

MARINE SPECIES MONITORING

For The U.S. Navy's Virginia Capes,
Cherry Point, Jacksonville, and Gulf of
Mexico Range Complexes

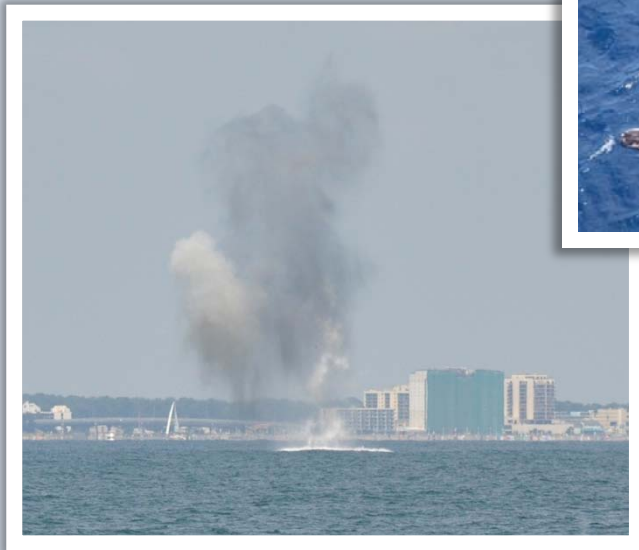
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LIST OF ACRONYMS AND ABBREVIATIONS

AMR	Adaptive Management Review
BiOp	Biological Opinion
BOMBEX	Bombing Exercise
CFR	Code of Federal Regulations
CHPT	Cherry Point
DoN	Department of the Navy
ESA	Endangered Species Act
FIREX	Firing Exercise
GOMEX	Gulf of Mexico
ICMP	Integrated Comprehensive Monitoring Program
IMPASS	Integrated Maritime Portable Acoustic Scoring and Simulator
JAX	Jacksonville
LOA	Letter of Authorization
m	meter(s)
MDE	Multiple Detonation Exercise
MINEX	Mine Neutralization Exercise
MISSILEX	Missile Exercise
MMO	marine mammal observer
MMPA	Marine Mammal Protection Act
NGO	non-governmental organization
NM	nautical mile(s)
NMFS	National Marine Fisheries Service
OPAREA	Operating Area
PAM	passive acoustic monitoring
RHIB	rigid-hulled inflatable boat
SAG	Scientific Advisory Group
U.S.	United States
USFF	U.S. Fleet Forces
VACAPES	Virginia Capes

SECTION I – INTRODUCTION

1. Background

The United States (U.S.) Navy developed range-complex monitoring plans to provide marine mammal and sea turtle monitoring as required under the Marine Mammal Protection Act (MMPA) of 1972 and the Endangered Species Act (ESA) of 1973. In order to issue an Incidental Take Authorization for an activity, Section 101(a)(5)(a) of the MMPA states that National Marine Fisheries Service (NMFS) must set forth “requirements pertaining to the monitoring and reporting of such taking.” The MMPA implementing regulations at 50 Code of Federal Regulations (CFR) Section 216.104(a)(13) note that requests for Letters of Authorization (LOAs) must include the suggested means of accomplishing the necessary monitoring and reporting that will result in increased knowledge of the species and of the level of taking or impacts on populations of marine mammals that are expected to be present. While the ESA does not have specific monitoring requirements, recent Biological Opinions (BiOps) issued by NMFS have included terms and conditions requiring the U.S. Navy to develop a monitoring program (NMFS 2009a, 2010). Therefore, as part of the issuance in 2009 of the original LOAs for the Virginia Capes (VACAPES) Range Complex, the Cherry Point (CHPT) Range Complex, and the Jacksonville (JAX) Range Complex [collectively referred to as the East Coast range complexes] (NMFS 2009b, 2009c, 2009d, respectively) and in 2011, for the Gulf of Mexico (GOMEX) Range Complex (NMFS 2011), the Navy published monitoring plans with specific monitoring objectives for the East Coast range complexes and the GOMEX Range Complex (Department of the Navy [DoN] 2009a, 2009b, 2009c, 2011a, respectively).

Based on discussions with NMFS, range-complex monitoring plans were designed as a collection of focused “studies” to gather data that will attempt 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., Protective Measures Assessment Protocol, major exercise measures agreed to by the Navy through permitting) effective at avoiding temporary threshold shift, injury, and mortality of marine mammals and sea turtles?

Monitoring methods proposed for the range-complex monitoring plans include a combination of research elements designed both to support range complex-specific monitoring, and to contribute information to a larger Navy-wide science-based program. These research elements include visual surveys from vessels or airplanes, passive acoustic monitoring (PAM), and marine mammal observers (MMOs). Each monitoring technique has advantages and disadvantages that vary temporally and spatially, as well as support one particular study objective better than another. The Navy uses a combination of techniques so that detection and observation of marine animals is maximized, and meaningful information can be derived to answer the research questions proposed above.

There are no modifications requested for the monitoring plans and LOA monitoring requirements from the 2011 LOAs (NMFS 2011a, 2011b, 2011c, 2011d). However, a modification to the LOAs has been issued by NMFS concerning taking of marine mammals incidental to mine-neutralization training using time-delay firing devices within the three East Coast range complexes, along with revised mitigation measures (NMFS 2012), to ensure that effects to marine mammals resulting from these activities will not exceed what was originally analyzed in the Final Rules for these range complexes (NMFS 2009a,

2009b, 2009c). As a result of discussions with NMFS, the Navy will explore the value of adding field measurements during monitoring of a future mine-neutralization event after evaluating the environmental variables affecting sound propagation in the area, such as shallow depths, seasonal temperature variation, bottom sediment composition, and other factors that would affect our confidence in the data collected. If such data can be collected without unreasonable costs and impacts to training, the Navy will move forward in incorporating the measurements into its monitoring program for East Coast mine-neutralization training.

A summary of the Navy's monitoring progress in the three East Coast range complexes and the GOMEX Range Complex to date can be found at the end of the report in **Table VI-1**.

2. Report Objectives

Design of the range-complex monitoring plans represented part of a new Navy-wide and regional assessment, and as with any new program, numerous coordination, logistic, and technical details continue to be refined. The scope of the range-complex monitoring plans was to lay out the background for monitoring, as well as to define initial procedures to be used in meeting certain study objectives derived from NMFS-Navy agreements.

Overall, and in support of the above statement, this report serves two main objectives under the VACAPES, CHPT, JAX, and GOMEX LOAs:

1. Present data and results from the Navy-funded marine mammal and sea turtle monitoring conducted in the VACAPES, CHPT, JAX, and GOMEX range complexes during the period from 2 January 2011 to 1 January 2012 (see **Sections II through V**). Included in this assessment are reportable metrics of monitoring as requested by NMFS. This report focuses on summarizing events monitored and data collected, and providing a brief description of the major accomplishments from techniques used this year. Primary focus over the first years of the monitoring program has been on establishing initial monitoring commitments, data collection efforts, and overall organization and coordination of the Navy-wide monitoring program.
2. Continue the adaptive management review (AMR) process by providing an overview of meetings and initiatives over the past year that support proposed revisions to the Navy's 2012 VACAPES, CHPT, JAX, and GOMEX Monitoring Plans as well as presenting progress made towards development of a Strategic Plan for Navy Monitoring that has been facilitated by establishing a Scientific Advisory Group (SAG) to review and provide recommendations on the Navy's monitoring program. Proposed changes primarily reflect input received from the scientific community and other stakeholders. **Section VI** provides an overview of the events that have prompted these most recent adaptive management actions.

SECTION II – VIRGINIA CAPES (VACAPES) RANGE COMPLEX

The geographic scope of the VACAPES Study Area includes the area from the shoreline out to the 3-nautical mile (NM) boundary of the Operating Area (OPAREA), as well as the VACAPES OPAREA (**Figure II-1**). The VACAPES Study Area also includes lower Chesapeake Bay.

There are 40 marine mammal species or stocks with possible or confirmed occurrence in the marine waters off Maryland, Virginia, and North Carolina within the VACAPES Range Complex (DoN 2008a). There are 35 cetacean species (e.g., whales, dolphins, and porpoises), four pinniped species (e.g., seals) and one sirenian species (West Indian manatee [*Trichechus manatus*]). There are also six species of threatened and endangered sea turtles (reviewed in DoN 2008a).

1. VACAPES Study Questions Overview

The goal of the VACAPES Monitoring Plan is to implement field methods chosen to address the long-term monitoring objectives outlined in the *Introduction* (**Section I**). In the VACAPES Monitoring Plan (DoN 2009a), the U.S. Navy proposed to implement a diversity of field methods to gather monitoring data for marine mammals and sea turtles in Navy training areas. Specifically, the Navy proposed to use visual surveys (aerial or vessel), deploy PAM devices when possible, and put marine mammal observers aboard Navy vessels to meet its goals during the current time period (**Table II-1**). Studies were specifically designed to meet the questions outlined in the *Introduction* (**Section I**).

Table II-1. 2011 VACAPES monitoring obligations under VACAPES Final Rule, LOA and BiOp.

STUDY 1 (behavioral responses)		
Aerial or Vessel Surveys	- 2 explosive events per year (one involving multiple detonations). When feasible, deploy hydrophone array during vessel surveys for passive acoustic monitoring.	Adaptive Management Review for 2011 (AMR)
Marine Mammal Observers (MMO)	- 1 explosive event per year.	
STUDY 2 (mitigation effectiveness)		
MMO/ Lookout Comparison	- 1 explosive event per year.	AMR
Vessel or Aerial Surveys Before And After Training Events	- 2 explosive events per year (one involving multiple detonations). When feasible, deploy hydrophone array during vessel surveys for passive acoustic monitoring.	

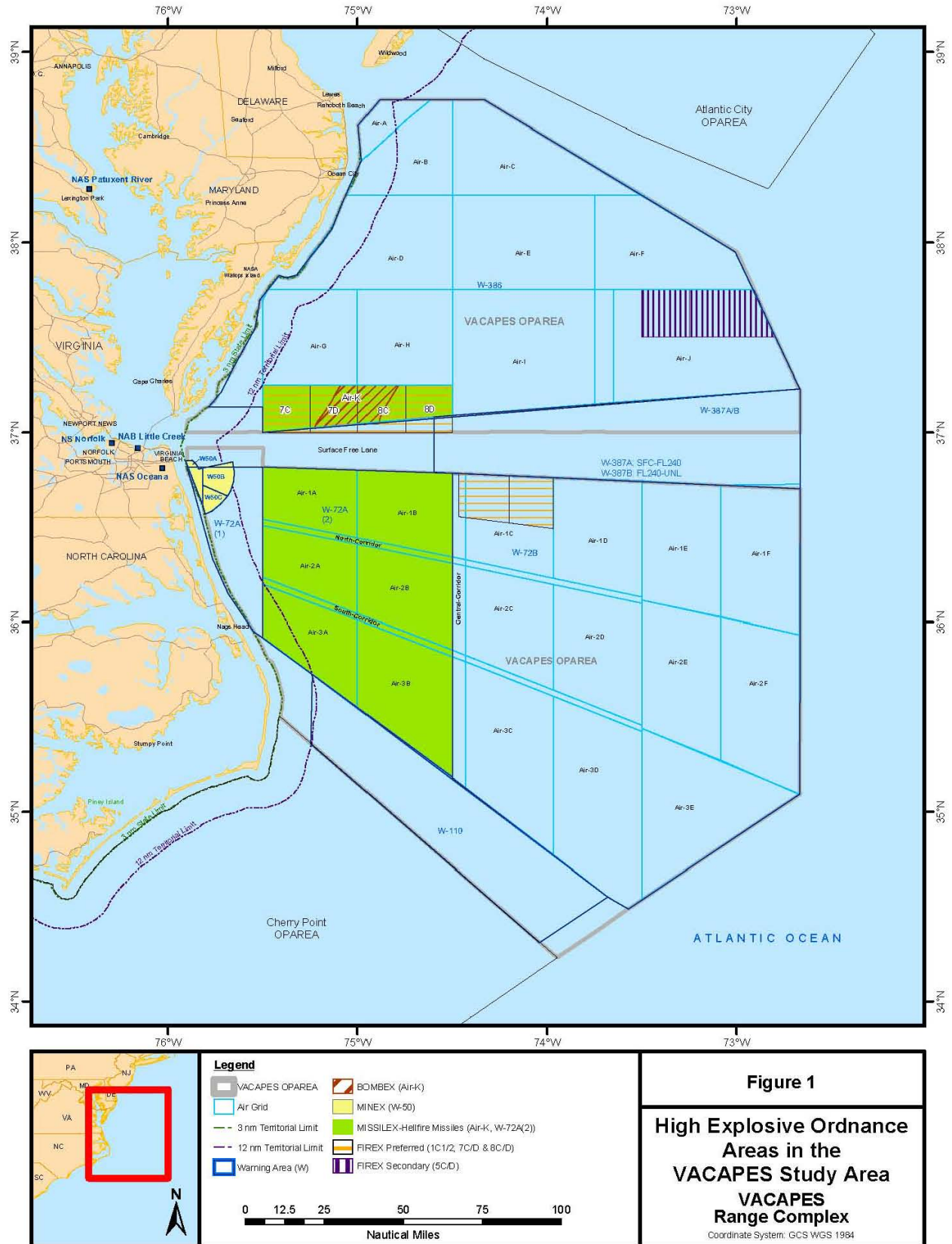


Figure II-1. VACAPES Study Area.

2. VACAPES Monitoring Accomplishments for 2011

During the 2 January 2011 – 1 January 2012 reporting period, U.S. Fleet Forces (USFF) implemented vessel and aerial surveys and deployed PAM devices. The monitoring efforts for 2011 were conducted within the mine neutralization exercise (MINEX) W-50 box in conjunction with a MINEX event, and the Firing Exercise (FIREX) 7C/7D training boxes in conjunction with a FIREX event.

Major accomplishments from the USFF's 2011 compliance monitoring in the VACAPES Study Area are shown in Table II-2 and include:

- Vessel Visual Surveys
 - Completed vessel survey within FIREX box (7C/7D) during a FIREX with Integrated Maritime Portable Acoustic Scoring and Simulator (IMPASS) event. During the event, the mitigation zone was the area within 600 yards (549 meters [m]) of the detonation site or within 70 yards (64 m) of the vessel.
 - Completed vessel surveys within the MINEX (W-50) box before, during, and after a MINEX event. During the event the boat stood off at 1,750 yards (1,600 m), and the MMOs visually surveyed the buffer zone around the detonation site.
- Aerial Visual Surveys
 - Completed aerial surveys within the FIREX (7C/7D) box before, during, and after a FIREX event.
- Passive Acoustic Monitoring
 - Passive acoustic buoys were deployed during a MINEX event to record any marine mammal vocalizations in the area.
- Marine Mammal Observers on Navy Platform
 - Four MMOs were deployed during a FIREX with IMPASS event on board the firing ship. During the event, the ship stood off at 1,775 yards (1,623 m) and the MMOs visually surveyed the area around the detonation site.
 - Seven MMOs were deployed on a Navy ship during a MINEX event. During the event, the boat stood off at 1,750 yards (1,600 m), and the MMOs visually surveyed the area around the detonation site.

Table II-2. U.S. Navy-funded monitoring accomplishments within the VACAPES Study Area from January 2011 to January 2012.

Study Type	Description of U.S. Navy EIS/LOA Monitoring Completed	Event Types Available for Monitoring	MMPA/ESA Requirement	Total Accomplished
Vessel or aerial surveys –before and after event (study 1 and 2)	Vessel surveys during 1 MINEX event and aerial surveys during 1 FIREX event.	MINEX, Missile Exercise (MISSILEX), FIREX, or Bombing Exercise (BOMBEX)	2 events (1 multiple detonation event)	2 events (1 multiple detonation event)
Marine Mammal Observers (studies 1 and 2)	MMOs visually surveyed before, during, and after 1 MINEX event.	MINEX, MISSILEX, or FIREX	1 event	2 events
Passive Acoustic Monitoring (study 2)	Deployed passive acoustic buoys during 1 MINEX event.	MINEX, MISSILEX, FIREX, or BOMBEX	Deploy hydrophone array during vessel surveys when feasible	1 event

2.1 VACAPES Vessel Visual Surveys

Vessel visual surveys for marine mammals were conducted using Navy MMOs during two naval exercises in VACAPES during the reporting period, associated with a FIREX with IMPASS training event in July and a MINEX training event in August.

2.1.1 FIREX with IMPASS Event – July

A vessel survey was conducted on 14 July 2011 in association with a FIREX with an IMPASS training event off the coast of Virginia. Four MMOs were stationed aboard a Navy vessel. One marine species sighting was made by Navy MMOs—a hardshell turtle—and is shown in **Figure II-2** in relation to the detonation location. For additional details, refer to **Appendix A** for the 2011 FIREX with IMPASS Event Trip Report.

Since inert ordnance was used in this FIREX with IMPASS event, there was no potential for exposure of marine mammals and sea turtles to explosions. The turtle sighting mentioned above was made on the ship by the MMOs during a time when rigid-hulled inflatable boats (RHIBs) were recovering a malfunctioning buoy (the firing event was temporarily halted). The sighting was estimated to be approximately 60 yards (54.5 m) from the observation vessel. The sighting was very brief, and no unusual behavior was observed. The area was monitored for 30 minutes, but the animal was not seen again and was assumed to have moved out of the area. Since the animal was not seen for 30 minutes within the 70 yard (64 m) mitigation zone, the second round of firing was able to commence. The second round of firing commenced approximately 45 minutes after the animal was sighted (15 minutes after the mitigation zone requirements were met). No additional marine mammal or sea turtle sightings were obtained within the mitigation zones (within 600 yards [549 m] of the detonation site or within 70 yards [64 m] of the vessel) during the FIREX with IMPASS event. Due to the fact that no marine mammals or sea turtles were observed within the mitigation zones 30 minutes prior to or while gunfire occurred, there are no data to suggest that any animals were exposed to inert ordnance during the event.

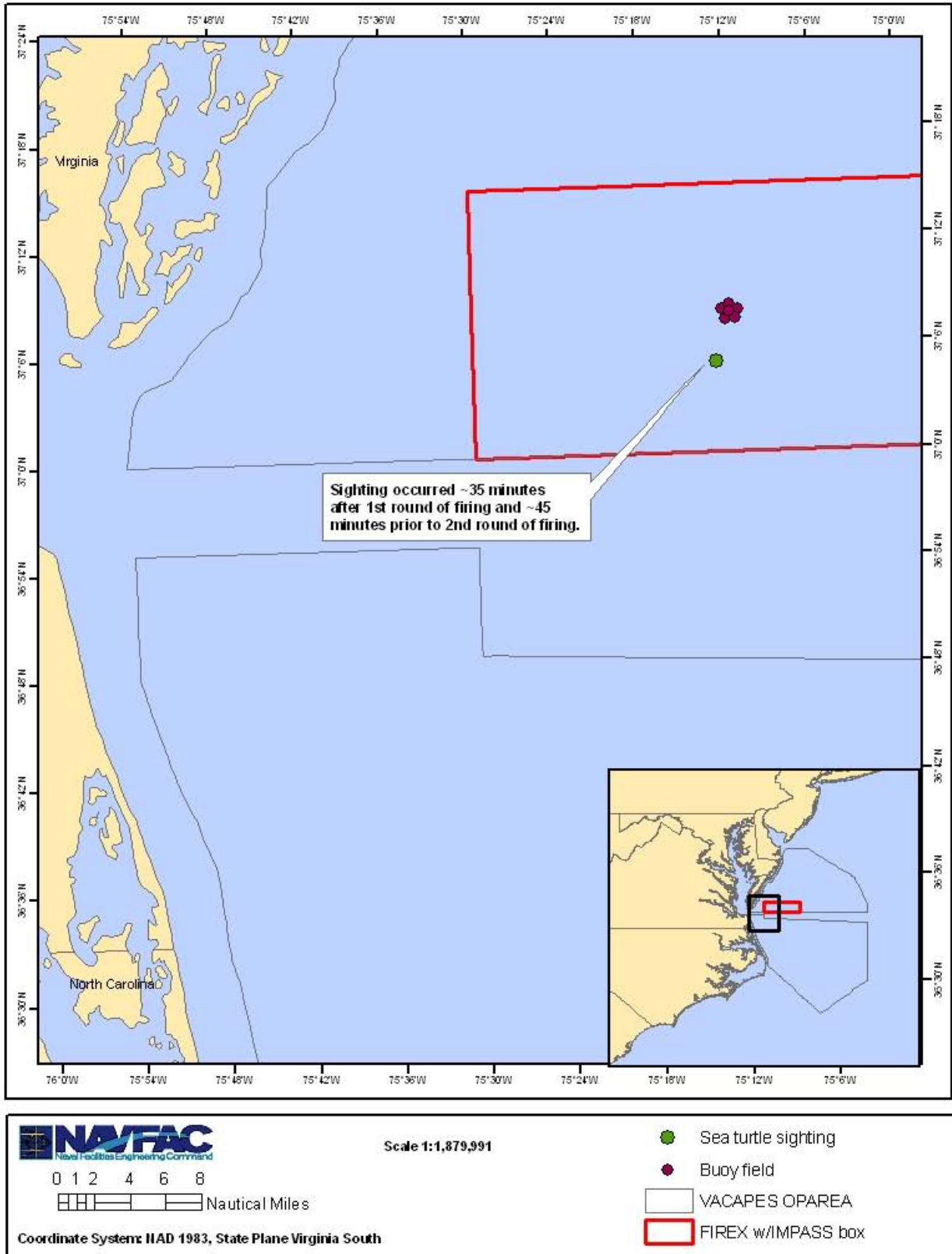


Figure II-2. Location of sea turtle sighting and buoy field location during the FIREX with IMPASS vessel survey conducted on 14 July 2011.

2.1.2 MINEX Event – August

Vessel surveys were conducted in association with a MINEX training event off the coast of Virginia Beach, Virginia. Seven MMOs were stationed aboard a Navy vessel. Surveys were conducted on 7-9 August 2011 before, during, and after the training event.

A total of 19 marine mammal and five sea turtle sightings were recorded by the Navy MMOs during the 3-day monitoring trip (**Table II-3**). All marine mammal sightings were of Atlantic bottlenose dolphins. Three marine mammal and three sea turtle sightings were made on 7 August, the day before the event (**Figure II-3**). Eight marine mammal and two sea turtle sightings were made on 8 August, the day of the MINEX event. The sightings that took place on 8 August are shown in **Figure II-4** in relation to the detonation location. Nine marine mammal sightings were recorded on 9 August, the day after the MINEX event, as shown in **Figure II-5**. For additional details, refer to **Appendix B** for the 2011 VACAPES MINEX Event Trip Report.

Table II-3. Summary of marine species sightings recorded by MMOs while conducting monitoring from a Navy vessel off the coast of Virginia during the August 2011 MINEX event.

Common Name	Scientific Name	Sightings	Individuals
Bottlenose dolphin	<i>Tursiops truncatus</i>	19	91-149*
Loggerhead turtle	<i>Caretta caretta</i>	1	1
Unidentified turtle		4	5

*Three sightings without group size estimates were not included in totals.

No injuries or mortalities of marine mammals or turtles were observed during the MINEX training event on 8 August. 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. There was only one sighting within this time frame—one unidentified sea turtle, approximately 26 minutes after the detonation on 8 August. The animal was sighted at a distance of approximately 1,730 yards (1,581 m) from the detonation site, which is outside the 700 yard (640 m) mitigation zone for marine mammals. 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.

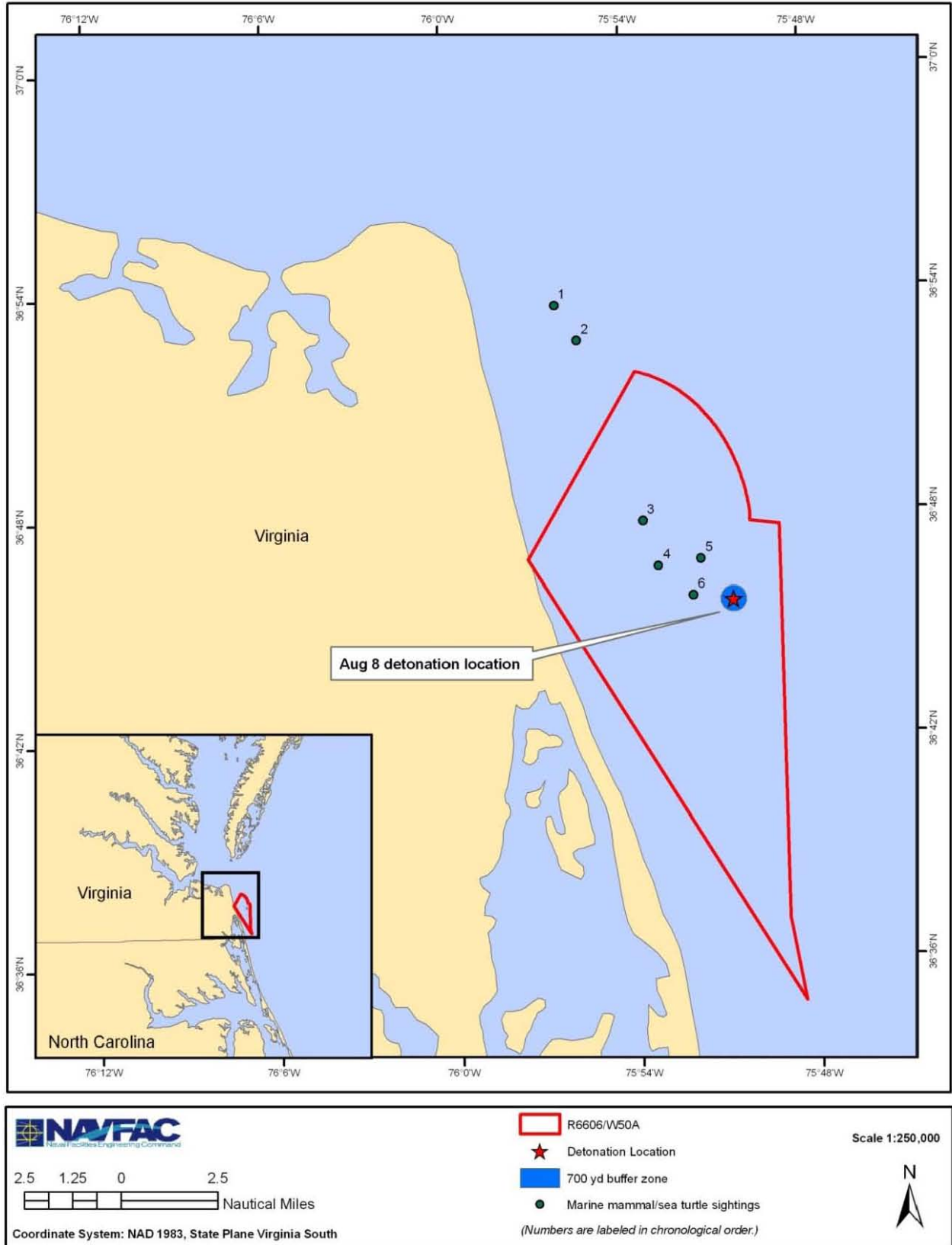


Figure II-3. Locations of sightings during pre-MINEX monitoring (7 August) and approximate detonation location.

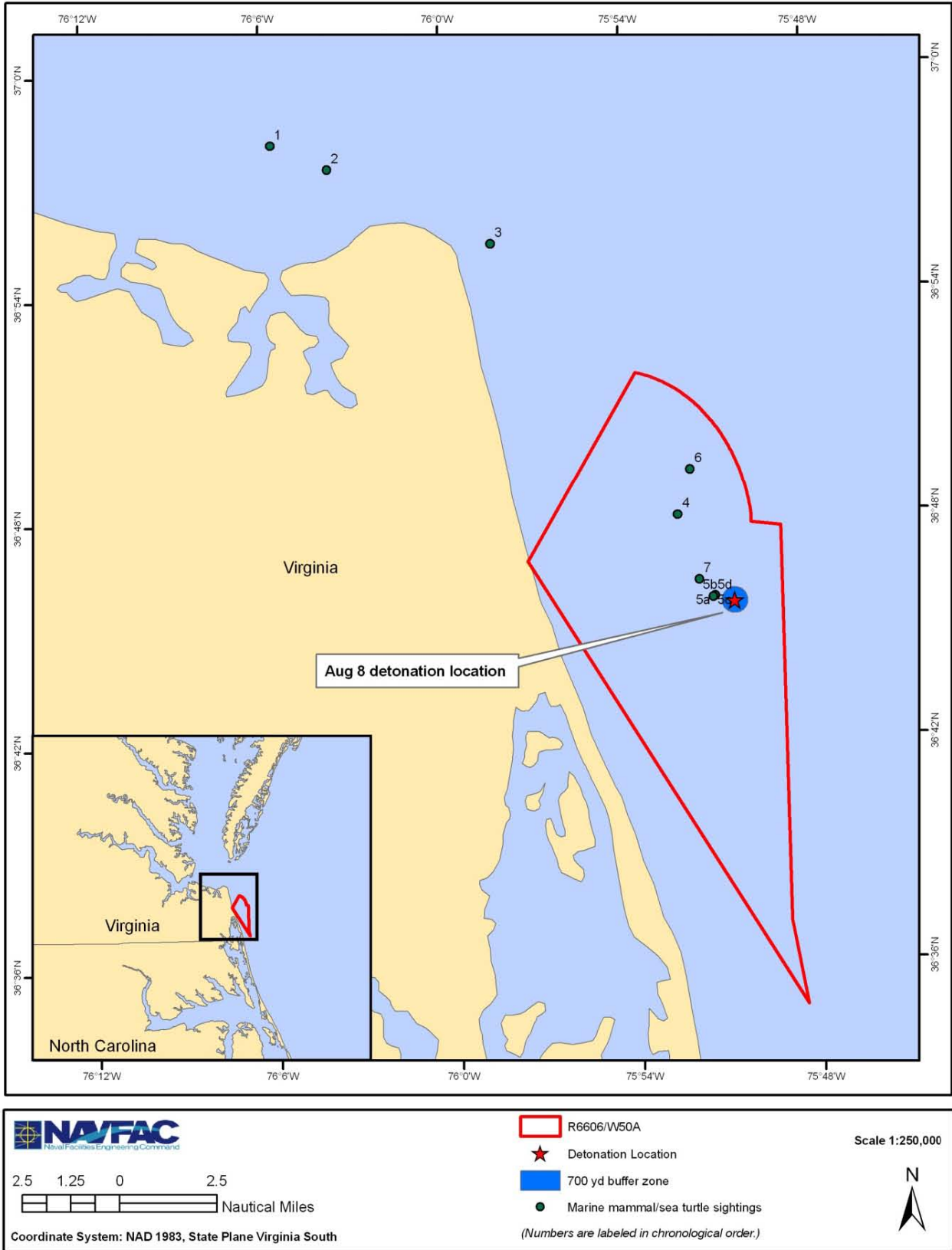


Figure II-4. Locations of sightings during MINEX monitoring (8 August) and approximate detonation location.

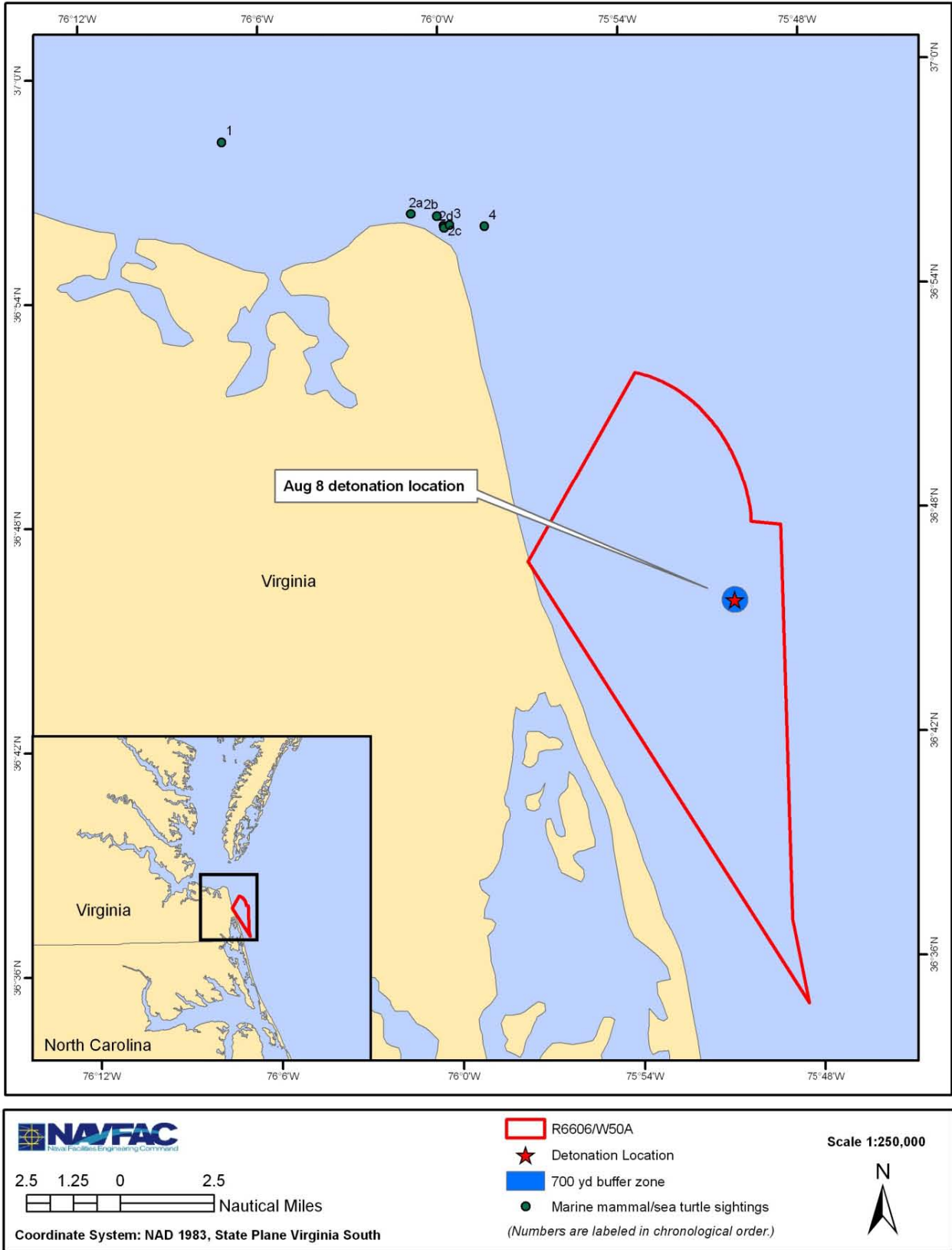


Figure II-5. Locations of sightings post-MINEX monitoring (9 August) and approximate detonation location.

2.2 VACAPES Aerial Visual Surveys

Aerial surveys were conducted in association with a FIREX training event with IMPASS off the coast of Virginia. Line-transect surveys were conducted on 13-15 July before, during, and after the training event. A summary of the sightings are presented in **Table II-4**.

Table II-4. Summary of marine species sightings from the aerial surveys conducted during 13-15 July 2011 for the FIREX with IMPASS training event in VACAPES.

Common Name	Scientific Name	Sightings	Individuals
Bottlenose dolphin	<i>Tursiops truncatus</i>	5	77
Pilot whale	<i>Globicephala</i> spp.	1	45
Unidentified dolphin		3	2*
Loggerhead turtle	<i>Caretta caretta</i>	102	105**
Kemp's ridley turtle	<i>Lepidochelys kempii</i>	1	1
Leatherback turtle	<i>Dermochelys coricea</i>	4	4
Unidentified ray		1	1
Ocean sunfish	<i>Mola mola</i>	1	1

*One sighting didn't have group size determined due to brevity of sighting

**Due to an extremely high sighting rate of sea turtles in the range after the first survey day, surveys for sea turtles were limited to one random transect line on subsequent days (14 and 15 July). Sightings for sea turtles on the chosen random transect line were multiplied by seven (number of transect lines) for total estimated sightings

Three sightings of marine mammals and 37 sightings of sea turtles were made during the 1-day pre-FIREX survey (**Figure II-6**). Due to the extremely high sighting rate of sea turtles in the range during the first survey day, on subsequent days (14 and 15 July) surveys for sea turtles were limited to one random transect line. Sightings for sea turtles on the chosen random transect line were multiplied by 7 (number of transect lines) to estimate total sightings. Two sightings of marine mammals and one sighting of a sea turtle ($n=7$ after multiplier factor) were made throughout the 1-day during-FIREX survey period (**Figure II-7**). Four sightings of marine mammals and nine sightings of sea turtles ($n=63$ after multiplier factor) were made during the 1-day post-FIREX survey (**Figure II-8**). Focal follows of three groups of bottlenose dolphins were conducted pre- and post-FIREX (see **Appendix C**). No injuries or mortalities of marine mammals or sea turtles were observed during the FIREX training event on 14 July. No live explosive rounds were used during the FIREX training. Therefore, no animals were exposed during this VACAPES FIREX with IMPASS training event. For additional details see **Appendix C** for the 2011 VACAPES FIREX Event Trip Report.

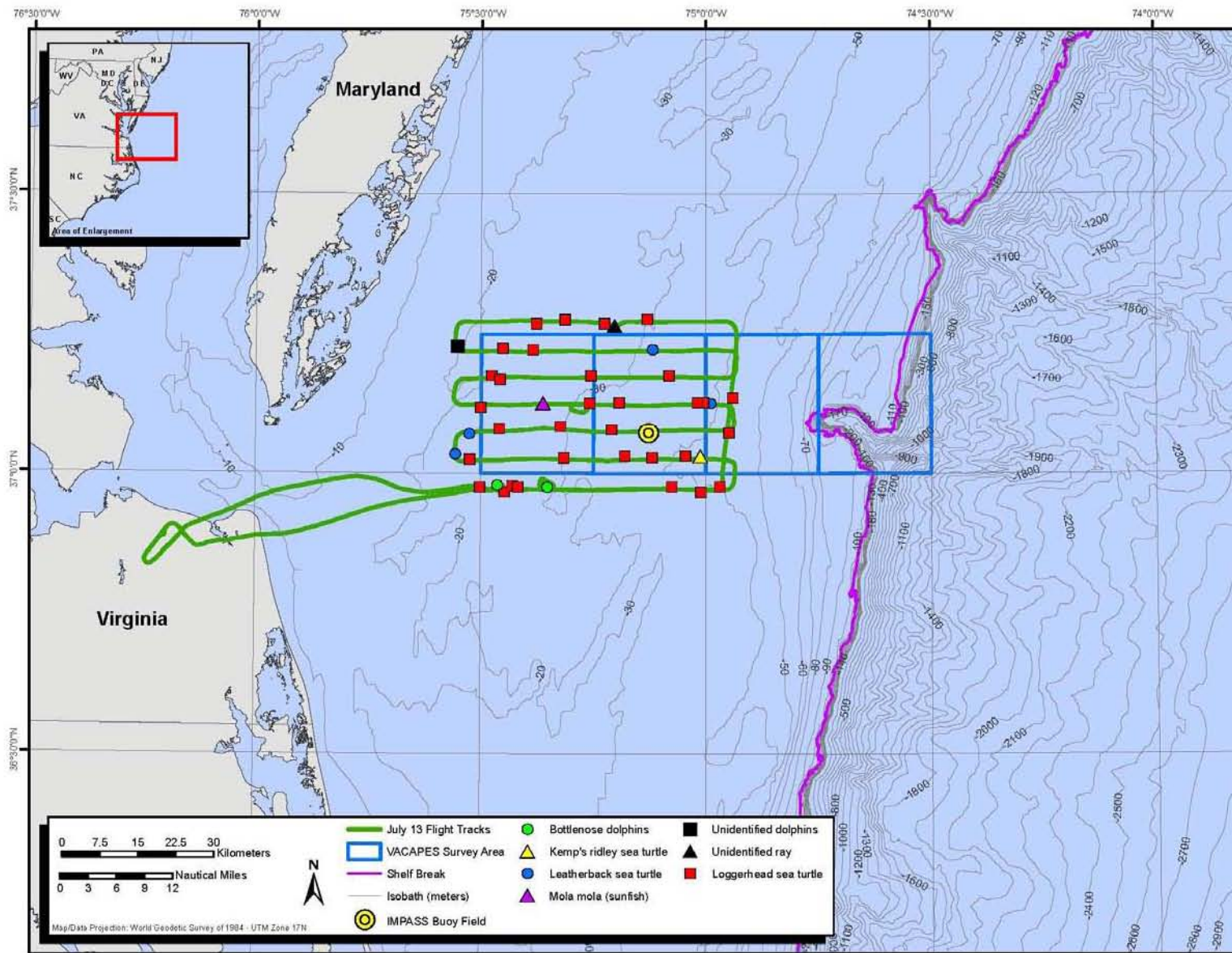


Figure II-6. Locations of cetacean and sea turtle sightings during pre-FIREX surveys (13 July).

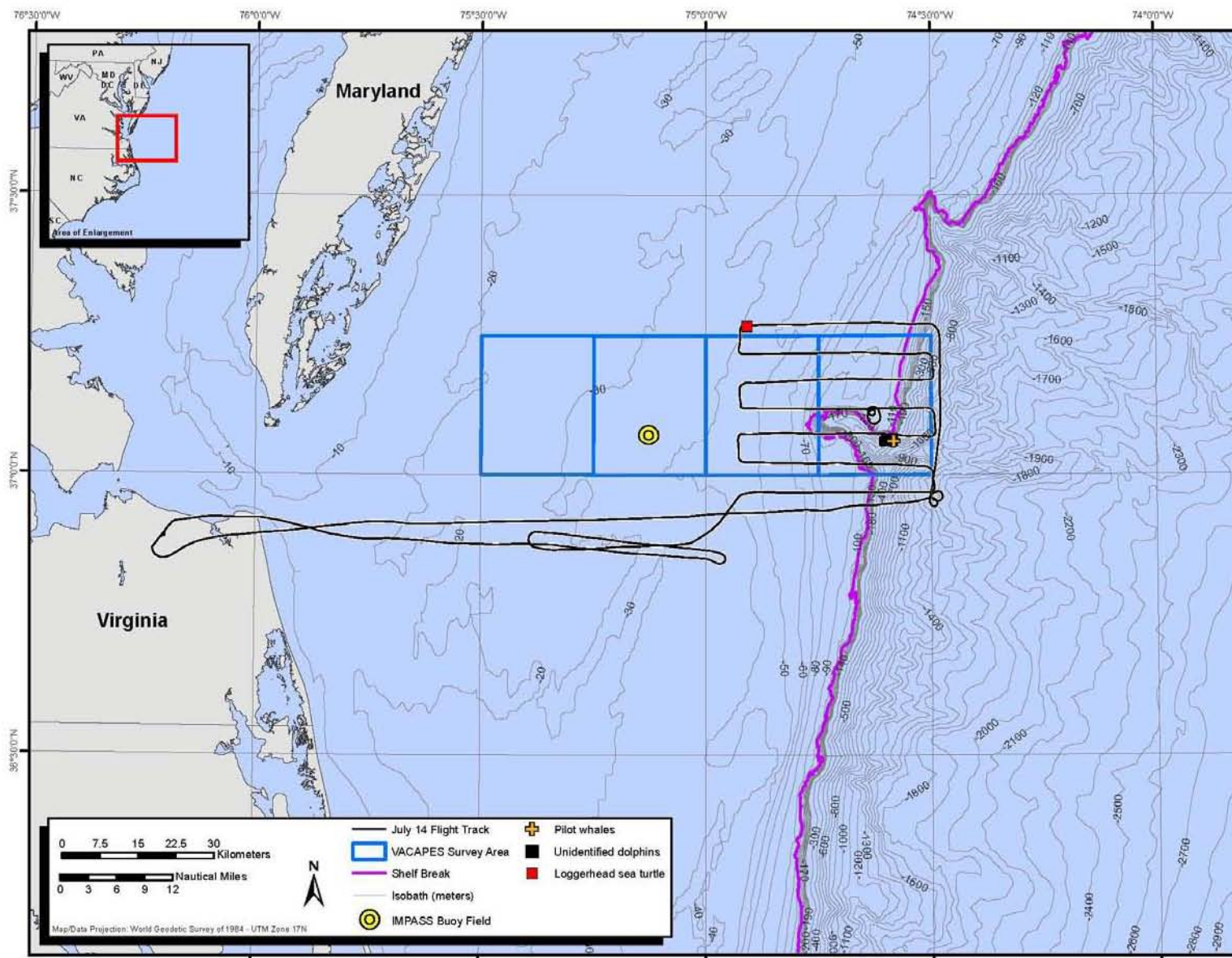


Figure II-7. Locations of cetacean and sea turtle sightings during FIREX surveys (14 July).

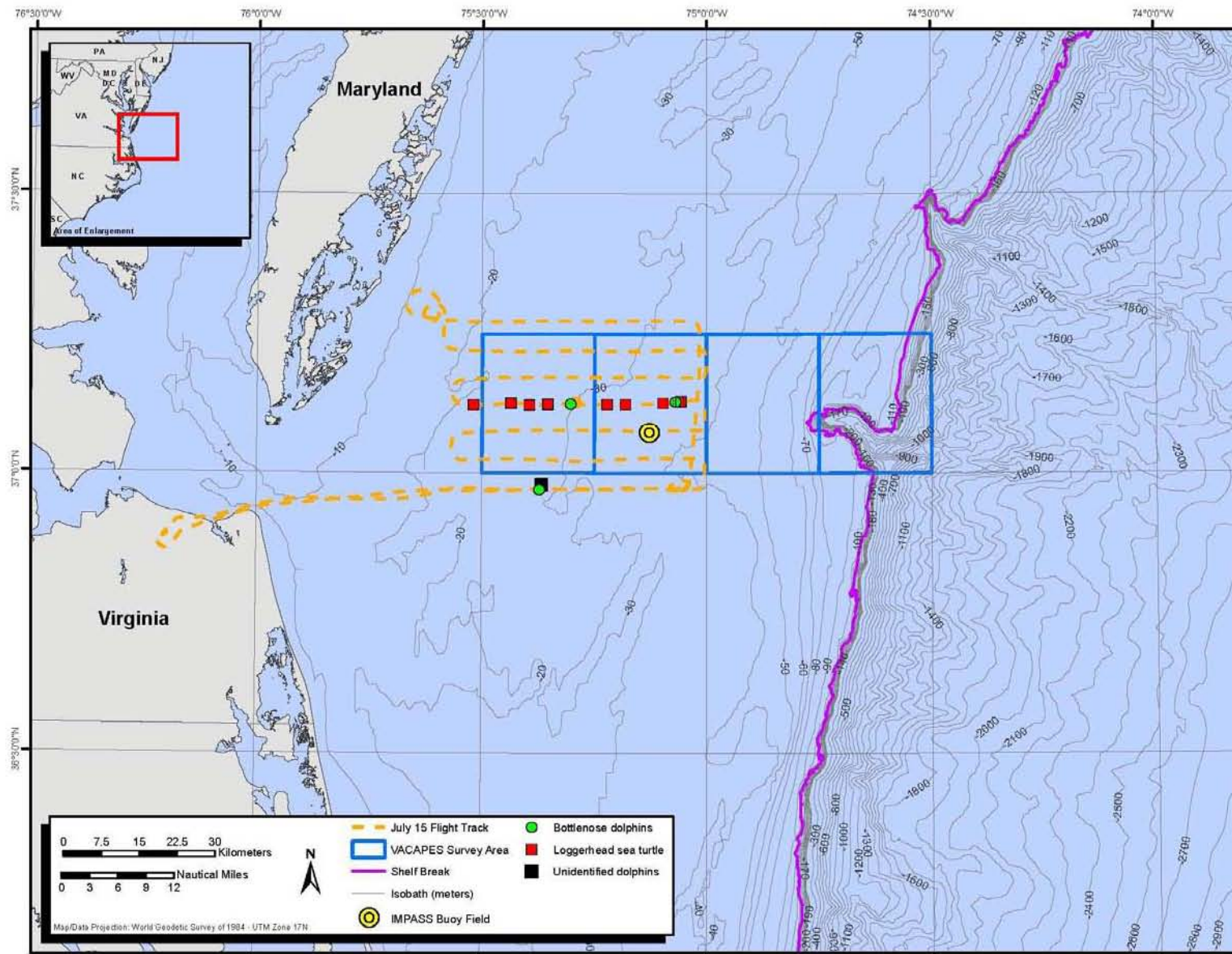


Figure II-8. Locations of cetacean and sea turtle sightings during post-FIREX surveys (15 July).

2.3 VACAPES Marine Mammal Observers (MMOs) on Navy Platforms

The U.S. Navy undertook monitoring of marine mammals during two naval exercises in VACAPES during the reporting period, associated with a FIREX with IMPASS training event in July and MINEX training event in August.

2.3.1 FIREX with IMPASS Event – July

Navy marine mammal biologists performed visual observations associated with a FIREX with IMPASS training event within the VACAPES Range Complex on 14 July 2011. Summary information regarding the visual observations obtained from the vessel survey is found in **Section 2.1.1**. For additional details, see **Appendix A** for the 2011 VACAPES FIREX with IMPASS Event Trip Report.

2.3.2 MINEX Event – August

Navy marine mammal biologists performed visual observations associated with the MINEX training event within the VACAPES Range Complex during 7-9 August 2011. Summary information regarding the visual observations obtained from the vessel surveys is found in **Section 2.1.2**. For additional details, see **Appendix B** for the 2011 VACAPES MINEX Event Trip Report.

2.4 VACAPES Passive Acoustic Monitoring (PAM)

Vessel surveys were conducted in association with a MINEX training event off the coast of Virginia Beach, Virginia in August (see **Section 2.1.2**; **Appendix B**). Acoustic buoys were deployed on 7 and 8 August to monitor marine mammal vocalization activity before, during, and after the MINEX event (see **Figures II-9** and **II-10**, respectively). Six buoys were deployed on both days (see **Appendix B**). Total successful recording time was approximately 38.3 hours, which included 22.75 hours on 7 August and 15.5 hours on 8 August.

At this time, no detailed analysis has been completed on the acoustic data set, except a quick visualization of the data. A preliminary analysis was performed on the 8 August data using 1-minute spectrogram windows. **Figure II-9** 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 and revealed assumed odontocete whistles. The image in the upper right displays the support RHIBs on site during the exercise. **Figure II-10** shows discrete whistle contours recorded by the monitoring buoy “Beaver” at approximately 13 (box A) and 14 (box B) seconds following the detonation. Based on earlier sightings from that day, the vocalizations are most likely from bottlenose dolphins. Plans are in place to conduct further analyses and any additional results that are found will be presented in the 2012 Monitoring Report.

There is no detailed analysis completed for the 2010 acoustic data (see DoN 2011b).

Spectrogram of 8 August Detonation

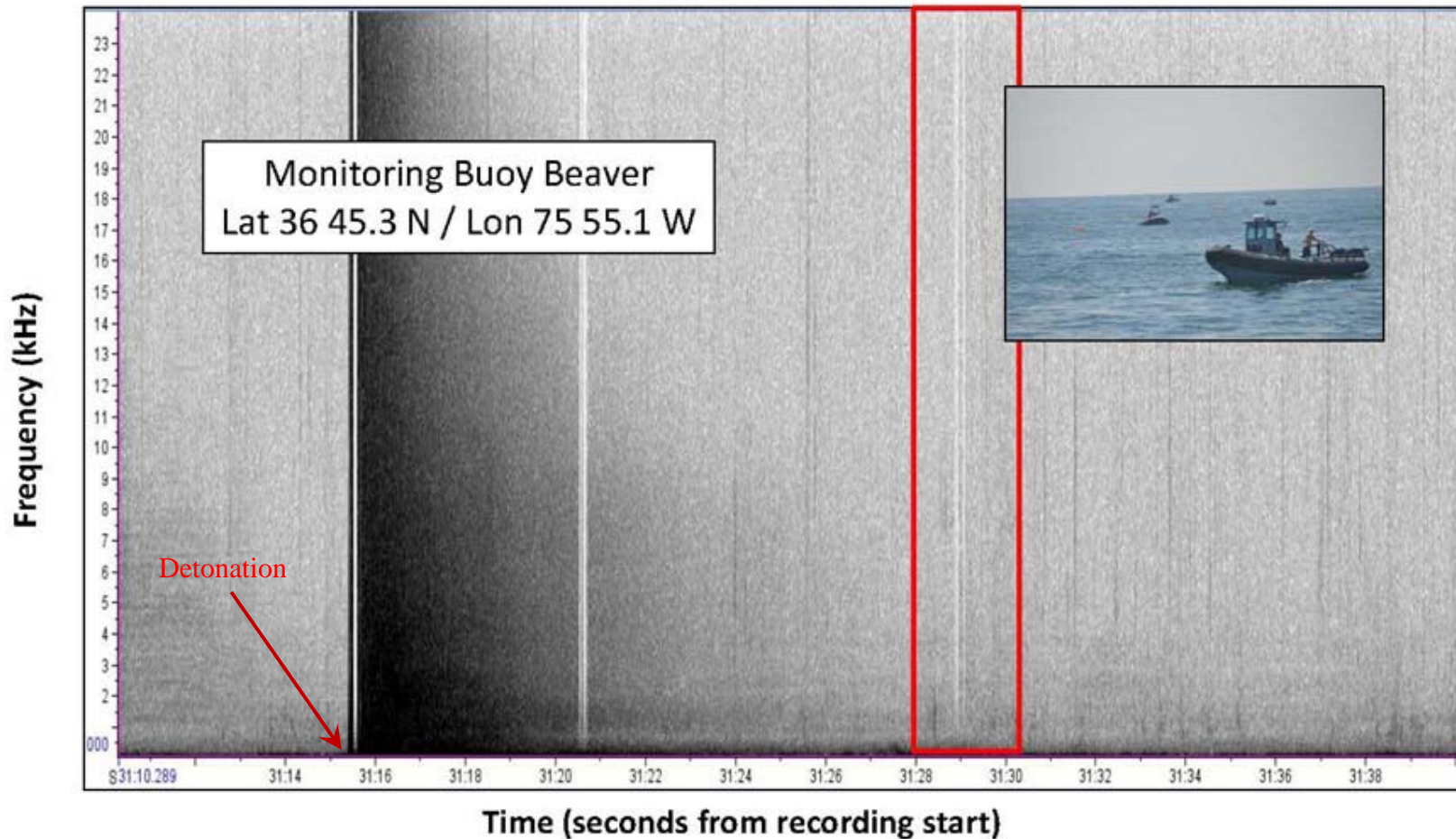


Figure II-9. Spectrogram of 8 August detonation recorded by monitoring buoy "Beaver." The portion of the recording outlined in red was investigated further and revealed what appear to be odontocete whistles; that segment is expanded in Figure II-10. The image in the upper right displays the support RHIBs on site during the exercise.

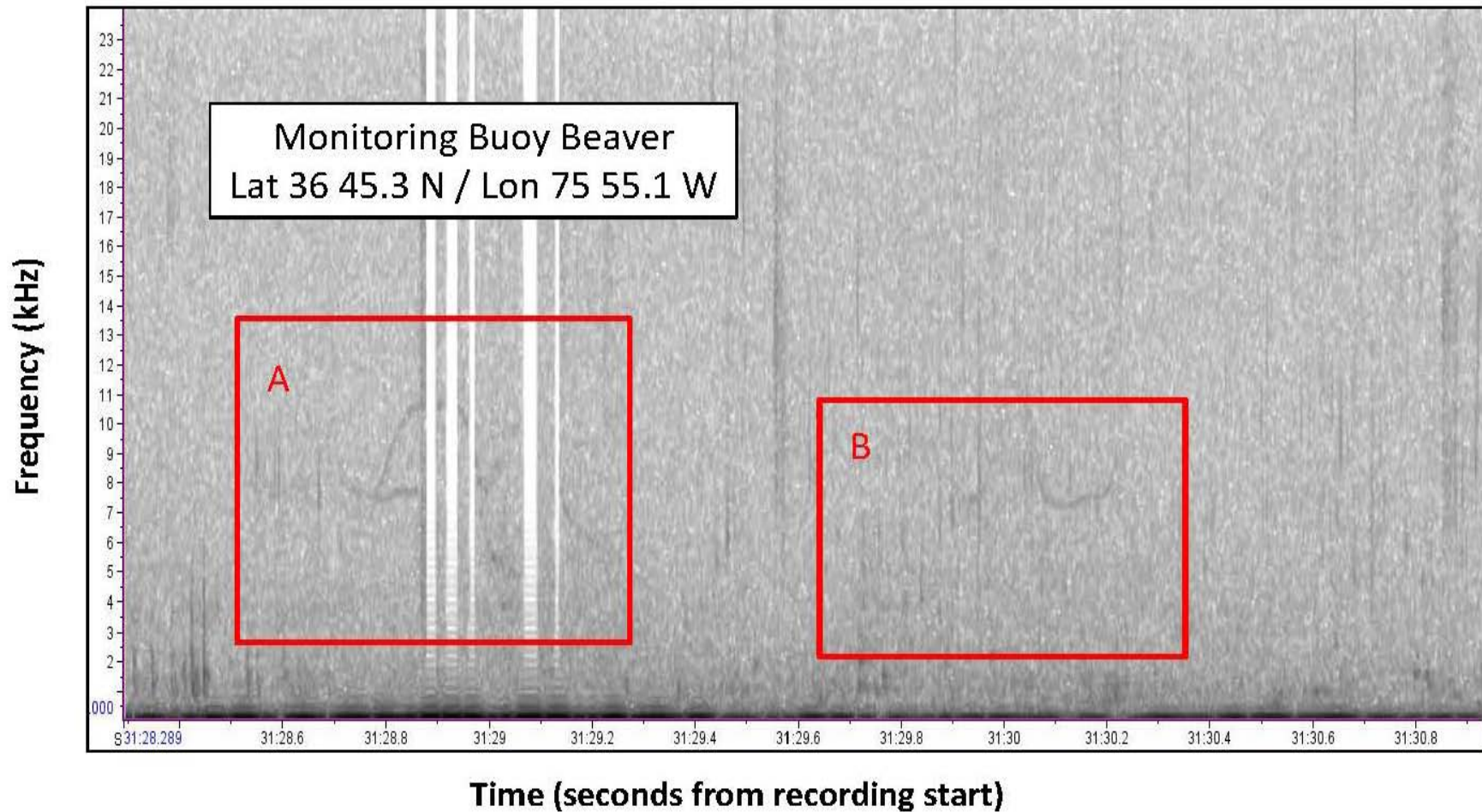


Figure II-10. Spectrogram of whistles in response to 8 August detonation. Discrete whistle contours recorded by monitoring buoy “Beaver” at approximately 13 (A) and 14 (B) seconds following the detonation. Given earlier sightings, the vocalizations are most likely from bottlenose dolphins.

SECTION III – CHERRY POINT (CHPT) RANGE COMPLEX

The geographic scope of the CHPT Study Area includes the area from the shoreline out to the 3 NM boundary of the OPAREA, as well as the Cherry Point OPAREA (**Figure III-1**).

There are 34 marine mammal species expected to occur regularly in the marine waters off North Carolina within the CHPT Study Area (DoN 2008b). There are 32 cetacean species (e.g., whales, dolphins, and porpoises), one pinniped species (e.g., seal) and one sirenian species (West Indian manatee). There are also six species of threatened and endangered sea turtles (reviewed in DoN 2008b).

1. CHPT Study Questions Overview

The goal of the CHPT Monitoring Plan is to implement field methods chosen to address the long-term monitoring objectives outlined in the *Introduction* (**Section I**). In the CHPT Monitoring Plan (DoN 2009b), the Navy proposed to implement a diversity of field methods to gather monitoring data for marine mammals and sea turtles in Navy training areas. Specifically, the Navy proposed to use visual surveys (aerial or vessel), deploy passive acoustic monitoring devices when possible, and put MMOs aboard Navy vessels, to meet its goals during the current time period. Studies were specifically designed to meet the questions outlined in the *Introduction* (**Section I**). **Table III-1** shows the 2011 monitoring objectives as initially agreed upon by the NMFS and Navy from the final CHPT Monitoring Plan.

Table III-1. 2011 CHPT monitoring obligations under CHPT Final Rule, LOA and BiOp.

STUDY 1 (behavioral responses)		
Aerial or Vessel Surveys	- 1 explosive event per year. When feasible, deploy hydrophone array during vessel surveys for passive acoustic monitoring.	Adaptive Management Review for 2011 (AMR)
Marine Mammal Observers (MMO)	- 1 explosive event per year.	
STUDY 2 (mitigation effectiveness)		
MMO/ Lookout Comparison	- 1 explosive event per year.	AMR
Vessel or Aerial Surveys Before And After Training Events	- 1 explosive event per year. When feasible, deploy hydrophone array during vessel surveys for passive acoustic monitoring.	

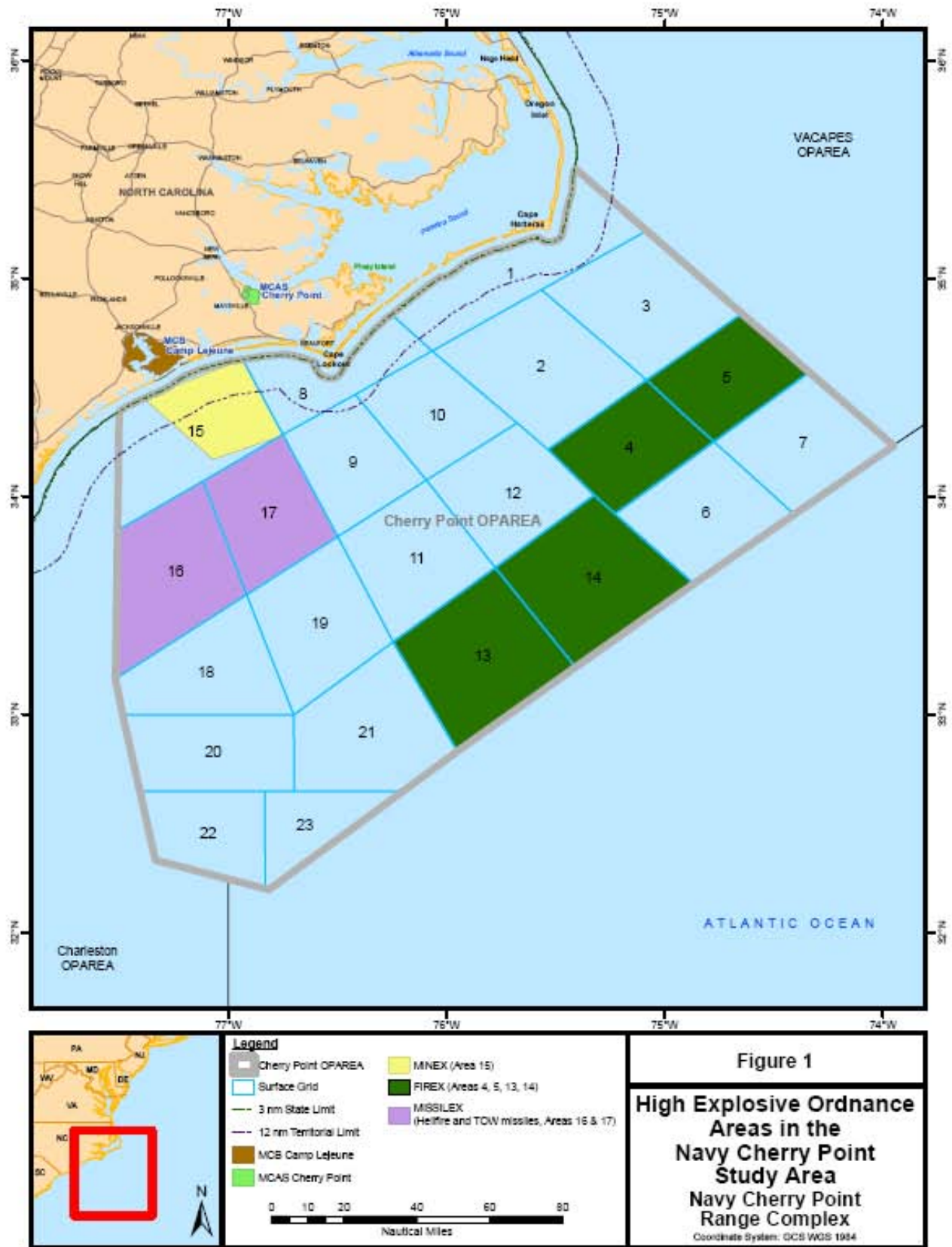


Figure III-1. CHPT Study Area.

2. CHPT Monitoring Accomplishments for 2011

During the 2 January 2011 – 1 January 2012 reporting period, USFF monitoring efforts were conducted in conjunction with a FIREX with IMPASS training event.

Major accomplishments from the USFF’s 2011 compliance monitoring in the CHPT Study Area are shown in Table III-2 and include:

- Aerial Visual Surveys
 - Completed aerial surveys within the U.S. Navy’s range box W-122 (Area 14) during a FIREX with IMPASS event.

Table III-2. U.S. Navy-funded monitoring accomplishments within the CHPT Study Area from January 2011 to January 2012.

Study Type	Description of U.S. Navy EIS/LOA Monitoring Completed	Event types Available for Monitoring	Annual MMPA/ESA Requirement	Total Accomplished
Vessel or aerial surveys before/during/after event (study 1 and 2)	Aerial or vessel visual surveys during 1 explosive event.	MINEX, MISSILEX, FIREX, or BOMBEX	1 event	1 event
Marine Mammal Observers (studies 1 and 2)	MMOs visually surveying from a Navy ship before, during and after 1 explosive event.	MINEX, MISSILEX, FIREX, or BOMBEX	1 event	Not feasible for events monitored
Passive Acoustic Monitoring (study 2)	Towed hydrophone arrays during shipboard surveys when feasible.	MINEX, MISSILEX, FIREX, or BOMBEX	Deploy hydrophone array during vessel surveys when feasible	Not feasible for events monitored

2.1 CHPT Aerial Visual Surveys

Aerial surveys were conducted in association with a FIREX with IMPASS training event off the coast of North Carolina. The pre-FIREX line-transect survey on 29 November was cancelled due to poor weather and low ceiling conditions. No sightings of marine mammals or sea turtles were recorded during 1.4 hours of total survey flight time (includes on-effort and off-effort intervals) within the survey area covering a 1-day period (30 November). One large unidentified whale was briefly seen approximately 18 kilometers (km) south of Lookout Bight, North Carolina (approximately 100 km outside of the survey area) on the transit back to the airport (**Figure III-2**). Attempts to relocate and confirm species ID in the high sea states were unsuccessful. As a result of the survey plane’s restricted access during the live-fire exercise, no naval vessels were seen within the area. For additional details, refer to **Appendix D** for the 2011 FIREX with IMPASS Event Trip Report.

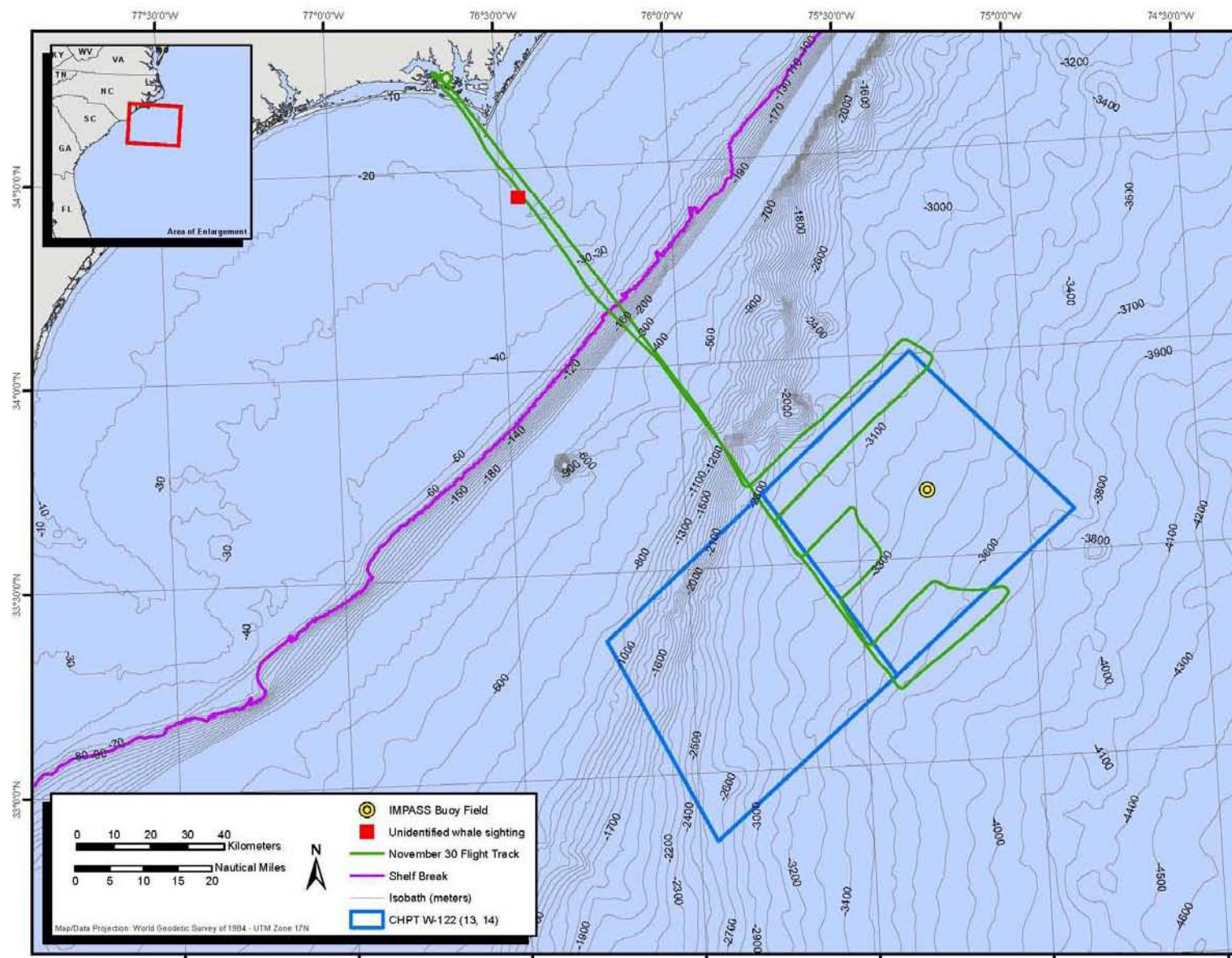


Figure III-2. Locations of all cetacean and sea turtle sightings recorded during FIREX surveys (30 November).

SECTION IV – JACKSONVILLE (JAX) RANGE COMPLEX

The geographic scope of the JAX Study Area includes the area from the shoreline out to the 3 NM boundary of the OPAREA, as well as the JAX OPAREA (**Figure IV-1**).

There are 30 marine mammal species or separate stocks with possible or confirmed occurrence in the marine waters off North Carolina, South Carolina, Georgia, and Florida within the JAX Study Area (DoN 2008c). There are 29 cetacean species (e.g., whales, dolphins, and porpoises) and one sirenian species (West Indian manatee). There are also six species of threatened and endangered sea turtles (reviewed in DoN 2008c).

1. JAX Study Questions Overview

The goal of the JAX Monitoring Plan is to implement field methods chosen to address the long-term monitoring objectives outlined in the *Introduction* (**Section I**). In the JAX Monitoring Plan (DoN 2009c), the U.S. Navy proposed to implement a diversity of field methods to gather monitoring data for marine mammals and sea turtles in U.S. Navy training areas. Specifically, the U.S. Navy proposed to use visual surveys (aerial or vessel), deploy passive acoustic monitoring devices when possible, and put MMOs aboard U.S. Navy vessels, to meet its goals during the current time period. Studies were specifically designed to meet the questions outlined in the *Introduction* (**Section I**) of this document. **Table IV-1** shows the 2011 monitoring objectives agreed upon by NMFS and U.S. Navy from the final JAX Monitoring Plan.

Table IV-1. 2011 JAX monitoring commitments under JAX Final Rule, LOA, and BiOp.

STUDY 1 (behavioral responses)		
Aerial or Vessel Surveys	- 2 explosive events per year, one of which is a multiple detonation event. When feasible, deploy hydrophone array during vessel surveys for passive acoustic monitoring.	Adaptive Management Review for 2011 (AMR)
Marine Mammal Observers (MMO)	- 1 explosive event per year.	
STUDY 2 (mitigation effectiveness)		
MMO/ Lookout Comparison	- 1 explosive event per year.	AMR
Vessel or Aerial Surveys Before And After Training Events	- 2 explosive events per year. When feasible, deploy hydrophone array during vessel surveys for passive acoustic monitoring.	

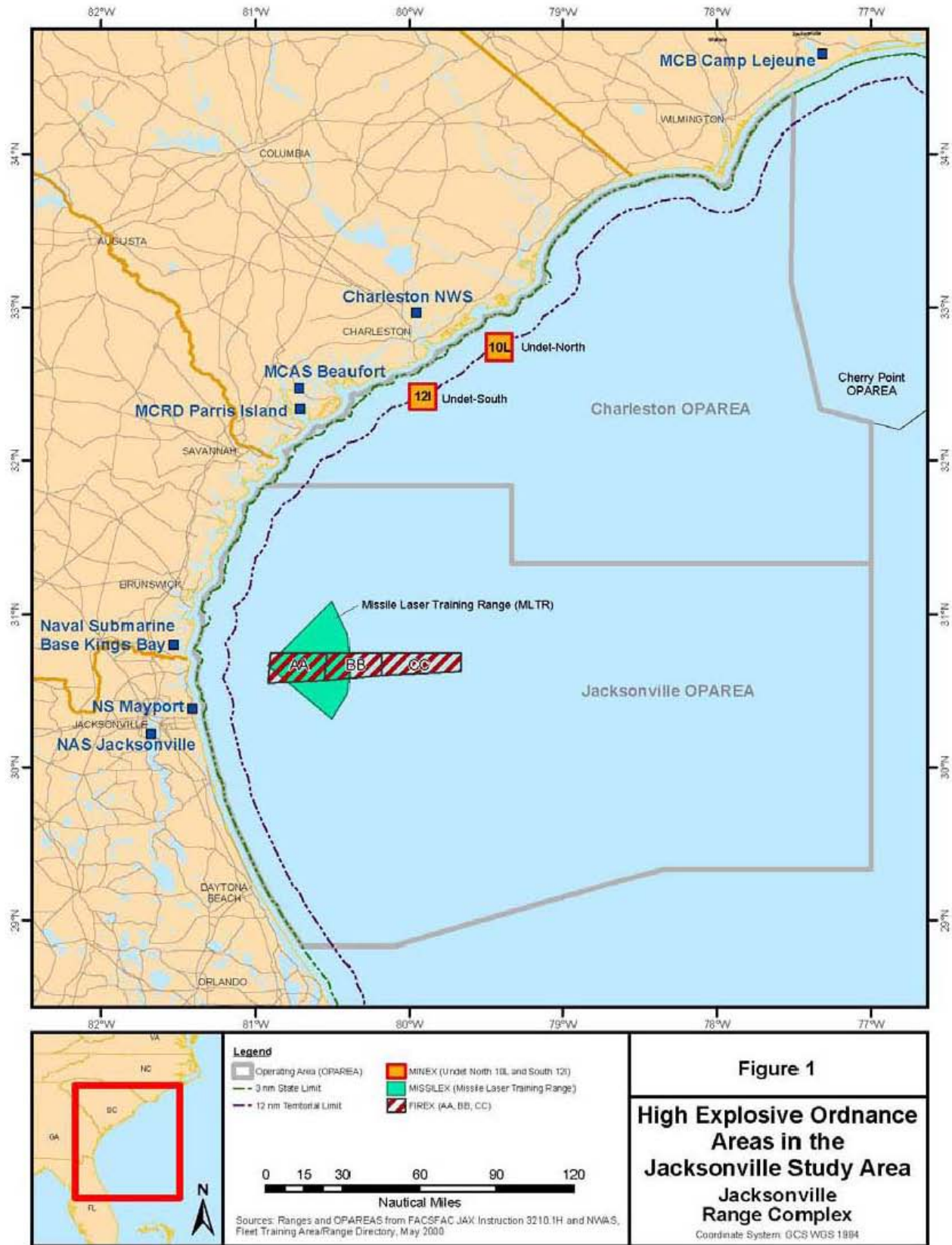


Figure IV-1. JAX Study Area.

2. JAX Monitoring Accomplishments for 2011

During the 2 January 2011 – 1 January 2012 reporting period, USFF monitoring efforts were conducted in conjunction with a FIREX with IMPASS training event.

Major accomplishments from the USFF's 2011 compliance monitoring in the JAX Study Area are shown in Table IV-2 and include:

- Aerial Visual Surveys
 - Completed aerial surveys within the FIREX BB/CC box before, during, and after one FIREX with IMPASS event.

Table IV-2. U.S. Navy funded monitoring accomplishments within the JAX Study Area from January 2011 to January 2012.

Study Type	Description of U.S. Navy EIS/LOA Monitoring Completed	Event Types Available for Monitoring	MMPA/ESA Requirement	Total Accomplished
Vessel or aerial surveys before and after event (study 1 and 2)	Aerial surveys during 2 MISSILEX events and aerial surveys during 2 FIREX events.	MINEX, MISSILEX, FIREX, or BOMBEX	2 events (1 multiple detonation event)	1 event (1 multiple detonation event)
Marine Mammal Observers (studies 1 and 2)	MMOs visually surveying before, during and after 1 FIREX event.	MINEX, MISSILEX, or FIREX	1 event	Not feasible for events monitored
Passive Acoustic Monitoring (study 2)	Not feasible for events monitored.	MINEX, MISSILEX, FIREX, or BOMBEX	Deploy hydrophone array during vessel surveys when feasible	Not feasible for events monitored

2.1 JAX Aerial Visual Surveys

Aerial surveys were conducted in association with a FIREX training event with IMPASS off the coasts of Georgia and Florida. Line-transect surveys were conducted on 19-21 September before, during, and after the training event. A summary of the sightings are presented in **Table IV-3**.

Table IV-3. Summary of marine species sightings from the aerial surveys conducted during 19-21 September 2011 for the FIREX with IMPASS training event in JAX.

Common Name	Scientific Name	Sightings	Individuals
Loggerhead turtle	<i>Caretta caretta</i>	8	8
Unidentified sea turtle		2	2

No sightings of marine mammals were recorded during these surveys. Sightings over the 3-day period included eight sightings of loggerhead sea turtles and two sightings of unidentified sea turtles. This survey was hindered by heavy rain and low cloud ceilings restricting both visibility and safe flying conditions. One sighting of a loggerhead sea turtle was made during the 1-day pre-FIREX survey

(Figure IV-2). Four sightings of sea turtles were made throughout the 1-day during-FIREX survey period **(Figure IV-3).** Five sightings of sea turtles were made during the 1-day post-FIREX survey **(Figure IV-4).** No injuries or mortalities to sea turtles were observed during the FIREX training event on 20 September. No live explosive rounds were used during the FIREX training; therefore, no animals were exposed to any explosive detonations during this JAX FIREX with IMPASS training event. The survey team did not conduct any focal follows because no sightings of marine mammals were recorded during the FIREX monitoring effort. For additional details, see **Appendix E** for the 2011 JAX FIREX with IMPASS Event Trip Report.

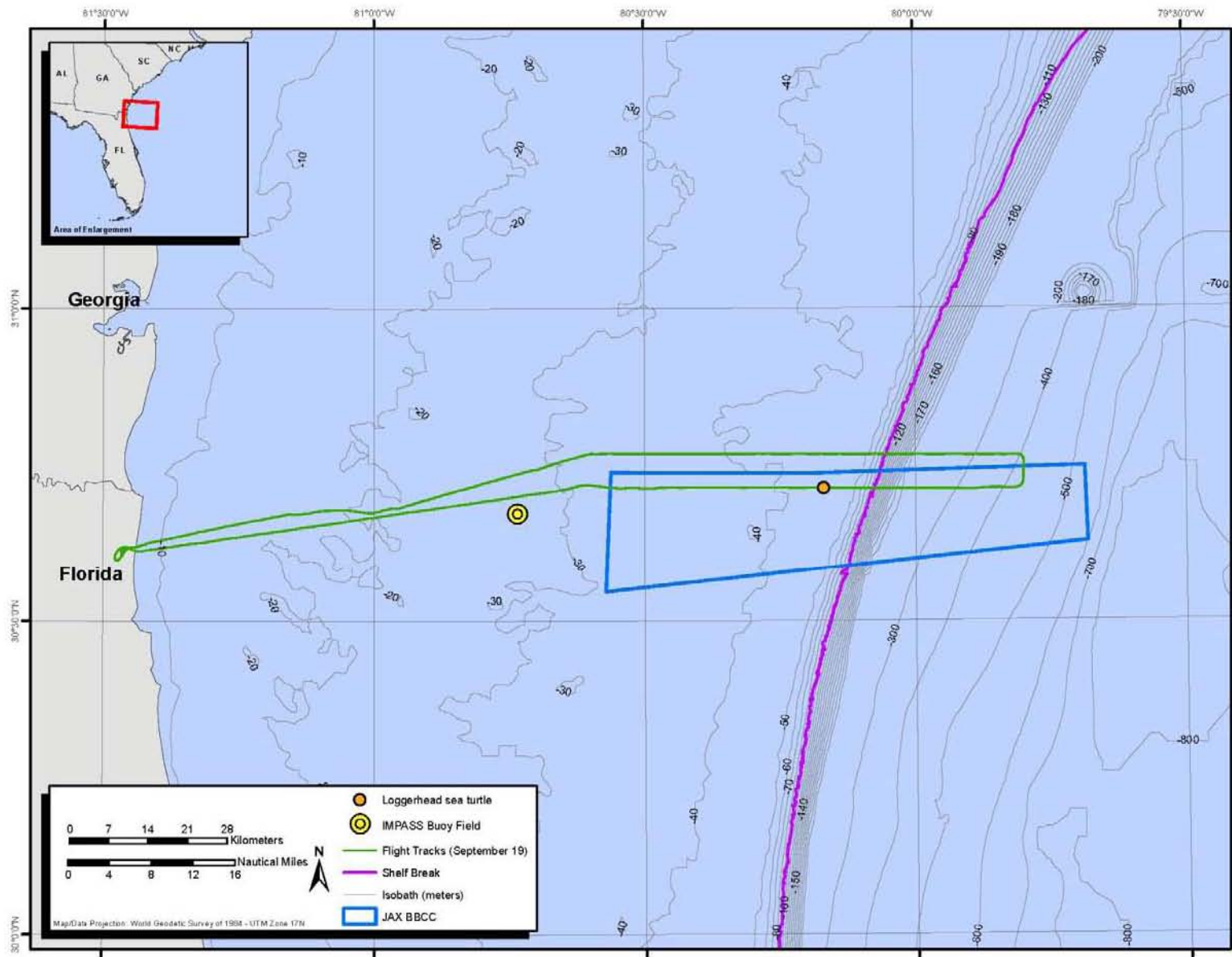


Figure IV-2. Locations of cetacean and sea turtle sightings recorded during pre-FIREX surveys (19 September).

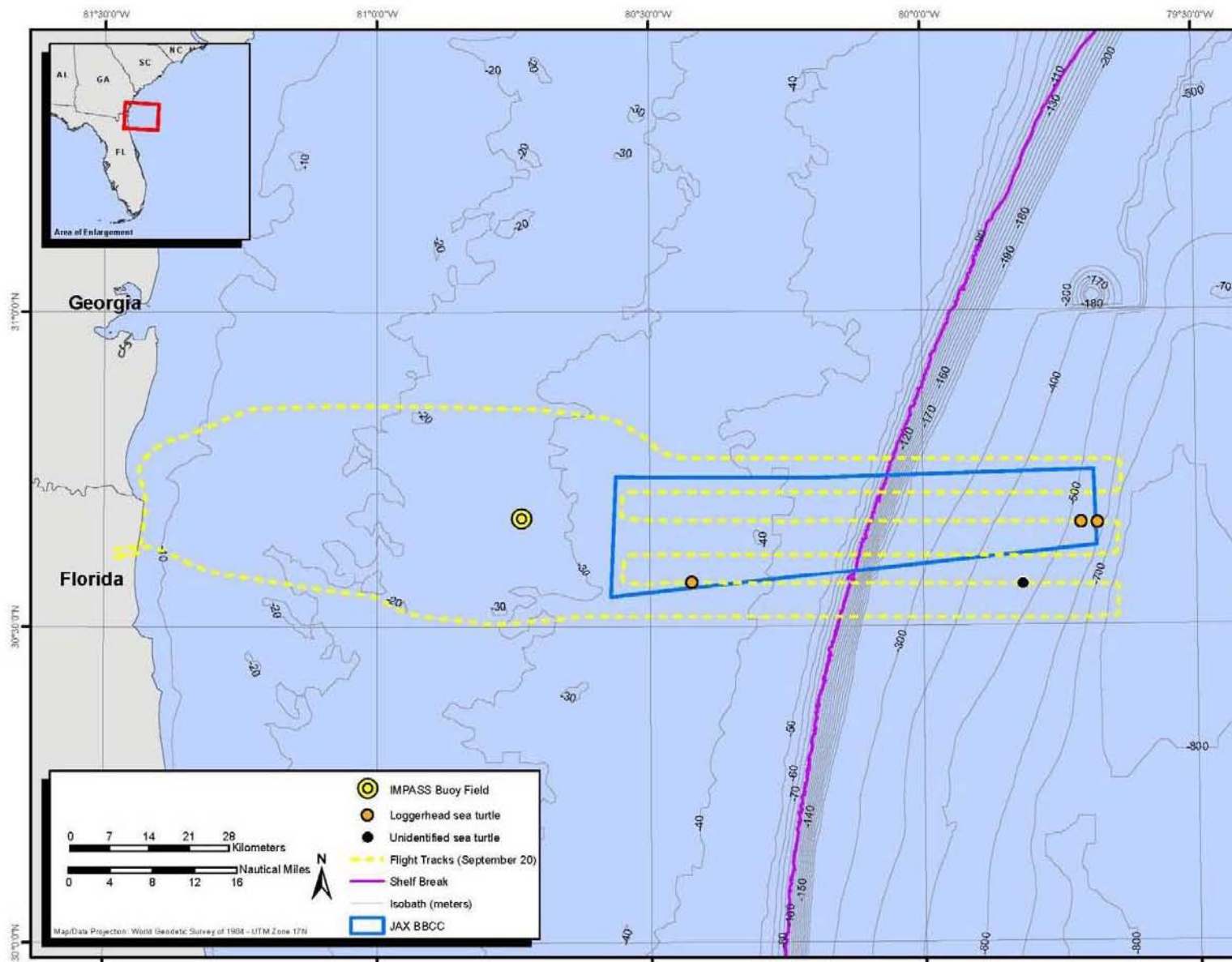


Figure IV-3. Locations of cetacean and sea turtle sightings recorded during FIREX surveys (20 September).

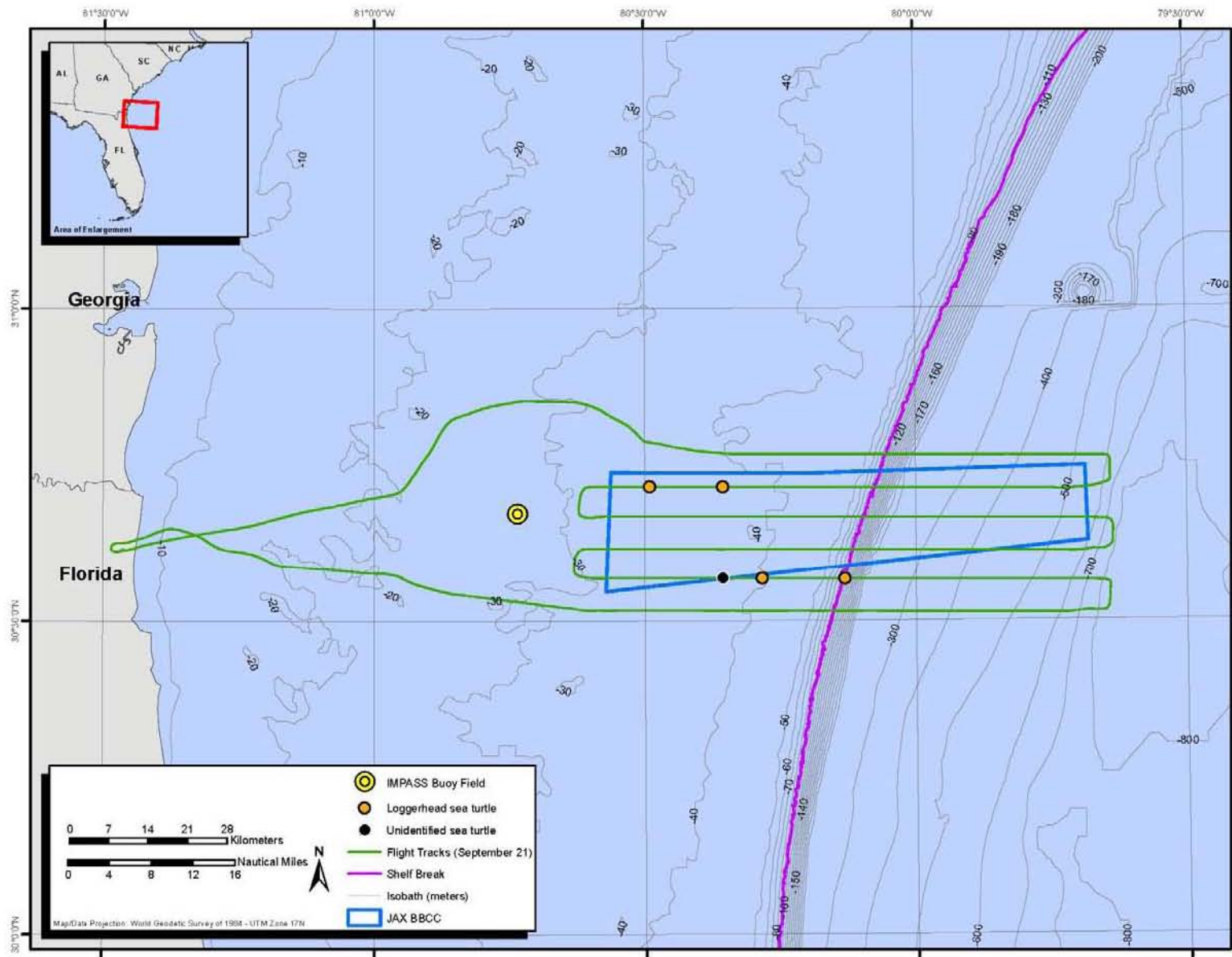


Figure IV-4. Locations of cetacean and sea turtle sightings recorded during post-FIREX surveys (21 September).

SECTION V – GULF OF MEXICO (GOMEX) RANGE COMPLEX

The geographic scope of the GOMEX Study Area includes the area from the shoreline out to the 3 NM boundaries of the Corpus Christi OPAREA, New Orleans OPAREA, Pensacola OPAREA, and Panama City OPAREA, as well as the OPAREAs (**Figure V-1**).

There are 29 marine mammal species with possible or confirmed occurrence in the marine waters off Texas, Louisiana, Mississippi, Alabama and Florida within the GOMEX Study Area (DoN 2007). There are 28 cetacean species (e.g., whales and dolphins) and one sirenian species (West Indian manatee). There are also six species of threatened and endangered sea turtles (reviewed in DoN 2007).

1. GOMEX Study Questions Overview

The goal of the GOMEX Monitoring Plan is to implement field methods chosen to address the long-term monitoring objectives outlined in the *Introduction* (**Section I**). In the GOMEX Monitoring Plan (DoN 2011), the U.S. Navy proposed to implement a diversity of field methods to gather monitoring data for marine mammals and sea turtles in U.S. Navy training areas. Specifically, the U.S. Navy proposed to use visual surveys (aerial or vessel), deploy passive acoustic monitoring devices when possible, and put MMOs aboard U.S. Navy vessels, to meet its goals during the current time period. Studies were specifically designed to meet the questions outlined in the *Introduction* (**Section I**) of this document. **Table V-1** shows the 2011 monitoring objectives agreed upon by NMFS and U.S. Navy from the final GOMEX Monitoring Plan.

Table V-1. 2011 GOMEX monitoring commitments under JAX Final Rule, LOA, and BiOp.

STUDY 1 (behavioral responses)		
Aerial or Vessel Surveys	- 1 explosive event per year. When feasible, deploy hydrophone array during vessel surveys for passive acoustic monitoring.	Adaptive Management Review for 2011 (AMR)
Marine Mammal Observers (MMO)	- 1 explosive event per year.	
STUDY 2 (mitigation effectiveness)		
MMO/ Lookout Comparison	- 1 explosive event per year.	AMR
Vessel or Aerial Surveys Before And After Training Events	- 1 explosive event per year. When feasible, deploy hydrophone array during vessel surveys for passive acoustic monitoring.	

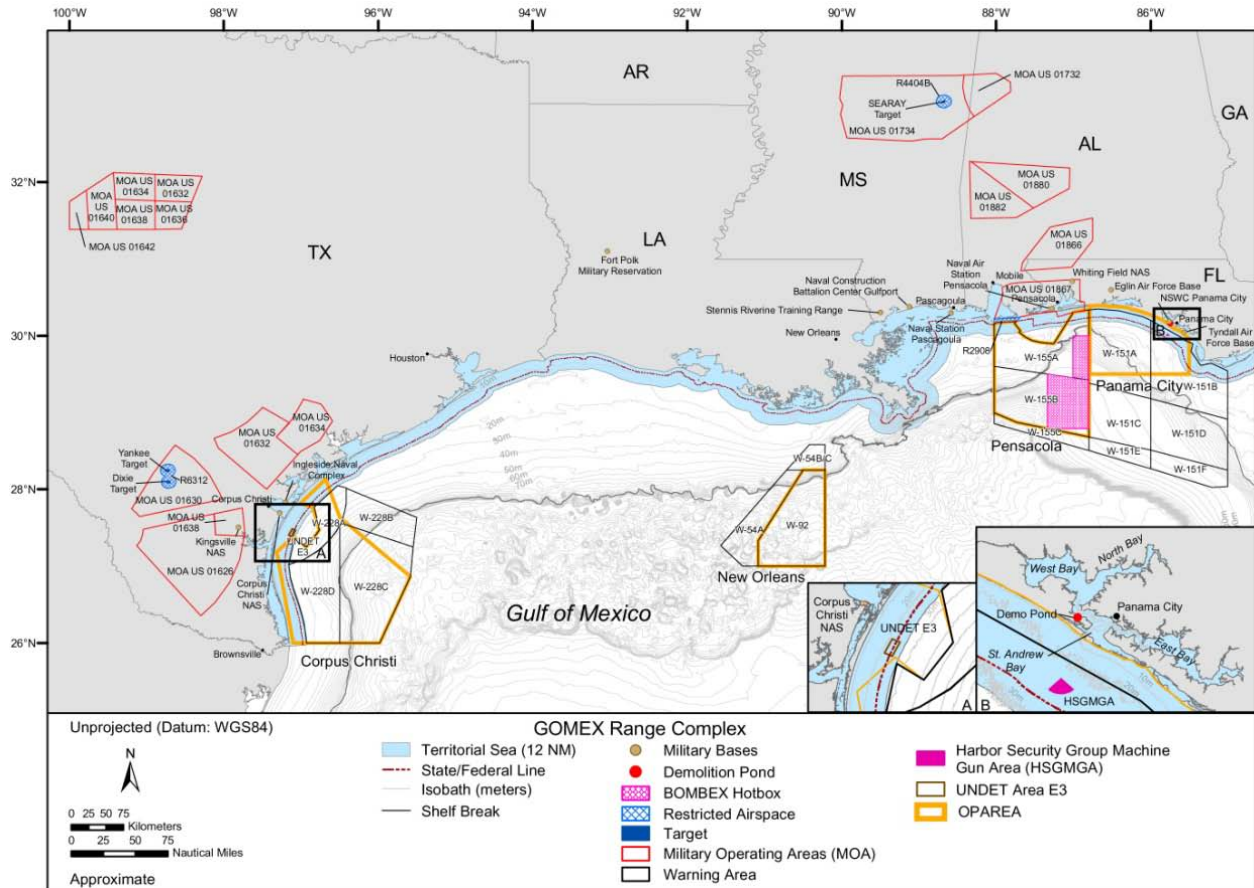


Figure V-1. GOMEX Study Area.

2. GOMEX Monitoring Accomplishments for 2011

From March 2011 – January 2011, there were no training events conducted and therefore no monitoring opportunities available for explosive events in the GOMEX OPAREA. Therefore, there is no monitoring to report at this time.

SECTION VI – ADAPTIVE MANAGEMENT RECOMMENDATIONS

Adaptive management is an iterative process of optimal decision making in the face of uncertainty, with an aim to reducing uncertainty over time via system monitoring (Williams et al. 2009). Within the natural resource management community, adaptive management involves ongoing, real-time learning and knowledge creation, both in a substantive sense and in terms of the adaptive process itself. Adaptive management focuses on learning and adapting, through partnerships of managers, scientists, and other stakeholders who learn together to achieve an overall net gain for ecosystems. Adaptive management helps science managers maintain flexibility in their decisions, knowing that uncertainties exist, and provides managers the latitude to change direction that will improve understanding of ecological systems to achieve management objectives. Taking action to improve progress towards desired outcomes is another function of adaptive management.

A 2010 Navy-sponsored monitoring meeting in Arlington, Virginia initiated a process to critically evaluate the current Navy monitoring plans and begin development of revisions/updates to both existing region-specific plans and the Navy-wide Integrated Comprehensive Monitoring Program (ICMP). Discussions at that meeting as well as the Navy/NMFS annual adaptive management meeting (October 2010) established a way forward for continued refinement of the Navy's monitoring program. This process included establishment of a SAG, composed of leading marine mammal scientists, with the initial task of developing recommendations that would serve as the basis for a Strategic Plan for Navy monitoring. The Strategic Plan is intended to be a primary component of the ICMP and to provide a "vision" for Navy monitoring across geographic regions—serving as guidance for determining how to most efficiently and effectively invest the marine species monitoring resources to address ICMP top-level goals and to satisfy MMPA (LOA) regulatory requirements. The objective of the Strategic Plan is to continue the evolution of Navy marine species monitoring towards a single integrated program, incorporating SAG recommendations, and establishing a more transparent framework for soliciting, evaluating, and implementing monitoring work across the Fleet range complexes. The Strategic Plan is currently being developed in coordination with input from NMFS Headquarters and the Marine Mammal Commission and will establish the process for soliciting, reviewing, and selecting the most appropriate monitoring projects to invest in across the Navy. It is anticipated that some current efforts will continue but the level of effort and investment may be allocated differently across Navy ranges.

Originally, five study questions were developed jointly by NMFS and the Navy as guidance for developing monitoring plans for both sonar and explosive training events, and all existing range-specific monitoring plans attempted to address each of these study questions as appropriate (not all questions applied to training activities being reported on here). However, the state of knowledge for the various range complexes is not equal, and many factors including level of existing information, amount of training activity, accessibility, and available logistics resources, all contribute to the ability to perform particular monitoring activities. In addition, the Navy monitoring program has historically been compartmentalized by range-complex and focused on effort-based metrics (e.g., survey days, trackline covered, etc.).

The Navy established the SAG in 2011 with the initial task of evaluating current Navy monitoring approaches under the ICMP and existing LOAs to develop objective scientific recommendations that would form the basis for the Strategic Plan. While recommendations were fairly broad and not prescriptive from a range complex perspective, the SAG did provide specific programmatic

recommendations that serve as guiding principles for the continued evolution of the Navy Marine Species Monitoring Program and provide a direction for the Strategic Plan development.

In June 2011, the Navy hosted a Marine Mammal Monitoring Workshop, with guidance and support from NMFS, which included scientific experts and representatives of environmental non-governmental organizations (NGOs). The purpose of the workshop was to present a consolidated overview of monitoring activities accomplished in 2009 and 2010 pursuant to the MMPA Final Rules currently in place, including outcomes of selected monitoring-related research and lessons learned, and to seek feedback on future directions. A significant outcome of this workshop was a recommendation to continue consolidating monitoring efforts from individual range-complex plans and to develop a single Strategic Plan for Navy Monitoring that will improve the return on investment by focusing specific objectives and projects where they can most efficiently and effectively be addressed throughout the Navy range complexes. The Strategic Plan is currently in development and will be incorporated as a primary component of the ICMP.

VACAPES Range Complex

There are no additional modifications requested for the VACAPES Monitoring Plan as amended by the June 2011 LOA monitoring requirements.

As noted in the *Introduction (Section I)*, the Navy will explore the value of adding field measurements during monitoring of a future mine-neutralization event after evaluating the environmental variables affecting sound propagation in the area, such as shallow depths, seasonal temperature variation, bottom sediment composition, and other factors that would affect our confidence in the data collected. If such data can be collected without unreasonable costs and impacts to training, the Navy will move forward in incorporating the measurements into its monitoring program for east coast mine-neutralization training.

CHPT Range Complex

There are no additional modifications requested for the VACAPES Monitoring Plan as amended by the June 2011 LOA monitoring requirements.

JAX Range Complex

There are no additional modifications requested for the VACAPES Monitoring Plan as amended by the June 2011 LOA monitoring requirements.

GOMEX Range Complex

There are no additional modifications requested for the GOMEX Monitoring Plan.

A summary of current monitoring progress for the VACAPES, CHPT, JAX and GOMEX range complexes for Year 1 through Year 3 (to date) is shown below in **Table VI-1**.

Table VI-1. Summary of monitoring progress for Years 1 through 3.

Range Complex	Monitoring Event	Annual Requirement	Year 1	Year 2	Year 3	Total	
			5 June 2009 - 4 June 2010	5 June 2010 - 4 June 2011	5 June 2011 - 4 June 2012	Required	Completed
VACAPES	Aerial or Vessel Survey	2 (1 Multiple Detonation Exercise [MDE])	2 MINEX (with PAM)	1 MINEX (with PAM), 1 IMPASS (1 MDE)	1 MINEX (with PAM), 1 IMPASS (1 MDE)	6 (3 MDE)	6 (2 MDEs)
	MMO on Navy Platform	1	2 MINEX	1 MINEX	2 (1 IMPASS, 1 MINEX)	3	4
CHPT	Aerial or Vessel Survey	1	0*	0*	1	3	1
	MMO on Navy Platform	1	0*	0*	0	3	0
JAX	Aerial or Vessel Survey	2 (1 MDE)	0	2 MISSILEX, 2 IMPASS (2 MDEs)	1 IMPASS (1 MDE)	6 (3 MDE)	5 (2 MDEs)
	MMO on Navy Platform	1	0	1 IMPASS	0	3	1
Range Complex	Monitoring Event	Annual Requirement	Year 1	Year 2	Year 3	Total	
			18 March 2011 - 17 March 2012	18 March 2012 - 17 March 2013	18 March 2013 - 17 March 2014	Required	Completed
GOMEX	Aerial or Vessel Survey	1	0*			3	0
	MMO on Navy Platform	1	0*			3	0

*No monitoring due to no training events being conducted.

NA = not applicable

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***Appendix A – MMO Report for VACAPES FIREX with IMPASS
in July 2011***

January 2012

**Trip Report, July 2011 FIREX Marine Mammal
Monitoring
VACAPES Range Complex**

Prepared for:
Commander, United States Fleet Forces Command



Prepared by:
Naval Facilities Engineering Command, Atlantic



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List of Acronyms and Abbreviations

CO	Commanding Officer
ft	feet
EST	Eastern Standard Time
FIREX	Firing Exercise
IMPASS	Integrated Maritime Portable Acoustic Scoring and Simulation System
km	kilometers
kts	knots (nautical miles per hour)
MMO	Marine Mammal Observer
nm	nautical miles
NMFS	National Marine Fisheries Service
PMAP	Protective Measures Assessment Protocol
VACAPES	Virginia Capes Range Complex
XO	Executive Officer
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 Plans (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 the Navy 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 is 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, four U.S. Navy MMOs (Ms. Sarah Bellau, Mr. Anu Kumar, Ms. Erin Swiader and Mr. Scott Haga) participated in a firing exercise (FIREX) with Integrated Maritime Portable Acoustic Scoring System (IMPASS) exercise on July 13-14. These MMOs were stationed aboard *USS THE SULLIVANS* (DDG 68). The primary goal of the FIREX monitoring effort was to collect data on marine mammals observed during operations and to answer the follow 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: FIREX WITH IMPASS DESCRIPTION

A FIREX involves bombardment of a target within an impact area by one or more ships. The scenario is as follows: the IMPASS is deployed by the firing ship and consists of five sonobuoys set in a pentagon-shaped arrangement at 1.3 km intervals. Within the ship’s combat system, the training system creates a virtual land mass that overlays the array and simulates land targets. The

ship then positions itself about 4 to 5 nm from the target area. The ship fires its ordnance into the target area; the sonobuoys detect the bearing to the acoustic noise resulting from the impact of a round landing in the water, and then transmit their GPS position and their bearing information to the ship. From the impact location data collected, the training system computer triangulates the exact point of impact of the round and, from those data, the exercise may be conducted as if the ship were firing at an actual land target. When the training is complete, the IMPASS buoy system is recovered by the ship. Inert ordnance was used in this FIREX with IMPASS event.

SECTION 3: METHODS

3.1. SHIPBOARD MARINE MAMMAL 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 *USS THE SULLIVANS* to accomplish its mission objectives. The only exception would be if a marine mammal was sighted by the MMO within the shut-down zone during the event (within 700 yds of the target for FIREX with IMPASS event) and was not sighted by the lookout, the MMO would report the sighting to the lookout for appropriate reporting and action.

The MMO survey was conducted on the bridge wing of *USS THE SULLIVANS*, with one MMO on each wing. During on-effort surveys, the MMOs would use the naked eye and 7X50 binoculars to scan the area from dead ahead to just abaft of the beam. In searching this area, the MMOs would start at the forward part of the sector and search aft. Binoculars were held so that the horizon was in the top third of the field of view. The field of view was scanned from the horizon towards the ship. Once the field of view was scanned, the binoculars were repositioned and the field of view was scanned again (Figure 1). Once the scan with the binoculars was completed, the eyes were rested for a few seconds and the entire sector was scanned with the naked eye.

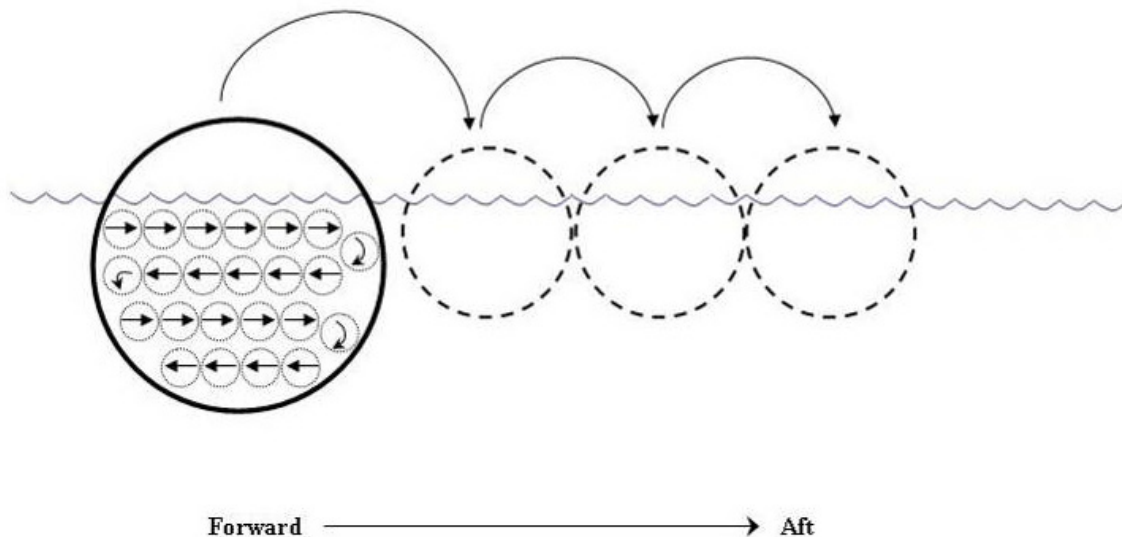


Figure 1. MMO Surface Searching Procedure

When an animal was visually detected the MMO would collect information on twenty-three sighting, environmental, and sonar parameters (Table 1). When practicable, still photographs were obtained by the MMO.

Table 1. Shipboard 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 vessel at the time of the sighting, provided by monitors on the bridge.
Detection Sensor	Either visual or aural (if detected passively by the sonar technician) and which MMO observed the animal.
Species/Group	Determined by the MMO.
Group Size	Estimated by the MMO.
# Calves	Estimated by the MMO.
Bearing (true)	Estimated by the MMO.
Distance (yds)	Estimated by the MMO using reticled binoculars.
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.
Operational Information	
Active sonar in use?	Specifically refers to MFAS.
Explosives in use?	This refers to whether an explosive event occurred within the monitoring rotation, not necessarily whether an explosion occurred at the specific time of the sighting.
Direction of ship travel	Provided by monitors on the bridge.
Animal motion	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
Mitigation implemented	If explosives in use, the measures implemented, if any, by the vessel.
Comments	Other comments as necessary.

3.2. SCHEDULE OF EVENTS

USS THE SULLIVANS departed Yorktown, Virginia, on 13 July at approximately 1500 Eastern Standard Time (EST). A FIREX with IMPASS using the 5 inch guns (bow) was conducted on 14 July, followed by the ship returning the IMPASS team and MMOs to Rudee Inlet, Virginia. A detailed schedule of events is provided below in Table 2.

Table 2. Schedule of Events

13 July	
Time	Notes
1500	<i>USS THE SULLIVANS</i> underway
1600	MMOs testing equipment/tour of vessel
1800	MMOs participate in IMPASS brief

14 July	
Time	Notes
0705	MMOs on effort / Buoy deployment begins
0749	FIREX begins
1144	MMOs off effort
1158	MMOs on effort
1302	FIREX ends / Buoy recovery begins
1312	MMOs off effort
1700	IMPASS team / MMOs return to Rudee Inlet

SECTION 4: RESULTS

One marine species sighting, of a hardshell turtle, was recorded by the MMOs (Table 3). The sighting as well as the buoy field location is shown on Figure 2.

Table 3. Marine Species Sightings Data

Data Category	Sighting 1
Sightings Information	
Effort (on/off)	on
Date	07/14/2011
Time	08:44
Location	37°05.112'N 075°13.583'W
Detection Sensor	Visual - Naked Eye
Species/Group	Hardshell Turtle
Group Size	1
# Calves	0
Bearing (true)	340°
Distance (yds)	60
Length of contact	?
Environmental Information	
Wave height (ft)	4-6
Visibility	unrestricted
BSS	4
Swell direction (true)	From NE
Wind direction (true)	NE
% glare	50%
% cloud cover	20%
Operational Information	
Active sonar in use?	no
Explosives in use?	no
Direction of ship travel	160°
Animal motion	parallel
Behavior	traveling
Mitigation implemented	N/A
Comments	Animal was sighted by an MMO on the bridge while firing was not occurring during RHIB recovery of a malfunctioning IMPASS buoy. Sighting occurred approximately 35 minutes after the completion of the 1 st round of firing, and 45 minutes prior to the start of the 2 nd round of firing. The area was clear when the 2 nd round of firing commenced.

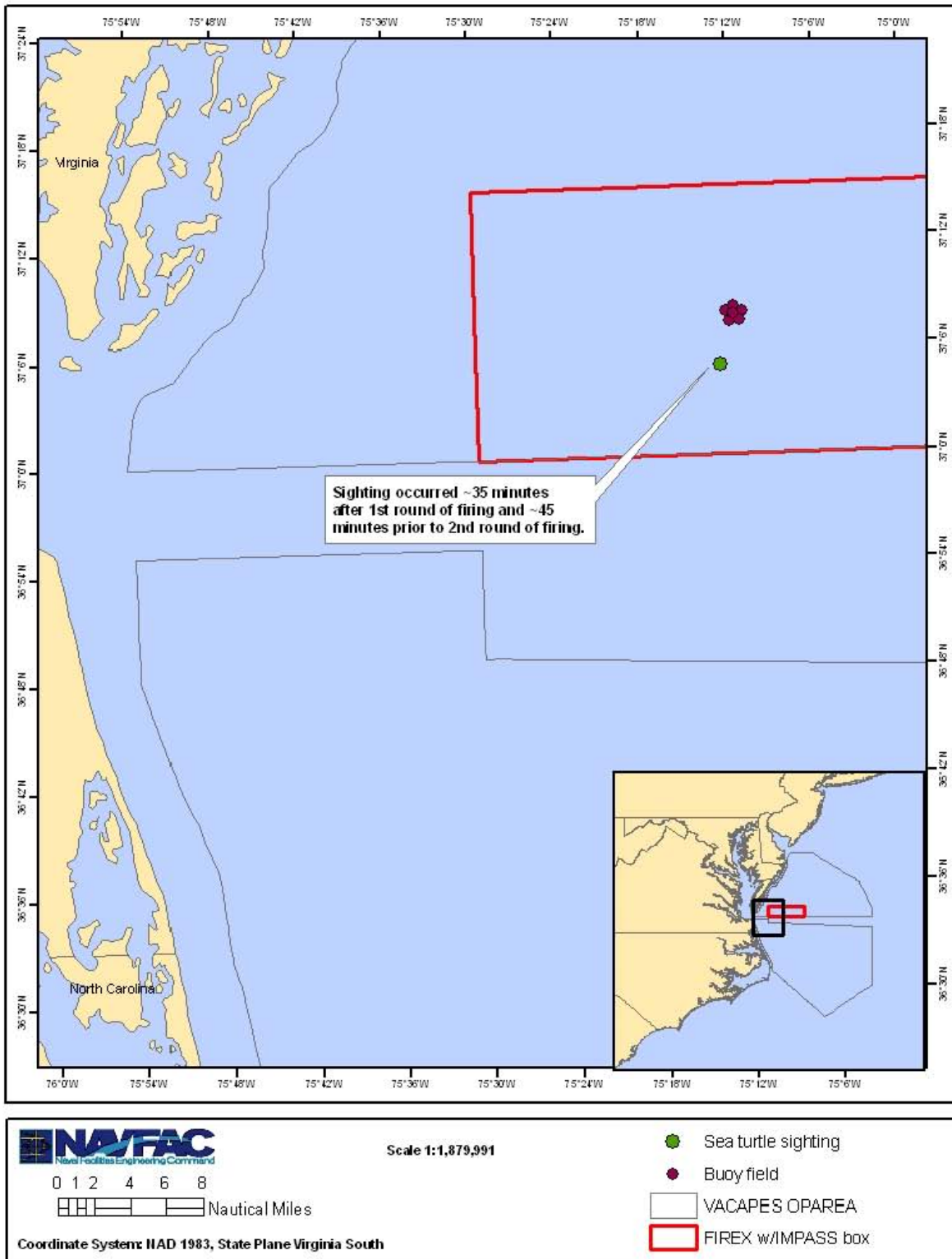


Figure 2. Sea Turtle Sighting and Buoy Field Location

SECTION 5: CONCLUSION

5.1. MARINE MAMMAL MONITORING

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

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

Because inert ordnance was used in this IMPASS event, there was no potential for exposure of marine mammals and sea turtles to explosives. One sea turtle sighting was obtained by *USS THE SULLIVANS* MMOs during the FIREX. The sighting occurred during RHIB recovery of a malfunctioning IMPASS buoy and was estimated to be approximately 60 yds from the vessel. The sighting was very brief, and no unusual behavior was observed. The area was monitored for 30 minutes, but the animal was not seen again and was assumed to have moved out of the area. Since the animal was not seen for 30 minutes within the 70 yd mitigation zone, the 2nd round of firing was able to commence. The 2nd round of firing commenced approximately 45 minutes after the animal was sighted (15 minutes after the mitigation zone requirements were met). No additional marine mammal or sea turtle sightings were obtained within the mitigation zones (within 600 yds of the detonation site or within 70 yds of the vessel) during the FIREX.

Due to the fact that no marine mammals or sea turtles were observed within the mitigation zones 30 minutes prior to or while gunfire occurred, there is no data to suggest that any animals were exposed to inert ordnance during the event.

2. If so, at what levels?

Due to the fact that no marine mammals or sea turtles were observed within the mitigation zones 30 minutes prior to or while gunfire occurred, there are no data to suggest that any animals were exposed to inert ordnance during the event.

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

Due to the fact that no marine mammals or sea turtles were observed within the mitigation zones 30 minutes prior to or while gunfire occurred, there are no data to suggest that any animals were exposed to inert ordnance during the event.

5.2. LESSONS LEARNED

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

5.2.1. Shipboard Marine Mammal Monitoring

- Methods are needed to continue to improve the close-aboard distance estimation by MMOs. Reticled binoculars are used for longer distance sightings; this method is not useful for close aboard sightings. Suggest that MMOs practice close-aboard distance estimation if possible.
- Previous MMO trips have only consisted of two or three Navy MMOs. For this trip, there were four Navy MMOs so that one could be a data recorder, two could observe, and one would be on break. Having a fourth MMO allowed everyone to have a break every fourth hour. It is recommended that a minimum of four MMOs go on all trips, if feasible.

5.2.2. Operational Information

- MMOs attended the pre-exercise brief with the IMPASS team, which eliminated confusion regarding timing and sequence of events. MMOs presented the purpose of their monitoring during the brief and cleared up confusion about their intentions. MMOs explained the VACAPES MMPA and ESA permit requirements and importance of environmental compliance as rationale for the MMO embark. This information was received well by the CO and XO. It is recommended that this continue to be done in the future.
- Coordination for this event went fairly smoothly and we were able to work out getting on the ship for the necessary time to complete the monitoring associated with the event. 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 *USS THE SULLIVANS* (DDG 68) for their outstanding support and hospitality during this cruise and Mr. Dennis Emhoff (RCST) 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.
- NMFS. 2010. Letter of Authorization, Taking Marine Mammals Incidental to U.S. Navy Training in the Virginia Capes Range Complex, issued June 3, 2010.

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***Appendix B – MMO Report for VACAPES MINEX
in August 2011***

Jan 2012

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

Prepared for:
Commander, United States Fleet Forces Command



Prepared by:
Naval Facilities Engineering Command, Atlantic



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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 follow 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		8 August		9 August	
Time	Notes	Time	Notes	Time	Notes
0813	YP686 underway	0820	YP686 underway	N/A	Off effort all day: fires in North Carolina forced a cancel of on effort observations
1017	MMOs on effort	0952	MMOs on effort		
1106	Buoy deployment begins	1217	MMOs off effort		
1150	Buoy deployment ends	1232	Buoy deployment begins / MINEX event begins / MMOs on effort		
1133	MMOs off effort	1253	Buoy deployment ends		
1140	MMOs on effort	1257	Detonation occurs		
1240	MMOs off effort	1329	MINEX event ends / MMOs off effort		
1309	MMOs on effort	1432	MMOs on effort		
1437	Buoy retrieval begins	1446	Buoy retrieval begins		
1533	Buoy retrieval ends	1522	Buoy deployment ends		
1536	MMOs off effort / YP686 return to port	1537	MMOs off effort / YP686 return to port		

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.

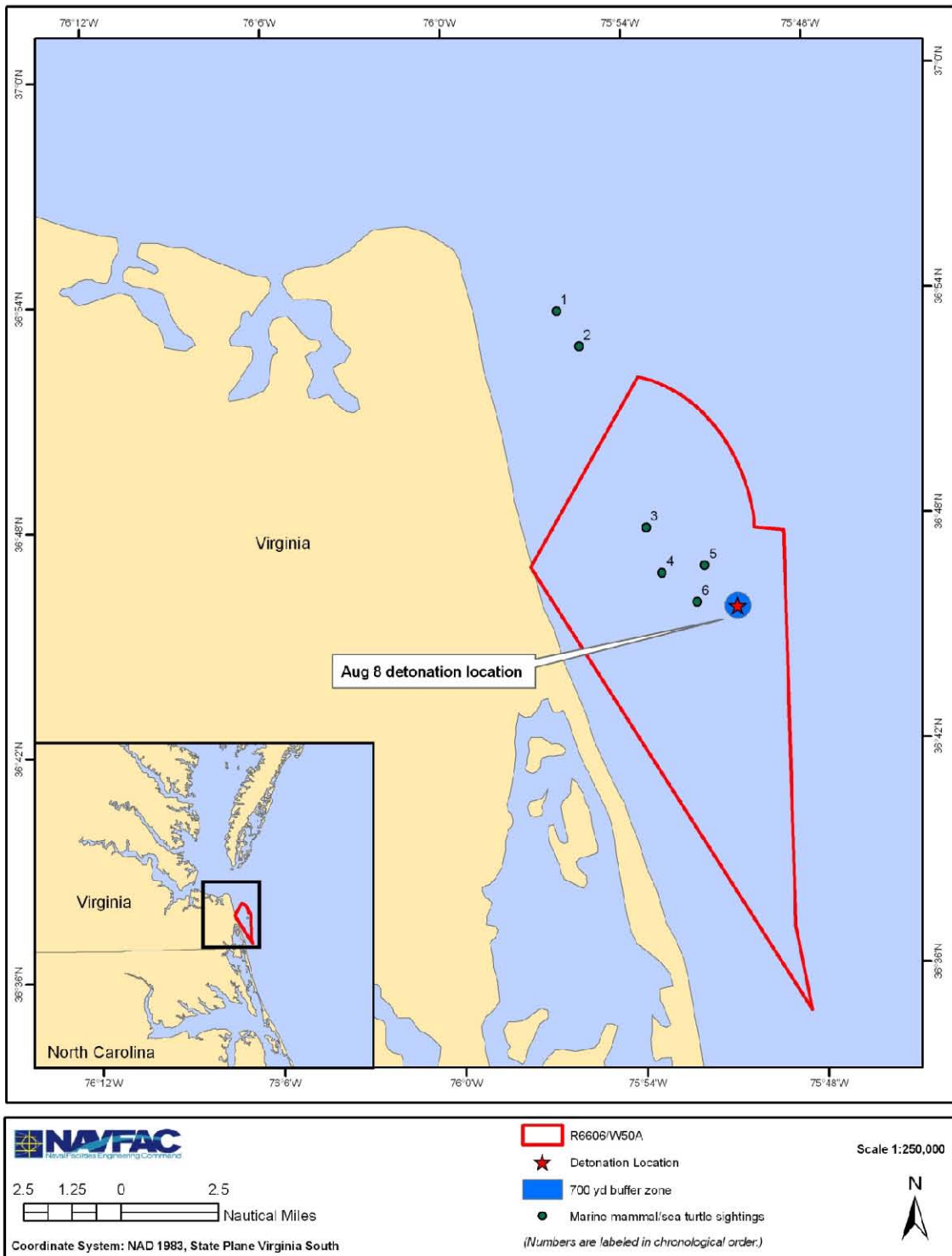


Figure 4-1. Location of sightings on 7 August 2011

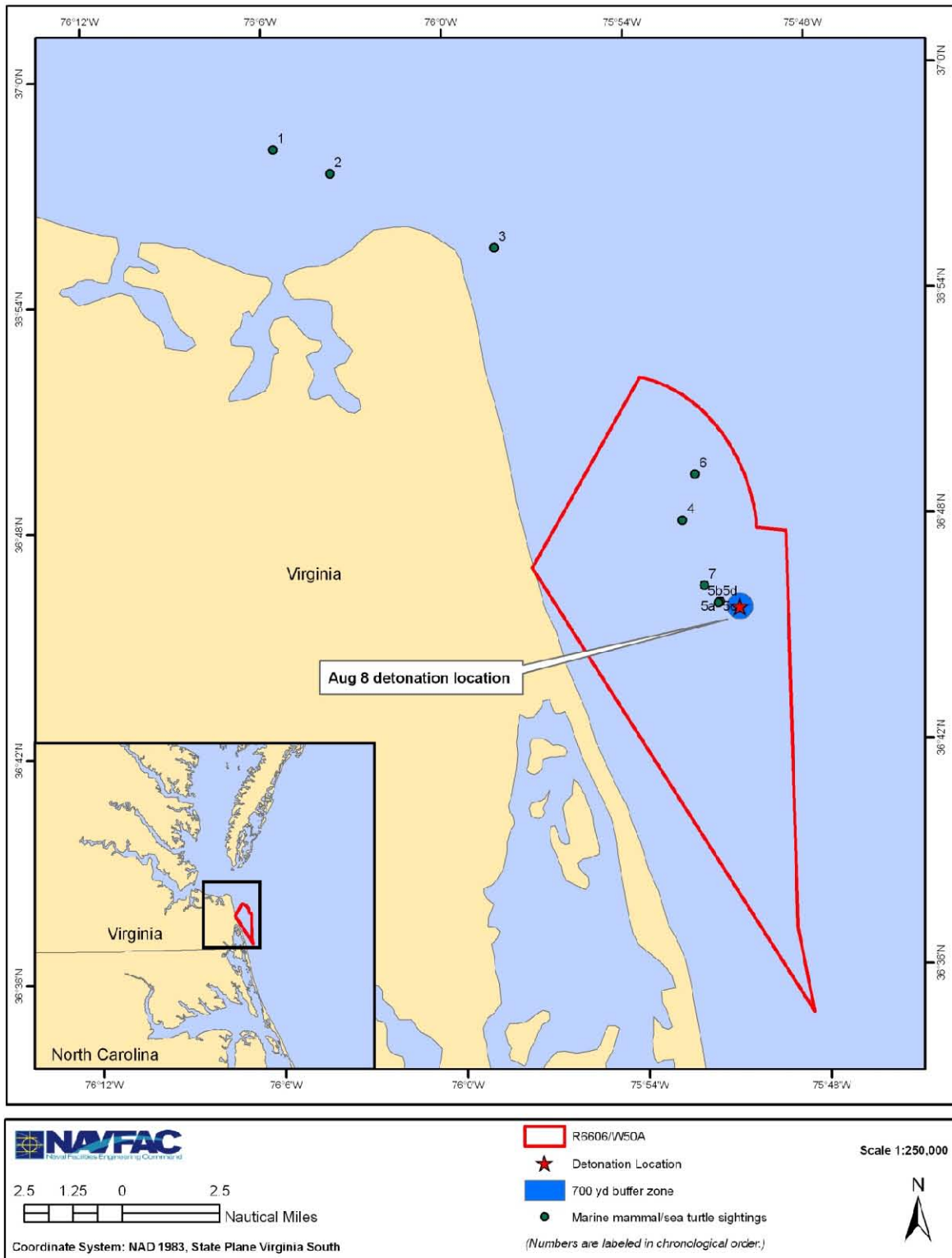


Figure 4-2. Location of sightings and approximate detonation location on 8 August 2011

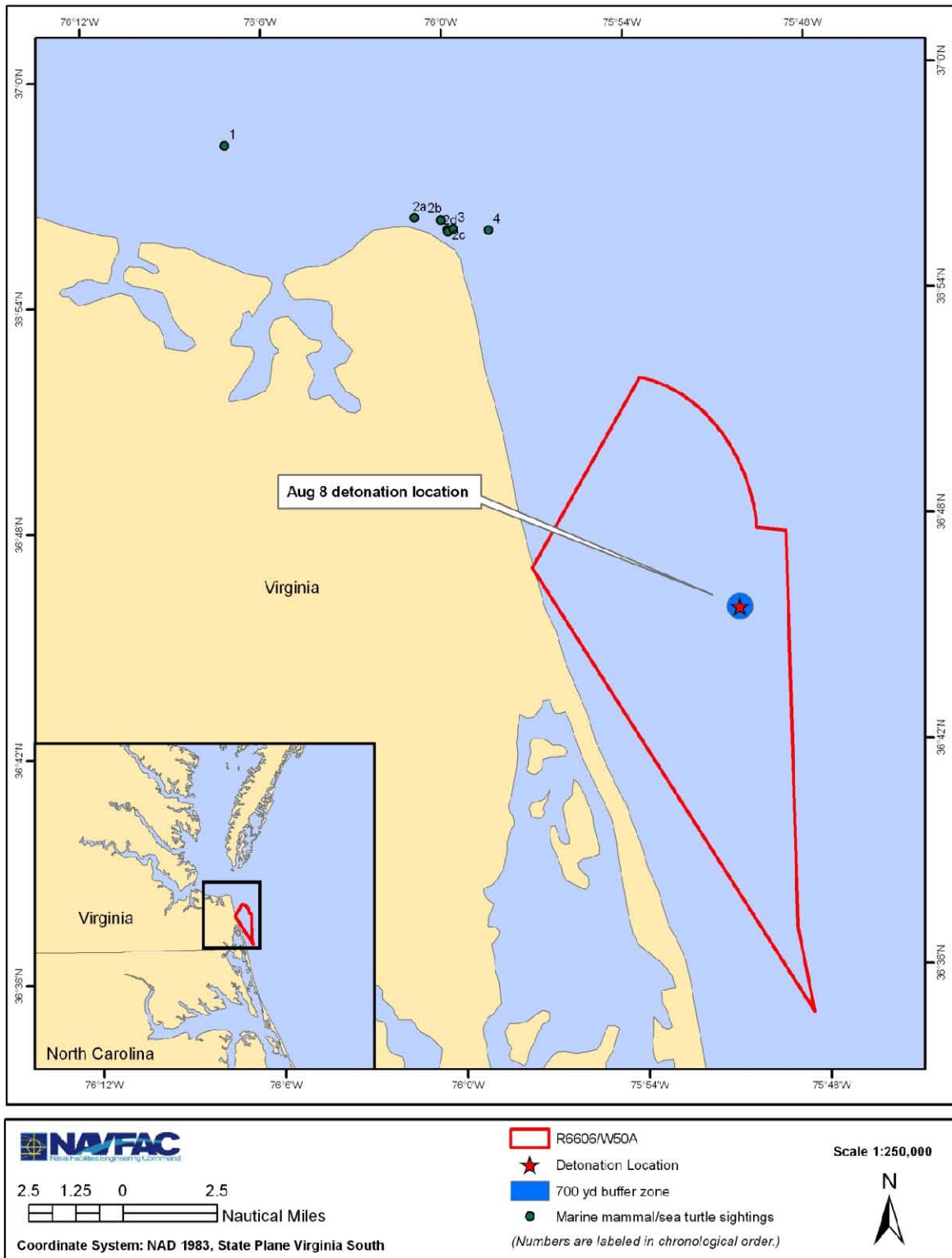


Figure 4-3. Location of sightings on 9 August 2011

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.

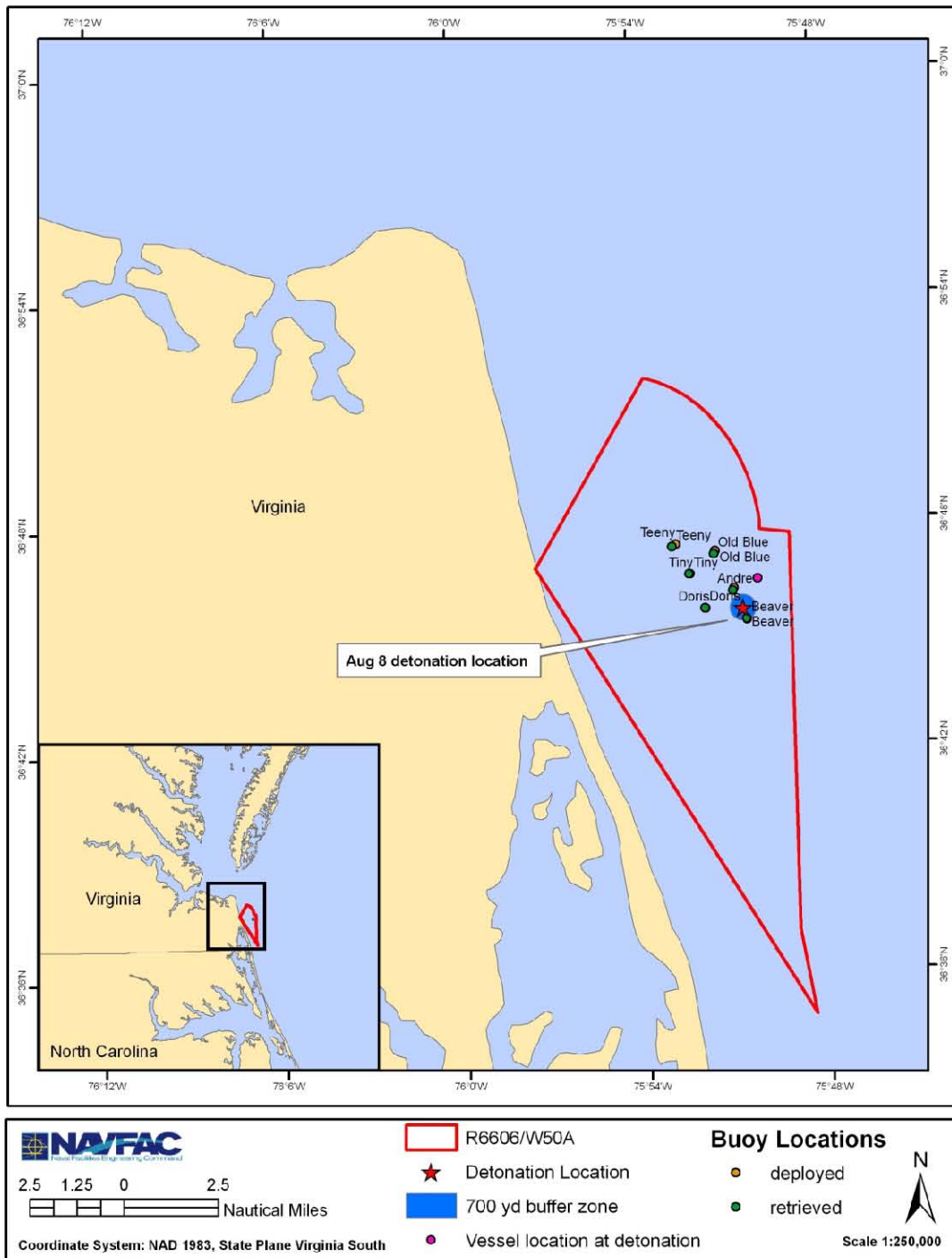


Figure 4-4. Location of Buoy Deployment and Recovery on 7 August 2011

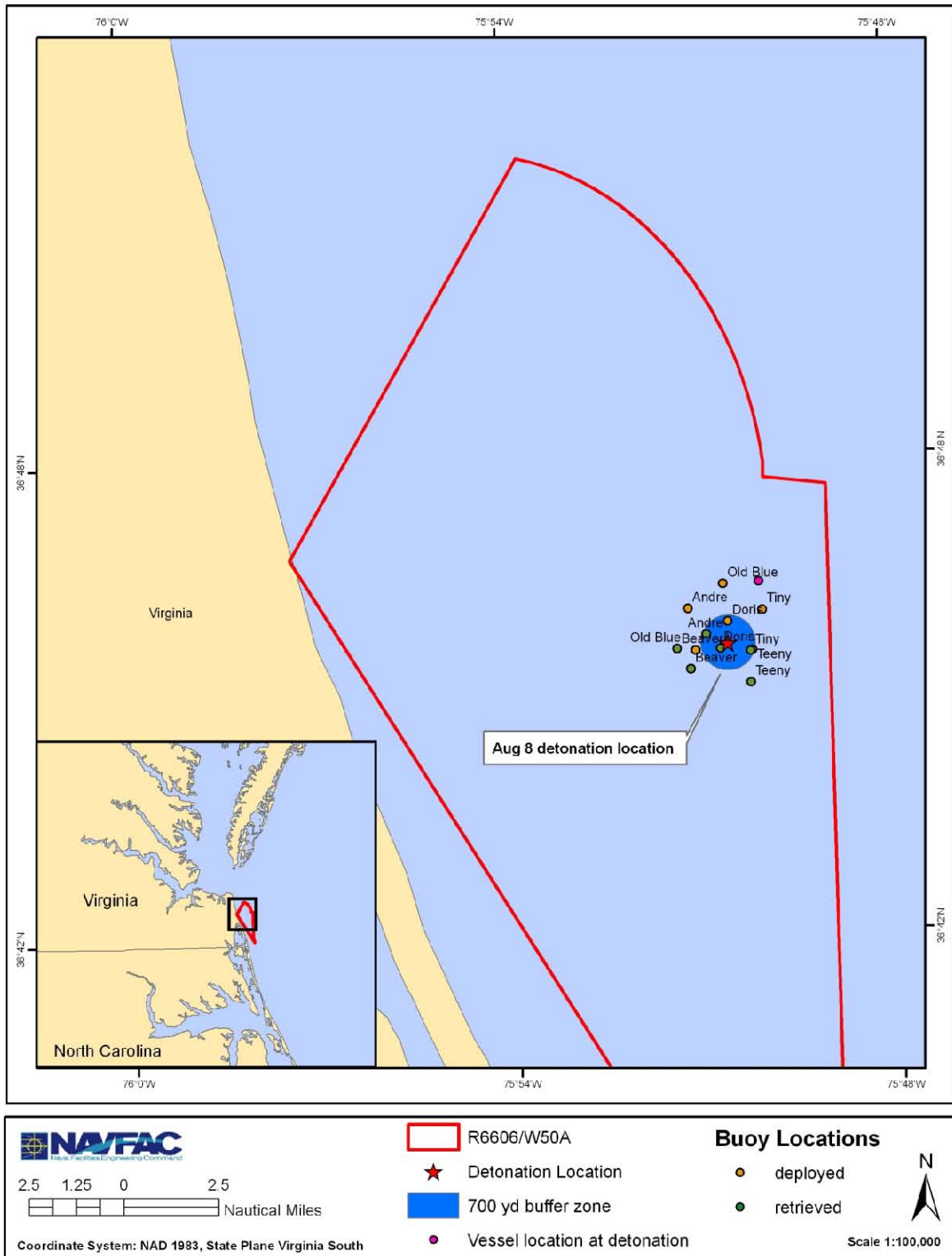


Figure 4-5. Location of Buoy Deployment on 8 August 2011

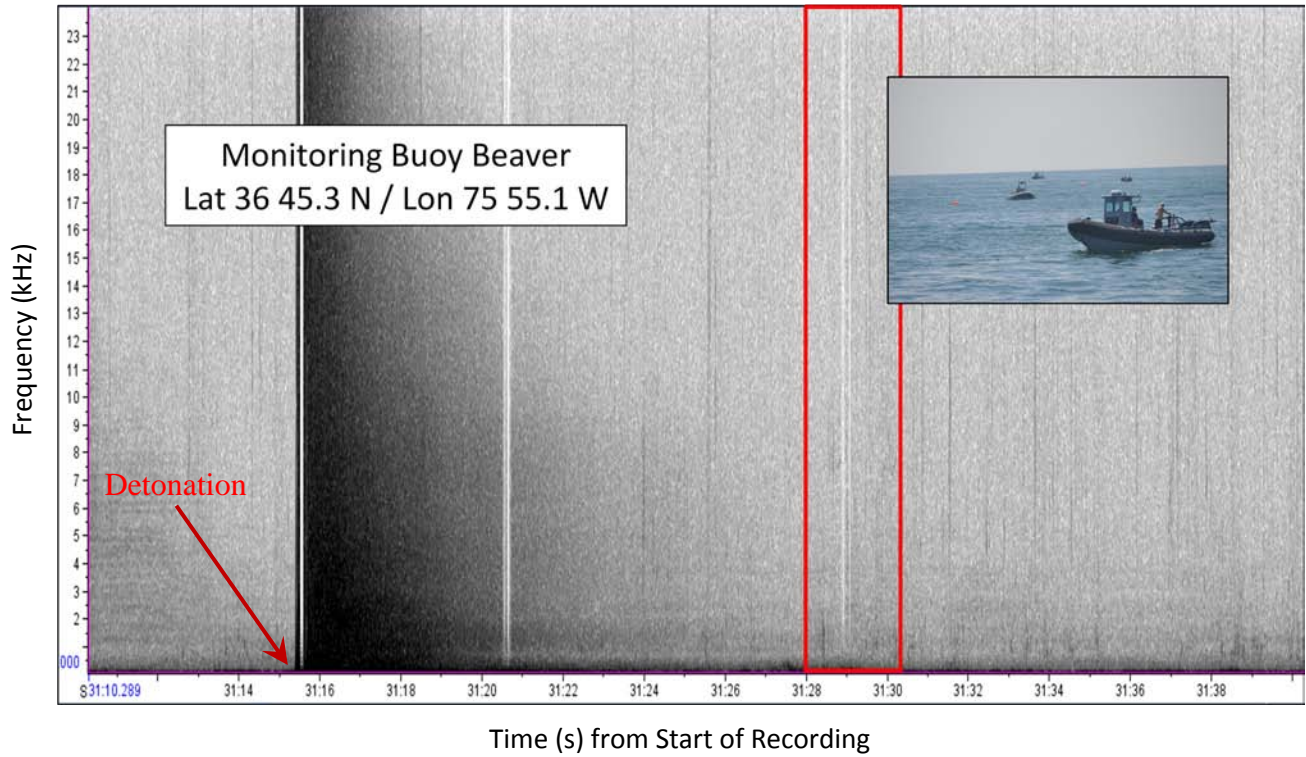


Figure 4-6. Spectrogram of Vocal Detection from Buoy “Beaver” on 8 August 2011

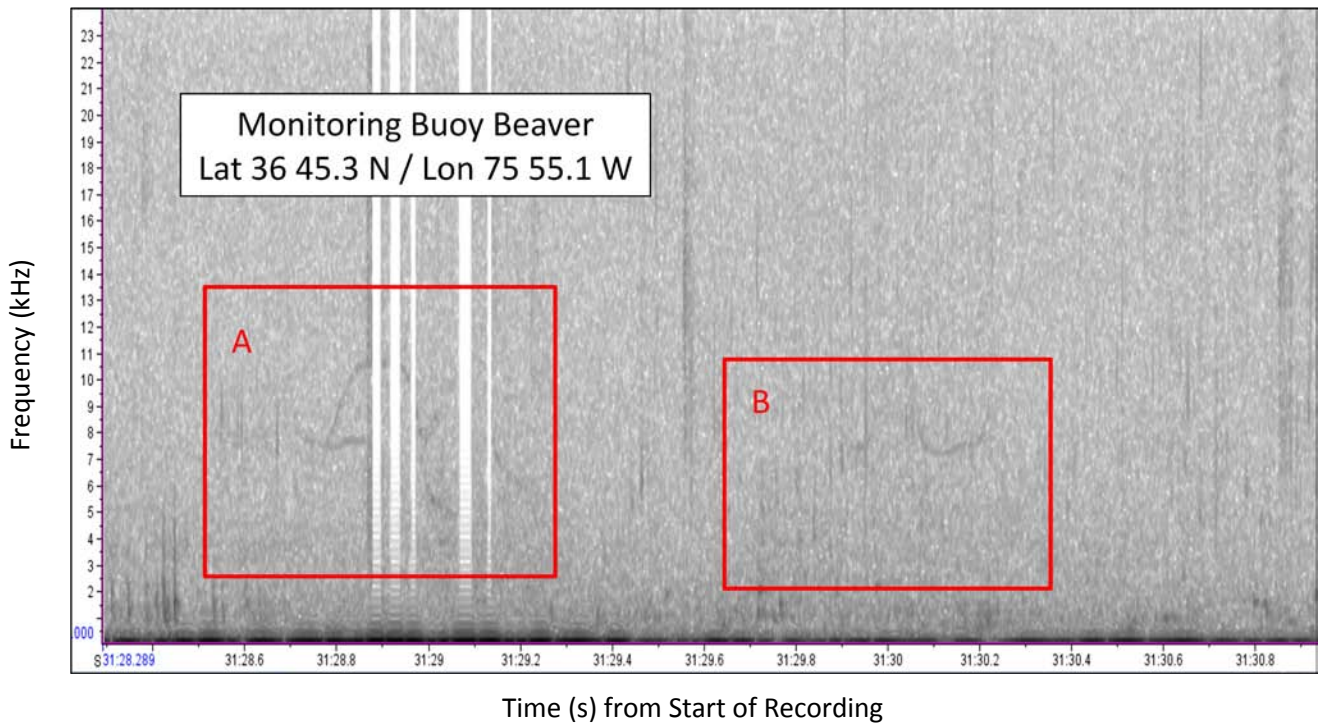


Figure 4-7. Spectrogram of Vocal Detection from Buoy “Beaver” on 8 August 2011

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.
- NMFS. 2009. Taking and Importing Marine Mammals; U.S. Navy Training in the Virginia Capes (VACAPES) Range Complex; Final Rule. June 15, 2009. 74FR28328.

***Appendix C – Aerial Survey Report for VACAPES FIREX with IMPASS,
13-15 July 2011***

Virginia Capes (VACAPES) FIREX with IMPASS

Marine Species Monitoring

AERIAL MONITORING SURVEYS

TRIP REPORT



13-15 July 2011

HDR

ACRONYMS AND ABBREVIATIONS

BSS	Beaufort sea state
FIREX	Firing Exercise
ft	feet
hr	hour
ICMP	Integrated Comprehensive Monitoring Program
IMPASS	Integrated Maritime Portable Acoustic Scoring and Simulator
km	kilometer(s)
km ²	square kilometers
m	meter(s)
min	minute(s)
MMO	Marine Mammal Observer
NEPM	Non-explosive Practice Munition
NM	nautical mile(s)
OPAREA	operating area
SPUE	Sightings Per Unit Effort
U.S.	United States
VACAPES	Virginia Capes Range Complex

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Section 1 Introduction

Aerial marine species monitoring occurred between 13 and 15 July 2011 for a Firing Exercise (FIREX) with Integrated Maritime Portable Acoustic Scoring and Simulator (IMPASS) in the Virginia Capes Range Complex (VACAPES) off the coast of Virginia within the United States (U.S.) Navy's FIREX 7C/7D training boxes. These types of 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). 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.

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 FIREX training event was focused on the U.S. Navy's VACAPES OPAREA boxes 7C and 7D with boxes 8C and 8D directly adjacent to the west being used as alternate observation areas if 7C/7D were closed out during live-fire exercises (see **Figure 1**). The 7C/7D training exercise area is approximately 21 kilometers (km) offshore, covers an area approximately 1,730 square kilometers (km²) in size, and ranges in bottom depth from 20 to 50 meters (m).

Aerial-Based Monitoring

Aerial-based monitoring effort was performed before, during, and after a FIREX with IMPASS within the VACAPES OPAREA from 13 to 15 July 2011 (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 1,000 feet (ft) at 100 knots 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 session was initiated at 1,000 ft or higher if conditions were appropriate (Smultea et al. 2009; refer to the survey methods on page 8 of this document). A lower altitude of approximately 700 to 800 ft was established after focal follow sessions for photography purposes to provide sharper images required for species identification.

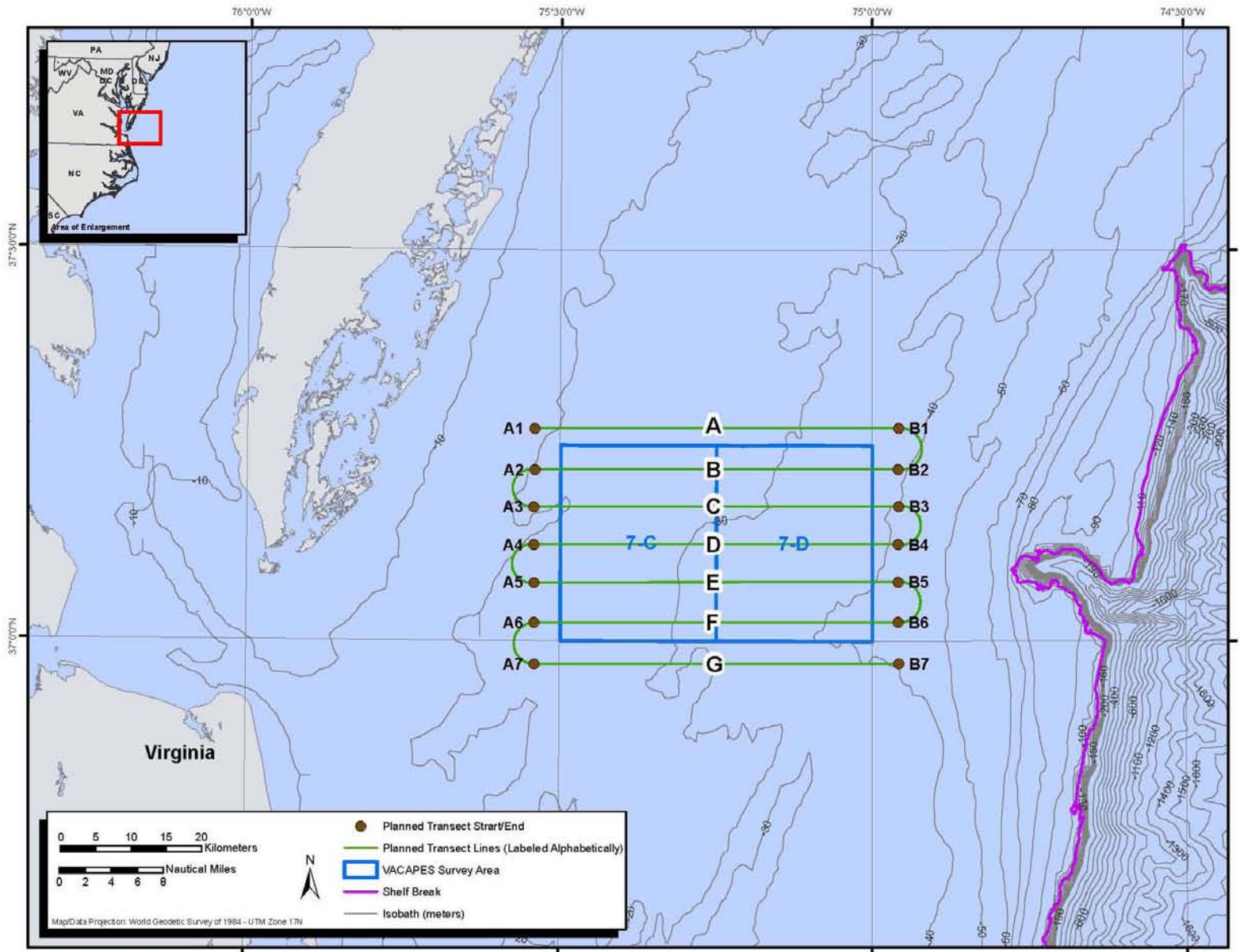


Figure 1. Pre-planned Tracklines for the Survey Effort for VACAPES FIREX Monitoring.

Table 1. Summary of Monitoring Effort for the VACAPES FIREX.

Date	Description	Start Time	Stop Time	Total Survey Minutes*	Total On-Effort Minutes	Trackline On-Effort Distance (km)
13 July	Transect survey (Pre-Event)	12:11	15:07	176	121	442
14 July (FIREX)	Transect survey (During-Event)	13:59	16:00	121	88	282
15 July	Transect survey (Post-Event)	08:32	11:12	160	116	403
Total				457 (≈7.6 hrs)	325 (≈5.4 hrs)	1,127 km

Note: * Total Survey Minutes reflect minutes occupied in the range/area of interest and include both on-effort (systematic) and off-effort (random) totals minutes.

The observation platform was a Cessna T337H Turbo Skymaster aircraft operating out of Norfolk International Airport in Norfolk, Virginia. Two surveys were conducted following pre-planned transect lines covering and extending approximately 2 nautical miles (NM) beyond the boundaries of the 7C/7D range boxes (see **Table 1, Figure 1**). Each survey was limited to a 5-hour (hr) maximum flight time window. Due to area restrictions on 14 July, a single survey was conducted following pre-determined transect lines covering the 8C/8D range boxes (approximately 1,340 km²) immediately to the east of boxes 7C/7D and consisted of waypoints shortened on the western side so as not to enter the 7C/7D boxes (see **Table 1, Figure 4**).

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

Survey effort included the entirety of the 7C/7D boxes (approximately 1,730 km²). Seven parallel tracklines running from west to east, measuring 51 km, and spaced approximately 5.8 km apart were flown during “systematic” efforts throughout the monitoring period and provided a total survey coverage area of approximately 1,730 km² (see **Figure 1**). Planned lines were followed when possible, but exact transects flown for each survey day were subject to modifications as a result of range exclusion by live-fire U.S. Navy exercises in the area, unfavorable weather conditions on the range, or hourly contact with naval flight operations via increasing the plane’s altitude (see **Table 1, Figures 2 through 5**).

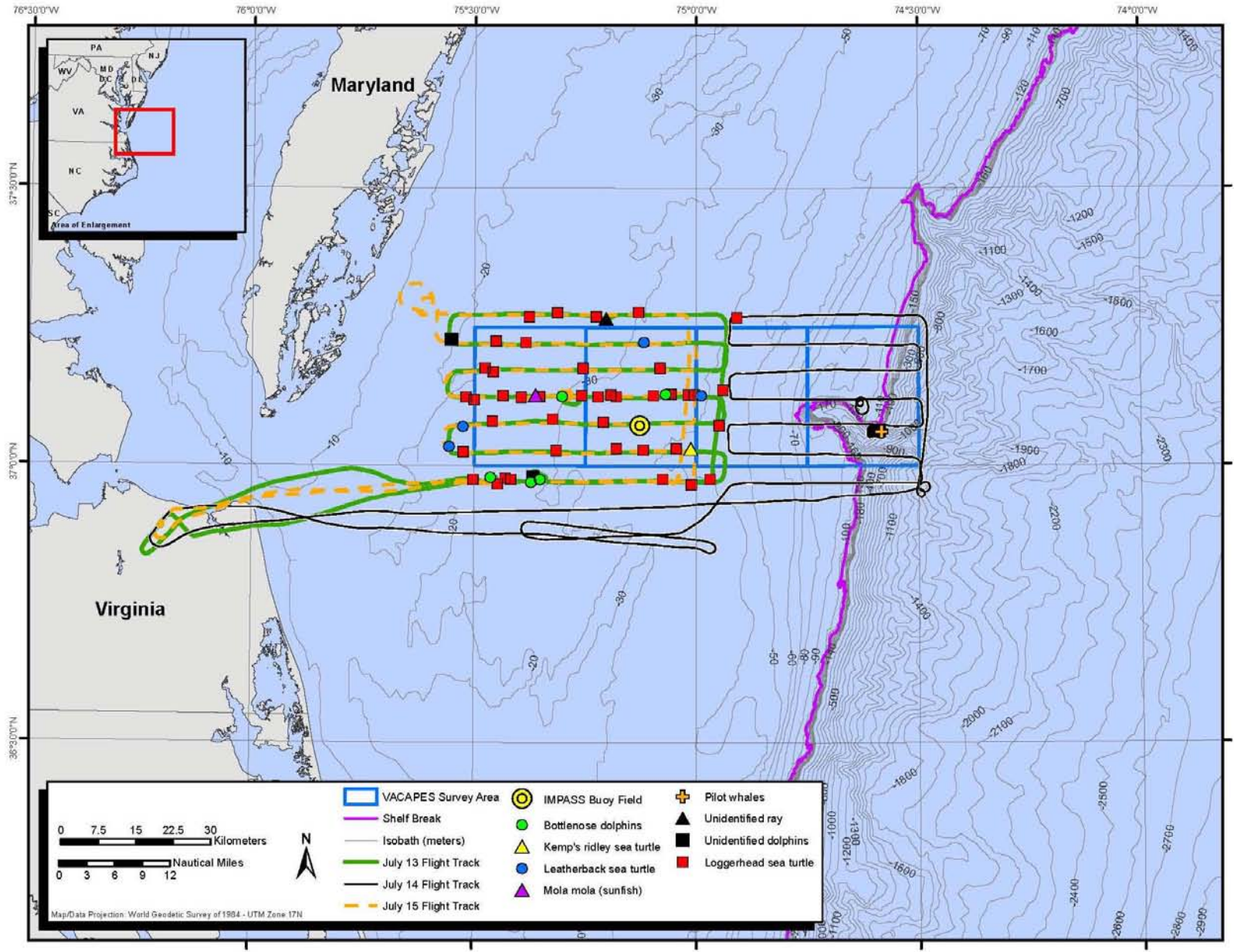


Figure 2. Location of All Cetacean and Sea Turtle Sightings Recorded During VACAPES FIREX Monitoring (13 -15 July).

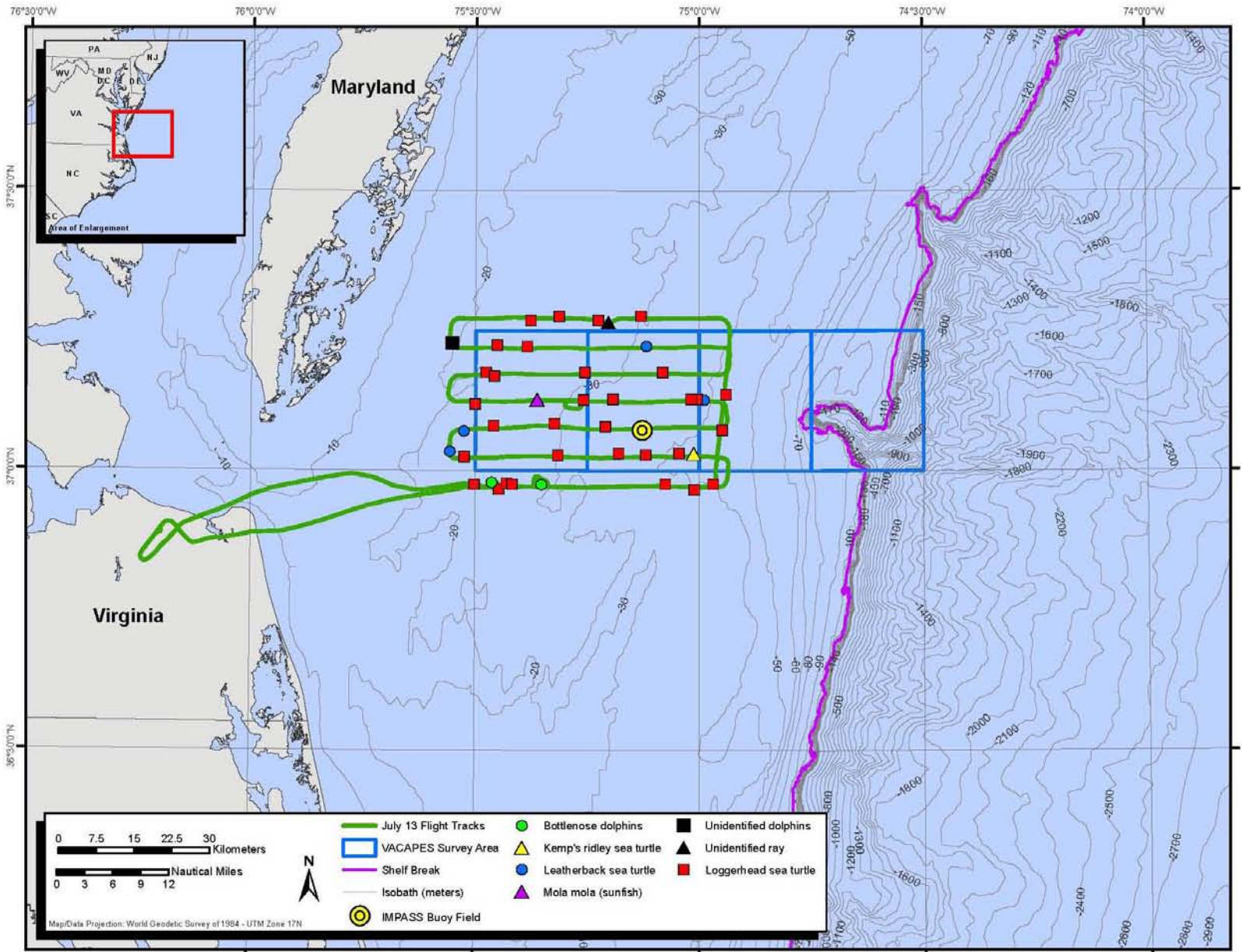


Figure 3. Location of Cetacean and Sea Turtle Sightings Recorded Pre-FIREX (13 July).

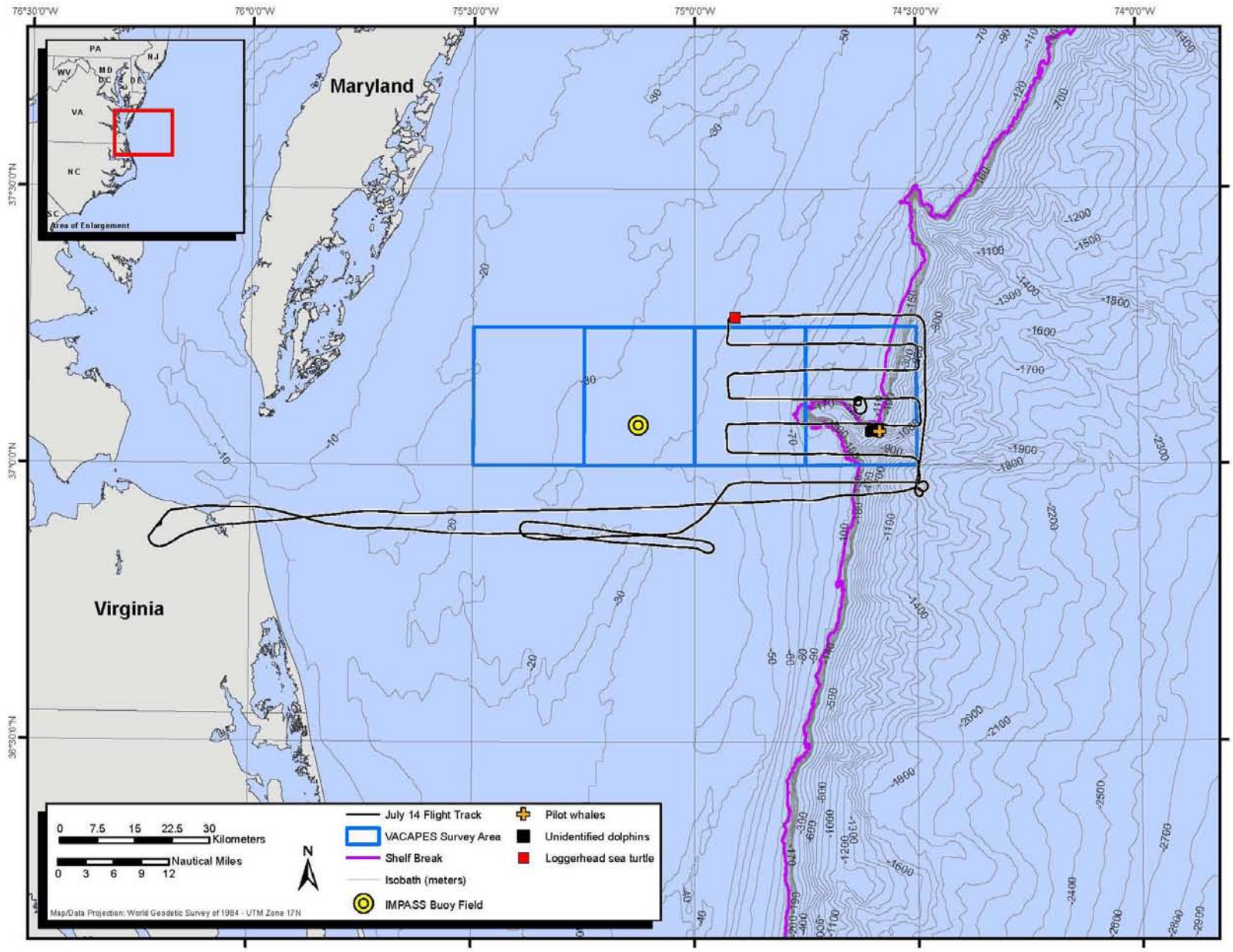


Figure 4. Location of Cetacean and Sea Turtle Sightings Recorded During FIREX (14 July).

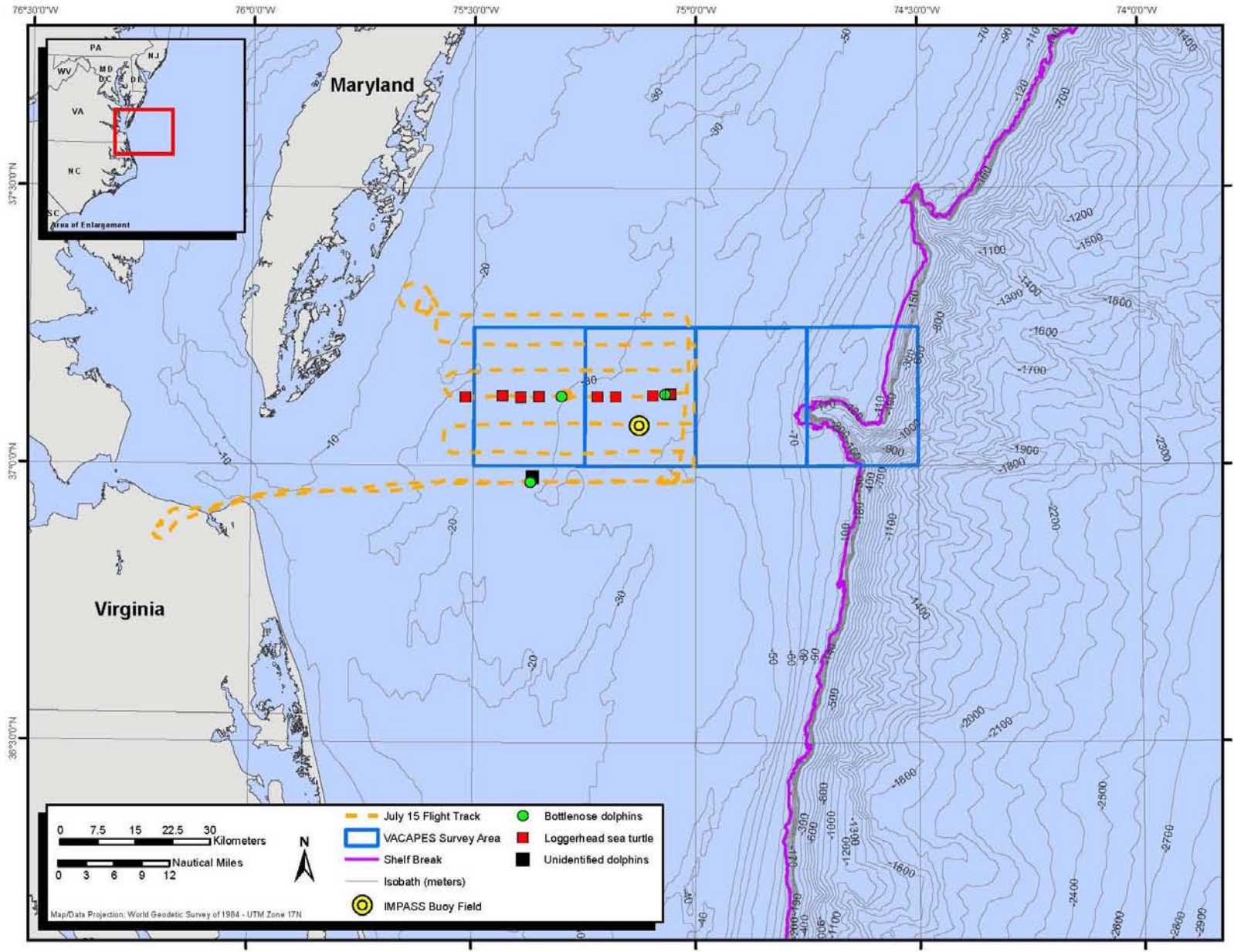


Figure 5. Location of Cetacean and Sea Turtle Sightings Recorded Post-FIREX (15 July).

The following describe the general survey approach:

1. Pre-planned 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 BSS, glare, and visibility were recorded for each transect flown.
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*, information included: (1) species identification and group size; (2) location and relative distance from the IMPASS site if available; (3) the behavior of marine mammals and sea turtles, including standard environmental and oceanographic parameters; (4) date, time, and visual conditions associated with each observation; (5) direction of travel relative to true North; and (6) 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 radial distance increased approximately 0.5 to 1.0 km. 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 are unknown, the aircraft circled the sighting to obtain digital photographs for species identification confirmation and estimate group size/composition.

Section 3 Results

Survey Effort

Observers visually surveyed approximately 1,127 km of on-effort trackline and an additional 1,509 km off-effort (connector lines and circling for focal follow or species ID) during three survey days for approximately 5.4 hr of on-effort status (see **Table 1**). BSS ranged from 1 to 5, with sightings made during each BSS (see **Table 3**). **Appendix A** contains a detailed description of environmental, oceanographic, and sighting conditions.

Sightings

Nine sightings of cetaceans and 107 sightings of sea turtles were recorded during 7.6 hr of total survey flight time (includes on-effort and off-effort intervals) within the survey area covering a 3-day period (see **Figure 2, Table 3**). Due to an extremely high sighting rate of sea turtles in the range after the first survey day, surveys for sea turtles were limited to one random transect line on subsequent days (14 and 15 July). Sightings for sea turtles on the chosen random transect line were multiplied by seven (number of transect lines) for total estimated sightings required for sightings per unit effort (SPUE) calculations. SPUE was calculated as the total survey effort (hr/km/NM) divided by the total number of marine mammal sightings ($n=9$) or sea turtles ($n=107$ [includes 13 July ($n=37$), 14 July ($n=7$), and 15 July ($n=63$) – see description above]). For this monitoring exercise, the SPUE for marine mammals was equal to one sighting per 0.8 hr, 125.2 km, and 67.6 NM, while the SPUE for sea turtles was equal to one sighting per 0.07 hr, 10.5 km, and 5.7 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
Pre-FIREX Sightings – 13 July 2011																
1	7/13/11	CC	1	1	1	-	12:12	12:13	2	36.976	-75.501	29	0.6	270	<50	Loggerhead turtle at the surface. No disturbance detected.
2	7/13/11	CC	1	1	1	-	12:13	-	2	36.968	-75.447	40	0.4	090	<50	Loggerhead turtle at the surface. No disturbance detected.
3	7/13/11	CC	1	1	1	-	12:14	-	2	36.978	-75.430	27	0.7	000	<50	Loggerhead turtle at the surface. No disturbance detected.
4	7/13/11	TT	15	14	15	1	12:16	12:30	2	36.976	-75.325	20	0.9	300	20	Group of 15 bottlenose dolphins travelling slowly. See Appendix B for focal follow data.
5	7/13/11	CC	1	1	1	-	12:38	-	2	36.977	-75.076	36	0.4	280	<50	Loggerhead turtle resting at the surface. No disturbance detected.
6	7/13/11	CC	1	1	1	-	12:40	-	2	36.967	-75.012	33	0.5	270	<50	Loggerhead turtle resting at the surface. No disturbance detected.
7	7/13/11	CC	1	1	1	-	12:41	-	2	36.977	-74.969	27	0.6	290	<50	Loggerhead turtle at the surface. No disturbance detected.
8	7/13/11	KR	1	1	1	-	12:46	-	2	37.031	-75.012	32	0.5	180	<50	Kemp's ridley turtle resting at the surface. No disturbance detected.
9	7/13/11	CC	1	1	1	-	12:47	-	2	37.032	-75.045	25	0.5	Unk.	<50	Loggerhead turtle resting at the surface. No disturbance detected.
10	7/13/11	CC	1	1	1	-	12:49	-	2	37.029	-75.120	40	0.4	180	<50	Loggerhead turtle resting at the surface. No disturbance detected.
11	7/13/11	CC	1	1	1	-	12:51	-	2	37.032	-75.180	21	0.8	225	<50	Loggerhead turtle resting at the surface. No disturbance detected.
12	7/13/11	CC	1	1	1	-	12:55	-	2	37.028	-75.315	45	0.3	270	<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
Pre-FIREX Sightings – 13 July 2011 (continued)																
13	7/13/11	CC	1	1	1	-	13:01	-	2	37.025	-75.524	45	0.3	90	<50	Loggerhead turtle resting at the surface. No disturbance detected.
14	7/13/11	DC	1	1	1	-	13:02	-	2	37.035	-75.557	51	0.3	225	<50	Leatherback turtle resting at the surface. No disturbance detected.
15	7/13/11	DC	1	1	1	-	13:04	-	2	37.071	-75.525	44	0.3	125	<50	Leatherback turtle resting at the surface. No disturbance detected.
16	7/13/11	CC	1	1	1	-	13:05	-	2	37.081	-75.459	27	0.6	110	<50	Loggerhead turtle resting at the surface. No disturbance detected.
17	7/13/11	CC	1	1	1	-	13:09	-	2	37.085	-75.323	30	0.6	145	<50	Loggerhead turtle resting at the surface. No disturbance detected.
18	7/13/11	CC	1	1	1	-	13:12	-	2	37.079	-75.209	30	0.6	270	<50	Loggerhead turtle resting at the surface. No disturbance detected.
19	7/13/11	DC	1	1	1	-	13:21	-	3	37.127	-75.990	50	0.3	270	<50	Leatherback turtle resting at the surface. No disturbance detected.
20	7/13/11	CC	1	1	1	-	13:21	-	3	37.128	-75.005	40	0.4	000	<50	Loggerhead turtle resting at the surface. No disturbance detected.
21	7/13/11	CC	1	1	1	-	13:22	-	3	37.129	-75.018	40	0.4	180	<50	Loggerhead turtle resting at the surface. No disturbance detected.
22	7/13/11	CC	1	1	1	-	13:27	-	3	37.128	-75.193	36	0.5	270	<50	Loggerhead turtle resting at the surface. No disturbance detected.
23	7/13/11	CC	2	2	2	-	13:28	-	3	37.128	-75.258	46	0.3	90	<50	2 loggerhead turtles 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
Pre-FIREX Sightings – 13 July 2011 (continued)																
24	7/13/11	MM	1	1	1	-	13:34	-	3	37.128	-75.361	58	0.2	Unk.	<50	Ocean sunfish logging at the surface. No disturbance detected.
25	7/13/11	CC	1	1	1	-	13:38	-	2	37.119	-75.450	30	0.6	270	<50	Loggerhead turtle resting at the surface, then dove.
26	7/13/11	CC	1	1	1	-	13:42	-	2	37.176	-75.476	40	0.4	90	<50	Loggerhead turtle resting at the surface. No disturbance detected.
27	7/13/11	CC	1	1	1	-	13:43	-	2	37.169	-75.457	39	0.4	270	<50	Loggerhead turtle resting at the surface. No disturbance detected.
28	7/13/11	CC	2	2	2	-	13:47	-	2	37.176	-75.255	47	0.3	90	<50	2 loggerhead turtles resting at the surface. No disturbance detected.
29	7/13/11	CC	1	1	1	-	13:51	-	2	37.177	-75.082	50	0.3	100	<50	Loggerhead turtle resting at the surface. No disturbance detected.
30	7/13/11	DC	1	1	1	-	14:01	-	2	37.223	-75.118	50	0.3	225	<50	Leatherback turtle resting at the surface. No disturbance detected.
31	7/13/11	CC	1	1	1	-	14:09	-	2	37.223	-75.384	40	0.4	270	<50	Loggerhead turtle resting at the surface. No disturbance detected.
32	7/13/11	CC	1	1	1	-	14:11	-	1	37.224	-75.451	32	0.6	270	<50	Loggerhead turtle resting at the surface. No disturbance detected.
33	7/13/11	Unid	1	1	1	-	14:14	-	2	37.223	-75.552	40	0.4	0	10	Unidentified single dolphin travelling north. No disturbance detected.
34	7/13/11	CC	1	1	1	-	14:20	-	1	37.269	-75.376	33	0.5	270	<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
Pre-FIREX Sightings – 13 July 2011 (continued)																
35	7/13/11	CC	1	1	1	-	14:21	-	1	37.276	-75.313	50	0.3	250	<50	Loggerhead turtle resting at the surface. No disturbance detected.
36	7/13/11	CC	1	1	1	-	14:24	-	1	37.269	-75.226	45	0.3	Unk.	<50	Loggerhead turtle resting at the surface. No disturbance detected.
37	7/13/11	UR	1	1	1	-	14:25	-	1	37.265	-75.203	60	0.2	225	<50	Unidentified species of ray detected at surface. No disturbance detected.
38	7/13/11	CC	1	1	1	-	14:27	-	2	37.277	-75.130	40	0.4	285	<50	Loggerhead turtle resting at the surface. No disturbance detected.
39	7/13/11	CC	1	1	1	-	14:35	-	3	37.137	-74.940	40	0.4	290	<50	Loggerhead turtle resting at the surface. No disturbance detected.
40	7/13/11	CC	1	1	1	-	14:37	-	3	37.074	-74.949	42	0.4	300	<50	Loggerhead turtle resting at the surface. No disturbance detected.
41	7/13/11	CC	1	1	1	-	14:53	-	3	36.976	-74.418	32	0.5	90	<50	Loggerhead turtle resting at the surface. No disturbance detected.
42	7/13/11	TT	9	10	8	1	14:54	15:05	3	36.980	-75.463	18	1.0	270	20	Group of 9 bottlenose dolphins travelling quickly. Varying levels of dispersion. See Appendix B for focal follow data.
During-FIREX Sightings – 14 July 2011																
43	7/14/11	Unid	-	-	-	-	14:39	-	5	37.064	-74.589	22	0.8	Unk.	>500	Quick look at unidentified dolphin species. Details unknown.

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-FIREX Sightings – 14 July 2011 (continued)																
44	7/14/11	GM	45	50	40	0	14:44	14:50	5	37.061	-74.583	60	0.2	90	>500	One large group and two smaller groups of pilot whales (undetermined species) travelling slowly. Difficult to follow in choppy seas, abrupt dive. Travel direction change possibly a result of plane overhead.
45	7/14/11	CC	1	1	1	-	15:40	15:40	5	37.267	-74.909	43	0.3	90	<50	Loggerhead turtle resting at the surface. No disturbance detected.
Post-FIREX Sightings – 15 July 2011																
46	7/15/11	TT	2	2	2	0	08:37	-	4	36.971	-75.372	40	0.4	320	20	Two bottlenose dolphins heading northwest, fast travel.
47	7/15/11	CC	2	2	2	-	09:23	-	3	37.130	-75.057	39	0.4	90	<50	Two loggerhead turtles resting at the surface. No disturbance detected.
48	7/15/11	CC	1	1	1	-	09:23	-	3	37.129	-75.063	38	0.4	Unk.	<50	Loggerhead turtle resting at the surface. No disturbance detected.
49	7/15/11	TT	1	1	1	0	09:23	-	3	37.129	-75.070	33	0.5	180	30	One bottlenose dolphins travelling.
50	7/15/11	CC	1	1	1	-	9:24	-	3	37.127	-75.097	41	0.4	090	<50	Loggerhead turtle resting at the surface. No disturbance detected.
51	7/15/11	CC	1	1	1	-	9:26	-	3	37.125	-75.180	42	0.3	000	<50	Loggerhead turtle resting at the surface. No disturbance detected.
52	7/15/11	CC	1	1	1	-	9:27	-	3	37.125	-75.221	49	0.3	090	<50	Loggerhead turtle resting at the surface. No disturbance detected.
53	7/15/11	TT	50	60	46	1	09:29	09:42	3	37.125	-75.303	80	0.1	000	20	2-5 subgroups of bottlenose dolphins travelling slowly. Varying levels of dispersion. See Appendix B for focal follow data.

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
Post-FIREX Sightings – 15 July 2011 (continued)																
54	7/15/11	CC	1	1	1	-	09:44	-	3	37.125	-75.353	51	0.3	090	<50	Loggerhead turtle resting at the surface. No disturbance detected.
55	7/15/11	CC	1	1	1	-	09:45	-	3	37.124	-75.394	29	0.6	090	<50	Loggerhead turtle resting at the surface. No disturbance detected.
56	7/15/11	CC	1	1	1	-	09:46	-	3	37.127	-75.435	42	0.3	225	<50	Loggerhead turtle resting at the surface. No disturbance detected.
57	7/15/11	CC	1	1	1	-	09:48	-	3	37.124	-75.518	50	0.3	45	<50	Loggerhead turtle resting at the surface. No disturbance detected.
58	7/15/11	Unid	1	1	1	0	11:08	-	3	36.972	-75.367	61	0.2	220	20	One unidentified dolphin sighted just under the water's surface.

Key:

CC = Loggerhead turtle (*Caretta caretta*)
 DC = Leatherback turtle (*Dermochelys coriacea*)
 GM = Pilot whale (*Globicephala* spp.)
 KR = Kemp's ridley turtle

Unid = Unidentified dolphin
 MM = Ocean sunfish (*Mola mola*)
 TT = Bottlenose dolphin (*Tursiops truncatus*)
 UR = Unidentified ray

Three sightings of cetaceans, 37 sightings of sea turtles, one sighting of an unidentified ray, and one sighting of an ocean sunfish were made during the 1-day pre-FIREX survey (see **Figure 3, Table 3**). Two sightings of cetaceans and one sighting of a sea turtle ($n=7$ after multiplier factor) were made throughout the 1-day during FIREX survey period (see **Figure 4, Table 3**). Four sightings of cetaceans and nine sightings of sea turtles ($n=63$ after multiplier factor) were made during the 1-day post-FIREX survey (see **Figure 5, Table 3**).

Sightings over the 3-day period included five sightings of bottlenose dolphins, one sighting of pilot whales, three sightings of unidentified dolphins, 102 sightings of loggerhead sea turtles, one sighting of a Kemp's ridley sea turtle, four sightings of leatherback sea turtles, one sighting of an unidentified species of ray, and one sighting of an ocean sunfish. **Table 4** provides a summary of sightings information and bottom depth information. Bottom depths for each sighting were estimated in 10-m ranges from plots of latitude and longitude for each sighting within a Geographic Information System. Due to difficulties associated with relocating small groups of marine mammals in a high BSS and heavy glare, digital photographs to determine or confirm species identification were not collected for all unidentified dolphins in the area.

Table 4. Summary of Sightings Recorded during Monitoring for VACAPES FIREX Training.

Species	Number of Sightings	Bottom Depth (m)
Bottlenose dolphin	5	20-40
Pilot whale	1	500-800
Unidentified dolphin	3	10-800
Loggerhead turtle	102	20-50
Kemp's ridley turtle	1	40-50
Leatherback turtle	4	20-40
Unidentified ray	1	20-30
Ocean sunfish	1	20-30

The FIREX event commenced at 05:45, and a total of 39 rounds of 5-inch Blind Loaded and Plugged Non-Explosive Practice Munition (NEPM) were fired. In addition, the unit also shot 1 NEPM round of 5-inch Illumination. NEPM was used first, which resulted in a successful training mission. Thus, no live-explosive rounds were used during the FIREX training. Therefore, no animals were exposed during this VACAPES FIREX with IMPASS training event.

Behavior

No visible evidence of unusual behavior was observed for the pre-FIREX surveys, during-FIREX surveys, or post-FIREX surveys (see **Table 3**). A mild response (travel direction shift) to the aircraft was noted from the group of pilot whales during circling attempts in BSS 5 conditions (Sighting 44 in **Table 3**). The survey team conducted three brief focal follows on 13 July and 15 July. The first focal follow was a period of 11 minutes (min) spent with a group of 15 bottlenose dolphins. The second focal follow was a period of 7 min spent with a group of 9 bottlenose dolphins. The third focal follow was a period of 5 min spent with a group of 50 highly-dispersed bottlenose dolphins. Detailed behavioral observations made during the

focal follows are presented in **Appendix B**. Photographs of suitable quality for species identification purposes were collected during several sightings of dolphins, pilot whales, and sea turtles. No video was collected during focal follows.

Section 4 Acknowledgements

We would like to thank Orion Aviation's Director Ed Coffman and pilots Stan Huddle and Cameron Radford. These data were obtained under National Marine Fisheries Service permit no. 14451 issued to Joseph R. Mobley, Jr.

Section 5 References

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APPENDIX A

Environmental, Oceanographic, and Sighting Conditions

Table A-1 shows the environmental, oceanographic, and sighting conditions encountered by Marine Mammal Observers (MMOs) during the pre-FIREX, during FIREX, and post-FIREX monitoring efforts.

Table A-1. Environmental, Oceanographic, and Sighting Conditions During Monitoring.

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 (%)
Pre-FIREX Survey Effort on 13 July 2011							
12:11	2	10	2	2	60	2	40
12:32	2	1	2	2	4	2	40
12:44	2	3	2	2	2	2	40
13:03	2	2	2	2	3	2	40
13:14	3	2	2	3	5	2	40
13:20	3	4	2	3	3	2	40
13:36	2	3	2	2	2	2	40
13:41	2	2	2	2	5	2	40
13:57	3	4	2	3	3	2	40
14:00	2	4	2	2	3	2	40
14:10	1	3	2	2	2	2	40
14:12	2	3	2	2	2	2	40
14:16	2	2	2	2	4	2	40
14:20	1	2	2	1	4	2	40
14:27	2	2	2	2	4	2	40
14:31	3	2	2	3	4	2	40
14:33	3	3	2	3	5	2	40
14:40	3	4	2	3	3	2	40
14:55	3	4	2	3	3	2	40
15:05	3	4	2	3	3	2	40
During FIREX Survey Effort on 14 July 2011							
13:59	5	3	1	5	4	1	60
14:14	5	4	1	5	3	1	80
14:27	5	3	1	5	4	1	80
14:38	5	3	1	5	4	1	80

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 (%)
During FIREX Survey Effort on 14 July 2011 (continued)							
14:51	5	3	1	5	4	1	80
14:55	5	4	1	5	3	1	80
15:02	5	4	1	5	3	1	80
15:12	5	3	1	5	4	1	80
15:27	5	4	1	5	4	1	80
15:39	5	3	1	5	4	1	80
15:53	5	2	1	5	5	1	80
16:00	5	2	1	5	5	1	80
Post-FIREX Survey Effort on 15 July 2011							
8:32	4	3	1	4	3	1	50
8:49	4	3	1	4	3	1	50
9:05	4	3	1	4	3	1	50
9:09	3	3	1	3	3	1	50
9:22	3	3	1	3	3	1	50
9:43	3	3	1	3	3	1	50
9:51	3	3	1	3	3	1	50
10:07	3	3	1	3	3	1	50
10:32	3	3	1	3	4	1	50
10:47	3	4	1	3	2	1	50
10:56	3	3	1	3	4	1	50
11:01	3	4	1	3	4	1	50

APPENDIX B

Focal Follow Data

Table B-1 shows the focal follow behavioral data from the VACAPES FIREX training 2011 monitoring efforts. Two focal follow events were conducted on 13 July 2011 and one on 15 July 2011; all were from groups of bottlenose dolphins within the survey area.

Table B-1. Focal Follow Behavior Data.

Record Number	Time	Date	Latitude	Longitude	Recorded Behavior
Sighting Number 4					
Species: <i>Tursiops truncatus</i> . Group size: 15.					
1	12:19	7/13/11	36.973	-75.360	Slow travel heading 300. Min Dispersal = 1, Max Dispersal = 6.
2	12:21	7/13/11	36.985	-75.349	Slow travel heading 300. Min Dispersal = 1, Max Dispersal = 6.
3	12:22	7/13/11	36.976	-75.346	Lining up side-by-side wide instead of long. Slow travel heading 000. Min Dispersal = 1, Max Dispersal = 3.
4	12:23	7/13/11	36.977	-75.346	Still tight group. Tighter group more single file than across. Slow travel heading 240. Min Dispersal = 1, Max Dispersal = 3.
5	12:24	7/13/11	36.981	-75.350	Slow travel heading 240. Min Dispersal = 1, Max Dispersal = 6.
6	12:25	7/13/11	36.975	-75.362	Group wider than long. Slow travel heading 240. Min Dispersal = 1, Max Dispersal = 6.
7	12:26	7/13/11	36.985	-75.362	11 individuals in sight. Slow travel heading 210. Min Dispersal = 1, Max Dispersal = 6.
8	12:27	7/13/11	36.975	-75.362	Forming into a wider than longer group. Tighter group. Slow travel heading 210. Min Dispersal = 1, Max Dispersal = 3.
9	12:28	7/13/11	36.976	-75.354	Same group formation as above. Slow travel heading 180. Min Dispersal = 1, Max Dispersal = 3.
10	12:29	7/13/11	36.986	-75.359	All individuals underwater.
11	12:30	7/13/11	36.985	-75.362	Slow travel heading 180. Min Dispersal = 1, Max Dispersal = 3.

Record Number	Time	Date	Latitude	Longitude	Recorded Behavior
Sighting Number 42					
Species: <i>Tursiops truncatus</i> . Group size: 9.					
1	14:57	7/13/11	36.978	-75.450	12 individuals in group. Fast travel heading 240. Min Dispersal = 1, Max Dispersal = 4.
2	14:59	7/13/11	36.974	-75.463	One calf in group. Fast travel heading 240. Min Dispersal = 1, Max Dispersal = 6.
3	15:00	7/13/11	36.972	-75.452	Tightly packed now. Starting to group. Fast travel heading 210. Min Dispersal = 1, Max Dispersal = 3.
4	15:02	7/13/11	36.975	-75.451	Fast travel heading 210. Min Dispersal = 1, Max Dispersal = 3.
5	15:03	7/13/11	36.973	-75.449	Plane directly over group. Difficulty keeping visual contact due to glare. Fast travel heading 210. Min Dispersal = 1, Max Dispersal = 3.
6	15:04	7/13/11	36.972	-75.453	Group spread out a little more. Highly likely this is the same group followed earlier in the survey given the sighting location.
Sighting Number 53					
Species: <i>Tursiops truncatus</i> . Group size: 50.					
1	09:37	7/15/11	37.133	-75.284	Five subgroups. Slow travel heading 090. Min Dispersal = 1, Max Dispersal = 10.
2	09:38	7/15/11	37.131	-75.298	Lost group in glare.
3	09:39	7/15/11	37.120	-75.290	Slow travel heading 090. Min Dispersal = 1, Max Dispersal = 10. 14 in one group. Roughly 46 total in area, at least one calf. Max dispersal between 2 groups = 10.
4	09:40	7/15/11	37.130	-75.281	Multiple subgroups formed into two main groups. Most surfacing around the same time. Slow travel heading 090. Min Dispersal = 1, Max Dispersal = 2.
5	09:42	7/15/11	37.127	-75.280	Slow travel. Difficulty staying with group.

***Appendix D – Aerial Survey Report for CHPT FIREX with IMPASS,
29-30 November 2011***

Cherry Point (CHPT) Firing Exercise (FIREX) with Integrated Maritime Portable Acoustic Scoring and Simulator (IMPASS)

Marine Species Monitoring

AERIAL MONITORING SURVEYS

TRIP REPORT



29-30 November 2011

ACRONYMS AND ABBREVIATIONS

CHPT	Cherry Point Range Complex
ft	feet/foot
FIREX	Firing Exercise
ICMP	Integrated Comprehensive Monitoring Program
IMPASS	Integrated Maritime Portable Acoustic Scoring and Simulator
in	inches
km	kilometer(s)
km ²	square kilometers
m	meter(s)
NEPM	Non-Explosive Practice Munition
NM	nautical mile(s)
OPAREA	operating area

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Section 1 Introduction

Aerial marine species monitoring occurred over 29 and 30 November 2011 for a Firing Exercise (FIREX) with Integrated Maritime Portable Acoustic Scoring and Simulator (IMPASS) Exercise that occurred in the Cherry Point Range Complex (CHPT) off the eastern coast of North Carolina within the U.S. Navy's range box W-122 (14). These types of 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). 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.

Section 2 Methods

Study Area

The U.S. Navy's CHPT OPAREA lies off the eastern coast of North Carolina. Protected marine species monitoring conducted during the CHPT FIREX training event was focused on the W-122 (14) box (see **Figure 1**). This area is approximately 120 to 180 kilometers (km) (65 to 98 nautical miles [NM]) offshore, covers an area approximately 3,700 square kilometers (km²) in size, and ranges in bottom depth from 2,700 to 3,800 meters (m).

The FIREX event commenced 29 November 2011 in area W-122 (14) and a total of 20 Non-Explosive Practice Munition (NEPM) rounds of 5 inch (in) Blind Loaded and Plugged were fired. Due to poor weather conditions, firing was stopped before the completion of the event. The FIREX event recommenced at 0750 on 30 November 2011 in area W-122 (14) and a total of 47 NEPM rounds of 5-in Blind Loaded and Plugged and 5 rounds of 5-in Illumination were fired, which resulted in a successful training mission. The event finished at 1300. No live explosive rounds were used during the FIREX training; therefore, no animals were exposed during this CHPT FIREX with IMPASS training event.

Aerial-Based Monitoring

Aerial-based monitoring effort was attempted during the FIREX with IMPASS within the CHPT OPAREA from 29 to 30 November 2011 (see **Figure 1, Table 1**). Survey methods were consistent with currently accepted Distance Sampling theory (Buckland et al. 2001) and followed

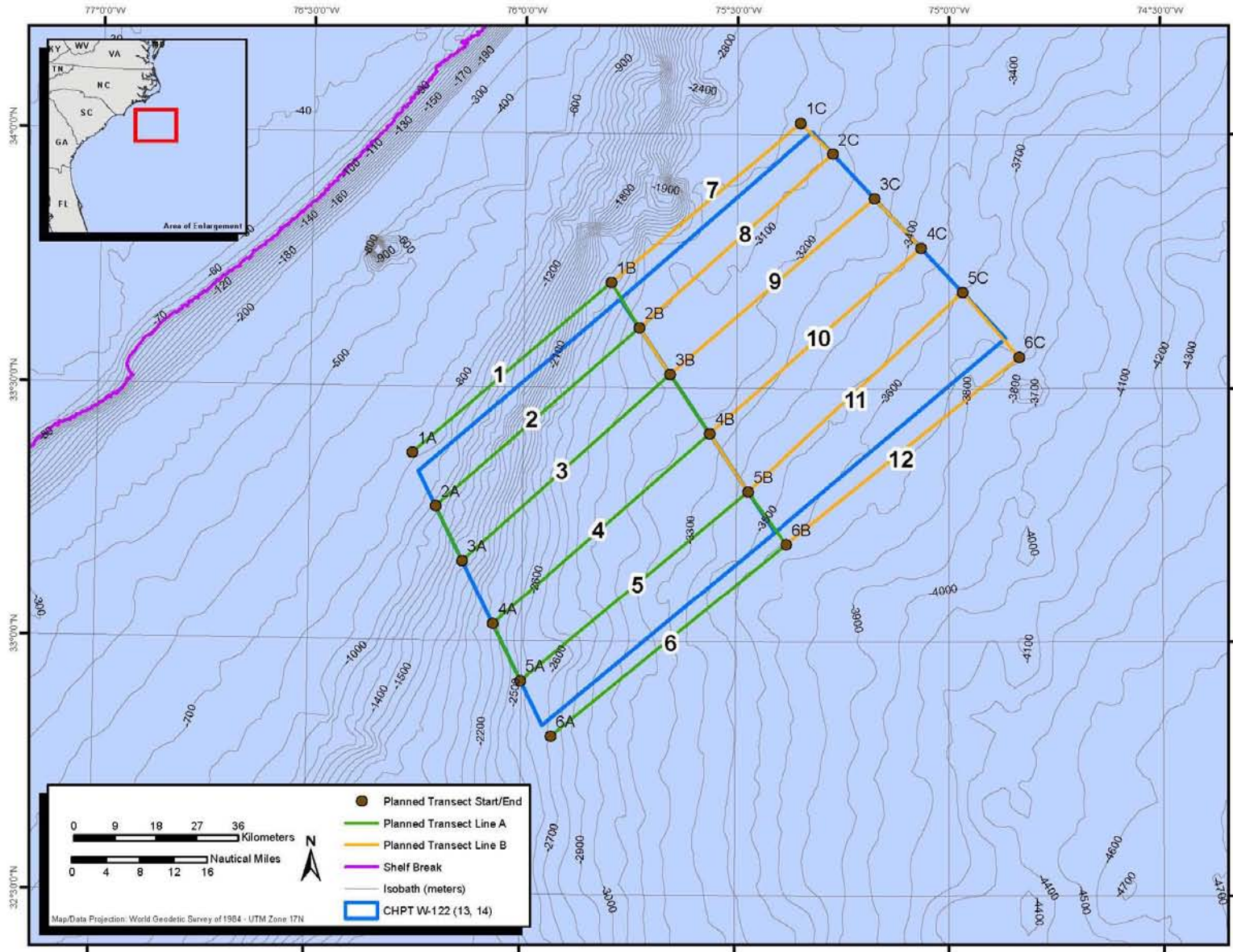


Figure 1. Pre-planned Tracklines for the Survey Effort for CHPT FIREX Monitoring.

a well-established protocol used for aerial surveys throughout all Navy Range Complexes (Smultea et al. 2009). A survey altitude of approximately 1,000 feet (ft) at 100 knots 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 session was initiated at 1,000 ft or higher if conditions were appropriate (Smultea et al. 2009; refer to the survey methods on page 4 of this document). A lower altitude of approximately 700 to 800 ft was established after focal follow sessions for photography purposes to provide sharper images required for species identification.

Table 1. Summary of Monitoring Effort for the CHPT FIREX Training.

Date	Description	Start Time	Stop Time	Total Survey Minutes*	Total On-Effort Minutes	Trackline On-Effort Distance (km)
29 November	Transect survey (Pre-Event)	Cancelled – Poor Weather				
30 November	Transect survey (During Event)	0911	1034	83	60	207
Total				83 (≈1.4 hrs)	60 (≈1.0 hrs)	207 km

Note: * Total Survey Minutes reflect minutes occupied 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 Beaufort-Morehead City Airport in Beaufort, North Carolina. One survey on 30 November was conducted following pre-planned transect lines covering and extending approximately 2-4 km beyond the boundaries of the W-122 (14) box (see **Figure 1, Table 1**). Each survey was limited to a 5-hour maximum flight time window. The pre-FIREX survey planned for 29 November was not executed due to poor weather conditions and a low cloud ceiling.

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, and were knowledgeable of marine mammal biology and behavior.

Table 2. Observers and Roles.

Observer	Role(s)
Lenisa Blair	Chief Scientist/Observer
Brad Dawe	Observer

Survey effort attempted to cover the entirety of the W-122 (14) box (approximately 3,700 km²). Six parallel tracklines running from southwest to northeast, measuring 56 km long and spaced approximately 12.5 km apart were to be flown during “systematic” efforts throughout the monitoring period and were designed to provide a total survey coverage area of approximately 4,340 km² (see **Figure 1**). Planned lines were followed when possible, but exact transects flown for each survey day were subject to modifications as a result of range exclusion by live-fire U.S.

Navy exercises in the area, unfavorable weather conditions on the range or hourly contact with naval flight operations requiring an increase in the plane's altitude (see **Figure 2, Table 1**).

The following describe the general survey approach:

1. Pre-planned 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.
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 CHPT Range Complex Monitoring Plan February 2009, information included (1) species identification and group size; (2) location and relative distance from the IMPASS site if available; (3) the behavior of marine mammals and sea turtles, including standard environmental and oceanographic parameters; (4) date, time, and visual conditions associated with each observation; (5) direction of travel relative to true North; and (6) 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 radial distance increased approximately 0.5 to 1.0 km. 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 species identification confirmation and to estimate group size/composition.

Section 3 Results

Survey Effort

Observers visually surveyed approximately 207 km of on-effort trackline and an additional 84 km off-effort (connector lines) during one survey day for approximately 1 hour of on-effort status (see **Table 1**). Beaufort Sea State ranged from 5 to 6, which significantly contributed to the lack of sightings in the area (see **Table 3**). **Appendix A** contains a detailed description of environmental, oceanographic, and sighting conditions.

Sightings

No sightings of cetaceans or sea turtles were recorded during 1.4 hours of total survey flight time (includes on-effort and off-effort intervals) within the survey area covering a 1-day period (see **Figure 2, Table 3**). On 30 November, one large unidentified whale was briefly seen approximately 18 km south of Lookout Bight, North Carolina (approximately 100 km outside of the survey area) on the transit back to the airport (see **Figure 2, Table 3**). Attempts to relocate and confirm species ID in the poor sea state was unsuccessful. As a result of the survey plane's restricted access during the live-fire exercise, no U.S. Naval vessels were seen within the area.

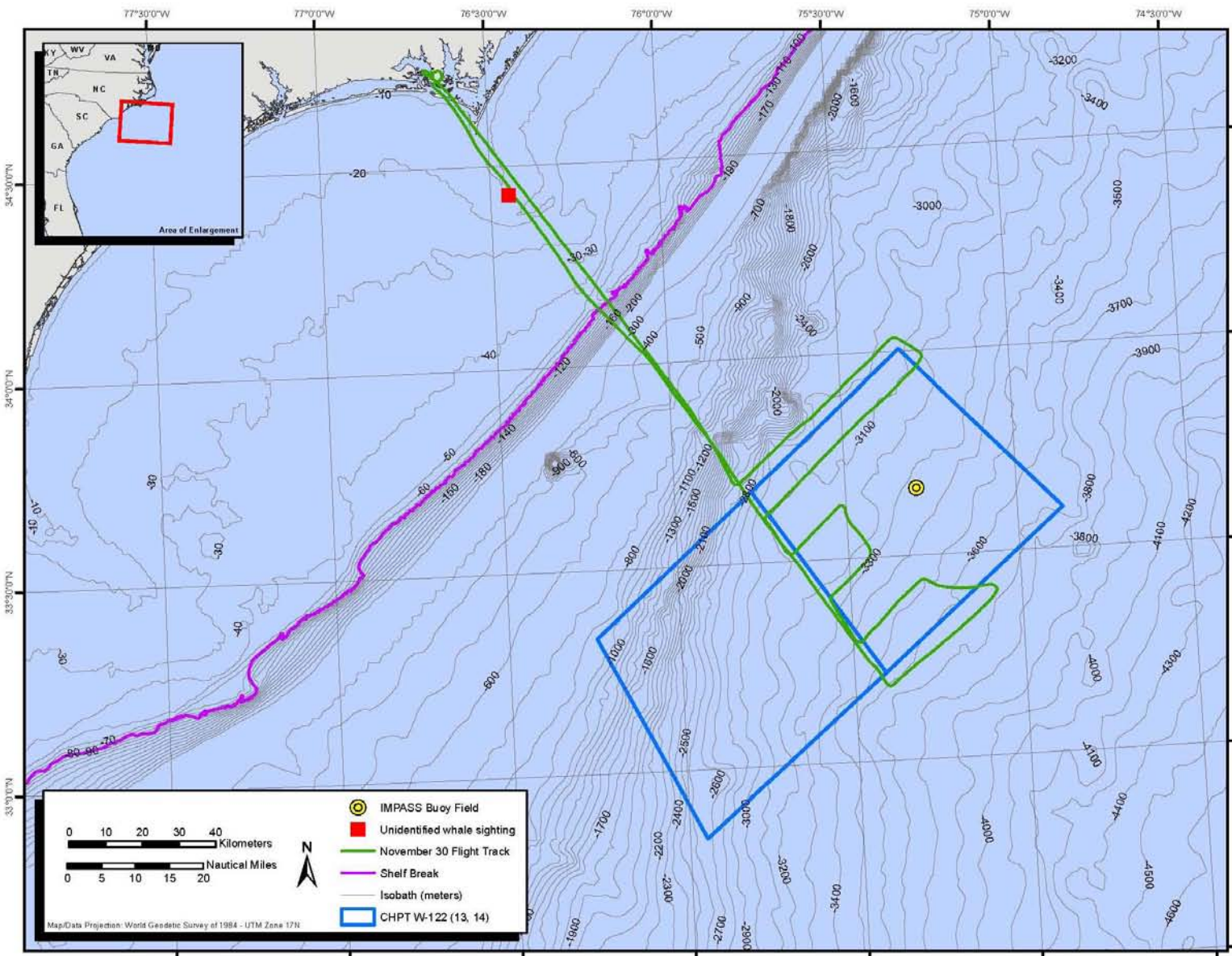


Figure 2. Locations of All Cetacean and Sea Turtle Sightings Seen During CHPT FIREX Monitoring (30 November).

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
Pre-FIREX Sightings on 29 November 2011																
Cancelled – Poor Weather, Low Ceiling																
During-FIREX Sightings on 30 November 2011																
No Sightings Seen Within Survey Area																
1	11/30/11	Unid Whale	1	1	1	-	11:16	-	5	34.432	-76.441	-	-	-	10-20	One large unidentified whale briefly seen <u>100 km outside of survey area</u> on transit route back to airport. Repeated circling attempts to re-locate animal in poor sea state were unsuccessful.

Key:

Unid Whale = Unidentified whale

Section 4 Acknowledgements

We would like to thank Orion Aviation's Director Ed Coffman and pilots Stan and Dave Huddle. These data were obtained under National Marine Fisheries Service permit no. 14451 issued to Joseph R. Mobley, Jr.

Section 5 References

- Buckland et al. 2001 Buckland, S.T., D.R. Anderson, K.P. Burnham, J.L. Laake, D.L. Borchers, and L. Thomas. 2001. *Introduction to distance sampling: Estimating abundance of biological populations*. Oxford University Press.
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APPENDIX A

Environmental, Oceanographic, and Sighting Conditions

Table A-1 shows the environmental, oceanographic, and sighting conditions encountered during FIREX 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 (%)
During-FIREX Survey Effort on 30 November 2011							
9:11	5	70	0.5	5	30	1	100
9:30	5	70	0.5	5	50	1	100
9:36	6	70	0.5	6	50	1	100
9:52	6	60	0.5	6	0	0.5	100
10:01	5	60	0.5	5	20	0.5	100
10:10	5	80	0.5	5	20	0.5	100
10:22	5	60	0.5	5	40	0.5	100

***Appendix E – Aerial Survey Report for JAX FIREX with IMPASS,
19-21 September 2011***

Jacksonville (JAX) Firing Exercise (FIREX) with Integrated Maritime Portable Acoustic Scoring and Simulator (IMPASS)

Marine Species Monitoring

AERIAL MONITORING SURVEYS

TRIP REPORT



19-21 September 2011

ACRONYMS AND ABBREVIATIONS

BSS	Beaufort sea state
FIREX	Firing Exercise
ft	feet
HDR EOC	HDR Environmental, Operations and Construction, Inc.
hr	hour(s)
ICMP	Integrated Comprehensive Monitoring Program
IMPASS	Integrated Maritime Portable Acoustic Scoring and Simulator
JAX	Jacksonville Range Complex
km	kilometer(s)
km ²	square kilometers
m	meter(s)
MMO	Marine Mammal Observer
NEPM	Non-Explosive Practice Munition
NM	nautical mile(s)
OPAREA	operating area
SPUE	Sightings Per Unit Effort
U.S.	United States

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Section 1 Introduction

Aerial marine species monitoring occurred between 19 and 21 September 2011 for a Firing Exercise (FIREX) with Integrated Maritime Portable Acoustic Scoring and Simulator (IMPASS) Exercise that occurred in the Jacksonville Range Complex (JAX) off the eastern coast of Florida within the United States (U.S.) Navy's FIREX boxes BB and CC. These types of 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). 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 Jacksonville OPAREA lies off the coast of the Georgia/Florida border. Protected marine species monitoring conducted during the JAX FIREX training event was focused on the BB and CC boxes within the JAX OPAREA (see **Figure 1**). This area is approximately 81 to 167 kilometers (km) (44 to 90 nautical miles [NM]) offshore, covers an area approximately 1,431 square kilometers (km²) in size, and ranges in bottom depth from 30 to 610 meters (m).

The FIREX event commenced at 05:45 on 20 September 2011, and a total of 47 Non-Explosive Practice Munition (NEPM) rounds of 5-inch Blind Loaded and Plugged were fired. In addition, the unit also shot four NEPM rounds of 5-inch Illumination. NEPM was used first, which resulted in a successful training mission. Thus, no live-explosive rounds were used during the FIREX training. Therefore, no animals were exposed during this JAX FIREX with IMPASS training event.

Aerial-Based Monitoring

Aerial-based monitoring effort was performed before, during, and after a FIREX with IMPASS within the JAX OPAREA from 19 to 21 September 2011 (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 1,000 feet (ft) at

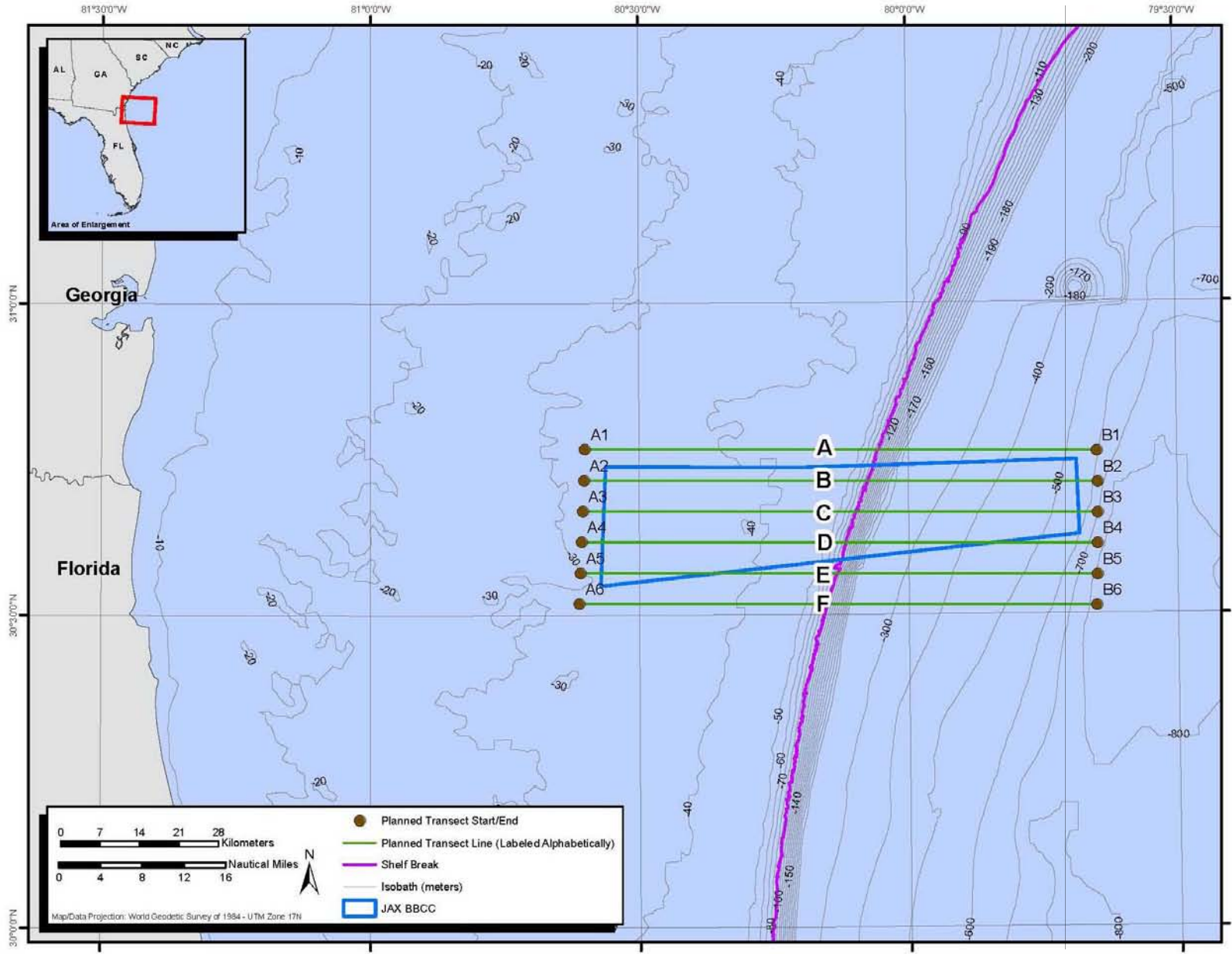


Figure 1. Pre-planned Tracklines for the Survey Effort for JAX FIREX Monitoring.

Table 1. Summary of Monitoring Effort for the JAX FIREX Training.

Date	Description	Start Time	Stop Time	Total Survey Minutes*	Total On-Effort Minutes	Trackline On-Effort Distance (km)
19 September	Transect survey (Pre-Event)	8:13	8:59	46	41	138
20 September	Transect survey (During Event)	8:31	11:15	163	153	516
21 September	Transect survey (Post-Event)	8:12	11:03	171	159	534
Total				381 (≈6.4 hours)	353 (≈5.9 hours)	1,188 km

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

100 knots 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 session was initiated at 1,000 ft or higher if conditions were appropriate (Smultea et al. 2009; refer to the survey methods on page 4 of this document). A lower altitude of approximately 700 to 800 ft was established after focal follow sessions for photography purposes to provide sharper images required for species identification.

The observation platform was a Cessna T337H Turbo Skymaster aircraft operating out of Fernandina Beach Municipal Airport in Fernandina Beach, Florida. Three surveys were conducted following pre-planned transect lines covering and extending approximately 3.5 km (1.9 NM) beyond the boundaries of the BB and CC boxes (see **Table 1, Figure 1**). Each survey was limited to a 5-hour (hr) maximum flight time window. The pre-FIREX survey on 19 September was not fully executed due to deteriorating weather conditions.

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, and were knowledgeable of marine mammal biology and behavior.

Table 2. Observers and Roles.

Observer	Role(s)
Lenisa Blair	Chief Scientist/Observer
Mark Cotter	Observer

Survey effort included the entirety of the BB and CC boxes (approximately 1,431 km²). Six parallel tracklines running from west to east, measuring 91 km long and spaced approximately 5.3 km apart were flown during “systematic” efforts throughout the monitoring period and provided a total survey coverage area of approximately 2,513 km² (see **Figure 1**). Planned lines were followed when possible, but exact transects flown for each survey day were subject to

modifications as a result of range exclusion by live-fire U.S. Navy exercises in the area, unfavorable weather conditions on the range or hourly contact with naval flight operations requiring an increase in the plane's altitude (see **Table 1, Figures 2 through 5**).

The following describe the general survey approach:

1. Pre-planned 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 Beaufort sea state (BSS), glare, and visibility were recorded for each transect flown.
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 *JAX Range Complex Monitoring Plan*, information included (1) species identification and group size; (2) location and relative distance from the IMPASS site if available; (3) the behavior of marine mammals and sea turtles, including standard environmental and oceanographic parameters; (4) date, time, and visual conditions associated with each observation; (5) direction of travel relative to true North; and (6) 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 radial distance increased approximately 0.5 to 1.0 km. 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 species identification confirmation and to estimate group size/composition.

Section 3 Results

Survey Effort

Observers visually surveyed approximately 1,188 km of on-effort trackline and an additional 1,268 off-effort (connector lines and circling for focal follow or species ID) during three survey days for approximately 5.9 hr of on-effort status (see **Table 1**). BSS ranged from 3 to 5 and sightings were made during all BSS (see **Table 3**). This survey was hindered by heavy rain, and low cloud ceilings restricting both visibility and safe flying conditions. **Appendix A** contains a detailed description of environmental, oceanographic, and sighting conditions.

Sightings

Zero sightings of marine mammals and 10 sightings of sea turtles were recorded during 6.4 hr of total survey flight time (includes on-effort and off-effort intervals) within the survey area covering a 3-day period (see **Figure 2, Table 3**). Sightings Per Unit Effort (SPUE) was calculated as the total survey effort (hr/km/NM) divided by the total number of sea turtles ($n=10$). For this monitoring exercise, the SPUE for sea turtles was equal to one sighting per 0.64 hr, 119 km, and 64.3 NM.

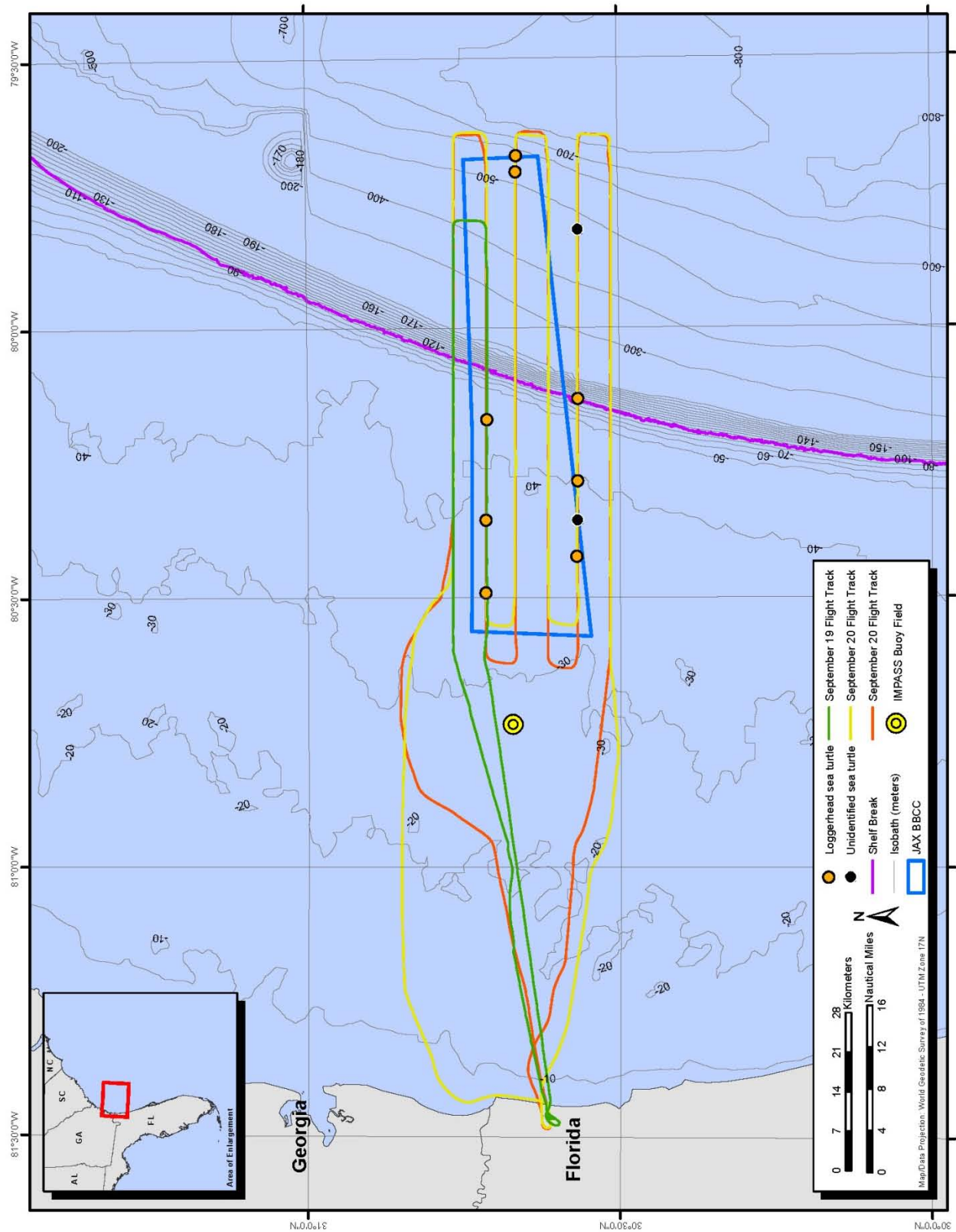


Figure 2. Locations of All Cetacean and Sea Turtle Sightings Recorded During JAX FIREX Monitoring (19-21 September).

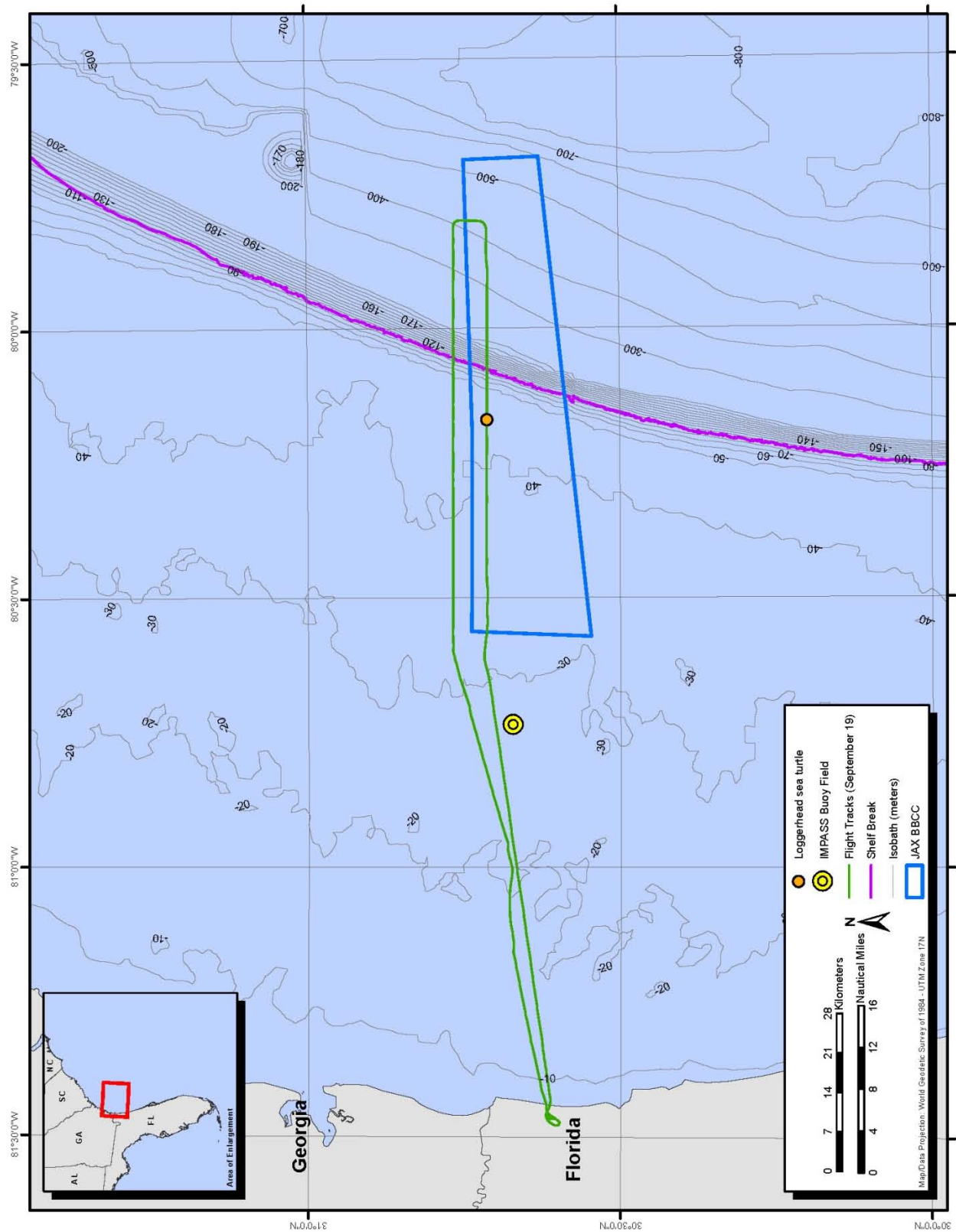


Figure 3. Locations of Cetacean and Sea Turtle Sightings Recorded Pre-FIREX Training (19 September).

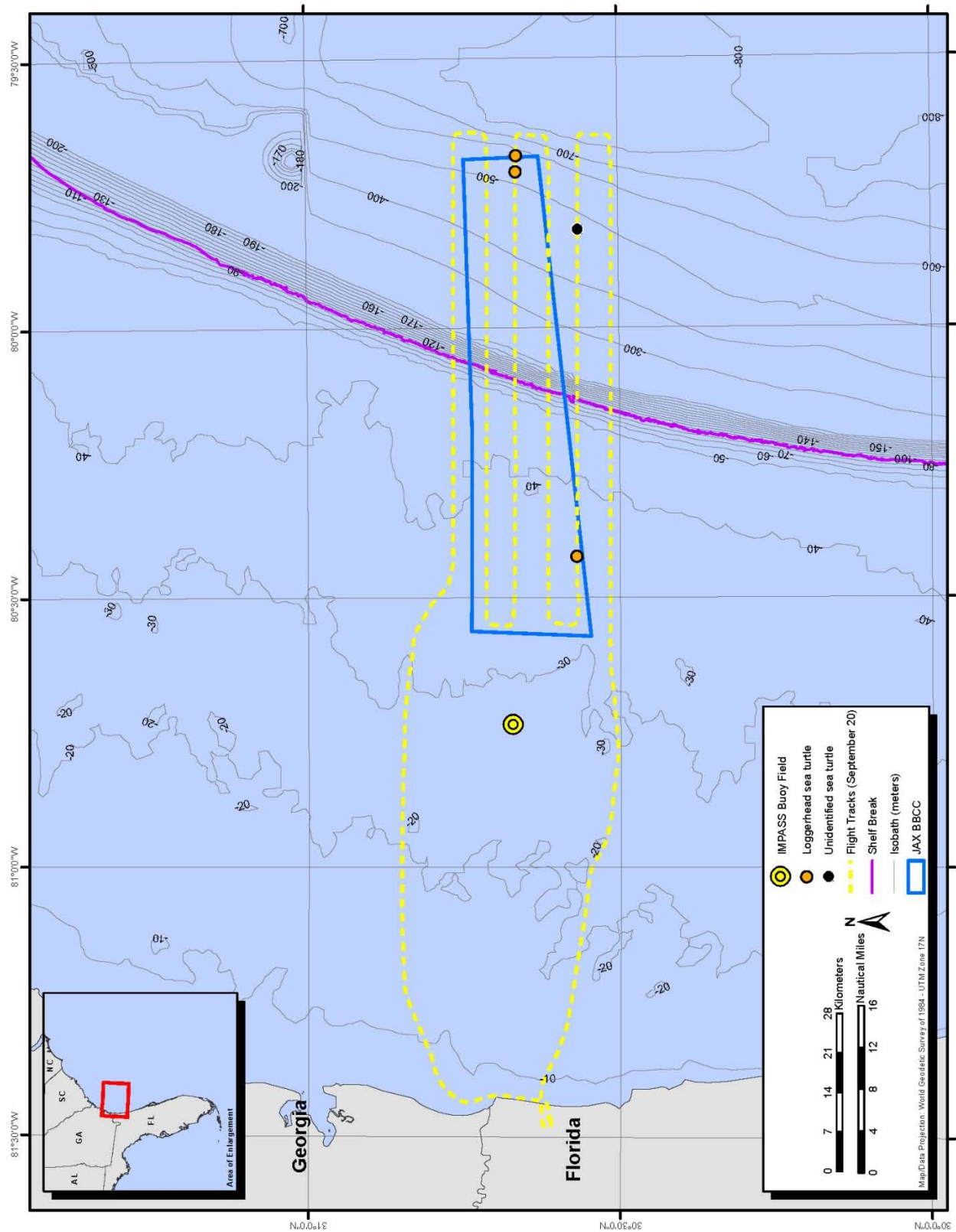


Figure 4. Locations of Cetacean and Sea Turtle Sightings Recorded During-FIREX Training (20 September).

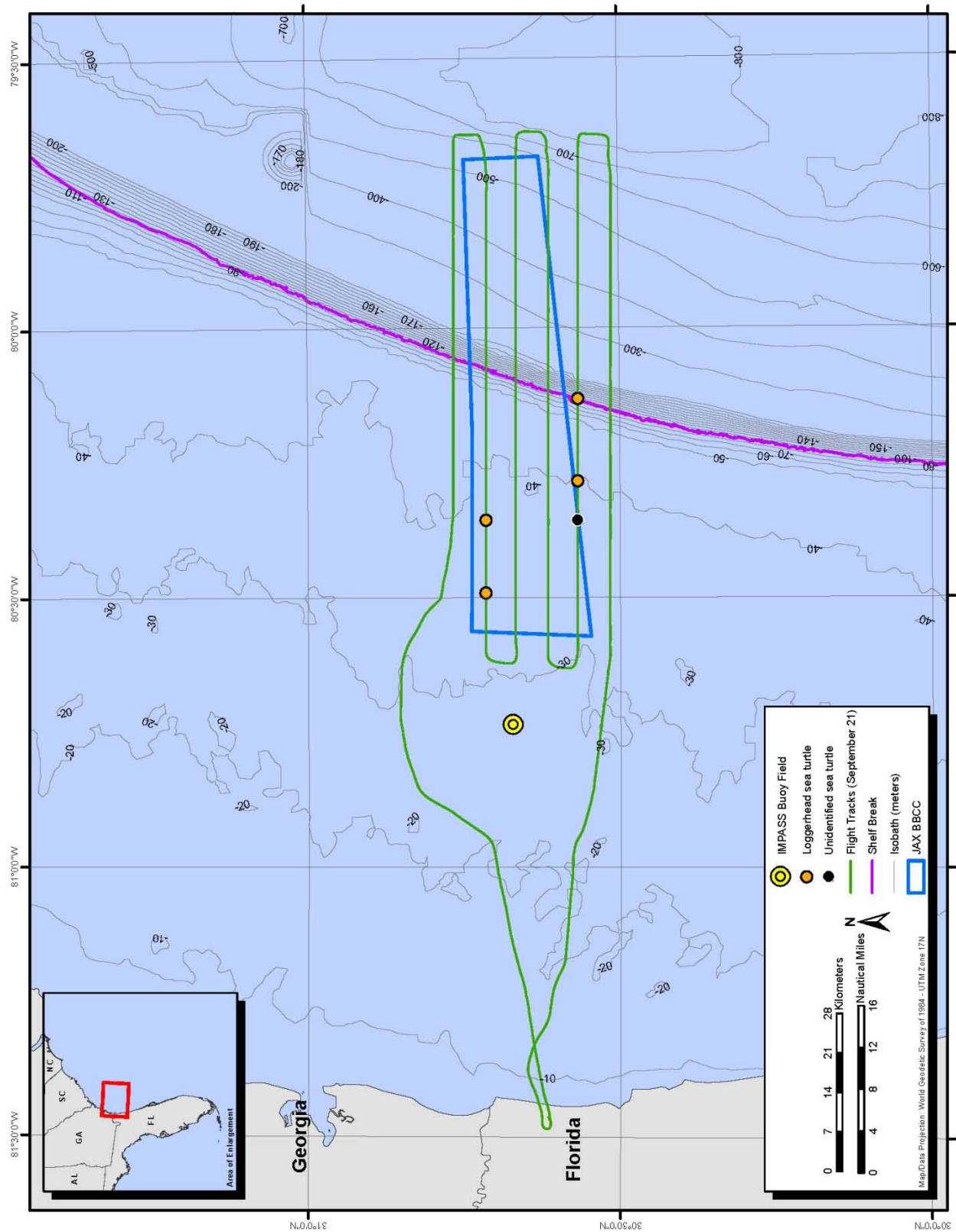


Figure 5. Locations of Cetacean and Sea Turtle Sightings Recorded Post-FIREX Training (21 September).

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
Pre-FIREX Sightings on 19 September 2011																
1	9/19/11	CC	1	1	1	-	8:48	-	5	30.713	-80.170	050	0.2	225	50	Loggerhead turtle resting at the surface. No disturbance detected
During-FIREX Sightings on 20 September 2011																
1	9/20/11	CC	1	1	1	-	9:49	-	3	30.664	-79.711	042	0.3	090	500	Loggerhead turtle resting at the surface. No disturbance detected
2	9/20/11	CC	1	1	1	-	9:50	-	3	30.663	-79.681	054	0.2	248	600	Loggerhead turtle resting at the surface. No disturbance detected
3	9/20/11	CC	1	1	1	-	10:23	-	3	30.570	-80.424	047	0.3	113	30	Loggerhead turtle resting at the surface. No disturbance detected
4	9/20/11	Unid ST	1	1	1	-	10:41	-	3	30.566	-79.819	032	0.5	Unk.	500	Unidentified sea turtle resting at the surface. No disturbance detected.
Post-FIREX Sightings on 21 September 2011																
1	9/21/11	CC	1	1	1	-	8:58	-	4	30.715	-80.356	030	0.5	000	40	Loggerhead turtle resting at the surface. No disturbance detected
2	9/21/11	CC	1	1	1	-	9:02	-	4	30.716	-80.491	040	0.4	045	30	Loggerhead turtle resting at the surface. No disturbance detected.
3	9/21/11	Unid ST	1	1	1	-	10:14	-	3	30.569	-80.357	032	0.5	180	40	Unidentified sea turtle resting at the surface. No disturbance detected.
4	9/21/11	CC	1	1	1	-	10:16	-	3	30.568	-80.284	036	0.4	045	40	Loggerhead turtle resting at the surface. No disturbance detected.
5	9/21/11	CC	1	1	1	-	10:23	-	3	30.567	-80.132	021	0.8	180	100	Loggerhead turtle resting at the surface. No disturbance detected.

Key:

CC = loggerhead turtle (*Caretta caretta*)

Unid ST = Unidentified sea turtle

One sighting of a sea turtle was made during the 1-day pre-FIREX survey (see **Figure 3, Table 3**). Four sightings of sea turtles were made throughout the 1-day during-FIREX survey period (see **Figure 4, Table 3**). Five sightings of sea turtles were made during the one-day post-FIREX survey (see **Figure 5, Table 3**).

Sightings over the 3-day period included eight sightings of loggerhead turtles and two sightings of unidentified sea turtles. **Table 4** provides a summary of sightings information and environmental data. Bottom depths for each sighting were estimated in 10 m ranges from plots of latitude and longitude for each sighting within a Geographic Information System.

Table 4. Summary of Sightings Recorded during Monitoring for JAX FIREX Training.

Species	Number of Sightings	Bottom Depths (m)
Loggerhead turtle	8	30-600
Unidentified turtle	2	40-500

Behavior

No visible evidence of unusual behavior was observed for the pre-FIREX, during-FIREX or post-FIREX surveys (see **Table 3**). The survey team did not conduct any focal follows, because no sightings of marine mammals were recorded during the FIREX monitoring effort.

Section 4 Acknowledgements

We would like to thank Orion Aviation's Director Ed Coffman and pilots Stan Huddle and Ryan MacGregor. These data were obtained under National Marine Fisheries Service permit no. 14451 issued to Joseph R. Mobley, Jr.

Section 5 References

- Buckland et al. 2001 Buckland, S.T., D.R. Anderson, K.P. Burnham, J.L. Laake, D.L. Borchers, and L. Thomas. 2001. *Introduction to Distance Sampling: Estimating Abundance of Biological Populations*. Oxford University Press.
- Smultea et al. 2009 Smultea, M.A., J.R. Mobley, Jr., and K. Lomac-MacNair. 2009. *Aerial Survey Monitoring for Marine Mammals and Sea Turtles in Conjunction with US Navy Major Training Events off San Diego, California, 15-21 October and 15-18 November 2008, Final Report*. Prepared by Marine Mammal Research Consultants, Honolulu, HI, and Smultea Environmental Sciences, LLC., Issaquah, WA, under Contract No. N62742-08-P-1936 and N62742-08-P-1938 for NAVFAC Pacific, EV2 Environmental Planning, Pearl Harbor, HI.

APPENDIX A

Environmental, Oceanographic, and Sighting Conditions

Table A-1 shows the environmental, oceanographic, and sighting conditions encountered by Marine Mammal Observers (MMOs) during the pre-FIREX, during-FIREX, and post-FIREX 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 (%)
Pre-FIREX Survey Effort on 19 September 2011							
8:13	4	30	1	4	0	1	100
8:36	5	30	1	5	0	1	100
8:40	6	20	0.5	6	10	0.5	100
8:45	5	20	0.5	5	10	0.5	100
8:50	4	20	0.5	4	10	0.5	100
During-FIREX Survey Effort on 20 September 2011							
8:31	3	25	1	3	10	1	100
8:49	4	25	1	4	10	1	100
8:57	3	25	1	3	0	1	100
9:08	3	45	1	3	0	1	100
9:24	3	50	1	3	10	1	100
9:28	3	50	1	3	60	1	100
9:54	2	40	1	2	50	1	100
9:55	3	40	1	3	50	1	100
10:20	3	50	1	3	30	1	100
10:49	3	45	1	3	20	1	100
Post-FIREX Survey Effort on 21 September 2011							
8:12	3	45	1	3	40	1	60
8:38	4	45	1	4	25	1	60
9:08	3	20	1	3	30	1	60
9:23	4	20	1	4	30	1	60
9:39	4	20	1	4	15	1	60
9:57	4	50	1	4	15	1	60
10:07	3	15	1	3	50	1	60
10:36	3	50	1	3	35	1	60
10:52	3	80	1	3	35	1	60

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