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Marine Species Monitoring

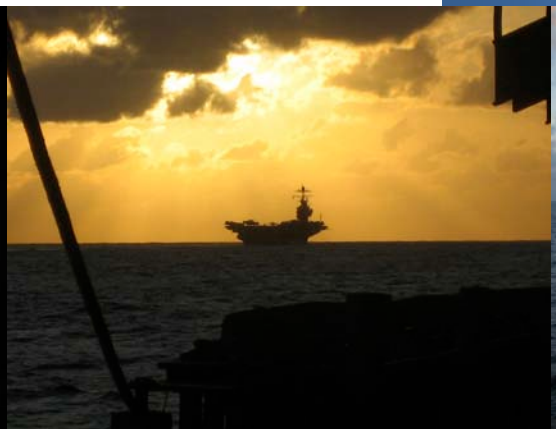
For The U.S. Navy's

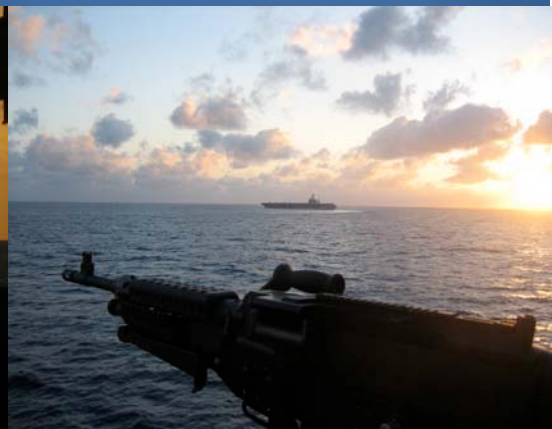
Atlantic Fleet Active Sonar Training

(AFAST)

September 2011

Annual Report 2011





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AFAST	Atlantic Fleet Active Sonar Training
AMAR	Autonomous Multi-channel Acoustic Readers
AMR	Adaptive Management Review
ASW	anti-submarine warfare
BiOp	Biological Opinion
CART	Classification and Regression Tree
CFR	Code of Federal Regulations
CHPT	Cherry Point
CNO	Chief of Naval Operations
COMPTUEX	Composite Training Unit Exercise
DoN	Department of the Navy
DTAG	digital acoustic tag
EIS	Environmental Impact Statement
ESA	Endangered Species Act
FY	fiscal year
GOM	Gulf of Mexico
HARP	High-frequency Acoustic Recording Package
hrs	Hours
ICMP	Integrated Comprehensive Monitoring Program
ITA	Incidental Take Authorization
JAX	Jacksonville
kHz	kilohertz
km	kilometers
LO	Lookout
LMMO	liaison marine mammal observer
LOA	Letter of Authorization
LTAS	long-term averaged spectrogram
m	meters
min	minutes
MFAS	mid-frequency active sonar
MMO	marine mammal observer
MMPA	Marine Mammal Protection Act
N45	Environmental Readiness Division
NM	nautical miles
NMFS	National Marine Fisheries Service
NUWCDIVNPT	Naval Undersea Warfare Center Division, Newport
OEIS	Overseas Environmental Impact Statement
ONR	Office of Naval Research
OPAREA	Operating Area
OT	observation team
PAM	passive acoustic monitoring
PTS	permanent threshold shift
R&D	research and development
SAG	Scientific Advisory Group
SEASWITI	Southeast Anti-submarine Warfare Integration Training Initiative
km^2	square kilometers
SST	sea surface temperature
TTS	temporary threshold shift
ULT	Unit Level Training
U.S.	United States
UNCW	University of North Carolina at Wilmington
USFF	U.S. Fleet Forces
USWTR	Undersea Warfare Training Range
VACAPES	Virginia Capes

SECTION I – INTRODUCTION & BACKGROUND

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 (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 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 also have included terms and conditions requiring the U.S. Navy to develop a monitoring program. In addition to range complex monitoring plans, a monitoring plan for Atlantic Fleet Active Sonar Training (AFAST) was developed for protected marine species, primarily marine mammals and sea turtles, as part of the environmental planning and regulatory compliance process associated with a variety of training activities. As part of the issuance of an LOA in early 2009 (NMFS 2009), the U.S. Navy published the AFAST Monitoring Plan (DoN 2009a).

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, which 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, temporary threshold shift [TTS], or permanent threshold shift [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 U.S. Navy's suite of mitigation measures for MFAS (e.g., Protective Measures Assessment Protocol) effective for avoiding TTS, injury, and mortality of marine mammals and sea turtles?

Monitoring methods proposed for the range complex monitoring plans include a combination of field methods designed both to support range complex-specific monitoring and to contribute information to a larger U.S. Navy-wide science-based program. These field methods include visual surveys from vessels or airplanes, passive acoustic monitoring (PAM), and marine mammal observers (MMOs) aboard U.S. Navy platforms participating in an exercise or event. Each monitoring technique has advantages and disadvantages that vary temporally and spatially and each method supports one particular study objective better than another. The U.S. Navy uses a combination of techniques so that detection and observation of marine animals is maximized, and meaningful information can be derived to address 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 coordinated Science & Technology (S&T) and Research & Development (R&D) program focused on marine mammals and sound. Total investment in the program for Fiscal Year (FY) 2011 was approximately $16 million, and continued funding at levels greater than $14 million is foreseen in subsequent years. Several significant projects relative to potential U.S. Navy operational impact to marine mammals are currently funded and ongoing within some U.S. Navy range complexes.

2. Integrated Comprehensive Monitoring Program (ICMP)

The Integrated Comprehensive Monitoring Program (ICMP) provides the overarching framework for coordination of the U.S. Navy's monitoring (DoN 2010b). It has been developed in direct response to permitting requirements for U.S. Navy ranges that are established in the various MMPA Final Rules, ESA Consultations, BiOps, and applicable regulations. As a framework document, the ICMP applies by regulation to those activities on ranges and operating areas (OPAREAs) for which the U.S. Navy sought and received ITAs.

The ICMP is intended for use as a planning tool to focus U.S. 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" and will be routinely updated, as needed. Initial areas of focus for improving U.S. Navy monitoring in 2010/2011 included further refinement of monitoring goals, adding characterization of the unique attributes associated with each range complex/study area to aid in shaping future monitoring projects, and broader description of the data management organization and access procedures.

The ICMP is evaluated annually through the Adaptive Management Review (AMR) process to: (1) assess progress, (2) provide a matrix of goals for the following year, and (3) make recommendations for refinement and analysis of the monitoring and mitigation techniques. This process includes conducting an annual AMR meeting at which the U.S. Navy and 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 discussions are incorporated by an addendum or revision to the ICMP. Official ICMP updates are provided to NMFS by December 31 annually (e.g., DoN 2010b).

Under the ICMP, monitoring measures prescribed in range-/project-specific monitoring plans and U.S. Navy-funded research relating to the effects of U.S. Navy training and testing activities on protected marine species should be designed to accomplish one or more of the following top-level goals as currently prescribed in the 2010 ICMP update (DoN 2010b):

(a) An increase in our understanding of the likely occurrence of marine mammals and/or ESA-listed marine species in the vicinity of the action (i.e., presence, abundance, distribution, and/or density of species).

(b) An increase in our understanding of the nature, scope, or context of the likely exposure of marine mammals and/or ESA-listed species to any of the potential stressors associated with the action (e.g., sound, explosive detonation, or expended materials), through better understanding of one or more of the following: 1) the nature of the action and its surrounding environment

(e.g., sound source characterization, propagation, and ambient noise levels); 2) the affected species (e.g., life history or dive patterns); 3) the likely co-occurrence of marine mammals and/or ESA-listed marine species with the action (in whole or part); and/or 4) the likely biological or behavioral context of exposure to the stressor for the marine mammal and/or ESA-listed marine species (e.g., age class of exposed animals or known pupping, calving, or feeding areas).

(c) An increase in our understanding of how individual marine mammals or ESA-listed marine animals respond (behaviorally or physiologically) to the specific stressors associated with the action (in specific contexts, where possible, e.g., at what distance or received level).

(d) An increase in our understanding of how anticipated individual responses, to individual stressors or anticipated combinations of stressors, may impact either: 1) the long-term fitness and survival of an individual; or 2) the population, species, or stock (e.g., through effects on annual rates of recruitment or survival).

(e) An increase in our understanding of the effectiveness of mitigation and monitoring measures, including increasing the probability of detecting marine mammals to better achieve the above goals (through improved technology or methodology), both generally and more specifically within the safety zone (thus allowing for more effective implementation of the mitigation). Improved detection technology will be rigorously and scientifically validated prior to being proposed for mitigation, and should meet practicality considerations (engineering, logistic, fiscal).

(f) A better understanding and record of the manner in which the authorized entity complies with the ITA and incidental take statement.

CNO N45 is responsible for maintaining and updating the ICMP, as necessary, reflecting the results of regulatory agency rulemaking, AMRs, best available science, improved assessment methodologies, and more effective protective measures. This is done as part of the AMR process, in consultation with U.S. Navy technical experts, Fleet Commanders, and Echelon II Commands as appropriate. The ICMP (updated in December 2010) is provided in **Appendix A**.

3. Report Objectives

Design of the range complex monitoring plans represented part of a new U.S. Navy-wide and regional assessment, and as with any new program, there are many coordination, logistical, and technical details that 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-U.S. Navy agreements.

Overall, this report serves two main objectives:

1. Present data and results from the U.S. Navy-funded marine mammal and sea turtle monitoring conducted in the AFAST Study Area during the period from August 2, 2010 to August 1, 2011 (**Section II**). Due to the time required to consolidate data and generate an annual monitoring report, this report covers a time period that includes the last half of the previous year's LOA (August 2, 2010 – January 21, 2011) as well as the first half of the current year's LOA (January 22, 2011 – August 1, 2011). Because the annual LOA period is January 22 – January 21, an additional table is included that briefly reviews monitoring accomplishments during the second

full year of the MMPA authorization (January 22, 2010 – January 21, 2011). Primary focus over the first years of the monitoring program has been on establishing initial monitoring commitments, initiating data-collection efforts, and overall organization and coordination of the U.S. Navy-wide monitoring program. This report will focus on summarizing collected data and providing a brief description of the major accomplishments from techniques used this year.

2. Continue the AMR process by providing an overview of meetings and initiatives and presenting progress made toward development of a Strategic Plan for U.S. Navy monitoring. The objectives of the meetings and initiatives over the past year have supported proposed revisions to the U.S. Navy's 2012 AFAST Monitoring Plan. A Scientific Advisory Group (SAG) was also established to review and provide recommendations on the U.S. Navy's monitoring program. Proposed changes primarily reflect input received from the scientific community and other stakeholders. **Section III** provides an overview of the events that have prompted these most recent adaptive management actions.

SECTION II – ATLANTIC FLEET ACTIVE SONAR TRAINING (AFAST) MONITORING

The AFAST Study Area encompasses waters along the U.S. East Coast and the Gulf of Mexico (GOM), consisting of range complex OPAREAs and adjacent waters (**Figure 1**). Potential environmental effects associated with the use of active sonar technology and the improved extended echo ranging system during Atlantic Fleet training exercises, maintenance, and research, development, test, and evaluation activities are more fully described in the *Atlantic Fleet Active Sonar Testing Environmental Impact Statement/Overseas Environmental Impact Statement* (AFAST EIS/OEIS; DoN 2008a).

There are 43 species of marine mammals that may be observed either seasonally or year-round in the AFAST Study Area (Waring et al. 2010). All receive protection under the MMPA, while seven are afforded additional protection under the ESA: North Atlantic right whale (*Eubalaena glacialis*), humpback whale (*Megaptera novaeangliae*), sei whale (*Balaenoptera borealis*), fin whale (*Balaenoptera physalus*), blue whale (*Balaenoptera musculus*), sperm whale (*Physeter macrocephalus*), and West Indian manatee (*Trichechus manatus*). There are six species of threatened and endangered sea turtles that occur in the AFAST Study Area (DoN 2008a): leatherback turtle (*Dermochelys coriacea*), loggerhead turtle (*Caretta caretta*), green turtle (*Chelonia mydas*), hawksbill turtle (*Eretmochelys imbricata*), Kemp's ridley turtle (*Lepidochelys kempii*), and olive ridley turtle (*Lepidochelys olivacea)*. The distribution and habitat preferences of these protected marine species are reviewed in various U.S. Navy Marine Resources Assessments for the U.S. East Coast and GOM (DoN 2005, 2007, 2008b, 2008c, and 2008d).

1. 2011 AFAST Monitoring Commitments

The goal of the AFAST Monitoring Plan is to implement field methods chosen to address the long-term monitoring objectives outlined in **Section I**. In the original AFAST 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 U.S. Navy training areas. Specifically, the U.S. Navy proposed to conduct visual surveys (aerial and vessels); to deploy PAM devices; and to put MMOs aboard U.S. Navy vessels to meet monitoring requirements for the 2011 monitoring period. Studies were specifically designed to address the questions outlined in **Section I**. **Table 1** shows the 2011 monitoring period commitments categorized by study objectives as agreed upon by NMFS and the U.S. Navy.

Table 1. 2011 Monitoring Commitments Under AFAST Final Rule, LOA, and Biological Opinion.

STUDY 1 and 3 (Objectives: to determine exposures to MFAS and behavioral responses at various levels [behavioral harassment, TTS, and PTS])	
Aerial Surveys During Training Events	1 event in conjunction with a SEASWITI, shallow Composite Training Unit Exercise (COMPTUEX), or unit level training (ULT) exercise.
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 (Objective: to analyze geographic redistribution as a result of exposure to MFAS)	
Aerial Surveys Before And After Training Events	1 event in conjunction with a SEASWITI, shallow COMPTUEX, or ULT exercise.
Aerial Surveys VACAPES/CHPT/JAX OPAREAs	48 days
Vessel Surveys VACAPES/CHPT/JAX OPAREAs	48 days
Passive Acoustics	Continue recording and data analysis for the 4 HARPS.
STUDY 4 (Objective: to measure mitigation effectiveness in avoiding TTS, injury, and mortality)	
MMO/ Lookout Comparison	40 hrs
Aerial Surveys Before And After Training Events	1 event in conjunction with a SEASWITI, shallow COMPTUEX, or ULT exercise.

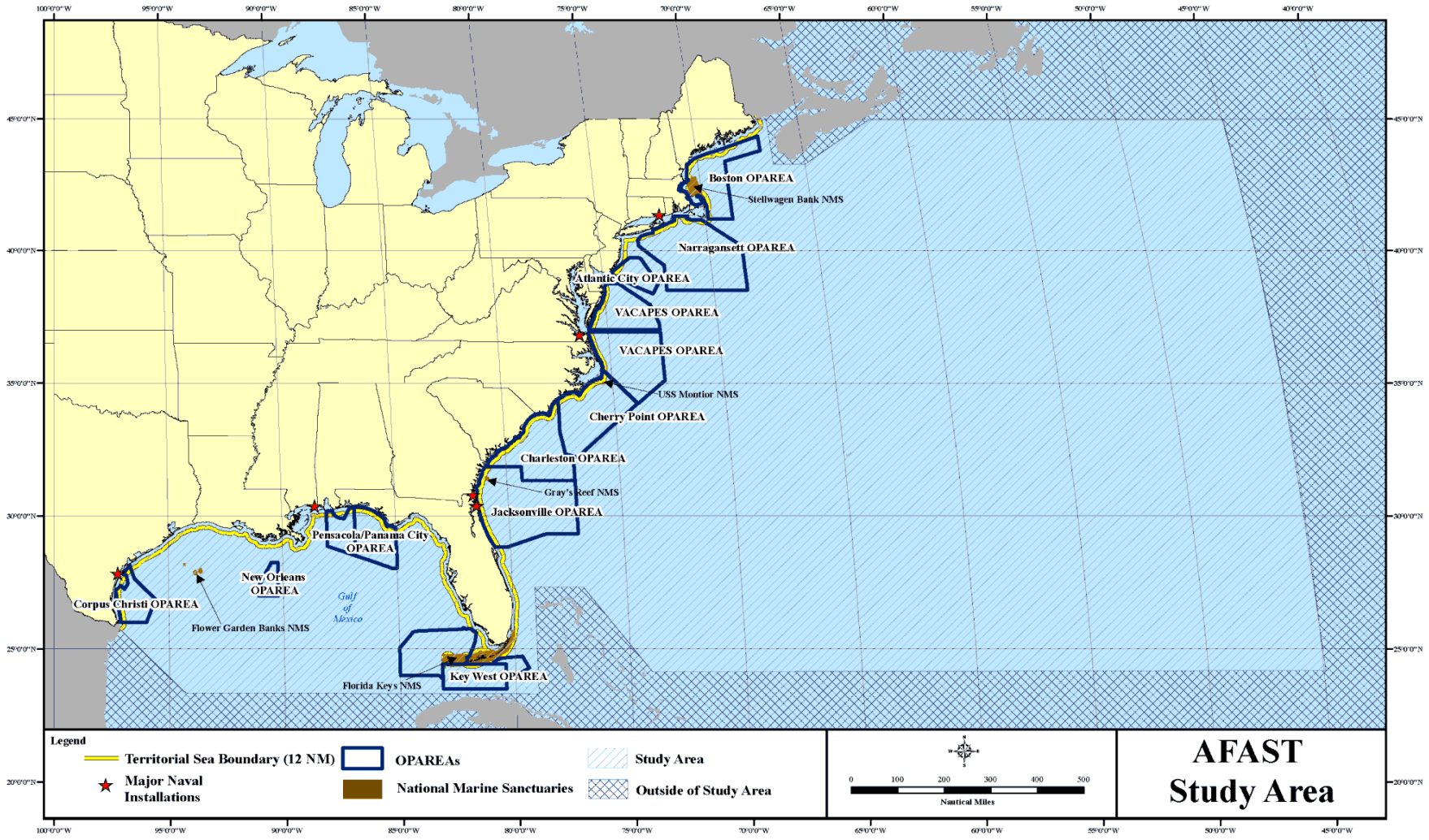

Figure 1. AFAST study area.

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2. AFAST Monitoring Accomplishments for the Reporting Period

During the August 2, 2010 – August 1, 2011 reporting period, U.S. Fleet Forces (USFF) implemented aerial and vessel surveys; deployed PAM devices; and conducted a behavioral-response study that deployed digital acoustic tags (DTAGs) on short-finned pilot whales (*Globicephala macrorynchus*). The majority of monitoring effort for the reporting period was conducted in two locations—Onslow Bay, and the Jacksonville (JAX) OPAREA—with an extension of survey effort off Cape Hatteras. These locations serve as primary study areas for longitudinal baseline monitoring efforts. These sites are also the primary locations for coordinated anti-submarine warfare (ASW) exercise monitoring events.

In the 2011 AFAST Monitoring Plan (DoN, 2009a), the U.S. Navy had proposed to reallocate some survey effort to support new initiatives that would more directly contribute to addressing the objectives of the ICMP. The modification did not include a change in overall effort, but rather was intended to enable the U.S. Navy to take advantage of additional monitoring locations within the Virginia Capes (VACAPES; Cape Hatteras survey area), Cherry Point (CHPT; Onslow Bay survey area), and JAX OPAREAs and techniques to address the questions proposed in the AFAST Monitoring Plan. The change also involved shifting some vessel and aerial survey effort from Onslow Bay to the north, off Cape Hatteras.

Total Fleet Forces Command investment in program development (ICMP, Scientific Advisory Group, Strategic Plan), AFAST monitoring fieldwork, analysis, and reporting was $2.8 million in FY10 and $2.45 million in FY11. **Appendix B** includes a listing of publications and presentations resulting from the AFAST monitoring program to date.

Major accomplishments from the USFF's 2010-2011 compliance monitoring in the AFAST Study Area included:

- Aerial Visual Surveys
    - Conducted monthly aerial surveys (weather permitting) at Onslow Bay and JAX sites to obtain longitudinal data trends. Initiated monthly surveys off Cape Hatteras.
    - Conducted aerial surveys before and after ASW training event in VACAPES.
    - Conducted aerial surveys before, during, and after ASW training event in JAX.
- Vessel Visual Surveys
    - Conducted monthly vessel surveys (weather permitting) at Onslow Bay and JAX sites to obtain longitudinal data trends.
    - Conducted photo-identification efforts, collecting 5,711 photographs at Cape Hatteras of short‐finned pilot whales, sperm whales, Atlantic bottlenose dolphins (*Tursiops truncatus*), Atlantic spotted dolphins (*Stenella frontalis*), Risso's dolphins (*Grampus griseus*) and Cuvier's beaked whales (*Ziphius cavirostris*).; 1,333 at Onslow Bay of Atlantic spotted dolphins and bottlenose dolphins; and 1,257 at JAX of Atlantic bottlenose dolphins and Atlantic spotted dolphins.
    - Conducted large-vessel survey with towed passive acoustic array before, during, and after ASW training event in JAX.
    - Conducted a behavioral response study off Cape Hatteras, using DTAGs on pilot whales.

- Obtained biopsy samples during the behavioral response study off Cape Hatteras, collecting a total of 23 samples from bottlenose dolphins, Atlantic spotted dolphins, and pilot whales.

- Passive Acoustic Monitoring
  - Maintained 4 High-frequency Acoustic Recording Packages (HARPs) in VACAPES/CHPT/JAX—total of 7 deployments (2 in Onslow Bay, 4 in JAX, 1 off Cape Hatteras).
  - Operated towed arrays during vessel surveys in Onslow Bay and JAX.
  - Operated towed array during large-vessel monitoring before, during, and after ASW training event in JAX.

- Marine Mammal Observers
  - Coordination of Navy MMOs for ASW exercises has not been possible throughout the duration of this reporting year, which extended from August 2, 2010 through August 1, 2011. The U.S. Navy could not coordinate involvement of MMOs because of logistic constraints and training exercise schedules.

- Observer Effectiveness Study
  - Completed pilot study preliminary analysis of study protocols.
  - Continued with methods refinement and data-collection trials.

Table 2 presents a summary of the major accomplishments for U.S. Navy-funded protected marine species monitoring within the AFAST Study Area to date in 2011 (January 22 through August 1). As mentioned in **Section I**, because the reporting period (August 2, 2010 – August 1, 2011) spans across two annual LOAs, **Table 3** provides a summary of accomplishments for January 22, 2010 through January 21, 2011, corresponding to the second full LOA period. In addition, monitoring is currently underway for coordinated ASW exercises in August and September that will be reported within the annual monitoring report for 2012. These efforts include aerial surveys and vessel surveys before, during, and after ASW training exercises, as well as deployment of a temporary array of 12 passive-acoustic recording units in coordination with an ASW training event in the JAX OPAREA. For the monitoring events that could not be accomplished due to safety issues, weather and/or changing ship schedules, the U.S. Navy will continue working with NMFS to develop the best plan to either capture these events during the remaining permit period or to focus those resources on monitoring that would better achieve the overarching goals of the monitoring program.

Table 2. U.S. Navy-funded Monitoring Accomplishments Within the AFAST Study Area For 2011 (January 22 Through August 1).

Study Type	Description of U.S. Navy EIS/LOA Monitoring	Associated Event Type	2011 MMPA/ESA Requirement	Total Accomplished as of August 1, 20111
Aerial surveys—during training event (studies 1 and 3)	n/a	SEASWITI, shallow COMPTUEX, or ULT	1 event in conjunction with a SEASWITI, shallow COMPTUEX, or ULT exercise.	0 events
Aerial surveys—before and after training event (studies 2 and 4)	n/a	SEASWITI, shallow COMPTUEX, or ULT	1 event in conjunction with a SEASWITI, shallow COMPTUEX, or ULT exercise.	0 events
Aerial surveys—VACAPES/CHPT/JAX (study 2)	1) Monthly surveys in Onslow Bay 2) Monthly surveys in JAX 3) Surveys off Cape Hatteras	n/a	48 days	24 days: 6 days Cape Hatteras; 4 days Onslow; 14 days JAX
Vessel surveys—during training event (study 3)	n/a	SEASWITI, shallow COMPTUEX, or ULT	2 events in conjunction with SEASWITI, shallow COMPTUEX, or ULT exercise.	0 events
Vessel surveys—VACAPES/CHPT/JAX (study 2)	1) Monthly surveys in Onslow Bay 2) Monthly surveys in JAX 3) Behavioral response study off Cape Hatteras	n/a	48 days	30 days: 3 days Onslow; 23 days Cape Hatteras; 3 days JAX
Marine Mammal Observers (studies 1 and 3)		SEASWITI or ULT	2 events in conjunction with SEASWITI or ULT exercises.	
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	SEASWITI, shallow COMPTUEX, or ULT	2 deployments of pop-up buoys in conjunction with SEASWITI, shallow COMPTUEX, or ULT exercises.	3 HARP deployments, and a total of zero hrs of towed array recording effort in Onslow Bay and JAX
MMO/Lookout Comparison Study	Develop observer comparison study and perform trials		40 hrs	Completed study design and initial pilot study analysis. Continued methods refinement and data collection

[1] Accomplishments only cover approximately the first 6 months of the current LOA period. Activities counting toward fulfillment of 2011 commitments are ongoing.

Table 3. U.S. Navy-funded Monitoring Accomplishments Within the AFAST Study Area From January 22, 2010 Through January 21, 2011, Corresponding to the Second Year LOA Period.

Study Type	Description of U.S. Navy EIS/LOA monitoring	Associated event type	MMPA/ESA requirement	Accomplished1
Aerial surveys – during training event (studies 1 and 3)	n/a	SEASWITI, shallow COMPTUEX, or ULT	1 event in conjunction with a SEASWITI, shallow COMPTUEX, or ULT exercise.	Aug 2010 ASW monitoring, VACAPES Dec 2010 ASW monitoring, SEASWITI, JAX
Aerial surveys – before and after training event (studies 2 and 4)	n/a	SEASWITI, shallow COMPTUEX, or ULT	1 event in conjunction with a SEASWITI, shallow COMPTUEX, or ULT exercise.	Aug 2010 ASW monitoring, VACAPES Dec 2010 ASW monitoring, SEASWITI, JAX
Aerial surveys – Onslow Bay and JAX (study 2)	1) Monthly surveys in Onslow Bay 2) Monthly surveys in JAX 3) Surveys off Cape Hatteras	n/a	48 days	55 days: 35 days Onslow Bay, 20 days JAX
Vessel surveys – during training event (study 3)	n/a	SEASWITI, shallow COMPTUEX, or ULT	2 events in conjunction with SEASWITI, shallow COMPTUEX, or ULT exercises.	Dec 2010, ASW monitoring, SEASWITI, JAX
Vessel surveys—Onslow Bay and JAX (study 2)	1) Monthly surveys in Onslow Bay 2) Monthly surveys in JAX 3) Behavioral response study off Cape Hatteras	n/a	48 days	29 days: 12 days Onslow Bay; 17 days JAX
Marine Mammal Observers (studies 1 and 3)		SEASWITI or ULT	2 events in conjunction with SEASWITI or ULT exercises.	
Passive Acoustic Monitoring (study 2)	1) Maintenance of 4 High-frequency Recording Packages (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	SEASWITI, shallow COMPTUEX, or ULT	2 deployments of pop-up buoys in conjunction with SEASWITI, shallow COMPTUEX, or ULT exercises.	6 deployments of HARPs, and a total of ~70 hrs of towed array recording effort in Onslow Bay and JAX
MMO/Lookout Comparison Study	Develop observer comparison study and perform trials		40 hrs	Completed study design and initial pilot study analysis. Continued methods refinement and data collection

3. Longitudinal Baseline Monitoring – VACAPES/CHPT/JAX

In 2005, the U.S. Navy contracted with a consortium of researchers from Duke University, the University of North Carolina at Wilmington (UNCW), the University of St. Andrews, and the NMFS' Northeast Fisheries Science Center to conduct a pilot study and subsequently develop a survey and monitoring plan. The plan prescribed a recommended approach for data collection at the proposed site of the Undersea Warfare Training Range (USWTR) in Onslow Bay off the coast of North Carolina. The identified methods included surveys (aerial/shipboard, frequency, spatial extent, etc.), PAM, photo-identification and data analysis (e.g., standard line-transect, spatial modeling) appropriate to establish a fine-scale seasonal baseline of protected species distribution and abundance (DoN 2010b). As a result, a protected marine species monitoring program was initiated in June 2007 in Onslow Bay. Due to a re-evaluation of the proposed location for USWTR, the preferred location was changed to the JAX OPAREA, and subsequently a parallel monitoring program was initiated in January 2009 at the new USWTR site off the coast of Jacksonville, Florida (DoN 2010b). In 2011, the program expanded beyond the previous Onslow Bay focus site to include a region off the coast of Cape Hatteras to the north, which also serves to complement a pilot whale behavioral study that was initiated in that region at the same time. The overall approach to program design and methods has been consistent with the work that has been performed in Onslow Bay over the past four years, and work at both locations continues to evolve in response to the AMR process and changing priorities.

In 2011, the longitudinal baseline study consisted of year-round multi-disciplinary monitoring through the use of shipboard and aerial visual surveys (24 days at each location, annually), photo-identification studies, biopsy sampling, and PAM with HARPs and towed arrays (DoN 2010b). Visual surveys were conducted monthly year-round (weather permitting) using sets of established pre-determined track lines and standard distance sampling techniques. Visual surveys complemented with PAM, using towed arrays and HARPs to catalog long-term species occurrence in all three regions. The original detailed plan for the USWTR monitoring programs is included as **Appendix C** and changes in the overall approach to this monitoring program are discussed in **Section III** – *Adaptive Management Recommendations*. A summary of accomplishments and basic results of these monitoring efforts for the reporting period is presented in the following subsections, and the previous annual report covering August 2009 through July 2010 is provided in **Appendix D**. The annual reporting period for this component of the AFAST monitoring program has been adjusted to avoid bisecting the field season and to allow researchers sufficient time to conduct analyses. As a result, a full report on activities since July 2010 will not be available until the spring of 2012 although a summary through July 2011 is included below. In addition, monthly progress reports covering all three locations (Cape Hatteras, Onslow Bay, and JAX) are provided in **Appendix E**.

Although the initial intent of the Onslow Bay and JAX monitoring program was to support development of the USWTR, the program has evolved into established fixed sites for the overall AFAST monitoring program, intended to provide robust baseline data supporting projects designed to examine the potential long-term effects to marine species that may be chronically exposed to ASW training. The monitoring at these sites provides a longitudinal baseline of marine species distribution and abundance in key U.S. 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 temporary fixed passive-acoustic arrays. 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.

3.1 VACAPES/CHPT/JAX Aerial Visual Surveys

Aerial surveys were conducted using standard distance-sampling protocols in all sites. See **Appendix D**, which includes the 2010 annual report with detailed analyses of survey data and **Appendix E**, the compilation of the individual detailed monthly trip reports for August 2, 2010 through August 1, 2011.

3.1.1 VACAPES (Cape Hatteras)

Aerial surveys were initiated at the Cape Hatteras survey area during May 2011. The survey area is made up of 26 tracklines, and the initial primary focus has been on the central 16 lines. To date, the four northernmost and five southernmost lines have not been surveyed. Sightings and effort details are presented in **Tables 4** and **5**, and **Figures 2** and **3**.

Table 4. Sightings From Aerial Surveys Conducted in the Cape Hatteras Survey Area, May Through July 2011.

Common Name	Scientific Name	# of Sightings	# of Individuals
Short-finned Pilot Whale	*Globicephala macrorhynchus*	13	304
Sperm Whale	*Physeter macrocephalus*	10	18
Mesoplodon Beaked Whale	*Mesoplodon* spp.	3	6
Cuvier's Beaked Whale	*Ziphius cavirostris*	1	4
Fraser's Dolphin	*Lagenodelphis hosei*	1	75
Bottlenose Dolphin	*Tursiops truncates*	8	113
Atlantic Spotted Dolphin	*Stenella frontalis*	1	50
Rough-toothed Dolphin	*Steno bredanensis*	1	4
Common Dolphin	*Delphinus delphis*	1	300
Unidentified Delphinid		1	4
Unidentified Cetacean		3	3
Loggerhead Turtle	*Caretta caretta*	18	27
Unidentified Sea Turtle		7	7
Unidentified Shark		2	2
Manta Ray	*Manta birostris*	5	5

Table 5. Effort Details From Aerial Surveys Conducted in the Cape Hatteras Survey Area, May Through July 2011.

Number of Survey Days	6
Total Hrs Underway*	37.3
Total Tracklines Covered	37.5

* Total hrs underway reported as Hobbs hrs = total engine time

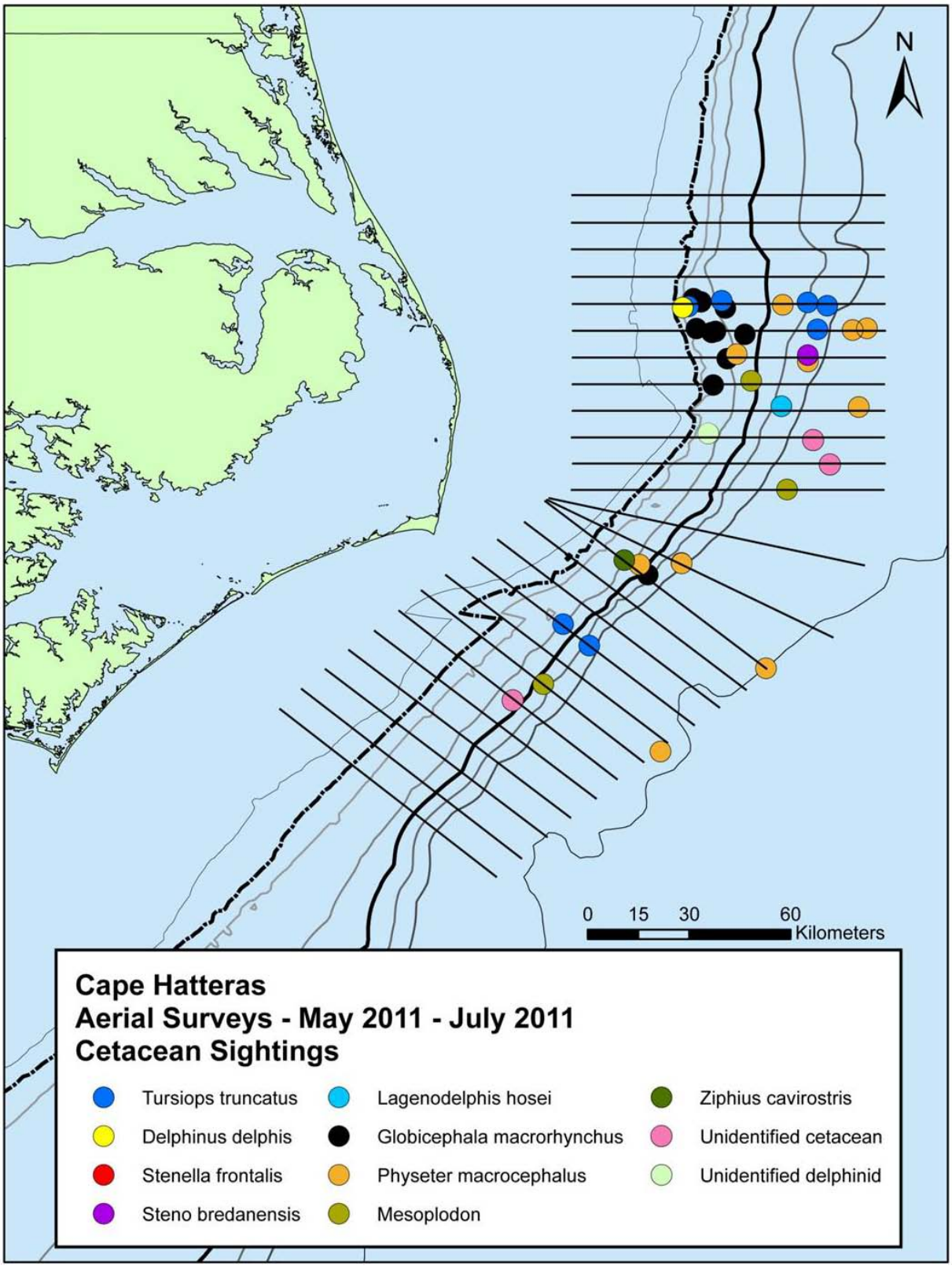

Figure 2. Locations of cetacean sightings from aerial surveys conducted in the Cape Hatteras survey area, May through July 2011.

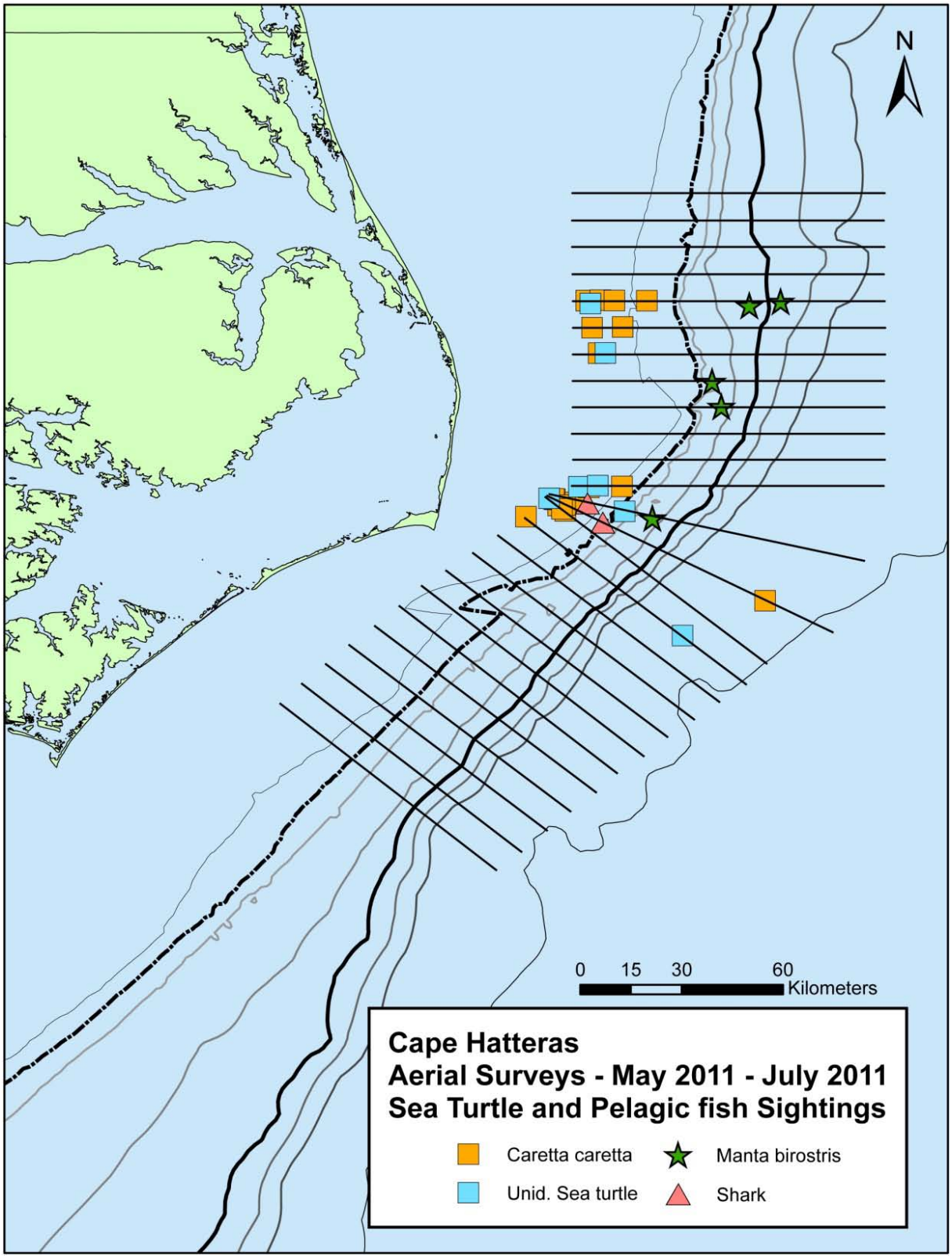

Figure 3. Locations of sea turtle and pelagic fish sightings from aerial surveys conducted in the Cape Hatteras survey area, May through July 2011.

3.1.2 Onslow Bay

The Onslow Bay site was surveyed from August 2010 through April 2011. Aerial survey effort was then shifted to the Cape Hatteras site starting in May 2011. Aerial surveys were conducted on 13 days during the period, representing 84 lines surveyed. No survey effort was conducted in January 2010 due to unfavorable weather conditions. Sightings and effort details are presented in **Tables 6** and **7**, and **Figures 4, 5,** and **6**.

Table 6. Sightings From Aerial Surveys Conducted in the Onslow Bay Survey Area, August 2010 Through April 2011.

Common Name	Scientific Name	# of Sightings	# of Individuals
Humpback Whale	*Megaptera novaeangliae*	1	2
Minke Whale	*Balaenoptera acutorostrata*	2	3
Bottlenose Dolphin	*Tursiops truncatus*	21	679
Atlantic Spotted Dolphin	*Stenella frontalis*	10	411
Risso's Dolphin	*Grampus griseus*	2	12
Unidentified Delphinid		3	11
Unidentified Cetacean		2	9
Loggerhead Turtle	*Caretta caretta*	89	181
Unidentified Sea Turtle		38	53
Unidentified Shark		11	11
Manta Ray	*Manta birostris*	15	17
Ocean Sunfish	*Mola mola*	8	9

Table 7. Effort Details From Aerial Surveys Conducted in the Onslow Bay Survey Area, August 2010 Through April 2011.

Number of Survey Days	13
Total Hrs Underway*	64.7
Total Tracklines Covered	84

* Total hrs underway reported as Hobbs hrs = total engine time

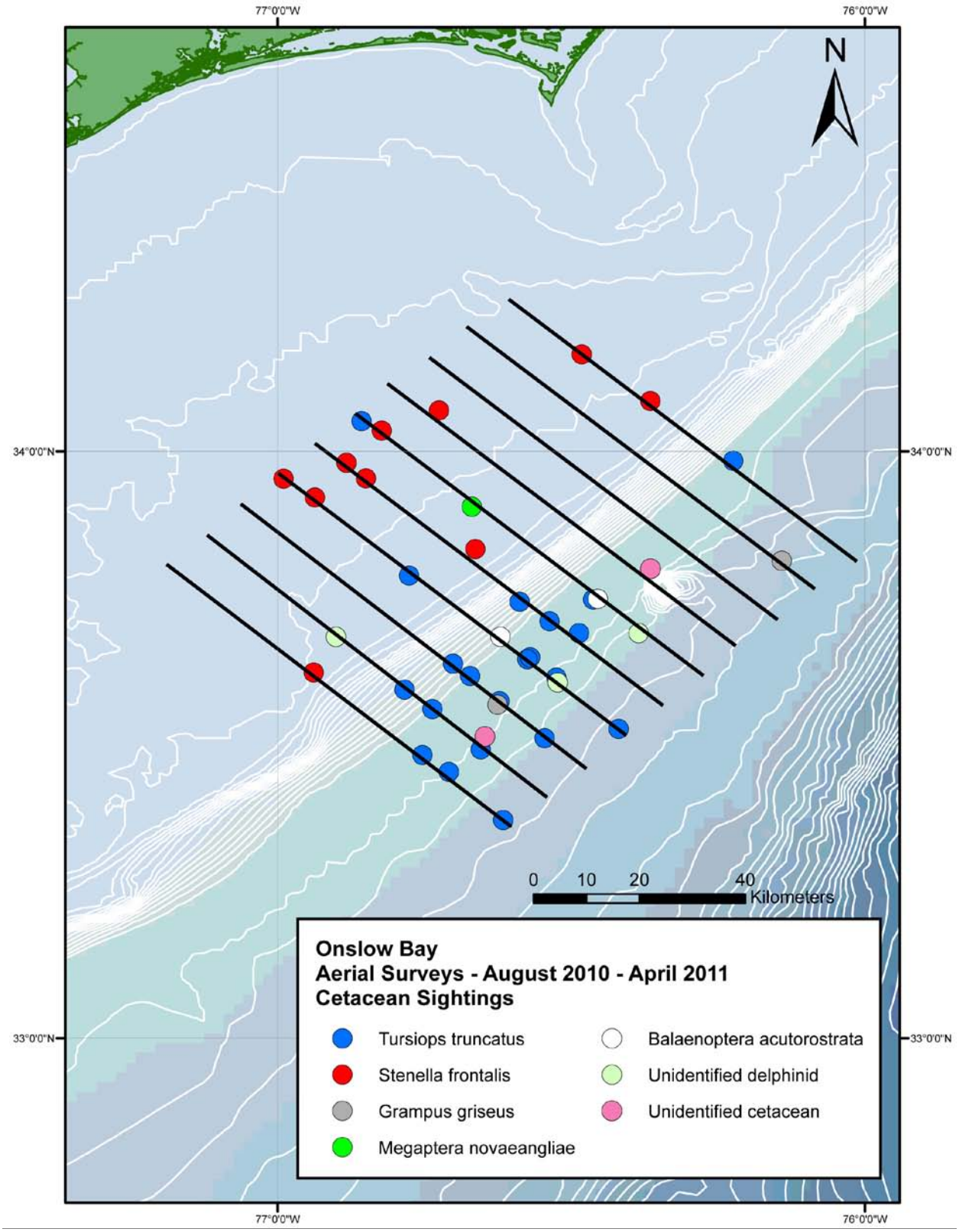

Figure 4. Locations of cetacean sightings from aerial surveys conducted in the Onslow Bay survey area, August 2010 through April 2011.

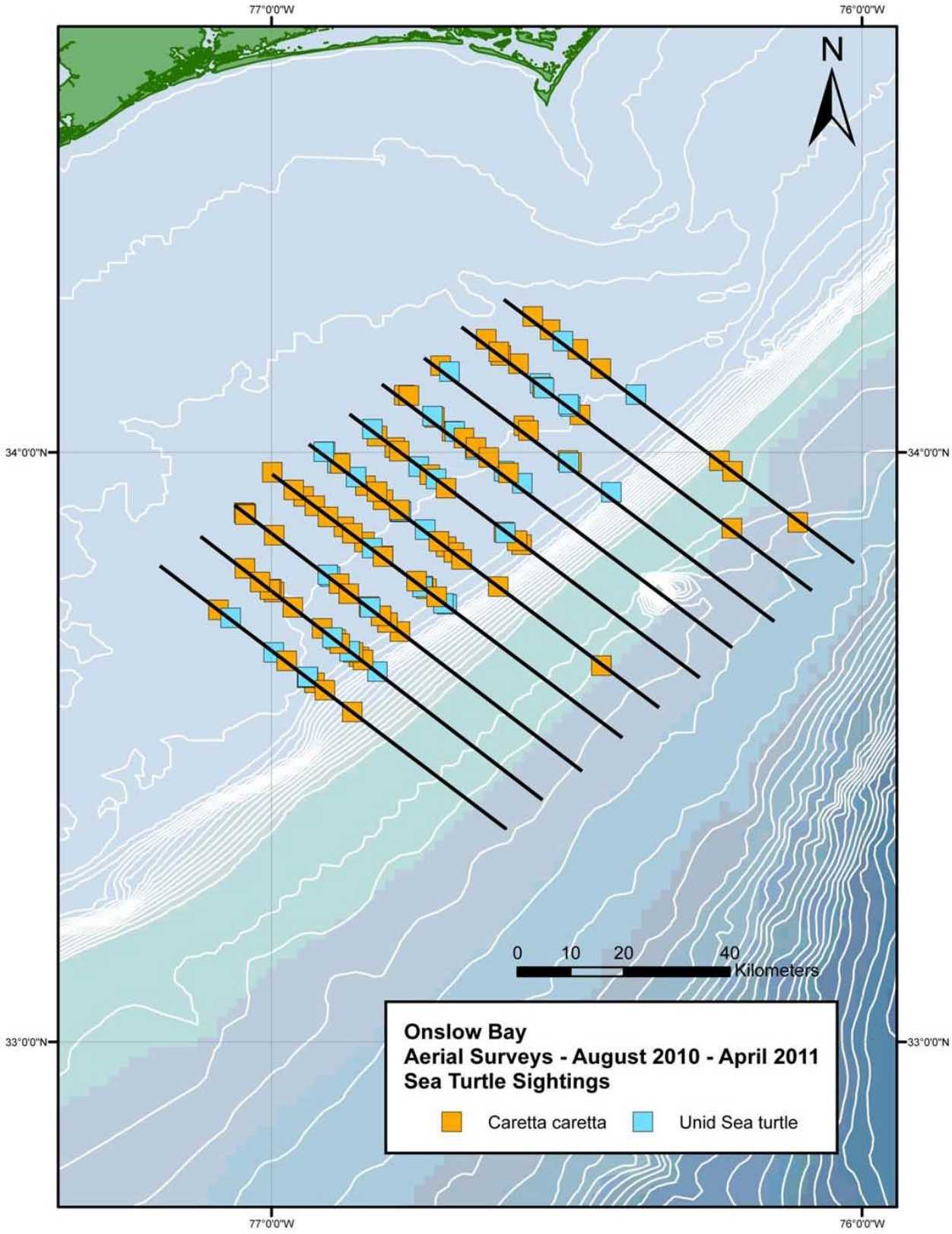

Figure 5. Locations of sea turtle sightings from aerial surveys conducted in the Onslow Bay survey area, August 2010 through April 2011.

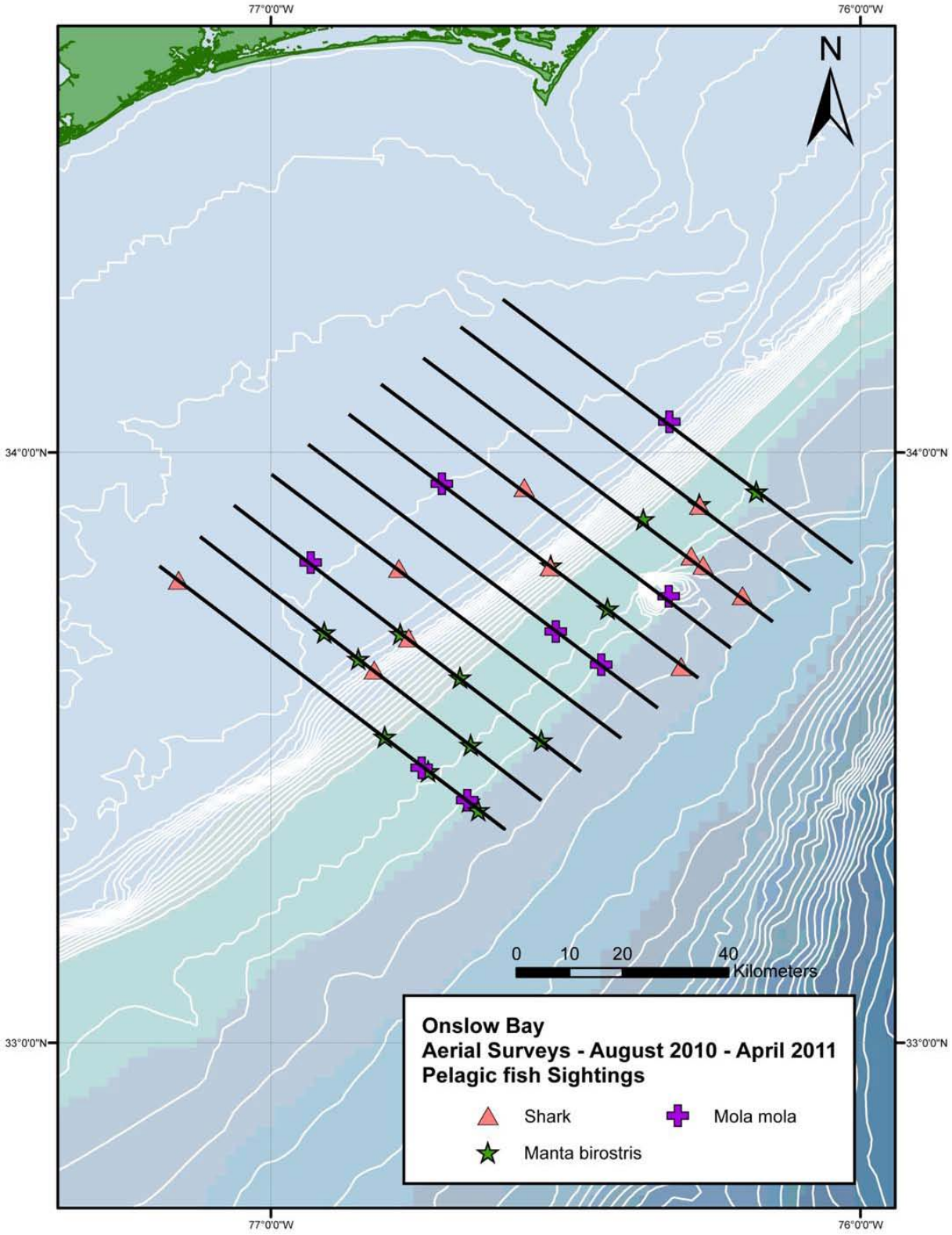

Figure 6. Locations of pelagic fish sightings from aerial surveys conducted in the Onslow Bay survey area, August 2010 through April 2011.

3.1.3 JAX

The JAX site was surveyed from August 2010 through July 2011. Aerial surveys were conducted on 27 days during this period, representing 190 lines surveyed. No survey effort was conducted in March 2011 due to unfavorable weather conditions. Aerial survey effort was reduced in April 2011 due to considerable damage to the survey plane from an incident of a taxiing plane hitting the parked aircraft; the plane was deemed inoperable for the remainder of the survey week. Sightings and effort details are presented in **Tables 8** and **9**, and **Figures 7, 8,** and **9**.

Table 8. Sightings From Aerial Surveys Conducted in the Jacksonville Survey Area, August 2010 Through July 2011.

Common Name	Scientific Name	# of Sightings	# of Individuals
Minke Whale	*Balaenoptera acutorostrata*	3	5
Humpback Whale	*Megaptera novaeangliae*	1	1
Short-finned Pilot Whale	*Globicephala macrorhynchus*	7	124
Bottlenose Dolphin	*Tursiops truncatus*	83	665
Atlantic Spotted Dolphin	*Stenella frontalis*	69	1366
Rough-toothed Dolphin	*Steno bredanensis*	1	45
Risso's Dolphin	*Grampus griseus*	13	248
Unidentified Delphinid		6	17
Loggerhead Turtle	*Caretta caretta*	443	598
Leatherback Turtle	*Dermochelys coriacea*	28	28
Kemp's Ridley Turtle	*Lepidochelys kempii*	2	2
Unidentified Sea Turtle		128	159
Whale Shark	*Rhincodon typus*	2	2
Unidentified Shark		76	269
Manta Ray	*Manta birostris*	8	10
Ocean Sunfish	*Mola mola*	20	20

Table 9. Effort Details for Aerial Surveys Conducted in the Jacksonville Survey Area, August 2010 Through July 2011.

Number of Survey Days	27
Total Hrs Underway *	149.2
Total Tracklines Covered	190

* Total hrs underway reported as Hobbs hrs = total engine time

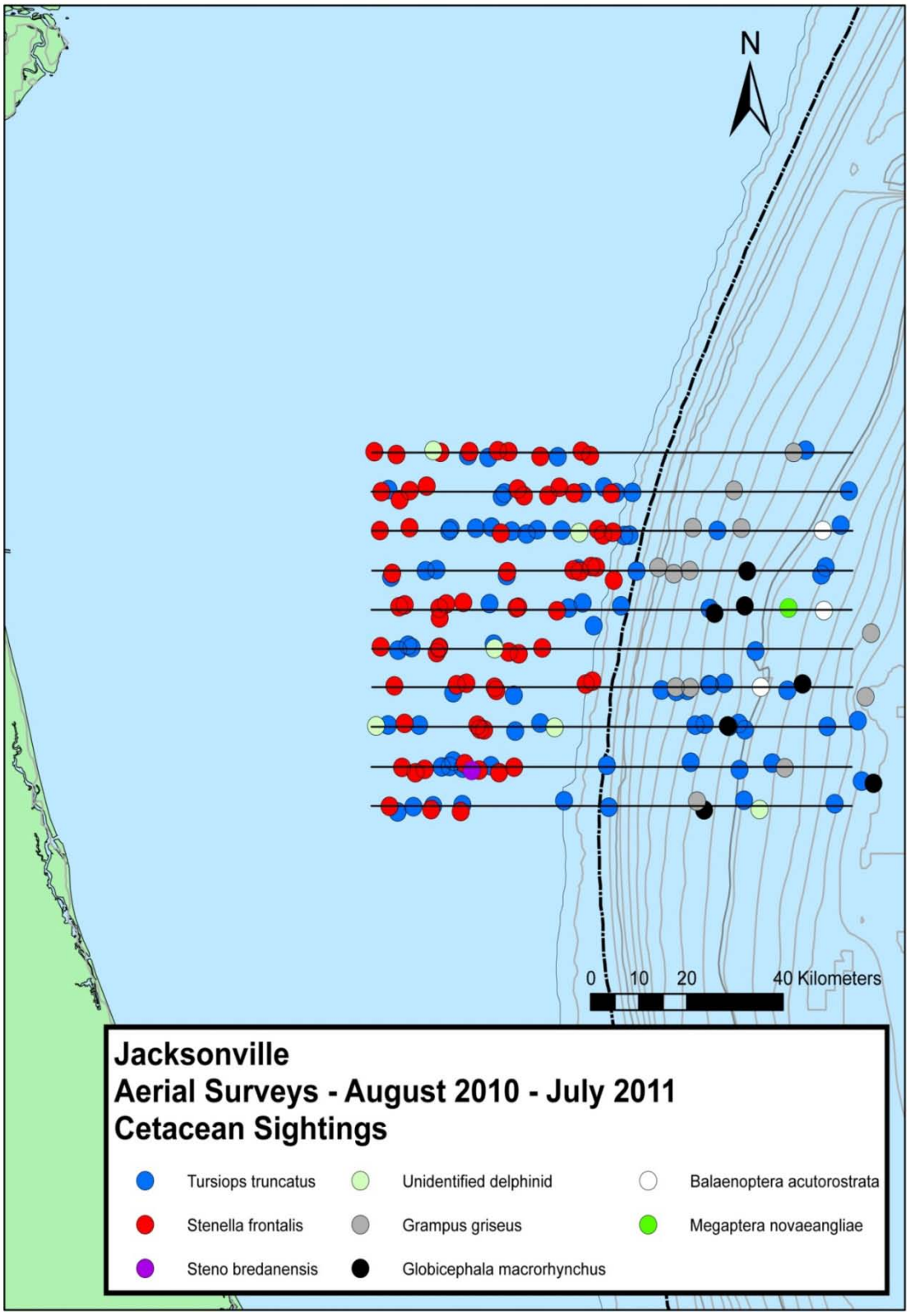

Figure 7. Locations of cetacean sightings from aerial surveys conducted in the JAX survey area, August 2010 through July 2011.

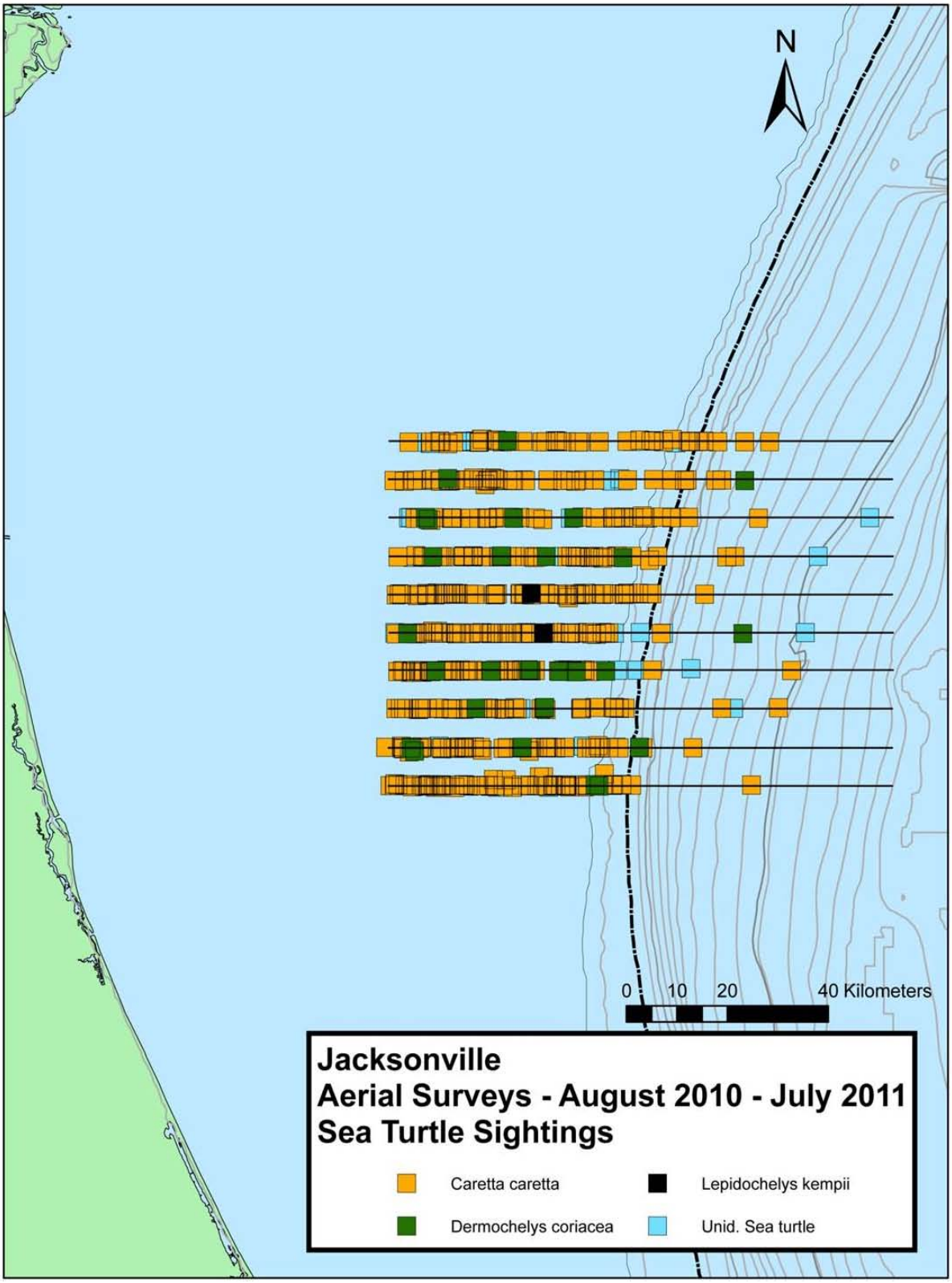

Figure 8. Locations of sea turtle sightings from aerial surveys conducted in the JAX survey area, August 2010 through July 2011.

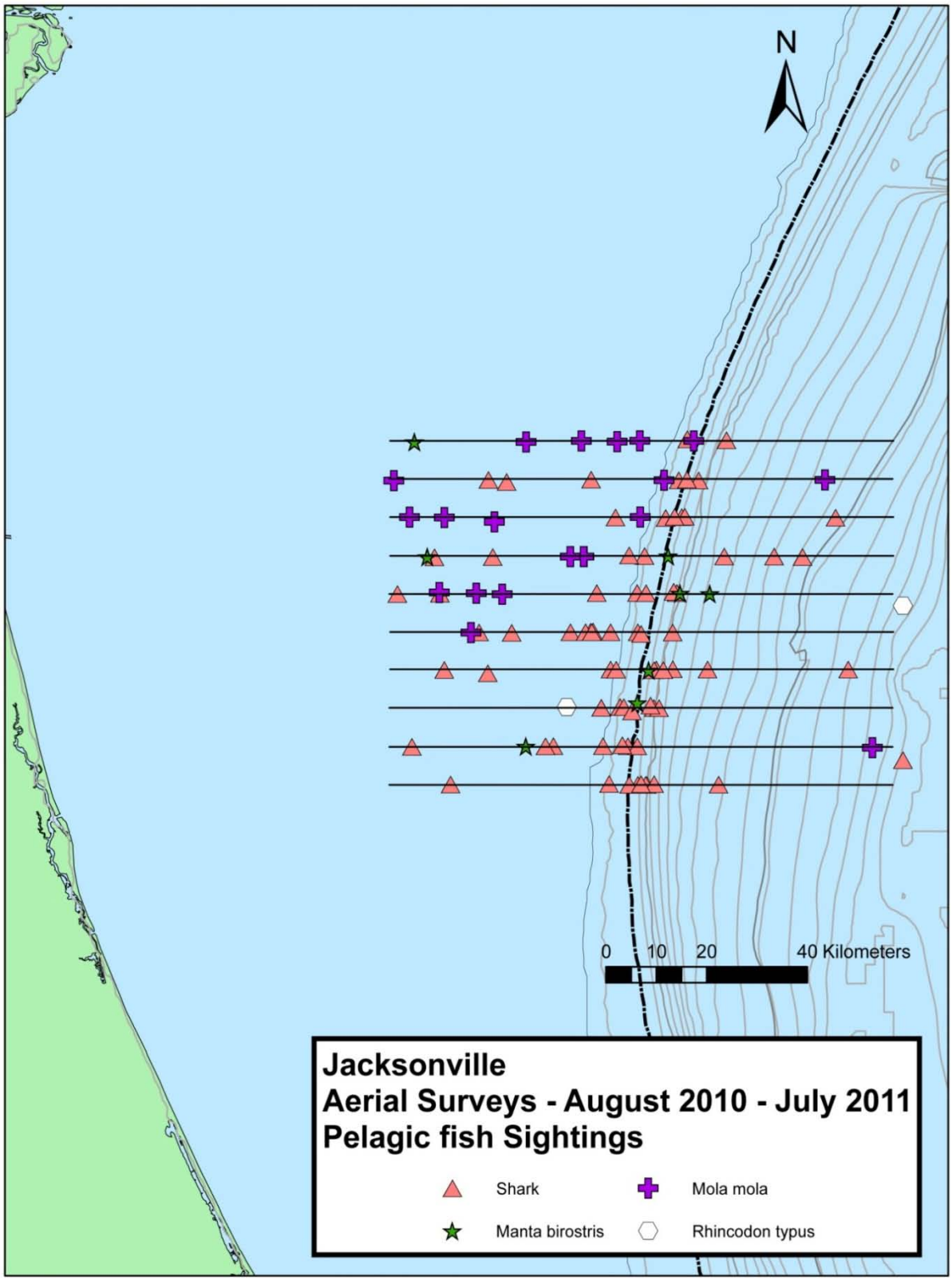

Figure 9. Locations of pelagic fish sightings from aerial surveys conducted in the JAX survey area, August 2010 through July 2011.

3.2 VACAPES/CHPT/JAX Vessel Visual Surveys

Vessel surveys were conducted using standard distance-sampling protocols in the Onslow Bay and JAX sites from August 1, 2010 through April 30, 2011. Fieldwork was also initiated off of Cape Hatteras in July 2010. Vessel survey methodology changed from line-transects to biopsy and photo-identification sampling beginning in May 2011.

3.2.1 Cape Hatteras

Researchers from Duke University and Woods Hole Oceanographic Institute began conducting efforts during July 2010 to deploy DTAGS (Johnson and Tyack 2003) on short-finned pilot whales off Cape Hatteras (see DoN 2010a). During four days at sea, researchers deployed five DTAGs. As a continuation of this effort, a behavioral response study was conducted in May and June 2011, targeting short-finned pilot whales along the continental shelf break off Cape Hatteras (refer to **Subsection 4** *Pilot Whale Behavioral Response Study – Cape Hatteras)*.

Fieldwork was conducted off Cape Hatteras on six days in May (May 22, 27, 28, 29, 30, and 31) and seven days in June (June 4, 5, 7, 14, 15, 22, and 27). On ten of these days (excluding May 27, 31, and June 22), there were two small boats surveying independently of each other. Therefore, field time was doubled each day that both boats were operating, for a total of 23 small-boat days. During the 13 field days, 82 sightings of seven species were recorded: short-finned pilot whales, bottlenose dolphins, common dolphins (*Delphinus delphis*), Atlantic spotted dolphins, Risso's dolphins, Cuvier's beaked whales, and sperm whales (**Table 10; Figure 10**).

Table 10. Summary of Cetacean Sightings in the Cape Hatteras Survey Area, May and June 2011.

Common Name	Scientific Name	Sightings	Individuals
Common Dolphin	*Delphinus delphis*	6	750
Short-finned Pilot Whale	*Globicephala macrorhynchus*	33	871
Risso's Dolphin	*Grampus griseus*	2	12
Sperm Whale	*Physeter macrocephalus*	1	1
Atlantic Spotted and Common Dolphin mixed	*Stenella* and *Delphinus*	1	85
Atlantic Spotted and Bottlenose Dolphin mixed	*Stenella* and *Tursiops*	1	100
Atlantic Spotted Dolphin	*Stenella frontalis*	8	582
Bottlenose Dolphin	*Tursiops truncatus*	27	403
Cuvier's Beaked Whale	*Ziphius cavirostris*	3	6

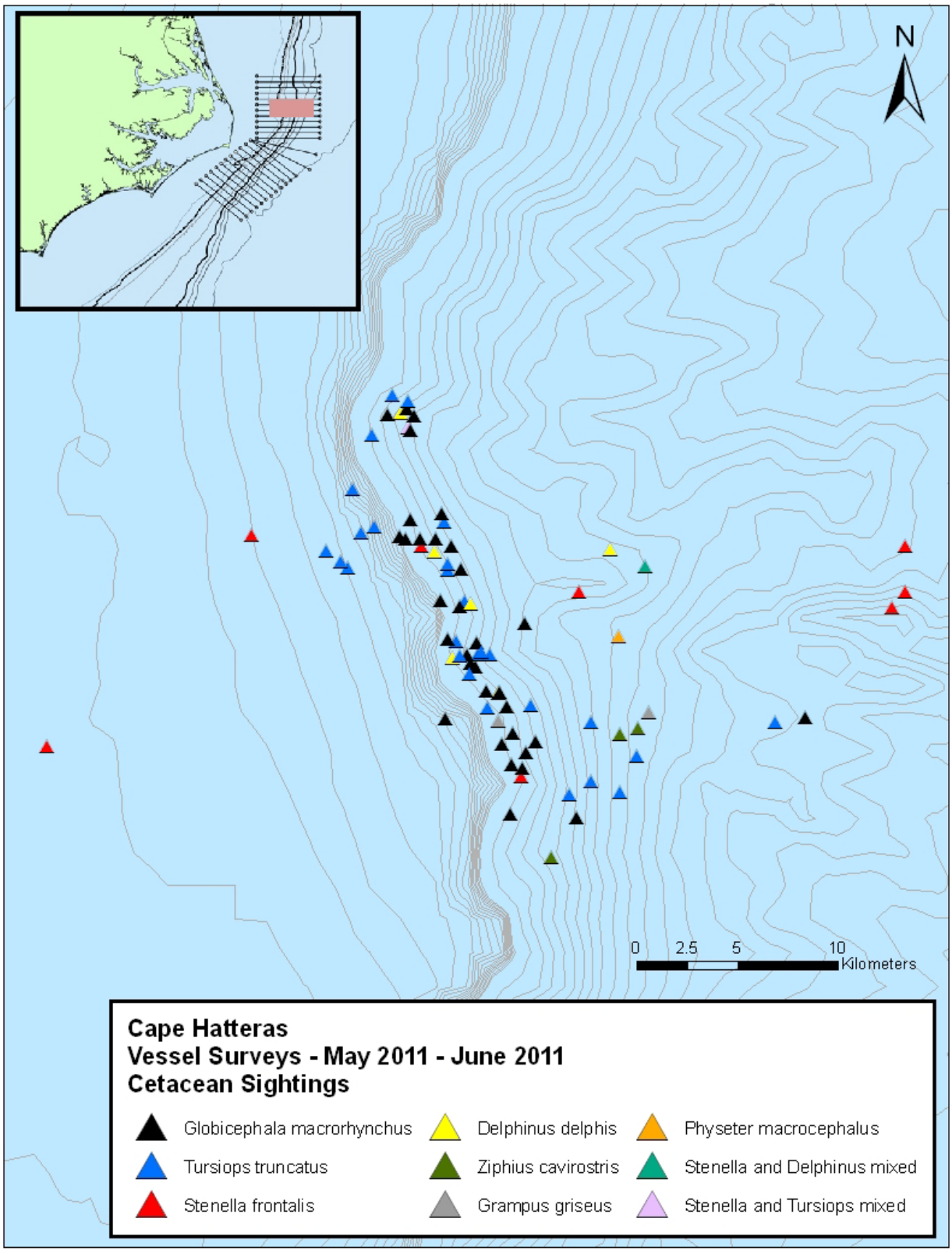

Figure 10. Summary of cetacean sightings in the Cape Hatteras survey area, May and June 2011.

Over the duration of the entire field project, 23 biopsy samples were collected from bottlenose dolphins (*n*=13), Atlantic spotted dolphins (*n*=6), and short-finned pilot whales (*n*=4) (**Table 11**). There was one additional skin sample from a short-finned pilot whale, obtained from the suction cup of a DTAG.

Table 11. Biopsy Samples Taken From Animals in the Cape Hatteras Survey Area, May and June 2011.

Common Name	Scientific Name	Number of Biopsies
Short-finned Pilot Whale	*Globicephala macrorhynchus*	4
Atlantic Spotted Dolphin	*Stenella frontalis*	6
Bottlenose Dolphin	*Tursiops truncatus*	13

The focus was on these species to address the following matters: (i) differentiating two forms of bottlenose dolphins (all samples to date have been collected from the pelagic white-peduncle form); (ii) examining the taxonomic identity of the small-bodied, pelagic form of Atlantic spotted dolphins; and (iii) determining sex of tagged short-finned pilot whales. Each tissue plug was sub-sampled and a reference sample will be provided to the NMFS-Southeast Fisheries Science Center's Marine Mammal Molecular Genetics Laboratory in Lafayette, Louisiana.

3.2.2 Onslow Bay

The Onslow Bay site was surveyed using line transect protocols from August 2010 through April 2011. Vessel surveys were conducted on 4 days during this period, representing 4 lines surveyed. No surveys were conducted during January through March 2011 due to unfavorable weather conditions. Two additional surveys for biopsy and photo-identification sampling were completed from May 2011 through July 2011. Sightings and effort details are presented in **Tables 12** and **13**, and **Figures 11** and **12**.

Table 12. Sightings From Vessel Surveys Conducted in the Onslow Bay Survey Area, August 2010 Through July 2011.

Common Name	Scientific Name	# of Sightings	# of Individuals
Bottlenose Dolphin	*Tursiops truncatus*	7	94
Atlantic Spotted Dolphin	*Stenella frontalis*	6	56
Loggerhead Turtle	*Caretta caretta*	2	2

Table 13. Effort Details for Vessel Surveys Conducted in the Onslow Bay Survey Area, August 2010 Through July 2011.

Number of Survey Days	6
Total Survey Hrs	19:30
Hrs On Effort	15:00
Total Tracklines Covered	4

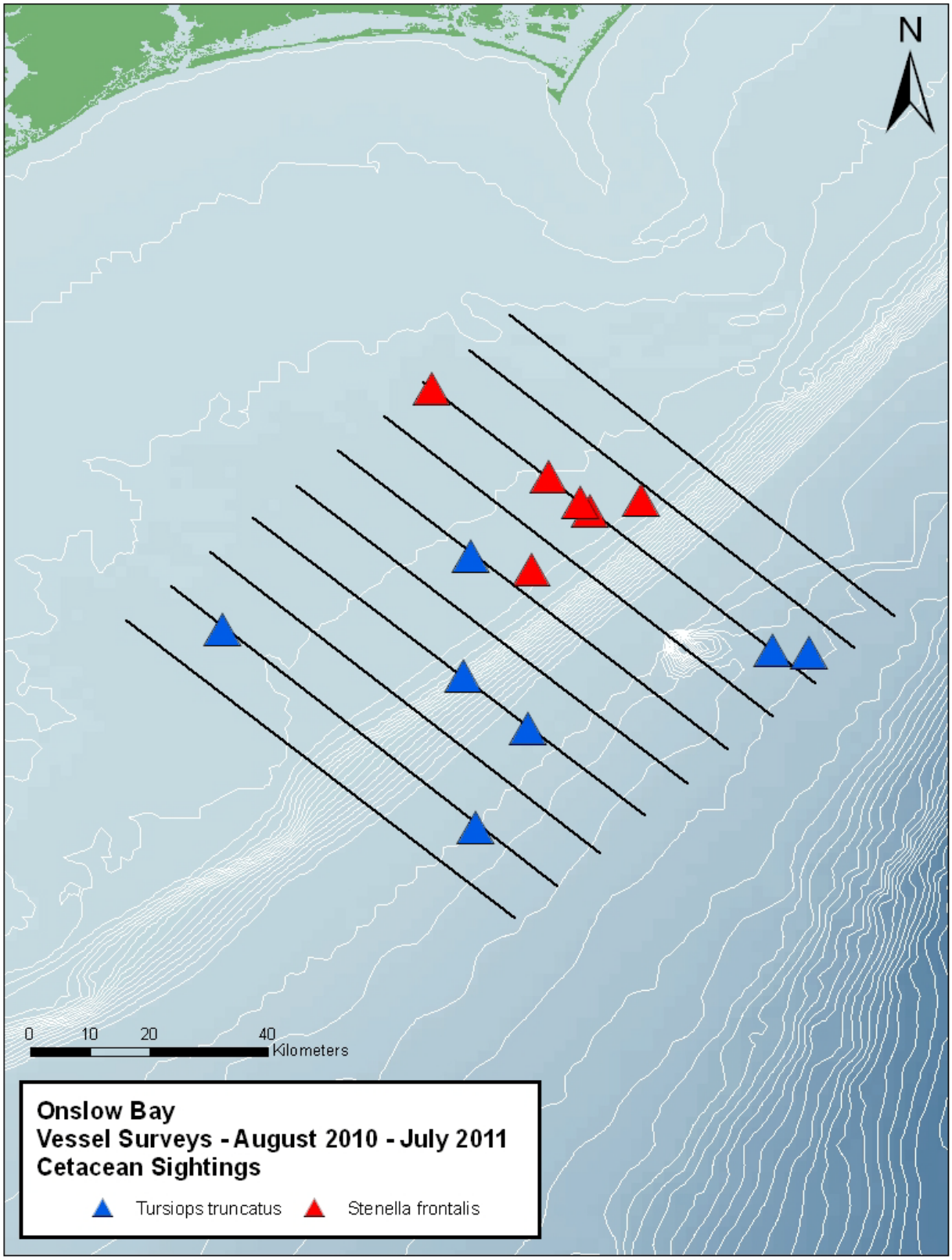

Figure 11. Locations of cetacean sightings from vessel surveys conducted in the Onslow Bay survey area, August 2010 through July 2011.

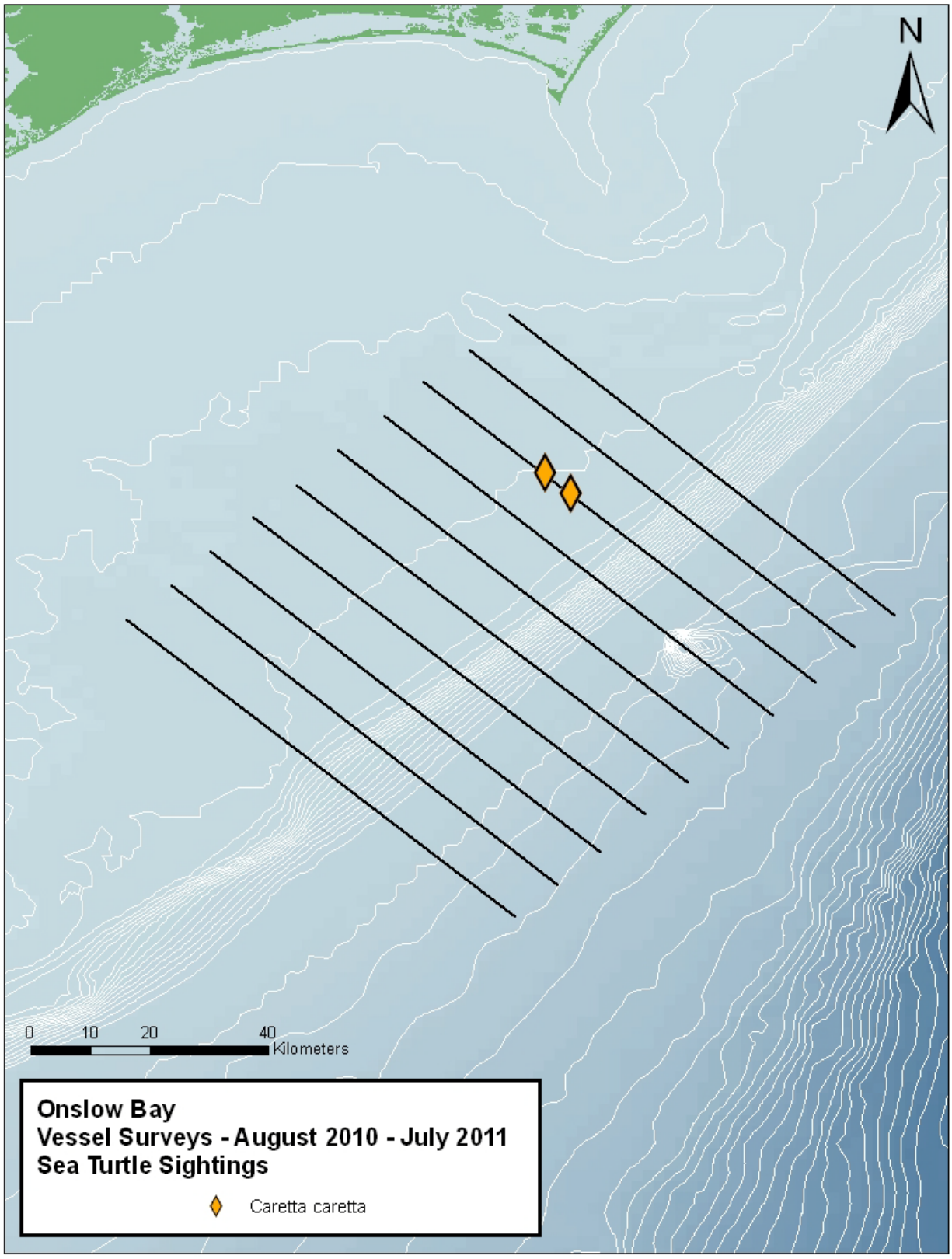

Figure 12. Locations of sea turtle sightings from vessel surveys conducted in the Onslow Bay survey area, August 2010 through July 2011.

3.2.3 JAX

The JAX site was surveyed using line-transect protocols from August 2010 through April 2011. Ten line-transect vessel surveys were conducted during this period, representing nine lines surveyed. There was no survey effort during February (a vessel survey on February 13 was aborted during transit to the range due to deteriorating sea conditions) or April. No vessel surveys utilizing the new biopsy and photo-identification methodology that went into effect as of May 2011 were conducted. Sightings and effort details are presented in **Tables 14** and **15**, and **Figures 13** and **14**.

Table 14. Sightings From Vessel Surveys Conducted in the Jacksonville Survey Area, August 2010 Through March 2011.

Common Name	Scientific Name	Sightings	Individuals
Bottlenose Dolphin	*Tursiops truncatus*	9	54
Atlantic Spotted Dolphin	*Stenella frontalis*	13	207
Hammerhead Shark	*Sphyrna* spp.	3	3
Leatherback Turtle	*Dermochelys coriacea*	7	7
Loggerhead Turtle	*Caretta caretta*	24	24
Unidentified Sea Turtle		8	8

Table 15. Effort Details for Vessel Surveys Conducted in the Jacksonville Survey Area, August 2010 Through March 2011.

Number of Survey Days	10
Total Survey Hrs	38:34
Hrs On Effort	33:36
Total Tracklines Covered	9

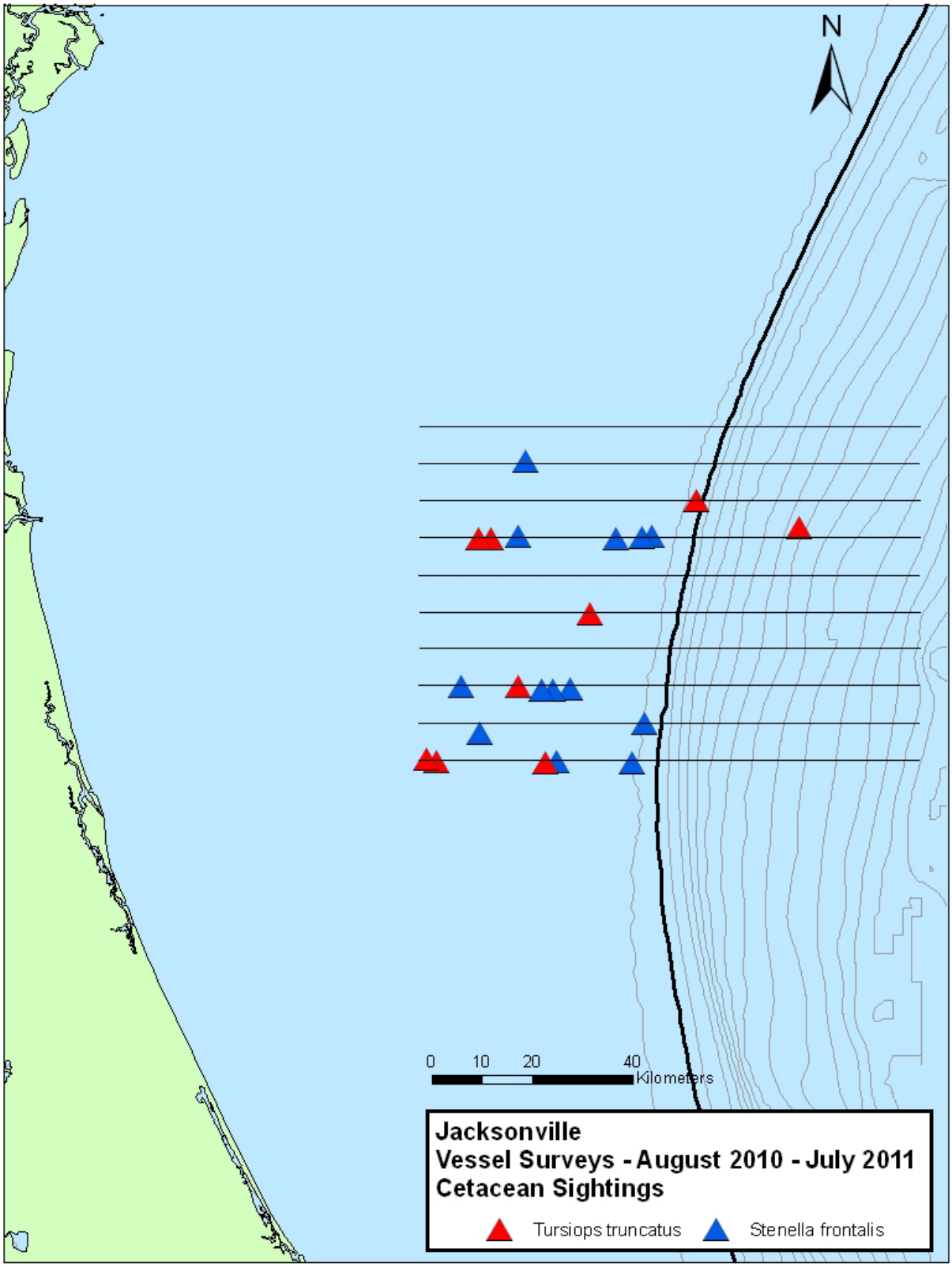

Figure 13. Locations of cetacean sightings from vessel surveys conducted in the JAX survey area, August 2010 through March 2011.

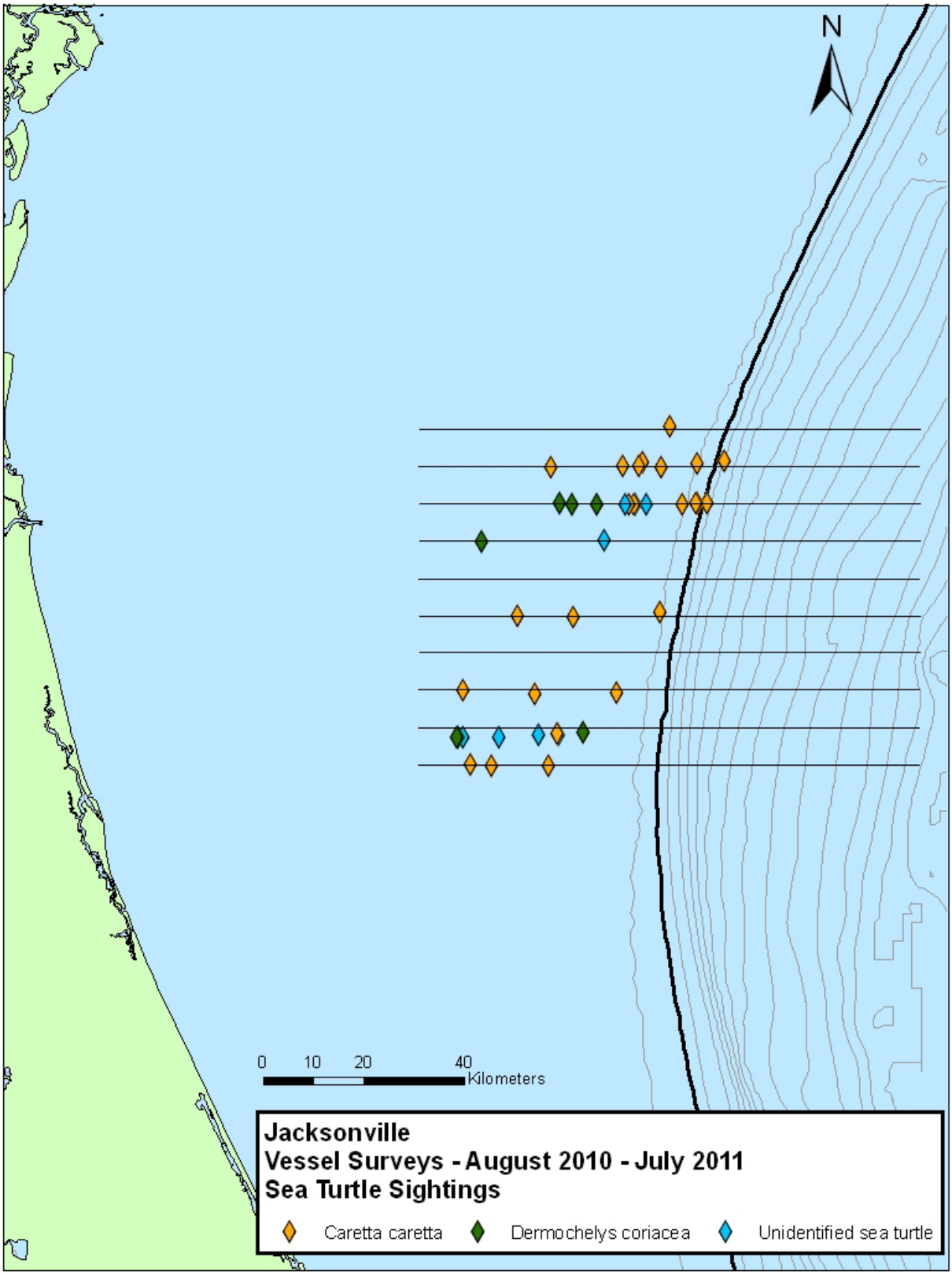

Figure 14. Locations of sea turtle sightings from vessel surveys conducted in the JAX survey area, August 2010 through March 2011.

3.3 VACAPES/CHPT/JAX Passive Acoustic Monitoring

Two PAM systems were used in conjunction with the VACAPES/CHPT/JAX baseline-monitoring projects: a multi-element towed array utilized during vessel surveys and bottom-mounted HARPs. The HARPs are intended to complement visual surveys by providing long-term continuous coverage regardless of weather conditions or day/night limitations.

3.3.1 Cape Hatteras

No PAM was conducted off Cape Hatteras from August 2, 2010 through August 1, 2011.

3.3.2 Onslow Bay

The towed array was deployed on one day of surveys during August 2010 in Onslow Bay. Three acoustic detections were made; one was identified to species (bottlenose dolphin) (**Table 16**). Two HARP deployments exceeding ten months were made in Onslow Bay for the reporting period (**Table 17, Figure 15**). Very large datasets were collected and are currently being analyzed.

Table 16. Effort Details for Towed Array Surveys Conducted in Onslow Bay, August 2, 2010 Through August 1, 2011.

Towed Array Effort (hrs)	# Detections	# Identified	Recording Effort (hrs)	# Survey Days with Array
4.82	3	1	2.3	1

Table 17. Deployment Details for the Onslow Bay HARPs.

Site	Deployment ID	Deployment Date	Retrieval Date	Depth (meters [m])	Sampling Rate	Duty Cycle	Data
A	Onslow 1 - 05A	29-Jul-10	10-Jun-11	174	200 kHz	5 minutes (min) on/5 min off	~2 TB
D	Onslow 2 - 05D	29-Jul-10	10-Jun-11	338	200 kHz	5 min on/5 min off	~2 TB

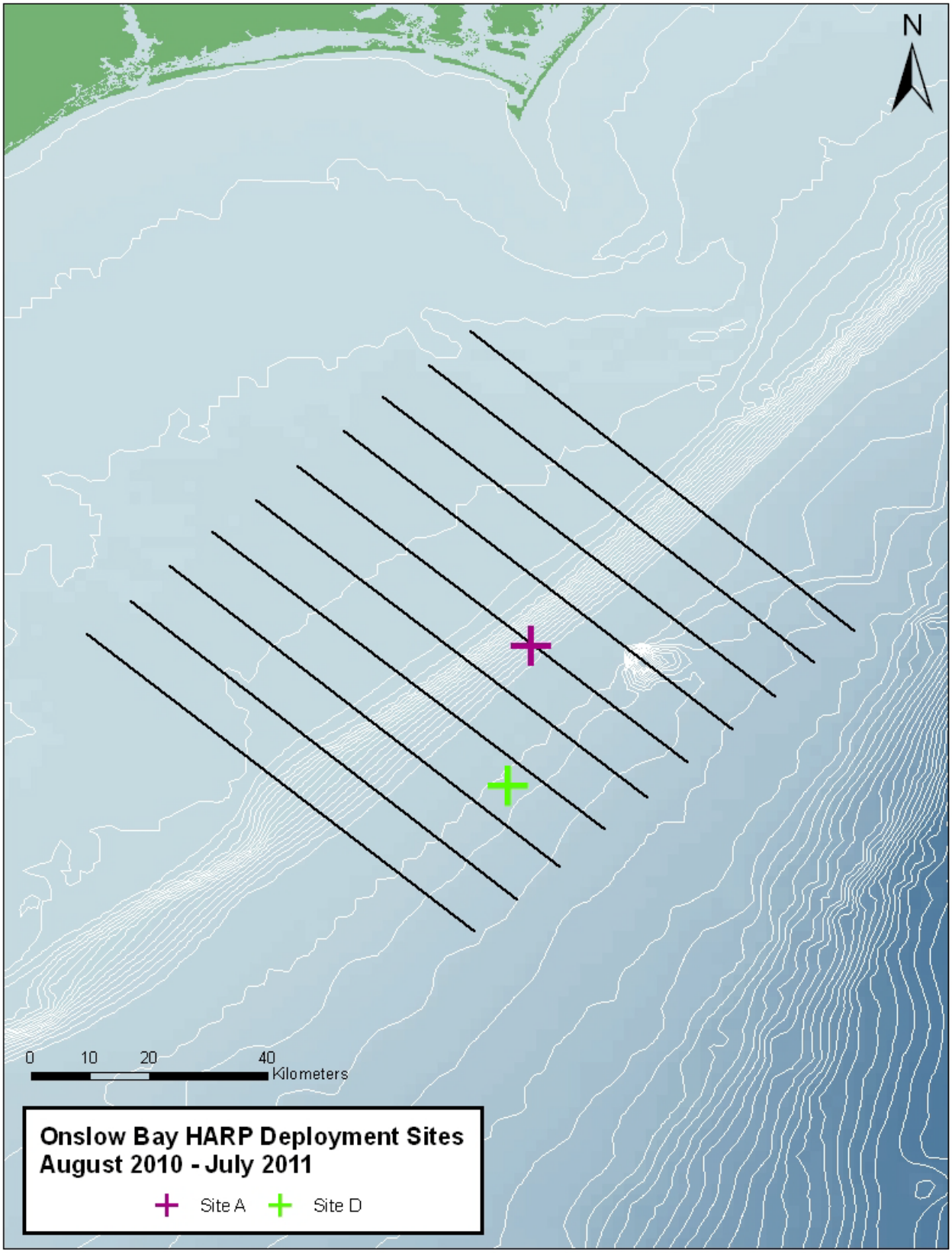

Figure 15. Locations of HARPs deployed in Onslow Bay, August 2010 through July 2011.

3.3.3 JAX

A towed array was deployed on one day of surveys during October 2010 in JAX. Three acoustic detections were made; one was identified to species (Atlantic spotted dolphin) (**Table 18**). Four HARP deployments were made in JAX during the reporting period—two each at both site A (30°17N, 80°13W) and site B (30°15N, 80°26W) (**Table 19, Figure 16**).

Table 18. Effort Details for Towed Array Surveys Conducted in the JAX USWTR, August 2, 2010 Through August 1, 2011.

Towed Array Effort (hrs)	# Detections	# Identified	Recording Effort (hrs)	# Survey Days with Array
N/A*	3	1	0.4	1

*computer problems resulted in loss of data

Table 19. Deployment Details for the JAX HARPs.

Site	Deployment ID	Deployment Date	Retrieval Date	Depth (m)	Sampling Rate	Duty Cycle	Data
A	JAX05-B	26-Aug-10	1-Feb-11	91	200 kHz	5 min on/10 min off	~2 TB
B	JAX05-A	26-Aug-10	1-Feb-11	37	200 kHz	5 min on/10 min off	~2 TB
A	JAX06-B	1-Feb-11	14-Jul-11	91	200 kHz	5 min on/10 min off	~2 TB
B	JAX06-A	1-Feb-11	14-Jul-11	37	200 kHz	5 min on/10 min off	~2 TB

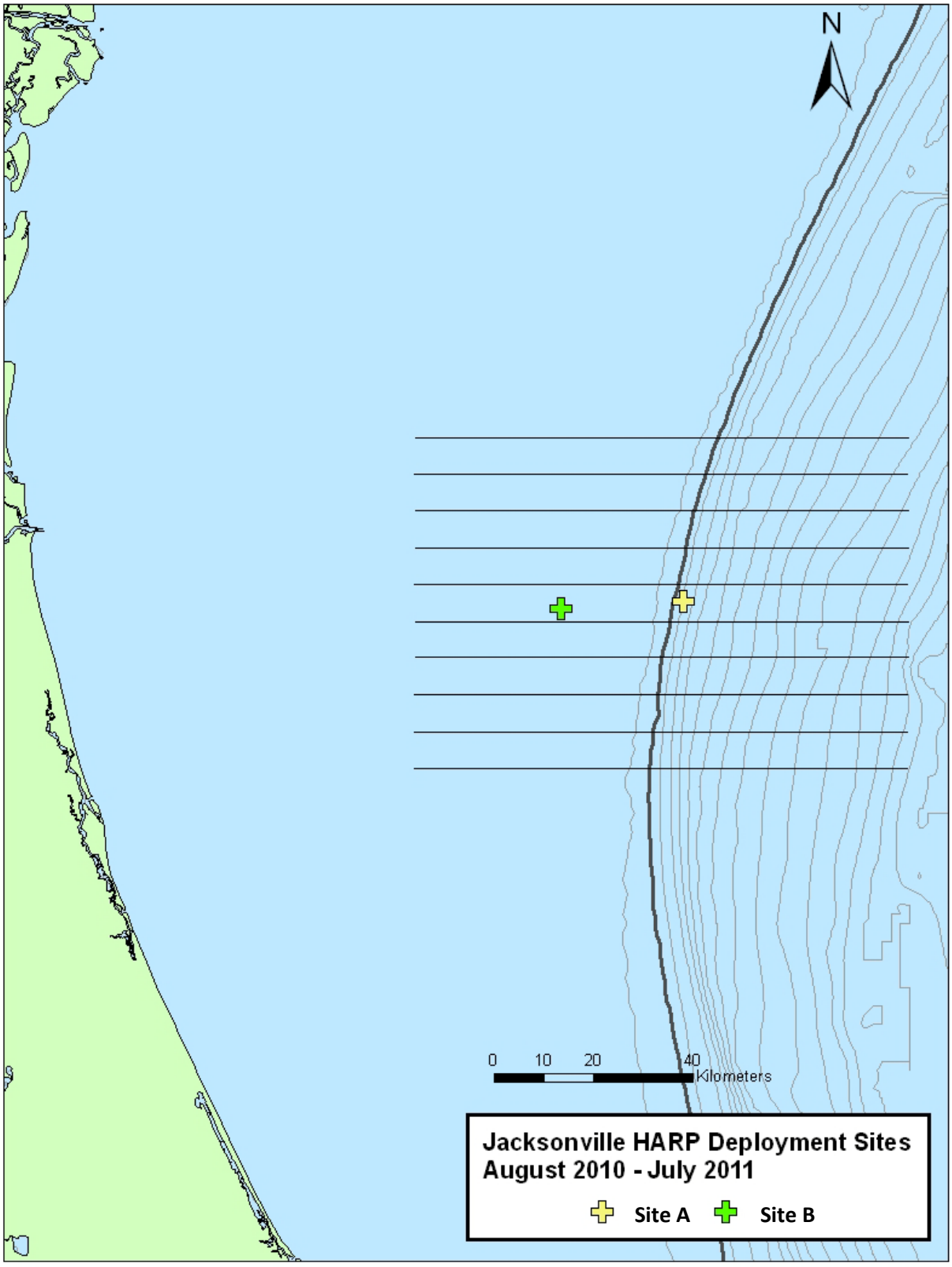

Figure 16. Locations of HARPs deployed in the JAX survey area, August 2010 through July 2011.

3.4 Acoustic Analyses for VACAPES/CHPT/JAX

3.4.1 Acoustic Analyses

Since the 2010 AFAST Annual Report (DoN 2010a), data analyses have been underway on PAM data collected in Onslow Bay, off Cape Hatteras, and in JAX.

Onslow Bay Towed Array Data:

Whistles and clicks from the towed-array data collected during survey efforts in Onslow Bay and off Cape Hatteras were analyzed for species-specificity. For whistles, 624 whistles from four species and 48 sightings were analyzed for species-specificity using CART (Classification and Regression Tree) analysis. CART analysis resulted in an optimal tree that used seven measured whistle variables and yielded an overall correct classification rate of 75.0 percent. Not all species visually sighted in Onslow Bay were included due to lack of acoustic recordings. Thus, this percentage is likely biased. Correct classification scores for the four species ranged from 40.0 to 92.3 percent. Clicks from five species recorded in Onslow Bay and off Cape Hatteras were analyzed, following methods similar to Soldevilla et al. (2008) to look at species-specificity. Distinct clicks were found only for Risso's dolphins.

Onslow Bay HARP Data:

Non-decimated data (>1 kilohertz [kHz]) from the fourth HARP deployment (HARPs 04A and 04C) have been analyzed using long-term averaged spectrograms (LTASs), and diel variation in the occurrence of vocal events was statistically tested using Kruskal-Wallis non-parametric analysis of variance. In addition, decimated data (<1 kHz) from the first four HARP deployments (01A, 02B, 03A, 04A, and 04C) were analyzed for baleen whale calls. Detections on three winter HARP deployments (01A, 04A, 04C) included fin whale 20-Hertz pulses; downsweeps (perhaps produced by sei whales); and four types of pulse trains (at least two of which are from minke whales [*Balaenoptera acutorostrata*]). Humpback whale calls were detected on one day in April (HARP 04C). Data were recently retrieved from the fifth HARP deployments in Onslow Bay (05A and 05D). The raw data are currently at Scripps Institution of Oceanography, undergoing the processing required, before analysis can take place.

JAX Towed Array:

A custom MATLAB-based spectral domain whistle and click detector was run on all of the towed-array data collected in JAX. This detector had poor performance (i.e., high false alarm rates) due to high noise in the shallow-water environment. The detections from the whistle and click detector were run through a Gaussian mixture model classification algorithm in MATLAB software (e.g., Roch et al. 2007) which resulted in low classification scores. The next step is to check all of the detections manually and remove the false detections. Then, the classifier can be re-run to determine whether acoustic detections can be statistically classified to species using both whistles and clicks.

JAX HARP Data:

Non-decimated data from HARPs 01A, 03A, and 04B were analyzed using LTASs. A quick review of some of the decimated data, from 04B, revealed right whale up-calls during April and May 2010. The data from the fifth deployment (05A and 05B) are ready to be analyzed. Data were recently retrieved from the sixth HARP deployments in JAX (06A and 06B). The raw data are currently at Scripps Institution of Oceanography, undergoing the processing required, before analysis can take place.

4. Pilot Whale Behavioral Response Study – Cape Hatteras

Controlled exposure playbacks were conducted with six pilot whales on May 27, 28, 29, 30, and June 4 and 7, 2011 (**Table 20; Appendix F**). Each whale was equipped with a DTAG, programmed for a 4-hour deployment. The 4-hour experimental periods consisted of: a 1-hour pre-exposure period; a 1-hour experimental or control period; a second 1-hour experimental or control period; and a 1-hour post-exposure period. During the entire 4 hrs, detailed, standardized behavioral observations of the focal (tagged) whale and its group were collected from one of the small vessels using a 5-minute point sampling protocol. During the experimental periods, the R/V *Volute* approached the tagged whale repeatedly with the Simrad EK60 scientific echo-sounder system turned on. The *Volute* made the same series of approaches in the control period, but with the echo sounder turned off. The choice of order of the control and experimental treatments was randomized for each whale. Five additional 4-hour follows on pilot whales were conducted without the EK60 or control treatments. All 11 DTAGs were retrieved and the data downloaded and backed up.

Table 20. DTAG Deployments on Pilot Whales in the Cape Hatteras Survey Area, May Through July 2011.

Date	Tag ID	Time On	Time Off	Total Time On Whale (hour:min)	Full Playback	Biopsy ID
27-May-11	Gm-11-147-a	9:04	13:33	4:29	Y	Sample from tag
28-May-11	Gm-11-148-a	10:29	14:50	4:21	Y	DWJ-11-03
29-May-11	Gm-11-149-b	10:33	14:50	4:17	N	AJR-11-02
29-May-11	Gm-11-149-c	10:58	14:24	3:26	Y	
30-May-11	Gm-11-150-a	10:54	15:10	4:16	Y	
30-May-11	Gm-11-150-b	11:25	14:46	3:21	N	
4-Jun-11	Gm-11-155-a	10:46	14:38	3:52	N	
5-Jun-11	Gm-11-156-a	13:33	16:29	2:56	N	
7-Jun-11	Gm-11-158-a	10:23	14:43	4:20	N	
7-Jun-11	Gm-11-158-b	12:10	16:35	4:25	Y	AJR-11-05
14-Jun-11	Gm-11-165-a	9:25	13:44	4:19	Y	AJR-11-06

5. Sea Turtle Satellite Tag Deployment

To refine estimates of sea turtle abundance in the survey area, three Wildlife Computer data-collecting Argos satellite SPLASH tags were deployed on adult nesting female loggerhead turtles in North Carolina during Summer 2010 (DoN 2010a). In addition to providing location, SPLASH tags transmit data in the form of 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 for refinement of our probability-of-detection function for loggerhead turtles by determining the proportion of time they spend at, or very close to the surface, where they can be sighted by visual observers. A summary of findings for each tagged turtle follows.

Pointe

After nesting on Emerald Isle, on June 26, 2010, Pointe, carrying deployed tag 096290, headed east, around Cape Lookout, and then moved into deeper waters farther off the coast. She then moved slowly southwest, into The Bahamas, through the Florida Keys, and onto the western side of the Florida Peninsula, in the GOM. This is the first adult loggerhead tracked while migrating from North Carolina into the GOM (**Figure 17**).

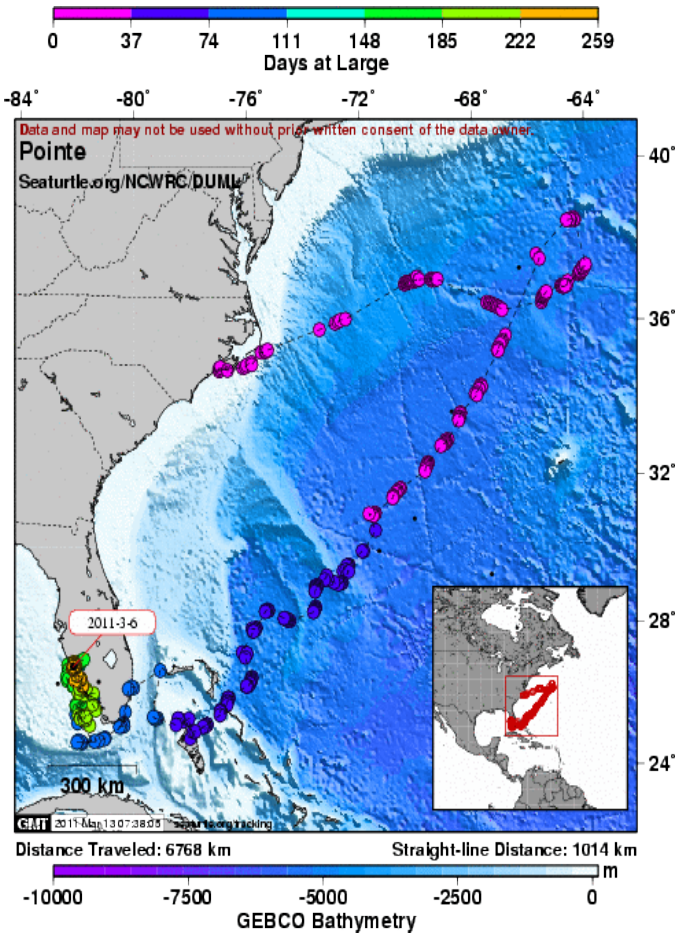

Figure 17. Map of satellite-tracked movements of Pointe, June 26, 2010 to March 6, 2011.

Pointe's average monthly dive depth decreased as summer turned to fall and winter (**Figure 18**). This follows closely with her track, showing a higher percentage of deeper dives when she traveled offshore after nesting and a higher percentage of relatively shallow dives as she settled in nearshore waters of Florida for the winter (**Figures 19** and **20**). Pointe's average dive duration increased as summer turned to fall and winter (**Figures 21** and **22**). The tag recorded relatively higher than expected average dive duration in June, but this result may have been skewed by the low number of days recorded in June (five days). A large percentage (approximately 90percent in July and August) of Pointe's dives lasted less than 5 min in duration (**Figure 22**). The SPLASH tag registers a new dive each time the saltwater switch is activated. In areas where waves are larger, this could cause a large number of dives to be recorded while the turtle is at the surface breathing. This may account for the large number of dives recorded less than 5 min in duration and less than 10 m in depth in July and August 2010, while Pointe travelled offshore. This hypothesis is further supported by the percentage of time that Pointe spent at different

depths. While a large percentage of her dives are shallow and of short duration, she did not spend a proportional amount of dive time at shallow depths, but instead spent a larger proportion of her time at deeper depths while offshore during the summer and at consistently shallower depths (<20 m) while in the coastal waters of Florida during fall and winter (**Figure 23**). Pointe's average monthly dive depth showed little relationship with average monthly sea surface temperature (SST) (**Figure 24**). This finding is not surprising, since Pointe spent portions of both summer and winter months in shallow water. Pointe's average monthly dive duration increased as average monthly SST decreased, suggesting she may have been conserving energy in cooler waters by taking longer, resting dives at the bottom (**Figure 25**). These results suggest that at least for some turtles, our detection of individuals will decrease during colder months of the year as turtles are spending a larger amount of time at depth, where they cannot be detected by observers.

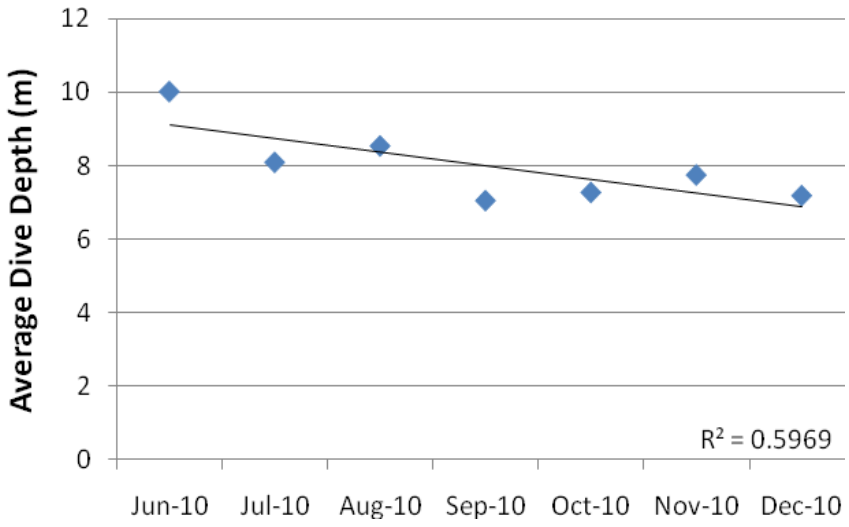

Figure 18. Average monthly dive depth for Pointe.

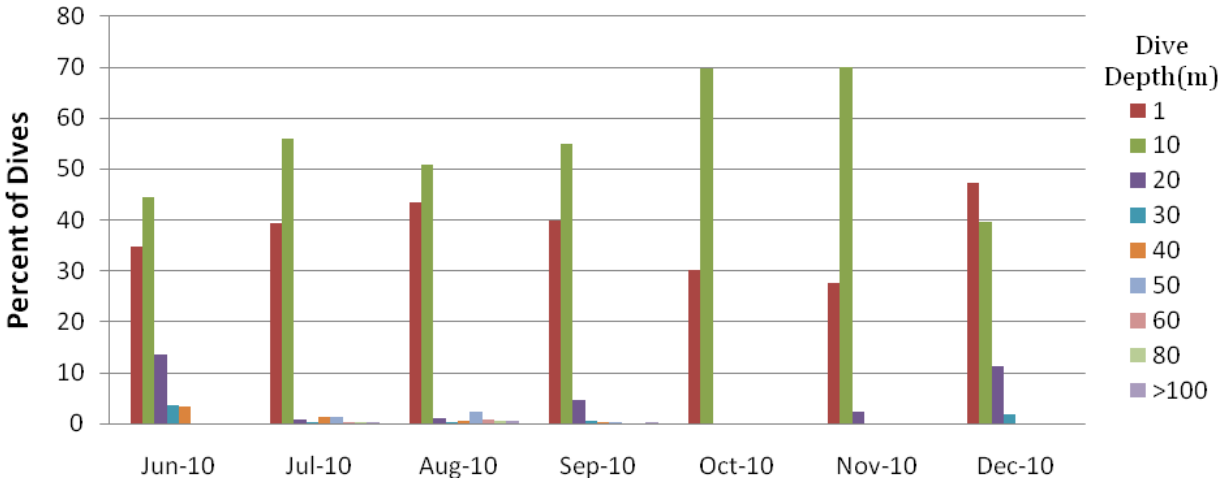

Figure 19. Monthly percent of dives at each dive depth recorded by the SPLASH tag (Pointe). Bin labels describe the upper bound of dive's greatest depth. For example, dives binned as 1 m include all dives <1 m, dives binned as 10 m include all dives between 1.1 and 10 m. >100 denotes dives between 80.1 and 100 m and all dives greater than 100 m.

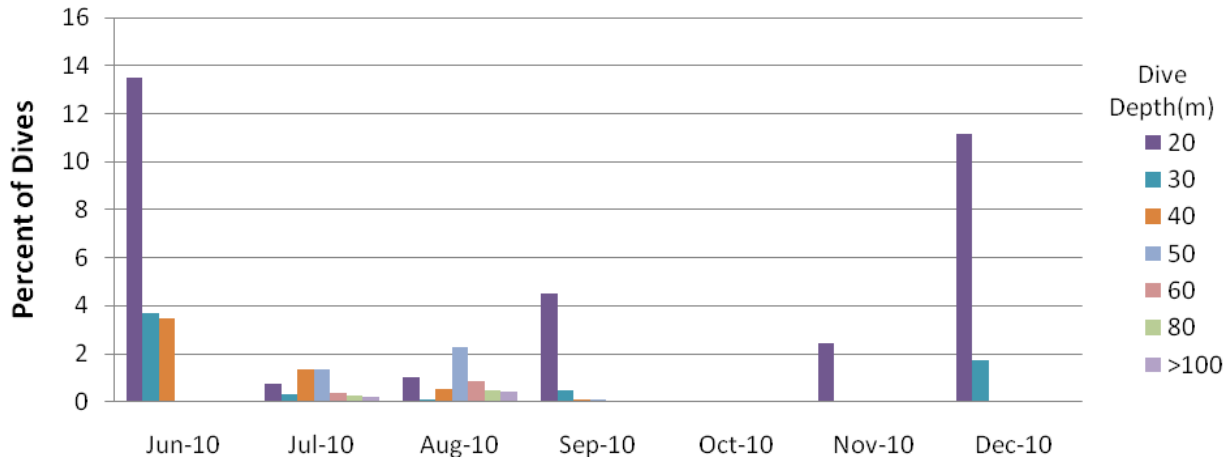

Figure 20. Monthly percent dives at each dive depth recorded by the SPLASH tag, excluding bins <10 m (Pointe).

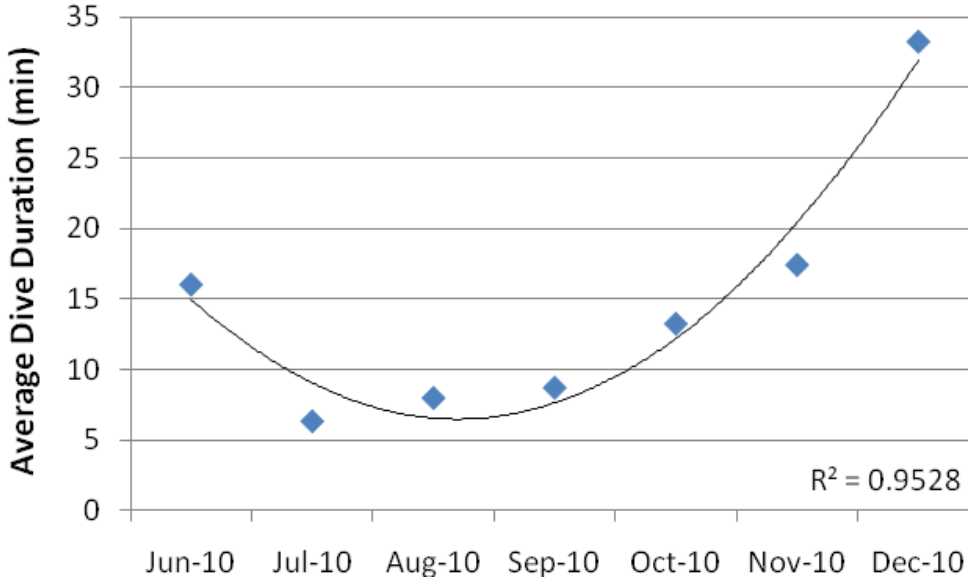

Figure 21. Average monthly dive duration (Pointe).

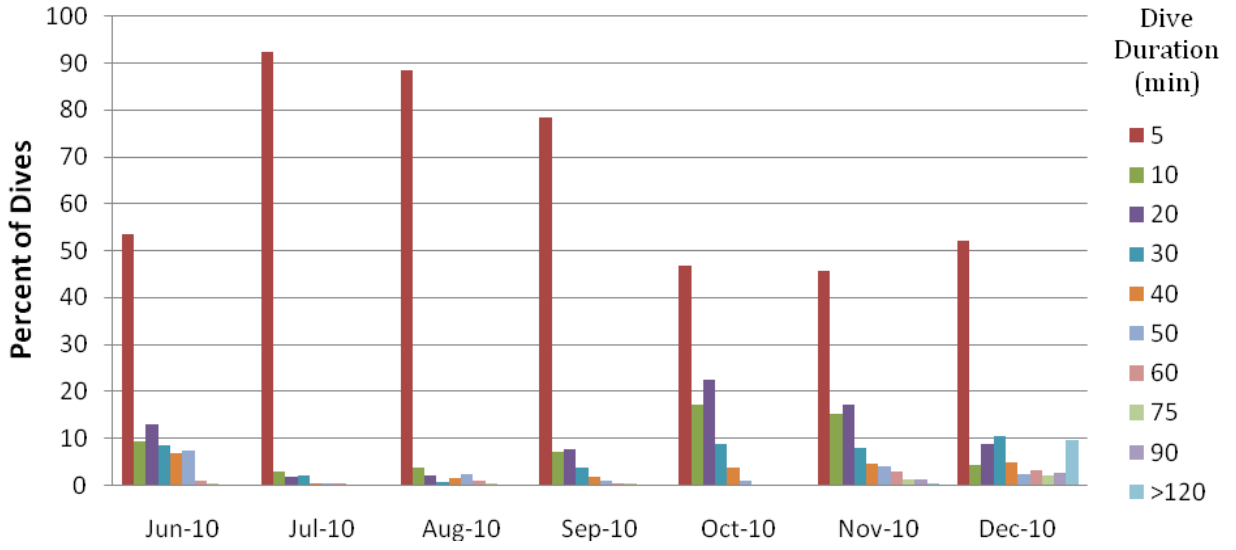

Figure 22. Monthly percent of dives at each dive duration recorded by the SPLASH tags (Pointe). Bin labels describe the upper bound of the dive's greatest duration. For example, dives binned as 5 min include all dives ≤5 min; dives binned as 10 min include all dives between 5.1 and 10 min; >120 min denotes dives between 90.1 and 120 min and all dives longer than 120 min.

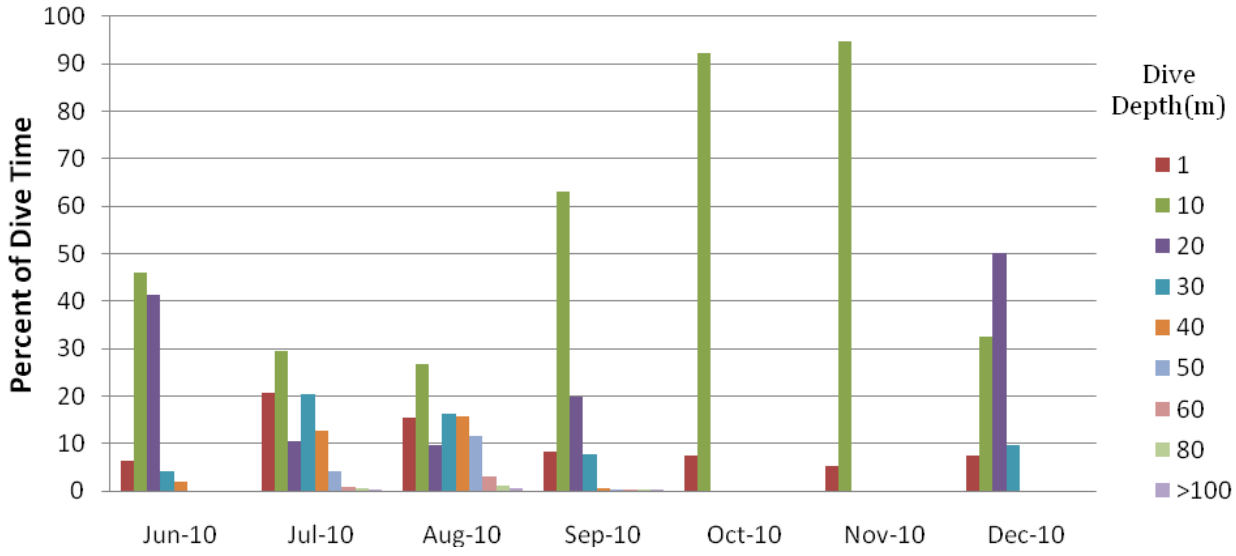

Figure 23. Monthly percentage of time spent at each depth recorded by the SPLASH tags (Pointe). Bin labels describe the upper bound of the depth bin. For example, time binned as 1 m includes time spent at a depth of ≤1 m; time binned as 10 m includes time spent between depths of 1.1 and 10 m; and >100 m denotes time spent between 80.1 and 100 m and all time spent at depths greater than 100 m.

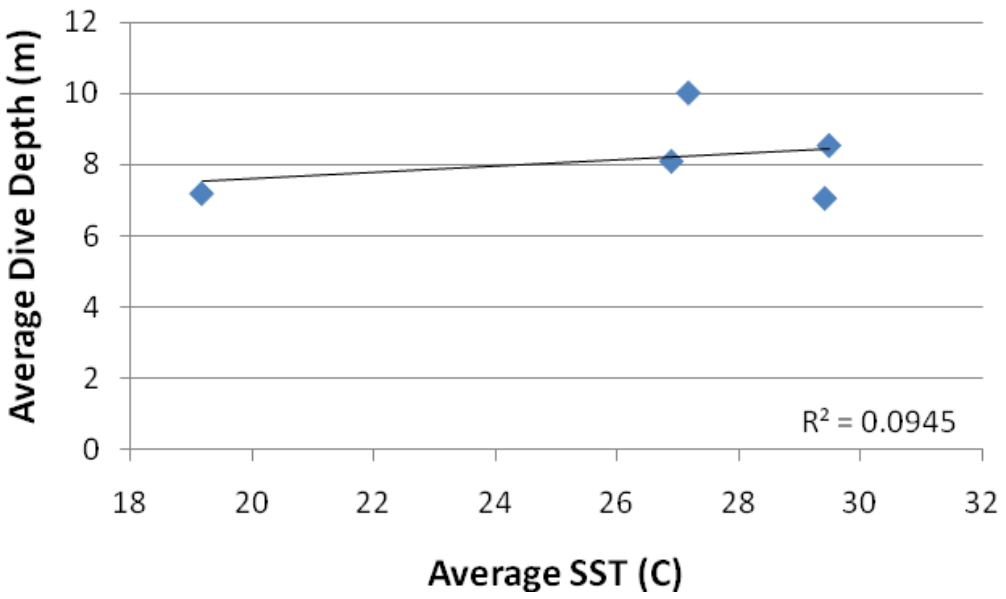

Figure 24. Average monthly dive depth vs. average monthly sea surface temperature (Pointe).

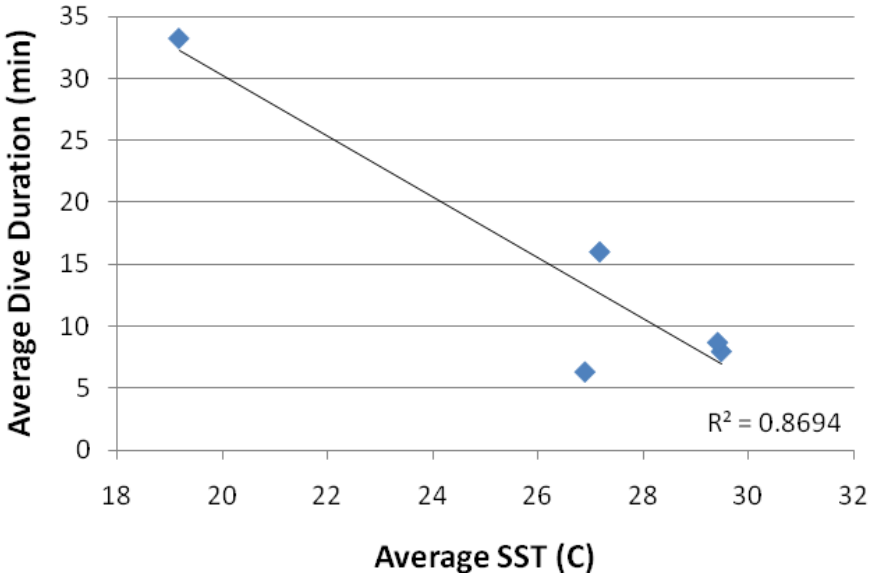

Figure 25. Average monthly dive duration vs. average monthly sea surface temperature (Pointe).

Grace

After nesting on Emerald Isle on July 7, 2010, Grace was outfitted with deployed tag 096291. Grace's satellite tag transmitted intermittently, making it difficult to follow her exact movements. Nevertheless, she did make a foray out into deeper waters off the continental shelf, and subsequently moved back into coastal waters off Carteret County (North Carolina) (**Figure 26**). The tag stopped transmitting on August 26, 2010.

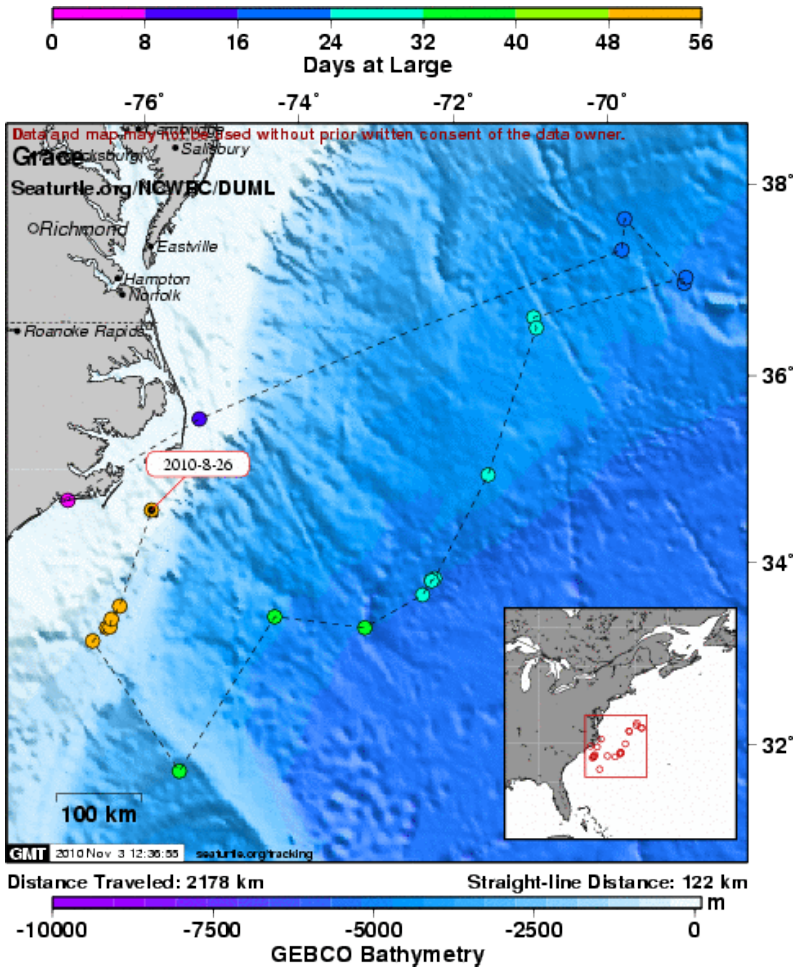

Figure 26. Map of satellite-tracked movements of Grace, July 7, 2010 to August 26, 2010.

Due to the short duration of Grace's SPLASH tag, few inferences can be made about the relationships between dive depth, dive duration, time at depth, temperature, and time of year. During the months of July and August 2010, Grace spent much of her time offshore in deeper waters, however, the dives recorded by the SPLASH tag demonstrate that she made relatively shallow dives with the majority <10 m in depth (**Figure 27**). Like Pointe, the majority (>90%) of Grace's recorded dives were less than 5 min in duration (**Figure 28**). Grace appeared to spend a majority of her time diving at depths >10 m, suggesting that her shallow dives were of short duration (**Figure 29**).

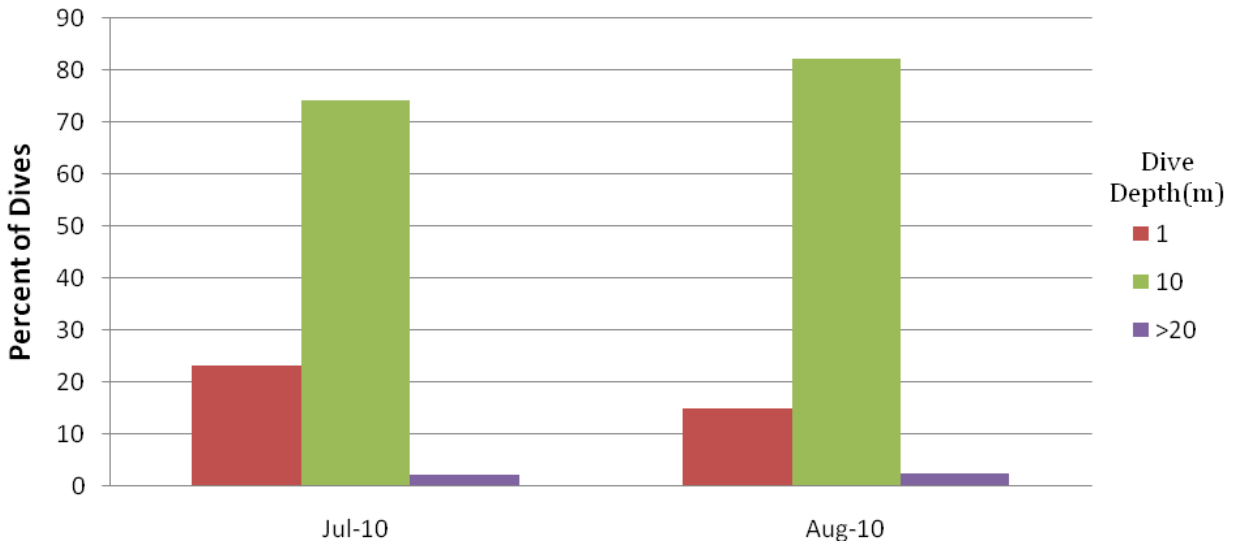

Figure 27. Monthly percent of dives at each dive depth recorded by the SPLASH tag (Grace). Bin labels describe the upper bound of the dive's greatest depth. For example, dives binned as 1 m include all dives <1 meter; dives binned as 10 m include all dives between 1.1 and 10 meters; and >20m denotes dives between 10.1 and 20 meters and all dives greater than 20 meters.

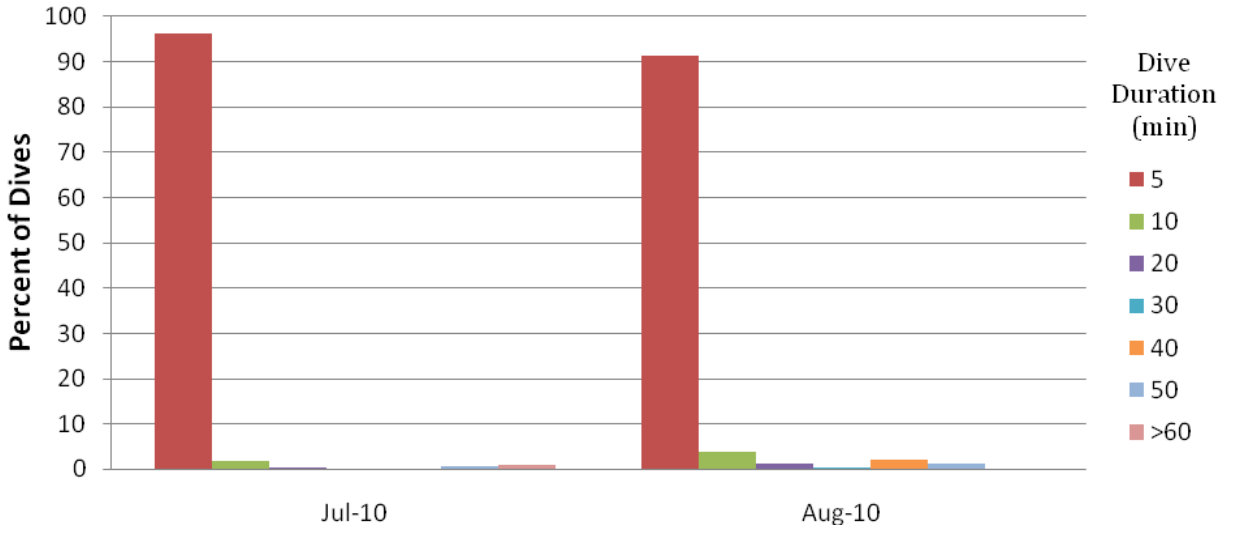

Figure 28. Monthly percent dives at each dive depth recorded by the SPLASH tag, excluding bins <10 m (Grace). Bin labels describe the upper bound of the dive's greatest duration. For example, dives binned as 5min include all dives <5 minutes, dives binned as 10min include all dives between 5.1 and 10 minutes. >60min denotes dives between 50.1 and 60 minutes and all dives longer than 60 minutes.

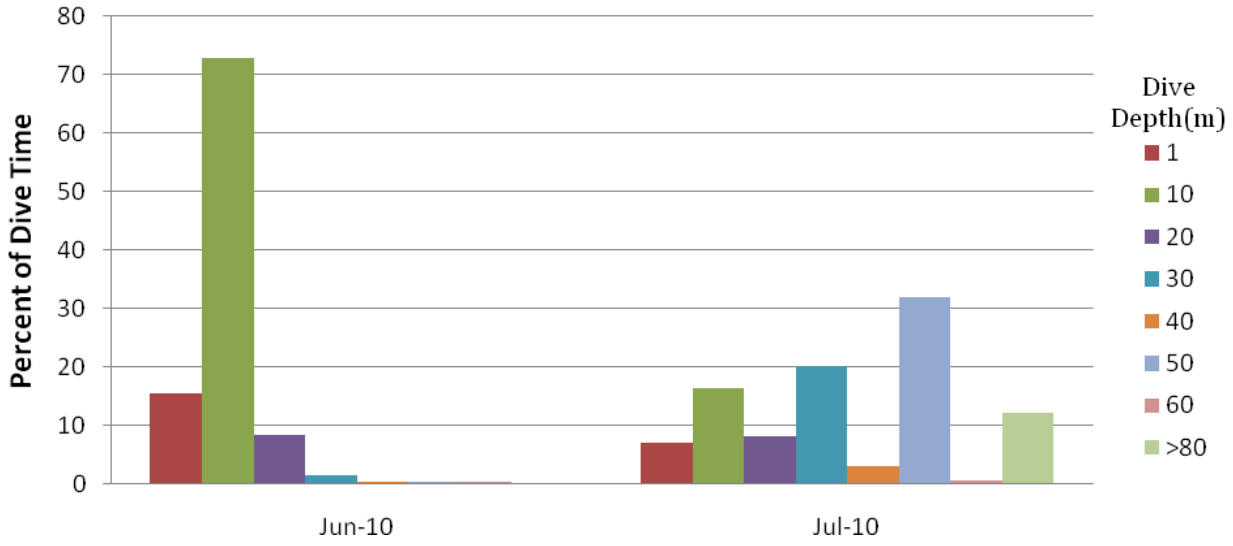

Figure 29. Percentage of time spent at each depth recorded by the SPLASH tag (Grace). Bin labels describe the upper bound of the depth bin. For example, time binned as 1m includes time spent at a depth of <1m, time binned as 10m includes time spent between depths of 1.1 and 10m. >80 m denotes time spent at depths between 60.1 and 80m and all time spent at depths greater than 80 m.

Pati

Pati was observed returning to the water after a false crawl at Hammocks Beach State Park on Bear Island on the night of July 21, 2010. She was tagged with tag 096292 that night. On the night of July 24, 2010, she nested on Brown's Island. In the following weeks, Pati traveled south along the coast, passing through waters off South Carolina, Georgia, and Florida. She then appeared to take up residency off the coast of Palm Bay, Florida until January 1, 2011 (**Figure 30**).

Unlike Point and Grace, Pati stayed in coastal waters. Like Pointe, Pati's average monthly dive depth decreased slightly as summer turned to fall and winter (**Figure 31**), and she settled in nearshore waters of Florida. The majority of Pati's dives were less than 10 m in depth, however, she had a higher percentage of dives greater than 10 m in depth than either Pointe or Grace (**Figure 32**). Unlike Pointe, Pati's average dive duration did not appear to change as summer turned to fall and winter (**Figure 33**). A large percentage (up to 80 percent) of Pati's dives lasted less than 5 min in duration (**Figure 34**). Like Pointe, the percentage of time Pati spent at different depths does not correspond with the large number of shallow dives (<10 m). Pati spent more time at depths greater than 20 m, suggesting that her shallow dives were likely also short in duration (**Figure 35**). Pati's average dive depth decreased slightly with average SST (**Figure 36**), however, we found little relationship between average dive duration and SST (**Figure 37**). These results mimic those found when comparing dive depth and duration to month of the year, suggesting that Pati made few or no changes to her dive patterns as the seasons changed.

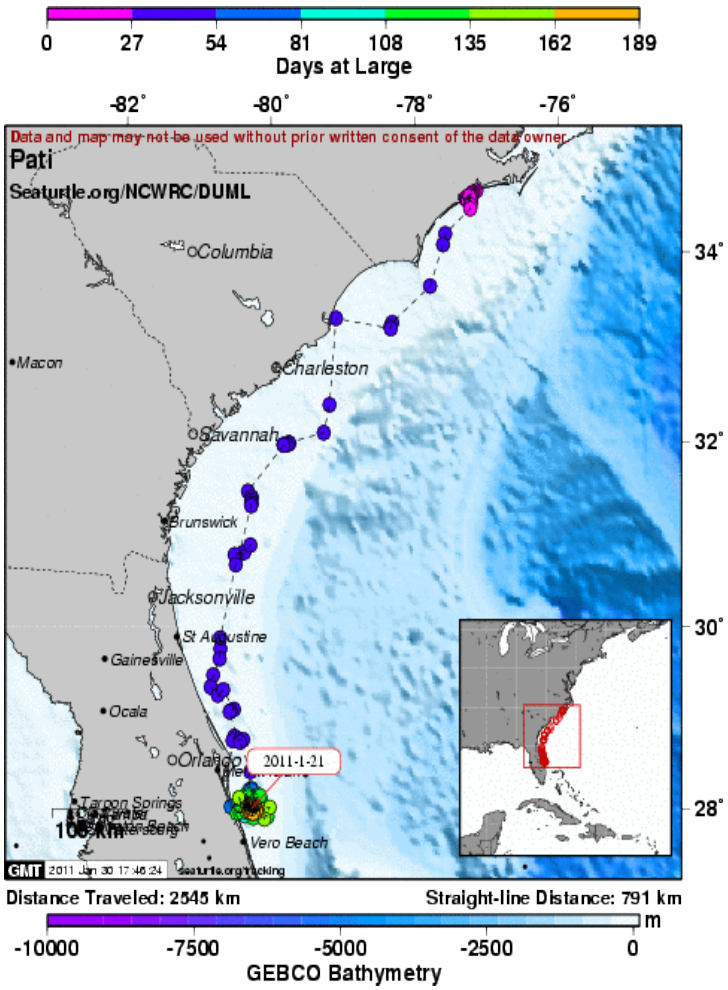

Figure 30. Map of satellite tracked movements of Pati, July 21, 2010 to January 1, 2011.

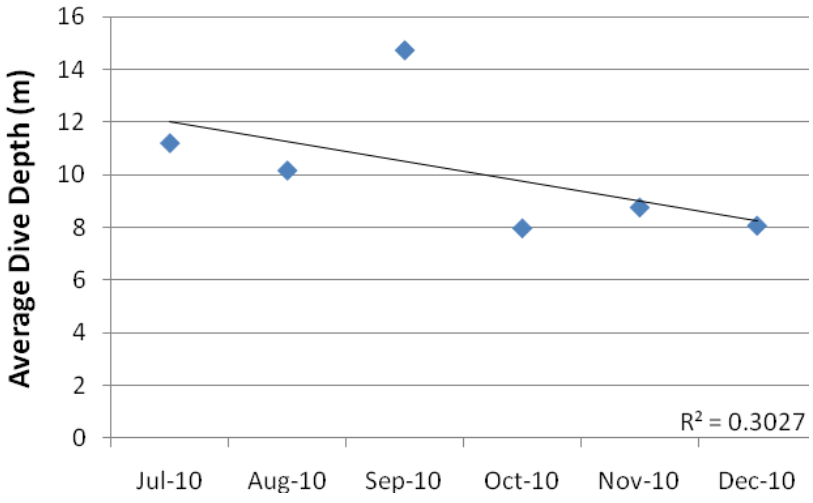

Figure 31. Average monthly dive depth (Pati).

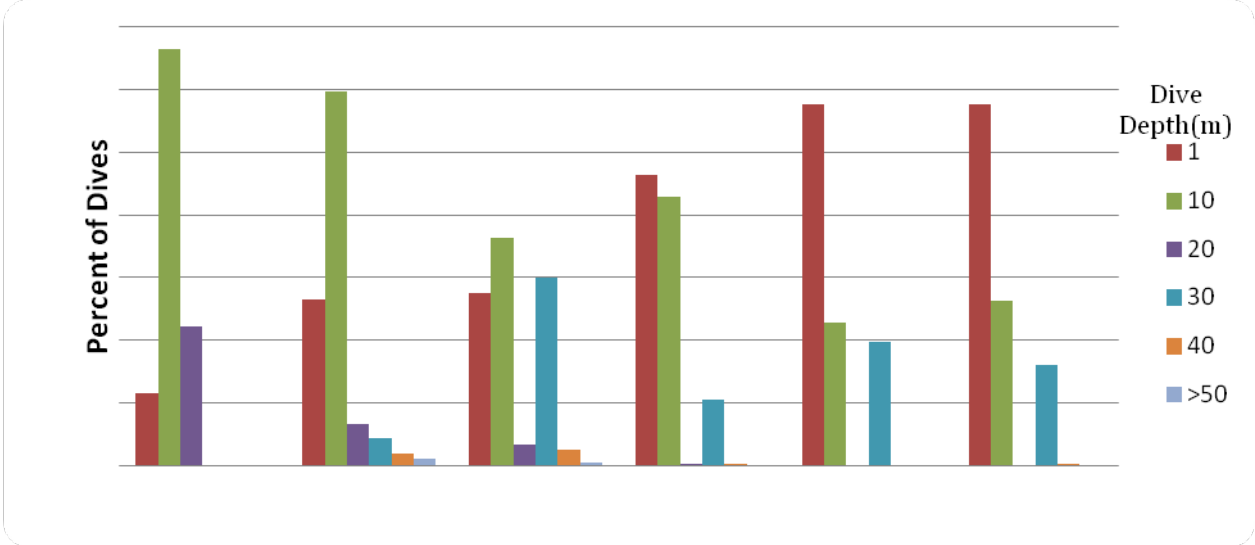

Figure 32. Monthly percent of dives at each dive depth recorded by the SPLASH tag (Pati). Bin labels describe the upper bound of the dive's greatest depth. For example, dives binned as 1m include all dives <1m, dives binned as 10m include all dives between 1.1 and 10m. >50m denotes dives between 40.1 and 50m and all dives greater than 50m.

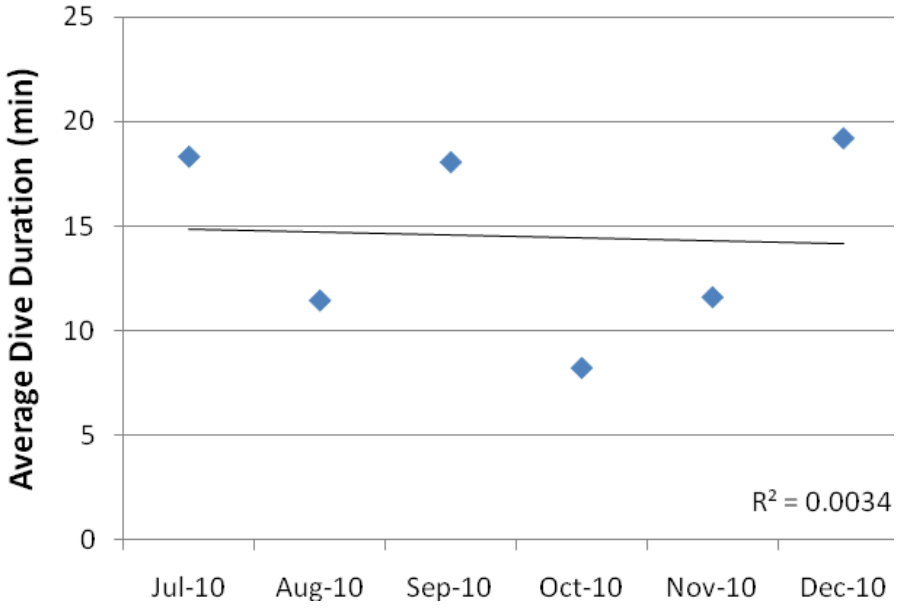

Figure 33. Average monthly dive duration (Pati).

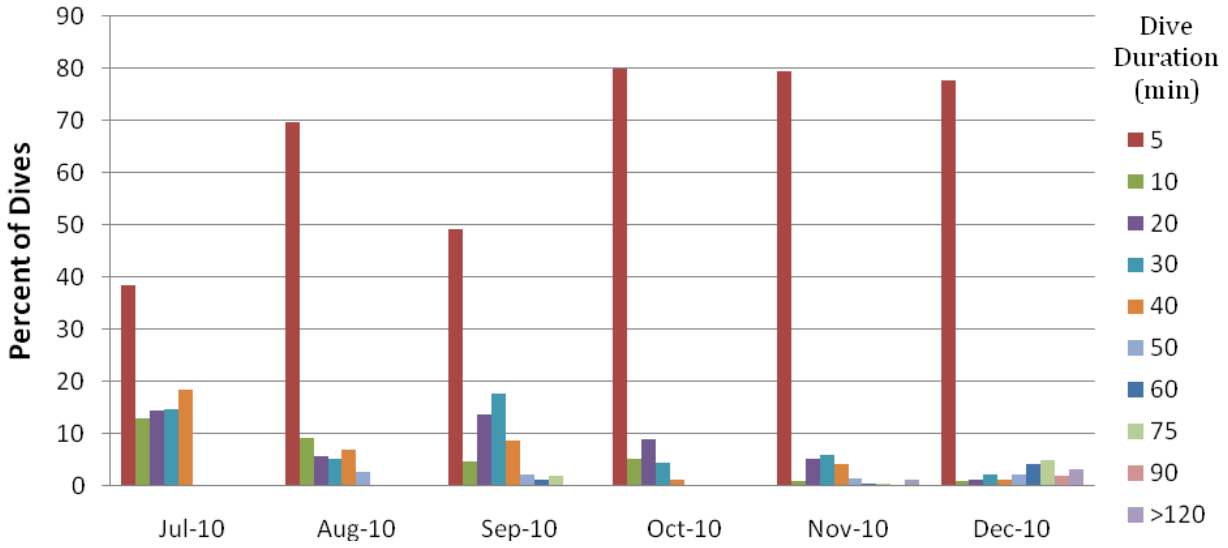

Figure 34. Monthly percent of dives at each dive duration recorded by the SPLASH tag (Pati). Bin labels describe the upper bound of the dive's greatest duration. For example, dives binned as 5min include all dives <5 minutes, dives binned as 10min include all dives between 5.1 and 10 minutes. >120min denotes dives between 90.1 and 120 minutes and all dives longer than 120 minutes.

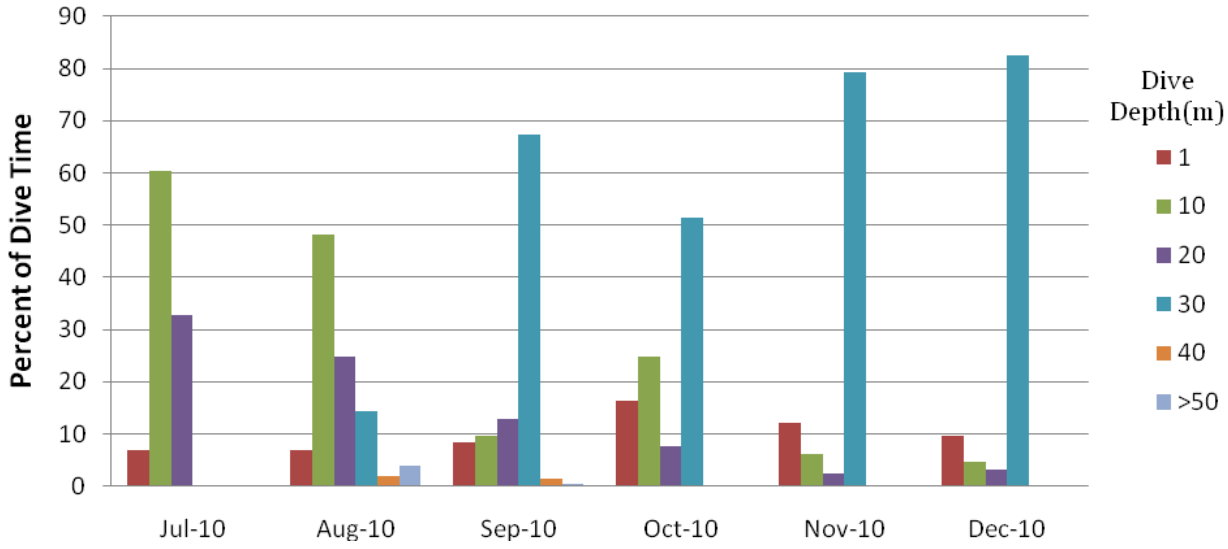

Figure 35. Percentage of time spent at each depth recorded by the SPLASH tag (Pati). Bin labels describe the upper bound of the depth bin. For example, time binned as 1m includes time spent at a depth of <1 m, time binned as 10 m includes time spent between depths of 1.1 and 10 m. >50 m denotes time spent at depths between 50.1 and 50 m and all time spent at depths greater than 50 m.

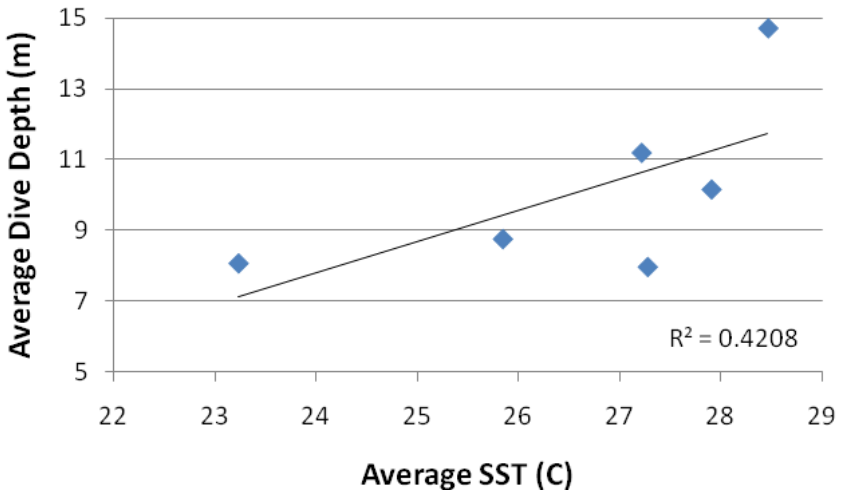

Figure 36. Average monthly dive depth vs. average monthly sea surface (Pati).

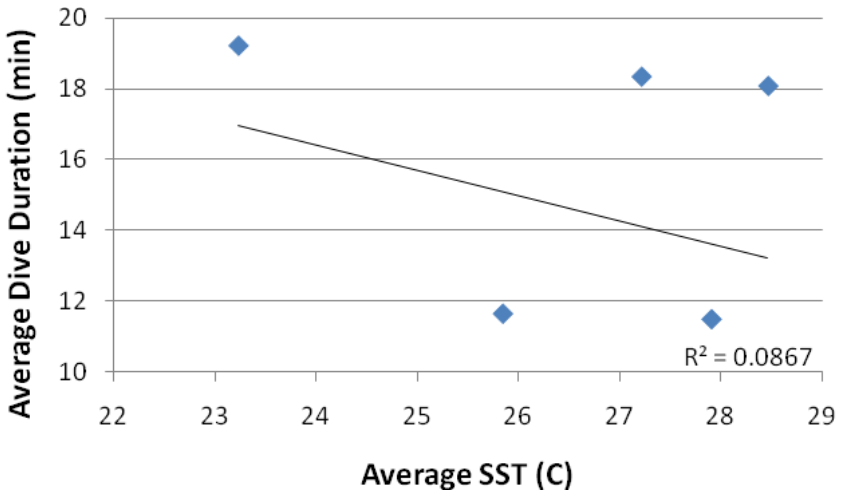

Figure 37. Average monthly dive duration vs. average monthly sea surface (Pati).

6. Coordinated ASW Exercise Monitoring

Monitoring of coordinated ASW exercises is one of the primary components being used to address specific monitoring questions posed in the AFAST Monitoring Plan (DoN 2009a) and the NMFS-issued LOA (NMFS 2009). Scheduling of protected marine species monitoring that involves civilian aircraft and ships operating concurrently with multiple U.S. Navy aircraft and ships in the same area requires extensive pre-survey coordination between multiple U.S. 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 U.S. Navy assets.

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

Both passive acoustic and visual (aerial and vessel survey) monitoring methods were employed to address before/after and before/during/after monitoring requirements. Coordinated ASW exercise monitoring components for this reporting period are presented below.

6.1 Passive Acoustics

Towed Array

Vessel-based monitoring that included a towed array was conducted during December 3-5, 2010 in association with Southeast Anti-submarine Warfare Integration Training Initiative (SEASWITI), an ASW event that occurred in JAX off the eastern coast of Florida, within the U.S. Navy's proposed boundaries of the USWTR (**Appendix G**). There were visual (see **Section 6.3**) and acoustic components. Thirty acoustic detections of cetaceans were collected during nearly 27 hrs of survey effort. Thirteen detections were classified as sperm whales; five detections were classified as sperm whales and delphinids (vocalizing simultaneously); one detection was classified as sperm whales and possible beaked whales; and 11 detections were classified as delphinids. A summary of PAM survey effort is provided in **Table 21**.

Table 21. Summary of JAX ASW Acoustic Monitoring Effort During the December 2010 SEASWITI.

Date	Total Distance	Duration*
December 3, 2010	116.5 km	7.42 hr
December 4, 2010	122.2 km	9.53 hr
December 5, 2010	139.2 km	9.78 hr

Note: * Reflects all min within and outside of the specified area of interest while the hydrophone array was recording.

Pop-up Buoy Deployments

A pilot project was conducted in July 2008 at the Onslow Bay site incorporating shipboard and vessel visual surveys and an array of PAM "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. Following this successful pilot study, two focused PAM efforts were conducted in the JAX OPAREA during the previous reporting period (see DoN 2010a), each including the deployment of nine pop-up buoys arranged in an array configuration. The goal was to establish intensive short-term (20-30 days) PAM before, during, and after two specific ASW events. Efforts are currently underway to review and analyze data from these deployments and results are expected to be available for the 2012 AFAST Annual Monitoring Report.

A deployment of nine Cornell pop-up units was planned and attempted in December 2010 to coincide with an ASW training event in the JAX OPAREA; however, weather conditions and safety concerns prevented the hardware from being deployed.

Deployment of 12 JASCO Autonomous Multi-channel Acoustic Recorders (AMAR) sampling at 96 kHz for approximately 30 days is scheduled to occur in the JAX OPAREA in September 2011. Synchronization of the units for localization purposes is via three pingers spaced within the array grid. The AMARs will be deployed approximately 10 days prior to the planned 5-day ASW exercise and will remain active for approximately 10 days following the exercise. The goal of this effort is to establish short-term (20-30 days) PAM before, during, and after a specific ASW event. Analysis of the collected data will be determined once recovery has been completed.

6.2 Aerial Surveys

Aerial surveys were coordinated before/after two ASW training events during the reporting period. A summary of survey effort and sightings is provided in **Table 22**. Complete survey and sighting details for each training event are included in **Appendices H** and **I**.

Table 22. Visual Survey Effort and Marine Mammal Observation Summary for Coordinated ASW Exercise Monitoring.

Date	Km Surveyed	Hrs Flown	Cetacean Sightings	Total Numbers of Cetaceans	Turtle Sightings	Total Numbers of Turtles
9-Aug-10 (aerial)	169	3.3	7	313	5	5
10-Aug-10 (aerial)	195	1.6	0	0	0	0
3-Dec-10 (aerial)	616	5.3	2	22	5	5
4-Dec-10 (aerial)	560	3.6	0	0	1	1
4-Dec-10 (aerial)	392	2.8	0	0	1	1
5-Dec-10(aerial)	588	6.3	0	0	2	2
3-Dec-10 (vessel)	115	9.0	1	40	0	0
4-Dec-10 (vessel)	127	10.4	2	22	0	0
5-Dec-10 (vessel)	81	5.7	1	0	0	0

Aerial monitoring was conducted August 9-10, 2010 in good to fair sighting conditions, for an ASW exercise, off the coast of Virginia in VACAPES (**Appendix H**). Focal-follow behavioral data were collected during seven separate sightings. Observers visually surveyed 197 nautical miles (NM) (364 kilometer [km]) of systematic transects and 538 NM (997 km) of combined trackline (including systematic transects and crosslegs between transects) during two days for 4.86 hrs of total on- and off-effort.

Seven cetacean sightings were recorded: one group of bottlenose dolphins; two groups of short-finned pilot whales; one group of sperm whales; two groups of pantropical spotted dolphins (*Stenella attenuata*), and one group of unidentified dolphins. There were five sightings of loggerhead turtles.

Aerial monitoring was conducted during December 3-5, 2010 in association with a SEASWITI event that occurred in JAX (**Appendix I**). Twenty-one tracklines provided a total survey coverage area of approximately 928 square kilometers (km^2). Sighting conditions were poor. Two sightings of cetaceans (unidentified species) and nine sightings of sea turtles (7 loggerhead turtles, 1 leatherback turtle, and one unidentified species) were recorded during 18 hrs of total survey flight time.

In addition, aerial surveys before/during/after an ASW event are planned for September 2011 in both the VACAPES and JAX OPAREAs.

6.3 Vessel Surveys

Vessel-based monitoring was conducted during December 3-5, 2010 in association with a SEASWITI event that occurred in JAX (**Table 22, Appendix G**). There were both visual and PAM components. Due to extremely poor sighting conditions, marine mammal and sea turtle sightings in the area were lower than expected. Three marine mammal sightings were recorded during 25 hrs of survey time: three groups of Atlantic spotted dolphins and one group of unidentified cetaceans. Three of the four visual sightings were with dolphins that approached the survey vessel to bow-ride. No sightings of sea turtles were made during the cruise.

7. AFAST Marine Mammal Observers (MMOs)

The coordination of Navy MMOs for ASW exercises has not been possible throughout the duration of this reporting year, which extended from August 2, 2010 through August 1, 2011. The U.S. Navy could not coordinate involvement of MMOs because of logistic constraints and training exercise schedules. Therefore, this section focuses on the progress made for the U.S. Navy LO Effectiveness study.

7.1 U.S. Navy Lookout Effectiveness Study

The U.S. Navy undertakes monitoring of marine mammals during naval exercises and has mitigation procedures designed to minimize risk to these animals. One key component of this monitoring and mitigation is the shipboard lookouts (LOs, also known as watchstanders), who are part of the standard operating procedure that ships use to detect objects (including marine mammals) within a specific area around the ship during events. The watchstanders are an element of monitoring requirements specified by NMFS in the MMPA LOAs. The goal is to detect mammals entering ranges of 200, 500, and 1000 yards around the vessel, which correspond to distances at which various mitigation actions should be performed. In addition to the lookouts, officers on the bridge search visually and sonar operators listen for vocalizations. We refer to all of these observers together as the “observation team” (OT). The aim of this study is to determine 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 observed 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 search and collect information on marine mammals that are detected by themselves and the OT.

Work was previously conducted to design and test a protocol for determining the effectiveness of the LOs in visually detecting marine mammals. The field protocol for the experiments was developed in consultation with members of the Naval Undersea Warfare Center Division, Newport (NUWCDIVNPT); USFF; NAVFAC; Commander, U.S. Pacific Fleet; and NMFS. The basic concept is that trained MMOs are situated on board a vessel during daylight at-sea exercises, in locations where they can watch for marine mammals and communicate with one another, but not cue the LO. The MMOs then work to set up opportunistic trials where they detect a surfacing of a marine mammal at a measured location and record whether that surfacing was also detected (a successful trial) or not (an unsuccessful trial) by the LO.

It was found to be necessary to have an additional "liaison" MMO (LMMO) stationed with the LO, and in communication with the other MMOs, to help report when and where LOs detected surfacings. It was also necessary to have an additional team member tasked solely with data recording. In addition to recording surfacing events, MMOs attempted to keep track of which surfacings belonged to the same school or animals. The revised protocol (**Appendix J**; Burt and Thomas 2010) was applied to one further at-sea exercise (off Southern California), making four datasets in total.

In parallel with field protocol development, methods are being developed for using the data generated by these experiments to estimate the probability of animals entering the stand-off range undetected. An analysis method to allow for intermittent availability is also being developed, since many marine mammal species remain on (or close to) the surface for significant periods between dives, and so are "intermittently available" for detection. The extended methods currently only use information about the location of LO detections, but could conceivably be extended further to use information from the MMO LO trials. As a proof of concept, both the instantaneous and intermittent availability models to data collected in the at-sea experiments will be applied. Our objective is to provide results in next year's annual report.

Recommendations for future data-collection efforts are to focus on a single vessel type and an area where the number of trials-per-cruise is likely to be maximized. Resources would be devoted to extending the intermittent availability models so that they use both the locations of observed animals and the outcomes of the MMO trials, thereby unifying the models developed to date for instantaneous and intermittent availability.

Major accomplishments related to this project to-date include initial development of data collection protocols and analytic methods, data collection trials, completed a proof of concept for detection functions, consultation with NMFS technical staff for input on analysis methods, and investment in continued refinement of the analytic methods and focus on additional data collection in 2011/2012.

U.S. Navy Fleet training organizations are currently evaluating the preliminary results from the proof-of-concept phase to determine if improvements in lookout training programs are warranted. Initial steps in progress include evaluating incorporation of marine mammal survey techniques into watchstander training and revision of Marine Species Awareness Training. As more data become available, other options for improving lookout training will be evaluated as appropriate.

8. Summary

The U.S. Navy has developed and followed a suite of requirements and techniques identified in the MMPA and ESA permits for AFAST activities. These included collecting longitudinal baseline data on marine species; analysis of tagging efforts for sea turtles; behavioral response studies; monitoring immediately before, during, and after ASW exercises; and evaluating the effectiveness of the mitigations implemented such as the use of LOs during U.S. Navy training exercises.

Through the implementation of numerous research methods established in the Cape Hatteras, Onslow Bay, and the JAX OPAREA, a collection of critical baseline information for the AFAST Study Area is well underway. Data collected to date will allow researchers to examine potential effects, if any, from exposure to ASW training. Current baseline research reveals trends in abundance and distribution of marine mammal and sea turtle species, and will allow scientists to examine the short-term effects of U.S. Navy training on marine species. Potential long-term effects to ASW training exercises will be monitored through a comparison of baseline data and information collected during training exercises and throughout AFAST monitoring during training exercises focused in the VACAPES, CHPT, and JAX OPAREAs. Research-based initiatives have been implemented within the VACAPES and CHPT OPAREAs including Cape Hatteras and Onslow Bay waters. The research at Cape Hatteras utilized both vessel and aerial platforms over 19 survey days and focused over the central portion of the study site. Scientists observed nine species/genera of marine mammals including: short-finned pilot whale, sperm whale, Mesoplodon beaked whales, Cuvier's beaked whale, Fraser's dolphin (*Lagenodelphis hosei*), Atlantic bottlenose dolphin, Atlantic spotted dolphin, rough-toothed dolphin (*Steno bredanensis*), and common dolphin. The loggerhead turtle was the only species of identified sea turtle sighted during the past year in Cape Hatteras. Prior to and along with the work done in Cape Hatteras, the U.S. Navy funded studies in Onslow Bay where both vessel and aerial platforms were utilized over 29 days of survey effort. Effort in Onslow Bay documented five species of marine mammals and one species of sea turtle. Species documented included humpback whale, minke whale, bottlenose dolphin, Atlantic spotted dolphin, and Risso's dolphin. The loggerhead turtle was the only species of identified sea turtle sighted in the Onslow Bay area. Contracted marine biologists for the U.S. Navy have also focused on gathering baseline data in the proposed USWTR area located in the JAX OPAREA. Aerial and vessel observers conducted over 37 days and documented seven species of marine mammals present in the area: minke whale, humpback whale, short-finned pilot whale, bottlenose dolphin, Atlantic spotted dolphin, rough-toothed dolphin, and Risso's dolphin. Three species of sea turtles occurred during vessel and aerial monitoring including: loggerhead turtle, leatherback turtle, and Kemp's ridley turtle. PAM was conducted in both Onslow Bay and the JAX OPAREA. Researchers employed towed hydrophone arrays and HARPs to detect marine mammal vocalizations. While the analysis for PAM is preliminary, four species of marine mammals were documented from these vocalizations in Onslow Bay and distinct calls of humpback whales and Risso's dolphins were recorded. The analysis for JAX recordings has not been completed; however, scientists have noted that right whale calls comprised some of the vocalizations.

To refine estimates of sea turtle abundance in the survey area, three SPLASH tags were deployed on adult nesting female loggerhead turtles in North Carolina during Summer 2010 (DoN 2010a). Data from these tags will allow for refinement of our probability for the detection function for loggerhead turtles by determining the proportion of time they spend at, or very close to the surface, where they can be sighted by visual observers. Analyses revealed that some turtles spent a longer amount of time at depth during colder months. These findings indicate that sea turtles would be more difficult to detect during colder periods of the year.

Behavioral response studies were also initiated during the reporting period. Researchers from Woods Hole Oceanographic Institution and Duke University deployed eleven DTAGS on short-finned pilot whales off Cape Hatteras. Analysis is ongoing with results of the tagging effort to be included in the 2011-2012 annual report.

In addition to increasing the amount of essential baseline research, efforts have continued to support the requirements outlined in the AFAST LOA with regards to monitoring during U.S. Navy training exercises. Despite logistical challenges with U.S. Navy training events, both passive acoustic and visual monitoring occurred during two ASW events. Monitoring conducted in conjunction with VACAPES August 2010 training exercises included observations of marine mammals typically found in waters near the continental slope. During a separate ASW training exercise in the JAX OPAREA during December 2010 (SEASWITI), marine mammal and sea turtle sightings were lower than anticipated, likely a direct result of poor weather and visibility for both aerial and vessel-based surveys conducted in the area. Species sighted were consistent with the longitudinal studies.

Finally, the U.S. Navy has completed a portion of the initial work required to execute a lookout effectiveness study. A field protocol has been developed and current work focuses on refining methods to examine the likelihood of a marine mammal entering stand-off ranges undetected. Additional data will be collected in 2011 and 2012 with results expected to be included in the 2011-2012 AFAST Annual Report.

SECTION III – 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 and feedback. 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 managers maintain flexibility in their decisions, knowing that uncertainties exist, and provides managers the latitude to change direction so as to improve understanding of ecological systems to achieve management objectives. Taking action to improve progress toward desired outcomes is another function of adaptive management.

A 2010 U.S. Navy-sponsored monitoring meeting in Arlington, Virginia initiated a process to critically evaluate the current U.S. Navy monitoring plans and begin development of revisions/updates to both existing region-specific plans and the ICMP. Discussions at that meeting, and at the U.S. Navy/NMFS annual adaptive management meeting in October 2010, established a way forward for continued refinement of the U.S. Navy's monitoring program. This process included establishing 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 U.S. Navy monitoring. The Strategic Plan is intended to be a primary component of the ICMP and to provide a "vision" for U.S. 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 satisfy MMPA (LOA) regulatory requirements. The objectives of the Strategic Plan will be to continue the evolution of U.S. Navy marine-species monitoring toward a single integrated program, incorporating SAG recommendations, and to establish 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 U.S. Navy ranges.

Originally, five study questions were developed between NMFS and the U.S. Navy as guidance for developing monitoring plans (as presented in **Section I**), and all existing range-specific monitoring plans attempted to address each of these study questions. 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 U.S. Navy monitoring program has historically been compartmentalized by range complex and focused on effort-based metrics (survey days, trackline covered, etc.).

The U.S. Navy established the SAG in 2011 with the initial task of evaluating current naval monitoring approaches under the ICMP and existing LOA's 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 U.S. Navy Marine

Species Monitoring Program and provide a direction for the Strategic Plan development. Key recommendations that have direct bearing on future AFAST monitoring include:

1. dispensing with the previous broad "study questions" and instead working within a conceptual framework of knowledge, from basic information on the occurrence of species within each range complex, to more specific matters of exposure, response, and consequences;
2. striving to move away from a "box-checking" mentality and to design monitoring studies according to scientific objectives rather than cataloging effort expended; and
3. approaching the U.S. Navy Marine Species Monitoring Program holistically and selecting projects that offer the best opportunity to advance understanding of the issues, as opposed to establishing range-specific requirements.

Specific to AFAST, the SAG noted that the combination of line-transect aerial surveys, photo-identification, and PAM has proven particularly useful. There are several other important monitoring opportunities, including: exposure-response studies; the use of satellite tags to characterize medium-term response to exposure; and the use of DTAGs to monitor acute response to exposure. In addition, there is a unique opportunity for addressing potential stock- or population-level consequences, specifically at the planned USWTR site in the JAX OPAREA before and after concentration of sonar activities occur in the proposed USWTR location off Jacksonville. The SAG recommended that the spatial coverage for monitoring within AFAST be expanded to sample the full range of marine mammal habitats that are exposed to U.S. Navy training activities.

In June 2011, the U.S. Navy hosted a Marine Mammal Monitoring Workshop with guidance and support from NMFS, which included scientific experts and representatives of environmental non-governmental organizations. 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 to continue consolidating monitoring efforts from individual range-complex plans and to develop a single Strategic Plan for U.S. Navy Monitoring that will improve the return on investment by focusing on specific objectives and projects where they can most efficiently and effectively be addressed throughout the U.S. Navy's range complexes. The Strategic Plan is currently in development, although some specific changes in monitoring approaches are proposed for the 2012 AFAST LOA renewal. The Strategic Plan will be incorporated as a primary component of the ICMP.

Results of recent meeting and recommendations from the SAG, as well as successes and challenges in the field, continue to feed the AMR process. For 2012, the U.S. Navy proposes to allow for increased flexibility under the AFAST LOA within the VACAPES, CHPT, and JAX OPAREAs in order to allow continued input and guidance from the SAG and research community. **Table 23** summarizes proposed monitoring commitments under the AFAST LOA for 2012-2014. Emphasis before, during, and after visual surveys will be decreased and more resources will be directed to PAM of ASW exercises and the associated data analysis. This proposal does not necessarily decrease the amount of investment, but rather focuses resources on methods and projects proposed by the scientific community through the Strategic Planning process that offer the best opportunity for advancing our knowledge and addressing ICMP top-level goals U.S. Navy-wide.

Table 23. U.S. Navy's Proposed 2012-2014 Annual Monitoring Commitments for AFAST.

Marine Mammal Observers (MMOs)	2 events in conjunction with exercises.
MMO/ Lookout Comparison Study	40 hrs data-collection trials.
Aerial Surveys -VACAPES/CHPT/JAX OPAREAs	36 days.
Vessel Surveys -VACAPES/CHPT/JAX OPAREAs	24 days.
Marine Mammal Tagging	JAX in coordination with vessel surveys - study design to be developed.
Passive Acoustics – Baseline	Continue recording and data analysis for 3 strategically located HARPs.
Passive Acoustics – Exercise Monitoring	2 deployments of pop-up buoys in conjunction with exercises.

- Specific to the VACAPES/CHPT/JAX baseline monitoring projects, the methods are being modified in response to recommendations from the SAG, as well as the increasing level of knowledge within these regions since beginning this effort over four years ago. The modifications include: Discontinuing standard line-transect shipboard surveys in Onslow Bay and JAX and replace with photo-identification and biopsy sampling effort in Onslow Bay and JAX.
- Adding a photo-identification and biopsy-sampling component off Cape Hatteras.
- Significantly reducing aerial line-transect survey effort in Onslow Bay and re-allocating this survey effort to Cape Hatteras.
- Reducing the number of HARPs from two to one in both Onslow Bay and JAX and adding a HARP off Cape Hatteras. All three of these HARPs will monitor year-round.

The rationale for these changes is as follows. First, our survey area is expanding to include Cape Hatteras, based on the overlap of high marine mammal densities and U.S. Navy training activity in that region. Second, surveys are focusing on residency and population structure with ship-board surveys because: (1) adequate data are being obtained with which to estimate density from aerial line-transect sampling; (2) limited photo-identification data from Onslow Bay suggests considerable residency in that area despite minimal sampling; and (3) a large number of deep-diving marine mammal species in either Onslow Bay or JAX are not being observed and are likely to be missed during aerial surveys. Finally, we are reducing the number of HARPs deployed from four to three to reduce the incoming data stream that has been too voluminous to analyze given existing resources.

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Appendix A – Integrated Comprehensive Monitoring Program. 2010 Update (Included on CD, Enclosure 4)

Appendix B – Publications and Presentations Resulting from AFAST-related Monitoring Efforts

PUBLICATIONS

Foley, H. J., R. C. Holt, R. E. Hardee, P. B. Nilsson, K. A. Jackson, A. J. Read, D. A. Pabst, and W. A. McLellan. 2011. Observations of a western North Atlantic right whale (*Eubalaena glacialis*) birth offshore of the protected southeast U.S. critical habitat. *Marine Mammal Science* 27(3):E234-E240.

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Appendix C – Onslow/JAX Monitoring Plan
(Included on CD, Enclosure 4)

Appendix D – Onslow Bay/JAX Annual Monitoring Report: August 2009 – July 2010 (Included on CD, Enclosure 4)

Appendix E – Cape Hatteras/Onslow Bay/
JAX Monthly Progress Reports
(Included on CD, Enclosure 4)

Appendix F – Behavioral Response Study Report – 2011
(Included on CD, Enclosure 4)

Appendix G – December 2010 SEASWITI Monitoring:
Vessel Survey and Towed Array Report
(Included on CD, Enclosure 4)

Appendix H – August 2010 ASW Monitoring:
VACAPES Aerial Survey Report
(Included on CD, Enclosure 4)

Appendix I – December 2010 SEASWITI Monitoring:
JAX Aerial Survey Report
(Included on CD, Enclosure 4)

Appendix J – Navy Lookout Protocol, Revised December 2010
(Included on CD, Enclosure 4)