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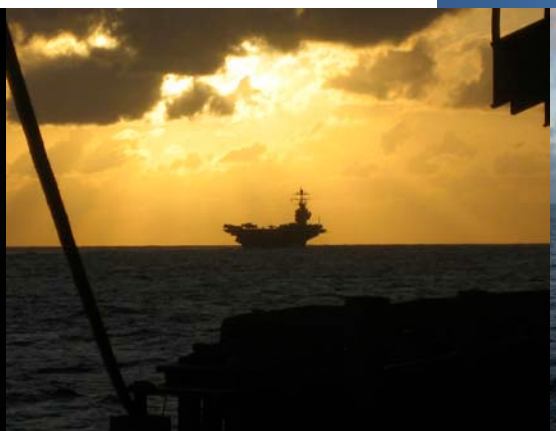
Marine Species Monitoring

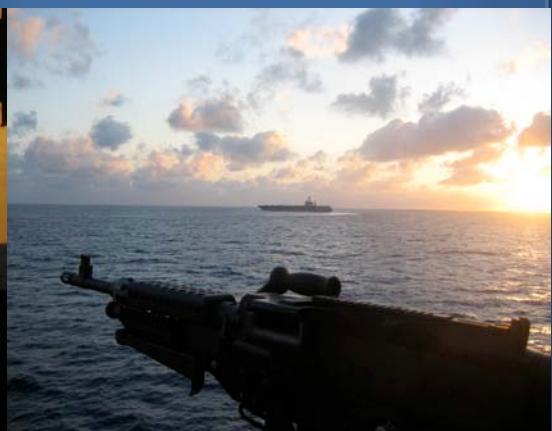
For The U.S. Navy's

Atlantic Fleet Active Sonar Training (AFAST)

September 2010

Annual Report 2010





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List of Acronyms

AMR	Adaptive Management Review
ARP	acoustic recording package
AS	aerial survey
ASW	anti-submarine warfare
BiOP	ESA Biological Opinion
COMPTUEX	Composite Training Unit Exercises
CNO	Chief of Naval Operations
CREEM	Centre for Research into Ecological and Environmental Modeling
dB	decibel
EIS	Environmental Impact Statement
DoN	Department of the Navy
ESA	Endangered Species Act
ft	feet
FY	fiscal year
GUNEX	Gunnery Exercise, Surface-to-Surface
HARP	high-frequency acoustic recording package
HQ	headquarters
JTFEX	Joint Task Forces Exercises
ITA	Incidental Take Authorization
LMMO	liaison marine mammal observer
LOA	Letter of Authorization
M3R	Marine Mammal Monitoring on Navy Ranges
MFAS	mid-frequency active sonar
MMO	marine mammal observer
MMPA	Marine Mammal Protection Act
MMPI	marine mammal PhotoID
MTE	Major Training Exercise
nm	nautical mile
NMFS	National Marine Fisheries Service
NOAA	National Oceanographic and Atmospheric Administration
NUWC	Naval Undersea Warfare Center
OEIS	Overseas Environmental Impact Statement
ONR	Office of Naval Research
OT	observation team
PAM	passive acoustic monitoring
PMAP	Protective Measures Assessment Protocol
PTS	permanent threshold shift
R&D	research and development
RL	receive level
TTS	temporary threshold shift
VS	vessel survey

INTRODUCTION

Background

The U.S. Navy developed Range Complex specific 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 (ITA) 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 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 Endangered Species Act (ESA) does not have specific monitoring requirements, recent Biological Opinions issued by National Marine Fisheries Service (NMFS) also have included terms and conditions requiring the Navy to develop a monitoring program. Therefore, as part of the issuance of an LOA in early 2009 (NMFS 2009), the Navy published a Monitoring Plan with specific monitoring objectives for the Atlantic Fleet Active Sonar Training (AFAST) (DoN 2009).

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 that are described more fully in the AFAST Monitoring Plan:

1. Are marine mammals and sea turtles exposed to mid-frequency active sonar (MFAS), especially at levels associated with adverse effects (i.e., based on NMFS' criteria for behavioral harassment, TTS, or PTS)? If so, at what levels are they exposed?

2. If marine mammals and sea turtles are exposed to MFAS in the AFAST study area, do they redistribute geographically as a result of continued exposure? If so, how long does the redistribution last?

3. If marine mammals and sea turtles are exposed to MFAS, what are their behavioral responses to various levels?

4. Is the Navy's suite of mitigation measures for MFAS (e.g., Protective Measures Assessment Protocol (PMAP), major exercise measures agreed to by the Navy through permitting) effective at avoiding TTS, 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 to support both Range Complex specific monitoring, and 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 (MMO). Each monitoring technique has advantages and disadvantages that vary temporally and spatially, as well as support one particular study objective better than another (DoN 2009). The Navy intends to use 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.

In addition to Fleet-funded Monitoring Plans described above, the Chief of Naval Operations (CNO) Environmental Readiness Division (N45) and the Office of Naval Research (ONR) have developed a coordinated Science & Technology and Research & Development program focused on marine mammals and sound. Total investment in this program for fiscal year (FY) 2010 was approximately $22 million, and continued funding at levels greater than $14 million is foreseen in subsequent years. Several significant projects relative to potential Navy operational impact to marine mammals are currently funded and ongoing within some Navy Range Complexes.

Integrated Comprehensive Monitoring Program (ICMP)

The Integrated Comprehensive Monitoring Program (ICMP) provides the overarching framework for coordination of the United States Navy monitoring program. It has been developed in direct response to Navy Range permitting requirements established in the various MMPA Final Rules, ESA Consultations, Biological Opinions, and applicable regulations. As a framework document, the ICMP applies by regulation to those activities on ranges and operating areas for which the Navy sought and received incidental take authorizations.

The ICMP is intended for use as a planning tool to focus Navy monitoring priorities pursuant to ESA and MMPA requirements. Top priority will always be given to satisfying the mandated legal requirements across all ranges. Once legal requirements are met, any additional monitoring-related research will be planned and prioritized using guidelines provided by the ICMP, consistent with availability of both funding and scientific resources. As a planning tool, the ICMP is a "living document." It will be routinely updated as the Program matures. Initial areas of focus for maturing the document in 2010/2011 include further refinement of monitoring goals, adding a characterization of the unique attributes associated with each range complex / study area to aid in shaping future monitoring projects, as well as a broader description of the data management organization and access procedures.

The ICMP will be evaluated annually through the adaptive management process to assess progress, provide a matrix of goals for the following year, and make recommendations for refinement and analysis of the monitoring and mitigation techniques. This process includes conducting an annual Adaptive Management Review (AMR) at which the Navy and National Marine Fisheries Service (NMFS) jointly consider the prior year goals, monitoring results, and related science advances to determine if modifications are needed to more effectively address monitoring program goals. Modifications to the ICMP that result from AMR decisions will be incorporated by an addendum or revision to the ICMP. The ICMP updates will be provided to NMFS by 31 December annually beginning in 2010. The adaptive management process recurs annually, with some modifications to the process in 2011 when the Navy, with guidance and support from NMFS, is to host a Monitoring Workshop that incorporates outside experts and expanded participation.

OPNAV (N45) is responsible for maintaining and updating the ICMP, as necessary, reflecting the results of future regulatory agency rulemaking, adaptive management reviews, best available science, improved assessment methodologies, and more effective protective measures. This will be done in consultation with Navy technical experts, Fleet Commanders, and Echelon II Commands as appropriate and as part of the adaptive management process. The complete Integrated Comprehensive Monitoring Program as submitted to NMFS in December 2009 is provided in Appendix A.

Report Objective

Design of the Range Complex specific Monitoring Plans represented part of a new Navy-wide and regional assessment, and as with any new program, there are many coordination, logistic, and technical details that continue to be refined. The scope of the Range Complex Monitoring Plans was to layout the background for monitoring, as well as 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:

1) Under the AFAST LOA, present data and results from the Navy-funded marine mammal and sea turtle monitoring conducted in the AFAST study area during the period from 2 August 2009 to 1 August, 2010. Due to time required to consolidate data and generate an annual monitoring report, this report covers a time period that includes the last half of the first year LOA (2 Aug 2009 – 21 Jan 2010) as well as the first half of the second year LOA (22 Jan 2010 – 1 Aug 2010). Because the annual LOA period is 22 Jan – 21 Jan, an additional table is included that briefly reviews monitoring accomplishments during the first full year of the MMPA authorization (22 Jan 2009 – 21 Jan 2010). Given the relatively new start of this ambitious program, this report will focus mostly on summarizing collected data, and providing a brief description of the major accomplishments from techniques used this year.

2) Set the foundation for adaptive management review with NMFS for incorporation of proposed revisions to the Navy's CY 2011 AFAST Monitoring Plan based on actual lessons learned to date. This can include data quality in answering the original study questions, assessment of logistic feasibility, availability of monitoring resources, use of new techniques not originally incorporated in this year's Monitoring Plan, and any other pertinent information.

ATLANTIC FLEET ACTIVE SONAR TRAINING (AFAST)

The AFAST study area consists of the range complexes' at-sea operating areas, and adjacent waters along the U.S. East Coast and Gulf of Mexico (**Figure 1**).

There are forty-three species of marine mammals that may be observed either seasonally or year-round in the AFAST study area; seven are endangered. In addition, there are six species of threatened and endangered sea turtles that may occur either seasonally or year-round in parts of the AFAST study area (Reviewed in DoN, 2005, 2007, 2008a, 2008b, and 2008c).

Part I - AFAST Monitoring Plan Accomplishments

AFAST STUDY QUESTIONS OVERVIEW

The goal of the AFAST Monitoring Plan is to implement field methods chosen to address the long term monitoring objectives outlined in the Introduction. In the AFAST monitoring plan (DoN 2009), 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 and vessel), deploy passive acoustic monitoring devices, and put marine mammal observers aboard Navy vessels to meet its goals in FY09. Studies were specifically designed to meet the questions outlined in the Introduction section of this document. **Table 1** shows the CY 2010 monitoring objectives as agreed upon by the NMFS and Navy.

LONGITUDINAL BASELINE MONITORING

In June 2007 a protected marine species monitoring program was initiated in Onslow Bay off the North Carolina Coast. The Navy contracted with a consortium of researchers from Duke University, the University of North Carolina at Wilmington, the University of St. Andrews, and the NMFS Northeast Fisheries Science Center to conduct a pilot study analysis and subsequently develop a survey and monitoring plan that prescribes the recommended approach for data collection including surveys (aerial/shipboard, frequency, spatial extent, etc.), passive acoustic monitoring, photo identification and data analysis (standard line-transect, spatial modeling, etc.) necessary to establish a fine-scale seasonal baseline of protected species distribution and abundance.

The program now consists of year-round multi-disciplinary monitoring through the use of shipboard and aerial visual surveys (24 days each annually), photo identification studies, biopsy sampling, and passive acoustic monitoring. Passive acoustic monitoring is accomplished through use of a towed array during shipboard surveys as well as long-term deployment of High-frequency Acoustic Recording packages. Surveys are conducted year-round using established track lines and standard distance sampling techniques. The detailed plan for this monitoring program is included as **Appendix B**. A summary of accomplishments and basic results of these monitoring efforts for the reporting period are presented within the remainder of this report, however, the detailed year 2 (July 2008-June 2009) and year 3 (July 2009-July 2010) annual reports for the program are included as **Appendices C and D**. In addition, monthly monitoring progress reports for both locations are provided in **Appendix E**.

The initial intent of the Onslow Bay and Jacksonville (JAX) monitoring program was to support development of an Undersea Warfare Training Range (USWTR). However, the program has evolved into

established fixed sites for the overall AFAST monitoring program designed to provide meaningful data on potential long-term effects to marine species that may be chronically exposed to ASW training. The monitoring at these two sites provides a longitudinal baseline of marine species distribution and abundance in Navy training areas during periods when training is not occurring. In addition, these sites are being used as areas to conduct coordinated ASW exercise monitoring using a variety of methods including aerial/shipboard visual surveys and passive acoustics. Monitoring both during and outside of training events is intended to gather important data that will begin to address the questions outlined in the Introduction.

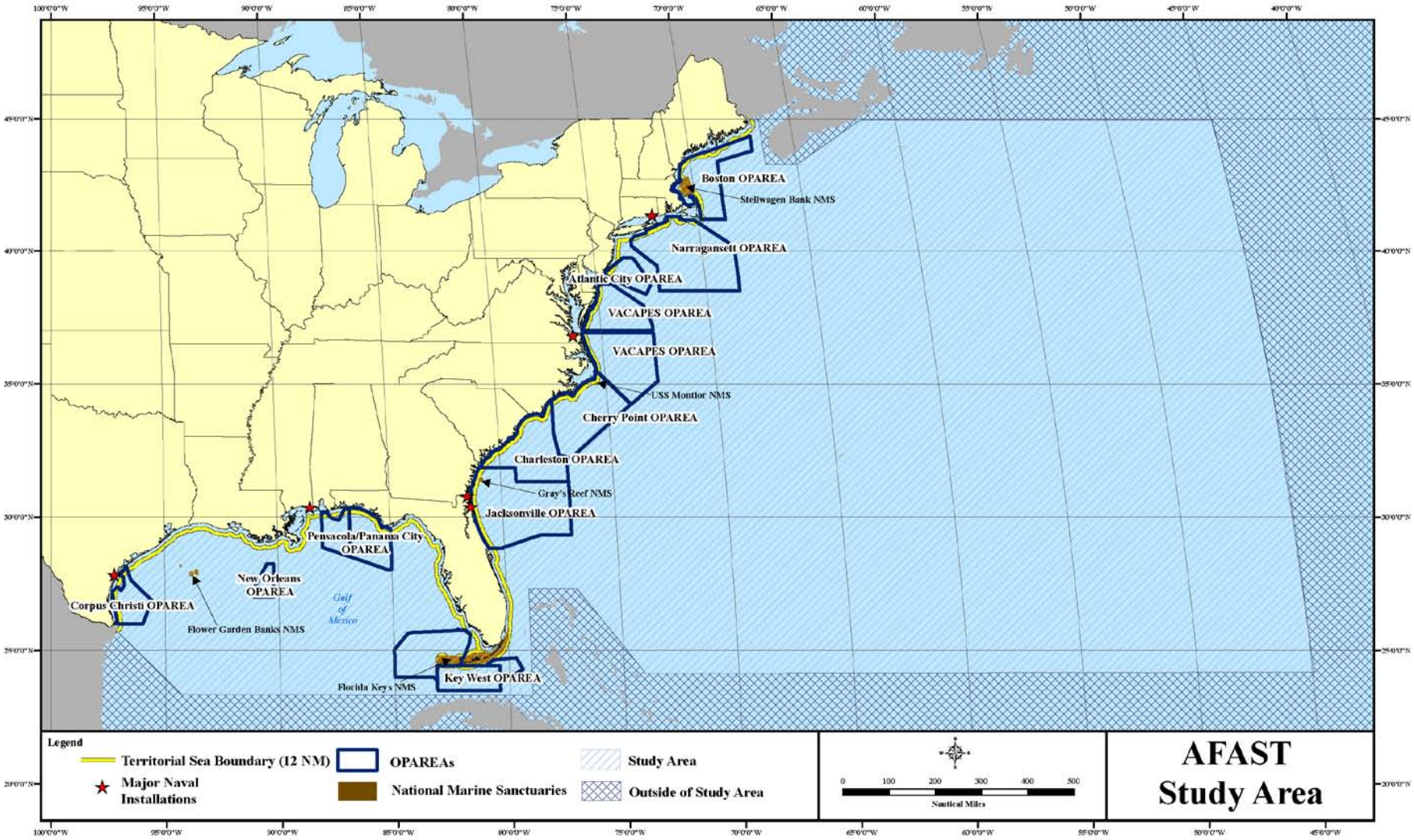

Figure 1. AFAST Study Area.

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Table 1. 2010 AFAST monitoring requirements under AFAST Final Rule, LOA and Biological Opinion.

Study Type	Description of U.S. Navy EIS/LOA monitoring	Associated event type	MMPA/ESA requirement
Aerial surveys –during training event (studies 1 and 3)	n/a	SEASWITI, shallow COMPTUEX, or ULT	1 event*
Aerial surveys –before and after training event (studies 2 and 4)	n/a	SEASWITI, shallow COMPTUEX, or ULT	1 event*
Aerial surveys –Onslow Bay and JAX (study 2)	Monthly surveys in Onslow Bay or JAX	n/a	48 days
Vessel surveys –during training event (study 3)	n/a	SEASWITI, shallow COMPTUEX, or ULT	2 events
Vessel surveys— Onslow Bay and JAX (study 2)	Monthly surveys in Onslow Bay or JAX	n/a	48 days
Marine Mammal Observers (studies 1 and 3)	n/a	ULT	2 events
Passive Acoustic Monitoring (study 2)	1) Maintenance of 4 HARPS (2 in Onslow Bay and 2 in Jacksonville) 2) Use of pop-up buoys for exercise monitoring 3) Use of towed array during vessel surveys (when feasible)	shallow COMPTUEX (pop-up buoys)	Maintenance of four devices (HARPS), use pop-up buoys and towed array (when feasible)
MMO/Lookout Comparison Study	Conduct observer comparison trials		40 hours

* If an aerial survey is conducted before, during and after for a specific event, then that survey fulfills both requirements.

AFAST MONITORING ACCOMPLISHMENTS FOR THE REPORTING PERIOD

During the 2 Aug 2009 – 1 Aug 2010 reporting period, USFF implemented aerial and vessel surveys, deployed marine mammal observers on a Navy platforms and deployed passive acoustic recording devices. The majority of monitoring effort for the reporting period has been conducted in two locations, Onslow Bay and the Jacksonville (JAX) Operating Area (OPAREA). These locations serve as primary study areas for longitudinal baseline monitoring efforts discussed above. These sites are also the primary locations for coordinated ASW exercise monitoring events, which are discussed below.

Major accomplishments from the U.S. Fleet Forces' 2009-2010 compliance monitoring in the AFAST study area include:

- Aerial Visual Surveys
    - Completed monthly aerial surveys (weather permitting) at Onslow Bay and JAX sites to obtain longitudinal data trends.
    - Completed aerial surveys before and after training events
- Vessel Visual Survey
    - Completed monthly vessel surveys (weather permitting) at Onlsow Bay and JAX sites to obtain longitudinal data trends.
    - Obtained photo-ID samples from both Onslow Bay and JAX
    - Conducted strip transect sea bird counts concurrent with the marine mammal surveys in both Onslow Bay and JAX.
- Passive Acoustic Monitoring
    - Maintained four HARPs for long-term passive acoustic monitoring.
    - Operated towed arrays during vessel surveys in Onslow Bay and JAX.
    - Deployed 2 arrays of Pop-up buoys (9 each) in conjunction with focused ASW exercise monitoring in JAX.
- Marine Mammal Observers
    - MMOs were successfully deployed on Navy ships involved in two separate ASW training events in the JAX OPAREA.
- Observer Effectiveness Study
    - Study design and development completed
    - Four data collection trials were performed aboard Navy cruisers and one frigate in the Hawaii Range Complex (HRC), Southern California Range Complex (SOCAL), and JAX Range Complex.

Table 2 presents a summary of the major accomplishments for Navy funded marine species monitoring within the AFAST study area for 2010 (January 22 through August 1). As mentioned in the Introduction, because the period of this report (2 Aug 2009 – 1 Aug 2010) spans across 2 Letters of Authorization, **Table 3** provides a summary of accomplishments for Jan 22, 2009 through Jan 21, 2010, corresponding to the first year LOA period. In addition, monitoring is currently underway for coordinated ASW

exercises in August that will be reported within the annual monitoring report for 2011. These efforts will accomplish aerial surveys and vessel surveys before, during, and after training exercises associated with the 2010 monitoring requirements. In addition, the aerial and vessel surveys at Onslow Bay and JAX (study 2) will continue as scheduled.

Table 2. U.S. Navy funded monitoring accomplishments within the AFAST study area for 2010 (January 22 through August 1).

Study Type	Description of U.S. Navy EIS/LOA monitoring	Associated event type	2010 MMPA/ESA requirement	Total accomplished as of August 1, 2010
Aerial surveys – during training event (studies 1 and 3)	n/a	SEASWITI, shallow COMPTUEX, or ULT	1 event*	0 events
Aerial surveys – before and after training event (studies 2 and 4)	n/a	SEASWITI, shallow COMPTUEX, or ULT	1 event*	1 event
Aerial surveys – Onslow Bay and JAX (study 2)	Monthly surveys in Onslow Bay or JAX	n/a	48 days	29 days
Vessel surveys – during training event (study 3)	n/a	SEASWITI, shallow COMPTUEX, or ULT	2 events	0 events
Vessel surveys— Onslow Bay and JAX (study 2)	Monthly surveys in Onslow Bay or JAX	n/a	48 days	20 days
Marine Mammal Observers (studies 1 and 3)	n/a	ULT	2 events	2 events
Passive Acoustic Monitoring (study 2)	1) Maintenance of 4 HARPS (2 in Onslow Bay and 2 in Jacksonville) 2) Use of pop-up buoys for exercise monitoring 3) Use of towed array during vessel surveys (when feasible)	shallow COMPTUEX (pop-up buoys)	Maintenance of four devices (HARPS), use pop-up buoys and towed array (when feasible)	Maintaining 4 HARPs, used pop-up buoys in conjunction with 2 ASW exercises, and a total of ~60 hours of towed array effort in Onslow Bay and JAX
MMO/Lookout Comparison Study	Conduct observer comparison trials		40 hours	70 hours Atlantic 97 hours Pacific

* If an aerial survey is conducted before, during and after for a specific event, then that survey fulfills both requirements.

Table 3. U.S. Navy funded monitoring accomplishments within the AFAST study area from 22 January 2009 to 21 January 2010, corresponding to the first year LOA period.

Study Type	Description of U.S. Navy EIS/LOA monitoring	Associated event type	MMPA/ESA requirement	Accomplished
Aerial surveys – during training event (studies 1 and 3)	n/a	SEASWITI, shallow COMPTUEX, or ULT	30 hours [1]	0 hours
Aerial surveys – before and after training event (studies 2 and 4)	n/a	SEASWITI, shallow COMPTUEX, or ULT	40 hours [1]	33 hours
Aerial surveys – Onslow Bay and JAX (study 2)	1) Monthly surveys in Onslow Bay 2) Monthly surveys in JAX	n/a	100 hours[1] (Onslow) 100 hours[1] (JAX)	162 hours (Onslow) 162 hours (JAX)
Vessel surveys – during training event (study 3)	n/a	SEASWITI, shallow COMPTUEX, or ULT	100 hours [1]	0 hours
Vessel surveys— Onslow Bay and JAX (study 2)	1) Monthly surveys in Onslow Bay 2) 4 days in Cape Hatteras 3) July surveys in JAX	n/a	125 hours[1] (Onslow) 125 hours[1] (JAX)	143 hours (Onslow) 91 hours (JAX) 26 hours (Cape Hatteras)
Marine Mammal Observers (studies 1 and 3)	60 hours from 27-30 April 2009	ULT	60 hours	60 hours
Passive Acoustic Monitoring (study 2)	1) Deployment of 4 HARPS (2 in Onslow Bay and 2 in Jacksonville) 2) Use of pop-up buoys for exercise monitoring 3) Use of towed array during vessel surveys	shallow COMPTUEX (pop-up buoys)	Deploy up to four devices and use pop-up buoys	Deployed four high frequency recording packages (HARPs) , used pop-up buoys in conjunction with exercise, and a total of ~80 hours of towed array recording effort in Onslow Bay and JAX
MMO/Lookout Comparison Study	Develop observer comparison study and perform trials		40 hours	Completed study design and development – initial trials planned

[1] Monitoring requirements for the initial 2009 year of the LOA were designated in hours of effort. The 2010 renewal changed requirements for certain monitoring activities to be based on events.

AFAST AERIAL VISUAL SURVEYS

Aerial surveys are planned monthly in both Onslow Bay and JAX. However, in JAX no surveys were flown during April and May due to adverse weather conditions. A summary of the results is presented below. For more detailed information, see **Appendices C-E**, which include annual reports and a compilation of the individual monthly trip reports.

***Onslow Bay – 2 August 2009 through 1 August 2010*:** Aerial surveys were conducted on 23 days during the period, representing 176 lines surveyed. Sightings and effort details are presented in **Tables 4 and 5**, and **Figures 1, 2 and 3**.

Table 4. Summary of marine species sightings from the observer aircraft in Onslow Bay, 2 August 2009 through 1 August 2010.

Common Name	Scientific Name	# of Sightings	# of Individuals
Bottlenose Dolphin	*Tursiops truncatus*	57	820
Spotted Dolphin	*Stenella frontalis*	24	467
Short-finned Pilot Whale	*Globicephala macrorhynchus*	4	81
Risso's Dolphin	*Grampus griseus*	2	11
Common Dolphin	*Delphinus delphis*	1	20
Sperm Whale	*Physeter macrocephalus*	1	1
Fin Whale	*Balaenoptera physalus*	1	1
Unidentified Delphinid		4	23
Loggerhead Sea Turtle	*Caretta caretta*	269	495
Leatherback Sea Turtle	*Dermochelys coriacea*	4	4
Unidentified Sea Turtle		95	139
Basking Shark	*Cetorhinus maximus*	1	1
Unidentified Shark		16	16
Manta Ray	*Manta birostris*	27	30
Unidentified Ray		2	3
Ocean Sunfish	*Mola mola*	6	6

Table 5. Effort details from aerial surveys conducted in Onslow Bay, 2 August 2009 through 1 August 2010.

Number of Survey Days	23
Total Hours Underway (Hobbs)	129
Total Tacklines Covered	176

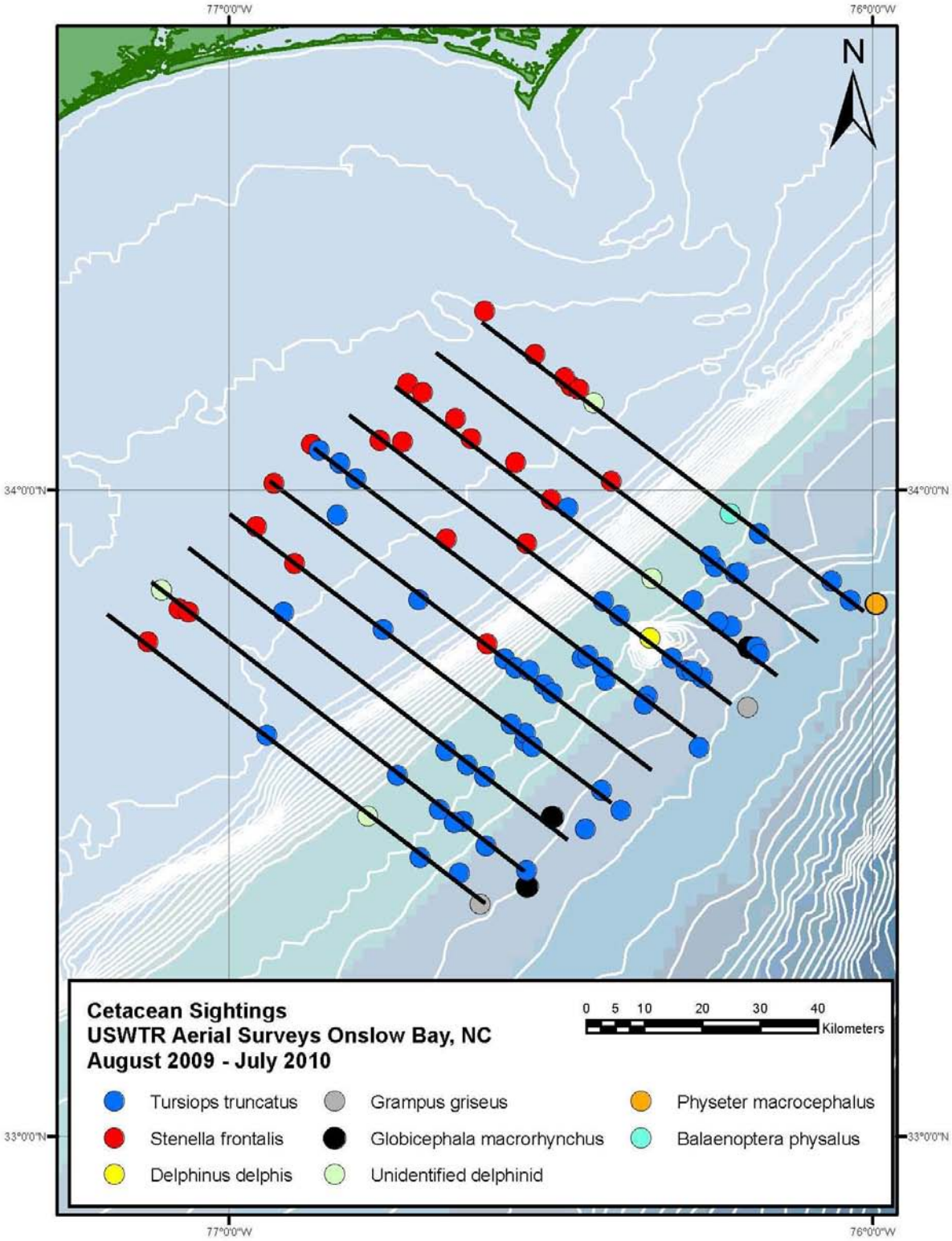

Figure 2. Locations of cetacean sightings from aerial surveys conducted in Onslow Bay, August 2009 through July 2010.

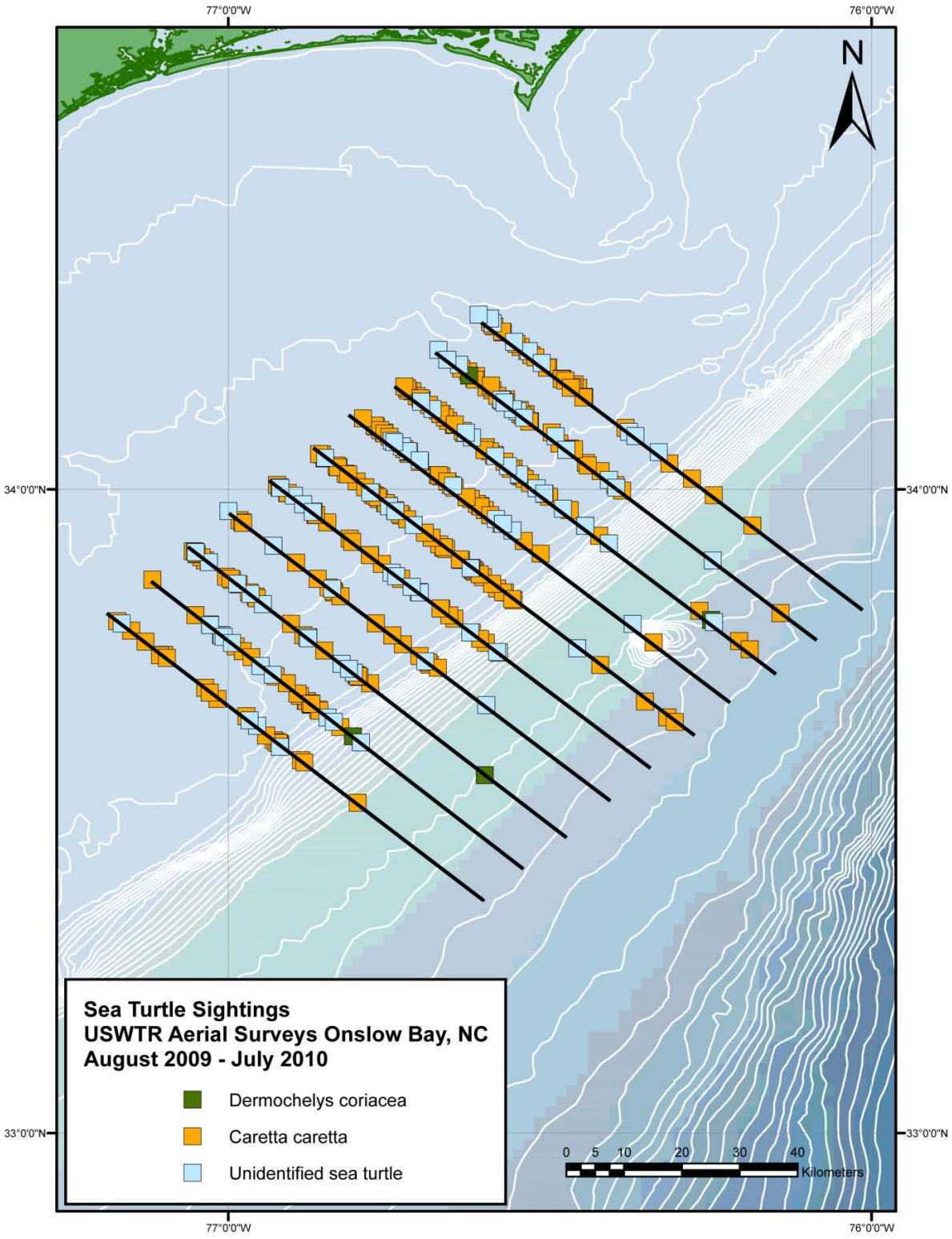

Figure 3. Locations of sea turtle sightings from aerial surveys conducted in Onslow Bay, August 2009 through July 2010.

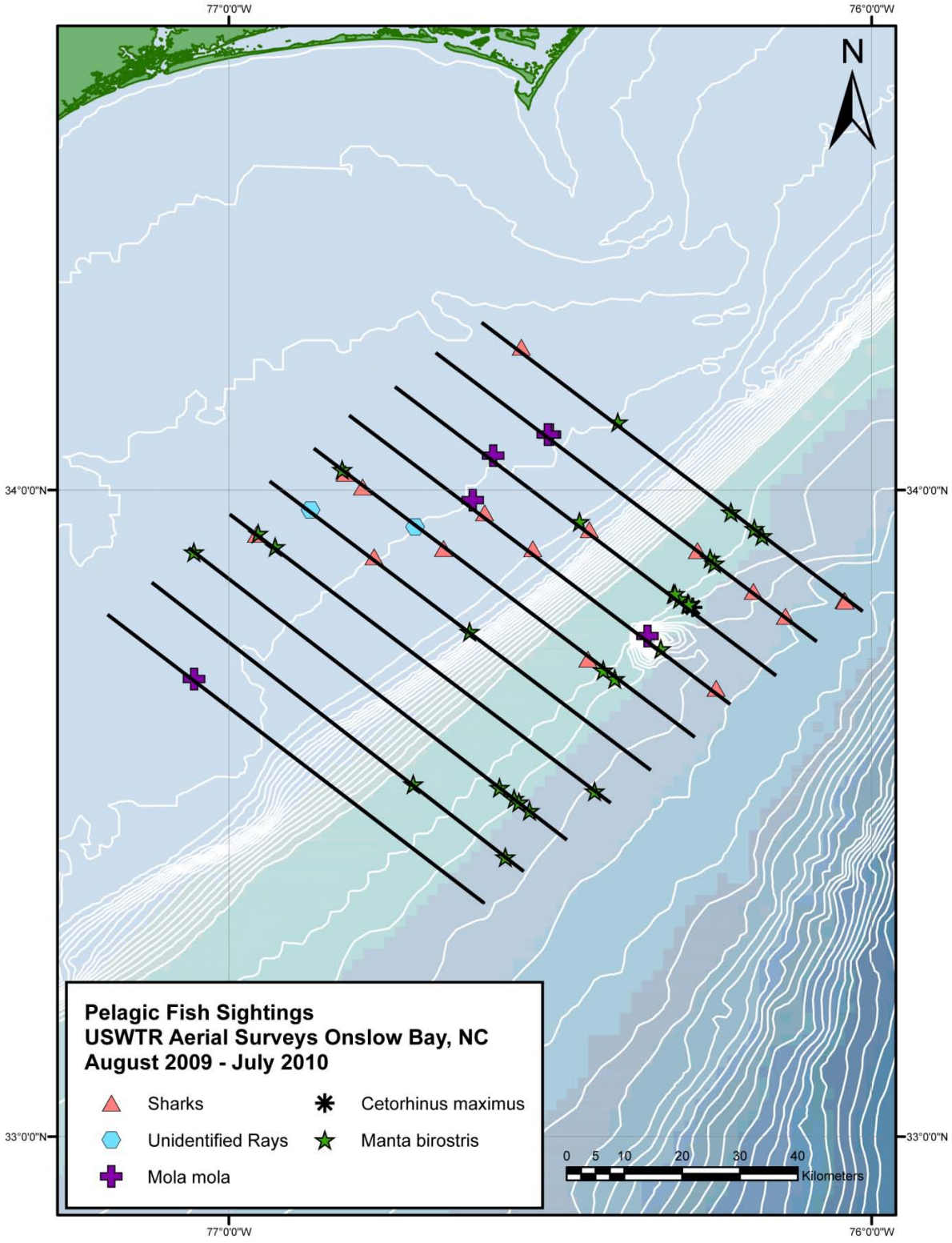

Figure 4. Locations of pelagic fish sightings from aerial surveys conducted in Onslow Bay, August 2009 through July 2010.

JAX - 2 August 2009 through 1 August 2010: Aerial surveys were conducted on 37 days during this period, representing 269 lines surveyed. Sightings and effort details are presented in **Tables 6 and 7**, and **Figures 5, 6 and 7**.

Common Name	Scientific Name	# of Sightings	# of individuals
North Atlantic Right Whale	*Eubalaena glacialis*	3	4
Minke Whale	*Balaenoptera acutorostrata*	2	2
Sperm Whale	*Physeter macrocephalus*	1	2
Dwarf or Pygmy Sperm Whale	*Kogia* species	1	1
Short-finned Pilot Whale	*Globicephala macrorhynchus*	3	69
Risso's Dolphin	*Grampus griseus*	13	177
Rough-toothed Dolphin	*Steno bredanensis*	2	77
Bottlenose Dolphin	*Tursiops truncatus*	114	998
Atlantic Spotted Dolphin	*Stenella frontalis*	118	1953
Unidentified Delphinid		28	120
Loggerhead Sea Turtle	*Caretta caretta*	716	926
Leatherback Sea Turtle	*Dermochelys coriacea*	48	49
Kemp's Ridley Sea Turtle	*Lepidochelys kempii*	1	1
Unidentified Sea Turtle		244	353
Whale Shark	*Rhincodon typus*	2	2
Hammerhead Shark	*Sphyrna sp.*	59	69
Unidentified Shark		46	57
Manta Ray	*Manta birostris*	29	39
Ocean Sunfish	*Mola mola*	9	11
Swordfish	*Xiphias gladius*	1	2
Billfish		1	1

Table 6. Summary of marine species sightings seen from the observer aircraft in JAX, 2 August 2009 through 1 August 2010.

Number of Survey Days	37
Total Hours Underway (Hobbs)	219.8
Total Tracklines Covered	269

Table 7. Effort details from aerial surveys conducted in JAX, 2 August 2009 through 1 August 2010.

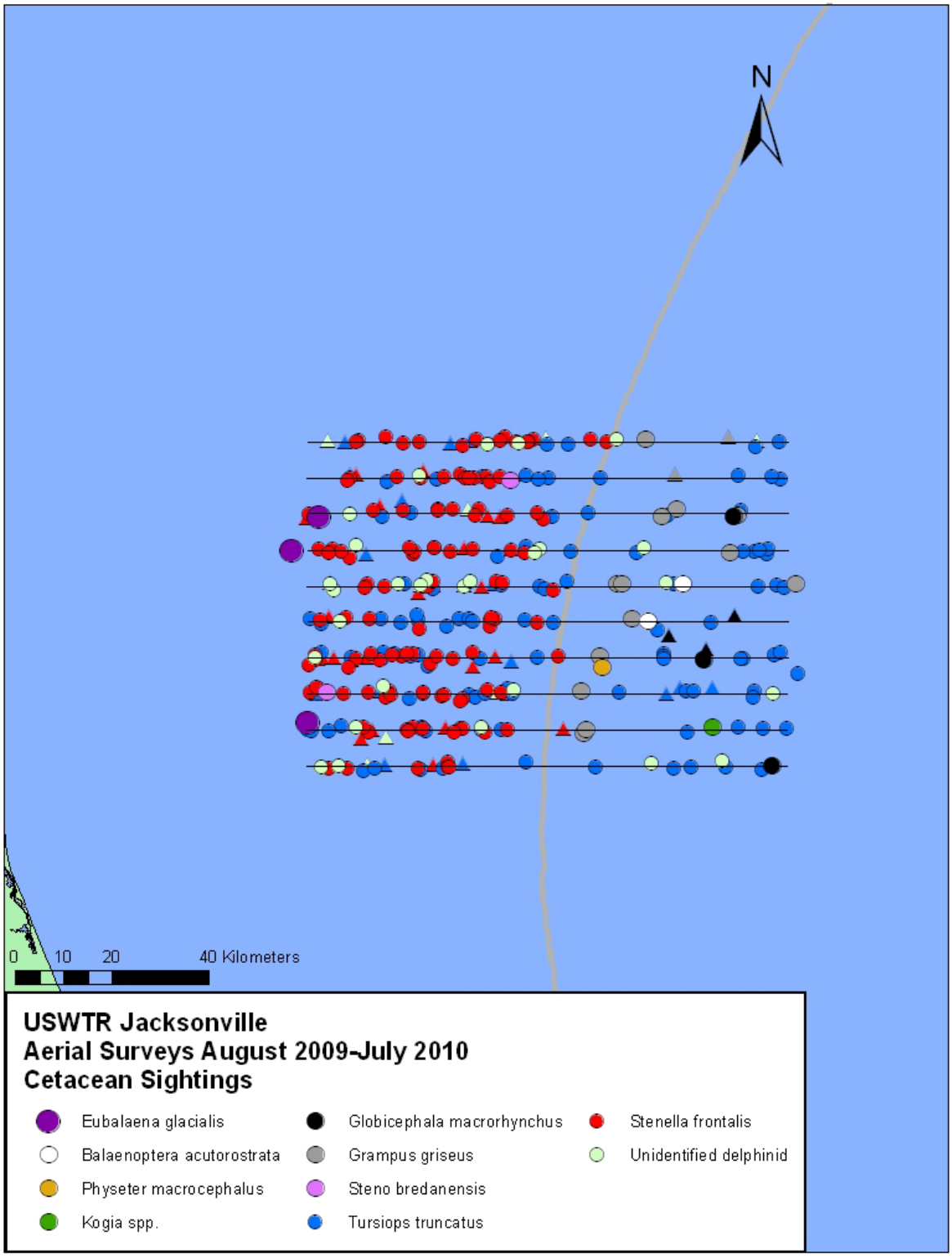

Figure 5. Locations of cetacean sightings from aerial surveys conducted in JAX, August 2009 through July 2010.

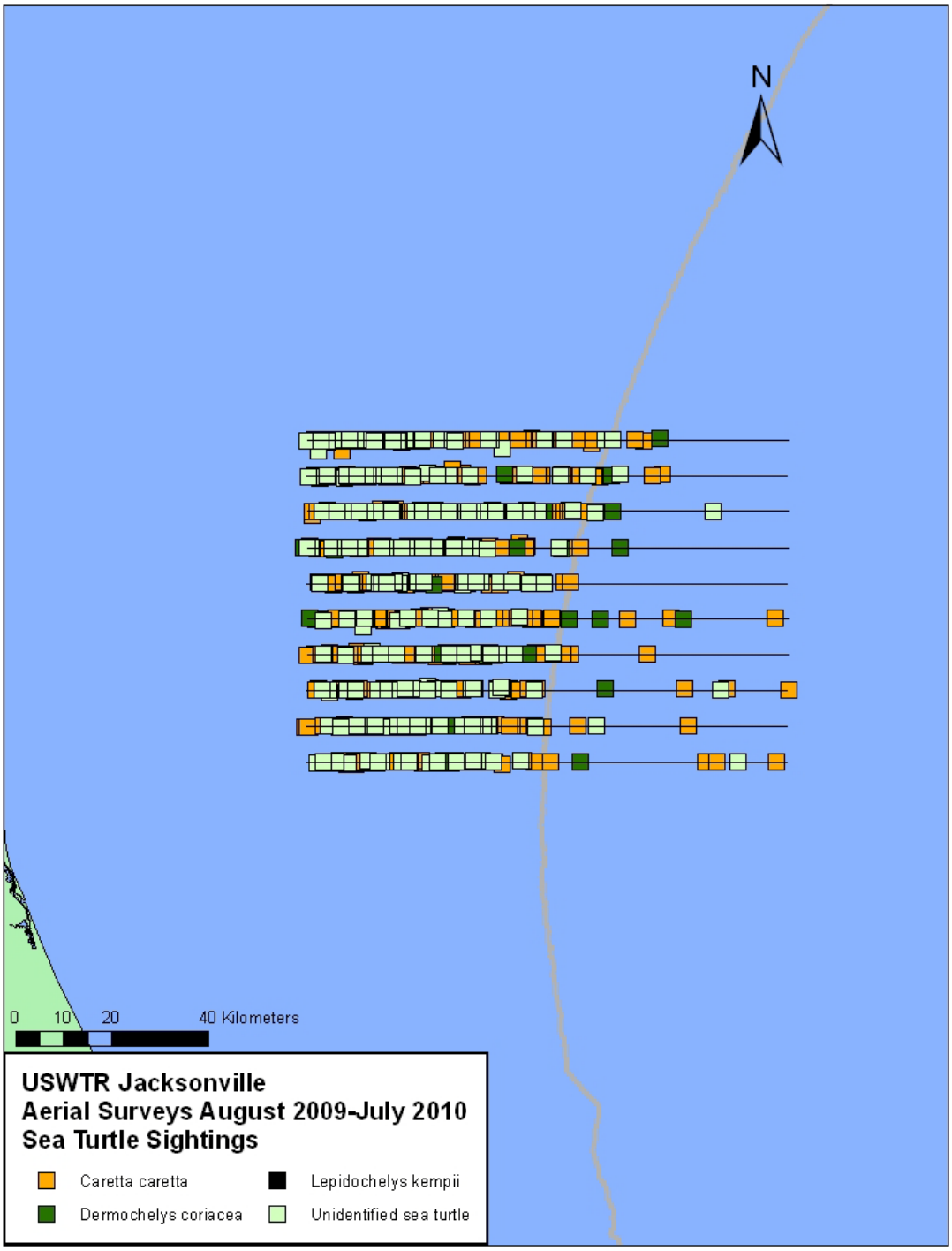

Figure 6. Locations of sea turtle sightings from aerial surveys conducted in JAX, August 2009 through July 2010.

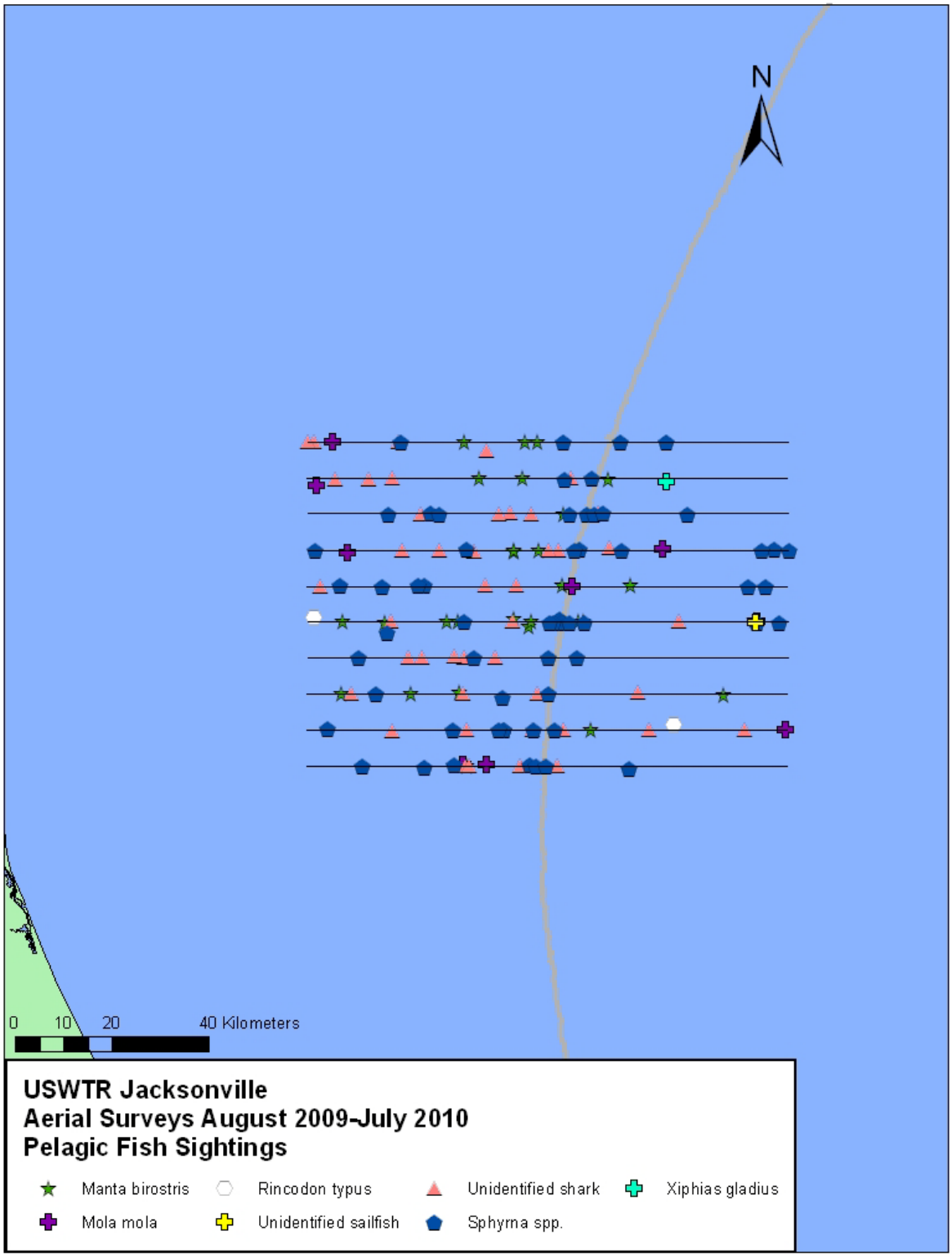

Figure 7. Locations of pelagic fish sightings from aerial surveys conducted in JAX, August 2009 through July 2010.

Right Whale Sightings and Observed Birth

On March 20, at 10:20, a female right whale (*Eubalaena glacialis*) was observed giving birth to the west of the USWTR range (**Figure 8**) at 30.04219N, -080.70404W (**Figure 9**). The aerial survey team observed a large, single right whale for 27 minutes prior to the appearance of the new born calf. The calf appeared at the surface after the adult had remained submerged, out of view, for several minutes. The survey team continued observations for approximately 19 minutes before leaving the site and returning to land. At this point, the Florida Fish and Wildlife Conservation Commission aerial survey team moved in to continue documentation. Using photos taken by the two aerial survey teams, the New England Aquarium later confirmed the female whale as "Derecha" # 2360, in the North Atlantic Right Whale Catalog. The sighting is notable because it occurred outside existing critical right whale habitat and because it was only the second North Atlantic right whale birth observed. 4 North Atlantic right whales have been observed by the survey team since aerial surveys began in January 2009 in the vicinity of the USWTR range location.

Figure 8. Image of adult female right whale (Eg # 2360) with newborn calf off the coast of Jacksonville, FL.

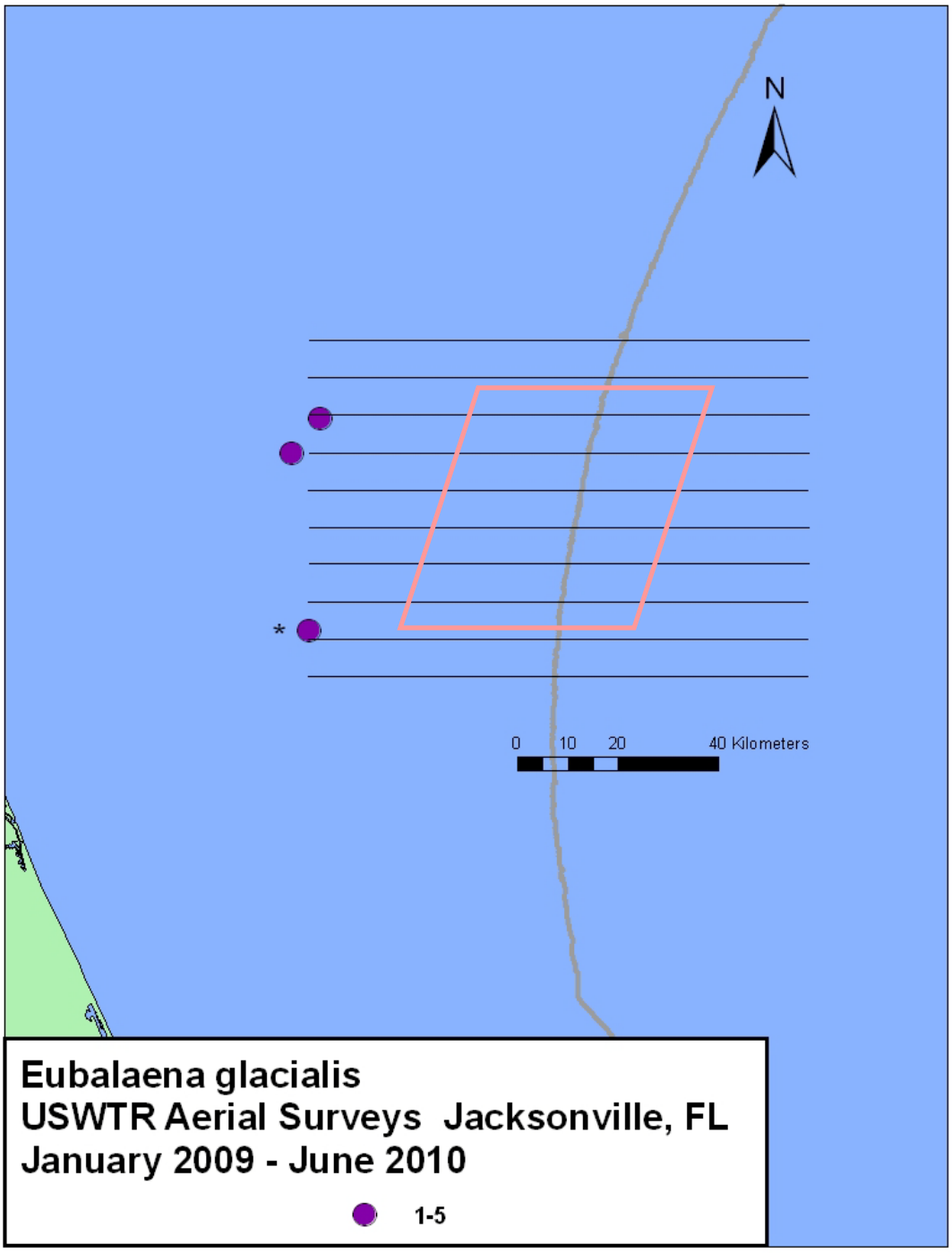

Figure 9. Plot of right whale (Eubalaena glacialis) sightings. Asterisk denotes observed right whale birth (see text above for description).

AFAST VESSEL VISUAL SURVEYS

Vessel surveys were conducted using standard USWTR protocols in both Onslow Bay and JAX USWTR sites from August 2, 2009 through August 1, 2010, along with a targeted short-finned pilot whale DTAG, biopsy, and photo-id exercise along the continental shelf break off Cape Hatteras, NC in July. A summary of the results is presented below.

Onslow Bay – 2 August 2009 through 1 August 2010: Vessel surveys were conducted on 20 days during this period, representing 19.5 lines surveyed. Sightings and effort details are presented in **Tables 8 and 9**, and **Figures 10 and 11**.

Table 8. Summary of marine species sightings seen from the observer vessel in Onslow Bay, 2 August 2009 through 1 August 2010.

Common Name	Scientific Name	# of Sightings	Mean Group Size
Bottlenose Dolphin	*Tursiops truncatus*	28	11.2
Spotted Dolphin	*Stenella frontalis*	18	28.2
Bottlenose or Spotted Dolphin		1	1.0
Risso's Dolphin	*Grampus griseus*	3	25.3
Rough-toothed Dolphin	*Steno bredanensis*	1	27.0
Pilot Whale	*Globicephala macrorhyncus*	2	26.5
Unidentified Delphinid		1	2.0
Loggerhead Sea Turtle	*Caretta caretta*	47	1.0
Leatherback Sea Turtle	*Dermochelys coriacea*	2	1.0
Unidentified Sea Turtle		1	1.0

Table 9. Effort details for vessel surveys conducted in the Onslow Bay USWTR, 2 August 2009 through 1 August 2010.

Number of Survey Days	20
Total Survey Hours	110
Hours On Effort	104
Total Tracklines Covered	19.5

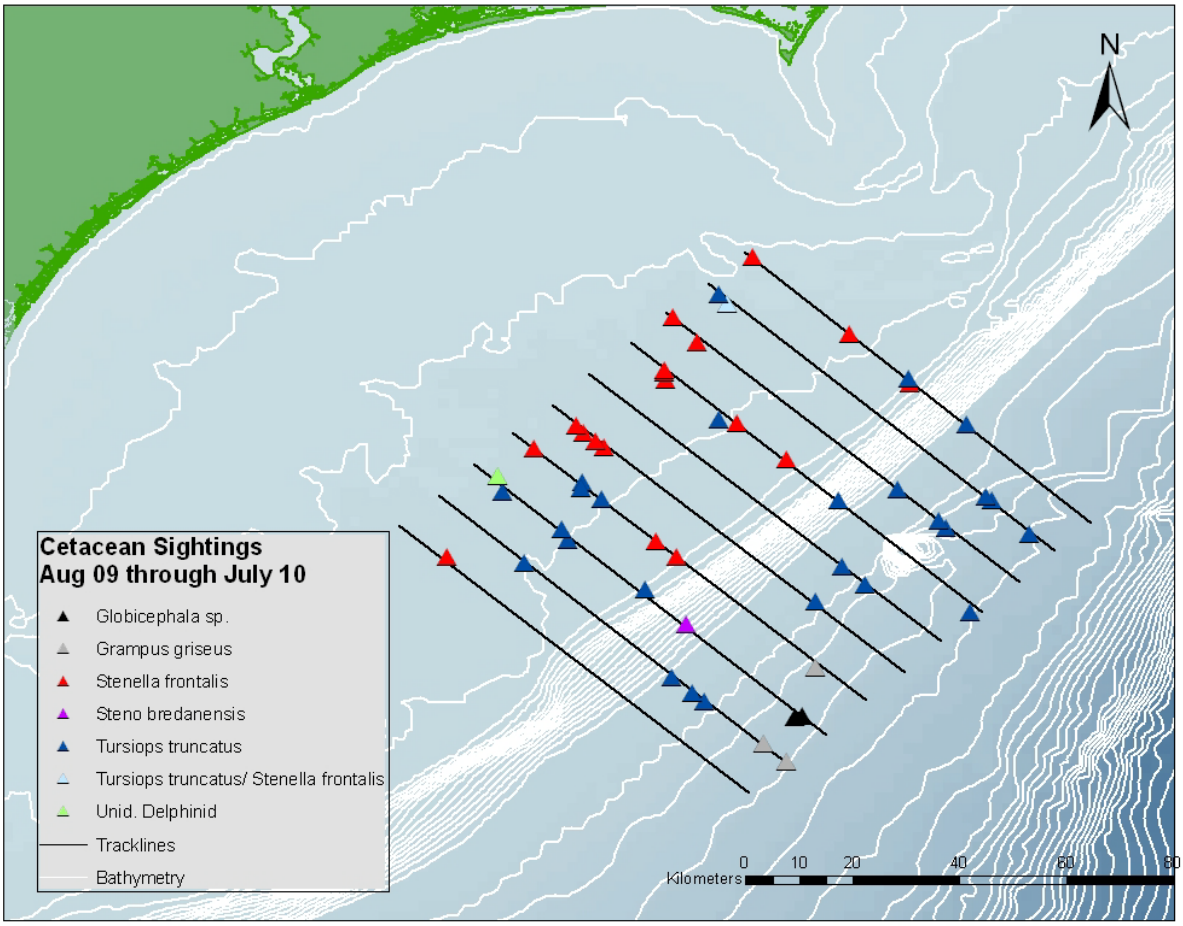

Figure 10. Locations of cetacean sightings from vessel surveys conducted in Onslow Bay, August 2009 through July 2010.

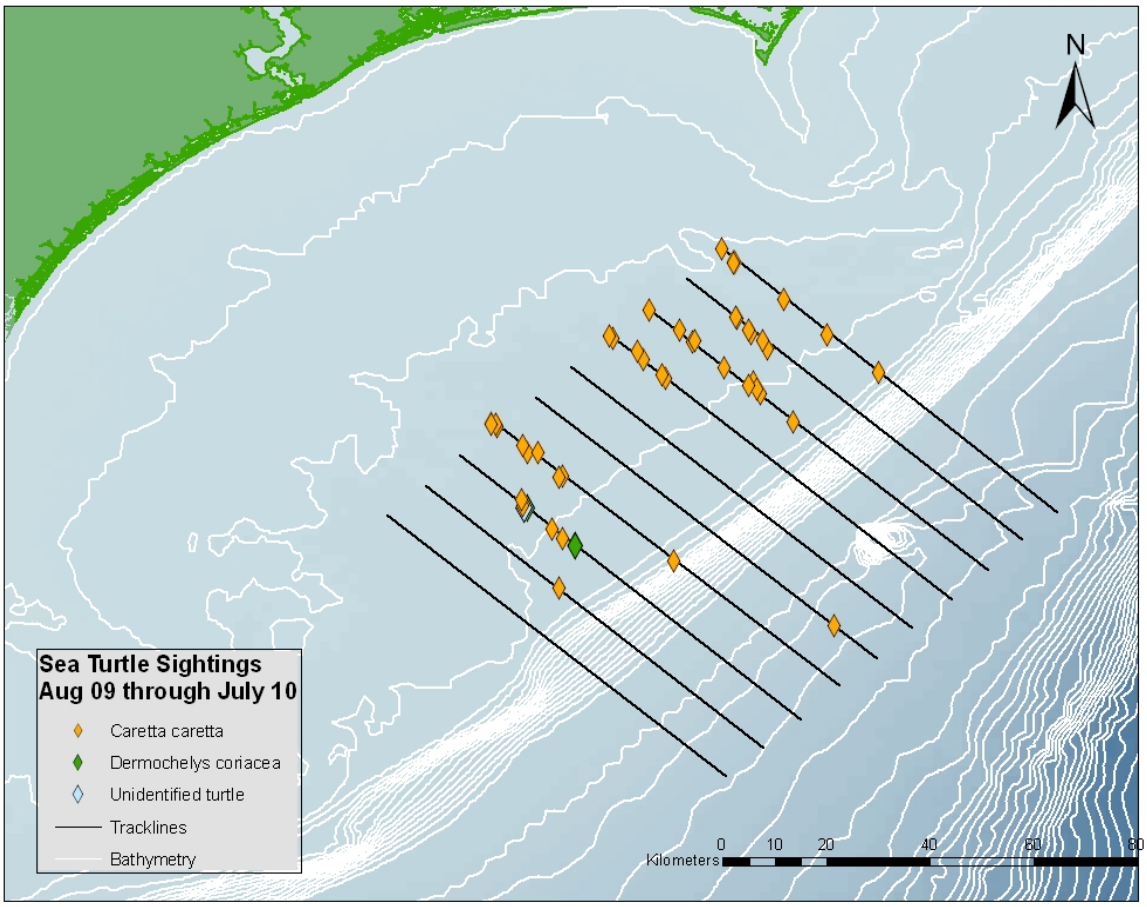

Figure 11. Locations of sea turtle sightings from vessel surveys conducted in the Onslow Bay USWTR, August 2009 through July 2010.

Pilot Whale Behavioral Response Studies July 2010: Researchers from Duke University and Woods hole Oceanographic Institute are currently conducting a series research cruises to deploy digital acoustic tags, DTAGS (Johnson and Tyack 2003) on short-finned pilot whales off Cape Hatteras. They began their field work on July 4th, 2010 and remained offshore through July 7th. During these four days at sea they deployed five DTAGs on pilot whales (see **Table 10**). The DTAG is a small, lightweight tag which is placed on a whale using a carbon-fiber pole and attached via four silicon suction cups. The DTAG is equipped with a pressure sensor, three-axis magnetometer and accelerometers that measure, depth, heading, pitch, and roll, five times per second. The tag contains two hydrophones that record stereo sound continuously at a sampling rate of 192 KHz. The tag is also equipped with a VHF antenna that allows radio tracking of animals while they are at the surface and facilitates re-location of the tag upon release from the whale. Data are archived on the tag during deployment and later downloaded for calibration and analysis. The duration of tag deployments is established by programming the release mechanism prior to attaching the tag to a whale. One DTAG remained on the tagged whale overnight for a total recoding period of more than 17 hours (see **Table 10**, and **Figures 12 and 13**). The team was also able to collect skin biopsy samples of three of the tagged whales for future molecular determination of the sex of these individuals.

When sea conditions permitted, focal follows of tagged animals were conducted from a RHIB during daylight hours. Location, group size, spread, synchrony and composition, behavioral state and environmental conditions were recorded at 5-minute intervals. These detailed behavioral observations could not be collected at night, but the *R/V Stellwagen* followed the tagged whale closely using the VHF radio signal. In addition, the presence of prey was monitored using an onboard fisheries acoustic system (with 38 and 120 kHZ transducers) and measured physical features of the water column using an Acoustic Doppler Current Profiler (ADCP) and CTD casts.

Data from these tagging efforts will be analyzed in Matlab to generate descriptive metrics for the diving and acoustic behavior of each whale. These include time-depth profiles for the duration of the tag deployment.

Table 10. DTAG deployments on pilot whales off Cape Hatteras during 4-7 July 2010.

Date	Tag ID	Time On	Time Off	Total Time on whale (h:mm)	Biopsy ID
4-Jul-10	GM10_185b	14:30	20:20	5:50	ASF-001
5-Jul-10	GM10_186a	11:10	11:40	0:30	
5-Jul-10	GM10_186b	14:32	20:03	5:31	ASF-003
6-Jul-10	GM10_187a	8:43	10:55	2:12	
6-Jul-7 Jul-10	GM10_187b	12:53	6:15	17:22	ASF-004

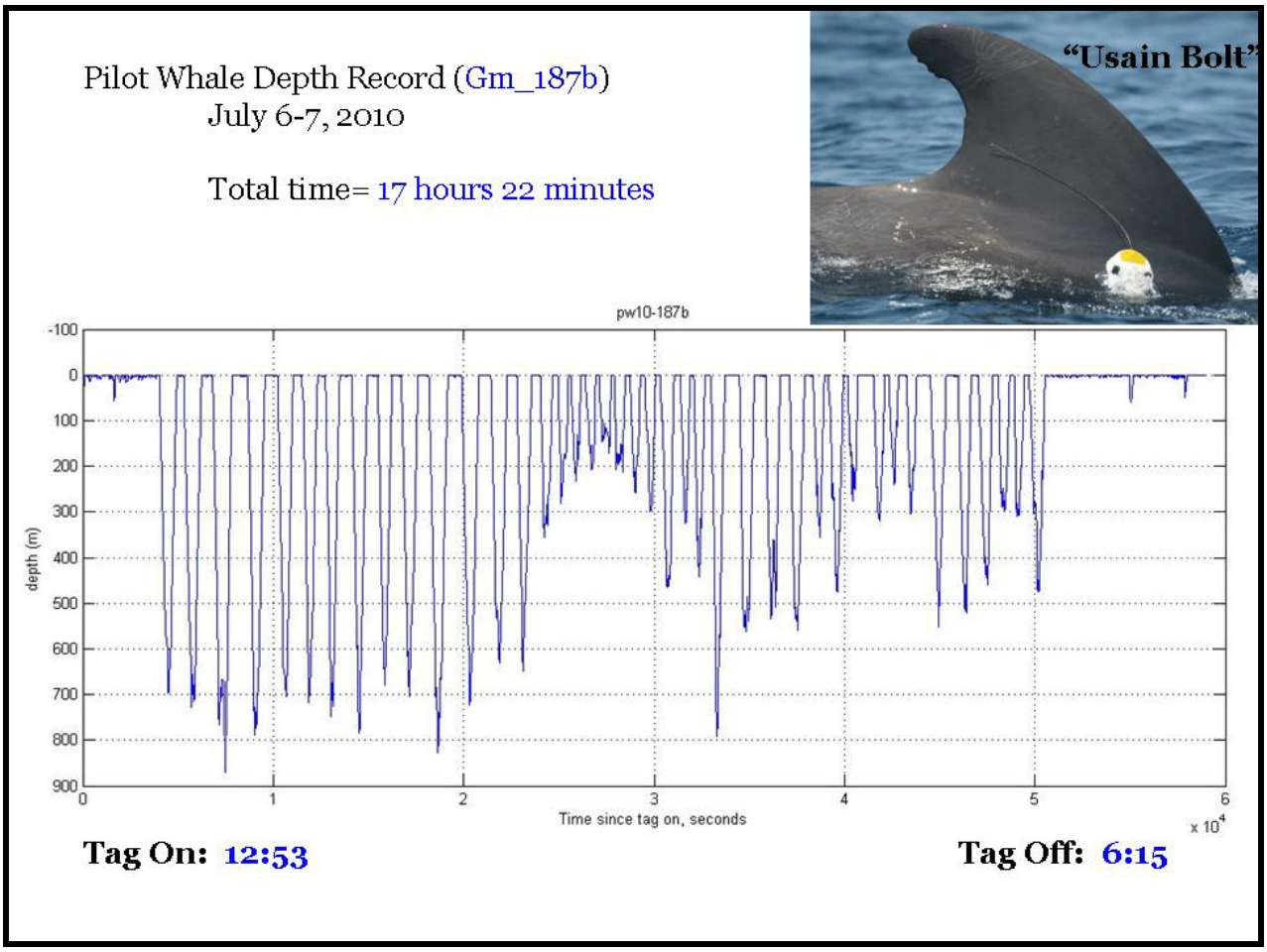

Figure 12. Dive profile of pilot whale, Gm_187b, equipped with a DTAG July 6-7, 2010.

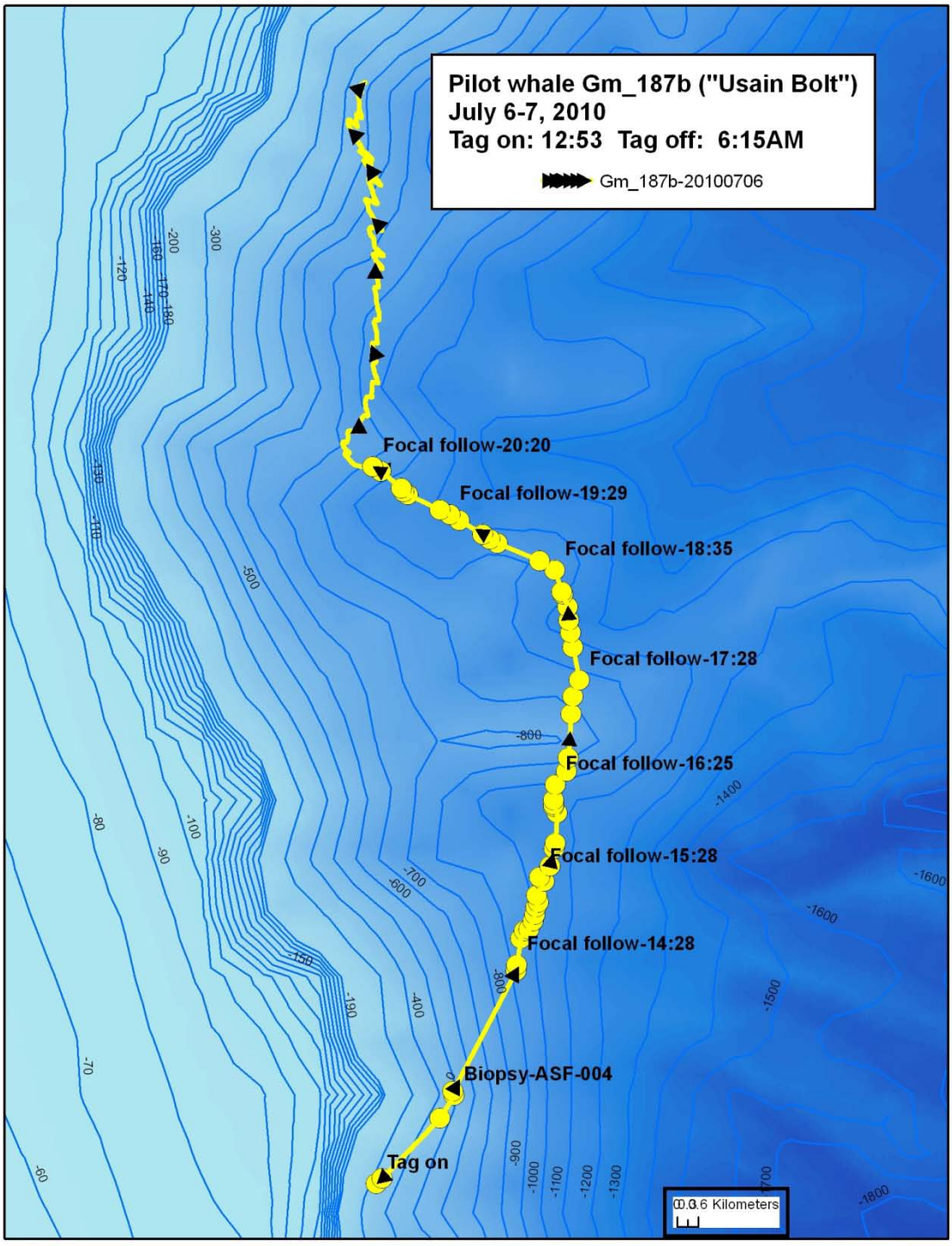

Figure 13. Plot of track of focal follow of pilot whale, Gm_187b, equipped with DTAG, July 6-7, 2010.

Sea Turtle Satellite Tag Deployment

To refine our estimates of sea turtle abundance in the survey area we have deployed three Wildlife Computer data-collecting Argos satellite SPLASH tags on adult nesting female loggerhead sea turtles in North Carolina. In addition to providing location, SPLASH tags provide histograms of time spent at predefined depth and temperature bins, as well as the amount of time the tag is wet and dry. Data from these tags will allow us to refine our probability of detection function for loggerhead sea turtles by determining the proportion of time they spend at, or very close to the surface where they can be sighted by visual observers. We deployed tag 096290 (Pointe) on 26 June, 2010 on Emerald Isle, NC (**Figure 14**), tag 096291 (Grace) on 7 July, 2007 on Emerald Isle, NC (http://www.seaturtle.org/tracking/?tag_id=96291) and tag 096292 (Pati) on 21 July, 2010 in Hammocks Beach State Park on Bear Island, NC (http://www.seaturtle.org/tracking/?tag_id=96292).

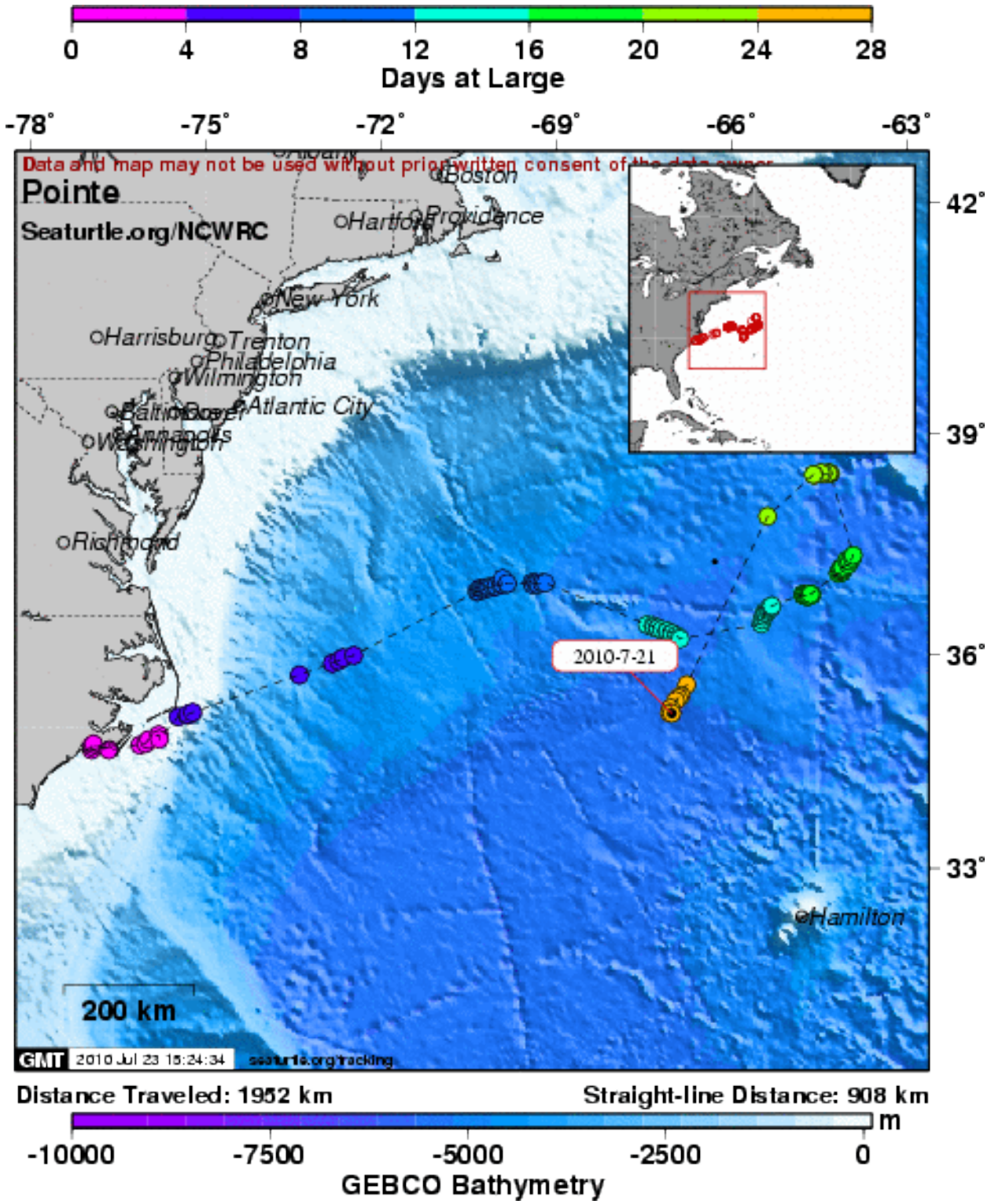

Figure 14. Map of "Pointe," a loggerhead sea turtle equipped with a SPLASH tag on 26 June 2010.

JAX – 2 August 2009 through 1 August 2010: Vessel surveys were conducted on 24 days during the reporting period, representing 20 lines surveyed. Sightings and effort details are presented in **Tables 11 and 12**, and **Figures 15 and 16**.

Table 11. Sightings from vessel surveys conducted in the proposed JAX USWTR, 2 August 2009 through 1 August 2010.

Common Name	Scientific Name	# of Sightings	# of individuals
Short-finned Pilot Whale	*Globicephala macrorhynchus*	3	100
Bottlenose Dolphin	*Tursiops truncatus*	17	111
Atlantic Spotted Dolphin	*Stenella frontalis*	27	178
Risso's Dolphin	*Grampus griseus*	2	43
Unidentified Delphinid		13	24
Hammerhead Shark	*Sphyrna sp.*	1	1
Leatherback Sea Turtle	*Dermochelys coriacea*	4	4
Loggerhead Sea Turtle	*Caretta caretta*	47	48
Kemp's Ridley Sea Turtle	*Lepidochelys kempii*	1	1
Unidentified Sea Turtle		3	3

Table 12. Effort details for vessel surveys conducted in the proposed JAX USWTR, 2 August 2009 through 1 August 2010.

Number of Survey Days	24
Total Survey Hours	99:37
Hours On Effort	88:08
Total Tracklines Covered	20

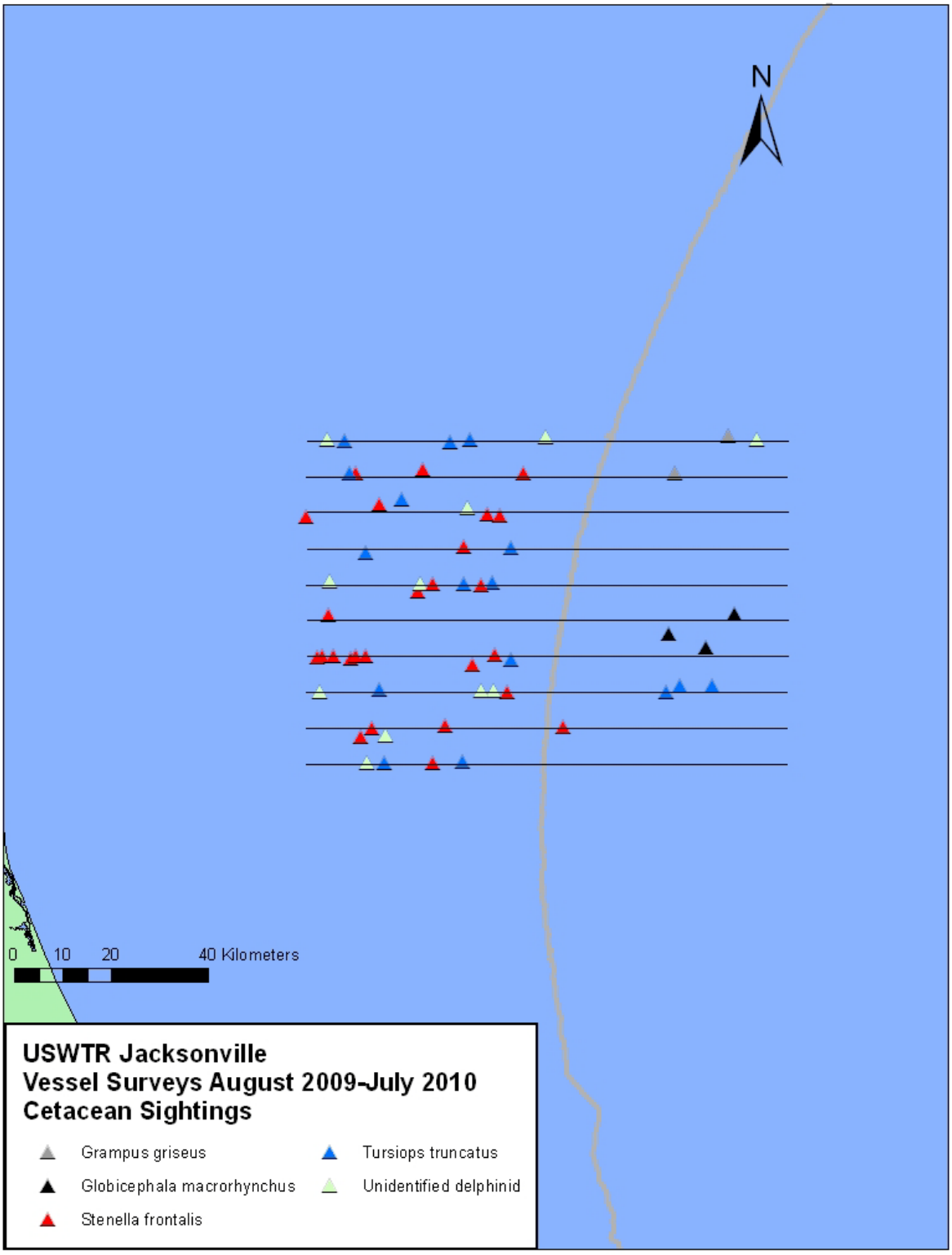

Figure 15. Locations of cetacean sightings from vessel surveys conducted in JAX, August 2009 through July 2010.

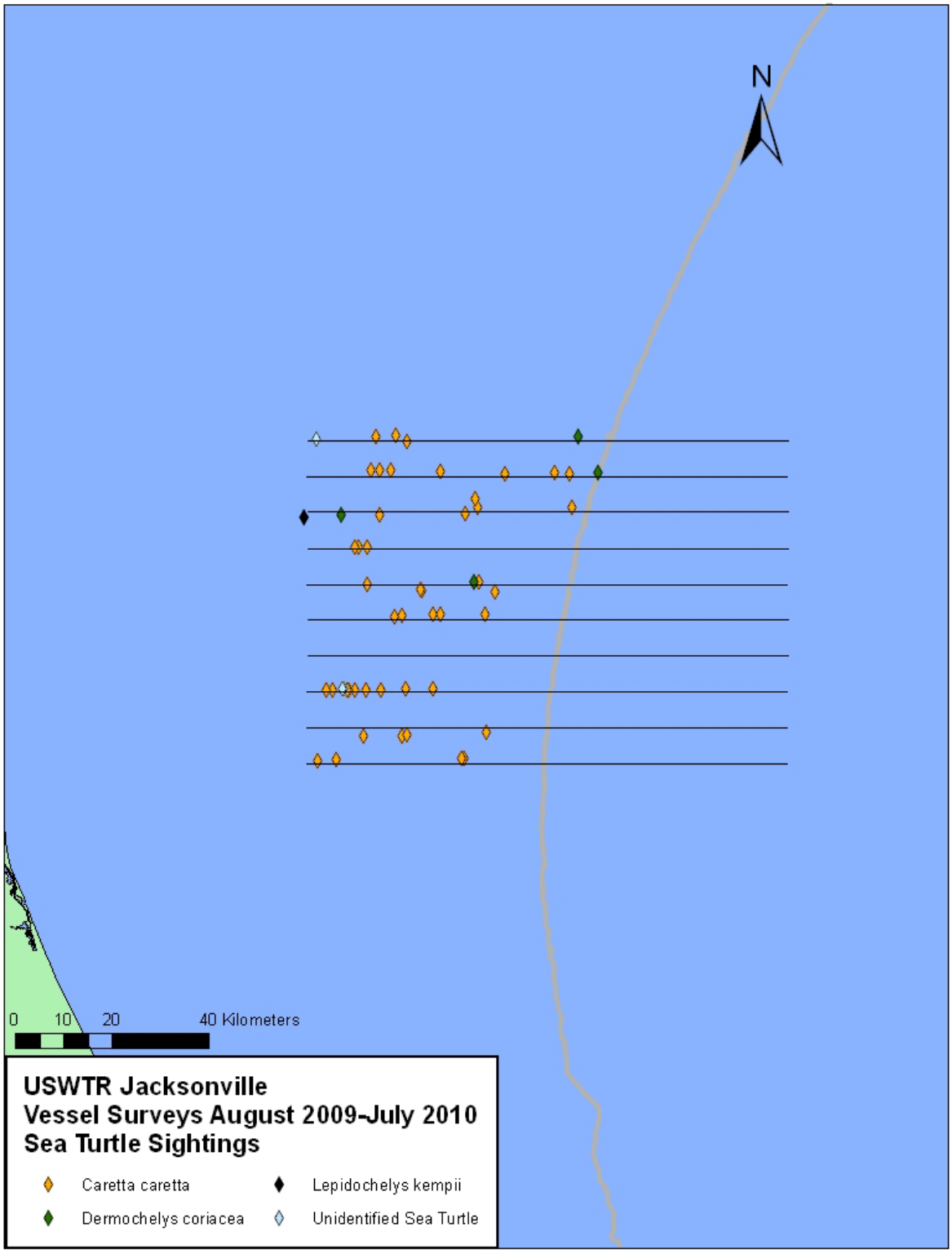

Figure 16. Locations of turtle sightings from vessel surveys conducted in JAX, August 2009 through July 2010.

AFAST PASSIVE ACOUSTIC MONITORING (PAM)

Three passive acoustic systems have been used during AFAST monitoring in Onslow Bay and JAX - a multi-element towed array used during vessel surveys, bottom mounted high-frequency acoustic recorder packages (HARPs), and pop-up buoys. Thorough analysis of all acoustic data is underway. A summary of passive acoustic monitoring effort is provided below. For more detailed information and preliminary results of towed-array and HARP data see **Appendix D**.

Onslow Bay towed array and HARPs: The towed array was deployed on 17 days of surveys in Onslow Bay during the reporting period. A total of 70 acoustic detections were made, 40 of which were identified to species (**Table 13**). Three HARPs deployments were made in Onslow Bay for the reporting period (**Table 14, Figure 17**).

Table 13. Effort details for towed array surveys conducted in Onslow Bay, 2 August 2009 through 1 August 2010.

Towed Array Effort (hrs)	# detections	# identified	Recording effort (hrs)	# Survey Days with Array
84.5	70	40	31.04	17

Table 14. Deployment details for the Onslow Bay HARPs.

Site	Deployment Date	Retrieval Date	Depth (m)	Sampling Rate	Duty Cycle	Data
A	24-APR-09	16-SEP-09	174	200 kHz	5min on, 5 min off	2 TB
A	8-NOV-09	19-JUN10	171	200 kHz	5min on, 10 min off	1.2 TB
C	8-NOV-09	19-JUN-10	335	200 kHz	5min on, 10 min off	2TB

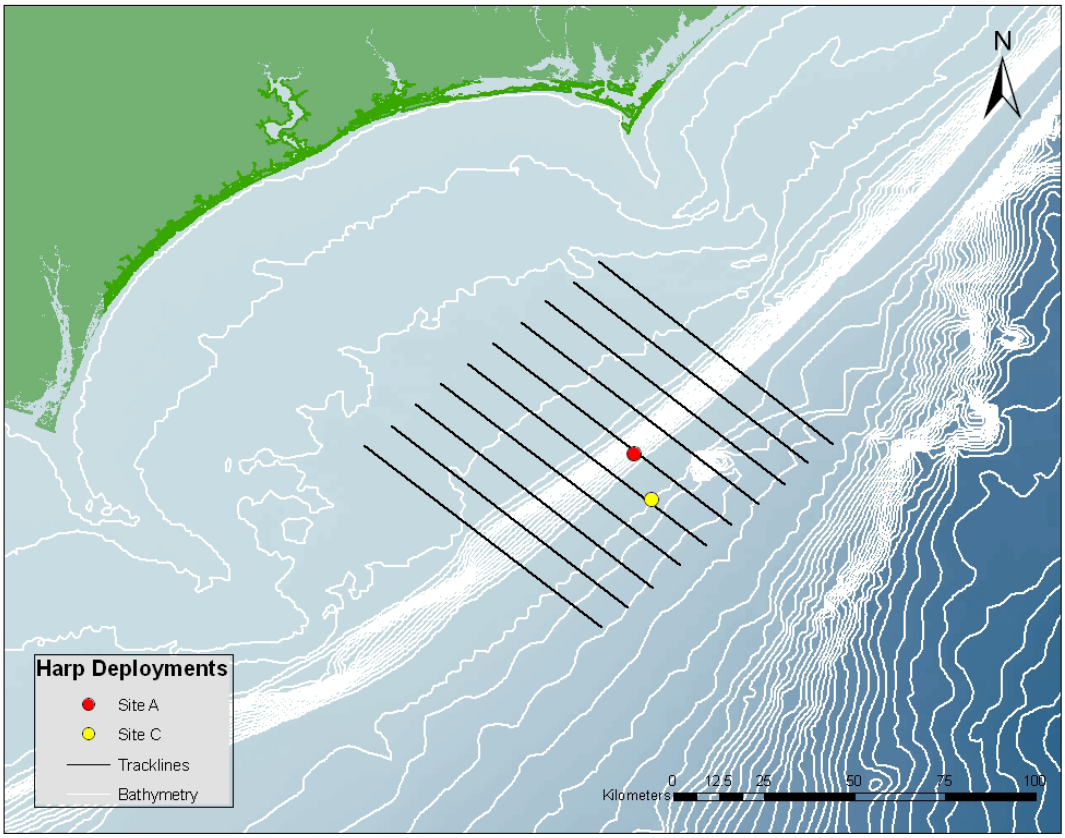

Figure 17. Locations of HARPs deployed in Onslow Bay, 2 August 2009 through 1 August 2010.

JAX - towed array and HARPs: The towed array was deployed on 19 days of surveys in JAX. A total of 48 acoustic detections were made, 31 of which were identified to species (**Table 15**). Six HARP deployments were made in JAX during the reporting period (**Table 16, Figure 18**).

Table 15. Effort details for towed array surveys conducted in the JAX USWTR, 2 August 2009 through 1 August 2010.

Towed Array Effort (hrs)	# detections	# identified	Recording effort (hrs)	# Survey Days with Array
54.7	48	31	21.5	19

Table 16. Deployment details for the JAX HARPs.

Site	Deployment Date	Retrieval Date	Depth (m)	Sampling Rate	Duty Cycle	Data
JAX 1	30-MAR-09	16-SEP-09	40	200 kHz	5min on, 5 min off	2 TB
JAX 2	30-MAR-09	16-SEP-09	80	200 kHz	5min on, 10 min off	.8 TB
JAX 1	23-SEP-09	21-FEB-10	40	200 kHz	5min on, 10 min off	-
JAX 2	16-SEP-09	21-FEB-10	80	200 kHz	5min on, 10 min off	1.3 TB
JAX 1	9-MAR-10	23-AUG-10	40	200 kHz	5min on, 10 min off	NA
JAX 2	21-FEB-10	23-AUG-10	80	200 kHz	5min on, 10 min off	NA

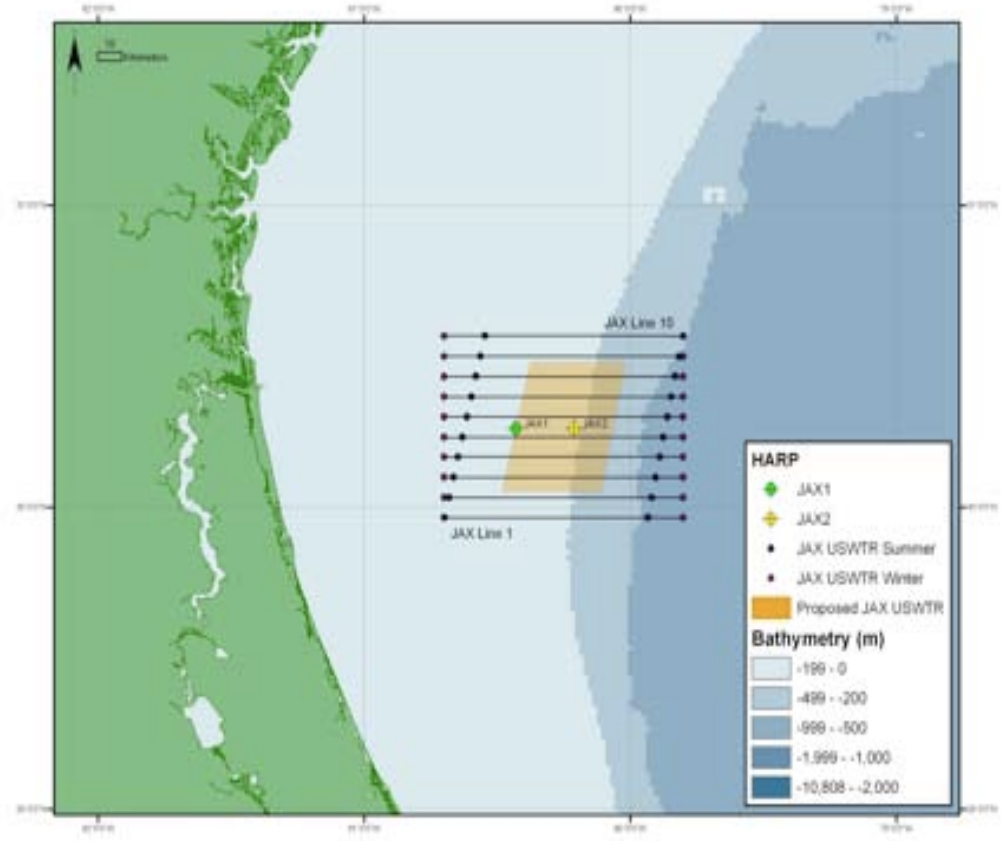

Figure 18. Locations of HARPs deployed in the JAX USWTR.

COORDINATED ASW EXERCISE MONITORING

Coordinated ASW exercise monitoring events are one of the primary components being used to address specific monitoring questions posed in the AFAST monitoring plan and Letter of Authorization. Both passive acoustic and visual monitoring methods have been employed to address before/after (aerial surveys) and before/during/after (passive acoustics) monitoring requirements.

Passive Acoustics – pop-up buoys

A pilot project was conducted in July 2008 at the Onslow Bay location incorporating shipboard and vessel visual surveys and an array of passive acoustic monitoring "pop-up" buoys developed by Cornell University. The pop-ups were deployed approximately 10 days prior to the planned 2-day ASW exercise and remained active for up to a week following the exercise. Despite some challenges this was a successful pilot study and the design and coordination has been refined based on lessons learned from the experience. This early pilot study not only provided data points that will be used in future analysis, but also provided proof-of-concept data for determining the feasibility of using diverse field methods in the AFAST study area.

For this reporting period two focused ASW exercise passive acoustic monitoring efforts were conducted in the JAX OPAREA, each including the deployment of 9 pop-up buoys arranged in an array configuration. The goal was to establish intensive short-term (20-30 day) passive acoustic monitoring before, during, and after specific ASW events. **Figures 19** and **20** show the locations of the pop-up buoys relative to the exercise boxes for each deployment. The first set of buoys was deployed from September 11, 2009 through October 8, 2009 and collected 695GB of data. The second set of buoys was deployed from December 4, 2009 through January 7, 2010 and collected 708GB of data. **Tables 17 and 18** provide details of each deployment including sampling configurations and quantity of data collected. Analysis of data from both deployments is currently in progress.

Aerial Surveys

Aerial surveys were coordinated before/after 3 ASW training events during the reporting period. Two events coincided with the pop-up buoy deployments discussed above and were conducted September 14-18, 2009 and December 8-10, 2009. The third set of surveys was conducted June 4-7, 2010 in the JAX OPAREA. A summary of survey effort and sightings is provided in **Table 19**. Complete survey and sighting details for each event are included in **Appendix E** for the corresponding time periods.

36 tracklines were flown from September 14-18, 2009. Weather conditions for the surveys were good with the exception of 14 September when conditions were fair. There were a total of 39 encounters with cetaceans during aerial survey effort. Species encountered included Stenella frontalis (20 sightings), Tursiops truncates (10 sightings), Grampus griseus (3 sightings), Steno bredanensis (1 sighting), and 5 sightings of unidentified delphinids.

Aerial surveys were conducted on December 8 and 10, 2009, although a storm system in the area resulted in sub-optimal survey conditions. Ten survey lines were flown on December 8th in sub-optimal weather conditions and two lines were completed on December 10th before the survey was aborted due to very poor sea state and visibility. No cetaceans were encountered during the surveys.

Thirty-six tracklines were flown in good to fair conditions June 4-7, 2010. Cetacean sightings consisted of one encounter with shortfinned pilot whales (Globicephala macrorhynchus) and three encounters with Atlantic-spotted dolphins (Stenella frontalis).

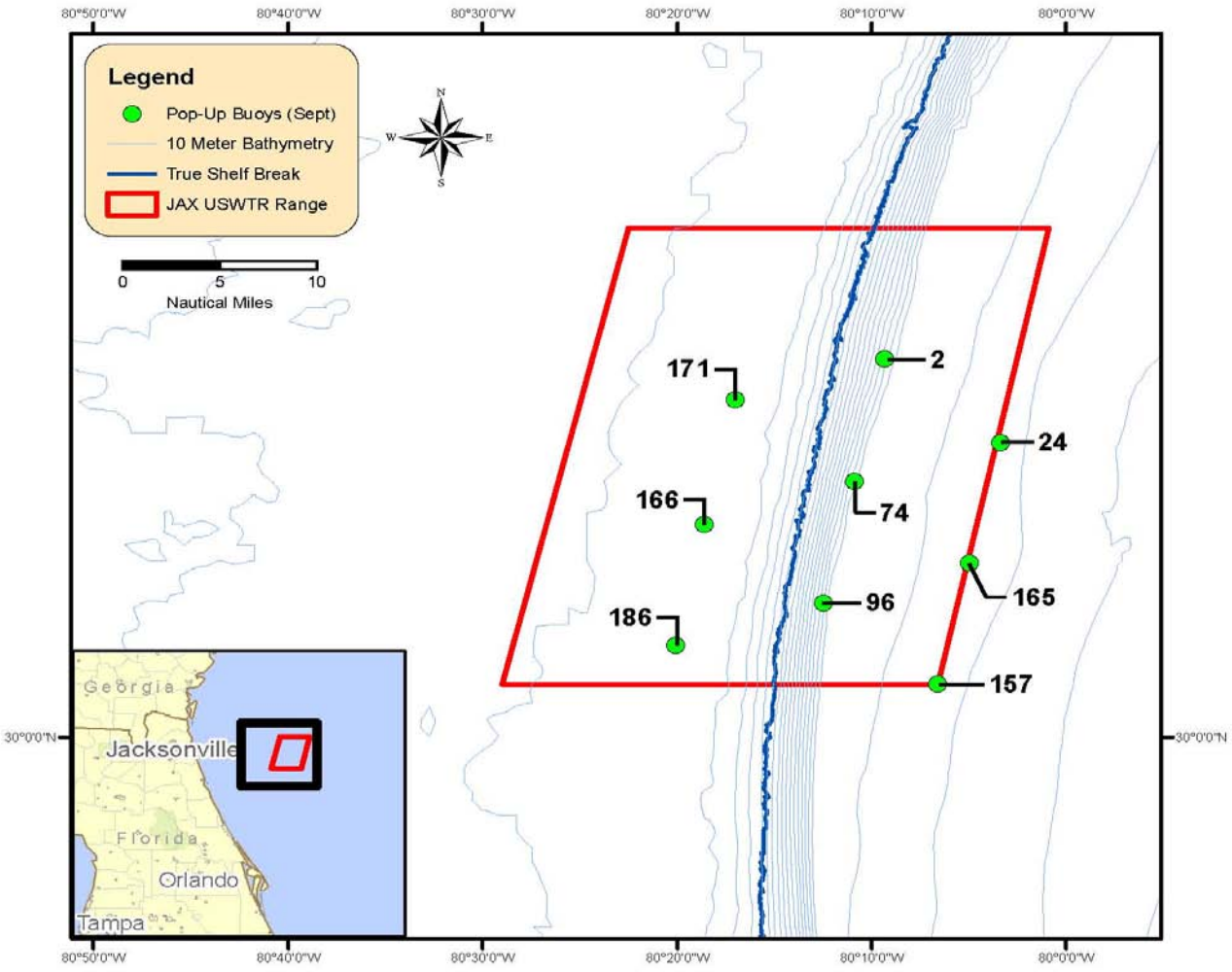

Figure 19. Location of JAX Pop-up buoy deployment, September 2009.

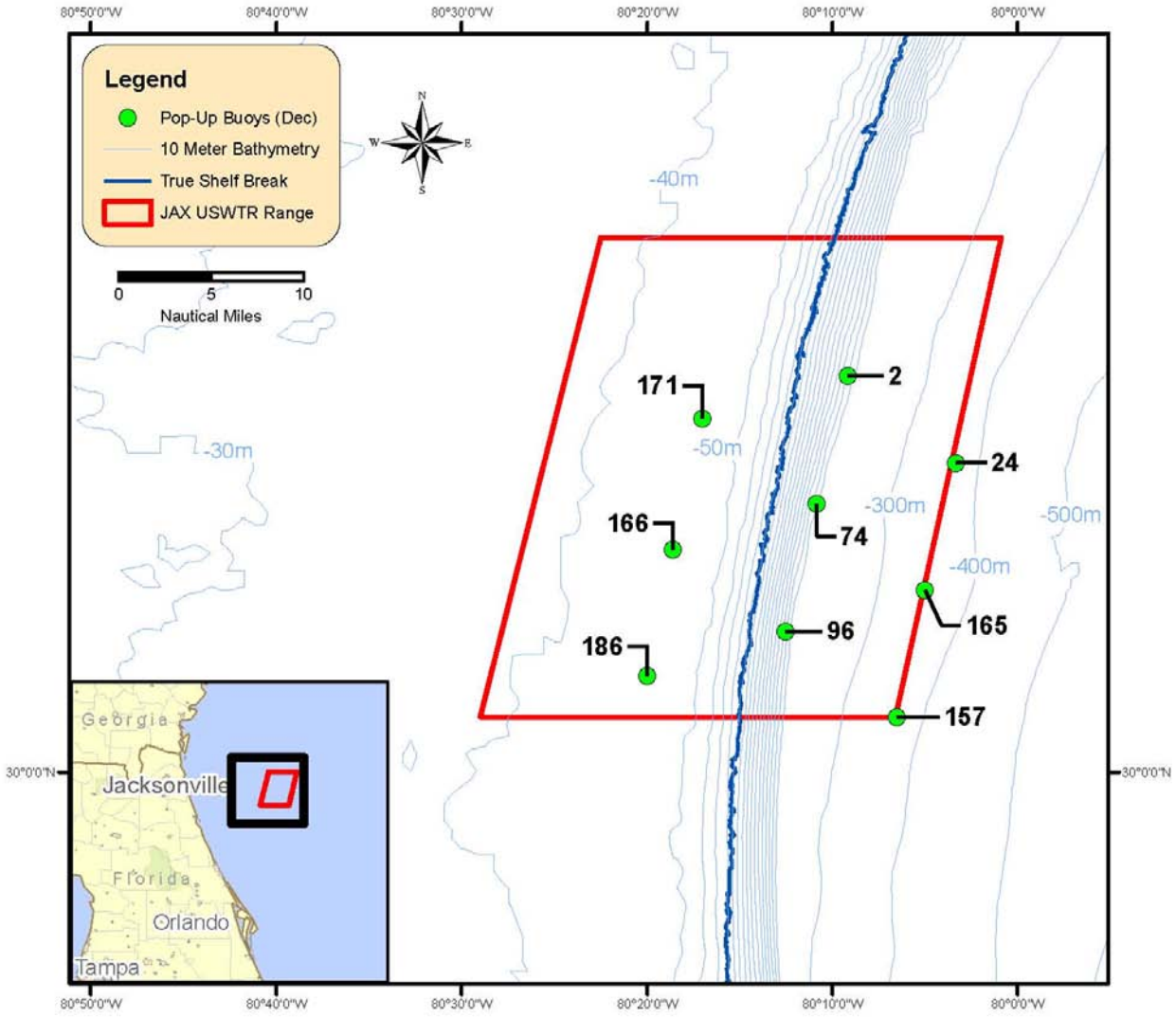

Figure 20. Location of JAX Pop-up buoy deployment, December 2009.

Table 17. Details for JAX Pop-up buoy deployment, September 2009.

Site ID	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
Popup ID	157	165	24	2	74	96	186	166	171
Deployment Date	13-Sep-09	13-Sep-09	13-Sep-09	13-Sep-09	13-Sep-09	13-Sep-09	13-Sep-09	13-Sep-09	13-Sep-09
Recovery Date	8-Oct-09	8-Oct-09	8-Oct-09	8-Oct-09	8-Oct-09	8-Oct-09	8-Oct-09	8-Oct-09	8-Oct-09
Target Latitude	30° 03.000 N	30° 09.816 N	30° 16.657 N	30° 21.430 N	30° 14.492 N	30° 07.600 N	30° 05.223 N	30° 12.050 N	30° 19.081 N
Target Longitude	80° 06.600 W	80° 04.980 W	80° 03.356 W	80° 09.352 W	80° 10.905 W	80° 12.500 W	80° 20.056 W	80° 18.600 W	80° 17.004 W
Actual Latitude	30° 03.015 N	30° 09.867 N	30° 16.686 N	30° 21.435 N	30° 14.505 N	30° 07.594 N	30° 05.218 N	30° 12.052 N	30° 19.092 N
Actual Longitude	80° 06.575 W	80° 04.966 W	80° 03.361 W	80° 09.331 W	80° 10.879 W	80° 12.486 W	80° 20.055 W	80° 18.585 W	80° 17.010 W
Site Depth (Ft.)	1000 +	1,000 +	1,000 +	550	661	629	146	152	146
Sampling	2 KHz Cont.	32 KHz Cont.	2 KHz Cont.	32 KHz Cont.	32 KHz Cont.	32 KHz Cont.	32KHz Cont.	2 KHz Cont.	32 KHz Cont.

Table 18. Details for JAX Pop-up buoy deployment, December 2009.

Site ID	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
Popup ID	157	165	24	2	74	96	186	166	171
Deployment Date	4-Dec-09	4-Dec-09	4-Dec-09	4-Dec-09	4-Dec-09	4-Dec-09	4-Dec-09	4-Dec-09	4-Dec-09
Recovery Date	7-Jan-10	7-Jan-10	7-Jan-10	7-Jan-10	7-Jan-10	7-Jan-10	7-Jan-10	7-Jan-10	7-Jan-10
Target Latitude	30° 03.000 N	30° 09.816 N	30° 16.657 N	30° 21.430 N	30° 14.492 N	30° 07.600 N	30° 05.223 N	30° 12.050 N	30° 19.081 N
Target Longitude	80° 06.600 W	80° 04.980 W	80° 03.356 W	80° 09.352 W	80° 10.905 W	80° 12.500 W	80° 20.056 W	80° 18.600 W	80° 17.004 W
Actual Latitude	30° 3.005 N	30° 9.854 N	30° 16.680 N	30° 21.357 N	30° 14.480 N	30° 7.609 N	30° 5.220 N	30° 12.019 N	30° 19.051 N
Actual Longitude	80° 6.508 W	80° 4.981 W	80° 3.332 W	80° 9.170 W	80° 10.843 W	80° 12.503 W	80° 20.000 W	80° 18.581 W	80° 16.984 W
Site Depth (Ft.)	1,000 +	1,000 +	1,000 +	~600	~600	~600	145	150	145
Sampling	2 KHz Cont.	32 KHz Cont.	2 KHz Cont.	32 KHz Cont.	32 KHz Cont.	32 KHz Cont.	32 KHz Cont.	2 KHz Cont.	32 KHz Cont.

Table 19. Survey effort and marine mammal observation summary for coordinated ASW exercise monitoring.

Date	KM surveyed	Hrs surveyed	Sightings	Total individuals
14-Sep-09	434	3.2	2	13
15-Sep-09	854	8	10	200
16-Sep-09	512	6.4	14	215
18-Sep-09	854	8.1	13	167
8-Dec-09	854	5.3	0	0
10-Dec-09	173	2	0	0
4-Jun-10	854	6.3	1	14
5-Jun-10	854	5.3	1	40
6-Jun-10	854	6.6	2	22
7-Jun-10	512	3.4	0	0

AFAST MARINE MAMMAL OBSERVERS (MMOs)

Navy marine mammal observers (MMOs) participated in two Southeastern Antisubmarine Warfare Integrated Training Initiative (SEASWITI) exercises in the JAX OPAREA on 15-19 March 2010 and 4-9 June 2010. MMOs were embarked on Guided Missile Destroyers (DDGs). MMOs conducted visual observations from the bridge wings of the *DDG* during daylight hours. They worked alongside the Navy lookouts, conducting visual searches for marine species. Visual monitoring for both events was conducted in coordination with data collection for a Navy Lookout Effectiveness Study (details below).

March 2010 SEASWITI: Effort and environmental information was collected on multiple occasions, including when the MMOs began observing (i.e., "on effort"), at each rotation, as weather changes occurred, and when the MMOs went off effort. The MMOs spent approximately 27.5 hours searching for marine species during the event (**Table 20**). Three observers were posted during virtually all of the on-effort hours; therefore this study comprised a total of just over 82 hours of marine mammal shipboard monitoring. During the times that the vessel was entering or exiting Mayport, Florida, limited time was spent on effort because of the set-up and break-down procedures as well as allowing sailors to complete their tasks without interference. For each day at sea, approximately 7 hours were spent on-effort. Sea conditions were less conducive for obtaining sightings on the afternoon of 17 March and most of 18 March because of winds (**Table 21**). MMOs were off effort for less than 3 hours during the course of the event because of rain on the afternoon of 17 March and the morning of 18 March

Table 20. Monitoring Effort and Environmental Conditions during the March 2010 SEASWITI.

Date	Hours of Effort	Time	Beaufort Sea State	% Cloud Cover	Visibility
15 Mar	4 h 21 min	1354-1359, 1419-1507, 1512-1703, 1802-1939	1-4	50-90	Good-excellent
16 Mar	6 h 37 min	0732-0746, 0901-1204, 1304-1315, 1458-1624, 1745-1928	2-4	30-90	Good
17 Mar	7 h 51 min	0733-1159, 1304-1404, 1425-1636, 1743-1757	2-4	90-100, occasional rain & windy	Moderate-good
18 Mar	7 h 57 min	0712-0813, 1011-1206, 1255-1700, 1820-1916	3-6	75-100, occasional rain & windy	Moderate
19 Mar	1 h 8 min	0710-0818	2	0, Cold & windy	Good
Total	**27 h 54 min**		**2-6**		

Table 21. Marine Mammal Observer Sighting Data from the March 2010 SEASWITI.

Species	Independent MMO Sightings	Independent Navy Lookout Team Sightings	Sightings by both Teams	Group Size (range)
Atlantic spotted dolphin (*Stenella frontalis*)	3	1	5	1-20
Unidentified dolphin	1	1	1	2
Unidentified whale	0	1	0	1
Total	**4**	**3**	**6**	

Detailed sighting information is included in Appendix F

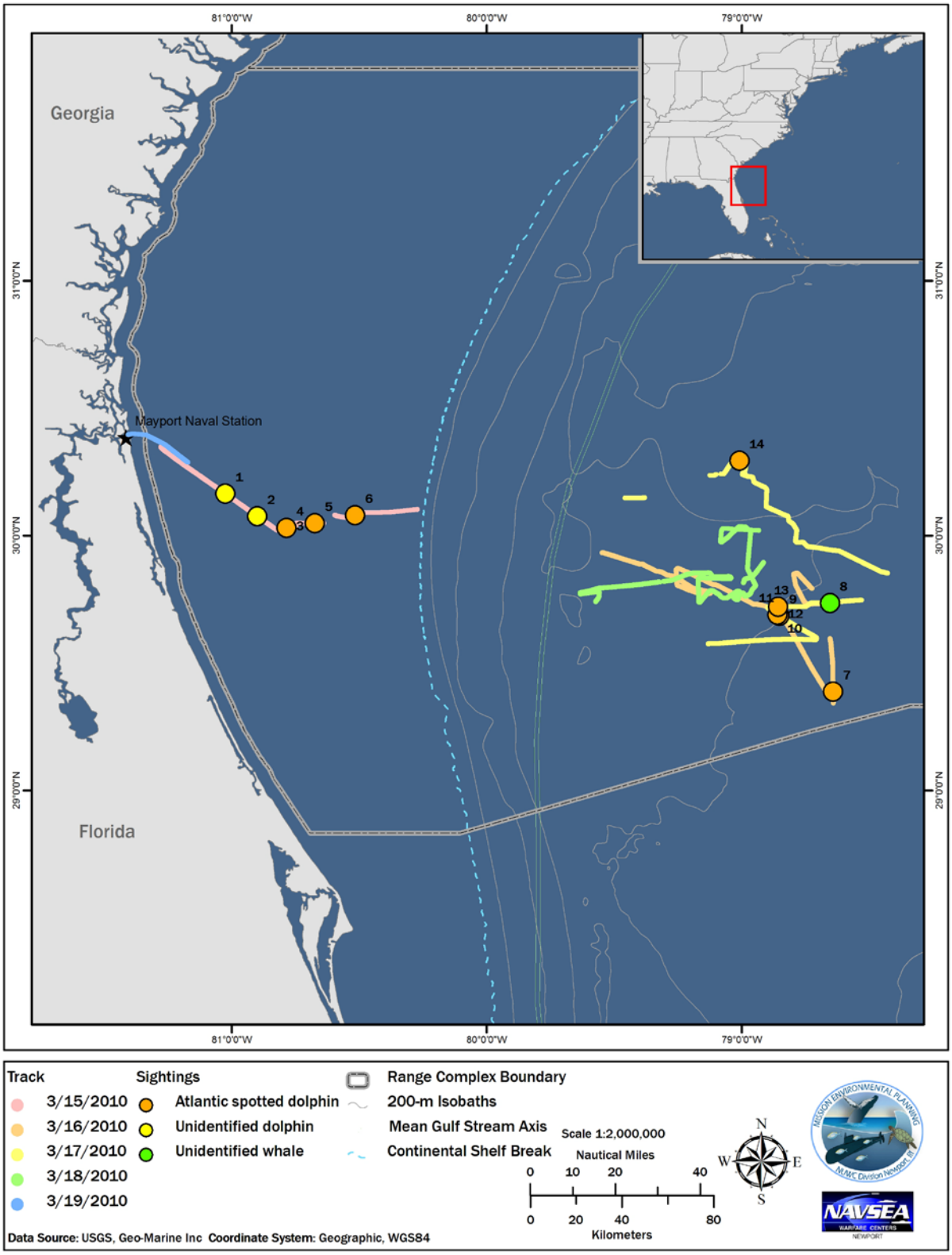

Figure 21. Ship and marine mammal sighting locations during the March 2010 SEASWITI.

June 2010 SEASWITI: Observer effort and environmental information was collected when the MMOs began effort, at each rotation, as weather changes occurred, and when the MMOs went off effort. The MMOs spent approximately 42 hours searching for marine species during the event (**Table 22**). Three observers were active during virtually all of the on effort hours; therefore this study comprised a total of just over 126 hours of marine mammal shipboard monitoring. During the times that the vessel was entering or exiting Mayport, Florida, limited time was spent on effort because of the set-up and break-down procedures as well as allowing sailors to complete their tasks without interference. For every day at sea, approximately 8.5- 9.5 hours were spent on effort (**Table 23**).

Table 22. Monitoring Effort and Environmental Conditions during the June 2010 SEASWITI.

Date	Hours of Effort	Time	Beaufort Sea State	% Cloud Cover	Visibility
04 Jun	5 hr 35 min	1022-1200, 1346-1404, 1552-1701, 1741-2011	1 – 2	90 – 100	Good
05 Jun	8 hr 23 min	0736-952, 1045-1152, 1319-1554, 1707-1932	2 – 3	0 – 80	Good – Excellent
06 Jun	8 hr 27 min	0754-1100, 1314-1534, 1704-2005	1 – 3	0 – 100 periods of rain	Moderate – Excellent
07 Jun	9 hr 25 min	0655-1125, 1331-1659, 1838-2005	3 – 4	15 – 80	Good – Excellent
08 Jun	9 hr 7 min	0703-0827, 1004-1159, 1300-1430, 1542-2000	2 – 4	0 – 10	Excellent
09 Jun	1 hr 8 min	0603-0711	2	20	Good
Total	**42 hr 5 min**		**1 – 4**	**0 – 100**	**Moderate – Excellent**

Table 23. Marine Mammal Observer Sighting Data from the June 2010 SEASWITI.

Species	Independent MMO Sightings	Independent Navy Lookout Team Sightings	Sightings by both Teams	Group Size (range)
Atlantic spotted dolphin (*Stenella frontalis*)	2	0	0	4-7
Unidentified dolphin	11	2	4	1-15
Unidentified cetacean	0	1	0	4-6
Unidentified turtle	1	0	0	1
Total	**14**	**3**	**4**	

Detailed sighting information is included in Appendix G

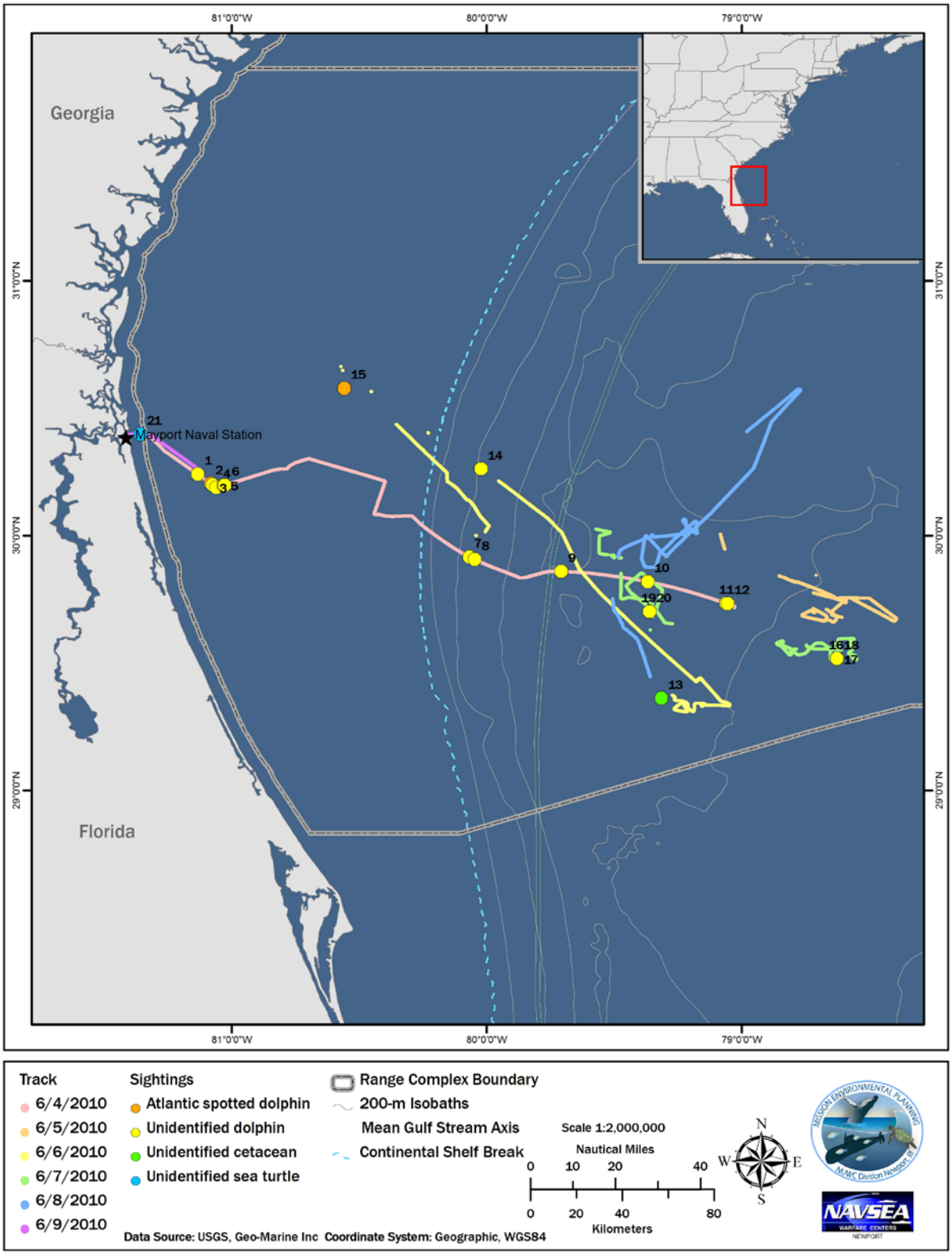

Figure 22. Ship and marine mammal/sea turtle locations during the June 2010 SEASWITI.

NAVY LOOKOUT EFFECTIVENESS STUDY

The US Navy uses lookouts (LO) to detect anything in the water, including marine mammals. Depending on the nature of the activity the ship is engaged in, action may need to be taken if the animal is within certain ranges of the ship. Therefore, it is important to be able to detect all animals that come within these ranges and also determine how far away the animals are with accuracy. Navy lookouts are positioned so that the waters all around the ship can be searched. In addition to dedicated lookouts, officers on the bridge may also be searching and sonar operators may also be listening for vocalizations. We refer to all of these observers together as the "observation team" (OT). The aim of this project is to calibrate the OT effectiveness in terms of detecting and identifying marine mammals. Of particular interest is the probability of an animal getting within a defined range of the vessel without being sighted by the OT, as well as determining the accuracy of the OT (primarily the LO) in determining species group (whale, dolphin, etc.) group size and position. In order to achieve this, experienced MMOs are required to be searching and collecting information on marine mammals that both they and the OT detect.

Overview of analysis methods

Three statistical models are required to estimate the probability of an animal getting within a defined stand-off range without being detected by the OT: (1) a model of the probability that an animal, or group of animals, at the surface is detected by the OT as a function of the animal's position relative to the ship; (2) a model of surfacing behavior of the animal/group; and (3) a model of animal/group movement. The data collected during the survey described here will be used to parameterize the first model. The latter two models will be parameterized from literature sources. To obtain parameters for the first model, the data required will be information on every surfacing of an animal (or group) detected by the MMOs and whether, or not, the OT saw it.

Since the action taken by the vessel once a sighting has been made depends on the distance recorded by the OT, and to some extent the species, we will also make an assessment of the accuracy of distance and species (or species group) determination – although the only data we have to compare this with are the distances and species recorded by MMOs, which may also not be error free. Therefore, while we can estimate the magnitude of the differences between OT and MMO distances and species determinations, we cannot make statements about absolute accuracy of either.

Overview of data collection methods

In order to obtain a realistic probability of OT detection of every marine mammal surfacing, it is important that the OT not deviate from their normal observing technique. However, some additional information from the OT will be needed: namely, location details on each surfacing if possible. Since this information is not typically recorded, and interference with the normal operation of the OT is not desired, one MMO is designated to ensure that this information is obtained (as detailed below). The designated MMO is referred to as the liaison MMO (LMMO) and they will need to coordinate with the OT. The other MMOs also search and record every surfacing in such a way that the OT is not cued to the MMO sighting. To distinguish the other MMOs from the LMMO, we refer to them as surveying MMOs (SMMOs).

With the SMMOs searching and recording every surfacing, a combination of line transect distance sampling (DS) and mark-recapture (MR) methods can be used to estimate the required probability of detection for each surfacing. These methods are frequently used in marine mammal surveys, but

generally without the complication of recording each surfacing. The idea is that when the SMMOs detect an animal surfacing, they are setting up a "trial" for the OT, which can either result in the OT detecting that surfacing or not. The model assumes that probability of detection is a function of distance (both ahead and abeam of the ship), whether that group was sighted by the OT before, and potentially other variables. Animals (or groups) that are more-or-less continually at the surface (such as large groups of dolphins) can be analyzed in a similar framework, but here the probability of detection is modeled as a continuous hazard rather than only when discrete surfacing occurs. The data required for continuously available animals is: when and where the SMMOs first detected them, regular updates on position, when and where the OT first detected them (if they did), when and where the OT lost contact with them and when and where the SMMOs lost contact with them.

The primary members of the OT are the dedicated LOs; however, there are also observers on the bridge and possibly an acoustic 'observer,' although the search effort for these observers will be variable depending on their other duties. Nevertheless, sightings information from these observers will also be required. We plan that the LMMO will be stationed next to the LO; hence it is important that other members of the OT communicate their detections to the LO so that the LMMO can record them. If this does not happen, it may be necessary to station an additional LMMO on the bridge, so they can record detections made by the bridge observers.

A key element of this method is that the OT must search as usual and search independently from the SMMOs. If the LO or other observers are aware of sightings made by the SMMOs, the premise of the analysis will break down.

Another key element is that the SMMOs must be able to determine if a detection of a surfacing they have made has been detected by the OT or not (i.e. was the trial a "success" or "failure"). The LMMO is responsible for communicating all OT detections to the SMMOs, who can then judge if this corresponds with a detection they have made. Also, information about the timing and location of detections will be recorded by a fourth MMO (the data MMO [DMMO] for all detections) so that determination of which are duplicates can be refined offline, after the survey.

In addition to the detection probability information, SMMO observers will also provide information on species and group size with which to calibrate the OT.

The most important surfacings are those made before the OT detects the animals, and the first surfacing detected by the OT. Thereafter, repeat detections of the same animal/group by the OT are useful information for refining the detection function shape, and for gleaning information about surfacing rates, but do not bear directly on the main question we wish to answer. Hence, most effort by the SMMOs should go into detecting marine mammals before the OT has seen them, and determining whether each of these surfacings is detected by the OT. Once a group has been detected, the SMMOs should feel free to concentrate on searching for new animals/groups, unless tracking of already detected groups is straightforward. One of the two SMMOs should be searching for new groups, especially if the other SMMO is following a group. The SMMOs are encouraged to search with binoculars or big eye binoculars as much as possible.

Lookout Effectiveness Trials Completed

The Navy has successfully completed four Lookout Effectiveness data collection trials thus far. The primary functions of these initial efforts were to test and refine the methodology. Of the four studies, one was completed in Hawaii (Submarine Commanders Course [SCC ops]) and SOCAL (Unit level

training), and two were completed off the coast of Jacksonville, FL (Southeastern Anti-Submarine Warfare Integrated Training Initiative [SEASWITI]). Each study had four MMOs participating, observing from sunrise to sunset each day underway, with short breaks during meals. **Table 24** is a summary of the monitoring effort and data collected by the MMOs thus far. It is important to note that the data presented represents the overall sighting record at all distances from the observation platform. For the purpose of mitigation effectiveness it will be necessary to determine what difference, if any, in sighting effectiveness there is between the OT and MMOs for animals before entering the mitigation zone. Further analysis of these data and additional future lookout effectiveness data are needed before any conclusions can be drawn from the results. **Appendices F and G** provide for detailed reports from each effort conducted in the Atlantic.

Table 24. Lookout Effectiveness Data Collection Trials

FFG A	DDG A	DDG B	DDG C
Hawaii Range Complex	JAX OPAREA	JAX OPAREA	SOCAL OPAREA
February 2010	March 2010	June 2010	August 2010
49.5 Hrs Team Effort	27.5 Hrs Team Effort	42 Hrs Team Effort	48.1 Hrs Team Effort
24 Sightings by MMOs	16 Sightings by MMOs	14 Sightings by MMOs	93 Sightings by MMOs
Of the 24 sightings by MMOs, 9 were seen by OT	Of the 16 sightings by MMOs, 4 were seen by OT	Of the 14 sightings by MMOs, 4 were seen by OT	Of the 93 sightings seen by MMOs, 39 were seen by OT
4 additional sightings by OT, not MMOs	3 additional sightings by OT, not MMOs	3 additional sightings by OT, not MMOs	5 additional sightings of by OT, not MMOs

Part II - AFAST 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. 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 how to create and maintain sustainable ecosystems. Adaptive management helps science managers maintain flexibility in their decisions, knowing that uncertainties exist and provides managers the latitude to change direction will improve understanding of ecological systems to achieve management objectives; and is about taking action to improve progress towards desired outcomes.

In March, 2009, the Navy convened government and academic researchers to review the Navy's range complex monitoring plans. This diverse group of experts reviewed the methods that currently exist for monitoring, methods expected to be available in five years, and the Navy's current plans. The team reinforced that the current methods being used by the Navy for monitoring were robust and strongly recommended that Navy continue to use a diversity of methods simultaneously. For AFAST monitoring, as well as monitoring conducted in other range complexes, the Navy was successful in using a diversity of field methods to gather visual and acoustic data towards answering the questions posed by Navy and NMFS.

A follow-up workshop is planned for October 2010 in which technical experts will be asked to critically evaluate the goals and objectives of the Navy's monitoring plans as established through the Integrated Comprehensive Monitoring Program and individual monitoring plans contained in each of the Navy's Letters of Authorization. The objective of this workshop is to determine the most efficient use of limited resources in addressing questions associated with potential impacts of Navy training on marine mammals and other protected marine species. To further this objective, the participants will evaluate proposed revisions to the current study questions and associated study designs. The inputs provided at the workshop will be used to inform the adaptive management process of Navy-wide marine species monitoring.

The Navy's adaptive management of the AFAST Monitoring Plan will involve close coordination with NMFS to align marine mammal monitoring with the Plan's overall objectives as stated within earlier sections of the Plan and in the Introduction of this report.

Scheduling monitoring that involves civilian aircraft and ships operating concurrently with multiple Navy aircraft and ships in the same area, requires extensive pre-survey coordination between multiple Navy commands. The USFF operational community provided critical interface and coordination that was instrumental in allowing for researchers to conduct monitoring in close-proximity to Navy assets. The USFF operational community also provided berthing for Navy MMOs on surface vessels.

Cancellations or major date shifts in Navy training events based on logistics, fiscal, or operational needs were challenging to overcome. These kind of changes are difficult to predict and more importantly, more difficult to reschedule from a monitoring prospective when contracts have been awarded, survey equipment has been purchased, rented or relocated; personnel availability and transport arranged; and fixed date contracts put into place.

In light of lessons learned during implementation of the 2009 and 2010 AFAST Monitoring Plan, and as part of the Navy's adaptive management review for AFAST, the Navy proposes to reallocate some survey effort to support new initiatives that will more directly contribute to addressing the objectives of the Integrated Comprehensive Monitoring Program. A modification of the 2010 Plan is shown in **Table 25**. The modification does not include a change in overall effort, rather it is meant to enable the Navy to take advantage of additional monitoring locations and techniques to address the questions proposed in the AFAST monitoring plan. Combined aerial and shipboard visual surveys have been conducted routinely at the Onslow Bay location for over 3 years. This has established a relatively detailed baseline of marine species distribution and habitat use of that location. The proposed change involves shifting vessel and/or aerial survey effort from the current location in Onslow Bay to the north, off Cape Hatteras. The surveys off Cape Hatteras will be the initial work supporting a study examining the behavioral ecology, prey fields, and reactions to sound of cetaceans. The project is an expansion of previous research conducted on pilot whales and other deep-diving odontocetes by researchers from Duke University and Woods Hole Oceanographic Institution. Baseline data will be collected in 2010-2011 from boat-based visual surveys which may also include tagging, biopsy, photo ID, and tracking. The project is anticipated to span approximately 3 years to include future experimental response studies and prey field mapping. For 2011 the Navy proposes allow for flexibility among multiple sites within the VACAPES, CHPT, and JAX OPAREAs in order to support new monitoring efforts, such as the Cape Hatteras study, and more effectively address the primary objectives of the AFAST monitoring plan and ICMP.

Table 25. Navy's adaptive management review for AFAST showing edits to 2010 monitoring and proposed 2011 monitoring (strike through are deletions and red font are additions).

STUDY 1 and 3 (exposures and behavioral responses)		
Aerial Surveys During Training Events	- 1 event in conjunction with a SEASWITI, shallow COMPTUEX, or ULT exercise.	Adaptive Management Review (AMR)
Marine Mammal Observers (MMO)	- 2 events in conjunction with SEASWITI or ULT exercises.	
Vessel surveys (study 3 only)	- 2 events in conjunction with SEASWITI, shallow COMPTUEX, or ULT exercises.	
Passive Acoustics	- 2 deployments of pop-up buoys in conjunction with SEASWITI, shallow COMPTUEX, or ULT exercises.	
STUDY 2 (geographic redistribution)		
Aerial Surveys Before And After Training Events	- 1 event in conjunction with a SEASWITI, shallow COMPTUEX, or ULT exercise.	AMR
Aerial Surveys ~~Onslow Bay/ Jacksonville~~ VACAPES/CHPT/JAX OPAREAs	- 48 days	
Vessel Surveys ~~Onslow Bay/ Jacksonville~~ VACAPES/CHPT/JAX OPAREAs	- 48 days	
Passive Acoustics	Continue recording and data analysis for the 4 HARPS.	
STUDY 4 (mitigation effectiveness)		
MMO/ Lookout Comparison	- 40 hours	AMR
Aerial Surveys Before And After Training Events	- 1 event in conjunction with a SEASWITI, shallow COMPTUEX, or ULT exercise.	

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Appendix A - Integrated Comprehensive Monitoring Program

UNITED STATES NAVY

INTEGRATED COMPREHENSIVE MONITORING PROGRAM

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