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**Trip Report, Marine Mammal Monitoring
Mine Neutralization Exercise Event, August 2011
VACAPES Range Complex**

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Commander, United States Fleet Forces Command



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List of Acronyms and Abbreviations

deg C	degrees Celsius
EOD	Explosive ordnance disposal
EST	Eastern Standard Time
ft	feet
kg/m ³	kilograms per cubic meter
km	kilometers
kts	knots (nautical miles per hour)
lb	pound
m	meters
mg/L	milligrams per Liter
MINEX	Mine Neutralization Exercise
MMO	Marine Mammal Observer
nm	nautical miles
NMFS	National Marine Fisheries Service
PMAP	Protective Measures Assessment Protocol
psu	practical salinity units
VACAPES	Virginia Capes Range Complex
yd(s)	yards

SECTION 1: INTRODUCTION

In order to train with explosives, the Navy must obtain a permit from the National Marine Fisheries Service (NMFS) under the Marine Mammal Protection Act and Endangered Species Act. The Virginia Capes (VACAPES) Range Complex Monitoring Plan (DoN 2009), finalized in June 2009, was developed with NMFS to comply with the requirements under the permits obtained for explosives training (NMFS 2009). The VACAPES Range Complex Monitoring Plan is one component of the overall effort the Navy is undertaking to understand its potential effects and the biological consequences of those effects to protected marine species. The VACAPES Range Complex Monitoring Plan has been designed as a collection of focused “studies” to gather data that will allow us to address the following questions:

1. What are the behavioral responses of marine mammals and sea turtles that are exposed to explosives at specific levels?
2. Is the Navy’s suite of mitigation measures for explosives (e.g., PMAP, major exercise measures agreed to by the Navy through permitting) effective at avoiding TTS, injury, and mortality of marine mammals and sea turtles?

In order to answer these questions, data are to be collected through various means, including contracted vessel and aerial surveys, passive acoustics, and placing marine mammal observers (MMOs) aboard Navy assets.

As part of this data collection effort, seven U.S. Navy MMOs (Ms. Sarah Bellau, Ms. Christiana Boerger, Ms. Danielle Buonantony, Mr. Scott Haga, Mr. Dave MacDuffee, Ms. Deanna Rees, and Ms. Mandy Shoemaker) participated in a Mine Neutralization Exercise (MINEX) from 7 to 9 August 2011. These MMOs were stationed aboard the *Annapolis YP686*. MMOs rotated positions throughout the day, with one MMO stationed as an observer on each of the two bridge wings and one MMO stationed as a data recorder on the ship deck during the event. The primary goal of the monitoring effort was to collect data on marine mammals observed during operations and to answer the following questions:

1. Are marine mammals and sea turtles exposed to explosives?
2. If so, at what levels?
3. Did exposed marine mammals/sea turtles show a behavioral response?

A secondary goal for the monitoring was to familiarize the MMOs with at-sea Navy operations and to gather information to facilitate future MMO opportunities. This secondary goal is captured as “lessons learned” in Section 5.2.

SECTION 2: MINE NEUTRALIZATION EXERCISE (MINEX) EVENT DESCRIPTION

During a Mine Neutralization Exercise (MINEX) event, explosive ordnance disposal (EOD) personnel detect, identify, evaluate, and neutralize mines. In this specific case, small boats deployed two EOD divers. The EOD divers searched area to locate the training mine shape. Once found, in order to neutralize the mine, the EOD divers placed a 20 pound (lb) explosive charge on the mine. A timer on the charge was activated (~10 minutes) and then the EOD divers swam over and were picked up by the nearby small boats and taken a specified distance away from the charge for safety reasons. This event was performed on August 8th and participants were members of the EODTEU-2 group located out of Dam Neck, Virginia.

SECTION 3: METHODS

3.1. SHIPBOARD MARINE MAMMAL MONITORING

The vessel surveys were conducted on the bridge wings of the *Annapolis YP686* (16 feet [ft] above water's surface), with a minimum of one observer on each wing. On-effort monitoring conducted before and after the event involved visual surveys using methods similar to those used during line-transect surveys. Observers would use the naked eye and 7X50 binoculars to scan the area from dead ahead to just abaft of the beam.

On-effort monitoring conducted during the event involved the ship being approximately 1,750 yds (1,600 m) away from the detonation site, where the MMOs would use the naked eye and 7X50 binoculars to scan the detonation site and surrounding mitigation zone. MMO surveys were conducted on a not-to-interfere basis, which means that the MMOs would not replace required Navy lookouts and would not dictate operational requirements/maneuvers. The only exception would be if a marine mammal or sea turtle was sighted by the MMO within the mitigation zone for the specified event (within 700 yds of the detonation site for a MINEX event), and was not sighted by the lookout, the MMO would report the sighting to the lookout for appropriate reporting and action.

When an animal was visually detected, the MMO would collect information on sighting, environmental, and operational parameters (Table 3-1). When practicable, still photographs were obtained by the MMOs. In addition to visual monitoring, a hydrophone was put in the water to monitor marine mammal vocal activity before, during, and after the events.

Table 3-1. MMO Data Category Descriptions

Data Category	Description
Sightings Information	
Effort (on/off)	On effort means actively searching for marine mammals; time spent off effort could result from vacating the bridge wing for operational reasons.
Date	Format in mm/dd/yy.
Time	Time provided in Eastern Standard Time (EST).
Location	This is the location of the YP686 at the time of the sighting, provided by MMOs.
Detection Sensor	Visual, provided by MMOs.
Species/Group	Determined by the MMO.
Group Size	Estimated by the MMO.
# Calves	Estimated by the MMO.
Behavior	<u>Individual behaviors:</u> breach, porpoise, spin, bowride, feeding, head slap, social, tail slap, pectoral fin slap, other <u>Whale behaviors:</u> blow, no blow rise, fluke up, peduncle arch, unidentified large splash <u>Group behaviors:</u> rest, mill, travel, surface active travel, surface active mill
Animal bearing (true)	Estimated by the MMO.
Animal motion relative to ship	Estimated by the MMO (closing, parallel, opening).
Distance from ship (yds)	Estimated by the MMO using reticled binoculars or naked eye.
Length of contact	Estimated by the MMO.
Environmental Information	
Wave height (ft)	Estimated by the MMO.
Visibility	Estimated by the MMO.
BSS	Estimated by the MMO.
Swell direction (true)	Estimated by the MMO.
Wind direction (true)	Estimated by the MMO.
% glare	Estimated by the MMO.
% cloud cover	Estimated by the MMO.
Wind speed	Estimated by the MMO.
Operational Information	
Active sonar in use?	Specifically refers to MFAS.
Explosives in use?	Determined by the MMO.
Direction of ship travel	Provided by monitors on the bridge.
Mitigation implemented	If explosive exercise underway, the measures implemented, if any, by the Navy Operators.
Comments	Other comments as necessary.

3.2. SCHEDULE OF EVENTS

As shown in Table 3-2, *Annapolis YP686* departed out of Little Creek Amphibious Base in Virginia Beach, Virginia at 0813 on 7 August and conducted pre-event monitoring from 1017 to 1536 Eastern Standard Time (EST) and deployed and subsequently retrieved six buoys in the area. On 8 August, the *Annapolis YP686* conducted pre-event monitoring from 0952 to 1217 EST. The *Annapolis YP686* deployed six buoys and conducted monitoring during the MINEX event from 1232 to 1329 EST, with the detonation occurring at 1257 EST. Event monitoring was conducted approximately 1,750 yds (1,600 m) from the detonation site. Post-event monitoring and buoy retrieval was then conducted from 1432 to 1537 EST. An additional day of post-event monitoring was scheduled for 9 August; however, MMOs aboard the *Annapolis YP686* remained off effort the entire day due to extremely poor visibility and sighting conditions caused by smoke from the North Carolina forest fires.

Table 3-2. Schedule of Events

7 August	
Time	Notes
0813	YP686 underway
1017	MMOs on effort
1106	Buoy deployment begins
1150	Buoy deployment ends
1133	MMOs off effort
1140	MMOs on effort
1240	MMOs off effort
1309	MMOs on effort
1437	Buoy retrieval begins
1533	Buoy retrieval ends
1536	MMOs off effort / YP686 return to port

8 August	
Time	Notes
0820	YP686 underway
0952	MMOs on effort
1217	MMOs off effort
1232	Buoy deployment begins / MINEX event begins / MMOs on effort
1253	Buoy deployment ends
1257	Detonation occurs
1329	MINEX event ends / MMOs off effort
1432	MMOs on effort
1446	Buoy retrieval begins
1522	Buoy deployment ends
1537	MMOs off effort / YP686 return to port

9 August	
Time	Notes
N/A	Off effort all day: fires in North Carolina forced a cancel of on effort observations

SECTION 4: RESULTS

Visual

A total of 19 marine mammal and five sea turtle sightings was recorded by the MMOs (Table 4-1) during the 3-day monitoring trip. All marine mammal sightings were of Atlantic bottlenose dolphins. Three marine mammal and three sea turtle sightings occurred on 7 August, the day before the event, and are shown in Figure 4-1. The marine mammal and sea turtle sightings on 8 August, the day of the MINEX event, are shown in Figure 4-2 in relation to the detonation location. The off-effort marine mammal sightings on 9 August, the day after the MINEX event, are shown in Figure 4-3. The Map ID row in Tables 4-1 through 4-3 refers to the labeled numbers in Figures 4-1 through 4-3. If the MMO was unable to record the bearing of the animal(s), the ship's location, range, and heading were used, as indicated in the table.

For sightings that were obtained between 30 minutes pre-detonation and 30 minutes post-detonation, calculations were made to determine whether it was probable the animals could have been exposed to the detonation. Only one sighting fell within this time frame, which was a visual sighting of one unidentified sea turtle obtained approximately 26 minutes after the detonation on 8 August. The animal was sighted approximately 1,730 yds (1,581 m) away from the detonation site, which is outside the 700-yd mitigation zone. Due to the distance from the detonation site, it is unlikely that the sea turtle was exposed to the explosion. The sighting was brief, and no unusual behavior was observed.

Table 4-1. Marine Mammal and Sea Turtle Sightings on 7 August 2011

Data Category	Sighting 1	Sighting 2	Sighting 3	Sighting 4	Sighting 5	Sighting 6
Map ID*	1	2	3	4	5	6
Sightings Information						
On Effort (on/off)	Off	Off	On	On	On	On
Date	8/7/2011	8/7/2011	8/7/2011	8/7/2011	8/7/2011	8/7/2011
Time	9:45	9:52	10:27	14:13	13:28	15:28
Ship Location (Lat) N	36.53.602	36.52.644	36.47.762	36.46.556	36.46.683	36.45.742
Ship Location (Long) W	75.56.357	75.55.634	75.53.593	75.53.118	75.51.659	75.51.936
Detection Sensor	Visual	Visual	Visual	Visual	Visual	Visual
Species/Group	Bottlenose Dolphins	Bottlenose Dolphins	Bottlenose Dolphins	Sea Turtle	Sea Turtle	Sea Turtle
Group Size			12-36	1	1	2
# Calves	No	No	1 +	No	No	No
Behavior			Feeding/Erratic, Traveling			
Animal bearing (true)**	vessel	vessel	300	270	340	20
Animal motion relative to ship	portside					portside
Distance from ship	700 yd	0 yd	50 yd	50 yd	75 yd	15 yd
Environmental Information						
Wave height (ft)	light to moderate	light to moderate	light to moderate	light to moderate	light to moderate	light to moderate
Visibility	Good	Good	Good	Good	Good	Good
BSS	3	3	3	3	3	3
Operational Information						
Active sonar in use?	No	No	No	No	No	No
Explosives in use?	No	No	No	No	No	No
Heading of ship			320		160	
Mitigation implemented	No	No	No	No	No	No
Comments			Vessel slowed down on Sighting #3 in order to observe.			

*Map ID related to the labeled numbers in Figures 4-1, 4-2, and 4-3; ** If the MMO was unable to record the bearing of the animal, the ship's location was used for mapping purposes.

Table 4-2. Marine Mammal and Sea Turtle Sightings on 8 August 2011

Data Category	Sighting 7	Sighting 8	Sighting 9	Sighting 10	Sighting 11	Sighting 12	Sighting 13	Sighting 14	Sighting 15	Sighting 16
Map ID*	1	2	3	4	5a	5b	5c	5d	6	7
Sightings Information										
Effort (on/off)	Off	Off	Off	On	On	On	On	On	On	On
Date	8/8/2011	8/8/2011	8/8/2011	8/8/2011	8/8/2011	8/8/2011	8/8/2011	8/8/2011	8/8/2011	8/8/2011
Time	8:48	8:55	9:19	10:04	10:49	10:51	10:51	10:51	13:23	15:28
Ship Location (Lat) N	36.58.089	36.57.420	36.55.335	36.47.953	36.45.728	36.45.737	36.45.738	36.45.738	36.49.178	36.46.208
Ship Location (Long) W	76.05.663	76.03.872	75.58.417	75.52.422	75.51.215	75.51.296	75.51.298	75.51.298	75.51.974	75.51.756
Detection Sensor	Visual	Visual	Visual	Visual	Visual	Visual	Visual	Visual	Visual	Visual
Species/Group	Bottlenose Dolphins	Bottlenose Dolphins	Bottlenose Dolphins	Bottlenose Dolphins	Bottlenose Dolphins	Bottlenose Dolphins	Bottlenose Dolphins	Loggerhead Sea Turtle	Sea Turtle	Bottlenose Dolphins
Group Size	2	4	3	2	2 to 3	2	joined - 9	1	1	15-20
# Calves	No	No	No	No	No	No	No	No	No	No
Behavior	Bowriding			Breaching	Traveling	Fluking				Breaching
Animal bearing (true)**	vessel	270	vessel	10	27	vessel	240	20	190	290
Animal motion relative to ship	bowriding									
Distance from ship	100 yd	100 yd	3153 yd	100 yd	0 yd	0 yd	1690 yd	1171 yd	20 yd	3153 yd
Environmental Information										
Wave height (ft)	light	light	light	light	light	light	light	light	light	light
Visibility	Good	Good	Good	Good	Good	Good	Good	Good	Good	Good
BSS	1	1	1	1	1	1	1	1	1	1
Operational Information										
Active sonar in use?	No	No	No	No	No	No	No	No	No	No
Explosives in use?	No	No	No	No	No	No	No	No	Yes: ~26 min. prior to sighting	No
Bearing of ship		110								
Mitigation implemented	No	No	No	No	No	No	No	No	No	No
Comments				Followed for 2 minutes, then lost	5a-5c loose group joined together					

*Map ID related to the labeled numbers in Figures 4-1, 4-2, and 4-3; ** If the MMO was unable to record the bearing of the animal, the ship's location was used for mapping purposes.

Table 4-3. Marine Mammal and Sea Turtle Sightings on 9 August 2011

Data Category	Sighting 17	Sighting 18	Sighting 19	Sighting 20	Sighting 21	Sighting 22	Sighting 23	Sighting 24
Map ID*	1	2a	2b	2c	2d	3	4	5
Sightings Information								
Effort (on/off)	Off	Off	Off	Off	Off	Off	Off	Off
Date	8/9/2011	8/9/2011	8/9/2011	8/9/2011	8/9/2011	8/9/2011	8/9/2011	8/9/2011
Time	8:39	9:11	9:18	9:23	9:30	9:45	12:32	12:55
Ship Location (Lat) N	36.58.252	36.56.233	36.56.135	36.55.941	36.55.908	36.55.886	36.55.808	
Ship Location (Long) W	76.07.206	76.00.859	76.00.285	75.59.956	75.59.848	75.59.741	75.58.591	
Detection Sensor	Visual	Visual	Visual	Visual	Visual	Visual	Visual	Visual
Species/Group	Bottlenose Dolphins	Bottlenose Dolphins	Bottlenose Dolphins	Bottlenose Dolphins	Bottlenose Dolphins	Bottlenose Dolphins	Bottlenose Dolphins	Bottlenose Dolphins
Group Size	8 to 10	4 to 6	2 to 3	2 to 3	2 to 3	2 to 3		20-40
# Calves	1	No	No	No	No	No		No
Behavior								
Animal bearing (true)	120	110	260	180	150	150	320	348
Animal motion relative to ship								
Distance from ship	100 yd	200-400 yd	200 yd	200 yd	250 yd	50 yd	1500 yd	100 yd
Environmental Information								
Wave height (ft)	light	light	light	light	light	light	light	light
Visibility	Poor	Poor	Poor	Poor	Poor	Poor	Poor	Poor
BSS	1	1	1	1	1	1	1	1
Operational Information								
Active sonar in use?	No	No	No	No	No	No	No	No
Explosives in use?	No	No	No	No	No	No	No	No
Bearing of ship								
Mitigation implemented	No	No	No	No	No	No	No	No
Comments	On-effort for Post Event Cancelled	Extreme Smoke from Fires in NC	3 Hydrophone buoys deployed	Hydrophone over bow, tracking group		Moved to 90 degree bearing		1 buoy deployed

*Map ID related to the labeled numbers in Figures 4-1, 4-2, and 4-3.

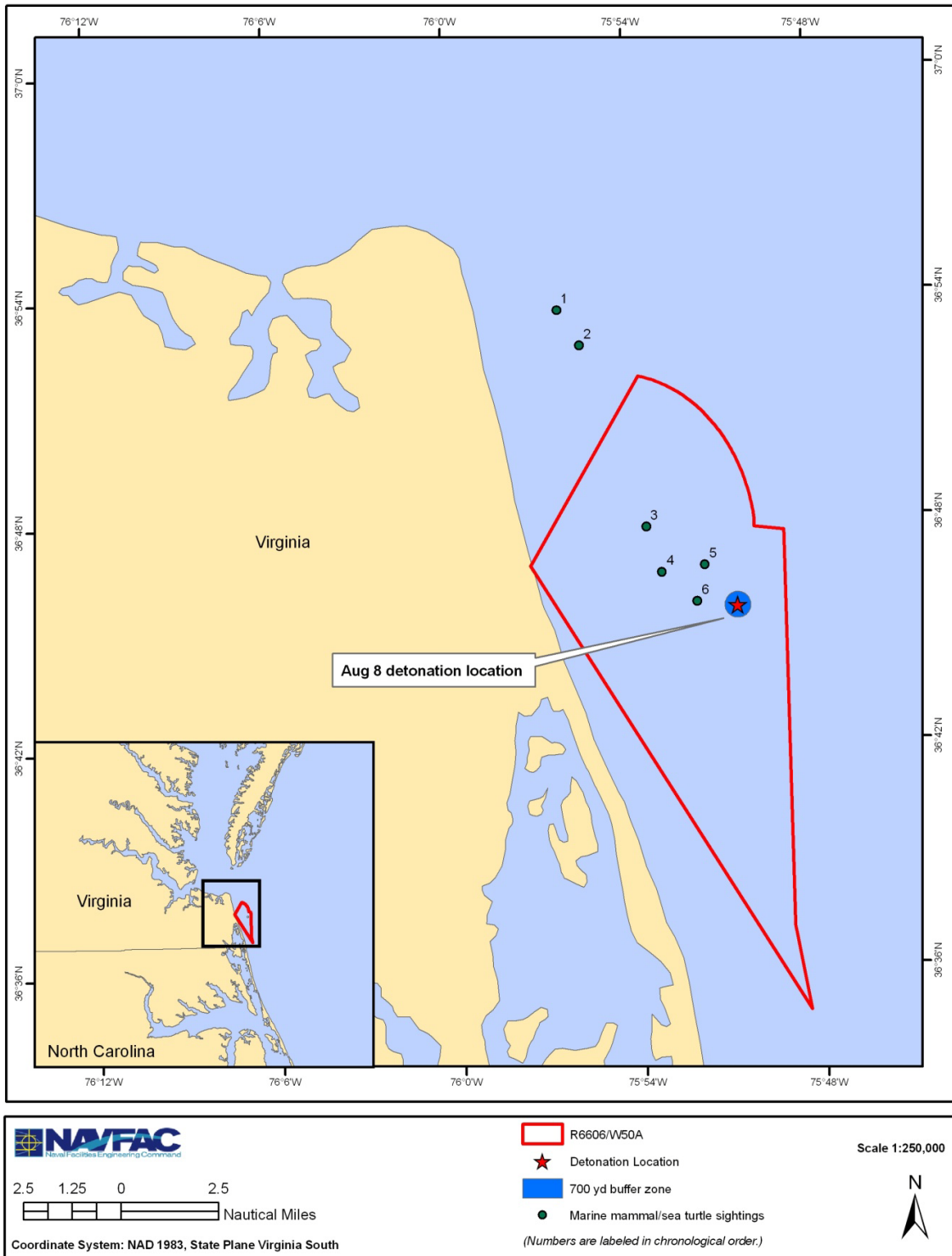


Figure 4-1. Location of sightings on 7 August 2011

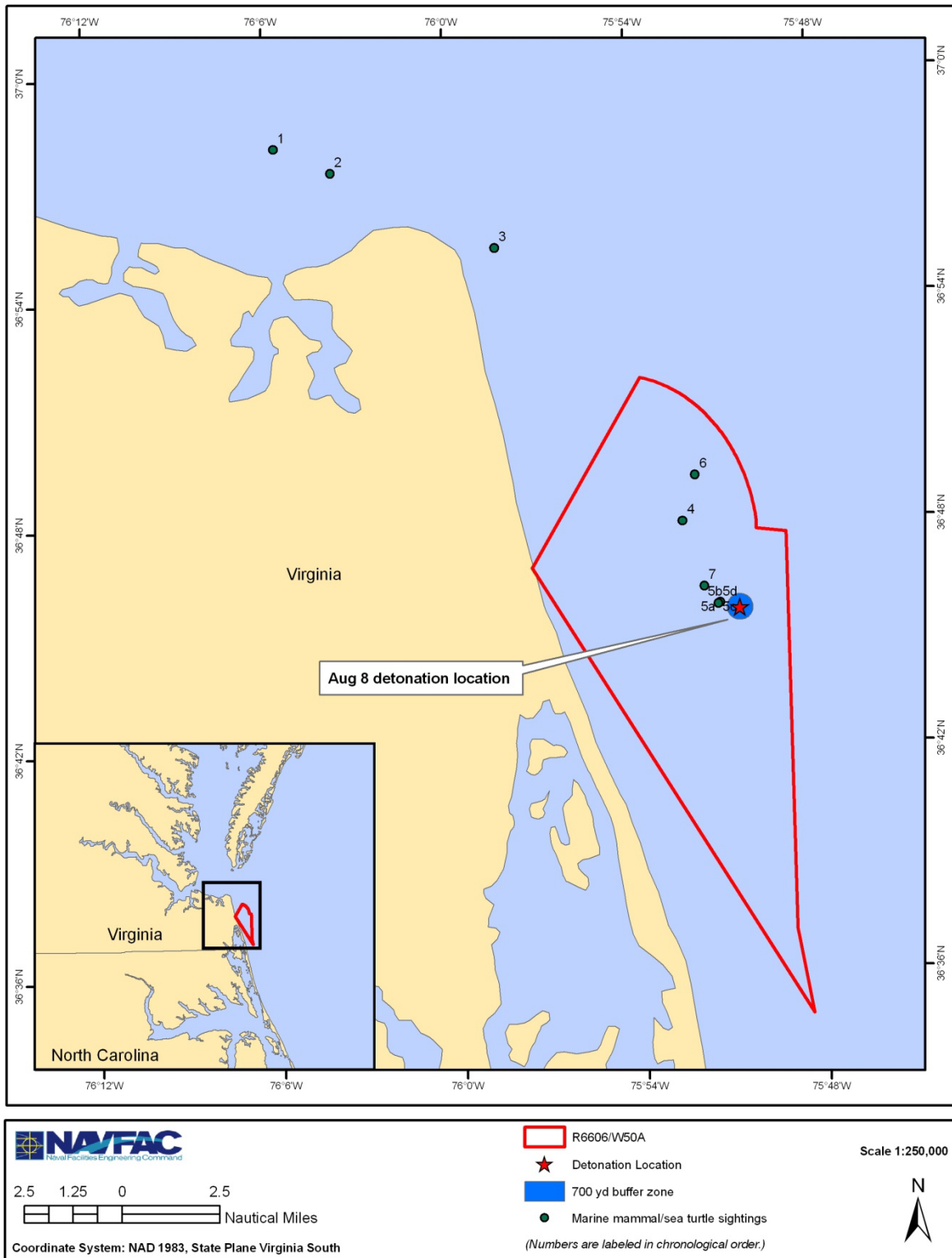


Figure 4-2. Location of sightings and approximate detonation location on 8 August 2011

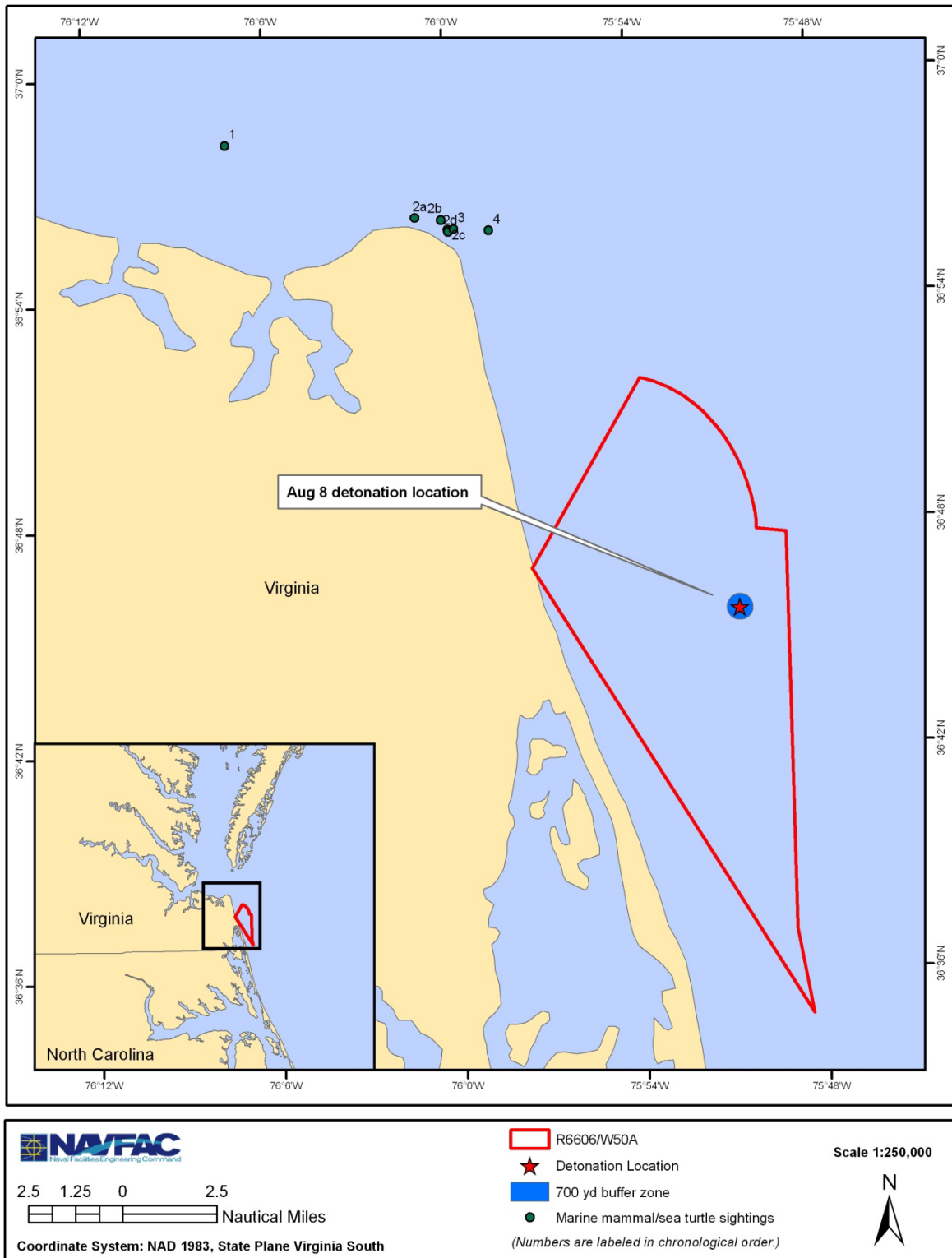


Figure 4-3. Location of sightings on 9 August 2011

Acoustic

Acoustic buoys were deployed on 7 and 8 August to monitor marine mammal vocalization activity before and during the MINEX event (see Figures 4-4 and 4-5, respectively). Six buoys were deployed on both days. Total successful recording time was approximately 38.3 hours, which included 22.75 hours on 7 August, 15.5 hours on 8 August. The 8 August detonation location is shown in Figure 4-4 for the sole purpose of providing context to the locations sampled during monitoring on 7 August (the day before the detonation).

At this time, no analysis has been completed on the acoustic dataset, except a quick visualization of the data using Cornell's Raven analysis package. Figure 4-6 shows a spectrogram from the 8 August 2011 detonation recording on the monitoring buoy named "Beaver." The portion of the recording outlined in red was investigated further (expanded in Figure 4-7) and revealed what are assumed to be odontocete whistles. The image in the upper right displays the support RHIBs on site during the exercise. Figure 4-7 shows discrete whistle contours recorded by the monitoring buoy "Beaver" at approximately 13 (box A) and 14 (box B) seconds following the detonation. Given earlier sightings, the vocalizations are most likely from bottlenose dolphins (*Tursiops truncatus*). Plans are in place for further analysis and any additional results that are found will be presented in the 2012 Monitoring Report.

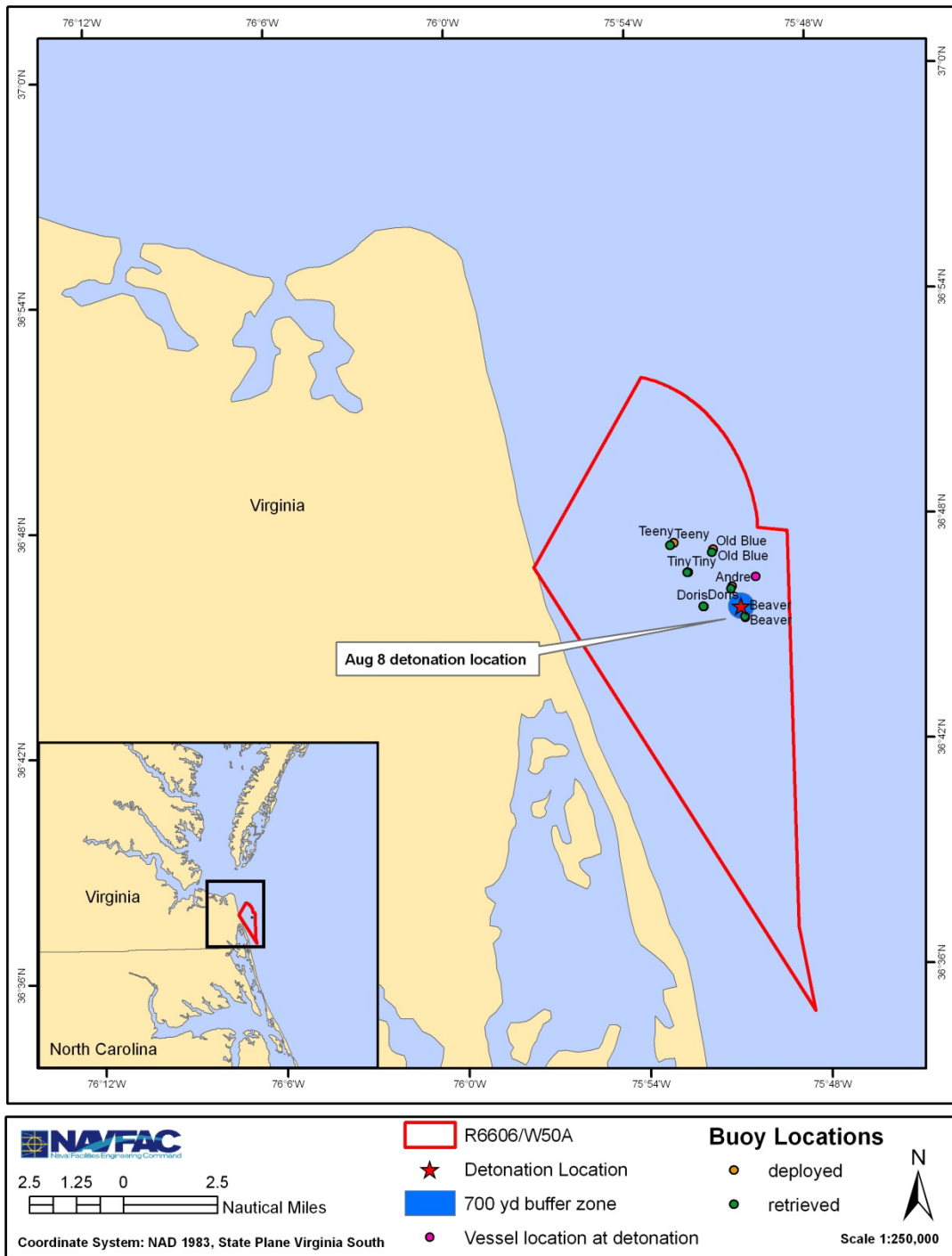


Figure 4-4. Location of Buoy Deployment and Recovery on 7 August 2011

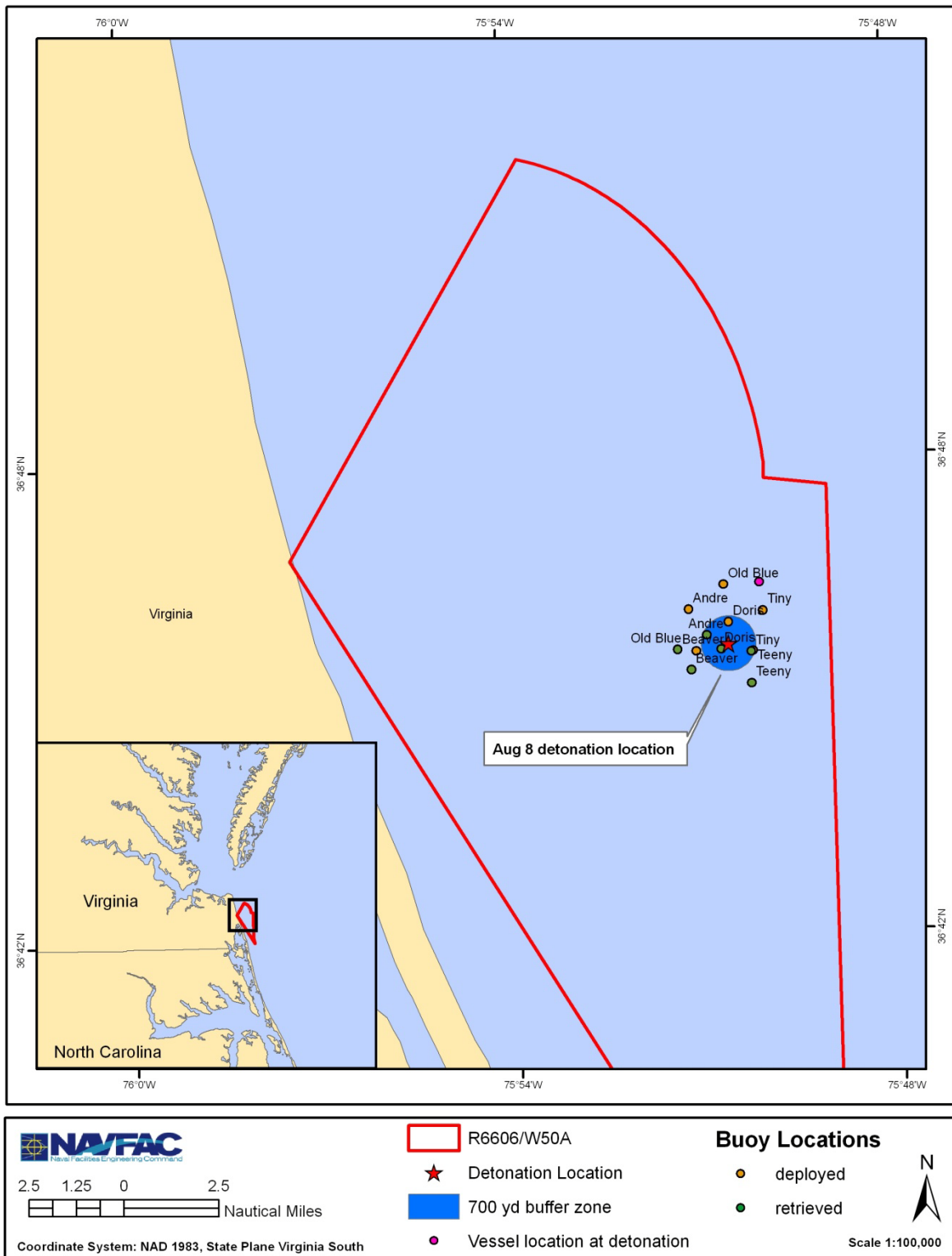


Figure 4-5. Location of Buoy Deployment on 8 August 2011

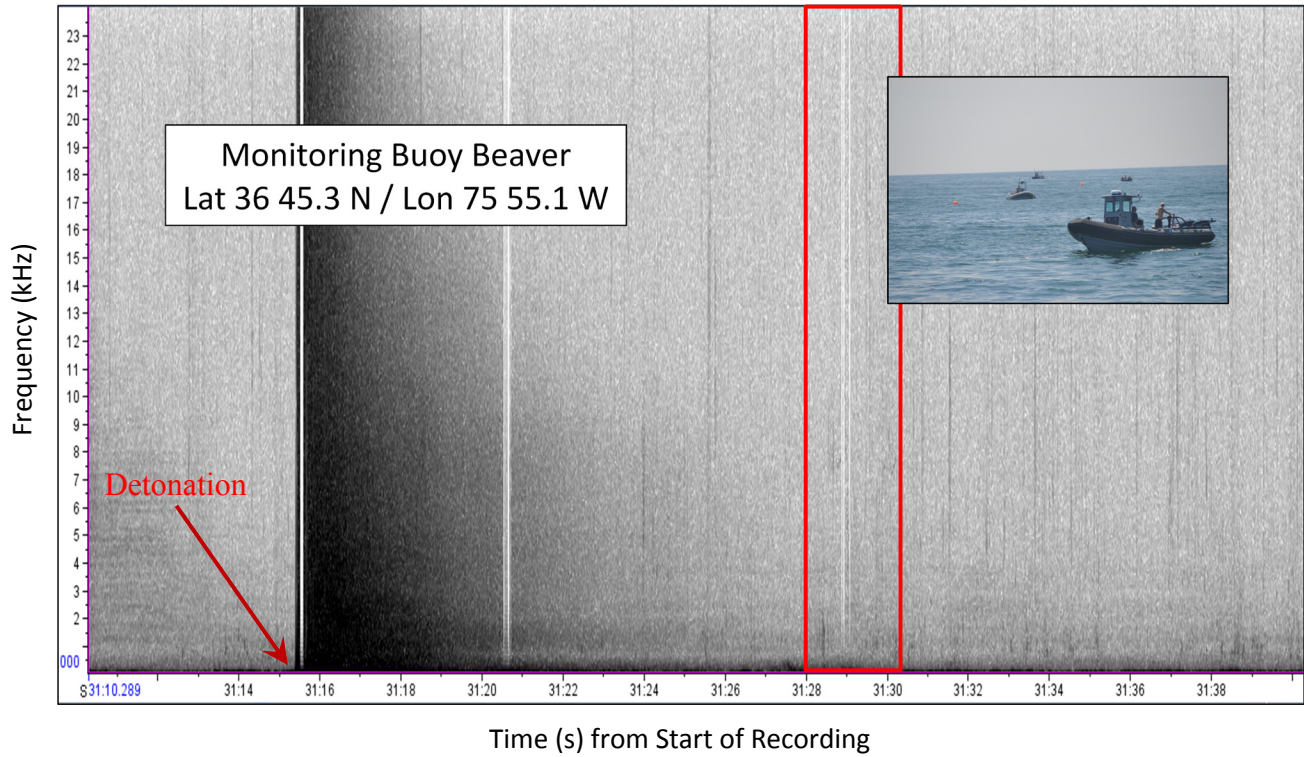


Figure 4-6. Spectrogram of Vocal Detection from Buoy “Beaver” on 8 August 2011

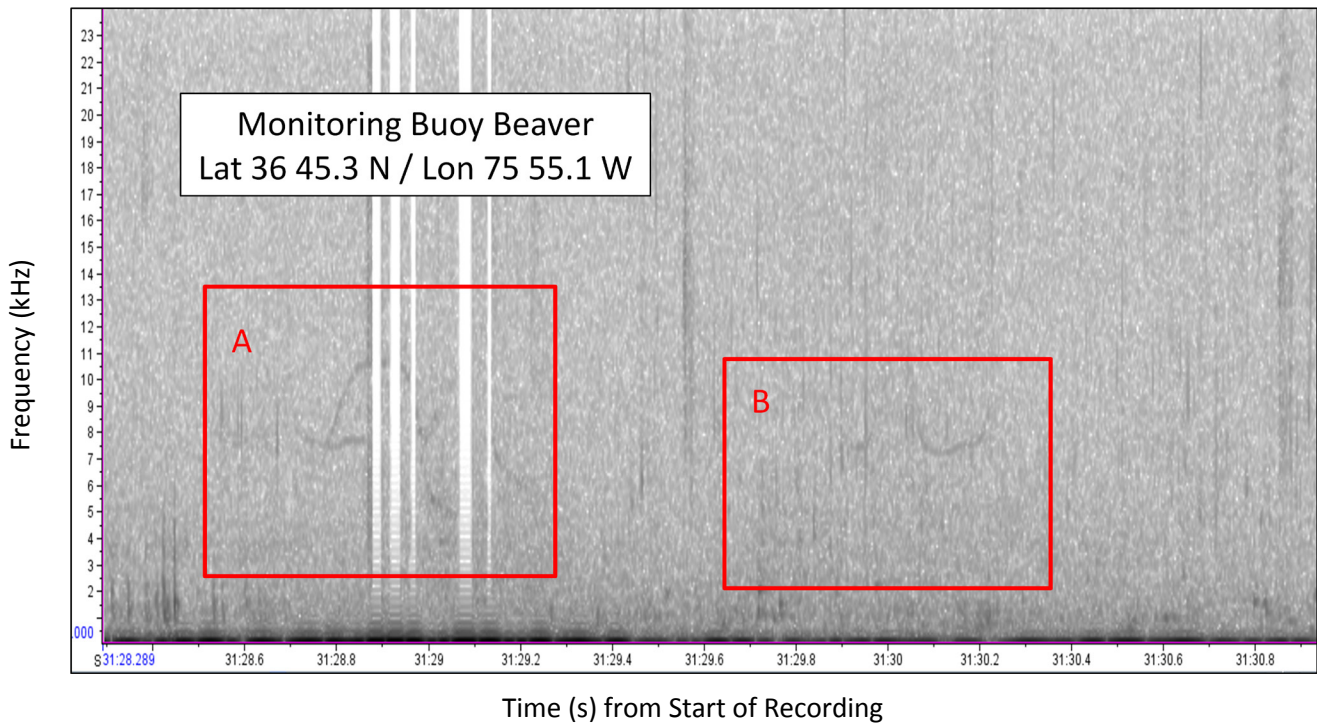


Figure 4-7. Spectrogram of Vocal Detection from Buoy “Beaver” on 8 August 2011

SECTION 5: CONCLUSION

5.1. MARINE MAMMAL MONITORING

The goal of the VACAPES MINEX monitoring effort is summarized below, with a conclusion regarding each of the specific questions that were asked:

1. Are marine mammals and sea turtles exposed to explosives?

On 8 August, a sighting of one individual sea turtle was made approximately 26 minutes post-detonation. The sighting did not occur within the mitigation zone. Based on the sighting information, it is assumed that the animal was not exposed to the detonation.

On 8 August, approximately 13 seconds following the detonation (Figure 4-7), vocalizations (presumed to be bottlenose dolphins) were captured on one of the buoys. At this time it is unclear whether the delphinids were close enough to the detonation to be exposed. Plans are in place for further analysis to be completed, and results will be included in the 2012 Monitoring Report.

2. If so, at what levels?

Based on the visual sighting information, it is assumed that the sea turtle was not exposed to the detonation.

For the vocalizations that were obtained on 8 August, at this time it is unclear how far away the individuals were from the detonation site. If this information can be obtained, estimations can be made regarding whether the individuals were exposed and at what levels. Plans are in place for further analysis to be completed, and results will be included in the 2012 Monitoring Report.

3. Did exposed marine mammals/sea turtles show a behavioral response?

No unusual behavior was observed during any of the visual sightings, and based on visual sighting data it does not look as though any marine mammal or sea turtles were exposed during the explosive event.

Based on the acoustic data, it is unclear at this point whether the vocalizing animals were exposed during the explosive event. No behavioral data can be drawn from the acoustic data at this time, but any results that can be drawn in the future will be included in the 2012 Monitoring Report.

5.2. LESSONS LEARNED

A few lessons learned were noted for the VACAPES MINEX event monitoring effort, and are separated into those for shipboard monitoring and operational information below.

5.2.1. Shipboard Marine Mammal Monitoring

- Continue to ensure that a detailed log (leave port, begin on-effort, begin event, end event, off-effort, and return to port) is kept for each day of monitoring.
- Recommend that improvements continue to be made to ensure consistency among MMOs regarding filling out the sighting forms. For example, use same format for coordinates, distance, etc. Future priority will be to look into upgrading to a computer-based format for logging information.
- Methods are needed to continue to improve the close-aboard distance estimation by MMOs. Reticled binoculars were used for longer-distance sightings, but this method was not useful for close aboard sightings. Suggest that MMOs practice close aboard distance estimation if possible.
- It is recommended that passive acoustic monitoring continue to be a priority in order to supplement the visual monitoring.

5.2.2. Operational Information

- Future monitoring efforts should continue to make every attempt possible to organize a pre-event brief. This allows the environmental staff to present the goals of the monitoring and explain what information is needed for their planning efforts, as well as the opportunity to learn more about the event(s) that will be taking place.
- A field communication plan is extremely vital for successful monitoring on Navy ranges. It is imperative to have multiple forms of potential communication in case the preferred method does not work. Communication needs to take place in the event range schedulers need to confirm that MMOs have permission to be on the range, as well as to get updates regarding schedule of event(s).
- Need to continue to improve pre-planning coordination between operators and MMOs to ensure that monitoring opportunities and data gathering are maximized.

SECTION 6: ACKNOWLEDGEMENTS

We thank the officers and crew of the *EODTEU-2* unit for their outstanding support and cooperation with our monitoring efforts. We thank the US Naval Academy Annapolis for supplying the monitoring boats and crews to support the MMO work. We also thank USFF's environmental staff for pre-planning coordination.

SECTION 7: REFERENCES

- DoN. 2009. Virginia Capes (VACAPES) Range Complex Monitoring Plan-Final 15 June 2009. Department of the Navy, Commander. U.S. Fleet Forces Command.
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