June 2011

Cruise Report, Marine Species Monitoring & Lookout Effectiveness Study

Submarine Commanders Course 11-1 and Undersea Warfare Exercise

February 2011, Hawaii Range Complex

Prepared for:
Commander, Pacific Fleet

Prepared by:

Ms. Amy Farak – Naval Undersea Warfare Center Division, Newport
Dr. Thomas Jefferson – HDR
Ms. Julie Rivers – United States Pacific Fleet Environmental Readiness
Dr. Robert Uyeyama – Naval Facilities Engineering Command, Pacific

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ft	foot (feet)
km	kilometer(s)
m	meter(s)
MFAS	mid-frequency active sonar
MMO	marine mammal observer
nm	nautical mile(s)
yd(s)	yard(s)

SECTION 1 INTRODUCTION

In order to address requirements under the Marine Mammal Protection Act Letters of Authorization permitted to the U.S. Navy, three U.S. Navy civilian marine mammal observers (MMOs; Ms. Amy Farak, Ms. Julie Rivers, and Dr. Robert Uyeyama) and one U.S. Navy contractor (Dr. Thomas A. Jefferson) participated in two consecutive ASW exercise events in the Hawaii Range Complex from 15-22 February, 2011 (Figure 1). These MMOs were stationed aboard a U.S. Navy destroyer, hereafter referred to as DDG-D. The goals of the monitoring and this study were to:

1. Collect data to assess the effectiveness of the Navy lookout team.
2. Obtain data to characterize the possible exposure of marine species to mid-frequency active sonar (MFAS).
3. Achieve close coordination between the contracted aerial survey team, Navy aircraft on the range, range control, and the MMO team aboard DDG-D to facilitate maximizing survey time and project safety.

1.1. SHIPBOARD MONITORING

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-D to accomplish its mission objectives. The exceptions would be if a marine mammal or sea turtle was sighted by the MMO within the shut-down zone during MFAS use (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 MMO survey on DDG-D was conducted on the bridge wings (elevated 66 feet [ft; 20 m] above the waterline), with two MMOs actively search for marine mammals and sea turtles, one MMO recording data, and one MMO acting as a liaison with the bridge team/lookouts to relay their sightings. Liaison MMO and recording MMO would also search while not otherwise engaged in their primary role. 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.

1.2. AERIAL MONITORING

Aerial surveys were conducted during the Submarine Commanders Course (16-18 February) under contract Contract #N62742-10-D-3011 CTO KB07, using similar methods as were used during the August 2008/09 and February 2009/10 surveys, including ship-following orbital tracks, shoreline surveys, and assisting in the pre-exercise tagging effort. The primary goals of the aerial monitoring were to locate and identify marine species before, during, and after the training event, and to monitor and report observations of their behavior. This included monitoring for any potentially injured or harmed marine species and any unusual behavior or changes in behavior, distribution, numbers, and species associations of animals observed during the training event. Communications between the survey aircraft and the MMO team aboard DDG-D were enabled by an aviation VHF radio handset brought by the MMO team.

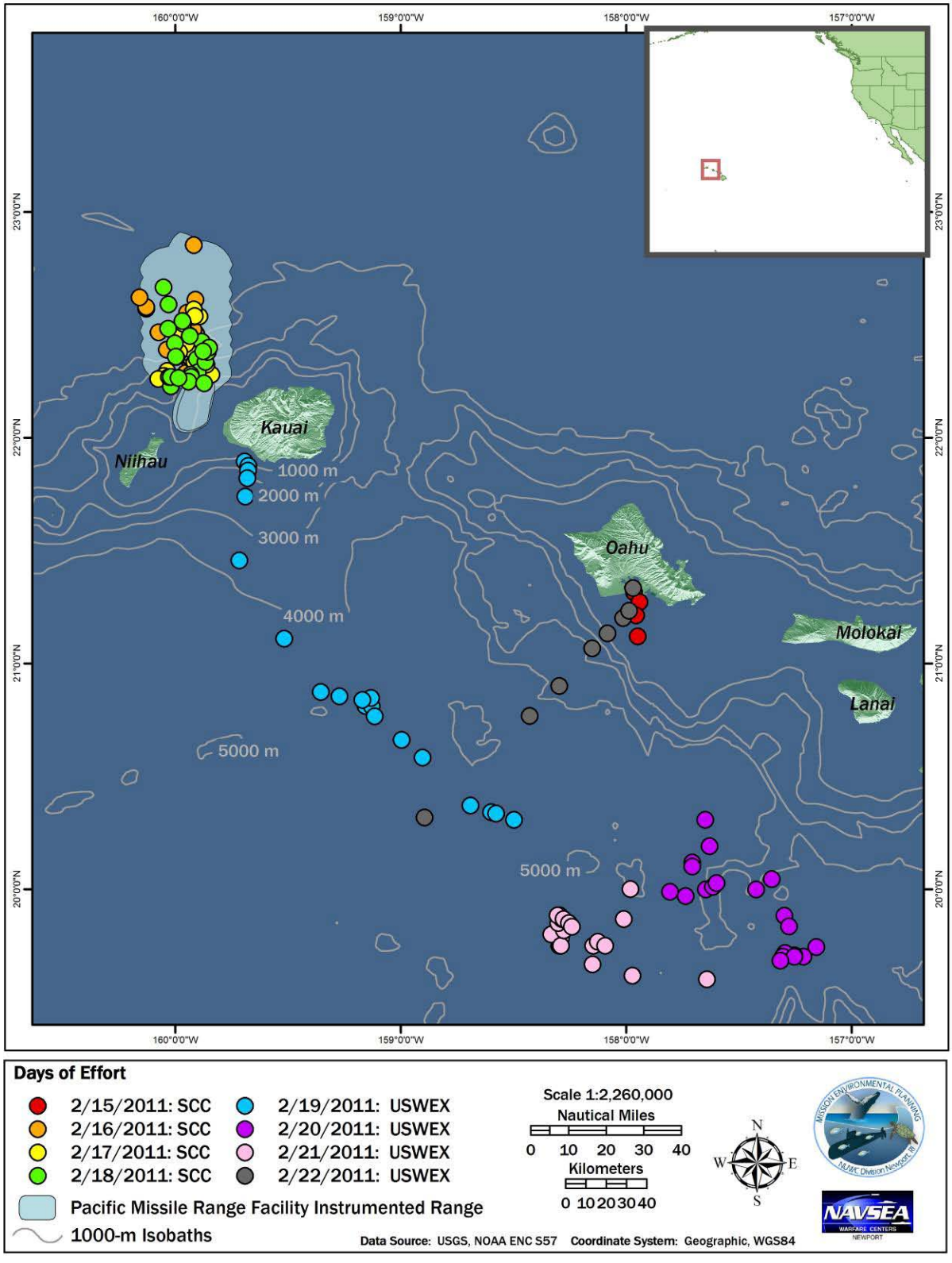

Figure 1. Location of MMO Effort

In addition to this Navy cruise report focusing on shipboard activities, the aerial survey contractor (Dr. Joseph Mobley, HDR) will provide a comprehensive scientific report detailing their methods, observations, and recommendations.

SECTION 2 RESULTS

2.1. SHIPBOARD MONITORING

Effort and environmental information was collected when the MMOs began effort, at each rotation, and as significant weather changes occurred. The MMO team spent 61 hours 31 minutes, and 10 seconds searching for marine species during the two training events (Table 1). For all four observers, a total of 246 hours, 4 minutes, and 40 seconds of marine species shipboard monitoring was conducted. Beaufort Sea States ranged from 1 to 6, with the majority of the time occurring in Sea States 3 – 5 (Figure 2 and Figure 3). Unexpectedly, periods of low sea states in offshore waters southwest of Oahu occurred on 19 February (Figure 4). This allowed for better sighting conditions and allowed for additional species identification. From 16 – 18 February, effort was located to the north and west of Kauai, whereas 20-21 February were spent south of Oahu; all other days were spent transiting to and from these areas.

Table 1. Effort Hours and Environmental Conditions

Date	Team Hours On-Effort	Beaufort Sea State (range)	% Cloud Cover	Visibility
15 Feb 11	58 min 20 sec	2 – 4	80 – 90	Excellent
16 Feb 11	9 hr 33 min 29 sec	3 – 6	70 – 100	Good – Moderate
17 Feb 11	9 hr 31 min 34 sec	5 – 6	70 – 100	Good – Moderate
18 Feb 11	9 hr 26 min 50 sec	2 – 6	15 – 75	Good – Moderate
19 Feb 11	9 hr 12 min 41 sec	1 – 4	60 – 90	Good – Moderate
20 Feb 11	9 hr 0 min 07 sec	3 – 6	25 – 95	Good – Moderate
21 Feb 11	8 hr 42 min 40 sec	3 – 5	30 – 100*	Poor – Moderate
22 Feb 11	4 hr 5 min 29 sec	3 – 4	25 – 50	Good
Total	**60 hr 31 min 10 sec** (242 hours, 4 minutes, 40 seconds for 4 observers)	**1 – 6**	**25 – 100**	**Poor – Good**

** rain encountered*

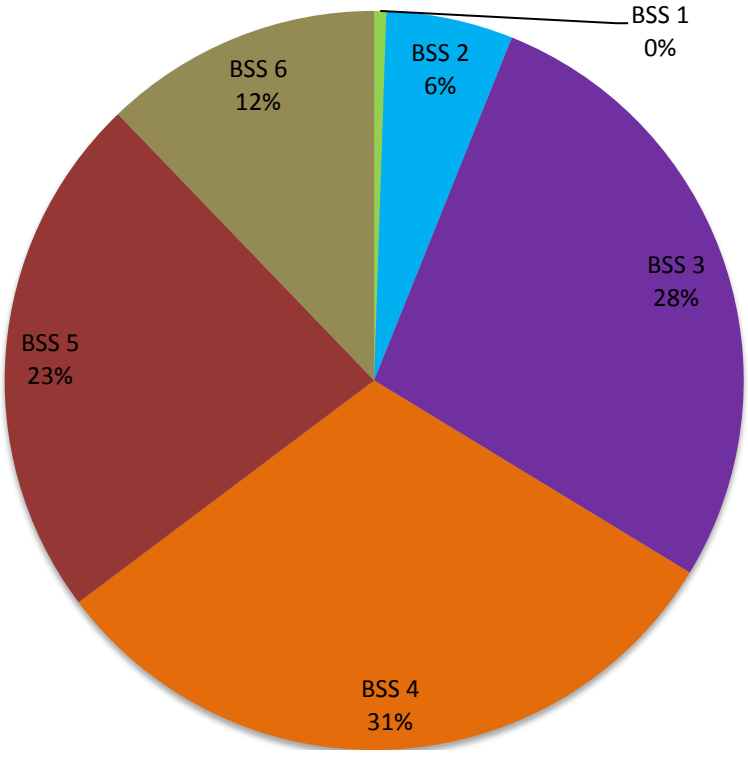

Figure 2. Total Percentage of Effort at Beaufort Sea States

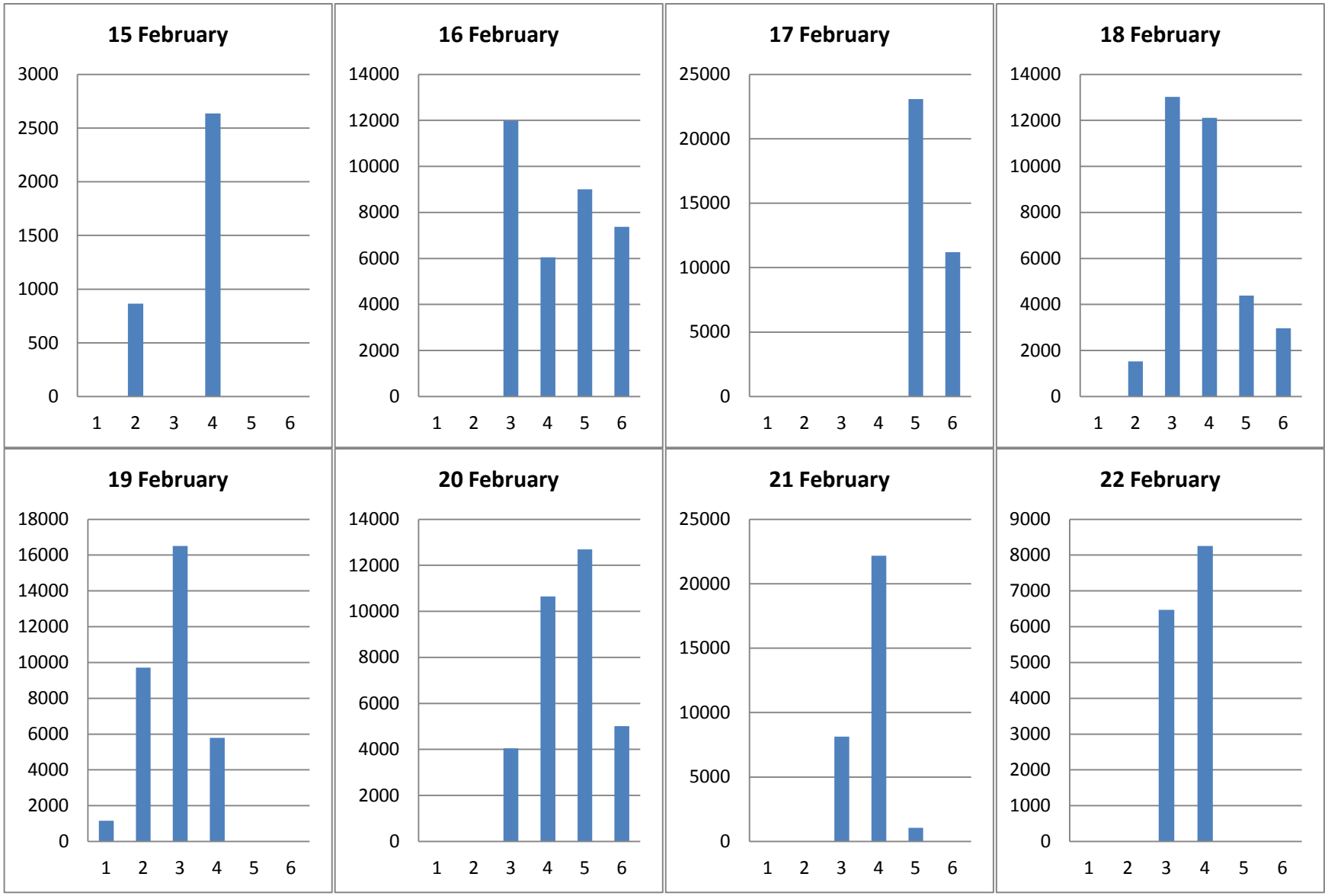

Figure 3. Daily Percentage of Effort at Beaufort Sea States

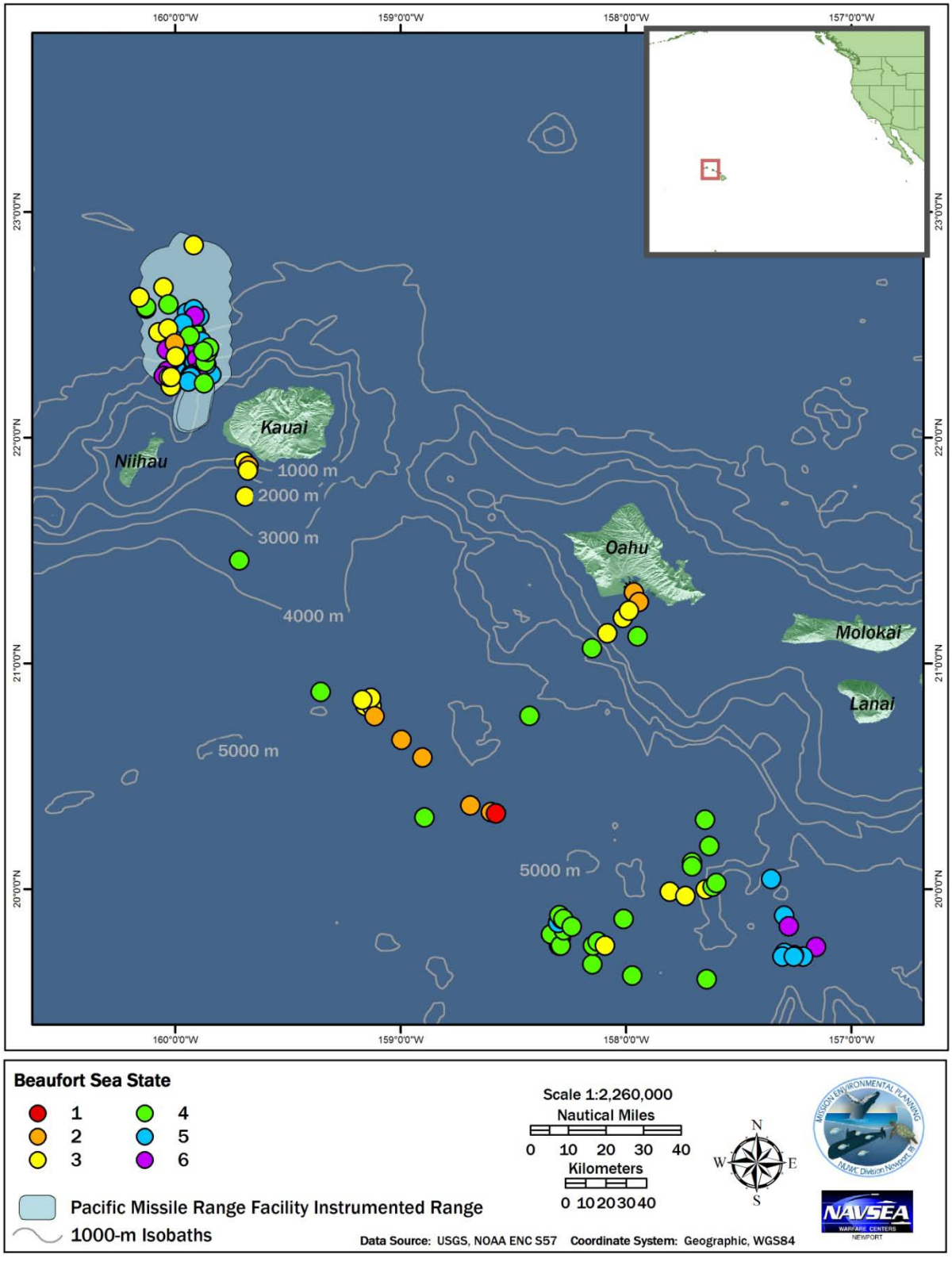

Figure 4. Beaufort Sea State at Effort Locations

In total, 35 sightings of marine mammals and one sea turtle were recorded during the eight days of observation (Table 4 and Figure 5). Two sightings (sighting numbers 34 and 35) were made by the Navy lookout team during entry into port. The MMOs, however, question the validity of these data points, as the lookout making the sighting was not a normal lookout, he was focused on obtaining bearings to landmarks for safe navigation, and the MMOs were not able to resight the animals, even when they were indicated as being close aboard the vessel. As such, these sightings data are included in Table 4, but are not included in the additional summary tables below.

Seventeen of the sightings were made independently by the MMOs, that is, not seen by the Navy lookout team (Table 2). Additionally, five sightings were made by the Navy lookout team but were not sighted by the MMOs and species information could not be obtained. Eighteen sightings were identifiable to species; one sighting each of Risso's dolphin (*Grampus griseus*), spinner dolphin (*Stenella longirostris*), striped dolphin (*Stenella coeruleoalba*), pilot whale (*Globicephala macrorhynchus*), and green turtle (*Chelonia mydas*), and 13 sightings of humpback whales (*Megaptera novaeangliae*; Table 3).

Table 2. Marine Mammal and Sea Turtle Sightings by Observer

Date	Independent MMO Sightings	Independent Navy Lookout Team Sightings	Sightings by both Teams
15 Feb	0	1	4
16 Feb	3	0	0
17 Feb	4	0	1
18 Feb	4	2	3
19 Feb	3	1	2
20 Feb	1	0	0
21 Feb	0	0	0
22 Feb	2	1	2
Total	**17**	**6**	**11**

Table 3. Unique sightings by species

Species	Unique animal group sightings	Total number of animals (based on best group size estimate)
Risso's dolphin	1	40
Spinner dolphin	1	45
Striped dolphin	1	23
Pilot whale	1	18
Humpback whale	13	27
Unidentified *Stenella* sp.	1	10
Unidentified small cetacean	1	10
Unidentified balaenopterid	2	3
Unidentified whale	12	16
Green sea turtle	1	1
Total	**34**	**176**

Table 4. Marine Mammal and Sea Turtle Sightings

Data Category	Sighting 1	Sighting 2	Sighting 3	Sighting 4	Sighting 5	Sighting 6	Sighting 7
Sightings Information							
Effort (on/off)	On	On	On	On	On	On	On
Date	2/15/2011	2/15/2011	2/15/2011	2/15/2011	2/15/2011	2/16/2011	2/16/2011
Time	153707	154005	154210	154323	154456	140623	140747
Location	21.3029 -157.9581	21.2926 -157.9524	21.2855 -157.9485	21.2813 -157.9463	21.2813 -157.9463	22.2749 -159.9529	22.2774 -159.9188
Detection Sensor	MMO & Bridge	Bridge	MMO & Bridge	MMO & Bridge	MMO & Bridge	MMO	MMO
Species/Group	Humpback whale	Humpback whale	Humpback whale	Humpback whale	Spinner dolphin	Humpback whale	Humpback whale
Group Size (min/max/best)	2/2/2	1/1/1	3/3/3	1/1/1	40/60/45	1/1/1	1/1/1
# Calves							
Bearing (rel)	20	340	15	25	10	335	345
Distance (m)	5624.45	2011.68	4297.25	3502.28	4297.25	6729.16	15857.29
Environmental Information							
Wave height (ft)	< 3 ft	< 3 ft	< 3 ft	< 3 ft	< 3 ft	> 6 ft	> 6 ft
Visibility	Excellent	Excellent	Excellent	Excellent	Excellent	Moderate	Moderate
BSS	2	2	2	2	2	6	6
% cloud cover	80	80	80	80	80	100	100
% glare						0	0
Operational Information							
Sonar on/off	Off	Off	Off	Off	Off	On	On
Ship bearing (true)						45	45
Animal motion	None		None	None	Closing		
Sighting Cue/ Behavior	Saw 2 blows twice separated by a couple seconds. Animals were traveling	Blow	Saw blow, some surface activity. Animals dove as we approached.	Traveling	Bow riding	Blow	Breaching
Mitigation implemented	None	None	None	None	None	None	None
Comments							

Table 2 (cont). Marine Mammal and Sea Turtle Sightings Information

Data Category	Sighting 8	Sighting 9	Sighting 10	Sighting 11	Sighting 12	Sighting 13	Sighting 14
Sightings Information							
Effort (on/off)	On	On	On	On	On	On	On
Date	2/16/2011	2/17/2011	2/17/2011	2/17/2011	2/17/2011	2/17/2011	2/18/2011
Time	144227	073909	081044	084318	163711	173426	094749
Location	22.3108 -159.9416	22.4286 -159.9663	22.3667 -159.9021	22.2226 -159.8471	22.3145 -160.0236	22.2359 -160.0426	22.2990 -159.8759
Detection Sensor	MMO	MMO	MMO	MMO	MMO	Lookout	MMO & Bridge
Species/Group	Unidentified whale	Unidentified whale	Unidentified whale	Unidentified whale	Unidentified balaenopterid	Unidentified whale	Humpback whale
Group Size (min/max/best)	2/3/2	3/5/4	1/1/1	1/1/1	2/2/2	1/1/1	4/5/4
# Calves							
Bearing (rel)	40	20	270	50	90	278	5
Distance (m)	6118.88	3349.49	4297.25	5624.45	4297.25	804.67	3502.28
Environmental Information							
Wave height (ft)	> 6 ft	4 – 6 ft	4 – 6 ft	4 – 6 ft	4 – 6 ft	4 – 6 ft	4 – 6 ft
Visibility	Moderate	Good	Good	Good	Moderate	Moderate	Moderate
BSS	6	5	5	5	5	6	4
% cloud cover	100	75	80	80	100	100	60
% glare	0	0	25	25	0	0	0
Operational Information							
Sonar on/off	On	On	Off	Off	Off	Off	On
Ship bearing (true)	270	180		47	209	32	15
Animal motion		None	None	None	None		
Sighting Cue/ Behavior	Blow	At least 3 bushy, angled blows.	Blow	Blow	Blow	Small, whale-sized head sticking out of water.	Multiple blows, animals fluked.
Mitigation implemented	None	None	None	None	None	None	Bridge slowed upon initial sighting, and subsequently turned off sonar.
Comments	Potentially the same animal as sighting 7.	Unknown if angled blow was due to wind. Likely humpback or sperm whales.			Probable humpback whale	Saw with naked eye. Possible minke based on description.	Changed travel direction, split into two groups and dove under us as ship approached*

* see raw data sheets for detailed behavioral observations for this sighting

Table 2 (cont). Marine Mammal and Sea Turtle Sightings Information

Data Category	Sighting 15	Sighting 16	Sighting 17	Sighting 18	Sighting 19	Sighting 20	Sighting 21
Sightings Information							
Effort (on/off)	On	On	On	On	On	On	On
Date	2/18/2011	2/18/2011	2/18/2011	2/18/2011	2/18/2011	2/18/2011	2/18/2011
Time	095827	101134	105832	130944	142612	151134	171121
Location	22.3244 -159.8681	22.3648 -159.8757	22.3709 -159.8668	22.6786 -160.0604	22.5441 -160.0344	22.4620 -160.0066	22.2279 -160.0463
Detection Sensor	Bridge	Bridge	MMO	MMO	MMO	MMO & Bridge	MMO & Lookout
Species/Group	Unidentified whale	Unidentified whale	Unidentified whale	Unidentified whale	Unidentified whale	Pilot whale	Humpback whale
Group Size (min/max/best)		1	1/2/1	1/1/1	2/2/2	12/30/18	2/3/2
# Calves							
Bearing (rel)	port bow	20	271	340	340	355	80
Distance (m)	1828.8	9144	6729.16	4297.25	732.71	1623.53	2343.29
Environmental Information							
Wave height (ft)	4 – 6 ft	4 – 6 ft	4 – 6 ft	< 3 ft	4 – 6 ft	< 3 ft	< 3 ft
Visibility	Moderate	Moderate	Good	Good	Moderate	Good	Good
BSS	4	4	4	3	4	3	3
% cloud cover	60	60	0	70	25	40	45
% glare	0	0	75	0	70	60	25
Operational Information							
Sonar on/off	On	On	Off	Off	Off	Off	Off
Ship bearing (true)		80	293	333	181	turning	
Animal motion			None		None	None	Parallel
Sighting Cue/ Behavior		Blow	Blow	Blow	Blow	resting	Traveling
Mitigation implemented	None	None	None	None	None	None	None
Comments							

Table 2 (cont). Marine Mammal and Sea Turtle Sightings Information

Data Category	Sighting 22	Sighting 23	Sighting 24	Sighting 25	Sighting 26	Sighting 27
Sightings Information						
Effort (on/off)	On	On	On	On	On	On
Date	2/18/2011	2/19/2011	2/19/2011	2/19/2011	2/19/2011	2/19/2011
Time	173349	071041	092419	093604	095943	165504
Location	22.2680 -160.0411	21.8983 -159.6893	21.3597 -159.7108	21.3093 -159.6861	21.2026 -159.6281	20.4026 -158.7243
Detection Sensor	MMO	MMO & Lookout	Lookout	MMO	MMO	MMO & Lookout
Species/Group	Humpback whale	Humpback whale	Unidentified whale	Unidentified *Stenella* sp.	Unidentified balaenopterid	Striped dolphin
Group Size (min/max/best)	1/1/1	4/4/4	1	5/20/10	1/1/1	15/30/23
# Calves		1				
Bearing (rel)	65	356	355	110	20	330
Distance (m)	6118.88			1623.53	4862.98	1623.53
Environmental Information						
Wave height (ft)	< 3 ft	< 3 ft	< 3 ft	< 3 ft	< 3 ft	< 3 ft
Visibility	Good	Moderate	Good	Good	Good	Good
BSS	3	2	4	4	4	2
% cloud cover	45	95	60	60	60	90
% glare	25	0	20	20	20	5
Operational Information						
Sonar on/off	Off	Off	Off	Off	Off	Off
Ship bearing (true)	90	100	182	154	133	108
Animal motion	None	Parallel		Parallel		Parallel
Sighting Cue/Behavior	Blow	Animals were observed resting at the surface. Two animals fluked up but came right back to same spot. At end of sighting, animals were slowly traveling northward along coast.	Saw blow and fluke.	Splashes, small *Stenella* sized bodies observed	Tall, thin blow at initial distance, then a flukeprint and a less distinguished blow observed past the beam.	Porpoising
Mitigation implemented	None	None	Ship turned immediately to 152 deg, unknown if it was a result of the whale sighting or tactical maneuvers.		None	None
Comments					Likely blue, fin, or sei whale; 99% sure not a humpback.	

Table 2 (cont). Marine Mammal and Sea Turtle Sightings Information

Data Category	Sighting 28	Sighting 29	Sighting 30	Sighting 31	Sighting 32	Sighting 33
Sightings Information						
Effort (on/off)	On	On	On	On	On	On
Date	2/19/2011	2/20/2011	2/22/2011	2/22/2011	2/22/2011	2/22/2011
Time	174633	084717	125707	131453	134530	135538
Location	20.3223 -158.5413	20.0198 -157.7719	21.2141 -158.0171	21.2179 -158.0123	21.2586 -157.9580	23.7744 -157.9386
Detection Sensor	MMO	MMO	MMO	Bridge	MMO & Lookout	MMO
Species/Group	Risso's dolphin	Unidentified small cetacean	Humpback whale	Unidentified whale	Unidentified whale	Humpback whale
Group Size (min/max/best)	32/50/40	5/20/10	3/4/3	1	1	2/2/2
# Calves						
Bearing (rel)	340	70	50	110	350	40
Distance (m)	3210.01	5624.45	6729.16	2040.56	182.88	4297.25
Environmental Information						
Wave height (ft)	< 3 ft	4 – 6 ft	< 3 ft	< 3 ft	< 3 ft	< 3 ft
Visibility	Good	Good	Good	Good	Good	Good
BSS	1	4	3	3	3	3
% cloud cover	90	40	50	45	45	45
% glare	0	15	0	0	0	0
Operational Information						
Sonar on/off	Off	Off	Off	Off	Off	Off
Ship bearing (true)	110	238	58		60	
Animal motion	Parallel	None				
Sighting Cue/ Behavior	Saw bodies, animals were milling	Saw splashes and body.	Blow, resting at surface	Blow	Blow	Blow, animals traveling
Mitigation implemented		None	None	None	None	None
Comments	Black, smallish body, tall dorsals, 3 m long, blunt head; everything consistent with Risso's. Animals milling in loose dispersed group; at one point some were coming out of water more as if to bow ride, but then didn't. Some porpoised out of water, saw one leap out of water; most animals darker coloration, but some were whiteish.	Vessel was maneuvering, could not resight the animals.		Distance not provided by bridge personnel, estimated by MMO after sighting.		

Table 2 (cont). Marine Mammal and Sea Turtle Sightings Information

Data Category	Sighting 34	Sighting 35	Sighting 36
Sightings Information			
Effort (on/off)	On	On	On
Date	2/22/2011	2/22/2011	2/22/2011
Time	135819	140349	140349
Location	21.2821 -157.9459	21.3014 -157.9573	21.3014 -157.9573
Detection Sensor	Lookout	Lookout	MMO & Lookout
Species/Group	Unidentified whale	Unidentified whale	Green turtle
Group Size (min/max/best)	1	2	1/1/1
# Calves			
Bearing (rel)	45	170	70
Distance (m)	137.16	2754.73	15.24
Environmental Information			
Wave height (ft)	< 3 ft	< 3 ft	< 3 ft
Visibility	Good	Good	Good
BSS	3	3	3
% cloud cover	45	45	45
% glare	0	0	0
Operational Information			
Sonar on/off	Off	Off	Off
Ship bearing (true)		330	330
Animal motion			
Sighting Cue/ Behavior	Blow	Blow	Swimming, dove when reached abeam.
Mitigation implemented	None	None	None
Comments	Animal was not resighted by MMO; as sighting happened while entering port, lookouts were focused on obtaining bearings to landmarks, and different lookouts where on watch, we are unsure if this sighting was actually an animal. Data point not included in future summaries.	Animals were not resighted by MMO; as sighting happened while entering port, lookouts were focused on obtaining bearings to landmarks, and different lookouts where on watch, we are unsure if this sighting was actually an animal. Data point not included in future summaries	

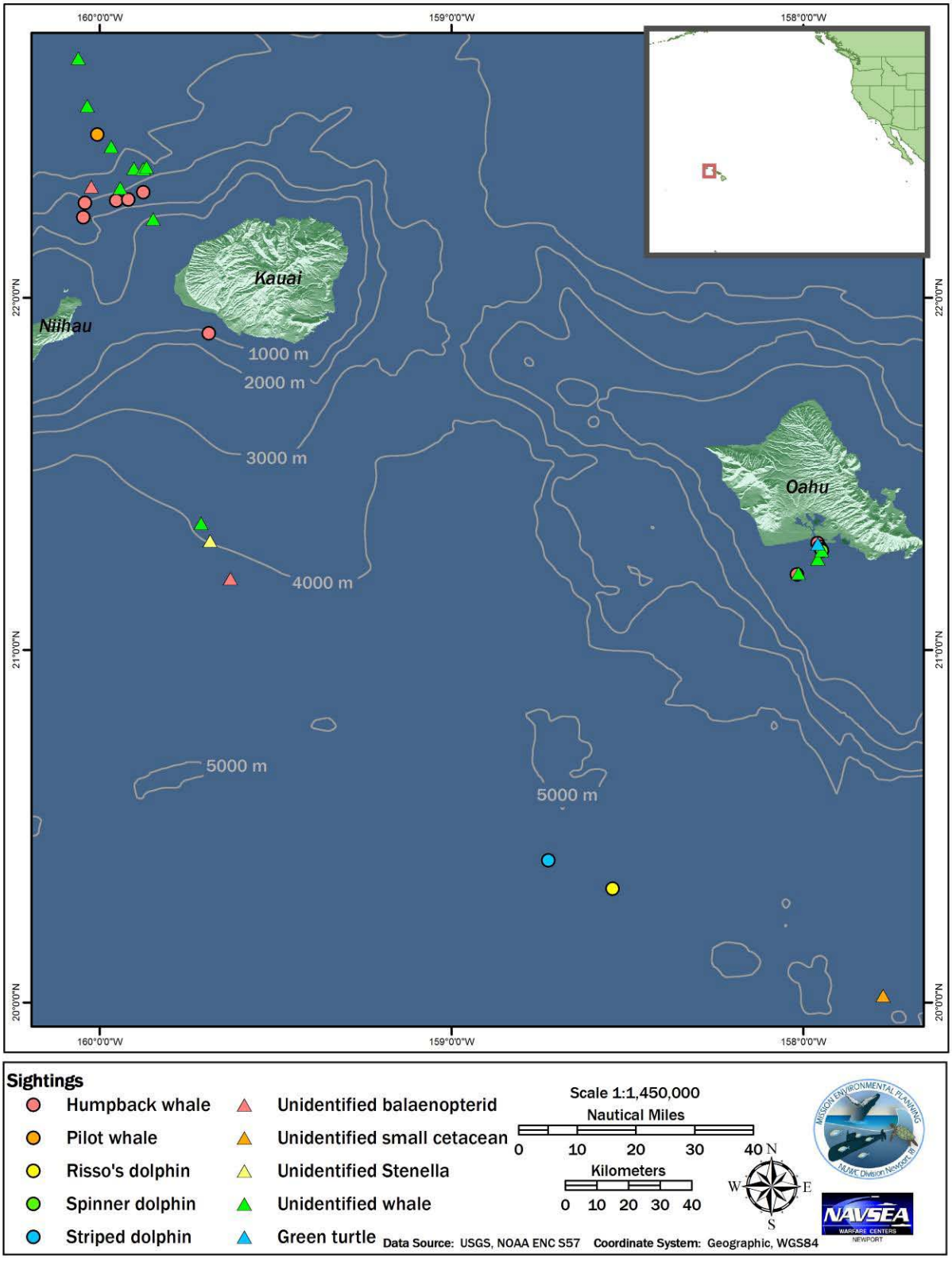

Figure 5. Marine Mammal and Sea Turtle Sighting Locations

Twenty-three of the sightings (68%) were considered trials for the lookout effectiveness study. Trials were conducted on all but one day of the study, for an average rate of 0.38 trials per hour across all eight days (Table 5).

Table 5. Effort Hours, Sighting Rates, and Trial Rates

Date	Hours MMO Team Effort	# of Unique Sightings*	Sightings/ Hour	# of Trials	Trials/Hour
15 Feb	58 min 20 sec	5	5.14	4	4.11
16 Feb	9 hr 33 min 29 sec	3	0.31	3	0.31
17 Feb	9 hr 31 min 34 sec	5	0.52	4	0.42
18 Feb	9 hr 26 min 50 sec	9	0.95	6	0.64
19 Feb	9 hr 12 min 41 sec	6	0.65	4	0.43
20 Feb	9 hr 0 min 07 sec	1	0.11	1	0.11
21 Feb	8 hr 42 min 40 sec	0	0.00	0	0.00
22 Feb	4 hr 5 min 29 sec	5	1.22	1	0.24
Total		**34**	**0.56**	**23**	**0.38**

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

Of particular interest was sighting 14, as behavioral information was able to be gathered while active sonar was in use. Initial sighting of a group of 4 humpback whales was observed approximately 3800 yds (3500 m) from the vessel at bearing 005° relative (as recorded by the MMOs). On the fourth resight of the animals by the MMOs, the bridge team also sighted the animals at an estimated distance of 2000 yds (1800 m) (Note: at the same time, MMO noted the animals at 3 reticles (1154 m) off the starboard bow. Immediately upon sighting the animals, the ship slowed speed to steerage, and called down for CIC to halt active sonar. On the animals' fifth surfacing, the animals had turned sharply away from the vessel, but on the sixth surfacing, turned 180° towards the vessel and dove under the bow of the ship. Two minutes later, the cow calf pair were observed surfacing about 100 yds (91 m) off the port beam and the other two animals were observed about 300 yds (182 m) astern of the vessel. The entire sighting duration was 8 minutes and 18 seconds.

In addition to marine mammal and sea turtle sightings, 93 seabirds were recorded during this effort (Table 6 and Figure 6). Seabird sightings were not recorded if identification at least to family level was not possible. Because seabird data collection was not an objective of this study, data was only collected when it would not interfere with marine mammal data collection. Species observed included Laysan albatross, Red-footed booby, brown booby, black-footed albatross, white-tailed tropicbird, gadfly petrel, gadfly petrel, sooty tern, white tern, and various unidentified birds.

Table 6. Bird Sightings

Date	Sighting Number	Time	Species	Group Size	Location	
15 Feb	1	175611	Tropicbird		21.19842	-157.9591
16 Feb	2	082157	Laysan albatross	1/1/1	22.41833	-159.9656
16 Feb	3	084209	Red-footed booby	1/1/1	22.37158	-159.9337
16 Feb	4	091727	Laysan albatross	1/1/1	22.39036	-159.9380
16 Feb	5	093111	Brown booby	1/1/1	22.42553	-159.9718
16 Feb	6	110035	Booby	1/1/1	22.56667	-160.1281
16 Feb	7	114204	Laysan albatross	3/3/3	22.59389	-160.1658
16 Feb	8	114230	Booby	1/1/1	22.59583	-160.1661
16 Feb	9	133014	Albatross (probable Laysan)		22.35003	-159.9823
16 Feb	10	144828	Red-footed booby		22.32369	-159.9391
16 Feb	11	162954	Laysan albatross		22.46186	-159.9191
16 Feb	12	165131	Black-footed albatross		22.5085	-159.9187
16 Feb	13	172153	Red-footed booby		22.58611	-159.9179
17 Feb	14	072514	Red-footed booby	1/1/1	22.45708	-159.9735
17 Feb	15	073410	Red-footed booby	1/1/1	22.43989	-159.9659
17 Feb	16	074645	Laysan albatross	1/1/1	22.41072	-159.9593
17 Feb	17	082900	Red-footed booby	1/1/1	22.28469	-159.8555
17 Feb	18	090102	Red-footed booby and tropicbird	1 each	22.27064	-159.8378
17 Feb	19	091651	Laysan albatross	1/1/1	22.30983	-159.8790
17 Feb	20	091752	Laysan albatross	2/2/2	22.31222	-159.8819
17 Feb	21	092033	White-tailed tropicbird	1/1/1	22.31483	-159.8909
17 Feb	22	093216	Laysan albatross	1/1/1	22.32406	-159.9278
17 Feb	23	094403	Red-footed booby	1/1/1	22.34608	-159.9534
17 Feb	24	094550	Tropicbird	1/1/1	22.34708	-159.9480
17 Feb	25	111852	Red-footed booby	1/1/1	22.36817	-159.9216
17 Feb	26	131404	Black-footed booby	1/1/1	22.54967	-159.9033
17 Feb	27	162818	Laysan albatross	1/1/1	22.33133	-160.0128
17 Feb	28	163222	Red-footed booby	3/3/3	22.32292	-160.0182
17 Feb	29	163222	Gadfly petrel	1/1/1	22.32292	-160.0182
17 Feb	30	165547	Laysan albatross	1/1/1	22.28331	-160.0436
17 Feb	31	172256	Laysan albatross	1/1/1	22.23558	-160.0579
17 Feb	32	174744	Black-footed albatross	1/1/1	22.25719	-160.0433
18 Feb	33	074629	Red-footed booby	1/1/1	22.39322	-159.8907
18 Feb	34	075345	Laysan albatross	1/1/1	22.37947	-159.8951
18 Feb	35	075611	Red-footed booby	1/1/1	22.37261	-159.8997
18 Feb	36	080817	Laysan albatross	1/1/1	22.33361	-159.9035
18 Feb	37	081520	Red-footed booby	1.1.1	22.26111	-159.9079
18 Feb	38	083450	Laysan albatross	1/1/1	22.29328	-159.9175
18 Feb	39	093043	Laysan albatross	1/1/1	22.23547	-159.8653
18 Feb	40	093600	Red-footed booby	1/1/1	22.25275	-159.8690

Date	Sighting Number	Time	Species	Group Size	Location	
18 Feb	41	093700	Laysan albatross	1/1/1	22.25689	-159.8667
18 Feb	42	103650	Red-footed booby	1/1/1	22.39239	-159.8491
18 Feb	43	104359	Black-footed albatross	1/1/1	22.38467	-159.8516
18 Feb	44	111451	Frigatebird	1/1/1	22.40414	-159.8907
18 Feb	45	113031	Red-footed booby	1/1/1	22.44219	-159.9270
18 Feb	46	113251	Red-footed booby	2/2/2	22.44819	-159.9327
18 Feb	47	130445	Red-footed booby	3/3/3	22.66494	-160.0511
18 Feb	48	141308	Black-footed albatross	1/1/1	22.57042	-160.0347
18 Feb	49	164731	Red-footed booby	1/1/1	22.23097	-159.9903
18 Feb	50	172106	Red-footed booby	1/1/1	22.24142	-160.0559
18 Feb	51	175832	Laysan albatross	1/1/1	22.26414	-159.9815
19 Feb	52	072316	Tropicbird	1/1/1	21.88764	-159.6763
19 Feb	53	073754	Tropicbird	3/3/3	21.84258	-159.6781
19 Feb	54	082609	Red-footed booby	1/1/1	21.62922	-159.7015
19 Feb	55	084415	Red-footed booby	2/2/2	21.5465	-159.7112
19 Feb	56	094530	White-tailed tropicbird		21.26786	-159.6662
19 Feb	57	100607	White-tailed tropicbird	1/1/1	21.17733	-159.6003
19 Feb	58	101125	White-tailed tropicbird	1/1/1	21.15731	-159.5757
19 Feb	59	121057	Unidentified albatross	1/1/1	20.811	-159.1418
19 Feb	60	133451	White-tailed tropicbird	1/1/1	20.81342	-159.1201
19 Feb	61	141155	Red-footed booby	5/5/5	20.84639	-159.1885
19 Feb	62	143429	Booby	4/4/4	20.84642	-159.1961
19 Feb	63	153543	Brown booby	2/2/2	20.66133	-158.9955
19 Feb	64	155701	Sooty terns, dark shearwaters (unknown species), frigatebird	25/45/35	20.59542	-158.9168
20 Feb	65	074609	Frigatebird	1/1/1	20.16344	-157.6577
20 Feb	66	081217	Laysan albatross	1/1/1	20.09725	-157.7113
20 Feb	67	081526	Frigatebird	1/1/1	20.09161	-157.7160
20 Feb	68	105646	Shearwater	1/1/1	20.00678	-157.4329
20 Feb	69	144716	Frigatebird	1/1/1	19.70592	-157.2277
21 Feb	70	072001	Red-footed booby	1/1/1	19.62458	-157.9643
21 Feb	71	074338	Sooty tern	30/50/40	19.15917	-158.0626
21 Feb	72	074855	Buller's Shearwater	1/1/1	19.65717	-158.0859
21 Feb	73	075849	Sooty Tern	6/6/6	19.66903	-158.1299
21 Feb	74	081559	Unidentified tropicbird	1/1/1	19.69011	-158.2057
21 Feb	75	082333	Sooty tern	15/20/18	19.69972	-158.2397
21 Feb	76	082949	Red-footed booby & Sooty tern	35/50/45	19.70767	-158.2678
21 Feb	77	095029	Sooty tern	1/1/1	19.85894	-158.2930
21 Feb	78	114720	Red-footed booby	1/1/1	19.78878	-158.2834
21 Feb	79	133845	Red-footed booby	1/1/1	19.88253	-158.2843
21 Feb	80	153535	Red-footed booby	1/1/1	19.80322	-158.1905

Date	Sighting Number	Time	Species	Group Size	Location	
21 Feb	81	165532	Red-footed booby	2/2/2	19.75808	-158.1070
22 Feb	82	103305	Sooty tern	6/6/6	20.61481	-158.5685
22 Feb	83	104053	Red-footed booby	1/1/1	20.65536	-158.5321
22 Feb	84	104501	Tropicbird	1/1/1	20.67686	-158.6629
22 Feb	85	112705	Tropicbird	3/3/3	20.89217	-158.3138
22 Feb	86	121253	White tern (aka fairy tern)	6/6/6	21.08514	-158.1498
22 Feb	87	121253	Frigatebird	1/1/1	21.08514	-158.1498
22 Feb	88	121905	White tern (aka fairy tern)	1/1/1	21.10631	-158.1315
22 Feb	89	122905	White tern (aka fairy tern)	1/1/1	21.10631	-158.0914
22 Feb	90	122905	Sooty tern	2/2/2	21.10631	-158.0914
22 Feb	91	123123	Tropicbird	1/1/1	21.14728	-158.0820
22 Feb	92	124833	Red-footed booby	16/50/25	21.1935	-158.0275
22 Feb	93	133444	Red-footed booby	1/1/1	21.24503	-157.9803

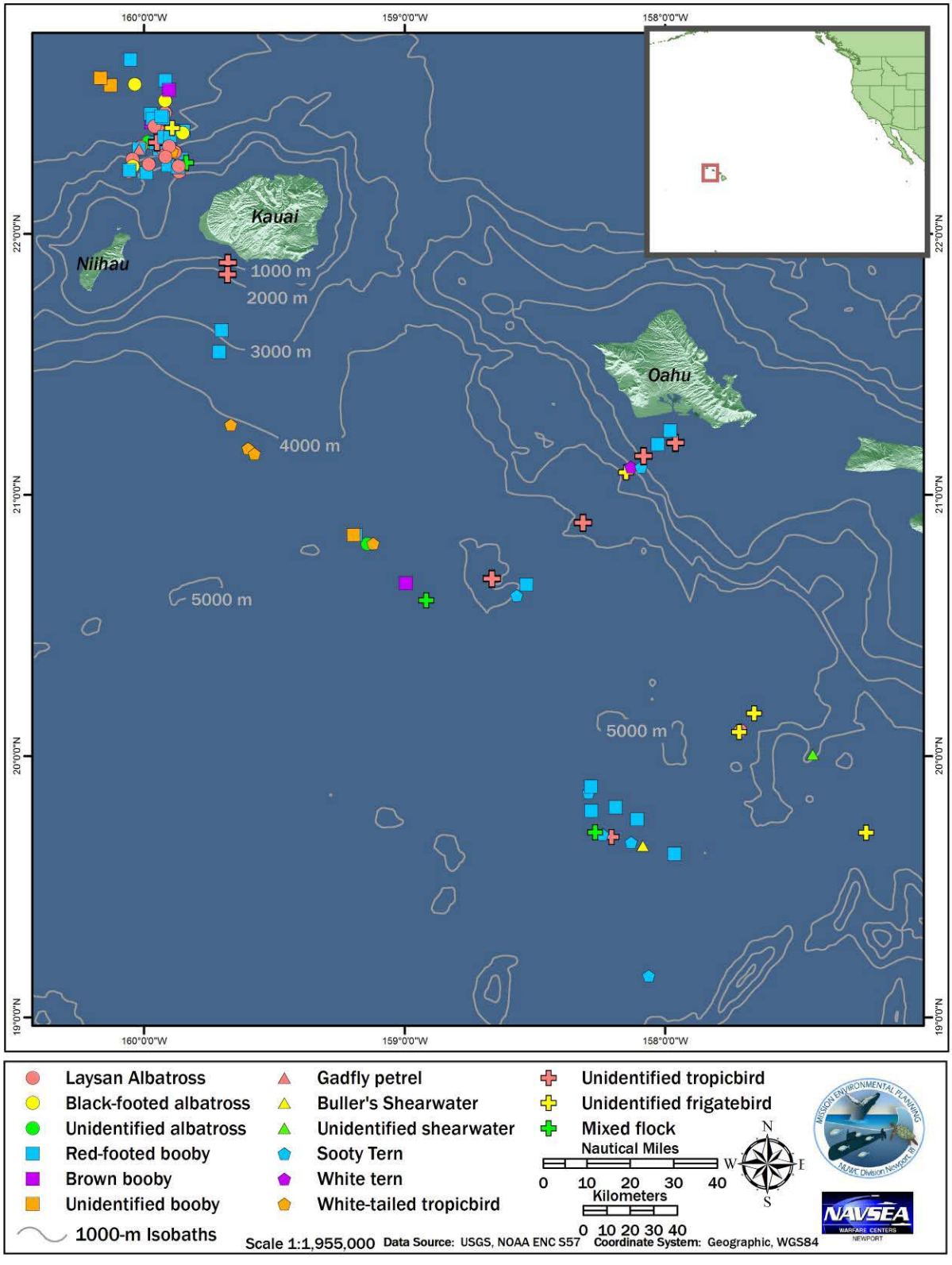

Figure 6. Bird Sighting Locations

2.2. AERIAL MONITORING

Sightings and focal follow information will be reported by the contractor under a separate report.

SECTION 3 CONCLUSION

3.1. MARINE MAMMAL MONITORING GOALS

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.

   The data collected provides the highest number of trials collected in Hawaiian waters. This event is the fourth 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-D. This information can be used to determine, if MFAS was in use, 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.

3. Achieve close coordination between the contracted aerial survey team, Navy aircraft on the range, range control, and the MMO team aboard DDG-D to facilitate maximizing survey time and project safety

   Communication between the survey aircraft, MMOs, range control, and other aircraft was successful, maintaining safety of all participants.

3.2. PROTOCOL AND EQUIPMENT RECOMMENDATIONS

Changes to the data forms, protocols, and recommended equipment and logistics were made by the MMO team, and will be considered for implementation in future studies.

3.2.1. Data Forms

Specific data form recommendations include:

- Sightings form
  - Need to add “Sightings” to the top of the form to distinguish it more easily from the Effort form
  - Combine number of calves and group size into one column
  - Combine animal bearing and distance into one column

  - Hyphenate "Mitigation" and add "Y/N" in cells; specific information on type of mitigation would be added to comments column
  - Change last column to "Behavior/Type of Mitigation/Comments"
  - Add a column field for ship speed; the data was used for the initial data analysis. Rather than actual speeds, categories of speed (e.g., < 5 kts, 5-10 kts, etc) could be used
- Effort Form
  - Need to add "Effort" to the top of the form to distinguish it more easily from the Sightings form.
  - Visibility column can be narrowed, add categories to circle
  - Change glare to total percent glare for 180 degrees; given amount of maneuvering, a 180 degree percent glare would be more useful

3.2.2. Lookout Effectiveness Study Protocol

- Include a cover letter with the report for Navy internal discussions to provide observations not suitable for the report
- A challenge noted by the MMOs is surveying while the ship is moving at high speeds and/or when the relative wind is directly towards the MMOs. Relative wind speeds in excess of 40 kts occurred at various times, making observation for the MMOs and the lookouts difficult. Protocol should account for this type of challenge in detecting animals from which to run trials.
- When the MMOs observe animals directly off the bow that are not observed by the LO team, it can be a challenge to determine when to abandon the trial and inform the LO team for appropriate mitigation. When faced with this challenge, it is recommended that the MMOs err on the side of caution and inform the LO team if the ship is traveling quickly and sonar is active.
- Need to update the protocol document to account for recent changes.
  - As part of the update, eliminate unnecessary information (e.g., history) so that it is more straightforward for what the MMOs will be doing.
  - Report needs to include better description of how sightings are to be numbered (e.g., decimal numbering, when bridge/lookout sees animal at the same time, etc)
- Each lookout acted differently around the MMOs. Some of the lookouts were very aware of our presence and were using us to cue them for animals.
- Need to be careful about indicating when the lookouts arrive or leave the bridge wings; if they can hear us, they are aware we are monitoring them as well.
- Recommendations for a brief to the CO/XO/crew
  - Clarify that the MMOs are not part of their mitigation and that we are not replacing their lookouts nor the chain of command for the lookouts.
  - Request the information on why we are there be provided to the crew; many crewmembers (officers and enlisted) were unsure why we were there.
  - Stress the motivation: the lookouts are the most important form of mitigation, and this importance needs to be made clearer.

- Mitigation requirements for each of the two exercises required discussion between the CPF representative and the ship's officers. Interpretation of the mitigation requirements by the ship's CO and other officers was different than the intent of the mitigation. Discussions between the CPF representative and the ship was required to clarify and correct these discrepancies. For future cruises, recommend the brief include additional information regarding the Fleet messages and PMAP to clarify any questions as they arise.

- DDG-D indicated that sightings made by the MMOs were to be reported with observations made by the lookouts to satisfy daily reporting requirements. Clarification was required to inform the ship that the MMOs were not part of their chain of command with regard to reporting. Recommend future Fleet messages and brief ensure it is clear that sightings made by MMOs are separate from any reporting required for the ship.