Virginia Capes (VACAPES)
Anti-Submarine Warfare Exercise (ASWEX)

Marine Species Monitoring

AERIAL MONITORING SURVEYS

TRIP REPORT

Naval Facilities Engineering Command

31 August and 10 September 2011

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Risso's dolphin off of VACAPES, photo taken under NOAA Permit 14551

Table of Contents

ACRONYMS AND ABBREVIATIONS ii
SECTION 1 INTRODUCTION 1
SECTION 2 METHODS 1
SECTION 3 RESULTS 7
SECTION 4 ACKNOWLEDGEMENTS 15
SECTION 5 REFERENCES 15

Appendix

A. Environmental, Oceanographic, and Sighting Conditions 17
B. Focal Follow Data 19

Figures

Figure 1. Predetermined Tracklines for the Survey Effort for VACAPES ASWEX Monitoring 2
Figure 2. Locations of All Cetacean, Sea Turtle, Ray, Shark, and Sunfish Sightings Seen During VACAPES ASWEX Monitoring (31 Aug and 10 Sept). 4
Figure 3. Locations of Cetacean, Sea Turtle, and Ray Sightings Seen During ASWEX Training (31 August) 5
Figure 4. Locations of Cetacean, Sea Turtle, Ray, and Sunfish Sightings Seen During ASWEX Training (10 September) 6

Tables

Table 1. Summary of Monitoring Effort for the VACAPES ASWEX Training 3
Table 2. Observers and Roles 3
Table 3. Summary of Sightings 8
Table 4. Summary of Sightings and Depth Recorded during Monitoring for VACAPES ASWEX Training. 14

Acronyms and Abbreviations

ASWEX	Anti-Submarine Warfare Exercise
HDR EOC	HDR Environmental, Operations and Construction, Inc.
ICMP	Integrated Comprehensive Monitoring Program
km	kilometer(s)
km^2	square kilometer(s)
m	meter(s)
MMO	marine mammal observer
NM	nautical mile(s)
OPAREA	Operating Area
SPUE	Sightings Per Unit Effort
U.S.	United States
VACAPES	Virginia Capes

Section 1 Introduction

Aerial marine-species monitoring occurred on 31 August and 10 September 2011 for an Anti-Submarine Warfare Exercise (ASWEX) training event off the coast of Virginia in the United States (U.S.) Navy's Virginia Capes (VACAPES) Range Complex. ASWEX events occur periodically throughout the year and allow the U.S. Navy to fulfill essential training requirements.

As part of the compliance requirements of the Marine Mammal Protection Act of 1972 and the Endangered Species Act of 1973, the U.S. Navy developed the Integrated Comprehensive Monitoring Program (ICMP, U.S. Navy 2010). The ICMP applies by regulation to those activities on U.S. Navy training ranges and operating areas (OPAREAs) for which the U.S. Navy sought and received incidental take authorizations. In order to support the U.S. Navy in meeting regulatory requirements for monitoring established under the Final Rules and to provide a mechanism to assist with coordination of program objectives under the ICMP, monitoring of marine mammals and sea turtles during this exercise included visual surveys from a fixed-wing aircraft.

The results of marine mammal monitoring reported here are part of a long-term monitoring effort under the U.S. Navy's Marine Species Monitoring Program **(**Contract # N62470-10-D-3011) issued to HDR Environmental, Operations and Construction, Inc. (HDR EOC).

Section 2 Methods

Study Area

The U.S. Navy's VACAPES OPAREA lies primarily off the coast of Virginia. Protected marine species monitoring conducted during the VACAPES ASWEX training exercise was focused within the U.S. Navy's VACAPES OPAREA boxes 1B1, 1B2, 1B3, 1B4, 2B1, 2B2, 2B3, and 2B4. The VACAPES ASWEX monitoring area is approximately 80 kilometers (km) offshore, covering an area approximately 875 square kilometers (km^2) in size, and ranging in bottom depth from 30 to 1,400 meters (m).

Aerial-Based Monitoring

Aerial-based monitoring was performed on 31 August and 10 September 2011—both during the ASWEX training exercise (see **Figure 1; Table 1**). Survey methods were consistent with currently accepted Distance Sampling theory (Buckland et al. 2001) and followed a well-established protocol used for aerial surveys throughout all U.S. Navy Range Complexes (Smultea et al. 2009). A survey altitude of approximately 305 m at 185 km per hour was maintained while on-effort, but might have varied slightly based on weather conditions in the area. Once a marine mammal sighting was made, a focal-follow circling session was attempted at 305 m or higher if conditions were appropriate (Smultea et al. 2009; refer to the survey methods general survey approach point number 3 on page 9 of this document). A lower altitude of approximately 213 to 244 m was established after focal-follow sessions for photography purposes to provide sharper images required for species identification.

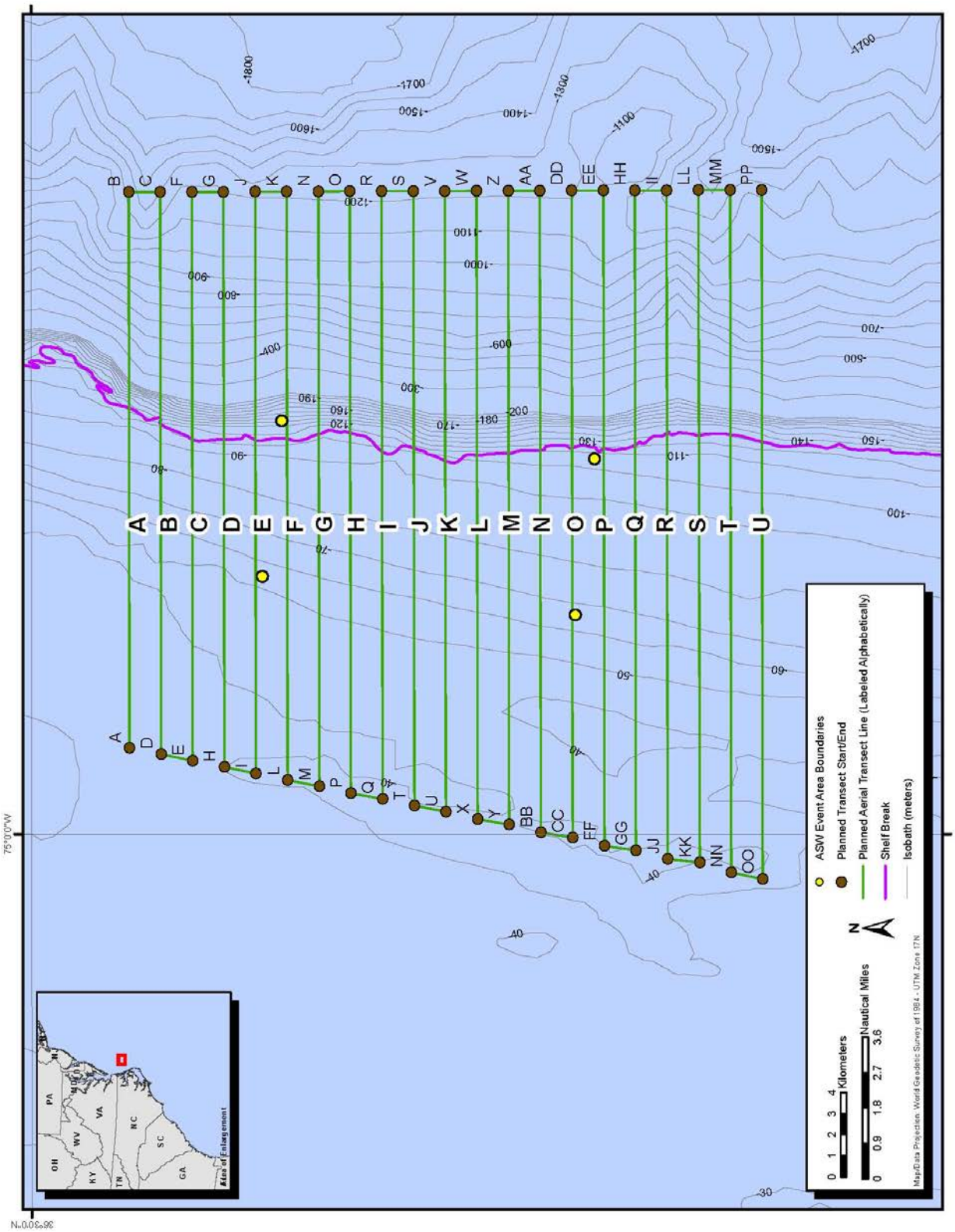

Figure 1. Predetermined Tracklines for the Survey Effort for VACAPES ASWEX Monitoring

Table 1. Summary of Monitoring Effort for the VACAPES ASWEX Training

Date	Description	Start Time	Stop Time	Total Survey Minutes*	Total On-Effort Minutes	Trackline On-Effort Distance (km)
31 August	Transect survey (During Event)	12:35	16:04	209	163	540
10 September	Transect survey (During Event)	13:59	18:05	246	104	350
Total				**455 (≈7.6 hours)**	**267 (≈4.5 hours)**	**890 km**

Note: * Total Survey Minutes reflect minutes flown in the range/area of interest and include both on-effort (systematic) and off-effort (connector/circling) total minutes.

The observation platform was a Cessna T337H Turbo Skymaster aircraft operating out of Norfolk International Airport in Norfolk, Virginia. Two surveys were conducted on 31 August and 10 September following pre-determined transect lines over the ASWEX training exercise area (approximately 875 km^2) and consisting of waypoints designed to extend beyond the planned exercise box (if permitted by U.S. Navy flight operations) during each survey day during each 5-hour maximum survey flight time window (see **Table 1**, **Figure 1**).

Both aerial observers (see **Table 2**) were experienced with line-transect survey methodology, had experience in identification of Atlantic marine mammal and sea turtle species, were knowledgeable of marine mammal biology and behavior, and had previous experience conducting marine mammal and sea turtle observations from aircraft.

Table 2. Observers and Roles

Observer	Role(s)
Dan Engelhaupt	Chief Scientist/Observer
Lenisa Blair	Observer

Twenty-one parallel tracklines running east-west, measuring 26 to 31 km long and spaced approximately 1.4 km apart, were flown during "systematic" efforts throughout the surveys, providing a total survey coverage area of approximately 875 km^2 (see **Figure 1**). Planned lines were followed when possible, but exact transects followed for each survey day were subject to modifications as a result of weather conditions on the range or hourly contact with naval flight operations via increasing the plane's altitude (see **Table 1, Figures 2 through 4**).

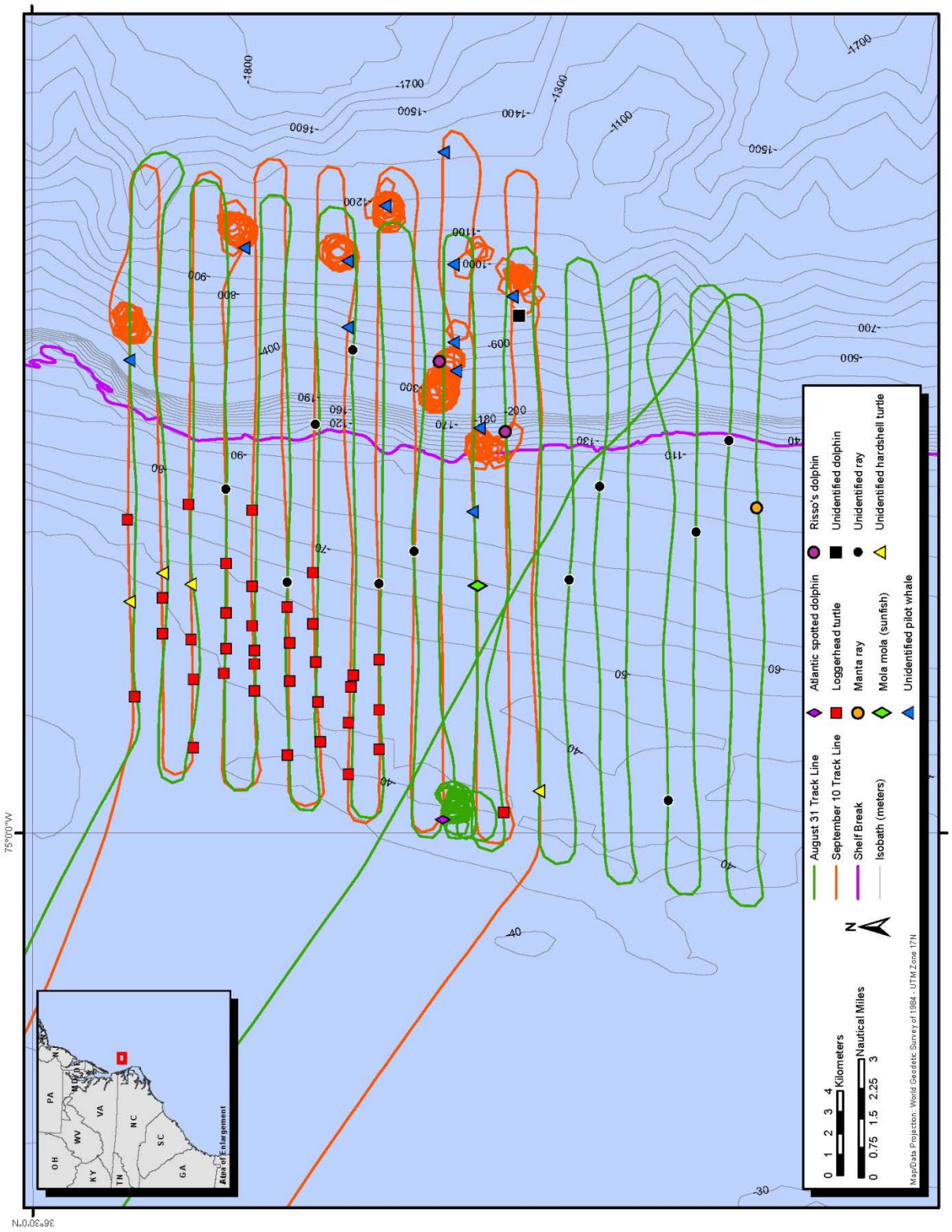

Figure 2. Locations of All Cetacean, Sea Turtle, Ray, Shark, and Sunfish Sightings Seen During VACAPES ASWEX Monitoring (31 Aug and 10 Sept).

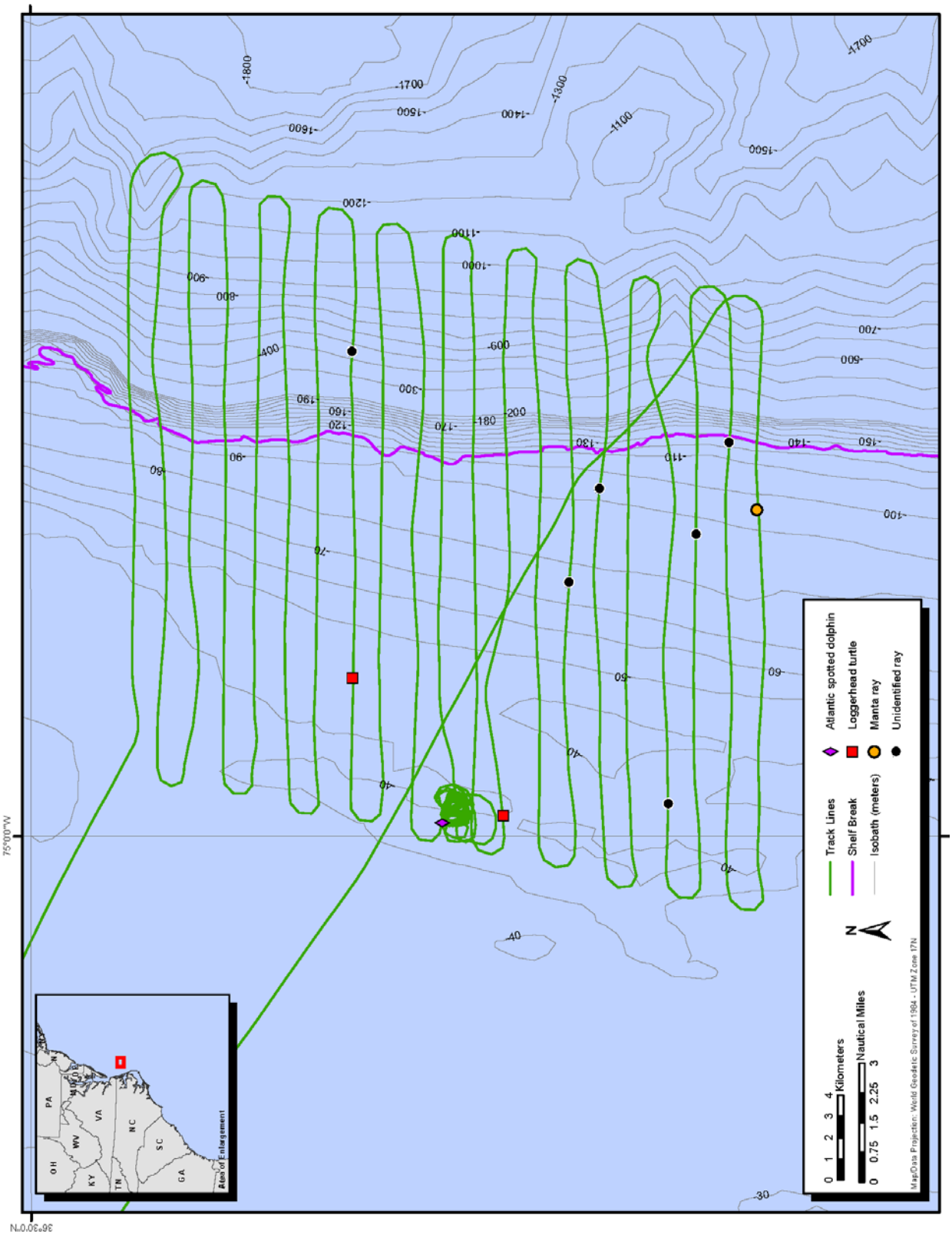

Figure 3. Locations of Cetacean, Sea Turtle, and Ray Sightings Seen During ASWEX Training (31 August)

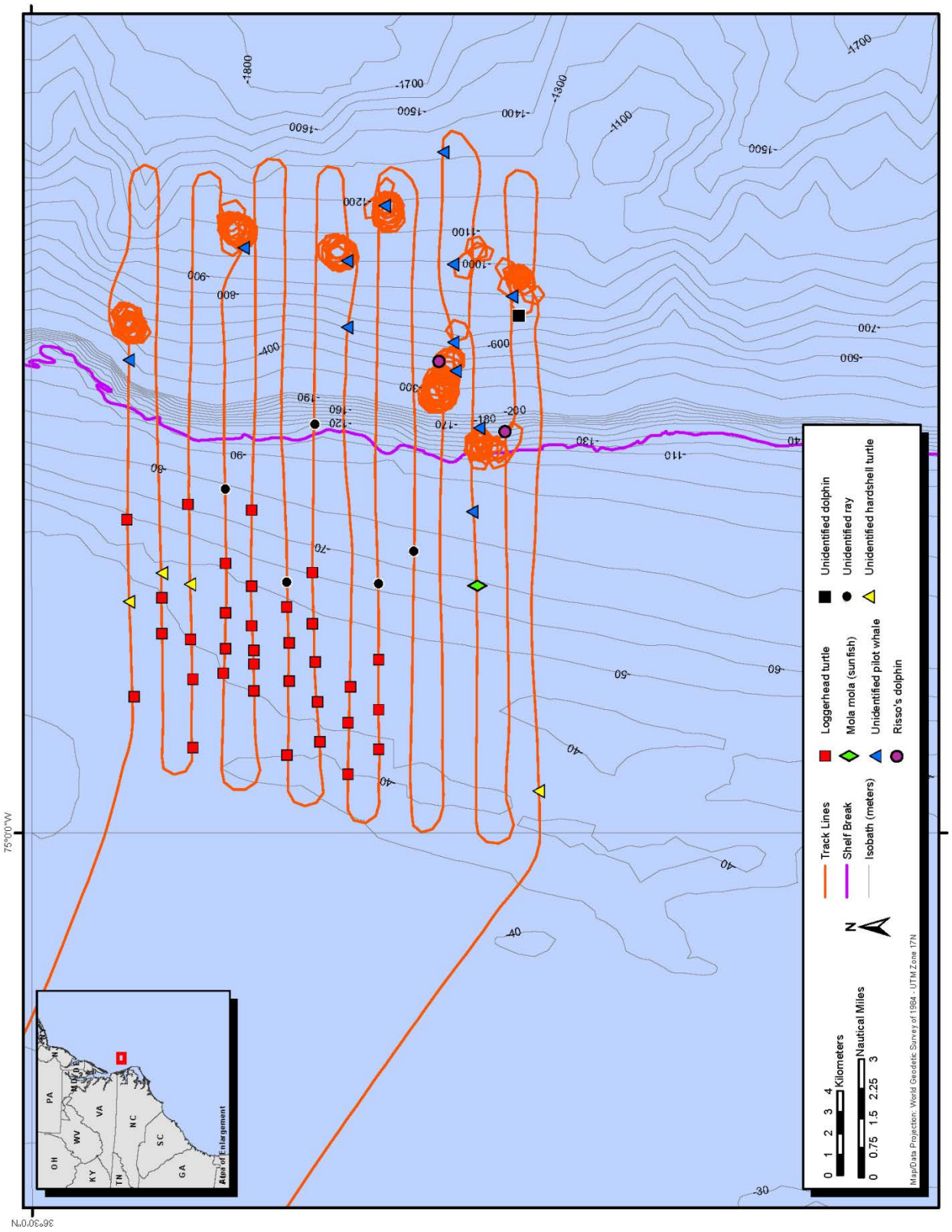

Figure 4. Locations of Cetacean, Sea Turtle, Ray, and Sunfish Sightings Seen During ASWEX Training (10 September)

The general survey approach was:

1. Pre-determined transect lines and waypoints were followed using methods described by Smultea et al. (2009) until a marine mammal/sea turtle group was sighted. Variables such as sea state, glare, and visibility were recorded for each transect flown and whenever conditions changed.
2. Upon sighting a marine mammal/sea turtle group, basic sighting information was recorded per established protocol (see Smultea et al. 2009). As outlined in the VACAPES Range Complex Monitoring Plan February 2009 (U.S. Navy 2009), information included (1) species identification and group size; (2) location and relative distance from the ASWEX site if available; (3) the behavior of marine mammals and sea turtles; (4) standard environmental and oceanographic parameters; (5) date, time, and visual conditions associated with each observation; (6) direction of travel relative to true north; and (7) duration of the observation.
3. If the species appeared suitable for a focal follow, the aircraft increased altitude to approximately 365 to 455 m and maintained a radial distance of approximately 0.5 to 1.0km. Then, the aircraft circled the sighting to obtain detailed behavior information as long as possible and logistically feasible. Focal follows occurred for a minimum of 5 minutes, including an observer taking video and digital photographs when possible.
4. If the sighting was not selected for a focal follow, and species and group size were unknown, the aircraft circled the sighting to obtain digital photographs for confirmation of species identification and estimation of group size/composition.

Section 3 Results

Survey Effort

Observers visually surveyed approximately 890 km of on-effort tracklines and an additional 834 km of combined off-effort (connector lines and circling for focal follow or species ID) during 2 days, for approximately 4.5 hours of on-effort status (see **Table 1**). Beaufort sea state ranged from 2 to 4, and all sightings were made in Beaufort sea states between 2 and 4 (see **Table 3**). **Appendix A** contains a detailed description of environmental, oceanographic, and sighting conditions.

Sightings

Sixteen sightings of cetaceans and 39 sightings of sea turtles were recorded during 7.6 hours of total survey flight time within the survey area (see **Figure 2**, **Table 3**). Sightings Per Unit Effort (SPUE) was calculated as the total survey effort (hours/km/nautical miles [NM]) divided by the total number of marine mammal sightings (n=16) or sea turtles (n=39). For this monitoring exercise, the SPUE for marine mammals was equal to one sighting per 0.5 hours, 55.6 km, and 30.0 NM, and the SPUE for sea turtles was equal to one sighting per 0.19 hours, 22.8 km, and 12.3 NM.

Table 3. Summary of Sightings

Sighting No.	Date	Species	Group Size Best/High/Low			Calves	Start Time	Stop Time	Beaufort Sea State	Latitude	Longitude	Vert. Angle	Distance off Track (km)	Heading	Bottom Depth (m)	Behavioral Summary
During ASWEX Sightings – 31 August 2011																
1	8/31/11	UR	1	1	1	-	13:39	-	4	36.364	-74.746	030	0.5	Unk.	400	Unidentified ray sighted at the surface. No disturbance detected.
2	8/31/11	CC	1	1	1	-	13:43	-	4	36.364	-74.917	029	0.6	180	<50	Loggerhead turtle resting at the surface. No disturbance detected.
3	8/31/11	SF	60	70	50	3	14:03	14:28	3	36.326	-74.993	037	0.4	090	40	Group of approximately 60 Atlantic spotted dolphins travelling in 3 subgroups. Some surface activity. See focal follow data in **Appendix B**.
4	8/31/11	CC	1	1	1	-	14:46	-	4	36.300	-74.989	033	0.5	090	<50	Loggerhead turtle resting at the surface. No disturbance detected.
5	8/31/11	UR	1	1	1	-	15:07	-	4	36.272	-74.867	035	0.4	Unk.	70	Unidentified ray sighted at the surface. No disturbance detected.
6	8/31/11	UR	1	1	1	-	15:15	-	4	36.259	-74.818	051	0.2	Unk.	90	Unidentified ray sighted at the surface. No disturbance detected.
7	8/31/11	UR	2	2	2	-	15:36	-	4	36.230	-74.983	030	0.5	Unk.	30	Two unidentified rays sighted at the surface. No disturbance detected.
8	8/31/11	UR	1	1	1	-	15:43	-	4	36.218	-74.842	020	0.8	Unk.	80	Unidentified ray sighted at the surface. No disturbance detected.
9	8/31/11	UR	1	1	1	-	15:49	-	4	36.204	-74.794	019	0.9	Unk.	120	Unidentified ray sighted at the surface. No disturbance detected.
10	8/31/11	MR	2	2	2	-	16:01	-	4	36.192	-74.829	050	0.3	000	90	Two manta rays travelling north. No disturbance detected.
During ASWEX Sightings – 10 September 2011																
1	9/10/11	CC	1	1	1	-	14:00	-	3	36.457	-74.928	035	0.4	Unk.	<50	Loggerhead turtle resting at the surface. No disturbance detected.
2	9/10/11	Unid ST	1	1	1	-	14:01	-	3	36.459	-74.878	042	0.3	Unk.	<50	Unidentified sea turtle resting at the surface. No disturbance detected.

Sighting No.	Date	Species	Group Size Best/High/Low			Calves	Start Time	Stop Time	Beaufort Sea State	Latitude	Longitude	Vert. Angle	Distance off Track (km)	Heading	Bottom Depth (m)	Behavioral Summary
During ASWEX Sightings – 10 September 2011 (continued)																
3	9/10/11	CC	1	1	1	-	14:02	-	3	36.460	-74.835	060	0.2	Unk.	50	Loggerhead turtle resting at the surface. No disturbance detected
4	9/10/11	GM	19	22	16	0	14:04	14:20	3	36.459	-74.751	050	0.3	120	300	Group of approximately 19 unidentified pilot whales travelling at varying speeds, with changes in group dispersion. See focal follow data in **Appendix B**.
5	9/10/11	Unid ST	1	1	1	-	14:29	-	3	36.445	-74.863	032	0.5	Unk.	<50	Unidentified sea turtle resting at the surface. No disturbance detected.
6	9/10/11	CC	1	1	1	-	14:29	-	3	36.445	-74.876	050	0.3	Unk.	<50	Loggerhead turtle resting at the surface. No disturbance detected.
7	9/10/11	CC	2	2	2	-	14:29	-	3	36.445	-74.895	030	0.5	Unk.	<50	Two loggerhead turtles resting at the surface. No disturbance detected.
8	9/10/11	CC	1	1	1	-	14:32	-	3	36.432	-74.955	036	0.4	Unk.	<50	Loggerhead turtle resting at the surface. No disturbance detected.
9	9/10/11	CC	1	1	1	-	14:33	-	3	36.432	-74.919	030	0.5	Unk.	<50	Loggerhead turtle resting at the surface. No disturbance detected.
10	9/10/11	CC	1	1	1	-	14:33	-	3	36.433	-74.898	030	0.5	Unk.	<50	Loggerhead turtle resting at the surface. No disturbance detected.
11	9/10/11	Unid ST	1	1	1	-	14:34	-	3	36.433	-74.869	025	0.7	Unk.	<50	Unidentified sea turtle resting at the surface. No disturbance detected.
12	9/10/11	CC	1	1	1	-	14:35	-	3	36.434	-74.827	030	0.5	Unk.	70	Loggerhead turtle resting at the surface. No disturbance detected.
13	9/10/11	GM	15	16	10	-	14:41	15:44	3	36.410	-74.692	030	0.5	180	1000	Group of 15 unidentified pilot whales travelling slowly south in tight formation. See **Appendix B** for focal follow data.
14	9/10/11	UR	1	1	1	-	15:00	-	3	36.418	-74.819	042	0.3	Unk.	70	Unidentified ray sighted at the surface. No disturbance detected.
15	9/10/11	CC	1	1	1	-	15:01	-	3	36.418	-74.858	025	0.7	Unk.	50	Loggerhead turtle resting at the surface. No disturbance detected.

Sighting No.	Date	Species	Group Size Best/High/Low			Calves	Start Time	Stop Time	Beaufort Sea State	Latitude	Longitude	Vert. Angle	Distance off Track (km)	Heading	Bottom Depth (m)	Behavioral Summary
During ASWEX Sightings – 10 September 2011 (continued)																
16	9/10/11	CC	1	1	1	-	15:02	-	3	36.418	-74.884	052	0.2	270	<50	Loggerhead turtle resting at the surface. No disturbance detected.
17	9/10/11	CC	1	1	1	-	15:02	-	3	36.418	-74.903	052	0.2	270	<50	Loggerhead turtle resting at the surface. No disturbance detected.
18	9/10/11	CC	7	7	7	-	15:02	-	3	36.419	-74.916	047	0.3	various	<50	Seven loggerhead turtles at the surface all facing different directions. No disturbance detected.
19	9/10/11	CC	1	1	1	-	15:06	-	3	36.406	-74.925	053	0.2	Unk.	<50	Loggerhead turtle resting at the surface. No disturbance detected.
20	9/10/11	CC	3	3	3	-	15:06	-	3	36.406	-74.911	043	0.3	Unk.	<50	Three loggerhead turtles resting at the surface. No disturbance detected.
21	9/10/11	CC	3	3	3	-	15:06	-	3	36.406	-74.904	047	0.3	Unk.	<50	Three loggerhead turtles resting at the surface. No disturbance detected.
22	9/10/11	CC	2	2	2	-	15:06	-	3	36.407	-74.891	040	0.4	270	<50	Two loggerhead turtles resting at the surface. No disturbance detected.
23	9/10/11	CC	1	1	1	-	15:07	-	3	36.407	-74.870	057	0.2	180	<50	Loggerhead turtle resting at the surface. No disturbance detected.
24	9/10/11	CC	1	1	1	-	15:08	-	3	36.407	-74.830	020	0.8	270	70	Loggerhead turtle resting at the surface. No disturbance detected.
25	9/10/11	UR	1	1	1	-	15:19	-	3	36.392	-74.868	045	0.3	Unk.	50	Unidentified ray sighted at the surface. No disturbance detected.
26	9/10/11	CC	1	1	1	-	15:19	-	3	36.392	-74.881	049	0.3	270	<50	Loggerhead turtle resting at the surface. No disturbance detected.
27	9/10/11	CC	1	1	1	-	15:19	-	3	36.391	-74.900	032	0.5	270	<50	Loggerhead turtle resting at the surface. No disturbance detected.
28	9/10/11	CC	1	1	1	-	15:20	-	3	36.391	-74.920	038	0.4	180	<50	Loggerhead turtle resting at the surface. No disturbance detected.
29	9/10/11	CC	1	1	1	-	15:21	-	3	36.392	-74.959	050	0.3	090	<50	Loggerhead turtle resting at the surface. No disturbance detected.

Sighting No.	Date	Species	Group Size Best/High/Low			Calves	Start Time	Stop Time	Beaufort Sea State	Latitude	Longitude	Vert. Angle	Distance off Track (km)	Heading	Bottom Depth (m)	Behavioral Summary
During ASWEX Sightings – 10 September 2011 (continued)																
30	9/10/11	CC	1	1	1	-	15:23	-	2	36.378	-74.952	042	0.3	270	<50	Loggerhead turtle resting at the surface. No disturbance detected.
31	9/10/11	CC	1	1	1	-	15:23	-	2	36.379	-74.931	040	0.4	270	<50	Loggerhead turtle resting at the surface. No disturbance detected.
32	9/10/11	CC	1	1	1	-	15:24	-	2	36.380	-74.910	050	0.3	270	<50	Loggerhead turtle resting at the surface. No disturbance detected.
33	9/10/11	CC	1	1	1	-	15:24	-	2	36.381	-74.890	070	0.1	180	<50	Loggerhead turtle resting at the surface. No disturbance detected.
34	9/10/11	CC	1	1	1	-	15:25	-	2	36.381	-74.863	042	0.3	270	60	Loggerhead turtle resting at the surface. No disturbance detected.
35	9/10/11	UR	2	2	2	-	15:27	-	2	36.380	-74.785	052	0.2	255	120	Two unidentified rays sighted at the surface. No disturbance detected.
36	9/10/11	GM	13	13	4	0	15:32	15:44	3	36.366	-74.699	034	0.5	270	1000	Group of 13 unidentified pilot whales travelling slowly in tight group. See **Appendix B** for focal follow data.
37	9/10/11	GM	10	10	10	0	15:46	-	3	36.366	-74.734	065	0.1	270	600	Group of 10 unidentified pilot whales not associated with Sighting 36. No disturbance detected.
38	9/10/11	CC	1	1	1	-	15:51	-	3	36.365	-74.923	032	0.5	180	<50	Loggerhead turtle resting at the surface. No disturbance detected.
39	9/10/11	CC	1	1	1	-	15:51	-	3	36.366	-74.942	035	0.4	270	<50	Loggerhead turtle resting at the surface. No disturbance detected.
40	9/10/11	CC	1	1	1	-	15:52	-	3	36.366	-74.969	045	0.3	279	<50	Loggerhead turtle resting at the surface. No disturbance detected.
41	9/10/11	CC	1	1	1	-	15:54	-	3	36.353	-74.956	044	0.3	120	<50	Loggerhead turtle resting at the surface. No disturbance detected.
42	9/10/11	CC	1	1	1	-	15:54	-	3	36.353	-74.935	040	0.4	270	<50	Loggerhead turtle resting at the surface. No disturbance detected.
43	9/10/11	CC	1	1	1	-	15:55	-	3	36.353	-74.909	054	0.2	180	<50	Loggerhead turtle resting at the surface. No disturbance detected.

Sighting No.	Date	Species	Group Size Best/High/Low			Calves	Start Time	Stop Time	Beaufort Sea State	Latitude	Longitude	Vert. Angle	Distance off Track (km)	Heading	Bottom Depth (m)	Behavioral Summary
During ASWEX Sightings – 10 September 2011 (continued)																
44	9/10/11	UR	1	1	1	-	15:56	-	3	36.353	-74.869	038	0.4	320	60	Unidentified ray sighted at the surface. No disturbance detected.
45	9/10/11	GM	14	14	13	0	16:02	16:12	3	36.350	-74.670	030	0.5	210	1100	Group of 14 unidentified pilot whales travelling at various speeds with some surface activity. See **Appendix B** for focal follow data.
46	9/10/11	UR	1	1	1	-	16:20	-	3	36.338	-74.852	030	0.5	270	70	Unidentified ray sighted at the surface. No disturbance detected.
47	9/10/11	GM	15	18	7	0	16:31	16:36	3	36.320	-74.757	040	0.4	210	400	Two subgroups of unidentified pilot whales travelling SW within 100 m of each other. No disturbance detected.
48	9/10/11	GG	30	40	13	1	16:38	16:57	3	36.327	-74.752	Unk.	-	270	500	Multiple subgroups of Risso's dolphins travelling slowly and milling. Many changes in group composition and formation. Group spotted by pilot while circling Sighting 47. See **Appendix B** for focal follow data.
49	9/10/11	GM	20	20	20	0	17:03	-	3	36.325	-74.642	045	0.3	225	1300	20 unidentified pilot whales seen while off-effort.
50	9/10/11	GM	30	35	25	1	17:06	-	3	36.321	-74.701	060	0.2	320	1000	Multiple subgroups of unidentified pilot whales spread out travelling slowly. No focal follow possible to fading light.
51	9/10/11	GM	8	8	8	0	17:10	-	3	36.321	-74.742	040	0.4	270	1000	Group of 8 unidentified pilot whales seen travelling while circling sighting 50. No disturbance detected.
52	9/10/11	GM	10	10	10	0	17:13	-	3	36.313	-74.831	032	0.5	180	80	Group of 10 unidentified pilot whales spread out, travelling south. No disturbance detected.

Sighting No.	Date	Species	Group Size Best/High/Low			Calves	Start Time	Stop Time	Beaufort Sea State	Latitude	Longitude	Vert. Angle	Distance off Track (km)	Heading	Bottom Depth (m)	Behavioral Summary
During ASWEX Sightings – 10 September 2011 (continued)																
53	9/10/11	MM	1	1	1	-	17:14	-	3	36.311	-74.870	050	0.3	Unk.	60	Ocean sunfish seen resting near the surface. No disturbance detected.
54	9/10/11	GG	25	25	5	0	17:23	-	3	36.299	-74.789	055	0.2	Unk.	150	Group of 5 Risso's dolphins travelling at first sighting. Additional subgroups detected totaling 25 individuals. No disturbance detected.
55	9/10/11	GM	40	50	30	0	17:29	-	3	36.310	-74.787	055	0.2	various	160	Many subgroups of unidentified pilot whales with various headings but overall group appears to be travelling North. Possible some dolphins mixed in but not confirmed sightings. Light low making circling difficult. No disturbance detected.
56	9/10/11	GM	8	10	6	0	17:39	-	3	36.296	-74.718	047	0.3	000	900	Group of 8 unidentified pilot whales travelling north. No disturbance detected.
57	9/10/11	Unid	50	60	10	0	17:43	-	3	36.293	-74.728	032	0.5	180	800	Likely mix of short-beaked common dolphins and bottlenose dolphins, or common dolphins and Atlantic spotted dolphins travelling south. Lost in low light conditions. No disturbance detected.
58	9/10/11	Unid ST	1	1	1	-	18:04	-	3	36.285	-74.978	050	0.3	180	<50	Unidentified sea turtle resting at the surface. No disturbance detected.

Key:

CC = Loggerhead turtle (*Caretta caretta*)
GG = Risso's dolphin *(Grampus griseus)*
GM = Unidentified pilot whale (*Globicephala* spp.)
MM = Ocean sunfish (*Mola mola*)
MR = Manta ray *(Manta birostris)*
SF = Atlantic spotted dolphin (*Stenella frontalis*)
Unid = Unidentified dolphin
Unid ST = Unidentified sea turtle
UR = Unidentified ray

One sighting of marine mammals, 2 sightings of sea turtles, and 7 sightings of rays were made during the 31 August ASWEX survey (see **Figure 3**, **Table 3**). Fifteen sightings of marine mammals, 37 sightings of sea turtles, 5 sightings of unidentified rays, and 1 sighting of an ocean sunfish (*Mola mola*) were made during the 10 September ASWEX survey (see **Figure 4**, **Table 3**). Sightings over the 2-day period included 1 sighting of Atlantic spotted dolphins (*Stenella frontalis*); 12 sightings of unidentified pilot whales (*Globicephala* sp.); 2 sightings of Risso's dolphins (*Grampus griseus*); 1 sighting of unidentified marine mammals (likely a mix of short-beaked common dolphins [*Delphinus delphis*] and bottlenose dolphins (*Tursiops truncatus*), or common dolphins and Atlantic spotted dolphins); 35 loggerhead turtles (*Caretta caretta*); 4 sightings of unidentified sea turtles; one sighting of manta rays (*Manta birostris*); 11 sightings of unidentified rays; and one ocean sunfish (*Mola mola*). Due to difficulties associated with relocating small groups of marine mammals in a high Beaufort sea state and heavy glare, digital photographs to determine or confirm species identification were not collected for the unidentified dolphin sighting. **Table 4** provides a summary of sightings information and environmental data. Bottom depths for each sighting were estimated in 10-m ranges from the maps from Geographic Information System plots of latitude and longitude for sightings.

Table 4. Summary of Sightings and Depth Recorded during Monitoring for VACAPES ASWEX Training.

Species	Number of sightings	Bottom Depths
Atlantic spotted dolphin	1	40 m
Unidentified pilot whale	12	80-1300 m
Risso's dolphin	2	150-500 m
Unidentified dolphin	1	800 m
Loggerhead turtle	35	< 70 m
Unidentified turtle	4	< 50 m
Manta ray	1	90 m
Unidentified ray	11	30-400 m
Ocean sunfish	1	60 m

Behavior

No visible evidence of unusual behavior was observed during the ASWEX surveys (see **Table 3**). The survey team attempted a total of six focal follows on 31 August and 10 September. The first focal follow was a period of 15 minutes spent with a group of approximately 60 Atlantic spotted dolphins. The second focal follow was a period of 11 minutes spent with a group of approximately 19 unidentified pilot whales that were traveling at various speeds. The third focal follow was a period of 9 minutes spent with a group of 15 unidentified pilot whales traveling in a tight formation. The fourth focal follow was a period of 9 minutes spent with a group of 10 unidentified pilot whales slowly traveling in a tight formation. The fifth focal follow was a period of 6 minutes spent with a group of 14 unidentified pilot whales that were traveling with some surface-active individuals. The sixth focal follow was a period of 15 minutes spent with multiple subgroups of approximately 30 Risso's dolphins traveling slowly and milling. Detailed behavioral observations made during the focal follows are presented in **Appendix B**. Photographs of suitable quality for species identification purposes were collected during the majority of sightings. No video was collected during focal follows.

Section 4 Acknowledgements

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APPENDIX A

Environmental, Oceanographic, and Sighting Conditions

Table A-1 shows the environmental, oceanographic, and sighting conditions encountered during the ASWEX monitoring efforts.

Time	Beaufort Left MMO	Glare Left MMO (%)	Visibility Distance Left MMO (km)	Beaufort Right MMO	Glare Right MMO (%)	Visibility Distance Right MMO (km)	Cloud Cover (%)
ASWEX Survey Effort on 31 August 2011							
12:35	4	30	1	4	70	1	60
12:44	4	60	1	4	30	1	60
12:52	4	30	1	4	85	1	60
13:02	4	70	1	4	26	1	60
13:10	4	30	1	4	90	1	60
13:20	4	70	1	4	26	1	60
13:28	4	30	1	4	85	1	60
13:38	4	70	1	4	20	1	60
13:45	4	30	1	4	85	1	60
13:55	4	80	1	4	15	1	60
14:03	3	30	1	3	85	1	60
14:28	4	30	1	4	50	1	60
14:38	4	75	1	4	10	1	60
14:46	4	20	1	4	40	1	60
14:55	4	75	1	4	26	1	60
15:03	4	25	1	4	35	1	60
15:13	4	50	1	4	20	1	60
15:21	4	30	1	4	20	1	60
15:30	4	60	1	4	10	1	60
15:38	4	20	1	4	24	1	60
15:48	4	60	1	4	15	1	60
15:55	4	20	1	4	10	1	60
ASWEX Survey Effort on September 10, 2011							
13:59	3	20	1	3	90	1	30
14:22	3	20	1	3	90	1	30
14:24	3	80	1	3	5	1	30
14:33	3	20	1	3	75	1	30
14:40	3	80	1	3	10	1	30
14:57	3	80	1	3	10	1	30
15:05	3	20	1	3	50	1	30
15:14	3	70	1	3	10	1	30
15:21	2	70	1	2	10	1	30
15:23	2	20	1	2	50	1	30

Time	Beaufort Left MMO	Glare Left MMO (%)	Visibility Distance Left MMO (km)	Beaufort Right MMO	Glare Right MMO (%)	Visibility Distance Right MMO (km)	Cloud Cover (%)
ASWEX Survey Effort on September 10, 2011 (continued)							
15:31	3	60	1	3	15	1	30
15:47	3	60	1	3	15	1	30
15:54	3	20	1	3	40	1	30
16:15	3	60	1	3	10	1	30
16:25	3	15	1	3	35	1	30
17:01	3	15	1	3	35	1	30
17:05	3	40	1	3	15	1	30
17:12	3	40	1	3	15	1	30
17:18	3	20	1	3	30	1	30
17:38	3	20	1	3	30	1	30
17:41	3	40	1	3	20	1	30
17:58	3	40	1	3	20	1	30

APPENDIX B
Focal-Follow Data

Table B-1 shows the focal-follow behavioral data from the VACAPES ASWEX training 2011 monitoring efforts—all within the survey area. One focal-follow event was conducted on 31 August 2011 and five on 10 September 2011; one was with Atlantic spotted dolphins, four were with unidentified pilot whales, and one was with Risso's dolphins.

Table A-1. Focal Follow Behavior Data

Record Number	Time	Date	Latitude	Longitude	Recorded Behavior
Sighting Number 3					
Species: *Stenella frontalis*. Group size: ≈60.					
1	14:12	8/31/11	36.319	-74.995	Travel heading 090. Minimum (Min) Dispersal = 1, Maximum (Max) Dispersal = 6. Two tight groups.
2	14:14	8/31/11	36.316	-74.988	Travel heading 090. Min Dispersal = 1, Max Dispersal = 6. Tightly packed together.
3	14:15	8/31/11	36.315	-74.984	Slow travel heading 090. Min Dispersal = 1, Max Dispersal = 6. Little group of 6 behind larger group. Three subgroups within the bigger group.
4	14:16	8/31/11	36.320	-74.981	Slow travel heading 090. Min Dispersal = 1, Max Dispersal = 6. All groups are forming together again.
5	14:17	8/31/11	36.325	-74.983	Slow travel heading 090. Min Dispersal = 1, Max Dispersal = 6. Three subgroups in tight, forming more of a line. Lots of time under the water.
6	14:18	8/31/11	36.326	-74.985	Slow travel heading 090. Min Dispersal = 1, Max Dispersal = 6. Same as above.
7	14:19	8/31/11	36.325	-74.985	Slow travel heading 030. Min Dispersal = 1, Max Dispersal = 6. Same as above.
8	14:20	8/31/11	36.324	-74.983	Slow travel heading 030. Min Dispersal = 1, Max Dispersal = 6. Front couple animals doing more splashes than others. Still one big group. 3-4 calves in group.
9	14:21	8/31/11	36.323	-74.979	Slow travel heading 030. Min Dispersal = 1, Max Dispersal = 6. Split into two groups. One milling in spot, other travelling. Pretty even split in numbers 30-30.
10	14:22	8/31/11	36.324	-74.978	Slow travel heading 030. Min Dispersal = 1, Max Dispersal = 6. Two groups split still.

Record Number	Time	Date	Latitude	Longitude	Recorded Behavior
Sighting Number 3 (continued)					
11	14:23	8/31/11	36.324	-74.980	Slow travel heading 030. Min Dispersal = 1, Max Dispersal = 6. One group taking off in more of a faster travel and other group is slower, but still travelling to catch up. Not fast travel on either though.
12	14:24	8/31/11	36.323	-74.978	Slow travel heading 030. Min Dispersal = 1, Max Dispersal = 6. All travelling, some weaving in and out of group. Splashing. Staying tight together as a group though.
13	14:25	8/31/11	36.329	-74.981	Slow travel heading 030. Min Dispersal = 1, Max Dispersal = 6. Same as above. More together instead of two distinct groups. Lots of surface activity within group, but still general travelling behavior.
14	14:26	8/31/11	36.328	-74.978	Slow travel heading 030. Min Dispersal = 1, Max Dispersal = 2. Travel good speed. Broken off two groups. Front group more surface active, back group more calm slow travel.
15	14:27	8/31/11	36.329	-74.980	Slow travel heading 000. Min Dispersal = 1, Max Dispersal = 6. Same as above. Left group to continue with transect.
Sighting Number 4					
Species: *Globicephala* spp. Group size: ≈19.					
1	14:09	9/10/11	36.453	-74.728	Travel heading 120. Min Dispersal = 1, Max Dispersal = 3. Mostly underwater.
2	14:10	9/10/11	36.455	-74.725	Travel heading 120. Min Dispersal = 1, Max Dispersal = 3. Dispersed now. Approximately 6 now, but started with 20.
3	14:11	9/10/11	36.456	-74.723	Slow travel heading 120. Min Dispersal = 1, Max Dispersal = 2. Slow travel, same distance apart.
4	14:14	9/10/11	36.464	-74.736	Travel heading 120. Min Dispersal = 1, Max Dispersal = 3. 15 now in this group, tightly packed together now.
5	14:13	9/10/11	36.454	-74.740	Slow travel heading 120. Min Dispersal = 1, Max Dispersal = 3. Larger and smaller group are starting to merge. Larger coming from behind smaller group.
6	14:14	9/10/11	36.455	-74.727	Slow travel heading 180. Min Dispersal = 1, Max Dispersal = 3.
7	14:16	9/10/11	36.461	-74.739	Slow travel heading 180. Min Dispersal = 1, Max Dispersal = 4. Groups have merged fully now. Lining up side by side, more in formation.
8	14:16	9/10/11	36.452	-74.733	Slow travel heading 180. Min Dispersal = 1, Max Dispersal = 4. Another small group is leading the way a bit more now. Very slow travel happening if any.

Record Number	Time	Date	Latitude	Longitude	Recorded Behavior
Sighting Number 4 (continued)					
9	14:18	9/10/11	36.463	-74.732	Slow travel heading 180. Min Dispersal = 1, Max Dispersal = 4. Mostly underwater now. Keep losing in the glare during circling.
10	14:19	9/10/11	36.464	-74.737	Slow travel heading 180. Min Dispersal = 1, Max Dispersal = 6. All underwater. Two came up, now back under. Most of group still travelling. Three groups now instead of 2. Back larger group split up.
11	14:20	9/10/11	36.465	-74.735	Slow travel heading 145. Min Dispersal = 1, Max Dispersal = 2. Three subgroups. 1-2 body lengths within subgroups. Distance between subgroups is 6-10 body lengths.
Sighting Number 13					
Species: *Globicephala* spp. Group size: 15.					
1	14:46	9/10/11	36.414	-74.675	Slow travel heading 180. Min Dispersal = 1, Max Dispersal = 2. Tightly grouped and in line formation.
2	14:47	9/10/11	36.417	-74.675	Slow travel heading 180. Min Dispersal = 1, Max Dispersal = 2. Tightly grouped and in line formation.
3	14:48	9/10/11	36.419	-74.683	Slow travel heading 180. Min Dispersal = 1, Max Dispersal = 2. Tightly grouped and in line formation. Some individuals are straggling back about 2 body lengths, but mostly same formation.
4	14:49	9/10/11	36.418	-74.686	Slow travel heading 180. Min Dispersal = 1, Max Dispersal = 2. Mostly underwater, a couple are coming up for air now. Same group, same directions as above. No noticeable disturbance.
5	14:50	9/10/11	36.416	-74.689	Slow travel heading 180. Min Dispersal = 1, Max Dispersal = 2. Mostly underwater in line, as above. In view are mainly 5 in middle with dark spots underwater for others.
6	14:51	9/10/11	36.411	-74.692	Slow travel heading 180. Min Dispersal = 1, Max Dispersal = 2. Tight formation. 1-2 body lengths apart, chorus line formation. Count of 15.
7	14:52	9/10/11	36.410	-74.690	Slow travel heading 180. Min Dispersal = 1, Max Dispersal = 2. In glare at first. Still travelling, not as much in line as bunched together with a few in the back. Travel below water, travel above water.
8	14:53	9/10/11	36.404	-74.685	Slow travel heading 180. Min Dispersal = 1, Max Dispersal = 2. In glare at first. Mostly underwater. A couple individuals surfacing.
9	14:54	9/10/11	36.418	-74.681	Surface active travel heading 270. Min Dispersal = 1, Max Dispersal = 4. Still lined up, same distance apart, 1-2 body lengths. Not very fast travel.

Record Number	Time	Date	Latitude	Longitude	Recorded Behavior
Sighting Number 13 (continued)					
10	14:55	9/10/11	36.405	-74.688	Slow travel heading 180. Min Dispersal = 1, Max Dispersal = 2. Exactly the same as above. Slightly tighter grouped together than before. Still slow travel.
11	14:55	9/10/11	36.413	-74.676	Slow travel heading 180. Min Dispersal = 1, Max Dispersal = 2. Exactly the same as above. Slightly tighter grouped together than before. Still slow travel. Left the group to carry on with lines. Glare is a slight issue for constant circling.
Sighting Number 36					
Species: *Globicephala* spp. Group size: 13.					
1	15:36	9/10/11	36.368	-74.698	Slow travel heading 225. Min Dispersal = 1, Max Dispersal = 3. Eight in group now travelling. Lined up chorus line. Additional group of 4 individuals 1-2 body lengths apart.
2	15:38	9/10/11	36.378	-74.691	Slow travel heading 225. Min Dispersal = 1, Max Dispersal = 3. In glare.
3	15:39	9/10/11	36.369	-74.702	Slow travel heading 225. Min Dispersal = 1, Max Dispersal = 4. Swimming towards surface. Still 9 in group.
4	15:39	9/10/11	36.369	-74.688	Slow travel heading 225. Min Dispersal = 1, Max Dispersal = 4. Nine in larger group. Smaller group close by within 200 meters. Mostly underwater.
5	15:40	9/10/11	36.377	-74.692	Slow travel heading 225. Min Dispersal = 1, Max Dispersal = 4. In glare at first. 30 secs into this minute, they are still traveling west and lined up. Still a few loners spread away from group. One is behind, one is in front.
6	15:42	9/10/11	36.363	-74.692	Slow travel heading 225. Min Dispersal = 1, Max Dispersal = 4. Lined up same as above.
7	15:43	9/10/11	36.374	-74.696	Slow travel heading 225. Min Dispersal = 1, Max Dispersal = 4. Glare at first. 30 secs into it, they're heading WSW. Lined up still for group of 9. One animal is 4 body lengths from others that are tightly packed.
8	15:44	9/10/11	36.370	-74.689	Slow travel heading 225. Min Dispersal = 1, Max Dispersal = 4. Still lined up with one 4 body lengths away from others.
9	15:45	9/10/11	36.374	-74.700	Slow travel heading 225. Min Dispersal = 1, Max Dispersal = 4. Still group of 9 lined up 5 body lengths from others. Little bit aside and ahead of the group for the one individual.

Record Number	Time	Date	Latitude	Longitude	Recorded Behavior
Sighting Number 45					
Species: *Globicephala* spp. Group size: 14.					
1	16:07	9/10/11	36.344	-74.665	Surface active travel heading 210. Min Dispersal = 1, Max Dispersal = 4. Unorganized group structure. More surface activity than previous groups.
2	16:08	9/10/11	36.352	-74.667	Travel heading 210. Min Dispersal = 1, Max Dispersal = 4. Back group lined up traveling. Front group all underwater except one. Single file/double file line.
3	16:09	9/10/11	36.355	-74.669	Slow travel heading 210. Min Dispersal = 1, Max Dispersal = 4. Front group is mainly underwater. Back group is lined up and traveling. All underwater now, but a couple more in front and 6-7 in back.
4	16:11	9/10/11	36.343	-74.670	Travel heading 210. Min Dispersal = 1, Max Dispersal = 4. Front group is underwater and lost. Back group is more bunched than in a line.
5	16:12	9/10/11	36.355	-74.677	Travel heading 210. Min Dispersal = 1, Max Dispersal = 4. All individuals underwater except for 2.
6	16:13	9/10/11	36.343	-74.675	Slow travel heading 210. Min Dispersal = 1, Max Dispersal = 1. 4 up now, traveling, dispersed about one body length. Front of group may be surfacing, but hard to tell in glare. Leaving them - mainly underwater and glare is difficult.
Sighting Number 48					
Species: *Grampus griseus*. Group size: 30.					
1	16:42	9/10/11	36.330	-74.774	Slow travel heading 320. Min Dispersal = 1, Max Dispersal = 2. Risso's dolphins. 3-4 separate subgroups surrounding this group of 9. Subgroups have 4, 5, and another loner. Groups are all moving very slow.
2	16:43	9/10/11	36.322	-74.765	Slow travel heading 320. Min Dispersal = 1, Max Dispersal = 2. Tight group, same direction as before. 1-2 body lengths of each other. Starting to line up more. More of a pyramid than a chorus line.
3	16:44	9/10/11	36.321	-74.761	Slow travel heading 320. Min Dispersal = 1, Max Dispersal = 4. Group is squaring out. Dispersal of 1-4. One calf in subgroup.
4	16:45	9/10/11	36.327	-74.757	Milling. Heading 270. Min Dispersal = 1, Max Dispersal = 4. Lined up more in chorus line than square now. Subgroup forming together and now 10 in that one. Original bigger group is closing in on subgroup.

Record Number	Time	Date	Latitude	Longitude	Recorded Behavior
Sighting Number 48 (continued)					
5	16:46	9/10/11	36.332	-74.761	Milling/slow travel heading 270. Min Dispersal = 1, Max Dispersal = 4. Same as above. Total count of 12 now over 3 counts.
6	16:47	9/10/11	36.332	-74.771	Milling/slow travel heading 270. Min Dispersal = 1, Max Dispersal = 4. Same as above. Total count of 12 now over 3 counts. Lost in glare. Very little splashing, up for a quick breath, then back under. Another group of 10 seen now. Total of approximately 30 total animals and groups are starting to congregate a bit.
7	16:49	9/10/11	36.320	-74.767	Milling. Heading 270. Min Dispersal = 1, Max Dispersal = 4. Same as above. Groups still converging very slowly on each other. Other 2 groups are traveling more NW than this group, which are traveling West.
8	16:50	9/10/11	36.325	-74.761	Milling/slow travel heading 270. Min Dispersal = 1, Max Dispersal = 4. Same as above. More of a loose group formation.
9	16:51	9/10/11	36.334	-74.768	Milling. Heading 270. Min Dispersal = 1, Max Dispersal = 4. In glare at start. Trying for more pictures.
10	16:52	9/10/11	36.328	-74.778	Slow travel heading 270. Min Dispersal = 1, Max Dispersal = 4. Group is stretching out more front to back.
11	16:53	9/10/11	36.324	-74.777	Slow travel heading 270. Min Dispersal = 1, Max Dispersal = 4. Split off into 2 smaller groups 1-2 body lengths apart. 2 smaller groups are max 4 body lengths apart. Mostly subsurface travel.
12	16:54	9/10/11	36.320	-74.770	Slow travel heading 270. Min Dispersal = 1, Max Dispersal = 4. Smaller groups are combined again. 13 total in group. Group becoming more circular in formation.
13	16:55	9/10/11	36.328	-74.763	Slow travel heading 270. Min Dispersal = 1, Max Dispersal = 4. Same as above. More of a circular group than line formation. No social activity. No calves seen in this group, but one calf was seen in subgroup earlier that was merging with this group.
14	16:57	9/10/11	36.331	-74.779	Slow travel heading 270. Min Dispersal = 1, Max Dispersal = 3. Eleven total. Dropping down to 800 for better pictures. Stop focal follow.