 June	4 hours 50 minutes	13:05-16:02 16:38-17:30 18:37-19:38	2-3	0-20	Excellent
5 June	8 hours 42 minutes	7:41-11:45 14:13-17:16 18:15-19:50	2-3	17.5-85	Excellent
6 June	8 hours 49 minutes	7:26-8:04 8:27-11:31 12:37-17:44	2-3	7.5-90	Excellent
7 June	6 hours 57 minutes	6:45-8:09 11:55-13:29 14:45-17:44 18:30-19:30	2-5	0-19	Excellent
8 June	2 hours 3 minutes	7:41-9:44	2	20-60	Excellent
Total	31 hours 21 minutes		2-5	0-90	Excellent

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

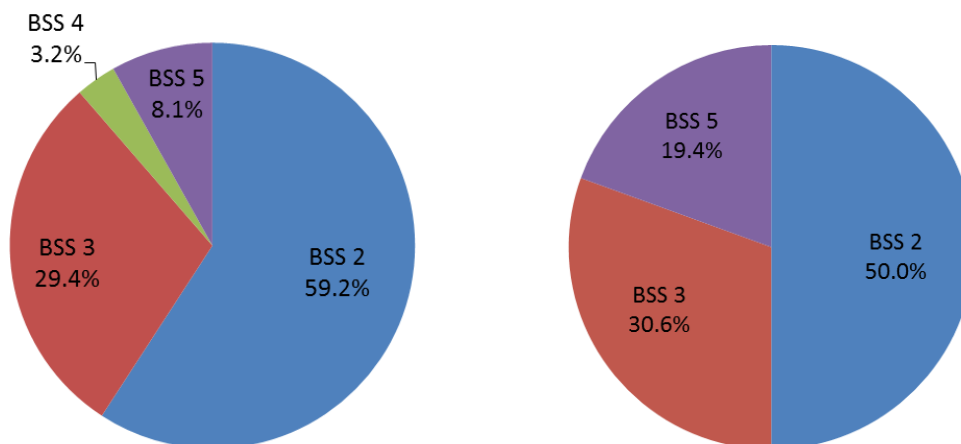


Figure 1. Total percentage of effort (left) and sightings (right) at various Beaufort Sea States (BSS)

In total, 36 unique sightings (in which each sighting does not include subsequent re-sightings or separate sightings of the same animal(s) made by the MMOs and LOs) comprising at least 393 individual marine animals were recorded during the four days of observation (Figure 2). MMOs made 33 sightings independent of the Navy's LO team (Table 2). The LO team did not have any sightings independent of the MMOs. There were 3 sightings made by both teams. The ship log was obtained at the end of the cruise, but did not contain any new marine mammal or sea turtle information.

Seabird sightings were not recorded on this trip. A total of 215 photographs were taken of sea turtles, *Sargassum*, 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
4 June	2	0	1	3
5 June	4	0	2	6
6 June	11	0	0	11
7 June	13	0	0	13
8 June	3	0	0	3
Total	33	0	3	36

Trials, or sightings in which the MMOs detected animals before the Navy LOs, were successfully conducted on all days of the event, with all of the 36 sightings (100%) available for trials. There was an average rate of 1.15 sightings per hour of effort and an average rate of 1.15 trials per hour of effort across all four days (Table 3). The fourth day of effort (June 7) had the greatest frequency of trials, with 1.87 trials per hour of effort. The greatest frequency of unique sightings also occurred on June 7, with 1.87 sightings per hour of effort (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
4 June	4 hours 50 minutes	3	0.62	3	0.62
5 June	8 hours 42 minutes	6	0.69	6	0.69
6 June	8 hours 49 minutes	11	1.25	11	1.25
7 June	6 hours 57 minutes	13	1.87	13	1.87
8 June	2 hours 3 minutes	3	1.46	3	1.46
Cumulative	31 hours 21 minutes	36	1.15	36	1.15

Of the 36 marine animal sightings, 15 were identified to the species level. Visual sightings included 5 sightings of bottlenose dolphins (*Tursiops truncatus*), 1 sighting of striped dolphins (*Stenella coeruleoalba*), 1 sighting of common dolphins (*Delphinus delphis*), 6 sightings of unidentified dolphins, 3 green sea turtles (*Chelonia mydas*), 5 loggerhead sea turtles (*Caretta caretta*), 13 sightings of unidentified sea turtles, and 2 sightings of unidentified biological activity (Table 4, Figure 2). Photographs of a few of the sightings are provided in Figure 3 and Figure 4.

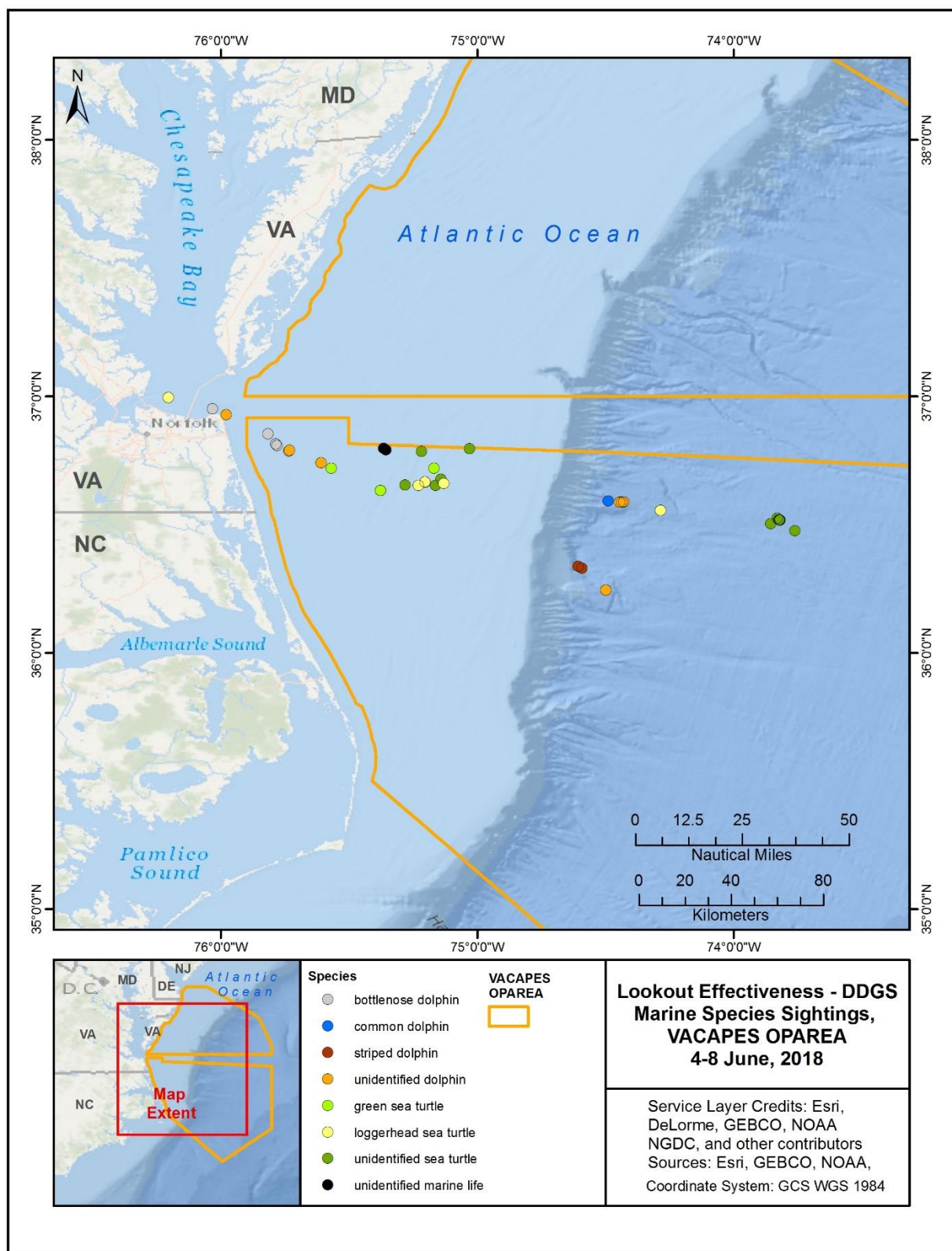


Figure 2. Marine animal sightings in the Virginia Capes Range Complex



Figure 3. Striped dolphins surfacing from Sighting 21 on 7 June 2018



Figure 4. Unidentified sea turtles amongst *Sargassum* mats from Sighting 23 on 7 June 2018

Table 4. Unique Marine Mammal and Sea Turtle Sightings

Data Category	Sighting 1	Sighting 2	Sighting 3	Sighting 4	Sighting 5	Sighting 6
Sighting Information						
Effort	On	On	On	On	On	On
Date	06/04/18	06/04/18	06/04/18	06/05/18	06/05/18	06/05/18
Time (EDT)	13:10	13:42	16:45	7:54	8:05	8:07
Location	36.9284	36.8079	36.6327	36.8149	36.7896	36.7874
	-75.9790	-75.7810	-75.3774	-75.7860	-75.7316	-75.7355
Detection Sensor	MMO	MMO	MMO/LO	MMO/LO	MMO	MMO/LO
Species/Group	Unidentified dolphin	Bottlenose dolphin	Green sea turtle	Bottlenose dolphin	Unidentified dolphin	Bottlenose dolphin
Group Size Estimate (estimated range)	1	2	1	2 (2-3)	3 (2-5)	1 (1-2)
# Calves	0	0	0	0	0	0
Animal Bearing (relative degrees)	35	60	270	20	340	320
Distance (m)	2667	727	6	6	571	20
Animal Motion	Parallel	Parallel	Parallel	Closing	None	Closing
Sighting Cue	Breach	Dorsal fin	Body	Dorsal fin	Dorsal fin	Body
Behavior	Breaching	Traveling	Traveling	Traveling	Traveling	Traveling
Environmental Information						
Beaufort Sea State	3	3	2	2	2	2
Wave Height (ft)	0-3	0-3	0-3	0-3	0-3	0-3
Visibility	E	E	E	E	E	E
Glare (%)	25	25	35	30	30	30
Cloud Cover (%)	20	20	10	17.5	17.5	17.5
Operational Information						
Sonar	Off	Off	Off	Off	Off	Off
Ship Bearing (true degrees)	120	129	335	122	120	120
Mitigation Implemented	No	No	No	No	No	No
Comments			LO saw at same time	LO saw animals 1 minute after MMO		LO saw animals 1 minute 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 7	Sighting 8	Sighting 9	Sighting 10	Sighting 11	Sighting 12
Sighting Information						
Effort	On	On	On	On	On	On
Date	06/05/18	06/05/18	06/05/18	06/06/18	06/06/18	06/06/18
Time (EDT)	8:36	9:50	15:25	7:38	9:15	9:24
Location	36.7414 -75.6090	36.7911 -75.3561	36.7201 -75.5686	36.7966 -75.0296	36.6528 -75.2300	36.6550 -75.2808
Detection Sensor	MMO	MMO	MMO	MMO	MMO	MMO
Species/Group	Unidentified dolphin	Unidentified biological activity	Green sea turtle	Unidentified sea turtle	Loggerhead sea turtle	Unidentified sea turtle
Group Size Estimate (estimated range)	2 (2-3)	2	1	1	1	1
# Calves	0	0	0	0	0	0
Animal Bearing (relative degrees)	45	20	270	335	340	280
Distance (m)	1333	10	100	100	200	65
Animal Motion	Parallel	Parallel	Parallel	None	None	Closing
Sighting Cue	Splash	Body	Body	Body	Body	Body
Behavior	Traveling	Traveling	Traveling	Traveling	Traveling	Traveling
Environmental Information						
Beaufort Sea State	2	2	2	2	2	2
Wave Height (ft)	0-3	0-3	0-3	0-3	0-3	0-3
Visibility	E	E	E	E	E	E
Glare (%)	30	30	0	10	0	0
Cloud Cover (%)	55	35	65	62.5	90	90
Operational Information						
Sonar	Off	Off	Off	Off	Off	Off
Ship Bearing (true degrees)	90.5	90	279.2	140	275	0
Mitigation Implemented	No	No	No	No	No	No
Comments		Possible shark		Possible loggerhead		

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 13	Sighting 14	Sighting 15	Sighting 16	Sighting 17	Sighting 18
Sighting Information						
Effort	On	On	On	On	On	On
Date	06/06/18	06/06/18	06/06/18	06/06/18	06/06/18	06/06/18
Time (EDT)	10:54	12:51	13:05	13:12	13:15	13:24
Location	36.7980 -75.3647	36.7856 -75.2175	36.7204 -75.1692	36.6766 -75.1419	36.6602 -75.1303	36.6529 -75.1620
Detection Sensor	MMO	MMO	MMO	MMO	MMO	MMO
Species/Group	Unidentified biological activity	Unidentified sea turtle	Green sea turtle	Unidentified sea turtle	Loggerhead sea turtle	Unidentified sea turtle
Group Size Estimate (estimated range)	1	1	1	1	1	1
# Calves	0	0	0	0	0	0
Animal Bearing (relative degrees)	35	350	90	90	350	90
Distance (m)	1000	66	3	40	50	5
Animal Motion	None	Closing	Parallel	Opening	Parallel	Parallel
Sighting Cue		Body	Body	Body	Body	Body
Behavior		Traveling	Traveling	Traveling	Logging	Traveling
Environmental Information						
Beaufort Sea State	2	3	3	3	3	3
Wave Height (ft)	0-3	0-3	0-3	0-3	0-3	0-3
Visibility	E	E	E	E	E	E
Glare (%)	2	30	30	30	30	30
Cloud Cover (%)	30	35	35	35	35	35
Operational Information						
Sonar	Off	Off	Off	Off	Off	Off
Ship Bearing (true degrees)	260	112	148	153	154	290
Mitigation Implemented	No	No	No	No	No	No
Comments	Possible sea turtle. Sighting cue and behavior were not recorded					

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

Table 7. Unique Marine Mammal and Sea Turtle Sightings (cont'd)

Data Category	Sighting 19	Sighting 20	Sighting 21	Sighting 22	Sighting 23	Sighting 24
Sighting Information						
Effort	On	On	On	On	On	On
Date	06/06/18	06/06/18	06/07/18	06/07/18	06/07/18	06/07/18
Time (EDT)	13:27	13:27	6:55	7:40	12:05	13:09
Location	36.6651	36.6672	36.3375	36.2440	36.5031	36.5247
	-75.2040	-75.2034	-74.6074	-74.4980	-73.8560	-73.8308
Detection Sensor	MMO	MMO	MMO	MMO	MMO	MMO
Species/Group	Unidentified sea turtle	Loggerhead sea turtle	Striped dolphin	Unidentified dolphin	Unidentified sea turtle	Unidentified sea turtle
Group Size Estimate (estimated range)	1	1	10 (5-30)	30 (20-50)	160 (110-200)	160 (100-200)
# Calves	0	0	0	0	0	0
Animal Bearing (relative degrees)	90	315	330	340	270	270
Distance (m)	100	100	2667	1600	6	300
Animal Motion	Parallel	Opening	Opening	None	None	None
Sighting Cue	Body	Body	Splash	Splash	Body	Body
Behavior	Traveling	Traveling	Milling	Bowriding	Logging	Logging
Environmental Information						
Beaufort Sea State	3	3	3	3	5	5
Wave Height (ft)	0-3	0-3	0-3	0-3	0-3	0-3
Visibility	E	E	E	E	E	E
Glare (%)	30	30	30	30	30	40
Cloud Cover (%)	45	45	0	0	10	11.5
Operational Information						
Sonar	Off	Off	Off	Off	Off	Off
Ship Bearing (true degrees)	291	291	130	120	270	140
Mitigation Implemented	No	No	No	No	No	No
Comments			MMO sighted same group at 7:03	Dolphins were bowriding the oiler after RAS	Multiple turtles in <i>Saragasm</i> mats, off Port and Stbd side. SMMOs counted turtles for 5 min, estimated 3-5 turtles per min. 20 min= 80 turtles for each SMMO	Multiple turtles in <i>Sargasum</i> mats, off Port and Stbd side. SMMOs counted turtles for 5 min, estimated 3-5 turtles per min. 20 min= 80 turtles for each SMMO

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

Table 8. Unique Marine Mammal and Sea Turtle Sightings (cont'd)

Data Category	Sighting 25	Sighting 26	Sighting 27	Sighting 28	Sighting 29	Sighting 30
Sighting Information						
Effort	On	On	On	On	On	On
Date	06/07/18	06/07/18	06/07/18	06/07/18	06/07/18	06/07/18
Time (EDT)	13:19	13:21	13:23	13:24	14:46	18:34
Location	36.5189 -73.8240	36.5182 -73.8227	36.5178 -73.8214	36.5169 -73.8198	36.4768 -73.7623	36.5552 -74.2852
Detection Sensor	MMO	MMO	MMO	MMO	MMO	MMO
Species/Group	Unidentified sea turtle	Unidentified sea turtle	Unidentified sea turtle	Unidentified sea turtle	Unidentified sea turtle	Loggerhead sea turtle
Group Size Estimate (estimated range)	1	1	2	4 (3-5)	128 (96-160)	1
# Calves	0	0	0	0	0	0
Animal Bearing (relative degrees)	340	315	315	315	90	320
Distance (m)	30	30	50	50	50	50
Animal Motion	Parallel	Parallel	Parallel	Parallel	Parallel	Closing
Sighting Cue	Body	Body	Body	Body	Body	Body
Behavior	Logging	Logging	Logging	Logging	Logging	Diving
Environmental Information						
Beaufort Sea State	5	5	5	5	5	2
Wave Height (ft)	0-3	0-3	0-3	0-3	0-3	0-3
Visibility	E	E	E	E	E	E
Glare (%)	40	40	40	40	10	40
Cloud Cover (%)	11.5	11.5	11.5	11.5	7.5	11
Operational Information						
Sonar	Off	Off	Off	Off	Off	Off
Ship Bearing (true degrees)	140	140	140	140	75	284
Mitigation Implemented	No	No	No	No	No	No
Comments	Individual turtle not associated with <i>Sargasum</i> mats	Individual turtle not associated with <i>Sargasum</i> mats	Group of turtles not associated with <i>Sargasum</i> mats	Group of turtles not associated with <i>Sargasum</i> mats	Multiple turtles in <i>Sargasum</i> mats, off Port and Stbd side. SMMOs counted turtles for 5 min, estimated 1-3 turtles per min. 16 min= 64 turtles for each SMMO	Individual turtle not associated with <i>Sargasum</i> mats

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

Table 9. Unique Marine Mammal and Sea Turtle Sightings (cont'd)

Data Category	Sighting 31	Sighting 32	Sighting 33	Sighting 34	Sighting 35	Sighting 36
Sighting Information						
Effort	On	On	On	On	On	On
Date	06/07/18	06/07/18	06/07/18	06/08/18	06/08/18	06/08/18
Time (EDT)	19:13	19:19	19:29	8:04	9:01	9:35
Location	36.5883 -74.4287	36.5878 -74.4367	36.5916 -74.4892	36.8545 -75.8162	36.9514 -76.0321	36.9960 -76.2035
Detection Sensor	MMO	MMO	MMO	MMO	MMO	MMO
Species/Group	Unidentified dolphin	Unidentified dolphin	Common dolphin	Bottlenose dolphin	Bottlenose dolphin	Loggerhead sea turtle
Group Size Estimate (estimated range)	1	6 (4-9)	12 (10-15)	4 (3-5)	2 (2-5)	1
# Calves	0	0	0	0	0	0
Animal Bearing (relative degrees)	315	40	45	90	355	315
Distance (m)	667	1333	571	571	3	3
Animal Motion	Opening	Opening	Closing	Parallel	Opening	None
Sighting Cue	Splash	Splash	Splash	Dorsal fin	Body	Body
Behavior	Traveling	Traveling	Traveling	Traveling	Traveling	Diving
Environmental Information						
Beaufort Sea State	2	2	2	2	2	2
Wave Height (ft)	0-3	0-3	0-3	0-3	0-3	0-3
Visibility	E	E	E	E	E	E
Glare (%)	40	40	40	10	0	0
Cloud Cover (%)	11	11	11	60	20	20
Operational Information						
Sonar	Off	Off	Off	Off	Off	Off
Ship Bearing (true degrees)	291	286	268	300	342	289
Mitigation Implemented	No	No	No	No	No	No
Comments	MMO sighted same group at 19:17 with more animals: 5 (3-7)					

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 eighteenth 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-S. 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.