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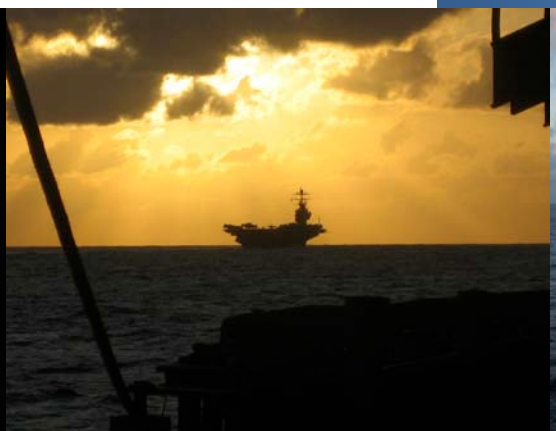
Marine Species Monitoring

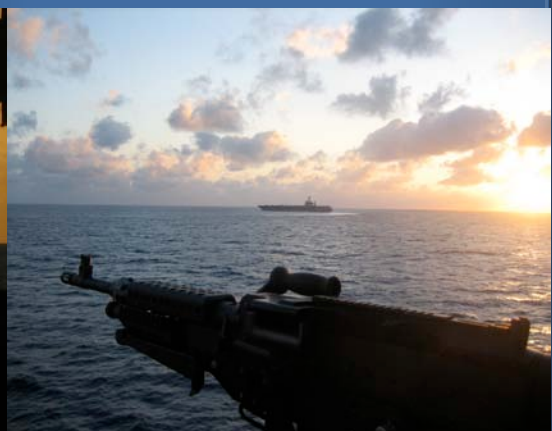
For The U.S. Navy's

Atlantic Fleet Active Sonar Training (AFAST)

September 2010

Annual Report 2010





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List of Acronyms

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

INTRODUCTION

Background

The U.S. Navy developed Range Complex specific Monitoring Plans to provide marine mammal and sea turtle monitoring as required under the Marine Mammal Protection Act (MMPA) of 1972 and the Endangered Species Act (ESA) of 1973. In order to issue an Incidental Take Authorization (ITA) for an activity, Section 101(a) (5) (a) of the MMPA states that National Marine Fisheries Service (NMFS) must set forth "requirements pertaining to the monitoring and reporting of such taking." The MMPA implementing regulations at 50 CFR Section 216.104 (a) (13) note that requests for Letters of Authorization (LOAs) must include the suggested means of accomplishing the necessary monitoring and reporting that will result in increased knowledge of the species and of the level of taking or impacts on populations of marine mammals that are expected to be present. While the Endangered Species Act (ESA) does not have specific monitoring requirements, recent Biological Opinions issued by National Marine Fisheries Service (NMFS) also have included terms and conditions requiring the Navy to develop a monitoring program. Therefore, as part of the issuance of an LOA in early 2009 (NMFS 2009), the Navy published a Monitoring Plan with specific monitoring objectives for the Atlantic Fleet Active Sonar Training (AFAST) (DoN 2009).

Based on discussions with NMFS, Range Complex Monitoring Plans were designed as a collection of focused "studies" to gather data that will attempt to address the following questions that are described more fully in the AFAST Monitoring Plan:

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

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

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

4. Is the Navy's suite of mitigation measures for MFAS (e.g., Protective Measures Assessment Protocol (PMAP), major exercise measures agreed to by the Navy through permitting) effective at avoiding TTS, injury, and mortality of marine mammals and sea turtles?

Monitoring methods proposed for the Range Complex Monitoring Plans include a combination of research elements designed to support both Range Complex specific monitoring, and contribute information to a larger Navy-wide science-based program. These research elements include visual surveys from vessels or airplanes, passive acoustic monitoring (PAM), and marine mammal observers (MMO). Each monitoring technique has advantages and disadvantages that vary temporally and spatially, as well as support one particular study objective better than another (DoN 2009). The Navy intends to use a combination of techniques so that detection and observation of marine animals is maximized, and meaningful information can be derived to answer the research questions proposed above.

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

Integrated Comprehensive Monitoring Program (ICMP)

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

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

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

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

Report Objective

Design of the Range Complex specific Monitoring Plans represented part of a new Navy-wide and regional assessment, and as with any new program, there are many coordination, logistic, and technical details that continue to be refined. The scope of the Range Complex Monitoring Plans was to layout the background for monitoring, as well as define initial procedures to be used in meeting certain study objectives derived from NMFS-Navy agreements.

Overall, and in support of the above statement, this report serves two main objectives:

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

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

ATLANTIC FLEET ACTIVE SONAR TRAINING (AFAST)

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

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

Part I - AFAST Monitoring Plan Accomplishments

AFAST STUDY QUESTIONS OVERVIEW

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

LONGITUDINAL BASELINE MONITORING

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

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

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

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

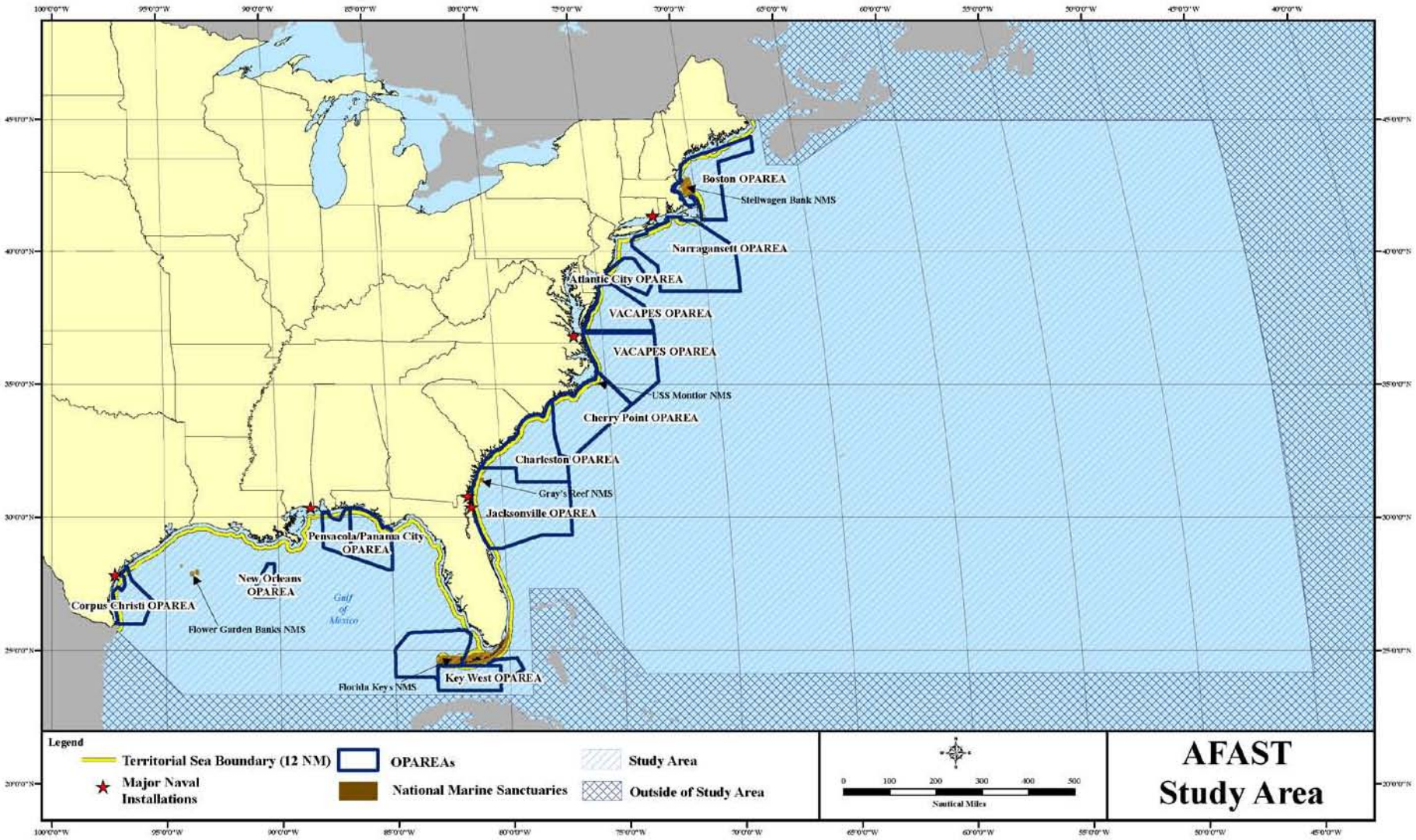

Figure 1. AFAST Study Area.

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

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

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

AFAST MONITORING ACCOMPLISHMENTS FOR THE REPORTING PERIOD

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

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

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

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

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

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

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

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

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

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

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

AFAST AERIAL VISUAL SURVEYS

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

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

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

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

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

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

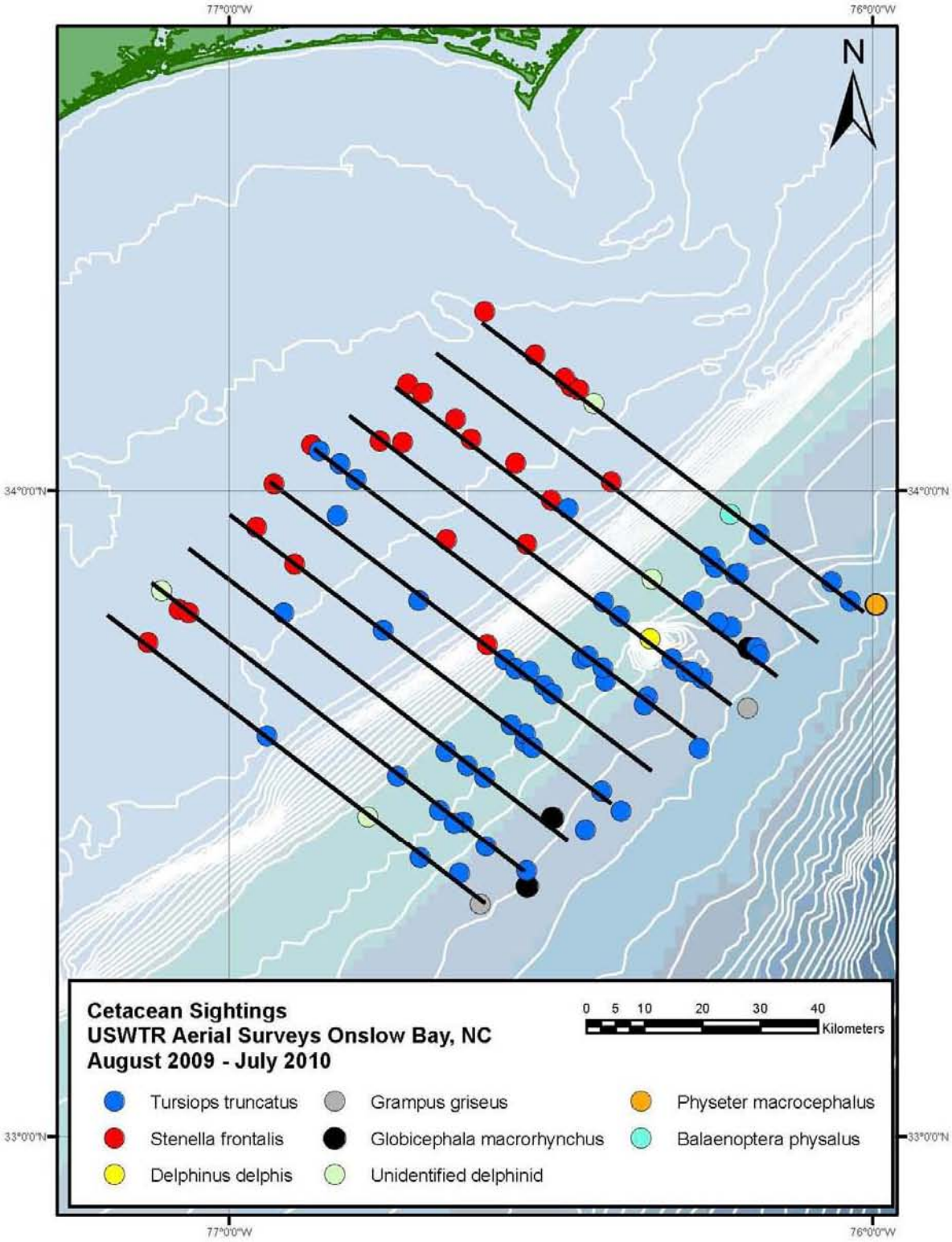

Figure 2. Locations of cetacean sightings from aerial surveys conducted in Onslow Bay, August 2009 through July 2010.

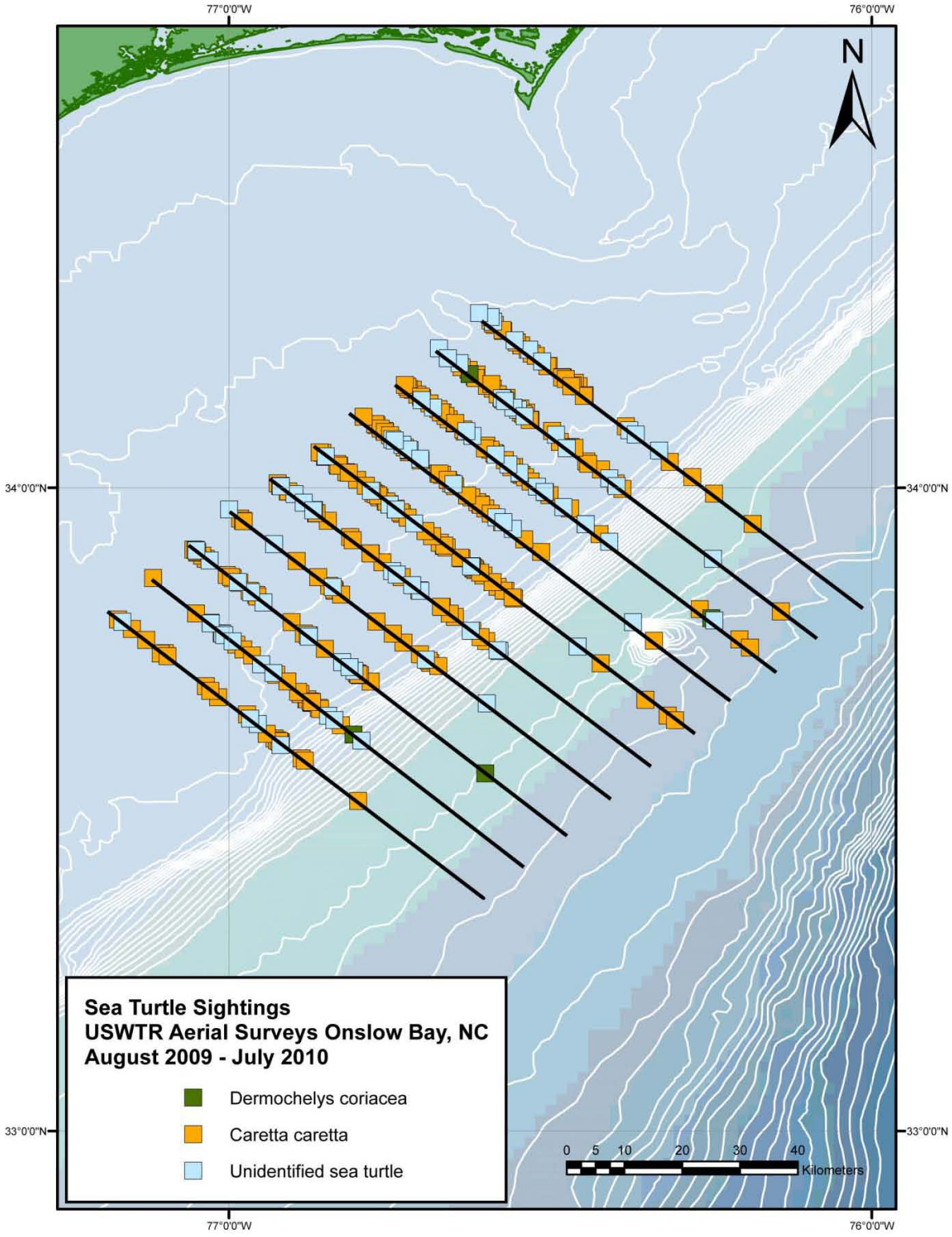

Figure 3. Locations of sea turtle sightings from aerial surveys conducted in Onslow Bay, August 2009 through July 2010.

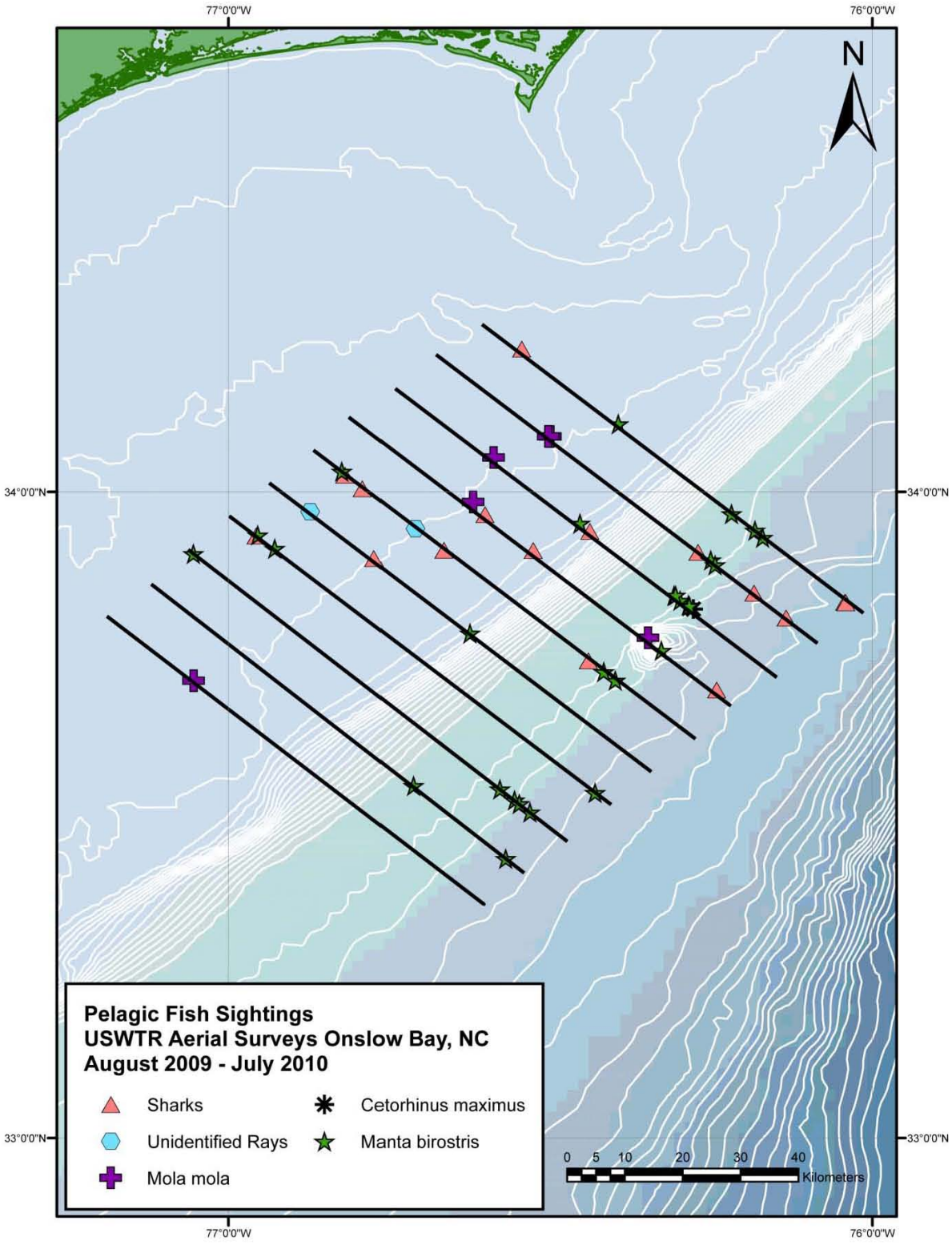

Figure 4. Locations of pelagic fish sightings from aerial surveys conducted in Onslow Bay, August 2009 through July 2010.

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

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

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

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

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

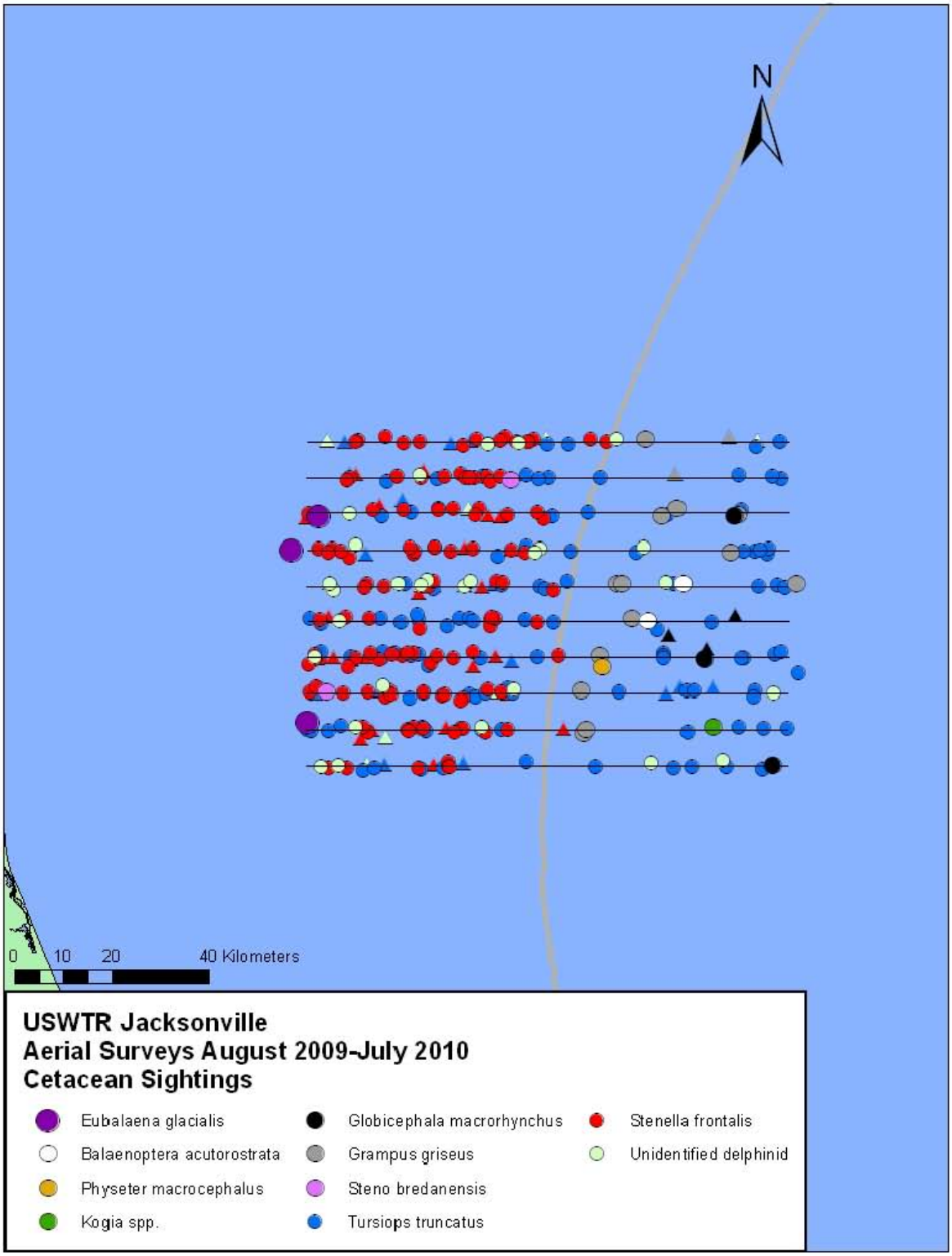

Figure 5. Locations of cetacean sightings from aerial surveys conducted in JAX, August 2009 through July 2010.

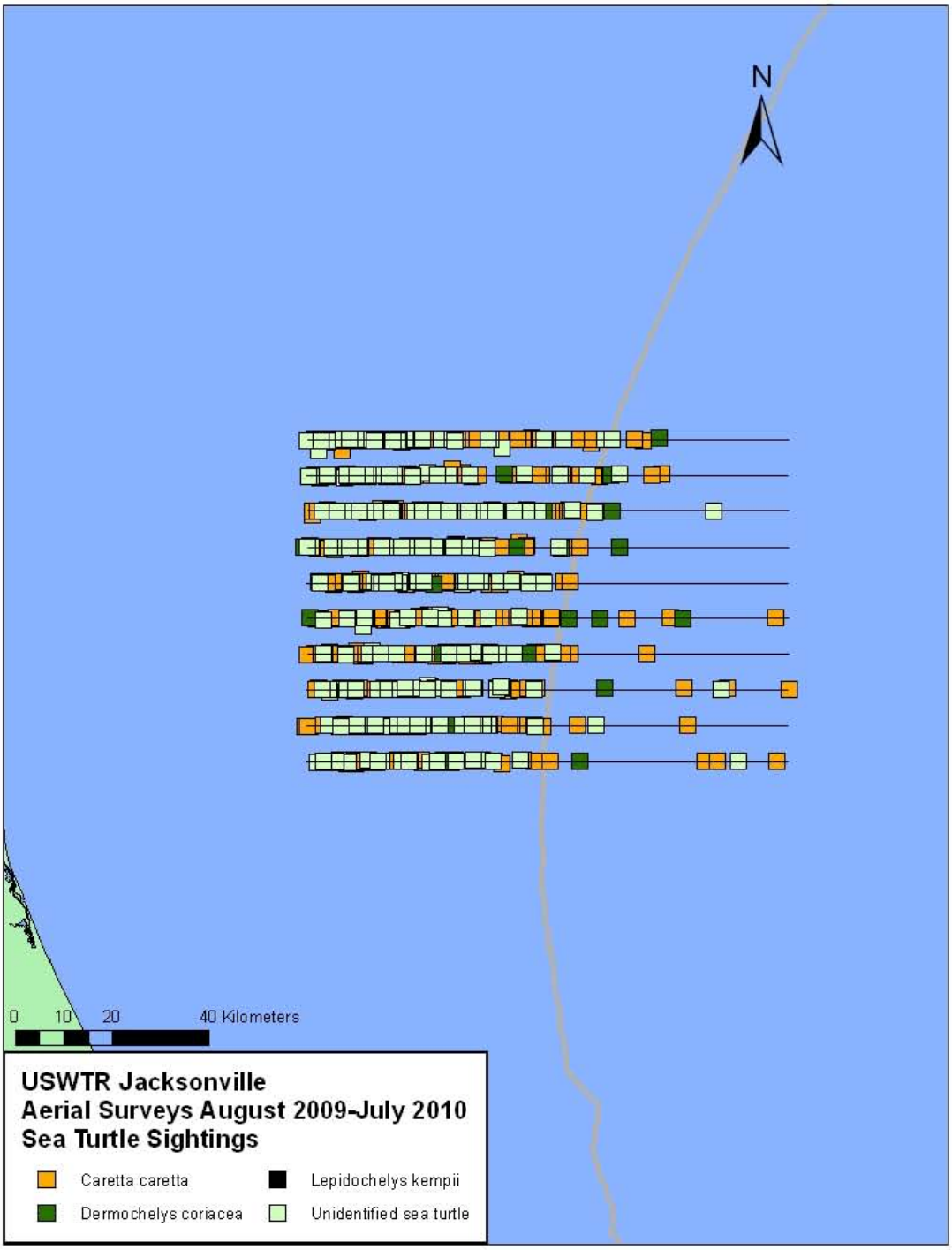

Figure 6. Locations of sea turtle sightings from aerial surveys conducted in JAX, August 2009 through July 2010.

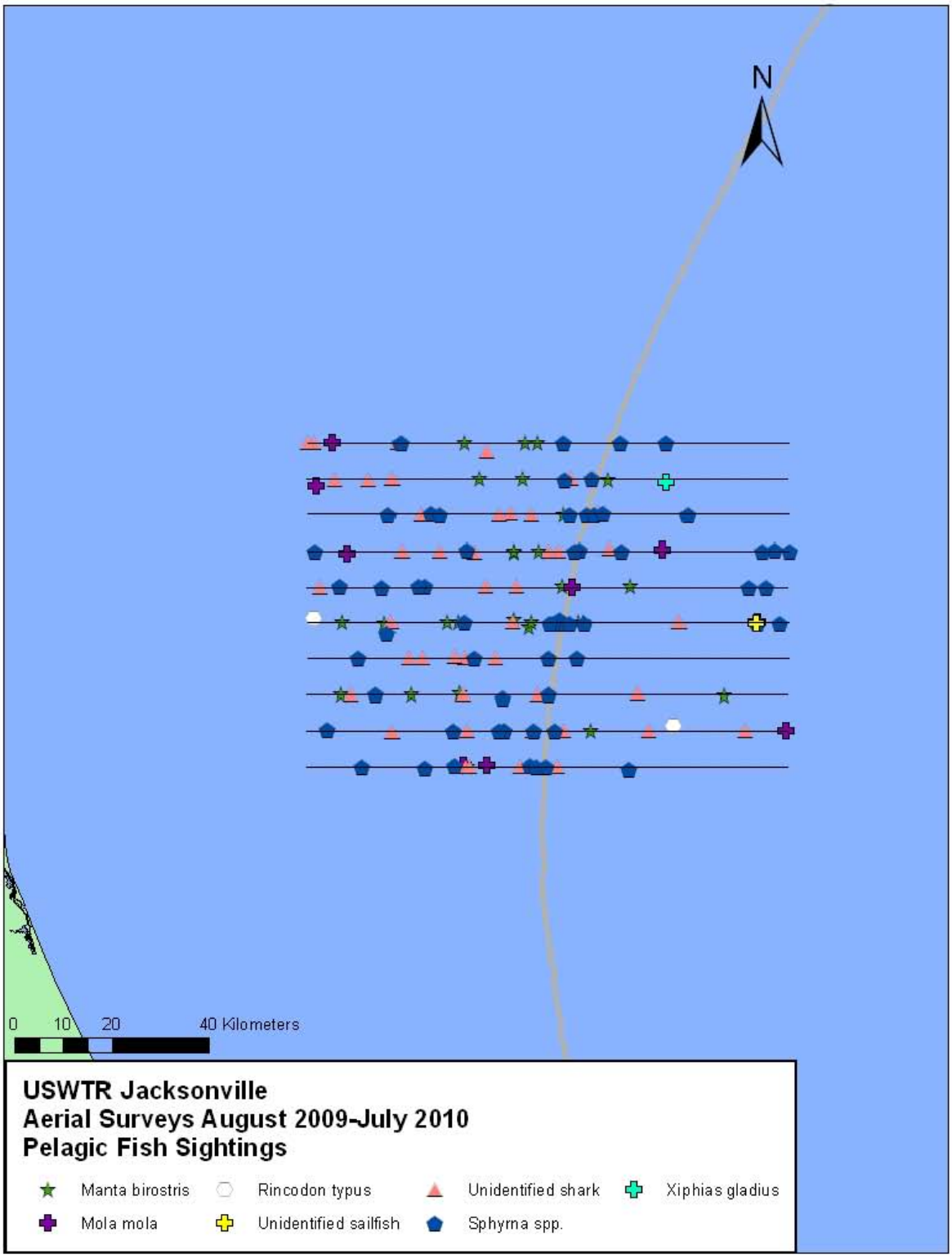

Figure 7. Locations of pelagic fish sightings from aerial surveys conducted in JAX, August 2009 through July 2010.

Right Whale Sightings and Observed Birth

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

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

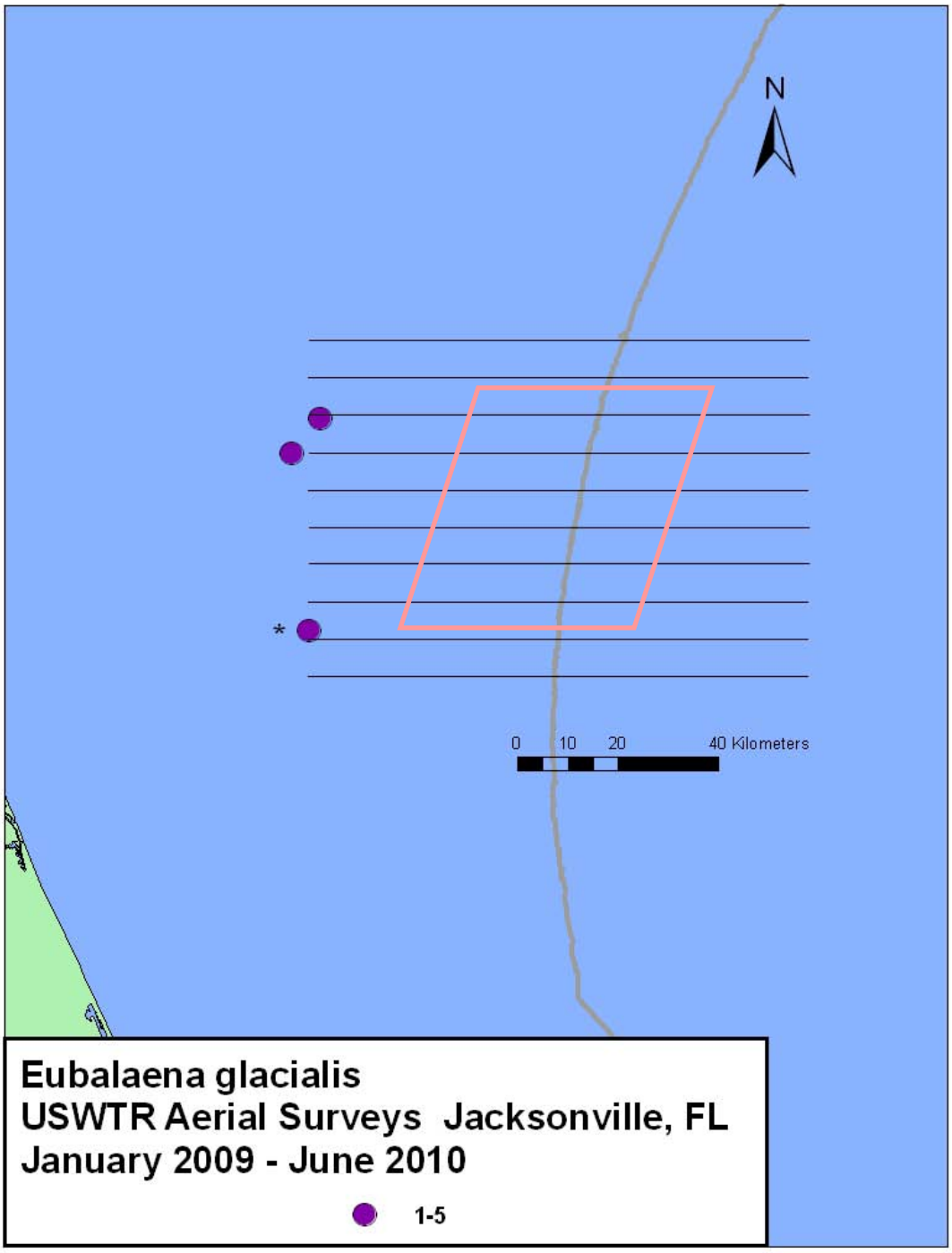

Figure 9. Plot of right whale (Eubalaena glacialis) sightings. Asterisk denotes observed right whale birth (see text above for description).

AFAST VESSEL VISUAL SURVEYS

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

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

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

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

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

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

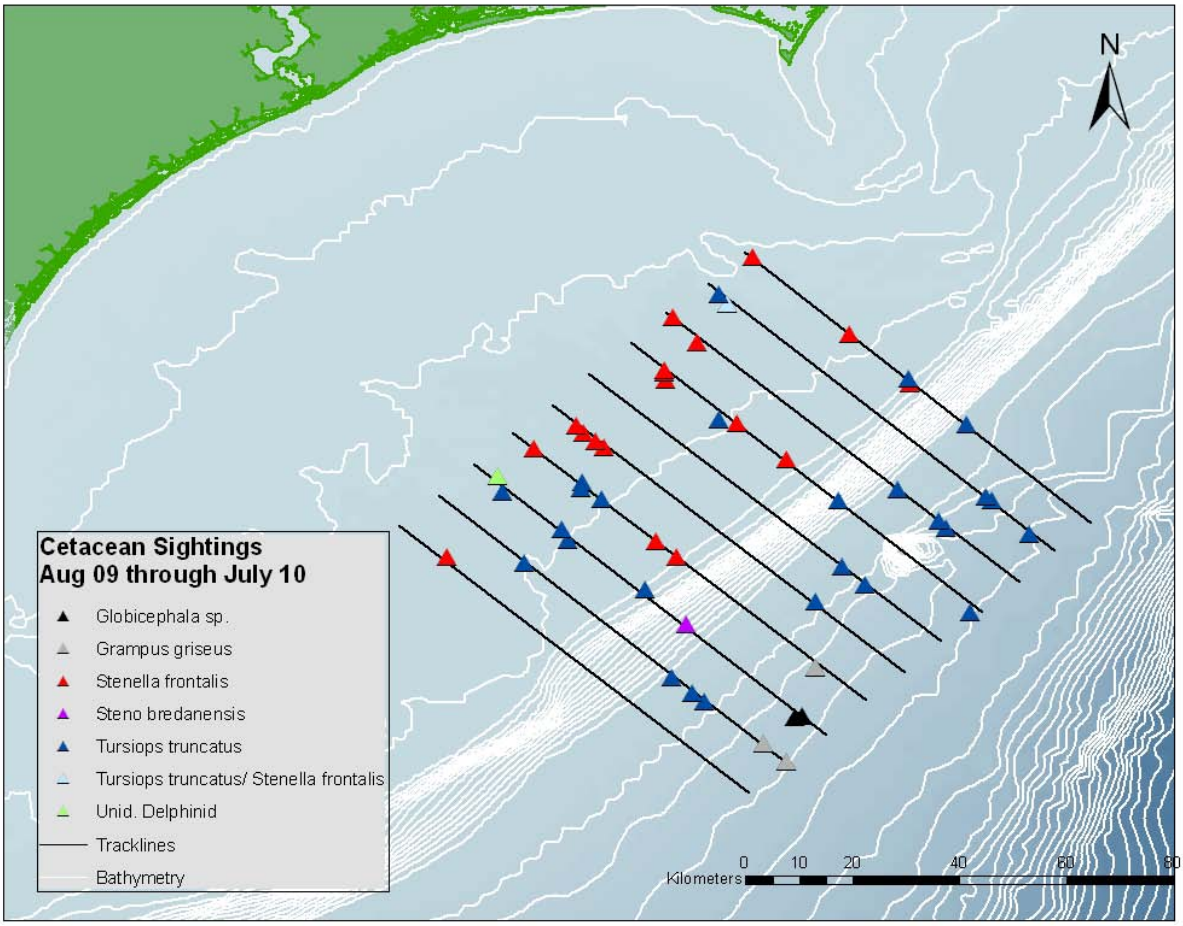

Figure 10. Locations of cetacean sightings from vessel surveys conducted in Onslow Bay, August 2009 through July 2010.

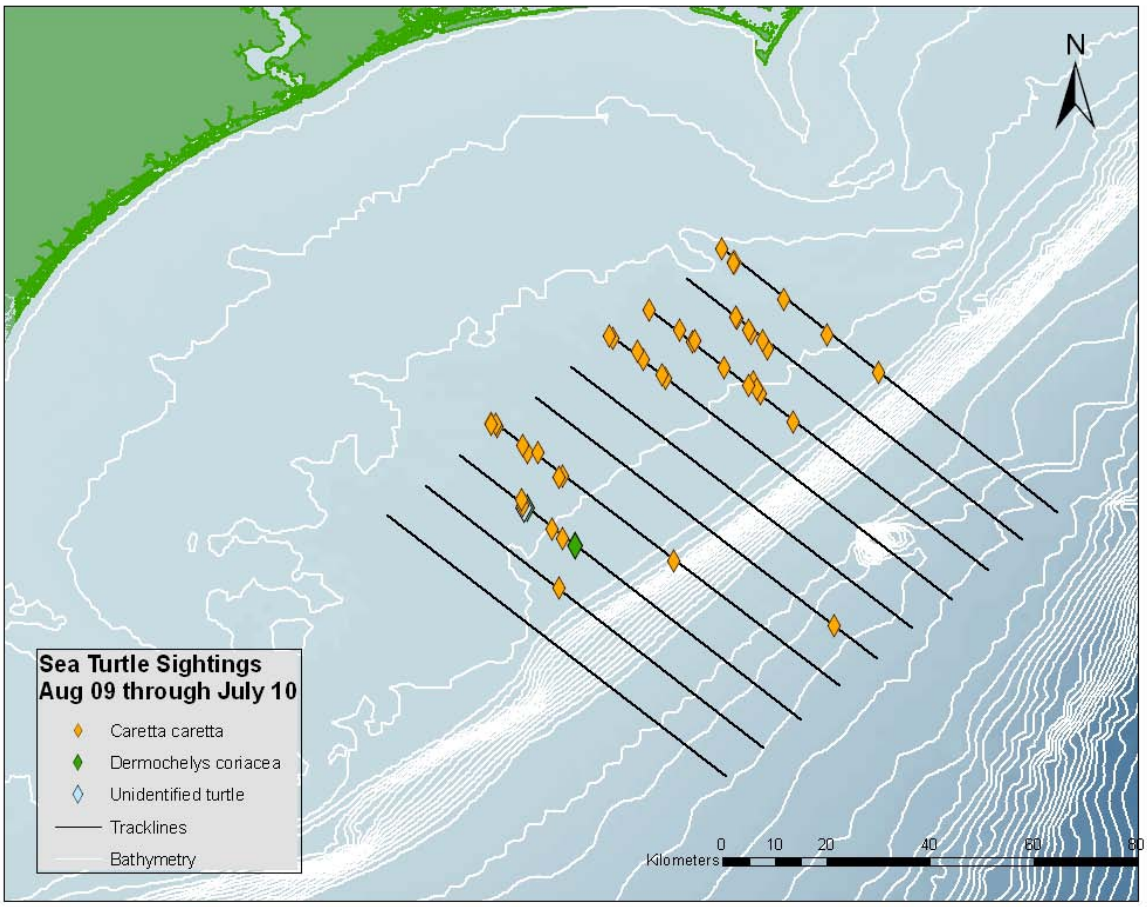

Figure 11. Locations of sea turtle sightings from vessel surveys conducted in the Onslow Bay USWTR, August 2009 through July 2010.

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

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

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

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

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

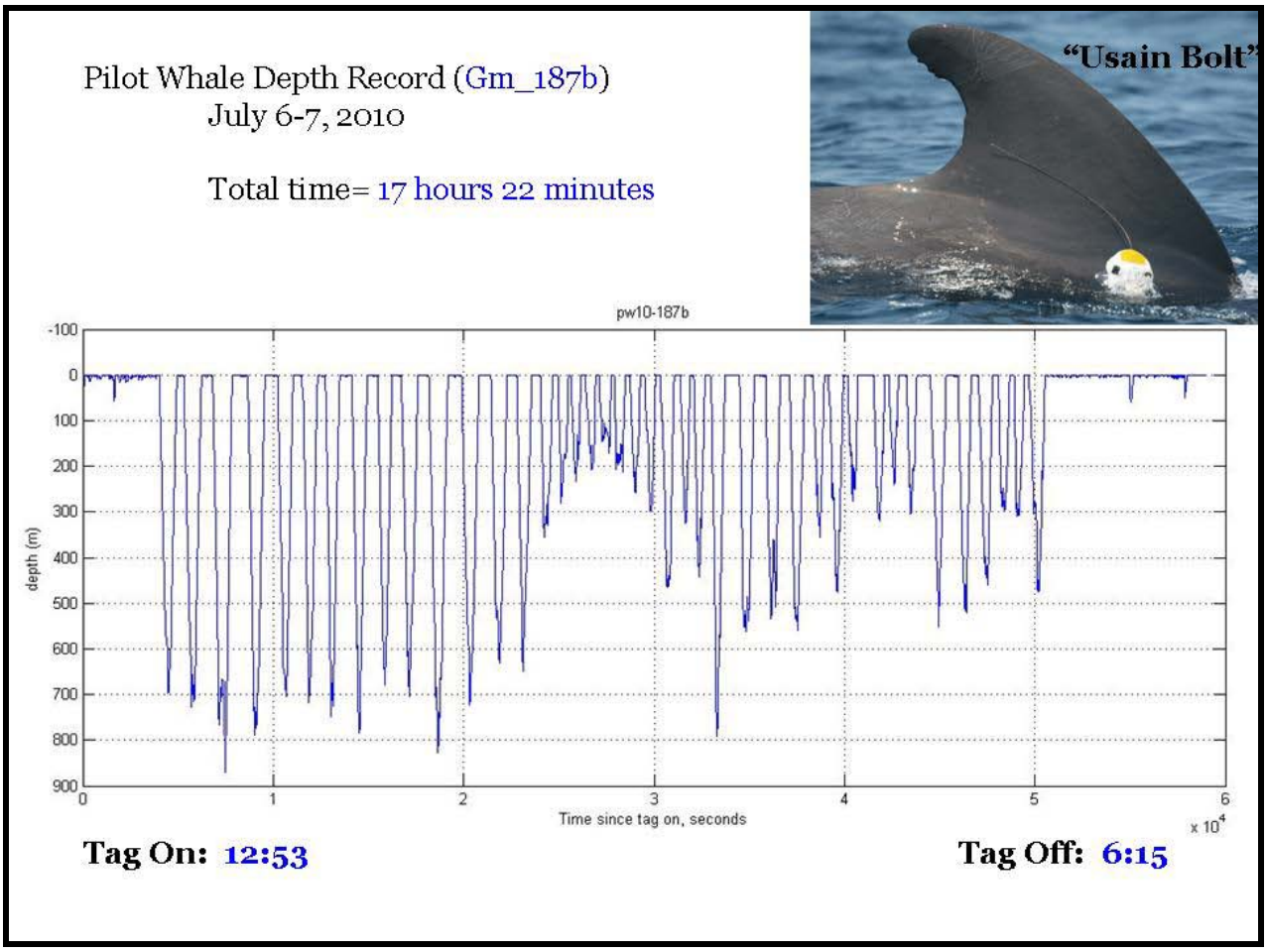

Figure 12. Dive profile of pilot whale, Gm_187b, equipped with a DTAG July 6-7, 2010.

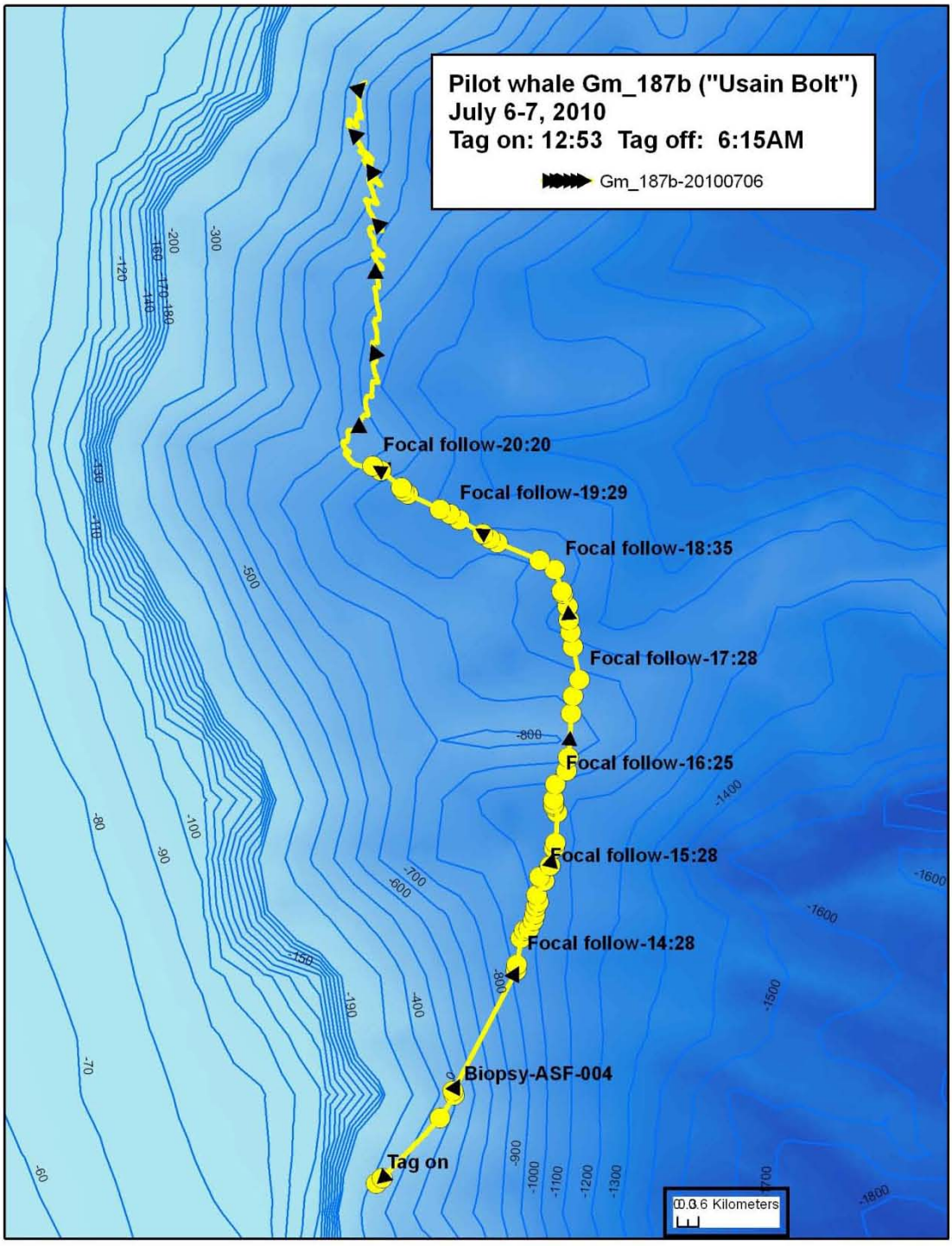

Figure 13. Plot of track of focal follow of pilot whale, Gm_187b, equipped with DTAG, July 6-7, 2010.

Sea Turtle Satellite Tag Deployment

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

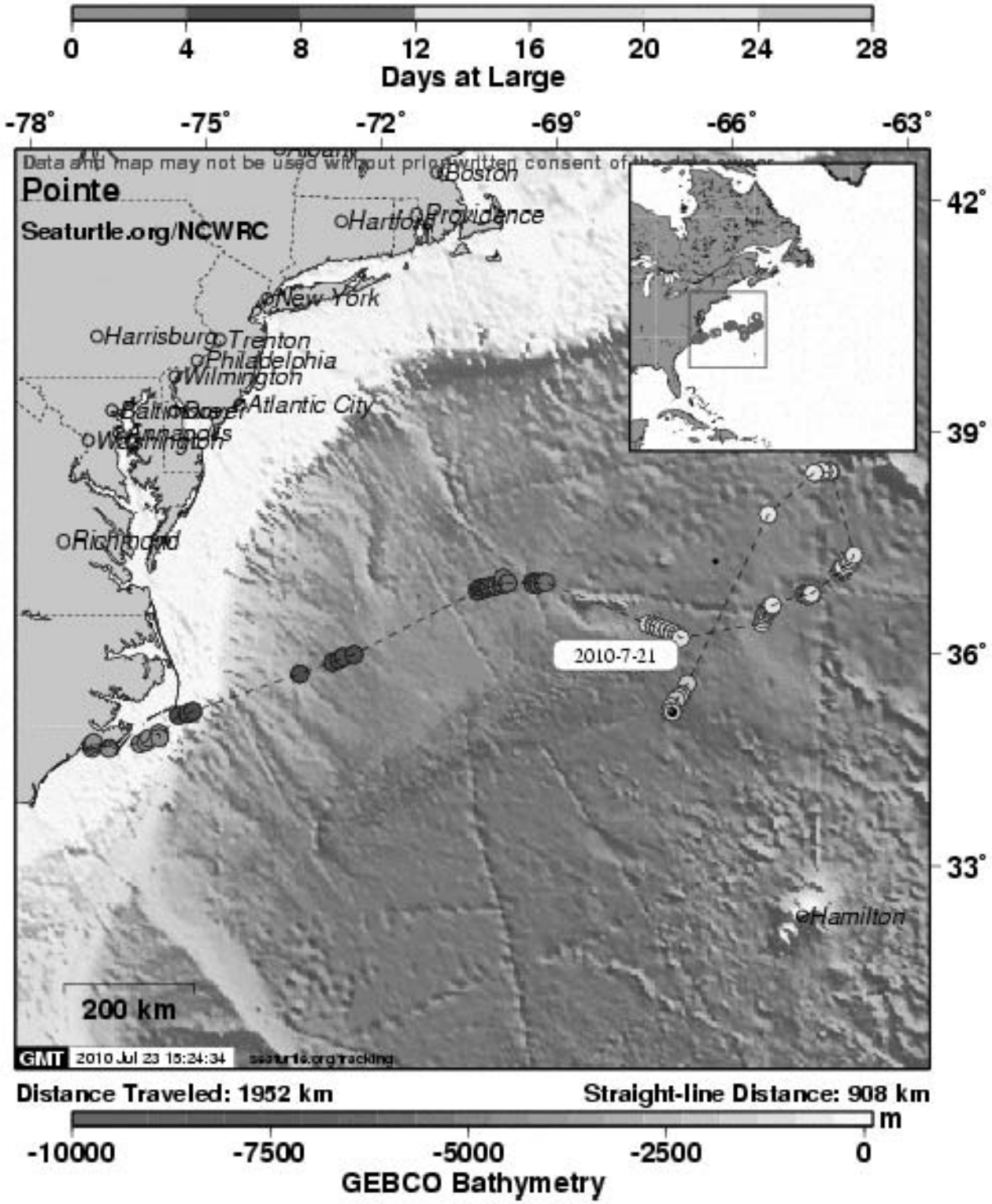

Figure 14. Map of "Pointe," a loggerhead sea turtle equipped with a SPLASH tag on 26 June 2010.

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

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

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

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

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

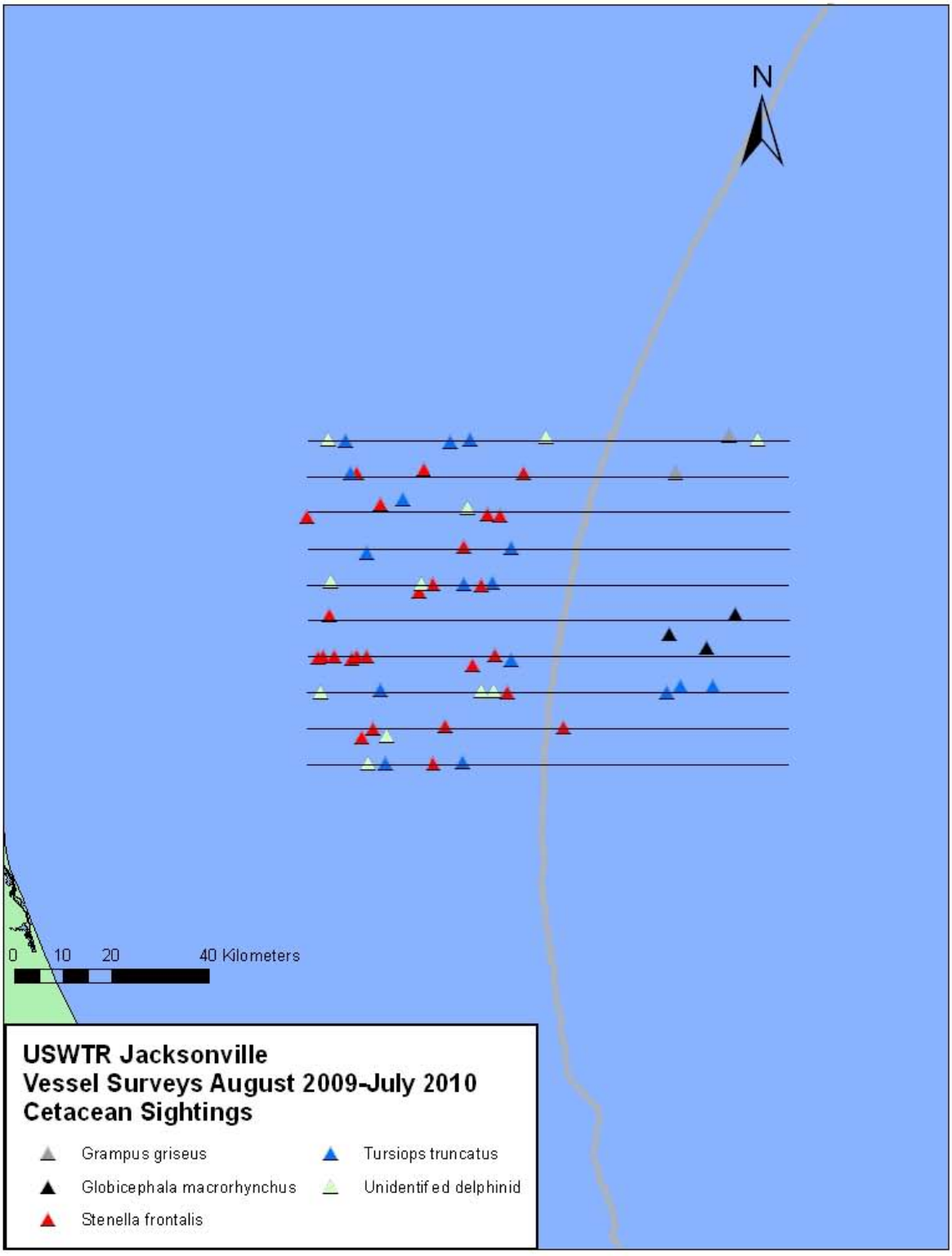

Figure 15. Locations of cetacean sightings from vessel surveys conducted in JAX, August 2009 through July 2010.

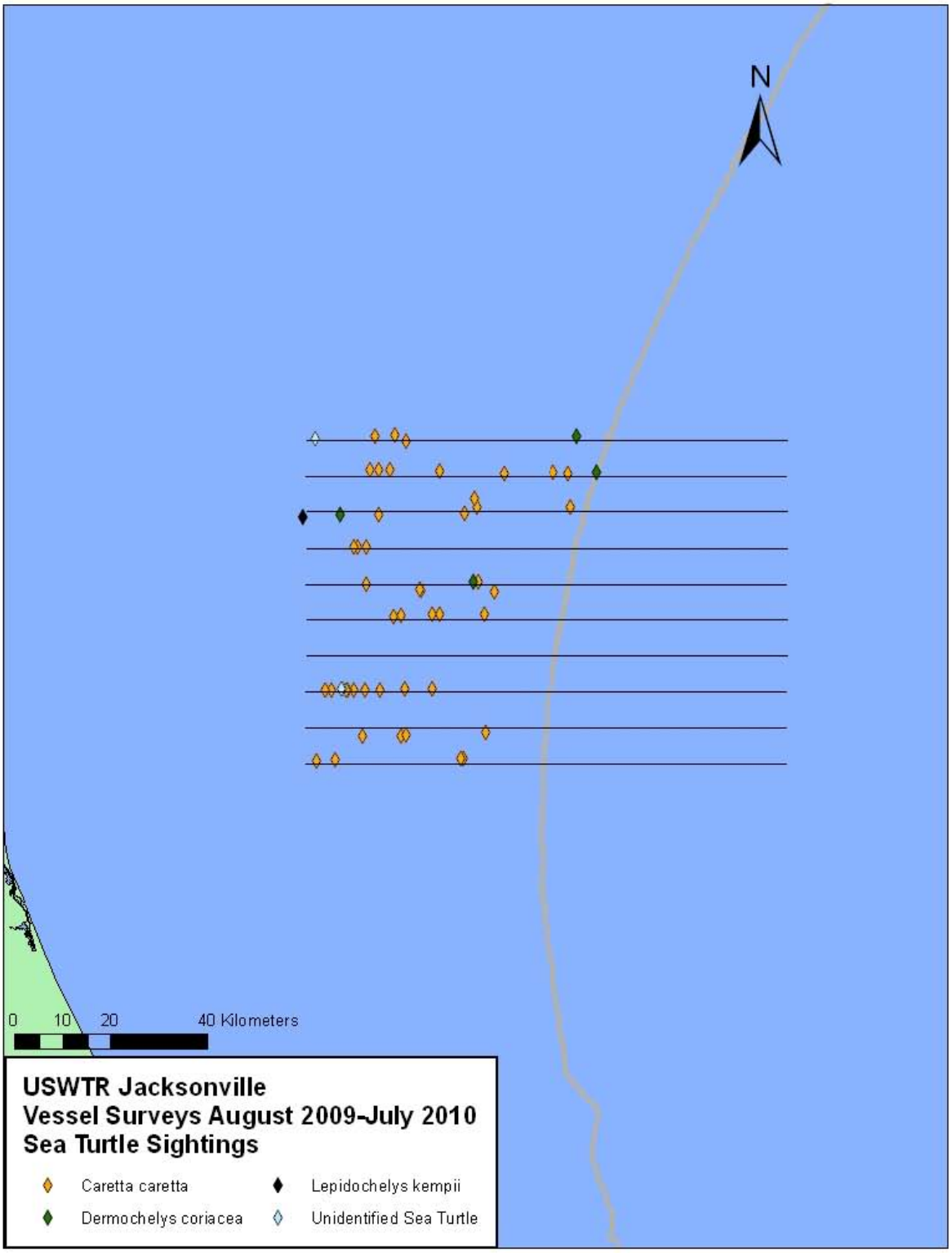

Figure 16. Locations of turtle sightings from vessel surveys conducted in JAX, August 2009 through July 2010.

AFAST PASSIVE ACOUSTIC MONITORING (PAM)

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

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

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

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

Table 14. Deployment details for the Onslow Bay HARPs.

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

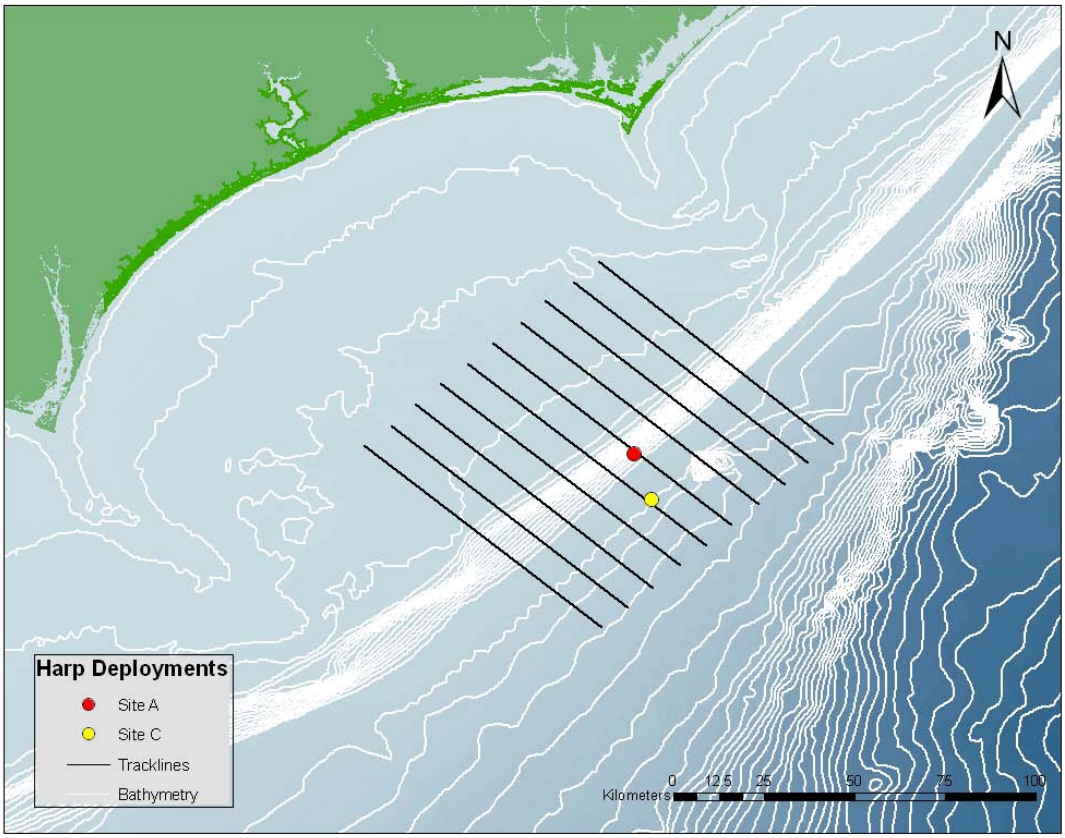

Figure 17. Locations of HARPs deployed in Onslow Bay, 2 August 2009 through 1 August 2010.

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

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

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

Table 16. Deployment details for the JAX HARPs.

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

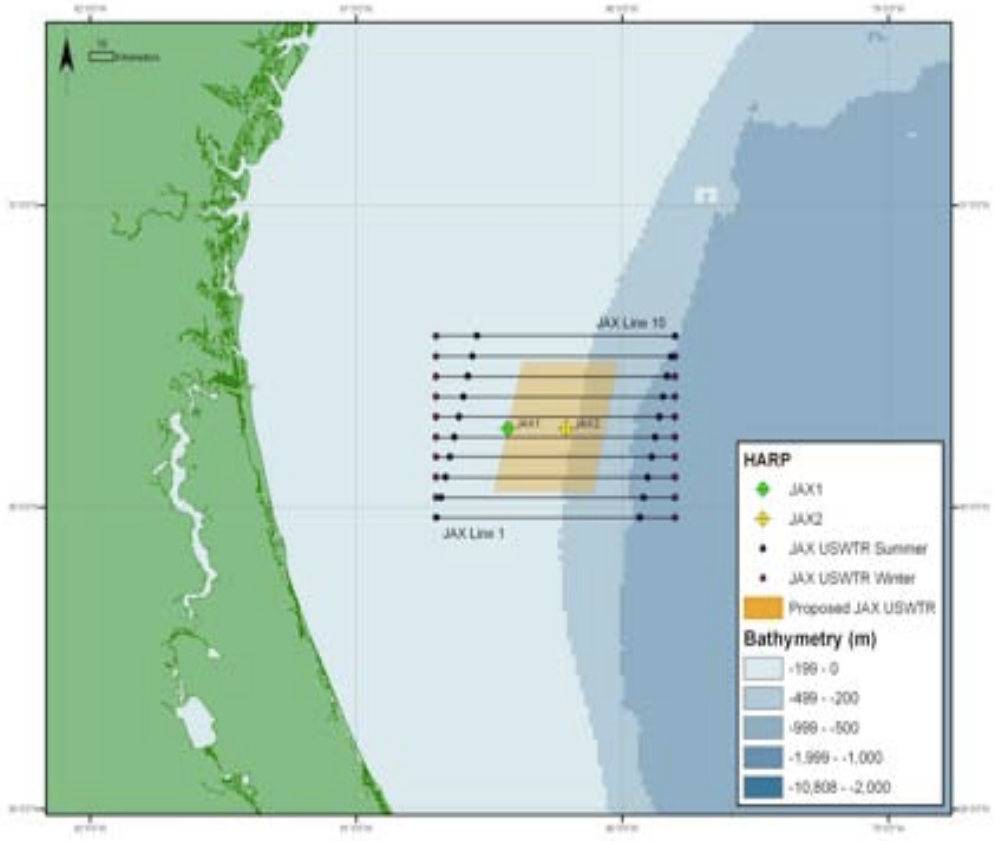

Figure 18. Locations of HARPs deployed in the JAX USWTR.

COORDINATED ASW EXERCISE MONITORING

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

Passive Acoustics – pop-up buoys

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

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

Aerial Surveys

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

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

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

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

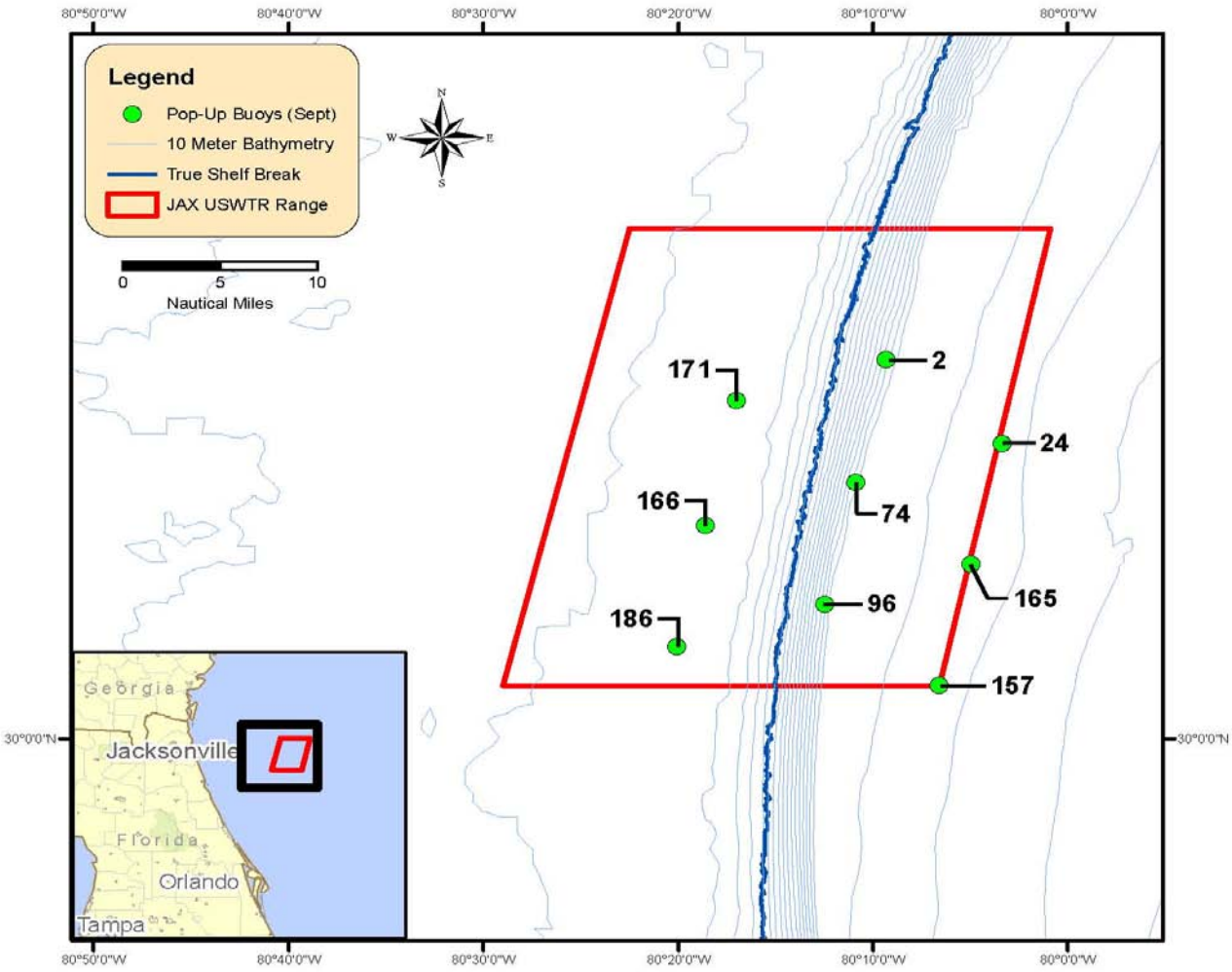

Figure 19. Location of JAX Pop-up buoy deployment, September 2009.

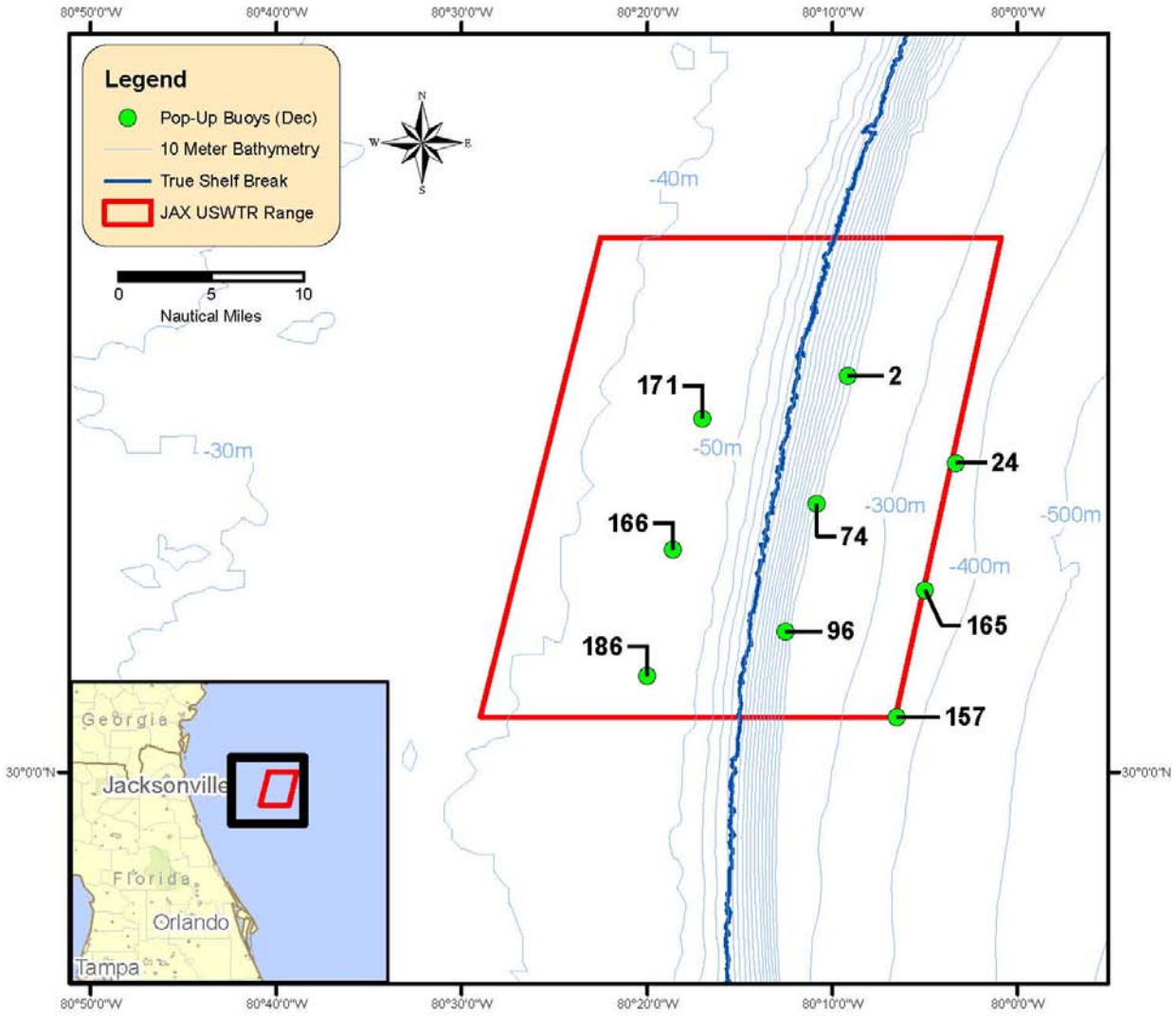

Figure 20. Location of JAX Pop-up buoy deployment, December 2009.

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

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

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

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

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

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

AFAST MARINE MAMMAL OBSERVERS (MMOs)

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

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

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

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

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

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

Detailed sighting information is included in Appendix F

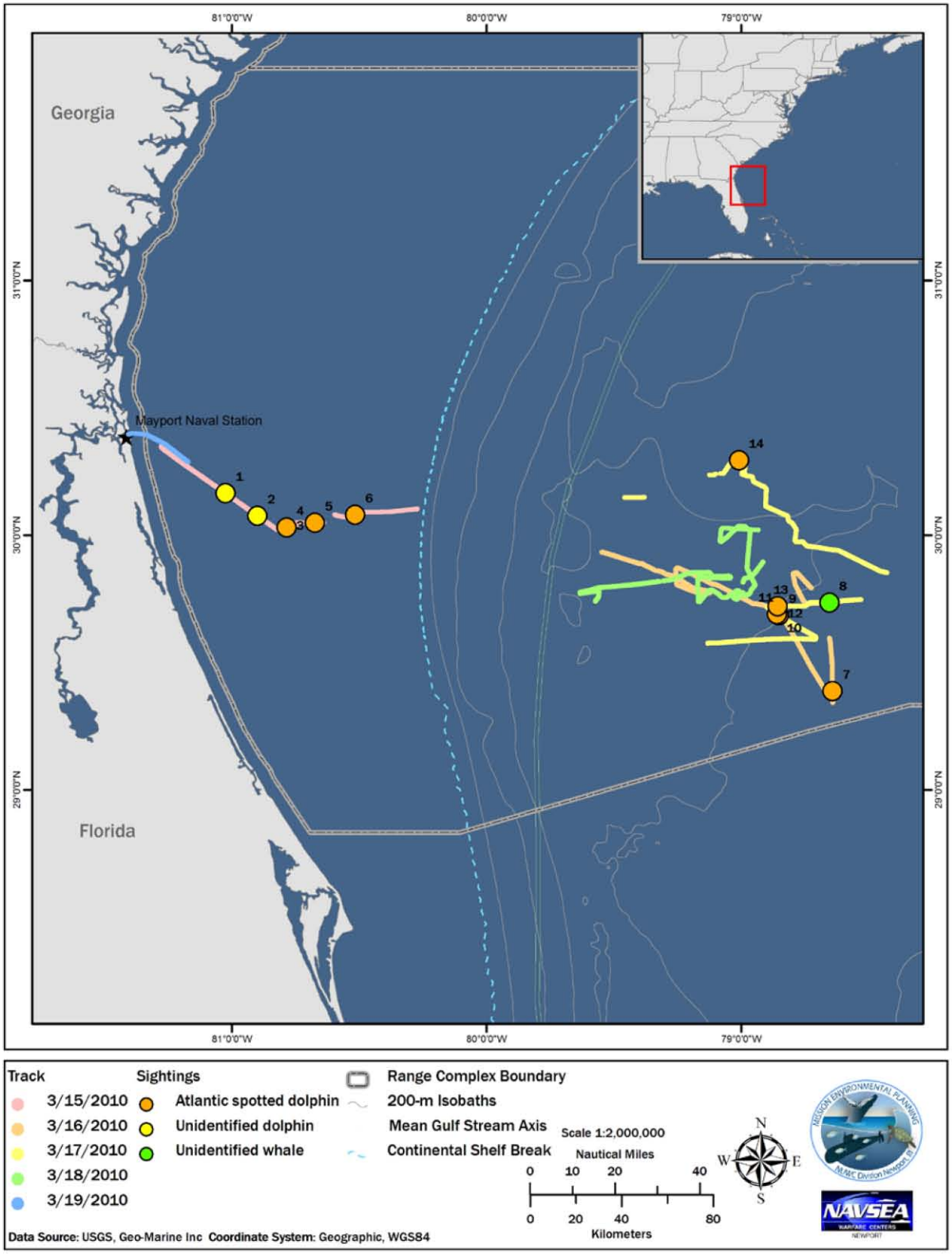

Figure 21. Ship and marine mammal sighting locations during the March 2010 SEASWITI.

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

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

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

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

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

Detailed sighting information is included in Appendix G

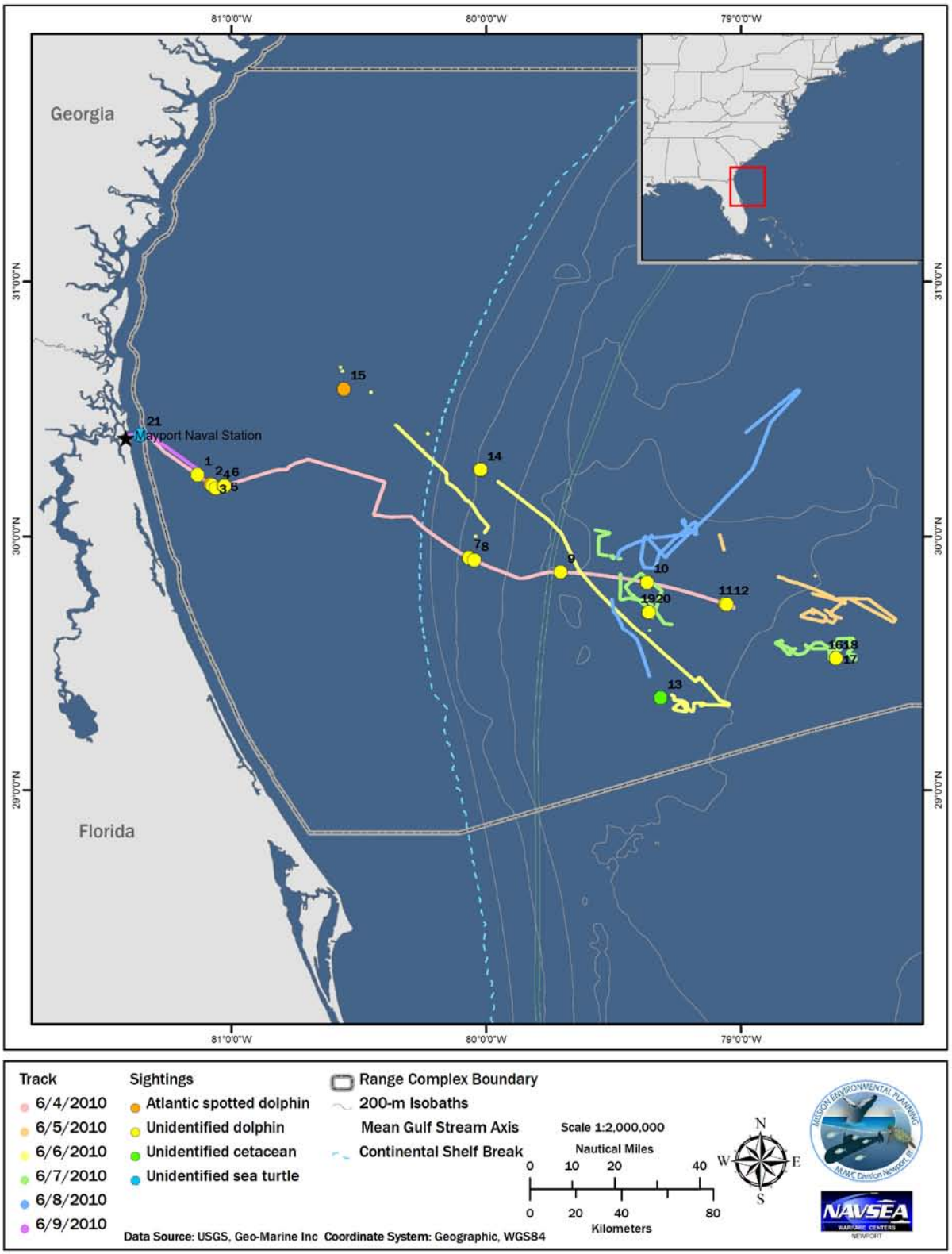

Figure 22. Ship and marine mammal/sea turtle locations during the June 2010 SEASWITI.

NAVY LOOKOUT EFFECTIVENESS STUDY

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

Overview of analysis methods

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

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

Overview of data collection methods

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

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

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

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

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

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

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

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

Lookout Effectiveness Trials Completed

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

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

Table 24. Lookout Effectiveness Data Collection Trials

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

Part II - AFAST Adaptive Management Recommendations

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

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

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

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

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

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

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

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

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

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Observer Effectiveness Study:

Study Design and Development

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Appendix A - Integrated Comprehensive Monitoring Program

UNITED STATES NAVY

INTEGRATED COMPREHENSIVE MONITORING PROGRAM

23 December 2009

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EXECUTIVE SUMMARY

The Navy is responsible for compliance with a suite of Federal environmental laws and regulations that apply to marine mammals and other marine protected species, including the Endangered Species Act (ESA) and the Marine Mammal Protection Act (MMPA). As part of the regulatory compliance process associated with these Acts, the Navy is responsible for meeting specific requirements for monitoring and reporting on activities involving active sonar and/or detonations from underwater explosives.

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

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

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

Section 1 introduces the ICMP, including purpose, objectives, specific ranges and geographic areas included, and additional background material. Section 2 describes overall monitoring goals and prioritization guidelines. Section 3 discusses standard data collection and management procedures. Section 4 addresses the coordination of reporting requirements, including a specific timeline for coordination of the current year's reporting requirements, and the recordkeeping system that documents how each Range Complex contributes to ongoing monitoring objectives. Section 5 outlines the adaptive management process, including provisions for annual reviews as well as a monitoring workshop in 2011. Section 6 discusses near-term plans for continued maturation of the Monitoring Program.

Section 7 provides roles and responsibilities among the various Navy components. References are listed in Section 8.

OPNAV (N45) is responsible for maintaining and updating this ICMP as required to reflect the results of future regulatory agency final rulemaking, adaptive management reviews, best available science, improved assessment methodologies, or more effective protective measures. This will be done in consultation with Navy technical experts, Fleet Commanders, and Echelon II Commands as appropriate as part of the adaptive management process.

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1. INTRODUCTION

The Navy is responsible for compliance with a suite of Federal environmental laws and regulations that apply to marine mammals and other marine protected species, including the Endangered Species Act (ESA) and the Marine Mammal Protection Act (MMPA). As part of the regulatory compliance process associated with these Acts, the Navy is responsible for meeting specific requirements for monitoring and reporting on military readiness activities involving active sonar and underwater detonations from explosives and explosive munitions. These military readiness activities include both Fleet training events and Navy-funded research, development, test and evaluation (RDT&E) activities.

This Integrated Comprehensive Monitoring Program (ICMP) plan provides the overarching framework for coordination of the United States Navy monitoring program. It is intended for use as a planning tool to focus Navy monitoring priorities pursuant to ESA and MMPA requirements and as an adaptive management tool to analyze and refine monitoring and mitigation techniques over time. It has been developed in direct response to Navy Range permitting requirements established in the various MMPA Final Rules, ESA Consultations, Biological Opinions, and applicable regulations. As a framework document, the ICMP applies by regulation to those activities on ranges and operating areas for which the Navy sought and received incidental take authorizations.

The ICMP currently includes specific monitoring plans that have been or are being developed for the Southern California (SOCAL) Range Complex, Atlantic Fleet Active Sonar Training (AFAST) Study Area, Hawaii Range Complex (HRC), Mariana Islands Range Complex (MIRC), Northwest Training Range Complex (NWTRC), Gulf of Alaska (GOA), Virginia Capes (VACAPES) Range Complex, Cherry Point Range Complex, Jacksonville (JAX) Range Complex[1], Gulf of Mexico (GOMEX) Range Complex, Naval Sea Systems Command Naval Undersea Warfare Center Keyport (NUWC Keyport) Range Complex, and Naval Sea Systems Command Naval Surface Warfare Center Panama City Division (NSWC PCD) Study Area. These range complexes and study areas are depicted in Figure 1. Note that the AFAST study area encompasses multiple smaller ranges. Additional ranges or study areas may be added to the ICMP consistent with future Navy range permitting requirements.

Table 1 provides a status listing of the MMPA Final Rules for ranges and study areas presently included in the ICMP, and the applicable dates for those Final Rules that are in effect. This table is current as of 27 November 2009. Unless otherwise specified, references to "MMPA Final Rules" throughout this document include all of the rules listed by Table 1 that have a status of "In Effect". A listing of the corresponding Letters of Authorization and Monitoring Plans in effect as of the data date is provided in the Reference section. While the ICMP also applies to range-specific monitoring plans that are still being developed, modifications to the ICMP may be required to appropriately reflect requirements established by future Rules.

[1] Note, the Jacksonville Range Complex includes operating areas for both Jacksonville, FL and Charleston, SC and is sometimes referred to as the Charleston / Jacksonville (CHASJAX) Range Complex. For purposes of this document, references to this Range Complex will simply be as Jacksonville Range Complex, which is consistent with the nomenclature used in the MMPA Final Rule.

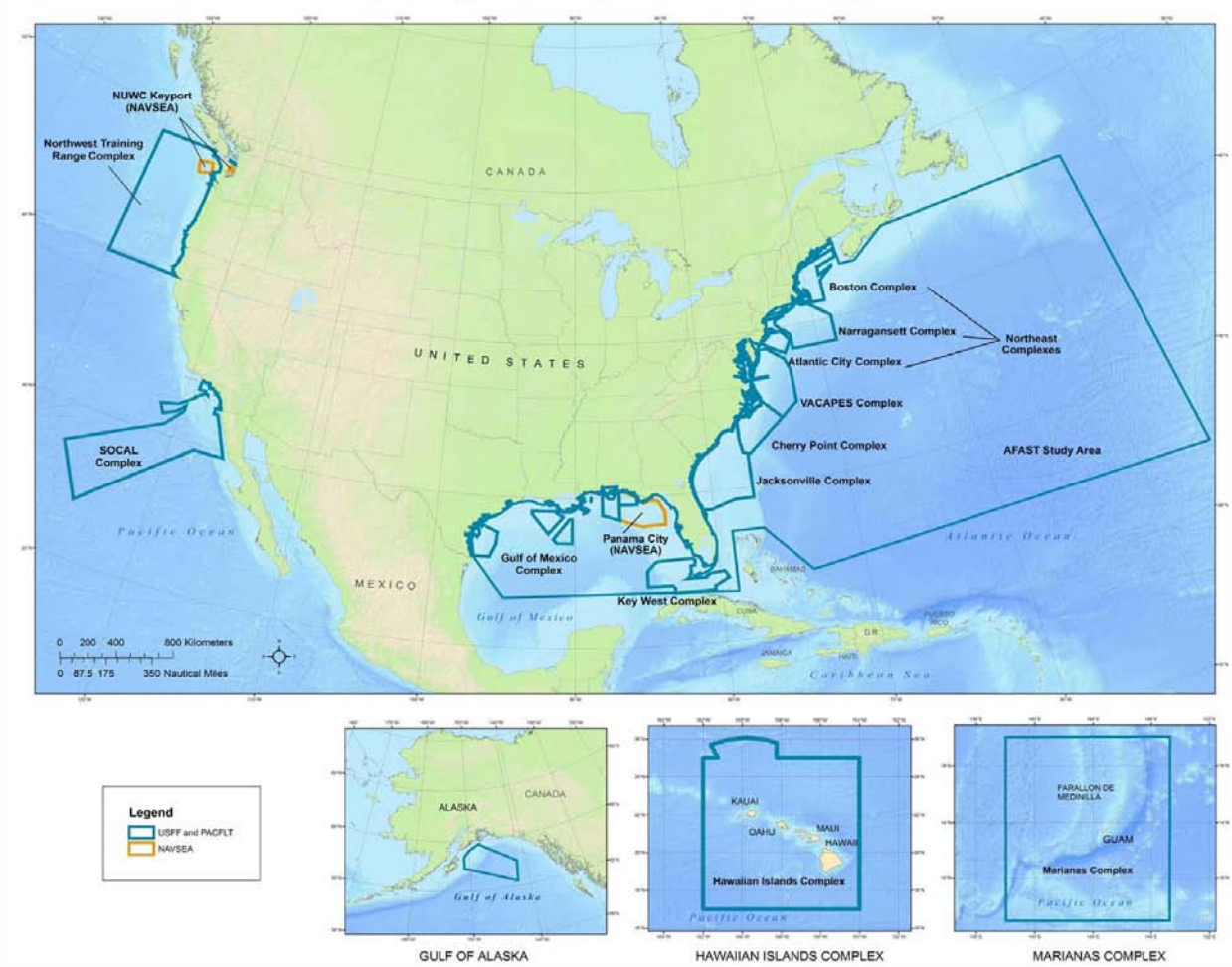

Figure 1: Navy Range Complexes and Study Areas included under the ICMP

Table 1: Status of MMPA Final Rules for Navy Range Complexes included in the ICMP
(Data date: 27 November 2009)

RANGE	MMPA Final Rule Reference (or status)	Dates Applicable
Hawaii Range Complex (HRC)	**IN EFFECT**: Taking and Importing Marine Mammals; U.S. Navy Training in the Hawaii Range Complex; Final Rule, 74 Fed. Reg. 1456 (January 12, 2009) (to be codified at 50 C.F.R. § 216).	5 Jan 2009 – 5 Jan 2014
Southern California (SOCAL) Range Complex	**IN EFFECT**: Taking and Importing Marine Mammals; U.S. Navy Training in the Southern California Range Complex; Final Rule, 74 Fed. Reg. 3883 (January 21, 2009) (to be codified at 50 C.F.R. § 216).	14 Jan 2009 - 14 Jan 2014
Atlantic Fleet Active Sonar Training (AFAST) Study Area	**IN EFFECT**: Taking and Importing Marine Mammals; U.S. Navy's Atlantic Fleet Active Sonar Training (AFAST); Final Rule, 74 Fed. Reg. 4844 (January 27, 2009) (to be codified at 50 C.F.R. § 216).	22 Jan 2009 - 22 Jan 2014
Cherry Point Range Complex	**IN EFFECT:** Taking and Importing Marine Mammals; U.S. Navy Training in the Cherry Point Range Complex; Final Rule, 74 Fed. Reg. 28370 (June 15, 2009) (to be codified at 50 C.F.R. § 218).	5 Jun 2009 – 4 Jun 2014
Jacksonville (JAX) Range Complex	**IN EFFECT**: Taking and Importing Marine Mammals; U.S. Navy Training in the Jacksonville Range Complex; Final Rule, 74 Fed. Reg. 28349 (June 15, 2009) (to be codified at 50 C.F.R. § 218).	5 Jun 2009 – 4 Jun 2014
Virginia Capes (VACAPES) Range Complex	**IN EFFECT**: Taking and Importing Marine Mammals; U.S. Navy Training in the Virginia Capes Range Complex; Final Rule, 74 Fed. Reg. 28328 (June 15, 2009) (to be codified at 50 C.F.R. § 218).	5 Jun 2009 – 4 Jun 2014
Naval Sea Systems Command Naval Surface Warfare Center Panama City Division (NSWC PCD) Study Area	**PROPOSED:** Taking and Importing Marine Mammals; U.S. Naval Surface Warfare Center Panama City Division Mission Activities; Proposed Rule, 74 Fed. Reg. 20156 (April 30, 2009) (to be codified at 50 C.F.R. § 218).	TBD. Proposed Rules closed to public comments on 1 Jun 2009.
Naval Sea Systems Command Naval Undersea Warfare Center Keyport (NUWC Keyport) Range Complex	**PROPOSED**: Taking and Importing of Marine Mammals; U.S. Navy's Research, Development, Test, and Evaluation Activities Within the Naval Sea Systems Command Naval Undersea Warfare Center Keyport Range Complex; Proposed Rules, 74 Fed. Reg. 32264 (July 7, 2009) (to be codified at 50 C.F.R. § 218).	TBD. Proposed Rules closed to public comments on 6 Aug 2009.
Northwest Training Range Complex (NWTRC)	**PROPOSED**: Taking and Importing Marine Mammals; Navy Training Activities Conducted Within the Northwest Training Range Complex; Proposed Rules, 74 Fed. Reg. 33828 (July 13, 2009) (to be codified at 50 C.F.R. § 218).	TBD. Proposed Rules closed to public comments on 19 Aug 2009.
Gulf of Mexico (GOMEX) Range Complex	**PROPOSED**: Taking of Marine Mammals Incidental to Specified Activities; Taking Marine Mammals Incidental to Training Operations Conducted Within the Gulf of Mexico Range Complex; Proposed Rules, 74 Fed. Reg. 33960 (July 14, 2009) (to be codified at 50 C.F.R. § 218).	TBD. Proposed Rules closed to public comments on 13 Aug 2009.
Mariana Islands Range Complex (MIRC)	**PROPOSED**: Taking and Importing Marine Mammals; Military Training Activities and Research, Development, Testing and Evaluation Conducted Within the Mariana Islands Range Complex (MIRC); Proposed Rule, 74 Fed. Reg. 53796 (October 20, 2009) (to be codified at 50 C.F.R. § 218).	TBD. Proposed Rules closed to public comments on 19 Nov 2009.
Gulf of Alaska (GOA) Range Complex	**STATUS:** Letter of Authorization (LOA) application submitted to NMFS on March 20, 2009 and revised/resubmitted on November 20, 2009.	TBD

There are two broad categories of authorized activities covered by the ICMP. These include:

1) Authorized Fleet activities carried out on Fleet-permitted ranges in support of military readiness, and
2) Authorized Navy Acquisition Community RDT&E activities carried out on NAVSEA-permitted ranges in support of military readiness.

There are variations in the monitoring and mitigation requirements between Fleet and Acquisition Community activities. This is in part due to the significant differences in the nature of activities conducted by these two communities relative to factors such as the types of sound sources, numbers and size of platforms (boats, ships, aircraft), as well as numbers of individuals involved. Monitoring and mitigation measures are tailored to the specific authorized activities consistent with permitting requirements. For the Fleet-permitted ranges, the associated monitoring plans are generally "range-specific" and apply across all authorized activities on that range. For the NAVSEA-permitted ranges, their monitoring plans tend to be "project-specific", that is, specifically tailored to each individual authorized activity.

Appendices A and B provides a listing by range complex / study area of specific sound sources and activities included in the associated MMPA Final Rules / Proposed Rules for the Fleet and Naval Sea Systems Command (NAVSEA) action proponents respectively. Note that for Atlantic ranges in the AFAST study area, monitoring and mitigation requirements for mid-frequency active sonar (MFAS), high-frequency active sonar (HFAS), and underwater detonations from explosive sonobuoy (specifically IEER) Fleet military readiness activities are addressed in the AFAST MMPA Final Rule. Monitoring requirements associated with Fleet military readiness activities involving other types of underwater detonations are established in the MMPA Final Rules for the individual range complexes (e.g., VACAPES, JAX, Cherry Point, and GOMEX) where these activities will be conducted.

The MMPA Final Rules detail specific requirements for this document. The following quote is from the Final Rule for the SOCAL Range Complex[2]. Similar language is found in each of the other MMPA Final Rules listed by Table 1.

> "The Navy shall complete an Integrated Comprehensive Monitoring Plan (ICMP) in 2009. This planning and adaptive management tool shall include:
> (1) A method for prioritizing monitoring projects that clearly describes the characteristics of a proposal that factor into its priority.
> (2) A method for annually reviewing, with NMFS, monitoring results, Navy R&D, and current science to use for potential modification of mitigation or monitoring methods.
> (3) A detailed description of the Monitoring Workshop to be convened in 2011 and how and when Navy/NMFS will subsequently utilize the findings of the Monitoring Workshop to potentially modify subsequent monitoring and mitigation.
> (4) An adaptive management plan.
> (5) A method for standardizing data collection across Range Complexes."

[2] See 74 Fed. Reg. 3915 (January 21, 2009) (50 C.F.R.§216.175(c)).

The MMPA Final Rules further provide that the primary objectives of the ICMP are to:

- Monitor and assess the effects of Navy activities on protected marine species;
- Ensure that data collected at multiple locations is collected in a manner that allows comparison between and among different geographic locations;
- Assess the efficacy and practicality of the monitoring and mitigation techniques;
- Add to the overall knowledge base of protected marine species and the effects of Navy activities on these species.

The ICMP meets these requirements and objectives by:

- Identifying top-level goals for the monitoring program, as well as guidelines for use in prioritizing monitoring projects and related RDT&E activities;
- Defining standard procedures for the compilation and management of data from range/project-specific monitoring plans;
- Establishing an adaptive management process that includes annual reviews with NMFS;
- Making provisions to review relevant monitoring-related research and, where appropriate, incorporate findings as updates to the range/project-specific monitoring plans and mitigation measures through adaptive management; and
- Providing an unclassified recordkeeping system that will allow interested parties to see how each Range Complex is contributing to ongoing monitoring.

As the overarching framework, the ICMP focuses Navy monitoring priorities pursuant to ESA and MMPA requirements. However, the ICMP does not include or specify the actual monitoring fieldwork components, nor does it commit to fund specific monitoring-related activities. Individual Navy permit-holders and research sponsors are responsible for defining the range/project-specific fieldwork components and research activities for their respective range monitoring plans and research programs. Top priority will always be given to satisfying the mandated legal requirements across all ranges. Once legal requirements are met, any additional monitoring-related activities will be planned and prioritized using guidelines provided by the ICMP, consistent with availability of both funding and scientific resources.

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

The ICMP is organized in the following way. Section 2 describes overall monitoring goals and prioritization guidelines. Section 3 discusses standard data collection and management procedures. Section 4 addresses the coordination of reporting requirements and the recordkeeping system that documents how each Range Complex contributes to ongoing

monitoring objectives. Section 5 outlines the adaptive management review process, including provisions for a monitoring workshop in 2011. Section 6 discusses near-term plans for continued maturation of the Monitoring Program. Section 7 provides roles and responsibilities among the various Navy components. References are listed in Section 8.

2. MONITORING GOALS AND PRIORITIZATION GUIDELINES

Research relating to the effects of anthropogenic sound on marine species is an evolving science. The Navy is committed to utilizing the best available science in developing and implementing the monitoring programs required pursuant to ESA and MMPA. The Navy demonstrated this commitment by funding approximately $26 million annually in marine mammal-related research projects for fiscal years 2007-2009[3] to better understand how marine mammals hear and how they are affected by sound. Researchers at Navy laboratories and warfare centers are investigating marine-mammal bioacoustics, marine mammal distribution and abundance, and passive acoustic detection of marine mammals. The Navy also collaborates with universities, institutes, conservation agencies, private industries, and independent researchers around the world to better understand what combinations of ocean conditions, bathymetry, and sonar usage patterns may lead to marine species disturbances. The Navy intends to continue this level of annual investment in protected marine species research over the next five years.[4]

As the overarching framework for coordination of the Navy's monitoring efforts, the ICMP guides the research investment by establishing top-level goals and guidelines for use in prioritizing monitoring projects and related RDT&E activities. The guidelines are not intended to supersede the specific legal requirements that each range complex must meet for monitoring and mitigation of ongoing Navy military readiness activities as detailed by its governing Letter of Authorization (LOA). Top priority will continue to be given to satisfying the mandated legal requirements across all ranges.

To meet requirements in the MMPA Final Rules for Navy Range Complexes[5], this section provides a method for prioritizing monitoring projects that clearly describes the characteristics of a proposal that factor into its priority. However, as noted previously, the ICMP does not specify or commit to fund specific monitoring-related research; that remains the responsibility of individual research sponsors. The ICMP also makes provisions for maintaining an unclassified record of Navy-sponsored monitoring projects and research using the procedures described in Section 4.

The adaptive management process described in Section 5 will be used to review and, when appropriate, incorporate findings from relevant research as updates to the range/project-specific monitoring plans. Adaptive management will also be used to evaluate and update the goals and priorities presented here on an annual basis. ICMP updates resulting from the adaptive management process will be documented and provided to NMFS by 31 December annually beginning in 2010.

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[3] Research funding level from http://www.navy.mil/oceans/environmental.html on 14 April 2009.

[4] Projected investment level from http://www.navy.mil/oceans/science.html on 15 July 2009.

[5] *E.g.*, 50 C.F.R. § 216.175(c).

2.1 MONITORING GOALS

Monitoring measures prescribed in range/project-specific monitoring plans and Navy-funded research relating to the effects of anthropogenic sound on protected marine species should be designed to accomplish one or more of the following top-level goals:

- An increase in the probability of detecting marine mammals and other threatened or endangered marine species, both within the safety zone (thus allowing for more effective implementation of the mitigation) and in general to generate more data to contribute to the effects analyses.

- An increase in our understanding of how many marine mammals and other threatened or endangered marine species are likely to be exposed to levels of Mid-Frequency Active Sonar (MFAS), High-Frequency Active Sonar (HFAS), underwater detonations, or other stimuli that are associated with specific adverse effects, such as behavioral harassment, Temporary Threshold Shift (TTS), or Permanent Threshold Shift (PTS).

- An increase in our understanding of how marine mammals and other threatened or endangered marine species respond (behaviorally or physiologically) to MFAS/HFAS, underwater detonations, or other stimuli at specific received levels that result in the anticipated take of individual animals.

- An increase in our understanding of how anticipated adverse effects on individual animals may impact the population, species, or stock (specifically through effects on annual rates of recruitment or survival).

- An increase in our understanding of the effectiveness of certain mitigation and monitoring measures.

- A better understanding and record of the manner in which the authorized entity complies with the incidental take authorization.

As the overall ICMP continues to develop, these top-level goals will be further refined through the development of a series of subquestions associated with each goal. The combination of top-level goals and associated subquestions will then be used to shape future monitoring efforts. This goal refinement effort will be an important area of focus for the Program during 2010.

Several of the top-level goals listed above focus on understanding the short-term effects to individual animals from naval anthropogenic sound. For the purposes of the ICMP, short-term is defined as the period during which the behavioral response is empirically determined or presumed to be directly attributable to exposure to naval anthropogenic sound.

To begin to address these top-level goals, the current set of range-specific Monitoring Plans have been designed as a collection of focused ‘‘studies’’ to gather data that will allow the Navy to address the following questions (not all questions apply to each range):

- 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?

- If marine mammals (and sea turtles) are exposed to MFAS, do they redistribute geographically as a result of continued exposure? If so, how long does the redistribution last?

- If marine mammals (and sea turtles) are exposed to MFAS, what are their behavioral responses to various received levels?

- What are the behavioral responses of marine mammals and sea turtles that are exposed to explosives?

- Is the Navy's suite of mitigation measures for MFAS (e.g., measures agreed to by the Navy through permitting) effective at avoiding TTS, injury, and mortality of marine mammals?

Monitoring measures that are put in place to meet the above goals and focused studies will produce data sets that include short-term individual observations. These observations, in combination with parallel monitoring and data analysis efforts by others, support research efforts directed towards identifying biologically significant behavioral responses that may have either cumulative or population-level effects. These data sets will also support the assessment of population trends, including species composition, distribution, and abundance, to determine the efficacy of mitigation and monitoring measures, and increase knowledge regarding the response of marine mammals and other threatened or endangered marine species to Navy sound sources. These data sets may also help to provide important information on the geographic and temporal extent of key habitats and provide baseline information to account for natural perturbations such as El Niño or La Niña events. Additionally, the data sets will provide observational data and baseline information to determine the spatial and temporal extent of reactions to Navy operations, or indirect effects from changes in prey availability and distribution. These data sets will be managed and made available for use by the procedures outlined in Section 3.

In developing range/project-specific monitoring plans or research programs to address these top-level goals and focused studies, sponsors should strive to prevent creating situations that leave the Navy "data rich but information poor." That is, it is often easier to collect some types of information than it is to analyze and draw meaningful conclusions from it. One example of this potential situation is the collection of marine mammal vocalizations using passive acoustic monitoring, where terabytes of acoustic data can be collected over the course of a given monitored event. To fully benefit from this type of monitoring and data collection investment, it is critical that sufficient funding for data analysis be factored into the program plans.

2.2 PRIORITIZATION GUIDELINES

In establishing prioritization guidelines, it is important to "begin with the end in mind." The desired end-result from Navy monitoring and mitigation conducted pursuant to ESA and MMPA requirements is a comprehensive and accurate assessment of applicable Navy military readiness and scientific research activities that involve active sonar and/or underwater detonations, performed in a manner that enables Fleet Commands, Program Executive Offices (PEOs), and other Echelon II Commands to meet their requisite operational, training, acquisition, research, development, testing, and evaluation requirements.

The guidelines presented here maximize marine resource protection by focusing Navy efforts and resources on those geographic areas where potential effects to marine mammals and other threatened or endangered marine species are most likely to occur due to concentrated and repetitive Navy activities. However, the guidelines are not intended to preclude monitoring activities in other areas of moderate or low Navy use when there might be special biological circumstances or other overriding considerations. The guidelines are intended for use when developing or modifying range/project-specific monitoring plans and monitoring-related research programs that will be considered as part of the adaptive management process described in Section 5. The guidelines are not intended to supersede the specific legal requirements that each range complex must meet for monitoring and mitigation of ongoing Navy military readiness activities as detailed in its governing LOA. Top priority will continue to be given to satisfying the mandated legal requirements across all ranges. Once legal requirements are met, additional monitoring activities will be prioritized using the guidelines that follow, consistent with availability of both funding and scientific resources.

In shaping, designing or evaluating prospective monitoring projects, sponsors should consider the following factors for each proposal:

a. Number of monitoring goals that the project addresses,

b. Relative density of marine mammals and other protected marine species in the proposed area,

c. Relative occurrence of concentrated and repetitive Navy active sonar activities in the proposed area,

d. Level of anticipated impacts to marine mammals in the area,

e. Presence of unique biological and /or physical attributes that better allow monitoring goals to be addressed,

f. Degree to which the proposed activity might provide unique contributions or additional diversity to the data set collection that will assist in meeting the top-level goals,

g. Ability to leverage and/or augment existing efforts by Navy monitoring to positive effect,

h. Availability of specialized Navy assets within a specific area to support monitoring efforts, e.g. instrumented ranges,

i. Return on investment as measured by confidence level in the likelihood of obtaining meaningful monitoring data based on factors such as prior success with the specific method itself, anticipated sea states, seasonal weather patterns, local animal densities and migration patterns, and anticipated success rate for integrating the monitoring method with training events, and

j. Degree to which the proposed activity might affect the ability of Navy Commands to meet their requisite operational, training, acquisition, research, development, testing, and evaluation requirements.

Many of the factors listed above are highly dependent on the specific location at which the proposed activity is to be conducted. To better assist planning efforts within the ICMP, a characterization of the unique attributes associated with each range complex / study area will be developed and added as an update to this document during 2010.

The monitoring requirements established in the MMPA Final Rules listed by Table 1 are currently in effect for five-year periods beginning in 2009. To fully evaluate and respond to the effects of naval anthropogenic sound on living marine resources, it is anticipated that monitoring time frames extending beyond the initial five years will be needed.

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3. DATA COLLECTION AND MANAGEMENT

This section discusses standardized data collection and management methods in support of Navy monitoring activities, and is a required element of the ICMP under the MMPA Final Rules for Navy ranges and operating areas. The Navy makes substantial investments in monitoring programs to ensure compliance with terms of ESA consultations and MMPA authorizations, and to provide for adaptive program management. Standardized procedures are essential to make the most of this investment. The objective for this standardization is to collect data in a manner that will enable comparison between and among different geographic locations to the extent that is scientifically justifiable. These standardized approaches apply to both range/project-specific monitoring plans as well as Navy-funded R&D studies.

Improved monitoring and assessment methodologies are likely to be developed as the science surrounding marine species monitoring continues to evolve. These improvements will be reviewed and assessed annually as part of the adaptive management process conducted jointly by Navy and NMFS. This process will determine whether modifications to the standardized collection and management methods are appropriate for the upcoming year. If so, updates to the ICMP will be made to reflect the results of Navy-NMFS adaptive management decisions to incorporate the improved monitoring and assessment methodologies as standard procedures and provided to NMFS by 31 December annually. As discussed in Section 5, adaptive management reviews will be done in consultation with Navy technical experts, Fleet Commanders, and Echelon II Commands as appropriate.

3.1 DATA COLLECTION

There is a large suite of monitoring methods that may be used to detect, locate, identify, and study the behaviors and responses of individual marine animals *in situ*. Some of the more prevalent categories of monitoring techniques and tools include:

- Visual Observations made using Navy lookouts, Civilian Marine Species Observers, vessel-based surveys, aerial surveys, shore surveys, and photo-identification,
- Acoustic Monitoring using both passive and active methods, and
- Behavioral Monitoring through tag attachments.

This suite of methods is continually evolving in step with advances in research. Each monitoring technique has advantages and disadvantages that vary temporally and spatially. Therefore, a combination of techniques is generally recommended so that the detection and observation of marine animals is maximized. The optimal choice of monitoring approach will vary depending on the purpose for the monitoring, the type of data to be collected, and a number of other factors such as the species of concern (whether frequently on surface, deep-diving, or cryptic), animal density, geographical location, weather, visibility, expected sea state conditions, type of Navy activities conducted in the area, and the total size of the area to be monitored. The particular choice of monitoring approaches will also be influenced by duration of monitoring period, effectiveness, practicality, impact to training, and cost.

It is beyond the scope of this framework document to fully describe this suite of monitoring methods or to prescribe "best practices" for the implementation of these independent techniques for monitoring purposes. Instead, the focus here is on prescribing both essential as well as desired data elements to be collected and recorded as "standard data" to support future data comparisons to the extent that is scientifically appropriate.

This section prescribes the data elements that are to be collected as standard practice for both range/project-specific monitoring as well as Navy-funded R&D studies. While it may not be scientifically valid to directly combine data sets from varied platforms such as shipboard and aerial surveys, the use of standardized sampling and survey protocols will be critical to meeting the overall monitoring goals, as well as assisting better data comparison between years and across different sets of observations. While detailed sampling and survey protocols are specific to independent monitoring techniques and outside the scope of this document, some overall guidelines on sample size and statistical analysis are provided by Appendix C.

Each range/operating area LOA designates particular types and quantities of military readiness activities that require mitigation, monitoring, and reporting pursuant to MMPA and ESA. The LOA details the specific mitigation measures that must be implemented when conducting these activities, and the data that is to be recorded and documented for the various compliance reports. While the information presented here is intended to highlight common data collection requirements from the LOAs, requirements imposed in the range/project-specific LOA take precedence over the information listed here.

The MMPA Final Rules pertaining to Fleet military readiness activities prescribe essential data elements that are to be recorded for individual marine mammal sightings during MFAS/HFAS Major Training Exercises (MTEs) and SINK Exercises (SINKEXs). Table 2 highlights these essential data elements. As one step towards collecting this data in a standardized manner, formatted marine species sighting forms are used by Navy lookouts during monitored military readiness activities. Appendix D provides the current Fleet version of this form. Note, while the LOAs prescribe the collection of these data elements specifically during Fleet MTEs and SINKEXs, the marine species sighting form may also be used to document sightings during other monitored military readiness activities. Its use is not strictly limited to MTEs or SINKEXs.

The MMPA Proposed Rules pertaining to RDT&E activities also prescribe the reporting of individual marine mammal sightings. For purposes of standardized data collection, Marine Species Observers monitoring RDT&E activities, as well as third-party biologists under contract to the Navy for marine species monitoring, should be tasked to collect (at minimum) the essential data elements highlighted by Table 2. They may elect to use a different format than that presented in Appendix D as long as these essential data elements are included. In addition, the governing LOA, once issued, should be verified in event additional essential data elements are prescribed for marine species sightings associated with RDT&E activities. To the extent possible, data will be collected from all distinct habitats in the region to avoid potential sampling bias.

Table 2 also lists additional oceanographic data elements that are highly desirable to fully support analysis of the observations and associated acoustic propagation conditions. Distribution and abundance of marine species are highly dependent on oceanographic

DATA ELEMENTS TO BE RECORDED FOR INDIVIDUAL MARINE ANIMAL SIGHTINGS ASSOCIATED WITH MONITORED MILITARY READINESS ACTIVITIES	
COMMON DATA ELEMENTS	
1)	Location of sighting (lat / long)
2)	Species (if species not possible— indication of whale/dolphin/pinniped/turtle)
3)	Number of individuals
4)	Calves observed (y/n)
5)	Initial Detection Sensor
6)	Indication of specific type of platform observation made from (including, for example, type of surface vessel, i.e., FFG, DDG, or CG)
7)	Length of time observers maintained visual contact with marine animal(s)
8)	Wave height (in feet)
9)	Visibility
10)	Sonar source in use (y/n). If impulsive or explosive source in use, skip to line 15.
IF ACTIVE SONAR SOURCE IN USE:	
11)	Indication of whether animal is <200yd, 200–500yd, 500–1000yd, 1000– 2000yd, or >2000yd from sonar source in (10) above
12)	Mitigation Implementation— Whether operation of sonar sensor was delayed, or sonar was powered or shut down, and how long the delay was.
13)	If source in use (from 10 above)) is hull-mounted, true bearing of animal from ship, true direction of ship's travel, and estimation of animal's motion relative to ship (opening, closing, parallel)
14)	Observed behavior— Watchstanders shall report, in plain language and without trying to categorize in any way, the observed behavior of the animals (such as animal closing to bow ride, paralleling course/ speed, floating on surface and not swimming, etc.) [END for active source essential data elements]
IF IMPULSIVE/EXPLOSIVE SOURCES ARE BEING USED:	
15)	Whether sighting was before, during, or after detonations/exercise, and how many minutes before or after.
16)	Distance of individual/group from actual detonations—or target spot if not yet detonated—use four categories to define distance: (a) The modeled injury threshold radius (MITR) for the largest explosive used in that exercise type in that OPAREA; (b) the required exclusion zone (e.g., 1 nm for SINKEX); (c) the required observation distance (if different than the exclusion zone) (e.g., 2 nm for SINKEX); and (d) greater than the required observed distance. In this example, the observer would indicate if < MITR, from MITR — 1 nm, from 1 nm—2 nm, and > 2 nm.
17)	Observed behavior— Watchstanders will report, in plain language and without trying to categorize in any way, the observed behavior of the animals (such as animal closing to bow ride, paralleling course/ speed, floating on surface and not swimming etc.), including speed and direction.
18)	Resulting mitigation implementation—Indicate whether explosive detonations were delayed, ceased, modified, or not modified due to marine mammal presence and for how long.
19)	If observation occurs while explosives are detonating in the water, indicate munition type in use at time of marine mammal detection. [END for explosive source essential data elements]
OPTIONAL DATA ELEMENTS, PROVIDE AS AVAILABLE or KNOWN	
20)	Sound Velocity Profile for location
21)	Sea surface temperature
22)	Presence of strong gulf stream currents, fronts, and/or mesoscale eddies (y/n)
23)	Other prominent oceanographic features

Table 2: Data Elements to be recorded for individual marine animal sightings associated with monitored military readiness activities

conditions and other environmental factors. Some scientific literature suggests that animals often limit their range to certain habitat areas or broad ocean regions based on sea surface temperature, bathymetric features, and prey abundance. Thus, it is desirable to include data from additional oceanographic and environmental monitoring, predictive forecasts of oceanographic conditions, or some mix of both to account for ambient conditions. The Navy's meteorological and oceanographic community has an extensive array of ocean data gathered by satellite sensing, direct measurements, and predictive models that may be used to support this. Oceanographic conditions can be monitored by a variety of different platforms including satellites, *in situ* observation systems such as buoys, and vessel surveys. For more extensive monitoring efforts, UAVs or gliders might be utilized to obtain oceanographic data. In addition, the recent distribution of joint civilian-government agency Ocean Observing Systems, ocean monitoring satellites, and in-situ buoys offer multiple information sources that could support the Navy's protected marine species monitoring program. Whenever possible, these optional data elements should be recorded for individual marine mammal sightings or relevant groups of individual sightings when made in close proximity to each other. Note that these optional data elements, if available, are typically recorded pre- or post-monitoring by personnel other than the Navy lookouts assigned to sight for marine animals.

3.2 DATA MANAGEMENT

As previously discussed, results from Navy-funded monitoring activities will establish time-series data sets that may be used to research trends in species abundance, behavioral reactions and mitigation effectiveness. The data collected through protected marine species monitoring and mitigation activities across all permitted Navy range complexes and relevant Navy-funded RDT&E activities will be incorporated into an electronic centralized data repository established under the guidance of OPNAV N45. These data will be used to support a Navy-wide analysis of monitoring and produce required reports for NMFS on behalf of the Navy Action Proponent. The electronic central repository will include data that are the result of activities conducted under the MMPA authorizations, such as monitoring data from sonar activities and underwater detonations from designated ranges and OPAREAS, marine species sighting observations, and exercise reports pertaining to protected marine species monitoring. The repository will also include annual results from Navy-funded R&D programs such as technical and professional journal articles. Due to the potential for inclusion of classified data, distribution of raw acoustic time series data from monitoring activities is subject to the written consent of the Secretary of the Navy or appointed designee. Unclassified NMFS-required monitoring reports, as specified by the MMPA Final Rules, will be made publicly available by posting on the internet.

As the ICMP matures, and greater amounts of monitoring data are recorded and available for analysis, ways of efficiently organizing this data to support discovery and access within the bounds of existing regulations will become increasingly important. Navy and NMFS will continue to work together to develop a data-sharing process that best supports the regulatory process in a transparent manner. Procedures will be developed in a structured manner to meet specific access requirements for the various Fleet, Scientific, and General Public user groups. Unclassified NMFS-required monitoring reports as specified by the

MMPA Final Rules are currently available on the NMFS website. These reports along with unclassified results from monitoring-related Navy R&D programs will also be publicly available from the Navy repository by the end of calendar year 2010. A more complete description of the data management organization and access procedures will be provided in the next ICMP update.

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4. REPORTING

This section addresses the overarching structure and coordination that will be used to coordinate reporting requirements from range/project-specific monitoring plans, and the recordkeeping system that tracks and documents how each Range Complex or Operating Area contributes to ongoing monitoring.

4.1 REPORT COORDINATION

The Navy is required to monitor and report on the effects of Navy actions on protected marine species. The MMPA Final Rules and LOAs specify the compilation of reports that summarize range/project-specific monitoring activities, analyses and results. These reports are submitted to the NMFS Office of Protected Resources (NMFS OPR) and provide critical inputs to the adaptive management process that allows the Navy and NMFS to assess and refine the Navy's overall monitoring effort. If there is a conflict between the reporting information described here and the requirements specified in the NMFS MMPA LOA, the LOA requirements take precedence.

Navy range action proponents are responsible for report development and submittal. The action proponents include Commander United States Fleet Forces Command (USFF), Commander Pacific Fleet (CPF), and Commander Naval Sea Systems Command (NAVSEA). Note, while Commander NAVSEA is the Action Proponent, he has designated Commander NUWC Keyport Division and Commander NSWC Panama City Division as the responsible individuals for report development and submittal. It is recognized that some information provided in the annual reports may be classified and not releasable to the public.

For the Fleet range complexes and study areas, there are two recurring reports required annually: an Annual Exercise Report and an Annual Monitoring Plan Report.

The primary purpose of the Annual Exercise Report is to report on authorized military readiness activities conducted within each range complex or study area, as well as the monitoring and mitigation performed in association with those activities. Table 3 provides a summary of contents for this multi-part report. As noted in Section 1, Anti-Submarine Warfare (ASW) military readiness activities that take place within the AFAST Study Area are covered in entirety under the AFAST MMPA Final Rules and LOA. Subsequently, only the explosives summary section is required in the Annual Exercise Report for the Cherry Point, Jacksonville, Virginia Capes, and Gulf of Mexico Range Complexes.

The Annual Monitoring Plan Report describes the implementation and results from the associated range/project-specific monitoring plan. It relies on standardized data collection methods across the Navy range complexes to allow for comparison of different geographic locations. The individual range reports may be provided to NMFS within a consolidated report that includes the required Monitoring Plan Reports from multiple Range Complexes.

For the NAVSEA ranges, there is a single recurring annual report required on RDT&E military readiness activities authorized under their permit. This report includes an estimated number of hours of sonar operation broken down by source type as well as a report of all marine mammal sightings.

Summary Sections contained in the Annual Exercise Report
Summary of MFAS/HFAS Major Training Exercises
a) Exercise info for Integrated Coordinated, and Major Training Exercises (MTEs)
– (i) Exercise designator. – (ii) Date that exercise began and ended. – (iii) Location. – (iv) Number and types of active sources used in the exercise. – (v) Number and types of passive acoustic sources [*sic*] used in exercise. – (vi) Number and types of vessels, aircraft, etc., participating in exercise. – (vii) Total hours of observation by lookouts. – (viii) Total hours of all active sonar source operation. – (ix) Total hours of each active sonar source (along with explanation of how hours are calculated for sources typically quantified in alternate way (buoys, torpedoes, etc.)). – (x) Wave height (high, low, and average during exercise).
b) Individual marine mammal sighting info (for each sighting in each MTE).
– See list of data elements described in Section 3.1
c) An evaluation (based on data gathered during all of the MTEs) of the effectiveness of mitigation measures designed to avoid exposing marine mammals to mid-frequency sonar. This evaluation shall identify the specific observations that support any conclusions the Navy reaches about the effectiveness of the mitigation.
ASW Summary
a) Summarized information For MTEs & non-major training exercises Include total annual hours of each type of sonar source (along with explanation of how hours are calculated for sources typically quantified in alternate way (buoys, torpedoes, etc.)), plus other range-specific information.
b) Cumulative Impact Report
c) Annual (and seasonal, where practicable) depiction of non-major training exercises geographically across the Study Area.
SINKEX Summary
a) Exercise info for each SINKEX completed that year
– (i) Location. – (ii) Date and time exercise began and ended. – (iii) Total hours of observation by lookouts before, during, and after exercise. – (iv) Total number and types of rounds expended/explosives detonated. – (v) Number and types of passive acoustic sources used in exercise. – (vi) Total hours of passive acoustic search time. – (vii) Number and types of vessels, aircraft, etc., participating in exercise. – (viii) Wave height in feet (high, low, and average during exercise). – (ix) Narrative description of sensors and platforms utilized for marine mammal detection and timeline illustrating how marine mammal detection was conducted.
b) Individual marine mammal sighting info (for each sighting in each MTE).
– See list of data elements described in Section 3.1
IEER / AEER Summary
– (i) Total number of IEER and AEER events conducted. – (ii) Total expended/detonated rounds (buoys). – (iii) Total number of self-scuttled IEER rounds.
Explosives Summary
– (i) Total annual number of each type of explosive exercise (of those identified as part of the ''specified activity'' in this MMPA Final Rule) conducted in the action area – (ii) Total annual expended/detonated rounds (missiles, bombs, etc.) for each explosive type.

Table 3: Summary Sections contained in the Annual Exercise Report
Each range complex submits annual summaries as applicable for authorized military readiness activities.

The annual reporting requirements associated with the MMPA Final Rules are designed to provide NMFS with monitoring data from the previous year to allow NMFS to consider the data and issue annual LOAs. As part of the adaptive management process described in Section 5, NMFS and the Navy will meet yearly, prior to LOA issuance, to discuss these annual reports and to determine whether mitigation or monitoring modifications are appropriate. Range/project-specific monitoring plans are then updated and submitted as part of the LOA Renewal Application. If substantial modification, as determined by NMFS, to the described mitigation or monitoring will occur during the upcoming season, the NMFS will provide the public a period of 30 days for review and comment on the request.

There are also non-recurring reporting requirements. For both Fleet and NAVSEA ranges and study areas, these requirements include a draft "Range Complex 5-year Comprehensive Report" that analyzes and summarizes all multi-year marine mammal information gathered during authorized activities for which annual reports are required. This report is submitted at the end of the fourth year of the rule, covering activities that occurred through a specified data cutoff date.

For the Fleet ranges only, the non-recurring requirements also include a draft "Comprehensive National ASW Report" that analyzes, compares, and summarizes the active sonar data gathered from Navy lookouts pursuant to the implementation of range-specific monitoring plans. This National ASW Report is not required for the Cherry Point, Jacksonville, Virginia Capes, and Gulf of Mexico Range Complexes, as active sonar data from these OPAREAS is included in the AFAST reporting requirements. Further guidance to support the preparation of these two comprehensive reports will be promulgated by OPNAV N45 in conjunction with the Adaptive Management Process.

Table 4 provides an overall summary listing of report dates under the current MMPA Final Rules, current as of 27 November 2009. Similar reporting requirements are anticipated for Navy range complexes that have yet to receive MMPA authorizations. NMFS is responsible for establishing the specific timeline for each year's report submittals. It should be noted that, as part of adaptive management, there might be a potential total overhaul of the report submission dates to better streamline the overall process.

The Navy shall respond to NMFS comments and requests for additional information or clarification on the individual annual or comprehensive reports if submitted within three months of receipt. These reports will be considered final after the Navy has addressed NMFS' comments or provided the requested information, or three months after the submittal of the draft if NMFS does not comment by then.

It is anticipated that reporting requirements will be added pursuant to the implementation of monitoring plans and MMPA Final Rules for the Naval Surface Warfare Center Panama City Division Study Area, Naval Undersea Warfare Center Keyport Range Complex, Mariana Islands Range Complex, the Northwest Training Range Complex, and the Gulf of Alaska Range Complex. The ICMP plan will be updated as appropriate to reflect these requirements through the adaptive management process.

Table 4: Common reporting requirements for range complexes/study areas covered by ICMP
(Data date: 27 November 2009)

RANGE	Annual Exercise Report	Annual Monitoring Plan Report	5-Year Comprehensive Monitoring Report	Comprehensive National ASW Report
Hawaii Range Complex (HRC)	1 Aug cutoff / 1 Oct submit	1 Aug cutoff / 1 Oct submit	1 June 2012 cutoff / 30 Nov 2012 submit	1 Jan 2014 cutoff / June 2014 submit
Southern California (SOCAL) Range Complex	1 Aug cutoff / 1 Oct submit	1 Aug cutoff / 1 Oct submit	1 June 2012 cutoff / 30 Nov 2012 submit	1 Jan 2014 cutoff / June 2014 submit
Atlantic Fleet Active Sonar Training (AFAST) Study Area	1 Aug cutoff / 1 Oct submit	1 Aug cutoff / 1 Oct submit	1 June 2012 cutoff / 30 Nov 2012 submit	1 Jan 2014 cutoff / June 2014 submit
Cherry Point Range Complex	Annual report required, but submittal date not specified.	1 Jan cutoff / 1 Mar submit	1 Dec 2012 cutoff / 31 May 2013 submit	Not Applicable
Jacksonville (JAX) Range Complex	Annual report required, but submittal date not specified.	1 Jan cutoff / 1 Mar submit	1 Dec 2012 cutoff / 31 May 2013 submit	Not Applicable
Virginia Capes (VACAPES) Range Complex	Annual report required, but submittal date not specified.	1 Jan cutoff / 1 Mar submit	1 Dec 2012 cutoff / 31 May 2013 submit	Not Applicable
Naval Surface Warfare Center Panama City Division (NSWC PCD) Study Area	Not Applicable	PROPOSED: 1 Jun cutoff / 1 Sep submit	PROPOSED: 1 June 2012 cutoff / 30 Nov 2012 submit	Not Applicable
Naval Undersea Warfare Center Keyport (NUWC Keyport) Range Complex	Not Applicable	PROPOSED: 1 Sep cutoff / 1 Dec submit	PROPOSED: 1 Sep 2013 [*sic*] cutoff / 30 Jun 2013 submit	Not Applicable
Northwest Training Range Complex (NWTRC)	PROPOSED: 1 Aug cutoff / 1 Oct submit	PROPOSED: 1 Jun cutoff / 1 Sep submit	PROPOSED: 1 June 2013 cutoff / 30 Nov 2013 submit	PROPOSED: 1 Jan 2014 cutoff / June 2014 submit
Gulf of Mexico (GOMEX) Range Complex	Annual report required, but submittal date not specified.	PROPOSED: 1 Sep cutoff / 1 Nov submit	PROPOSED: 1 Sep 2013 cutoff / 30 Mar 2014 submit	Not Applicable
Mariana Islands Range Complex (MIRC)	PROPOSED: 1 Jun cutoff / 15 Nov submit	PROPOSED: 15 Sep cutoff / 15 Nov submit	PROPOSED: 15 Jul 2014 [*sic*] cutoff / 30 Nov 2013 submit	PROPOSED: 1 Jan 2014 cutoff / June 2014 submit
Gulf of Alaska (GOA) Range Complex	TBD	TBD	TBD	Other MMPA Final Rules indicate that GOA will be included in this report, but GOA MMPA Final Rule not yet published.

4.2 RECORDKEEPING SYSTEM

OPNAV (N45) is responsible for coordinating the development, funding, and assessment of Navy marine research, and ensuring prioritization of research monitoring projects consistent with the top-level goals and priorities established by the ICMP or other applicable legal requirements. Monitoring activities will be allocated and resourced based on the strength of particular and specific monitoring proposals. With NMFS concurrence, they will not be allocated based on maintaining an equal (or commensurate to effects) distribution of monitoring effort across the Range complexes. For example, if careful prioritization and planning through the ICMP (which would include a review of both past monitoring results and current scientific developments) were to show that a large, intense monitoring effort in on one range complex would likely provide extensive, robust and much-needed data that could be used to understand the effects of sonar on the marine environment throughout different geographical areas, it may be appropriate to have other Range Complexes dedicate money, resources, or staff to the specific monitoring proposal identified as ''high priority'' by the Navy and NMFS, in lieu of focusing on smaller, lower priority projects divided throughout their home Range Complexes. In the event that monitoring is allocated in this fashion, clear recordkeeping is needed to demonstrate how each Range Complex / project is contributing to all of the ongoing monitoring. This will be done by maintaining a record of these resource allocation decisions in the electronic central data repository previously discussed in Section 3.

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5. ADAPTIVE MANAGEMENT

The MMPA Final Rules for Navy Range Complexes[6] require an adaptive management process to be established. Section 5.1 describes the process that will be used to annually review, with NMFS, monitoring results, Navy RDT&E, and current science to use for potential modification of mitigation or monitoring methods. The MMPA Final Rules also prescribe a Monitoring Workshop to be held in 2011 to review cumulative monitoring results from 2009 and 2010. Section 5.2 discusses this Monitoring Workshop, as well as how and when Navy/NMFS will subsequently utilize the findings of the Monitoring Workshop to potentially modify subsequent monitoring and mitigation.

5.1 ANNUAL REVIEWS

The reporting requirements associated with the MMPA Final Rules are designed to provide NMFS with monitoring data from the previous year in sufficient time to allow NMFS to consider the data before reissuing subsequent LOAs. Using the data collection and reporting procedures previously described in Sections 3 and 4, the Navy's monitoring data and marine species sighting observations will be consolidated and made available for analysis. NMFS and Navy will then meet to conduct an annual Adaptive Management Review (AMR). The AMR is a multipart review at which NMFS and the Navy jointly consider prior year goals, monitoring results and advancing science to assess overall progress. The review will determine if modifications are needed in mitigation or monitoring measures to more effectively address monitoring program goals. The AMR will consider data as available from across all of the range complexes included within the ICMP. At present, only one AMR per year is planned, and it will be applicable to all range complexes covered by the ICMP. The AMR will also consider an updated matrix of goals and prioritization guidelines proposed for the following year.

OPNAV N45 is responsible for the overall AMR meeting coordination and agenda. Navy action proponents will be asked to assign staff familiar with range/project-specific monitoring results to participate in this review and present an overview of the past year's monitoring activities. Additionally, sponsors of Navy-funded monitoring-related research will be asked to participate and provide a summary of their activities and accomplishments. Other potential presentation and discussion topics for the AMR include:

- Lessons learned from previous year's monitoring efforts,
- Other (outside of Navy-funded) monitoring-related science advances,
- Effectiveness of existing monitoring and mitigation tools,
- Operational feasibility of new tools and technologies,
- Recommendations for refinement and analysis of monitoring and mitigation methods, and
- Recommendations for the next year's monitoring activities.

[6] *E.g.*, 50 C.F.R. § 216.175(c).

If available, collaboration with regional NMFS scientists, academic scientists, and other non-Navy subject matter experts will be informally sought.

Products of the AMR include a determination as to whether mitigation or monitoring modifications are appropriate for the upcoming year, and an updated matrix of monitoring goals and prioritization guidelines. Adaptations and refinements to monitoring programs that result from the AMR will be incorporated into the range/project-specific monitoring plans as they come up for renewal in the normal course of events.

Adaptive Management will also lead to updates and improvements to the overall ICMP. The updated matrix of goals and prioritization guidelines resulting from the AMR will be incorporated by an annual addendum or revision to the ICMP. Additionally, expanded descriptions of the data repository, details for data standardization protocols, expanded information on range-specific characteristics, and planning information for the 2011 Monitoring Workshop are among the candidate information to be included in future updates. Annual ICMP updates will be provided to NMFS by 31 December beginning in 2010.

With the annual Adaptive Management Review, NMFS and Navy will have the ability to consider new data from different sources for purposes of making minor modifications to improve the effectiveness of range/project-specific monitoring plans, or to potentially identify substantial changes for subsequent 5-year regulations. This could result in mitigation or monitoring measures being added, modified, or deleted for subsequent annual LOAs. If a request to renew a Letter of Authorization indicates that a substantial modification as determined by NMFS to the described activity, mitigation, or monitoring during the upcoming season will occur, NMFS will provide the public a period of 30 days for review and comment on the request.

AMRs potentially could lead to significant restructuring of the monitoring plans put forward by individual ranges. In order to obtain robust, much-needed data that addresses high priority monitoring goals, monitoring activities may be prioritized and resourced based on the likely contribution of specific monitoring proposals to stated monitoring goals, as well as the likely technical success of the proposed monitoring approach based on a review of past monitoring results. This is in contrast to allocating monitoring resources based on maintaining an equal (or commensurate to effects) distribution of monitoring effort across Range complexes. For example, if careful prioritization and planning were to suggest that a large, intense monitoring effort in one Range Complex could be used to understand the effects of sonar throughout different geographical areas, it may be appropriate to have other Range Complexes dedicate money, resources, or staff to the specific monitoring proposal identified as ‘‘high priority’’ by the Navy and NMFS, in lieu of focusing on smaller, lower priority projects divided throughout their home Range Complexes.

A record of decisions and monitoring resource allocations made as a result of the AMR will be documented and maintained in the electronic central data depository previously discussed in Section 3. This will allow NMFS and other interested parties to see how each Range Complex is contributing to all of the ongoing monitoring (funding, staffing, and level of effort).

This adaptive management process recurs annually. However, there will be modifications to the process in 2011, when the Navy, with guidance and support from NMFS, is to host a Monitoring Workshop that incorporates outside experts and expanded participation.

5.2 MONITORING WORKSHOP IN 2011

As part of the Adaptive Management process in 2011, the Navy, with guidance and support from NMFS, will convene a Monitoring Workshop, including marine mammal and acoustic experts as well as other interested parties. This Monitoring Workshop, tentatively scheduled for April 2011 at a location yet to be determined, will present a consolidated overview of monitoring activities accomplished in 2009 and 2010 pursuant to the regulations in place to govern the unintentional taking of marine mammals incidental to authorized activities conducted on Navy ranges and operating areas. It will also include outcomes of selected monitoring-related research activities. One possible outcome of this workshop is the potential identification of substantial changes in monitoring approaches for subsequent 5-year regulations.

Participation in this jointly sponsored NMFS / Navy Workshop will be by invitation only. Participants will include, among others, recognized experts in marine species monitoring from across Government, academia, and the private sector. After considering the current science and working within the framework of available resources and feasibility of implementation, Monitoring Workshop participants will be asked to submit their individual recommendations to the Navy and NMFS. Navy and NMFS will then analyze the input from the Monitoring Workshop participants and determine the best way forward from a national perspective.

The workshop will not be used to seek or achieve consensus on a way forward for the monitoring program. NMFS has statutory responsibility to prescribe regulations pertaining to monitoring and reporting, and will develop in coordination with the Navy the most effective and appropriate monitoring and reporting protocols for future authorizations. As necessary, NMFS will incorporate any changes into future LOAs and future rules. If the modification to the described activity, mitigation, or monitoring is determined by NMFS to be substantial, NMFS will provide the public a period of 30 days for review and comment.

OPNAV N45 will take the lead for Navy in coordinating this Monitoring Workshop with NMFS. There will be a series of detailed planning meetings for this 2011 workshop starting with the 2010 Adaptive Management Review.

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6. ICMP NEAR-TERM DEVELOPMENT FOCUS AREAS

To be an effective planning tool, the ICMP must continue to develop and evolve over time. Specific recommendations for near-term development of the ICMP have been suggested throughout the document, and are compiled here for ease in tracking. A progress report covering each of the focus areas listed below will be included with the Adaptive Management Review. Updated information will also be included in the next annual revision of this document, which will be provided to NMFS by December 31, 2010.

There are three specific areas that have been identified for the initial ICMP near-term development.

1. **Top-level Goal Refinement**. The Navy, in consultation with NMFS, will refine the top-level goals provided by section 2 through the development of a series of subquestions associated with each goal. The combination of top-level goals and associated subquestions will then be used to identify, in advance, at the ICMP level, the types of monitoring projects that would achieve these goals. For example, the series of subquestions in combination with a review of existing data might lead to proposing a density survey in a data-poor area, or proposing to tag an animal and record its responses to a nearby exercise.

2. **Characterization of Navy Range Complexes / Study Areas**. Many of the prioritization guideline factors provided by section 2 are highly dependent on the specific location at which the proposed monitoring activity is to be conducted. To better assist planning efforts within the ICMP, one would like to predict a confidence level for the likelihood of obtaining meaningful monitoring data in any given location based on factors such as prior success with the specific monitoring method itself, anticipated sea states, seasonal weather patterns, local animal densities and migration patterns, and anticipated success rate for integrating the monitoring method with training events at that location. For this framework document to support that level of comparative analysis, it needs to include reference information that allows the user a top-level view of attributes across the various Navy range complexes. This characterization of the unique attributes associated with each range complex / study area will be developed and results added with the next update.

3. **Data Management Organization and Access Procedures Development**. Section 3 provided a preliminary description of the centralized electronic repository for data associated with the ICMP, and the types of data that might be made available, as appropriate, to various categories of users. At present, there is a mix of classified and unclassified data that falls under the ICMP umbrella. As the ICMP matures, and greater amounts of monitoring data are recorded and available for analysis, ways of efficiently organizing this data to support discovery and access within the bounds of existing regulations will become increasingly important. Navy and NMFS will continue to work together to develop a data-sharing process that best supports the regulatory process in a transparent manner. Procedures will be developed in a structured manner to meet specific access requirements for the various Fleet, Scientific, and General Public user groups. Unclassified NMFS-required monitoring reports as specified by the MMPA Final Rules are currently available on the NMFS website. These reports along with unclassified results from monitoring-related Navy R&D programs will also be publicly available from the Navy repository by the end of calendar year 2010. A more complete description of the data management organization and access procedures will be provided in the next ICMP update.

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7. ROLES AND RESPONSIBILITIES

OPNAV (N45) is responsible for maintaining and updating this ICMP as appropriate to reflect future regulatory agency final rulemaking, adaptive management reviews, best available science, improved assessment methodologies, or more effective protective measures. This will be done in consultation with Navy technical experts, Fleet Commanders, and Echelon II Commands as appropriate.

OPNAV (N45) shall

- Coordinate the development, funding, and assessment of Navy marine research, ensuring prioritization of monitoring projects consistent with the top-level goals established by the ICMP or other applicable legal requirements.
- Establish an electronic central repository that includes both monitoring data from activities conducted under the MMPA authorizations and annual results from Navy-funded R&D programs.
- Review annual ESA and MMPA reports prepared by Echelon II Commands to ensure a standardized approach is maintained that will enable appropriate consolidation and comparison of data.
- Chair an annual Adaptive Management Review (AMR) with NMFS on a schedule that supports the reissuance of LOA and annual Biological Opinions (BO) to maintain uninterrupted Fleet training and operations as well as Acquisition Community RDT&E activities. Attendees should include representatives from OPNAV, Office of the Assistant Secretary of the Navy for Installations and Environment (OASN I&E), Office of Naval Research (ONR), and Echelon II commands. OPNAV (N45) may approve additional attendees.
- In conjunction with the Adaptive Management Review, submit an annual evaluation of monitoring-related goals and priorities to NMFS.
- Co-chair planning sessions with NMFS to address detailed planning for the April 2011 Monitoring Workshop.

USFF, CPF, NAVSEA, and other permit holders shall

- Coordinate completion of environmental planning, permitting, consultations, and reports to support uninterrupted Fleet training and research, development, testing, and evaluation requirements,
- Conduct monitoring measures consistent with applicable NMFS MMPA Final Rules, Biological Opinions, and other governing legal requirements,
- Monitor changes in ESA species, critical habitats, Habitat Areas of Particular Concern (HAPC), sanctuaries and protected marine species regulations as it may effect Navy military readiness activities authorized under their permits, and
- Assign staff to participate in the Adaptive Management Review.

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8. REFERENCES

MMPA FINAL RULES / PROPOSED RULES:

Taking and Importing Marine Mammals; U.S. Navy Training in the Hawaii Range Complex; Final Rule, 74 Fed. Reg. 1456 (January 12, 2009) (to be codified at 50 C.F.R. pt. 216).

Taking and Importing Marine Mammals; U.S. Navy Training in the Southern California Range Complex; Final Rule, 74 Fed. Reg. 3883 (January 21, 2009) (to be codified at 50 C.F.R. pt. 216).

Taking and Importing Marine Mammals; U.S. Navy's Atlantic Fleet Active Sonar Training (AFAST); Final Rule, 74 Fed. Reg. 4844 (January 27, 2009) (to be codified at 50 C.F.R. pt. 216).

Taking and Importing Marine Mammals; U.S. Navy Training in the Cherry Point Range Complex; Final Rule, 74 Fed. Reg. 28370 (June 15, 2009) (to be codified at 50 C.F.R. pt. 218).

Taking and Importing Marine Mammals; U.S. Navy Training in the Jacksonville Range Complex; Final Rule, 74 Fed. Reg. 28349 (June 15, 2009) (to be codified at 50 C.F.R. pt. 218).

Taking and Importing Marine Mammals; U.S. Navy Training in the Virginia Capes Range Complex; Final Rule, 74 Fed. Reg. 28328 (June 15, 2009) (to be codified at 50 C.F.R. pt. 218).

Taking and Importing Marine Mammals; U.S. Naval Surface Warfare Center Panama City Division Mission Activities; Proposed Rule, 74 Fed. Reg. 20156 (April 30, 2009) (to be codified at 50 C.F.R. pt. 218).

Taking and Importing of Marine Mammals; U.S. Navy's Research, Development, Test, and Evaluation Activities Within the Naval Sea Systems Command Naval Undersea Warfare Center Keyport Range Complex; Proposed Rules, 74 Fed. Reg. 32264 (July 7, 2009) (to be codified at 50 C.F.R. pt. 218).

Taking and Importing Marine Mammals; Navy Training Activities Conducted Within the Northwest Training Range Complex; Proposed Rules, 74 Fed. Reg. 33828 (July 13, 2009) (to be codified at 50 C.F.R. pt. 218).

Taking of Marine Mammals Incidental to Specified Activities; Taking Marine Mammals Incidental to Training Operations Conducted Within the Gulf of Mexico Range Complex; Proposed Rules, 74 Fed. Reg. 33960 (July 14, 2009) (to be codified at 50 C.F.R. pt. 218).

Taking and Importing Marine Mammals; Military Training Activities and Research, Development, Testing and Evaluation Conducted Within the Mariana Islands Range Complex (MIRC); Proposed Rule, 74 Fed. Reg. 53796 (October 20, 2009) (to be codified at 50 C.F.R. pt. 218).

LETTERS OF AUTHORIZATION / REQUESTS FOR LETTER OF AUTHORIZATION:

Commander, Naval Surface Warfare Center Panama City Division. Request for Letter of Authorization for the incidental harassment of marine mammals resulting from the Naval Surface Warfare Center Panama City Division Mission Activities. Submitted to National Marine Fisheries Service March 2008.

Commander, Naval Undersea Warfare Command Division Keyport. Request for Letter of Authorization for the incidental harassment of marine mammals resulting from Navy Research, Development, Test, and Evaluation Activities conducted within the NAVSEA NUWC Keyport Range Complex Extension. Submitted to National Marine Fisheries Service April 2008.

Commander, U.S. Fleet Forces Command. Request for Letter of Authorization for the incidental harassment of marine mammals resulting from Navy Training Operations conducted within the Gulf of Mexico Study Area. Submitted to National Marine Fisheries Service October 2008.

Commander, U.S. Fleet Forces Command. Request for Letter of Authorization for the incidental harassment of marine mammals resulting from Training and Research, Development, Testing and Evaluation Activities conducted within the Mariana Islands Range Complex. Submitted to National Marine Fisheries Service August 2008.

Commander, U.S. Fleet Forces Command. Request for Letter of Authorization for the incidental harassment of marine mammals resulting from Training and Research, Development, Testing and Evaluation Activities conducted within the Mariana Islands Range Complex, Update #1. Submitted to National Marine Fisheries Service February 2009.

Commander, U.S. Pacific Fleet. Request for Letter of Authorization for the incidental harassment of marine mammals resulting from Navy Training Activities conducted within the Northwest Training Range Complex. Submitted to National Marine Fisheries Service September 2008.

Commander, U.S. Pacific Fleet. Request for Letter of Authorization for the incidental harassment of marine mammals resulting from Navy Training Activities conducted within the Gulf of Alaska Range Complex. Submitted to National Marine Fisheries Service November 2009.

Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service Letter of Authorization signed 8 January 2009 for Commander, U.S. Pacific Fleet incidental to take marine mammals incidental to Navy exercises conducted in the Hawaii Range Complex (HRC).

Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service Letter of Authorization signed 22 January 2009 for Commander, U.S. Fleet Forces Command to take marine mammals incidental to Navy activities conducted in the Atlantic Fleet Active Sonar Training (AFAST) in the Atlantic Ocean and Gulf of Mexico.

Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service Letter of Authorization signed 22 January 2009 for Commander, U.S. Pacific Fleet incidental to take marine mammals incidental to Navy exercises conducted in the Southern California (SOCAL) Range Complex.

Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service Letter of Authorization signed 5 June 2009 for Commander, U.S. Fleet Forces Command to take marine mammals incidental to U.S. Navy training activities conducted in the Cherry Point Range Complex in the Atlantic Ocean.

Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service Letter of Authorization signed 5 June 2009 for Commander, U.S. Fleet Forces Command to take marine mammals incidental to U.S. Navy training activities conducted in the Jacksonville (JAX) Range Complex in the Atlantic Ocean.

Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service Letter of Authorization signed 5 June 2009 for Commander, U.S. Fleet Forces Command to take marine mammals incidental to U.S. Navy training activities conducted in the Virginia Capes (VACAPES) Range Complex in the Atlantic Ocean.

RANGE-SPECIFIC MONITORING PLANS

Hawaii Range Complex Monitoring Plan dated December 2008.

Atlantic Fleet Active Sonar Training Range Complex Monitoring Plan dated January 2009.

Southern California Range Complex Monitoring Plan dated 9 January 2009.

Jacksonville Range Complex Monitoring Plan (draft) dated February 2009.

VACAPES Range Complex Monitoring Plan (draft) dated February 2009.

Cherry Point Range Complex Monitoring Plan dated April 2009.

Northwest Training Range Complex Monitoring Plan (draft) dated 20 April 2009.

OTHER REFERENCES:

CNO Memo dated 6 Mar 2006, “Mid-Frequency Active Sonar Effects Analysis Interim Policy”.

DRAFT United States Navy Comprehensive Marine Species Monitoring Program dated October 2007. Naval Facilities Engineering Command Pacific, Pearl Harbor, HI. Prepared by: ManTech SRS Technologies, Inc., 3865 Wilson Boulevard, Suite 800, Arlington, VA 22203 under Contract No. N68711-02-D-8043; Task Order No. 0035 in collaboration with: Cascadia Research Collective; Centre for Research into Ecological and Environmental Modeling, University of St. Andrews; Greeneridge Sciences, Inc.; LGL Limited; Kim Holland, Ph.D. University of Hawaii; and U. S. Navy Marine Resources Support Group.

Endangered Species Act (ESA), 16 U.S.C. §1531, *et seq*.

Executive Order 12114, “Environmental Effects Abroad of Major Federal Actions”.

Marine Mammal Protection Act (MMPA), 16 U.S.C. §1361, *et seq*., as amended by the 2004 National Defense Authorization Act, Pub. L. No. 108-136, 319, 117, Stat. 1433.

National Environmental Policy Act (NEPA), 42 U.S.C. §4321, *et seq.*

OPNAVINST 5090.1C, Environmental Readiness Program Manual dated 30 October 2007.

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APPENDIX A:

Sound Sources and Activities authorized or anticipated to be authorized under the MMPA Final Rules for Fleet Training Range Complexes / Study Areas

Range Green: Proposed Rules Yellow: TBD Sound Source / Activity	AFAST	SOCAL	HRC	VACAPES	Cherry Pt	JAX	NWTRC	GOMEX	MIRC	GOA
Use of mid-frequency active sonar (MFAS) and high frequency active sonar (HFAS) sources for Fleet Training:										
AN/AQS–22 or 13 (helicopter dipping sonar)	X	X	X						X	
AN/BQQ–10 or 5 (submarine mounted sonar)	X	X	X						X	
AN/BQS–15 (submarine navigation)	X	X					X		X	
AN/SLQ–25 (NIXIE—towed countermeasure)	X	X								
AN/SQQ–32 (over the side mine-hunting sonar)	X									
AN/SQS–53 (hull-mounted sonar)	X	X	X				X		X	
AN/SQS–56 (hull-mounted sonar)	X	X	X				X		X	
AN/SSQ–125 (AEER sonar sonobuoys)	X	X					X		X	
MK–1 or 2 or 3 or 4 (Submarine-fired Acoustic Device Countermeasure (ADC))	X									
MK–46 or 54 (lightweight torpedoes)	X	X							X	
MK–48 (heavyweight torpedoes)	X	X	X				X		X	
Noise Acoustic Emitters (NAE - Sub-fired countermeasure)	X									
SSQ–62 DICASS (sonobuoys)	X	X	X				X		X	
MK-84 range tracking pingers for ASW tracking							X		X	
Portable Undersea Tracking Range Uplink							X		X	
Detonation of underwater explosives for Fleet Training:										
AN/SSQ–110A (IEER explosive sonobuoy) (5 lbs)	X	X	X				X		X	
MK–48 Heavyweight Torpedo (851 lbs)		X	X				X		X	
Airborne Mine Neutralization System (AMNS)				X						
Demolition Charges (20 lbs)		X	X	X	X	X	X		X	
AGM–65 E/F Maverick missile (78.5 lbs)		X	X	X		X	X		X	
Harpoon missile (448 lbs)		X	X				X		X	
AGM–114 Hellfire missile				X	X	X	X		X	
AGM–88 High-speed anti-radiation missile (HARM)				X			X		X	
Tube-launched Optically tracked Wire-guided (TOW) missile					X					
SLAM missile							X		X	
MK–82 Bomb / GBU-12		X	X				X		X	
MK–83 Bomb / GBU-16 / GBU -32		X	X	X			X	X	X	
MK–84 Bomb / GBU-10		X	X				X		X	
5” Naval Gunfire (9.5 lbs)		X	X	X	X	X	X		X	
76 mm rounds (1.6 lbs)		X	X				X		X	
MK3A2 anti-swimmer concussion grenades (0.5 lbs)						X		X	X	
Training Events or Activity:										
ASW Exercise	X	X	X				X		X	
MINEX (Neutralization, Avoidance, Countermeasures)	X	X	X	X	X	X	X		X	
MISSILEX (Air-to-Surface)		X	X	X	X	X	X		X	
MISSILEX (Surface-to-Surface)			X							
BOMBEX (Air-to-Surface)		X	X	X			X	X	X	
SINKEX		X	X				X		X	
GUNEX (Surface-to-Surface)		X	X				X		X	
Naval Surface Fire Support			X							
FIREX with Integrated Maritime Portable Acoustic Scoring System (IMPASS)				X	X	X				
Small Arms Training with grenades						X		X	X	
Maintenance	X	X								
RDT&E (unspecified)	X	X							X	

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APPENDIX B:

Sound Sources and Activities anticipated to be authorized under the MMPA Final Rules for NAVSEA RDT&E Ranges / Study Areas

Range **Green: Proposed Rules** **Sound Source / Activity**	**NUWC Keyport**	**NSWC PCD**
Use of mid-frequency and high frequency active sound sources for NAVSEA RDT&E:		
Acoustic communication modems, HF	X	X
Acoustic devices for general range and UUV tracking (HF)	X	
Aids to navigation (range equipment)	X	
AN/AQS-22 (helicopter dipping sonar)	X	
AN/AQS–20 (helicopter towed mine-hunting sonar)		X
AN/SQQ–32 (over the side mine-hunting sonar)		X
AN/SQS–53/56 (hull-mounted sonar, Kingfisher)		X
AN/WLD–11 RMS Navigation (HF)	X	X
F84Y (Tower-mounted parametric sonar used to simulate mine-like objects, HF)		X
Object detection and navigation sonars (multiple HF)	X	X
Range Targets with active acoustic devices (MF, HF)	X	
Sidescan Sonars (multiple HF frequencies)	X	X
Sonobuoys, active	X	
Special Test Systems with active acoustic devices (MF, HF)	X	
Sub-bottom profilers (MF, HF)	X	X
Torpedo Sonars (HF)	X	
TVSS (Toroidal Volume Search Sonar, HF)		X
Detonation of underwater explosives for NAVSEA RDT&E:		
Live Ordnance (1 – 10 lb net explosive weight)		X
Live Ordnance (11 – 75 lb net explosive weight)		X
Live Ordnance (76 – 600 lb net explosive weight)		X
Line Charges (1750 lb net explosive in 5 lb increments)		X
Projectiles (5in, 40mm, 30mm, 20mm, 76mm, 25mm, and small arms)		X
NAVSEA RDT&E Activity:		
Acoustic and non-acoustic sensor testing	X	
Countermeasure testing	X	
Impact testing	X	
Inert mine detection, classification, and localization	X	
Ordnance Live T&E		X
Projectile Firing T&E		X
Sonar T&E		X
Surf zone clearing T&E with line charges		X
Surface Operations – equipment deployment and recovery	X	X
Surface Operations – system development	X	X
Surface Operations – test support	X	X
Surface Operations – tows	X	X
UUV and UAS testing	X	
Vehicle propulsion testing	X	

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APPENDIX C:
Sample size and Statistical analysis

Specific guidelines for sample size and statistical analysis are under development. This is a PLACEHOLDER for a FUTURE UPDATE.

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APPENDIX D:
Marine Mammal Sighting Form for Navy Lookouts

Version 3.0N - 19 MAR 09

USS_________________ DAILY MARINE MAMMAL LOG

A. DTG: Z	B. Species/Type of Mammal:	C. Number of Mammals:	D. Calves: YES/NO
E. Initial Detection Source: VISUAL / AURAL	F. Initial Brg/Rng: T / Yds	G. Unit Position: LAT: LONG:	
H. Unit Course/Speed: T / Kts	I. Last Known Brg/Rng: T / Yds	J. Total Time Visually Observed: MIN	
K. Wave Height: FT	L. Visibility: NM	M. MFAS Active:	N. MFAS Action Taken:
IF MFAS WAS TRANSMITTING WHEN MAMMAL WAS SIGHTED AND SUBSEQUENTLY POWERED DOWN/SHUT DOWN, OR COURSE CHANGED:			
O. Duration of Action: MIN	P. Maneuver Conducted:	Q. Degrees of Course Chg: DEG	R. Range Action Taken: YDS
S. Action impact (note 1):			
T. Narrative of observation (note 2) :			

A. DTG: Z	B. Species/Type of Mammal:	C. Number of Mammals:	D. Calves: YES/NO
E. Initial Detection Source: VISUAL / AURAL	F. Initial Brg/Rng: T / Yds	G. Unit Position: LAT: LONG:	
H. Unit Course/Speed: T / Kts	I. Last Known Brg/Rng: T / Yds	J. Total Time Visually Observed: MIN	
K. Wave Height: FT	L. Visibility: NM	M. MFAS Active:	N. MFAS Action Taken:
IF MFAS WAS TRANSMITTING WHEN MAMMAL WAS SIGHTED AND SUBSEQUENTLY POWERED DOWN/SHUT DOWN, OR COURSE CHANGED:			
O. Duration of Action: MIN	P. Maneuver Conducted:	Q. Degrees of Course Chg: DEG	R. Range Action Taken: YDS
S. Action impact (note 1):			
T. Narrative of observation (note 2) :			

A. DTG: Z	B. Species/Type of Mammal:	C. Number of Mammals:	D. Calves: YES/NO
E. Initial Detection Source: VISUAL / AURAL	F. Initial Brg/Rng: T / Yds	G. Unit Position: LAT: LONG:	
H. Unit Course/Speed: T / Kts	I. Last Known Brg/Rng: T / Yds	J. Total Time Visually Observed: MIN	
K. Wave Height: FT	L. Visibility: NM	M. MFAS Active:	N. MFAS Action Taken:
IF MFAS WAS TRANSMITTING WHEN MAMMAL WAS SIGHTED AND SUBSEQUENTLY POWERED DOWN/SHUT DOWN, OR COURSE CHANGED:			
O. Duration of Action: MIN	P. Maneuver Conducted:	Q. Degrees of Course Chg: DEG	R. Range Action Taken: YDS
S. Action impact (note 1):			
T. Narrative of observation (note 2) :			

A. DTG: Z	B. Species/Type of Mammal:	C. Number of Mammals:	D. Calves: YES/NO
E. Initial Detection Source: VISUAL / AURAL	F. Initial Brg/Rng: T / Yds	G. Unit Position: LAT: LONG:	
H. Unit Course/Speed: T / Kts	I. Last Known Brg/Rng: T / Yds	J. Total Time Visually Observed: MIN	
K. Wave Height: FT	L. Visibility: NM	M. MFAS Active:	N. MFAS Action Taken:
IF MFAS WAS TRANSMITTING WHEN MAMMAL WAS SIGHTED AND SUBSEQUENTLY POWERED DOWN/SHUT DOWN, OR COURSE CHANGED:			
O. Duration of Action: MIN	P. Maneuver Conducted:	Q. Degrees of Course Chg: DEG	R. Range Action Taken: YDS
S. Action impact (note 1):			
T. Narrative of observation (note 2) :			

Note 1: Tactical Degradation Assessment. Impact examples: None. Slight - Degraded ASW screen when ship maneuvered to open whales. Moderate: Lost Contact when power reduced. Significant: Engagement interrupted when MFAS was Shutdown.
Note 2: Describe actions of marine mammals and ship's reactions. Aircraft include altitude. Narrative examples: Dolphins sighted at 1200 YDS off Port bow, closing the ship, CPA of 600 YDS. Powered down MFAS for 35 min until lost sight of whales.
Porpoises sighted by Lookouts using NVGs, range 550 YDS, opening the ship. Powered down MFAS -6dB for 10 min until outside of 1000 YDS.
LoneWolf 42, flying SW at 60kts, 1200 FT, sighted pod of dolphins within 100 YDS DICASS 12. Buoy was not active at the time.

Example:

A. DTG: 061234 Z JAN 09	B. Species/Type of Mammal: Whale	C. Number of Mammals: 2	D. Calves: YES/NO
E. Initial Detection Source: VISUAL / AURAL	F. Initial Brg/Rng: 215 T / 1400 Yds	G. Unit Position: LAT: 123456N LONG: 1234555E	
H. Unit Course/Speed: 265 T / 12 Kts	I. Last Known Brg/Rng: 095 T / 900 Yds	J. Total Time Visually Observed: 14 MIN	
K. Wave Height: 4 FT	L. Visibility: 12 NM	M. MFAS Status: ON	N. MFAS Action Taken: Powerdown
IF MFAS WAS TRANSMITTING WHEN MAMMAL WAS SIGHTED AND SUBSEQUENTLY POWERED DOWN/SHUT DOWN, OR COURSE CHANGED:			
O. Duration of Action: 14 MIN	P. Maneuver Conducted: Turn Stbd	Q. Degrees of Course Chg: 45 DEG	R. Range Action Taken: 800 YDS
S. Action impact (note 1): slight - degraded integrity of ASW screen, as ship maneuvered to avoid whales			
T. Narrative of observation (note 2): two whales paralleled ship's course, CPA of 600 yds after maneuver. Powered down MFAS for 14 min until lost sight of whales.			

Data Fields:

A. DDHHMM Z MMM YY
B. WHALE / DOLPHIN / PORPOISE / SEAL / SEAL LION / TURTLE /GENERIC (i.e unknown)
C. Number
D. YES / NO
E. VISUAL / AURAL
F. Bearing in Degrees True / Range in Yards
G. Position: DDMMSS N/S DDDMMSS E/W
H. Course in Degrees True / Speed in Knots
I. Bearing in Degrees True / Range in Yards
J. Minutes
K. Feet
L. Nautical Miles
M. NO / YES
N. Powerdown -6dB / Powerdown -10dB / Shutdown / None
O. Minutes
P. Turn STBD / Turn PORT / -
Q. Degrees
R. Range in Yards
S. Tactical Degradation Assessment examples:
   - None
   - Slight - Degraded ASW screen integrity when ship maneuvered to open whales.
   - Moderate - Lost Contact when power reduced.
   - Significant - Engagement interrupted when MFAS was Shutdown.
T. Observation examples:
   - Dolphins sighted at 1200 YDS off Port bow, closing the ship. Maneuvered to confirm Bow Riding and continued MFAS operations
   - Pod of whales sighted fin slapping 600 YDS off STBD bow, paralleling ships course. Ship maneuvered to Port to open range.
   - Porpoises sighted 250 YDS off STBD Beam, opening ship. Powered down MFAS by -6dB until they opened to 1000 YDS. Lost sight astern.
   - DragonSlayer 12, flying NW at 60 kts, 1200FT, spotted pod of dolphins within 150 YDS of DICASS Buoy 12. Buoy was passive at the time, and remained so until dolphins were seen leaving the area. 80% cloud layer at 3500 FT. Photos taken.

Appendix B - Onslow/JAX Monitoring Plan

Survey Plan for Monitoring the Proposed USWTR in Onslow Bay

Revised July 2007

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1. Aims

The General Purpose of the project, as specified in the Scope of Work, is as follows:

> The proposed baseline study and monitoring program must provide site-specific pre-installation baseline data in order to develop meaningful monitoring for marine protected species (marine mammals and sea turtles) over time. Baseline data sought includes species distribution, abundance, density estimates, and seasonal movement and habitat usage patterns specific to Onslow Bay and the proposed USWTR area. Regular monitoring to assess trends in species composition, distribution, and abundance will be based on the data collected in the baseline study.

Therefore the aim of this document is to produce a coherent plan to estimate density and document patterns of distribution and seasonal residency of species of interest in the proposed USWTR site and adjacent waters.

2. Species of interest in Onslow Bay

Our focus is on all protected species occurring in the proposed USWTR site, but in preparing this monitoring plan we paid particular attention to the following species: sperm whales (*Physeter macrocephalus*), beaked whales (*Ziphius* and *Mesoplodon spp*.), humpback and other balaenopterid whales (*Megaptera novaeangliae* and *Balaenoptera spp*.), right whales (*Eubalaena glacialis*) and several genera of pelagic odontocetes (*Stenella spp*., *Tursiops truncatus*, *Globicephala spp*., *Grampus griseus*, and *Delphinus delphis*), as well as leatherback (*Dermochelys caretta*) and loggerhead (*Caretta caretta*) sea turtles. A

number of other species occur in the area but they are unlikely to be encountered in sufficient numbers to obtain precise estimates of abundance (*e.g*. dwarf and pygmy sperm whales, *Kogia spp*.).

3. Survey Area

As the consequences of activity inside the USWTR area may extend outside the range itself, we propose to survey an area that extends 10 nautical miles in each direction from the boundaries of the USWTR. The USWTR area is 25 nm long and 20 nm wide, so the entire monitoring area is 45 nm long and 40 nm wide. The total survey area is thus 1800 square nautical miles, with 28% of this area within the USWTR itself.

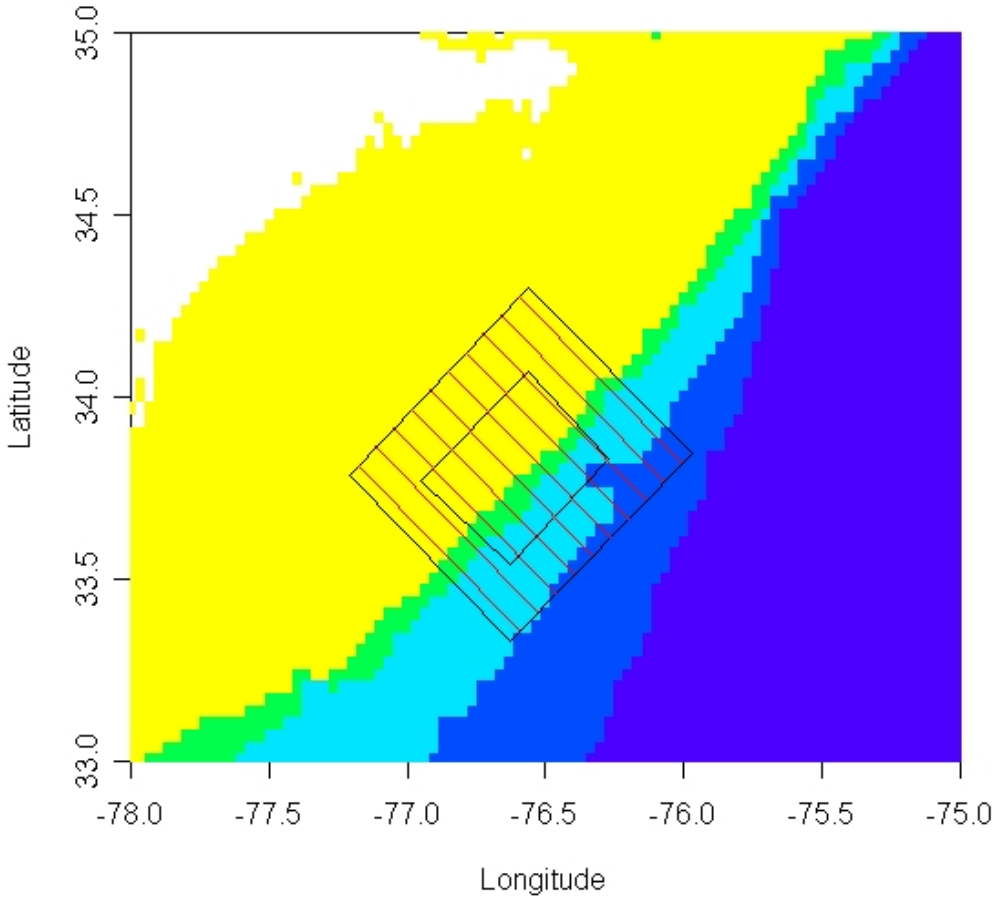

Figure 1. Survey area in Onslow Bay, encompassing the proposed USWTR site (inner box). Ten transect lines are depicted in red, each approximately 40 nm in length. Bathymetry is depicted by color: yellow is less than 100 m deep, green is between 100 and 500 m, pale-blue is between 500 and 1000 m, medium blue is between 1000 and 2000 m, and deep blue is deeper than 2000 m deep. Land is indicated in white.

This survey area incorporates a variety of habitats from the shallow waters of the shelf to the continental slope. The Gulf Stream meanders through the eastern portion of the survey area, flowing towards the northeast.

We have established ten 40-nm long transect lines that cross the survey area, oriented parallel to the short axis of the USWTR boundaries, as shown in Figure 1 (*i.e.* approximately from NW to SE). The transect lines are spaced approximately 5 nautical miles apart. Transect lines begin 2.5 nm within the north and south borders and provide an effective transect width that covers the entire box. This yields a total of 400 nm of survey track line. These ten transect lines will be surveyed by both aerial and shipboard platforms.

4. General Approach

We initially investigated the use of a Before-After Control-Impact Paired (BACI-P) study design in which monitoring surveys would commence in both the USWTR and a paired control site before training exercises commenced and then continue in both areas after the range became operational. To determine whether this approach could reliably detect an effect of training activities within the proposed USWTR, we simulated the movement and behavioural responses of a number of species over the eastern Atlantic seaboard of the U.S. The aim of the simulations was to determine whether avoidance or fatal exposure (as a worse case scenario) to mid-frequency sonar in the USWTR could be detected statistically given a realistic level of monitoring. The results of this simulation modelling (Paxton et al. 2005) indicated that it would be difficult, if not impossible to detect demographic effects of the USWTR (if any should occur) at any realistic sampling intensities. In fact, in the absence of daily sampling, reliable detection of even the worst possible effects of the USWTR was deemed unlikely. Therefore, in this monitoring plan we have placed emphasis on documenting species occurrence, estimating densities, and establishing patterns of residency so that we can better understand patterns of use for species inhabiting the USWTR area prior to the commencement of training exercises. We anticipate a re-evaluation of this monitoring approach after collection of two or three years of baseline data.

5. Survey Methods

As noted above, the monitoring program must yield reliable information on marine mammal occurrence, densities and distribution in the USWTR and adjacent waters. Every survey method has scientific and logistical advantages and disadvantages; by combining multiple methodologies we hope to ensure the most complete and effective monitoring program. The use of multiple approaches also helps to overcome the biases that are associated with particular survey methods. We describe some of the most important sources of bias below.

During line transect surveys *availability bias* is caused when animals are submerged (and thus undetectable) while they are within sighting range from the survey platform. Aerial surveys tend to suffer from larger availability bias than shipboard surveys because animals are within detectable range of fast-moving platforms for much shorter periods than from slow-moving platforms. Availability bias is particularly problematic for deep-diving species, such as beaked and sperm whales (Barlow and Gisiner 2006).

In addition to availability bias, line transect surveys are often also subject to *perception bias* because observers fail to see some animals which are at the surface within the field of view and thus available for detection. Conventional distance sampling methods (Buckland et al. 2001) avoid this bias but require that all available animals on the transect line are detected (this is often referred to as the assumption that g(0)=1).

Table 1 summarizes the main potential biases and issues arising from line transect surveys of the main species of interest, together with a summary of the survey method we propose to address these issues.

5.1. Aerial Surveys

5.1.1 General Considerations

Aerial line-transect surveys provide high quality data on the distribution and density of both marine mammals and sea turtles and are possible even when sea states hamper vessel surveys. We will employ aerial surveys year-round, and complement this approach with shipboard surveys during months in which such work is feasible (see below).

During aerial surveys we will pay particular attention to the methodological issues associated with perception bias. The most successful methods of dealing with failure of the g(0)=1 assumption involve use of two teams of independent observers surveying the same animals (see Laake and Borchers, 2004). However, in addition to being substantially more demanding in execution (requiring double the number of observers and a survey platform on which pairs of observers can be isolated from one another) double-platform methods involve substantially more complex analysis methods and relatively large sample sizes for reliable estimation. Most of our survey effort will, therefore, use single-observer team survey methods which satisfy, as nearly as possible the g(0)=1 assumption. We will employ a four-seat aircraft with a NOAA-certified pilot and co-pilot in each front seat and left and right observers in the two rear seats.

Table 1. Biases associated with line transect surveys, by species. "Availability bias" arises when animals are unavailable for detection (e.g. submerged) while within detectable range; "Perception bias" arises when available animals are not observed within detection range.

Species	**Bias from aerial line transect survey?**	**Bias from ship line transect survey?**	**Other issues**	**Suggested Mode of Survey**
Sperm whales	Yes; availability bias	Yes; availability bias	Can be detected acoustically	Aerial plus ship with acoustics
Beaked whales	Yes; availability bias	Yes; availability bias	May be detected acoustically	Aerial plus ship with acoustics
Migrating baleen whales	Likely; availability bias	Likely not		Aerial and ship
Fin whales	Likely; availability bias	Likely not		Aerial and ship
Pelagic dolphins	Yes; availability and perception bias for individuals but not schools	Likely for individuals and small schools: availability and perception bias.	May respond to ship before detection. Species identification may be problematic	Aerial or ship
Sea Turtles	Yes; availability and perception bias	Yes; availability and perception bias		Aerial and ship

We hope to supplement this approach with some double-platform effort to estimate g(0). We may also explore use of the *cue-counting* method. A "cue" is any instantaneous detectable manifestation of animal presence; a whale blow is a cue; a whale breaking the surface is a cue, a whale fluking is a cue, and so on. The cue-counting method involves recoding the distance to every detected cue, whether or not it comes from an animal

previously detected. This can be viewed as a moving point transect method in which cue density per unit time, rather than animal density, is estimated. Estimated cue density per unit time is then converted to animal density by dividing it by an estimate of cue rate per animal. We will explore the costs and benefits of the double-platform and cue-counting approaches when field work commences this summer.

Because it is likely that the transect line will be obscured, or partially obscured, from observers' view in the aircraft, we are not confident that it will be possible to search in a way that all available animals on the transect line will be detected. However, while it is unlikely that all available animals at small *perpendicular* distances from the transect line can be detected, it may be possible to ensure that all available animals at small *radial* distances are detected. Therefore, we propose to use radial-distance based distance sampling methods on the aerial survey.

Depending on shipboard sample sizes, it may be possible to combine shipboard and aerial estimates in analyses so that they are equally unbiased. For many species perception and availability bias will be lower for shipboard surveys so it may be possible to use the aerial survey estimates as indices of abundance and to estimate the relative bias of the index by comparison with shipboard estimates over a period of time.

5.1.2 Aerial Survey Monitoring Plan

We propose to fly each trackline during every month of the year. We anticipate that this level of survey effort will require three field days each month. Aerial surveys will be conducted monthly beginning in June, 2007. Data to be collected during these surveys is presented in Appendices A and B.

We have calculated very approximate estimates of the expected number of sightings for the aerial survey using our estimated level of survey effort and previous surveys conducted in this area (McLellan et al. 1999). These calculations come from a modified version of the simulations used previously by Paxton et al. (2005). Table 2 shows the estimates obtained from simulating three years of surveys in the proposed survey region shown in Figure 1. Our calculations suggest that some species will be detected very infrequently with this level of aerial survey effort.

It should be noted that the estimated detection rates from the simulations are based on relatively few observations, as sample sizes from previous surveys (McLellan et al. 1999) were quite small. The information shown in Table 2 should, therefore, be interpreted with caution and used as no more than a rough guide. One of the most important functions of the baseline aerial survey effort will be to establish year-round baseline information on species occurrence and density and their patterns of seasonal variation.

Aerial surveys will be conducted in accordance to *NOAA Fisheries- Southeast Region (SER) Minimum Aircraft and Crew Provisions Right Whale Data Collection Activities*. Surveys will be carried out in over-wing, twin-engine aircraft, Cessna 337 airplanes, which are maintained under provisions of 14 Code of Federal Regulations (CFR) Part 135. Each plane will be equipped with the necessary electronic positioning equipment and safety gear required to conduct marine mammal surveys. Two pilots will be used for each flight. Both pilots will meet requirements as specified in 14 CFR Part 135; the pilot-in-command will meet or exceed all additional NOAA requirements.

Surveys will be flown at an altitude of 300 m and an airspeed of 160 km/hr. Surveys will be flown only under safe operating conditions. Two observers, one positioned on each side of the aircraft, will carry out surveys. Observers and coordinators will have appropriate egress and sea survival training and be equipped with all NOAA required safety gear. The plane will be equipped and the pilots will fly tracklines coordinates with a Global Navigation System (GPS) to permit precise trackline fidelity. Each observer will use an independent GPS to record the precise time and geographic position of all sightings. The left and right observers record sightings independently. When a sighting cue is encountered, the radial and horizontal sighting angle, determined *via* wing-strut marks, will be recorded. At this point, if the observer requires additional identification and count information, the track will be broken to allow the plane to close on the sighting. In this closing mode, the precise location of the sighting will be determined and all relevant biological information will be collected. In these cases, the observer who first encounters the sighting will take the "lead" and that observer's GPS will mark the break in effort, all points relevant to the sighting, and the point at which the team goes back on effort on a trackline. These sightings can provide an additional check on the ability of observers to determine sightings cues while on effort on the trackline. All data sightings will be manually recorded in real time on sighting data sheets. This recording method gives precise locations while giving the observer the opportunity to continuously record information while still circling the sighting. Many different methods are employed to record aerial survey data. When using O2 Cessna's, there is a strong commitment to reduce the amount of equipment in the observer cockpit. Having the observers store locations on individual GPSs and record other data on datasheets on clipboards reduces the amount of electronics, wires and clutter in the plane. Back on ground, the observers will download data from the GPS units and transcribe their sighting data into a digital spreadsheet. A unified data set that takes both the left and right side observations into account is then generated. Specific sightings from both the left and right side will be entered in temporal order. This provides an opportunity to edit and clarify any disparate data. A unified waypoint and sightings spreadsheet is produced and forwarded to the research team with regular uploads to the OBIS website.

UNCW holds NOAA Scientific Permit No. 948-1692-00, which authorizes aerial and shipboard surveys for all cetaceans encountered in the western North Atlantic (expiration date 5/21/2011).

The aerial surveys will be conducted by the research team from the University of North Carolina Wilmington and coordinated by William McLellan. Details of this survey team are provided in Appendix C.

Table 2. Expected monthly mean "daily" sightings from simulations (mean from three trials). The asterisk denotes number of groups not individuals.

Species	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec
Sperm whales	1.00	0.33	0.33	0.33	0	0	0		0	0	0.33	1.00
Beaked whales	1.00	0	1.00	0.67	0.33	1.00	0.33	0.33	0	0.67	0.33	0.33
Baleen whales	0	0	0	75	2	0	0	0	2	10	23	1
Fin whales	10	27	30	30	37	22	0	0	0	0	6	11
Cold-water dolphins*	10	15	19	15	21	10	0	0	0		3	7
Warm-water dolphins*	2	4	3	2	2	2	1	2	1	1	3	1
Leatherback turtles	0	0	0	0	0	0	0.33	0.33	0.67	0.33	0	0

*Schools

5.2. Vessel Surveys

5.2.1 General Considerations

Vessel-based survey platforms provide a greater probability of sighting deep-diving species, especially beaked whales, which may be missed during aerial surveys (Barlow and Gisiner 2006). Shipboard observers are also more likely to be able to confirm species identity, particularly for animals that are difficult to distinguish from the air. Vessel-based platforms allow for biopsy sampling to ensure that all species encountered are correctly identified, as described below.

To ensure maximum detection rates, we will employ a traditional single visual survey team, supplemented by acoustic monitoring using a towed hydrophone array. The towed array will facilitate compilation of an acoustic library of species-specific recordings, which will be useful for the passive acoustic monitoring component of this research program (see below).

The use of a shipboard platform will also allow us to monitor the use of the USWTR and adjacent areas by individual animals using photo-identification techniques. Species for which this approach is feasible include sperm whales, beaked whales, humpback whales, bottlenose dolphins, spotted dolphins, pilot whales and Risso's dolphins. These methods can be used to examine seasonal and inter-annual patterns of residency. This information will be critical to interpreting any changes in density documented in the USWTR area.

Our ship-board surveys will be used primarily to estimate density and secondarily to facilitate collection of biopsy samples and photographs for individual identification. Ship-board surveys will provide the following information: species-specific patterns of occurrence, data that can be used to generate species-specific estimates of density; and information on residency patterns and stock structure of marine mammals.

5.2.2 Vessel Survey Monitoring Plan

We plan to survey every trackline each month during the summer (June – October), when we anticipate a total of six survey days per month. Sea conditions are conducive to vessel surveys during this period; it is harder to conduct such surveys in the winter, when there are fewer workable sea days. Vessel surveys will commence in June, 2007.

For these vessel line transect surveys, we will employ the M/V Sensation, a 53' charter vessel based in Morehead City, NC. At a survey speed of 10 knots, the vessel can cover approximately two transect lines each day, and we will survey every transect line each month. We will also survey each trackline at least once in the winter (November to May), when we have allocated 10 days for vessel surveys. These winter surveys will be opportunistic in nature, taking advantage of the brief windows of good weather during this season.

Whilst on effort during vessel line transect surveys, we will employ a team of six researchers plus the vessel captain. Two observers will use 7 x 50 hand-held binoculars to search ahead of the vessel. The captain will monitor the trackline with naked eye. A dedicated recorder will enter information on sightings and environmental conditions into a laptop that will have a feed to a GPS unit. Data will be recorded using software (VisSurvey) developed and modified for our surveys by Dr. Lance Garrison (NOAA/SEFSC). Data to be collected during these line transect surveys is presented in Appendix D.

To prepare for these surveys, a classroom training exercise was held for all marine mammal observers at the Duke University Marine Laboratory in Beaufort, NC on April 24th, 2007. The workshop was led by Ms. Erin LaBrecque, who has extensive experience as a shipboard observer for NOAA and who has received training from the CREEM group at the University of St. Andrews, Scotland. Observers were instructed in line transect theory, field methods, data collection protocols, and species identification.

While conducting these line transect surveys, we will also tow a hydrophone array approximately 150 m behind the M/V Sensation to record the presence of vocalizing marine mammals. This towed array will consist of four elements, each with a frequency response between 2-100 kHz and a sensitivity of -165 dB re 1V/μPa. The array will be connected to a MOTU Traveler, which will digitize the incoming sounds. The MOTU Traveler is capable of processing sounds at 24-bit resolution and a maximum sampling rate of 192 kHz. Collecting data at this resolution and sampling rate will allow for comparisons between data collected by the array and that collected by the HARPs (see 5.3 below).

Incoming acoustic signals will be monitored in real-time with the software program *Ishmael* by a dedicated acoustician. When sounds of interest (marine mammal whistles, echolocation clicks, burst-pulses, unusual or unidentified sounds, etc.) occur, continuous recordings will be made onto the laptop or an external hard drive using *Ishmael*. In addition, we will use the software program *WhalTrak2* (operated on a second computer) in conjunction with *Ishmael* to help localize sound producing marine mammals. *Ishmael* is capable of localizing vocalizing animals via beam-forming and phone-pair algorithms, and *WhalTrak2* is capable of plotting these angles in reference to the ship's location. *WhalTrak2* is also capable of keeping a log of the ship's position (via a GPS feed), localizations made, and any comments entered by the acoustician. The visual line-transect observers will not be informed of the presence or location of any vocalizing marine mammal until it is certain the animals are behind the vessel.

Finally, after each vessel survey, recordings will be analyzed using a MATLAB-based acoustical software program called *Triton*, developed in John Hildebrand's lab at the Scripps Institute of Oceanography. These array recordings will be used to describe

species-specific vocalizations, so that we can determine which species are recorded by the HARPs.

Seabird counts will be made concurrently during these surveys by an experienced observer who will record seabirds in a 90 degree bow-beam arc within 300 m of the survey vessel. Observations will be made on the side of the vessel with the best visibility (Tasker et al. 1984). Sighting distances will be estimated using a handheld rangefinder (Heinemann 1981) and recorded as within 100, 200 or 300 m of the vessel. We will record the number of individuals and their behavior (sitting, flying, or foraging), together with associations with other marine species. The presence of ship-following birds will be noted separately to avoid biases in quantitative analyses. Data will be recorded on a dedicated laptop computer (separate from that used for marine mammal sightings).

As stated above, the vessel line transect survey team will consist of six individuals. Four individuals will rotate through the marine mammal observer and recorder stations on 30-minute watches (one observer will be at a rest station). A fifth researcher will monitor the passive acoustic monitoring system towed behind the vessel at all times while underway. This individual will be in the main cabin, visually isolated from the line transect survey crew. The sixth individual will be responsible for seabird sightings.

In addition to the line-transect surveys, at least one day each month will be devoted entirely to photo-identification and biopsy sampling. On these days we will employ a research platform that is capable of deploying a small rigid-hull inflatable, from which we can more readily collect biopsy samples (when appropriate) and photographs for individual identification. During these surveys, we will employ the R/V Cape Fear, a 70' research vessel based in Wilmington, NC.

All shipboard surveys will be conducted under NOAA Scientific Permit No. 948-1692-00, held by UNCW, which authorizes aerial and shipboard surveys for all cetaceans encountered in the western North Atlantic (expiration date 5/21/2011). Biopsies will be conducted under the authorization of the SEFSC/NOAA Fisheries Permit (Appendix E).

The surface vessel surveys will be conducted by the research team from Duke University and coordinated by Kim Urian. Details of the personnel comprising this survey team are included as Appendix F.

5.3. Passive acoustic monitoring

5.3.1 General Considerations

We will supplement traditional visual surveys from aircraft and ships with passive acoustic monitoring in the proposed USWTR. This approach will allow continuous monitoring over long periods and is particularly useful during periods of inclement weather. Passive acoustic monitoring prior to instrumentation of the USWTR will help to identify the full spectrum of vocalizing marine mammals that inhabit this area.

Traditionally, this approach has been limited to species that vocalize at relatively low frequencies, such as baleen whales. More recently, however, remotely deployed passive acoustic monitoring systems, known as High-frequency Acoustic Recording Packages (HARPs) have been developed by John Hildebrand at the Scripps Institution of Oceanography. These devices can monitor areas for long time periods (months) and provide information on the use of these areas by a variety of vocalizing marine mammals. These techniques are now being used in a cost-effective manner in many inaccessible areas, such as remote seamounts in the Pacific Ocean.

The HARPs can sample at 200 KHz and typically collect several terabytes of data during their deployment (which subsequently requires a labor-intensive analysis). A full description of the technical specifications of the HARPs is provided by Wiggins and Hildebrand (2007).

We will employ HARPs in the USWTR to provide detailed information on the seasonal occurrence and relative density of vocalizing marine mammals, particularly those that are difficult to survey using traditional visual techniques. This approach will also facilitate assessment of the efficacy of visual monitoring techniques during aerial and ship-board surveys by comparing which species are detected by the two methods. We will use species-specific vocalizations obtained from the towed array and vessel surveys (see above) to ground-truth the specific identity of vocalizing marine mammals detected by the HARPs.

Due to the large number of acoustic detections we expect during these deployments, we propose to place one HARP within the USWTR and a second unit in an adjacent control site (see below). This will allow us to compare and contrast the number of vocalizing marine mammals in the USWTR and a similar area once construction begins and training exercises commence. Unlike the situation with traditional visual surveys, we *may* have sufficient statistical power to detect an effect of the USWTR with this passive acoustic monitoring approach.

5.3.2 Passive Acoustic Monitoring Plan

We will deploy a single HARP on a mooring within the USWTR during the summer of 2007. We will deploy a second unit at a control site well outside the USWTR, likely to the southwest of Cape Fear. Both units will be deployed from the R/V Cape Fear. We will ensure that both units are situated in similar environments (e.g. depth, position

relative to the Gulf Stream and bottom type). The units will be moored at depths of approximately 200 m. The units will record continuously (*i.e*. no duty cycle) for approximately three months. In late October or early November, we will employ the R/V Cape Fear again to retrieve the HARPs. Once the units are onboard, we will download the data (approximately 2 terabytes) at sea, a process that takes about three hours, and then redeploy each unit. In the second deployment, we will employ a duty cycle of 15 minutes on and 15 minutes off, thus extending the recording duration of the units to six months. We will retrieve the HARPs again in March or April of 2008.

The HARPs will be provided by Dr. John Hildebrand of the Scripps Institute of Oceanography (SIO), who will also provide technical assistance in analysis. The research team from Duke University will be responsible for the deployment and retrieval of the units and will work with SIO to fully analyze the data. Andrew Read will be responsible for coordinating this aspect of the monitoring program.

6. Disposition of Data and Samples

Each research team will be responsible for editing data on a timely basis. Monthly data summaries from the aerial surveys and vessel surveys will be provided to the NTR and to the analytical team at the University of St. Andrews by the University of North Carolina Wilmington and Duke University, respectively. In addition, the NTR will receive monthly reports of all activities (purchases, field work, analysis, and reporting).

In addition, survey tracks and the location of sightings will be posted monthly on OBIS-SEAMAP (http://seamap.env.duke.edu/). The University of St. Andrews will estimate density and abundance from both data sets and make this information available at the end of the contract period.

Duke University and the Scripps Institution of Oceanography will provide estimates of the number of vocalizing marine mammals at the USWTR at the end of the contract period.

All biopsy samples will be provided to Dr. Patty Rosel (NOAA/SEFSC) for species identification and archiving. Photographic catalogs of individually distinctive marine mammals will be housed at Duke and shared with researchers at NOAA and elsewhere. Hard (or digital) copies of these catalogs will be provided to the Navy at the end of the project period.

We will provide the Navy with an Annual Report at the end of the project period. Prior to submission of this Report, we will hold a formal Program Review with Navy and NOAA personnel to brief them on progress and challenges. We also intend to hold an interim Program Review in November 2007, approximately half-way through the project period.

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Appendix A

Date:_____ Observers: 12 34 Pilot: 3 Co-Pilot: 4 Page _____ of _____

Flight Origin: Wilmington VA Beach

Time	Waypoint #	Event	Heading	Track #	Obsrv #	Alt(ft)	Visibility	BSS	Cloud	Glare L	Glare R	Angle	Sighting Cue	Species	Reliability	Min #	Max #	Best Est	Calves Y/N	Avoid Y/N	Pho/Vid (Y/N)	Comments

Appendix B.

Codes for Variables on Aerial Survey Data Sheet

Date: YYYYMMDD **Track#:** opportunistic track line=99

Event:

1.1 = On effort/on track
1.2 = Off effort

3.1 = Change in environmental conditions

10.0 = Opportunistic sighting(s)

2.0 = Sighting-breaking track/off effort (real time)
2.2 = Sighting of commercial fishing vessel
2.4 = Sighting of marine mammal (real location)
2.7 = Sighting of sea turtle (real location)
2.8 = Sighting of large vessel (Military, commercial, etc..)
2.9 = Unidentified sighting, requires comments

Sighted by: 1=pilot 2=recorder 3=observer left side 4=observer right side

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Reliability of Species ID:
1 = definite
2 = probable
3 = possible/unsure

Visibility:
1 = clear to horizon
2 = half the distance to the horizon
3 = less than half the distance to the horizon

Sea State:
0 = slick, calm, mirror-like
1 = small waves
2 = whitecaps 0-33%, waves 1-2 feet
3 = whitecaps 33-50%, waves 2-3 feet
4 = whitecaps 50-65%, waves 3-5 feet
5 = whitecaps >65%, waves >5 feet
6 = too rough too survey

Cloud Cover:
01 = clear
02 = partly cloudy
03 = continuous layer of clouds
04 = rain
05 = haze
99 = other, requires comments

Glare:
1 = none
2 = 0-25% of half circle viewing area
3 = 25-50% of half circle viewing area
4 = >50% of half circle viewing area

* Enter 9 in appropriate fields where data was not recorded

Appendix C. Aerial Survey Team (UNCW).

Dr. D. Ann Pabst (Project Leader)
Duties: Dr. Pabst will provide scientific and fiscal oversight during all aspects of the project. She will provide grant management during the course of the project and will be responsible for the development of interim and final reports.
Qualifications: Dr. Pabst is full Professor at UNCW. She holds a Ph.D. from Duke University and has over 25 years of experience working with marine mammals. She has directed or served on over 30 graduate and post-graduate student committees. She has managed over 40 large granted projects from inception to completion. She has served as the Secretary for the Society for Marine Mammalogy and is currently an Associate Editor for Marine Mammal Science.

William McLellan (Aerial Survey Team Leader & Marine Mammal Observer)
Duties: Mr. McLellan will supervise all aspects of the aerial surveys from observer hiring to project completion. He will insure data quality by performing edits on the entire database. He will provide quality assurance for the project and trouble shoot any situations that arise during the project's term. He will be available to fly in the event of a down observer.
Qualifications: William McLellan has 24 years of experience working with marine mammals. He is a NOAA Fisheries Certified marine mammal observer and has conducted over 12 months of high seas marine mammal experience working in three oceans on numerous marine mammal survey and fisheries related projects. He has managed 9 separate aerial survey projects directed at determining marine mammal distribution and abundance in the waters of the mid-Atlantic. He is the North Carolina State Stranding Coordinator and the Large Whale Mortality Team Leader for the mid-Atlantic and has direct experience with all but two species of marine mammals in the north Atlantic ocean.

Observer/Coordinator TBA (Aerial Surveys and Marine Mammal Observer)
Duties: The Coordinator/Observer will first monitor weather and sea state conditions to determine when the best conditions are available in the USWTR monitoring site. They will inform William McLellan of a possible weather window and a decision to fly will be made. They will contact Orion Aviation and make arrangements for a plane and crew to be onsite for the duration of the aerial effort. They will coordinate the flight schedule with the other observer, and finally, they will fly the survey effort. The coordinator will be responsible for the data to be entered in all appropriate data files and provide the first edit of the database. They will forward high quality digital images to all cetacean catalogues operating in the Atlantic should appropriate sightings occur, including the Right Whale Catalog, the Humpback Catalog, and the Mid-Atlantic Bottlenose Dolphin Catalog. They will be responsible for all equipment used for data analysis and reporting (computers, plotting software, website service, database management at Duke, OBIS interface, etc.).

Qualifications: The current pool has been reduced down to two individuals (from an initial pool of over 65 applicants). The remaining two individuals have between 3 & 5 years experience flying marine mammal specific aerial surveys. They both have taken on positions of responsibility in their respective programs. We are waiting on the results of the international background check required by federal grants before we can offer this position.

Observer TBA (Aerial Surveys and Marine Mammal Observer)
Duties: The Observer will be aboard all flights. They will assist in all aspects of data entry and data editing. They will assist in digital image manipulations and manage all gear related to the aerial survey effort while in the plane (GPS, cameras, flight suits, emergency egress equipment, raft, satellite phone, etc.). The Observer will aid Duke Marine Lab vessel survey efforts as needed.
Qualifications: The current pool has been reduced to three individuals (from an initial 55 applicants) for this position. The remaining three individuals have between 2-3 years of experience flying marine mammal specific aerial surveys. We are waiting on the results of the international background check required by federal grants before we can offer this position.

Appendix D. Data fields to be collected for Duke shipboard surveys for USWTR monitoring program.

Date
Observer
- Starboard
- Port

Data recorder
Port of origin
Track number/ID
Time
Waypoint
Event:
- On effort/track
- Off effort
- Break transect
- Change in environmental conditions
- Sighting-marine mammal
- Sighting-sea turtle
- Sighting-fishing vessel-commercial
- Sighting-fishing vessel-recreational
- Sighting-large vessel
- Opportunistic sighting

Heading
Sighted by Captain, Recorder, Starboard-Observer, Port-Observer
BSS
Visibility
Cloud Cover
Glare
- Left
- Right

Wind speed/Direction
Wave height
Temperature
Depth

Range/Distance
Bearing/Angle
Activity
Sighting cue
Species code
Reliability of Species ID
Best estimate of group size
Number of calves

Appendix E. Shipboard Survey Team (Duke University).

Andrew Read (Principal Investigator & Marine Mammal Observer)
Duties: Dr. Read is responsible for all scientific aspects of this aspect of the monitoring plan, including project oversight, design and reporting. In addition, Dr. Read will act as an observer and be responsible for collecting biopsy samples.
Qualifications: Dr. Read is the Rachel Carson Associate Professor of Marine Conservation Biology at Duke University. He holds a Ph.D. in marine biology from the University of Guelph in Canada and has been conducting research on marine mammals for over 25 years. Dr. Read is President-Elect of the Society for Marine Mammalogy, a member of the Scientific Committee of the International Whaling Commission, the Committee of Scientific Advisors of the Marine Mammal Commission, and the IUCN Cetacean Specialist Group.

Kim Urian (Survey Team Leader & Marine Mammal Observer)
Duties: Ms. Urian is responsible for all aspects of survey logistics and planning and is responsible for the photo-identification component of this monitoring plan. She is also responsible for data quality control and dissemination. She will also act as an observer.
Qualifications: Kim Urian has 18 years of experience in marine mammal research and is an expert in photo-identification. She has conducted previous line transect surveys for marine mammals in Onslow Bay for UNCW and the Woods Hole Oceanographic Institution. Ms. Urian holds a bachelor's degree in biology from the University of Colorado and a Master's degree in marine biology from UNCW.

Danielle Waples (Marine Mammal Observer)
Duties: Ms. Waples will act as an observer during line transect surveys and as a photographer during photo-ID surveys. She is responsible for biopsy sample preservation and dissemination.
Qualifications: Danielle Waples has 20 years experience in marine mammal research. For the past seven years she has worked as a Research Associate at Duke University Marine Lab with Dr. Andy Read. In addition to her work at Duke, Ms. Waples has worked as a marine mammal observer for NOAA-SWFSC, in the Bay of Fundy for the Woods Hole Oceanographic Institution, and in the Mediterranean Sea on the Littoral Warfare Advanced Development (LWAD) project for Marine Acoustics, Inc. She received her undergraduate degree in human biology from Stanford University and holds a Master's degree in marine sciences from the University of California at Santa Cruz.

Lynne Williams (Acoustician)
Duties: Ms. Williams is responsible for passive acoustic monitoring during surveys.
Qualifications: Ms. Williams has seven years of experience conducting marine mammal bio-acoustics. She holds undergraduate and Master's degrees in marine biology from UNCW. The research for her master's thesis was on manatee vocalizations. She has

spent the past year working in the laboratory of Dr. John Hildebrand at the Scripps Institute of Oceanography. Ms. Williams is currently a Ph.D. student at Duke.

Lucie Hazen (Project Manager & Marine Mammal Observer)
Duties: Ms. Hazen is responsible for project management, including execution of the spending plan. She will also act as a marine mammal observer.
Qualifications: Ms. Hazen worked previously as a fisheries observer for the NOAA Pacific Islands Fisheries Science Center. Ms. Hazen has two years of experience in marine mammal research project management at Duke. Prior to that she completed a Masters degree at the School of Aquatic & Fisheries Science at the University of Washington (UW). She also holds an undergraduate degree in Biology from UW.

Lesley Thorne (Seabird Observer)
Duties: Ms. Thorne will conduct seabird observations and analyses.
Qualifications: Ms. Thorne has seven years of experience conducting marine mammal and seabird surveys. She has conducted field work in the Bay of Fundy, Onslow Bay and the Gulf of Mexico. She holds a bachelor's degree in ecology from the University of Guelph in Canada and is currently a Ph.D. student at Duke.

Alternate observers will be chosen for survey when required from a pool of researchers at DUML and elsewhere. There were more than twenty participants at the observer training session, so we will have a number of trained observers to act as alternate observers.

Appendix F. NOAA/SEFSC Biopsy Permit

U.S. Department of Commerce
National Oceanic & Atmospheric Administration
National Marine Fisheries Service

Southeast Fisheries Science Center
3209 Frederic Street
Pascagoula, MS 39568

228-762-4591
Keith.D.Mullin@noaa.gov

10 April 2007

Andrew J. Read, Ph.D.
Duke University
135 Duke Marine Lab Road
Beaufort, N.C. 28516

Dear Andy,

By this letter, you are hereby designated to act as co-investigator for the Southeast Fisheries Science Center under MMPA Permit No. 779-1633-02 to conduct biopsy sampling and Level B harassment of marine mammals in the Atlantic Ocean, Gulf of Mexico and Caribbean Sea. This authorization shall be subject to the following conditions:

1. A copy of this permit shall be in your possession during the proposed work.

2. A written and tabular summary of the work you conduct under the permit should be provided to me by 1 February 2008. Please read the permit and note the research conditions relating to activities authorized under the permit (e.g., photo-identification studies and biopsy sampling) and the detailed reporting requirements.

3. No commercial photography or film-making activities may be conducted while working under this permit nor shall the research be conducted from a vessel engaged in commercial activities, without prior permission from the NMFS Permits Division, Office of Protected Resources. Please note the photography/filming restrictions in Section E for further details.

4. This authorization is in force until 31 December 2007.

Thank you and good luck.

Sincerely,

Keith D. Mullin, Ph.D.
Research Fishery Biologist

Enclosure (Permit No. 779-1633-02)

cc: M. Payne, NMFS Office of Protected Resources

Technical Proposal for further Monitoring of Protected Species in the Proposed Onslow Bay and Jacksonville USWTRs – February 2009 to January 2010
Task Order 0047, Modification 1

February 5 2009

Andrew Read & David Johnston
Center for Marine Conservation
Nicholas School of the Environment, Duke University
Beaufort, NC

D. Ann Pabst & William A. McLellan
Biology and Marine Biology
University of North Carolina Wilmington
Wilmington NC

1. Aims

This document amends earlier technical proposals to conduct further aerial and shipboard surveys and passive acoustic deployments in two proposed USWTR on the east coast of the US, with the aim to document patterns of distribution and seasonal residency of protected species. These data will eventually be critical to estimating density of protected species in these USWTRs. Our general approach is to replicate the survey plan used to monitor the proposed USWTR site in Onslow Bay, NC during 2007, 2008 and 2009.

2. Species of interest in the shelf waters of eastern Florida

At present, very little is known about the occurrence and density of cetaceans in the shelf waters of eastern Florida, and in the proposed JAX USWTR. In fact, there is considerably less knowledge about the distribution of cetaceans in this area than was the case prior to the commencement of the current monitoring program in Onslow Bay in 2007. Species that may be encountered include: sperm whales (*Physeter macrocephalus*), beaked whales (*Ziphius* and *Mesoplodon spp*.), humpback and other balaenopterid whales (*Megaptera novaeangliae* and *Balaenoptera spp*.) and several genera of pelagic odontocetes (*Pseudorca crassidens*, *Peponocephala electra*, *Stenella spp*., *Tursiops truncatus*, *Globicephala spp.*, *Grampus griseus*, and *Delphinus delphins*), as well as leatherback (*Dermochelys caretta*) and loggerhead (*Caretta caretta*) sea turtles. Furthermore, the proposed JAX USWTR is located directly offshore of the calving habitat of endangered North Atlantic right whales (*Eublaena glacialis*). Right whales use the near-shore shelf waters of central Florida each winter to give birth to and nurse their calves. The current minimum population estimate (N_{min}) used in U.S. management (based on a count of known individuals alive during 2001) is 313 individuals, and it is believed that the true abundance of North Atlantic right whales is not much greater than this number (Waring et al. 2007). The species is listed as *Endangered* under the U.S. Endangered Species Act and as a *Strategic Stock* under the U.S. Marine Mammal Protection Act.

3. Species of interest in Onslow Bay

Our focus is on all protected species occurring in the proposed USWTR site, but in preparing this monitoring plan we paid particular attention to the following species: sperm whales (*Physeter macrocephalus*), beaked whales (*Ziphius* and *Mesoplodon spp*.), humpback and other balaenopterid whales (*Megaptera novaeangliae* and *Balaenoptera spp*.), right whales (*Eubalaena*

glacialis) and several genera of pelagic odontocetes (*Stenella spp.*, *Tursiops truncatus*, *Globicephala spp.*, *Grampus griseus*, and *Delphinus delphins*), as well as leatherback (*Dermochelys caretta*) and loggerhead (*Caretta caretta*) sea turtles.

4. Survey Areas

Onslow Bay USWTR

As the consequences of activity inside the USWTR area may extend outside the range itself we propose to survey an area that extends 10 nautical miles in each direction from the boundaries of the USWTR. The USWTR area is 25 nm long and 20 nm wide, so the entire monitoring area is 45 nm long and 40 nm wide. The total survey area is thus 1800 square nautical miles, with 28% of this area within the USWTR itself.

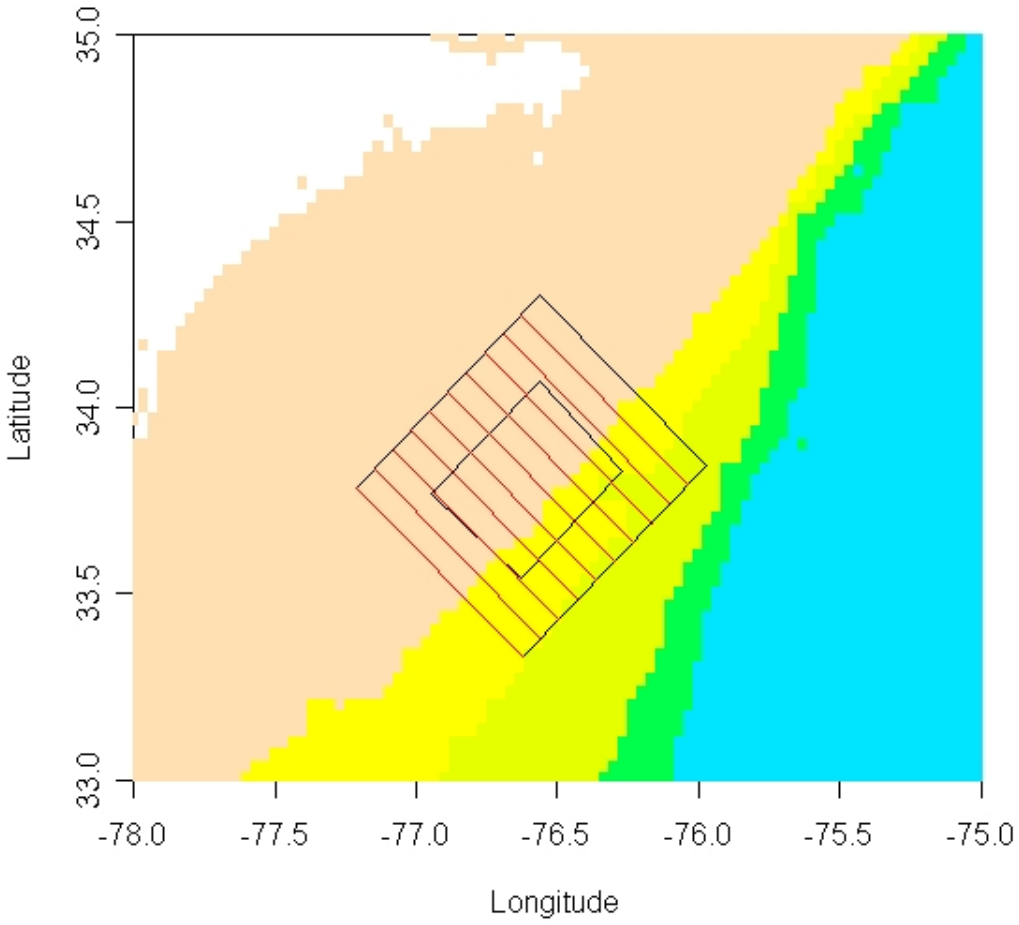

Figure 1. Survey area in Onslow Bay, encompassing the proposed USWTR site (inner box). Ten transect lines are depicted in red, each approximately 40 nm in length. Bathymetry is depicted by color: beige is less than 100 m deep, yellow is between 100 and 500 m, green-yellow is between 500 and 1000 m, green is between 1000 and 2000 m, and blue is between 2000 and 3000 m deep. Land is indicated in white.

This survey area incorporates a variety of habitats from the shallow waters of the shelf to the continental slope. The Gulf Stream meanders through the eastern portion of the survey area, flowing towards the northeast.

We have established ten 40-nm long transect lines that cross the survey area, oriented parallel to the short axis of the USWTR boundaries (e.g. approximately from NW to SE). The transect lines are spaced approximately 5 nautical miles apart. Transect lines begin 2.5 nm within the north and south borders and provide an effective transect width that covers the entire box. This yields a total of 400 nm of survey track line. These ten transect lines will be surveyed by both aerial and shipboard platforms.

JAX USWTR

We will survey an area similar in size and configuration to that monitored in Onslow Bay (see above.). The survey region extends 5 - 10 nautical miles beyond the east/west boundaries of the JAX USWTR, depending on the season and lines surveyed – see below. The proposed USWTR area is 25 nm long and 20 nm wide and the approximate area of the entire survey range during winter is 1,674 nm^2

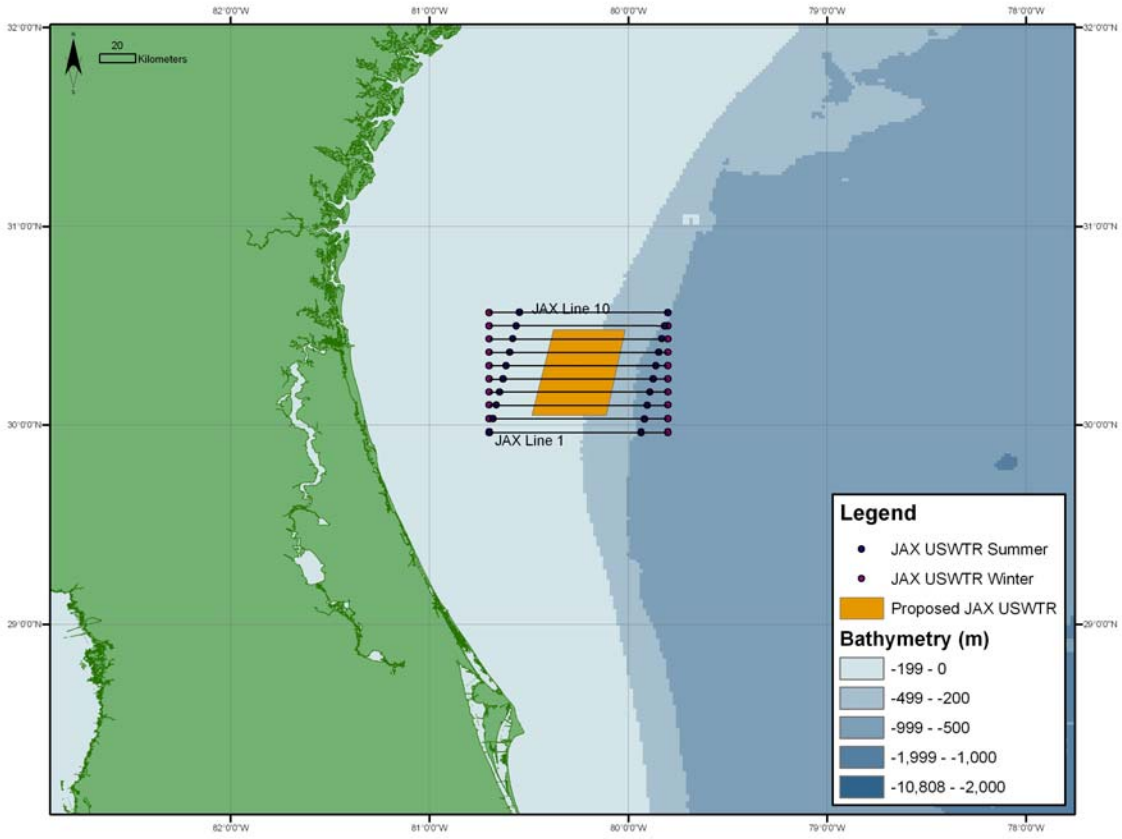

Figure 1. Location of the proposed JAX USWTR and potential survey tracklines for protected species monitoring.

This survey area incorporates a variety of habitats from the shallow waters of the continental shelf (less than 200m) to the deeper Blake Plateau (approximately 500m). For winter surveys, we have established ten transect lines (46.5 nm long for winter; 40 nm long for summer – see figure 2) that cross the proposed USWTR oriented parallel to the short axis of the USWTR boundaries

(*e.g.* approximately from NW to SE) and perpendicular to the dominant environmental variables that may affect the distribution of cetaceans (primarily bathymetry and the Gulf Stream). The transect lines are spaced approximately 4 nautical miles apart. The extended winter survey lines are designed to cover areas inshore of the USWTR that are not covered by ongoing aerial surveys for right whales during the winter months. These ten transect lines will be surveyed by both aerial and shipboard platforms.

5. General Approach

Previous research for the Onslow Bay region examined the potential efficacy of a Before-After Control-Impact Paired (BACI-P) study design, in which monitoring surveys would commence in both the USWTR area and a paired control site before training exercises commenced and then continue in both areas after the range became operational. The aim of the simulations was to determine whether avoidance or fatal exposure (as a worse case scenario) to mid-frequency sonar in the USWTR could be detected statistically given a realistic level of monitoring. The results of this simulation modelling (Paxton et al. 2005) indicated that it would be difficult, if not impossible, to detect demographic effects of the USWTR (if any should occur) at any realistic sampling intensities. In fact, in the absence of daily sampling, reliable detection of even the worst possible effects of the USWTR was unlikely. The results of our surveys in Onslow Bay have substantiated these model outputs, revealing low densities of cetaceans in the USWTR and surrounding area. Given the paucity of data on the occurrence and density of marine mammals at the JAX USWTR site, and the low densities documented for the Onslow Bay site, we believe that a BACI-P approach will not be feasible for either area. Thus, we will continue to conduct a monitoring plan for both sites site that places emphasis on documenting species occurrence, estimating densities, and establishing patterns of residency.

6. Survey Methods

The monitoring program must yield reliable information on marine mammal occurrence, densities and distribution in the JAX USWTR and adjacent waters. Every survey method has scientific and logistical advantages and disadvantages; by combining multiple methodologies we hope to ensure the most complete and effective monitoring program. The use of multiple approaches also helps to overcome the biases that are associated with particular survey methods. The combination of multiple approaches has worked extremely well in Onslow Bay and we replicate that philosophy here.

Survey Team and Project Management

The surface vessel and aerial surveys will be conducted by a dedicated research teams stationed in Beaufort NC and the Jacksonville area. The JAX team will be coordinated locally by a team leader employed by the University of North Carolina, Wilmington (UNCW). Dr. David Johnston from Duke University will be responsible for overall project management, data integration and reporting.

6.1. Aerial Surveys

Aerial line-transect surveys provide high quality data on the distribution and density of both marine mammals and sea turtles and are possible even when sea states hamper vessel surveys. We will employ a four-seat aircraft with a pilot and co-pilot in each front seat and left and right observers in the two rear seats.

For this monitoring plan modification, we propose to fly on 24 survey days from July 2009 through January 2010 (Task 5). Aerial surveys will be conducted in accordance to *NOAA Fisheries- Southeast Region (SER) Minimum Aircraft and Crew Provisions Right Whale Data Collection Activities.* Surveys will be carried out in over-wing, twin-engine aircraft, Cessna 337 airplanes, which are maintained under provisions of 14 Code of Federal Regulations (CFR) Part 135. Each plane will be equipped with the necessary electronic positioning equipment and safety gear required to conduct marine mammal surveys. Two pilots will be used for each flight. Both pilots will meet requirements as specified in 14 CFR Part 135; the pilot-in-command will meet or exceed all additional NOAA requirements.

Surveys will be flown at an altitude of 300 m and airspeed of 160 km/hr. Surveys will be flown only under safe operating conditions. Two observers, one positioned on each side of the aircraft, will carry out surveys. Observers and coordinators will have appropriate egress and sea survival training and be equipped with all NOAA required safety gear. The plane will be equipped and the pilots will fly tracklines coordinates with a Global Positioning System (GPS) to permit precise trackline fidelity.

Each observer will use an independent GPS to record the precise time and geographic position of all sightings. The left and right observers record sightings independently. When a sighting cue is encountered, the radial and horizontal sighting angle, determined *via* wing-strut marks, will be recorded. At this point, if the observer requires additional identification and count information, the track will be broken to allow the plane to close on the sighting. In this closing mode, the precise location of the sighting will be determined and all relevant biological information will be collected. In these cases, the observer who first encounters the sighting will take the "lead" and that observer's GPS will mark the break in effort, all points relevant to the sighting, and the point at which the team goes back on effort on a trackline. These sightings can provide an additional check on the ability of observers to determine sightings cues while on effort on the trackline.

All data sightings will be manually recorded in real time on sighting data sheets. This recording method gives precise locations while allowing the observer the opportunity to continuously record information while circling the sighting. Many different methods are employed to record aerial survey data. When using O2 Cessna's, there is a strong commitment to reduce the amount of equipment in the observer cockpit. Having the observers store locations on individual GPS units and record other data on datasheets on clipboards reduces the amount of electronics, wires and clutter in the plane. Back on ground, the observers will download the GPS units and transcribe their sighting data into a digital spreadsheet. A unified data set that takes both the left and right side observations into account is then generated. Specific sightings from both the left and right side will be entered in temporal order. This provides an opportunity to edit and clarify any disparate data. A unified waypoint and sightings spreadsheet is produced and forwarded to the research team with regular uploads to the OBIS website.

The UNCW holds NOAA Scientific Permit No. 948-1692-00, which authorizes aerial and shipboard surveys for all cetaceans encountered in the western North Atlantic (expiration date 5/21/2011).

6.2. Vessel Surveys

Vessel-based survey platforms provide an increased probability of sighting deep-diving species, especially beaked whales, which may be missed during aerial surveys (Barlow and Gisiner 2006). Shipboard observers are also more likely to be able to confirm species identity, particularly for animals that are difficult to distinguish from the air. Vessel-based platforms allow for biopsy sampling to ensure that all species encountered are correctly identified, as described below.

To ensure maximum detection rates, we will employ a traditional single visual survey team, supplemented by acoustic monitoring using a towed hydrophone array. The towed array will facilitate compilation of an acoustic library of species-specific recordings, which will be useful for the passive acoustic monitoring component of this research program (see below).

The use of a shipboard platform will also allow us to monitor the use of the USWTR and adjacent areas by individual animals using photo-identification techniques. These methods can be used to examine seasonal and inter-annual patterns of residency. This information will be critical to interpreting any changes in density documented in the USWTR area.

Our vessel surveys will be used primarily to estimate density and collect *in situ* habitat data such as sea surface temperature and depth, for each sighting and secondarily to facilitate collection of biopsy samples and photographs for individual identification. Furthermore, our vessel surveys will allow us to collect oceanographic data (e.g. temperature, salinity, productivity profiles) that will provide an ecological context for visual detections of cetaceans and provide data for further acoustic modeling and interpretation. Vessel surveys will provide the following information: species-specific patterns of occurrence, data that can be used to help generate species-specific estimates of density; and information on habitat associations, residency patterns and stock structure of marine mammals.

For this amendment to the original monitoring plans, we will to conduct a total of 24 survey days from July 2008 through January 2010 (Task 5). These surveys will take advantage of the brief windows of good weather that occur in these offshore waters. Vessel surveys will commence in January 2009. We will employ a charter vessel based in the Jacksonville region for these surveys.

Whilst on effort during vessel line transect surveys, we will employ a team of four or five researchers plus the vessel captain. Two observers will use 7 x 50 hand-held binoculars and naked eye to search ahead of the vessel. A dedicated center recorder will monitor the trackline region and enter information on sightings and environmental conditions into a laptop that will have a feed to a GPS unit. A fourth researcher will monitor the towed hydrophone array.

Sea surface temperature and depth data will be collected automatically while underway and logged to the laptop computer to facilitate analyses of habitat associations. When possible, oceanographic profiles will be obtained while underway during surveys (XBT drops) and at predetermined stations (CTD casts).

While conducting these line transect surveys, we will tow a hydrophone array approximately 150m behind the vessel to record the presence of vocalizing marine mammals. This towed array will consist of four elements, each with a frequency response between 2-100 kHz and a sensitivity of -165 dB re 1V/ìPa. The array will be connected to a MOTU Traveler, which will digitize the incoming sounds. The MOTU Traveler is capable of processing sounds at 24-bit resolution and a maximum sampling rate of 192 kHz. Collecting data at this resolution and sampling rate will

allow for comparisons between data collected by the array and those collected by the High Frequency Acoustic Recording Packages, or HARPs (see 5.3 below).

Incoming acoustic signals will be monitored in real-time with the software program *Ishmael* by the onboard acoustician. When sounds of interest (marine mammal whistles, echolocation clicks, burst-pulses, unusual or unidentified sounds, etc.) occur, recordings will be made onto the laptop or an external hard drive using *Ishmael*. In addition, we will use the software program *WhalTrak2* (operated on a second laptop computer) in conjunction with *Ishmael* to help localize sound producing marine mammals. *Ishmael* is capable of localizing vocalizing animals via beam-forming and phone-pair algorithms, and *WhalTrak2* is capable of plotting these angles in reference to the ship's location. *WhalTrak2* is also capable of keeping a log of the ship's position (via a GPS feed), localizations made, and any comments entered by the acoustician. The visual line-transect observers will not be informed of the presence or location of any vocalizing marine mammal until it is certain the animals are behind the vessel.

In addition, whenever possible, seabird counts will be made concurrently during these surveys. A dedicated observer will record seabirds in a 90-degree bow-beam arc within 300m of the survey vessel. Observations will be made on the side of the vessel with the best visibility (Tasker et al. 1984). Sighting distances will be estimated using a handheld rangefinder (Heinemann 1981) and recorded as within 100, 200 or 300m of the vessel. We will record the number of individuals and their behavior (sitting, flying, or foraging), together with associations with other marine species. The presence of ship-following birds will be noted separately to avoid biases in quantitative analyses. Data will be recorded on a digital voice recorder.

All shipboard surveys will be conducted under NOAA Scientific Permit No. 948-1692-00, held by the UNCW and NOAA General Authorization No. 808-1798 as amended, both of which authorize aerial and shipboard surveys for all cetaceans likely to be encountered in the western North Atlantic. Biopsies will be conducted under the authorization of the SEFSC/NOAA Fisheries Permit.

6.3. Passive acoustic monitoring

We are currently supplementing traditional visual surveys from aircraft and ships with passive acoustic monitoring in both proposed USWTR sites. This approach allows continuous monitoring over long periods and is particularly useful during periods of inclement weather. Passive acoustic monitoring prior to instrumentation of both USWTRs will help to identify the full spectrum of vocalizing marine mammals that inhabit these areas.

For this monitoring plan modification, we will employ one further HARP in the Onslow Bay USWTR site to provide detailed information on the seasonal occurrence and relative density of vocalizing marine mammals, particularly those that are difficult to survey using traditional visual techniques (Task 6). This approach will also facilitate assessment of the efficacy of visual monitoring techniques during aerial and shipboard surveys by comparing which species are detected by the two methods. We will use species-specific vocalizations obtained from the towed array and vessel surveys (see above) to ground-truth the specific identity of vocalizing marine mammals detected by the HARPs. We will employ a chartered research vessel to deploy and retrieve the HARP.

This amendment also includes support for deployments of Cornell Pop-Up units in the JAX and Onslow USWTRs. We will employ a chartered research vessel to deploy and retrieve

pop-up recording units in the USWTR sites during planned exercises. This will include deployment and recovery of multiple pop-up units for 1 exercise per site (Task 7).

7. Disposition of Data and Samples

The field research team will be responsible for editing data on a timely basis and transmitting it digitally to David Johnston at Duke for reporting uses and integration on a monthly basis. Monthly data summaries from the aerial surveys and vessel surveys will be provided to the NTR. In addition, the NTR will receive monthly reports of all activities (purchases, field work, analysis, and reporting).

In addition, survey tracks and the location of sightings will be posted on OBIS-SEAMAP (http://seamap.env.duke.edu/) on a quarterly basis. All biopsy samples will be provided to Dr. Patricia Rosel (NOAA/SEFSC) for species identification and archiving. Photographic catalogs of individually distinctive marine mammals will be housed at Duke and shared with researchers at NOAA and elsewhere. Hard (or digital) copies of these catalogs will be provided to the Navy at the end of the project period. We will provide the Navy with an Annual Report at the end of the project period. Prior to submission of this Report, we will hold a formal Program Review with Navy and NOAA personnel to brief them on progress and challenges. We also intend to hold an interim Program Review in November 2009.

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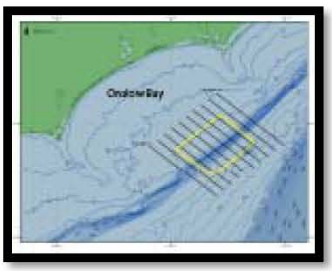
Appendix C - Onslow/JAX Annual Monitoring Report – 2008/2009

Protected Species Monitoring in the Proposed Undersea Warfare Training Range (USWTR) Onslow Bay, NC

Final Report, Year 2 (July 2008 – June 2009)

November 16, 2009






Executive Summary

This document comprises the second annual progress report to the Department of the Navy for the reporting period of July 2008 through June 2009 (Year Two). It includes data from the monitoring program for protected marine species at the proposed site of an Undersea Warfare Training Range (USWTR) in Onslow Bay, North Carolina. Aerial surveys, vessel-based surveys, and passive acoustics were techniques used to monitor the proposed USWTR site. Density estimates for marine mammals and sea turtles were determined from data collected during the aerial and vessel-based surveys. Two years of continuous monitoring have provided important baseline data on the density, abundance and distribution of marine mammals, sea turtles and seabirds, as well as information on movements and habitat use of these species in the proposed USWTR site.

Study Area

The proposed USWTR in Onslow Bay is 25 nm (46 km) long and 20 nm (37 km) wide. The survey area consists of a box that extends 20 nm in each direction past the proposed USWTR. Ten transect lines 40 nm (74 km) in length and spaced approximately 5 nm (9.3 km) apart crossed the survey area. Transect lines were oriented parallel to the short axis of the USWTR boundaries and perpendicular to the primary bathymetric and prevailing oceanographic features influencing the region. This design yielded a total of 400 nm (~740 km) of track line surveyed by both aerial and shipboard platforms.

Aerial Surveys

Personnel from the University of North Carolina at Wilmington conducted aerial surveys in the proposed USWTR site in Onslow Bay. Monthly aerial surveys of track lines were flown between June 2008 and June 2009. The goal was to survey the entire USWTR site (10 track-lines) twice per month. This goal was accomplished for seven of the twelve months. For the remaining months a single set of lines were flown except November, in which 16 lines were flown, and September, in which no lines were flown. A total of 64 cetacean sightings of 1,422 individuals, and 237 sea turtle sightings, representing 266 individuals, were observed while on effort in the study area. No right whales (*Eubalaena*

glacialis) were observed within the site. Three cetacean species were observed in the survey site while on effort including bottlenose dolphins (*Tursiops truncatus*; 36 sightings of 634 individuals), spotted dolphins (*Stenella frontalis*; 22 sightings of 717 individuals), and short-finned pilot whales (*Globicephala macrorhynchus*; 2 sightings of 30 individuals). In addition, there were four sightings of 41 individual dolphins where species identity could not be established with 100% certainty (*i.e*. "unidentified delphinids"). There was also a single "off effort" sighting of 20 Risso's dolphins (*Grampus griseus*) that was made during the transit between the offshore ends of track-lines 3 and 4. This sighting demonstrates the presence of this species near the proposed USWTR range but is not included in any of the analyses presented here.

As a comparison, during last year's aerial surveys 66 cetacean sightings, representing 853 individuals, were made (Table 1)(Pabst *et al*. 2008). The sightings by species were: bottlenose dolphins (33 sightings of 461 individuals), spotted dolphins (11 sightings of 177 individuals), short-finned pilot whales (3 sightings of 53 individuals), rough-toothed dolphins (*Steno bredanensis*; 3 sightings of 40 individuals), and Risso's dolphins (3 sightings of 20 individuals). In addition, a total of two sightings of five individuals were categorized as *T. truncatus / S. frontalis* and 11 sightings of 97 individuals were recorded as unidentified delphinids.

Vessel-Based Surveys

Researchers from Duke University conducted vessel-based surveys and passive acoustic monitoring in the proposed USWTR site in Onslow Bay. Twenty-two track lines were surveyed in approximately 102 hours and 1,609 km of survey effort. Most effort (73%) occurred in Beaufort Sea States 2 and 3. A total of 33 groups of cetaceans were sighted during vessel surveys (29 while on effort, four while off effort) and two species were observed: bottlenose dolphins (14 sightings), Atlantic spotted dolphins (17 sightings). Two sightings of unidentified delphinids were also recorded. Similar to Year One, in Year Two bottlenose dolphins were observed in both shallow and deep waters across the continental shelf break, whereas spotted dolphins were observed only in shallow waters on the continental shelf. No mixed-species groups were observed in Year Two. Forty-

nine loggerhead sea turtles (*Caretta caretta*) were also observed during Year Two surveys. Approximately 1000 digital images were taken for species identification and individual recognition during Year Two. No individuals of any species have been resighted in the USWTR.

Passive Acoustic Monitoring

During 17 surveys, a four-element hydrophone array was towed behind the vessel. Twenty groups of cetaceans (bottlenose dolphins and spotted dolphins) were detected with the hydrophone array and also were identified by visual observers. Recordings from the hydrophone array will be used to help identify species vocalizations recorded on a bottom-mounted acoustic recording device (High Frequency Acoustic Recording Package; HARP).

The HARP was deployed on three separate occasions since the start of Year One. The instrument was deployed, recovered and redeployed near the center of the USWTR site, close to the 200 m shelf break. In all three deployments, the instrument was programmed to record at a sample rate of 200 kHz for five-minute periods, separated by an inactive interval of five minutes. A total of 1,555 marine mammal vocal events have been identified since June 2007. Since commencing the HARP monitoring, sperm whales (*Physeter macrocephalus*) and a probable beaked whale have been detected using the HARP, but were not detected by aerial or vessel-based observers. Analysis of these recordings is ongoing.

Seabirds

Nearly 800 seabirds were observed in approximately 70 hours of survey effort between May 2008 and June 2009, yielding a sighting per unit effort (the number of seabirds recorded per hour of effort) between 0.72 and 61.64 per hour. Twenty-three species of seabird were recorded, with the greatest diversity observed during July and August 2008. Cory's (*Calonectris diomedea*) Shearwaters were the species sighted most frequently in both Year One and Year Two.

Density Estimation

Scientists from the University of St. Andrews conducted analysis of the data from the combined aerial and shipboard surveys of the USWTR from June 2007 through August 2009, combined with that of the earlier aerial surveys of the UNCW for Onslow Bay 1998/1999, allowed estimation of density surfaces for bottlenose dolphins *Tursiops truncatus,* spotted dolphins, *Stenella frontalis,* pilot and beaked whales combined, and loggerhead turtles *(Caretta caretta)* as well as providing some evidence of the environmental correlates of the animals distributions.

Detection functions were estimated from the multi-platform, multi-year USWTR survey data with additional data from UNCW right whale surveys, the 1998/1999 UNCW aerial surveys of Wallop Island, and shipboard surveys off Cape Hatteras. Abundance for the USWTR region and an outer margin of 20 n m around it was estimated using the estimated detection probabilities and separately estimating (a) animal presence/absence using a logistic general additive model and (b) estimating density given presence. Detection functions were not fitted to all of the detected species owing to a paucity of data (shipboard whale sightings).

Depending on the best fitted spatial models used, estimates were obtained as an average over the entire time period, for each year or for each month. At the highest resolution, estimates were obtained for the USWTR core region and the outer region for September 1998 through to July 1999 and June 2007 through to August 2009. Estimated bottlenose dolphin numbers varied between 20 (95% CI: 10 – 90, August 2008) and c. 100 (30 – 180, Jan 2008) for the inner region and from 60 (30 – 240, August 2008) to 290 (80 – 540, May 1999) for the outer region. Estimated spotted dolphin numbers varied from 0 (0 – 0) in 1998/1999 to 400 (110 – 1200) in January 2009 in the inner region and from 0 (0 – 0) in 1998/1999 to c. 920 (260 – 2700, in January 2009) in the outer region. Spotted dolphins only appeared in the shallower parts of the region of interest from 2007.

Pilot and beaked whale numbers were very low (< 10, 2 – 14) throughout the survey period. Estimated loggerhead turtle numbers varied from 2 (2 – 6) in July 1999 to 270

(50 – 800) in March 2009 in the inner region and from 5 (1 – 13) in July 1999 to 530 (90 – 1600) in March 2009 in the outer region. All the above estimates assumed perfect detection on the trackline. Small sample sizes result in very little power to detect trend in abundance but there was no evidence of a systematic decline in any species in the last ten years and substantial evidence for an increase in spotted dolphin numbers.

There was evidence that the abundance of bottlenose dolphins fluctuated with season (perhaps in response to temperature), as did the presence of loggerhead turtles who were likely to be associated with water between 18 – 20˚C. Spotted dolphins and loggerhead sea turtles were associated with shallower water less than 100 m deep.

AERIAL SURVEYS OF THE PROPOSED UNDER SEA WARFARE TRAINING RANGE (USWTR) IN ONSLOW BAY, NORTH CAROLINA, JULY 2008 TO JUNE 2009

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Executive Summary – Aerial Surveys

This document is an annual progress report to the U.S. Department of the Navy on aerial surveys conducted at the proposed Under Sea Warfare Training Range (USWTR) in Onslow Bay, North Carolina between July 2008 and June 2009. The aerial surveys were carried out by the University of North Carolina Wilmington. The goal was to survey the entire USWTR site (10 track-lines) twice per month. This goal was accomplished for seven of the twelve months. For the remaining months a single set of lines were flown except November, in which 16 lines were flown, and September, in which no lines were flown. A total of 64 cetacean sightings, of 1,422 individuals, and 237 sea turtle sightings, representing 266 individuals, were observed while on effort in the study area (Table 1, Figure 1). No right whales (*Eubalaena glacialis*) were observed within the site. Three cetacean species were observed in the survey site while on effort including bottlenose dolphins (*Tursiops truncatus*; 36 sightings of 634 individuals), spotted dolphins (*Stenella frontalis*; 22 sightings of 717 individuals), and short-finned pilot whales (*Globicephala macrorhynchus*; 2 sightings of 30 individuals). In addition, there were four sightings of 41 individual dolphins where species identity could not be established with 100% certainty (*i.e*. "unidentified delphinids"). There was also a single "off effort" sighting of 20 Risso's dolphins (*Grampus griseus*) that was made during the transit between the offshore ends of track-lines 3 and 4. This sighting demonstrates the presence of this species near the proposed USWTR range but is not included in any of the calculations presented here.

As a comparison, during last year's aerial surveys 66 cetacean sightings, representing 853 individuals, were made (Table 1)(Pabst *et al*. 2008). The sightings by species were: bottlenose dolphins (33 sightings of 461 individuals), spotted dolphins (11 sightings of 177 individuals), short-finned pilot whales (3 sightings of 53 individuals), rough-toothed dolphins (*Steno bredanensis*; 3 sightings of 40 individuals), and Risso's dolphins (3 sightings of 20 individuals). In addition, a total of two sightings of five individuals were categorized as *T. truncatus / S. frontalis* and 11 sightings of 97 individuals were labeled unidentified delphinids.

During the 2008-2009 season, the number of cetacean sightings varied by month, with the highest number of sightings occurring in March, April, May and June (Table 1).

Monthly sighting data from the 2007-2008 season showed a similar increase in sightings during the spring months.

A total of 266 sea turtles were observed during the study period. Of these, 226 were identified as loggerhead sea turtles (*Caretta caretta*), 39 were recorded as "unidentified sea turtles", and one was identified as a leatherback sea turtle (*Dermochelys coriacea*). Leatherback sea turtles had not been seen in the range during the 2007-2008 survey, but had been observed in December and July during aerial surveys conducted in 1997-1998.

As previously demonstrated in other aerial survey studies, sightings drop off dramatically as the Beaufort Sea State (BSS) increases. In the present study, as the BSS increased from one to three, cetacean sightings decreased from 14.10 to 1.93 per 1000 km surveyed, whereas sea turtle sightings decreased from 46.64 to 7.73 per 1000 km surveyed respectively.

In addition to cetaceans and sea turtles, other pelagic marine vertebrates, including manta rays, ocean sunfish and sharks, were sighted. The majority of vessels encountered in the proposed USWTR range were recreational fishing vessels, which were predominately observed shoreward of the 100 fathom depth contour.

Table 1. Total number of sightings and individuals for each species by month from June 2007 - June 2009 for the Onslow Bay, NC USWTR survey site. *No surveys were flown in January and September of 2008.

		2008						2009						
		July	August	September	October	November	December	January	February	March	April	May	June	Total
Tursiops truncatus	Sightings	2	1		4	3			2	3	6	9	6	**36**
	# of individuals	42	9		48	79			80	11	78	186	101	**634**
Stenella frontalis	Sightings		1			1			3	8	5	1	3	**22**
	# of individuals		22			30			160	257	198	25	25	**717**
Globicephala macrorhynchus	Sightings	2												**2**
	# of individuals	30												**30**
Unidentified delphinid	Sightings									1		2	1	**4**
	# of individuals									3		27	11	**41**
	Total sightings	**4**	**2**	**0**	**4**	**4**	**0**	**0**	**5**	**12**	**11**	**12**	**10**	**64**
	Total individuals	**72**	**31**	**0**	**48**	**109**	**0**	**0**	**240**	**271**	**276**	**238**	**137**	**1422**

		2007							2008						
		June	July	August	September	October	November	December	January	February	March	April	May	June	Total
Tursiops truncatus	Sightings	1				1	9	1			3	5	5	8	**33**
	# of individuals	80				40	113	1			33	43	67	84	**461**
Stenella frontalis	Sightings				1					4	1		1	4	**11**
	# of individuals				4					68	36		11	58	**177**
Globicephala macrorhynchus	Sightings	1											2		**3**
	# of individuals	32											21		**53**
Steno bredanensis	Sightings											1		2	**3**
	# of individuals											26		14	**40**
Grampus griseus	Sightings												1	2	**3**
	# of individuals												5	15	**20**
Tursiops/ Stenella frontalis	Sightings										1			1	**2**
	# of individuals										3			2	**5**
Unidentified delphinid	Sightings		1	1	1		4			2	1			1	**11**
	# of individuals		6	3	6		56			20	5			1	**97**
	Total sightings	**2**	**1**	**1**	**2**	**1**	**13**	**1**	**0**	**6**	**6**	**6**	**9**	**18**	**66**
	Total individuals	**112**	**6**	**3**	**10**	**40**	**169**	**1**	**0**	**88**	**77**	**69**	**104**	**174**	**853**

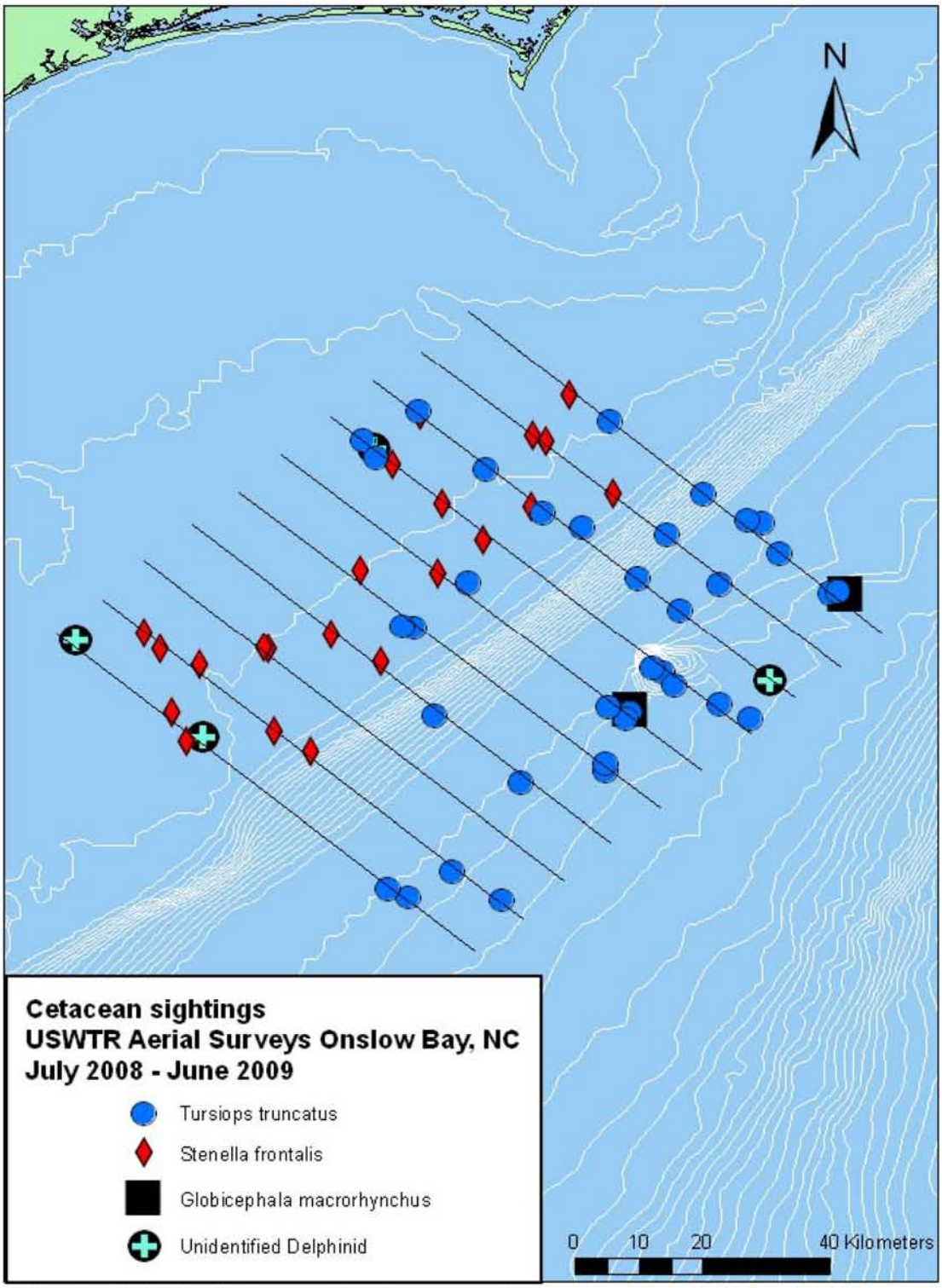

Figure 1. All cetacean sightings made during the 2008 – 2009 UNCW aerial surveys of the proposed USWTR site in Onslow Bay, NC.

Methodology

Survey design and logistics

The University of North Carolina Wilmington (UNCW) provided experienced aerial observers and contracted Orion Aviation, Siler City, NC, to provide planes and certified pilots. Surveys were conducted using NOAA – SER Minimum Aircraft and Crew Provisions Guidelines, which require that aircraft are CFR Part 135 certified and that pilots have demonstrated experience working below 1000 ft in support of biological observational studies. Surveys were flown in a Cessna 337 Skymaster, at 305 m altitude and 185 km/hr speed, with a pilot, co-pilot and two observers. Each observer wore a Nomex ® fire retardant suit, a Switlik ® inflatable life jacket, a personal Emergency Positioning Beacon (EPIRB), as well as additional safety equipment. An inflatable life-raft, plane EPIRB, and satellite phone were also onboard at all times.

The survey consisted of ten 74 km long track-lines spaced 6.5 km apart, which covered the proposed USWTR site and an 18 km boundary around the site in Onslow Bay (Fig. 2 and Table 2). The corners of the core USWTR site are: N34. 07°/W-76.56° (NW), N33.83°/ W-76.27° (NE), N33.54°/W-76.63° (SW), and N33.77°/W-76.95° (SE). Survey dates were chosen based upon weather and sea conditions, and access to restricted military areas within the site. Because the primary objective of the surveys was to locate and identify to species cetaceans and sea turtles, the sea state and consequent sighting conditions during surveys were key factors that dictated when to initiate and, if necessary, to abort, surveys. Low sea states (*i.e.* winds preferably 5 – 10 knots, but no more than 15 knots and seas maximum 4 feet) were selected to optimize sighting conditions. Sighting rates of small cetaceans drop off to near zero in a Beaufort Sea State (BSS) of four or higher, as demonstrated by several previous aerial survey studies (Gómez de Segura *et al*. 2006, DeMaster *et al.* 2001). Once an appropriate weather window was identified, observers from UNCW and Orion Aviation pilots would coordinate to meet at an FBO at the Wilmington, NC airport, from which all the surveys originated.

Table 2. Coordinates for track-line end points of the Onslow Bay, NC survey site

	Western Way Point		Eastern Way Point	
Transect Line	**Latitude**	**Longitude**	**Latitude**	**Longitude**
1	33.8119	-77.1926	33.3596	-76.6017
2	33.8620	-77.1249	33.4074	-76.5370
3	33.9146	-77.0666	33.4575	-76.4724
4	33.9671	-77.0020	33.5149	-76.4047
5	34.0148	-76.9342	33.5626	-76.3399
6	34.0673	-76.8726	33.6152	-76.2783
7	34.1198	-76.8017	33.6653	-76.2104
8	34.1723	-76.7431	33.7154	-76.1456
9	34.2119	-76.6721	33.7679	-76.0870
10	34.2724	-76.6104	33.8157	-76.0252

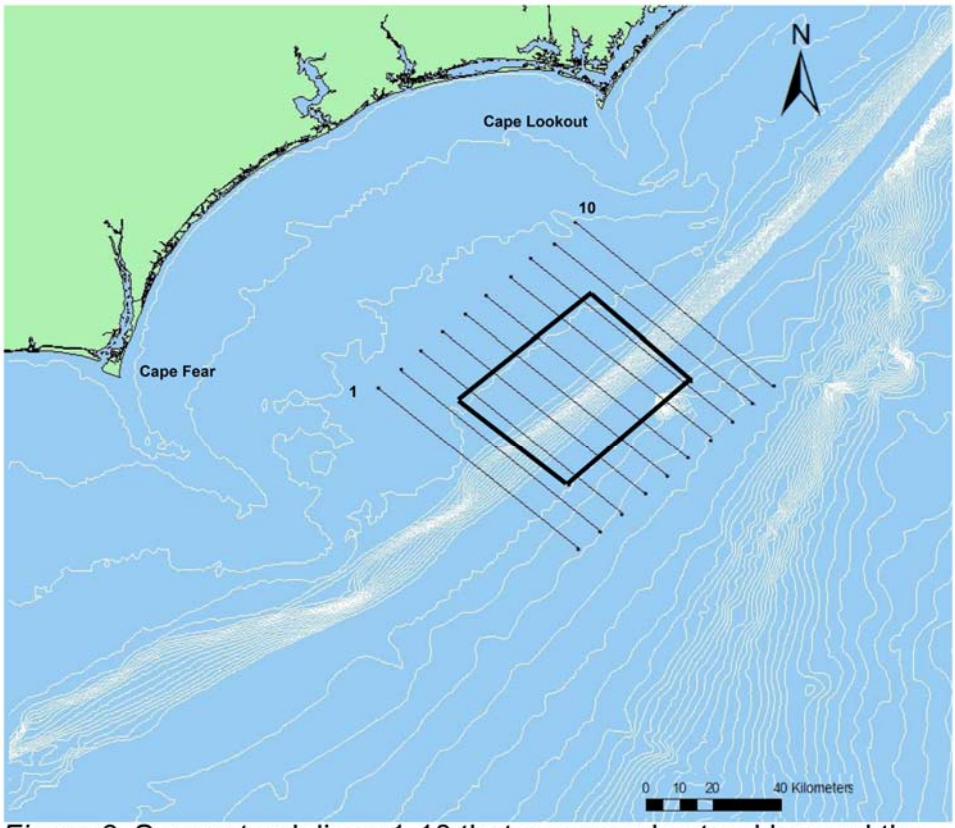

Figure 2. Survey track lines 1-10 that cover and extend beyond the boundaries of the proposed USWTR site in Onslow Bay, NC

Data collection

Each side of the plane was monitored by one observer with his or her own GPS unit, data sheet (see Appendix A), and binoculars, and each side was considered an independent strip transect. The start and end of transect lines, changes in environmental variables (*i.e*. cloud cover, BSS, visibility, and glare), and sightings of marine mammals, sea turtles and vessels in the survey area were recorded by each observer throughout the survey (see Appendix B for sighting codes). When a sighting cue was observed, horizontal and vertical angles between the plane and the sighting cue were recorded. Observers would then record a break track point and go off effort from the survey line to investigate the sighting. The plane would close on the sighting location and circle above the animal(s) to obtain photographic evidence of species. Initial and final locations of the sighting were recorded so that the distance of the initial sighting from the track line, and any general movements of animal(s), could be calculated. During a marine mammal encounter, the observer on the left side of the plane was the designated data recorder and the right observer took digital photographs to confirm species identification. The camera used was a Canon 40D with a 100-400 mm image stabilizer lens. The minimum and maximum numbers of animals in each sighting were estimated by both observers in the field and recorded. After photographic and sighting data were collected, the plane returned to the initial sighting location on the track line taking another waypoint marking the return to on effort surveys. All data collected during a sighting were recorded on the Sighting Data Sheet (Appendix C).

The plane did not break track for sightings of sea turtles, other marine vertebrates (*e.g*. sharks and rays) or vessels, however, these types of sightings were all recorded and logged.

Data analysis

Upon completion of a daily survey, GPS way points were downloaded to a desktop computer utilizing the GPS Utility software program (GPS Utility Limited, UK) and subsequently transferred into Microsoft ® Excel spread sheets. Observational data (*e.g*. start and stop track line, sightings, and weather conditions) were entered manually into the spread sheet for each GPS way point. All digital images collected during a

survey were also downloaded and separated into individual folders for each sighting that day. The use of digital photography allowed for enlargement of images once in the lab, which enhanced the ability to identify animals to species. For each sighting, a group of best images was selected based on visible diagnostic features. These images were used in conjunction with the preliminary species identification (ID) made in the field, based upon appearance, group size and behavior, to determine species identity. During the first year of surveys observers from Duke and UNCW met on two occasions to review sighting images and establish a clear set of diagnostic features to positively identify each cetacean species. These features were used by both teams during their photo analysis for the second year. Unless the dolphin species identity could be unequivocally established, the designation "unidentified delphinids" was used. Unidentifiable species were often the result of high BSS conditions where a clear set of images could not be obtained. Images obtained during a sighting were similarly employed to calculate group numbers, and a best estimate of group size was established based on field observations and images.

Geographical Information System (GIS) maps of sightings of cetaceans, sea turtles, other marine vertebrates, and vessels within the survey area were created. Positional data were imported from Excel spread sheets into Arc GIS version 9.2 (ESRI®, Redlands, CA), and used to plot sightings.

The distances between the break track waypoint (2.0) and the initial position of each sighting (2.4) was calculated using the online software Scripts Movable Type (http://www.movable-type.co.uk/scripts/latlong.html), which uses the Haversine formula to calculate distances between two geographical reference points. Since there is a bias in estimating the location of a group of mobile marine mammals from a fast moving airplane, the distances calculated between break track and sighting were recorded to 0.1 km. All data obtained during a marine mammal sighting (*e.g.* observational notes, group size, GPS coordinates and image numbers) were summarized in the Sighting Summary Sheet (See Appendices D and E for example and explanation). When all surveys for a month were completed, tables with sightings and effort (see Tables 3 and 4 for examples) were sent to Duke University Marine Lab (DUML) for inclusion in the monthly progress report compiled and sent by DUML to Geo-Marine Inc. (Plano, TX) and Parsons (Norfolk, VA).

Off effort sightings (*i.e.* "10.0" and sightings made on effort transits to and from the range) were not included in spread sheets used for data analysis.

Table 3. Sighting summary table of USWTR aerial surveys in Onslow Bay for June 2009.

Date	Time	On/Off Effort	Latitude	Longitude	Track Number	Species	Group Size
1-Jun-09	10:05	On	33.821909	-76.687991	5	Tursiops truncatus	3
1-Jun-09	10:36	On	33.773081	-76.476520	6	Caretta caretta	1
1-Jun-09	10:55	Off	34.052427	-76.730425	7	Mola mola	1
1-Jun-09	10:57	Off	34.064991	-76.736280	7	Stenella frontalis	3
1-Jun-09	11:05	On	34.053559	-76.718352	7	Stenella frontalis	6
1-Jun-09	11:42	On	33.964068	-76.450177	8	Tursiops truncatus	2
1-Jun-09	11:52	On	34.086870	-76.629366	8	Caretta caretta	1
1-Jun-09	11:55	On	34.155358	-76.718417	8	Unidentified Sea Turtle	1
1-Jun-09	12:05	On	34.056448	-76.466167	9	Unidentified Sea Turtle	1
1-Jun-09	12:27	On	33.927627	-76.170854	8	Tursiops truncatus	28
1-Jun-09	12:42	On	34.118759	-76.411411	10	Caretta caretta	1
1-Jun-09	12:44	On	34.171457	-76.471264	10	Caretta caretta	1
1-Jun-09	12:48	On	34.228561	-76.544918	10	Dermochelys coriacea	1
1-Jun-09	14:56	On	33.882602	-76.887040	4	Manta birostris	1
1-Jun-09	15:33	On	33.817667	-76.942687	3	Osteichthyes	1
1-Jun-09	15:47	On	33.767246	-76.990013	2	Stenella frontalis	13
1-Jun-09	16:42	On	33.437666	-76.695101	1	Tursiops truncatus	35
1-Jun-09	17:15	On	33.665030	-76.986169	1	Unidentified Delphinid	11
2-Jun-09	9:43	On	33.824363	-76.702676	5	Tursiops truncatus	8
2-Jun-09	10:26	On	33.685348	-76.629302	4	Chondrichthyes	1
2-Jun-09	10:55	On	33.902160	-77.050108	3	Caretta caretta	1
2-Jun-09	11:03	On	33.790918	-77.046095	2	Stenella frontalis	5
2-Jun-09	11:36	On	33.473489	-76.633977	2	Tursiops truncatus	25
2-Jun-09	14:24	On	33.844391	-76.188814	9	Unidentified Sea Turtle	1
2-Jun-09	14:32	On	34.030103	-76.429515	9	Unidentified Sea Turtle	1
2-Jun-09	14:55	On	33.920512	-76.407837	8	Manta birostris	1

Table 4. Example of June effort data submitted to Duke University Marine Lab

Date	Line	Sea State	Kilometers flown
1-Jun-09	5	1 to 2	74.4
1-Jun-09	6	1 to 2	73.1
1-Jun-09	7	1 to 2	73.8
1-Jun-09	8	1 to 2	72.5
1-Jun-09	9	1 to 2	72.5
1-Jun-09	10	2	70.3
1-Jun-09	4	1 to 2	74.7
1-Jun-09	3	1 to 2	75.0
1-Jun-09	2	1 to 2	72.0
1-Jun-09	1	1 to 2	68.8
2-Jun-09	6	1 to 2	74.6
2-Jun-09	5	1 to 2	70.8
2-Jun-09	4	1	74.7
2-Jun-09	3	1	74.7
2-Jun-09	2	1	70.1
2-Jun-09	1	1	74.1
2-Jun-09	10	1 to 3	75.1
2-Jun-09	9	1 to 3	73.2
2-Jun-09	8	1 to 3	76.3
2-Jun-09	7	1 to 3	78.3

Data storage

All data obtained during a flight (GPS coordinates and digital pictures) and transcribed notes (*e.g.* observations and sightings) are stored electronically in three separate places: on a networked computer hard drive (which is backed up twice a week), an external hard drive, and on separate CDRs or DVDs. Additionally, the original data sheets used in the plane [*i.e.* daily plane log (Appendix F), observer notes and sightings sheets] are stored in binders, as are electronically entered versions of the same and printed forms of all electronic files. All data are stored at UNCW. In addition, all survey data, once edited, are regularly posted online to OBIS SEAMAP (http://seamap.env.duke.edu/).

Results

Two full sets of survey track lines were flown for all months from July 2008 to June 2009 except for December 2008, February 2009 and April 2009 (10 track-lines or one full set each month), November 2008 (16 track-lines), and September 2009 (no surveys flown) for a total of 14,035.6 km (Table 5). Survey conditions ranged from a Beaufort Sea State (BSS) 1 to 4, with the majority of the surveys flown in a BSS 2 or 3 [BSS 1: 1,843.8 km (13.1%), BSS 2: 4,026.4 km (28.7%), BSS 3: 6,211.4 km (44.3 %), BSS 4: 1,953.9 km (13.9%)(Fig. 3a and 3b)]. For each survey month an average BSS value was calculated as a way of comparing conditions across months. This was done by taking the distance flown at each sea state multiplied by the BSS number (i.e. BSS 1 distances would be multiplied by 1) these values were then summed and divided by the total distance flown that month (Figure 3c). Survey effort was terminated at BSS greater than 4. Cetacean sighting rates dropped off dramatically as BSS increased beyond a BSS 2, with 26 sightings made in a BSS 1 (14.10 sightings/1000 km flown), 25 in a BSS 2 (6.21 sightings/1000 km flown), 12 in a BSS 3 (1.93 sightings/1000 km flown) and one sighting in a BSS 4 (0.51 sightings/ 1000 km flown) (Fig. 4a - c).

Table 5. Track lines and km flown during aerial surveys of the proposed USWTR site in Onslow Bay, NC, between July 2008 and June 2009. Track line numbers are listed in the order in which they were flown. *Only the inshore half of lines 1 thru 6 were flown due to range closure. A total of 196 tracklines were flown.

Date	Track lines flown AM	Track lines flown PM	Total km flwon per day
16-Jul-2008	10 to 5	1 to 4	703.6
17-Jul-2008	10 to 5	1, 4, 3, 2	664.0
1-Aug-2008	none	10 to 7	297.1
2-Aug-2008	6 to 1	none	436.8
3-Aug-2008	4 to 3	none	149.2
4-Aug-2008	1 to 2, 5 to 10	none	595.0
15-Oct-2008	6 to 1	7 to 10	736.0
16-Oct-2008	10 to 5	4 to 1	742.9
23-Nov-2008	10 to 7	1 to 6*	495.3
24-Nov-2008	1 to 6	none	440.6
30-Dec-2008	10 to 7	6 to 1	679.0
22-Jan-2009	1 to 6	7 to 10	744.9
7-Feb-2009	5 to 10	4 to 1	729.4
17-Feb-2009	5 to 8	4 to 1, 9-10	741.0
4-Mar-2009	5 to 10	4 to 1	735.0
5-Mar-2009	10 to 5	4 to 1	737.5
24-Apr-2009	10 to 5	none	442.8
25-Apr-2009	none	4 to 1	299.8
12-May-2009	6 to 1	none	443.9
28-May-2009	1 to 4	5 to 8	575.8
30-May-2009	none	10 to 5	442.8
31-May-2009	10 to 7 and 4 & 3	1 to 2 and 9 to 10	733.9
1-Jun-2009	5 to 10	4 to 1	727.1
2-Jun-2009	6 to 1	7 to 10	741.8
			14035.6

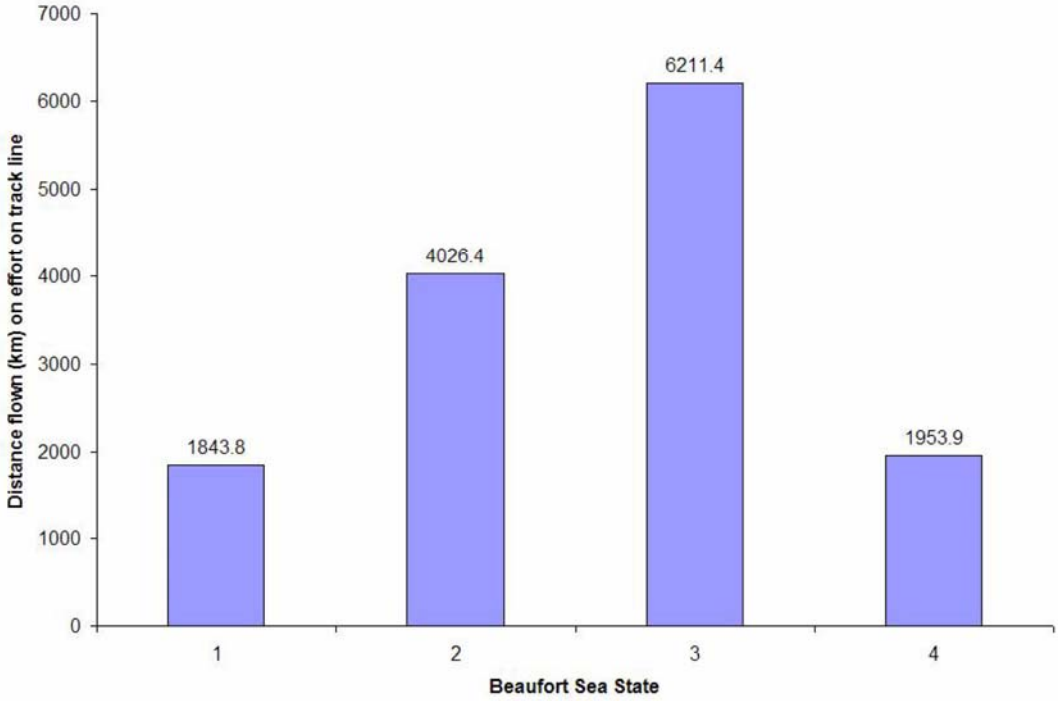

Figure 3a. **Total distance surveyed per Beaufort Sea State during the July 2008 – June 2009 UNCW USWTR aerial surveys in Onslow Bay, North Carolina.**

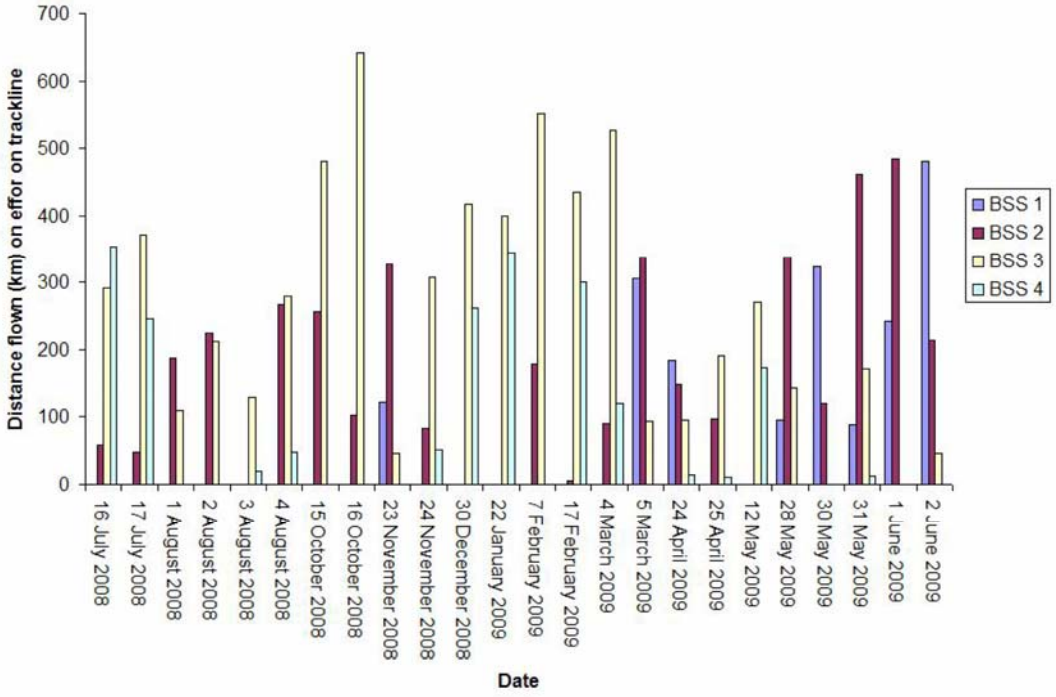

Figure 3b. **Effort by Beaufort Sea State for each survey day during the July 2008 – June 2009 UNCW USWTR aerial surveys in Onslow Bay, North Carolina.**

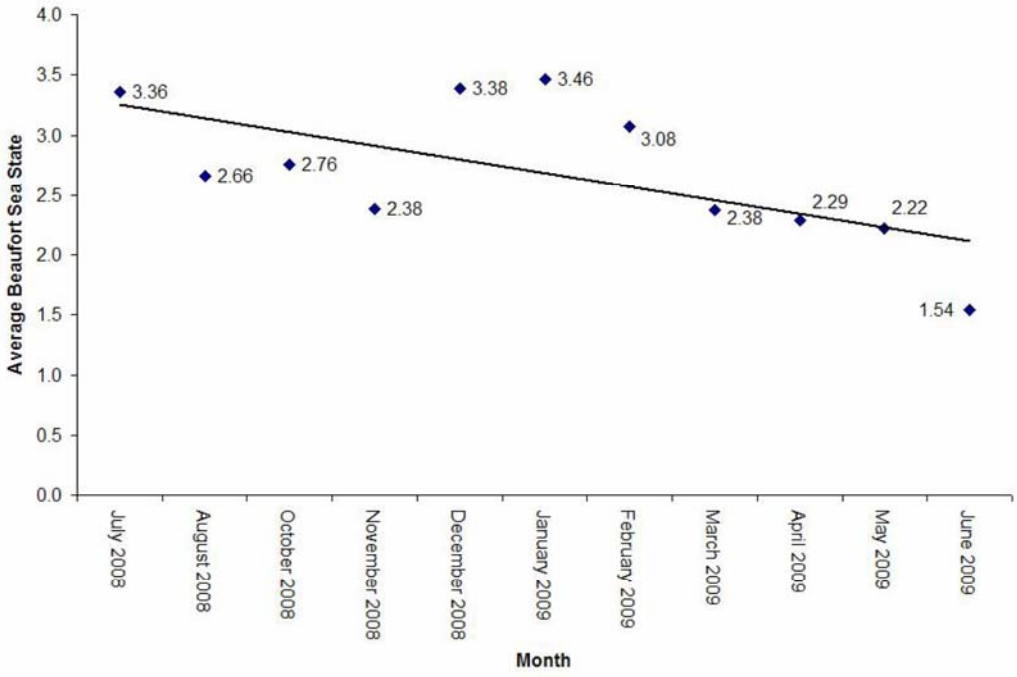

Figure 3c. **Average Beaufort Sea State for each month during the July 2008 – June 2009 UNCW USWTR aerial surveys in Onslow Bay, North Carolina. Values were calculated using the formula AvgBSS = [(Distance @ BSS 1 * 1)+(Distance @ BSS 2 * 2)+…/Total distance flown that day]**

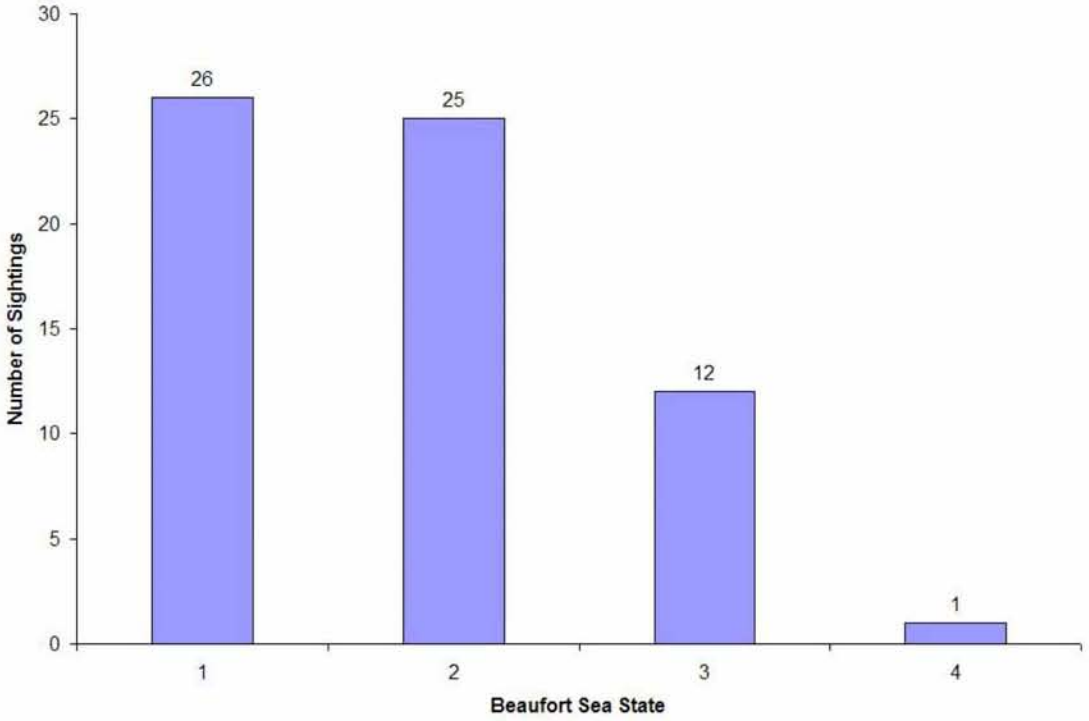

Figure 4a. **Total number of cetacean sightings per Beaufort Sea State during the July 2008 – June 209 aerial surveys in Onslow Bay, North Carolina.**

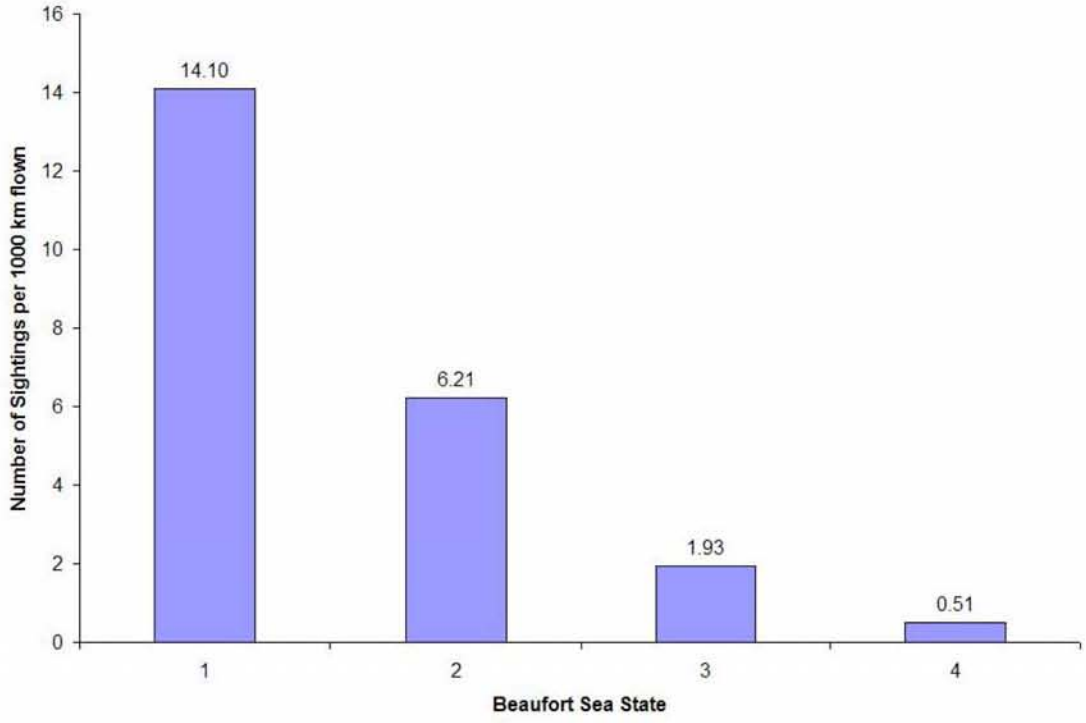

Figure 4b. **Cetacean sightings per 1000 km flown by Beaufort Sea State from July 2008 – June 2009 in the proposed USWTR site in Onslow Bay, North Carolina.**

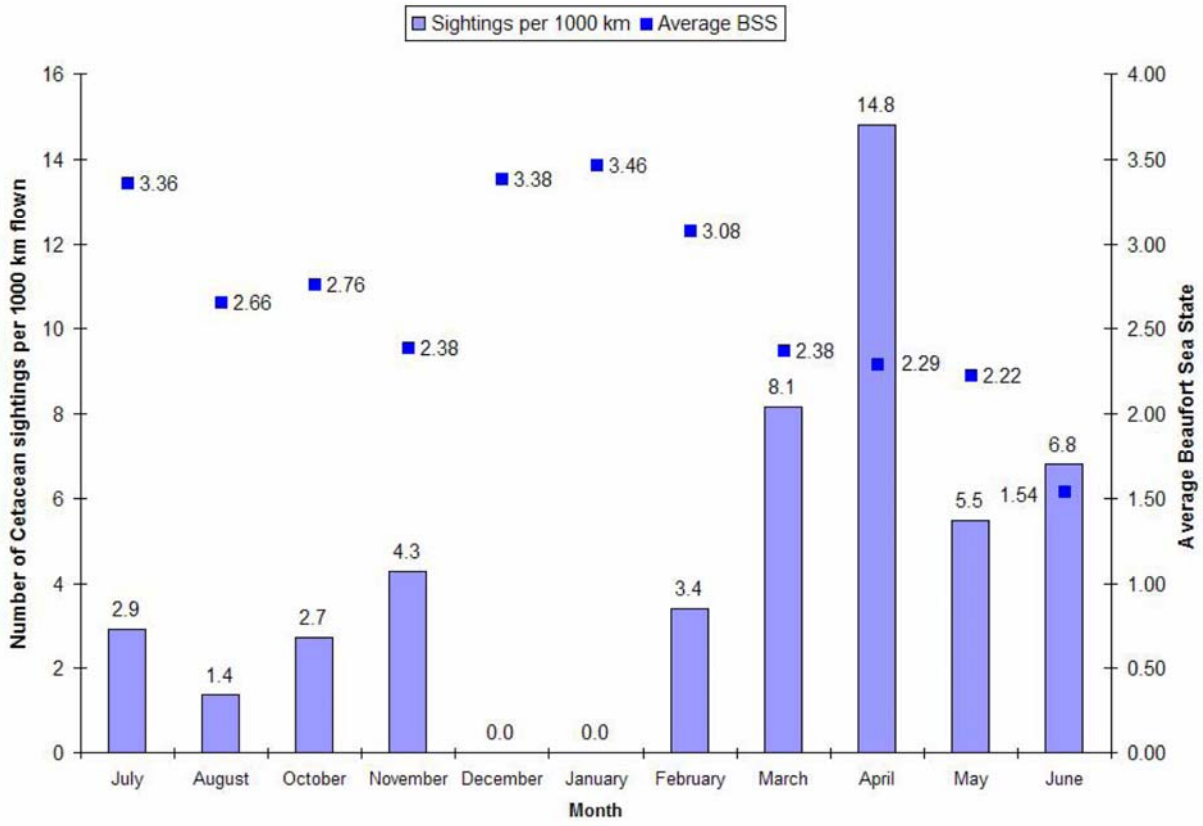

Figure 4c. **Cetacean sightings per 1000 km surveyed and the average Beaufort Sea State per month from July 2008 – June 2009 in the proposed USWTR site in Onslow Bay, North Carolina.**

The mean sighting distance for all cetacean sightings was 0.8 km (SD=0.4) and most sightings were made within 1.2 km of the plane (Fig.5a). The mean sighting distance tended to decrease as BSS increased (Fig. 5b). Average sighting distances were calculated after removing outliers. An outlier was defined as a value in excess of three standard deviations from the mean. Two sighting distances were removed from these calculations as outliers (*i.e.* sighting distances calculated at 2.11, and 2.3 km from the trackline). A single delphinid sighting was removed from our calculations as an actual location of the animal was not taken preventing a sighting distance from being calculated.

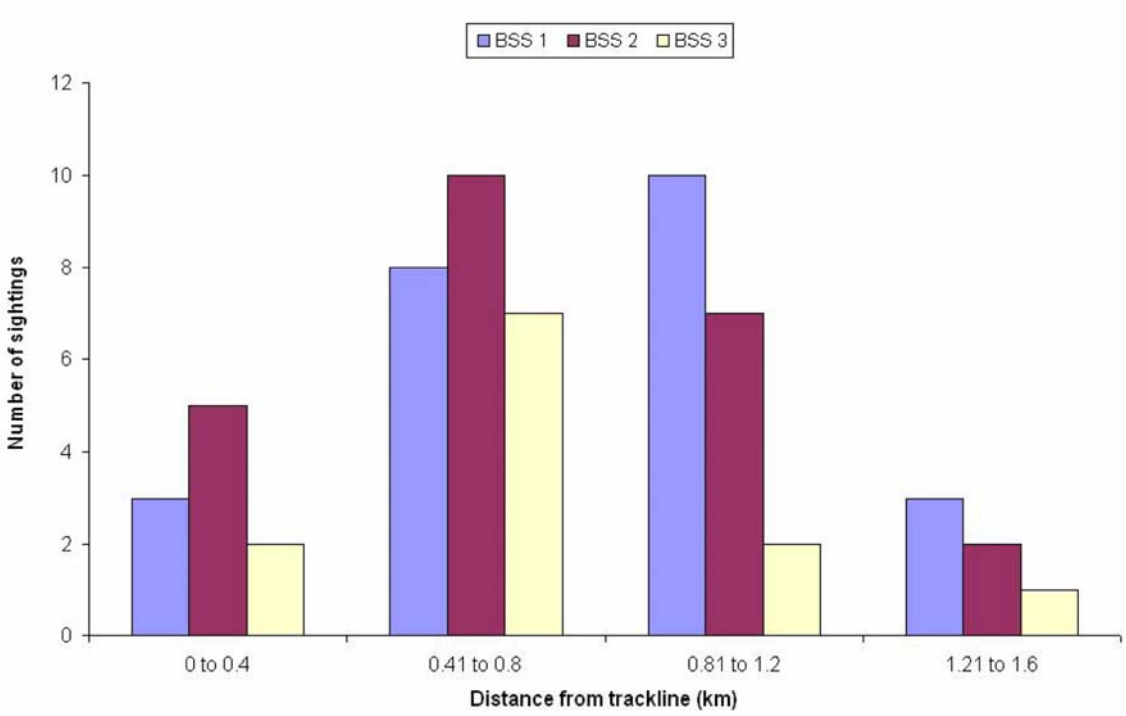

Figure 5a. **Sighting distances by Beaufort Sea State for cetacean sighting from July 2008 – June 2009 in the proposed USWTR site in Onslow Bay, North Carolina. A total of 60 sightings are graphed (2 outliers were removed and 1 delphinid sighting was omitted because an actual position was not taken).**

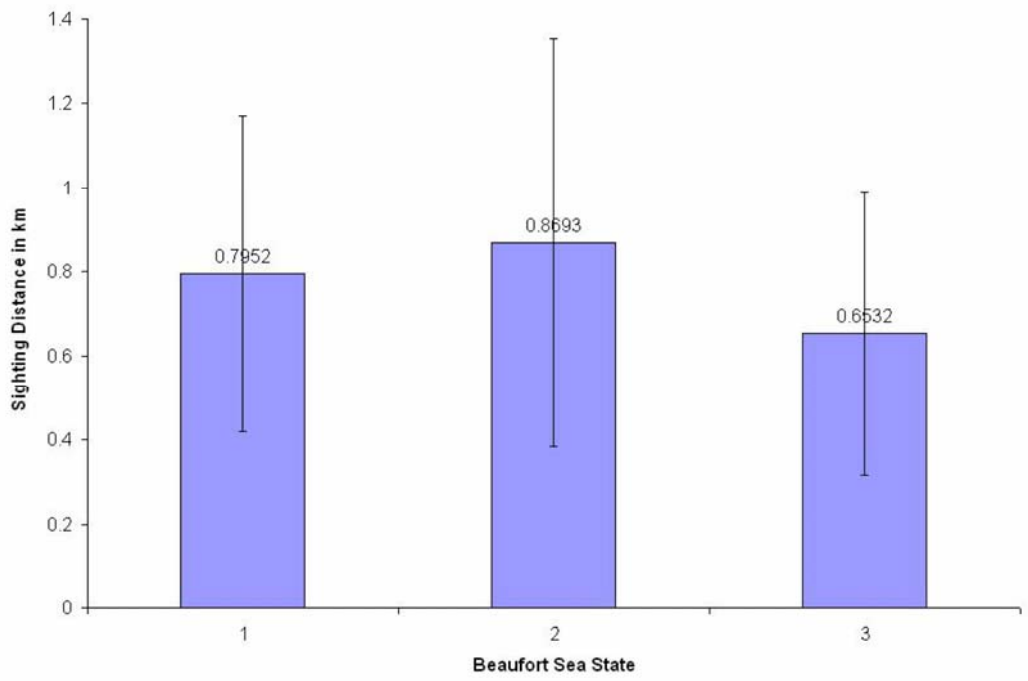

Figure 5b. **Mean sighting distance by Beaufort Sea State for all cetacean sightings from July 2008 – June 2009 in the proposed USWTR site in Onslow Bay, North Carolina. Error bars denote standard deviation for each category.**

Marine Mammal Sightings

No pinnipeds, baleen whales, or any odontocete species listed as endangered under the Endangered Species Act were observed in the Onslow Bay survey site during the surveys. On December 30, 2008 a north Atlantic right whale (*Eubalaena glacialis*) mother calf pair was encountered while returning from the USWTR range approximately 10 nm off the north end of Wrightsville Beach, NC. Photo-documentation was collected and provided to the New England Aquarium. A positive identification was returned for the mother as "Calvin" (Eg #2223) and her new calf. This off effort sighting was the only sighting of "Calvin" in the mid- and southeast Atlantic in the 2008-2009 season.

Species are listed below in order of decreasing number of sightings (*i.e.* most commonly sighted species first). Total number of individuals is based upon the best estimate of group size. Sighting data for the 2007-2008 surveys are also included for comparison purposes (Pabst *et al*. 2008). Summaries for each individual sighting are in Appendix D. All sightings for each month are summarized in Appendix G.

Bottlenose dolphins (*Tursiops truncatus*) (Table 6, Fig. 6)

The bottlenose dolphin was the most commonly observed cetacean species during the present study, based upon number of sightings. This species was observed 36 times for a total of 634 individuals. Group size ranged between 1-60 individuals (mean=17.6). Bottlenose dolphins were seen in July, August, (no survey in September), October, November, February, March, April, May, and June. Calves were seen in November, May and June. Based on the distance from shore (*e.g.* greater than 69 km), these bottlenose dolphins were most likely the offshore ecotype (Torres *et al*. 2003). Overall, smaller groups were encountered inshore, and larger groups were seen at and beyond the continental shelf break. This group size pattern was also observed during last year's surveys. During the 2007/2008 aerial survey of the same area, bottlenose dolphins were encountered 33 times for a total of 461 individuals. During the 1998/1999 aerial survey of the same area, bottlenose dolphins were encountered 17 times for a total of 151 individuals (McLellan *et al*. 1999). The current best estimate of offshore bottlenose dolphins in the Western Atlantic Ocean, between central Florida and Canada, is 81,588 (CV = 0.17) (NOAA Stock Assessment Report; Waring *et al*. 2007).

Date	Time	Way Point	Latitude	Longitude-1	Heading	Track Number	Angle out	Degree Forward	Best #
17-Jul-08	11:02	27	33.764159	-76.349701	NW	7	1	90°	30
17-Jul-08	11:45	41	33.698622	-76.380418	SE	6	3	120°	12
4-Aug-08	12:38	45	34.01133	-76.27702	NW	10	3	90°	9
15-Oct-08	9:41	7	33.616653	-76.415914	NW	5	3	60°	25
15-Oct-08	14:02	40	34.088073	-76.760254	SE	7	2	90°	3
15-Oct-08	14:46	51	33.892292	-76.370334	NW	8	3	70°	19
16-Oct-08	15:11	41	33.432662	-76.562262	SE	2	3	90°	1
23-Nov-08	10:31	24	33.8732	-76.085829	SE	10	2	90°	45
23-Nov-08	10:53	31	33.953335	-76.328943	NW	9	1	90°	13
23-Nov-08	11:32	43	33.846505	-76.310977	SE	8	1	90°	21
7-Feb-09	9:49	13	33.708546	-76.412508	NW	6	2	90°	50
7-Feb-09	11:30	40	33.974045	-76.215818	NW	10	2	90°	30
5-Mar-09	9:22	6	34.113989	-76.410242	SE	10	3	90°	4
5-Mar-09	10:37	33	34.046132	-76.585129	SE	8	3	120°	2
5-Mar-09	11:23	47	33.691181	-76.211484	NW	7	1	90°	5
24-Apr-09	10:11	19	33.969252	-76.195643	SE	10	3	120°	10
24-Apr-09	10:23	27	33.871845	-76.097792	SE	10	1	90°	10
24-Apr-09	10:45	34	33.883920	-76.255597	NW	9	2	90°	15
24-Apr-09	11:23	57	34.129500	-76.679869	SE	8	1	45°	2
24-Apr-09	12:02	75	33.739365	-76.318960	NW	7	2	90°	32
24-Apr-09	12:39	92	34.063458	-76.741129	NW	7	2	90°	9
28-May-09	9:38	10	33.448227	-76.724387	SE	1	3	110°	60
28-May-09	13:40	42	33.627112	-76.416079	SE	5	2	45°	40
28-May-09	14:00	48	33.690512	-76.386340	NW	6	2	45°	35
28-May-09	14:43	58	33.756924	-76.335357	SE	7	3	90°	10
30-May-09	14:29	39	33.711527	-76.255299	NW	7	2	90°	4
30-May-09	15:36	54	33.885123	-76.611188	SE	6	1	50°	3
31-May-09	9:47	23	33.984991	-76.505104	SE	8	3	100°	10
31-May-09	11:08	42	33.694609	-76.657794	SE	4	3	100°	9
31-May-09	11:51	46	33.601105	-76.536491	SE	4	3	100°	15
1-Jun-09	10:05	7	33.821909	-76.687991	SE	5	1	90°	3
1-Jun-09	11:42	35	33.964068	-76.450177	NW	8	3	90°	2
1-Jun-09	12:27	49	33.927627	-76.170854	NW	8	3	90°	28
1-Jun-09	16:42	84	33.437666	-76.695101	NW	1	2	90°	35
2-Jun-09	9:43	9	33.824363	-76.702676	NW	5	3	60°	8
2-Jun-09	11:36	31	33.473489	-76.633977	SE	2	1	90°	25

Table 6. All *Tursiops truncatus* sightings in the proposed USWTR site in Onslow Bay, NC for surveys conducted from July 2008 to June 2009.

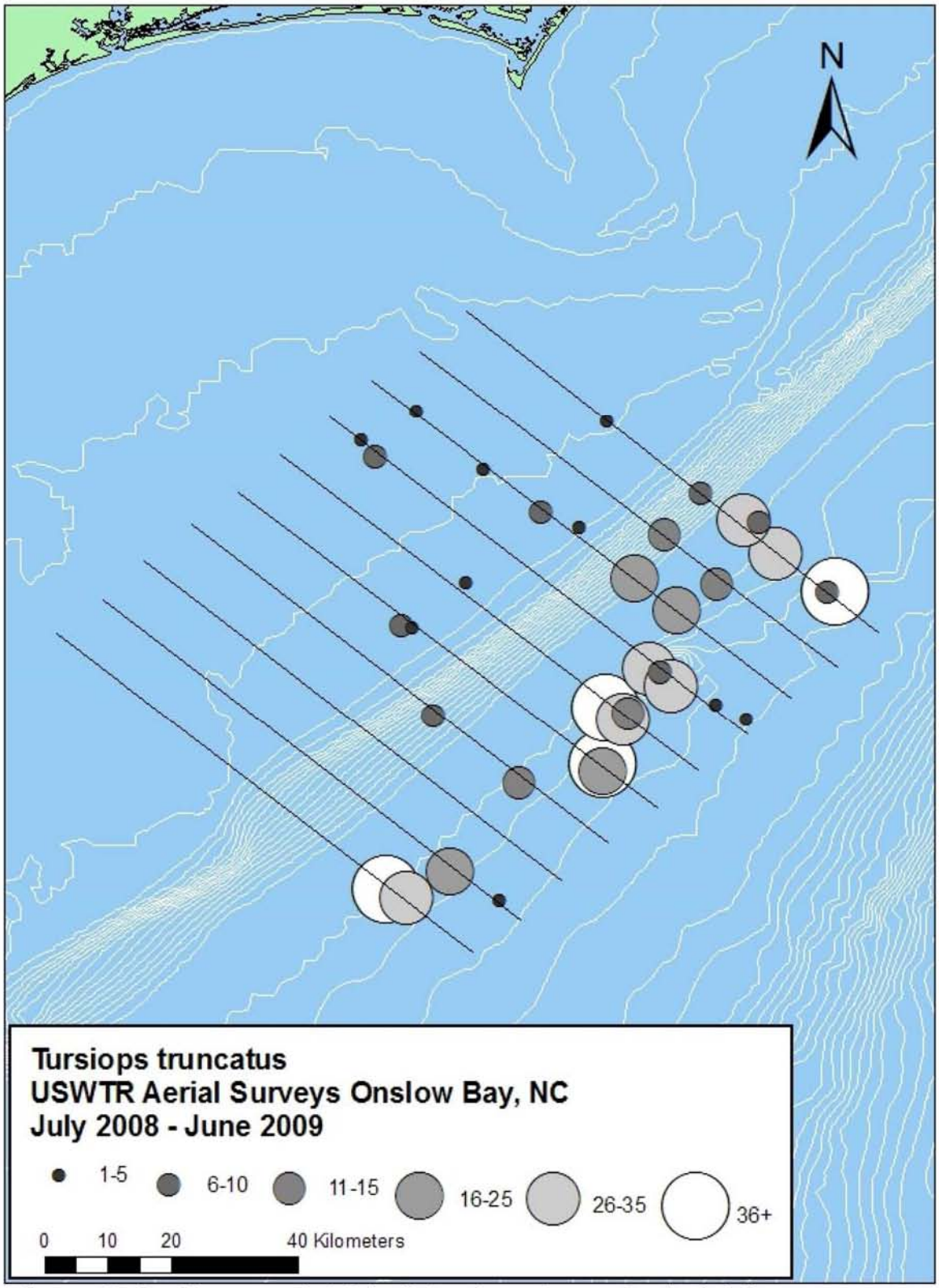

Figure 6. Bottlenose dolphin (*Tursiops truncatus*) sightings indicating group size.

Atlantic spotted dolphins (*Stenella frontalis*) (Table 7, Fig. 7)

The spotted dolphin was the second most commonly encountered species in the survey area, and represented the species for which the most individuals were observed. Groups of spotted dolphins were sighted 22 times for a total of 717 individuals. This species was encountered in August, (no survey was completed in September), November, February, March, April, May, and June. Group size ranged between five and 100 (mean group size = 32.4). Spotted dolphins were exclusively encountered on the shallower, inshore side of the continental shelf break. There are two distinct forms or ecotypes of the Atlantic spotted dolphin in the western north Atlantic: a heavily spotted, larger form that typically occurs on the continental shelf and is most often encountered around the 200 m isobar or in shallower water, and a less spotted and smaller form which occurs further offshore and around islands (Perrin *et al*. 1987, 1994). It is likely, based upon the sighting pattern observed, that the spotted dolphins observed during the present study belong to the continental shelf variety. During the 2007/2008 aerial survey of the same area, spotted dolphins were encountered 11 times for a total of 177 individuals. Spotted dolphins were not recorded during the 1998/1999 aerial surveys of the same area (McLellan *et al*. 1999). The abundance estimate for *S. frontalis* (both inshore and offshore ecotypes) in the western north Atlantic is 50,978 (CV=0.42); the status of the stock(s) is/are unknown (Waring *et al*. 2007).

Date	Time	Way Point	Latitude	Longitude-1	Heading	Track Number	Angle out	Degree Forward	Best #
2-Aug-08	10:56	26	33.789778	-76.893012	NW	3	2	90°	22
23-Nov-08	15:52	90	33.657244	-77.008915	NW	1	3	120°	30
7-Feb-09	14:20	55	33.791982	-76.899026	NW	3	2	90°	40
7-Feb-09	14:49	63	33.642891	-76.833414	SE	2	1	90°	90
17-Feb-09	14:42	38	34.086324	-76.500645	SE	9	2	90°	30
4-Mar-09	14:16	37	33.770836	-76.734183	SE	4	3	110°	15
4-Mar-09	15:10	53	33.672379	-76.886136	SE	2	1	90°	100
5-Mar-09	10:09	20	34.093806	-76.519452	NW	9	3	90°	20
5-Mar-09	10:26	29	34.12227	-76.678416	SE	8	3	90°	25
5-Mar-09	10:44	38	33.992231	-76.520647	SE	8	3	90°	8
5-Mar-09	11:59	67	33.897213	-76.653975	SE	6	1	120°	24
5-Mar-09	12:38	80	33.901567	-76.764022	NW	5	1	120°	35
5-Mar-09	16:29	117	33.699009	-77.030164	NW	1	3	90°	30
24-Apr-09	9:48	10	34.151427	-76.468262	SE	10	3	90°	55
24-Apr-09	10:58	40	34.012365	-76.406003	NW	9	2	45°	80
24-Apr-09	12:32	87	33.996132	-76.648635	NW	7	2	90°	37
24-Apr-09	12:22	83	33.944397	-76.589046	NW	7	2	120°	10
25-Apr-09	10:12	19	33.813468	-77.070257	NW	2	3	90°	16
28-May-09	11:00	30	33.811291	-76.804148	NW	4	2	110°	25
1-Jun-09	11:05	22	34.053559	-76.718352	SE	7	2	110°	7
1-Jun-09	15:47	77	33.767246	-76.990013	SE	2	3	60°	13
2-Jun-09	11:03	27	33.790918	-77.046095	SE	2	3	110°	5

Table 7. All *Stenella frontalis* sightings in the proposed USWTR site in Onslow Bay, NC for surveys conducted from July 2008 to June 2009.

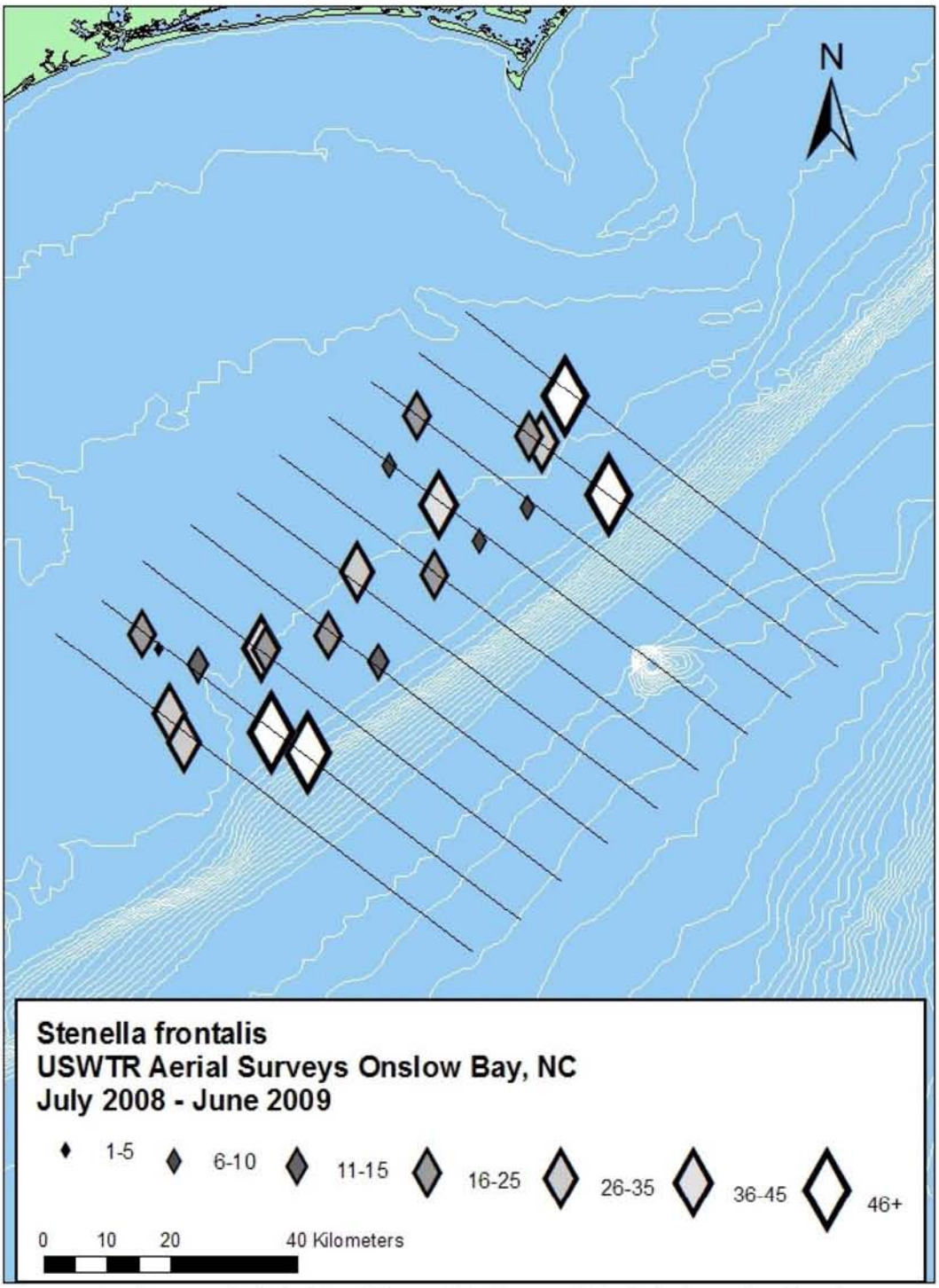

Figure 7. Spotted dolphin (*Stenella frontalis*) sightings indicating group size.

Short-finned pilot whales (*Globicephala macrorhynchus)* (Table 8, Fig. 8)

Short-finned pilot whales were encountered twice, both times in July 2008, for a total of 30 individuals. Both sightings of this species were offshore of the continental shelf break. During the 2007/2008 aerial survey of the same area, short-finned pilot whales were encountered three times for a total of 53 individuals Pilot whales of unidentified species were encountered once during the 1998/1999 aerial surveys, in May 1999 (McLellan *et al*. 1999).

Owing to the difficulty of differentiating short-finned and long-finned pilot whales (*Globicephala melas*) at sea, NMFS reports stock numbers and status as *Globicephala* spp. (Waring *et al*. 2007). The abundance estimate of *Globicephala* spp. (14,411, CV 0.43) is based upon shipboard surveys along the outer continental shelf of the US Atlantic between Florida and Maryland (Waring *et al*. 2007). The status of short-finned pilot whales in the U.S. Atlantic is currently unknown (Waring *et al*. 2007).

Date	Time	Way Point	Latitude	Longitude-1	Heading	Track Number	Angle out	Degree Forward	Best #
17-Jul-08	9:47	10	33.868501	-76.075161	SE	10	3	60°	18
17-Jul-08	11:54	43	33.703817	-76.380409	SE	6	3	90°	12

Table 8. All *Globicephala macrorhynchus* sightings in the proposed USWTR site in Onslow Bay, NC for surveys conducted from July 2008 to June 2009.

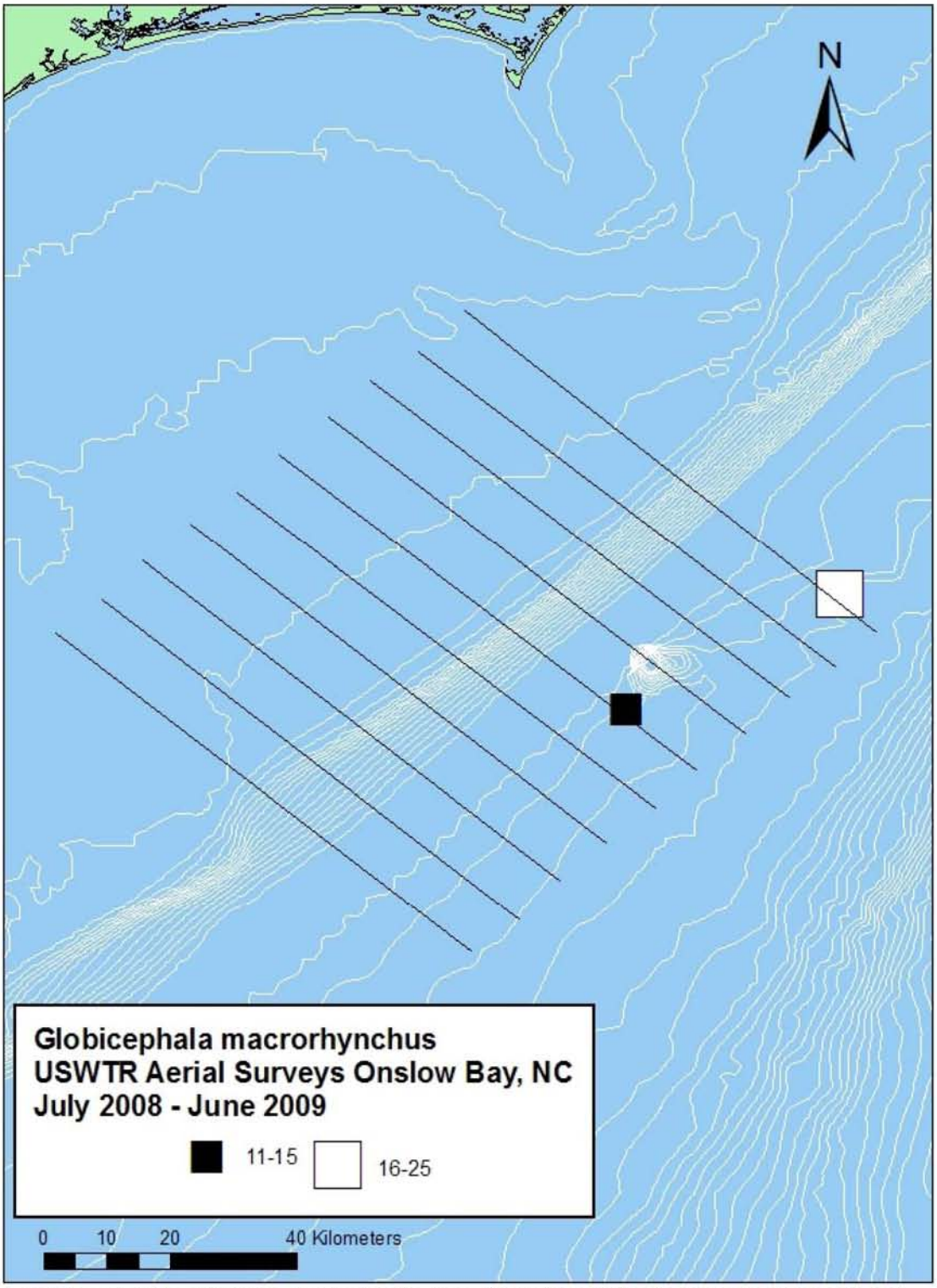

Figure 8. Short-finned pilot whales (*Globicephala macrorhynchus)* sightings indicating group size.

Risso's dolphins *(Grampus griseus)* (Table 9, Fig. 9 adjust)

While there were no "on effort" sightings of this species inside the USWTR, a single sighting was made during the "off effort" transit between the offshore ends of lines 3 and 4 on the 16 July 2008. A total of 20 individuals were observed including two adult animals with calves. This species was encountered three times during the 2007 – 2008 surveys; once in May 2008 and twice in June 2008, for a total of 20 individuals. A single calf (less than half the length of the associated larger animal) was observed during one of the encounters in June 2008. Risso's dolphins were also seen during the 1998 - 1999 aerial surveys in May and July (McLellan *et al*. 1999). All encounters occurred in offshore waters where Risso's dolphins have been found to reside along the mid-Atlantic continental shelf edge year round, with some movement north during spring, summer and fall, and into the mid-Atlantic Bight during winter (Waring *et al*. 2007). The best available estimate for Risso's dolphins based upon results from two US Atlantic surveys conducted in 2004 is 20,479 (CV=0.59) (Waring *et al*. 2007). The status of this species in the western Atlantic is unknown (Waring *et al*. 2007).

Date	Time	Way Point	Latitude	Longitude-1	Heading	Track Number	Angle out	Degree Forward	Best #	Comments
16-Jul-08	15:36	60	33.450539	-76.458058					20	Off effort sighting

Table 9. Risso's dolphin (*Grampus griseus*) sighting in the proposed USWTR site in Onslow Bay, NC for surveys conducted from July 2008 to June 2009.

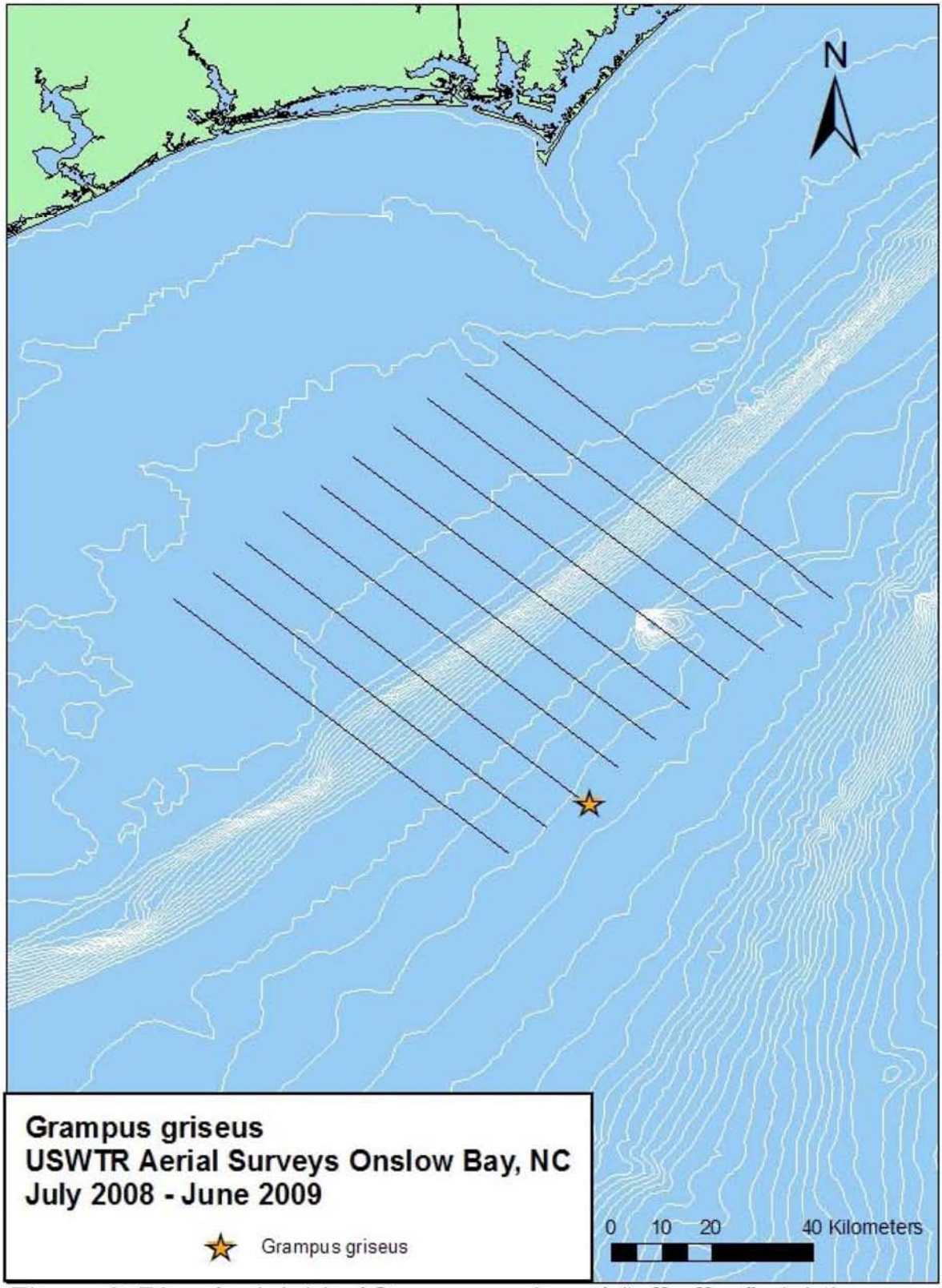

Figure 9. Risso's dolphin (*Grampus griseus*) "off effort" sighting.

Unidentified delphinids (Table 10, Fig. 10)

When no images were obtained or when images obtained during encounters were not of sufficient quality to make an unequivocal species identification, the designation "unidentified delphinids" was used. A total of 41 unidentified delphinids in four sightings were recorded. Group size of unidentified delphinids ranged between one and 26 (mean=10.3). During the 2007/2008 aerial survey 11 sightings for a total of 97 individuals were labeled as unidentified delphinids.

Date	Time	Way Point	Latitude	Longitude-1	Heading	Track Number	Angle out	Degree Forward	Best #
4-Mar-09	10:45	24	33.744182	-76.185632	NW	8	3	90°	3
12-May-09	11:40	35	33.803048	-77.166464	NW	1	3	90°	26
30-May-09	15:10	47	34.075319	-76.745905	NW	7	2	60°	1
1-Jun-09	17:15	88	33.66503	-76.986169	NW	1	1	90°	11

Table 10. All unidentified delphinids sightings in the proposed USWTR site in Onslow Bay, NC for surveys conducted from July 2008 to June 2009.

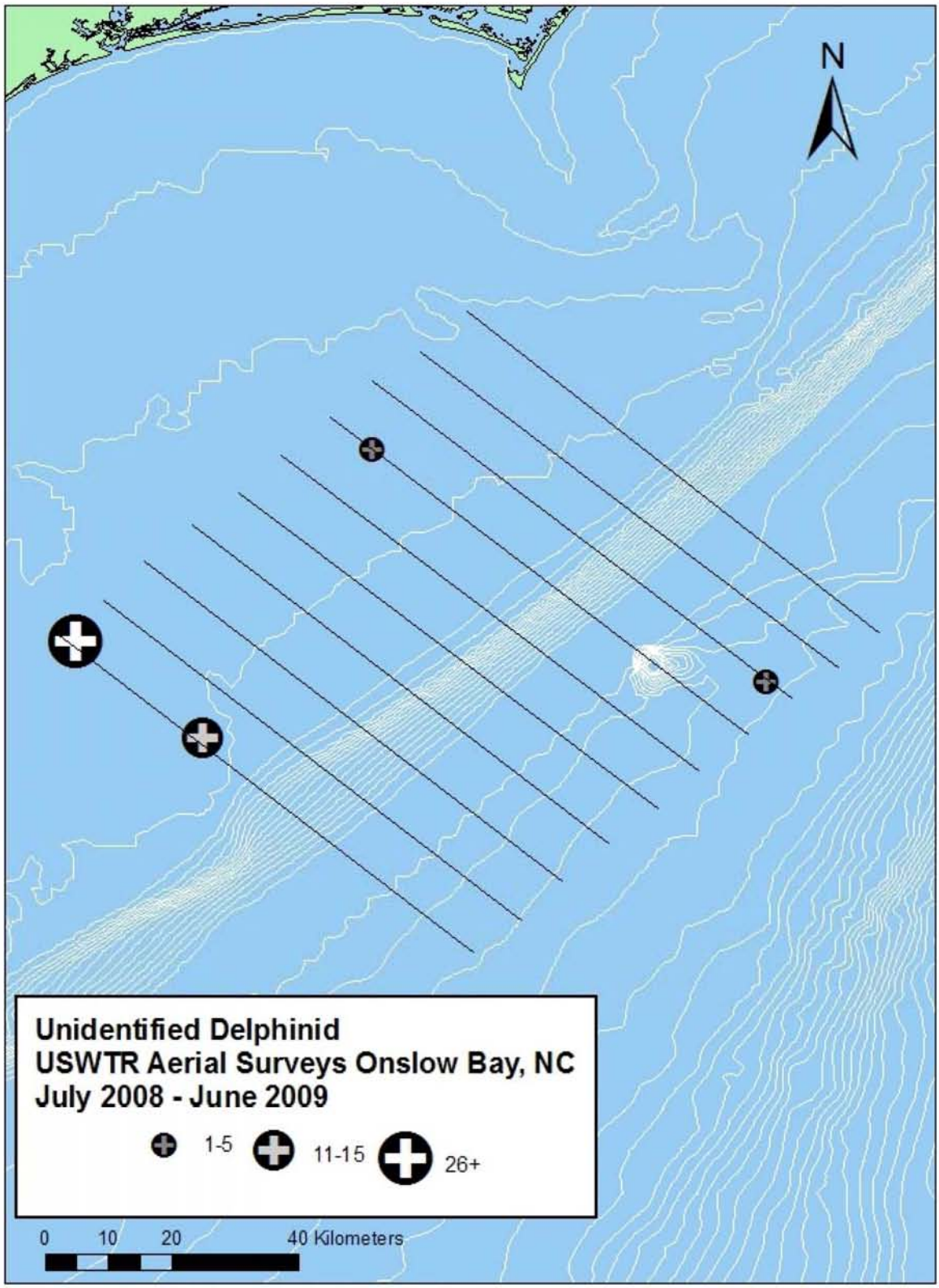

Figure 10. Unidentified delphinid sightings indicating group size.

Sea Turtles (Tables 11 to 13, Figs. 11 and 12a-c)

The most common sea turtle off the North Carolina coast is the loggerhead sea turtle (*Caretta caretta),* a species that nests along the NC coast and is listed as threatened under the US Endangered Species Act (National Marine Fisheries Service and U.S. Fish and Wildlife Service 2008). Other sea turtle species present in the mid-Atlantic are the green (*Chelonia mydas*), leatherback (*Dermochelys coriacea),* hawksbill *(Eretmochelys imbricata),* and Kemps Ridley (*Lepidochelys kempii)* (National Marine Fisheries Service and U.S. Fish and Wildlife Service 1991, 1992a, 1992b, 1993). A total of 266 sea turtles were seen in the survey area between July 2008 and June 2009. Of these, 226 were identified as loggerhead sea turtles and the 39 were recorded as "unidentified sea turtles". There was also a single leatherback sea turtle sighting in June, a species that had not been seen during the 2007/2008 season but had been seen in the 1998/1999 surveys (McLellan *et al*. 1999). Sea turtles were seen during all months surveyed except in July 2008, although abundance fluctuated throughout the year. The lowest densities were observed between July and January (0.0 to 2.7 sea turtles /1000 km) and the highest densities occurred between March and April (72.0 to 82.1 sea turtles /1000 km). The majority of sea turtles were observed shoreward of the continental shelf break. As expected, sea turtle sightings were strongly correlated with Beaufort Sea State.

Date	Time	Way Point	Latitude	Longitude-1	Heading	Track Number	Angle out	Degree Forward	Best #
1-Aug-08	16:04	24	34.038958	-76.695657	NW	7	3	90°	1
2-Aug-08	10:22	21	33.742594	-76.707212	SE	4	3	90°	1
2-Aug-08	11:11	29	33.912247	-77.066962	NW	3	2	90°	1
2-Aug-08	11:57	40	33.644080	-76.964473	NW	1	90	2°	1
15-Oct-08	9:13	4	33.989294	-76.767933	SE	6	2	90°	1
15-Oct-08	14:13	35	34.085084	-76.751627	SE	7	2	90°	1
15-Oct-08	14:18	43	33.984714	-76.621745	SE	7	2	130°	2
15-Oct-08	15:11	45	34.160593	-76.602592	SE	9	2	90°	1
16-Oct-08	10:11	11	34.162878	-76.731009	SE	8	2	90°	1
16-Oct-08	11:00	18	34.121808	-76.804246	NW	7	1	90°	1
16-Oct-08	11:05	19	34.025437	-76.812227	SE	6	2	90°	1
23-Nov-08	10:18	21	34.109247	-76.399888	SE	10	1	90°	1
23-Nov-08	10:20	22	34.083306	-76.367013	SE	10	2	90°	1
23-Nov-08	11:07	25	34.124958	-76.557463	NW	9	1	45°	1
23-Nov-08	12:07	41	34.077442	-76.745548	NW	7	2	90°	1
23-Nov-08	14:26	67	33.874893	-76.618261	SE	6	3	90°	1
23-Nov-08	15:00	74	33.960331	-77.003912	SE	4	1	90°	1
23-Nov-08	15:11	78	33.762723	-76.730951	SE	4	1	90°	2
23-Nov-08	15:29	71	33.894655	-77.040208	NW	3	1	90°	1
24-Nov-08	12:55	6	33.736975	-77.094039	SE	1	1	90°	1
24-Nov-08	14:44	10	33.892272	-77.037385	SE	3	2	3°	1
30-Dec-08	13:48	24	33.646497	-76.975000	SE	1	3	90°	1
30-Dec-08	13:50	25	33.605492	-76.919933	SE	1	3	90°	1
30-Dec-08	13:52	26	33.578012	-76.884516	SE	1	3	60°	1
30-Dec-08	14:17	21	33.665407	-76.870780	NW	2	1	90°	1
30-Dec-08	14:20	22	33.741291	-76.968918	NW	2	1	90°	1
30-Dec-08	15:02	28	33.764728	-76.735140	NW	4	1	90°	1
22-Jan-09	10:26	12	33.663271	-76.868349	NW	2	3	90°	2
7-Feb-09	9:26	6	33.834228	-76.699331	SE	5	3	90°	1
7-Feb-09	10:00	11	33.875123	-76.613947	NW	6	3	90°	1
7-Feb-09	10:03	12	33.942368	-76.705816	NW	6	4	90°	1
7-Feb-09	10:56	25	34.136500	-76.699785	NW	8	2	45°	1
7-Feb-09	11:18	34	33.794991	-76.122221	SE	9	2	45°	2
7-Feb-09	14:11	48	33.703733	-76.783065	NW	3	1	90°	1
7-Feb-09	14:12	49	33.716371	-76.798749	NW	3	3	90°	3
7-Feb-09	14:46	60	33.658782	-76.864830	SE	2	2	90°	1
7-Feb-09	15:23	60	33.608542	-76.923389	NW	1	3	90°	1
17-Feb-09	10:11	6	33.957656	-76.728973	NW	6	2	90°	1
17-Feb-09	12:51	20	33.900806	-76.911384	SE	4	2	90°	1
17-Feb-09	12:52	21	33.872492	-76.873191	SE	4	3	90°	1
17-Feb-09	13:42	27	33.690862	-76.897643	SE	2	2	90°	1
17-Feb-09	13:42	28	33.678229	-76.881284	SE	2	1	90°	1
17-Feb-09	14:09	25	33.641704	-76.970975	NW	1	2	90°	1
17-Feb-09	14:13	28	33.716001	-77.067279	NW	1	1	90°	1

Table 11. All *Caretta caretta* sightings in the proposed USWTR site in Onslow Bay, NC for surveys conducted from July 2008 to June 2009.

Date	Time	Way Point	Latitude	Longitude-1	Heading	Track Number	Angle out	Degree Forward	Best #
17-Feb-09	14:16	29	33.781273	-77.153022	NW	1	2	90°	1
17-Feb-09	14:17	33	33.786206	-77.159444	NW	1	2	90°	1
17-Feb-09	14:17	30	33.790234	-77.164722	NW	1	1	90°	1
17-Feb-09	15:22	37	34.186796	-76.501455	NW	10	2	90°	1
17-Feb-09	15:25	39	34.251821	-76.585047	NW	10	1	90°	1
4-Mar-09	10:09	11	33.924501	-76.682734	NW	6	2	90°	1
4-Mar-09	10:10	13	33.944289	-76.716012	NW	6	2	90°	1
4-Mar-09	10:10	14	33.952782	-76.733972	NW	6	2	90°	1
4-Mar-09	10:12	15	33.991931	-76.777413	NW	6	3	90°	1
4-Mar-09	10:26	19	33.974316	-76.606282	SE	7	3	90°	1
4-Mar-09	11:10	26	34.063691	-76.583742	NW	8	1	90°	1
4-Mar-09	11:15	27	34.165980	-76.733542	NW	8	2	90°	1
4-Mar-09	11:59	32	34.168174	-76.478305	NW	10	2	90°	1
4-Mar-09	11:59	33	34.180342	-76.493296	NW	10	3	90°	1
4-Mar-09	12:01	34	34.214459	-76.533296	NW	10	2	90°	1
4-Mar-09	14:48	48	33.716516	-76.800780	NW	3	3	90°	1
4-Mar-09	14:51	49	33.764887	-76.868203	NW	3	2	90°	1
4-Mar-09	14:54	51	33.841811	-76.965607	NW	3	3	90°	1
4-Mar-09	14:57	52	33.905291	-77.047214	NW	3	2	90°	1
4-Mar-09	15:04	47	33.786456	-77.041215	SE	2	2	90°	1
4-Mar-09	15:04	48	33.776813	-77.029883	SE	2	1	90°	1
4-Mar-09	15:05	49	33.764465	-77.012921	SE	2	2	90°	1
4-Mar-09	15:05	50	33.754695	-77.000041	SE	2	1	90°	1
4-Mar-09	15:09	51	33.690695	-76.906642	SE	2	2	90°	1
4-Mar-09	15:09	56	33.676729	-76.892476	SE	2	3	90°	1
4-Mar-09	15:45	64	33.481767	-76.759075	NW	1	3	90°	1
4-Mar-09	15:52	66	33.631594	-76.948973	NW	1	2	90°	2
4-Mar-09	15:53	67	33.648365	-76.974684	NW	1	3	90°	2
4-Mar-09	15:58	68	33.750784	-77.112554	NW	1	2	90°	2
4-Mar-09	15:59	69	33.785348	-77.159437	NW	1	1	90°	1
5-Mar-09	9:12	3	34.259277	-76.592480	SE	10	2	90°	1
5-Mar-09	9:13	5	34.231549	-76.555056	SE	10	2	90°	1
5-Mar-09	9:14	3	34.221049	-76.546716	SE	10	2	90°	1
5-Mar-09	9:15	4	34.194414	-76.522752	SE	10	2	90°	1
5-Mar-09	9:16	6	34.173124	-76.496880	SE	10	3	90°	1
5-Mar-09	9:17	7	34.152501	-76.467137	SE	10	1	90°	1
5-Mar-09	9:17	8	34.145857	-76.456643	SE	10	3	90°	1
5-Mar-09	9:19	9	34.114517	-76.411413	SE	10	3	90°	1
5-Mar-09	9:37	10	34.034687	-76.305650	SE	10	2	90°	1
5-Mar-09	9:39	12	33.991634	-76.248305	SE	10	3	90°	1
5-Mar-09	9:40	11	33.970383	-76.220800	SE	10	2	90°	1
5-Mar-09	10:15	24	34.115475	-76.541033	NW	9	1	90°	1
5-Mar-09	10:17	27	34.171097	-76.614878	NW	9	2	90°	1
5-Mar-09	10:19	23	34.207816	-76.664001	NW	9	2	90°	1
5-Mar-09	10:19	28	34.203019	-76.656623	NW	9	2	90°	1

Table 11 (Continued) All *Caretta caretta* sightings in the proposed USWTR site in Onslow Bay, NC for surveys conducted from July 2008 to June 2009.

Date	Time	Way Point	Latitude	Longitude-1	Heading	Track Number	Angle out	Degree Forward	Best #
5-Mar-09	10:23	31	34.150762	-76.719255	SE	8	3	90°	1
5-Mar-09	10:24	27	34.136761	-76.701541	SE	8	3	90°	2
5-Mar-09	10:42	36	34.004863	-76.527474	SE	8	2	90°	1
5-Mar-09	11:28	49	33.767885	-76.338348	NW	7	2	90°	1
5-Mar-09	11:33	52	33.888321	-76.490732	NW	7	2	90°	1
5-Mar-09	11:33	51	33.877784	-76.476576	NW	7	2	90°	1
5-Mar-09	11:33	52	33.892178	-76.495989	NW	7	1	90°	1
5-Mar-09	11:34	53	33.908190	-76.518077	NW	7	1	90°	1
5-Mar-09	11:35	53	33.923970	-76.541529	NW	7	2	60°	1
5-Mar-09	11:38	56	34.003011	-76.647040	NW	7	3	90°	1
5-Mar-09	11:39	54	34.017019	-76.666985	NW	7	3	90°	4
5-Mar-09	11:40	55	34.055768	-76.719444	NW	7	3	90°	1
5-Mar-09	11:47	59	34.052994	-76.858910	SE	6	3	90°	1
5-Mar-09	11:48	60	34.025048	-76.825502	SE	6	2	60°	1
5-Mar-09	11:49	61	34.001331	-76.787330	SE	6	3	90°	1
5-Mar-09	11:56	62	33.948273	-76.717760	SE	6	3	90°	1
5-Mar-09	11:58	65	33.905880	-76.658259	SE	6	2	90°	1
5-Mar-09	12:07	70	33.873560	-76.613959	SE	6	3	90°	1
5-Mar-09	12:34	78	33.805124	-76.658793	NW	5	3	90°	1
5-Mar-09	12:34	68	33.805564	-76.659556	NW	5	2	90°	1
5-Mar-09	12:36	69	33.854204	-76.717060	NW	5	1	90°	1
5-Mar-09	12:57	72	33.946938	-76.844484	NW	5	1	90°	1
5-Mar-09	12:58	73	33.972982	-76.875953	NW	5	2	90°	3
5-Mar-09	15:11	89	33.947366	-76.977663	SE	4	3	90°	1
5-Mar-09	15:12	90	33.914648	-76.932768	SE	4	1	90°	1
5-Mar-09	15:13	91	33.896828	-76.908673	SE	4	2	90°	1
5-Mar-09	15:15	92	33.849773	-76.855795	SE	4	1	90°	1
5-Mar-09	15:17	79	33.806393	-76.782012	SE	4	1	90°	1
5-Mar-09	15:18	93	33.789312	-76.757007	SE	4	3	90°	1
5-Mar-09	15:18	80	33.767430	-76.727868	SE	4	1	90°	1
5-Mar-09	15:42	85	33.713291	-76.802299	NW	3	1	90°	1
5-Mar-09	15:42	86	33.726540	-76.819227	NW	3	2	90°	1
5-Mar-09	15:43	87	33.738502	-76.834584	NW	3	1	90°	1
5-Mar-09	15:43	88	33.744750	-76.842955	NW	3	2	90°	1
5-Mar-09	15:44	89	33.778469	-76.898590	NW	3	1	90°	1
5-Mar-09	15:49	90	33.898740	-77.040711	NW	3	3	90°	1
5-Mar-09	15:54	104	33.829787	-77.082470	SE	2	2	90°	1
5-Mar-09	15:55	105	33.805706	-77.050264	SE	2	1	90°	1
5-Mar-09	15:57	106	33.761994	-76.993303	SE	2	2	90°	1
5-Mar-09	15:59	93	33.723830	-76.946609	SE	2	1	90°	1
5-Mar-09	16:00	108	33.678277	-76.886988	SE	2	3	90°	3
5-Mar-09	16:01	109	33.665950	-76.869617	SE	2	2	90°	1
5-Mar-09	16:01	94	33.668537	-76.873243	SE	2	1	90°	2
5-Mar-09	16:02	95	33.651745	-76.851343	SE	2	2	90°	1
5-Mar-09	16:26	102	33.641484	-76.967851	NW	1	2	90°	1

Table 11 (Continued). All *Caretta caretta* sightings in the proposed USWTR site in Onslow Bay, NC for surveys conducted from July 2008 to June 2009.

Date	Time	Way Point	Latitude	Longitude-1	Heading	Track Number	Angle out	Degree Forward	Best #
5-Mar-09	16:26	103	33.654194	-76.984757	NW	1	3	90°	1
5-Mar-09	16:33	106	33.748297	-77.106274	NW	1	1	90°	1
24-Apr-09	9:33	3	34.267071	-76.602777	SE	10	2	90°	1
24-Apr-09	9:35	5	34.221797	-76.532724	SE	10	3	90°	1
24-Apr-09	10:02	14	34.118761	-76.402646	SE	10	1	90°	2
24-Apr-09	10:04	15	34.094298	-76.375619	SE	10	1	90°	1
24-Apr-09	10:05	16	34.070895	-76.341670	SE	10	1	90°	1
24-Apr-09	10:31	30	33.854811	-76.077586	SE	10	1	40°	1
24-Apr-09	10:57	38	34.012194	-76.407013	NW	9	2	90°	1
24-Apr-09	11:08	43	34.058745	-76.470241	NW	9	3	90°	1
24-Apr-09	11:08	28	34.049851	-76.457049	NW	9	2	45°	1
24-Apr-09	11:08	29	34.062886	-76.476010	NW	9	1	60°	1
24-Apr-09	11:08	44	34.067309	-76.481896	NW	9	2	90°	2
24-Apr-09	11:11	30	34.117200	-76.540516	NW	9	2	90°	1
24-Apr-09	11:11	45	34.124932	-76.550406	NW	9	2	90°	2
24-Apr-09	11:11	46	34.128446	-76.555005	NW	9	3	90°	2
24-Apr-09	11:12	47	34.141468	-76.572734	NW	9	3	90°	1
24-Apr-09	11:13	48	34.170821	-76.617597	NW	9	2	90°	1
24-Apr-09	11:13	32	34.157560	-76.596036	NW	9	3	90°	1
24-Apr-09	11:13	33	34.171268	-76.618321	NW	9	3	90°	1
24-Apr-09	11:14	34	34.187332	-76.643437	NW	9	3	60°	1
24-Apr-09	11:19	53	34.164618	-76.733617	SE	8	1	90°	1
24-Apr-09	11:19	54	34.159609	-76.725310	SE	8	2	90°	1
24-Apr-09	11:19	37	34.162582	-76.730074	SE	8	3	60°	2
24-Apr-09	11:20	55	34.141372	-76.700966	SE	8	1	90°	1
24-Apr-09	11:37	63	34.030129	-76.556001	SE	8	2	90°	1
24-Apr-09	11:37	64	34.029088	-76.554367	SE	8	1	90°	1
24-Apr-09	11:37	40	34.021506	-76.542386	SE	8	3	90°	1
24-Apr-09	11:38	41	33.999129	-76.512543	SE	8	2	60°	1
24-Apr-09	12:20	80	33.925264	-76.550127	NW	7	3	90°	1
24-Apr-09	12:46	61	34.103790	-76.783318	SE	7	2	60°	1
24-Apr-09	14:52	100	34.057227	-76.860930	SE	6	3	90°	1
24-Apr-09	14:52	101	34.039952	-76.838541	SE	6	1	90°	1
24-Apr-09	14:52	66	34.040780	-76.839376	SE	6	2	30°	1
24-Apr-09	14:53	102	34.018162	-76.809557	SE	6	2	45°	1
24-Apr-09	14:55	67	33.988536	-76.768749	SE	6	2	60°	1
24-Apr-09	14:56	103	33.975468	-76.751264	SE	6	2	90°	1
24-Apr-09	14:56	68	33.973914	-76.748907	SE	6	1	60°	1
24-Apr-09	14:57	104	33.940844	-76.704275	SE	6	3	120°	1
24-Apr-09	14:58	105	33.918651	-76.675768	SE	6	3	90°	1
24-Apr-09	14:58	70	33.914387	-76.670629	SE	6	3	60°	2
24-Apr-09	14:59	106	33.910982	-76.666686	SE	6	3	90°	1
24-Apr-09	14:59	107	33.901816	-76.655485	SE	6	3	90°	1
24-Apr-09	15:33	78	33.955538	-76.848630	NW	5	3	90°	2
24-Apr-09	15:35	117	34.003770	-76.913145	NW	5	3	90°	1

Table 11 (Continued). All *Caretta caretta* sightings in the proposed USWTR site in Onslow Bay, NC for surveys conducted from July 2008 to June 2009.

Date	Time	Way Point	Latitude	Longitude-1	Heading	Track Number	Angle out	Degree Forward	Best #
25-Apr-09	10:30	27	33.758465	-77.116488	NW	1	2	90°	1
12-May-09	9:52	13	33.940350	-76.966487	SE	4	2	90°	1
30-May-09	13:32	9	33.824461	-76.152444	NW	9	2	90°	1
30-May-09	13:45	13	34.082491	-76.493980	NW	9	3	90°	1
30-May-09	13:49	17	34.170325	-76.608701	NW	9	3	45°	1
30-May-09	14:00	23	34.020507	-76.537506	SE	8	1	45°	1
30-May-09	14:56	33	33.961199	-76.585128	NW	7	2	60°	1
30-May-09	15:01	35	34.069648	-76.735551	NW	7	2	60°	1
30-May-09	15:27	52	33.983569	-76.758342	SE	6	2	60°	1
30-May-09	15:47	58	33.766050	-76.476238	SE	6	2	60°	1
30-May-09	16:04	62	33.707423	-76.532603	NW	5	2	45°	1
30-May-09	16:08	47	33.796473	-76.643934	NW	5	3	60°	1
30-May-09	16:11	63	33.867255	-76.736276	NW	5	2	90°	1
31-May-09	9:30	16	34.101090	-76.524424	NW	9	2	45°	1
31-May-09	9:32	17	34.147939	-76.593653	NW	9	1	60°	1
31-May-09	12:10	53	33.776648	-76.880422	NW	3	3	90°	1
1-Jun-09	10:36	13	33.773081	-76.476520	NW	6	1	90°	1
1-Jun-09	11:52	39	34.086870	-76.629366	NW	8	2	140°	1
1-Jun-09	12:42	46	34.118759	-76.411411	NW	10	2	60°	1
1-Jun-09	12:44	47	34.171457	-76.471264	NW	10	2	135°	1
2-Jun-09	10:55	22	33.902160	-77.050108	NW	3	1	90°	1

Table 11 (Continued). All *Caretta caretta* sightings in the proposed USWTR site in Onslow Bay, NC for surveys conducted from July 2008 to June 2009.

Date	Time	Way Point	Latitude	Longitude-1	Heading	Track Number	Angle out	Degree Forward	Best #
1-Jun-09	12:48	49	34.228561	-76.544918	NW	10	3	120°	1

Table 12. All *Dermochelys coriacea* sightings in the proposed USWTR site in Onslow Bay, NC for surveys conducted from July 2008 to June 2009.

Date	Time	Way Point	Latitude	Longitude-1	Heading	Track Number	Angle out	Degree Forward	Best #
1-Aug-08	15:15	15	34.213689	-76.672559	NW	9	3	60°	1
2-Aug-08	9:57	11	33.803131	-76.658313	NW	5	2	110°	1
4-Aug-08	12:04	36	34.173503	-76.620823	SE	9	3	90°	1
4-Aug-08	13:01	49	34.227853	-76.552963	NW	10	2	90°	1
23-Nov-08	10:11	19	34.249053	-76.580497	SE	10	2	90°	1
23-Nov-08	10:17	20	34.141235	-76.441115	SE	10	1	90°	1
23-Nov-08	11:07	35	34.122138	-76.553819	NW	9	2	90°	1
23-Nov-08	14:18	65	34.027954	-76.820858	SE	6	2	90°	1
23-Nov-08	14:26	68	33.864839	-76.605419	SE	6	2	90°	1
23-Nov-08	15:07	75	33.847092	-76.842064	SE	4	2	90°	1
23-Nov-08	15:42	86	33.682273	-76.891332	SE	2	1	90°	1
23-Nov-08	15:43	87	33.665602	-76.869826	SE	2	2	90°	1
7-Feb-09	10:04	13	33.959397	-76.729074	NW	6	1	90°	1
7-Feb-09	10:17	16	34.022661	-76.674604	SE	7	4	90°	1
7-Feb-09	10:44	25	33.890859	-76.371861	NW	8	3	90°	1
7-Feb-09	11:25	37	33.885607	-76.106496	NW	10	2	45°	1
7-Feb-09	13:37	50	33.936493	-76.956787	SE	4	3	45°	1
5-Mar-09	10:23	26	34.147207	-76.71607	SE	8	2	90°	1
5-Mar-09	11:41	56	34.063284	-76.732753	NW	7	2	90°	2
5-Mar-09	11:55	64	33.958232	-76.732161	SE	6	2	60°	1
5-Mar-09	12:07	65	33.877663	-76.618751	SE	6	3	90°	1
5-Mar-09	16:00	107	33.697654	-76.913258	SE	2	1	90°	1
5-Mar-09	16:34	107	33.78494	-77.155645	NW	1	3	120°	1
24-Apr-09	10:03	14	34.111250	-76.398725	SE	10	3	90°	2
24-Apr-09	11:14	49	34.194347	-76.654788	NW	9	1	90°	1
24-Apr-09	11:39	65	33.991338	-76.503323	SE	8	2	90°	1
24-Apr-09	12:21	81	33.946672	-76.575784	NW	7	2	90°	2
24-Apr-09	12:38	90	34.052584	-76.715796	NW	7	3	90°	1
25-Apr-09	9:20	10	33.954420	-76.983899	NW	4	1	90°	1
25-Apr-09	9:21	11	33.967967	-77.003633	NW	4	2	90°	1
25-Apr-09	10:32	28	33.711090	-77.052273	NW	1	2	90°	1
30-May-09	15:24	40	34.043226	-76.842363	SE	6	3	60°	1
30-May-09	15:31	41	33.887193	-76.63428	SE	6	3	60°	1
1-Jun-09	11:55	33	34.155358	-76.718417	NW	8	2	90°	1
1-Jun-09	12:05	37	34.056448	-76.466167	SE	9	3	120°	1
2-Jun-09	14:24	52	33.844391	-76.188814	NW	9	2	90°	1
2-Jun-09	14:32	55	34.030103	-76.429515	NW	9	1	90°	1

Table 13. All unidentified sea turtle sightings in the proposed USWTR site in Onslow Bay, NC for surveys conducted from July 2008 to June 2009.

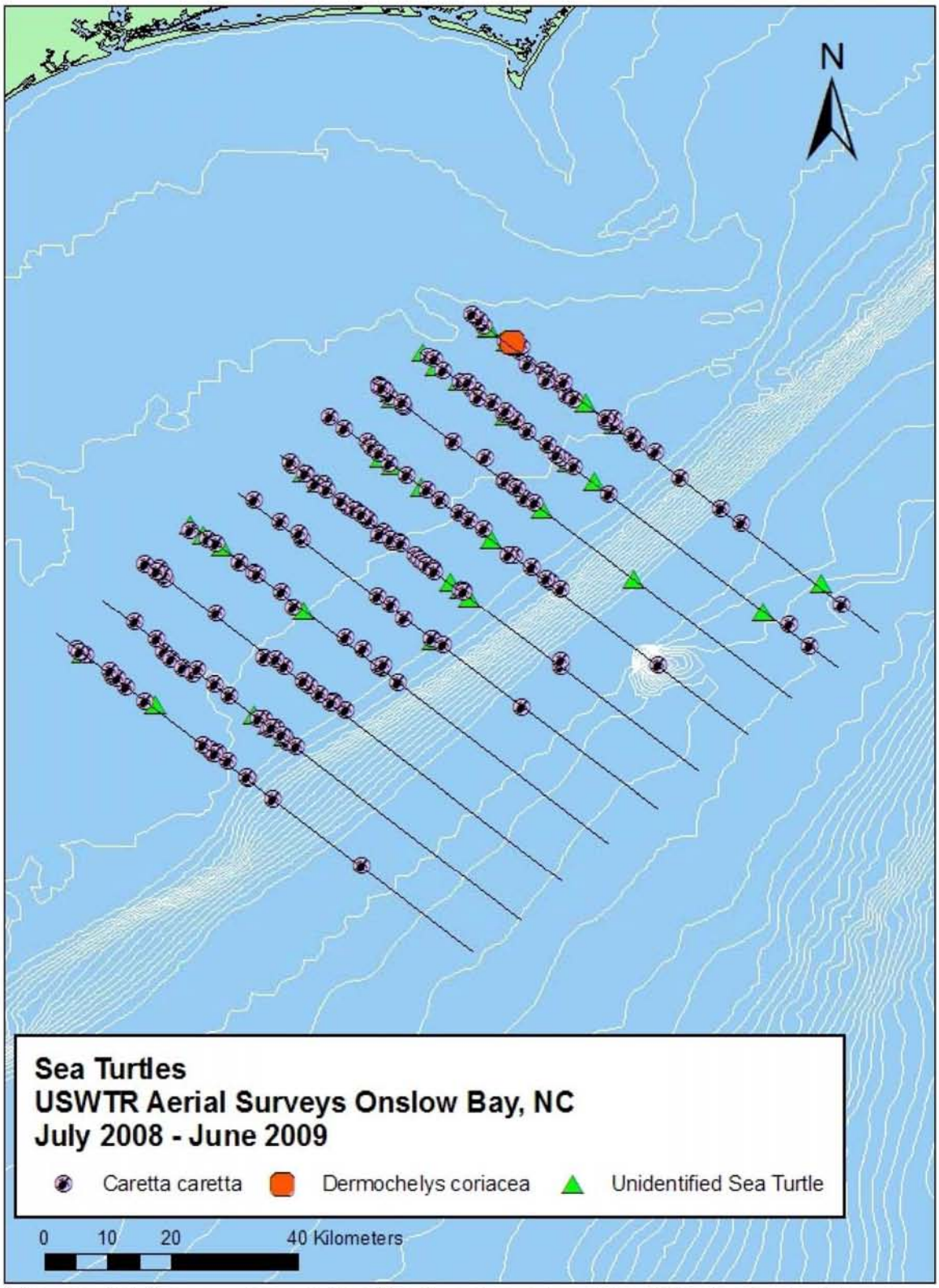

Figure 11. Loggerhead, leatherback and unidentified sea turtle sightings.

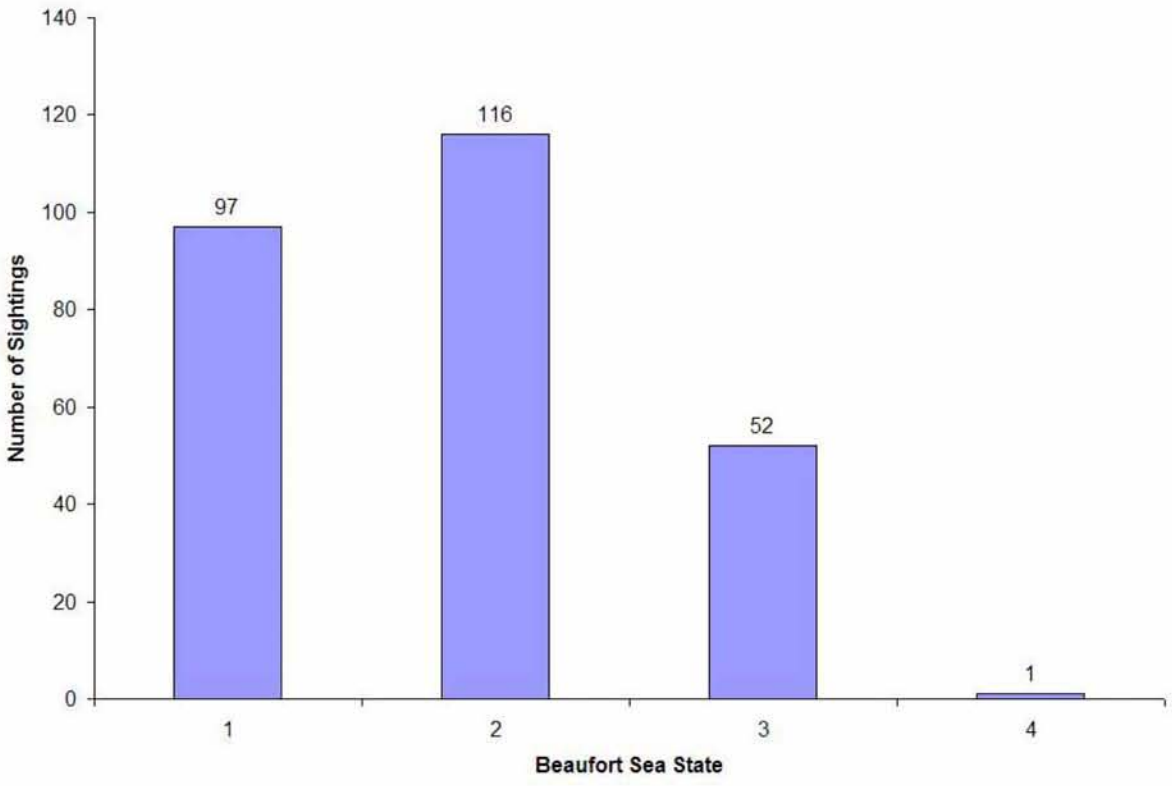

Figure 12a. **Total number of sea turtle sightings by Beaufort Sea State in the proposed USWTR site in Onslow Bay, North Carolina during the July 2008 – June 2009 surveys.**

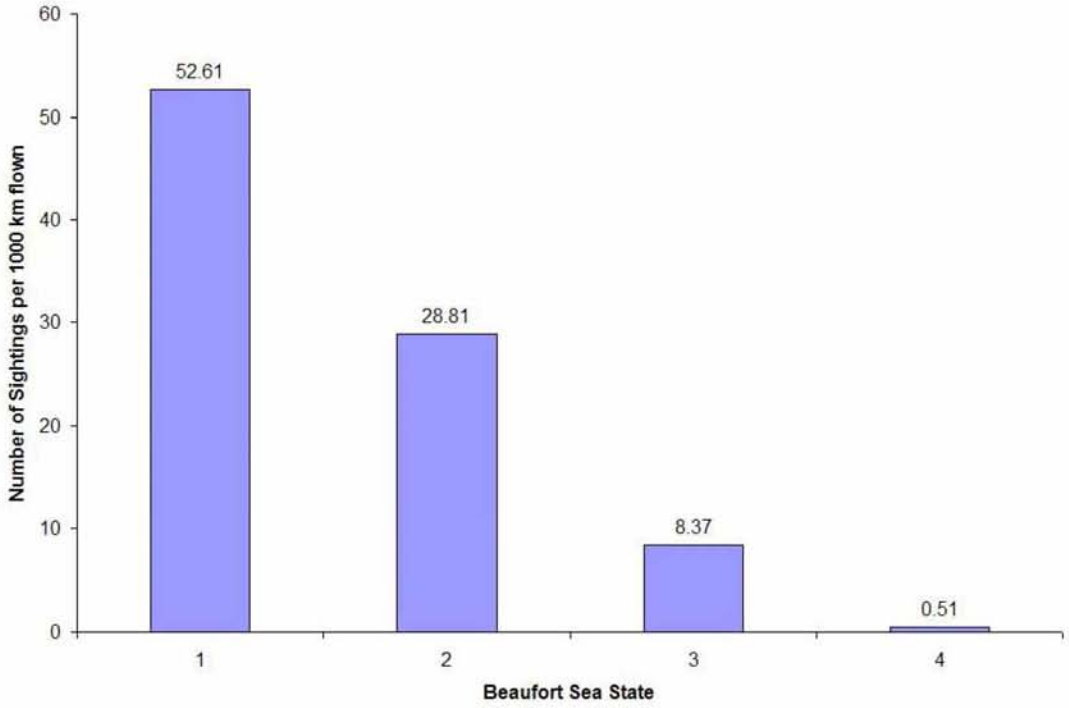

Figure 12b. **Turtle sightings per 1000 km flown by Beaufort Sea State during the July 2008 – June 2009 surveys in the proposed USWTR site in Onslow Bay, North Carolina.**

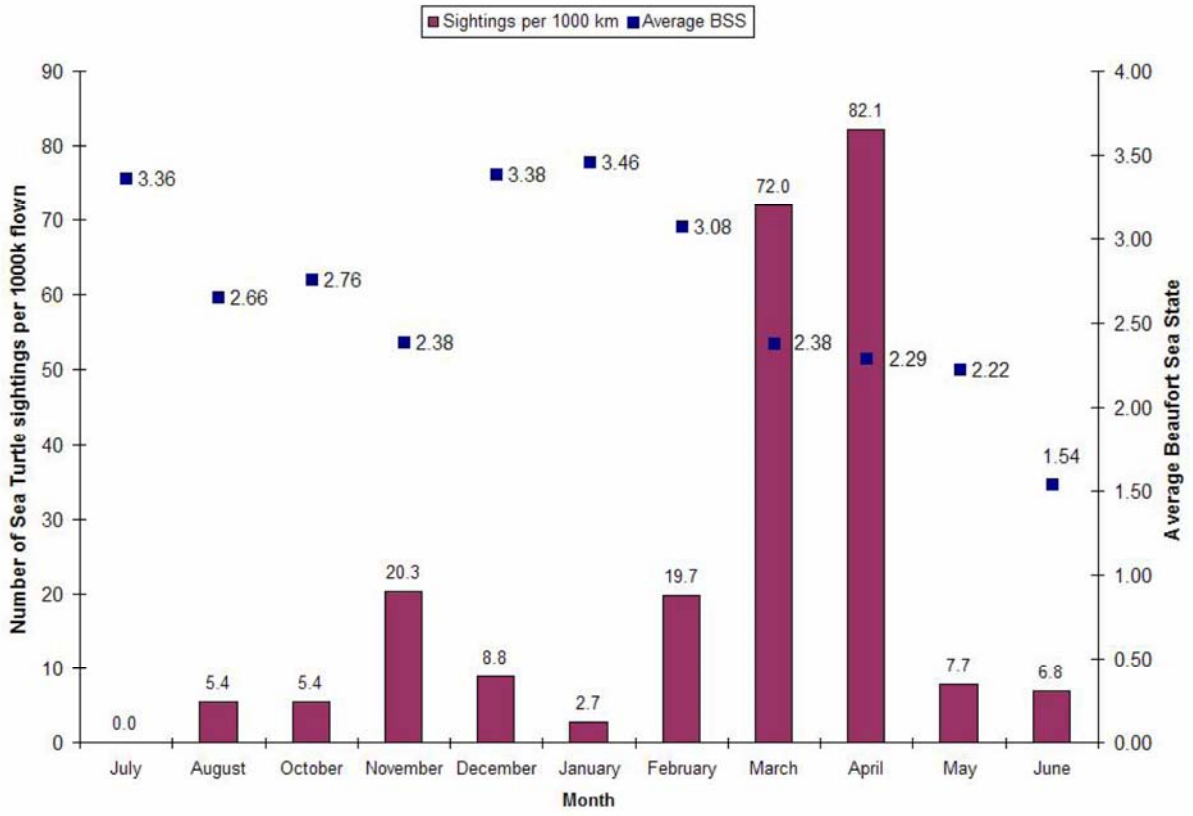

Figure 12c. **Number of Sea Turtles seen per 1000 km flown during the July 2008 – June 2009 surveys in the proposed USWTR site in Onslow Bay, North Carolina.**

Other Marine Vertebrate Sightings (Tables 14-17, Fig. 13)

Chondrichthyan fishes

A total of 14 sharks were observed throughout the survey period; hammerhead sharks (*Sphyrna* spp.) accounted for 78 percent of these sightings (n=11) (Table 14).

Twenty-seven manta rays (*Manta birostris*) were observed during the survey period. The majority of sightings (n=12) occurred during the February surveys (Table 15). There were also seven stingray sightings that could not be positively identified to species that were labeled as unidentified rays (Table 16).

Other fishes

Ocean sunfish (*Mola mola*) were encountered six times with no discernable spatial or temporal trends (Table 17).

Date	Time	Way Point	Latitude	Longitude-1	Heading	Track Number	Angle out	Degree Forward	Best #	Comments
15-Oct-08	15:23	60	33.919915	-76.285600	SE	9	2	11°	1	
23-Nov-08	15:22	70	33.767792	-76.874564	NW	3	2	90°	1	
7-Feb-09	10:46	26	33.939765	-76.433652	NW	8	2	45°	1	Hammerhead
7-Feb-09	10:47	23	33.941986	-76.436083	NW	8	3	90°	1	Hammerhead
5-Mar-09	12:16	72	33.665661	-76.342424	SE	6	3	90°	1	Hammerhead
5-Mar-09	16:02	110	33.639857	-76.836927	SE	2	2	90°	4	Hammerhead
24-Apr-09	12:19	53	33.898299	-76.510713	SE	7	3	60°	1	Hammerhead
30-May-09	13:43	12	34.049953	-76.451432	NW	9	3	90°	1	Hammerhead
31-May-09	10:34	32	33.800216	-76.383575	NW	7	3	90°	1	Hammerhead
31-May-09	10:48	37	34.10463	-76.784743	NW	7	3	90°	1	Hammerhead
2-Jun-09	10:26	16	33.685348	-76.629302	SE	4	4	90°	1	

Table 14. All shark sightings in the proposed USWTR site in Onslow Bay, NC for surveys conducted from July 2008 to June 2009.

Date	Time	Way Point	Latitude	Longitude-1	Heading	Track Number	Angle out	Degree Forward	Best #	Comments
23-Nov-08	10:24	16	33.989662	-76.246636	SE	10	3	90°	1	Large manta
23-Nov-08	14:38	62	33.960273	-76.862225	NW	5	2	90°	2	
22-Jan-09	10:57	17	33.548651	-76.584937	SE	3	3	45°	2	
7-Feb-09	11:35	35	34.019209	-76.282585	NW	10	2	60°	2	Below Surface
7-Feb-09	11:37	37	34.059904	-76.328800	NW	10	3	90°	1	
7-Feb-09	14:12	50	33.728410	-76.813923	NW	3	2	90°	1	
17-Feb-09	10:38	10	33.731035	-76.293904	SE	7	3	90°	2	
17-Feb-09	10:40	11	33.669269	-76.211215	SE	7	3	90°	1	
17-Feb-09	10:47	14	33.79302	-76.247628	NW	8	3	90°	1	
17-Feb-09	14:11	27	33.662654	-76.993829	NW	1	2	90°	2	Two manta rays
17-Feb-09	14:56	41	33.923845	-76.288003	SE	9	2	90°	2	
4-Mar-09	9:48	7	33.621785	-76.423133	SE	5	2	90°	1	
4-Mar-09	9:56	10	33.648188	-76.323446	NW	6	2	90°	1	
4-Mar-09	10:25	18	33.999432	-76.644062	SE	7	3	90°	1	
4-Mar-09	14:48	47	33.697078	-76.774192	NW	3	2	90°	1	
5-Mar-09	9:49	14	33.835216	-76.049972	SE	10	4	90°	1	
28-May-09	10:04	16	33.631837	-76.822565	NW	2	1	90°	1	Dark grey manta
28-May-09	11:12	32	33.962867	-76.995137	NW	4	1	90°	1	Light grey manta
31-May-09	9:42	22	34.072924	-76.609366	SE	8	1	60°	1	Brown-colored manta
1-Jun-09	14:56	58	33.882602	-76.887040	SE	4	1	60°	1	Brown-colored manta
2-Jun-09	14:55	60	33.920512	-76.407837	SE	8	3	110°	1	Circle for manta ray

Table 15. All *Manta birostris* sightings in the proposed USWTR site in Onslow Bay, NC for surveys conducted from July 2008 to June 2009.

Date	Time	Way Point	Latitude	Longitude-1	Heading	Track Number	Angle out	Degree Forward	Best #	Comments
4-Mar-09	9:55	8	33.633595	-76.305435	NW	6	1	90°	1	Yellow-brown large ray
4-Mar-09	10:39	18	33.704174	-76.259061	SE	7	2	90°	1	Large yellow stingray
4-Mar-09	10:39	18	33.704174	-76.259061	SE	7	2	90°	1	Large yellow stingray
5-Mar-09	9:42	13	33.964032	-76.208425	SE	10	1	90°	2	Two large yellow/brown rays
5-Mar-09	11:04	44	33.774620	-76.222852	SE	8	2	100°	1	Large yellow/brown ray
5-Mar-09	15:36	84	33.592176	-76.642626	NW	3	2	90°	1	Large brown ray

Table 16. All unidentified ray sightings in the proposed USWTR site in Onslow Bay, NC for surveys conducted from July 2008 to June 2009.

Date	Time	Way Point	Latitude	Longitude-1	Heading	Track Number	Angle out	Degree Forward	Best #
7-Feb-09	10:22	19	33.921963	-76.542083	SE	7	2	90°	1
5-Mar-09	10:51	39	33.952648	-76.46143	SE	8	3	100°	1
5-Mar-09	15:43	101	33.75787	-76.862445	NW	3	3	90°	1
24-Apr-09	11:43	67	33.919818	-76.385878	SE	8	1	90°	1
24-Apr-09	15:35	79	34.004660	-76.914460	NW	5	1	90°	1
25-Apr-09	9:21	7	33.961913	-76.994609	NW	4	1	90°	1

Table 17. All *Mola mola* sightings in the proposed USWTR site in Onslow Bay, NC for surveys conducted from July 2008 to June 2009.

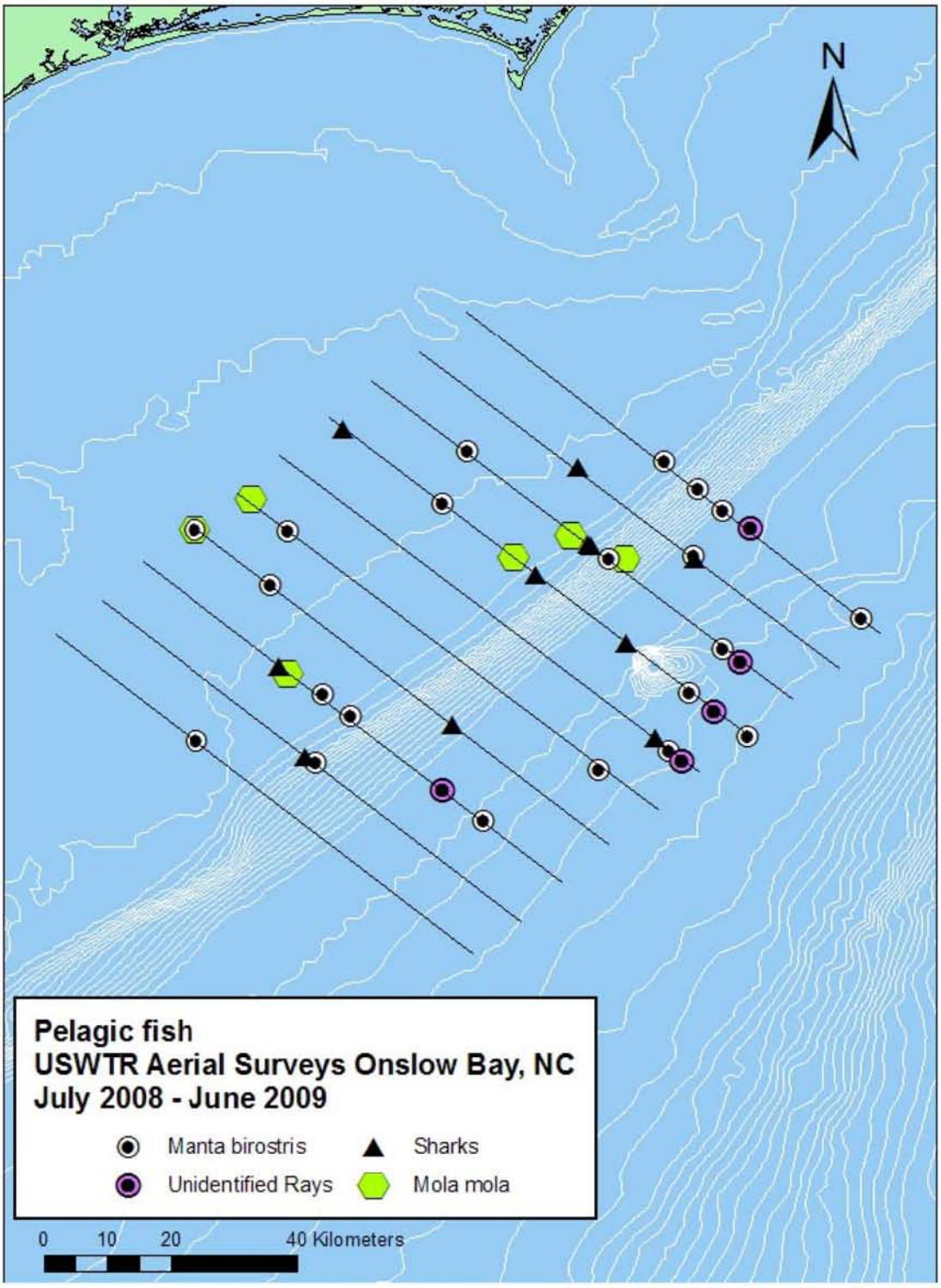

Figure 13. Ocean sunfish, Manta ray and shark sightings.

Vessel Sightings

Commercial (Table 18, Fig. 14)

A total of 57 commercial vessels were seen during the study. This category includes tankers, container/cargo vessels, and car carriers.

Date	Time	Way Point	Latitude	Longitude-1	Heading	Track Number	Angle out	Degree Forward	Best #	Comments
16-Jul-08	9:20	5	34.187347	-76.50110	SE	10	2	45°	1	Tanker bardge
16-Jul-08	9:21	5	34.182093	-76.494756	SE	10	4	110°	1	Tanker
16-Jul-08	9:21	6	34.171135	-76.48098	SE	10	5	30°	1	Large container
16-Jul-08	9:28	8	34.036359	-76.30324	SE	10	5	30°	1	Container Vessel
16-Jul-08	10:19	18	33.946815	-76.448735	SE	8	4	90°	1	Car carrier
16-Jul-08	14:28	45	33.606441	-76.933005	SE	1	1	90°	1	Tanker
17-Jul-08	9:28	4	34.176095	-76.484963	SE	10	4	90°	1	Large tanker
17-Jul-08	11:36	39	33.840782	-76.56245	SE	6	5	30°	1	Roll on roll off
17-Jul-08	12:15	29	33.617311	-76.283784	SE	6	3	70°	1	Cargo vessel
17-Jul-08	15:16	57	33.752289	-77.109885	SE	1	4	90°	1	Large cargo vessel
17-Jul-08	16:42	72	33.518244	-76.67309	NW	2	3	45°	1	Large cargo vessel
17-Jul-08	16:55	74	33.772607	-77.010308	NW	2	5	60°	2	Tug and Barge
1-Aug-08	14:33	4	34.148778	-76.452684	SE	10	4	120°	1	Large container vessel
1-Aug-08	16:04	22	34.035424	-76.691059	NW	7	4	45°	1	Large cargo vessel
2-Aug-08	9:48	14	33.630587	-76.434071	NW	5	2	30°	1	Large tanker
3-Aug-08	10:01	4	33.520698	-76.410762	SE	4	2	45°	1	Cargo vessel
3-Aug-08	10:15	8	33.627367	-76.693579	NW	3	4	45°	1	Resight of cargo vessel
4-Aug-08	9:46	7	33.606994	-76.796372	NW	2	3	90°	1	Large container vessel
4-Aug-08	9:55	9	33.780773	-77.017829	NW	2	2	110°	1	Large container vessel
4-Aug-08	11:32	29	33.865298	-76.341077	NW	8	4	90°	1	Large container vessel
4-Aug-08	12:06	37	34.13951	-76.574947	SE	9	4	90°	1	Barge
15-Oct-08	10:46	20	33.550513	-76.593242	NW	3	4	90°	1	Car carrier, 4-5 NM off, heading North
15-Oct-08	14:29	46	33.759297	-76.329095	SE	7	1	60°	1	Container vessel
15-Oct-08	14:41	40	33.799919	-76.254886	NW	8	1	45°	1	Large container vessel heading North
15-Oct-08	14:54	54	33.944438	-76.444453	NW	8	4	90°	1	Container vessel
15-Oct-08	15:46	64	33.984757	-76.241075	NW	10	3	30°	1	Container vessel, heading South
16-Oct-08	9:53	7	33.919965	-76.284417	NW	9	4	90°	1	Container vessel
16-Oct-08	14:05	34	33.762071	-76.729207	SE	4	4	45°	1	Large RORO
23-Nov-08	10:32	25	33.868158	-76.085522	SE	10	2	90°	1	Container vessel
23-Nov-08	11:00	23	33.976879	-76.361979	NW	9	3	60°	1	Large container vessel
23-Nov-08	11:39	33	33.788882	-76.241009	SE	8	4	60°	1	Large container vessel
23-Nov-08	11:40	46	33.809562	-76.267634	SE	8	2	45°	1	Tanker
23-Nov-08	11:54	37	33.811709	-76.399341	NW	7	1	60°	1	Large container
23-Nov-08	15:02	65	33.935387	-76.95964	SE	4	4	60°	1	Container
30-Dec-08	14:59	33	33.719661	-76.674984	NW	4	4	20°	1	Large container
30-Dec-08	15:04	34	33.812933	-76.798064	NW	4	3	90°	1	Large container RORO
30-Dec-08	15:04	29	33.823562	-76.812431	NW	4	4	40°	1	Large tanker
22-Jan-09	9:53	4	33.754067	-77.113782	SE	1	3	45°	1	Container vessel
22-Jan-09	9:59	7	33.617869	-76.935600	SE	1	1	20°	1	Large container vessel
7-Feb-09	14:01	46	33.472942	-76.491156	NW	3	4	30°	1	Tug boat
7-Feb-09	14:10	47	33.673640	-76.744927	NW	3	3	30°	1	Large container vessel
4-Mar-09	10:27	20	33.956903	-76.581816	SE	7	4	60°	1	Large container heading North
4-Mar-09	14:06	39	33.895674	-76.912028	SE	4	3	30°	1	Large container heading South
5-Mar-09	10:05	20	34.033383	-76.429585	NW	9	4	45°	1	Large tanker
5-Mar-09	10:59	42	33.887004	-76.369626	SE	8	3	30°	1	Tanker
5-Mar-09	12:18	73	33.635457	-76.307029	SE	6	3	90°	1	Large cargo vessel
5-Mar-09	15:34	98	33.523391	-76.558751	NW	3	3	60°	1	Cargo vessel
5-Mar-09	16:06	96	33.529684	-76.696443	SE	2	4	45°	1	Cargo vessel
5-Mar-09	16:27	115	33.664293	-76.99914	NW	1	4	30°	1	Large cargo vessel
25-Apr-09	9:10	4	33.717729	-76.678451	NW	4	1	60°	1	Large container
25-Apr-09	9:14	7	33.814184	-76.795686	NW	4	4	90°	1	Large container vessel

Table 18. All commercial vessel sightings in the proposed USWTR site in Onslow Bay, NC for surveys conducted from July 2008 to June 2009.

Date	Time	Way Point	Latitude	Longitude-1	Heading	Track Number	Angle out	Degree Forward	Best #	Comments
12-May-09	9:53	12	33.902390	-76.916227	SE	4	4	45°	1	Tanker
12-May-09	10:25	19	33.668301	-76.746463	NW	3	4	65°	1	Container vessel
12-May-09	10:26	20	33.693205	-76.777495	NW	3	4	60°	1	Tanker heading North
12-May-09	10:26	20	33.698030	-76.783474	NW	3	4	50°	1	Container vessel
12-May-09	10:48	26	33.665392	-76.871039	SE	2	4	60°	1	Large container heading South
12-May-09	11:08	31	33.485518	-76.759674	NW	1	4	60°	1	Roll on roll off
28-May-09	13:23	39	33.977910	-76.882768	SE	5	4	30°	1	Container ship
28-May-09	14:32	55	33.957779	-76.592999	SE	7	3	15°	1	Container vessel
30-May-09	14:12	27	33.760874	-76.200149	SE	8	3	30°	1	Cargo vessel
30-May-09	13:16	13	34.052162	-76.320504	SE	10	4	90°	1	Container ship
30-May-09	14:47	42	33.750939	-76.324048	NW	7	1	90°	1	Container ship
31-May-09	10:25	28	33.734337	-76.169646	SE	8	4	15°	1	Car carrier
31-May-09	14:22	66	33.609065	-76.92841	SE	1	2	90°	1	Container ship
1-Jun-09	10:46	12	33.998976	-76.781951	NW	6	4	90°	1	Tug and Barge
1-Jun-09	15:16	69	33.460745	-76.478690	NW	3	2	90°	1	Cargo vessel
1-Jun-09	16:29	71	33.528321	-76.692316	SE	2	4	60°	1	Tanker
1-Jun-09	17:08	76	33.545348	-76.837142	NW	1	1	60°	1	Large tug boat
2-Jun-09	11:33	27	33.526005	-76.682515	SE	2	4	110°	1	Cargo vessel
2-Jun-09	14:09	49	34.004389	-76.266916	SE	10	4	45°	1	Car carrier
2-Jun-09	14:58	62	33.888906	-76.369827	SE	8	1	90°	1	Tug and Barge

Table 18 (Continued). All commercial vessel sightings in the proposed USWTR site in Onslow Bay, NC for surveys conducted from July 2008 to June 2009.

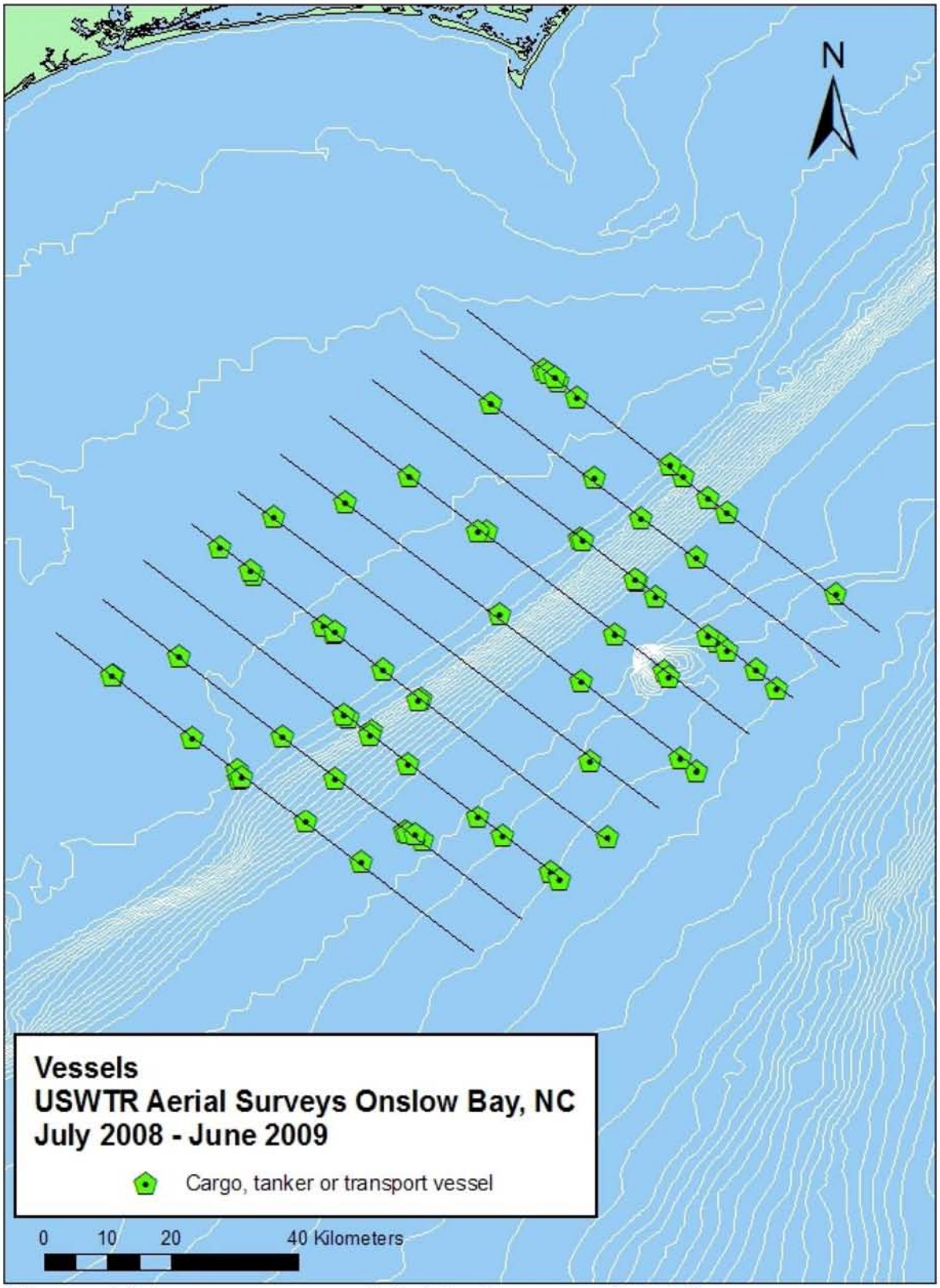

Figure 14. Large commercial shipping vessel sightings.

Military (Table 19, Fig. 15)

A total of 25 U.S. Military vessels were observed in the study site.

Date	Time	Way Point	Latitude	Longitude-1	Heading	Track Number	Angle out	Degree Forward	Best #	Comments
16-Jul-08	11:18	31	33.685111	-76.365502	SE	6	4	90°	1	Navy warship
16-Jul-08	16:29	45	33.851675	-76.83873	NW	4	2	60°	1	Navy vessel
17-Jul-08	12:11	46	33.678059	-76.363175	SE	6	3	90°	1	Military
17-Jul-08	12:25	51	33.726008	-76.542013	NW	5	3	45°	7	Line of military vessels
17-Jul-08	15:47	43	33.541936	-76.444718	NW	4	4	45°	1	Navy war ship
17-Jul-08	15:51	63	33.634754	-76.560937	NW	4	4	90°	1	Military vessel
17-Jul-08	15:51	45	33.624271	-76.547502	NW	4	3	90°	1	Navy war ship
17-Jul-08	15:53	46	33.674114	-76.614212	NW	4	3	60°	1	Navy war ship
7-Feb-09	10:49	29	33.982600	-76.494905	NW	8	6	90°	1	Military vessels
4-Mar-09	11:33	26	33.883448	-76.231747	SE	9	1	90°	1	USCG Cutter
24-Apr-09	11:50	69	33.807221	-76.271981	SE	8	3	90°	1	Navy aircraft carrier
24-Apr-09	15:06	110	33.745687	-76.446712	SE	6	4	45°	1	
25-Apr-09	9:10	6	33.735821	-76.702668	NW	4	4	60°	1	Navy vessel
25-Apr-09	9:50	16	33.409873	-76.541904	NW	2	4	60°	2	Navy frigate and submarine
31-May-09	11:53	47	33.550494	-76.447359	SE	4	2	45°	1	Frigate
31-May-09	15:33	75	33.835725	-76.048668	NW	10	3	45°	1	Frigate
2-Jun-09	14:14	49	33.90456	-76.137616	SE	10	4	10°	1	Large Navy vessel
2-Jun-09	14:24	53	33.835210	-76.175465	NW	9	4	90°	1	Navy vessel

Table 19. All military vessel sightings in the proposed USWTR site in Onslow Bay, NC for surveys conducted from July 2008 to June 2009.

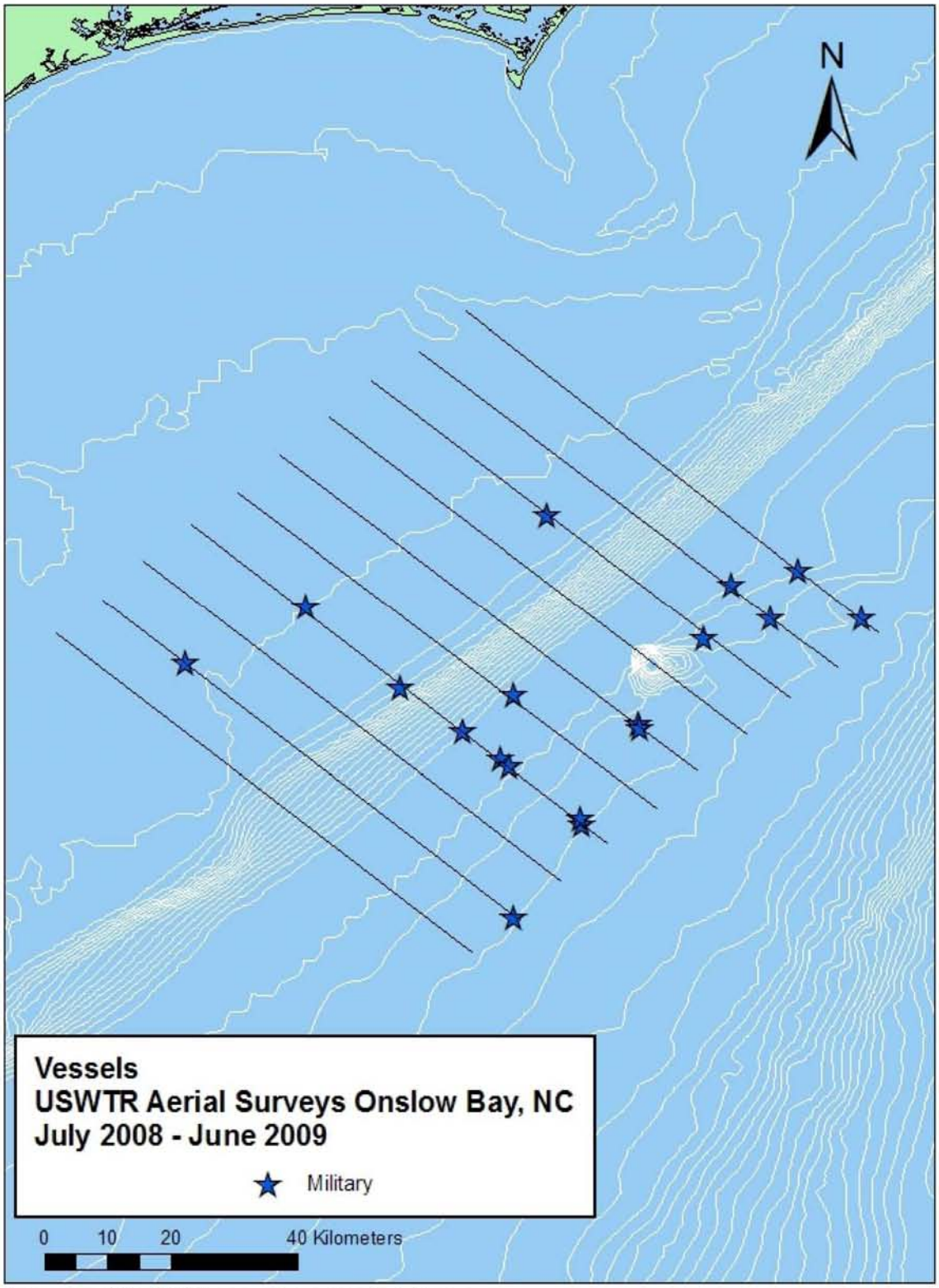

Figure 15. Military vessel sightings.

Recreational (Table 20, Fig. 16)

The most commonly sighted type of vessel in the survey area were recreational fishing vessels (n=334), with the majority of sightings occurring at or shoreward of the continental shelf break.

Date	Time	Way Point	Latitude	Longitude-1	Heading	Track Number	Angle out	Degree Forward	Best #	Comments
16-Jul-08	9:17	3	34.25831	-76.58709	SE	10	2	100°	1	Recreational fishing vessel
16-Jul-08	9:18	3	34.24197	-76.56703	SE	10	3	90°	1	Recreational fishing vessel
16-Jul-08	9:19	4	34.21183	-76.53096	SE	10	4	90°	1	Recreational fishing vessel
16-Jul-08	9:19	4	34.22262	-76.54397	SE	10	4	45°	1	Recreational fishing vessel
16-Jul-08	10:02	15	34.15987	-76.59747	NW	9	4	90°	1	Unid vessel
16-Jul-08	10:19	19	33.93397	-76.43258	SE	8	1	80°	1	Recreational fishing vessel
16-Jul-08	10:52	21	34.01300	-76.65912	NW	7	3	90°	1	Recreational fishing vessel
16-Jul-08	11:05	24	33.94263	-76.70162	SE	6	4	45°	1	Recreational fishing vessel
16-Jul-08	14:20	42	33.78776	-77.14290	SE	1	3	90°	1	Recreational fishing vessel
16-Jul-08	14:27	44	33.62612	-76.95817	SE	1	4	90°	1	Recreational fishing vessel
16-Jul-08	15:15	57	33.85070	-76.97993	SE	3	2	100°	1	Recreational fishing vessel
16-Jul-08	15:15	56	33.86403	-76.99879	SE	3	3	90°	1	Unid vessel
16-Jul-08	16:29	64	33.84285	-76.82495	NW	4	3	90°	1	Recreational fishing vessel
17-Jul-08	9:25	3	34.23195	-76.55654	SE	10	2	90°	1	Dive boat on anchor
17-Jul-08	9:30	3	34.14722	-76.44651	SE	10	2	60°	1	Recreational fishing vessel
17-Jul-08	9:30	5	34.14129	-76.43819	SE	10	2	90°	1	Recreational fishing vessel
17-Jul-08	9:36	6	34.01862	-76.28129	SE	10	4	60°	1	Recreational fishing vessel
17-Jul-08	10:36	20	34.01032	-76.52666	SE	8	1	90°	1	Recreational fishing vessel
17-Jul-08	10:41	22	33.91490	-76.40026	SE	8	4	90°	1	
17-Jul-08	16:01	65	33.85343	-76.84717	NW	4	3	45°	1	
17-Jul-08	16:12	68	33.87526	-77.00939	SE	3	4	30°	1	Recreational fishing vessel
17-Jul-08	16:52	53	33.71678	-76.93775	NW	2	3	90°	1	Recreational fishing vessel
1-Aug-08	14:27	3	34.25683	-76.58835	SE	10	3	45°	1	Head boat
1-Aug-08	14:29	3	34.23147	-76.55710	SE	10	2	90°	1	Recreational fishing vessel
1-Aug-08	14:39	6	34.02908	-76.29715	SE	10	3	90°	1	Recreational fishing vessel
1-Aug-08	14:39	5	34.02440	-76.29111	SE	10	2	30°	2	Recreational fishing vessel
1-Aug-08	14:40	6	33.99415	-76.25094	SE	10	3	45°	2	Recreational fishing vessel
1-Aug-08	15:01	11	33.92027	-76.29881	NW	9	4	45°	1	Recreational fishing vessel
1-Aug-08	15:01	12	33.91912	-76.29656	NW	9	2	90°	1	Recreational fishing vessel
1-Aug-08	15:02	12	33.94245	-76.32492	NW	9	2	30°	1	Recreational fishing vessel
1-Aug-08	15:03	13	33.98010	-76.36903	NW	9	2	90°	1	Recreational fishing vessel
2-Aug-08	9:08	4	34.01580	-76.80350	SE	6	3	45°	1	Recreational fishing vessel
2-Aug-08	9:31	9	33.78030	-76.49717	SE	6	4	45°	1	Recreational fishing vessel
2-Aug-08	10:48	23	33.67803	-76.75468	NW	3	1	90°	1	Dive boat
2-Aug-08	11:19	32	33.77017	-77.00784	SE	2	4	90°	1	Recreational fishing vessel
2-Aug-08	11:24	32	33.65206	-76.85683	SE	2	3	45°	1	Head boat
2-Aug-08	11:55	39	33.60180	-76.91422	NW	1	3	30°	1	Recreational fishing vessel
3-Aug-08	9:50	4	33.74489	-76.70366	SE	4	4	80°	1	Car carrier
3-Aug-08	10:17	8	33.66654	-76.74480	NW	3	3	60°	1	Luxury yacht
4-Aug-08	10:55	18	34.03884	-76.83400	NW	6	2	90°	1	Recreational fishing vessel
4-Aug-08	11:04	22	34.02005	-76.67004	SE	7	3	90°	1	Recreational fishing vessel
4-Aug-08	11:12	24	33.87294	-76.47831	SE	7	3	90°	1	Recreational fishing vessel
4-Aug-08	11:35	30	33.92073	-76.41145	NW	8	3	90°	1	Recreational fishing vessel
4-Aug-08	12:12	25	34.01291	-76.40914	SE	9	2	60°	1	Recreational fishing vessel
4-Aug-08	12:52	48	34.04393	-76.31196	NW	10	3	90°	1	Recreational fishing vessel
15-Oct-08	10:00	11	33.77686	-76.61302	NW	5	2	90°	1	Recreational fishing vessel

Table 20. All fishing vessel sightings in the proposed USWTR site in Onslow Bay, NC for surveys conducted from July 2008 to June 2009.

Date	Time	Way Point	Latitude	Longitude-1	Heading	Track Number	Angle out	Degree Forward	Best #	Comments
15-Oct-08	10:00	12	33.78903	-76.62955	NW	5	3	100°	1	Recreational fishing vessel
15-Oct-08	10:24	16	33.80372	-76.77895	SE	4	2	45°	1	Recreational fishing vessel
15-Oct-08	10:55	22	33.72529	-76.82178	NW	3	3	30°	1	Recreational fishing vessel
15-Oct-08	15:01	56	34.07482	-76.61281	NW	8	3	30°	1	Recreational fishing vessel
15-Oct-08	15:57	65	34.19311	-76.51035	NW	10	4	45°	1	Recreational fishing vessel
16-Oct-08	9:31	4	34.04411	-76.31845	SE	10	3	45°	1	Recreational fishing vessel
16-Oct-08	9:56	8	33.98112	-76.36570	NW	9	2	90°	2	Recreational fishing vessel
16-Oct-08	10:03	9	34.11470	-76.54295	NW	9	1	90°	1	Recreational fishing vessel
16-Oct-08	10:19	12	34.00675	-76.52457	SE	8	3	90°	1	Recreational fishing vessel
16-Oct-08	10:47	15	33.87929	-76.48577	NW	7	2	90°	2	Recreational fishing vessel
16-Oct-08	10:49	16	33.90935	-76.52422	NW	7	3	90°	2	Recreational fishing vessel
16-Oct-08	11:08	22	33.96461	-76.73621	SE	6	1	90°	1	Recreational fishing vessel
16-Oct-08	11:15	23	33.82617	-76.55474	SE	6	3	45°	1	Recreational fishing vessel
16-Oct-08	11:39	28	33.79053	-76.63741	NW	5	3	90°	1	Recreational fishing vessel
16-Oct-08	11:42	29	33.85148	-76.72171	NW	5	3	90°	1	Yacht
16-Oct-08	14:32	39	33.66759	-76.74480	NW	3	3	45°	1	Recreational fishing vessel
16-Oct-08	14:38	40	33.79328	-76.90756	NW	3	3	90°	1	Recreational fishing vessel
16-Oct-08	14:40	41	33.84417	-76.97370	NW	3	3	90°	1	Recreational fishing vessel
16-Oct-08	14:54	44	33.72406	-76.94352	SE	2	4	90°	1	Recreational fishing vessel
16-Oct-08	14:56	45	33.69122	-76.90225	SE	2	3	90°	1	Recreational fishing vessel
23-Nov-08	10:11	12	34.25150	-76.58355	SE	10	3	60°	1	
23-Nov-08	10:12	13	34.23821	-76.56644	SE	10	3	60°	1	Sail boat
23-Nov-08	10:12	14	34.23695	-76.56484	SE	10	3	90°	1	
23-Nov-08	10:21	15	34.05413	-76.32896	SE	10	4	60°	1	
23-Nov-08	11:00	34	33.97540	-76.36014	NW	9	1	90°	1	Recreational fishing vessel
23-Nov-08	11:06	24	34.10643	-76.53196	NW	9	2	90°	1	Recreational fishing vessel
23-Nov-08	11:07	26	34.13616	-76.57156	NW	9	3	90°	1	
23-Nov-08	11:11	36	34.19784	-76.65372	NW	9	3	90°	1	Recreational fishing vessel
23-Nov-08	11:15	39	34.15803	-76.72565	SE	8	1	90°	1	Sail boat
23-Nov-08	11:15	29	34.15159	-76.71569	SE	8	3	60°	1	
23-Nov-08	11:25	40	33.95351	-76.45551	SE	8	2	90°	1	Recreational fishing vessel
23-Nov-08	11:27	41	33.92853	-76.42324	SE	8	3	90°	1	Recreational fishing vessel
23-Nov-08	14:22	66	33.94207	-76.70718	SE	6	2	30°	1	Head boat
23-Nov-08	14:34	61	33.87248	-76.74558	NW	5	2	45°	1	
23-Nov-08	15:07	76	33.83848	-76.83077	SE	4	1	90°	2	Recreational fishing vessel
23-Nov-08	15:08	77	33.82964	-76.81937	SE	4	3	90°	1	Recreational fishing vessel
23-Nov-08	15:12	79	33.75364	-76.71871	SE	4	1	90°	1	Recreational fishing vessel
24-Nov-08	13:29	10	33.64140	-76.83774	NW	2	4	90°	1	Recreational fishing vessel
24-Nov-08	14:08	20	33.52642	-76.40786	SE	3	4	90°	1	Shrimper
24-Nov-08	14:33	27	33.99998	-76.91386	SE	5	4	90°	1	Recreational fishing vessel
24-Nov-08	14:34	28	33.99211	-76.90323	SE	5	1	90°	1	Recreational fishing vessel
24-Nov-08	15:08	33	33.81875	-76.54537	NW	6	2	90°	1	Recreational fishing vessel
24-Nov-08	15:09	34	33.83612	-76.56703	NW	6	4	90°	1	Recreational fishing vessel
30-Dec-08	14:25	23	33.86552	-77.12993	NW	2	3	30°	1	Recreational fishing vessel
30-Dec-08	14:36	25	33.71791	-76.80868	SE	3	2	90°	1	
22-Jan-09	9:55	5	33.70947	-77.06107	SE	1	2	60°	1	Recreational fishing vessel

Table 20 (Continued). All fishing vessel sightings in the proposed USWTR site in Onslow Bay, NC for surveys conducted from July 2008 to June 2009.

Date	Time	Way Point	Latitude	Longitude-1	Heading	Track Number	Angle out	Degree Forward	Best #	Comments
22-Jan-09	9:57	6	33.65516	-76.98721	SE	1	4	60°	1	Recreational fishing vessel
22-Jan-09	10:01	4	33.58085	-76.88832	SE	1	4	90°	1	Recreational fishing vessel
22-Jan-09	10:44	11	33.79235	-76.90641	SE	3	1	90°	1	Recreational fishing vessel
22-Jan-09	11:19	18	33.80870	-76.79618	NW	4	4	90°	1	Recreational fishing vessel
22-Jan-09	11:24	19	33.91591	-76.93338	NW	4	3	90°	4	Recreational fishing vessel
22-Jan-09	11:24	22	33.92196	-76.94112	NW	4	3	60°	1	Recreational fishing vessel
22-Jan-09	11:37	25	33.83196	-76.69545	SE	5	4	90°	1	Recreational fishing vessel
22-Jan-09	12:02	29	33.81868	-76.53904	NW	6	3	90°	2	Recreational fishing vessel
22-Jan-09	12:04	25	33.84403	-76.57138	NW	6	1	90°	1	Recreational fishing vessel
22-Jan-09	14:41	37	33.91565	-76.40460	NW	8	4	45°	1	Recreational fishing vessel
22-Jan-09	14:58	40	34.18541	-76.63188	SE	9	3	90°	1	Recreational fishing vessel
22-Jan-09	15:33	41	34.04702	-76.31849	NW	10	1	90°	1	Recreational fishing vessel
7-Feb-09	9:28	7	33.78175	-76.62823	SE	5	3	90°	1	Recreational fishing vessel
7-Feb-09	10:08	16	34.04624	-76.83728	NW	6	4	45°	1	Recreational fishing vessel
7-Feb-09	10:23	18	33.88237	-76.49061	SE	7	1	90°	1	Recreational fishing vessel
7-Feb-09	10:24	19	33.87246	-76.45543	SE	7	2	45°	1	Recreational fishing vessel
7-Feb-09	10:24	21	33.87539	-76.46982	SE	7	4	90°	2	Recreational fishing vessel
7-Feb-09	10:47	27	33.95599	-76.45772	NW	8	3	45°	1	Recreational fishing vessel
7-Feb-09	11:12	33	33.94045	-76.31319	SE	9	4	45°	1	Recreational fishing vessel
7-Feb-09	11:36	36	34.03632	-76.30337	NW	10	2	90°	1	Recreational fishing vessel
7-Feb-09	11:46	43	34.24440	-76.57245	NW	10	2	45°	2	Recreational fishing vessel
7-Feb-09	11:46	38	34.25102	-76.58132	NW	10	4	60°	2	Recreational fishing vessel
7-Feb-09	14:10	53	33.68284	-76.75639	NW	3	4	90°	1	Recreational fishing vessel
7-Feb-09	14:28	53	33.80525	-76.93033	NW	3	4	90°	1	Recreational fishing vessel
7-Feb-09	15:30	61	33.76277	-77.12805	NW	1	4	90°	1	Recreational fishing vessel
4-Mar-09	10:03	11	33.80614	-76.51730	NW	6	4	90°	1	Recreational fishing vessel
4-Mar-09	10:31	15	33.87248	-76.47154	SE	7	1	90°	1	Recreational fishing vessel
4-Mar-09	10:32	16	33.85769	-76.45365	SE	7	2	90°	1	Recreational fishing vessel
4-Mar-09	11:29	25	33.97966	-76.37794	SE	9	4	30°	1	Recreational fishing vessel
4-Mar-09	12:02	30	34.24950	-76.58205	NW	10	3	90°	1	Recreational fishing vessel
5-Mar-09	9:13	4	34.24979	-76.58227	SE	10	3	45°	1	Recreational fishing vessel
5-Mar-09	10:02	19	33.94959	-76.32534	NW	9	3	60°	1	Recreational fishing vessel
5-Mar-09	10:07	21	34.06674	-76.47861	NW	9	3	60°	1	Recreational fishing vessel
5-Mar-09	10:16	25	34.14038	-76.57116	NW	9	1	90°	1	Recreational fishing vessel
5-Mar-09	10:16	26	34.14930	-76.58290	NW	9	3	90°	2	Recreational fishing vessel
5-Mar-09	10:57	41	33.94551	-76.44407	SE	8	2	60°	1	Recreational fishing vessel
5-Mar-09	11:00	43	33.86589	-76.34561	SE	8	3	60°	2	Recreational fishing vessel
5-Mar-09	11:32	51	33.85665	-76.45219	NW	7	3	60°	8	Recreational fishing vessel
5-Mar-09	11:36	54	33.95099	-76.57939	NW	7	2	60°	1	Recreational fishing vessel
5-Mar-09	11:41	57	34.07086	-76.74619	NW	7	4	90°	1	Recreational fishing vessel
5-Mar-09	12:09	71	33.82682	-76.55497	SE	6	4	60°	1	Recreational fishing vessel
5-Mar-09	12:32	77	33.75993	-76.59868	NW	5	3	90°	2	Recreational fishing vessel
5-Mar-09	15:14	78	33.87911	-76.89033	SE	4	3	30°	1	Recreational fishing vessel
5-Mar-09	15:20	94	33.73502	-76.68175	SE	4	2	90°	1	Recreational fishing vessel
5-Mar-09	15:41	100	33.69630	-76.77063	NW	3	4	60°	1	Recreational fishing vessel
24-Apr-09	9:34	4	34.25787	-76.58755	SE	10	1	90°	1	Recreational fishing vessel

Table 20 (Continued). All fishing vessel sightings in the proposed USWTR site in Onslow Bay, NC for surveys conducted from July 2008 to June 2009.

Date	Time	Way Point	Latitude	Longitude-1	Heading	Track Number	Angle out	Degree Forward	Best #	Comments
24-Apr-09	9:35	4	34.23889	-76.55450	SE	10	3	90°	1	Recreational fishing vessel
24-Apr-09	10:07	17	34.01084	-76.27374	SE	10	4	120°	1	Recreational fishing vessel
24-Apr-09	10:19	18	33.92333	-76.16016	SE	10	4	60°	1	Recreational fishing vessel
24-Apr-09	10:53	37	33.92734	-76.29519	NW	9	3	60°	1	Recreational fishing vessel
24-Apr-09	10:54	25	33.93189	-76.29996	NW	9	4	45°	1	Recreational fishing vessel
24-Apr-09	11:11	31	34.13205	-76.55977	NW	9	2	60°	1	Head boat
24-Apr-09	11:15	50	34.19865	-76.66185	NW	9	2	90°	1	Head boat
24-Apr-09	11:41	66	33.93859	-76.44017	SE	8	3	45°	1	Recreational fishing vessel
24-Apr-09	11:41	42	33.93377	-76.43392	SE	8	2	45°	1	Recreational fishing vessel
24-Apr-09	11:46	45	33.89461	-76.37386	SE	8	1	90°	1	Duke survey vessel - Cetus
24-Apr-09	11:59	73	33.70155	-76.26230	NW	7	2	90°	1	
24-Apr-09	12:16	52	33.84876	-76.44962	SE	7	3	30°	1	Recreational fishing vessel
24-Apr-09	12:17	78	33.86902	-76.47315	NW	7	3	90°	5	Recreational fishing vessel
24-Apr-09	12:30	56	33.98614	-76.62510	SE	7	3	60°	1	Recreational fishing vessel
24-Apr-09	14:57	69	33.93811	-76.70032	SE	6	1	60°	1	Recreational fishing vessel
24-Apr-09	15:03	72	33.81424	-76.53968	SE	6	4	60°	1	Recreational fishing vessel
24-Apr-09	15:25	75	33.76954	-76.62249	NW	5	3	60°	2	Recreational fishing vessel
24-Apr-09	15:28	76	33.83356	-76.69360	NW	5	2	30°	2	Recreational fishing vessel
24-Apr-09	15:28	115	33.84425	-76.71403	NW	5	3	90°	1	Recreational fishing vessel
25-Apr-09	9:09	5	33.70409	-76.65534	NW	4	4	90°	1	Recreational fishing vessel
25-Apr-09	9:14	5	33.82508	-76.81226	NW	4	2	60°	1	Recreational fishing vessel
25-Apr-09	9:28	10	33.84485	-76.97598	SE	3	3	60°	1	Recreational fishing vessel
25-Apr-09	9:33	15	33.72844	-76.81537	SE	3	3	45°	1	Recreational fishing vessel
25-Apr-09	9:34	16	33.72071	-76.80498	SE	3	2	90°	1	Recreational fishing vessel
25-Apr-09	9:35	12	33.69104	-76.76538	SE	3	2	60°	1	Recreational fishing vessel
25-Apr-09	9:36	13	33.67884	-76.74888	SE	3	3	90°	2	Recreational fishing vessel
25-Apr-09	10:02	19	33.68100	-76.90121	NW	2	3	90°	1	Recreational fishing vessel
25-Apr-09	10:04	21	33.71916	-76.94040	NW	2	3	90°	1	Recreational fishing vessel
25-Apr-09	10:06	22	33.76508	-76.99699	NW	2	3	90°	1	Recreational fishing vessel
25-Apr-09	10:32	29	33.70528	-77.04536	NW	1	1	90°	1	Recreational fishing vessel
25-Apr-09	10:34	30	33.66290	-76.99482	NW	1	2	90°	1	Recreational fishing vessel
25-Apr-09	10:37	25	33.60027	-76.92029	SE	1	4	60°	1	Recreational fishing vessel
25-Apr-09	10:38	26	33.58261	-76.89969	SE	1	2	60°	1	Recreational fishing vessel
12-May-09	9:13	5	33.86620	-76.60644	SE	6	4	90°	1	Recreational fishing vessel
12-May-09	9:40	8	33.84056	-76.70271	NW	5	3	60°	2	Recreational fishing vessel
12-May-09	9:42	9	33.88235	-76.76245	NW	5	3	30°	1	Recreational fishing vessel
12-May-09	10:29	21	33.75533	-76.85891	NW	3	3	45°	1	Recreational fishing vessel
12-May-09	11:16	28	33.66604	-77.00164	NW	1	3	90°	1	Recreational fishing vessel
28-May-09	9:21	5	33.76047	-77.11794	SE	1	4	60°	1	Luxury yacht
28-May-09	9:21	6	33.74973	-77.10380	SE	1	4	90°	1	Sailing yacht
28-May-09	9:22	6	33.74455	-77.09749	SE	1	4	60°	1	Small fishing vessel
28-May-09	10:11	18	33.78187	-77.02126	NW	2	4	60°	1	Recreational fishing vessel
28-May-09	10:20	20	33.85475	-76.98559	SE	3	3	90°	1	Luxury yacht
28-May-09	10:22	23	33.80922	-76.92673	SE	3	4	30°	1	Recreational fishing vessel
28-May-09	13:31	35	33.79811	-76.64515	SE	5	4	30°	1	Recreational fishing vessel
28-May-09	14:18	46	33.96446	-76.74024	NW	6	1	90°	1	Recreational fishing vessel

Table 20 (Continued). All fishing vessel sightings in the proposed USWTR site in Onslow Bay, NC for surveys conducted from July 2008 to June 2009.

Date	Time	Way Point	Latitude	Longitude-1	Heading	Track Number	Angle out	Degree Forward	Best #	Comments
28-May-09	14:18	52	33.96596	-76.74242	NW	6	4	30°	1	Recreational fishing vessel
30-May-09	13:07	4	34.26120	-76.59586	SE	10	3	30°	1	Recreational fishing vessel
30-May-09	13:08	7	34.23961	-76.56224	SE	10	2	90°	1	Recreational fishing vessel
30-May-09	13:11	8	34.16401	-76.46601	SE	10	2	90°	1	Sail boat
30-May-09	13:14	10	34.10693	-76.39367	SE	10	2	90°	1	Recreational fishing vessel
30-May-09	13:14	11	34.09540	-76.37850	SE	10	1	90°	1	Recreational fishing vessel
30-May-09	13:15	12	34.08855	-76.37004	SE	10	3	90°	1	Sail boat
30-May-09	13:17	5	34.04959	-76.31716	SE	10	4	45°	1	Recreational fishing vessel
30-May-09	13:18	14	34.00965	-76.26988	SE	10	1	90°	1	Recreational fishing vessel
30-May-09	13:39	19	33.97088	-76.34846	NW	9	1	90°	1	Recreational fishing vessel
30-May-09	13:40	20	33.98660	-76.36805	NW	9	2	90°	1	Recreational fishing vessel
30-May-09	13:41	21	34.00679	-76.39472	NW	9	2	90°	1	Recreational fishing vessel
30-May-09	13:45	22	34.09811	-76.51477	NW	9	3	90°	1	Recreational fishing vessel
30-May-09	13:45	14	34.09753	-76.51394	NW	9	4	60°	1	Recreational fishing vessel
30-May-09	13:46	15	34.11269	-76.53420	NW	9	2	60°	2	Recreational fishing vessel
30-May-09	13:47	16	34.13339	-76.56312	NW	9	2	30°	1	Recreational fishing vessel
30-May-09	13:49	23	34.18082	-76.62494	NW	9	3	90°	1	Recreational fishing vessel
30-May-09	13:49	18	34.18031	-76.62402	NW	9	3	45°	1	Recreational fishing vessel
30-May-09	13:53	21	34.16109	-76.73597	SE	8	1	90°	1	Head boat
30-May-09	13:55	26	34.12497	-76.68361	SE	8	2	90°	1	Recreational fishing vessel
30-May-09	13:58	27	34.07058	-76.60551	SE	8	2	90°	5	Recreational fishing vessel
30-May-09	13:58	22	34.06281	-76.59415	SE	8	1	30°	1	Recreational fishing vessel
30-May-09	14:02	28	33.97754	-76.48011	SE	8	1	90°	1	Recreational fishing vessel
30-May-09	14:02	24	33.98257	-76.49087	SE	8	3	60°	1	Recreational fishing vessel
30-May-09	14:04	31	33.92843	-76.42328	SE	8	1	90°	1	Recreational fishing vessel
30-May-09	14:04	26	33.93712	-76.43350	SE	8	3	60°	1	Recreational fishing vessel
30-May-09	14:12	33	33.76656	-76.20942	SE	8	1	90°	1	Sail boat
30-May-09	14:54	32	33.90667	-76.51668	NW	7	2	45°	1	Recreational fishing vessel
30-May-09	14:56	43	33.95793	-76.57996	NW	7	1	90°	1	Recreational fishing vessel
30-May-09	14:57	44	33.97673	-76.60873	NW	7	2	90°	1	Recreational fishing vessel
30-May-09	14:58	45	33.98664	-76.62648	NW	7	2	90°	1	Recreational fishing vessel
30-May-09	15:01	34	34.05986	-76.72231	NW	7	4	45°	1	Recreational fishing vessel
30-May-09	16:10	49	33.84036	-76.70095	NW	5	4	90°	1	Recreational fishing vessel
30-May-09	16:16	50	33.98029	-76.87869	NW	5	1	60°	1	Recreational fishing vessel
31-May-09	8:52	4	34.25942	-76.59386	SE	10	1	45°	1	Recreational fishing vessel
31-May-09	8:52	4	34.26206	-76.59711	SE	10	2	60°	2	Recreational fishing vessel
31-May-09	8:53	5	34.24233	-76.56713	SE	10	2	45°	3	Recreational fishing vessel
31-May-09	8:54	6	34.23088	-76.55189	SE	10	3	90°	2	Recreational fishing vessel
31-May-09	8:55	5	34.20572	-76.52042	SE	10	2	60°	1	Recreational fishing vessel
31-May-09	8:56	7	34.16967	-76.47715	SE	10	2	30°	2	Recreational fishing vessel
31-May-09	8:58	6	34.13577	-76.43509	SE	10	3	60°	1	Recreational fishing vessel
31-May-09	8:58	8	34.13732	-76.43713	SE	10	1	45°	1	Recreational fishing vessel
31-May-09	8:59	7	34.10070	-76.38877	SE	10	3	90°	1	Recreational fishing vessel
31-May-09	8:59	9	34.09800	-76.38516	SE	10	1	60°	1	Recreational fishing vessel
31-May-09	9:00	8	34.09008	-76.37409	SE	10	3	45°	1	Recreational fishing vessel
31-May-09	9:00	10	34.08880	-76.37240	SE	10	1	45°	1	Recreational fishing vessel

Table 20 (Continued). All fishing vessel sightings in the proposed USWTR site in Onslow Bay, NC for surveys conducted from July 2008 to June 2009.

Date	Time	Way Point	Latitude	Longitude-1	Heading	Track Number	Angle out	Degree Forward	Best #	Comments
31-May-09	9:01	9	34.06507	-76.34458	SE	10	4	45°	1	Recreational fishing vessel
31-May-09	9:02	10	34.04810	-76.32259	SE	10	4	60°	1	Recreational fishing vessel
31-May-09	9:02	11	34.04663	-76.32050	SE	10	2	60°	2	Recreational fishing vessel
31-May-09	9:23	14	33.95637	-76.33518	NW	9	3	30°	1	Recreational fishing vessel
31-May-09	9:24	15	33.98384	-76.36823	NW	9	2	90°	10	Boats widely spaced
31-May-09	9:24	15	33.98382	-76.36815	NW	9	3	45°	6	Recreational fishing vessel
31-May-09	9:27	16	34.04088	-76.44250	NW	9	3	30°	1	Recreational fishing vessel
31-May-09	9:32	17	34.14606	-76.59124	NW	9	4	45°	4	Recreational fishing vessel
31-May-09	9:33	18	34.15934	-76.60824	NW	9	3	60°	2	Recreational fishing vessel
31-May-09	9:38	20	34.15775	-76.72953	SE	8	4	60°	3	Recreational fishing vessel
31-May-09	9:41	21	34.09920	-76.64330	SE	8	3	45°	1	Recreational fishing vessel
31-May-09	9:42	21	34.07478	-76.61164	SE	8	4	90°	1	Recreational fishing vessel
31-May-09	9:44	23	34.04017	-76.56854	SE	8	4	60°	3	Recreational fishing vessel
31-May-09	10:16	26	33.94858	-76.45572	SE	8	2	45°	1	Recreational fishing vessel
31-May-09	10:16	26	33.94737	-76.45452	SE	8	3	90°	6	Recreational fishing vessel
31-May-09	10:17	27	33.92528	-76.42428	SE	8	2	60°	2	Recreational fishing vessel
31-May-09	10:18	28	33.89515	-76.38219	SE	8	3	45°	2	Recreational fishing vessel
31-May-09	10:37	33	33.86441	-76.46453	NW	7	2	60°	1	Recreational fishing vessel
31-May-09	10:38	31	33.89131	-76.49949	NW	7	3	90°	6	Recreational fishing vessel
31-May-09	10:39	32	33.91520	-76.52966	NW	7	1	30°		Fishing vessel
31-May-09	10:39	35	33.91131	-76.52454	NW	7	2	60°	1	Recreational fishing vessel
31-May-09	10:41	33	33.94877	-76.57501	NW	7	3	60°	3	Recreational fishing vessel
31-May-09	10:42	36	33.98812	-76.62606	NW	7	3	30°	1	Recreational fishing vessel
31-May-09	10:43	34	34.00887	-76.65464	NW	7	3	60°	1	Recreational fishing vessel
31-May-09	10:48	35	34.10612	-76.78629	NW	7	1	30°	1	Recreational fishing vessel
31-May-09	10:56	38	33.94837	-76.98004	SE	4	3	90°	2	Recreational fishing vessel
31-May-09	10:57	39	33.92244	-76.94325	SE	4	2	45°	1	Recreational fishing vessel
31-May-09	10:58	40	33.91806	-76.93670	SE	4	3	45°	1	Recreational fishing vessel
31-May-09	11:01	40	33.83520	-76.82976	SE	4	1	110°	1	Recreational fishing vessel
31-May-09	11:03	41	33.78269	-76.75828	SE	4	3	45°	1	Recreational fishing vessel
31-May-09	11:05	42	33.74497	-76.70363	SE	4	4	30°	3	Recreational fishing vessel
31-May-09	12:02	50	33.58334	-76.62928	NW	3	3	45°	1	Recreational fishing vessel
31-May-09	12:06	52	33.67653	-76.74901	NW	3	4	45°	1	Recreational fishing vessel
31-May-09	12:12	50	33.83456	-76.95897	NW	3	3	45°	1	Yacht
31-May-09	12:12	54	33.83636	-76.96177	NW	3	2	45°	1	
31-May-09	12:15	55	33.90365	-77.05245	NW	3	3	45°	2	Recreational fishing vessel
31-May-09	14:14	62	33.77389	-77.14220	SE	1	2	90°	1	Recreational fishing vessel
31-May-09	14:15	63	33.75676	-77.11565	SE	1	2	90°	1	Recreational fishing vessel
31-May-09	14:18	64	33.70316	-77.04471	SE	1	3	90°	1	Recreational fishing vessel
31-May-09	14:19	58	33.68075	-77.01638	SE	1	2	30°	2	Recreational fishing vessel
31-May-09	14:20	65	33.66205	-76.99472	SE	1	3	90°	1	Recreational fishing vessel
31-May-09	14:22	67	33.59991	-76.91432	SE	1	1	90°	1	Recreational fishing vessel
31-May-09	14:22	59	33.61275	-76.93335	SE	1	2	45°	1	Recreational fishing vessel
31-May-09	14:23	68	33.58688	-76.89506	SE	1	3	90°	1	Recreational fishing vessel
31-May-09	14:47	73	33.65462	-76.84911	NW	2	2	90°	1	Recreational fishing vessel
31-May-09	14:47	64	33.64917	-76.84266	NW	2	2	45°	2	Recreational fishing vessel

Table 20 (Continued). All fishing vessel sightings in the proposed USWTR site in Onslow Bay, NC for surveys conducted from July 2008 to June 2009.

Date	Time	Way Point	Latitude	Longitude-1	Heading	Track Number	Angle out	Degree Forward	Best #	Comments
31-May-09	14:49	65	33.70634	-76.91962	NW	2	4	90°	1	Recreational fishing vessel
31-May-09	14:50	75	33.71577	-76.93412	NW	2	3	120°	1	Recreational fishing vessel
31-May-09	14:51	76	33.74727	-76.96624	NW	2	3	90°	1	Recreational fishing vessel
31-May-09	14:52	77	33.76349	-76.98893	NW	2	3	90°	1	Recreational fishing vessel
31-May-09	14:56	66	33.84626	-77.09346	NW	2	1	30°	1	Recreational fishing vessel
31-May-09	15:13	81	34.15806	-76.60535	SE	9	2	90°	1	Recreational fishing vessel
31-May-09	15:13	82	34.14383	-76.58215	SE	9	1	90°	1	Recreational fishing vessel
31-May-09	15:14	83	34.13395	-76.56970	SE	9	3	90°	1	Recreational fishing vessel
31-May-09	15:16	84	34.08632	-76.50391	SE	9	3	90°	1	Recreational fishing vessel
31-May-09	15:16	85	34.07979	-76.49547	SE	9	3	90°	1	Recreational fishing vessel
31-May-09	15:17	87	34.05309	-76.45953	SE	9	3	90°	1	Recreational fishing vessel
31-May-09	15:17	69	34.07320	-76.48823	SE	9	3	30°	1	Recreational fishing vessel
31-May-09	15:18	88	34.04252	-76.44669	SE	9	2	90°	1	Recreational fishing vessel
31-May-09	15:18	89	34.03619	-76.43861	SE	9	2	90°	1	Recreational fishing vessel
31-May-09	15:19	90	34.02249	-76.41783	SE	9	3	90°	1	Recreational fishing vessel
31-May-09	15:19	91	34.02005	-76.41408	SE	9	1	90°	1	Recreational fishing vessel
31-May-09	15:19	70	34.00829	-76.39947	SE	9	3	30°	2	Recreational fishing vessel
31-May-09	15:20	92	33.99570	-76.38602	SE	9	3	90°	3	Recreational fishing vessel
31-May-09	15:20	71	33.98600	-76.37053	SE	9	2	60°	1	Recreational fishing vessel
31-May-09	15:22	93	33.96181	-76.33654	SE	9	3	90°	1	Recreational fishing vessel
31-May-09	15:31	96	33.79053	-76.03628	SE	9	1	90°	1	Sailboat
31-May-09	15:41	99	34.01949	-76.28083	NW	10	3	100°	1	Recreational fishing vessel
31-May-09	15:43	100	34.05291	-76.33617	NW	10	3	90°	1	Recreational fishing vessel
31-May-09	15:53	103	34.17704	-76.50996	NW	10	1	90°	1	Recreational fishing vessel
31-May-09	15:57	79	34.26891	-76.60911	NW	10	2	30°	1	Recreational fishing vessel
1-Jun-09	9:59	5	33.87818	-76.75325	SE	5	1	90°	1	Recreational fishing vessel
1-Jun-09	10:01	7	33.83674	-76.69891	SE	5	3	60°	1	Recreational fishing vessel
1-Jun-09	10:39	11	33.84880	-76.57665	NW	6	3	90°	1	Recreational fishing vessel
1-Jun-09	10:48	14	34.04424	-76.84339	NW	6	3	90°	1	Recreational fishing vessel
1-Jun-09	11:08	25	34.02908	-76.68681	SE	7	1	90°	1	Recreational fishing vessel
1-Jun-09	11:10	22	33.97174	-76.60860	SE	7	3	90°	1	Recreational fishing vessel
1-Jun-09	11:13	26	33.91286	-76.52969	SE	7	1	90°	1	Sail boat
1-Jun-09	11:18	29	33.86982	-76.47661	SE	7	2	90°	1	Recreational fishing vessel
1-Jun-09	11:19	30	33.85142	-76.44963	SE	7	3	90°	1	Recreational fishing vessel
1-Jun-09	11:38	33	33.93902	-76.43165	NW	8	2	90°	1	Recreational fishing vessel
1-Jun-09	11:51	38	34.07193	-76.60959	NW	8	3	90°	1	Recreational fishing vessel
1-Jun-09	11:53	31	34.11927	-76.66502	NW	8	4	90°	1	Recreational fishing vessel
1-Jun-09	12:00	36	34.16405	-76.61550	SE	9	4	90°	1	Head boat
1-Jun-09	12:03	42	34.11266	-76.54450	SE	9	1	90°	1	Recreational fishing vessel
1-Jun-09	12:07	38	33.99957	-76.38849	SE	9	3	135°	1	Recreational fishing vessel
1-Jun-09	12:08	39	33.98047	-76.36898	SE	9	4	90°	2	Recreational fishing vessel
1-Jun-09	12:08	43	33.99341	-76.38208	SE	9	2	90°	10	Recreational fishing vessel
1-Jun-09	12:08	44	33.97476	-76.36158	SE	9	3	90°	2	Recreational fishing vessel
1-Jun-09	12:38	45	34.02313	-76.28281	NW	10	2	90°	4	Recreational fishing vessel
1-Jun-09	12:39	52	34.04852	-76.31739	NW	8	3	90°	1	Recreational fishing vessel
1-Jun-09	12:53	55	34.25146	-76.58285	NW	8	1	90°	3	Recreational fishing vessel

Table 20 (Continued). All fishing vessel sightings in the proposed USWTR site in Onslow Bay, NC for surveys conducted from July 2008 to June 2009.

Date	Time	Way Point	Latitude	Longitude-1	Heading	Track Number	Angle out	Degree Forward	Best #	Comments
1-Jun-09	14:52	57	33.96097	-76.98842	SE	4	3	45°	1	Recreational fishing vessel
1-Jun-09	15:05	60	33.67508	-76.61151	SE	4	4	45°	1	Recreational fishing vessel
1-Jun-09	15:26	71	33.67311	-76.75174	NW	3	4	90°	1	Recreational fishing vessel
1-Jun-09	15:31	63	33.78344	-76.89090	NW	3	4	60°	1	Recreational fishing vessel
1-Jun-09	15:41	74	33.83252	-77.08241	SE	2	3	45°	1	Recreational fishing vessel
1-Jun-09	15:42	67	33.80933	-77.05423	SE	2	1	60°	1	Recreational fishing vessel
1-Jun-09	15:43	75	33.79002	-77.03035	SE	2	3	60°	1	Recreational fishing vessel
1-Jun-09	16:22	80	33.67618	-76.88225	SE	2	4	60°	1	Recreational fishing vessel
1-Jun-09	17:31	91	33.71689	-77.06661	NW	1	2	90°	1	
1-Jun-09	17:33	78	33.77404	-77.14093	NW	1	1	45°	1	Recreational fishing vessel
2-Jun-09	9:09	4	34.03761	-76.82988	SE	6	4	90°	1	Sail boat
2-Jun-09	10:09	12	33.94466	-76.83870	NW	5	3	45°	1	Recreational fishing vessel
2-Jun-09	10:15	11	33.94455	-76.96786	SE	4	4	90°	1	Recreational fishing vessel
2-Jun-09	10:16	12	33.92505	-76.94171	SE	4	3	90°	1	Head boat
2-Jun-09	10:19	15	33.86039	-76.85367	SE	4	3	60°	1	Recreational fishing vessel
2-Jun-09	10:20	13	33.82827	-76.81977	SE	4	3	90°	1	Recreational fishing vessel
2-Jun-09	10:21	14	33.81357	-76.79928	SE	4	4	90°	1	Recreational fishing vessel
2-Jun-09	10:46	20	33.70233	-76.78595	NW	3	4	45°	1	Recreational fishing vessel
2-Jun-09	10:49	19	33.75417	-76.85349	NW	3	1	90°	1	Recreational fishing vessel
2-Jun-09	10:53	20	33.86521	-76.99550	NW	3	3	90°	1	Head boat
2-Jun-09	10:53	21	33.84942	-76.97655	NW	3	1	90°	1	Recreational fishing vessel
2-Jun-09	10:59	25	33.83867	-77.09091	SE	2	2	45°	1	Recreational fishing vessel
2-Jun-09	11:23	25	33.74897	-76.97846	SE	2	3	90°	1	Recreational fishing vessel
2-Jun-09	11:27	26	33.67421	-76.87487	SE	2	3	90°	1	Head boat
2-Jun-09	12:01	36	33.61999	-76.93812	NW	1	4	30°	1	Head boat
2-Jun-09	12:01	31	33.62971	-76.95068	NW	1	4	90°	1	Recreational fishing vessel
2-Jun-09	12:04	32	33.67923	-77.02017	NW	1	3	90°	2	Recreational fishing vessel
2-Jun-09	12:06	37	33.72723	-77.07590	NW	1	4	45°	1	Recreational fishing vessel
2-Jun-09	12:07	38	33.76306	-77.12878	NW	1	3	60°	1	Recreational fishing vessel
2-Jun-09	14:00	40	34.22877	-76.55226	SE	10	2	90°	2	Two small boats with lots of buoys
2-Jun-09	14:00	41	34.20859	-76.52912	SE	10	4	30°	1	Recreational fishing vessel
2-Jun-09	14:04	43	34.11846	-76.41178	SE	10	1	90°	1	Recreational fishing vessel
2-Jun-09	14:05	44	34.10624	-76.39640	SE	10	1	90°	1	Recreational fishing vessel
2-Jun-09	14:06	47	34.08216	-76.36564	SE	10	2	45°	1	Recreational fishing vessel
2-Jun-09	14:06	45	34.09209	-76.37830	SE	10	1	90°	1	Recreational fishing vessel
2-Jun-09	14:07	46	34.06405	-76.34315	SE	10	4	90°	1	Recreational fishing vessel
2-Jun-09	14:08	48	34.03339	-76.30400	SE	10	2	45°	1	Recreational fishing vessel
2-Jun-09	14:08	48	34.03483	-76.30566	SE	10	2	90°	1	Recreational fishing vessel
2-Jun-09	14:31	54	33.99183	-76.38030	NW	9	3	90°	1	Recreational fishing vessel
2-Jun-09	14:31	54	33.99139	-76.37966	NW	9	4	90°	1	Recreational fishing vessel
2-Jun-09	14:46	57	34.12808	-76.68080	SE	8	4	90°	2	Recreational fishing vessel
2-Jun-09	14:49	59	34.06381	-76.59602	SE	8	4	90°	1	Recreational fishing vessel
2-Jun-09	14:50	58	34.02253	-76.54579	SE	8	3	45°	1	Recreational fishing vessel
2-Jun-09	14:53	61	33.95435	-76.45751	SE	8	4	30°	2	Recreational fishing vessel
2-Jun-09	15:18	65	33.87454	-76.47600	NW	7	2	90°	2	Recreational fishing vessel
2-Jun-09	15:20	66	33.90724	-76.52172	NW	7	2	90°	1	Recreational fishing vessel

Table 20 (Continued). All fishing vessel sightings in the proposed USWTR site in Onslow Bay, NC for surveys conducted from July 2008 to June 2009.

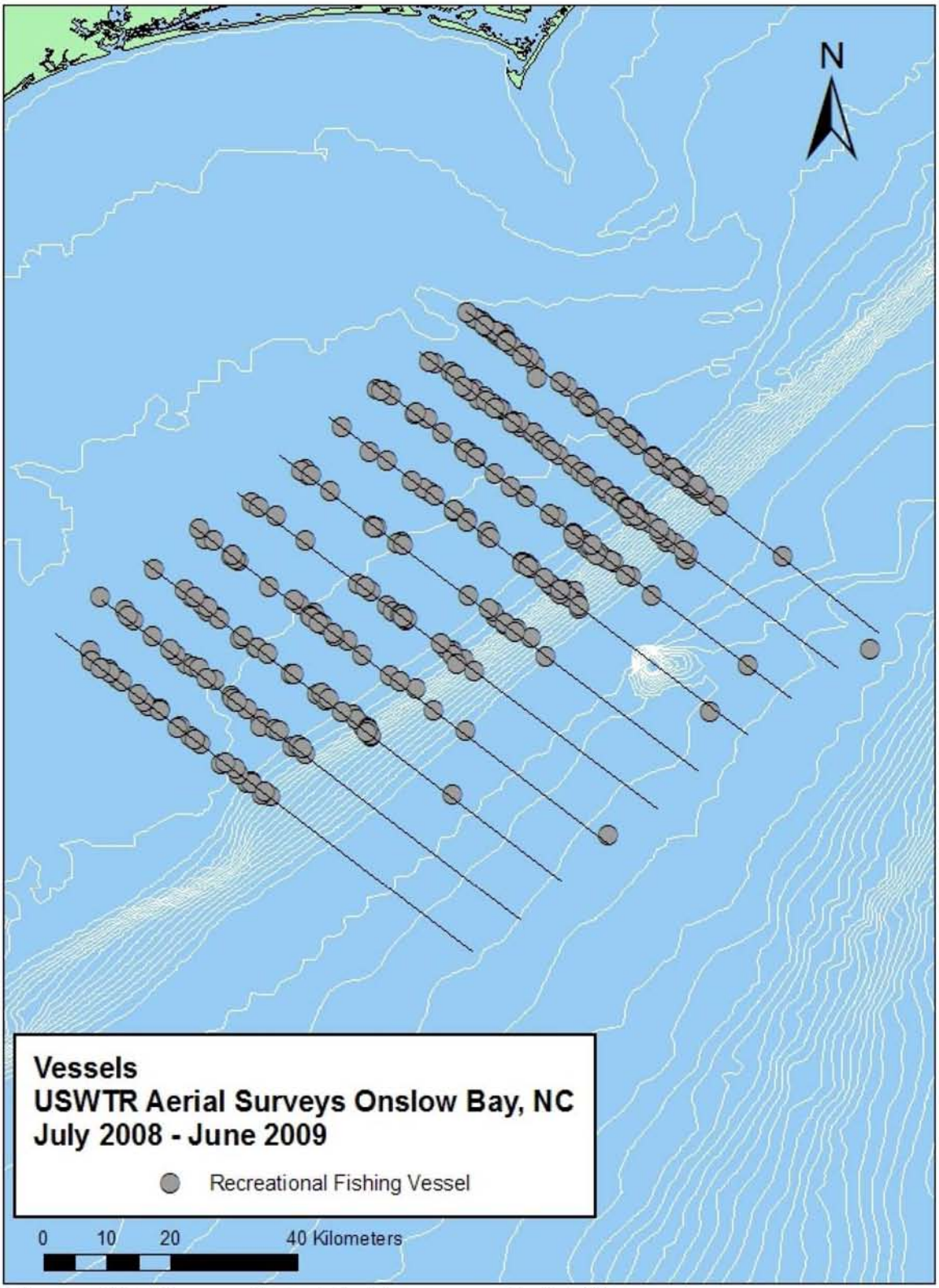

Figure 16. Recreational fishing vessel sightings.

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Date:_____ **Pilot:**_____ **Co-Pilot:**_____ **Page**_____

Left Observer :_____ **Right Observer:**_____ **Hobbs:**_____

Time	Waypoint #	Event	Heading	Track #	Obsrv #	Visibility	BSS	Cloud	Glare L	Glare R	Horizontal degree	Vertical Angle	Sighting Cue	Species	Reliability	Min #	Max #	Best Est	Comme

Appendix B

Codes for Variables on USWTR Aerial Survey Data Sheet

Date: YYYYMMDD **Track#:** opportunistic track line=99

Event:

1.1 = On effort/on track
1.2 = Off effort

3.1 = Change in environmental conditions

10.0 = Opportunistic sighting(s)
PF = Preflight
XB = Cross Beach
WU = Wheels Up
WD = Wheels Down
TE = Transit Leg on Effort

2.0 = Sighting-breaking track/off effort (real time)
2.2 = Sighting of commercial fishing vessel
2.3 = Vessel sighting
2.4 = Sighting of marine mammal (real location)
2.41 = Location of Sighting Cue, No Animals sighted
2.42 = Break from sighting
2.7 = Sighting of sea turtle (real location)
2.8 = Sighting of large vessel (Military, commercial, etc.)
2.9 = Unidentified sighting, requires comments

Sighted by: 1= pilot 2= co-pilot 3= observer left side 4= observer right side

Confidence of cue
1 = definite
2 = probable
3 = possible/unsure

Visibility:
1 = clear to horizon
2 = half the distance to the horizon
3 = less than half the distance to the horizon

Sea State:
0 = slick, calm, mirror-like
1 = small waves
2 = whitecaps 0-33%, waves 1-2 feet
3 = whitecaps 33-50%, waves 2-3 feet
4 = whitecaps 50-65%, waves 3-5 feet
5 = whitecaps >65%, waves >5 feet
6 = too rough too survey

Sighting Cues:
1 = Blow
2 = Splash
3 = Body Part
4 = Breach
5 = Other (needs comments)

Cloud Cover:
01 = clear
02 = partly cloudy
03 = continuous layer of clouds
04 = rain
05 = haze
99 = other, requires comments

Vertical Angle is given in rough increments of 20 degrees with 1 being directly on the trackline and 5 being anything outside of survey wide to horizon

Horizontal Angle is given assuming the nose of the plane is 0 degrees and directly off the wing is 90 degrees – measurements are taken from 1-180 on each side of the plane.

Glare
0 = No glare 1 = 0-25 %
2 = 25 -50 % 3 = >50%

Appendix B

Species List for Aerial Surveys		
Common Name	**Scientific Name**	**Species Code**
Cetaceans		
North Atlantic right whale	*Eubalaena glacialis*	Egl
minke whale	*Balaenoptera acutorostrata*	Bac
sei whale	*Balaenoptera borealis*	Bbo
fin whale	*Balaenoptera physalis*	Bph
Brydes whale	*Balaenoptera edeni*	Bed
humpback whale	*Megaptera novaeangliae*	Mno
unidentified balaenopterid	Family *Balaenopteridae*	BALA
sperm whale	*Physeter catadon*	Pca
pygmy sperm whale	*Kogia breviceps*	Kbr
dwarf sperm whale	*Kogia simus*	Ksi
unidentified Kogia	*Kogia* spp.	KOGI
bottlenose whale	*Hyperodon ampullatus*	Ham
Cuvier's beaked whale	*Ziphius cavirostris*	Zca
Mesoplodon beaked whale	Genus *Mesoplodon*	MESO
unidentified beaked whale	Family *Ziphiidae*	ZIPH
harbor porpoise	*Phocoena phocoena*	Pph
killer whale	*Orcinus orca*	Oor
melon-headed whale	*Peponocephala electra*	Pel
pygmy killer whale	*Feresa attenuata*	Fat
false killer whale	*Pseudorca crassidens*	Pcr
Risso's dolphin	*Grampus griseus*	Ggr
long-finned pilot whale	*Globicephala melaena*	Gme
short-finned pilot whale	*Globicephala macrorhynchus*	Gma
unidentified pilot whale	Genus *Globicephala*	GLOB
rough-toothed dolphin	*Steno bredanensis*	Sbr
Atlantic white-sided dolphin	*Lagenorhynchus acutus*	Lac
Fraser's dolphin	*Lagenodelphis hosei*	Lho
common dolphin	*Delphinus delphis*	Dde
bottlenose dolphin	*Tursiops truncatus*	Ttr
spotted dolphin	*Stenella frontalis*	Sfr
striped dolphin	*Stenella coeruleoalba*	Sco
spinner dolphin	*Stenella clymene*	Scl
unidentified *Stenella*	Genus *Stenella*	STEN
unidentified delphinid	Family *Delphinidae*	DELP
unidentified cetacean		CETA
Pinnipeds		
gray seal	*Halichoerus grypus*	Hgr
harbor seal	*Phoca vitulina*	Pvi
harp seal	*Phoca groenlandica*	Pgr
hooded seal	*Cystophora cristata*	Ccr
unidentified phocid	Family *Phocidae*	PHOC
Sea Turtles		
loggerhead	*Caretta caretta*	Cca
leatherback	*Dermochelys coriacea*	Dco
green	*Chelonia mydas*	Cmy
Kemp's ridley	*Lepidochelys kempii*	Lke
hawksbill	*Eretmochelys imbricata*	Eim
unidentified sea turtle		TURT
Other interesting sightings		
basking shark	*Cetorhinus maximus*	Cma
manta ray	*Manta birostris*	Mbi
ocean sunfish	*Mola mola*	Mmo
spotted eagle-ray	*Aetobatus narinari*	Ana
Unidentified elasmobranch Unidentified marine vertebrate		CHON VERT

Date:_____ - UNCW USWTR Aerial Survey - Sighting #_____

Sighting Data Sheet

Initial Sighting on Track

Time:_____ WP:_____ Sighting Cue:_____

Confidence: 1 2 3 4 Vertical Angle: 1 2 3 4 Horizontal Bearing in Degrees:_____

Observer:_____ Observer Side: L R

Beaufort Sea State: _____ Track Line: _____

Actual Time and Position of Sighting

Time: _____ WP #:_____

Species: _____ Numbers: (Low/ High/ Best):____/____/____

Photographer:_____ Frame Numbers: _____ to _____ Spacer:_____

Final Time and Position of Sighting

Time: _____ WP#: _____

Behavior and Additional Comments:

Complete Sighting Summaries.

Compiled here are all sighting summaries for animals seen during the July 2008-June 2009 USWTR Onslow Bay survey season. Each of the 64 on effort cetacean sightings is represented along with four additional sightings. Sighting 1 on July 16, 2008 and sighting 2 on October 16, 2008 were off effort sightings that occurred during transit between two USWTR track-lines. Sighting 2 on June 1, 2009 occurred within the USWTR range but was seen by the flights co-pilot and is thus recorded as an off effort sighting. Finally a summary was included for the right whale sighting made on December 30, 2008. This sighting was made a few miles off the coast of the north end of Wrightsville Beach and is included because of it importance in the conservation of the species.

Wednesday, July 16, 2008 Sighting # 1

Initial sighting on Track

Time: NA WP#: NA Lat: NA Long: NA
Vertical Angle: 2 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: Off Trackline: between 2 - 3 Beaufort Sea State: 1
Observer: PBN Observer side: Left

Actual Time and Position of Sighting

Time: 15:26 WP#: 60 Lat: 33.450539 Long: -76.458058
Species: *Grampus griseus* Numbers (Low/High/Best): 15 / 25 / 20
Features used in Species ID: Blunt or square head, body color dark with light "suspenders" on flanks, tall falcate dorsal fin.
Representative images used for Species ID: 666, 672, 673, 678
Photographer: RJM Frame numbers: 639 to 690 Spacer: None
Calculated distance from Trackline: NA

Final Time and Position of Sighting

Time: NA WP#: NA Lat: NA Long: NA
Calculated Distance Traveled: NA

Behavior and Additional Comments

When first sighted 3 to 5 animals "surfing" front side of waves, later group increased its rate of travel and began preforming low leaps and breaches. Heavy rains during the sighting. Animals leaping and fast "erratic movements, and non directional travel. Group spread out over hundreds of meters, split into smaller sub-groups of pairs, trios or groups of 4-5. Calves were observed

Thursday, July 17, 2008 Sighting # 1

Initial sighting on Track

Time: 9:45 WP#: 8 Lat: 33.860647 Long: -76.078314
Vertical Angle: 3 Horizontal Bearing in Degrees: 60 Sighting Cue: Body
On/Off Effort: On Trackline: 10 Beaufort Sea State: 3
Observer: RJM Observer side: Left

Actual Time and Position of Sighting

Time: 9:44 WP#: 9 Lat: 33.86417 Long: -76.080665
Species: *Globicephala macrorhynchus* Numbers (Low/High/Best): 12 / 20 / 18
Features used in Species ID: Dark body, square melon, robust dorsal fin situated ~ 1/3 of the way back the animals body.
Representative images used for Species ID: 698, 703, 711, 712, 722, 724, 725, 731, 739, 752, 754
Photographer: PBN Frame numbers: 692 to 793 Spacer: 794
Calculated distance from Trackline: 0.5 km

Final Time and Position of Sighting

Time: 9:54 WP#: 11 Lat: 33.860877 Long: -76.077699
Calculated Distance Traveled: 0.5 km

Behavior and Additional Comments

Animals moving slowly and spending much of the time below the surface. Initial sighting was of a group of 4 to 6 animals near the original group exhibiting the same behavior. After circling the animals for a short period, individuals began moving closer to one another but did not change any other behavior. Calves were observed

Thursday, July 17, 2008 Sighting # 2

Initial sighting on Track

Time: 11:00 WP#: 26 Lat: 33.767799 Long: -76.341207
Vertical Angle: 1 Horizontal Bearing in Degrees: 90 Sighting Cue: Splash
On/Off Effort: On Trackline: 7 Beaufort Sea State: 3
Observer: RJM Observer side: Left

Actual Time and Position of Sighting

Time: 11:02 WP#: 27 Lat: 33.764159 Long: -76.349701
Species: *Tursiops truncatus* Numbers (Low/High/Best): 25 / 30 / 30
Features used in Species ID: Short rostrum, uniform gray lateral coloration, robust body, and a broad based dorsal fin.
Representative images used for Species ID: 804, 807, 831, 833, 834, 836
Photographer: PBN Frame numbers: 795 to 840 Spacer: 841
Calculated distance from Trackline: 0.9 km

Final Time and Position of Sighting

Time: 11:06 WP#: 31 Lat: 33.768778 Long: -76.365262
Calculated Distance Traveled: 1.5 km

Behavior and Additional Comments

Animals in three closely paced groups following one another and traveling fast. Animals broke the surface briefly while surfacing to breathe and created large splashes and bubble trails.

No calves were observed

Thursday, July 17, 2008 Sighting # 3

Initial sighting on Track

Time: 11:44 WP#: 40 Lat: 33.692073 Long: -76.378848
Vertical Angle: 3 Horizontal Bearing in Degrees: 120 Sighting Cue: Splash
On/Off Effort: On Trackline: 6 Beaufort Sea State: 2
Observer: RJM Observer side: Left

Actual Time and Position of Sighting

Time: 11:45 WP#: 41 Lat: 33.698622 Long: -76.380418
Species: *Tursiops truncatus* Numbers (Low/High/Best): 8 / 12 / 12
Features used in Species ID: Robust body appearance, uniform gray color with light shoulder blaze ending behind the dorsal fin. Short rostrum with crease at the intersection with the melon.
Representative images used for Species ID: 857, 860, 862, 864, 865, 868, 871, 873
Photographer: PBN Frame numbers: 852 to 877 Spacer: 878
Calculated distance from Trackline: 0.7 km

Final Time and Position of Sighting

Time: 11:51 WP#: 42 Lat: 33.700454 Long: -76.37529
Calculated Distance Traveled: 0.5 km

Behavior and Additional Comments

Animals were moving in a closely packed group swimming very fast and causing a large splash when surfacing. Individuals overlapping and changing position within the group as they continued in one direction.

No calves were observed

Friday, July 17, 2009 Sighting # 4

Initial sighting on Track

Time: 11:44 WP#: 40 Lat: 33.692073 Long: -76.37885
Vertical Angle: 3 Horizontal Bearing in Degrees: 120 Sighting Cue: Body
On/Off Effort: On Trackline: 6 Beaufort Sea State: 2
Observer: RJM Observer side: Left

Actual Time and Position of Sighting

Time: 11:54 WP#: 43 Lat: 33.703817 Long: -76.380409
Species: *Globicephala macrorhynchus* Numbers (Low/High/Best): 10/12/12
Features used in Species ID: Dark body, bulbous/square melon, backwards sloping dorsal fin positioned far anterior on animal
Representative images used for Species ID: 847, 850, 893, 897, 900, 904, 912, 913, 916, 929, 933
Photographer: PBN Frame numbers: 842 - 972 Spacer: 973
Calculated distance from Trackline: 1.3 km

Final Time and Position of Sighting

Time: 12:09 WP#: 44 Lat: 33.709303 Long: -76.37812
Calculated Distance Traveled: 0.7 km

Behavior and Additional Comments

Group made up of singles or pairs of animals in a well spaced line. During almost the entire observation period individuals were hanging at the surface holding very still taking occasional breaths. At first there were around 7 animals "resting" at the surface but by the end of the encounter all animals were hanging at the surface. There were calves observed.

2 August 2008 Sighting # 1

Initial sighting on Track

Time: 10:54 WP#: 25 Lat: 33.791186 Long: -76.791186
Vertical Angle: 2 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Trackline: 3 Beaufort Sea State: 2
Observer: RJM Observer side: Right

Actual Time and Position of Sighting

Time: 10:56 WP#: 26 Lat: 33.789778 Long: -76.893012
Species: *Stenella frontalis* Numbers (Low/High/Best): 21/23/22
Features used in Species ID: White rostrum tip, coloration patterns (spots, blaze on flanks, alternating dark and light "bands" when viewed from above)
Representative images used for Species ID: 1123, 1124, 1128, 1129, 1130, 1134, 1136, 1141
Photographer: RJM Frame numbers: 1102 - 1143 Spacer: 1144
Calculated distance from Trackline: 0.6 km

Final Time and Position of Sighting

Time: 11.01 WP#: 22 Lat: 33.789455 Long: -76.890461
Calculated Distance Traveled: 0.2 km

Behavior and Additional Comments

Animals traveling "in a long line". Four mother/calf pairs, at least two of the calves seemed very small.

Tuesday, August 4, 2009 Sighting # 1

Initial sighting on Track

Time: 12:37 WP#: 44 Lat: 34.01310 Long: -76.26651
Vertical Angle: 3 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Trackline: 10 Beaufort Sea State: 2
Observer: PBN Observer side: Left

Actual Time and Position of Sighting

Time: 12:38 WP#: 45 Lat: 34.01133 Long: -76.27702
Species: *Tursiops truncatus* Numbers (Low/High/Best): 9/11/9
Features used in Species ID: Short rostrums, gray, sturdy/stocky, darker dorsal cape evident on some animals
Representative images used for Species ID: 1159, 1162, 1164, 1168, 1175, 1177
Photographer: RJM Frame numbers: 1145 - 1183 Spacer: 1184
Calculated distance from Trackline: 1.0 km

Final Time and Position of Sighting

Time: 12:51 WP#: 46 Lat: 34.01169 Long: -76.28705
Calculated Distance Traveled: 0.9 km

Behavior and Additional Comments

Fast travel, lots of splashes. Long dive times, lost dolphins several times (in BSS 2 with good sighting conditions) - evasive behavior of feeding? One mother/calf pair (calf seemed very small, less then half of the length of the mother).

15 October 2008 Sighting # 1

Initial sighting on Track

Time: 9:40 WP#: 6 Lat: 33.621686 Long: -76.421251
Vertical Angle: 3 Horizontal Bearing in Degrees: 60 Sighting Cue: Body
On/Off Effort: On Trackline: 5 Beaufort Sea State: 3
Observer: RJM Observer side: Right

Actual Time and Position of Sighting

Time: 9:41 WP#: 7 Lat: 33.616653 Long: -76.415914
Species: *Tursiops truncatus* Numbers (Low/High/Best): 20/30/25
Features used in Species ID: Sturdy animals with short rostrums, distinct high cape
Representative images used for Species ID: 1286, 1302, 1306 - 1308
Photographer: RJM Frame numbers: 1271 - 1312 Spacer: None
Calculated distance from Trackline: 0.7 km

Final Time and Position of Sighting

Time: 9:51 WP#: 8 Lat: 33.618865 Long: -76.421931
Calculated Distance Traveled: 0.6 km

Behavior and Additional Comments

Spaced out group - loose aggregation. Overall shape, size and color of animals seem to indicate T. truncatus. Subgroups of 2-4 animals in each spread out over a few hundred meters. Fairly quick travel.

No calves were observed.

Thursday, October 15, 2009 Sighting # 2

Initial sighting on Track

Time: 13:59 WP#: 39 Lat: 34.082779 Long: -76.756875
Vertical Angle: 2 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Trackline: 7 Beaufort Sea State: 2
Observer: PBN Observer side: Left

Actual Time and Position of Sighting

Time: 14:02 WP#: 40 Lat: 34.088073 Long: -76.760254
Species: *Tursiops truncatus* Numbers (Low/High/Best): 3/3/3
Features used in Species ID: Fairly large, falcate dorsal fin, over all sturdy impression, short rostrums, dark high cape
Representative images used for Species ID: 1313, 1317, 1318, 1323, 1326
Photographer: RJM Frame numbers: 1313 - 1357 Spacer: None
Calculated distance from Trackline: 0.7 km

Final Time and Position of Sighting

Time: 14:12 WP#: 41 Lat: 34.098269 Long: -76.764306
Calculated Distance Traveled: 1.2 km

Behavior and Additional Comments

Slow traveling, mainly subsurface. Close together.

No calves were observed.

15 October 2008 Sighting # 3

Initial sighting on Track

Time: 14:45 WP#: 50 Lat: 33.891100 Long: -76.373233
Vertical Angle: 2 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Trackline: 8 Beaufort Sea State: 3
Observer: RJM Observer side: Right

Actual Time and Position of Sighting

Time: 14:46 WP#: 51 Lat: 33.892292 Long: -76.370334
Species: *Tursiops truncatus* Numbers (Low/High/Best): 16 / 22 / 19
Features used in Species ID: High, distinct dark gray cape, falcate dorsal fin, short rostrum
Representative images used for Species ID: 1361 - 1363, 1374, 1375, 1381 - 1383, 1390, 1391
Photographer: RJM Frame numbers: 1358 - 1404 Spacer: None
Calculated distance from Trackline: 0.3 km

Final Time and Position of Sighting

Time: 14:51 WP#: 52 Lat: 33.888667 Long: -76.366554
Calculated Distance Traveled: 0.5 km

Behavior and Additional Comments

Traveling in a "bent" line, in sub-groups of 2 to 4, separated by tens of meters, looks like Tursiops.

No calves were observed.

16 October 2008 Sighting # 1

Initial sighting on Track

Time: 15:11 WP#: 40 Lat: 33.42462 Long: -76.556023
Vertical Angle: 3 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Trackline: 2 Beaufort Sea State: 2
Observer: RJM Observer side: Right

Actual Time and Position of Sighting

Time: 15:11 WP#: 41 Lat: 33.432662 Long: -76.562262
Species: *Tursiops truncatus* Numbers (Low/High/Best): 1/1/1
Features used in Species ID: Short rostrum length, robust body, lateral blaze ending behind dorsal fine, white coloration on dorsal side of peduncle
Representative images used for Species ID: 1416, 1418, 1419, 1421, 1423, 1430,1432, 1438-1442
Photographer: PBN Frame numbers: 1407 - 1446 Spacer: 1447
Calculated distance from Trackline: 1.065 km

Final Time and Position of Sighting

Time: 15:14 WP#: 42 Lat: 33.437478 Long: -76.563115
Calculated Distance Traveled: 0.54113 km

Behavior and Additional Comments

Single animal moving mainly subsurface with fairly good disturbance at surface when surfacing.

No calves were observed.

16 October 2008 Sighting # 2

Initial sighting on Track

Time: N/A WP#: N/A Lat: N/A Long: N/A
Vertical Angle: 3 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: Off Trackline: 1 and 2 Beaufort Sea State: 2
Observer: PBN Observer side: Right

Actual Time and Position of Sighting

Time: 15:19 WP#: 45 Lat: 33.370941 Long: -76.551326
Species: *Tursiops truncatus* Numbers (Low/High/Best): 2/2/2
Features used in Species ID: Short rostrum, robust body, blaze ending behind dorsal fin, rounded dorsal fin
Representative images used for Species ID: 1454, 1461 - 1465, 1472, 1474, 1477 - 1480
Photographer: PBN Frame numbers: 1448 - 1485 Spacer: 1486
Calculated distance from Trackline: N/A

Final Time and Position of Sighting

Time: N/A WP#: N/A Lat: N/A Long: N/A
Calculated Distance Traveled: N/A

Behavior and Additional Comments

No calves were observed.

23 November 2008 Sighting # 1

Initial sighting on Track

Time: 09:35 WP#: 6 Lat: 34.255539 Long: -77.351924
Vertical Angle: 3 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Trackline: 10 Beaufort Sea State: 1
Observer: RJM Observer side: Right

Actual Time and Position of Sighting

Time: 9:35 WP#: 7 Lat: 34.241088 Long: -77.355752
Species: *Stenella frontalis* Numbers (Low/High/Best): 25/40/30
Features used in Species ID: Coloration pattern, blaze on flanks, white rostrum tip

Representative images used for Species ID: 1593, 1594, 1603, 1606, 1607, 1615, 1616
Photographer: RJM Frame numbers: 1591-1617 Spacer: 1618
Calculated distance from Trackline: 1.6 km

Final Time and Position of Sighting

Time: 09.43 WP#: 8 Lat: 34.245668 Long: -77.356000
Calculated Distance Traveled: 0.5 km

Behavior and Additional Comments

Three groups - active. Lots of surface activity. Track Line was an on effort
transit from shore to track line 10. On effort but not in range.

No calves were observed.

23 November 2008 Sighting # 2

Initial sighting on Track

Time: 10:30 WP#: 23 Lat: 33.865154 Long: -76.083604
Vertical Angle: 2 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Trackline: 10 Beaufort Sea State: 2
Observer: PBN Observer side: Left

Actual Time and Position of Sighting

Time: 10:31 WP#: 24 Lat: 33.8732 Long: -76.085829
Species: *Tursiops truncatus* Numbers (Low/High/Best): 40/50/45
Features used in Species ID: Light caudal peduncle, distinctive dark gray dorsal cape, short rostrum

Representative images used for Species ID: 1648, 1650, 1651, 1654, 1656, 1657, 1658
Photographer: RJM Frame numbers: 1638-1658 Spacer: 1659
Calculated distance from Trackline: 0.9 km

Final Time and Position of Sighting

Time: 10:37 WP#: 26 Lat: 33.868425 Long: -76.094426
Calculated Distance Traveled: 0.95 km

Behavior and Additional Comments

In two groups, not bunched up. "Leisurely" travel.

Calves were observed.

Sunday, November 23, 2008 Sighting # 3

Initial sighting on Track

Time: 10:52 WP#: 30 Lat: 33.951376 Long: -76.327504
Vertical Angle: 3 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Trackline: 9 Beaufort Sea State: 2
Observer: RJM Observer side: Right

Actual Time and Position of Sighting

Time: 10:53 WP#: 31 Lat: 33.953335 Long: -76.328943
Species: *Tursiops truncatus* Numbers (Low/High/Best): 12/15/13
Features used in Species ID: Dark gray dorsal cape, light dorsal caudal peduncle

Representative images used for Species ID: 1664, 1665, 1671, 1672, 1676, 1677
Photographer: RJM Frame numbers: 1660 - 1686 Spacer: 1687
Calculated distance from Trackline: 0.25 km

Final Time and Position of Sighting

Time: 10:58 WP#: 32 Lat: 33.951673 Long: -76.330678
Calculated Distance Traveled: 0.24 km

Behavior and Additional Comments

Lots of activity, looks like social interaction (chasing). A shark observed in the group of dolphins - the latter seemed to ignore the former. Tight group - lots of white water.

No calves were observed.

23 November 2008 Sighting # 4

Initial sighting on Track

Time: 11:31 WP#: 42 Lat: 33.844468 Long: -76.312427
Vertical Angle: 2 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Trackline: 8 Beaufort Sea State: 2
Observer: PBN Observer side: Left

Actual Time and Position of Sighting

Time: 11:32 WP#: 43 Lat: 33.846505 Long: -76.310977
Species: *Tursiops truncatus* Numbers (Low/High/Best): 19/23/21
Features used in Species ID: Short rostrum, gray, with darker gray cape, light peduncle

Representative images used for Species ID: 1692 - 1695, 1704, 1706
Photographer: RJM Frame numbers: 1688 - 1709 Spacer: 1710
Calculated distance from Trackline: 0.26 km

Final Time and Position of Sighting

Time: N/A WP#: N/A Lat: N/A Long: N/A
Calculated Distance Traveled: N/A

Behavior and Additional Comments

Lots of activity - "chasing" - feeding or socializing?

No calves were observed.

23 November 2008 Sighting # 5

Initial sighting on Track

Time: 15:50 WP#: 76 Lat: 33.67022 Long: -77.00662
Vertical Angle: 3 Horizontal Bearing in Degrees: 120 Sighting Cue: Splash
On/Off Effort: On Trackline: 1 Beaufort Sea State: 2
Observer: PBN Observer side: Left

Actual Time and Position of Sighting

Time: 15:52 WP#: 90 Lat: 33.657244 Long: -77.008915
Species: *Stenella frontalis* Numbers (Low/High/Best): 20/40/30
Features used in Species ID: Alternating dark and light color patterns, white rostrum tip, blaze on flanks
Representative images used for Species ID: 1756, 1796, 1797, 1804, 1805
Photographer: RJM Frame numbers: 1726 - 1617 Spacer: 1618
Calculated distance from Trackline: 1.5 km

Final Time and Position of Sighting

Time: 16:08 WP#: 91 Lat: 33.651022 Long: -77.017208
Calculated Distance Traveled: 1.0 km

Behavior and Additional Comments

Fast moving, not showing a lot. In singles and small groups of up to five animals. Group spread out over several hundred meters.

No calves were observed.

30 December 2008 Sighting # 1

Initial sighting on Track

Time: 10:56 WP#: 11 Lat: 34.22702 Long: -77.68047
Vertical Angle: NA Horizontal Bearing in Degrees: N/A Sighting Cue: Body
On/Off Effort: Off Trackline: N/A Beaufort Sea State: 2
Observer: RJM Observer side: Left

Actual Time and Position of Sighting

Time: 10:56 WP#: 12 Lat: 34.224482 Long: -77.684875
Species: *Eubalaena glacialis* Numbers (Low/High/Best): 2/2/2
Features used in Species ID: Unmistakable; large, black, rotund whale, lacking a dorsal fin and with multiple white callosities on head
Representative images used for Species ID: 2511 - 2513, 2535, 2545, 2721, 2726, 2738
Photographer: PBN Frame numbers: 2499 - 2745 Spacer: N/A
Calculated distance from Trackline: 0.49 km

Final Time and Position of Sighting

Time: 11:18 WP#: 19 Lat: 34.229141 Long: -77.688053
Calculated Distance Traveled: 0.59

Behavior and Additional Comments

Right whale cow/calf pair, female later identified by UNCW and NEAq as Eg # 2223 - "Calvin". The calf seemed small, spent a lot of time around the head of female. The general direction of travel was south. Midway into sighting small recreational vessel (a "Carolina Skiff") approached whales with 100-150m. Three attempts made from plane to contact vessel via VHF 16, no contact was made. Reported to USCG.

Saturday, February 7, 2009 Sighting # 1

Initial sighting on Track

Time: 9:46 WP#: 11 Lat: 33.719172 Long: -76.410534
Vertical Angle: 2 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Trackline: 6 Beaufort Sea State: 3
Observer: ECW Observer side: Left

Actual Time and Position of Sighting

Time: 9:49 WP#: 13 Lat: 33.708546 Long: -76.412508
Species: *Tursiops truncatus* Numbers (Low/High/Best): 40 / 60 / 50
Features used in Species ID: Robust body type, compact rostrum with clear crease at melon, uniform gray body coloration withlight blaze terminating behind dorsal fin.
Representative images used for Species ID: 9, 34, 36, 38, 39
Photographer: RJM Frame numbers: 1 to 40 Spacer: 41
Calculated distance from Trackline: 1.196 km

Final Time and Position of Sighting

Time: 9:53 WP#: 14 Lat: 33.709904 Long: -76.418734
Calculated Distance Traveled: 0.5954 km

Behavior and Additional Comments

Animals were widely spaced traveling singly or in pairs in a southeast direction. Animals spent most of their time just below the surface with some diving deeper and occasionally swimming belly to belly.

No calves were observed

Saturday, February 7, 2009 Sighting # 2

Initial sighting on Track

Time: 11:29 WP#: 39 Lat: 33.973833 Long: -76.23032
Vertical Angle: 2 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Trackline: 10 Beaufort Sea State: 3
Observer: RJM Observer side: Right

Actual Time and Position of Sighting

Time: 11:30 WP#: 40 Lat: 33.974045 Long: -76.215818
Species: *Tursiops truncatus* Numbers (Low/High/Best): 20 / 40 / 30
Features used in Species ID: Light caudal peduncle, distinctive dark gray dorsal cape, short rostrum, shoulder blaze to behind dorsal fin.
Representative images used for Species ID: 54, 61, 64, 79
Photographer: RJM Frame numbers: 49 to 80 Spacer: 81
Calculated distance from Trackline: 1.337 km

Final Time and Position of Sighting

Time: 11:32 WP#: 41 Lat: 33.976973 Long: -76.222186
Calculated Distance Traveled: 0.6714 km

Behavior and Additional Comments

Animals were traveling southwest just below the surface in a dispersed group with some animals preforming shallow dives.

No calves were observed

Saturday, February 7, 2009 Sighting # 3

Initial sighting on Track

Time: 14:15 WP#: 54 Lat: 33.791670 Long: -76.900267
Vertical Angle: 2 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Trackline: 3 Beaufort Sea State: 3
Observer: RJM Observer side: Right

Actual Time and Position of Sighting

Time: 14:20 WP#: 55 Lat: 33.791982 Long: -76.899026
Species: *Stenella frontalis* Numbers (Low/High/Best): 30 / 50 / 40
Features used in Species ID: Shoulder blaze, white tip to beak and spotting pattern on flanks of body.
Representative images used for Species ID: 211, 215 and 217
Photographer: RJM Frame numbers: 194 to 244 Spacer: 245
Calculated distance from Trackline: 0.1198 km

Final Time and Position of Sighting

Time: 14:27 WP#: 56 Lat: 33.790089 Long: -76.909362
Calculated Distance Traveled: 0.9781 km

Behavior and Additional Comments

Animals were traveling quickly just below the surface occasionally jumping out of the water while surfacing. Group would disperse and then reform with animals traveling in many directions while within the group.

Saturday, February 7, 2009 Sighting # 4

Initial sighting on Track

Time: 14:46 WP#: 61 Lat: 33.638620 Long: -76.839465
Vertical Angle: 1 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Trackline: 2 Beaufort Sea State: 3
Observer: ECW Observer side: Left

Actual Time and Position of Sighting

Time: 14:49 WP#: 63 Lat: 33.642891 Long: -76.833414
Species: *Stenella frontalis* Numbers (Low/High/Best): 70 / 100 / 90
Features used in Species ID: Shoulder blaze, white tipped beak and spotting pattern on flanks of body.
Representative images used for Species ID: 253, 254, 258, 277, 278, 281, 285, 290, 292, 297
Photographer: RJM Frame numbers: 246 to 305 Spacer: 306
Calculated distance from Trackline: 0.7344 km

Final Time and Position of Sighting

Time: 14:57 WP#: 64 Lat: 33.654001 Long: -76.823448
Calculated Distance Traveled: 1.542 km

Behavior and Additional Comments

A large number of animals but well dispersed with majority in small groups of 2-3. Animals appear to be milling, traveling in all different directions, swimming just below the surface with conspicuous surfacing. One group branched off and formed a bigger group but then dispersed again.

Tuesday, February 17, 2009 Sighting # 1

Initial sighting on Track

Time: 14:39 WP#: 36 Lat: 34.08356 Long: -76.496163
Vertical Angle: 2 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Trackline: 9 Beaufort Sea State: 3
Observer: RJM Observer side: Left

Actual Time and Position of Sighting

Time: 14:42 WP#: 38 Lat: 34.08632 Long: -76.500645
Species: *Stenella frontalis* Numbers (Low/High/Best): 28 / 35 / 30
Features used in Species ID: Alternating light and dark dorsal areas, white rostrum tip, and spotted appearance on sides.
Representative images used for Species ID: 4219, 4220, 4223, 4226, 4234, 4250
Photographer: PBN Frame numbers: 4208 to 4255 Spacer: 4256
Calculated distance from Trackline: 0.5 km

Final Time and Position of Sighting

Time: 14:48 WP#: 39 Lat: 34.09173 Long: -76.496073
Calculated Distance Traveled: 0.7 km

Behavior and Additional Comments

Animals traveling away from track line in a tight bunch close to the surface. A slow rate of travel in a variety of directions was observed (milling)

No calves were observed

Wednesday, March 4, 2009 Sighting # 1

Initial sighting on Track

Time: 10:45 WP#: 21 Lat: 33.763459 Long: -76.184182
Vertical Angle: 3 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Trackline: 8 Beaufort Sea State: 4
Observer: RJM Observer side: Right

Actual Time and Position of Sighting

Time: NA WP#: NA Lat: NA Long: NA
Species: *Unidentified Delphinid* Numbers (Low/High/Best): 3 / 3 / 3
Features used in Species ID:
Representative images used for Species ID: NA
Photographer: NA Frame numbers: NA Spacer: NA
Calculated distance from Trackline: NA

Final Time and Position of Sighting

Time: NA WP#: NA Lat: NA Long: NA
Calculated Distance Traveled: NA

Behavior and Additional Comments

A group of three dolphins with no seen after the initial sighting cue.

No calves were observed

Wednesday, March 4, 2009 Sighting # 2

Initial sighting on Track

Time: 14:12 WP#: 36 Lat: 33.768266 Long: -76.737506
Vertical Angle: 3 Horizontal Bearing in Degrees: 110 Sighting Cue: Body
On/Off Effort: On Trackline: 4 Beaufort Sea State: 3
Observer: PBN Observer side: Left

Actual Time and Position of Sighting

Time: 14:16 WP#: 37 Lat: 33.770836 Long: -76.734183
Species: *Stenella frontalis* Numbers (Low/High/Best): 15 / 16 / 15
Features used in Species ID: Overall color pattern of alternating light and dark areas with a white tip to rostrum and a light shoulder blaze
Representative images used for Species ID: 4887, 4891, 4904, 4905, 4915, 4919
Photographer: RJM Frame numbers: 4883 to 4935 Spacer: 4936
Calculated distance from Trackline: 0.4195 km

Final Time and Position of Sighting

Time: 14:22 WP#: 38 Lat: 33.761217 Long: -76.722312
Calculated Distance Traveled: 1.532 km

Behavior and Additional Comments

Animals look small during initial sighting sequence. Animals formed a "disorganized" group with multiple changes in direction and where loosely associated. Overall coloration pattern suggested Stenella frontalis

No calves were observed

Wednesday, March 4, 2009 Sighting # 3

Initial sighting on Track

Time: 15:09 WP#: 52 Lat: 33.669594 Long: -76.885527
Vertical Angle: 3 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Trackline: 2 Beaufort Sea State: 2
Observer: PBN Observer side: Left

Actual Time and Position of Sighting

Time: 15:10 WP#: 53 Lat: 33.672379 Long: -76.886136
Species: *Stenella frontalis* Numbers (Low/High/Best): 90 / 110 / 100
Features used in Species ID: Light blaze on flank, alternating light and dark areas starting with white tip of rostrum
Representative images used for Species ID: 4961, 4965, 4973-4974, 4980, 5012
Photographer: RJM Frame numbers: 4937 to 5018 Spacer: 5019
Calculated distance from Trackline: 0.3148 km

Final Time and Position of Sighting

Time: NA WP#: NA Lat: None taken Long: None taken
Calculated Distance Traveled: NA

Behavior and Additional Comments

Large group, split into two groups. Apparent social interactions. Loose, "disorganized" group. Fast movements, low leaping surfacings, belly to belly swimming. Group created lots of splashes and white water.

No calves were observed

Thursday, March 5, 2009 Sighting # 1

Initial sighting on Track

Time: 9:19 WP#: 5 Lat: 34.11273 Long: -76.410002
Vertical Angle: 3 Horizontal Bearing in Degrees: 90 Sighting Cue: Splash
On/Off Effort: On Trackline: 10 Beaufort Sea State: 1
Observer: RJM Observer side: Left

Actual Time and Position of Sighting

Time: 9:22 WP#: 6 Lat: 34.11399 Long: -76.41024
Species: *Tursiops truncatus* Numbers (Low/High/Best): 4 / 4 / 4
Features used in Species ID: Uniform gray coloration, blunt rostrum and robust dorsal fin.

Representative images used for Species ID: 5027, 5043, 5055
Photographer: PBN Frame numbers: 5019 to 5061 Spacer: 5062
Calculated distance from Trackline: 0.1418 km

Final Time and Position of Sighting

Time: 9:34 WP#: 7 Lat: 34.11437 Long: -76.39691
Calculated Distance Traveled: 1.228 km

Behavior and Additional Comments

Original sighting of 3 animals were seen splashing at the surface and traveling at a slow rate of speed. During sighting a fourth dolphin was seen at which time animals were in two groups of two and widely spaced from one another. Animals performed faster surfacing and increased rate of speed. Group form 4 and traveled deep to the surface. Calves observed: Yes img 5035

Thursday, March 5, 2009 Sighting # 2

Initial sighting on Track

Time: 10:09 WP#: 19 Lat: 34.09635 Long: -76.515234
Vertical Angle: 3 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Trackline: 9 Beaufort Sea State: 1
Observer: RJM Observer side: Left

Actual Time and Position of Sighting

Time: 10:09 WP#: 20 Lat: 34.09381 Long: -76.519452
Species: *Stenella frontalis* Numbers (Low/High/Best): 10 / 20 / 20
Features used in Species ID: Distinguishing light tip to rostrum followed by dark, light alternating pattern along dorsal body. Small flukes and thin peduncles. Shoulder blaze terminates at level of d fin.
Representative images used for Species ID: 5084, 5085, 5092, 5094, 5111
Photographer: PBN Frame numbers: 5063 to 5136 Spacer: 5137
Calculated distance from Trackline: 0.4802 km

Final Time and Position of Sighting

Time: 10:14 WP#: 21 Lat: 34.09541 Long: -76.525093
Calculated Distance Traveled: 0.5491 km

Behavior and Additional Comments

First group of ten that was originally sighted was spread out in a long line traveling in a follow the leader fashion. A second group o f7 was seen about 200m from the first group. All animals were seen milling close to the surface with frequent surfacing. Animals were seen to be interaction with one another with some animals traveling in close pairs and some belly to belly swimming. No calves seen.

Thursday, March 5, 2009 Sighting # 3

Initial sighting on Track

Time: 10:24 WP#: 28 Lat: 34.12206 Long: -76.680634
Vertical Angle: 3 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Trackline: 8 Beaufort Sea State: 1
Observer: RJM Observer side: Left

Actual Time and Position of Sighting

Time: 10:26 WP#: 29 Lat: 34.12227 Long: -76.67842
Species: *Stenella frontalis* Numbers (Low/High/Best): 20 / 25 / 25
Features used in Species ID: Alternating light, dark coloration along dorsal surface with white at tip of rostrum. Thin caudal peduncle before a narrow smaller fluke.
Representative images used for Species ID: 5149, 5151, 5165, 5176
Photographer: PBN Frame numbers: 5138 to 52203 Spacer: 5204
Calculated distance from Trackline: 0.2051 km

Final Time and Position of Sighting

Time: 10:29 WP#: 30 Lat: 34.12716 Long: -76.684693
Calculated Distance Traveled: 0.7931 km

Behavior and Additional Comments

A line of about 20 animals was sighted heading south across our trackline. Group was evenly spaced and traveling slow and close to the surface where they would surface frequently. Animals showed little change in behavior during the sighting.

No calves sighted

Thursday, March 5, 2009 Sighting # 4

Initial sighting on Track

Time: 10:33 WP#: 32 Lat: 34.04629 Long: -76.573132
Vertical Angle: 3 Horizontal Bearing in Degrees: 120 Sighting Cue: Body
On/Off Effort: On Trackline: 8 Beaufort Sea State: 1
Observer: PBN Observer side: Right

Actual Time and Position of Sighting

Time: 10:37 WP#: 33 Lat: 34.04613 Long: -76.58513
Species: *Tursiops truncatus* Numbers (Low/High/Best): 2 / 2 / 2
Features used in Species ID: Animals with bigger fluke and peduncles than Stenella sp. Dorsal fin was more forward on the body as well.
Representative images used for Species ID: 5208, 5211, 5234, 5235
Photographer: PBN Frame numbers: 5205 to 5236 Spacer: 5237
Calculated distance from Trackline: 1.106 km

Final Time and Position of Sighting

Time: 10:40 WP#: 34 Lat: 34.04273 Long: -76.583253
Calculated Distance Traveled: 0.4157 km

Behavior and Additional Comments

Two animals were seen at the surface and showed little signs of avoidance.

No calves were observed

Thursday, March 5, 2009 Sighting # 5

Initial sighting on Track

Time: 10:43 WP#: 37 Lat: 33.99067 Long: -76.5114
Vertical Angle: 3 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Trackline: 8 Beaufort Sea State: 1
Observer: PBN Observer side: Right

Actual Time and Position of Sighting

Time: 10:44 WP#: 38 Lat: 33.99223 Long: -76.52065
Species: *Stenella frontalis* Numbers (Low/High/Best): 8 / 8 / 8
Features used in Species ID: Alternating light and dark pattern along dorsal surface of animals body. White tip to rostrum, shoulder blaze terminates behind d fin. Clear presence of spotting pattern.
Representative images used for Species ID: 5247, 5276-5279, 5281, 5283, 5302, 5304
Photographer: PBN Frame numbers: 5238 to 5305 Spacer: 5306
Calculated distance from Trackline: 0.8703 km

Final Time and Position of Sighting

Time: 10:50 WP#: 39 Lat: 33.99098 Long: -76.51701
Calculated Distance Traveled: 0.3632 km

Behavior and Additional Comments

A total of 8 animals seen separated into two groups each traveling fast and causing large splashes when surfacing. Second group was more widely spaced than first. As the sighting continued each group began a more leisurely rate of travel with increased time near the surface.
No calves observed

Thursday, March 5, 2009 Sighting # 6

Initial sighting on Track

Time: 11:14 WP#: 46 Lat: 33.67231 Long: -76.214173
Vertical Angle: 1 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Trackline: 7 Beaufort Sea State: 2
Observer: RJM Observer side: Left

Actual Time and Position of Sighting

Time: 11:23 WP#: 47 Lat: 33.69118 Long: -76.21148
Species: *Tursiops truncatus* Numbers (Low/High/Best): 5 / 5 / 5
Features used in Species ID: Animals had robust thoracic region and a a shorter rostrum and crease at junction with melon. High dark dorsal cape. Large set of flukes.
Representative images used for Species ID: 5382, 5401, 5428, 5430, 5431, 5432, 5445
Photographer: PBN Frame numbers: 5307 to 5472 Spacer: 5473
Calculated distance from Trackline: 2.113 km

Final Time and Position of Sighting

Time: 11:24 WP#: 48 Lat: 33.6744 Long: -76.22378
Calculated Distance Traveled: 2.1 km

Behavior and Additional Comments

Initial sighting of 2 animals traveling at moderate speed just below the surface with quick surfacings. An additional 3 animals joined the original group after which the animals spent an increase amount of time deep to the surface while traveling.
No calves were observed

Thursday, March 5, 2009 Sighting # 7

Initial sighting on Track

Time: 11:58 WP#: 66 Lat: 33.89674 Long: -76.646494
Vertical Angle: 1 Horizontal Bearing in Degrees: 120 Sighting Cue: Body
On/Off Effort: On Trackline: 6 Beaufort Sea State: 2
Observer: PBN Observer side: Right

Actual Time and Position of Sighting

Time: 11:59 WP#: 67 Lat: 33.89721 Long: -76.65398
Species: *Stenella frontalis* Numbers (Low/High/Best): 20 / 24 / 24
Features used in Species ID: Animal with alternating light and dark color patterning along dorsal surface. White tips to the rostrum, narrow peduncle and medium sized flukes.
Representative images used for Species ID: 5479, 5488, 5546
Photographer: PBN Frame numbers: 5474 to 5568 Spacer: 5569
Calculated distance from Trackline: 0.6929 km

Final Time and Position of Sighting

Time: 12:06 WP#: 68 Lat: 33.89888 Long: -76.64758
Calculated Distance Traveled: 0.6192 km

Behavior and Additional Comments

About 20 animals seen traveling slowly at the surface. Group condensed after circling began and then split into 3 groups (6, 12, 4) which all continued to travel just below the surface. Largest group spent increased time deep below the surface making them difficult to relocate - this may have been an avoidance behavior. No calves were observed

Thursday, March 5, 2009 Sighting # 8

Initial sighting on Track

Time: 12:37 WP#: 79 Lat: 33.89318 Long: -76.763212
Vertical Angle: 1 Horizontal Bearing in Degrees: 120 Sighting Cue: Body
On/Off Effort: On Trackline: 6 Beaufort Sea State: 2
Observer: PBN Observer side: Right

Actual Time and Position of Sighting

Time: 12:38 WP#: 80 Lat: 33.90157 Long: -76.764022
Species: *Stenella frontalis* Numbers (Low/High/Best): 35 / 35 / 35
Features used in Species ID: Animals with white tips to rostrum, alternating light and dark pattern along body, and should blaze that terminates behind the dorsal fin.
Representative images used for Species ID: 5590, 5592, 5599, 5600
Photographer: PBN Frame numbers: 5576 to 5647 Spacer: 5648
Calculated distance from Trackline: 0.9359 km

Final Time and Position of Sighting

Time: 12:54 WP#: 81 Lat: 33.87423 Long: -76.75903
Calculated Distance Traveled: 3.0 km

Behavior and Additional Comments

Large group of dolphins ~35 fanned out over a large area. Animals showed lots of milling activity seen at the surface. Sighting was cut short because of Mayday call on marine 16 that we responded to.

No calves were observed

Thursday, March 5, 2009 Sighting # 9

Initial sighting on Track

Time: 16:28 WP#: 116 Lat: 33.69154 Long: -77.03411
Vertical Angle: 3 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Trackline: 1 Beaufort Sea State: 1
Observer: PBN Observer side: Right

Actual Time and Position of Sighting

Time: 16:29 WP#: 117 Lat: 33.69901 Long: -77.030164
Species: *Stenella frontalis* Numbers (Low/High/Best): 30 / 30 / 30
Features used in Species ID: Animals had shoulder blaze that terminated behind the dorsal fin and had spotting on both sides. Lots of tactile interactions within group: rolling over, belly showing,ect.
Representative images used for Species ID: 5655, 5657, 5693, 5722
Photographer: PBN Frame numbers: 5649 to 5737 Spacer: 5738
Calculated distance from Trackline: 0.9073 km

Final Time and Position of Sighting

Time: 16:31 WP#: 118 Lat: 33.69822 Long: -77.033015
Calculated Distance Traveled: 0.2 km

Behavior and Additional Comments

Multiple small groups of dolphins were seen scattered over 100-200m area. All animals milling at the surface with lots of belly to belly swimming observed. A single shark was seen nearby the group of dolphins but no apparent interactions were observed.

No calves were observed

Friday, April 24, 2009 Sighting # 1

Initial sighting on Track

Time: 9:48 WP#: 9 Lat: 34.158381 Long: -76.462273
Vertical Angle: 3 Horizontal Bearing in Degrees: 90 Sighting Cue: Splash
On/Off Effort: On Trackline: 10 Beaufort Sea State: 1
Observer: RJM Observer side: Right

Actual Time and Position of Sighting

Time: 9:48 WP#: 10 Lat: 34.151427 Long: -76.468262
Species: *Stenella frontalis* Numbers (Low/High/Best): 50 / 60 / 55
Features used in Species ID: White rostrum tip, light flank blaze and obvious spotting pattern.
Representative images used for Species ID: 5798, 5801, 5817, 5834-36
Photographer: RJM Frame numbers: 5780 to 5853 Spacer: 5854
Calculated distance from Trackline: 0.9 km

Final Time and Position of Sighting

Time: 9:56 WP#: 11 Lat: 34.151094 Long: -76.462907
Calculated Distance Traveled: 0.5 km

Behavior and Additional Comments

Two (22 and 28 minimum) subgroups separated by 100m or so, animals swimming between groups. Fairly fast moving, erratic swimming. Very close group, tight cohesion. Circled animals between 750 and 1000 ft. No avoidance behavior was noted.

No calves were observed

Friday, April 24, 2009 Sighting # 2

Initial sighting on Track

Time: 10:10 WP#: 18 Lat: 33.956824 Long: -76.198993
Vertical Angle: 3 Horizontal Bearing in Degrees: 120 Sighting Cue: Splash
On/Off Effort: On Trackline: 10 Beaufort Sea State: 1
Observer: PBN Observer side: Left

Actual Time and Position of Sighting

Time: 10:11 WP#: 19 Lat: 33.969252 Long: -76.195643
Species: *Tursiops truncatus* Numbers (Low/High/Best): 10 / 11 / 10
Features used in Species ID: Overall elongate body and head shape. Gray body coloration with a light dorsal peduncle region.
Representative images used for Species ID: 5858, 5859
Photographer: RJM Frame numbers: 5855-5873 Spacer: 5874
Calculated distance from Trackline: 1.4 km

Final Time and Position of Sighting

Time: 10:13 WP#: 20 Lat: 33.967295 Long: -76.195643
Calculated Distance Traveled: 0.2 km

Behavior and Additional Comments

Group dove after initial fly over. Small subgrous (e.g. singles, 3's or 4's), separated by 10's to 100's of meters. Lots of subsurface swimming. Circled animals at between 750 and 1000ft with no avoidance behavior observed.

No calves were observed

Friday, April 24, 2009 Sighting # 3

Initial sighting on Track

Time: 10:21 WP#: 26 Lat: 33.871395 Long: -76.098462
Vertical Angle: 1 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Trackline: 10 Beaufort Sea State: 1
Observer: PBN Observer side: Left

Actual Time and Position of Sighting

Time: 10:23 WP#: 27 Lat: 33.871845 Long: -76.097792
Species: *Tursiops truncatus* Numbers (Low/High/Best): 9 / 9 / 10
Features used in Species ID: Dark dorsal cape and light dorsal peduncle region.
Representative images used for Species ID: 5886, 5887, 5892, 5897, 5914, 5915, 5916
Photographer: RJM Frame numbers: 5875 to 5920 Spacer: 5921
Calculated distance from Trackline: 0.08 km

Final Time and Position of Sighting

Time: 10:29 WP#: 28 Lat: 33.869757 Long: -76.102108
Calculated Distance Traveled: 0.5 km

Behavior and Additional Comments

White dorsal peduncle area. Subgroups of 1 to 5, separated by 100's f meters. Slow travel. Animals showed no signs of avoidance behavior.

No calves were observed

Friday, April 24, 2009 Sighting # 4

Initial sighting on Track

Time: 10:40 WP#: 33 Lat: 33.883920 Long: -76.238329
Vertical Angle: 2 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Trackline: 9 Beaufort Sea State: 1
Observer: RJM Observer side: Right

Actual Time and Position of Sighting

Time: 10:45 WP#: 34 Lat: 33.883920 Long: -76.255597
Species: *Tursiops truncatus* Numbers (Low/High/Best): 14 / 16 / 15
Features used in Species ID: Short rostrum, overall gray body coloration and a dark dorsal cape.

Representative images used for Species ID: 5922, 5925, 5935, 5937, 5952
Photographer: RJM Frame numbers: 5922 to 5959 Spacer: 5960
Calculated distance from Trackline: 1.594 km

Final Time and Position of Sighting

Time: 10:52 WP#: 35 Lat: 33.888304 Long: 76.250269
Calculated Distance Traveled: 0.4612 km

Behavior and Additional Comments

Slow travel with not much time spent near the surface. Looks like bottlenose dolphins because of animals long bodies and short beaks. Circled the animals between 750 and 1000 ft and they showed no signs of avoidance.

Friday, April 24, 2009 Sighting # 5

Initial sighting on Track

Time: 10:57 WP#: 39 Lat: 34.013492 Long: -76.408418
Vertical Angle: 2 Horizontal Bearing in Degrees: 45 Sighting Cue: Body
On/Off Effort: On Trackline: 9 Beaufort Sea State: 1
Observer: RJM Observer side: Right

Actual Time and Position of Sighting

Time: 10:58 WP#: 40 Lat: 34.012365 Long: -76.406003
Species: *Stenella frontalis* Numbers (Low/High/Best): 70 / 90 / 80
Features used in Species ID: Light flank blaze, alternating light and dark dorsal coloration pattern. Animals had obvious white tip to their rostrums
Representative images used for Species ID: 5961, 5981, 5983, 5998, 6003
Photographer: RJM Frame numbers: 5961 to 6054 Spacer: 6055
Calculated distance from Trackline: 0.3 km

Final Time and Position of Sighting

Time: 11:06 WP#: 41 Lat: 34.017488 Long: -76.408068
Calculated Distance Traveled: 0.6 km

Behavior and Additional Comments

Group made up of three sub-groups. Close association initially, became looser during the encounter, eventually group spread out over hundreds of meters. Circled animals at between 750 and 1000 ft. Animals showed no signs of avoidance.

Friday, April 24, 2009 Sighting # 6

Initial sighting on Track

Time: 11:21 WP#: 56 Lat: 34.123323 Long: -76.674774
Vertical Angle: 1 Horizontal Bearing in Degrees: 45 Sighting Cue: Body
On/Off Effort: On Trackline: 8 Beaufort Sea State: 1
Observer: PBN Observer side: Left

Actual Time and Position of Sighting

Time: 11:23 WP#: 57 Lat: 34.129500 Long: -76.679869
Species: *Tursiops truncatus* Numbers (Low/High/Best): 2 / 2 / 2
Features used in Species ID: uniform gray body coloration with light gray on dorsal caudal peduncle, broad flukes and a short rostrum.
Representative images used for Species ID: 6093, 6096, 6099, 6104, 6105
Photographer: RJM Frame numbers: 6056 to 6114 Spacer: 6115
Calculated distance from Trackline: 0.8317 km

Final Time and Position of Sighting

Time: 11:31 WP#: 61 Lat: 34.131094 Long: -76.681215
Calculated Distance Traveled: 0.2163 km

Behavior and Additional Comments

Fairly long dive times. Animals showed no signs of avoidance.

No calves were observed

Friday, April 24, 2009 Sighting # 7

Initial sighting on Track

Time: 12:01 WP#: 74 Lat: 33.741955 Long: -76.314136
Vertical Angle: 2 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Trackline: 10 Beaufort Sea State: 3
Observer: PBN Observer side: Left

Actual Time and Position of Sighting

Time: 12:02 WP#: 75 Lat: 33.739365 Long: -76.318960
Species: *Tursiops truncatus* Numbers (Low/High/Best): 30 / 38 / 32
Features used in Species ID: Robust body shape, light gray peduncle, broad flukes, uniform light gray body with a lighter gray blaze terminating behind the dorsal fin.
Representative images used for Species ID: 6125, 6142, 6149, 6168
Photographer: RJM Frame numbers: 6115 to 6189 Spacer: 6190
Calculated distance from Trackline: 0.5309 km

Final Time and Position of Sighting

Time: 12:11 WP#: 76 Lat: 33.736547 Long: -76.323966
Calculated Distance Traveled: 0.559 km

Behavior and Additional Comments

Slow surface travel. Fairly cohesive group. Animals showed no signs of avoidance behavior.

No calves were observed

Friday, April 24, 2009 Sighting # 8

Initial sighting on Track

Time: 12:21 WP#: 82 Lat: 33.957016 Long: -76.588721
Vertical Angle: 2 Horizontal Bearing in Degrees: 120 Sighting Cue: Splash
On/Off Effort: On Trackline: 7 Beaufort Sea State: 1
Observer: PBN Observer side: Left

Actual Time and Position of Sighting

Time: 12:22 WP#: 83 Lat: 33.944397 Long: -76.589046
Species: *Stenella frontalis* Numbers (Low/High/Best): 10 / 10 / 10
Features used in Species ID: White rostrum tip with an alternating light and dark coloration along the body
Representative images used for Species ID: 6199, 6200, 6216, 6223, 6225
Photographer: RJM Frame numbers: 6191 to 6264 Spacer: 6265
Calculated distance from Trackline: 1.4 km

Final Time and Position of Sighting

Time: 12:29 WP#: 84 Lat: 33.954122 Long: -76.584471
Calculated Distance Traveled: 1.1 km

Behavior and Additional Comments

Two subgroups of five animals each traveling leisurely at the surface. Spotting dolphin coloration , but overall body shape similar to Tursiops - determine ID from photographs. No avoidance behavior observed.

No calves were observed

Friday, July 24, 2009 Sighting # 9

Initial sighting on Track

Time: 12:31 WP#: 86 Lat: 33.999281 Long: -76.644279
Vertical Angle: 2 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Trackline: 7 Beaufort Sea State: 1
Observer: PBN Observer side: Left

Actual Time and Position of Sighting

Time: 12:32 WP#: 87 Lat: 33.996132 Long: -76.48635
Species: *Stenella frontalis* Numbers (Low/High/Best): 30 / 45 / 37
Features used in Species ID: Alternating dark and light dorsal color pattern, obvious white rostrum tip, visible spots on lateral surface of animals body.
Representative images used for Species ID: 6279, 6292, 6328
Photographer: RJM Frame numbers: 6267 to 6341 Spacer: 6342
Calculated distance from Trackline: 0.5349 km

Final Time and Position of Sighting

Time: 12:36 WP#: 88 Lat: 33.993872 Long: -76.649991
Calculated Distance Traveled: 0.2807 km

Behavior and Additional Comments

Fast moving animals with quick changes in direction. Very cohesive, tight groups - part of group "in a pile". Circled animal at between 750 and 1000 ft. No avoidance reaction noted.

No calves were observed

Friday, April 24, 2009 Sighting # 10

Initial sighting on Track

Time: 12:39 WP#: 91 Lat: 34.067127 Long: -76.734985
Vertical Angle: 2 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Trackline: 7 Beaufort Sea State: 1
Observer: PBN Observer side: Left

Actual Time and Position of Sighting

Time: 12:39 WP#: 92 Lat: 34.063458 Long: -76.741129
Species: *Tursiops truncatus* Numbers (Low/High/Best): 9 / 9 / 9
Features used in Species ID: Long, "stocky" but elongated dolphins, gray with darker gray cape short rostrum.
Representative images used for Species ID: 6360, 6361, 6365, 6366, 6376
Photographer: RJM Frame numbers: 6343 to 6393 Spacer: 6394
Calculated distance from Trackline: 0.7 km

Final Time and Position of Sighting

Time: 12:45 WP#: 93 Lat: 34.063285 Long: -76.734693
Calculated Distance Traveled: 0.03 km

Behavior and Additional Comments

Socializing, milling and non-directional movement to group. Two sharks (estimate size: <2m) following dolphin group at a distance of approximately 15-20 m. Circled animals between 750 and 1000 ft. No avoidance reaction noted.
No calves were observed

Saturday, April 25, 2009 Sighting # 1

Initial sighting on Track

Time: 10:11 WP#: 18 Lat: 33.820696 Long: -77.071278
Vertical Angle: 3 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Trackline: 2 Beaufort Sea State: 2
Observer: RJM Observer side: Left

Actual Time and Position of Sighting

Time: 10:12 WP#: 19 Lat: 33.813468 Long: -77.070257
Species: *Stenella frontalis* Numbers (Low/High/Best): 16 / 17 / 16
Features used in Species ID: White tip to rostrum with alternating light and dark body coloration. Shoulder blaze ending before or at level of dorsal fin. Spotting pattern over some of the animals bodies.
Representative images used for Species ID: 6140, 6411, 6415, 6418, 6436, 6438, 6454-6460
Photographer: PBN Frame numbers: 6404 to 6465 Spacer: 6466
Calculated distance from Trackline: 0.8 km

Final Time and Position of Sighting

Time: 10:21 WP#: 20 Lat: 33.806721 Long: -77.069029
Calculated Distance Traveled: 0.8 km

Behavior and Additional Comments

Animals were in a dense group traveling slowly at the surface either in a line or bunched closely together. Animals engaged ina lot of subsurface activity and interactions among animals. Body appearance of dolphins somewhat elongated. Circled animals between 750 and 1000ft. No avoidance behavior noted. No calves were observed

Tuesday, May 12, 2009 Sighting # 1

Initial sighting on Track

Time: 11:23 WP#: 33 Lat: 33.80007 Long: -77.17177
Vertical Angle: 3 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Trackline: 1 Beaufort Sea State: 3
Observer: RJM Observer side: Left

Actual Time and Position of Sighting

Time: 11:40 WP#: 35 Lat: 33.80305 Long: -77.16646
Species: *Unidentified Delphinid* Numbers (Low/High/Best): 23 / 27 / 26
Features used in Species ID: Streamlined gray body ~6-7ft long with central positioned dorsal fin. Clear rostrum present, vertical movement of caudal fin, and animals surfacing frequently.
Representative images used for Species ID: No images taken
Photographer: PBN Frame numbers: No images taken Spacer: None
Calculated distance from Trackline: 0.6 km

Final Time and Position of Sighting

Time: 11:48 WP#: 36 Lat: 33.81485 Long: -77.17013
Calculated Distance Traveled: 1.4 km

Behavior and Additional Comments

Animals difficult to relocate because of sea state conditions. Upon initial sighting animals were seen traveling side by side in a loosely packed straight line. Later sightings had animals moving into a denser group with many tactile interactions among individuals. Animals were fairly active while surfacing and spent most of their time just under the surface. Group showed no signs of avoidance. No calves seen

Thursday, May 28, 2009 Sighting # 1

Initial sighting on Track

Time: 9:35 WP#: 9 Lat: 33.452093 Long: -76.718627
Vertical Angle: 3 Horizontal Bearing in Degrees: 110 Sighting Cue: Splash
On/Off Effort: On Trackline: 1 Beaufort Sea State: 2
Observer: PBN Observer side: Right

Actual Time and Position of Sighting

Time: 9:38 WP#: 10 Lat: 33.448227 Long: -76.724387
Species: *Tursiops truncatus* Numbers (Low/High/Best): 50 / 70 / 60
Features used in Species ID: Short rostrum, well-defined crease at beak, slate gray with darker cape, broad-based dorsal fin, light-colored peduncle area, robust thoracic region.
Representative images used for Species ID: 7289, 7298, 7322, 7338, 7366, 7367
Photographer: PBN Frame numbers: 7288 to 7376 Spacer: 7377 to 7379
Calculated distance from Trackline: 0.7 km

Final Time and Position of Sighting

Time: 9:45 WP#: 11 Lat: 33.446113 Long: -76.730376
Calculated Distance Traveled: 0.6 km

Behavior and Additional Comments

Multiple sub groups porpoising quickly, light dorsal peduncle region.

No calves were observed

Thursday, May 28, 2009 Sighting # 2

Initial sighting on Track

Time: 10:58 WP#: 29 Lat: 33.818045 Long: -76.811912
Vertical Angle: 2 Horizontal Bearing in Degrees: 110 Sighting Cue: Body
On/Off Effort: On Trackline: 4 Beaufort Sea State: 1
Observer: REH Observer side: Left

Actual Time and Position of Sighting

Time: 11:00 WP#: 30 Lat: 33.811291 Long: -76.804148
Species: *Stenella frontalis* Numbers (Low/High/Best): 20 / 30 / 25
Features used in Species ID: Pointed, falcate dorsal fin, white-tipped rostrum, alternating light and dark patterning, light-colored blaze below dorsal fin, obvious spotted pattern.
Representative images used for Species ID: 7384, 7388, 7395, 7399, 7414
Photographer: PBN Frame numbers: 7380 to 7419 Spacer: 7420
Calculated distance from Trackline: 1.0 km

Final Time and Position of Sighting

Time: 11:05 WP#: 31 Lat: 33.812074 Long: -76.800995
Calculated Distance Traveled: 0.3 km

Behavior and Additional Comments

One tight group, moving slowly, staying close to the surface, little splashing or white water.

No calves were observed

Thursday, May 28, 2009 Sighting # 3

Initial sighting on Track

Time: 13:39 WP#: 41 Lat: 33.625263 Long: -76.419579
Vertical Angle: 2 Horizontal Bearing in Degrees: 45 Sighting Cue: Splash
On/Off Effort: On Trackline: 5 Beaufort Sea State: 2
Observer: REH Observer side: Left

Actual Time and Position of Sighting

Time: 13:40 WP#: 42 Lat: 33.627112 Long: -76.416079
Species: *Tursiops truncatus* Numbers (Low/High/Best): 30 / 50 / 40
Features used in Species ID: Broad-based dorsal fin, obvious crease between melon and rostrum, short blunt rostrum, robust thoracic region, slate gray, wide flukes, light-colored peduncle area.
Representative images used for Species ID: 7449, 7464, 7465, 7468, 7479, 7480
Photographer: PBN Frame numbers: 7421 to 7484 Spacer: 7485
Calculated distance from Trackline: 0.4 km

Final Time and Position of Sighting

Time: 13:48 WP#: 43 Lat: 33.627083 Long: -76.420899
Calculated Distance Traveled: 0.4 km

Behavior and Additional Comments

Eight to nine sub-groups, porpoising with some splashing and white ater, traveling quickly, widely spread over a larger area.

No calves were observed

Thursday, May 28, 2009 Sighting # 4

Initial sighting on Track

Time: 13:58 WP#: 47 Lat: 33.694522 Long: -76.388631
Vertical Angle: 2 Horizontal Bearing in Degrees: 45 Sighting Cue: Splash
On/Off Effort: On Trackline: 6 Beaufort Sea State: 1
Observer: REH Observer side: Left

Actual Time and Position of Sighting

Time: 14:00 WP#: 48 Lat: 33.690512 Long: -76.386340
Species: *Tursiops truncatus* Numbers (Low/High/Best): 25 / 45 / 35
Features used in Species ID: Short rostrum, borad-based dorsal fin, light-colored caudal peduncle, slate gray individuals with blaze terminating behind dorsal fin.
Representative images used for Species ID: 722, 7423, 7524, 7554
Photographer: PBN Frame numbers: 25 / 45 / 35 Spacer: 7558
Calculated distance from Trackline: 0.8 km

Final Time and Position of Sighting

Time: 14:06 WP#: 49 Lat: 33.690322 Long: -76.385158
Calculated Distance Traveled: 0.1 km

Behavior and Additional Comments

Multiple sub-groups of about 4-6 animals, porpoising quickly.

No calves were observed

Thursday, May 28, 2009 Sighting # 5

Initial sighting on Track

Time: 14:41 WP#: 57 Lat: 33.757755 Long: -76.330783
Vertical Angle: 3 Horizontal Bearing in Degrees: 90 Sighting Cue: Splash
On/Off Effort: On Trackline: 7 Beaufort Sea State: 2
Observer: PBN Observer side: Right

Actual Time and Position of Sighting

Time: 14:43 WP#: 58 Lat: 33.756924 Long: -76.335357
Species: *Tursiops truncatus* Numbers (Low/High/Best): 8 / 12 / 10
Features used in Species ID: Light colored peduncle, robust thoracic region, blunt rostrum, broad based dorsal fin, well defined crease between melon and rostrum.
Representative images used for Species ID: 7570, 7575, 7581, 7582, 7583
Photographer: PBN Frame numbers: 7559 to 7584 Spacer: 7585
Calculated distance from Trackline: 0.4 km

Final Time and Position of Sighting

Time: 14:53 WP#: 59 Lat: 33.751734 Long: -76.341588
Calculated Distance Traveled: 0.8 km

Behavior and Additional Comments

Two sub-groups,one with two animals and one with 8-10, both groups swimming quickly. One animal had a large circular scar on the right side of its dorsal fin.

No calves were observed

30 May 2009 Sighting # 1

Initial sighting on Track

Time: 14:19 WP#: 37 Lat: 33.703545 Long: -76.255636
Vertical Angle: 2 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Trackline: 7 Beaufort Sea State: 1
Observer: RJM Observer side: Right

Actual Time and Position of Sighting

Time: 14:29 WP#: 39 Lat: 33.711527 Long: -76.255299
Species: *Tursiops truncatus* Numbers (Low/High/Best): 3/4/4
Features used in Species ID: Animals displayed robust body, dark dorsal cape, blaze trailing behind dorsal fin, compact rostrum, white coloration on caudal peduncle
Representative images used for Species ID: 7609, 7602-7624, 7652, 7654, 7655, 7657
Photographer: RJM Frame numbers: 7606-7657 Spacer: 7658
Calculated distance from Trackline: 0.9 km

Final Time and Position of Sighting

Time: 14:44 WP#: 40 Lat: 33.722278 Long: -76.257567
Calculated Distance Traveled: 1.2 km

Behavior and Additional Comments

Individuals were spaced widely apart and traveling at 'normal' speeds.

No calves were observed.

30 May 2009 Sighting # 2

Initial sighting on Track

Time: 15:02 WP#: 46 Lat: 34.080650 Long: -76.750043
Vertical Angle: 2 Horizontal Bearing in Degrees: 60 Sighting Cue: Body
On/Off Effort: On Trackline: 7 Beaufort Sea State: 1
Observer: RJM Observer side: Right

Actual Time and Position of Sighting

Time: 15:10 WP#: 47 Lat: 34.075319 Long: -76.745905
Species: *Unidentified Delphinid* Numbers (Low/High/Best): 1/1/1
Features used in Species ID: Due to evasive behavior of animals and short time of encounter, species-identifying images were not obtained
Representative images used for Species ID: 7677
Photographer: RJM Frame numbers: 7659-7678 Spacer: 7679
Calculated distance from Trackline: 0.8 km

Final Time and Position of Sighting

Time: 15:18 WP#: 48 Lat: 34.063018 Long: -76.747865
Calculated Distance Traveled: 1.4 km

Behavior and Additional Comments

One evasive individual observed. Final position is an estimate as animal was not resighted at end of sighting. Individual spent majority of time well under the surface, making clear photographs difficult.

No calves were observed.

Saturday, May 30, 2009 Sighting # 3

Initial sighting on Track

Time: 15:31 WP#: 53 Lat: 33.878143 Long: -76.615686
Vertical Angle: 1 Horizontal Bearing in Degrees: 50 Sighting Cue: Body
On/Off Effort: On Trackline: 6 Beaufort Sea State: 1
Observer: HJF Observer side: Left

Actual Time and Position of Sighting

Time: 15:36 WP#: 54 Lat: 33.885123 Long: -76.611188
Species: *Tursiops truncatus* Numbers (Low/High/Best): 3/3/3
Features used in Species ID: Animals displayed a blunt rostrum, robust dorsal fin, and a shoulder blaze trailing behind dorsal fin
Representative images used for Species ID: 7688, 7689, 7691, 7693, 7694
Photographer: RJM Frame numbers: 7680 - 7702 Spacer: 7703
Calculated distance from Trackline: 0.9 km

Final Time and Position of Sighting

Time: 15:42 WP#: 55 Lat: 33.893453 Long: -76.614049
Calculated Distance Traveled: 1.0 km

Behavior and Additional Comments

Three individuals were traveling side by side.

No calves were observed.

31 May 2009 Sighting # 1

Initial sighting on Track

Time: 9:46 WP#: 22 Lat: 33.986694 Long: -76.497497
Vertical Angle: 3 Horizontal Bearing in Degrees: 100 Sighting Cue: Splash
On/Off Effort: On Trackline: 8 Beaufort Sea State: 2
Observer: REH Observer side: Right

Actual Time and Position of Sighting

Time: 9:47 WP#: 23 Lat: 33.984991 Long: -76.505104
Species: *Tursiops truncatus* Numbers (Low/High/Best): 10/10/10
Features used in Species ID: Short rostrum, broad-based dorsal fin, uniform gray coloration, broad flukes, light-colored peduncles
Representative images used for Species ID: 7712,7727,7730,7748,7753,7795,7798,7813,15,16
Photographer: REH Frame numbers: 7704 - 7817 Spacer: 7818 and 7819
Calculated distance from Trackline: 0.7 km

Final Time and Position of Sighting

Time: 10:14 WP#: 24 Lat: 33.963670 Long: -76.518260
Calculated Distance Traveled: 2.6 km

Behavior and Additional Comments

Group loosely packed, traveling at a moderate rate of speed, fairly good size, light-colored peduncles, surfacing fairly frequently.

No calves were observed.

Sunday, May 31, 2009 Sighting # 2

Initial sighting on Track

Time: 11:07 WP#: 41 Lat: 33.698041 Long: -76.646557
Vertical Angle: 3 Horizontal Bearing in Degrees: 100 Sighting Cue: Splash
On/Off Effort: On Trackline: 4 Beaufort Sea State: 2
Observer: REH Observer side: Right

Actual Time and Position of Sighting

Time: 11:08 WP#: 42 Lat: 33.694609 Long: -76.657794
Species: *Tursiops truncatus* Numbers (Low/High/Best): 8/10/9
Features used in Species ID: Short rostrum, broad-based dorsal fin, uniform gray coloration with a shoulder blaze trailing behind dorsal fin, light-colored peduncle, broad flukes
Representative images used for Species ID: 7841, 7843, 7844, 7851, 7871
Photographer: REH Frame numbers: 7820 - 7885 Spacer: 7886
Calculated distance from Trackline: 1.1 km

Final Time and Position of Sighting

Time: 11:36 WP#: 43 Lat: 33.715870 Long: -76.657162
Calculated Distance Traveled: 2.4 km

Behavior and Additional Comments

Two or three sub-groups of animals initially seen, after circling more animals joined the group which then fanned out into pairs or single animals, spending time below the surface but surfacing frequently, traveling slowly.

No calves were observed.

31 May 2009 Sighting # 3

Initial sighting on Track

Time: 11:43 WP#: 45 Lat: 33.594028 Long: -76.530503
Vertical Angle: 3 Horizontal Bearing in Degrees: 100 Sighting Cue: Splash
On/Off Effort: On Trackline: 4 Beaufort Sea State: 1
Observer: REH Observer side: Right

Actual Time and Position of Sighting

Time: 11:51 WP#: 46 Lat: 33.590568 Long: -76.505697
Species: *Tursiops truncatus* Numbers (Low/High/Best): 12/18/15
Features used in Species ID: Light-colored peduncle, short rostrum, uniform gray coloration, robust thoracic region, some individuals with shoulder blaze terminating behind dorsal fin
Representative images used for Species ID: 7839, 7896, 7899, 7921, 7922, 7923, 7933, 7935
Photographer: REH Frame numbers: 7887 - 7935 Spacer: 7936
Calculated distance from Trackline: 2.3 km

Final Time and Position of Sighting

Time: 11:51 WP#: 47 Lat: 33.590568 Long: -76.505697
Calculated Distance Traveled: 0.0 km

Behavior and Additional Comments

Animals very active at the surface, swimming in a tight bunch, lots of interactions between animals, rolling, showing bellies and milling in one position.

No calves were observed.

Monday, June 1, 2009 Sighting # 1

Initial sighting on Track

Time: 10:02 WP#: 6 Lat: 33.821909 Long: -76.687911
Vertical Angle: 1 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Trackline: 5 Beaufort Sea State: 2
Observer: PBN Observer side: Right

Actual Time and Position of Sighting

Time: 10:05 WP#: 7 Lat: 33.821909 Long: -76.687911
Species: *Tursiops truncatus* Numbers (Low/High/Best): 3/3/3
Features used in Species ID: Stubby rostrum, relatively wide fluke, gray uniform coloration, light caudal peduncle area
Representative images used for Species ID: 7953, 7962
Photographer: PBN Frame numbers: 7937 - 7970 Spacer: 7971
Calculated distance from Trackline: 0.9 km

Final Time and Position of Sighting

Time: N/A WP#: N/A Lat: N/A Long: N/A
Calculated Distance Traveled: N/A

Behavior and Additional Comments

Animals were originally traveling leisurely, but then displayed possible avoidance behaviors, becoming more evasive, and diving as we circled over them. Evasive behavior continued throughout sighting and animals were not relocated for a final position.

No calves were observed.

Monday, June 1, 2009 Sighting # 2

Initial sighting on Track

Time: 10:52 WP#: 17 Lat: 34.055790 Long: -76.723429
Vertical Angle: 2 Horizontal Bearing in Degrees: 125 Sighting Cue: Body
On/Off Effort: Off Trackline: 7 Beaufort Sea State: 1
Observer: WEM Observer side: Right

Actual Time and Position of Sighting

Time: 10:57 WP#: 18 Lat: 34.064991 Long: -76.73628
Species: *Stenella frontalis* Numbers (Low/High/Best): 3/3/3
Features used in Species ID: White rostrum tip, lighter blaze below dorsal fin, fusiform body shape with rapidly - narrowing peduncle
Representative images used for Species ID: 8014, 8015, 8020, 8025
Photographer: PBN Frame numbers: 7972 - 8040 Spacer: 8041
Calculated distance from Trackline: 1.6 km

Final Time and Position of Sighting

Time: 11:02 WP#: 19 Lat: 34.06864 Long: -76.721988
Calculated Distance Traveled: 1.4 km

Behavior and Additional Comments

Animals were traveling leisurely at the surface, and taking nearly vertical dives from the surface.

Calves were observed

Monday, June 1, 2009 Sighting # 3

Initial sighting on Track

Time: 11:03 WP#: 21 Lat: 34.045533 Long: -76.709924
Vertical Angle: 2 Horizontal Bearing in Degrees: 110 Sighting Cue: Body
On/Off Effort: On Trackline: 7 Beaufort Sea State: 1
Observer: PBN Observer side: Right

Actual Time and Position of Sighting

Time: 11:05 WP#: 22 Lat: 34053559 Long: -76.718352
Species: *Stenella frontalis* Numbers (Low/High/Best): 6/8/7
Features used in Species ID: White rostrum, blaze below dorsal fin, alternating light and dark bands starting at rostrum, long rostrum
Representative images used for Species ID: 8043, 8056, 8072
Photographer: PBN Frame numbers: 8042 - 8091 Spacer: 8092
Calculated distance from Trackline: 1.2 km

Final Time and Position of Sighting

Time: 11:06 WP#: 23 Lat: 34.049906 Long: -76.714795
Calculated Distance Traveled: 0.5 km

Behavior and Additional Comments

Two distinct groups observed, one with a minimum of 4 animals and the second with at least 2 individuals.

No calves were observed.

Monday, June 1, 2009 Sighting # 4

Initial sighting on Track

Time: 11:39 WP#: 34 Lat: 33.957429 Long: -76.453764
Vertical Angle: 3 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Trackline: 8 Beaufort Sea State: 2
Observer: PBN Observer side: Right

Actual Time and Position of Sighting

Time: 11:42 WP#: 35 Lat: 33.964068 Long: -76.450177
Species: *Tursiops truncatus* Numbers (Low/High/Best): 2/2/2
Features used in Species ID: Wide fluke, short rostrum, light caudal peduncle, dark cape close to blowhole, well-defined crease between melon and rostrum
Representative images used for Species ID: 8129, 8131 - 8133
Photographer: PBN Frame numbers: 8093 - 8138 Spacer: 8139
Calculated distance from Trackline: 0.8 km

Final Time and Position of Sighting

Time: 11:47 WP#: 36 Lat: 33.966795 Long: -76.445969
Calculated Distance Traveled: 0.5 km

Behavior and Additional Comments

Final position was approximate, and recorded at the last known position that the animal was observed.

No calves were observed.

Monday, June 1, 2009 Sighting # 5

Initial sighting on Track

Time: 12:25 WP#: 48 Lat: 33.927656 Long: -76.17715
Vertical Angle: 1 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Trackline: 8 Beaufort Sea State: 2
Observer: HJF Observer side: Left

Actual Time and Position of Sighting

Time: 12:27 WP#: 49 Lat: 33.927627 Long: -76.170854
Species: *Tursiops truncatus* Numbers (Low/High/Best): 26/30/28
Features used in Species ID: Light caudal peduncle, light blaze terminating at the caudal margin of dorsal fin, robust body, short rostrum, gray coloration with darker gray cape
Representative images used for Species ID: 8143, 8167 - 8171, 8214, 8223, 8259
Photographer: PBN Frame numbers: 8140-8321 Spacer: 8322
Calculated distance from Trackline: 0.6 km

Final Time and Position of Sighting

Time: 12:33 WP#: 50 Lat: 33.932266 Long: -76.1703559
Calculated Distance Traveled: 0.4 km

Behavior and Additional Comments

Distinct subgroups with a few outlying individuals were observed. The two main groups, separated by approximately 200m, consisted of one group with at least 17 individuals, while another coupe of approximately 6 individuals were displaying many simultaneous aerial behaviors.
No calves were observed

Monday, June 1, 2009 Sighting # 6

Initial sighting on Track

Time: 15:44 WP#: 76 Lat: 33.764760 Long: -76.996388
Vertical Angle: 3 Horizontal Bearing in Degrees: 60 Sighting Cue: Body
On/Off Effort: On Trackline: 1 Beaufort Sea State: 1
Observer: RJM Observer side: Left

Actual Time and Position of Sighting

Time: 15:47 WP#: 77 Lat: 33.665030 Long: -76.986169
Species: *Stenella frontalis* Numbers (Low/High/Best): 13/15/13
Features used in Species ID: Alternating bands of light and dark, white rostrum tip, light blaze below dorsal fin
Representative images used for Species ID: 8338, 8369, 8382
Photographer: REH Frame numbers: 8326 - 8396 Spacer: 8397 - 8399
Calculated distance from Trackline: 0.8 km

Final Time and Position of Sighting

Time: 16:16 WP#: 78 Lat: 33.663027 Long: -76.990255
Calculated Distance Traveled: 0.4 km

Behavior and Additional Comments

Group of approximately 13 in fairly close proximity hanging at surface with slow to moderate rate of travel, fanning out into a single file in ones or twos. After initial few circles group more widely spaced, difficult to relocate-possible avoidance.
No calves were observed.

Tuesday, June 2, 2009 Sighting # 7

Initial sighting on Track

Time: 16:41 WP#: 83 Lat: 33.436162 Long: -76.700086
Vertical Angle: 2 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Trackline: 1 Beaufort Sea State: 1
Observer: REH Observer side: Right

Actual Time and Position of Sighting

Time: 16:42 WP#: 84 Lat: 33.437666 Long: -76.695101
Species: *Tursiops truncatus* Numbers (Low/High/Best): 35/40/35
Features used in Species ID: Short rostrum, darker gray cape, wide flukes, light-colored caudal peduncle
Representative images used for Species ID: 8417, 8428, 8552
Photographer: REH Frame numbers: 8400 - 8587 Spacer: 8588 and 8589
Calculated distance from Trackline: 0.5 km

Final Time and Position of Sighting

Time: 17:03 WP#: 85 Lat: 33.463124 Long: -76.682449
Calculated Distance Traveled: 3.0 km

Behavior and Additional Comments

3-4 subgroups hanging at surface splashing with little directional travel. Each group with between 10-15 animals, belly showing and interaction with some tail slapping, splitting into groups of 4-6.

No calves were observed.

Monday, June 1, 2009 Sighting # 8

Initial sighting on Track

Time: 17:14 WP#: 87 Lat: 33.661438 Long: -76.992118
Vertical Angle: 1 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Trackline: 1 Beaufort Sea State: 1
Observer: REH Observer side: Right

Actual Time and Position of Sighting

Time: 17:15 WP#: 88 Lat: 33.665030 Long: -76.986169
Species: *Unidentified Delphinid* Numbers (Low/High/Best): 10/12/11
Features used in Species ID: Although images were somewhat blurry, the following characteristic were observed: white rostrum tip, light blaze below dorsal fin, alternating light and dark bands
Representative images used for Species ID: 8601
Photographer: REH Frame numbers: 8590 - 8622 Spacer: 8623 and 8624
Calculated distance from Trackline: 0.7 km

Final Time and Position of Sighting

Time: 17:28 WP#: 89 Lat: 33.663027 Long: -76.990255
Calculated Distance Traveled: 0.4 km

Behavior and Additional Comments

First sighted as 3 individuals well spaced below trackline. Tight group observed with splashing at surface, 10+ animals upon circling. Based on characteristics observed, species was likely Stenella frontalis. However, few and blurry images were obtained, hence the designation of unidentified Delphinid. No calves were observed.

Tuesday, June 2, 2009 Sighting # 1

Initial sighting on Track

Time: 9:41 WP#: 8 Lat: 33.829613 Long: -76.699445
Vertical Angle: 3 Horizontal Bearing in Degrees: 60 Sighting Cue: Body
On/Off Effort: On Trackline: 5 Beaufort Sea State: 1
Observer: RJM Observer side: Left

Actual Time and Position of Sighting

Time: 9:43 WP#: 9 Lat: 33.824363 Long: -76.702676
Species: *Tursiops truncatus* Numbers (Low/High/Best): 7/9/8
Features used in Species ID: Uniform gray coloration, light-colored peduncle, broad flukes

Representative images used for Species ID: 8627, 8638, 8642, 8653, 8658
Photographer: HJF Frame numbers: 8625 - 8659 Spacer: 8660 and 8661
Calculated distance from Trackline: 0.7 km

Final Time and Position of Sighting

Time: 10:04 WP#: 10 Lat: 33.819708 Long: -76.708385
Calculated Distance Traveled: 0.7 km

Behavior and Additional Comments

Loose groups traveling in single file formation in ones or two's. Animals very elusive traveling mainly well below the surface and only surfacing briefly. Upon resighting animal only found 2 animals - still being elusive.

No calves were observed.

Tuesday, June 2, 2009 Sighting # 2

Initial sighting on Track

Time: 11:01 WP#: 26 Lat: 33.79862 Long: -77.04353
Vertical Angle: 3 Horizontal Bearing in Degrees: 110 Sighting Cue: Body
On/Off Effort: On Trackline: 2 Beaufort Sea State: 1
Observer: HJF Observer side: Right

Actual Time and Position of Sighting

Time: 11:03 WP#: 27 Lat: 33.79092 Long: -77.0461
Species: *Stenella frontalis* Numbers (Low/High/Best): 3/6/5
Features used in Species ID: White-tipped rostrum, dramatic difference in coloration between smaller, more uniformly colored animal and larger animal with spotting and distinct blaze
Representative images used for Species ID: 8705c, 8712c, 8713c, 8714c
Photographer: HJF Frame numbers: 8662 - 8715 Spacer: 8716
Calculated distance from Trackline: 0.9 km

Final Time and Position of Sighting

Time: 11:21 WP#: 28 Lat: 33.78057 Long: -77.03863
Calculated Distance Traveled: 1.2 km

Behavior and Additional Comments

Initial group of 5 or 6 but upon resight only a pair seen - pair traveling slowly at the surface with most of time spent deep to the surface.

No calves were observed.

Tuesday, June 2, 2009 Sighting # 3

Initial sighting on Track

Time: 11:35 WP#: 30 Lat: 33.48153 Long: -76.63095
Vertical Angle: 1 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Trackline: 1 Beaufort Sea State: 1
Observer: HJF Observer side: Right

Actual Time and Position of Sighting

Time: 11:36 WP#: 31 Lat: 33.47349 Long: -76.63398
Species: *Tursiops truncatus* Numbers (Low/High/Best): 20 / 28 / 25
Features used in Species ID: Short rostrum, robust body appearance, light-colored peduncle, broad flukes, narrow blaze that terminates behind the dorsal fin.
Representative images used for Species ID: 8723c, 8724c, 8725c, 8733c, 8761c, 8764c, 8766c
Photographer: HJF Frame numbers: 8717 to 8771 Spacer: 8772
Calculated distance from Trackline: 0.9 km

Final Time and Position of Sighting

Time: 11:44 WP#: 32 Lat: 33.46859 Long: -76.63349
Calculated Distance Traveled: 0.5 km

Behavior and Additional Comments

Multiple smaller groups of 2 to 4 animals traveling slowly and surfacing frequently. initially only a few animals seen while circling group size grew to 25 animals.

Calves were observed

Appendix E

Notes on the Sighting Summary Sheet

The Sighting Summary, adapted from the Sighting Data Sheet used in the field (Fig. 3), integrates data gathered in the field with results from lab analyses to provide a full summary of each marine mammal sighting. A Sighting Summary was completed for all sightings, including sightings made while off-effort during transits between survey legs, as well as sighting cues which where never relocated.

The Sighting Summary sheet is broken into four sections; "Initial Sighting on Track", "Time and Position of Sighting", "Final Time and Position of Sighting", and "Behavior and Additional Comments". Each section and sub headings will be detailed below.

Initial Sighting on Track

Time*:* The time the break track GPS way-point was taken

WP#: GPS way-point number of the break track

Lat/Long: The latitude and longitude associated with the break track way-point

Track Line: The track line surveyed when the sighting was made

On/Off Effort: Whether the sighting was made during an active survey track line (i.e. On effort) or during transit BETWEEN track lines (i.e. off effort). Sightings made during off effort transit to and from the range are NOT included in the sighting summaries.

Sighting Cue: Whether the initial sighting was a splash, a breach or body part.

Vertical Angle: Vertical "angle" between 1 and 4, the lower edge of view ("1") to the horizon ("4"). A subjective and relative measure of how far away from the track line the initial sighting occurred.

Horizontal Bearing in Degrees: The horizontal degrees from front to back (0 to 180) at which the sighting occurred.

Observer: Three lettered initial of the observer who made the sighting

Observer Side: On which side of the plane in the direction of travel the sighting occurred.

Time and Position of Sighting

Time*:* The time the GPS way-point was taken while relocating animals and circling above

WP#: GPS way-point number of the sighting

Lat/Long: The latitude and longitude associated with the way point obtained while circling over animals

Beaufort Sea State: The sea state observed during the sighting

Species: Scientific binomial name of the marine mammal species involved in the sighting. When species identity could not be established unequivocally, the next higher taxonomic level to which identity could be established was used. If a cetacean was identified as a dolphin but images obtained during the encounter were not sufficient to establish species ID, the designation "unidentified delphinid" or "*T. truncatus/S. frontalis*" was used. The next higher level used was unidentified cetacean. If a large body was observed but

it could not be established whether a cetacean, fish/shark or turtle was involved in the sighting, the designation "unidentified marine vertebrate" was used.

Criteria used to identify species: Which species specific diagnostic features were used in classifying a sighting to species.

Best images used for species ID: The images obtained during the sighting that best displayed the features used to establish species.

Numbers (Low/ High/ Best): Low, high, and best estimate of number of animals involved in the sighting.

Calves observed? Whether any calves were observed during the encounter. A conservative measure was used, in that only animals roughly half the size of the associated larger animal (the presumed mother) were designated as calves.

Calculated Distance from Track Line: The distance between the break track way-point and the initial sighting way-point. For more information on how distance was calculated and errors inherent in this method, refer to the "Methods" section.

Photographer: Three lettered initials of observer seated in the right camera seat.

Card #: Memory card on which the photos from the particular sighting was made.

Frame Numbers: Starting and ending frame number

Spacer: Image used to separate sighting to clarify when one sighting ends and the next begins. Image typically of interior of plane or a 45 degree angle shot of the horizon.

Final Time and Position of Sighting

Time: WP#: Lat: Long: Calculated Distance traveled: ➔ see section above

Behavior and Additional Comments

Any behavioral notes obtained during the sighting (*e.g.* group formation, relative travel speed, feeding events or presumed copulation attempts, presence of other cetaceans or sharks in or around the animal(s) in the sighting, interaction with inanimate objects such marine debris). This section also includes notes on altitude of the survey plane during the encounter as well as any indications (or lack thereof) of the animal(s) reacting evasively to the presence of the plane.

Appendix F

Date:_____

USWTR Daily Plane Log Sheet

Pilot in Command:_____ Second in Command:_____

Observers:_____

Plane:_____

Time take off: _____ HOBBS Start:_____

Land for lunch:_____

Track Lines and Direction (e.g. N to S) Flown:_____

Take off after lunch:_____ HOBBS Stop:_____

Land:_____ HOBBS Total:_____

Track Lines and Direction (e.g. N to S) Flown:_____

Overall weather:_____

General Observations

_____

_____

_____

_____

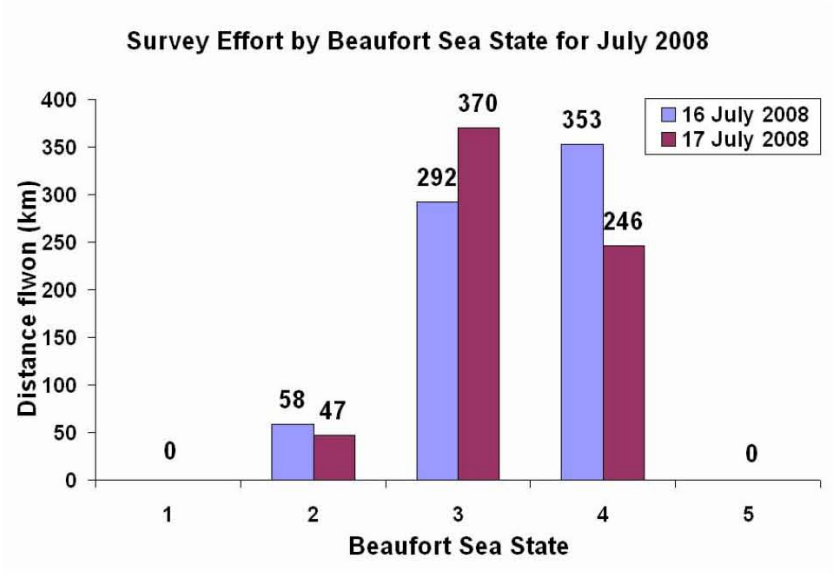
_____

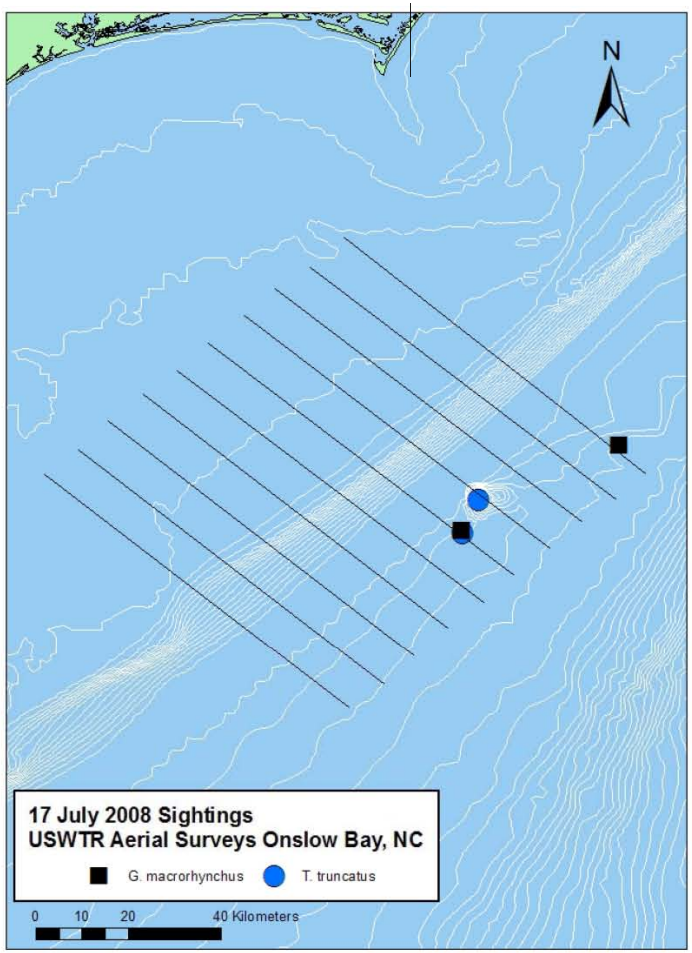
_____

_____

July 17. 2008

Species	Number of Sightings	Number of Individuals	Beaufort Sea State	Line number
Globicephala macrorhynchus	1	18	2	10
Globicephala macrorhynchus	1	12	1	6
Tursiops truncatus	1	30	1	7
Tursiops truncatus	1	12	1	6



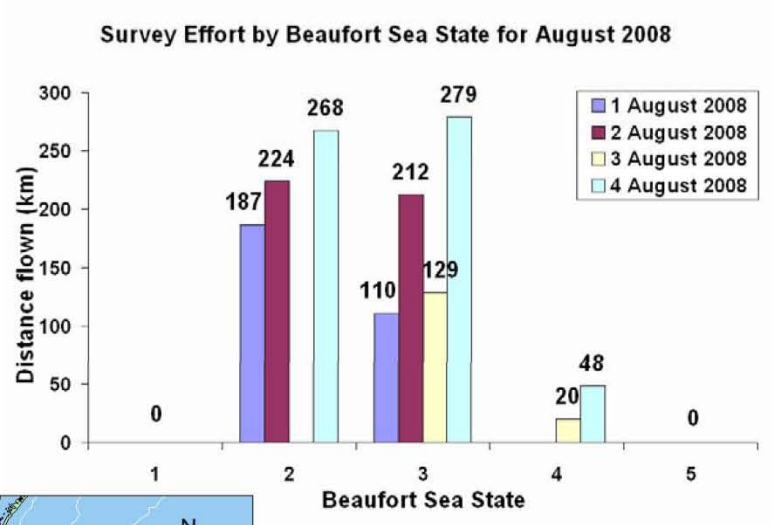


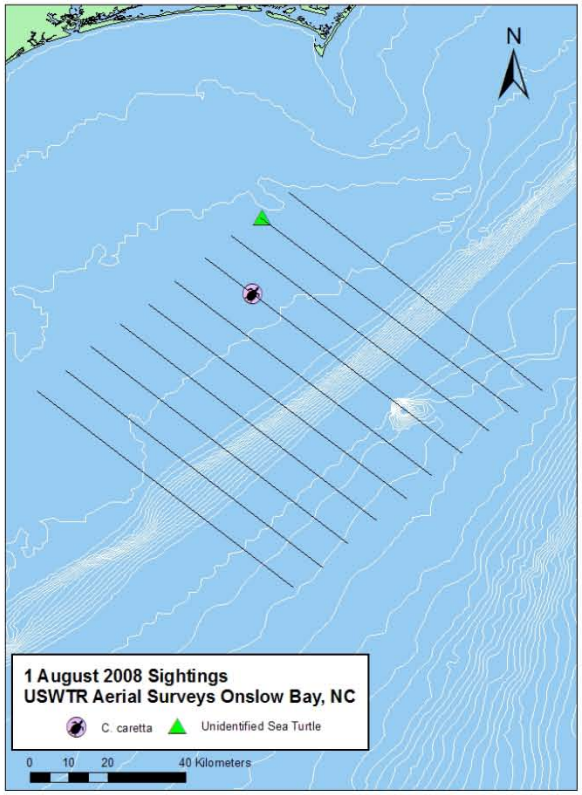
August 1, 2008

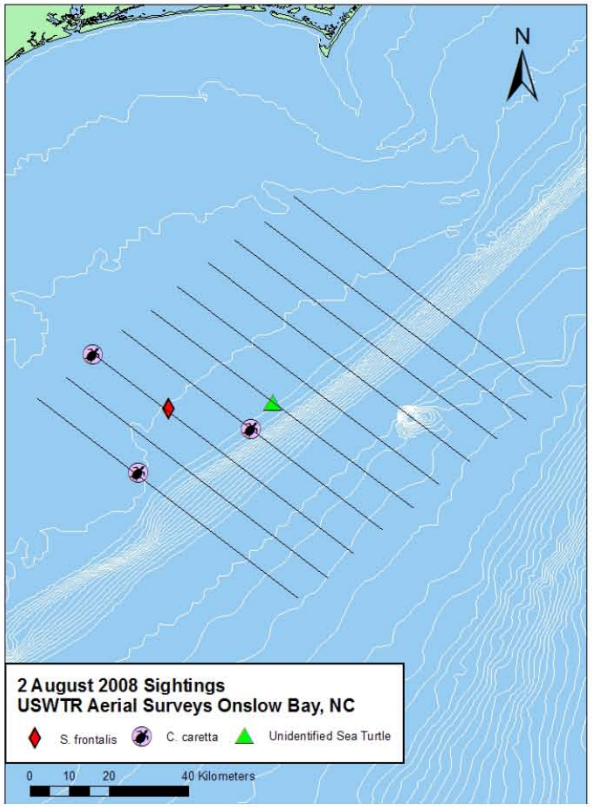
Species	Number of Sightings	Number of Individuals	Beaufort Sea State	Line number
Sea Turtle	2	2	2	-

August 2, 2008

Species	Number of Sightings	Number of Individuals	Beaufort Sea State	Line number
Stenella frontalis	1	22	2	3
Sea Turtle	4	4	2 to 3	-

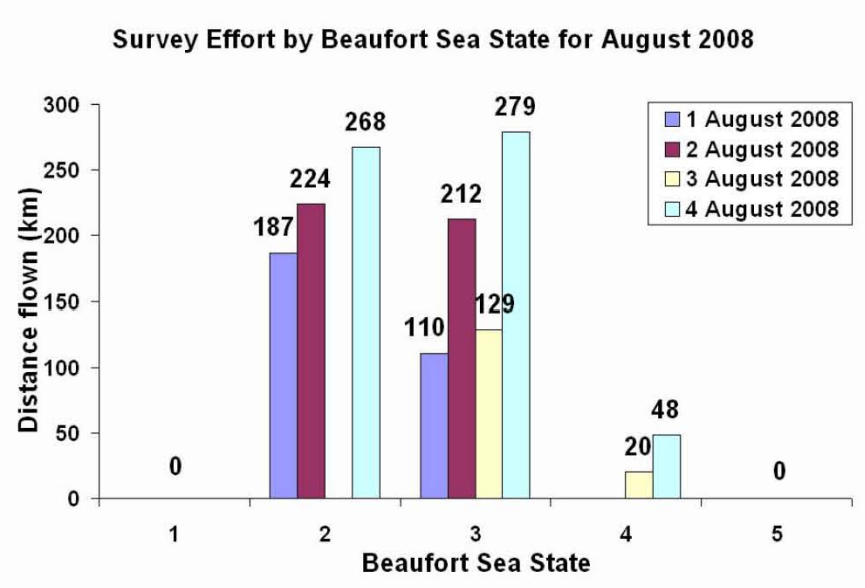


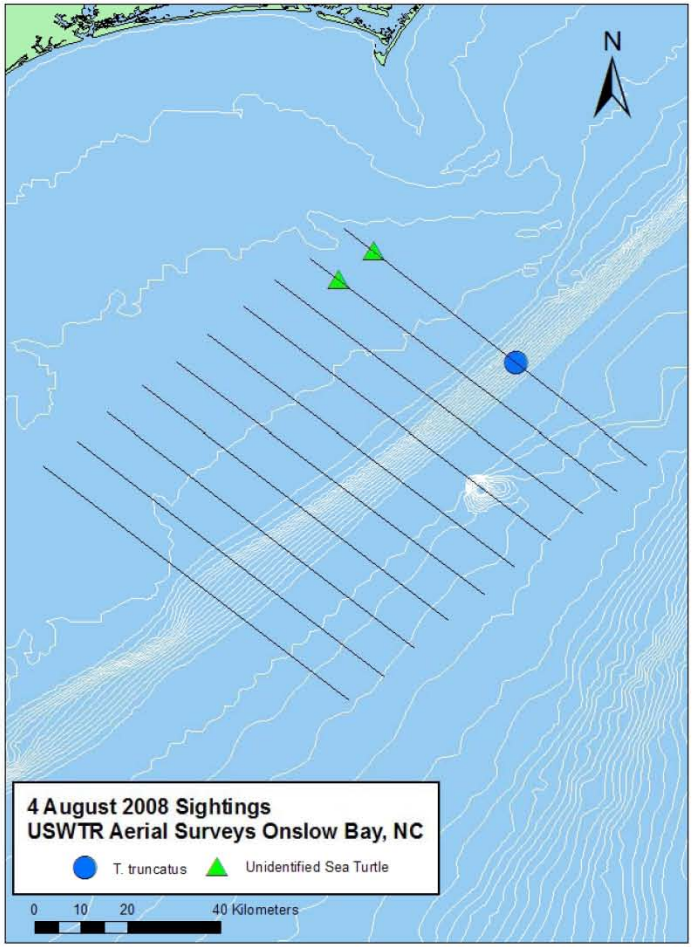




August 4, 2008

Species	Number of Sightings	Number of Individuals	Beaufort Sea State	Line number
Tursiops truncatus	1	9	2	10
Sea Turtle	2	2	2	-



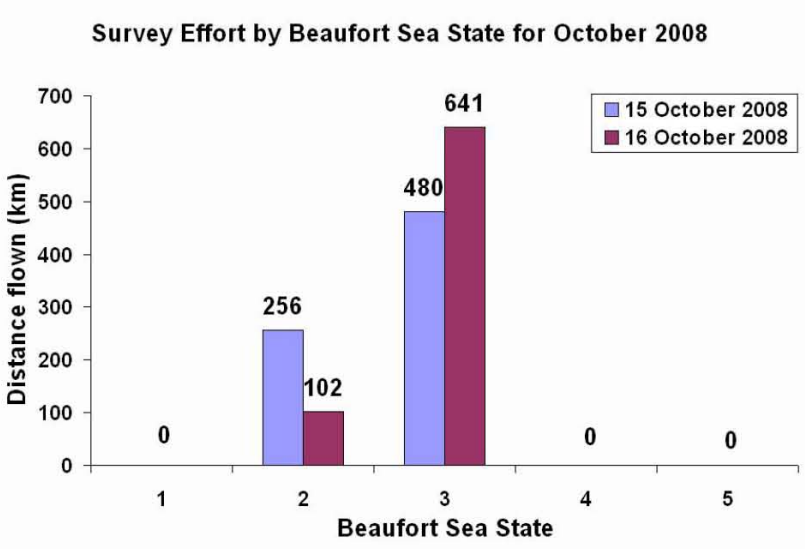


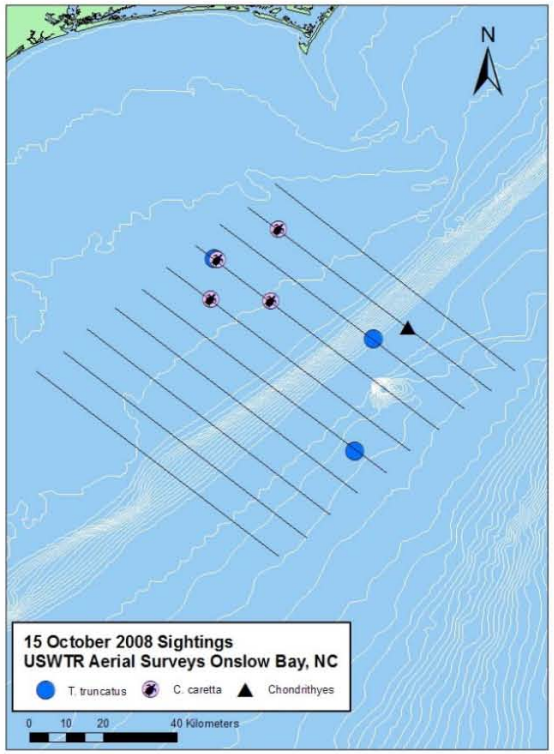
October 15, 2008

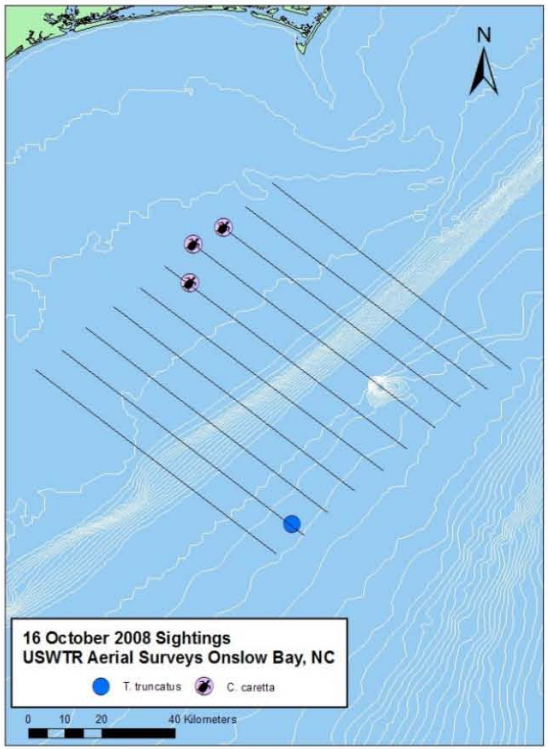
Species	Number of Sightings	Number of Individuals	Beaufort Sea State	Line number
Tursiops truncatus	1	25	3	5
Tursiops truncatus	1	3	2	7
Tursiops truncatus	1	19	3	8
Sea Turtle	4	5	2 to 3	-
Chondrichthyes	1	1	2	9

October 16, 2008

Species	Number of Sightings	Number of Individuals	Beaufort Sea State	Line number
Tursiops truncatus	1	1	2	2
Sea Turtle	3	3	2 to 3	-





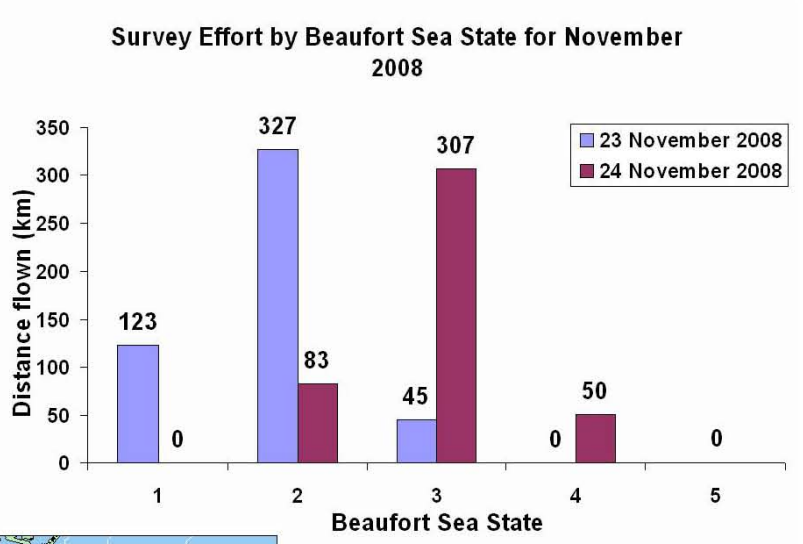


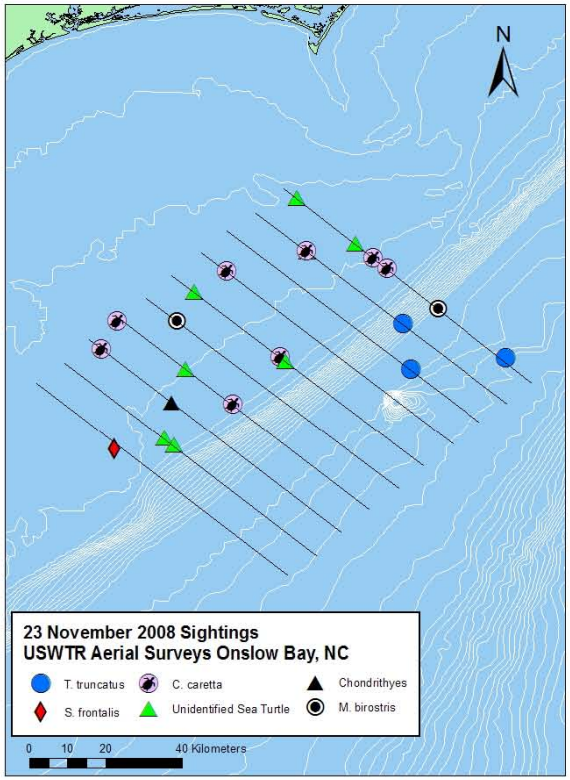
November 23, 2008

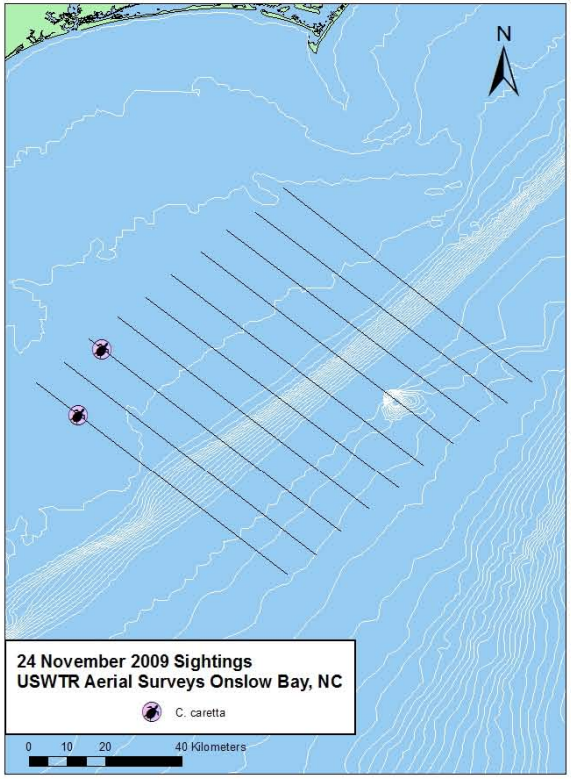
Species	Number of Sightings	Number of Individuals	Beaufort Sea State	Line number
Tursiops truncatus	1	45	2	10
Tursiops truncatus	1	13	2	10
Tursiops truncatus	1	21	2	8
Stenella frontalis	1	30	2	1
Sea Turtle	16	17	1 to 2	-
Manta birostris	2	3	1 to 2	-
Chondrichthyes	1	1	1	-

November 24, 2008

Species	Number of Sightings	Number of Individuals	Beaufort Sea State	Line number
Sea Turtle	2	2	2	-

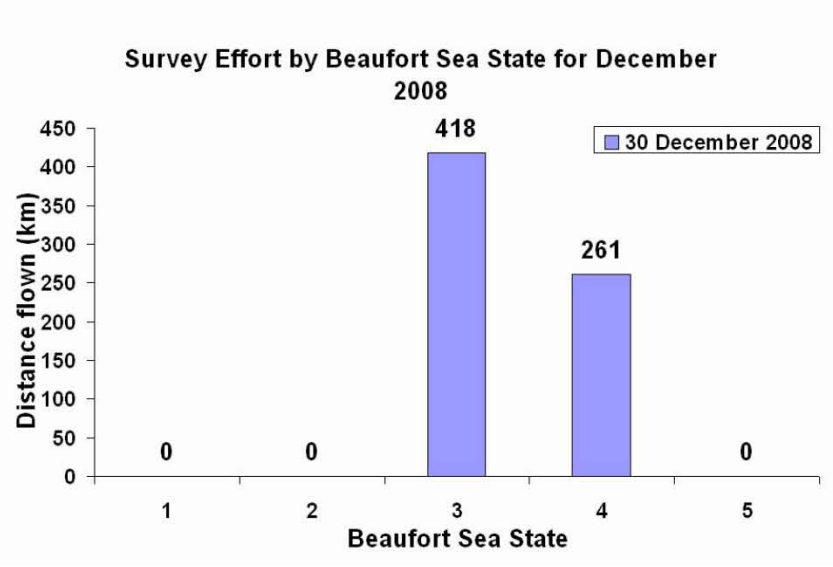


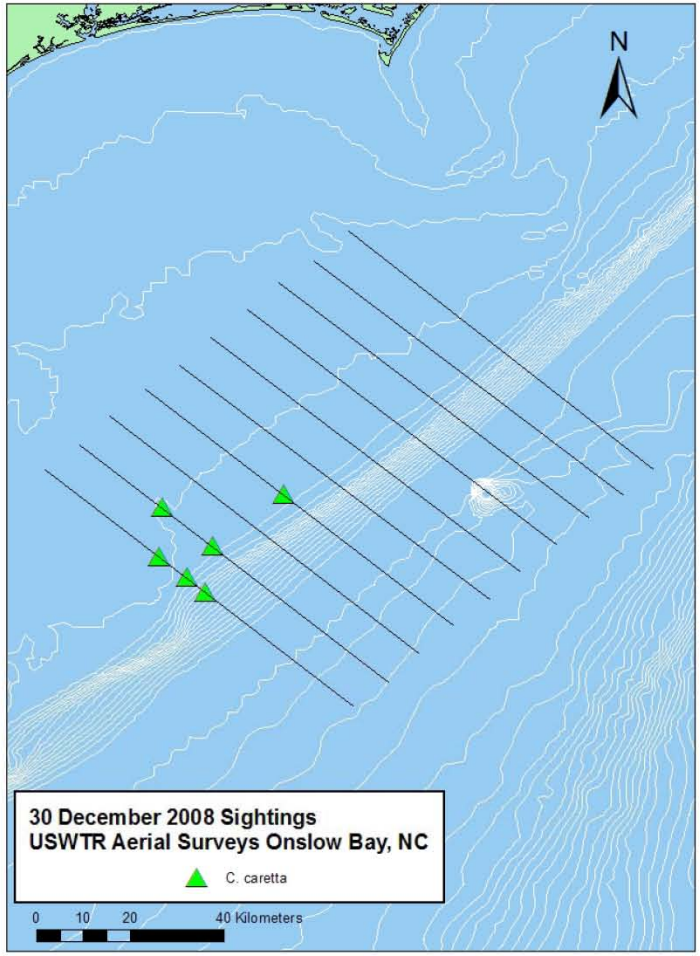




December 30, 2008

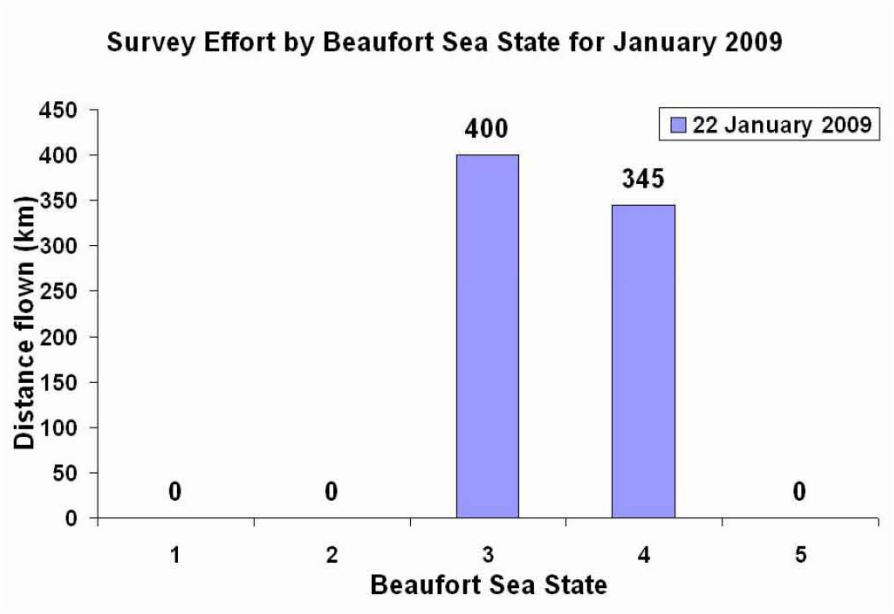
Species	Number of Sightings	Number of Individuals	Beaufort Sea State	Line number
Sea Turtle	6	6	3	-

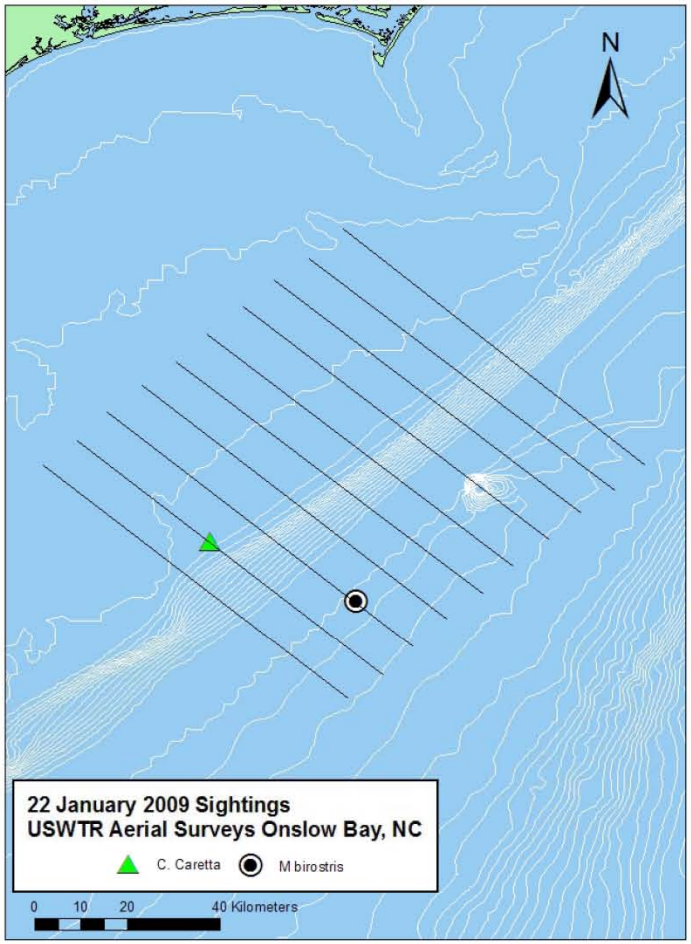




January 22, 2009

Species	Number of Sightings	Number of Individuals	Beaufort Sea State	Line number
Sea Turtle	1	2	3	-
Manta birostris	1	2	3	-



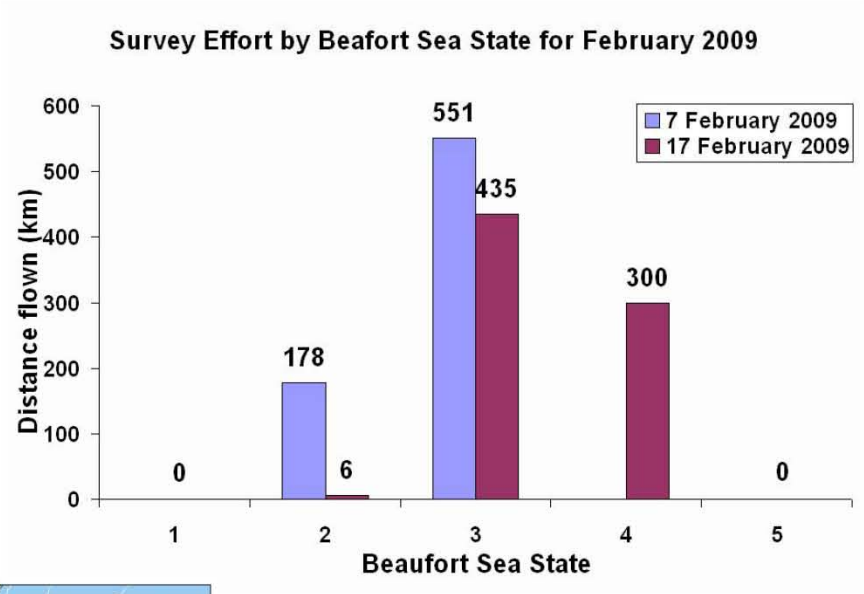


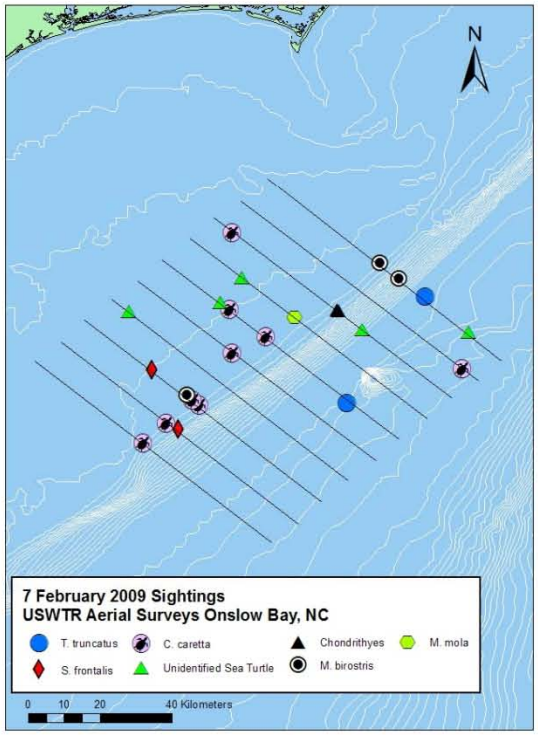
February 7, 2009

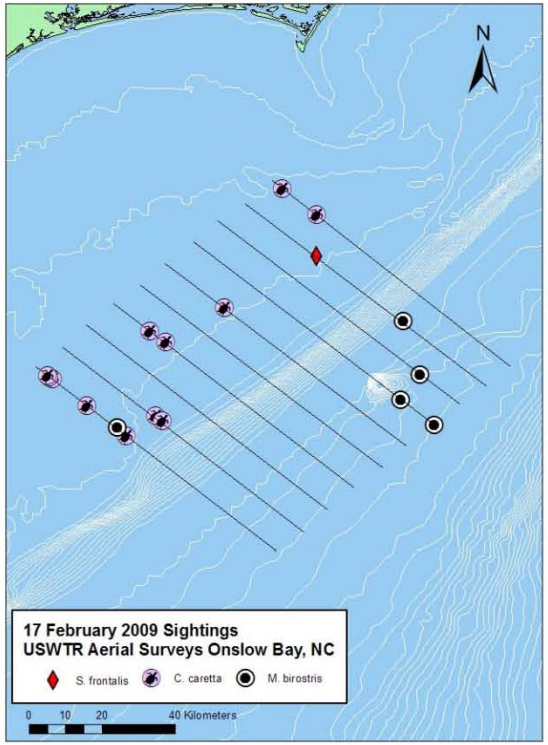
Species	Number of Sightings	Number of Individuals	Beaufort Sea State	Line number
Tursiops truncatus	1	50	3	6
Tursiops truncatus	1	30	3	10
Stenella frontalis	1	40	3	3
Stenella frontalis	1	90	3	2
Sea Turtle	13	16	2 to 3	-
Manta birostris	3	4	3	-
Chondrichthyes	2	2	2	-
Mola mola	1	1	3	-

February 17, 2009

Species	Number of Sightings	Number of Individuals	Beaufort Sea State	Line number
Stenella frontalis	1	30	3	9
Sea Turtle	12	12	3 to 4	-
Manta birostris	5	8	3 to 4	-

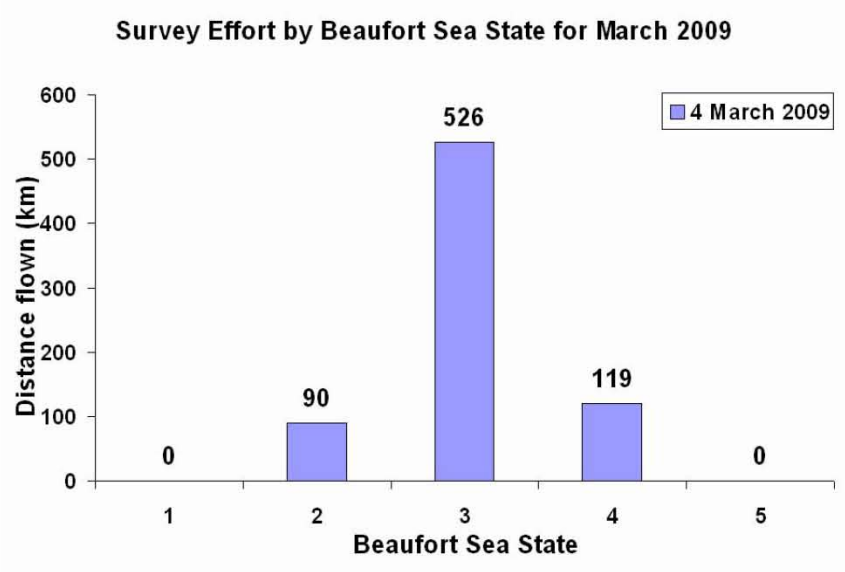


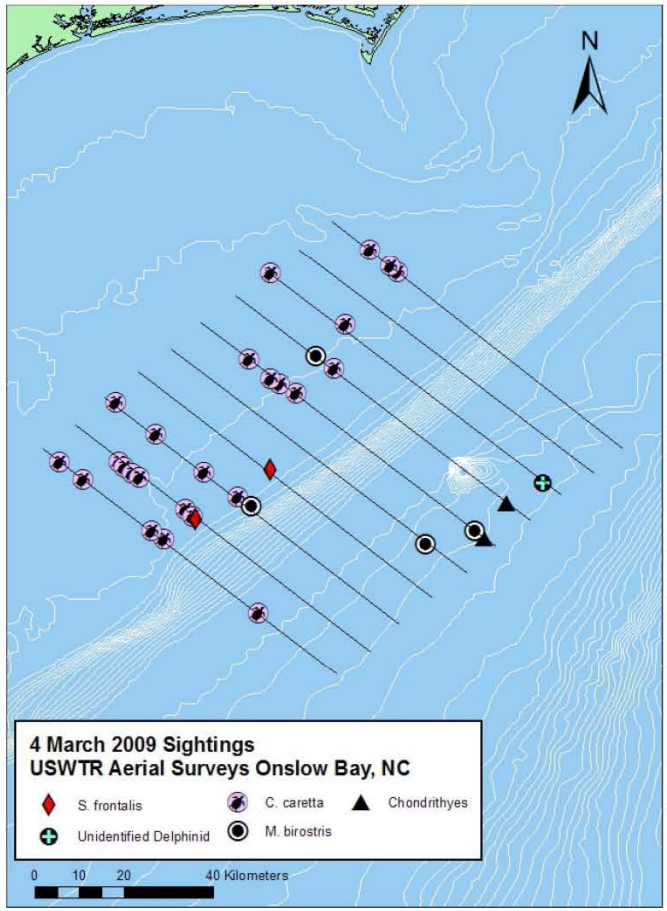




March 4, 2009

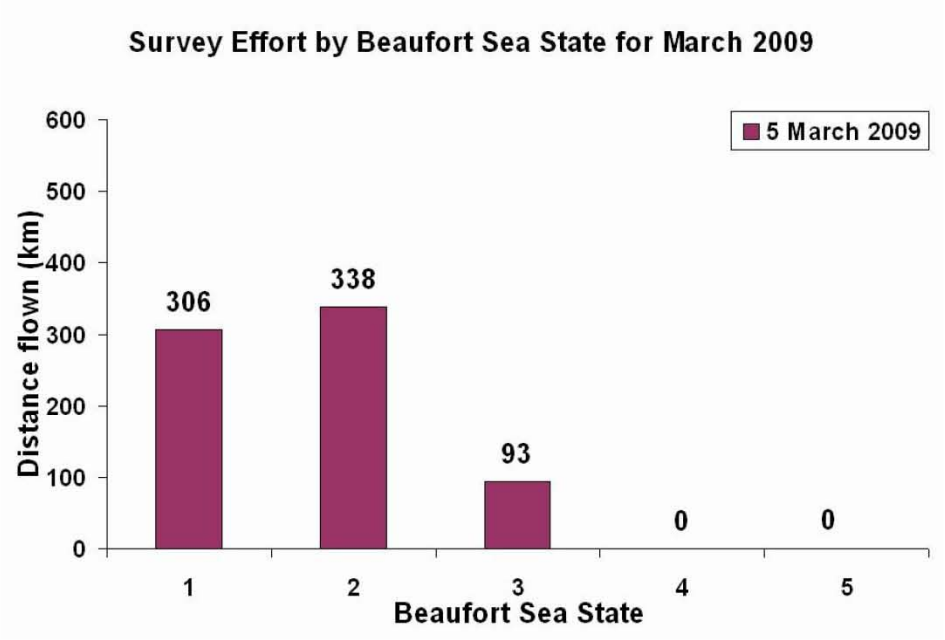
Species	Number of Sightings	Number of Individuals	Beaufort Sea State	Line number
Stenella frontalis	1	15	3	4
Stenella frontalis	1	100	2	2
Unidentified Delphinid	1	3	4	8
Sea Turtle	25	28	2 to 3	-
Manta birostris	4	4	3	-
Chondrichthyes	2	2	3 to 4	-

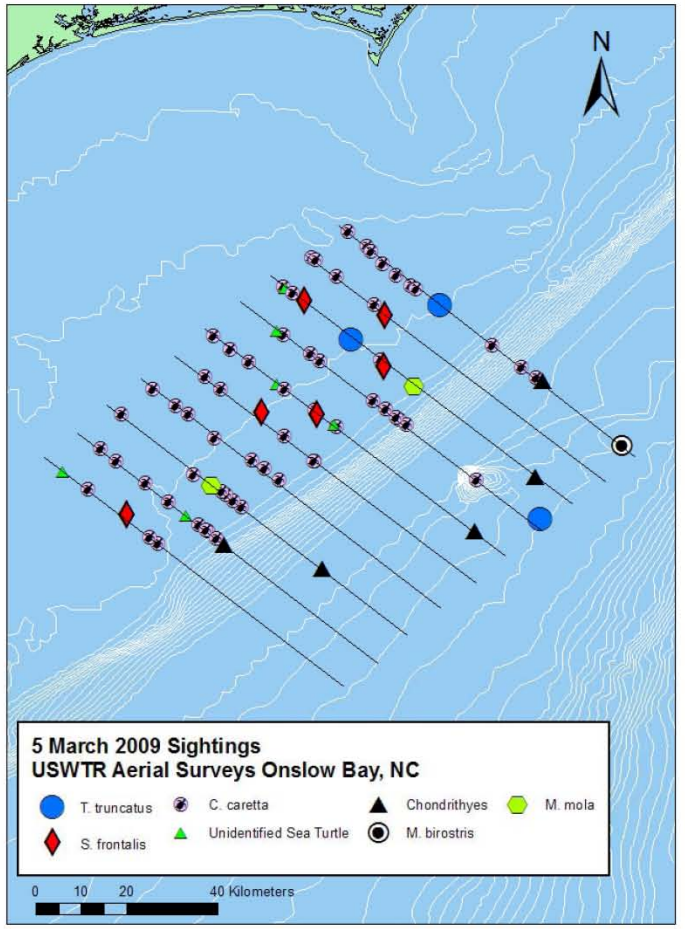




March 5, 2009

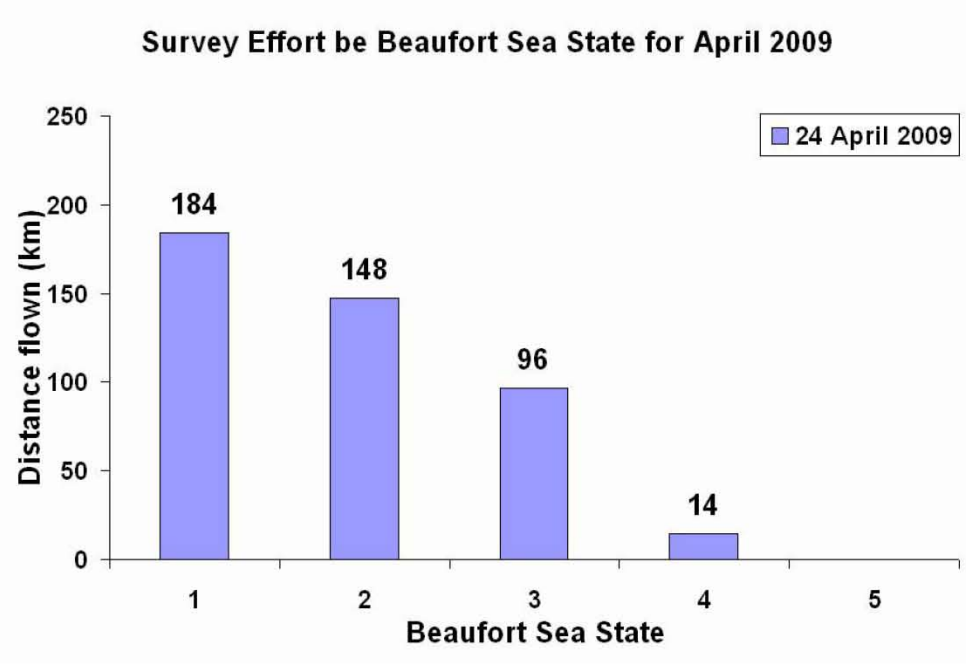
Species	Number of Sightings	Number of Individuals	Beaufort Sea State	Line number
Tursiops truncatus	1	4	1	10
Tursiops truncatus	1	2	1	8
Tursiops truncatus	1	5	2	7
Stenella frontalis	1	20	1	9
Stenella frontalis	1	25	1	8
Stenella frontalis	1	8	2	8
Stenella frontalis	1	24	2	6
Stenella frontalis	1	35	2	5
Stenella frontalis	1	30	1	1
Sea Turtle	67	77	1 to 2	-
Manta birostris	1	1	3	-
Chondrichthyes	5	9	1 to 3	-
Mola mola	2	2	1	-

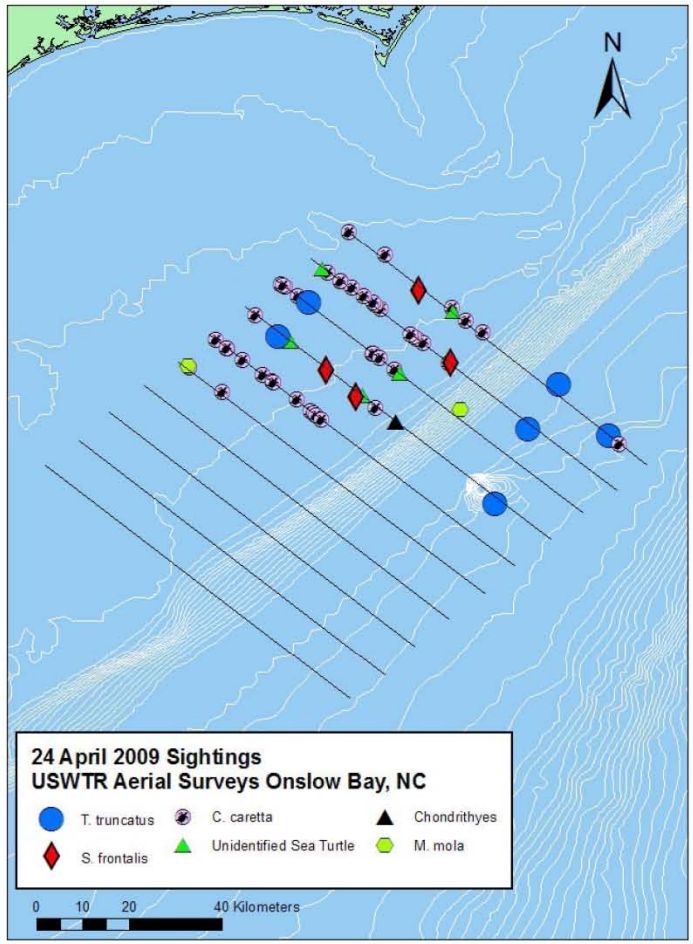




April 24, 2009

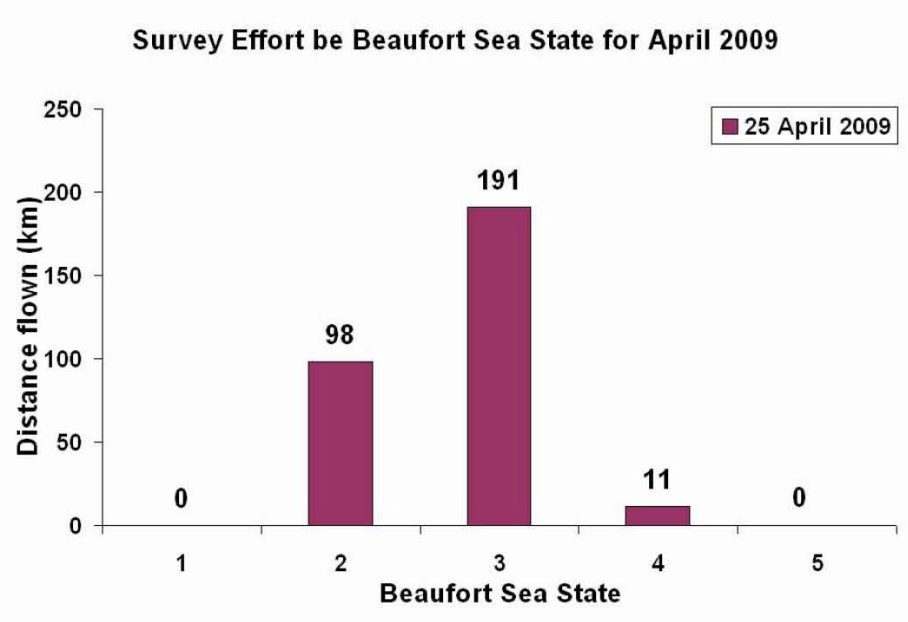
Species	Number of Sightings	Number of Individuals	Beaufort Sea State	Line number
Tursiops truncatus	1	10	1	10
Tursiops truncatus	1	10	1	10
Tursiops truncatus	1	15	1	9
Tursiops truncatus	1	2	1	8
Tursiops truncatus	1	32	3	7
Tursiops truncatus	1	9	1	7
Stenella frontalis	1	10	1	7
Stenella frontalis	1	55	1	10
Stenella frontalis	1	80	1	9
Stenella frontalis	1	37	1	7
Sea Turtle	48	57	1 to 2	-
Chondrichthyes	1	1	1	-
Mola mola	2	2	1 to 2	-

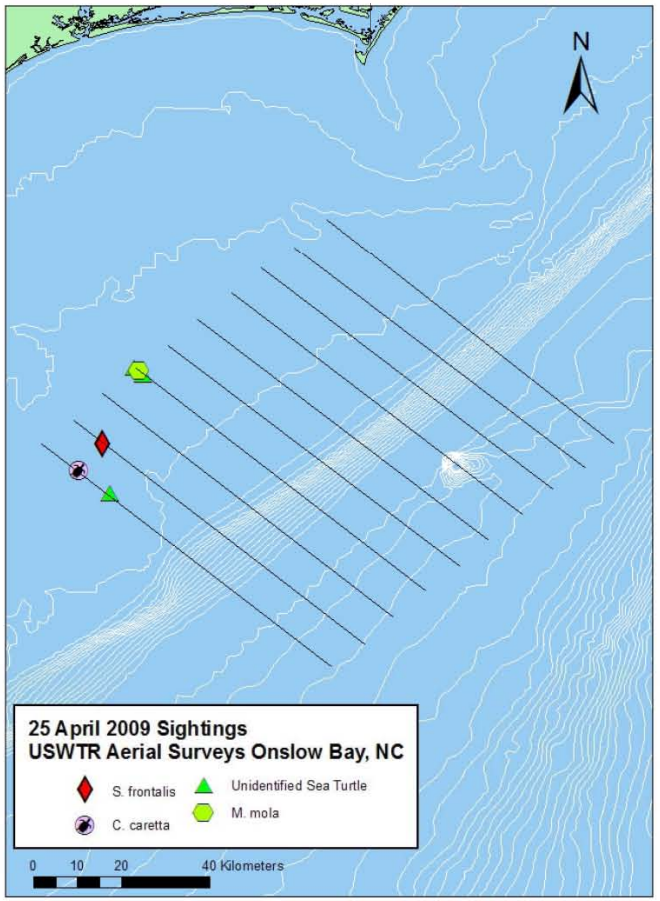




April 25, 2009

Species	Number of Sightings	Number of Individuals	Beaufort Sea State	Line number
Stenella frontalis	1	16	2	2
Sea Turtle	4	4	2	-
Mola mola	1	1	2	-



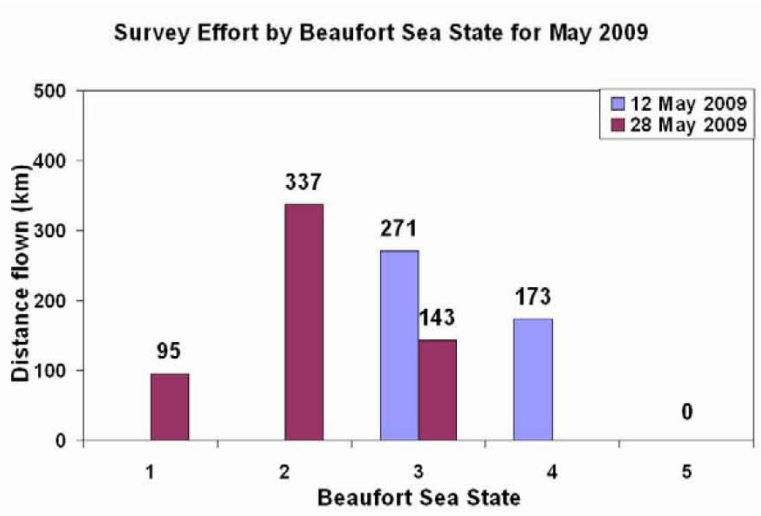


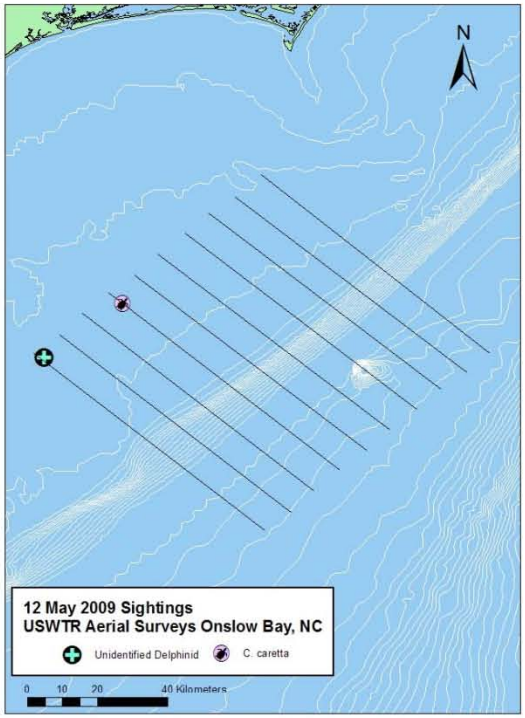
May 12, 2009

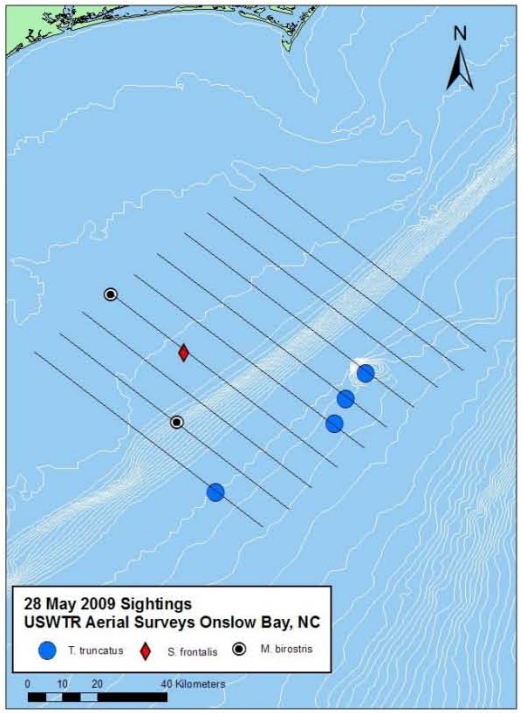
Species	Number of Sightings	Number of Individuals	Beaufort Sea State	Line number
Unidentified Delphinid	1	26	3	1
Sea Turtle	1	1	3	-

May 28, 2009

Species	Number of Sightings	Number of Individuals	Beaufort Sea State	Line number
Tursiops truncatus	1	60	2	1
Tursiops truncatus	1	40	2	5
Tursiops truncatus	1	35	1	6
Tursiops truncatus	1	10	2	7
Stenella frontalis	1	25	1	4
Manta birostris	2	2	1 to 2	-





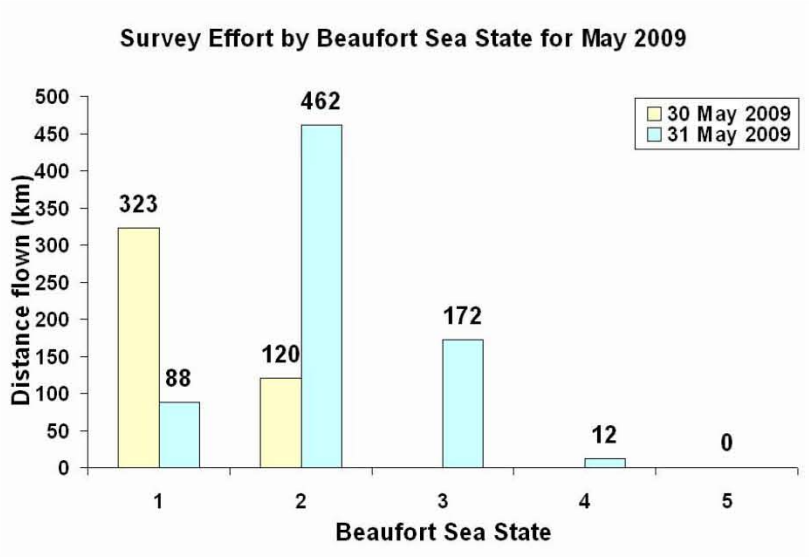


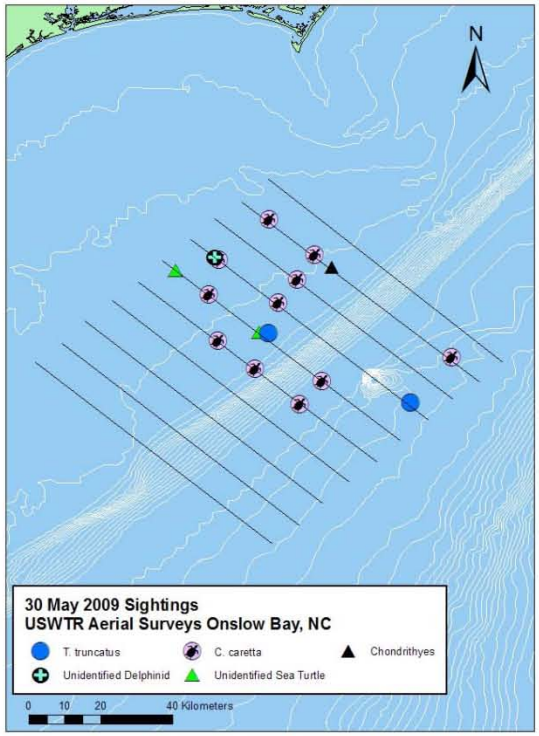
May 30, 2009

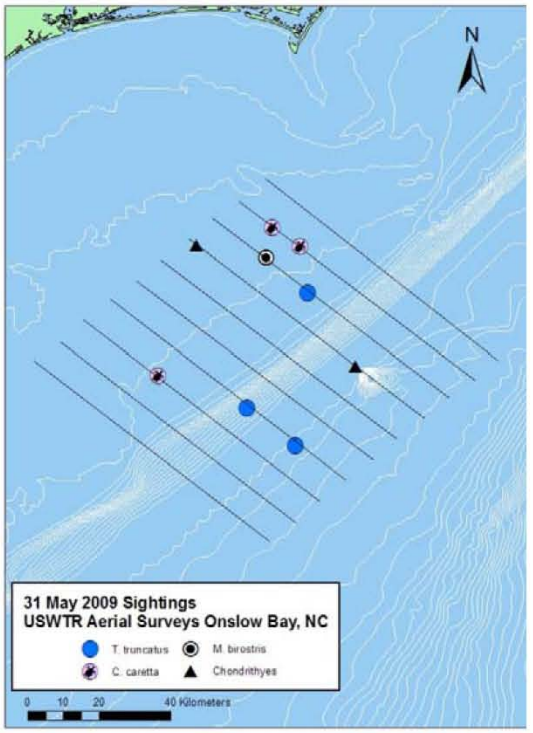
Species	Number of Sightings	Number of Individuals	Beaufort Sea State	Line number
Tursiops truncatus	1	4	1	7
Tursiops truncatus	1	3	1	6
Unidentified Delphinid	1	1	1	7
Sea Turtle	13	13	1 to 2	-
Chondrichthyes	1	1	2	-

May 31, 2009

Species	Number of Sightings	Number of Individuals	Beaufort Sea State	Line number
Tursiops truncatus	1	10	2	8
Tursiops truncatus	1	9	2	4
Tursiops truncatus	1	15	2	4
Sea Turtle	3	3	2	-
Chondrichthyes	1	1	1 to 2	-
Manta birostris	1	1	2	-

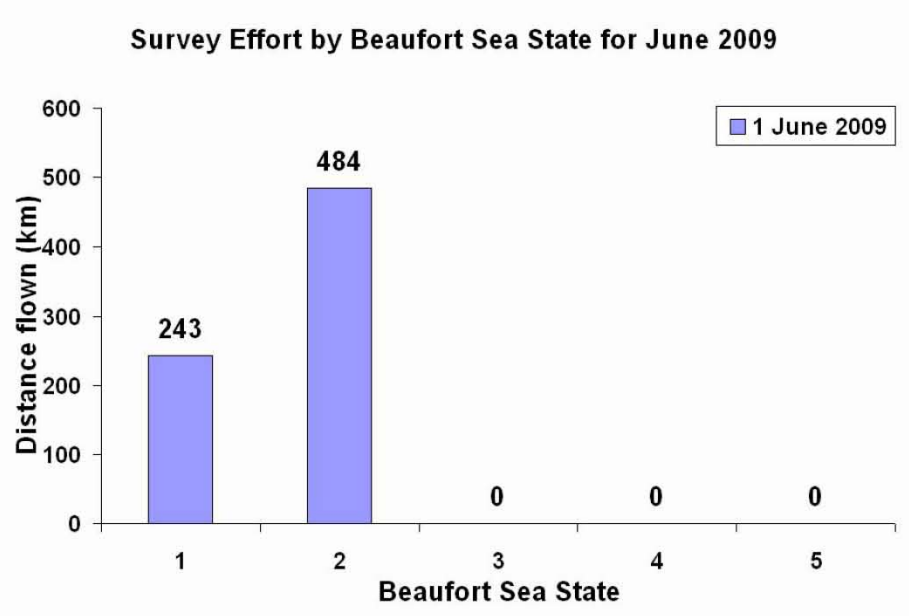


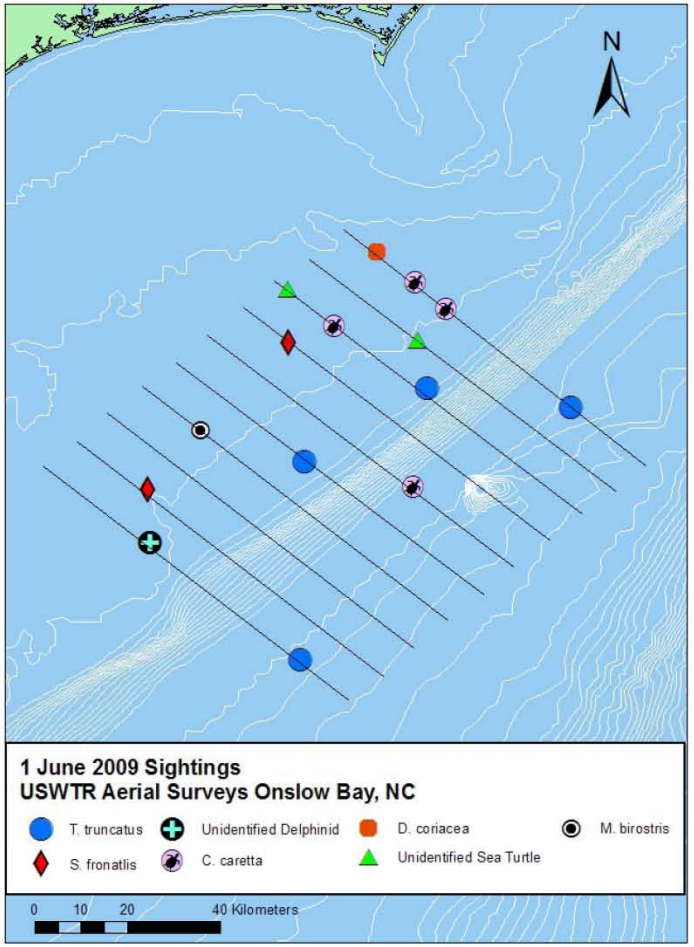




June 1, 2009

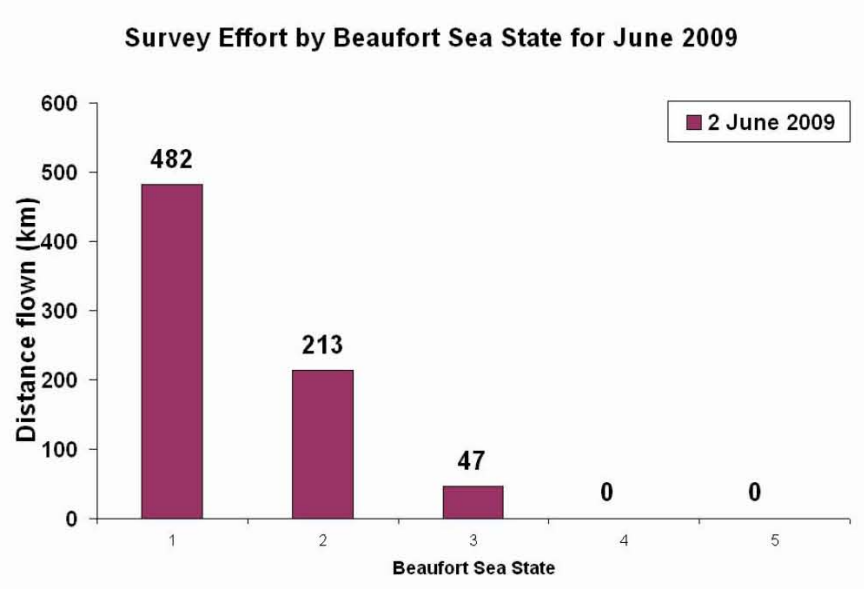
Species	Number of Sightings	Number of Individuals	Beaufort Sea State	Line number
Tursiops truncatus	1	3	2	5
Tursiops truncatus	1	2	2	8
Tursiops truncatus	1	28	2	8
Tursiops truncatus	1	35	1	1
Stenella frontalis	1	7	1	7
Stenella frontalis	1	13	1	2
Unidentified Delphinid	1	11	2	1
Sea Turtle	7	7	1 to 2	-
Manta birostris	1	1	1	-

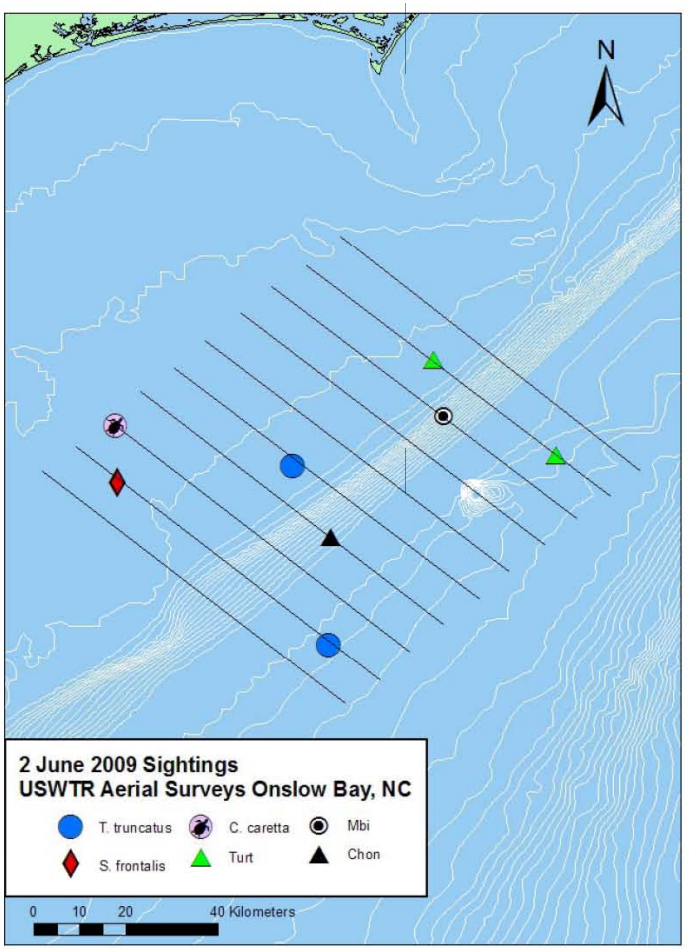




June 2, 2009

Species	Number of Sightings	Number of Individuals	Beaufort Sea State	Line number
Tursiops truncatus	1	8	1	5
Tursiops truncatus	1	25	1	2
Stenella frontalis	1	5	1	2
Sea Turtle	3	3	1 to 2	-
Chondrichthyes	1	1	1	-
Manta birostris	1	1	1	-





VESSEL-BASED SURVEYS AND PASSIVE ACOUSTIC MONITORING OF THE PROPOSED UNDER SEA WARFARE TRAINING RANGE (USWTR) IN ONSLOW BAY, NORTH CAROLINA JULY 2008 THROUGH JUNE 2009

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Norfolk, VA

Methodology

Study Area

The study area consists of a box approximately 37% larger than the proposed USWTR; the USWTR area itself is 25 nm (46 km) long and 20 nm (37 km) wide (approximately from NW to SE; Fig. 1). We survey ten 40 nm (74 km) long transect lines oriented parallel to the short axis of the USWTR boundaries and perpendicular to the prevailing bathymetric and oceanographic features influencing the study area. The transect lines are spaced approximately 5 nm (9.3 km) apart. This design yields a total of 400 nm (741 km) of track line available for surveys and all ten transect lines were surveyed by both aerial and shipboard platforms.

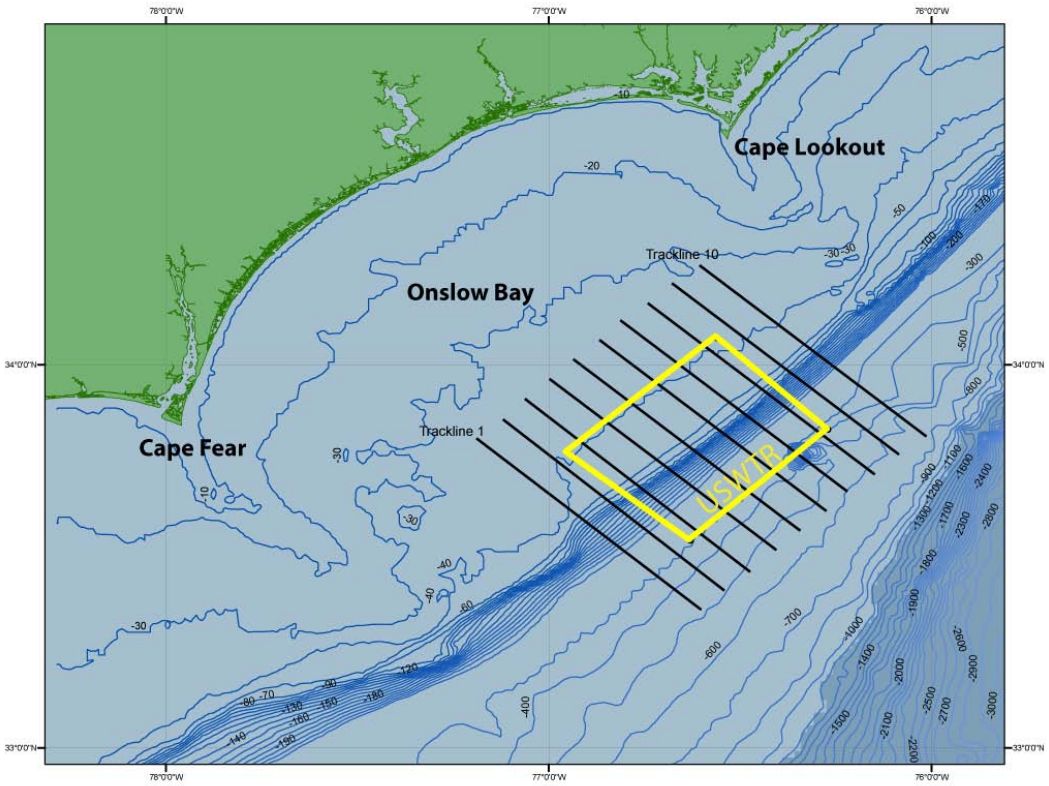


Figure 1. Map of the study area, the proposed Undersea Warfare Training Range (USWTR; yellow box) and bathymetry of Onslow Bay.

Vessel Survey Data Collection

Visual Surveys

Vessel-based survey platforms provide a greater probability of sighting deep-diving species than aerial surveys (Barlow and Gisiner 2006). Shipboard observers are also more likely to be able to confirm species identity, particularly for animals that are difficult to distinguish from the air. Additionally, vessel-based platforms allow for biopsy sampling and photographic identification.

To ensure maximum detection rates, we employed a traditional visual survey approach, supplemented by passive acoustic monitoring using a towed hydrophone array.

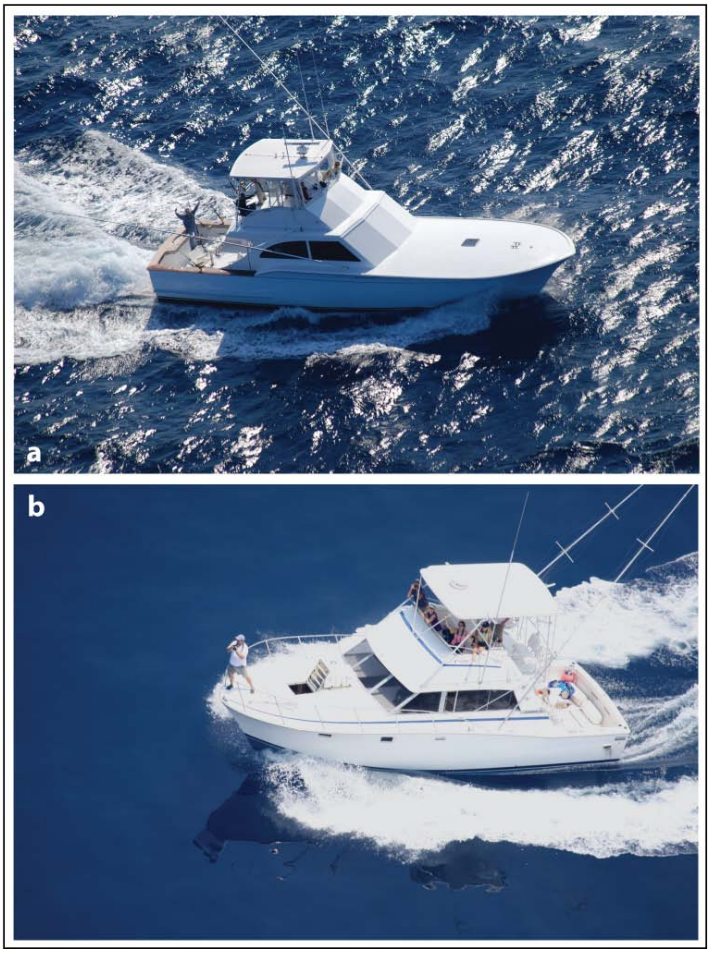


Figure 2. Aerial photogrpahs of the F/V *Sensation* (a) and the R/V *Cetus* (b).

Visual surveys for cetaceans and other marine megafauna were conducted from two survey platforms: the F/V *Sensation* (Fig. 2a), a 16m offshore fishing vessel and the R/V *Cetus* (Fig. 2b), a modified 12 m offshore fishing vessel.

Observations were made from the flying bridge (5.0m and 4.2m above waterline for the *Sensation* and *Cetus*, respectively) by naked eye and 7x50 binoculars. At the start of Year One a classroom training exercise was held for all marine mammal observers at the Duke University Marine Laboratory in

Beaufort, NC on April 24th, 2007.
The workshop was led by Ms. Erin LaBrecque, who received training from the Centre for Research into Ecological and Environmental Modeling (CREEM) group at the University of St. Andrews, Scotland, and who has extensive experience as a NOAA shipboard observer. Observers were instructed in line transect theory, field methods, data collection protocols, and species identification. Training of new observers in Year Two continued on an as-needed basis.

Two observers (port and starboard) scanned constantly from straight ahead to 90˚ abeam either side of the trackline. A center observer monitored the trackline, coordinated with the vessel skipper and acted as data recorder for sightings and environmental conditions. Observations were conducted following standard distance sampling/line transect methods for cetaceans, similar to those employed in Barlow (2006). During ship surveys, the location, species and behavior of each cetacean group were recorded. If turtles were encountered, the location and species were recorded. Each observer estimated group size independently and individual estimates were averaged at the end of the survey to generate an overall estimate of group size. Environmental conditions (weather, sea state, depth and sea surface temperature) were recorded every 30 minutes or more frequently if sighting conditions changed. Both sighting and environmental data were input into an at-sea data collection system (Vis-Survey, developed by Dr. Lance Garrison, NOAA/SEFSC) linked with the onboard GPS.

A shipboard platform allows us to monitor the use of the USWTR and adjacent areas by individual animals using photo-identification techniques. This approach is feasible for sperm whales, beaked whales, humpback whales, bottlenose dolphins, spotted dolphins, pilot whales and Risso's dolphins. Photo identification can provide information on patterns of seasonal, annual and inter-annual residency. Such information will be critical to interpreting any future changes in density in the USWTR area.

Thus, whenever possible, photographs of cetaceans were obtained for species confirmation and individual photo-identification. Photographs were taken with Canon or Nikon digital

SLRs (equipped with 100-300 mm zoom lenses) in 24-bit color at a resolution of 3072 X 2048 pixels and saved in jpg format.

Seabird counts were conducted by an experienced observer who recorded seabirds in a 90-degree bow-beam arc in a 300-meter strip on the starboard side of the ship (Tasker *et al*. 1984). The observer recorded the time and location of each bird sighting. Species identification, abundance, general behavior (sitting, flying, or foraging), and associations with other marine species were recorded for each sighting. The presence of ship-following birds was noted separately to avoid biases in quantitative analyses.

Passive Acoustic Monitoring

Passive acoustic data were collected in the proposed range using two methods: towed hydrophone array and bottom-mounted recorder.

Towed Array

A four-element array was towed behind the survey vessel at a speed of 10 knots to allow acoustic detection of nearby cetaceans. The towed array (Seiche Instruments, UK) consisted of four hydrophone elements with approximate linear sensitivity to frequencies between 1kHz and 100 kHz. The array was towed 150m behind the vessel and acoustic signals were routed to an analog-to-digital converter/mixer (MOTU Traveler, MOTU, Cambridge, MA) sampling at 192 kHz. These signals were then passed to two personal laptop computers outfitted with software for real-time visualization/recording (*Ishmael* 1.0) and spatial localization (*WhalTrak* 2.0) of cetacean sounds. A trained acoustician monitored the array and made recordings of all potential cetacean sounds detected, as well as other novel sounds. When possible, the acoustician attempted to localize cetacean vocalizations with time difference of arrival (TDOA) techniques involving two or more hydrophone elements and using *Ishmael* and *Whaltrak* software.

Bottom-mounted Recorder

To collect a time-series of acoustic data in the USWTR study area, a High Frequency Acoustic Recording Package or HARP (Wiggins and Hildebrand 2007) was employed. This instrument combined high and low frequency hydrophone elements for detecting the

vocalizations of both odontocete and mysticete whales and sampled at rates high enough to capture the echolocation clicks of many odontocetes. The HARP was deployed near the center of the USWTR box, close to the 200 m shelf break. In Year Two the second deployment was at 33.811°N and -76.428°W at a depth of 232 m; and the third deployment was at 33.790°N and -76.519°W at a depth of 174 m (see Fig. 3). In all deployments, the instrument was programmed to record at a sample rate of 200 KHz for five-minute periods separated by an inactive interval of five minutes.

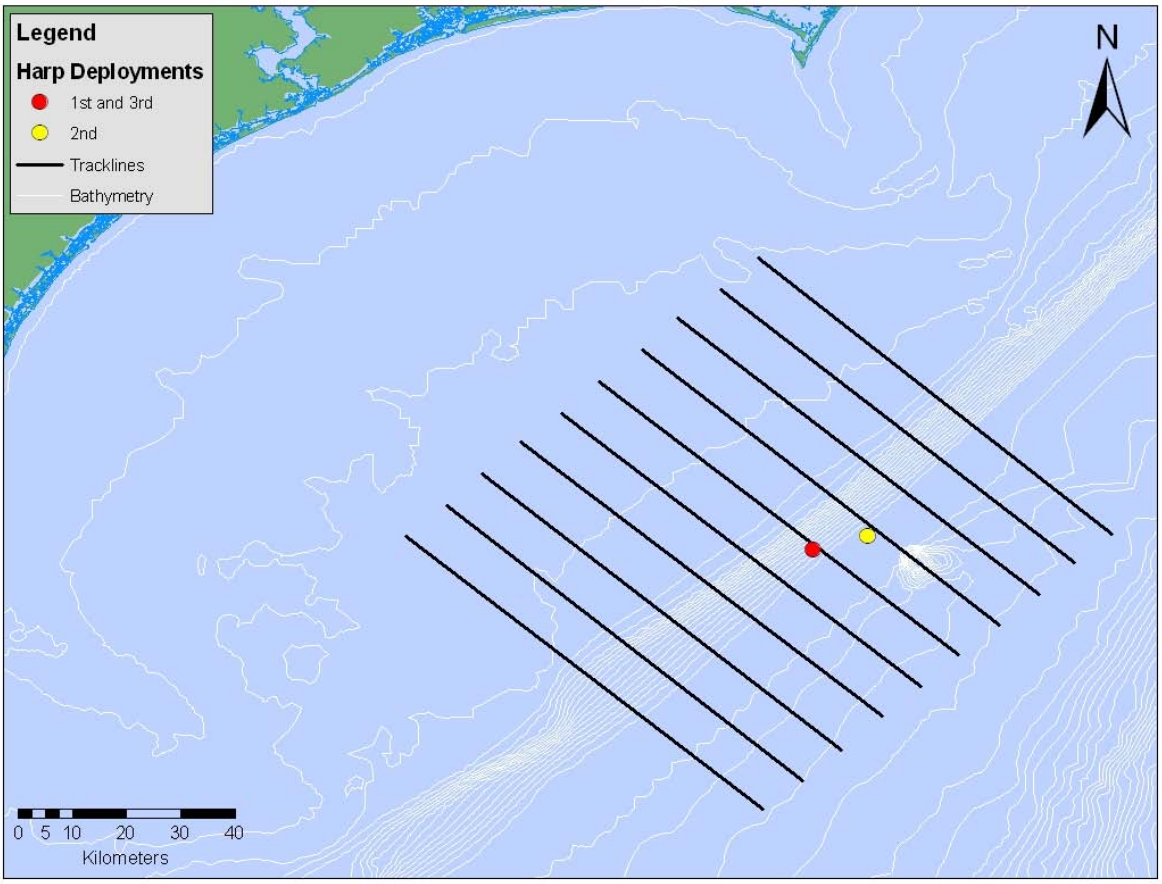


Figure 3. Location of HARP deployments in Onslow Bay, NC.

Data Analysis

Vessel survey effort and sighting data were compiled and mapped using ArcGIS 9.2 to illustrate the location of effort and sightings within the study area. In addition, the statistical distributions of survey effort, sea state and marine mammal sightings by synoptic depth and sea surface temperature were examined using JMP 8.0. The sighting data (including radial distance and bearing estimates for each cue) were forwarded to the CREEM at the University

of St. Andrews, UK for density estimation. Vessel based survey tracks and sighting locations from June-December 2007 have been posted on OBIS-SEAMAP (http://seamap.env.duke.edu/).

Acoustic Analysis

Towed hydrophone array recordings were analyzed with the sound analysis software program *Adobe Audition 2.0*. Selections of whistles and clicks with positive species identifications from concurrent visual observations were saved for future analysis of species-specific patterns. Discriminant function analyses (DFAs) will be performed to look for species-specificity in the whistles after measuring several parameters including, but not limited to, start, end, minimum, and maximum frequency; duration; number of inflection points; and number of steps. This approach is similar to that used by Oswald *et al.* (2003). We also plan to look for species-specific patterns, such as consistent peaks and notches, in the recorded clicks using techniques, similar to those employed by Soldevilla *et al.* (2008). Analyses of variance (ANOVAs) will be used to examine if there are species-specific frequency differences in peaks and notches of echolocation clicks. In addition, techniques that combine both whistles and clicks into a single classifying analysis will be explored, such as combining certain parameters of each call type into a single DFA. Inclusion of both call types may increase classification rates.

Marine mammal sounds were located in the HARP data using Long-Term Spectral Averages (LTSAs; Wiggens and Hildebrand 2007). LTSAs provide a way to examine hours to weeks of data on the same spectrogram, allowing for rapid review of large data sets. LTSAs made using a MATLAB-based acoustic program called *Triton* (Hildebrand Lab at Scripps Institution of Oceanography) were used to look for odontocete whistle and click events in the HARP data from the second (30 May 2008 – 10 September 2008) and third deployments (24 April 2009 – 9 August 2009; Fig. 4). These LTSAs were manually inspected in *Triton* for high-energy locations denoting whistle and click events. Whistle and click detectors built into the *Triton* software will be used to help find additional vocal events.

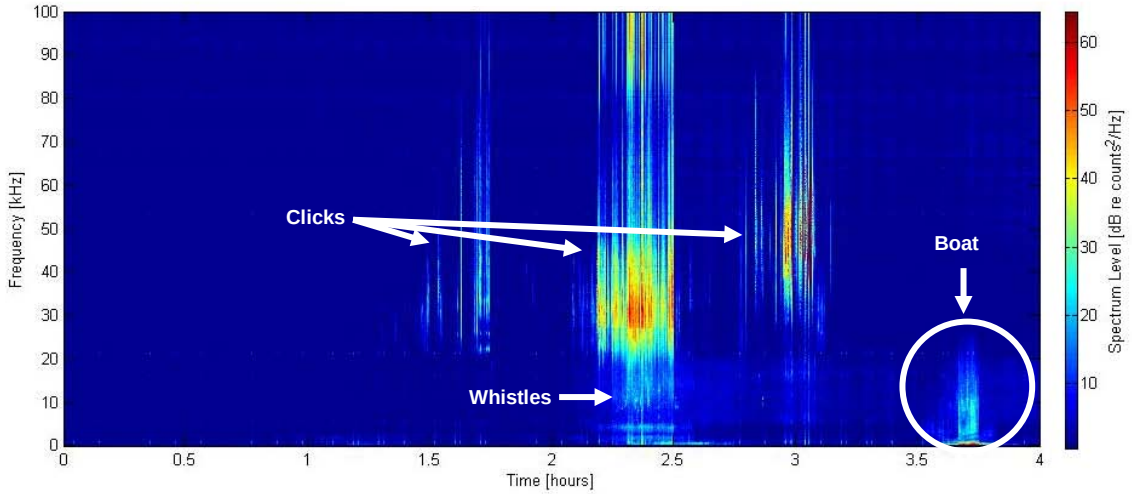


Figure 4. Example of a Long-Term Spectral Average (LTSA) produced using Triton software. This LTSA shows instances of unidentified odontocete vocalizations (clicks and whistles).

Once all whistles have been detected using both methods, loud and clear whistles with acceptable signal-to-noise ratios will be chosen for further analysis. The same parameters used in determining species-specific differences will be measured in these newly selected whistles. These values will then be processed using a combination of DFAs and Classification and Regression Trees (CART) to determine to which species the whistles most likely belong.

Once all click events have been detected, we will select one click from each click train for further analysis. The selected clicks will be examined for peaks and notches that occur within frequency ranges determined by towed array data for different species (if found). This examination will help determine which species produced the clicks.

At this point, for those instances when both whistles and clicks are detected in a single vocal event, the predicted species identification for both the whistles and clicks from that same event will be compared to determine if the same species was selected. In addition to determining the likely vocalizing species in this way, exploratory techniques that combine both whistles and clicks into a single classifying analysis will be tested.

Over the next few months, the HARP data from all three HARP deployments will be decimated to look for baleen whales. Once these analyses are complete and (1) all calls present in the HARP data have been found and (2) the species to which those calls most likely belong have been determined, the vocal events will be sorted by species to look for diel and seasonal patterns in their vocalizations.

Data Storage

All acoustic, visual survey and photographic data are archived on digital media and backed up on a Duke University network server.

Results

Vessel Survey Effort

Between 1 July 2008 and 30 June 2009, 21.75 tracklines were surveyed (Table 1) totaling approximately 102 hours of marine mammal surveys (85 hours on effort, 17 hours off effort) and 70 hours of on effort seabird surveys.

Surveys were conducted in Beaufort Sea States 0 to 4. Most survey effort (73%) was conducted in Beaufort 2 and 3; 19% of effort was conducted in optimal (Beaufort 0 and 1) sighting conditions (Fig. 5).

Table 1. Vessel survey effort. Year 1 includes June 2007 through June 2008. Year 2 includes July 2008 through June 2009.

Trackline	Year 1	Year 2
1	0.66	1
2	1.5	2
3	3	3
4	4	2
5	4	4
6	3	1.75
7	4.25	1
8	2.25	1.25
9	3	4
10	3.5	1.75
Total	**29.16**	**21.75**

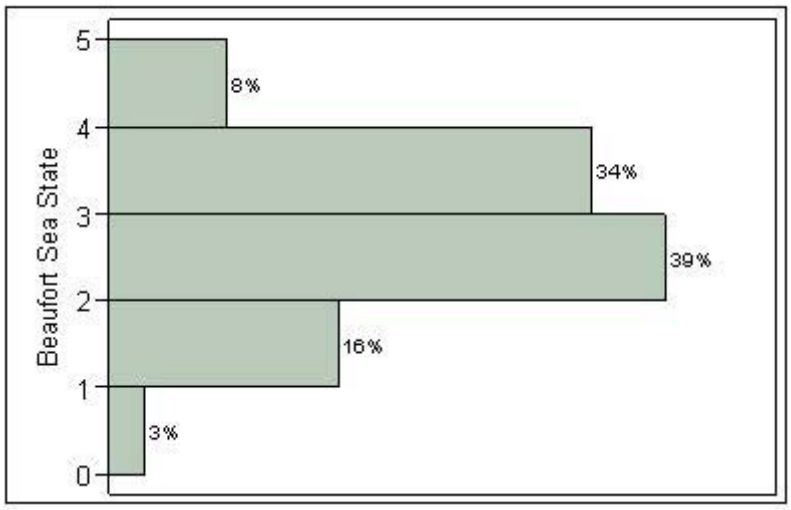


Figure 5. Distribution of sea state conditions (% of total effort) for vessel surveys during Year Two.

Marine Mammal and Sea Turtle Line Transect Sightings

Thirty-three marine mammal sightings were made during vessel surveys (29 while on effort, 4 while off effort) in Year Two (Table 2). Two species of cetaceans were detected visually in the study area: bottlenose dolphins (*Tursiops truncatus,* n=14; all on effort*)* and Atlantic spotted dolphins (*Stenella frontalis,* n=17; 14 on effort). In addition, the crew made two sightings of unidentified delphinids (one on effort). No mixed-species groups were observed (Table 3). The sightings per unit effort was, not surprisingly, highest in a Beaufort Sea State of 0, but sightings were consistently made in conditions as high as Beaufort 4 (Figure 6).

A total of 49 loggerhead sea turtle (*Caretta caretta*) were sighted during vessel surveys (43 on effort, 6 off effort) from 1 July 2008 through 30 June 2009 (Table 2, Table 4, Fig. 12).

Table 2. Vessel-based cetacean and sea turtle sightings made in the USWTR study area, July 2008 through June 2009.

Date	Vessel	Trackline	Depth (m)	Temp (°C)	Species	Group Size	Effort
7/2/08	Cetus	9	n/a	n/a	*Caretta caretta*	1	On
7/2/08	Cetus	9	n/a	n/a	*Caretta caretta*	1	On
7/2/08	Cetus	9	99.0	20.0	*Caretta caretta*	1	On
7/15/08	Sensation	3	521.2	28.8	*Tursiops truncatus*	1	On
7/16/08	Sensation	5	23.4	29.3	*Tursiops truncatus*	2	On
7/16/08	Sensation	5	42.6	29.2	*Tursiops truncatus*	2	On
7/25/08	Cetus	7	n/a	n/a	*Tursiops truncatus*	31	On
7/25/08	Cetus	7	n/a	n/a	*Caretta caretta*	1	On
7/25/08	Cetus	7	n/a	n/a	*Stenella frontalis*	5	On
8/12/08	Sensation	1	374.9	28.2	*Tursiops truncatus*	42	On
8/15/08	Sensation	5	n/a	n/a	*Caretta caretta*	1	On
8/15/08	Sensation	5	34.7	27.9	*Stenella frontalis*	2	On
8/19/08	Sensation	2	294.4	28.4	*Tursiops truncatus*	90	On
8/27/08	Sensation	8	35.8	28.2	Unid. Delphinid	2	Off
8/27/08	Sensation	10	482.8	28.6	Unid. Delphinid	2	On
8/27/08	Sensation	8	34.9	28.2	*Stenella frontalis*	4	On
9/29/08	Sensation	9	40.2	26.3	*Caretta caretta*	1	On
9/29/08	Sensation	9	36.0	26.2	*Stenella frontalis*	4	On
9/29/08	Sensation	9	33.3	26.1	*Caretta caretta*	1	Off
9/29/08	Sensation	9	33.3	26.1	*Stenella frontalis*	7	On
11/24/08	Cetus	9	39.7	24.3	*Stenella frontalis*	6	On
11/24/08	Cetus	9	36.9	23.5	*Stenella frontalis*	5	On
2/21/09	Sensation	5	43.9	17.7	*Caretta caretta*	1	On
2/21/09	Sensation	5	37.1	16.1	*Caretta caretta*	1	On
2/21/09	Sensation	5	35.8	16.1	*Caretta caretta*	1	On
2/21/09	Sensation	5	40.0	16.0	*Caretta caretta*	1	On
2/21/09	Sensation	5	42.4	16.4	*Caretta caretta*	1	On
2/21/09	Sensation	5	42.2	16.7	*Caretta caretta*	1	On
2/21/09	Sensation	5	43.0	16.9	*Caretta caretta*	1	On
2/21/09	Sensation	5	43.3	17.3	*Caretta caretta*	1	On
2/21/09	Sensation	5	245.1	19.9	*Tursiops truncatus*	4	On
2/21/09	Sensation	5	43.0	16.9	*Caretta caretta*	1	On
2/25/09	Sensation	6	70.2	17.6	*Caretta caretta*	1	On
2/25/09	Sensation	6	34.7	14.6	*Tursiops truncatus*	2	On
3/5/09	Sensation	3	47.9	19.1	*Caretta caretta*	1	On
3/5/09	Sensation	3	41.3	17.4	*Caretta caretta*	1	On
3/5/09	Sensation	3	47.9	19.1	*Caretta caretta*	1	On
3/5/09	Sensation	3	33.5	14.9	*Caretta caretta*	1	On
3/5/09	Sensation	3	34.0	15.2	*Caretta caretta*	1	On
3/5/09	Sensation	3	36.8	15.7	*Caretta caretta*	1	On
3/5/09	Sensation	3	42.8	18.4	*Caretta caretta*	1	On
3/5/09	Sensation	3	43.2	19.1	*Caretta caretta*	1	On

3/5/09	Sensation	3	43.5	19.1	*Caretta caretta*	1	On
3/5/09	Sensation	3	43.7	19.1	*Caretta caretta*	1	On
3/5/09	Sensation	3	44.1	19.1	*Caretta caretta*	1	On
3/5/09	Sensation	3	63.5	19.6	*Caretta caretta*	1	On
3/5/09	Sensation	3	37.5	15.3	*Caretta caretta*	1	On
4/24/09	Cetus	8	39.9	23.8	*Stenella frontalis*	3	On
4/24/09	Cetus	8	37.4	23.8	*Caretta caretta*	1	On
4/24/09	Cetus	8	31.8	22.2	*Stenella frontalis*	17	On
4/24/09	Cetus	8	34.3	22.2	*Caretta caretta*	1	On
4/24/09	Cetus	8	37.3	24.4	*Caretta caretta*	1	On
4/24/09	Cetus	8	37.9	23.8	*Caretta caretta*	1	On
4/24/09	Cetus	8	39.0	23.8	*Stenella frontalis*	3	On
4/24/09	Cetus	8	39.9	23.8	*Caretta caretta*	1	On
4/24/09	Cetus	8	39.9	23.8	*Caretta caretta*	1	Off
4/27/09	Sensation	4	33.3	22.1	*Caretta caretta*	1	On
4/27/09	Sensation	4	35.3	22.1	*Stenella frontalis*	5	On
4/27/09	Sensation	4	35.1	22.1	*Caretta caretta*	1	Off
4/27/09	Sensation	4	34.0	21.9	*Caretta caretta*	1	Off
4/27/09	Sensation	4	42.8	21.6	*Stenella frontalis*	26	Off
4/27/09	Sensation	4	36.8	22.1	*Caretta caretta*	1	On
4/27/09	Sensation	4	37.7	21.9	*Caretta caretta*	1	On
4/27/09	Sensation	4	407.8	23.8	*Tursiops truncatus*	6	On
4/27/09	Sensation	4	33.5	21.9	*Caretta caretta*	1	On
4/27/09	Sensation	4	35.8	21.9	*Caretta caretta*	1	On
4/28/09	Sensation	2	33.5	22.7	*Stenella frontalis*	3	Off
4/28/09	Sensation	2	63.3	24.4	*Caretta caretta*	1	On
4/28/09	Sensation	2	34.2	22.1	*Tursiops truncatus*	3	On
4/28/09	Sensation	2	34.0	22.3	*Caretta caretta*	1	Off
4/28/09	Sensation	2	33.3	22.2	*Caretta caretta*	1	Off
4/29/09	Sensation	5	35.7	22.0	*Stenella frontalis*	11	Off
4/29/09	Sensation	5	409.7	26.0	*Tursiops truncatus*	26	On
4/29/09	Sensation	5	51.2	25.5	*Stenella frontalis*	12	On
6/1/09	Sensation	3	235.9	26.1	*Tursiops truncatus*	4	On
6/1/09	Sensation	3	223.1	26.1	*Tursiops truncatus*	3	On
6/1/09	Sensation	3	158.4	25.7	*Tursiops truncatus*	8	On
6/2/09	Cetus	10	49.3	9.9	*Caretta caretta*	1	On
6/2/09	Cetus	10	40.8	9.9	*Stenella frontalis*	27	On
6/2/09	Cetus	10	33.9	9.9	*Caretta caretta*	1	On
6/24/09	Cetus	9	35.0	9.0	*Stenella frontalis*	26	On
6/24/09	Cetus	9	30.3	9.0	*Caretta caretta*	1	On

Table 3. Number of cetacean sightings and mean group size for Year 1 and Year 2 for each species observed.

Species	Sightings		Mean Group Size
	Year 1	Year 2	
Globicephala sp.	1	0	**40**
Grampus griseus	3	0	**35.7**
Stenella frontalis	6	17	**8.7**
Tursiops truncatus	23	14	**10.8**
Unid. Delphinid	3	2	**1.6**
Total:	**36**	**33**	

Table 4. Number of sea turtle sightings per year for each species observed.

Species	Sightings	
	Year 1	Year 2
Caretta caretta	19	49
Unid. Turtle	1	0
Total:	20	49

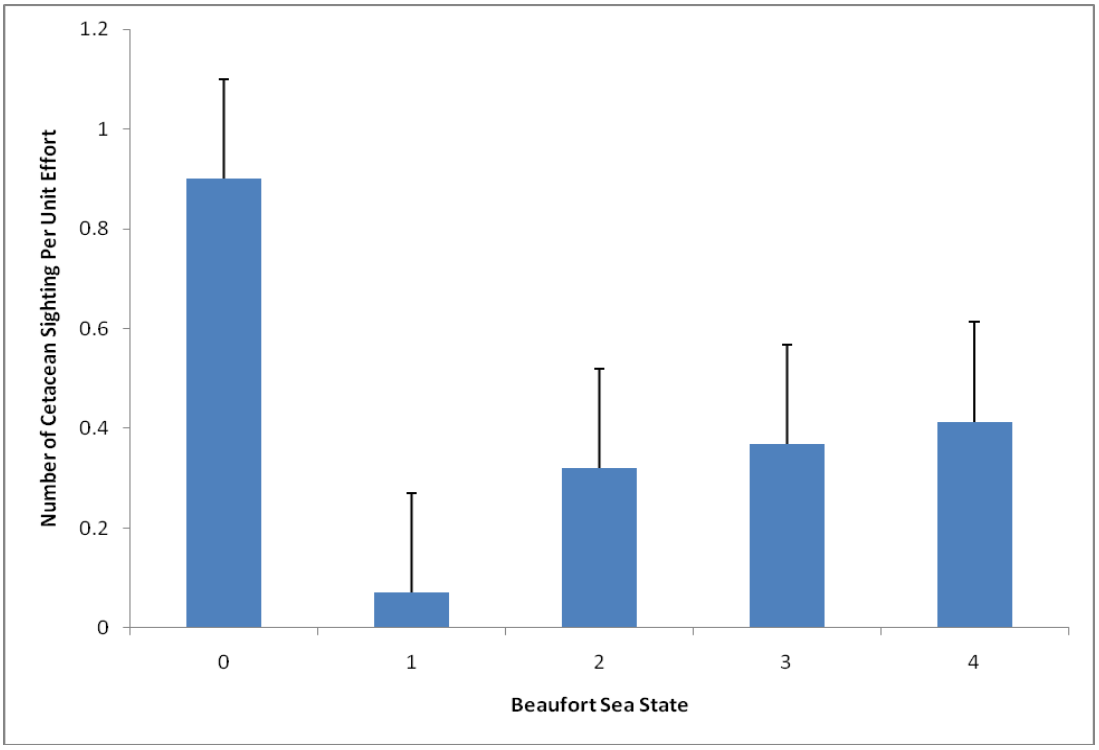


Figure 6. Number of cetacean sightings in Year Two corrected for hours on effort in each Beaufort sea state.

Descriptive statistics for bottlenose dolphins and spotted dolphins are presented in Figures 7 and 8 respectively. In general, bottlenose dolphins were detected in waters deeper than spotted dolphins (mean water depth of 217m *versus* 38m respectively). Mean group size for bottlenose dolphins was slightly greater than for spotted dolphins (15 *versus* 10 individuals per group).

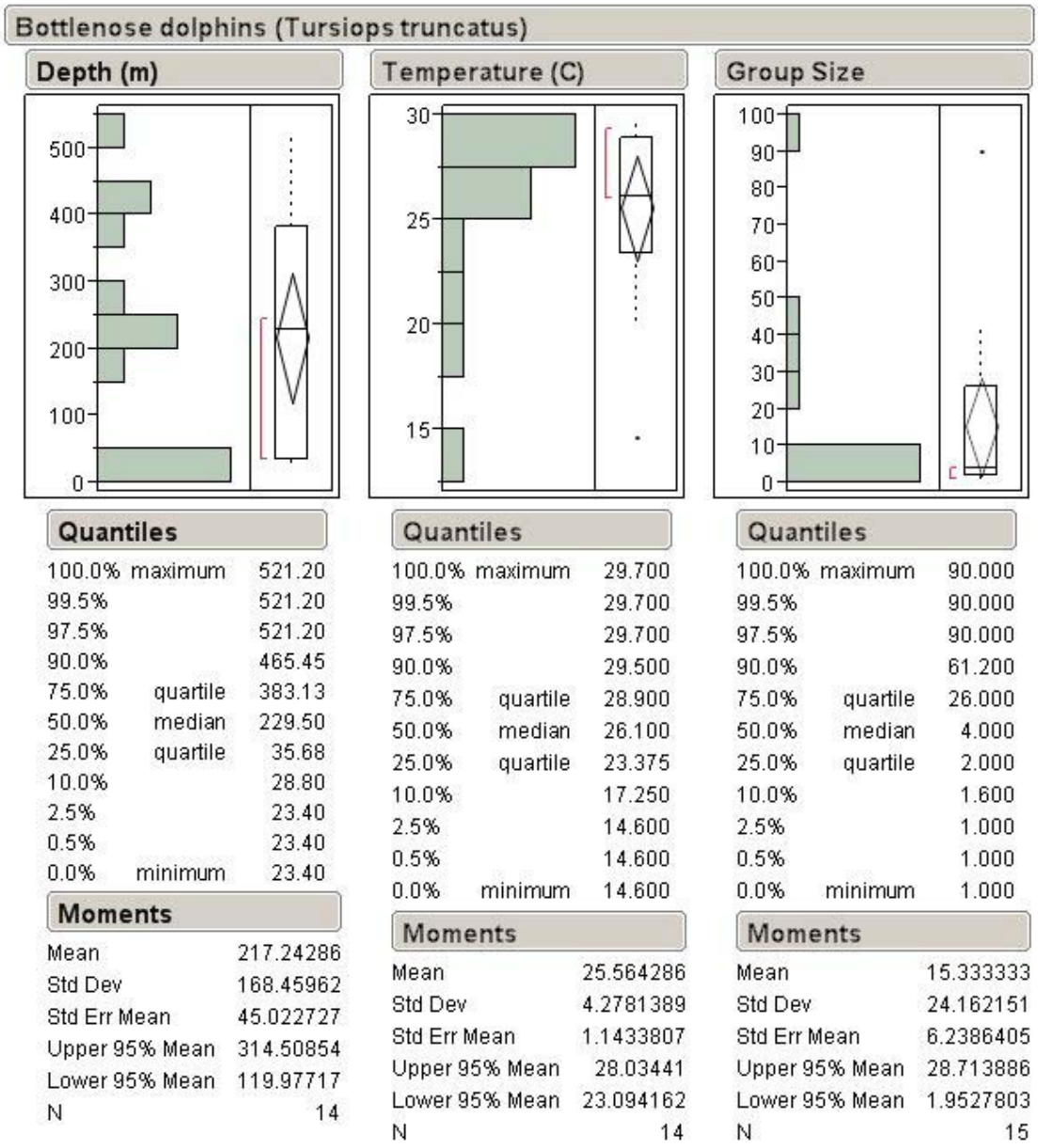


Figure 7. Descriptive statistics for depth, sea surface temperature, and group size estimates for bottlenose dolphin (*Tursiops truncatus*) sightings during vessel line transects surveys in the USWTR study area (July 2008 through June 2009).

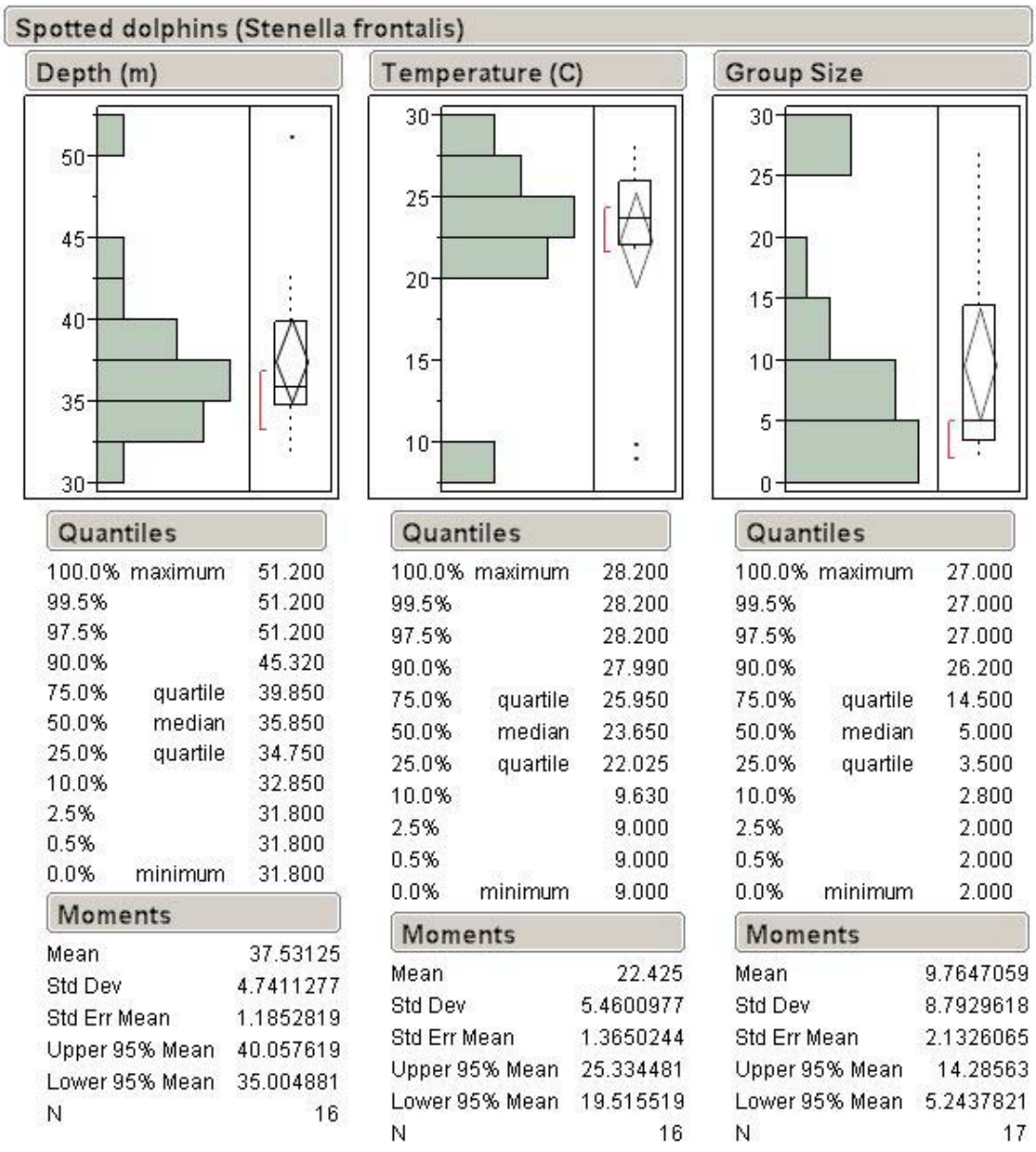


Figure 8. Descriptive statistics for depth, sea surface temperature, and group size estimates for Atlantic spotted dolphins (*Stenella frontalis*) sightings during vessel line transects surveys in the USWTR study area (July 2008 through June 2009).

Distributions and Habitat Associations of Cetaceans

The distributions of marine mammal sightings, by species, are presented in Figures 9 through 11. In general, spotted dolphin sightings were restricted to shallow shelf waters, whereas bottlenose dolphin distributions ranged over a large area with most animals detected in deeper waters. This trend was consistent in both years of the monitoring program.

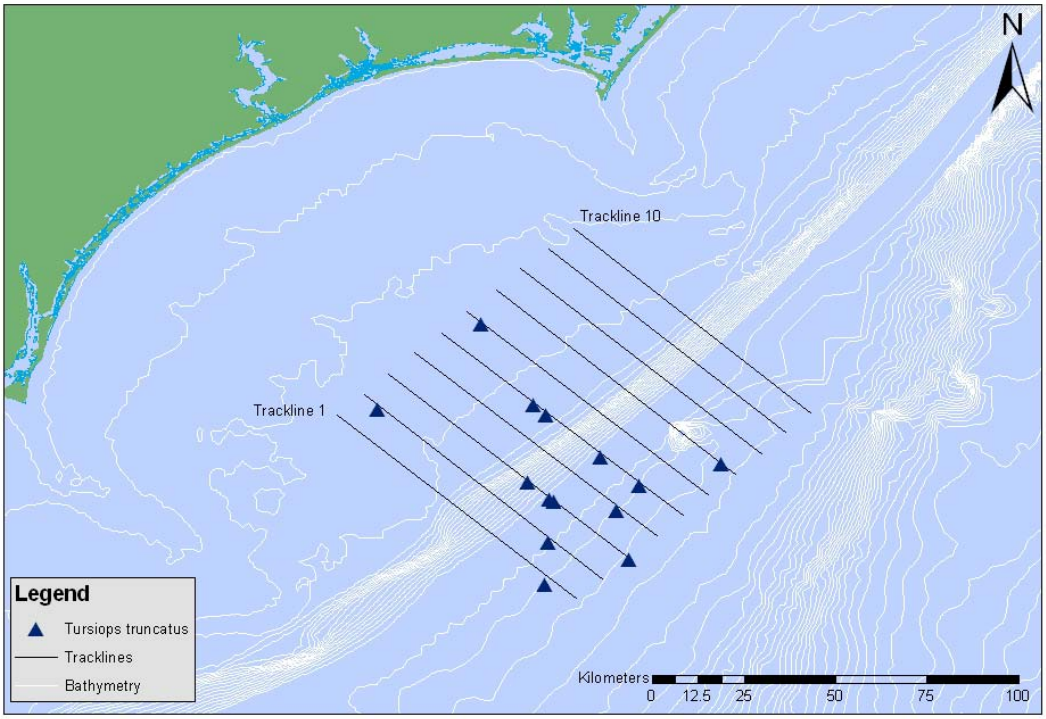


Figure 9. Distribution of bottlenose dolphin (*Tursiops truncatus*) sightings made during vessel-based surveys in Onslow Bay, NC, July 2008 through June 2009.

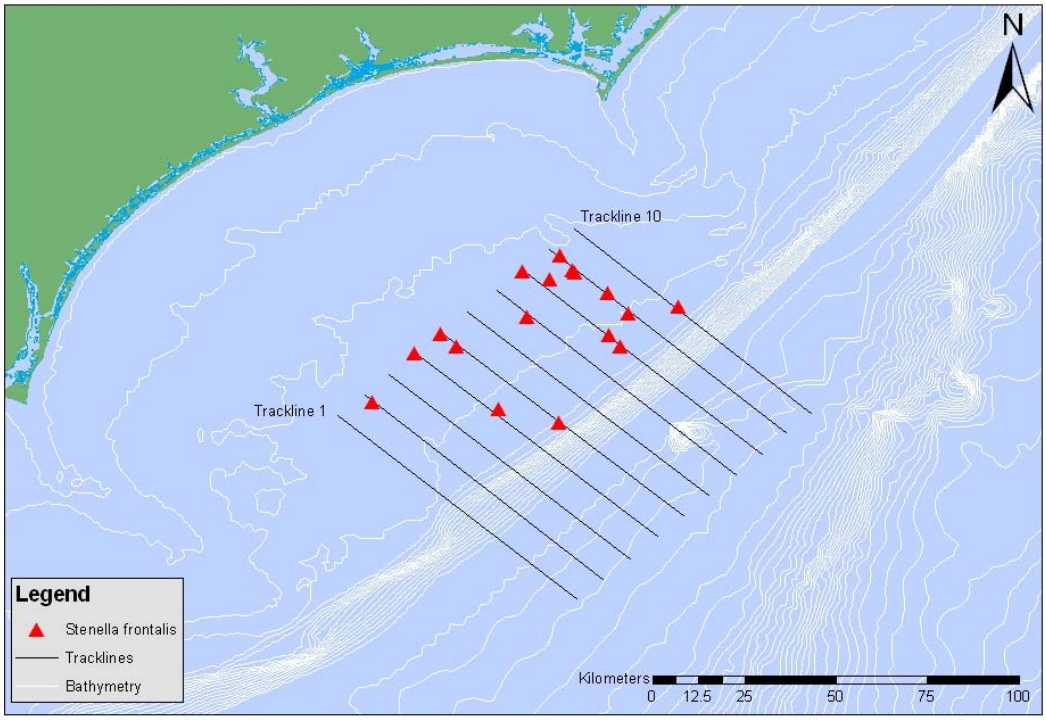


Figure 10. Distribution of Atlantic spotted dolphin (*Stenella frontalis*) sightings made during vessel-based surveys in Onslow Bay, NC, July 2008 through June 2009.

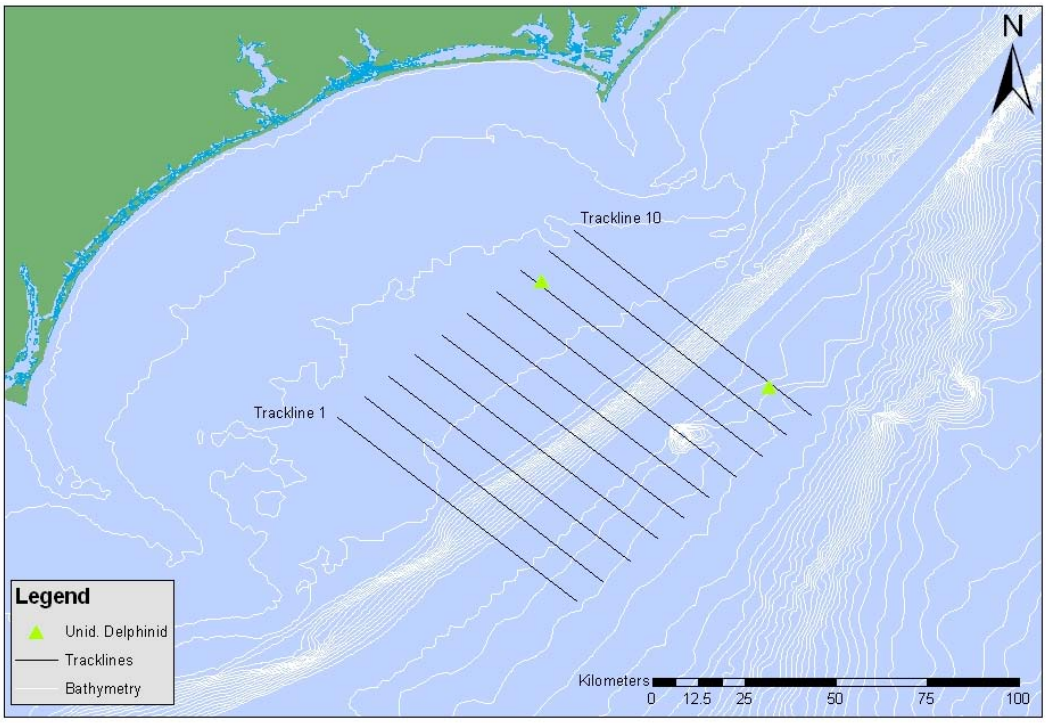


Figure 11. Distribution of other cetacean sightings made during vessel-based surveys in Onslow Bay, NC, July 2008 through June 2009.

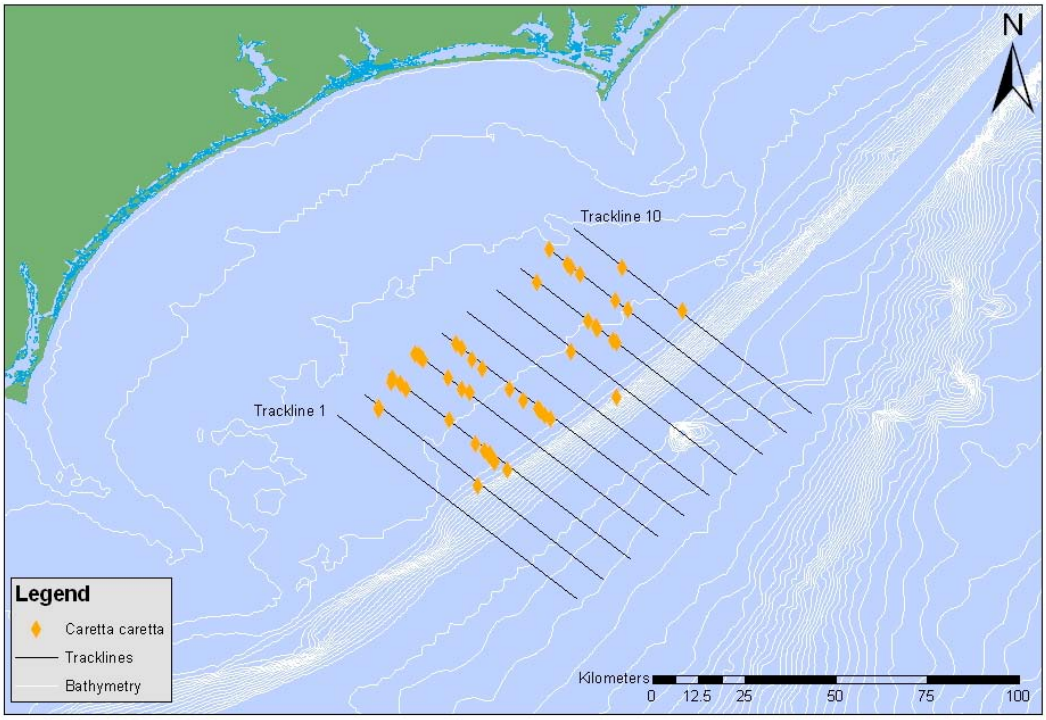


Figure 12. Distribution of loggerhead sea turtle (*Caretta caretta*) sightings made during vessel-based surveys in Onslow Bay, NC, July 2008 through June 2009.

Seasonality of Effort and Sightings

Due to unfavorable survey conditions, there was no effort in four months during Year Two. Trends in seasonality are therefore difficult to interpret (Figs. 13,14). Sea turtle presence appears to peak in February through April, however with no survey effort in January and May this apparent peak may be exaggerated.

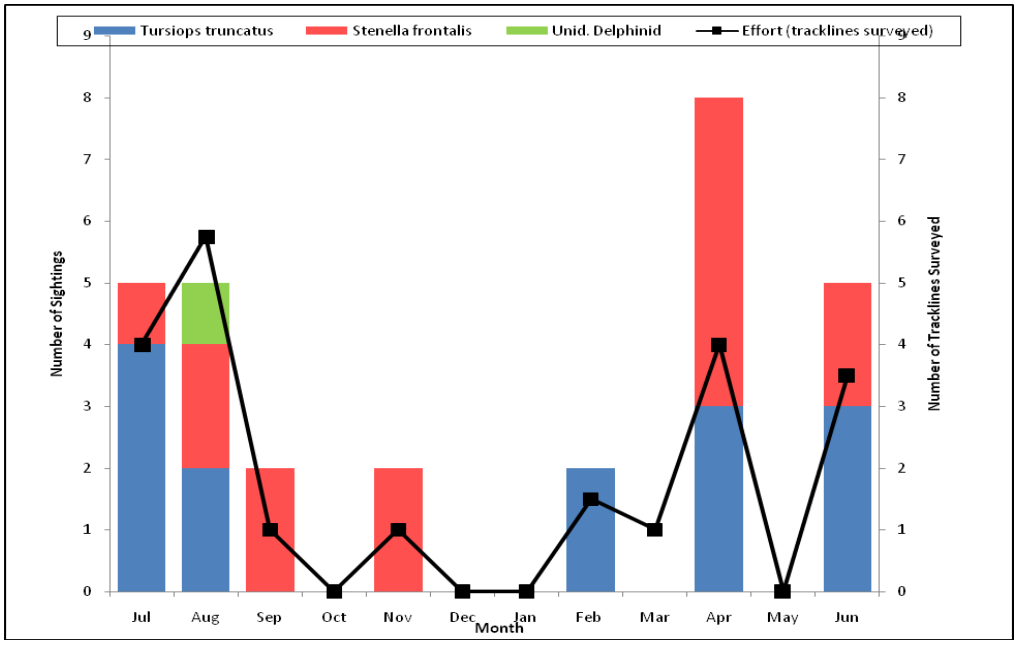


Figure 13. Number of cetacean sightings by month and effort (number of tracklines surveyed) in Year Two.

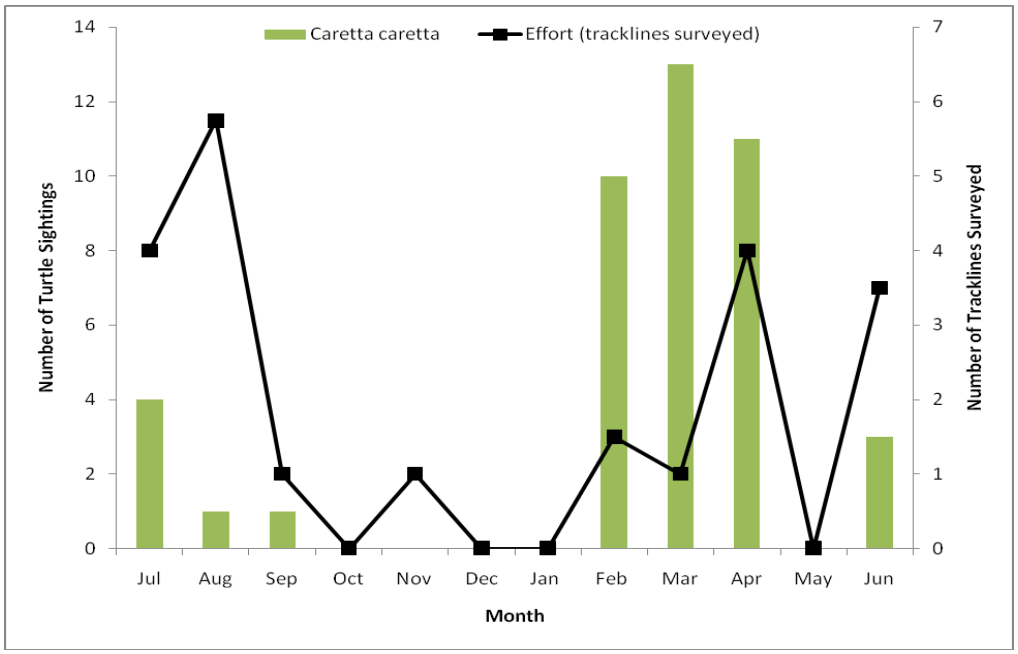


Figure 14. Number of turtle sightings by month displayed with effort (number of tracklines surveyed) in Year Two.

Photographic Effort

Approximately 970 digital images were taken for species confirmation and individual identification. Every attempt was made to photograph all animals encountered, primarily to validate species identification, but also to develop photo-identification catalogs for cetacean species in Onslow Bay. Of the 33 cetacean sightings recorded in Year Two, images were obtained from all but seven encounters. In addition, images taken during the vessel-based surveys have been used to identify diagnostic features and for comparison with images taken on the aerial surveys to improve species identification.

Images taken during surveys in Onslow Bay in Year Two were added to photo-identification catalogs for bottlenose and spotted dolphins. In Year Two, more groups of spotted dolphins were encountered and 26 new identifications were added to the catalog of spotted dolphins (Table 6). However, no pilot whales or Risso's dolphins were observed during the reporting period for Year Two (Tables 5 and 6).

To date, there have been no re-sightings of any individuals photographed, within years or between years. Images of bottlenose and spotted dolphins identified from the USWTR surveys were compared to dorsal fin images taken during monthly surveys conducted in 2000-2003 in the coastal waters up to 15 miles offshore from Masonboro Inlet to New River Inlet. Although there were re-sightings of animals within those surveys, no matches were found to the dolphins identified from the USWTR surveys. Images of the dorsal fins of stranded cetaceans were also compared to photo-identification catalogs for Onslow Bay, but no matches have been found to date.

Table 5. Number of individual identifications from images taken during vessel-based surveys in Onslow Bay, July 2008 through June 2009.

Species	Sightings	Images	Unique IDs	Total Catalog Size
Tursiops truncatus	14	271	26	78
Stenella frontalis	17	698	26	29

Table 6. Comparison of photo-identification effort between Year 1 (June 2007-July 2008) and Year 2 (July 2008 through June 2009).

	Year 1			Year 2		
	Sightings	Images	Unique IDs	Sightings	Images	Unique IDs
Tursiops truncatus	24	472	52	14	271	26
Stenella frontalis	5	76	3	17	698	26
Globicephala spp.	1	105	8	0	0	0
Grampus griseus	2	182	5	0	0	0

Passive Acoustic Monitoring

From 1 July 2008 to 30 June 2009, 17 USWTR line-transect surveys were conducted with the towed hydrophone array. During these surveys, 20 groups of animals positively identified by the visual observers were recorded. Of these 20 groups, seven were visually identified as offshore bottlenose dolphins and 13 were identified as Atlantic spotted dolphins (Table 7). Further spectral analysis (measuring different parameters mentioned above) will be conducted over the next few months.

Table 7. Number of recordings made using towed array between 1 July 2008 – 30 June 2009. Total monitoring time was 70.6 hours.

Species	Total # of Days Detected	Total # of Detections	Total Duration of Recordings (h:mm)
Stenella frontalis	10	13	6:07
Tursiops truncatus	6	7	3:52
Unidentified	9	15	4:45

During this past year, the HARP data from the second and third deployments have been analyzed using LTSAs to look for high-energy events (such as whistles and clicks). In the second HARP deployment 595 marine mammal vocal events and 19 mid-frequency sonar events were found. Most of the marine mammal vocal events have not yet been identified to

species (more *in situ* data collection with the towed array is needed), but it was possible to classify eight events as probable sperm whales (one of which consisted of a coda), one as a probable pilot whale, and 20 as probable Risso's dolphins (see Figure 15 for an example of Risso's clicks found in both the towed array and HARP data). The duration of the 595 odontocete vocal events in the second HARP ranged from one minute to just over 10.5 hours, with an average duration of 35 minutes. In the third HARP deployment 399 marine mammal vocal events were found using the LTSAs. As with the data from the second HARP deployment, most of the marine mammal vocal events have not yet been identified to species, but it was possible to classify eight events as probable sperm whales, seven as probable Risso's dolphins, and one as a possible beaked whale. The duration of the 399 odontocete vocal events in the third HARP ranged from one minute to just over 8.5 hours, with an average duration of 36 minutes. These results are summarized in Table 8 and Figures 16-21.

Table 8. Number of days recorded and total number, number of days with, and percentage of hours with vocal events for all HARP deployments to date.

HARP Deployment	# Days Recorded	# Days with Vocal Events	# Hours Recorded	# 1-Hr Bins with Vocal Events	Total # of Vocal Events
1	99	95	2344	924	561
2	104	100	2473	769	595
3	107	93	2559	540	399

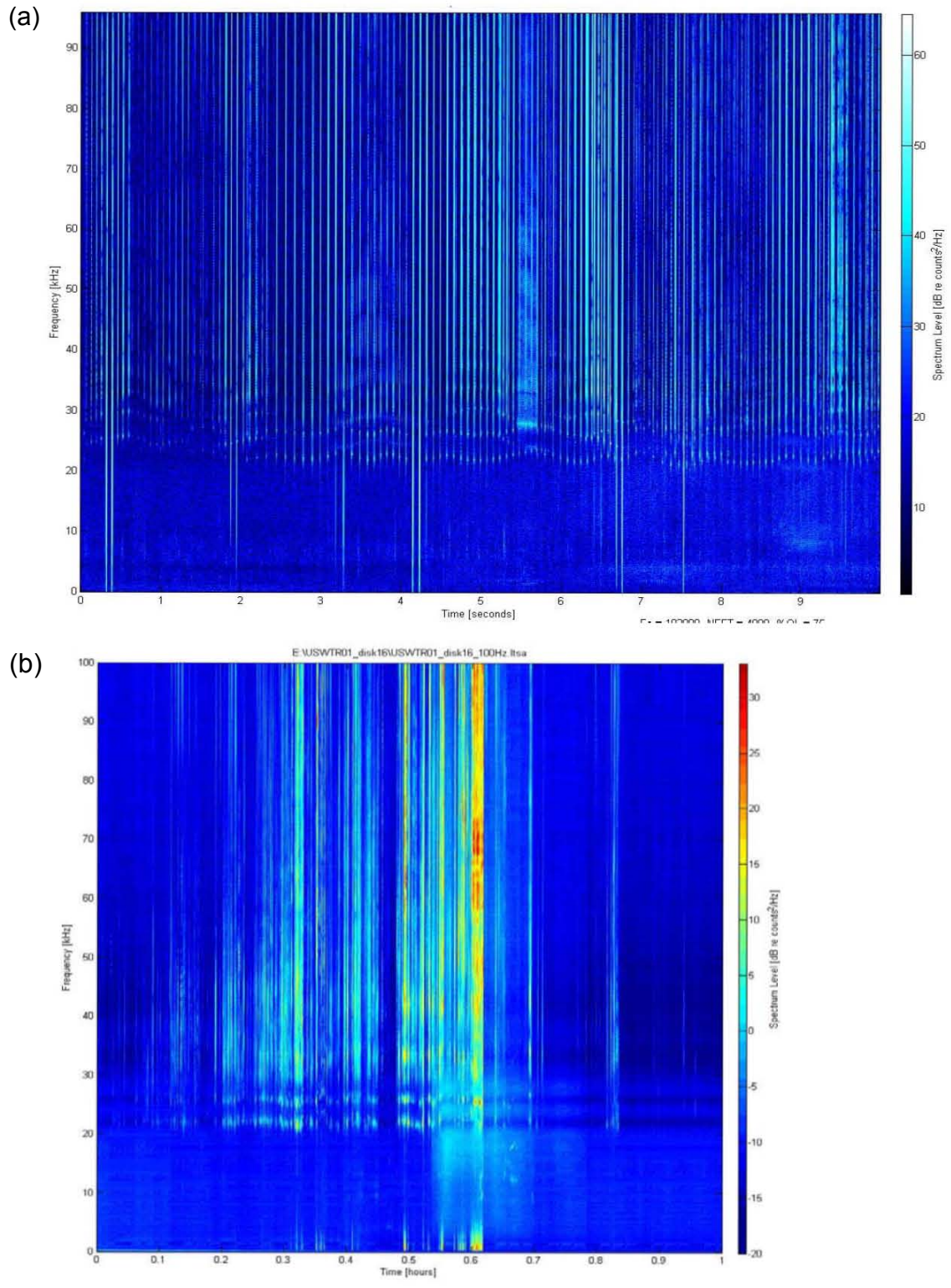
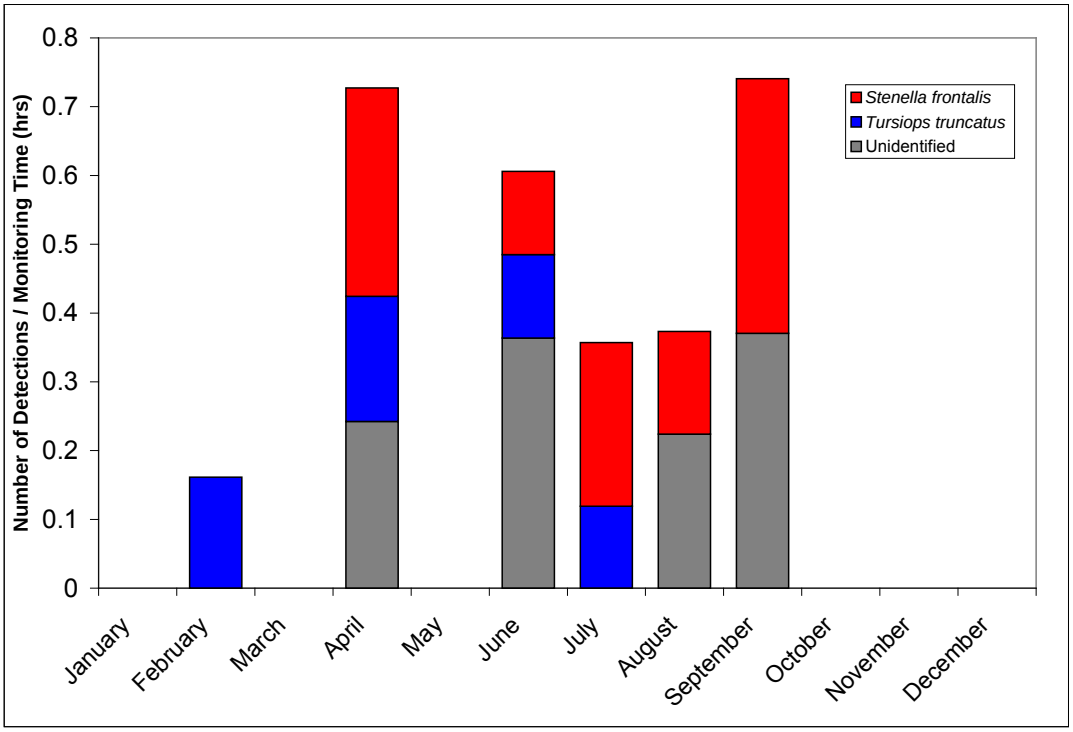


Figure 15. Spectrograms showing (a) Risso's clicks recorded on the towed array and (b) probable Risso's clicks recorded on the HARP. Similar patterns have been described for Risso's dolphins off Southern California (Soldevilla *et al*. 2008).

(a)



(b)

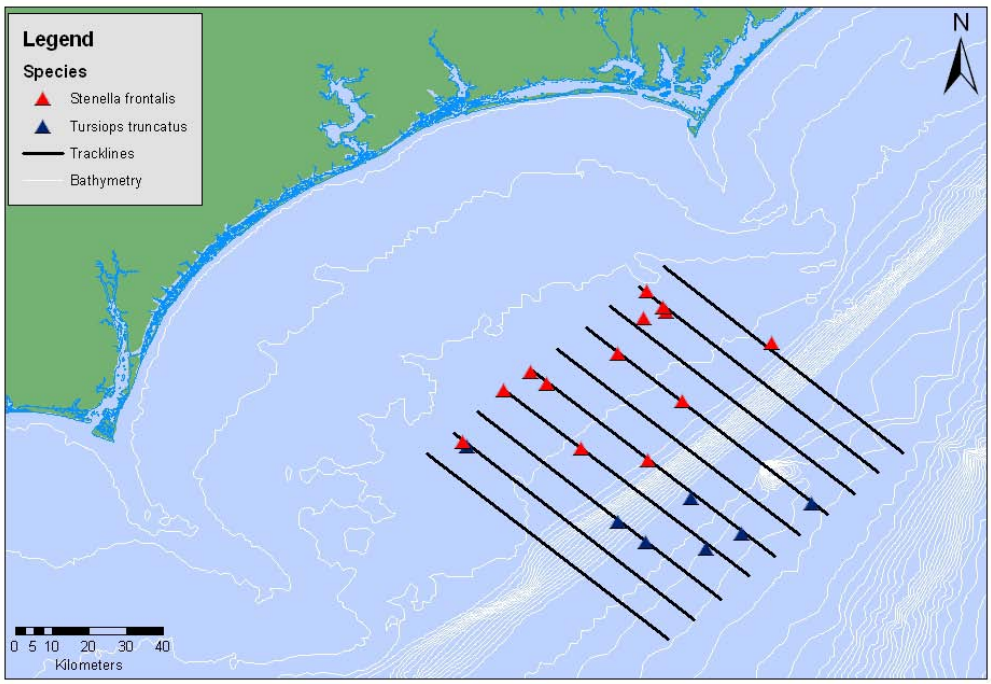


Figure 16. (a) Number of detections from the HARP per monitoring time (hrs) for each species by month and (b) distribution of known species recorded by the array and positively identified by visual observers.

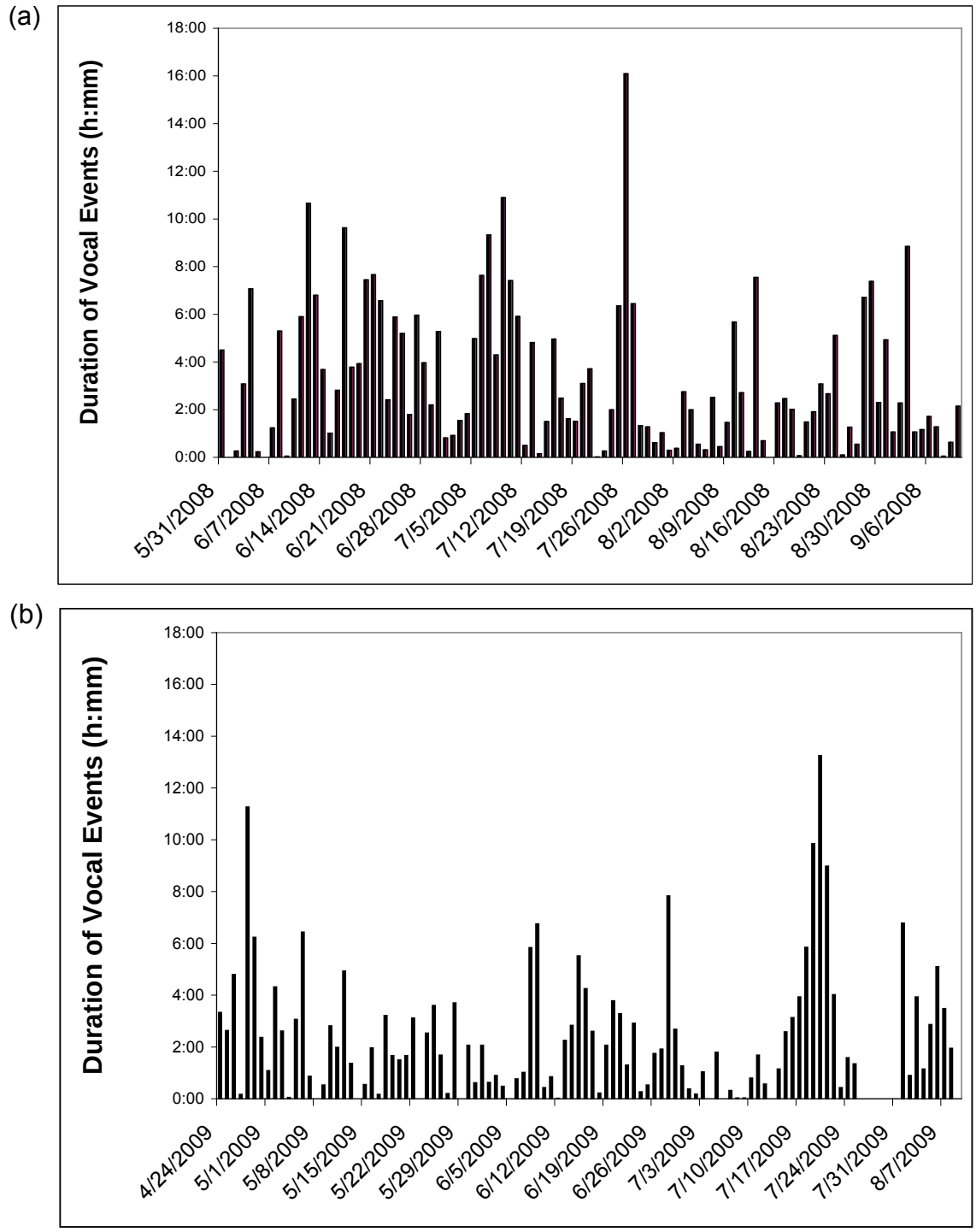


Figure 17. Total duration of vocal events (whistles and clicks) for each day during the (a) second HARP deployment and (b) third HARP deployment. Vocal events were found using LTSAs.

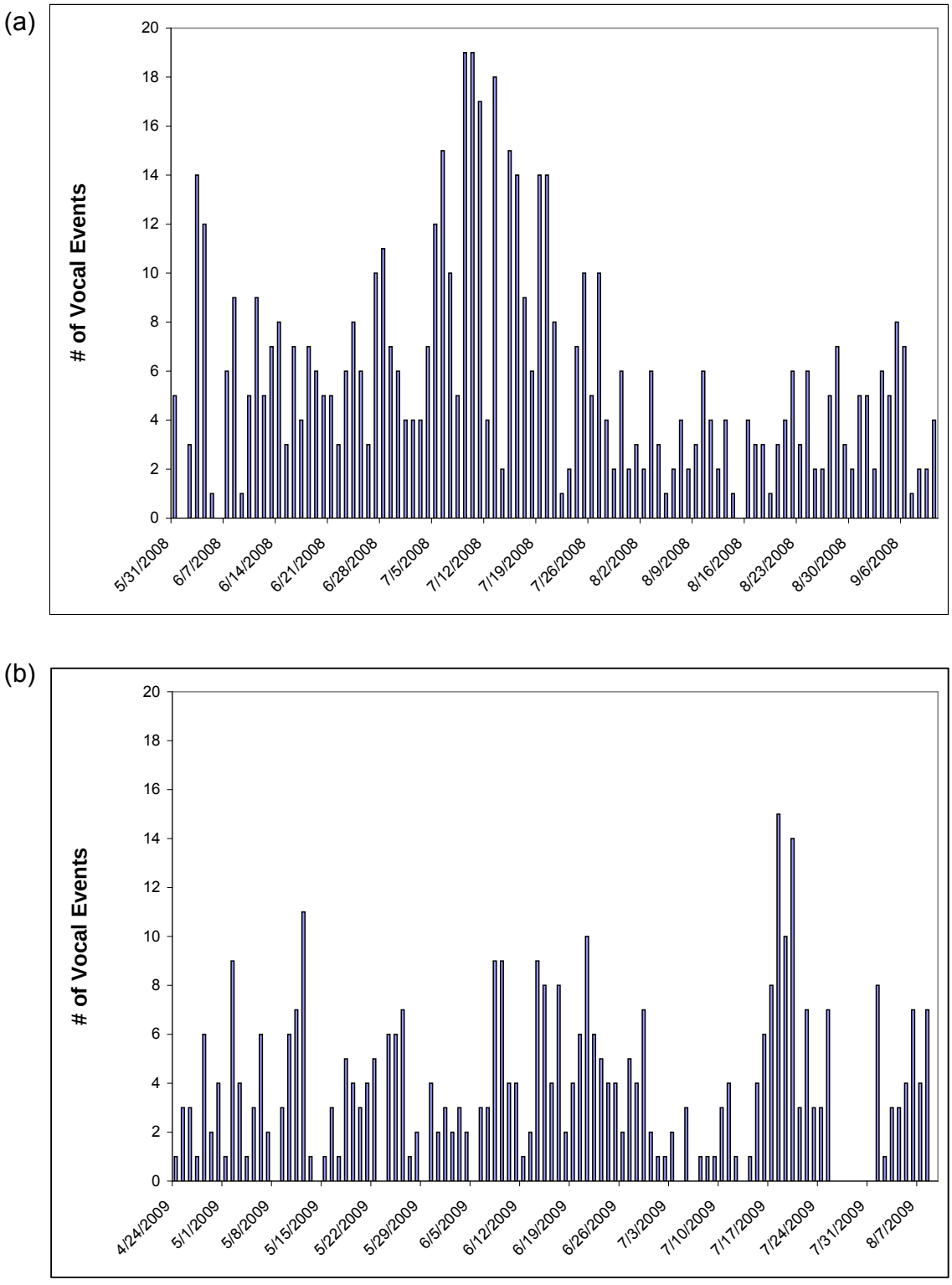
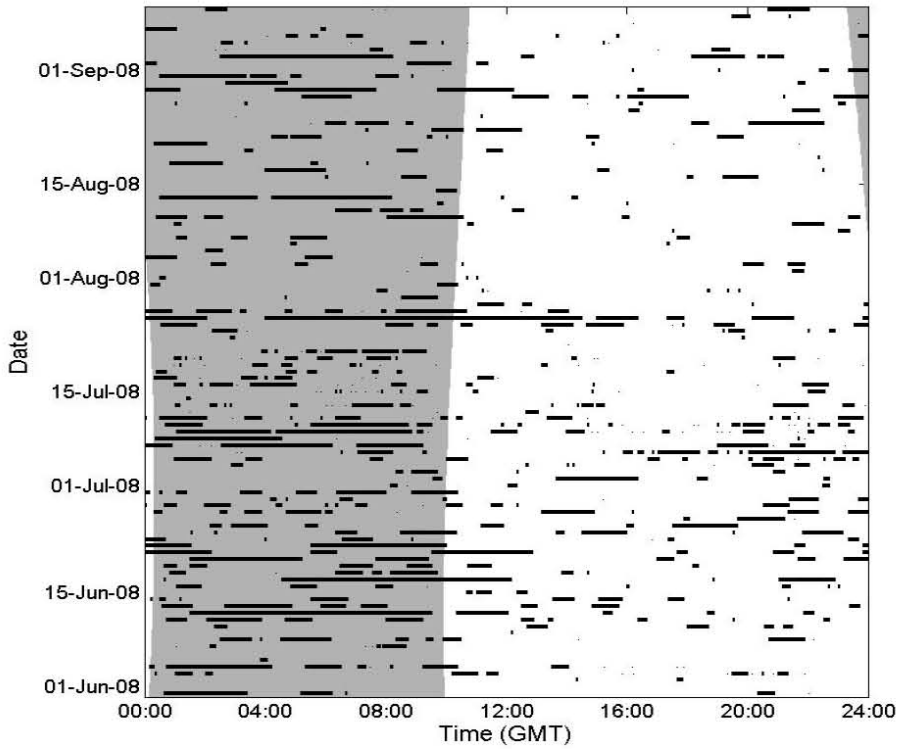


Figure 18. Total number of vocal events (whistles and clicks) for each day during (a) the second HARP deployment and (b) the third HARP deployment. Vocal events were found using LTSAs.

(a)



(b)

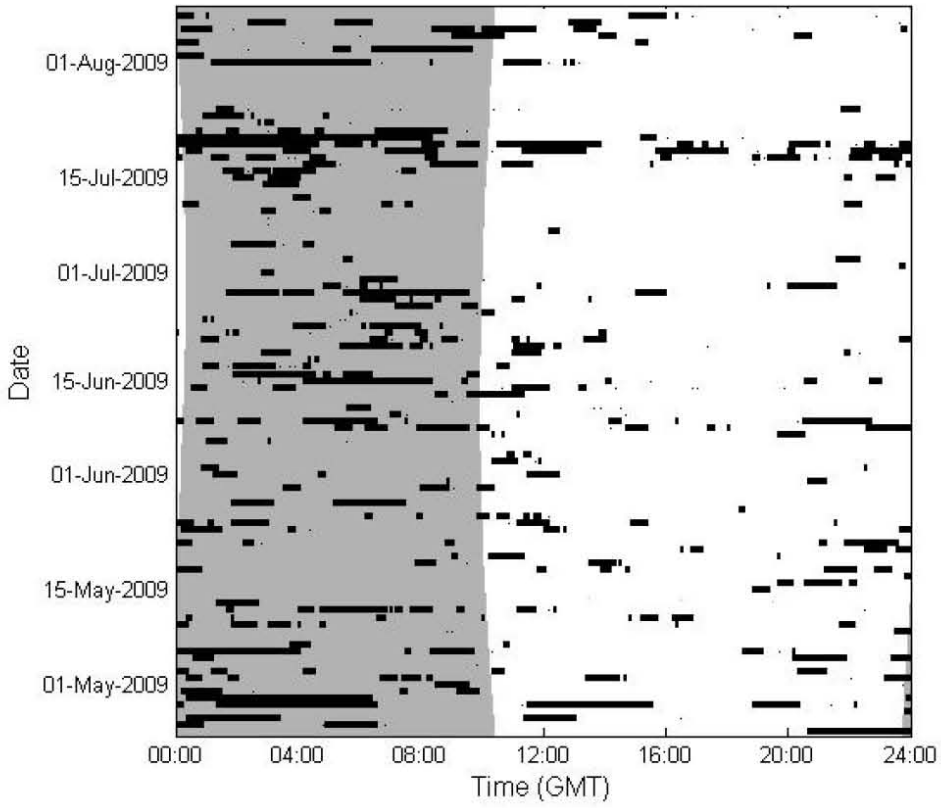


Figure 19. Time of vocal events for (a) the second HARP deployment and (b) the third HARP deployment. Shading indicates periods of darkness, determined from the U.S. Naval Observatory (http://aa.usno.navy.mil).

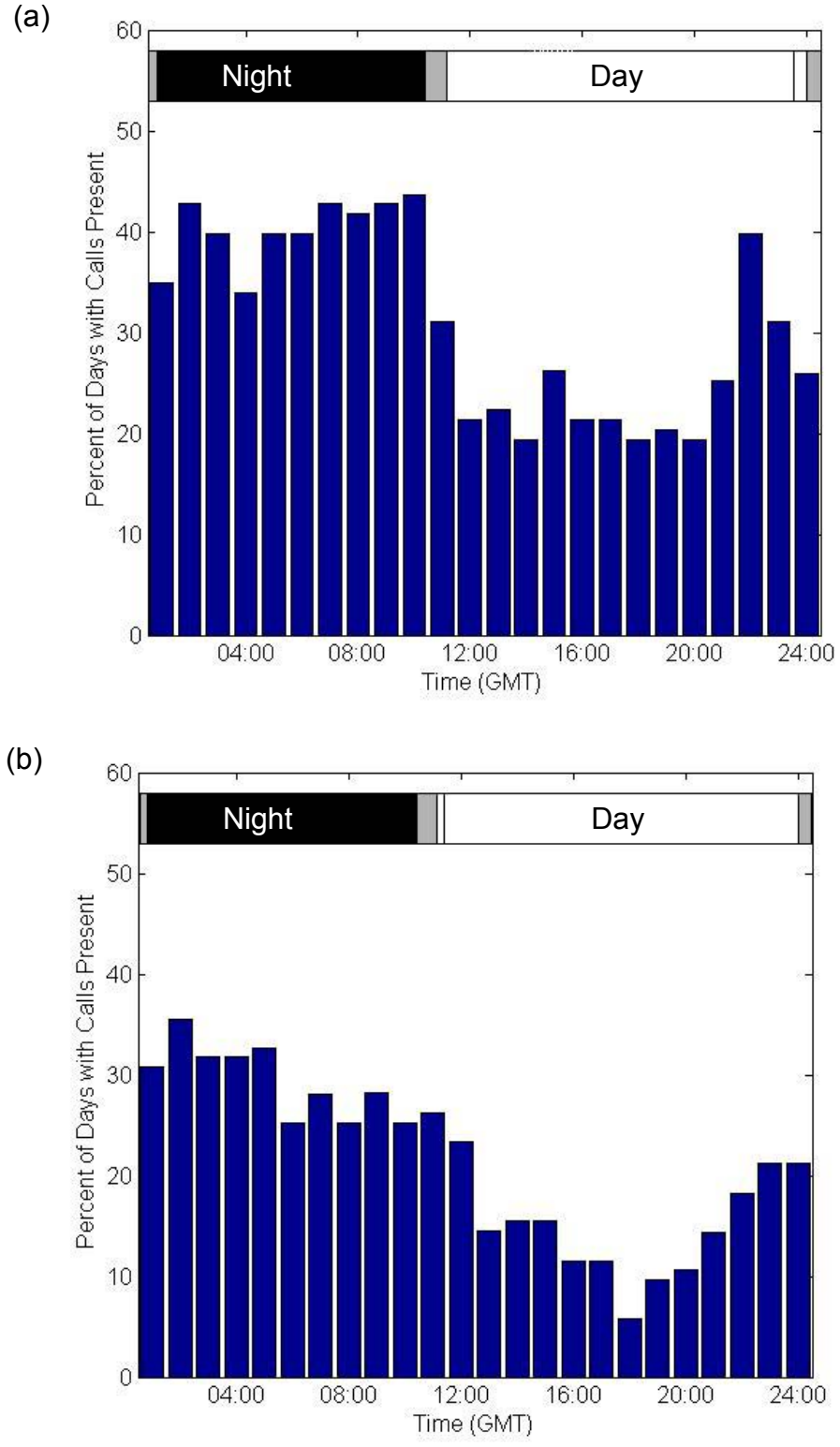


Figure 20. Number of days with calls (normalized by total number of hours recorded by each HARP) by time of day (GMT) for (a) the second HARP deployment and (b) the third HARP deployment.

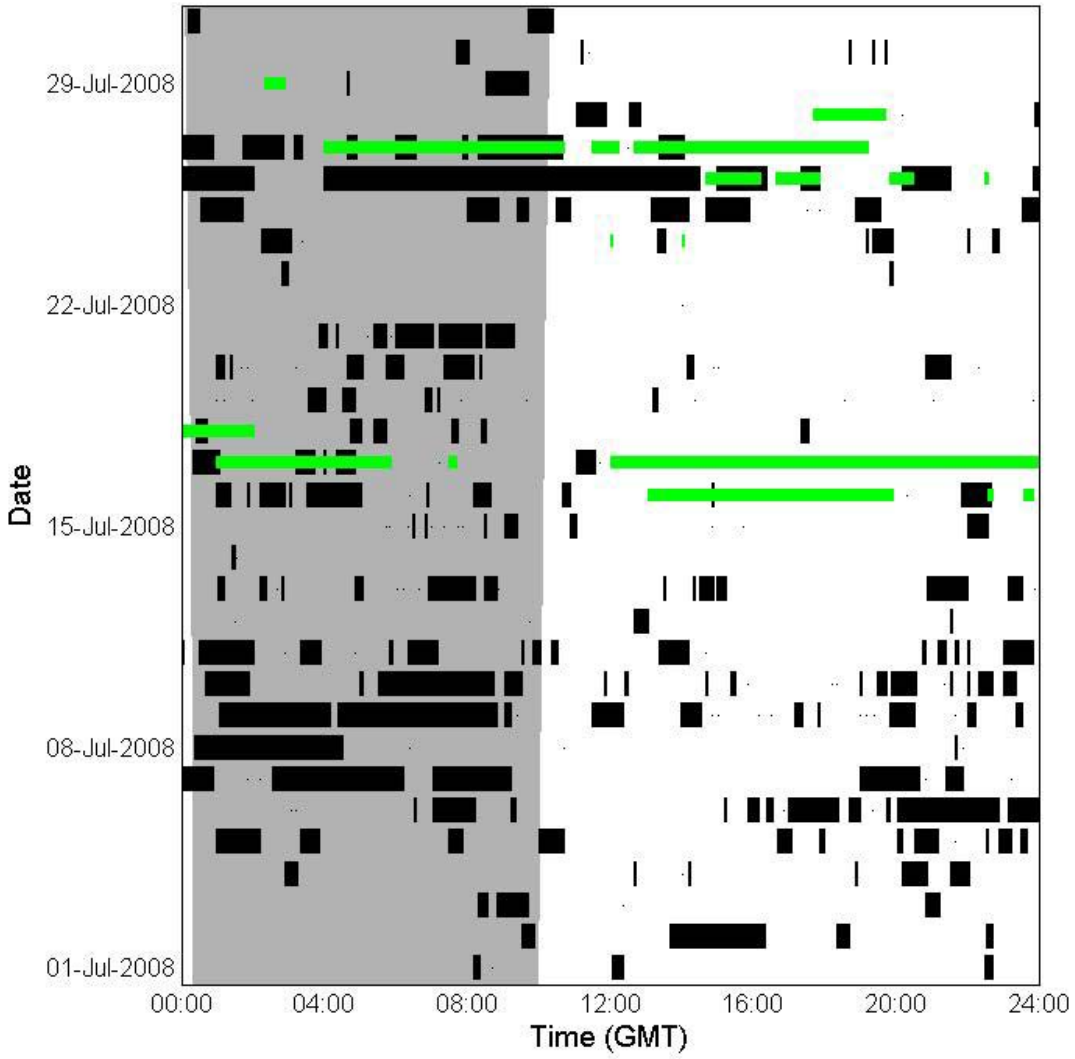


Figure 21. Time of vocal events (black bars) and sonar events (green bars) for the second HARP deployment during July 2008. Shading indicates periods of darkness, determined from the U.S. Naval Observatory (http://aa.usno.navy.mil).

Seabird Observations

During Year Two of Onslow Bay surveys, a total of 788 birds were recorded in approximately 70 hours of seabird observations (Table 9). The sightings-per-unit-effort (SPUE) ranged between 0.72 and 61.64 and was highest in February. A total of 23 bird species were identified, with the largest number of species observed during the months of August 2008 and April 2009. The highest diversity values were observed in July and August of 2008, and in April and June of 2009.

Table 10 shows the species of seabird observed in each survey month. Cory's Shearwaters (*Calonectris diomedea*) were the most commonly sighted species, but Greater Shearwaters (*Puffinus gravis*), Common Terns (*Sterna hirundo*) and Wilson's Storm Petrels (*Oceanites oceanicus)* were also observed frequently. Phalaropes (*Phalaropus* sp.) were also common though it was often not possible to identify these birds to the species level.

The mean depth, sea surface temperature and distance to continental shelf for each observed seabird species is shown in Table 11. Most bird species were associated with warmer Gulf Stream waters, but Northern Fulmars (*Fulmarus glacialis*), Red Phalaropes (*Phalaropus fulicarius*) and Northern Gannets (*Morus bassanus*) were observed in cooler shelf waters. Black-capped Petrels (*Pterodroma hasitata)* and Wilson's Storm Petrels were typically observed in deep waters closer to the continental shelf. The distribution of seabirds observed during surveys in Onslow Bay is shown in Figures 22 through 26.

Figure 27 shows the seasonal SPUE by species in Onslow Bay during both years of seabird surveys. Overall, the highest SPUE values were observed in the fall, followed by the winter and spring. The lowest values of SPUE were observed in summer. Cory's Shearwaters and Common Terns comprised a large proportion of the fall SPUE, whereas Phalaropes accounted for a large proportion of the winter SPUE. Sightings were more evenly distributed among species in the summer and spring. Audubon's Shearwaters (*Puffinus lherminieri*), Greater Shearwaters, Cory's Shearwaters and unidentified Shearwater species were most frequently observed in the summer, but also observed in spring. Black-capped Petrels, Wilson's Storm Petrels and unidentified Phalarope species were observed during spring months.

Table 9. **Seabird sighting statistics by month during surveys in Onslow Bay, NC from June 2008 through June 2009. The sighting per unit effort (SPUE) was calculated by dividing the total number of birds observed by the total number of hours surveyed, while diversity was calculated using the Shannon Diversity Index**.

Month	Number of Species Observed	Total Number of Birds Observed	Diversity	Total Hours Surveyed	SPUE by Month
Jun-08	5	35	1.17	7.83	4.47
Jul-08	8	49	1.69	14.95	3.28
Aug-08	12	156	1.48	19.68	7.93
Sep-08	5	146	1.11	4.57	31.97
Nov-08	1	2	0.00	2.77	0.72
Jan-09	1	3	0.00	0.63	4.74
Feb-09	8	187	1.17	3.05	61.64
Apr-09	12	195	1.74	14.78	13.19
Jun-09	6	14	1.63	1.12	12.54
OVERALL	**23**	**788**	**1.11**	**69.38**	**15.61**

Table 10: Seabird sightings by month from June 2008 through June 2009 during surveys in Onslow Bay, NC.

Month	Jun-08	Jul-08	Aug-08	Sep-08	Nov-08	Jan-09	Feb-09	Apr-09	Jun-09	TOTAL
Audubon's Shearwaters (*Puffinus lherminieri*)	10	5	13	1			5	7	3	**44**
Cory's Shearwaters (*Calonectris diomedea*)	12	11	56	50				0	2	**131**
Greater Shearwaters (*Puffinus gravis*)	1	4	7					62		**74**
Manx Shearwaters (*Puffinus puffinus*)	0	1	0	10		1	2	1	1	**16**
Unidentified Shearwaters (*Puffinus* sp.)	2	11	10	5			1	6	1	**36**
Black-capped Petrels (*Pterodroma hasitata)*	0		1	9				13		**23**
Leach's Petrel (*Oceanodroma leucorhoa*)	0		0					0	1	**1**
Wilson's Storm Petrels (*Oceanites oceanicus)*	2	12	3					48	1	**66**
Unidentified Storm Petrels	0	1	0					6	1	**8**
Bridled Terns (*Onychoprion anaethetus)*	0	1	33					2		**36**
Sooty Terns (*Onychoprion fuscatus*)	0	1	1					5		**7**
Arctic Tern (Sterna paradisaea)	0		1					2	4	**7**
Black Tern (*Chlidonias niger*)	0		0					0		**0**
Common Tern (*Sterna hirundo*)	0		2	70				4		**76**
Unidentified Tern	0		5					8		**13**
White-tailed Tropicbirds (*Phaethon lepturus)*	1		0					0		**1**
Parasitic Jaeger (*Stercorarius parasiticus*)	0		1					3		**4**
Pomarine Jaeger (*Stercorarius pomarinus*)	0		0					14		**14**
Unidentified Jaeger (*Stercorarius* sp.)	0		0					6		**6**
Red Phalarope (*Phalaropus fulicarius*)	0		0				31	2		**33**
Red-necked Phalarope (*Phalaropus lobatus*)	0	2	1					0		**3**
Unidentified Phalarope (*Phalaropus* sp.)	6		20				74	0		**100**
Northern gannet (*Morus bassanus*)	0		0				2	0		**2**
Northern fulmar (*Fulmarus glacialis*)	0		0				2	0		**2**
Herring gull (*Larus argentatus*)	0		0				3	0		**3**
Bonaparte's Gull (*Chroicocephalus philadelphi*)	0		0				64	0		**64**
Unidentified Gull	0		0		2	2	1	0		**5**
Common Loon	0		0				1	0		**1**
Falcon (*Falco* sp.)	0		0					0		**0**
Great Blue Heron (*Ardea herodias*)	0		1					0		**1**
Mourning Dove (*Zenaida macroura*)	0		0					0		**0**
Unidentifed bird	1		1				2	3		**7**
Unidentified swallow	0		0					0		**0**
Unidentified sparrow	0		0	1				0		**1**
Unidentified sandpiper	0		0					3		**3**
TOTAL	**35**	**49**	**156**	**146**	**2**	**3**	**188**	**195**	**14**	**788**

Table 11. Mean depth, sea surface temperature (SST) and distance to continental shelf for commonly sighted seabird species from surveys in Onslow Bay, NC

Species	Mean SST	Mean depth (m)	Mean distance to shelf (km)
Audubon's Shearwater (*Puffinus lherminieri*)	78.70	-284.65	54.09
Black Tern (*Chlidonias niger*)	77.80	-217.67	66.37
Black-capped Petrel (*Pterodroma hasitata)*	78.83	-529.41	28.69
Bridled Tern (*Onychoprion anaethetus)*	80.63	-196.17	75.15
Common Tern (*Sterna hirundo*)	78.22	-100.25	79.00
Cory's Shearwater (*Calonectris diomedea*)	82.59	-188.86	66.24
Greater Shearwater (*Puffinus gravis*)	80.97	-246.18	60.64
Manx Shearwater (*Puffinus puffinus*)	80.40	-331.82	43.30
Northern fulmar (*Fulmarus glacialis*)	61.47	-43.00	89.20
Northern gannet (*Morus bassanus*)	63.84	-48.00	82.78
Parasitic Jaeger (*Stercorarius parasiticus*)	78.27	-304.25	57.65
Pomarine Jaeger (*Stercorarius pomarinus*)	75.66	-234.64	63.88
Red Phalarope (*Phalaropus fulicarius*)	62.39	-40.43	94.06
Red-necked Phalarope (*Phalaropus lobatus*)	81.21	-344.00	50.45
Sooty Tern (*Onychoprion fuscatus*)	80.40	-193.00	62.87
White-tailed Tropicbird (*Phaethon lepturus)*	79.21	-307.21	52.35
Wilson's Storm Petrel (*Oceanites oceanicus)*	82.72	-609.00	11.99

Table 12. Species codes for seabirds observed on Onslow Bay surveys

Seabird Species	Species Code
Arctic Tern (*Sterna paradisaea*)	ARTE
Audubon's Shearwater (*Puffinus lherminieri*)	AUSH
Black Tern (*Chlidonias niger*)	BLTE
Black-capped Petrel (*Pterodroma hasitata)*	BCPE
Bridled Tern (*Onychoprion anaethetus)*	BRTE
Common Tern (*Sterna hirundo*)	COTE
Cory's Shearwater (*Calonectris diomedea*)	COSH
Greater Shearwater (*Puffinus gravis*)	GRSH
Leach's Petrel (*Oceanodroma leucorhoa*)	LESP
Manx Shearwater (*Puffinus puffinus*)	MASH
Northern Fulmar (*Fulmarus glacialis*)	NOFU
Northern Gannet (*Morus bassanus*)	NOGA
Parasitic Jaeger (*Stercorarius parasiticus*)	PAJA
Pomarine Jaeger (*Stercorarius pomarinus*)	POJA
Red Phalarope (*Phalaropus fulicarius*)	REPH
Red-necked Phalarope (*Phalaropus lobatus*)	RNPH
Sooty Tern (*Onychoprion fuscatus*)	SOTE
Unidentified Jaeger (*Stercorarius* sp.)	UNJA
Unidentified Phalarope (*Phalaropus* sp.)	UNPH
Unidentified Shearwater (*Puffinus* sp.)	UNSH
Unidentified Storm Petrel	UNSP
Unidentified Tern	UNTE
Wilson's Storm Petrel (*Oceanites oceanicus)*	WISP
White-tailed Tropicbird (*Phaethon lepturus)*	WTTR

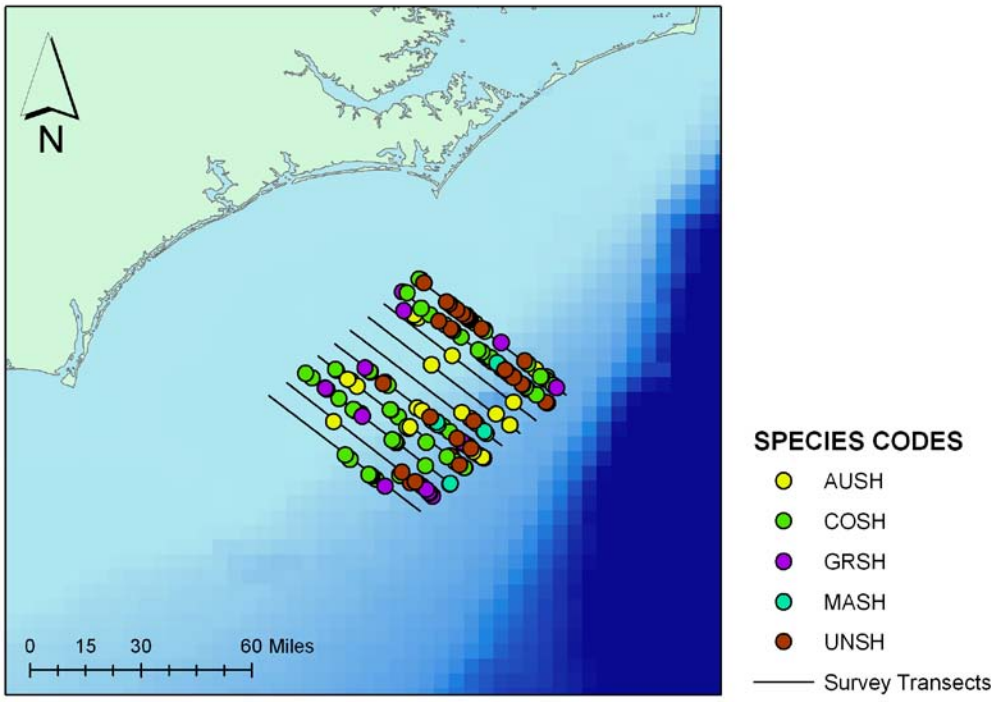


Figure 22: Distribution of Shearwater species observed during surveys in Year Two in Onslow Bay, NC. Seabird codes are listed in Table 12.

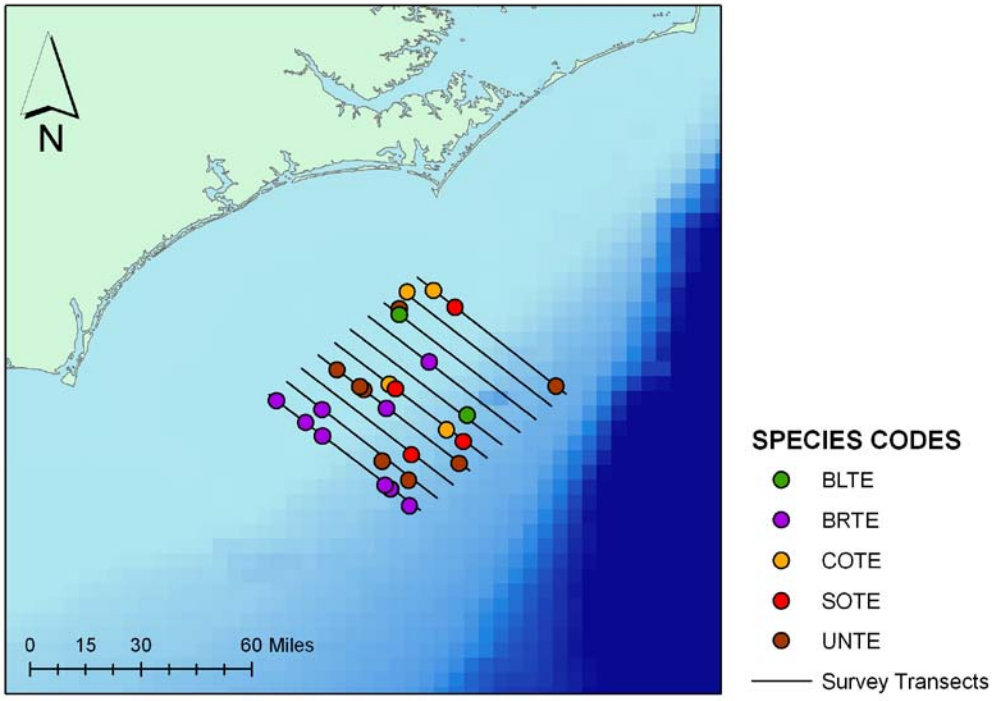


Figure 23: Distribution of Tern species observed during surveys in Year Two in Onslow Bay, NC. Seabird codes are listed in Table 12.

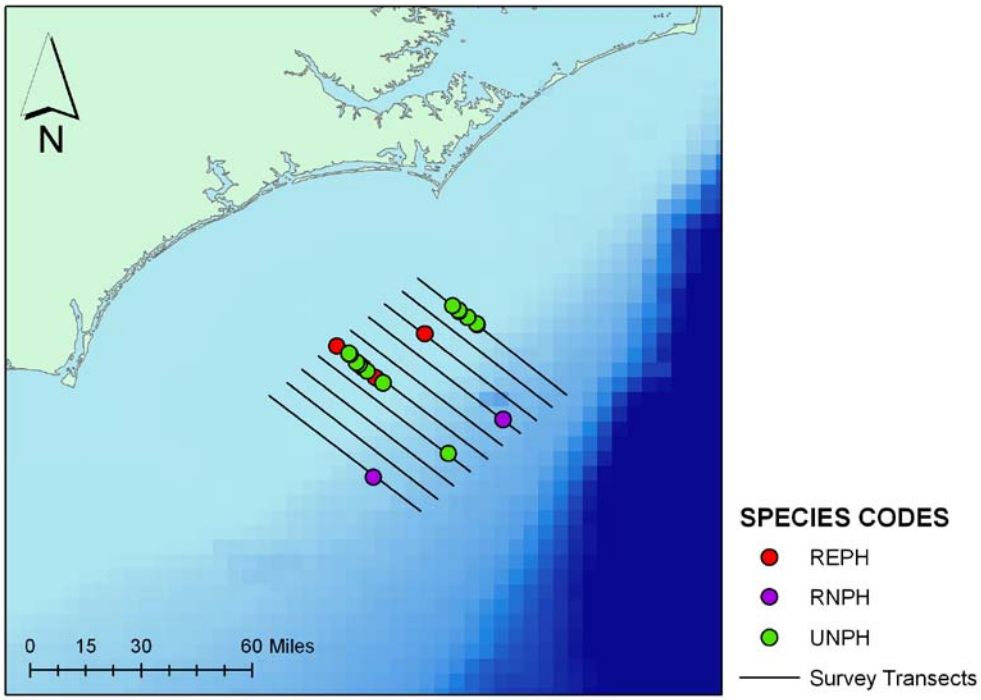


Figure 24. Distribution of Phalarope species observed during surveys in Year Two in Onslow Bay, NC. Seabird codes are listed in Table 12.

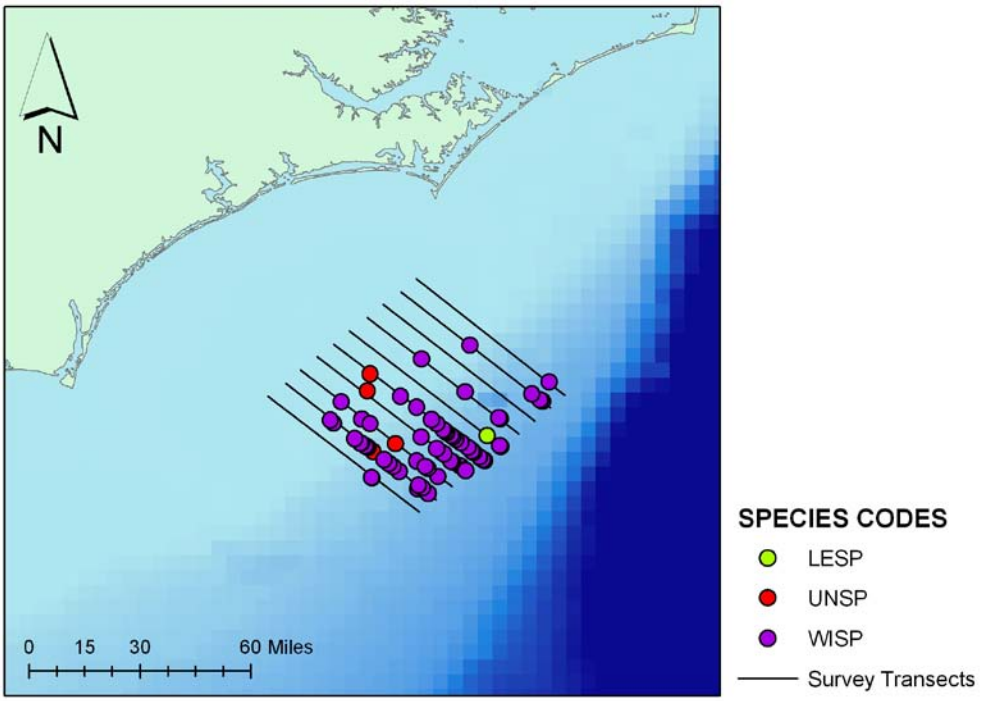


Figure 25. Distribution of Storm Petrel species observed during surveys in Year Two Onslow Bay, NC. Seabird codes are listed in Table 12.

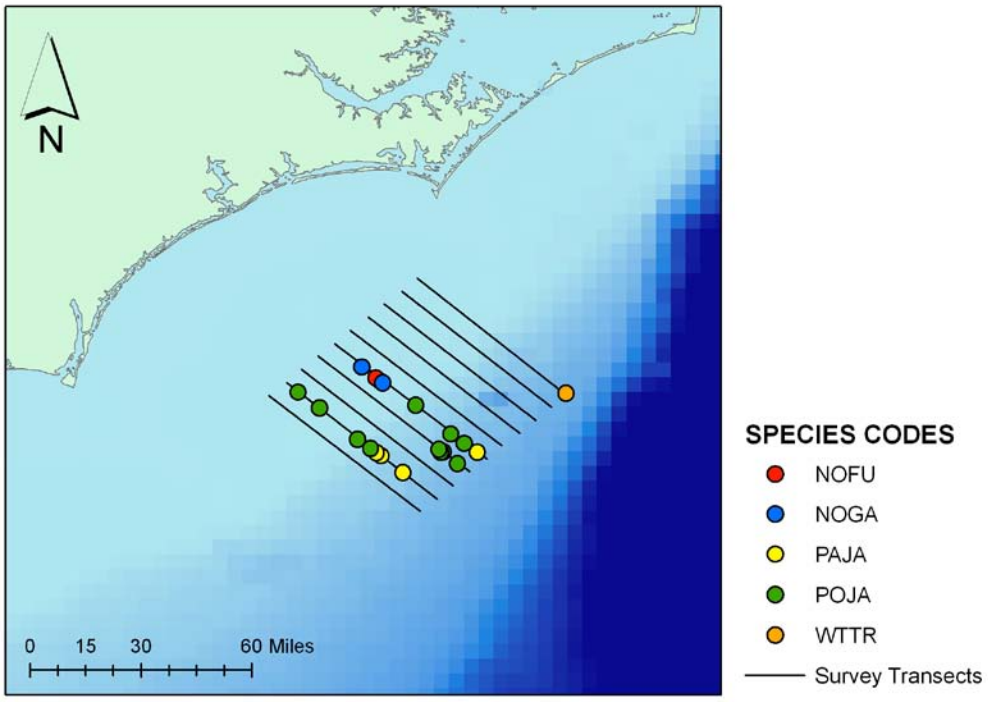


Figure 26: Distribution of seabird species uncommonly observed during Year Two surveys in Onslow Bay, NC. Seabird codes are listed in Table 12.

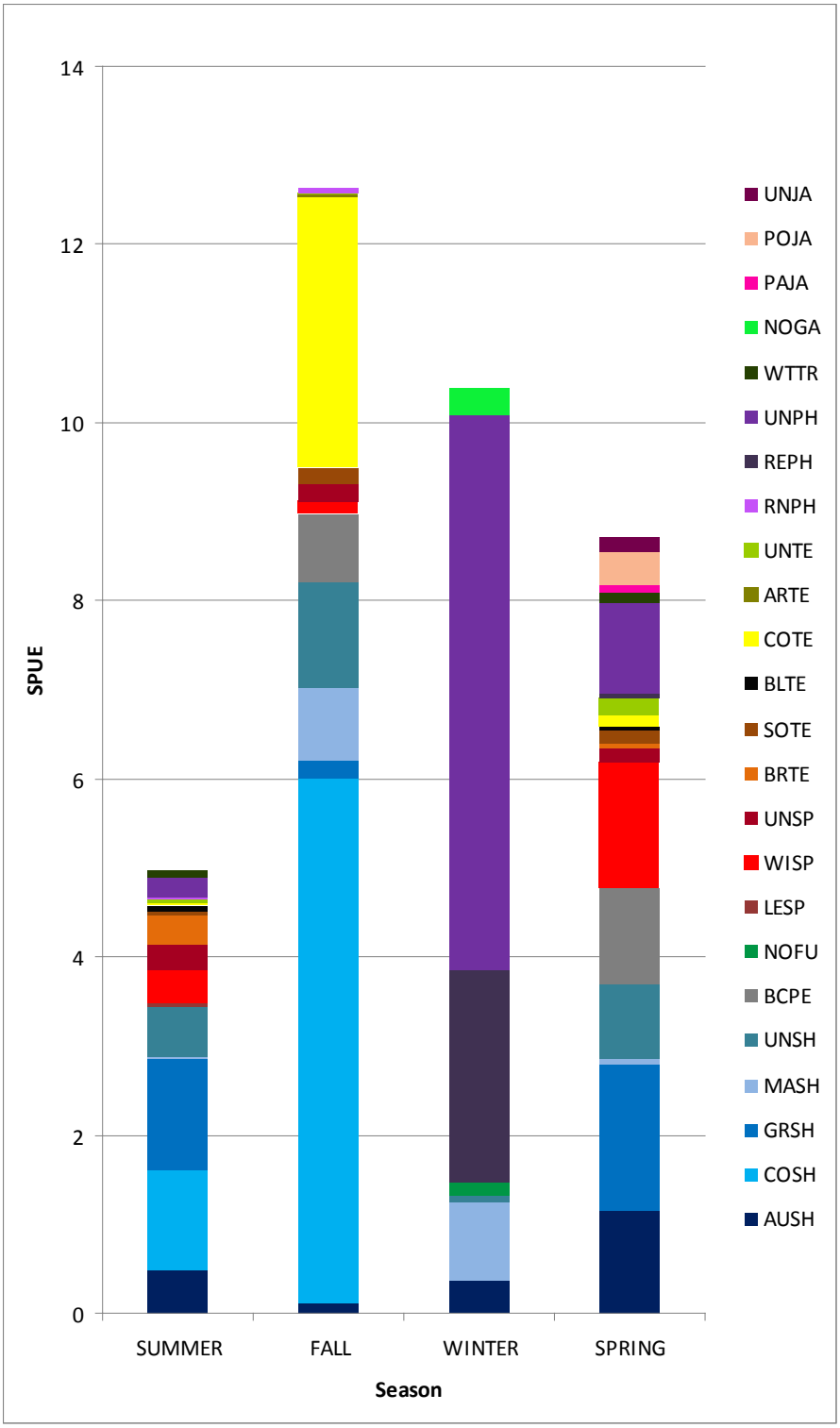


Figure 27. Seasonal sightings per unit effort (SPUE) by species in Year One and Year Two of Onslow Bay surveys. Seabird codes are listed in Table 12. Seasons were defined as follows: Summer (June, July and August); Fall (September, October and November); Winter (December, January and February); and Spring (March, April and May).

Vessel Sightings

A total of 118 vessels were encountered in the study area during vessel surveys, ranging from small recreational boats to large cargo vessels. The number of each category of vessels sighted, classified by category, is presented in Figure 28.

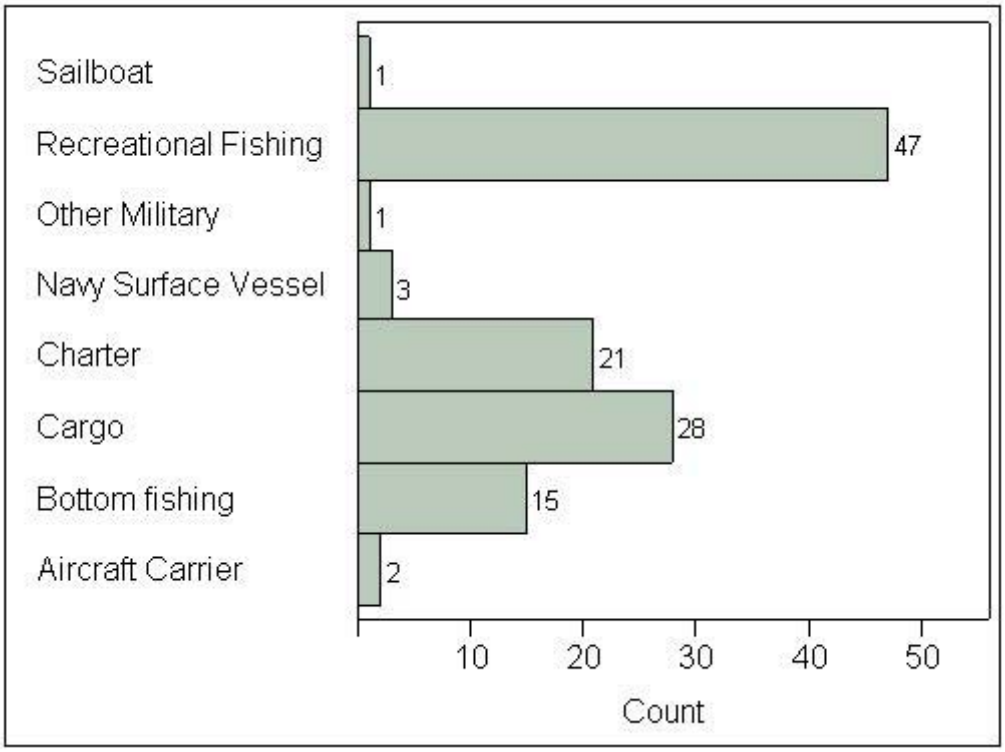


Figure 28. Distribution of vessels observed during surveys in Onslow Bay, NC, July 2008 through June 2009.

Acknowledgements

We thank Joel Bell (Naval Facilities Engineering Command Atlantic) for support and guidance and Jason See (GeoMarine, Inc.) for contract administration. Keith Mullin and Kathy Foley allowed us to work under their biopsy permit (779-1633). Dr. Lance Garrison modified VisSurvey for our use. For assistance with the HARP we thank Dr. John Hildebrand, Chris Garsha and Tim Boynton. For the shipboard surveys, we thank Matt Besch, Pete Zook, Ryan McAlarney, Peter Nilsson and numerous other observers. A special thanks goes to Captain Dale Britt for his expertise and good nature. Surveys were conducted under NOAA Scientific Permit No. 948-1692-00, held by the UNCW.

Analysis of the UNCW and Duke University Aerial and Shipboard Surveys of the USWTR on the Atlantic Coast of the USA for the period June 2007 to August 2009 (also including analysis of the UNCW aerial survey data 1998 – 1999)

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Abstract

Analysis of the data from the combined aerial and shipboard surveys of the USWTR carried out by Duke University and the University of North Carolina at Wilmington for the period June 2007 through August 2009, combined with that of the earlier aerial surveys of the UNCW for Onslow Bay 1998/1999, allowed estimation of density surfaces for bottlenose dolphins *Tursiops truncatus,* spotted dolphins, *Stenella frontalis,* pilot and beaked whales combined, and loggerhead turtles *(Caretta caretta)* as well as providing some evidence of the environmental correlates of the animals distributions.

Detection functions were estimated from the multi-platform, multi-year USWTR survey data with additional data from the UNCW right whale surveys as well as the 1998/1999 UNCW aerial surveys of Wallop Island as well as additional sightings data from the shipboard surveys that took place off Cape Hatteras. Abundance for the USWTR region and an outer margin of 20 nm about it, was estimated using the estimated detection probabilities and separately estimating (a) animal presence/absence using a logistic general additive model and (b) estimating density given presence. Detection functions were not fitted to all of the detected species owing to a paucity of data (shipboard whale sightings).

Depending on the best fitted spatial models used, estimates were obtained as an average over the entire time period, for each year or for each month. At the highest resolution, estimates were obtained for the USWTR core region and the outer region for September 1998 through to July 1999 and June 2007 through to August 2009. Estimated bottlenose dolphin numbers varied between 20 (95% CI: 10 – 90, August 2008) and c. 100 (30 – 180, Jan 2008) for the inner region and from 60 (30 – 240, August 2008) to 290 (80 – 540, May 1999) for the outer region. Estimated spotted dolphin numbers varied from 0 (0 – 0) in 1998/1999 to 400 (110 – 1200) in January 2009 in the inner region and from 0 (0 – 0) in 1998/1999 to c. 920 (260 – 2700, in January 2009) in the outer region. Spotted dolphins only appeared in the shallower parts of the region of interest from 2007.

Pilot and beaked whale numbers were very low (< 10, 2 – 14) throughout the survey period. Estimated loggerhead turtle numbers varied from 2 (2 – 6, July 1999) to 270 (50 – 800, March 2009) in the inner region and from 5 (1 – 13, July 1999) to 530 (90 – 1600, March 2009) in the outer region. All the above estimates assumed perfect detection on the trackline. Small sample sizes result in very little power to detect trend in abundance but there was no evidence of a systematic decline in any species in the last ten years and substantial evidence for an increase in spotted dolphin numbers.

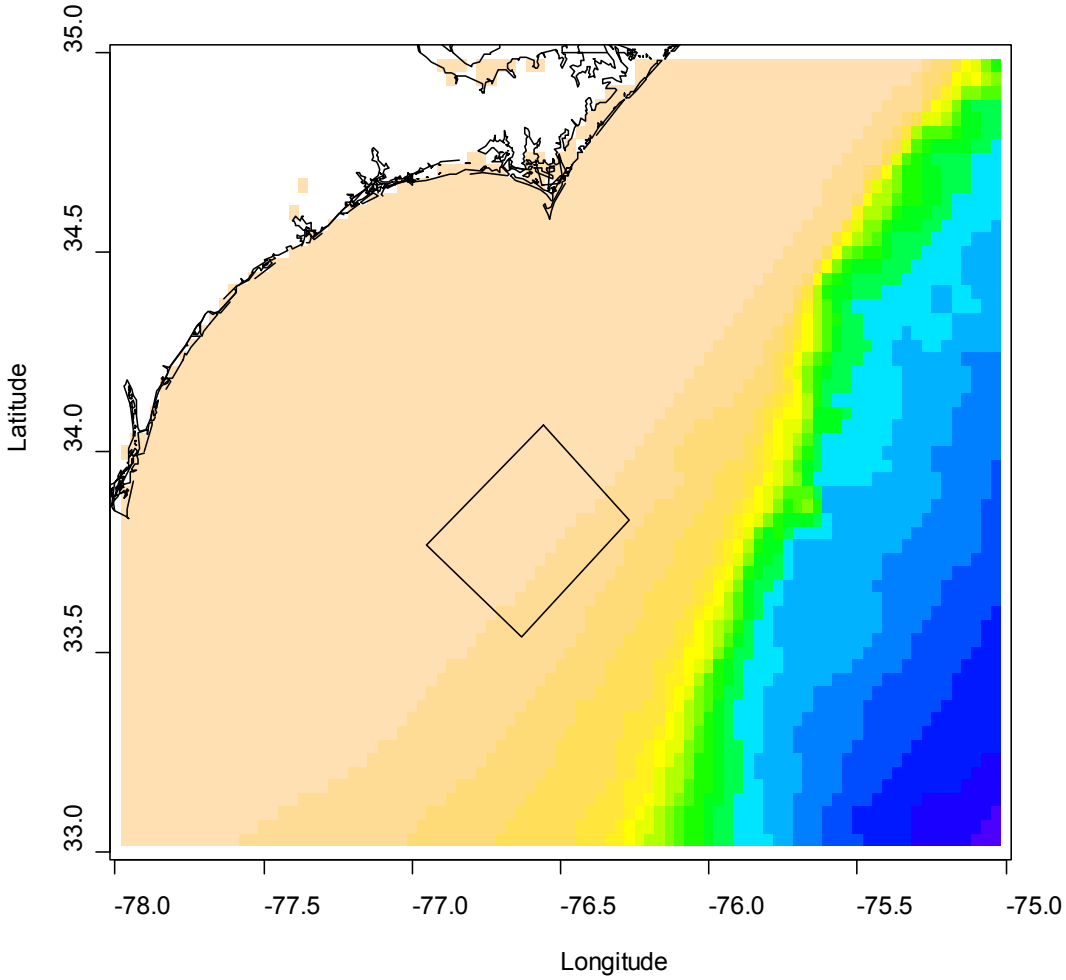
There was evidence that the abundance of bottlenose dolphins fluctuated with season (perhaps in response to temperature), as did the presence of loggerhead turtles who were likely to be associated with water between 18 – 20˚C. *Stenella* dolphins and loggerhead turtles preferred were associated with shallower waters of less than 100m.

Introduction

This document explains the analysis of the USWTR aerial and shipboard survey data for 2007 – 2009, carried out by the University of North Carolina at Wilmington (UNCW) and Duke University respectively. The aim of these surveys was to establish base line data on the density of marine mammals in the USWTR region and if possible to develop a preliminary density surface of animals in the area of interest. Of further interest was the possibility that there could be environmental predictors of the marine animal density as well as any trends in abundance. Given the paucity of actual sightings within the region of interest such an analysis can supply only a preliminary investigation of animal numbers and all conclusions from this analysis should be regarded as tentative. Fortunately further survey data from the area was available from the aerial surveys done by UNCW off Onslow Bay from September 1998 to July 1999. Additionally sightings data undertaken from the same aerial platform was available from the ongoing right whale surveys carried out by UNCW closer to the coastline and the surveys undertaken near Wallop Island in 1998 and 1999. A dditional shipboard sightings data was also available from a dedicated survey off Cape Hatteras in 2007.

Thus the analysis undertaken here, aimed to integrate the sightings and effort data from the 1998-1999 Onslow Bay survey (hereafter "Onslow survey"), the current ongoing aerial survey by UNCW (hereafter "USWTR aerial" survey) and the ongoing shipboard survey by Duke University (hereafter "USWTR ship" survey) augmented with sightings alone data from the 1998 – 1999 Wallop Island surveys (hereafter "Wallop" survey), ship sightings data from Cape Hatteras (hereafter "Hatteras" survey) and the ongoing aerial right whale surveys (hereafter "right whale" survey) to increase to precision associated with the estimate of the detection functions and ultimately abundance.

Figure 1. The core USWTR area and depths (m) at 2 minute intervals. Each colour represents 200 m intervals from 4200 m depth (violet in lower right hand corner)

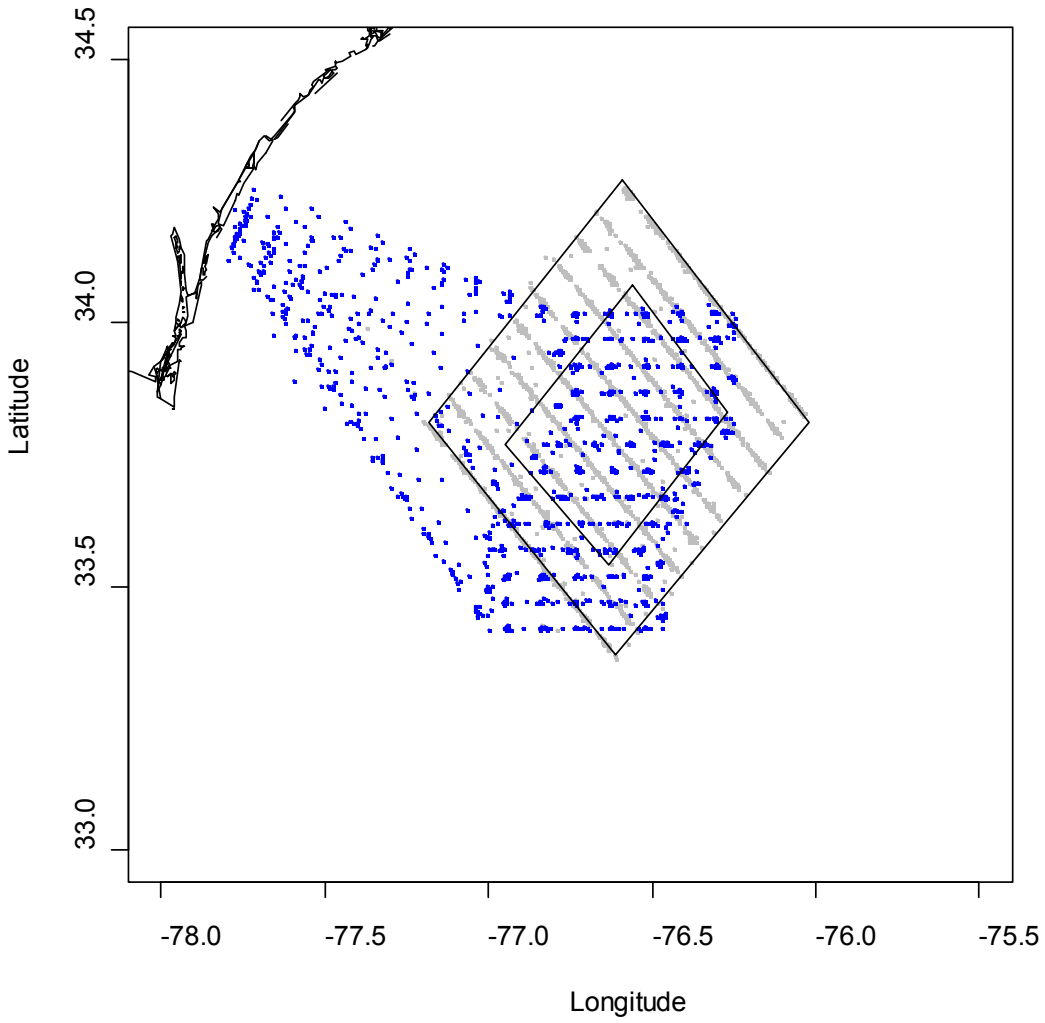


Methods

Area of interest and survey area

The USWTR area is given in figure 1 with approximate boundaries given by the black line. The boundaries are approximately 25 miles long (SW to NE) and 20 miles wide (NW to SE). The survey area extended to outside of this USWTR core by 20 nm (see grey transect lines in figures 2 and 3) so the total survey area is 1800 square nautical miles, with 500 of this (28%) within the USWTR itself. The survey area could be divided into a core region (inside the USWTR) and an outer non-core region. Abundance estimates were obtained for both regions.

Figure 2. Realized aerial effort segments for USWTR 2007/2008 (grey) and Onslow 1998/1999 (blue). Individual points represent the midpoints of each segment.



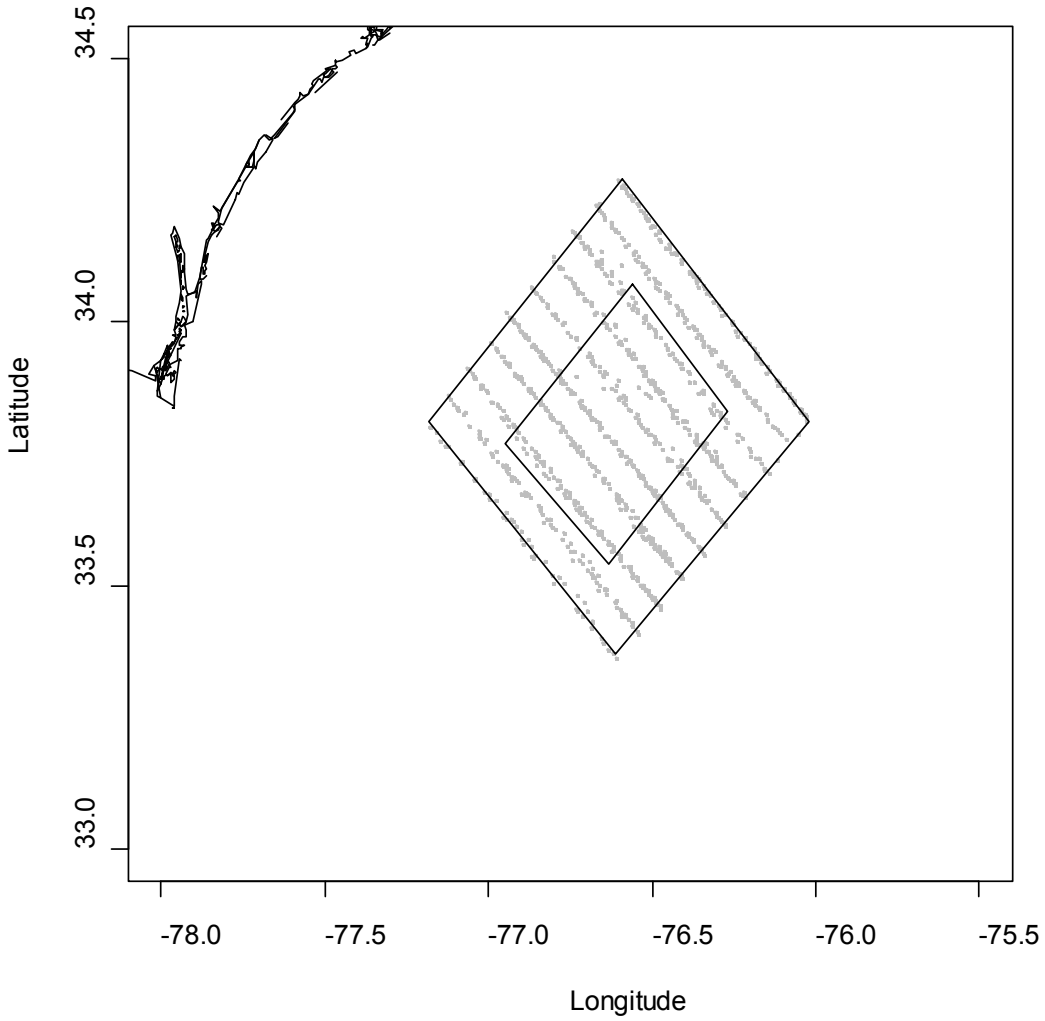
The realized aerial survey effort consisted of 12821 km in 1998/1999 and 31800 km from June through and including August 2009 and can be seen in figure 2.

The area covered by the shipboard survey was almost identical to that of the USWTR aerial survey (Figure 3) except no realized effort was expanded outward from the shore. The total realized effort analysed here was 4294 km. Two vessels were used: the *Sensation* and the *Cetus*. There was no evidence that detection varied between the two (see results). The temporal coverage of the surveys is given in table 1.

Table 1. Temporal Coverage of Surveys (A= Aerial, S = Shipboard)

Month	**1998**	**1999**	**2007**	**2008**	**2009**
Jan		*A*			*A,S*
February				*A*	*A,S*
March		*A*		*A,S*	*A,S*
April		*A*		*A*	*A,S*
May		*A*		*A,S*	*A*
June		*A*	*A,S*	*A,S*	*A, S*
July		*A*	*A,S*	*A,S*	*A, S*
August			*A,S*	*A,S*	*A, S*
September	*A*		*A,S*	*A,S*	
October	*A*		*A,S*	*A*	
November	*A*		*A,S*	*A,S*	
December	*A*		*A*	*A*	

Figure 3. Realized ship effort for USWTR 2007/2008 (grey)



Statistical analysis

Overview

In order to generate a density estimate of each species/taxa of interest and where possible to identify environmental variables driving animal abundance, the data were analysed by first estimating the probability of detection associated with each sighting and then estimating abundance per segment of trackline within the truncation distance. This assumed that detection on the trackline occurred with probability one (see below for discussion). The estimated densities comprised the inputs for a two stage modelling process. First probability of presence is modelled (as a logistic generalized additive model (GAM) and then estimated density given presence is modelled. Predictions are

made for all over the area of interest based on the two models. The product of these two predictions gives an estimated relative abundance surface for the area. Relative because it does not take into account of time spent submerged and imperfect detection on the trackline.

From this an estimate of the total number of animals in the area of interest was obtained. All animal species were initially considered but only 4 taxa were modeled in detail: bottlenose dolphins *Tursiops truncatus,* spotted dolphins *Stenella frontalis,* medium sizes whales (i.e. pilot whales *Globicephala* sp. and ziphids) and loggerhead turtles *Caretta caretta.* It may be that with increased sample sizes, data from other species will become adequate for analysis.

Estimation of Detection Probabilities

In conventional line transect sampling the probability of detection depends only on the perpendicular distance of the sighting to the transect, and at zero perpendicular distance this is assumed to be one (denoted by $g(0) = 1$). In this analysis the effects of covariates, other than perpendicular distance were incorporated into the detection function model. This was achieved by setting the scale parameter in the model to be an exponential function of the covariates (Marques 2001). Thus the probability of detection becomes a multivariate function, $g(y,\boldsymbol{v})$, representing the probability of detection at perpendicular distance y and covariates $\boldsymbol{v}$ ($\boldsymbol{v} = v_1,..,v_Q$ where Q is the number of covariates). Using either a hazard-rate $(1-\exp(-y/\sigma)^{-b})$ or half-normal detection function $(\exp(-y^2/2\,\sigma^2))$ (Buckland et al. 2001), the covariates were incorporated via the scale term, σ, where for sighting j, σ has the form::

$$\sigma_k = \exp\left(\beta_0 + \sum_{q=1}^{Q}(\beta_q v_{kq})\right)$$

here β_0 and β_q (q=1,…,Q) are parameters to be estimated. With this formulation, it is assumed that the covariates may affect the rate at which detection probability decreases as a function of distance, but not the shape of the detection function.

A stepwise backward selection procedure was used (starting from the previous best models) to decide which covariates to include in the model, with a minimum Akaike's Information Criterion (AIC) inclusion criterion. All model selection was

performed in the program *Distance* (v5.0; Thomas *et al*. 2002), and then the final selected models were re-fitted using a set of customized functions (mrds v.1.3.1) in the statistical programming package *R* (*R* Developmental Core Team, 2002). This facilitated estimation of variance within *R* – (see below).

This procedure was followed for dolphins. In the case of aerialsightings of turtles, shipboard sightings of turtles and shipboard sightings of medium whales. The paucity of data required a slightly different approach. Here the sightings were considered as coming from fairly narrow strip half transects of 500, 80 and 200 m width respectively.

Estimation of density surfaces

In most cases the number of transect segments containing sightings was extremely low. This made fitting of models difficult so a variety of modelling approaches were undertaken. The initial aim was to implement a modified version of the 'count model' of Hedley et al. (1999) was used to model the trend in spatial distribution of the different species. The response variable for the model was calculated from the estimated number of individuals for a segment $\hat{N}_i$, for each i^{th} segment. This was calculated using an estimator similar to the Horvitz-Thompson estimator (Horvitz and Thompson 1952), as follows:

$$\hat{N}_i = \sum_{j=1}^{n_i} \frac{s_{ij}}{\int_o^w \hat{g}(y, v_{ij})\pi(y)dy}, \qquad i = 1, \ldots, T,$$

where, for segment *i*, $\int_0^w \hat{g}(y, v_{ij})\pi(y)dy$ is the estimated probability of detection of the *j*th detected pod, n_i is the number of detected pods in the segment and s_j is the size of the *j*th pod. The total number of transect segments is denoted by *T*. By assumption, $p(y)$, the probability density function of actual (not necessarily observed) perpendicular distances is uniform up to the truncation distance. This is satisfied by randomly located transects.

Having obtained the estimated number of individuals in each segment, the density in segment *i*, $\hat{D}_i$, was estimated by $\hat{N}_i / a_i$ where a_i is the area of segment *i*. Segment area was calculated as the length of the segment multiplied by twice the truncation distance used to model the detection function. The survey tracklines were initially divided up into

distinct segments based on when crafts had gone off effort and/or a change in environmental characteristics. A variety of segment lengths was tried in the range of 5 – 13 km. Eventually 10km km was selected as an appropriate compromise between maximising the ratio of non-zero to zero segments, maintaining environmental resolution and giving some measure of spatial independence (see results). In the case of the main USWTR aerial data set this gave 3374 segments. In the case of the Onslow data this meant 1370 segments for the aerial survey with 738 segments for the shipboard survey (143 for *Cetus* and 1045 for *Sensation*).

Attempts to model density directly were unsuccessful because of the high frequency of zeros. Zero-inflated methods were tried but these proved impossible to implement successfully for this data set. Therefore the presence or absence of animals in a particular segment was modeled using a logistic GAM. The predicted probability of presence of animals in a segment was then multiplied by the predicted non-zero density in a segment. Again because of the paucity of the data attempts to model varying non-zero density proved unsuccessful so in all cases the mean of the non-zero density was used. This may introduce a potential bias in that zeros are over represented i.e. some zeros are not true zeros but simply segments of low density where the animals though present were not observed.

The covariates considered in the analyses were longitude (*Lon*) and latitude (*Lat*), sea surface temperature (*Temp*) and depth (*Depth*), day of the year (*Dayofyear*) and year of survey (*Year)*. Unlike previous analyse of data *Dayofyear* was now considered considered as a cyclic cubic spline so the second derivative of the curve for *Dayofyear* would meet at the beginning and end of the year. Sea surface temperatures were taken during the shipboard survey but additional data was needed for the aerial survey and the prediction grid. Sea surface temperatures were obtained from the National Oceanic and Atmospheric Administration (NOAA, http://dss.ucar.edu/datasets/ds277.0/data/oiv2/) at one degree and weekly resolution and were an updated set (based on the analysis of Reynolds *et al*. (2002)). Depths were obtained from the ETOPO2 2 minute resolution relief data available from National Oceanographic and Atmospheric Administration (http://www.ngdc.noaa.gov/mgg/image/2minrelief.html). Temperatures and depths were associated with effort segments by finding the closest point in the temperature and

bathymetry data to the midpoint of the effort segments using great circle distances (and additionally, time for temperature). Finally *Survey* was a factor variable which indicated the platform used (plane, *Cetus* or *Sensation*) but this was only considered in a model if the level associated with surveying from a plane took the lowest value i.e. the use of *Survey* reflects differences in g(0) between aerial and shipboard surveys.

Scatterplots of the explanatory variables are shown in figure 4. Unsurprisingly *Temp* and *Dayofyear* were strongly correlated with each other as were *Lon, Lat* and *Depth* thus the inclusion of only one of these correlated variables in the final models should not be interpreted as necessarily precluding the influence of others. As *Temp* and *Dayofyear* were correlated on *Dayofyear* was used in the abundance analyses.

Unbiased risk estimation implemented in the *mgcv* package (v. 1.5-2, Wood 2009) in *R* (v. 2.9.0) was used for covariate selection in the logistic model, augmented with diagnostic plots, using the principles described in Wood (2001). All covariates were considered for inclusion in the model as 1D smooths of untransformed covariate values. In addition, 2D smooths of *Lat* and *Lon* (as kilometer deviations from the equator and longitude 77˚W) were considered for inclusion into the GAM. A maximum of 4 degrees of freedom (5 knots) were allowed in the selection of 1D smooths for *Depth, Temp* and *Dayofyear*. In the case of *Lat* and *Lon,* 6 degrees of freedom (7 knots) and up to 13 degrees of freedom (14 knots) were allowed in the case of 2D smooths, thus allowing moderate flexibility but reducing the possibility of overfitting. The presence of unexplained spatial variation was checked by inspection of semivariograms of the residuals of the models. Data was fitted to all data across all years.

Due to gaps, changes in direction, stops in search effort along transects and changes in environmental conditions, effort could not always be split into segments of the desired length (see later). Therefore, the size of each segment varied and so the model was weighted by segment area.

The presence only data was modeled in the same way as above although sometimes models had to have smooths removed in order not generate spuriously high results in the bootstrap.

The aim of all the initial models above was to estimate a density surface (see below). To investigate the underlying biological basis of the distributions of the animals,

model selection for *Tursiops, Stenella* and *Caretta* presence-absence models was repeated without *Lon* and *Lat*. Sometimes the final biological model selected corresponded to the density surface only models. In this case sea surface temperature *Temp* was also considered as a variable as a replacement for *Dayofyear*.

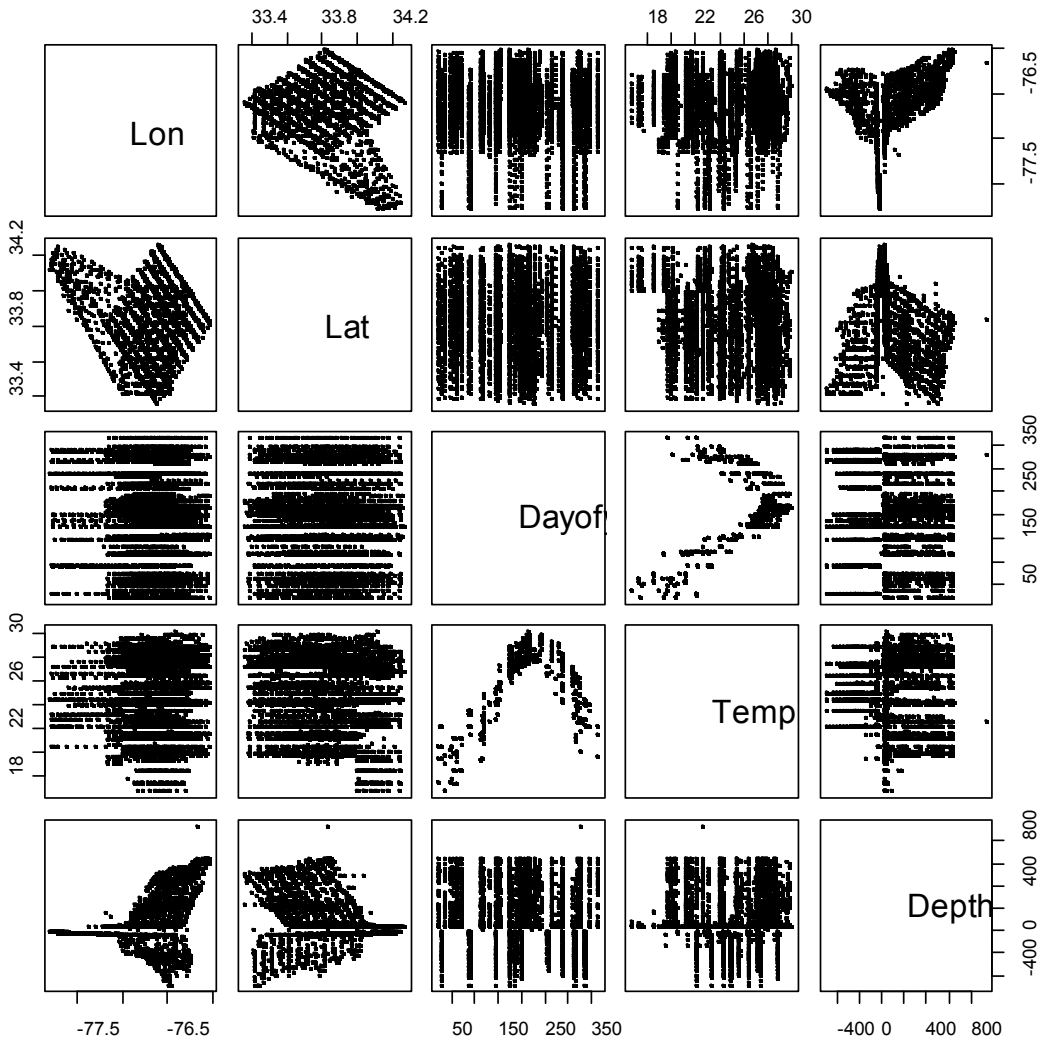
Prediction

The final model was used to predict density of marine animals throughout the survey region over a 2 minute resolution grid that was spanning the inner core USWTR area and the surveyed area around it. Animal abundance was estimated by numerically integrating under this predicted density surface. If survey mode was included in the model, abundance was predicted assuming the survey mode with the largest coefficient in the model as this would reflect the best detection on the trackline. Predictions were made for June of each of the survey years (although June was not surveyed in 1998) to allow comparison between years. Obviously models that did not contain *Dayofyear, Temp* or *Year* produced identical predictions for each of the four years and months.

Variance estimation

Variance estimation was undertaken by bootstrapping the entire process above based on a selection of effort legs. S ometimes models had to be simplified to work without generating unrealistically high estimates in the bootstrap.

Figure 4. Relationship of potential explanatory continuous variables used in density surface modeling.


Lon
Lat
Dayof
Temp
Depth
33.4
33.8
34.2
18
22
26
30
-76.5
-77.5
34.2
33.8
33.4
350
250
150
50
30
26
22
18
800
400
0
-400
-77.5
-76.5
50
150
250
350
-400
0
400
800

Results

Aerial Surveys

In the case of the USWTR and right whale aerial surveys the surveys were carried out from the observation plane flying at a height of 305 m (1000 ft). The aerial surveys from 1998/1999 were carried out with almost precisely the same protocol as the ongoing USWTR surveys except that the plane flew at 230 m (750 ft). Thus the sightings data from these two surveys could be readily combined. Estimates of perpendicular distance were obtained either by reference to direct estimates of distance by observers, trigonometry from the declination angle of the plane to the observed animals or by trigonometry from the position of the plane at first observation of the animals and subsequent location directly above the animals. A total of 2832 sightings were initially available from all surveys (Onslow: 163, Wallop: 229, USWTR: 761 and right whale surveys: 1679). These numbers are for animals that could be assigned to reasonably specific taxonomic categories (see below). However for some sightings (primarily turtles) distance estimates were not available. It was assumed that such sightings occurred at random so detection probabilities (and hence estimated numbers, see below) were allocated to these sightings after estimation of the detection function with a proportion assumed lost due to being beyond the truncation distance (as in the sample of known distance sightings).

Sightings were grouped together based on the a priori similarity of form of the species seen. Table 1 gives the number of sightings before and after truncation, for taxa where there were sufficient numbers to allow further investigation. There were three morphologically similar groups dolphins (all species commonly referred to as dolphins), turtles (all turtles species) and whales (baleanopterids, pilot whales and beaked whales). Future work may allow splitting of these groups.

Table 1. Aerial sightings with distances by species group

Sightings group	**Species within group (where identified)**	**Number of sightings before truncation**	**Truncation distance**	**Number of sightings after truncation**
Dolphins	Bottlenose, common, Risso's, spotted, rough toothed and unidentified dolphins	226	1500 m	215
Whales	Beaked whales, pilot whales, other whales	40	1500 m	35
Turtles	Loggerhead, Leatherback, Kemp's Ridley and unidentified turtles	534*	500 m	419

**Does not include sightings without distances.*

Shipboard Surveys

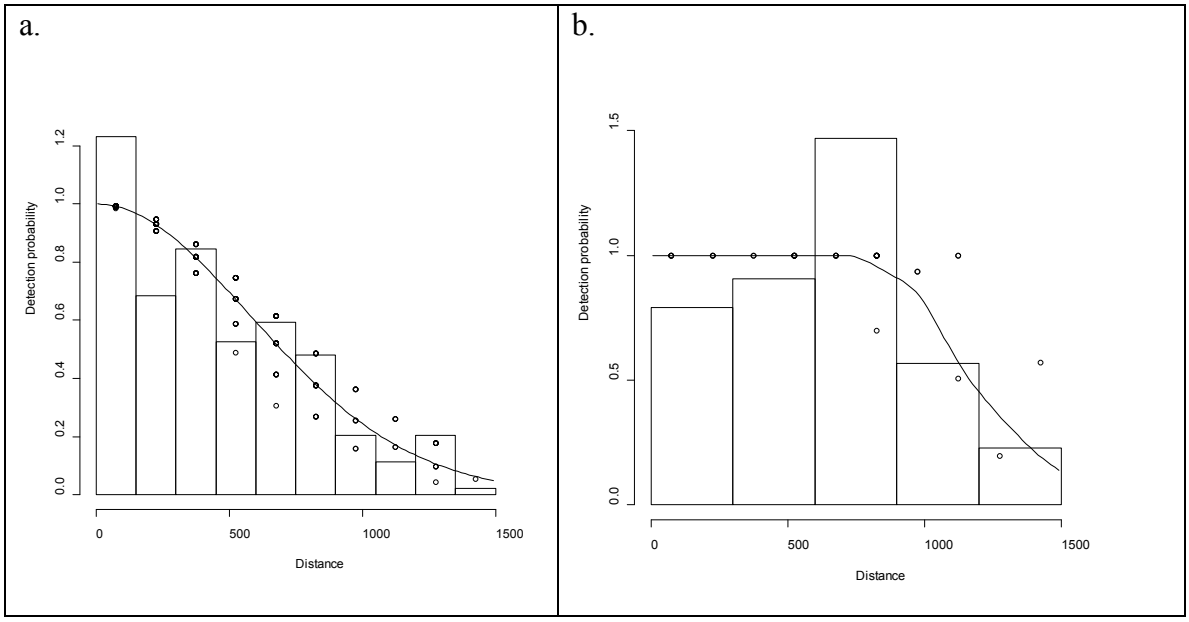
In the case of the shipboard sightings there were few sightings (n = 168) even when complemented by the additional sightings from off Cape Hatteras. Again the sightings were grouped by visual type to determine a detection function (table 2).

Table 2. Shipboard sightings by species group. Includes sightings from aerial surveys off Wallop Island and right whale surveys as well as shipboard surveys off Cape Hatteras.

Sightings group	**Species within group (where identified)**	**Number of sightings before truncation**	**Truncation distance**	**Number of sightings after truncation**
Dolphins	Bottlenose, common, Risso's, spotted, rough toothed and unidentified dolphins	86	300 m	59
Medium whales	Beaked whales and pilot whales	10	200m	6
Turtles	*Loggerhead, Leatherback, Kemp's Ridley* and unidentified turtles	60	80 m	43

**Does not include sightings without distances who are subsequently randomly assigned to be in or out of the truncation distance.*

Figure 5. Aerial survey detection functions for a. dolphins (data binned into 150 m intervals), b. all medium and large whales.

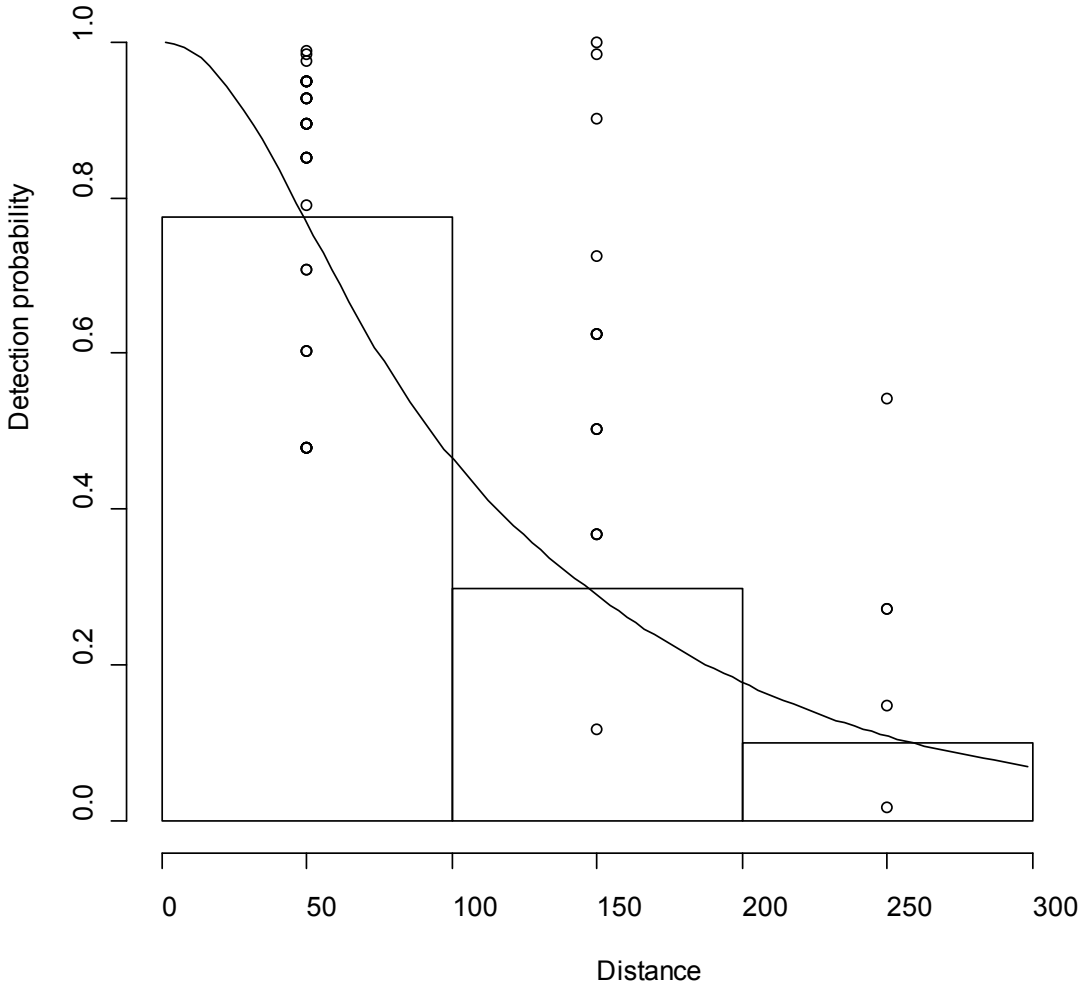


Aerial survey detection functions

In the case of dolphins and turtles, sightings data were fitted in *Distance* initially and then integrated into the whole analysis. Dolphin sightings were binned into 150 m widths and right truncated at 1.5 km. The best fit detection function for dolphins was a half normal function with distance and Beaufort Sea State. The detection function associated with the lowest AIC for medium whales were hazard rate functions with Beaufort sea state (Figure 5).

The perpendicular distance distribution of turtle detections did not conform to the usual assumption of monotonically declining detection probability with increasing distance and so a flat detection function of 1 o ut to 500m (corresponding to a strip transect survey with a strip of 1000m width) was used in this case. The reasons for the unusual distribution are not known but it may have been caused in part by rounding of distances.

Figure 6. Ship survey detection functions for dolphins



Ship survey detection functions

Dolphin sightings were binned into 100 m widths and right truncated at 300 m. The best fit for dolphins was a half-normal detection function (see Figure 6). Beaufort sea state was included as a variable. Turtles were assumed to be in a strip transect out to 80 m. Medium size whales were also assumed to be in a strip transect to 200 m.

Table 3. Predictive and explanatory biological models for each species. s() indicates a smoothed function of the variable of interest. The final column gives the number of the relevant figure.

Species	**Model**	**Terms in model**	**Figure number**
Tursiops truncatus	Predictive, logistic component	*s(Depth) + s(Dayofyear) + Year*	7
	Explanatory logistic component.	*s(Depth) + s(Dayofyear) + Year*	8
	Non-zero density component	*Year*	7
Stenella frontalis	Predictive, logistic component	*Survey + s(Depth) + s(Dayofyear) + Year*	9
	Explanatory logistic component	*Survey + s(Depth) + s(Dayofyear) + Year*	10
	Non-zero density component	*Year*	9
Collective medium sized whales	Predictive, logistic component.	None	
	Explanatory logistic component	None	
	Non-zero density component	None	
Caretta caretta	Predictive, logistic component.	*Survey + s(Depth) + s(Dayofyear) + Year*	11
	Explanatory logistic component	*Survey + s(Depth) + s(Temp) + Year*	12
	Non-zero density component	*Year*	

Estimation of density surfaces

The final fitted models for predicting abundance and for biological explanation are given in table 3. The best performing models can be found in table 3.

Bottlenose dolphins *Tursiops truncatus*

In the case of bottlenose dolphins only 129 segments had a density greater than zero. Figure 7 shows monthly predicted abundances and their confidence intervals. Estimated bottlenose dolphin numbers varied between 20 (95% CI: 10 – 90, August 2008) and c. 100 (30 – 180, Jan 2008) for the inner region and from 60 (30 – 240, August 2008) to 290 (80 – 540, May 1999) for the outer region. Note that the upper boundary of the estimates are moderately high especially for the outer zone. This is probably caused by edge effects in the bootstrap. Nonetheless it compares favourably with an analysis equivalent to a conventional distance analysis with different encounter rates for each year (i.e. assuming constant but different mean density for each year) had a mean abundance in the USWTR box of 65 (51 - 590).

A depth association can also possibly be discerned (figure 8) but the pattern probably reflects depth as a describing the data spatially rather than a real spatial preference. A difference both across and within years can be seen (figure 7), this is also

seen in the figure. There is however evidence of a difference over the course of the year with numbers peaking in winter (figure 8) presumably as a response to temperature changes. There was no evidence that there was residual spatial correlation in the data.

Figure 7. Estimated abundance of Tursiops a. inside (black) and immediately outside (red) the USWTR region (no error bars shown for clarity, b. the inside abundances with 95% confidence intervals (in blue)

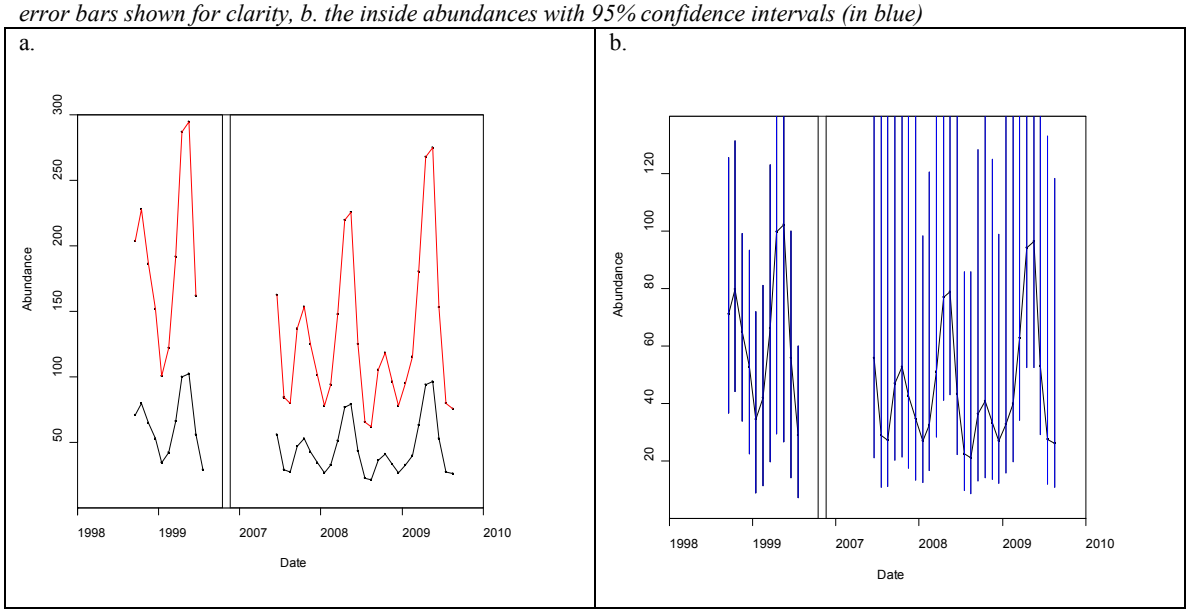
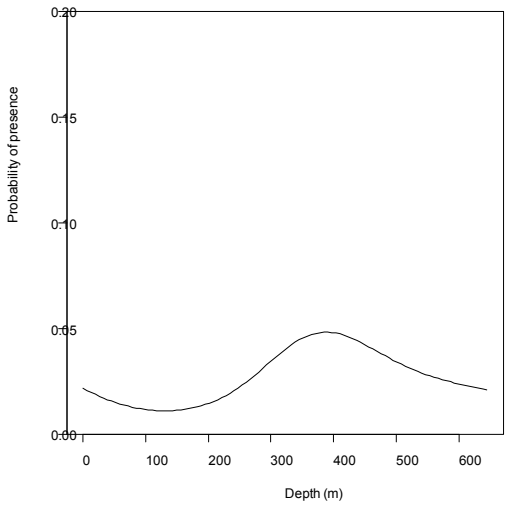


Figure 8. Probability of presence of Tursiops in response to a. Depth, and b. Dayofyear in 2009.

a.



Spotted dolphin Stenella frontalis

In the case of *S. frontalis* there were 51 non-zero segments. A predictive model was fitted consisting of smooths of *Depth, Dayofyear* with *Year* as a factor. Unsurprisingly the estimates were associated with a wide confidence interval. Figure 9 gives the predicted abundances for of each month of interest. Estimated spotted dolphin numbers varied from 0 (0 – 0) in 1998/1999 to 400 (110 – 1200) in January 2009 in the inner region and from 0 (0 – 0) in 1998/1999 to c. 920 (260 – 2700, in January 2009) in the outer region. *Stenella* was not seen in the area during the UNCW 1997 – 1998 surveys and only appeared in 2007 since then its predicted numbers have increased considerably.

If a spatial model of presence absence is based with *Year* only as a predictor then the predctions for the USWTR box are 1998 & 1999 (0, 95% confidence interval 0 – 0), 2007 (5, 0 – 35), 2008 (20, 9 – 44), and 2009 (110, 70, 230). In this case, the use of spatial model has not reduced the variance in the abundance estimates although it does allow elucidation of the specific factors that influence the distribution spotted dolphins.

There was no evidence of spatial correlation in the data except over very small distances (<0.5 km) presumably caused by successive densities of zero across years. Although year considered as a factor, was in the model selected using ubre, the resultant stepping of the predictions looks unrealistic with a sudden jump in numbers between December and January.

The explanatory model consisted of *Temp, Depth* and *Year* although *Temp* explained little of the variation and there is no obvi ous explanation for the pattern of responses seen. *Stenella frontalis* was strongly associated with shallower water (Figure 10).

Ziphids and pilot whales

In the case of the ziphids and pilot whales only 11 segments has non-zero estimates thus no attempt was made to model density. As the estimates were not based on t emporal variables the values did not vary. The best MEAN estimate of these whales abundance is 5 (2 – 8) in the inner zone and 9 (3 – 14) in the outer zone. Little interpretation can be made of these results at this stage but it should be stressed that these numbers represent animals at the surface only.

Figure 9. Estimated abundance of Stenella a. inside (black) and immediately outside (red) the USWTR region (no error bars shown for clarity, b. the inside abundances with 95% confidence intervals (in blue)

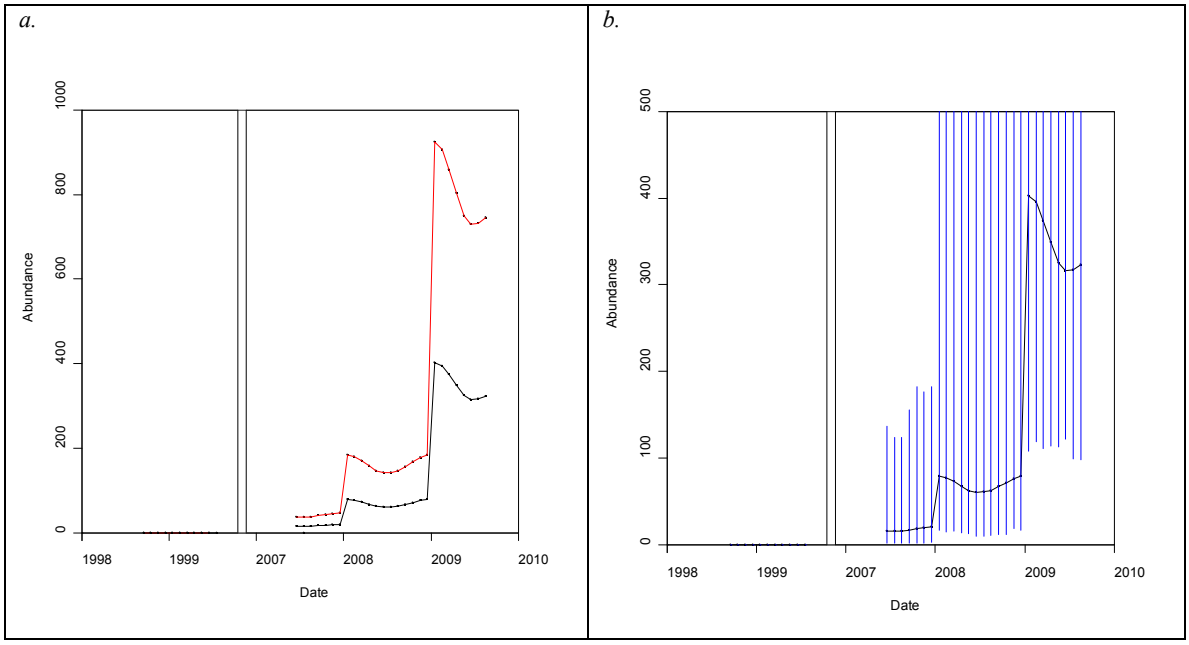
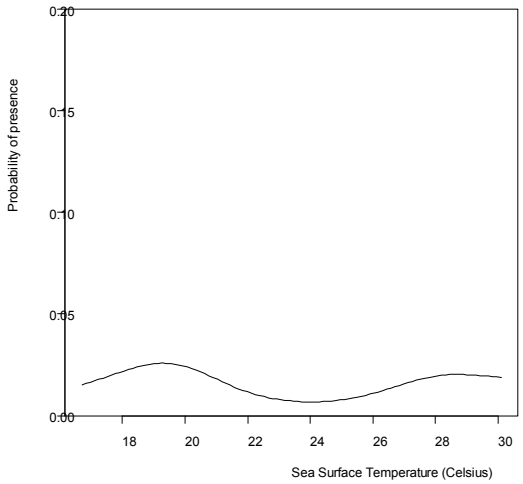


Figure 10. Probability of presence of *Stenella frontalis* in response to *a. Sea surface temperature* and *b. Depth in 2009*..

a.



Caretta caretta

In the case of loggerhead turtles there were 253 non-zero segments. Presence was modelled with smooths of *Depth and Dayof year with Year as a factor.* alone to ensure stability in bootstrap with density if present assumed to be constant. Figure 9 gives the estimates by month. If a constant density surface is assumed then the point estimate of population size in the USWTR box is 44 (18 – 89) outside the USWTR box it is 84(34 – 170)

Explanatory model selection suggested that both *Depth* and *Temp* were significant with turtles were more likely to be present in shallower and surprisingly colder waters (figure 12). This result was also seen in the analysis of the data from last year as well. This could reflect a real temperature preference or reflect an annual cycling. In terms of day of the year this corresponds to a decreased probability of presence in late July. There was no evidence of spatial correlation in the data except over very small distances (<0.5 km) presumably caused by successive densities of zero across years.

Figure 9. Estimated abundance of loggerhead turtles a. inside (black) and immediately outside (red) the USWTR region (no error bars shown for clarity, b. the inside abundances with 95% confidence intervals (in blue)

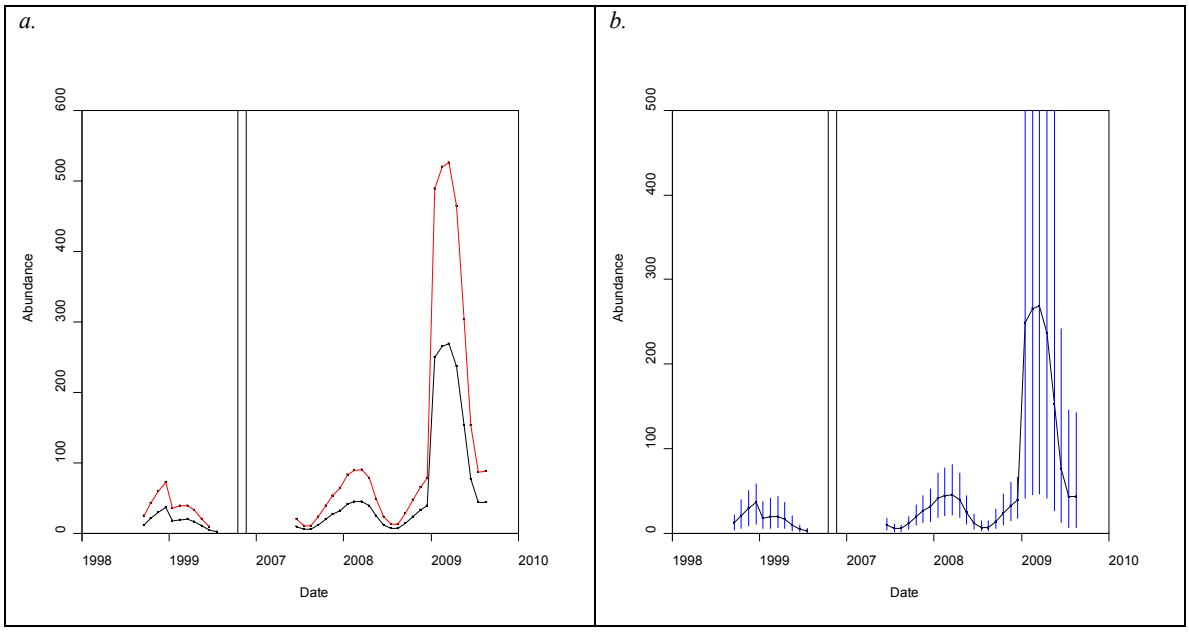
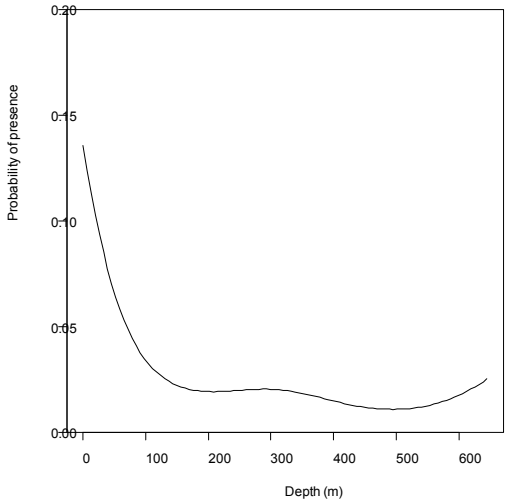


Figure 12. Probability of presence of *Caretta caretta* in response to a. depth and b. sea surface temperature. Rug marks indicate a datum at that covariate value.

a.



Discussion

Given the lack of sightings any conclusions about the reasons for the estimated distributions in the region should be regarded as extremely tentative. The lack of sightings for species other than those analysed above precluded estimates for other species. Nonetheless it seems reasonable to conclude that the region as a whole has few large marine fauna (save perhaps turtles, see below), data are inadequate to estimate trend except in the case of *Stenella* and there is no evidence that any species has reduced in numbers over the time period considered. However the above results are all based on single observers with g(0) (detection probability) assumed to be one on the trackline for the species of interest.

There are two reasons that g(0) may be less than 1. Firstly there is an availability bias associated with the presence of species at the surface. Cetaceans and turtles can spend only a small proportion of their time at the surface (see below). This bias was ameliorated here by only predicting using the factor associated with ships in models that had factors for ship or aircraft (this effectively makes the g(0) estimate for aircraft no more negatively biased than that for ships). The second reason is perception bias: animals are missed on the trackline even if they are at the surface. Smaller cetaceans that don't form highly detectable pods and some of the more cryptic species that are not prominent at the surface may not be detected even when on the trackline. Both availability bias and perception bias tend to be greater for fast-moving observers and are therefore greater for aircraft than for ships (see comparisons of $g(0)$ in Palka 2005a and 2005b)

It might be expected that *Survey* should always appear in the models as $g(0)$ should generally be higher for a ship than a plane. This was not always the case here - due in part to the low power to detect this effect because of the low number of sightings. In the case of bottlenose dolphins, a higher density was associated with aerial surveys! Survey was not included in the final models if this was the case.

Correcting for availability bias due to diving can be done if the expected times of availability and unavailability are known as well as the transit speed of the observation vessel (e.g. Laake et al. 1997, Hedley and Bannister 2004, Paxton et al. submitted). These correction methods break down somewhat as the speed of the survey platform gets closer to that of the animals. They may therefore not work well for shipboard surveys but are

likely to be quite adequate for aerial surveys. They do, ho wever, depend on ha ving reliable estimates of mean times of availability and unavailability. Because mean times were not available for all species, because they may differ within the species groups used in our analysis (groups determined in part by small sample size), and because mean times may be location-dependent, we have not used them here. Instead we correct g(0) bias for aircraft to be no greater than that from ships and accept that density and abundance estimates are likely negatively biased by some unknown amount.

Where it has been investigated *Mesoplodon densirostris* has been found to spend c. 26% of the time underwater (Baird *et al.* 2004) and Barlow (1999) estimated g(0)s of 0.45 and 0.23 for *Mesoplodon* and *Ziphius* respectively.

Forney et al. (1995) estimated *g*(0) to be 0.67 for smaller dolphin groups and Palka (2005a and b) estimated *g*(0) for small cetaceans to be in the range 0.58 – 0.95 depending on the craft used.

Where investigated loggerhead turtles have been found to spend c. 90% of their time diving (Houghton et al. 2002) but animals who are just submerged (which can be 60% of the time (Polovina *et al.* 2003) may be amenable to detection especially from air dependent on water opaqueness. g(0) for this species could very considerably and the abundance estimates given here could be severely biased. Further no attempt was made (at this stage) to include sightings of animals recorded only as unspecified turtles.

Numbers in the inner and outer boxes are clearly correlated suggesting that there is no reason to believe animals are being displaced from the USWTR box.

The limited tentative biological conclusions that can be drawn reflect existing knowledge in the literature. The bottlenose dolphins prefer deeper water compared to spotted dolphins and last years finding of an association of loggerhead turtles with cooler waters is confirmed this year.

Recommendations for the future

The USWTR survey work is ongoing, issues of potential interest in USWTR survey work in the future might include:

1. Improving detection function and density estimates by supplementing existing detections with those from future surveys.

2. Investigation of reliable methods for estimating g(0) without double-observer survey. Options include cue-based methods and use of appropriate availability correction methods based on data on availability patterns for each species.
3. Further elucidation of the environmental drivers of cetacean density in the area of interest perhaps by the use of additional variables.
4. Records of water opaqueness may be useful for in the generation of detection functions of turtles.

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Appendix D - Onslow/JAX Annual Monitoring Report – 2009/20010

Executive Summary

This is the third annual progress report of a monitoring program for protected marine species at two proposed sites of Undersea Warfare Training Ranges (USWTR) in Onslow Bay, North Carolina and Jacksonville, Florida. The reporting period for this document extends from July 2009 through June 2010. Aerial surveys, vessel-based surveys, and passive acoustics were used to monitor the two USWTR sites. Density estimates for marine mammals and sea turtles were generated from data collected during aerial and vessel-based line transect surveys. In Onslow Bay, three years of monitoring have yielded a comprehensive picture of the density, distribution and abundance of marine mammals and on the distribution and relative abundance of sea turtles and seabirds. The first year of monitoring in Jacksonville has provided new information on the density and distribution of marine mammals and sea turtles in this area.

Study Areas

The proposed USWTR site in Onslow Bay is 25 nm (46 km) long and 20 nm (37 km) wide (approximately 1700 km^2). The survey area extends 20 nm in each direction past the proposed boundaries of the USWTR. Ten transect lines 40 nm (74 km) in length and spaced approximately 5 nm (9.3 km) apart cross the survey area, oriented parallel to the short axis of the USWTR boundaries and perpendicular to the primary bathymetric and prevailing oceanographic features influencing the region (Figure i-a). This design yields a total of 400 nm (~740 km) of track line surveyed by both aerial and shipboard platforms.

The proposed Jacksonville (JAX) USWTR site is 25 nm (46 km) long and 20 nm (37 km) wide (approximately 1700 km^2). Ten 39 nm (72.5 km) long tracklines, spaced 4 nm (7.4 km) apart, transect the USWTR area. The survey area straddles the continental shelf and Blake Plateau and includes neritic, shelf waters and pelagic, offshore waters (Figure i-b). Aerial survey tracklines in JAX are longer (86 km) than those flown in the Onslow Bay study area to minimize the area without survey coverage between the USWTR area and Early Warning System (EWS) aerial surveys for North Atlantic right whales (*Eubalaena glacialis*).

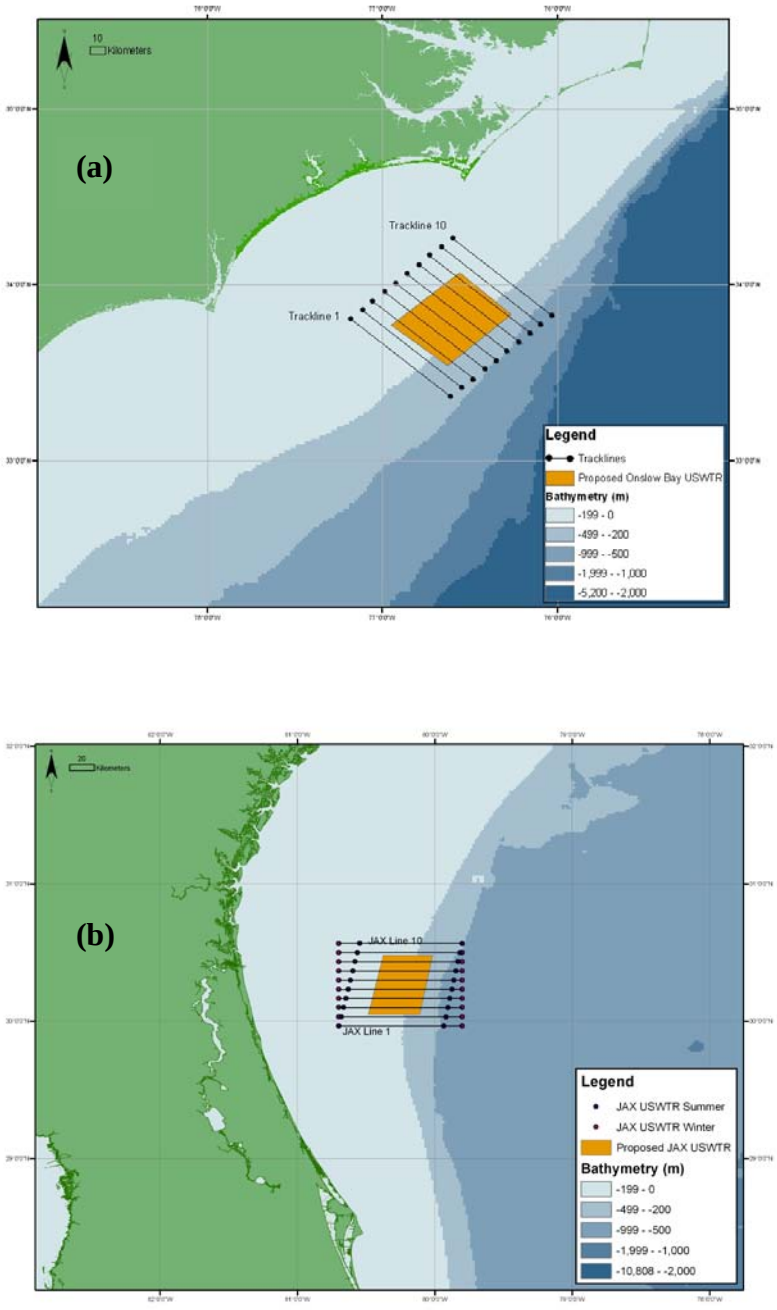


Figure i. **Maps depicting the proposed USWTR areas and tracklines used for vessel and aerial surveys: (a) Onslow Bay, NC; and (b) Jacksonville, FL.**

Aerial Surveys for Cetaceans and Sea Turtles – Onslow Bay

Researchers from the University of North Carolina at Wilmington conducted aerial surveys in the proposed USWTR site in Onslow Bay. Aerial surveys were flown monthly between June 2009 and June 2010. The goal was to survey the entire USWTR site (10 track lines) twice per month. This goal was accomplished for seven of the twelve months. For the remaining months a single set of lines were flown except September, in which 16 lines were flown, and May, in which no lines were flown because of adverse weather conditions. A total of 86 cetacean sightings of 1,371 individuals and 374 sea turtle sightings of 646 individuals were recorded while on effort in the study area. Six cetacean species were observed in the survey area while on effort, including: bottlenose dolphins (*Tursiops truncatus*; 53 sightings of 791 individuals); spotted dolphins (*Stenella frontalis*; 24 sightings of 467 individuals); short-finned pilot whales (*Globicephala macrorhynchus*; two sightings of 63 individuals); Risso's dolphins (*Grampus griseus* one sighting of six individuals); common dolphins (*Delphinus delphis*; one sighting of 20 individuals); and a fin whale (*Balaenoptera physalus*; one sighting of a single individual). Four sightings of 23 individual dolphins were recorded in which it was not possible to determine species identity with certainty (termed "unidentified delphinids"). There were also four off effort sightings of bottlenose dolphins, two off-effort sightings of short-finned pilot whales, and single off-effort sightings of Risso's dolphins and a sperm whale (*Physeter macrocephalus*) near or in the USWTR range. No mixed-species groups were observed. Most (501 of 646) sea turtles observed were identified as loggerheads (*Caretta caretta*); 141 were recorded as "unidentified sea turtles" and four were leatherback sea turtles (*Dermochelys coriacea*). Sighting efficiency dropped dramatically as the Beaufort Sea State (BSS) increased. For example, as BSS increased from one to three, cetacean sightings per unit effort (SPUE) decreased from 13.2 to 1.9 per 1000 km surveyed and sea turtle SPUE decreased from 156.9 to 1.9 per 1000 km surveyed respectively. In addition to cetaceans and sea turtles, other pelagic marine vertebrates, including manta rays (*Manta birostris*), ocean sunfish (*Mola mola*) and sharks were observed. Most vessels encountered in the proposed USWTR were recreational fishing vessels, which were observed predominantly shoreward of the 200 m depth contour.

Vessel-Based Surveys for Cetaceans and Sea Turtles – Onslow Bay

Researchers from Duke University conducted vessel-based surveys for marine mammals and sea turtles in the proposed USWTR site in Onslow Bay. Twenty-one track lines were surveyed in approximately 115 hours of survey effort. Most (69%) effort occurred in Beaufort Sea States 2 and 3. A total of 55 groups of cetaceans were sighted during vessel surveys (45 while on effort, ten while off effort) and five species were observed: bottlenose dolphins (29 sightings), Atlantic spotted dolphins (17 sightings), Risso's dolphins (three sightings), pilot whales (2 sightings), and rough-toothed dolphins *Steno bredanensis* (one sighting). One sighting was made of a group of dolphins that were either bottlenose or spotted dolphins and two sightings were made of unidentified delphinids. As in the previous two years, bottlenose dolphins were observed in both shallow and deep waters across the continental shelf break, whereas spotted dolphins were observed only in shallow waters on the continental shelf. No mixed-species groups were observed. Fifty sea turtle sightings were recorded during vessel surveys (34 while on effort, 16 while off effort) and two species were observed: loggerhead sea turtles (48 sightings) and leatherback sea turtles (2 sightings). One turtle sighting was not identified to species. Over 1,300 digital images were taken for species identification and individual recognition. Analysis of these photographic images resulted in resightings of five bottlenose dolphins and one spotted dolphin during the three years of surveys in Onslow Bay. Several of these resightings span periods of a year or more, suggesting some degree of residency in the study area. In July 2009 additional surveys were conducted off Cape Hatteras with one of our survey vessels to improve the probability detection functions used to calculate marine mammal densities in Onslow Bay. Thirty sightings were recorded in four days of survey effort, far exceeding the sightings per unit effort in Onslow Bay, and providing additional data with which to estimate the probability detection functions. In June 2010 we deployed a Wildlife Computer satellite-linked SPLASH tag on an adult nesting female loggerhead sea turtle. This tag, along with two others deployed after the reporting period, will provide data on diving behavior that will be used to estimate the probability of detecting loggerhead turtles at the surface, where they can be sighted by visual observers.

Passive Acoustic Monitoring – Onslow Bay

Researchers from Duke University conducted vessel-based and fixed passive acoustic monitoring in the proposed USWTR site in Onslow Bay. During 18 vessel-based surveys, a four-element hydrophone array was towed behind the vessel, resulting in 91.2 hours of passive acoustic monitoring. Forty groups of cetaceans were detected with the hydrophone array and also identified by visual observers (23 groups of bottlenose dolphins, eleven groups of Atlantic spotted dolphins, three groups of Risso's dolphins, two groups of pilot whales, and a single group of rough-toothed dolphins). Recordings from the hydrophone array will be used to help identify species in vocalizations recorded on bottom-mounted acoustic recording devices (High Frequency Acoustic Recording Package; HARP). HARPs have been deployed on three occasions since the start of monitoring in Year One. The instruments were deployed, recovered and redeployed near the center of the USWTR site, close to the 200 m shelf break. In all three deployments, the instruments were programmed to record at a sample rate of 200 kHz for five-minute periods, separated by an inactive interval of ten minutes. Two deployments in the summer months showed a trend towards increased vocal events during the night hours, whereas the single deployment during fall/winter exhibited greater number of vocal events at dawn. Risso's dolphins and sperm whale clicks were extracted from the dataset; both species follow a similar trend in diel variation, with an increase of the number of vocal events at night. Analysis of these recordings is ongoing.

Vessel-Based Surveys for Seabirds – Onslow Bay

Researchers from Duke University conducted vessel-based surveys for seabirds in the proposed USWTR site in Onslow Bay; these surveys were synoptic with those described above for marine mammals and sea turtles. More than 60 seabirds were observed in approximately 12 hours of survey effort between July 2009 and September 2009, yielding a sighting per unit effort (the number of seabirds recorded per hour of effort) between 1.08 and 6.87 per hour. Three species of seabird were recorded, with Cory's Shearwaters (*Calonectris diomedea*) being sighted most frequently, followed by Greater Shearwaters (*Puffinus gravis*) and Wilson's Storm Petrels (*Oceanites oceanicus*). Analysis of all three years of vessel-based seabird surveys will be completed in the autumn of 2010.

Aerial Surveys for Cetaceans and Sea Turtles – Jacksonville

Researchers from Duke University and UNCW conducted aerial surveys in the proposed USWTR site in Jacksonville. Preliminary aerial surveys were performed from January through March 2009, resulting in 35 tracklines surveyed. Regularly scheduled aerial surveys commenced in June 2009. Beginning in June, the goal was to survey the entire USWTR site (10 tracklines) twice per calendar month, which was accomplished for eleven of thirteen months. In October 2009 and May 2010 only ten tracklines were covered. Survey coverage was intensified during North Atlantic right whale (*Eubalaena glacialis*) calving season (December 2009 through April 2010) during which time 143 tracklines were flown, for an average of 29 tracklines surveyed per month. In addition, upon request from the US Navy, additional survey coverage was provided during Navy exercises in September 2009 and June 2010. Thus, a total of 534 tracklines (29,839 km) were surveyed during the reporting period. Most (41%) survey effort was flown in BSS 2. A total of 323 sightings of 3,718 cetaceans were observed while on effort in the study area. Nine species of cetaceans were observed while on effort, including: bottlenose dolphins (132 sightings of 1179 individuals); Atlantic spotted dolphins (124 sightings of 2080 individuals); Risso's dolphins (16 sightings of 228 individuals); short-finned pilot whales (two sightings of 19 individuals); sperm whales (one sighting of two individuals); dwarf or pygmy sperm whales (*Kogia* spp.; one sighting of one individual); rough-toothed dolphins (one sighting of 50 individuals); minke whales (*Balaenoptera acutorostrata*; six sightings of eight individuals); and North Atlantic right whales (*Eubalaena glacialis*; two sightings of three individuals). A noteworthy encounter occurred on 20 March 2010 when the aerial survey team observed and documented the birth of a North Atlantic right whale calf in the survey area. The birth occurred outside the designated Right Whale Critical Habitat and represents only the second documentation of the birth of a North Atlantic right whale birth. In addition, there were 37 sightings of 139 individuals where species identity could not be established with certainty (*i.e.* "unidentified delphinids"). An off-effort encounter of a mother/calf right whale pair was recorded approximately 3 km west of the survey area. In addition, there were two off-effort sightings of Atlantic spotted dolphins and two of unidentified

delphinids in or near the survey area. The number of cetacean sightings varied by month, with the highest number of encounters recorded from January through April 2010 and September 2009. A total of 1,543 sea turtles were recorded during the study period. Of these, 1,169 were identified as loggerhead sea turtles, 50 as leatherbacks, one as a Kemp's Ridley sea turtle (*Lepidochelys kempii*), and 323 were "unidentified sea turtles". Sea turtles were observed during every month, with higher numbers during late spring and early summer. Sighting efficiency dropped dramatically as BSS increased. For example, as BSS increased from 1 to 3, cetacean SPUE decreased from 21.4 to 3.3 per 1000 km surveyed and sea turtle SPUE decreased from 91.3 to 23.2 per 1000 km surveyed, respectively. In addition to cetaceans and sea turtles, several species of sharks, manta rays and ocean sunfish were observed. Commercial, Navy and recreational vessels were encountered in the survey area, with most belonging to the latter category.

Vessel-Based Surveys for Cetaceans and Sea Turtles – Jacksonville

Researchers from Duke University and UNCW conducted vessel-based surveys in the proposed USWTR site in Jacksonville, Florida. Twenty-two track lines were surveyed in approximately 96 hours of survey effort. Most (78%) survey effort occurred in BSS 2 and 3. A total of 56 groups of cetaceans were sighted during vessel surveys (48 while on effort, eight while off effort) and four species were observed: bottlenose dolphins (15 sightings); Atlantic spotted dolphins (24 sightings); pilot whales (three sightings); and Risso's dolphins (two sightings). Twelve sightings were made of unidentified delphinids. Bottlenose dolphins were observed in deeper and slightly warmer waters than Atlantic spotted dolphins. Fifty-seven sea turtle sightings were recorded during vessel surveys (34 while on effort, 16 while off effort) and three species were observed: loggerhead sea turtles (48 sightings), leatherback sea turtles (five sightings), and Kemp's Ridley sea turtles (one sighting). Three turtle sightings were not identified to species. Approximately 3,300 digital images were taken for the purposes of species identification and individual recognition.

Passive Acoustic Monitoring – Jacksonville

Researchers from Duke University and UNCW conducted vessel-based and fixed passive acoustic monitoring in the proposed USWTR site in Jacksonville. During 19 surveys, a four-element hydrophone array was towed behind the vessel, resulting in 62.6 hours of passive acoustic monitoring. Nineteen groups of cetaceans were detected with the hydrophone array and identified by visual observers (eight bottlenose, eight Atlantic spotted dolphins, two Risso's dolphins, one pilot whale). Recordings from the hydrophone array will be used to help identify species vocalizations recorded on bottom-mounted acoustic recording devices (High Frequency Acoustic Recording Package; HARP). Between July 1, 2009 and June 30, 2010, four HARP recoveries and re-deployments occurred at two sites in the Jacksonville, FL USWTR range. These deployments yielded 305 recording days, of which 282 days have been analyzed in the high (5 - 100 kHz) and low (10 - 1,000 Hz) frequency ranges. Delphinid clicks were detected in 1,376 (36%) and 1,097 (51%) one-hour bins at the inshore and offshore sites, respectively. Delphinid whistles were detected in 640 (17%) and 387 (18%) one-hour bins at the inshore and offshore sites, respectively. Whistles and clicks were detected more frequently during the night at the offshore site. At the inshore site, whistles were detected more frequently during the day at the inshore site, while clicks showed no diel trend. No known baleen whale calls were detected at either site, though a complex, stereotyped low-frequency call, likely produced by a fish or cetacean, was frequently detected at the offshore site.

Density Estimation

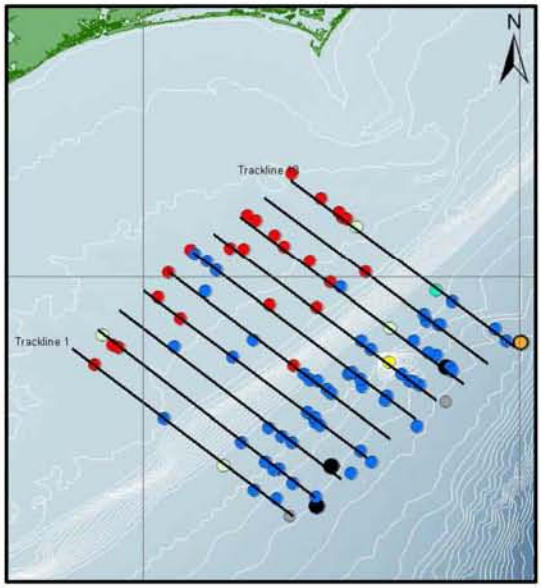
Analysis of data from aerial and shipboard surveys of the Onslow Bay USWTR site from June 2007 to June 2010, combined with that of earlier aerial surveys of the UNCW for Onslow Bay 1998 and 1999, allowed maps of animal density to be estimated by scientists from the University of St. Andrews. The species of interest were bottlenose dolphins, spotted dolphins, pilot and beaked whales (combined) and loggerhead turtles. As well as estimating abundance, the statistical models developed also provided insight into some of the environmental correlates of the animals distributions. Detection functions were estimated from the multi-platform, multi-year USWTR survey data with additional data

from the UNCW right whale surveys, the 1998/1999 UNCW aerial surveys of Wallop Island and additional sightings data from the shipboard surveys that took place off Cape Hatteras in 2009. Detection functions were not fitted to all of the detected species owing to a paucity of data (namely shipboard whale sightings) but fitted to a species group. Estimates of abundance were obtained for both the core USWTR region and an outer region using the estimated detection probabilities and then separately estimating (a) animal presence/absence using a logistic general additive model and (b) density given presence. Depending on the spatial models chosen, estimates were obtained either as an average for the entire time period, for each year or for each month. At the highest level of resolution, separate estimates were obtained for the USWTR core region and the outer region for the time period September 1998 to July 1999 and June 2007 to June 2010. Estimated bottlenose dolphin numbers varied between 29 (95% CI: 16 - 137, July 2008) and 100 (32 - 202, April 1999) for the core USWTR region and from 77 (43 - 380, July 2008) to 264 (84 – 540, April 1999) for the outer region. Estimated spotted dolphin numbers varied from 0 (0 – 0) in 1998/1999 to 344 (125 - 660, October 2009) in the core region and from 0 (0 – 0) in 1998/1999 to 854 (361 - 1548, in October 2009) in the outer region. Spotted dolphins were not present in the region of interest prior to 2007. Pilot and beaked whale numbers were very low; 5 (1 – 9) in the inner region and 8 (1 – 18) in the outer region throughout the survey period. Estimated loggerhead turtle numbers varied from 2 (1 – 4; July 1999) to 176 (41 – 390; March 2009) in the core USWTR region and from 4 (1 – 8; July 1999) to 350 (82 – 775; March 2009) in the outside region.
These abundance estimates are based on the assumption that detection is certain on the trackline. Small sample sizes result in very little power to detect trend in abundance but there was no evidence of a systematic decline in any species in the last ten years and some evidence for an increase in spotted dolphin numbers. There abundance of bottlenose dolphins, spotted dolphins and loggerhead turtles appears to fluctuate throughout the year, perhaps in response to sea surface temperature.

Analysis of data from aerial and shipboard surveys of the Jacksonville USWTR, undertaken by Duke University and the University of North Carolina at Wilmington, for the period June 2009 to June 2010 was also performed. The species for which were

sufficient numbers to generate detection functions were bottlenose dolphins (*Tursiops truncatus),* spotted dolphins *(Stenella frontalis),* leatherback (*Dermochelys coriacea)* and loggerhead turtles *(Caretta caretta)*. Detection functions were not fitted to other species owing to a paucity of data. Estimates of abundance were obtained for both the core USWTR region and the outer region. The results from the aerial and shipboard surveys were generally similar. Estimates of abundance of *Tursiops* in the core USWTR region varied from 20 to 560 (maximum CV 99%) depending on season, *Stenella* varied from 0 to 30 (maximum CV 42%) perhaps again depending on season. For sea turtle abundance, *Dermochelys* were strongly seasonal with a peak in the autumn whereas *Caretta* peaked in summer.

AERIAL SURVEYS OF THE PROPOSED UNDER SEA WARFARE TRAINING RANGE (USWTR) IN ONSLOW BAY, NORTH CAROLINA, JULY 2009 TO JUNE 2010



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Summary of Onslow Bay Aerial Surveys

This document is an annual progress report to the U.S. Department of the Navy on aerial surveys conducted at the proposed Under Sea Warfare Training Range (USWTR) in Onslow Bay, North Carolina between July 2009 and June 2010. The aerial surveys were carried out by the University of North Carolina Wilmington. The goal was to survey the entire USWTR site (10 tracklines) twice per month. This goal was accomplished for seven of the twelve months. For the remaining months a single set of lines were flown except September, in which 16 lines were flown, and May, in which no lines were flown because of weather conditions. A total of 86 cetacean sightings, of 1371 individuals, and 374 sea turtle sightings, representing 646 individuals, were observed while on effort in the study area (Table 1, Figure 1). No right whales (*Eubalaena glacialis*) were observed within the site. Six cetacean species were observed in the survey site while on effort including bottlenose dolphins (*Tursiops truncatus*; 53 sightings of 791 individuals), spotted dolphins (*Stenella frontalis*; 24 sightings of 467 individuals), short-finned pilot whales (*Globicephala macrorhynchus*; two sightings of 63 individuals), Risso's dolphin (*Grampus griseus* one sighting of six individuals), common dolphin (*Delphinus delphis*; one sighting of 20 individuals) and a fin whale (*Balaenoptera physalus*; one sighting of a single individual). There were four sightings of 23 individual dolphins where species identity could not be established with 100% certainty (here termed "unidentified delphinids"). There were also eight off effort sightings of bottlenose dolphins (n=4), short-finned pilot whales (n=2), Risso's dolphin (n=1), and a sperm whale (*Physeter macrocephalus*) (n=1) that were recorded near or in the USWTR range. Off effort sightings data are included in tables, maps and descriptions of the corresponding species to demonstrate the seasonal presence and distribution of species. All effort calculations, though, use only on effort sightings data.

A total of 646 sea turtles were observed during the study period. Of these, 501 were identified as loggerhead sea turtles (*Caretta caretta*), 141 were recorded as "unidentified sea turtles", and four were identified as leatherback sea turtles (*Dermochelys coriacea*).

As previously demonstrated in other aerial survey studies, sightings drop off dramatically as the Beaufort Sea State (BSS) increases. In the present study, as the BSS

increased from one to three, cetacean sightings decreased from 13.16 to 1.89 per 1000 km surveyed, whereas sea turtle sightings decreased from 156.87 to 1.89 per 1000 km surveyed respectively.

In addition to cetaceans and sea turtles, other pelagic marine vertebrates, including manta rays, ocean sunfish and sharks, are reported here. The majority of vessels encountered in the proposed USWTR range were recreational fishing vessels, which were predominately observed shoreward of the 100 fathom depth contour.

With the close of this year's surveys there has now been three years of aerial effort conducted in the Onslow Bay USWTR range. An analysis of the combined three years of cetacean and sea turtle sightings has been conducted and is presented in Appendix A.

Table 1. Total number of sightings and individuals for each species by month from July 2009 – June 2010 for the Onslow Bay, North Carolina USWTR survey site.

		2009						2010						
		July	August	September	October	November	December	January	February	March	April	May	June	Total
Tursiops truncatus	Sightings		5	4	11	2		12	1	11	2		5	**53**
	# of individuals		51	66	129	42		169	11	176	48		99	**791**
Stenella frontalis	Sightings		5	5	6			4	2		1		1	**24**
	# of individuals		115	41	70			142	26		18		55	**467**
Globicephala macrorhynchus	Sightings		1						1					**2**
	# of individuals		40						23					**63**
Steno bredanensis	Sightings													**0**
	# of individuals													**0**
Grampus griseus	Sightings		1											**1**
	# of individuals		6											**6**
Delphinus delphis	Sightings									1				**1**
	# of individuals									20				**20**
Physeter macrocephalus	Sightings													**0**
	# of individuals													**0**
Balaenoptera physalus	Sightings									1				**1**
	# of individuals									1				**1**
Unidentified delphinid	Sightings			1			2			1				**4**
	# of individuals			3			17			3				**23**
	Total sightings	**0**	**12**	**10**	**17**	**2**	**2**	**16**	**4**	**14**	**3**	**0**	**6**	**86**
	Total individuals	**0**	**212**	**110**	**199**	**42**	**17**	**311**	**60**	**200**	**66**	**0**	**154**	**1371**

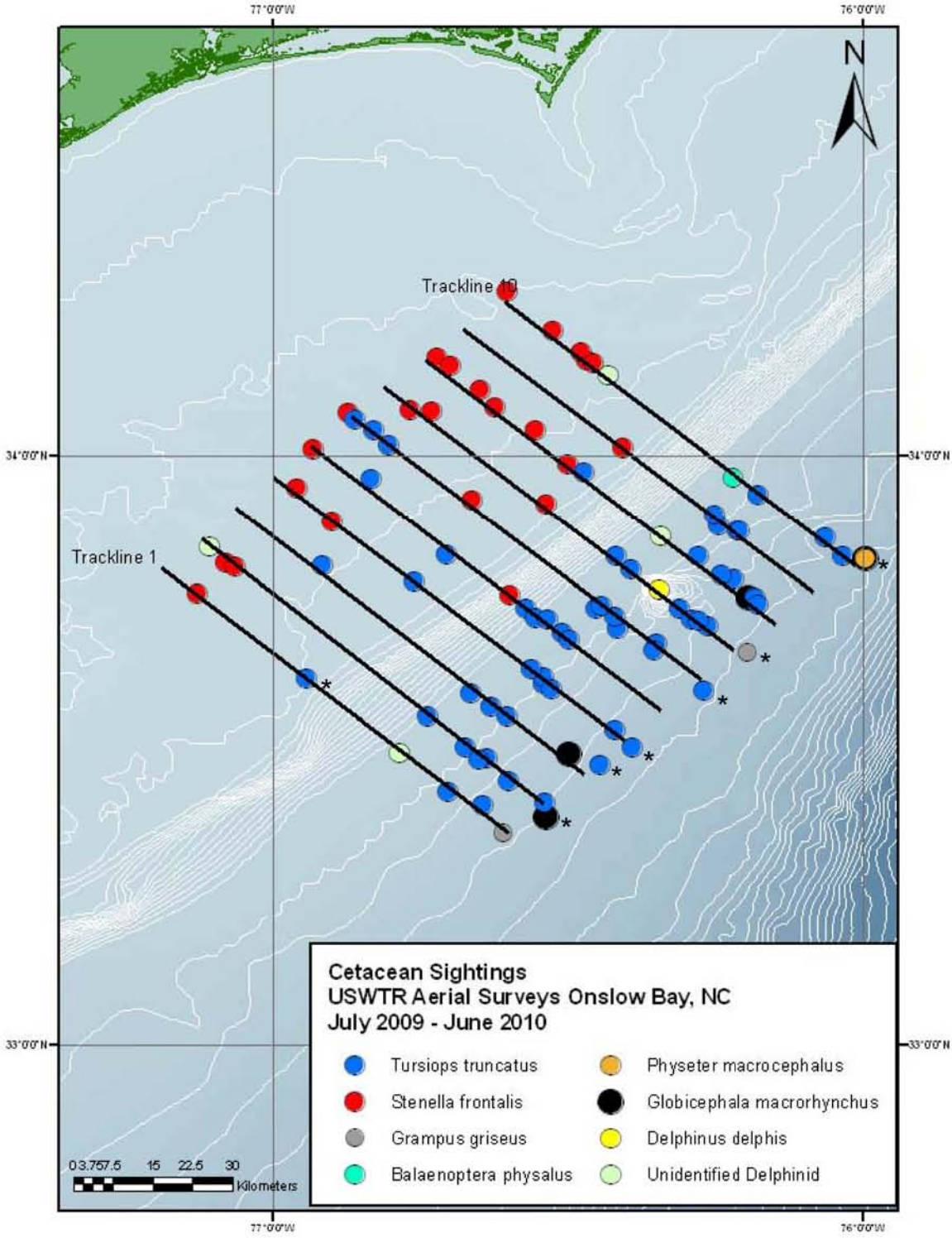

Figure 1. All cetacean sightings during the 2009-2010 aerial surveys of the proposed USWTR site in Onslow Bay, North Carolina. Asterisk denotes off effort sightings.

Methodology

Survey design and logistics

The University of North Carolina Wilmington (UNCW) provided experienced aerial observers and contracted Orion Aviation, Siler City, NC, to provide planes and certified pilots. Surveys were conducted using NOAA – SER Minimum Aircraft and Crew Provisions Guidelines, which require that aircraft are CFR Part 135 certified and that pilots have demonstrated experience working below 1000 ft in support of biological observational studies. Surveys were flown in a Cessna 337 Skymaster, at 305 m altitude and 185 km/hr speed, with a pilot, co-pilot and two observers. Each observer wore a Nomex ® fire retardant suit, a Switlik ® inflatable life jacket, a personal Emergency Positioning Beacon (EPIRB), as well as additional safety equipment. An inflatable life-raft, plane EPIRB, and satellite phone were also onboard at all times.

The survey consisted of ten 74 km long track-lines spaced 6.5 km apart, which covered the proposed USWTR site and an 18 km boundary around the site in Onslow Bay (Fig. 2 and Table 2). The corners of the core USWTR site are: N34. 07°/W-76.56° (NW), N33.83°/ W-76.27° (NE), N33.54°/W-76.63° (SW), and N33.77°/W-76.95° (SE). Survey dates were chosen based upon weather and sea conditions, and access to restricted military areas within the site. Because the primary objective of the surveys was to locate and identify to species cetaceans and sea turtles, the sea state and consequent sighting conditions during surveys were key factors that dictated when to initiate and, if necessary, to abort, surveys. Low sea states (*i.e.* winds preferably 5 – 10 knots, but no more than 15 knots and seas maximum 4 feet) were selected to optimize sighting conditions. Sighting rates of small cetaceans drop off to near zero in a Beaufort Sea State (BSS) of four or higher, as demonstrated by several previous aerial survey studies (Gómez de Segura *et al*. 2006, DeMaster *et al.* 2001). Once an appropriate weather window was identified, observers from UNCW and Orion Aviation pilots would coordinate to meet at an FBO at the Wilmington, NC airport, from which all the surveys originated.

Table 2. Coordinates for trackline end points of the Onslow Bay, North Carolina survey site.

	Western Way Point		Eastern Way Point	
Transect Line	**Latitude**	**Longitude**	**Latitude**	**Longitude**
1	33.8119	-77.1926	33.3596	-76.6017
2	33.8620	-77.1249	33.4074	-76.5370
3	33.9146	-77.0666	33.4575	-76.4724
4	33.9671	-77.0020	33.5149	-76.4047
5	34.0148	-76.9342	33.5626	-76.3399
6	34.0673	-76.8726	33.6152	-76.2783
7	34.1198	-76.8017	33.6653	-76.2104
8	34.1723	-76.7431	33.7154	-76.1456
9	34.2119	-76.6721	33.7679	-76.0870
10	34.2724	-76.6104	33.8157	-76.0252

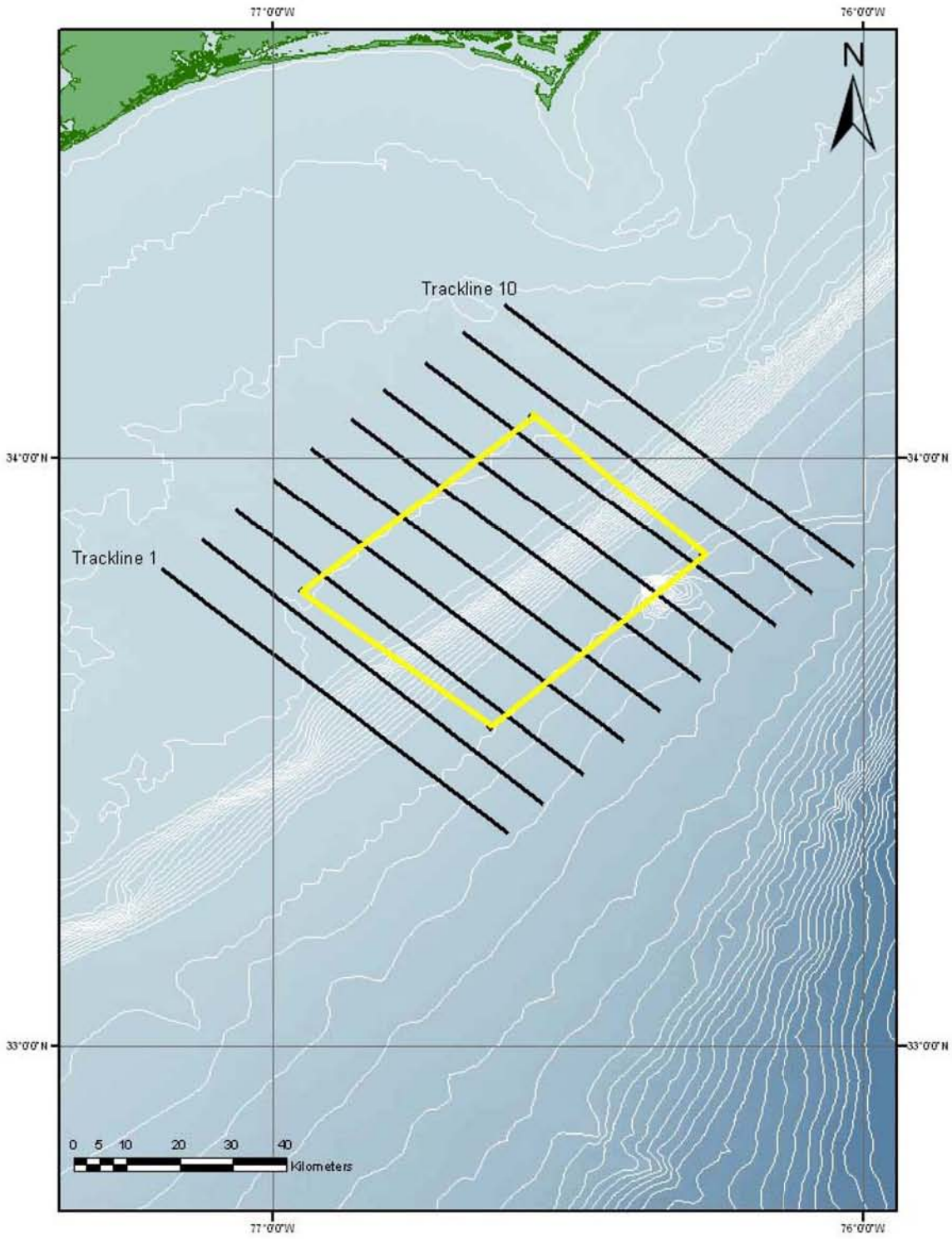

Figure 2. Survey tracklines 1-10 that cover and extend beyond the boundaries of the proposed USWTR site in Onslow Bay, North Carolina.

Data collection

Each side of the plane was monitored by one observer with his or her own GPS unit, data sheet (see Appendix B), and binoculars, and each side was considered an independent strip transect. The start and end of transect lines, changes in environmental variables (*i.e*. cloud cover, BSS, visibility, and glare), and sightings of marine mammals, sea turtles and vessels in the survey area were recorded by each observer throughout the survey (see Appendix C for sighting codes). When a sighting cue was observed, horizontal and vertical angles between the plane and the sighting cue were recorded. Observers would then record a break track point and go off effort from the survey line to investigate the sighting. The plane would close on the sighting location and circle above the animal(s) to obtain photographic evidence of species. Initial and final locations of the sighting were recorded so that the distance of the initial sighting from the track line, and any general movements of animal(s), could be calculated. During a marine mammal encounter, the observer on the left side of the plane was the designated data recorder and the right observer took digital photographs to confirm species identification. The camera used was a Canon 40D with a 100-400 mm image stabilizer lens. The minimum and maximum numbers of animals in each sighting were estimated by both observers in the field and recorded. After photographic and sighting data were collected, the plane returned to the initial sighting location on the track line taking another waypoint marking the return to on effort surveys. All data collected during a sighting were recorded on the Sighting Data Sheet (Appendix D).

The plane did not break track for sightings of sea turtles, other marine vertebrates (*e.g*. sharks and rays) or vessels, however, these types of sightings were all recorded and logged.

Data analysis

Upon completion of a daily survey, GPS way points were downloaded to a desktop computer utilizing the GPS Utility software program (GPS Utility Limited, UK) and subsequently transferred into Microsoft ® Excel spread sheets. Observational data (*e.g*. start and stop track line, sightings, and weather conditions) were entered manually

into the spread sheet for each GPS way point. All digital images collected during a survey were also downloaded and separated into individual folders for each sighting that day. The use of digital photography allowed for enlargement of images once in the lab, which enhanced the ability to identify animals to species. For each sighting, a group of best images was selected based on visible diagnostic features. These images were used in conjunction with the preliminary species identification (ID) made in the field, based upon appearance, group size and behavior, to determine species identity. During the first year of surveys observers from Duke and UNCW met on two occasions to review sighting images and establish a clear set of diagnostic features to positively identify each cetacean species. These features were used by both teams during their photo analysis during the subsequent years. Unless the dolphin species identity could be unequivocally established, the designation "unidentified delphinids" was used. Unidentifiable species were often the result of high BSS conditions where a clear set of images could not be obtained. Images obtained during a sighting were similarly employed to calculate group numbers, and a best estimate of group size was established based on field observations and images.

Geographical Information System (GIS) maps of sightings of cetaceans, sea turtles, other marine vertebrates, and vessels within the survey area were created. Positional data were imported from Excel spread sheets into Arc GIS version 9.2 (ESRI®, Redlands, CA), and used to plot sightings.

The distances between the break track waypoint (2.0) and the initial position of each sighting (2.4) was calculated using the online software Scripts Movable Type (http://www.movable-type.co.uk/scripts/latlong.html), which uses the Haversine formula to calculate distances between two geographical reference points. Since there is a bias in estimating the location of a group of mobile marine mammals from a fast moving airplane, the distances calculated between break track and sighting were recorded to 0.1 km. All data obtained during a marine mammal sighting (*e.g.* observational notes, group size, GPS coordinates and image numbers) were summarized in the Sighting Summary Sheet (See Appendices E and F for example and explanation). When all surveys for a month were completed, tables with sightings and effort (see Tables 3a-b and 4 for

examples) were included in the monthly progress report compiled and sent by DUML to Parsons (Norfolk, VA).

Off effort sightings (*i.e.* "10.0" and sightings made on effort transits to and from the range) were not included in spread sheets used for data analysis.

Table 3a. Example of a cetacean sighting summary table of USWTR aerial surveys in Onslow Bay, North Carolina for June 2010 that would be included in monthly reports.

Date	Time	On / Off Effort	Latitude	Longitude	Track Number	Species	Common Name	Group Size
16-Jun-10	11:04	On	34.013141	-76.406738	9	*S. frontalis*	Atlantic Spotted Dolphin	55
17-Jun-10	10:07	On	33.574286	-76.630432	3	*T. truncatus*	Bottlenose Dolphin	21
17-Jun-10	14:37	On	33.871597	-76.208675	9	*T. truncatus*	Bottlenose Dolphin	13
18-Jun-10	9:20	On	33.637239	-76.561817	4	*T. truncatus*	Bottlenose Dolphin	8
18-Jun-10	9:38	On	33.556626	-76.603283	3	*T. truncatus*	Bottlenose Dolphin	32
18-Jun-10	10:36	On	33.430727	-76.703646	1	*T. truncatus*	Bottlenose Dolphin	25

Table 3b. Example of a sea turtle sighting summary table of USWTR aerial surveys in Onslow Bay, North Carolina for June 2010 that would be included in monthly reports.

Date	Time	On / Off Effort	Latitude	Longitude	Line	Species	Common Name	Group Size
16-Jun-10	10:45	On Effort	34.061262	-76.601679	8	*C. caretta*	Loggerhead Sea Turtle	1
16-Jun-10	10:48	On Effort	34.13628	-76.700404	8	Unid. Sea Turtle	Unid. Sea Turtle	1
16-Jun-10	10:57	On Effort	34.161591	-76.591787	9	*C. caretta*	Loggerhead Sea Turtle	1
16-Jun-10	11:01	On Effort	34.06234	-76.462631	9	*C. caretta*	Loggerhead Sea Turtle	2
16-Jun-10	11:38	On Effort	34.142977	-76.447917	10	*C. caretta*	Loggerhead Sea Turtle	1
16-Jun-10	11:39	On Effort	34.158292	-76.467704	10	*C. caretta*	Loggerhead Sea Turtle	1
17-Jun-10	14:24	On Effort	34.088759	-76.497305	9	*C. caretta*	Loggerhead Sea Turtle	1
18-Jun-10	9:12	On Effort	33.722898	-76.674437	4	*C. caretta*	Loggerhead Sea Turtle	1
18-Jun-10	10:15	On Effort	33.699048	-76.909166	2	*C. caretta*	Loggerhead Sea Turtle	1
18-Jun-10	10:52	On Effort	33.617614	-76.941325	1	*C. caretta*	Loggerhead Sea Turtle	1
18-Jun-10	10:55	On Effort	33.684558	-77.029150	1	*C. caretta*	Loggerhead Sea Turtle	1

Table 4. Example of June effort data included in monthly reports.

Date	Line	Sea State	Kilometers Flown	Hobbs Hours
16-Jun-10	5	1 to 2	74.2	3.7
16-Jun-10	6	1 to 2	74.1	
16-Jun-10	7	1 to 2	74.2	
16-Jun-10	8	2 to 3	74.8	
16-Jun-10	9	2 to 3	74.7	
16-Jun-10	10	2 to 3	72.9	
17-Jun-10	1	2 to 3	74.3	6.4
17-Jun-10	2	2 to 3	74.0	
17-Jun-10	3	2 to 3	71.8	
17-Jun-10	4	2	74.4	
17-Jun-10	5	2	74.1	
17-Jun-10	6	2	73.7	
17-Jun-10	7	2	74.3	
17-Jun-10	8	2	75.2	
17-Jun-10	9	2	74.5	
17-Jun-10	10	2	73.7	
18-Jun-10	4	1 to 3	73.5	2.9
18-Jun-10	3	1 to 2	73.5	
18-Jun-10	2	1 to 2	74.6	
18-Jun-10	1	1 to 2	72.9	

Data storage

All data obtained during a flight (GPS coordinates and digital pictures) and transcribed notes (*e.g.* observations and sightings) are stored electronically in three separate places: on a networked computer hard drive (which is backed up twice a week), an external hard drive, and on separate CDRs or DVDs. Additionally, the original data sheets used in the plane [*i.e.* daily plane log (Appendix G), observer notes and sightings sheets] are stored in binders, as are electronically entered versions of the same and printed forms of all electronic files. All data are stored at UNCW. In addition, all survey data, once edited, are regularly posted online to OBIS Seamap (http://seamap.env.duke.edu/).

Results

Two full sets of survey tracklines were flown for all months from July 2009 to June 2010 except for the months of November, December and February (10 tracklines or one full set each month), September (16 tracklines), and May (no surveys flown due to

weather) for a total of 13538.1 km (Table 5). Survey conditions ranged from a Beaufort Sea State (BSS) 1 to 4, with the majority of the surveys flown in a BSS 2 or 3 [BSS 1: 1823.1 km (13.5%), BSS 2: 5638.6 km (41.6%), BSS 3: 5017.7 km (37.1 %), BSS 4: 1058.7 km (7.8%)(Fig. 3a and 3b)]. For each survey month an average BSS value was calculated to compare conditions across months. This process was done by taking the distance flown at each sea state multiplied by the BSS number (i.e. BSS 1 distances would be multiplied by 1); these values were then summed and divided by the total distance flown that month (Figure 3c). Survey effort was terminated at BSS greater than 4. Cetacean sighting rates dropped off dramatically as BSS increased beyond a BSS 2, with 24 sightings made in a BSS 1 (13.16 sightings/1000 km flown), 44 in a BSS 2 (7.80 sightings/1000 km flown), 16 in a BSS 3 (3.19 sightings/1000 km flown) and 2 sighting in a BSS 4 (1.89 sightings/ 1000 km flown) (Fig. 4a - c).

Table 5. Tracklines and km flown during aerial surveys of the proposed USWTR site in Onslow Bay, North Carolina between July 2009 and June 2010. Trackline numbers are listed in the order in which they were flown.

Date	Tracklines Flown AM	Tracklines Flown PM	Daily Total km flown
8-Jul-2009		5 to 10	445.4
27-Jul-2009	1 to 4	7 to 10	594.7
28-Jul-2009	6 to 1		446.3
17-Aug-2009	10 to 7		297.6
18-Aug-2009	1 to 4	5 to 10	734.3
19-Aug-2009	6 to 1		445.7
12-Sep-2009	1 to 6	10 to 7	727.8
30-Sep-2009		5 to 10	445.3
1-Oct-2009	5 to 10	1 to 4	736.2
2-Oct-2009	1 to 6		442.6
21-Oct-2009	10 to 7		291.3
8-Nov-2009	1 to 6		446.5
9-Nov-2009	7 to 10		296.2
17-Dec-2009	5 to 10	4 to 1	741.2
14-Jan-2010	5 to 10	1 to 4	737.4
15-Jan-2010	1 to 6	7 to 10	732.4
21-Feb-2010	1 to 6	10 to 7	734.8
8-Mar-2010	10 to 7	6 to 1	627.1
9-Mar-2010	5 to 10		354.8
10-Mar-2010	4 to 1		296.1
11-Apr-2010	5 to 10	4 to 1	743.6
12-Apr-2010	10 to 5	1 to 4	741.5
16-Jun-2010	5 to 10		444.9
17-Jun-2010	1 to 6	7 to 10	739.9
18-Jun-2010	4 to 1		294.6
			13538.1

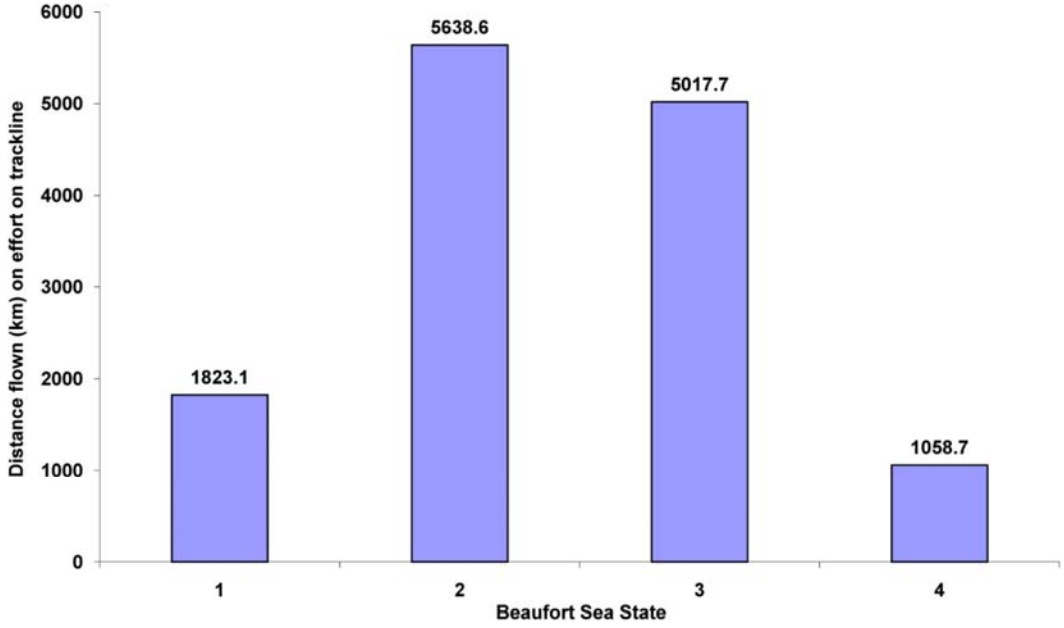

Figure 3a. Total distance surveyed per Beaufort Sea State during the July 2009 – June 2010 USWTR aerial surveys in Onslow Bay, North Carolina.

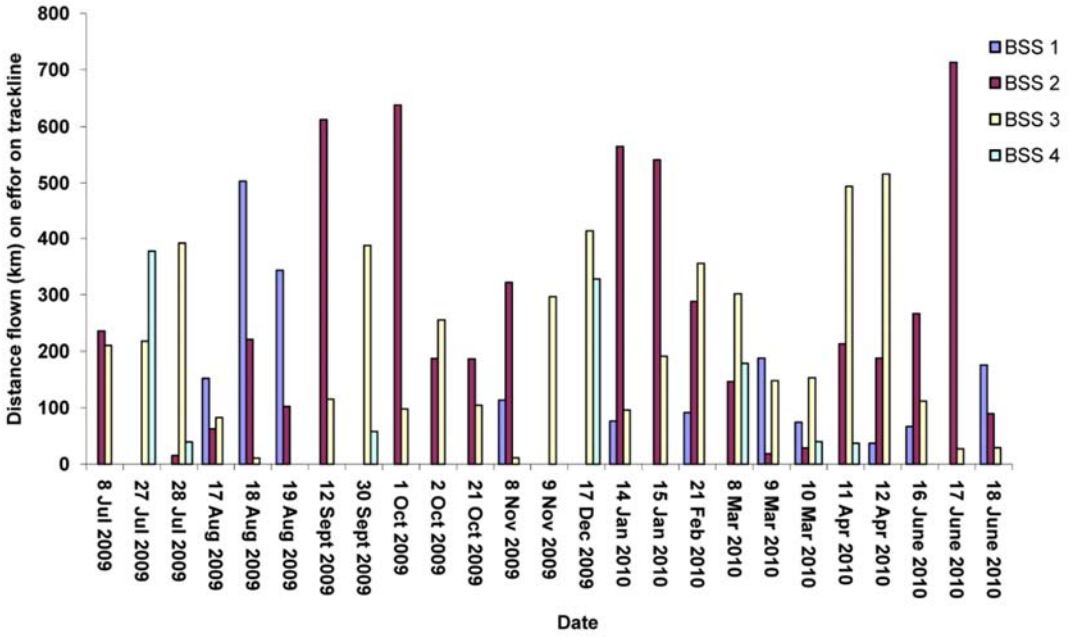

Figure 3b. Effort by Beaufort Sea State for each survey day during the July 2009 – June 2010 USWTR aerial surveys in Onslow Bay, North Carolina.

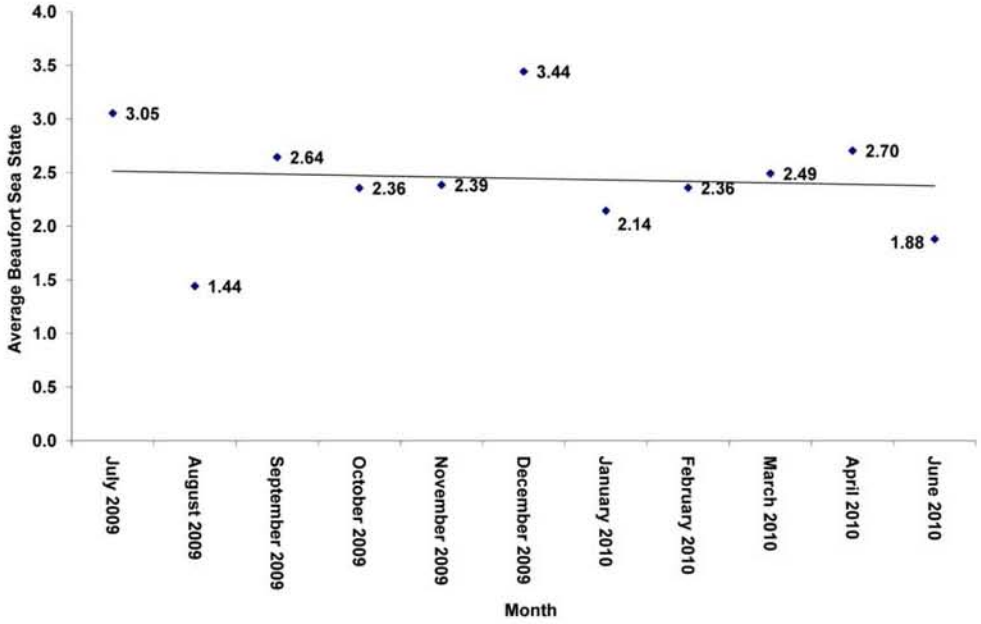

Figure 3c. Average Beaufort Sea State for each month during the July 2009 – June 2010 USWTR aerial surveys in Onslow Bay, North Carolina. Values were calculated using the formula AvgBSS = [(Distance @ BSS 1*1)+(Distance @ BSS 2*2)+…/Total distance flown that day].

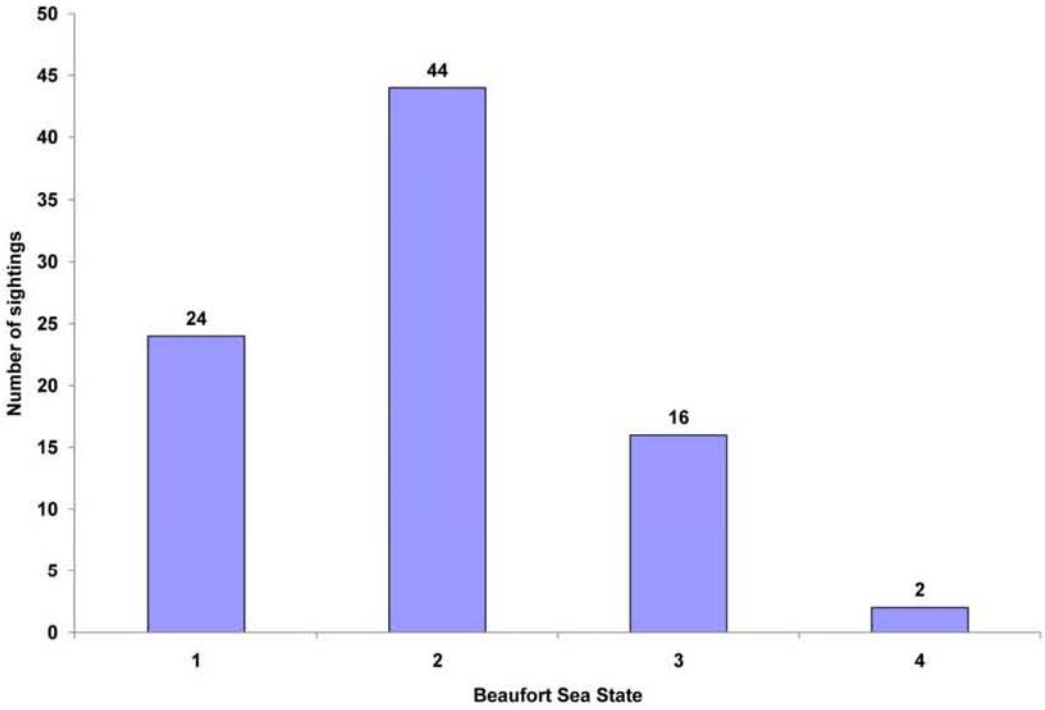

Figure 4a. Total number of cetacean sightings per Beaufort Sea State from July 2009 – June 2010 in the proposed USWTR site in Onslow Bay, North Carolina.

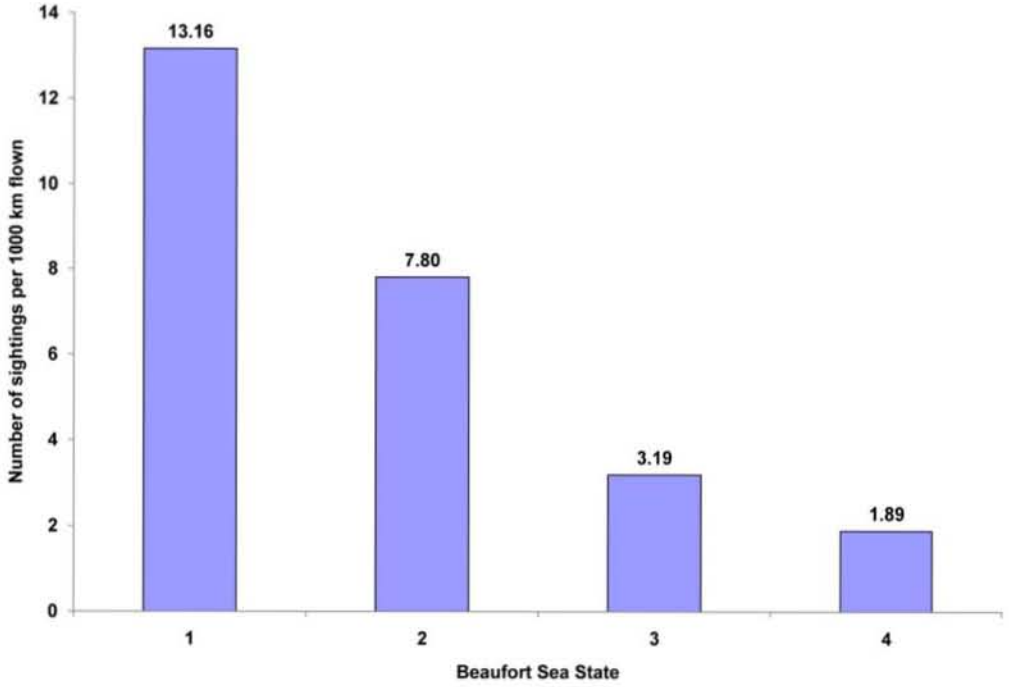

Figure 4b. Cetacean sightings per 1000 km flown by Beaufort Sea State from July 2009 – June 2010 in the proposed USWTR site in Onslow Bay, North Carolina.

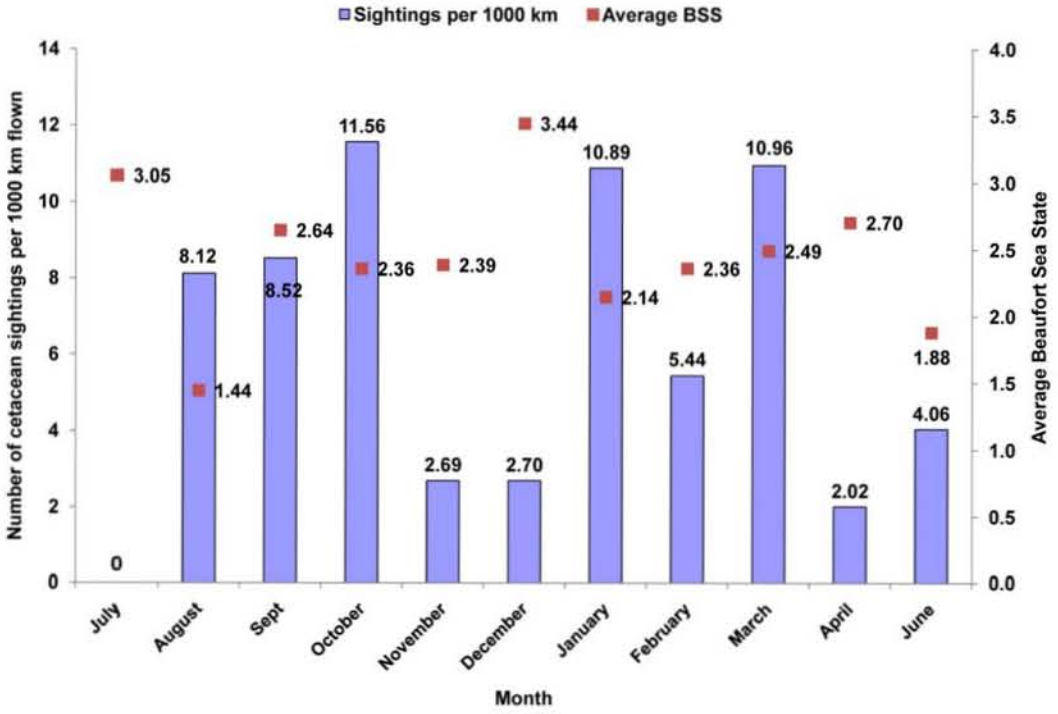

Figure 4c. Cetacean sightings per 1000 km surveyed and the average Beaufort Sea State per month from July 2009 – June 2010 in the proposed USWTR site in Onslow Bay, North Carolina.

The mean sighting distance for all cetacean sightings was 0.7 km from the trackline and most sightings were made within 1.2 km of the plane (Fig.5a). The mean sighting distance tended to decrease as BSS increased (Fig. 5b). Average sighting distances were calculated after removing outliers. An outlier was defined as a value in excess of three standard deviations from the mean. This year, a single sighting was removed from these calculations as an outlier (*i.e.* sighting distance calculated as 5.139 km from the trackline). An additional single unidentified delphinid sighting was removed from these calculations as the location of the animal was not taken preventing a sighting distance from being calculated.

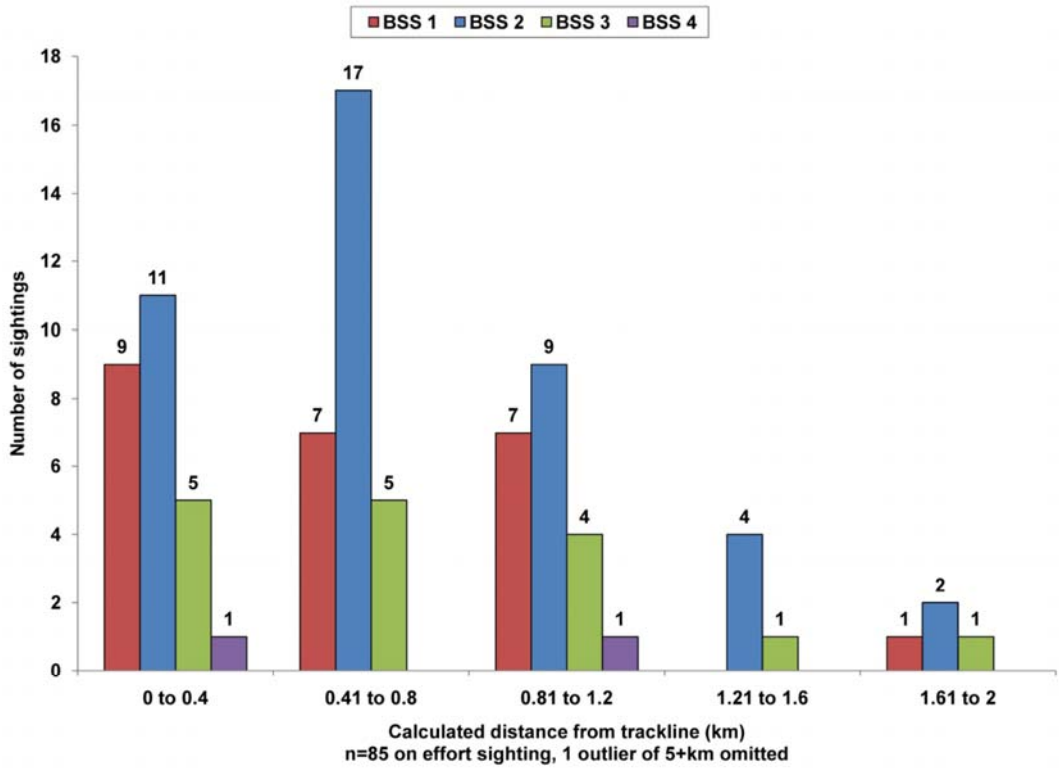

Figure 5a. Sighting distances by Beaufort Sea State for cetacean sightings from July 2009 – June 2010 in the proposed USWTR site in Onslow Bay, North Carolina. A total of 85 sightings are graphed (1 outlier distance of 5+ km was removed).

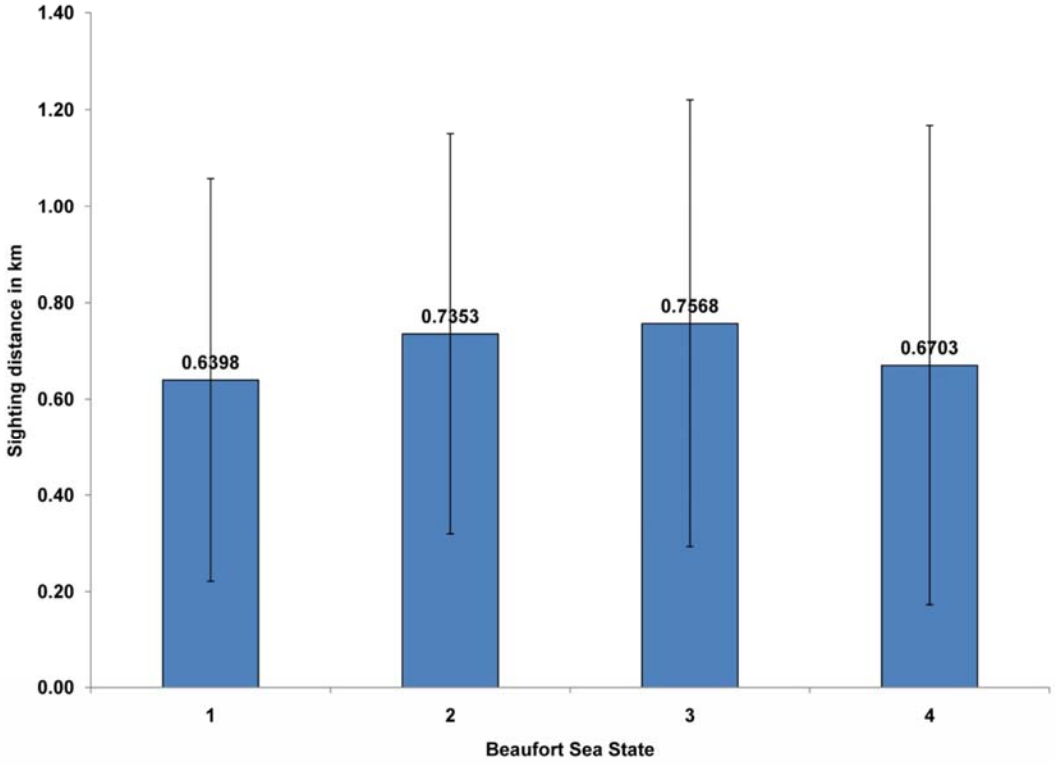

Figure 5b. Mean sighting distance by Beaufort Sea State for all cetacean sightings from July 2009 – June 2010 in the proposed USWTR site in Onslow Bay, North Carolina. Error bars denote standard deviation for each category.

Marine Mammal Sightings

On March 9, 2010 a single fin whale (*Balaenoptera physalus*) was spotted and documented on the offshore portion of line 10, marking the first baleen whale recorded within the Onslow Bay USWTR survey area. On October 21, 2009 there was also an off effort sighting of a sperm whale (*Physeter macrocephalus*) at the offshore end of line 10, although this individual dove before photographs could be collected. These animals are of special interest as they are listed as endangered under the Endangered Species Act. While sperm whales have been detected acoustically within the USWTR survey area, this sighting provides the first visual confirmation of this species near the site. The survey team also recorded a nearshore sighting of three North Atlantic right whales (*Eubalaena glacialis*) on November 8, 2009 approximately 3.5 miles off of Fort Fisher at Kure Beach, North Carolina. All animals were photo-documented as they moved south and these images were provided to the New England Aquarium for individual identification. The right whales were identified as Eg 3142 (female), 3513 (females) and 3648 (male).

Species are listed below in order of decreasing number of sightings with the most commonly sighted species first. Total number of individuals reported here is the sum of the best estimate of group size for each sighting. Sightings data for the past two years (Pabst *et al.* 2008, McAlarney *et al.* 2009), as well as for the UNCW 1998/1999 aerial survey (McLellan *et al.* 1999), are included for comparison purposes. Summaries for each individual sighting are in Appendix E. All sightings for each month are summarized in Appendix H.

Bottlenose dolphins (*Tursiops truncatus*) (Table 6, Fig. 6)

The bottlenose dolphin was the most commonly observed cetacean species during the present study, based upon number of sightings and number of individuals. This species was observed 53 times for a total of 791 individuals. Group size ranged between 1-65 individuals (mean=14). Bottlenose dolphins were observed in August, September, October, November, January, February, March, April, and June. Calves (defined as an individual less than or equal to one-half the total length of the associated adult) were seen in September, October, January, February, March and June. Based on the distance from shore (*i.e.* greater than 69 km), these bottlenose dolphins were most likely the offshore ecotype (Torres *et al*. 2003). Overall, smaller groups were encountered throughout the survey area while larger groups were only seen at and beyond the continental shelf break with one exception. This group size pattern was also observed during last year's surveys. During the 2008/2009 aerial survey period bottlenose dolphins were encountered 36 times for a total of 634 individuals. During the 2007/2008 aerial survey of the same area, bottlenose dolphins were encountered 33 times for a total of 461 individuals. During the 1998/1999 aerial survey of the same area, bottlenose dolphins were encountered 17 times for a total of 151 individuals. The current best estimate of offshore bottlenose dolphins in the Western Atlantic Ocean, between central Florida and Canada, is 81588 (CV = 0.17) (Waring *et al*. 2008).

Table 6. All bottlenose dolphin *(Tursiops truncatus)* sightings in the proposed USWTR site in Onslow Bay, North Carolina for surveys conducted from July 2009 - June 2010.

Date	Time	Way Point	Latitude	Longitude-1	Heading	Track Number	Angle out	Degree Forward	Best #
18-Aug-09	9:37	6	33.620708	-76.942240	SE	1	1	90°	2
18-Aug-09	10:15	19	33.504820	-76.674391	NW	2	4	90°	35
18-Aug-09	11:22	39	33.611807	-76.541171	NW	4	1	90°	2
18-Aug-09	11:40	48	33.784330	-76.761268	NW	4	1	90°	3
19-Aug-09	11:04	20	33.811234	-76.916236	NW	3	1	100°	3
19-Aug-09	12:00	32	33.449196	-76.601237	SE	2	3	90°	8
12-Sep-09	11:29	39	33.681102	-76.350511	NW	6	1	90°	1
12-Sep-09	11:36	43	33.705709	-76.415980	NW	6	3	90°	3
12-Sep-09	15:35	80	33.788579	-76.219790	SE	8	3	45°	19
30-Sep-09	14:15	25	33.881552	-76.244972	SE	9	2	90°	43
1-Oct-09	8:42	6	33.739176	-76.572540	SE	5	2	100°	4
1-Oct-09	8:56	10	33.724444	-76.555044	SE	5	3	110°	8
1-Oct-09	10:14	34	33.827829	-76.418514	SE	7	3	90°	15
1-Oct-09	10:24	38	33.740108	-76.312358	SE	7	2	60°	6
1-Oct-09	11:01	50	33.972348	-76.473672	NW	8	3	90°	2
1-Oct-09	15:42	97	33.596687	-76.664434	SE	3	3	90°	19
2-Oct-09	9:50	15	33.475239	-76.447250			2	90°	11
2-Oct-09	10:01	18	33.504595	-76.392273			1	90°	8
2-Oct-09	10:07	21	33.535099	-76.421927	NW	4	3	90°	15
21-Oct-09	11:32	22	33.932099	-76.176954	NW	10	2	90°	6
21-Oct-09	12:37	38	33.756576	-76.181401	NW	8	1	90°	2
21-Oct-09	12:43	41	33.829105	-76.279533	NW	8	4	90°	40
21-Oct-09	13:47	58	33.720393	-76.290826	SE	7	1	90°	12
8-Nov-09	13:51	10	33.407155	76.643227	SE	1	3	90°	38
8-Nov-09	14:55	32	33.623729	76.540808	NW	4	1	90°	4
14-Jan-10	10:34	15	33.668686	-76.355825	NW	6	3	90°	5
14-Jan-10	10:44	20	33.740090	-76.452193	NW	6	3	110°	5
14-Jan-10	11:33	39	33.805552	-76.393617	SE	7	2	90°	3
14-Jan-10	11:51	45	33.746017	-76.176662	NW	8	2	90°	15
14-Jan-10	13:01	66	33.829063	-76.035037	NW	10	1	90°	1
15-Jan-10	9:45	16	33.558281	-76.738722	NW	2	1	90°	8
15-Jan-10	10:39	30	33.602597	-76.529002	NW	4	1	90°	20
15-Jan-10	11:25	44	33.698764	-76.511070	SE	5	3	90°	22
15-Jan-10	11:44	49	33.601521	-76.270769		TE	2	60°	8
15-Jan-10	12:02	54	33.725468	-76.420365	NW	6	2	90°	14
15-Jan-10	12:23	62	34.041882	-76.828397	NW	6	1	90°	3
15-Jan-10	12:35	66	34.061379	-76.860277	NW	6	3	60°	46
15-Jan-10	15:02	87	33.709471	-76.265296	SE	7	2	90°	27
21-Feb-10	14:41	43	33.897988	-76.253719	NW	9	3	90°	11
8-Mar-10	15:30	48	33.487350	-76.636780	SE	2	1	90°	4
8-Mar-10	15:43	52	33.410814	-76.538489	SE	2	3	90°	5
9-Mar-10	9:02	5	33.960739	-76.832647	SE	5	3	90°	15
9-Mar-10	9:17	11	33.830343	-76.706071	SE	5	2	90°	6
9-Mar-10	9:32	17	33.720726	-76.534367	SE	5	3	90°	20
9-Mar-10	9:52	23	33.743504	-76.443130	NW	6	3	60°	65

Table 6 (Continued). All bottlenose dolphin (*Tursiops truncatus)* sightings in the proposed USWTR site in Onslow Bay, North Carolina for surveys conducted from July 2009 - June 2010.

Date	Time	Way Point	Latitude	Longitude-1	Heading	Track Number	Angle out	Degree Forward	Best #
9-Mar-10	10:11	35	34.017554	-76.803091	NW	6	2	90°	5
9-Mar-10	10:57	54	33.719563	-76.280838	SE	7	1	90°	9
9-Mar-10	11:14	60	33.796304	-76.241464	NW	8	1	60°	13
9-Mar-10	12:03	76	33.871443	-76.213856	SE	9	1	90°	30
9-Mar-10	12:19	82	33.858932	-76.064517	NW	10	3	90°	4
11-Apr-10	11:15	37	33.484779	-76.651031	SE	2	1	100°	40
12-Apr-10	11:17	37	33.685951	-76.498036	NW	5	1	90°	8
17-Jun-10	10:07	19	33.574286	-76.498036	SE	3	1	90°	21
17-Jun-10	14:37	47	33.871597	-76.498036	SE	9	2	90°	13
18-Jun-10	9:20	7	33.637239	-76.561817	SE	4	2	100°	8
18-Jun-10	9:38	13	33.556626	-76.603283	NW	3	1	60°	32
18-Jun-10	10:36	24	33.430727	-76.703646	NW	1	1	90°	25

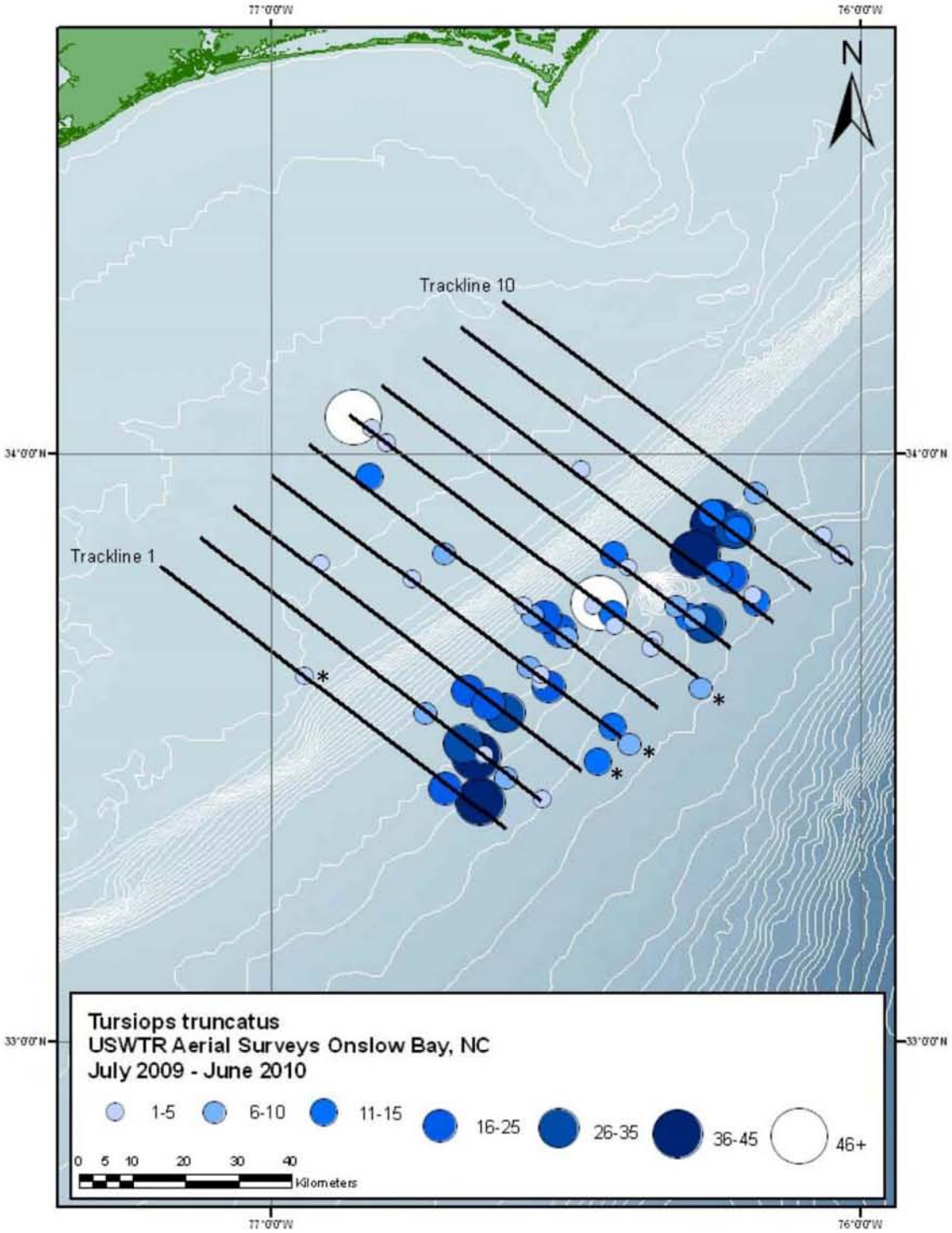

Figure 6. Bottlenose dolphin (*Tursiops truncatus*) sightings indicating group size. Asterisk denotes off effort sightings.

Atlantic spotted dolphins (*Stenella frontalis*) (Table 7, Fig. 7)

The spotted dolphin was the second most commonly encountered species in the survey area, both by number of sightings and number of individuals. Groups of spotted dolphins were sighted 24 times for a total of 467 individuals. This species was encountered in August, September, October, January, February, April, and June. Group size ranged between two and 65 (mean group size = 19). At least one calf was observed within a group during both September and October. Spotted dolphins were almost exclusively encountered on the shallower, inshore side of the continental shelf break except for one sighting that occurred on the shelf break. There are two distinct forms or ecotypes of the Atlantic spotted dolphin in the western north Atlantic: a heavily spotted, larger form that typically occurs on the continental shelf and is most often encountered around the 200 m isobar or in shallower water, and a less spotted and smaller form which occurs further offshore and around islands (Perrin *et al*. 1987, 1994). It is likely, based upon the sighting pattern observed, that the spotted dolphins observed during the present study belong to the continental shelf variety. During the 2008/2009 aerial survey of the same area, spotted dolphins were encountered 22 times for a total of 717 individuals. During the 2007/2008 aerial survey, spotted dolphins were encountered 11 times for a total of 177 individuals. Spotted dolphins were not recorded during the 1998/1999 aerial surveys, although the lines flown in that survey did not extend as far west as in the current surveys (McLellan *et al*. 1999). The abundance estimate for *S. frontalis* (both inshore and offshore ecotypes) in the western north Atlantic is 50978; the status of the stock(s) is/are unknown (Waring *et al*. 2007).

Table 7. All spotted dolphin (*Stenella frontalis)* sightings in the proposed USWTR site in Onslow Bay, North Carolina for surveys conducted from July 2009 - June 2010.

Date	Time	Way Point	Latitude	Longitude-1	Heading	Track Number	Angle out	Degree Forward	Best #
17-Aug-09	15:27	7	34.160575	-76.468974	SE	10	3	90°	35
18-Aug-09	11:50	53	33.886683	-76.898185	NW	4	2	60°	2
18-Aug-09	14:21	64	33.761505	-76.599899	SE	5	3	60°	65
18-Aug-09	15:02	75	34.070793	-76.872859	NW	6	2	45°	9
19-Aug-09	11:28	27	33.815988	-77.078934	SE	2	3	90°	4
12-Sep-09	9:51	16	33.811053	-77.063150	NW	2	2	90°	7
12-Sep-09	10:50	30	33.943367	-76.958318	NW	4	3	90°	12
12-Sep-09	14:08	57	34.173510	-76.478967	SE	10	1	100°	14
12-Sep-09	15:03	70	34.164627	-76.722763	SE	8	2	110°	4
12-Sep-09	15:14	75	34.110018	-76.648676	SE	8	2	90°	4
1-Oct-09	9:45	23	34.076573	-76.766611	SE	7	3	90°	20
1-Oct-09	11:11	54	34.042681	-76.555923	NW	8	3	90°	6
1-Oct-09	11:29	58	34.150825	-76.699600	NW	8	2	90°	9
1-Oct-09	12:29	73	34.209822	-76.525553	NW	10	2	90°	27
1-Oct-09	14:29	83	33.765256	-77.127123	SE	1	3	100°	4
21-Oct-09	13:02	47	34.079645	-76.624388	NW	8	3	90°	4
14-Jan-10	13:25	72	34.276465	-76.603520	NW	10	3	90°	37
15-Jan-10	14:27	76	34.074558	-76.731663	SE	7	1	90°	30
15-Jan-10	14:43	83	33.917354	-76.538055	SE	7	1	90°	28
15-Jan-10	16:29	107	34.156027	-76.457154	NW	10	2	60°	47
21-Feb-10	11:26	22	33.924674	-76.662710	NW	6	3	90°	18
21-Feb-10	15:17	54	33.984780	-76.500092	SE	8	1	90°	8
16-Jun-10	11:04	26	34.013141	-76.406738	SE	9	3	90°	55
11-Apr-10	9:53	16	34.010019	-76.930714	NW	5	3	90°	18

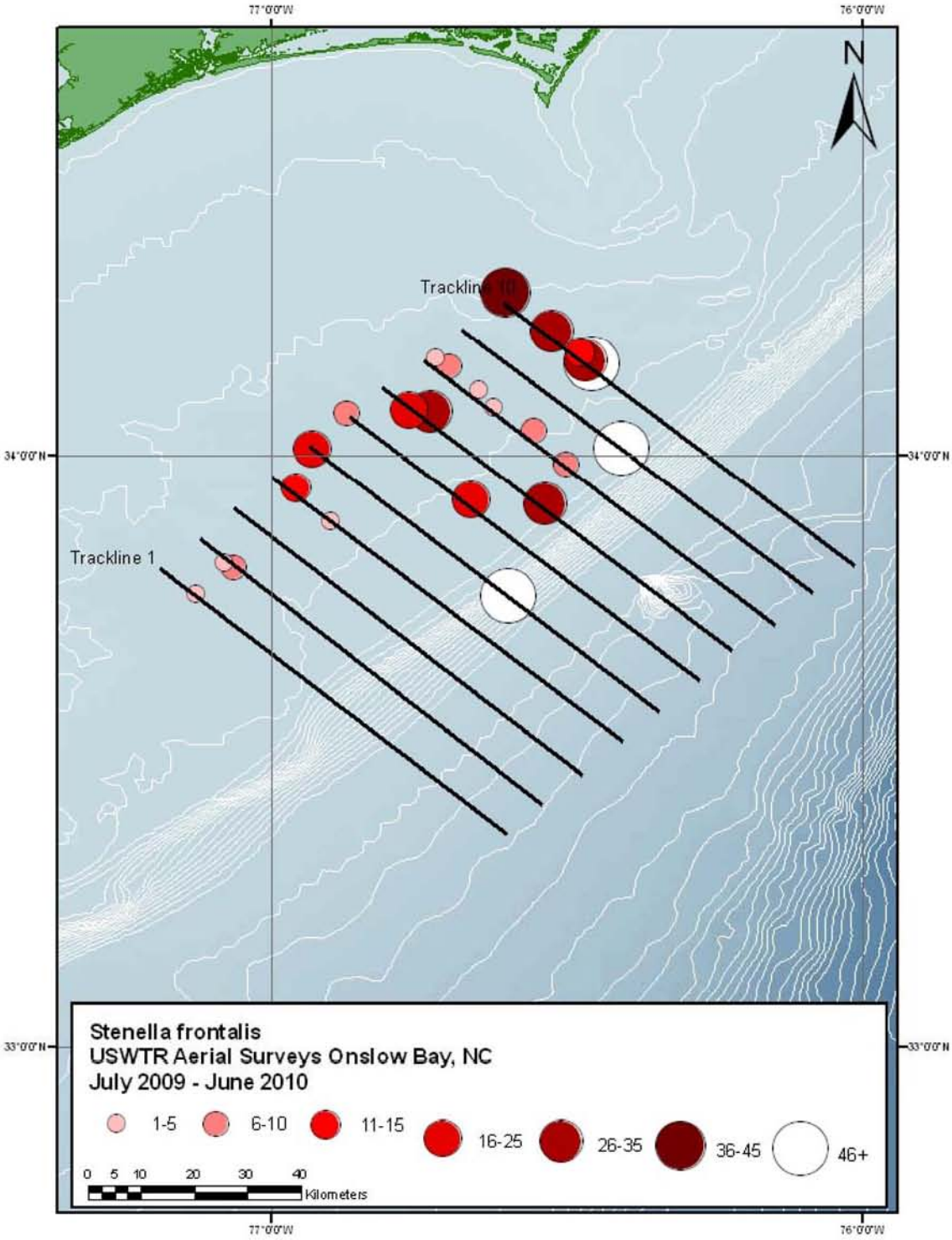

Figure 7. Spotted dolphin *(Stenella frontalis)* sightings indicating group size.

Short-finned pilot whales (*Globicephala macrorhynchus)* (Table 8, Fig. 8)

Short-finned pilot whales were encountered twice, for a total of 63 individuals. Both sightings of this species were offshore of the continental shelf break. As is common for sightings of this species in the survey area, a calf was present in both of these encounters. During the 2008/2009 aerial survey of the same period, short-finned pilot whales were encountered twice for a total of 30 individuals. During the 2007/2008 aerial survey of the same area, short-finned pilot whales were encountered three times for a total of 53 individuals. Pilot whales of unidentified species were encountered once during the 1998/1999 aerial surveys, in May 1999.

Owing to the difficulty of differentiating short-finned and long-finned pilot whales (*Globicephala melas*) at sea, NMFS reports stock numbers and status as *Globicephala* spp. (Waring *et al*. 2007). The abundance estimate of *Globicephala* spp. (31139, CV 0.27) is based upon shipboard surveys along the outer continental shelf of the US Atlantic between Florida and Maryland in 2004 (Waring *et al*. 2009).

Table 8. All short-finned pilot whale (*Globicephala macrorhynchus)* sightings in the proposed USWTR site in Onslow Bay, North Carolina for surveys conducted from July 2009 - June 2010.

Date	Time	Way Point	Latitude	Longitude-1	Heading	Track Number	Angle out	Degree Forward	Best #
18-Aug-09	10:59	33	33.493955	-76.498147	SE	3	3	90°	40
19-Aug-09	12:20	37	33.386885	-76.537104			2	90°	6
21-Oct-09	11:08	18	33.823938	-75.995138		TE	1	90°	12
21-Feb-10	15:39	59	33.757085	-76.192980	SE	8	2	90°	23

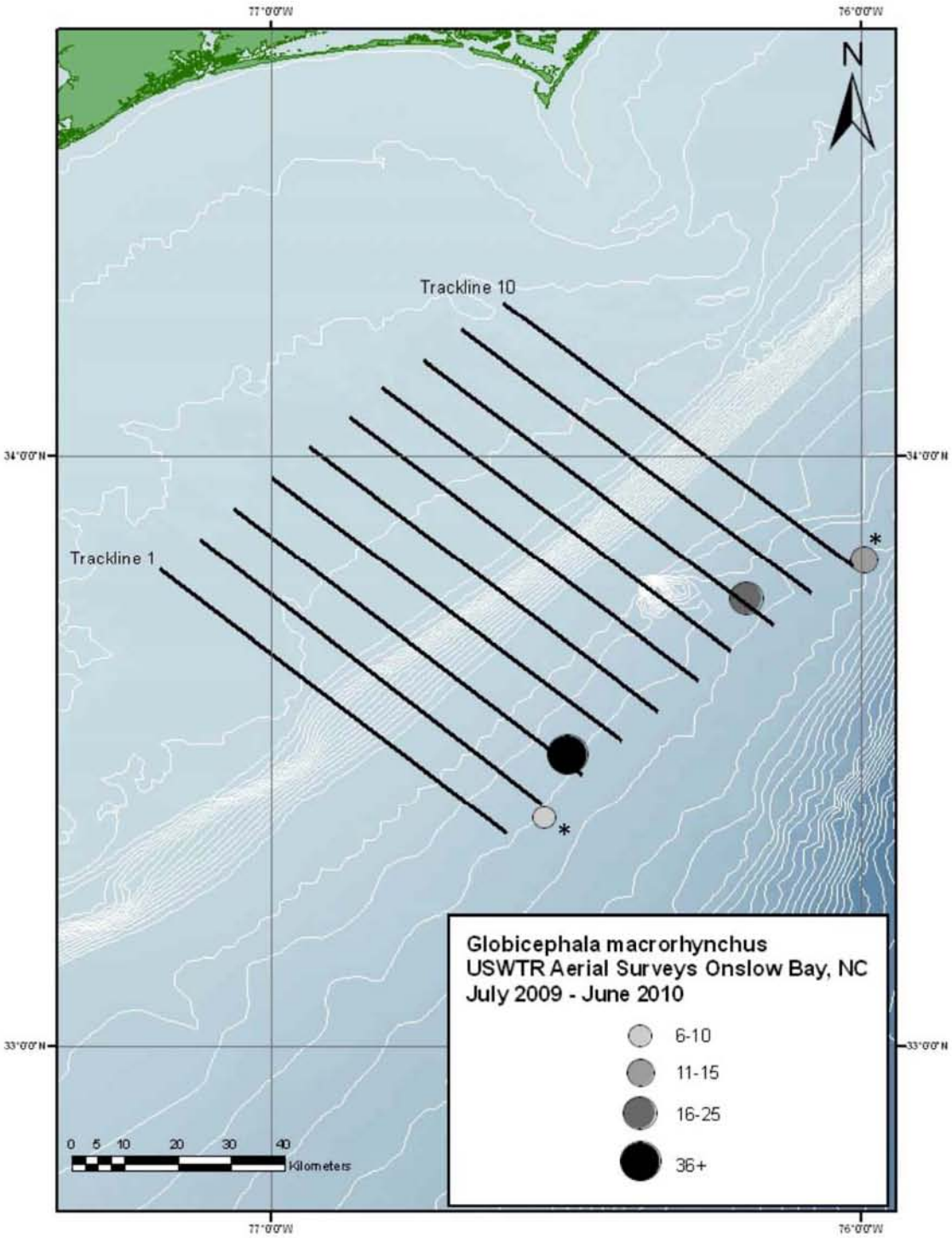

Figure 8. Short-finned pilot whales *(Globicephala macrorhynchus)* sightings indicating group size. Asterisk denotes off effort sightings.

Risso's dolphins *(Grampus griseus)* (Table 9, Fig. 9)

There was a single sighting of a group of 20 Risso's dolphins during the 2009-2010 aerial surveys. There was a single "off effort" sighting of a group of 20 Risso's dolphin during the 2008-2009 survey, which included two adult animals with calves. This species was encountered three times during the 2007-2008 surveys; once in May 2008 and twice in June 2008, for a total of 20 individuals. A single neonate calf (less than half the length of the associated larger animal) was observed during one of the encounters in June 2008. Three groups of Risso's dolphins for 28 individuals were also seen in May and July during the 1998-1999 aerial surveys. All encounters occurred in offshore waters where Risso's dolphins have been found to reside along the mid-Atlantic continental shelf edge year round, with some movement north during spring, summer and fall, and into the mid-Atlantic Bight during winter (Waring *et al*. 2007). The best available estimate for Risso's dolphins based upon results from two US Atlantic surveys conducted in 2004 is 20479 (CV=0.59) (Waring *et al*. 2009).

Table 9. All Risso's dolphin (*Grampus griseus)* sightings in the proposed USWTR site in Onslow Bay, North Carolina for surveys conducted from June 2009 - July 2010.

Date	Time	Way Point	Latitude	Longitude-1	Heading	Track Number	Angle out	Degree Forward	Best #
18-Aug-09	9:57	13	33.358769	-76.610723	SE	1	2	90°	6
15-Jan-10	15:16	92	33.664086	-76.195214		TE	1	90°	5

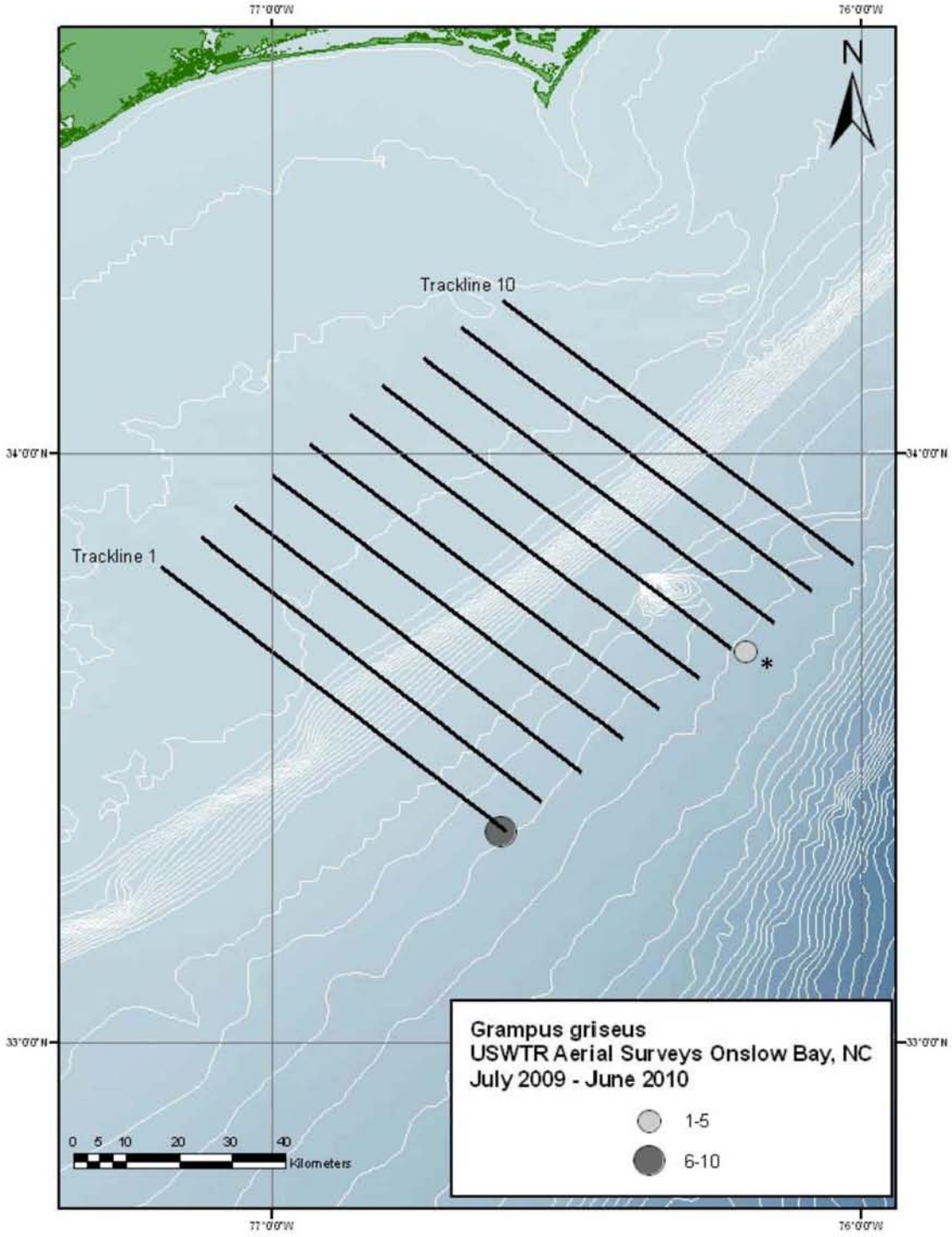

Figure 9. Risso's dolphin (*Grampus griseus*) sightings indicating group size. Asterisk denotes off effort sighting.

Common Dolphins (*Delphinus delphis*) (Table 10, Fig. 10)

A single group of 20 common dolphins with a single calf present was encountered on March 9, 2010 inside the USWTR survey area. These animals had not been observed in the two years prior but were present in the aerial surveys conducted in 1998/99. During the 1998/1999 surveys a total of 14 sightings, representing 194 individuals, were observed in the months of September, October, June and July. The sighting this year occurred in deeper waters offshore of the shelf break on line 7; in 1998/1999 however, sightings occurred throughout the range. The current best estimate of common dolphins in the Western Atlantic Ocean, between central Florida and Canada, is 120743 (CV = 0.23) (Waring *et al*. 2008).

Table 10. All common dolphin (*Delphinus delphis)* sightings in the proposed USWTR site in Onslow Bay, North Carolina for surveys conducted from June 2009 - July 2010.

Date	Time	Way Point	Latitude	Longitude-1	Heading	Track Number	Angle out	Degree Forward	Best #
9-Mar-10	10:42	49	33.770576	-76.346663	SE	7	1	110°	20

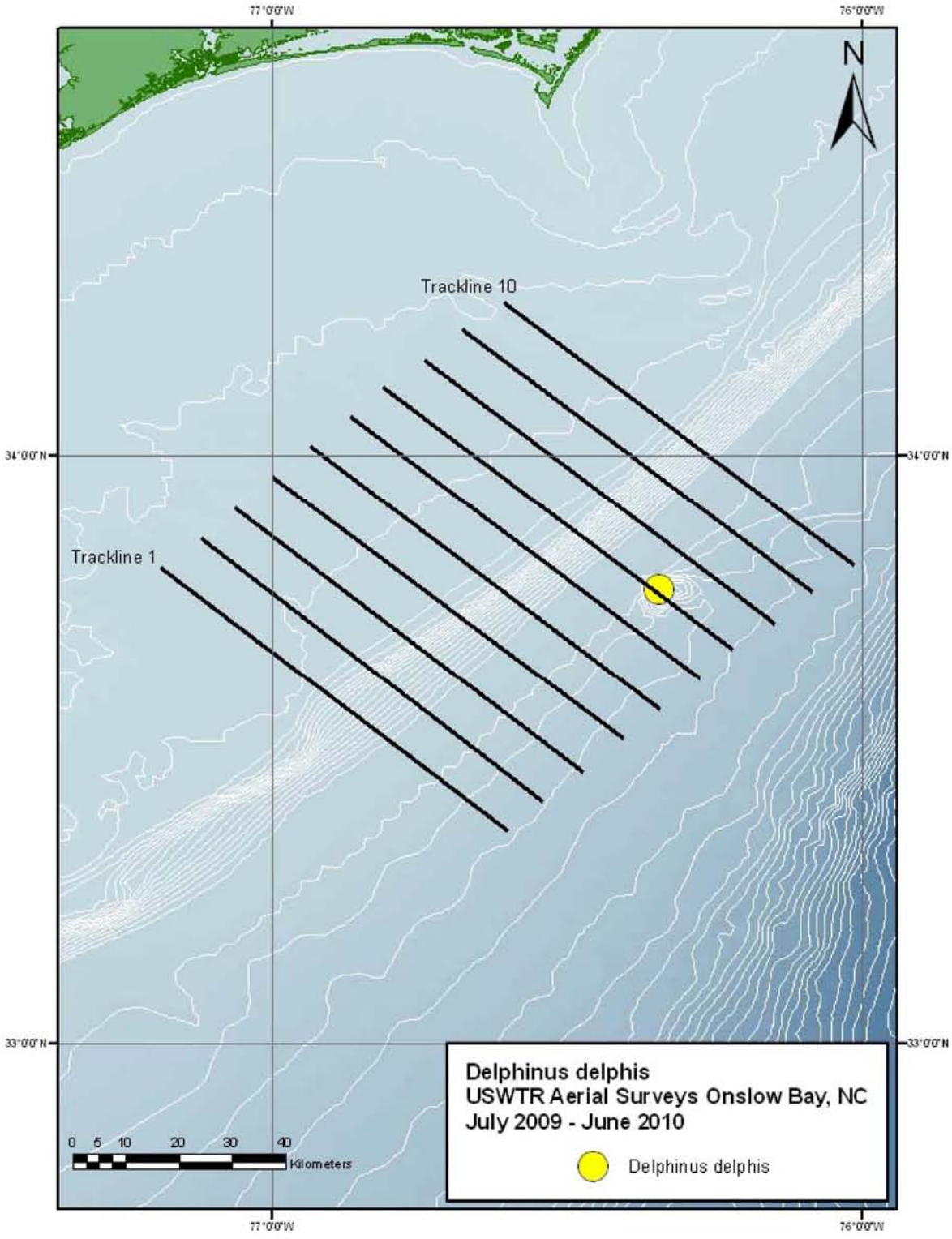

Figure 10. Common dolphin (*Delphinus delphis*) sighting.

Sperm Whale (*Physeter macrocephalus*) (Table. 11, Fig. 11)

On October 21, 2009 while on an "off effort" transit to the offshore end of line 10, a single sperm whale was encountered. Although no photographs of this sighting were possible, there is high confidence in the species ID. Sperm whales are listed as endangered under the Endangered Species Act, and the current best population estimate in the Western North Atlantic is 4804 (CV=0.38) (Waring *et al.* 2007). During the two years prior to this survey period and during the aerial surveys in 1998-99 there were no sightings of sperm whales. Acoustic recordings of sperm whales have been collected from HARPS deployed within the USWTR, although the exact position of the animals could not be specified. This recent sighting confirms the presence of this species near the USWTR range.

Table 11. All sperm whale *(Physeter macrocephalus)* sightings in the proposed USWTR site in Onslow Bay, North Carolina for surveys conducted from June 2009 - July 2010.

Date	Time	Way Point	Latitude	Longitude-1	Heading	Track Number	Angle out	Degree Forward	Best #	Comments
21-Oct-09	11:08	18	33.823938	-75.995138		TE	1	90°	1	No resight of Sperm whale

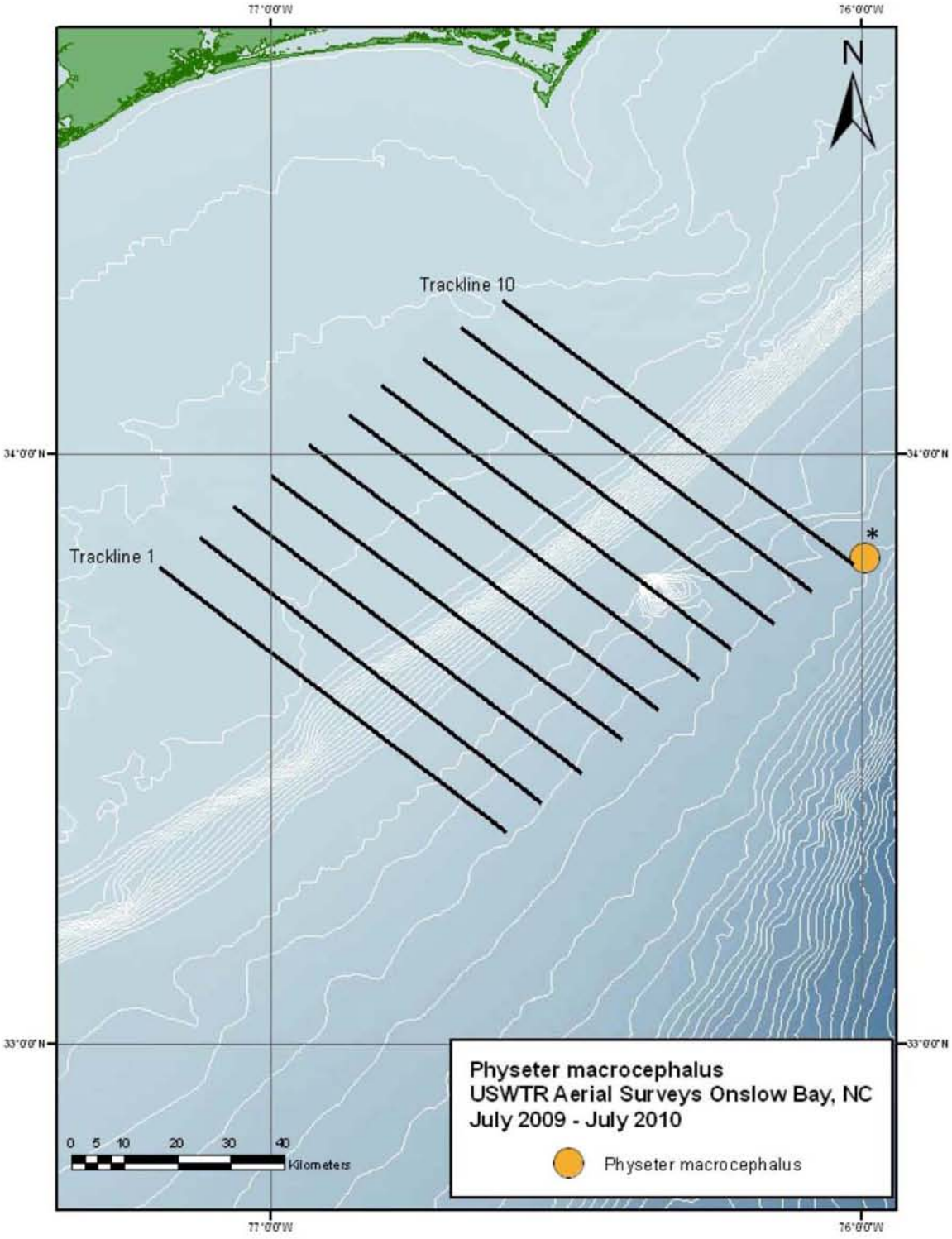

Figure 11. Sperm whale (*Physeter macrocephalus*) sighting. Asterisk denotes off effort sighting.

Fin Whale (*Balaenoptera physalus*) (Table 12, Fig. 12)

A single fin whale sighting was made on March 9, 2010 offshore of the shelf break on line 10. Fin whales are listed as endangered under the Endangered Species Act and the current best population estimate in the Western North Atlantic is 2269 (CV=0.37) (Waring *et al.*, 2009). This species has not been observed in any of the previous surveys in the Onslow Bay USWTR site but was observed further north at the Wallops Island site in 1998/99 (McLellan *et al.*, 1999) and off the mouth of the Chesapeake Bay, VA during right whale aerial surveys in 2001 (McLellan *et al.*, 2001), 2002 (McLellan *et al.*, 2002), 2005-06 (McLellan *et al.*, 2006), and 2006-07 (McLellan *et al.*, 2007).

Table 12. All fin whale (*Balaenoptera physalus)* sightings in the proposed USWTR site in Onslow Bay, North Carolina for surveys conducted from June 2009 - July 2010.

Date	Time	Way Point	Latitude	Longitude-1	Heading	Track Number	Angle out	Degree Forward	Best #
9-Mar-10	12:30	86	33.963446	-76.221540	NW	10	3	90°	1

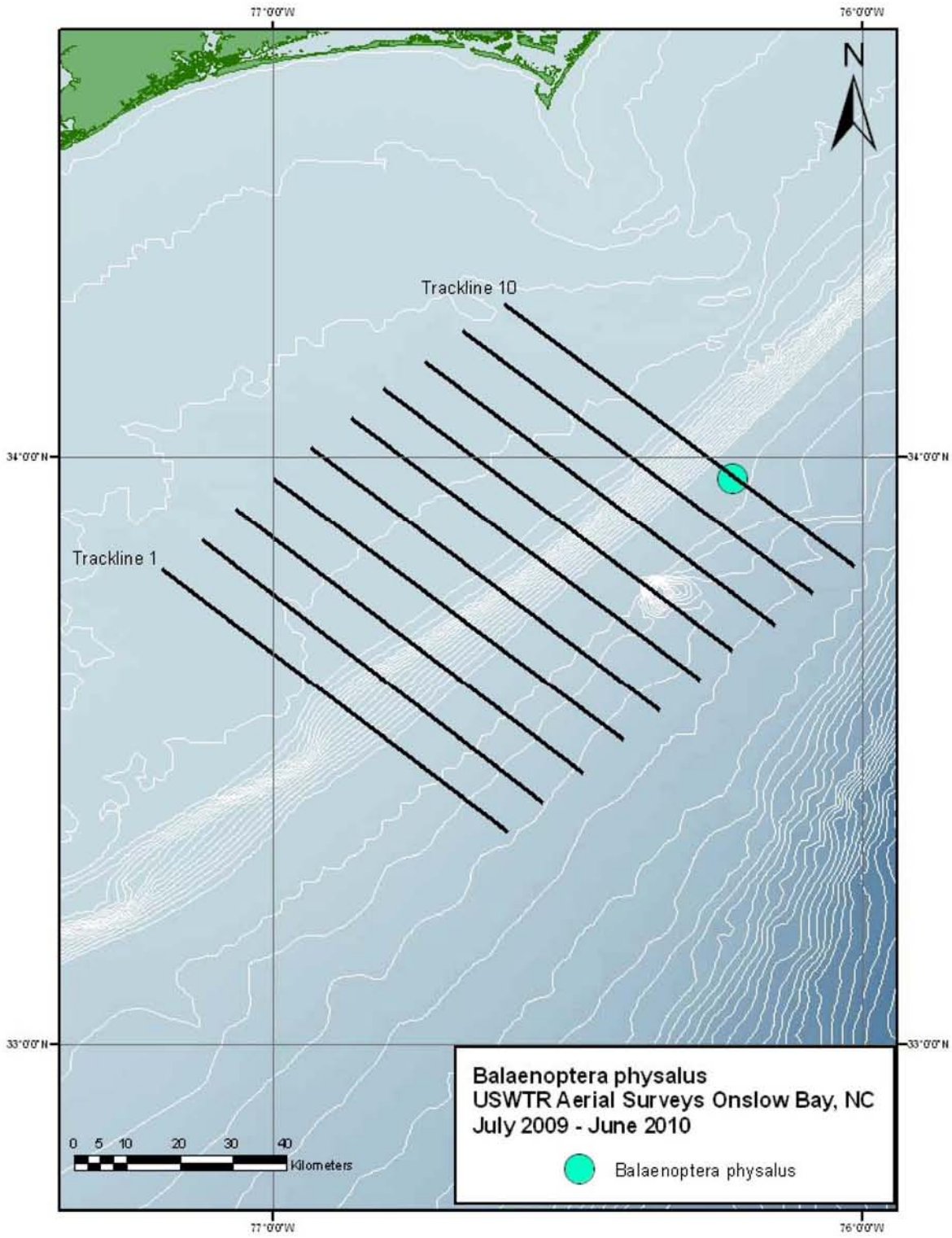

Figure 12. Fin whale (*Balaenoptera physalus*) sighting.

Unidentified delphinids (Table 13, Fig. 13)

When no images were obtained or when images obtained during encounters were not of sufficient quality to make an unequivocal species identification, the designation "unidentified delphinids" was used. A total of 4 sightings of 23 individuals were labeled as unidentified delphinids during the 2009-2010 survey period. In 2008-2009 a total of 41 unidentified delphinids in four sightings were recorded. During the 2007/2008 aerial survey 11 sightings for a total of 97 individuals were labeled as unidentified delphinids.

Table 13. All unidentified delphinid sightings in the proposed USWTR site in Onslow Bay, North Carolina for surveys conducted from June 2009 - July 2010.

Date	Time	Way Point	Latitude	Longitude-1	Heading	Track Number	Angle out	Degree Forward	Best #
12-Sep-09	9:08	7	33.494854	-76.785000	SE	1	3	100°	3
17-Dec-09	10:56	18	33.862939	-76.343101	NW	8	1	90°	2
17-Dec-09	11:56	28	34.135101	-76.433447	NW	10	3	90°	15
10-Mar-10	9:57	17	33.844501	-77.105389	SE	2	2	90°	3

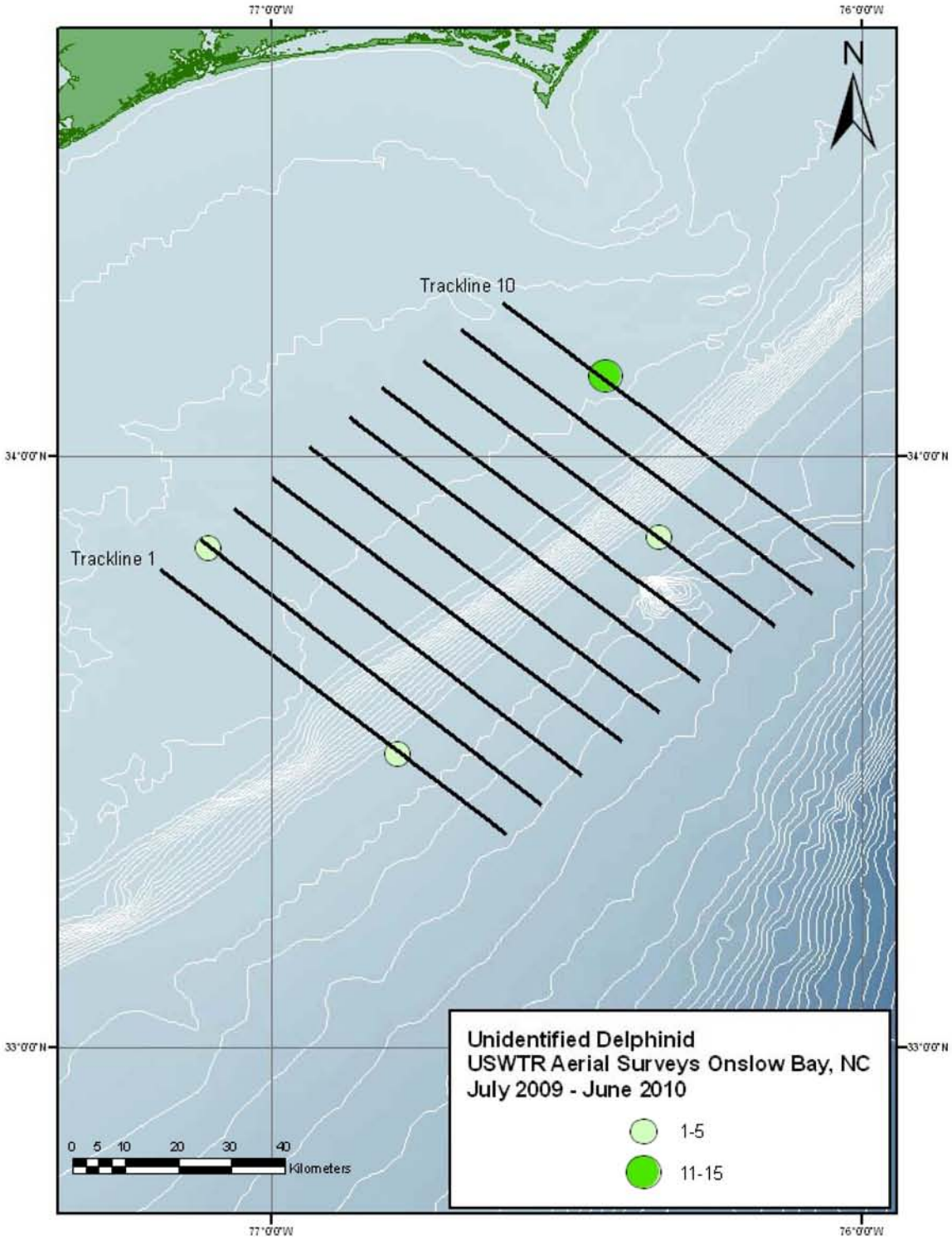

Figure 13. Unidentified delphinid sightings indicating group size.

Sea Turtles (Tables 14 to 16, Figs. 14 and 15a-c)

The most common sea turtle off the North Carolina coast is the loggerhead sea turtle (*Caretta caretta),* a species that nests along the NC coast and is listed as threatened under the US Endangered Species Act (National Marine Fisheries Service and U.S. Fish and Wildlife Service 2008). Other sea turtle species present in the mid-Atlantic are the green (*Chelonia mydas*), leatherback (*Dermochelys coriacea),* hawksbill *(Eretmochelys imbricata),* and Kemp's Ridley (*Lepidochelys kempii)* (National Marine Fisheries Service and U.S. Fish and Wildlife Service 1991, 1992a, 1992b, 1993). A total of 646 sea turtles were seen in the survey area in 2009-2010, which is higher than observed in any previous year. Of these, 501 were identified as loggerhead sea turtles, 141 were recorded as "unidentified sea turtles" and four leatherback sea turtles were observed (three in October and one in March). Leatherback turtles have now been sighted in two consecutive years with a single individual observed in June 2009. They were not seen during the 2007/2008 season but four animals had been seen in the 1998-99 surveys.

In comparison, during the 2007-2008 survey season 208 loggerhead sea turtles and 60 "unidentified sea turtles" were recorded. During the 2008-2009 season 226 loggerhead sea turtles and 36 "unidentified sea turtles" were observed.

Sea turtles were observed in every month of the survey period, although abundance fluctuated throughout the year. The lowest densities were observed in June, July and January (8.11, 5.38 and 6.75 sea turtles /1000 km respectively) and the highest densities occurred in January, February and March (102.74, 70.76, and 176.07 sea turtles /1000 km respectively). The majority of sea turtles were observed shoreward of the continental shelf break. As expected, sea turtle sightings were strongly correlated with Beaufort Sea State.

Table 14 . All loggerhead sea turtle (*Caretta caretta)* sightings in the proposed USWTR site in Onslow Bay, North Carolina for surveys conducted from July 2009 - June 2010.

Date	Time	Way Point	Latitude	Longitude-1	Heading	Track Number	Angle out	Degree Forward	Best #
8-Jul-09	13:53	10	33.878084	-76.623097	NW	6	2	90°	1
8-Jul-09	14:57	24	34.195802	-76.656175	SE	9	2	90°	2
8-Jul-09	15:03	27	34.071089	-76.484849	SE	9	2	110°	1
17-Aug-09	15:46	11	33.991071	-76.245475	SE	10	2	30°	1
17-Aug-09	16:16	18	34.183486	-76.627424	NW	9	1	90°	1
17-Aug-09	16:22	21	34.152674	-76.714152	SE	8	4	90°	1
17-Aug-09	16:26	22	34.065601	-76.599661	SE	8	1	90°	1
17-Aug-09	16:27	23	34.032553	-76.556431	SE	8	3	90°	1
17-Aug-09	16:49	28	33.762449	-76.338879	NW	7	3	60°	1
18-Aug-09	9:27	4	33.743025	-77.099780	SE	1	2	100°	1
18-Aug-09	9:49	11	33.513235	-76.798926	SE	1	4	90°	1
18-Aug-09	10:27	23	33.671233	-76.879581	NW	2	3	90°	1
18-Aug-09	10:42	28	33.833583	-76.957856	SE	3	2	90°	1
18-Aug-09	10:44	29	33.791287	-76.902571	SE	3	3	90°	1
18-Aug-09	11:38	46	33.759375	-76.728531	NW	4	3	90°	1
18-Aug-09	11:46	51	33.840069	-76.835571	NW	4	3	90°	1
18-Aug-09	15:13	80	34.088615	-76.758118	SE	7	2	90°	1
18-Aug-09	15:16	82	34.020482	-76.668820	SE	7	3	90°	1
18-Aug-09	15:18	83	33.974456	-76.608827	SE	7	3	90°	1
19-Aug-09	11:21	23	33.889617	-77.036512	NW	3	3	60°	1
12-Sep-09	8:47	4	33.742486	-77.106245	SE	1	2	90°	1
12-Sep-09	10:02	19	33.859967	-77.118067	NW	2	1	100°	1
12-Sep-09	10:15	23	33.698725	-76.779526	SE	3	3	90°	1
30-Sep-09	12:15	4	33.898165	-76.779545	SE	5	2	90°	1
1-Oct-09	12:25	71	34.158049	-76.456182	NW	10	1	90°	1
1-Oct-09	14:44	86	33.674688	-77.017042	SE	1	1	90°	1
1-Oct-09	15:20	91	33.790268	-77.028675	NW	2	1	90°	1
2-Oct-09	9:19	11	33.852473	-76.983985	SE	3	3	90°	1
21-Oct-09	12:03	32	34.173013	-76.617934	SE	9	2	60°	1
21-Oct-09	13:15	53	34.097636	-76.770540	SE	7	2	60°	1
8-Nov-09	13:28	6	33.647821	-76.972049	SE	1	1	90°	2
8-Nov-09	14:09	16	33.679399	-76.888699	NW	2	2	90°	1
8-Nov-09	14:15	17	33.804874	-77.051340	NW	2	1	60°	1
8-Nov-09	14:21	20	33.894745	-77.041877	SE	3	1	60°	2
8-Nov-09	14:24	21	33.840048	-76.967916	SE	3	2	90°	2
8-Nov-09	14:30	24	33.708602	-76.796400	SE	3	3	100°	3
8-Nov-09	15:26	40	34.007062	-76.924330	SE	5	2	90°	3
8-Nov-09	15:36	42	33.799470	-76.648673	SE	5	2	45°	1
8-Nov-09	16:09	46	34.034573	-76.830253	NW	6	2	90°	3
14-Jan-10	10:09	7	33.923697	-76.811427	SE	5	3	60°	1
14-Jan-10	10:30	12	33.646098	-76.317713	NW	6	1	90°	2
14-Jan-10	10:31	13	33.670578	-76.352304	NW	6	3	90°	1
14-Jan-10	11:04	23	33.874559	-76.619818	NW	6	1	90°	1
14-Jan-10	11:06	24	33.909722	-76.665854	NW	6	1	90°	2
14-Jan-10	11:11	30	34.024434	-76.817598	NW	6	1	90°	4

Table 14 (Continued). All loggerhead sea turtle (*Caretta caretta)* sightings in the proposed USWTR site in Onslow Bay, North Carolina for surveys conducted from July 2009 - June 2010.

Date	Time	Way Point	Latitude	Longitude-1	Heading	Track Number	Angle out	Degree Forward	Best #
14-Jan-10	11:21	34	34.012311	-76.659354	SE	7	1	90°	4
14-Jan-10	11:23	35	33.977871	-76.613812	SE	7	2	60°	4
14-Jan-10	12:09	48	33.928146	-76.423492	NW	8	2	90°	2
14-Jan-10	12:17	52	34.100200	-76.649405	NW	8	3	60°	2
14-Jan-10	12:28	56	34.117338	-76.545862	SE	9	3	90°	6
14-Jan-10	12:28	57	34.106038	-76.531052	SE	9	2	60°	3
14-Jan-10	12:30	58	34.071325	-76.485160	SE	9	3	90°	2
14-Jan-10	16:12	90	33.607468	-76.925138	NW	1	1	90°	1
14-Jan-10	16:16	91	33.691822	-77.036045	NW	1	2	110°	1
15-Jan-10	9:15	7	33.604474	-76.919300	SE	1	2	90°	1
15-Jan-10	9:17	8	33.576127	-76.881928	SE	1	2	60°	1
15-Jan-10	9:57	20	33.666273	-76.872060	NW	2	2	90°	1
15-Jan-10	10:18	25	33.711685	-76.801000	SE	3	2	90°	1
15-Jan-10	11:05	35	33.952166	-76.982796	NW	4	2	90°	1
15-Jan-10	11:12	39	33.948889	-76.846308	SE	5	2	90°	1
15-Jan-10	11:20	42	33.761875	-76.599828	SE	5	1	90°	1
15-Jan-10	12:11	57	33.874170	-76.618101	NW	6	2	60°	2
15-Jan-10	12:16	59	33.990441	-76.771721	NW	6	2	45°	2
15-Jan-10	12:17	60	34.012474	-76.800743	NW	6	1	90°	1
15-Jan-10	14:37	79	34.042827	-76.702060	SE	7	1	60°	1
15-Jan-10	14:39	80	33.985401	-76.623156	SE	7	1	45°	2
15-Jan-10	15:31	95	33.943784	-76.445273	NW	8	1	90°	1
15-Jan-10	15:48	98	34.116694	-76.541219	SE	9	2	90°	1
15-Jan-10	15:51	100	34.041217	-76.444075	SE	9	1	90°	1
21-Feb-10	9:33	7	33.667997	-76.872876	NW	2	2	90°	1
21-Feb-10	9:35	8	33.709395	-76.926478	NW	2	2	60°	1
21-Feb-10	12:00	25	34.034801	-76.828779	NW	6	2	60°	1
21-Feb-10	14:01	34	34.253342	-76.586512	SE	10	3	90°	1
21-Feb-10	14:03	35	34.208810	-76.529055	SE	10	2	90°	2
21-Feb-10	14:55	47	34.123505	-76.546724	NW	9	2	90°	2
21-Feb-10	15:04	50	34.157408	-76.722546	SE	8	2	45°	1
21-Feb-10	15:07	51	34.106766	-76.658314	SE	8	2	60°	1
21-Feb-10	16:19	65	34.081816	-76.749535	NW	7	1	90°	2
8-Mar-10	13:21	20	34.034656	-76.829645	SE	6	3	60°	1
8-Mar-10	13:24	21	33.974706	-76.750432	SE	6	2	90°	2
8-Mar-10	13:25	22	33.961879	-76.733515	SE	6	1	90°	1
8-Mar-10	13:28	23	33.891283	-76.640286	SE	6	2	90°	2
8-Mar-10	14:13	34	33.886270	-76.894710	SE	4	2	90°	2
8-Mar-10	14:15	35	33.861046	-76.861237	SE	4	3	60°	3
8-Mar-10	15:08	44	33.683007	-76.892560	SE	2	1	90°	1
9-Mar-10	9:12	8	33.898118	-76.780137	SE	5	2	90°	1
9-Mar-10	9:14	9	33.861196	-76.731401	SE	5	3	60°	1
9-Mar-10	9:25	14	33.804625	-76.656746	SE	5	2	90°	1
9-Mar-10	9:27	15	33.767922	-76.608612	SE	5	1	90°	1
9-Mar-10	10:01	27	33.827833	-76.556565	NW	6	3	60°	2

Table 14 (Continued). All loggerhead sea turtle (*Caretta caretta)* sightings in the proposed USWTR site in Onslow Bay, North Carolina for surveys conducted from July 2009 - June 2010.

Date	Time	Way Point	Latitude	Longitude-1	Heading	Track Number	Angle out	Degree Forward	Best #
9-Mar-10	10:02	28	33.840224	-76.572808	NW	6	3	60°	2
9-Mar-10	10:04	30	33.878250	-76.622588	NW	6	2	45°	3
9-Mar-10	10:06	31	33.925011	-76.684041	NW	6	1	90°	1
9-Mar-10	10:08	32	33.967823	-76.740828	NW	6	2	60°	1
9-Mar-10	10:09	33	33.988278	-76.767975	NW	6	2	60°	3
9-Mar-10	10:28	41	34.022386	-76.674311	SE	7	2	90°	4
9-Mar-10	10:29	42	34.002681	-76.648498	SE	7	2	90°	2
9-Mar-10	10:29	43	33.988287	-76.629720	SE	7	2	60°	3
9-Mar-10	10:31	44	33.960023	-76.592718	SE	7	2	60°	5
9-Mar-10	11:37	65	34.052926	-76.585845	NW	8	2	60°	1
9-Mar-10	11:39	66	34.090787	-76.635594	NW	8	1	90°	1
9-Mar-10	11:40	67	34.111894	-76.663395	NW	8	2	60°	1
9-Mar-10	11:41	68	34.139577	-76.699706	NW	8	3	90°	3
9-Mar-10	11:53	73	34.037500	-76.441284	SE	9	2	90°	3
10-Mar-10	9:06	3	33.948010	-76.977026	SE	4	2	60°	3
10-Mar-10	9:16	5	33.730928	-76.689260	SE	4	3	90°	1
10-Mar-10	10:15	23	33.656404	-76.858287	SE	2	2	60°	1
11-Apr-10	9:48	13	33.960538	-76.863675	NW	5	2	90°	1
11-Apr-10	9:50	14	34.003161	-76.920216	NW	5	3	60°	1
11-Apr-10	10:46	29	33.773411	-76.883261	NW	3	2	90°	1
11-Apr-10	10:52	30	33.900722	-77.049539	NW	3	2	90°	1
11-Apr-10	14:08	54	34.022195	-76.672521	SE	7	3	90°	1
11-Apr-10	14:08	55	34.012545	-76.659842	SE	7	1	90°	1
11-Apr-10	14:56	64	34.114997	-76.542141	SE	9	2	90°	1
11-Apr-10	15:01	66	33.998321	-76.387938	SE	9	1	60°	1
11-Apr-10	15:34	73	34.226395	-76.552354	NW	10	3	100°	1
12-Apr-10	9:08	4	34.215017	-76.535104	SE	10	1	90°	1
12-Apr-10	9:10	5	34.169130	-76.476012	SE	10	2	90°	1
12-Apr-10	9:20	9	34.016787	-76.279442	SE	10	1	90°	1
12-Apr-10	9:48	15	34.105410	-76.532150	NW	9	2	60°	1
12-Apr-10	9:58	18	34.141664	-76.701370	SE	8	2	90°	1
12-Apr-10	10:00	19	34.101123	-76.648155	SE	8	2	90°	1
12-Apr-10	10:01	20	34.059282	-76.593320	SE	8	2	90°	1
12-Apr-10	10:41	26	34.110676	-76.790741	NW	7	2	90°	2
12-Apr-10	10:47	30	34.023453	-76.813501	SE	6	2	60°	1
12-Apr-10	10:48	31	34.003460	-76.787213	SE	6	2	60°	1
16-Jun-10	10:45	21	34.061262	-76.601679	NW	8	3	100°	1
16-Jun-10	11:38	32	34.142977	-76.447917	NW	10	2	90°	1
16-Jun-10	11:39	34	34.158292	-76.467704	NW	10	1	90°	1
17-Jun-10	14:24	45	34.088759	-76.497305	SE	9	2	90°	1
8-Jul-09	15:41	27	34.235277	-76.562036	NW	10	2	90°	1
28-Jul-09	10:51	15	33.660413	-76.864951	SE	2	2	90°	1
17-Aug-09	15:48	13	33.943945	-76.185304	SE	10	2	90°	1
17-Aug-09	16:00	18	33.808016	-76.141633	NW	9	2	100°	1
17-Aug-09	16:08	20	34.006983	-76.398432	NW	9	3	90°	1

Table 14 (Continued). All loggerhead sea turtle (*Caretta caretta)* sightings in the proposed USWTR site in Onslow Bay, North Carolina for surveys conducted from July 2009 - June 2010.

Date	Time	Way Point	Latitude	Longitude-1	Heading	Track Number	Angle out	Degree Forward	Best #
17-Aug-09	16:15	23	34.154200	-76.589502	NW	9	3	100°	1
17-Aug-09	16:23	28	34.117362	-76.668036	SE	8	3	90°	1
17-Aug-09	16:27	29	34.043280	-76.570644	SE	8	4	90°	1
17-Aug-09	16:40	31	33.764413	-76.205987	SE	8	3	90°	1
17-Aug-09	16:40	32	33.751701	-76.189365	SE	8	3	90°	1
17-Aug-09	17:03	40	34.055212	-76.719894	NW	7	2	90°	1
18-Aug-09	10:45	18	33.770614	-76.875567	SE	3	4	60°	1
18-Aug-09	11:37	32	33.727864	-76.687137	NW	4	2	90°	1
18-Aug-09	14:56	51	33.991932	-76.775291	NW	6	2	90°	1
18-Aug-09	16:09	64	34.028738	-76.421312	SE	9	2	60°	1
19-Aug-09	9:31	7	33.839874	-76.570116	SE	6	2	90°	1
19-Aug-09	10:03	13	33.960298	-76.864501	NW	5	3	60°	1
19-Aug-09	11:20	23	33.864351	-77.003550	NW	3	3	90°	1
19-Aug-09	11:22	24	33.904012	-77.055396	NW	3	4	90°	1
12-Sep-09	11:01	27	33.994148	-76.908442	SE	5	1	90°	1
12-Sep-09	14:54	56	34.139652	-76.576097	NW	9	2	60°	1
12-Sep-09	15:11	61	34.122552	-76.674267	SE	8	1	90°	1
12-Sep-09	15:32	65	33.811576	-76.267942	SE	8	2	60°	1
30-Sep-09	12:40	8	33.727209	-76.421946	NW	6	1	90°	1
30-Sep-09	13:48	20	34.144996	-76.707060	NW	8	3	90°	1
1-Oct-09	8:33	5	33.884291	-76.761412	SE	5	1	90°	1
1-Oct-09	10:59	34	33.967964	-76.469564	NW	8	1	90°	1
1-Oct-09	12:25	49	34.163205	-76.462239	NW	10	1	45°	1
1-Oct-09	14:47	61	33.610435	-76.929048	SE	1	2	45°	1
2-Oct-09	9:04	9	33.671246	-76.878142	NW	2	2	90°	1
2-Oct-09	10:25	21	33.842027	-76.836401	NW	4	2	90°	1
21-Oct-09	12:02	30	34.187579	-76.638317	SE	9	3	60°	1
21-Oct-09	12:04	32	34.158849	-76.598833	SE	9	2	90°	1
21-Oct-09	12:04	33	34.145489	-76.581990	SE	9	1	90°	1
21-Oct-09	12:58	44	34.032365	-76.560665	NW	8	3	60°	1
21-Oct-09	13:10	48	34.153882	-76.720640	NW	8	1	90°	4
21-Oct-09	13:15	51	34.099198	-76.772674	SE	7	2	60°	1
8-Nov-09	14:08	10	33.665816	-76.871465	NW	2	1	90°	1
8-Nov-09	14:13	11	33.756276	-76.988613	NW	2	2	60°	2
8-Nov-09	14:21	14	33.899431	-77.049546	SE	3	2	90°	1
8-Nov-09	16:00	37	33.846249	-76.582095	NW	6	1	90°	1
9-Nov-09	9:48	7	34.020247	-76.544867	NW	8	1	90°	1
17-Dec-09	12:13	28	34.189596	-76.502615	NW	10	2	90°	1
17-Dec-09	15:37	45	33.780631	-77.151036	NW	1	1	90°	1
14-Jan-10	10:14	5	33.814917	-76.669130	SE	5	2	90°	1
14-Jan-10	10:30	8	33.638825	-76.306292	NW	6	2	90°	1
14-Jan-10	11:04	15	33.872254	-76.616934	NW	6	2	90°	1
14-Jan-10	11:06	17	33.914810	-76.672279	NW	6	1	60°	1
14-Jan-10	11:09	20	33.985336	-76.765886	NW	6	1	60°	1
14-Jan-10	11:18	25	34.092177	-76.764066	SE	7	2	60°	1

Table 14 (Continued). All loggerhead sea turtle (*Caretta caretta)* sightings in the proposed USWTR site in Onslow Bay, North Carolina for surveys conducted from July 2009 - June 2010.

Date	Time	Way Point	Latitude	Longitude-1	Heading	Track Number	Angle out	Degree Forward	Best #
9-Mar-10	9:11	8	33.918617	-76.807588	SE	5	2	90°	1
9-Mar-10	9:25	13	33.815028	-76.670268	SE	5	3	100°	3
9-Mar-10	9:26	14	33.777730	-76.621617	SE	5	1	90°	4
9-Mar-10	10:02	26	33.829569	-76.558756	NW	6	1	60°	2
9-Mar-10	10:03	27	33.853433	-76.589936	NW	6	2	90°	6
9-Mar-10	10:03	28	33.868095	-76.609311	NW	6	3	60°	6
9-Mar-10	10:05	29	33.910465	-76.665191	NW	6	2	90°	7
9-Mar-10	10:06	30	33.932773	-76.694397	NW	6	1	90°	8
9-Mar-10	10:07	31	33.953511	-76.722034	NW	6	2	90°	6
9-Mar-10	10:08	32	33.978584	-76.754946	NW	6	2	90°	9
9-Mar-10	10:09	33	33.995584	-76.777413	NW	6	3	60°	11
9-Mar-10	10:26	38	34.062607	-76.726383	SE	7	2	90°	4
9-Mar-10	10:28	39	34.007107	-76.654329	SE	7	1	90°	3
9-Mar-10	10:31	40	33.946583	-76.575289	SE	7	2	60°	6
9-Mar-10	10:32	41	33.920036	-76.540688	SE	7	3	90°	9
9-Mar-10	11:34	58	33.988721	-76.501293	NW	8	1	60°	1
9-Mar-10	11:37	59	34.053929	-76.587145	NW	8	2	90°	9
9-Mar-10	11:40	61	34.117421	-76.670594	NW	8	2	90°	4
9-Mar-10	11:49	64	34.137698	-76.574108	SE	9	2	90°	7
9-Mar-10	12:50	77	34.095748	-76.382541	NW	10	3	90°	4
9-Mar-10	12:56	79	34.243997	-76.573399	NW	10	2	90°	8
10-Mar-10	9:11	6	33.834044	-76.825617	SE	4	2	60°	1
10-Mar-10	9:13	7	33.792268	-76.770787	SE	4	1	90°	1
10-Mar-10	9:44	16	33.749665	-76.850862	NW	3	2	90°	1
10-Mar-10	9:49	20	33.861604	-76.996910	NW	3	1	90°	1
10-Mar-10	9:51	21	33.903755	-77.052064	NW	3	1	60°	3
10-Mar-10	10:10	27	33.748703	-76.977710	SE	2	1	90°	1
10-Mar-10	10:14	30	33.658099	-76.860420	SE	2	2	90°	1
10-Mar-10	10:41	37	33.606329	-76.921889	NW	1	2	90°	2
10-Mar-10	10:48	41	33.763636	-77.128773	NW	1	2	60°	3
11-Apr-10	9:05	4	34.054570	-76.854696	SE	6	2	90°	2
11-Apr-10	11:01	27	33.739419	-76.964370	SE	2	3	90°	1
11-Apr-10	11:05	28	33.667044	-76.870733	SE	2	3	90°	1
11-Apr-10	11:57	35	33.795604	-77.172689	NW	1	3	90°	1
11-Apr-10	14:40	51	34.009990	-76.530938	NW	8	1	90°	1
11-Apr-10	14:53	56	34.170840	-76.616313	SE	9	2	45°	1
11-Apr-10	15:31	60	34.171487	-76.481811	NW	10	2	60°	1
12-Apr-10	9:06	3	34.260347	-76.593000	SE	10	2	90°	3
12-Apr-10	9:07	4	34.245283	-76.574369	SE	10	1	90°	2
12-Apr-10	9:09	5	34.205325	-76.522603	SE	10	2	100°	4
12-Apr-10	9:58	21	34.131522	-76.688228	SE	8	3	90°	2
12-Apr-10	10:46	34	34.055040	-76.859105	SE	6	3	90°	4
12-Apr-10	14:35	49	33.773823	-77.011464	NW	2	1	90°	1
16-Jun-10	10:57	19	34.161591	-76.591787	SE	9	2	90°	1
16-Jun-10	11:01	20	34.062340	-76.462631	SE	9	2	90°	2

Table 14 (Continued). All loggerhead sea turtle (*Caretta caretta)* sightings in the proposed USWTR site in Onslow Bay, North Carolina for surveys conducted from July 2009 - June 2010.

Date	Time	Way Point	Latitude	Longitude-1	Heading	Track Number	Angle out	Degree Forward	Best #
14-Jan-10	11:23	28	33.967905	-76.601169	SE	7	2	60°	1
14-Jan-10	13:18	54	34.144279	-76.446622	NW	10	2	60°	1
14-Jan-10	13:20	56	34.189273	-76.504534	NW	10	1	90°	1
15-Jan-10	9:17	5	33.579637	-76.886918	SE	1	1	60°	1
15-Jan-10	9:55	14	33.630946	-76.825886	NW	2	1	60°	1
15-Jan-10	10:13	19	33.830949	-76.955997	SE	3	3	90°	2
15-Jan-10	10:18	20	33.710213	-76.799080	SE	3	3	90°	5
15-Jan-10	10:55	26	33.741221	-76.702998	NW	4	2	60°	2
15-Jan-10	10:56	27	33.773269	-76.745160	NW	4	3	90°	1
15-Jan-10	11:00	29	33.847695	-76.843923	NW	4	3	90°	3
15-Jan-10	11:05	30	33.948782	-76.978225	NW	4	1	45°	1
15-Jan-10	12:10	42	33.863797	-76.604394	NW	6	1	90°	5
15-Jan-10	12:12	43	33.907346	-76.661745	NW	6	1	90°	2
15-Jan-10	12:15	45	33.959703	-76.731066	NW	6	2	60°	3
15-Jan-10	12:15	46	33.978821	-76.756144	NW	6	1	60°	2
15-Jan-10	14:25	55	34.087031	-76.757116	SE	7	2	90°	2
15-Jan-10	14:40	58	33.973712	-76.608101	SE	7	1	90°	1
15-Jan-10	15:34	68	34.022094	-76.547805	NW	8	1	90°	4
15-Jan-10	15:37	70	34.087611	-76.633540	NW	8	3	90°	3
15-Jan-10	16:18	77	34.040514	-76.314311	NW	10	1	45°	1
21-Feb-10	11:22	20	33.876367	-76.620640	NW	6	2	60°	1
21-Feb-10	11:23	21	33.890604	-76.638503	NW	6	3	90°	1
21-Feb-10	12:00	24	34.037150	-76.831854	NW	6	2	60°	2
21-Feb-10	12:01	25	34.048215	-76.850544	NW	6	2	90°	2
21-Feb-10	14:01	30	34.255498	-76.589260	SE	10	3	90°	1
21-Feb-10	14:03	31	34.221560	-76.545455	SE	10	2	90°	1
21-Feb-10	14:05	32	34.171494	-76.480713	SE	10	2	60°	3
21-Feb-10	14:52	43	34.063529	-76.468725	NW	9	2	90°	3
21-Feb-10	14:55	45	34.117065	-76.537982	NW	9	1	90°	2
21-Feb-10	14:56	46	34.140015	-76.568197	NW	9	2	90°	5
21-Feb-10	14:58	47	34.176295	-76.615111	NW	9	3	90°	4
21-Feb-10	15:04	50	34.160274	-76.726437	SE	8	2	45°	3
21-Feb-10	15:12	51	34.016392	-76.539278	SE	8	2	90°	4
21-Feb-10	16:13	62	33.973686	-76.608215	NW	7	2	90°	1
21-Feb-10	16:18	64	34.058254	-76.720467	NW	7	1	90°	2
21-Feb-10	16:19	65	34.087095	-76.757460	NW	7	3	45°	2
8-Mar-10	9:28	4	34.172064	-76.481553	SE	10	2	60°	1
8-Mar-10	9:28	5	34.159272	-76.465052	SE	10	2	45°	1
8-Mar-10	10:46	20	33.900383	-76.514606	NW	7	2	60°	1
8-Mar-10	13:58	31	33.840730	-76.704016	NW	5	2	60°	1
8-Mar-10	14:47	41	33.709701	-76.798452	NW	3	2	60°	1
8-Mar-10	14:54	44	33.859603	-76.994319	NW	3	1	90°	2
8-Mar-10	16:00	55	33.605138	-76.921055	NW	1	2	90°	1
8-Mar-10	16:06	57	33.738402	-77.095697	NW	1	2	60°	1
9-Mar-10	8:57	4	33.994510	-76.907648	SE	5	2	90°	1

Table 14 (Continued). All loggerhead sea turtle (*Caretta caretta)* sightings in the proposed USWTR site in Onslow Bay, North Carolina for surveys conducted from July 2009 - June 2010.

Date	Time	Way Point	Latitude	Longitude-1	Heading	Track Number	Angle out	Degree Forward	Best #
18-Jun-10	9:12	5	33.722898	-76.674437	SE	4	2	90°	1
18-Jun-10	10:15	16	33.699048	-76.909166	SE	2	2	90°	1
18-Jun-10	10:52	25	33.617614	-76.941325	NW	1	2	90°	1
18-Jun-10	10:55	26	33.684558	-77.029150	NW	1	2	90°	1

Table 15. All leatherback sea turtle (*Dermochelys coriacea)* sightings in the proposed USWTR site in Onslow Bay, North Carolina for surveys conducted from July 2009 - June 2010.

Date	Time	Way Point	Latitude	Longitude-1	Heading	Track Number	Angle out	Degree Forward	Best #
1-Oct-09	10:47	46	33.797331	-76.249619	NW	8	3	90°	1
2-Oct-09	9:34	13	33.556246	-76.601330	SE	3	2	90°	1
9-Mar-10	11:47	71	34.176778	-76.625806	SE	9	2	90°	1
1-Oct-09	15:12	64	33.616420	-76.806435	NW	2	2	90°	1

Table 16. All unidentified sea turtle sightings in the proposed USWTR site in Onslow Bay, North Carolina for surveys conducted from July 2009 - June 2010.

Date	Time	Way Point	Latitude	Longitude-1	Heading	Track Number	Angle out	Degree Forward	Best #
8-Jul-09	14:58	25	34.183342	-76.634894	SE	9	2	110°	2
18-Aug-09	9:44	9	33.600015	-76.919668	SE	1	3	90°	1
18-Aug-09	10:30	24	33.725727	-76.950003	NW	2	2	90°	1
18-Aug-09	11:37	45	33.733042	-76.693974	NW	4	2	100°	1
18-Aug-09	12:02	57	33.966525	-76.999787	NW	4	3	90°	1
18-Aug-09	15:46	88	33.943606	-76.445136	NW	8	4	90°	1
18-Aug-09	16:06	94	34.082670	-76.491323	SE	9	4	90°	1
18-Aug-09	16:36	97	34.089557	-76.377171	NW	10	2	110°	1
19-Aug-09	9:55	9	33.777906	-76.624098	NW	5	3	90°	1
19-Aug-09	9:59	11	33.870794	-76.746317	NW	5	3	90°	1
12-Sep-09	11:48	47	33.877798	-76.623473	NW	6	2	90°	1
12-Sep-09	11:52	48	33.973903	-76.750209	NW	6	3	45°	1
12-Sep-09	14:01	53	34.265715	-76.593059	SE	10	1	90°	1
12-Sep-09	14:50	66	34.061652	-76.474511	NW	9	3	100°	1
1-Oct-09	10:06	30	33.954023	-76.583867	SE	7	3	90°	1
21-Oct-09	11:54	28	34.196512	-76.512789	NW	10	2	90°	1
21-Oct-09	11:56	29	34.229434	-76.555606	NW	10	2	60°	2
21-Oct-09	12:57	45	34.001956	-76.520666	NW	8	2	90°	1
21-Oct-09	13:16	54	34.066873	-76.730287	SE	7	1	90°	1
21-Oct-09	13:23	55	33.936095	-76.558414	SE	7	1	90°	1
8-Nov-09	14:08	15	33.645901	-76.845813	NW	2	1	90°	1
8-Nov-09	14:27	22	33.770925	-76.877474	SE	3	2	45°	1
9-Nov-09	10:01	8	34.135681	-76.570197	SE	9	2	90°	1
17-Dec-09	11:19	23	34.124850	-76.557451	SE	9	2	90°	1
17-Dec-09	14:59	43	33.773244	-77.010398	SE	2	2	90°	1
17-Dec-09	15:06	45	33.606821	-76.793782	SE	2	2	60°	1
14-Jan-10	10:07	5	33.965648	-76.867731	SE	5	1	90°	2
14-Jan-10	10:12	8	33.840001	-76.702502	SE	5	2	60°	1
14-Jan-10	10:17	9	33.746442	-76.579315	SE	5	2	90°	3
14-Jan-10	11:08	27	33.966343	-76.740460	NW	6	2	90°	6
14-Jan-10	11:19	33	34.059438	-76.720813	SE	7	1	90°	3
14-Jan-10	11:24	36	33.946586	-76.573009	SE	7	2	90°	3
14-Jan-10	12:12	49	33.993659	-76.508969	NW	8	3	90°	3
14-Jan-10	12:14	50	34.036416	-76.565283	NW	8	1	60°	2
14-Jan-10	12:15	51	34.051552	-76.585052	NW	8	2	90°	3
14-Jan-10	15:30	82	33.821663	-76.946388	NW	3	2	45°	1
14-Jan-10	15:40	86	33.789380	-77.028498	SE	2	3	90°	1
15-Jan-10	9:14	5	33.641101	-76.967232	SE	1	2	90°	1
15-Jan-10	9:55	19	33.639060	-76.836189	NW	2	2	60°	1
15-Jan-10	9:59	22	33.712078	-76.931008	NW	2	1	90°	1
15-Jan-10	11:10	38	33.990576	-76.898168	SE	5	2	90°	1
15-Jan-10	15:55	103	34.014760	-76.408320	SE	9	1	90°	1
21-Feb-10	15:08	52	34.080735	-76.621368	SE	8	1	90°	2
21-Feb-10	15:34	57	33.793947	-76.244950	SE	8	1	90°	1
9-Mar-10	10:25	40	34.075464	-76.746079	SE	7	2	60°	1

Table 16 (Continued). All unidentified sea turtle sightings in the proposed USWTR site in Onslow Bay, North Carolina for surveys conducted from July 2009 - June 2010.

Date	Time	Way Point	Latitude	Longitude-1	Heading	Track Number	Angle out	Degree Forward	Best #
9-Mar-10	11:49	72	34.135153	-76.570658	SE	9	1	60°	2
10-Mar-10	9:49	12	33.853603	-76.986306	NW	3	1	100°	2
10-Mar-10	9:51	13	33.902847	-77.050866	NW	3	2	90°	3
10-Mar-10	10:10	20	33.761414	-76.994305	SE	2	1	90°	2
10-Mar-10	10:50	32	33.791794	-77.165896	NW	1	2	90°	3
12-Apr-10	9:44	14	34.002838	-76.396980	NW	9	2	90°	1
12-Apr-10	10:46	29	34.049133	-76.849504	SE	6	1	90°	1
12-Apr-10	14:52	52	33.721309	-76.812493	SE	3	2	90°	1
17-Aug-09	15:21	4	34.258671	-76.589011	SE	10	3	90°	1
17-Aug-09	15:23	5	34.215023	-76.532874	SE	10	2	110°	1
17-Aug-09	15:43	9	34.057868	-76.330946	SE	10	3	90°	1
17-Aug-09	16:17	24	34.193935	-76.641233	NW	9	3	90°	2
17-Aug-09	16:18	25	34.216918	-76.673388	NW	9	2	90°	2
18-Aug-09	9:33	5	33.632870	-76.955154	SE	1	3	60°	1
19-Aug-09	9:59	12	33.865322	-76.739106	NW	5	1	90°	1
19-Aug-09	10:15	18	33.845945	-76.838537	SE	4	2	90°	1
1-Oct-09	10:20	25	33.791158	-76.371512	SE	7	1	90°	1
1-Oct-09	11:58	45	33.889715	-76.246905	SE	9	1	90°	1
21-Oct-09	11:58	27	34.271778	-76.611080	NW	10	1	60°	1
21-Oct-09	12:05	34	34.121615	-76.550240	SE	9	2	90°	2
21-Oct-09	13:09	47	34.125001	-76.682664	NW	8	1	90°	1
21-Oct-09	13:17	52	34.058683	-76.719290	SE	7	3	90°	1
8-Nov-09	14:22	15	33.887182	-77.030274	SE	3	2	90°	1
14-Jan-10	11:07	18	33.944545	-76.712111	NW	6	2	90°	1
14-Jan-10	11:10	21	33.995354	-76.779329	NW	6	1	60°	1
14-Jan-10	11:20	26	34.045413	-76.702587	SE	7	3	90°	1
14-Jan-10	11:21	27	34.005927	-76.650882	SE	7	3	90°	1
14-Jan-10	12:08	37	33.916353	-76.408430	NW	8	2	60°	1
14-Jan-10	12:12	39	33.993358	-76.508537	NW	8	2	90°	1
14-Jan-10	12:13	40	34.023472	-76.548059	NW	8	2	60°	2
14-Jan-10	12:27	43	34.139535	-76.575368	SE	9	1	90°	1
14-Jan-10	13:15	53	34.082984	-76.367326	NW	10	2	90°	1
14-Jan-10	15:02	67	33.665026	-76.598966	SE	4	1	90°	1
14-Jan-10	15:25	71	33.715429	-76.805102	NW	3	1	90°	1
15-Jan-10	10:02	16	33.771174	-77.007343	NW	2	2	90°	1
15-Jan-10	15:32	67	33.970031	-76.479706	NW	8	2	60°	3
8-Mar-10	14:04	33	33.976917	-76.883754	NW	5	1	90°	1
8-Mar-10	14:48	42	33.729017	-76.823853	NW	3	1	90°	1
9-Mar-10	8:58	5	33.965190	-76.868758	SE	5	1	90°	1
9-Mar-10	9:15	10	33.848781	-76.715022	SE	5	3	90°	4
9-Mar-10	9:28	15	33.747555	-76.582032	SE	5	2	60°	3
10-Mar-10	9:08	4	33.912517	-76.929805	SE	4	2	90°	1
10-Mar-10	9:45	17	33.768800	-76.875785	NW	3	2	60°	1
10-Mar-10	9:48	19	33.837673	-76.965543	NW	3	2	90°	1
11-Apr-10	9:19	6	33.753297	-76.457730	SE	6	1	90°	1

Table 16 (Continued). All unidentified sea turtle sightings in the proposed USWTR site in Onslow Bay, North Carolina for surveys conducted from July 2009 - June 2010.

Date	Time	Way Point	Latitude	Longitude-1	Heading	Track Number	Angle out	Degree Forward	Best #
12-Apr-10	9:49	17	34.111477	-76.540201	NW	9	2	45°	2
12-Apr-10	9:53	18	34.201625	-76.659705	NW	9	2	90°	2
12-Apr-10	10:00	22	34.088152	-76.631007	SE	8	1	90°	3
12-Apr-10	10:40	31	34.073505	-76.742117	NW	7	2	60°	4
12-Apr-10	11:45	41	34.002549	-76.919181	NW	5	2	90°	1
16-Jun-10	10:48	16	34.136280	-76.700404	NW	8	3	60°	1

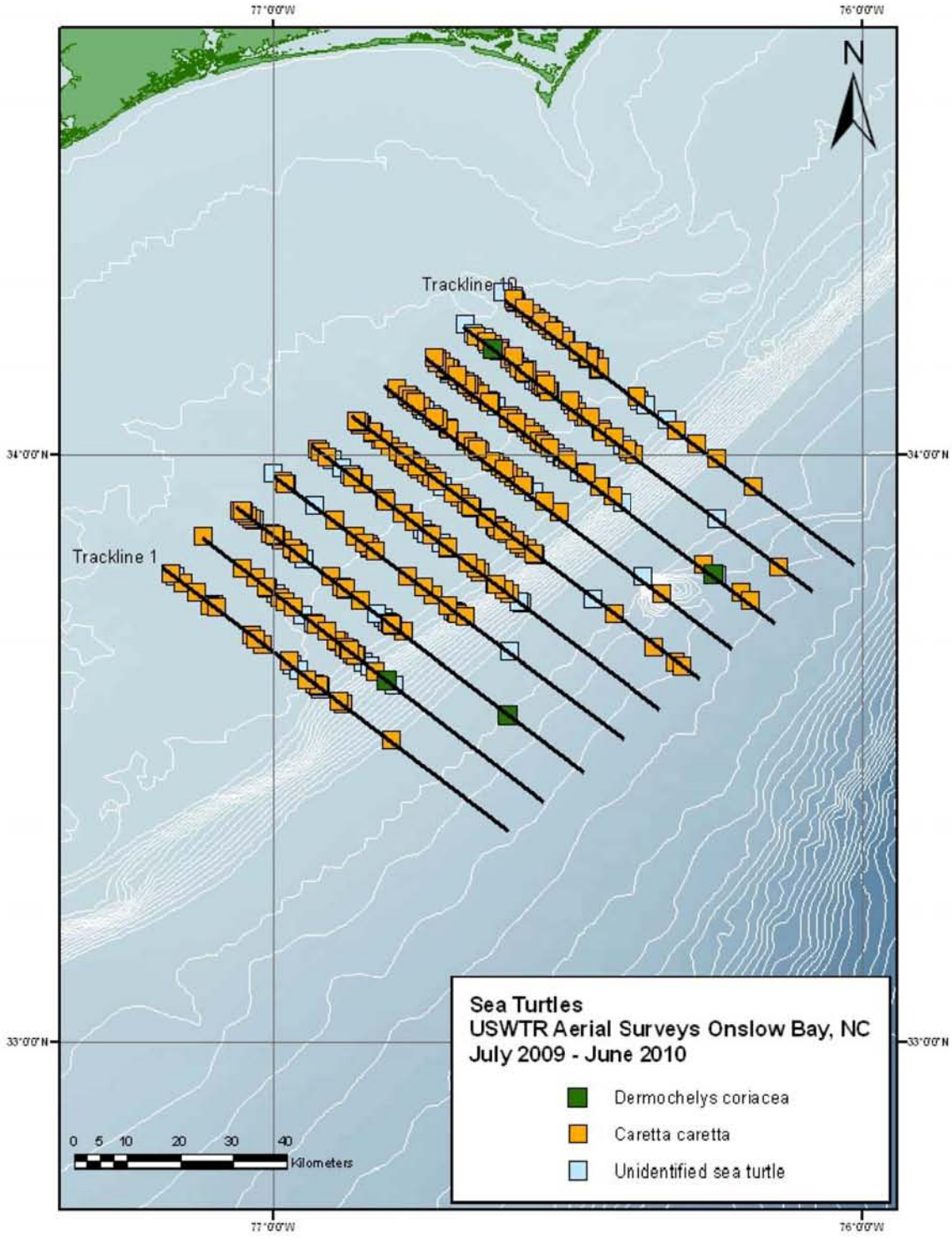

Figure 14. Loggerhead *(Caretta caretta)*, leatherback *(Dermochelys coriacea)* and unidentified sea turtle sightings.

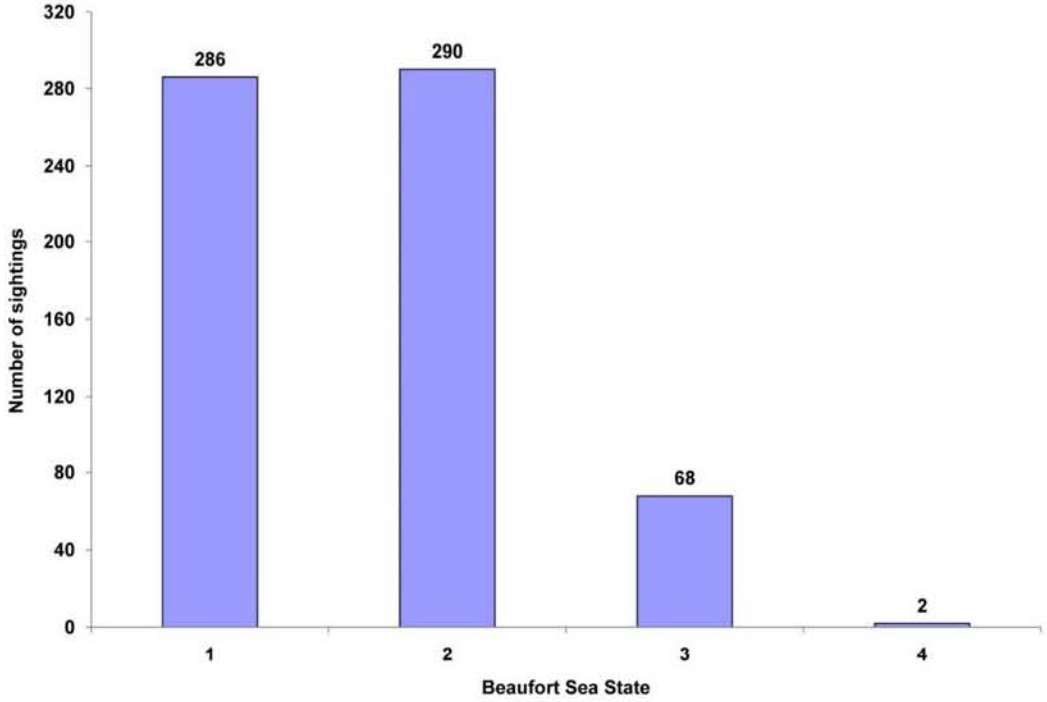

Figure 15a. Total number of sea turtle sightings by Beaufort Sea State in the proposed USWTR site in Onslow Bay, North Carolina during the July 2009 – June 2010 surveys.

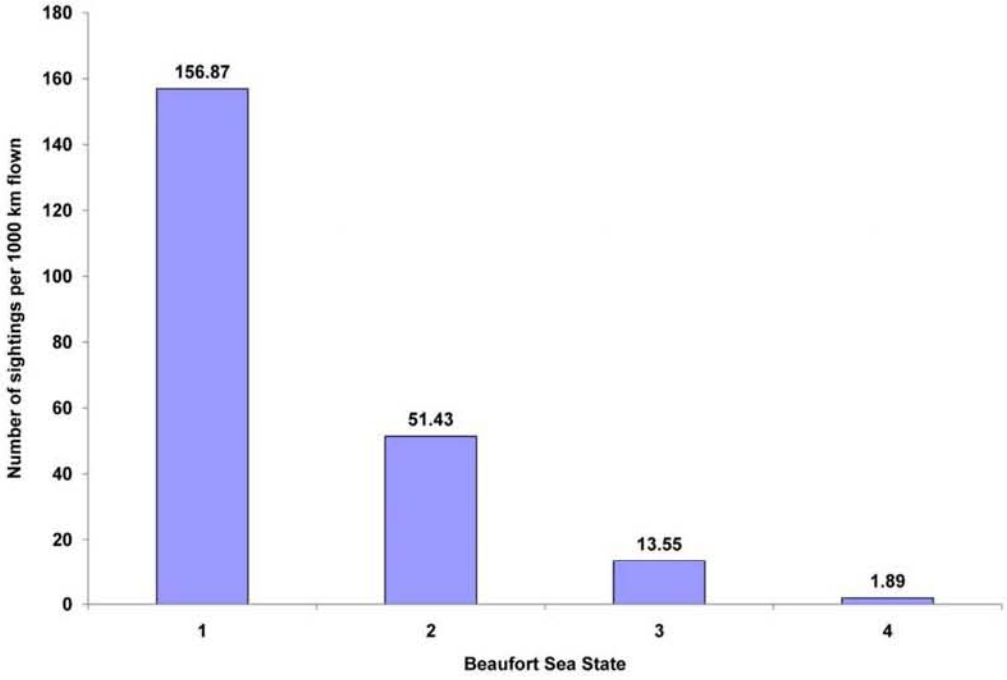

Figure 15b. Sea turtle sightings per 1000 km flown by Beaufort Sea State in the proposed USWTR site in Onslow Bay, North Carolina during the July 2009 – June 2010 surveys.

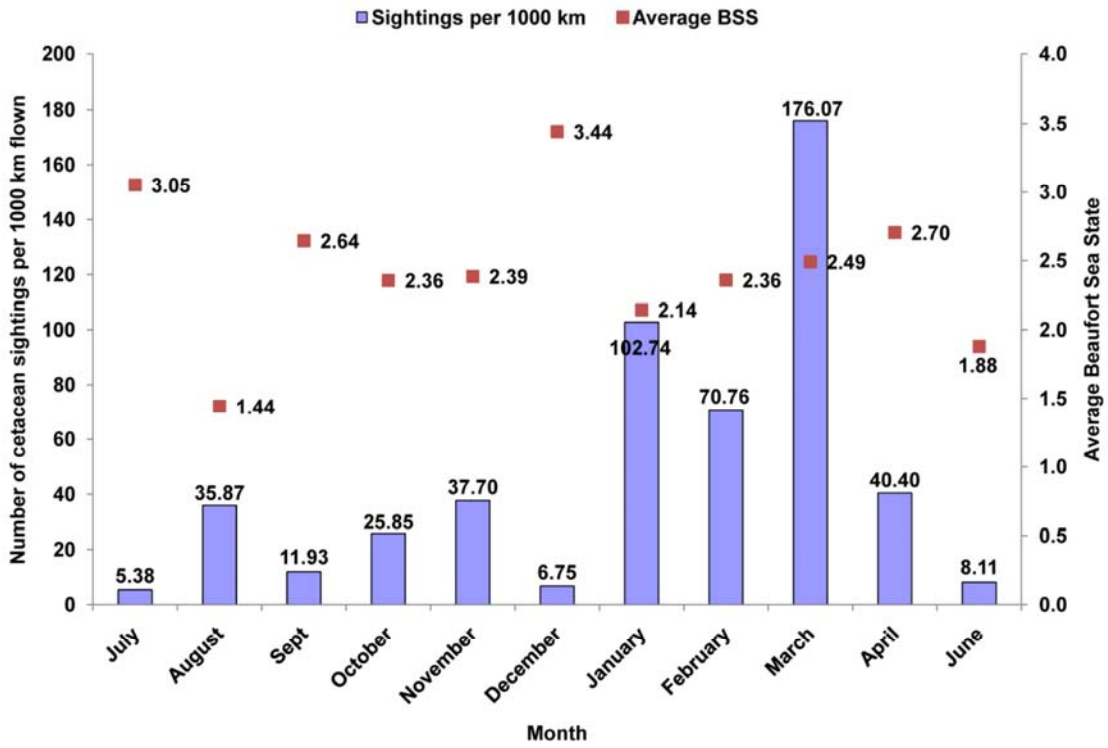

Figure 15c. Sea turtle sightings per 1000 km surveyed and the average Beaufort Sea State per month from July 2009 – June 2010 in the proposed USWTR site in Onslow Bay, North Carolina.

Other Marine Vertebrate Sightings (Tables 17-21, Fig. 16)

Chondrichthyan fishes

A total of 16 sharks were observed throughout the survey period; hammerhead sharks (*Sphyrna* spp.) accounted for 37.5 percent of these sightings (n=6) (Table 17).

Thirty manta rays (*Manta birostris*) were observed during the survey period (Table 19). There were also three stingray sightings that could not be positively identified to species that were labeled as unidentified rays (Table 20).

Other fishes

Ocean sunfish (*Mola mola*) were encountered six times with no discernable spatial or temporal trends (Table 21).

Table 17. All shark sightings in the proposed USWTR site in Onslow Bay, North Carolina for surveys conducted from July 2009 - June 2010.

Date	Time	Way Point	Latitude	Longitude-1	Heading	Track Number	Angle out	Degree Forward	Best #	Comments
18-Aug-09	12:00	56	33.931810	-76.957381	NW	4	2	90°	1	Shark
1-Oct-09	11:57	65	33.906816	-76.271371	SE	9	3	90°	1	Hammerhead
1-Oct-09	12:08	69	33.828874	-76.041557	NW	10	2	90°	1	Hammerhead
14-Jan-10	10:43	18	33.738783	-76.441747	NW	6	2	60°	1	Shark
14-Jan-10	11:10	29	34.005303	-76.792311	NW	6	2	60°	1	Hammerhead
14-Jan-10	12:51	62	33.843731	-76.184231	SE	9	3	90°	1	Shark
16-Jun-10	9:20	6	33.897298	-76.774481	SE	5	3	100°	1	
17-Aug-09	16:58	39	33.965171	-76.602357	NW	7	3	90°	1	Shark
12-Sep-09	14:34	49	33.829536	-76.043032	SE	10	2	90°	1	
12-Sep-09	14:39	52	33.805075	-76.134349	NW	9	2	90°	1	
21-Oct-09	11:55	26	34.221290	-76.545231	NW	10	1	90°	1	Hammerhead
8-Nov-09	16:09	39	34.026326	-76.819095	NW	6	1	90°	1	
14-Jan-10	11:06	16	33.910137	-76.666348	NW	6	2	90°	1	
15-Jan-10	15:30	66	33.939211	-76.439378	NW	8	1	90°	1	Hammerhead
21-Feb-10	15:59	59	33.693865	-76.242194	NW	7	2	90°	1	
9-Mar-10	10:33	42	33.909817	-76.527488	SE	7	1	60°	1	Hammerhead

Table 18. All basking shark (*Cetorhinus maximus)* sightings in the proposed USWTR site in Onslow Bay, North Carolina for surveys conducted from July 2009 - June 2010.

Date	Time	Way Point	Latitude	Longitude-1	Heading	Track Number	Angle out	Degree Forward	Best #
9-Mar-10	11:23	54	33.818982	-76.278775	NW	8	2	90°	1

Table 19. All manta ray (*Manta birostris)* sightings in the proposed USWTR site in Onslow Bay, North Carolina for surveys conducted from July 2009 - June 2010.

Date	Time	Way Point	Latitude	Longitude-1	Heading	Track Number	Angle out	Degree Forward	Best #	Comments
19-Aug-09	9:22	4	34.031991	-76.823887	SE	6	2	90°	1	
1-Oct-09	16:21	107	33.912515	-76.928150	NW	4	2	90°	1	
21-Oct-09	11:50	27	34.105472	-76.395207	NW	10	3	90°	1	
14-Jan-10	13:10	69	33.966317	-76.219038	NW	10	3	90°	1	
15-Jan-10	11:19	40	33.781688	-76.625787	SE	5	1	90°	1	
9-Mar-10	10:56	52	33.754886	-76.328231	SE	7	2	45°	1	
10-Mar-10	9:33	8	33.523232	-76.556337	NW	3	1	90°	1	
10-Mar-10	9:34	9	33.540252	-76.579102	NW	3	1	90°	1	
11-Apr-10	14:33	59	33.839643	-76.308652	NW	8	2	90°	1	
11-Apr-10	15:06	68	33.894794	-76.251376	SE	9	2	100°	1	
12-Apr-10	9:38	12	33.887300	-76.244550	NW	9	1	90°	1	Submerged
12-Apr-10	10:12	22	33.824923	-76.286256	SE	8	3	90°	1	Huge
19-Aug-09	10:11	16	33.933344	-76.954704	SE	4	2	100°	1	
21-Oct-09	12:54	43	33.951383	-76.454676	NW	8	2	90°	2	
9-Mar-10	9:49	20	33.708572	-76.399774	NW	6	1	90°	1	
9-Mar-10	9:50	21	33.721972	-76.417632	NW	6	2	90°	1	
9-Mar-10	12:27	73	33.929774	-76.170647	NW	10	3	45°	1	
10-Mar-10	9:26	9	33.534839	-76.431222	SE	4	1	90°	1	
10-Mar-10	9:32	12	33.504492	-76.532448	NW	3	1	90°	1	
10-Mar-10	9:33	13	33.517681	-76.548948	NW	3	2	90°	1	
10-Mar-10	10:25	32	33.432877	-76.570050	SE	2	3	90°	1	
11-Apr-10	10:52	23	33.904697	-77.054657	NW	3	2	90°	1	
11-Apr-10	11:10	29	33.545720	-76.713460	SE	2	2	90°	1	
11-Apr-10	14:32	49	33.832283	-76.299161	NW	8	2	90°	1	
12-Apr-10	9:24	11	33.940655	-76.182569	SE	10	1	90°	3	
12-Apr-10	10:12	24	33.840251	-76.306231	SE	8	2	100°	1	Jumping
12-Apr-10	10:12	25	33.823703	-76.284702	SE	8	1	90°	1	

Table 20. All unidentified ray sightings in the proposed USWTR site in Onslow Bay, North Carolina for surveys conducted from July 2009 - June 2010.

Date	Time	Way Point	Latitude	Longitude-1	Heading	Track Number	Angle out	Degree Forward	Best #
14-Jan-10	10:06	4	33.969675	-76.873067	SE	5	2	90°	1
14-Jan-10	11:07	25	33.943307	-76.710469	NW	6	2	60°	2

Table 21. All ocean sunfish (*Mola mola)* sightings in the proposed USWTR site in Onslow Bay, North Carolina for surveys conducted from July 2009 - June 2010.

Date	Time	Way Point	Latitude	Longitude-1	Heading	Track Number	Angle out	Degree Forward	Best #
30-Sep-09	13:17	15	33.774529	-76.348901	SE	7	3	90°	1
11-Apr-10	14:57	65	34.086161	-76.504031	SE	9	3	90°	1
17-Aug-09	16:12	22	34.085993	-76.500693	NW	9	2	90°	1
15-Jan-10	9:10	4	33.707818	-77.054313	SE	1	1	45°	1
15-Jan-10	15:35	69	34.053398	-76.588992	NW	8	1	90°	1
21-Feb-10	16:14	63	33.984712	-76.620900	NW	7	1	90°	1

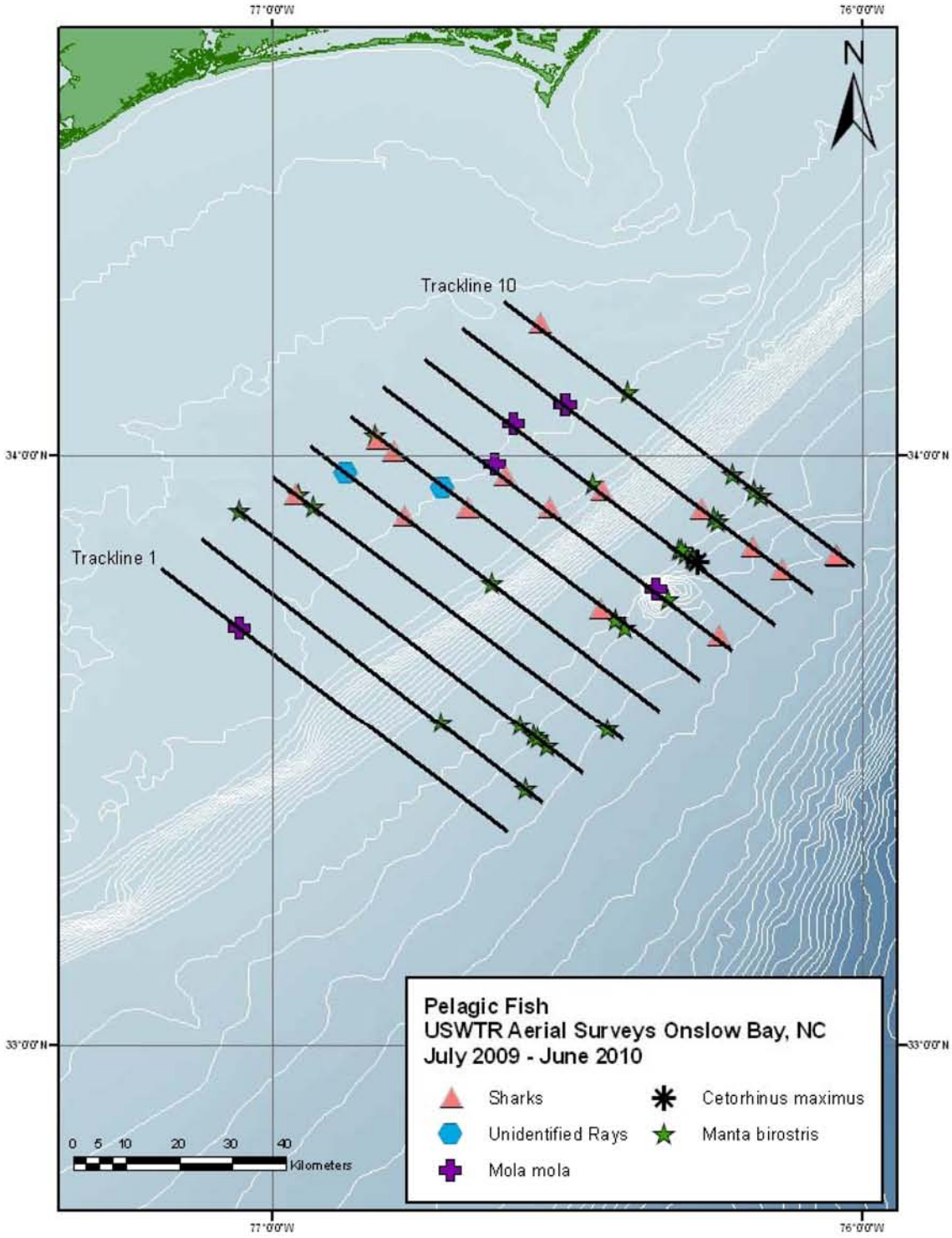

Figure 16. Ocean sunfish (*Mola mola),* manta ray (*Manta birostris*), basking shark (*Cetorhinus maximus*), unidentified sharks, and unidentified ray sightings.

Vessel Sightings

Commercial (Table 22, Fig. 17)

A total of 62 commercial vessels were seen during the study. This category includes tankers, container/cargo vessels, and car carriers.

Table 22. All commercial vessel sightings in the proposed USWTR site in Onslow Bay, North Carolina for surveys conducted from July 2009 - June 2010.

Date	Time	Way Point	Latitude	Longitude-1	Heading	Track Number	Angle out	Degree Forward	Best #	Comments
8-Jul-09	15:33	32	34.072633	-76.352907	NW	10	3	75°	1	Cargo vessel
28-Jul-09	9:18	5	33.775829	-76.486917	SE	6	4	45°	1	Car carrier
28-Jul-09	9:26	7	33.622975	-76.287048	SE	6	2	30°	1	Car carrier
28-Jul-09	10:13	16	33.538346	-76.435840	SE	4	1	90°	1	Container vessel
17-Aug-09	16:08	17	34.003663	-76.393792	NW	9	3	60°	1	Cargo vessel
18-Aug-09	14:46	70	33.765550	-76.477402	NW	6	5	60°	1	Container vessel
12-Sep-09	14:28	61	33.944271	-76.188512	SE	10	4	90°	1	Car carrier
30-Sep-09	12:31	7	33.577326	-76.355783	SE	5	3	30°	1	Transport vessel
30-Sep-09	13:35	20	33.907432	-76.397717	NW	8	4	30°	1	Cargo vessel
1-Oct-09	10:10	32	33.864559	-76.468963	SE	7	3	60°	1	Cargo vessel
1-Oct-09	16:15	105	33.781328	-76.753291	NW	4	4	45°	2	Cargo vessel
1-Oct-09	16:17	106	33.835421	-76.829296	NW	4	3	30°	1	Large yacht
2-Oct-09	9:07	8	33.732485	-76.956252	NW	2	4	90°	1	Tanker
17-Dec-09	15:30	50	33.612646	-76.930678	NW	1	2	30°	1	Cargo vessel
14-Jan-10	11:08	28	33.972772	-76.749098	NW	6	4	90°	1	Tug and Barge
15-Jan-10	10:52	33	33.668979	-76.608231	NW	4	4	60°	2	Cargo vessel
15-Jan-10	14:40	81	33.963731	-76.595013	SE	7	3	60°	2	Cargo vessel
8-Mar-10	15:09	45	33.664927	-76.869129	SE	2	4	45°	1	
8-Mar-10	15:59	57	33.585261	-76.894799	NW	1	4	45°	1	Tanker
10-Mar-10	10:20	24	33.548455	-76.719120	SE	2	4	90°	1	Car carrier
11-Apr-10	10:17	22	33.750232	-76.712942	SE	4	4	45°	1	Container vessel
11-Apr-10	11:53	46	33.725960	-77.081086	NW	1	4	90°	1	Car carrier
16-Jun-10	9:51	10	33.897973	-76.649266	NW	6	4	60°	1	Container vessel
16-Jun-10	11:11	29	33.988319	-76.365949	SE	9	4	100°	1	
17-Jun-10	9:33	8	33.569180	-76.749182	NW	2	4	60°	1	Cargo vessel
17-Jun-10	10:31	24	33.707056	-76.661150	NW	4	3	45°	1	Cargo vessel
17-Jun-10	15:18	52	34.145320	-76.451196	NW	10	1	90°	1	Cargo vessel
8-Jul-09	14:24	14	33.732044	-76.296077	SE	7	3	30°	1	Cargo vessel
27-Jul-09	9:09	4	33.610407	-76.927314	SE	1	4	30°	1	Container vessel
17-Aug-09	15:45	11	34.006533	-76.265088	SE	10	4	45°	1	Container vessel
17-Aug-09	15:52	14	33.856398	-76.073834	SE	10	3	90°	1	Tanker
18-Aug-09	9:32	4	33.651833	-76.980065	SE	1	4	45°	1	Cargo vessel
18-Aug-09	16:32	67	33.988681	-76.247849	NW	10	4	60°	1	Cargo vessel
19-Aug-09	9:23	4	34.014270	-76.800128	SE	6	5	90°	1	Tug boat
19-Aug-09	9:28	6	33.903985	-76.654495	SE	6	5	90°	1	Tanker
19-Aug-09	12:36	35	33.518931	-76.810789	NW	1	5	60°	1	Container vessel
12-Sep-09	8:50	5	33.687047	-77.034606	SE	1	4	30°	1	Cargo vessel
12-Sep-09	9:36	11	33.564086	-76.729819	NW	2	4	45°	1	Cargo vessel
12-Sep-09	10:14	17	33.705580	-76.791420	SE	3	3	45°	3	Cargo vessel
12-Sep-09	14:24	48	34.040499	-76.312226	SE	10	3	45°	1	Cargo vessel
30-Sep-09	12:15	4	33.892835	-76.771446	SE	5	1	45°	1	Car carrier
30-Sep-09	14:49	29	34.075758	-76.358203	NW	10	4	90°	1	Car carrier
1-Oct-09	15:53	72	33.550020	-76.594788	SE	3	3	45°	1	Container vessel
2-Oct-09	10:14	18	33.599099	-76.507958	NW	4	3	30°	1	Container vessel
21-Oct-09	11:48	25	34.073803	-76.354470	NW	10	3	45°	1	Tanker
8-Nov-09	14:29	16	33.734845	-76.830604	SE	3	4	60°	1	Cargo vessel
9-Nov-09	10:11	11	33.939980	-76.311930	SE	9	1	45°	1	Cargo
17-Dec-09	9:32	4	33.898428	-76.780213	SE	5	3	45°	1	Container vessel

Table 22 (Continued). All commercial vessel sightings in the proposed USWTR site in Onslow Bay, North Carolina for surveys conducted from July 2009 - June 2010.

Date	Time	Way Point	Latitude	Longitude-1	Heading	Track Number	Angle out	Degree Forward	Best #	Comments
14-Jan-10	11:03	14	33.849828	-76.587737	NW	6	3	90°	1	Cargo vessel
15-Jan-10	9:23	8	33.540931	-76.836067	SE	1	4	45°	1	Tanker
15-Jan-10	15:57	74	33.972366	-76.352700	SE	9	4	45°	1	Container vessel
21-Feb-10	16:06	60	33.830730	-76.421029	NW	7	4	90°	1	Cruise ship
10-Mar-10	10:11	28	33.728673	-76.951883	SE	2	3	30°	1	Cargo vessel
11-Apr-10	9:39	11	33.779334	-76.624761	NW	5	4	30°	1	Cargo vessel
11-Apr-10	10:43	21	33.716392	-76.808834	NW	3	4	60°	1	Cargo vessel
16-Jun-10	9:24	3	33.814428	-76.665425	SE	5	3	45°	1	Container vessel
18-Jun-10	10:33	20	33.384871	-76.637854	NW	1	3	45°	1	Container vessel

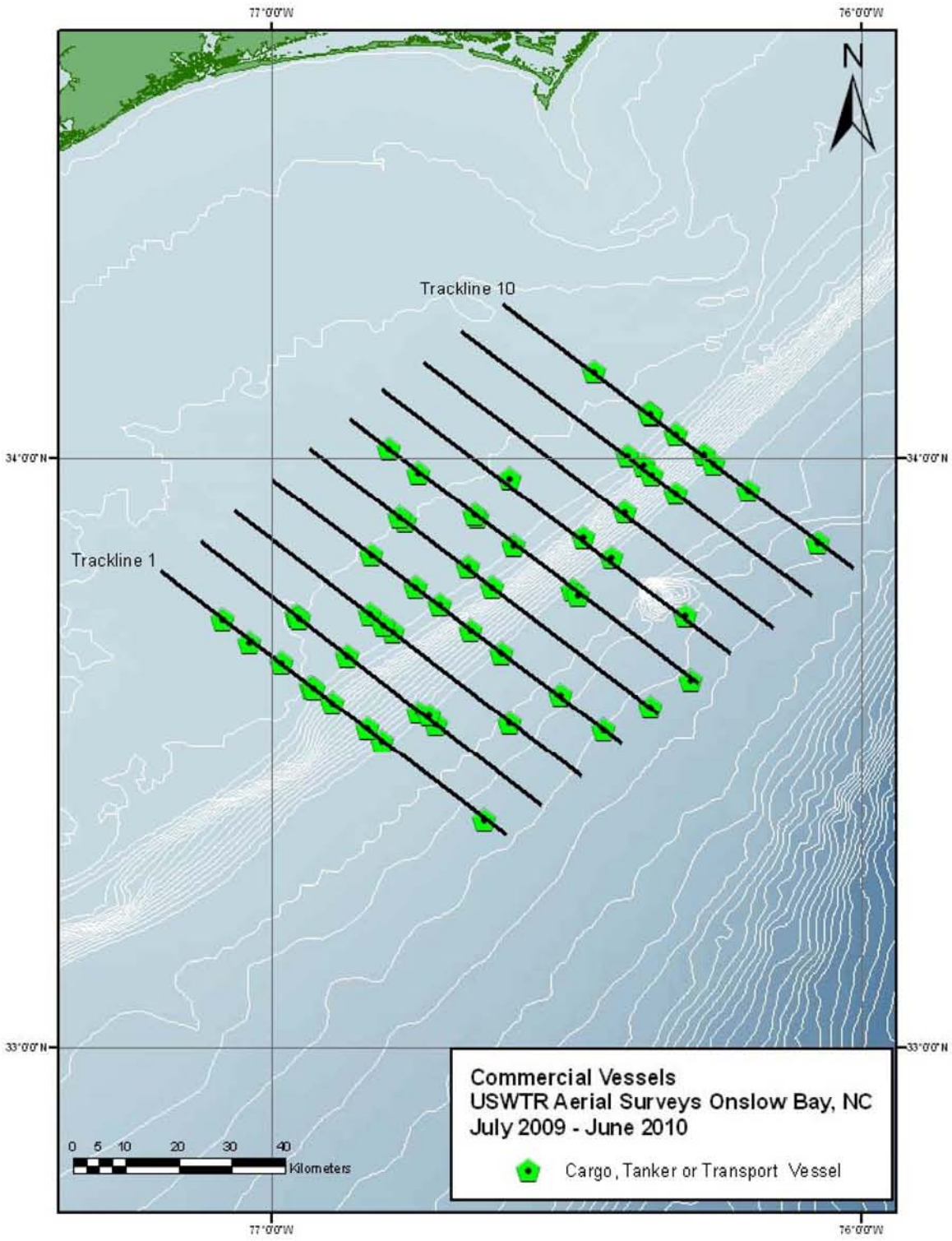

Figure 17. Large commercial shipping vessel sightings.

Military (Table 23, Fig. 18)

A total of two U.S. Military vessels were observed in the study site.

Table 23. All military vessel sightings in the proposed USWTR site in Onslow Bay, North Carolina for surveys conducted from July 2009 - June 2010.

Date	Time	Way Point	Latitude	Longitude-1	Heading	Track Number	Angle out	Degree Forward	Best #	Comments
12-Apr-10	9:19	8	34.051475	-76.322325	SE	10	4	90°	1	Navy warship
1-Oct-09	9:17	12	33.645814	-76.316561	NW	6	3	90°	1	Military vessel

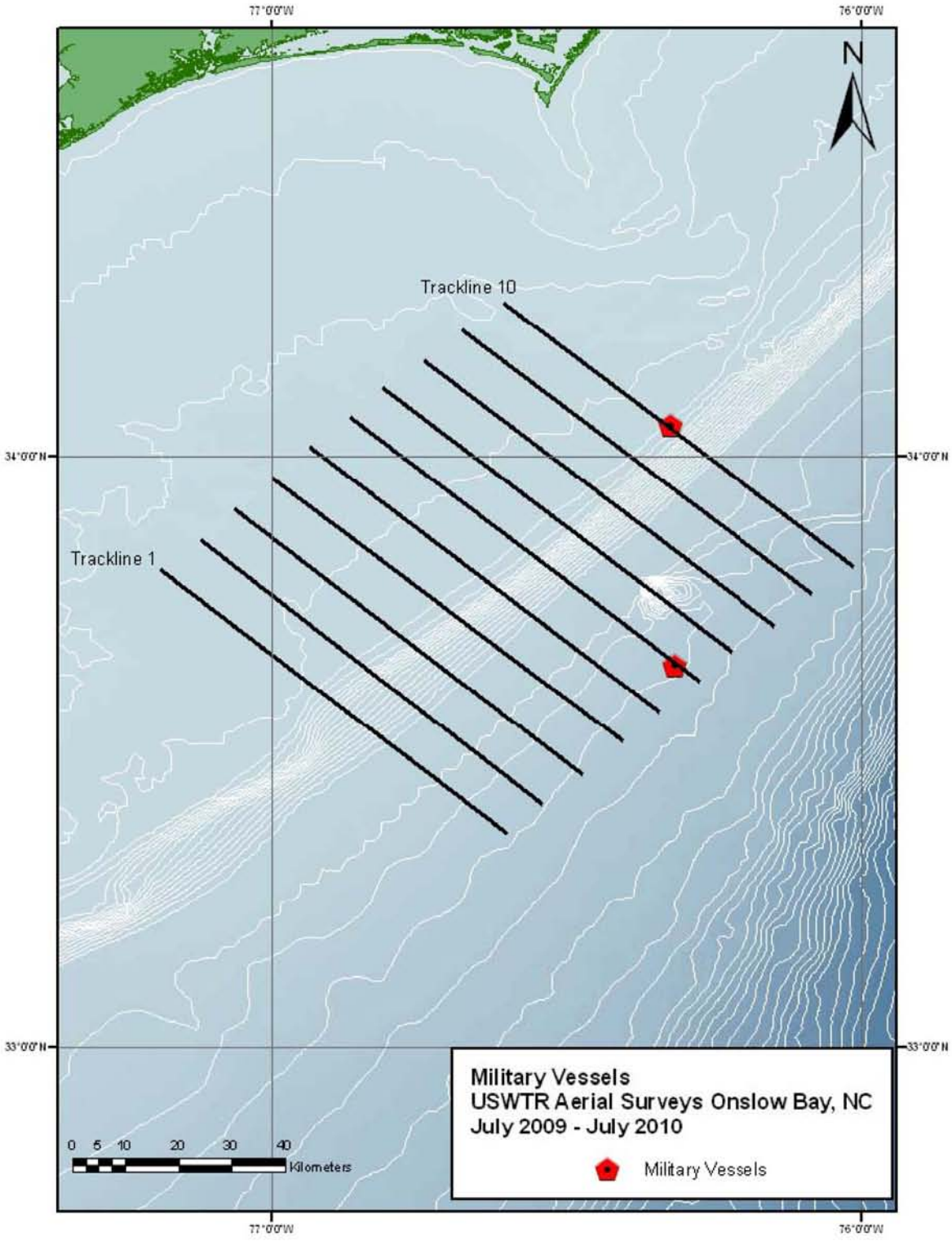

Figure 18. Military vessel sightings.

Recreational (Table 24, Fig. 19)

The most commonly sighted types of vessel in the survey area were recreational fishing vessels (n=308), with the majority of sightings occurring at or shoreward of the continental shelf break.

Table 24. All other vessel sightings in the proposed USWTR site in Onslow Bay, North Carolina for surveys conducted from July 2009 to June 2010.

Date	Time	Way Point	Latitude	Longitude-1	Heading	Track Number	Angle out	Degree Forward	Best #	Comments
8-Jul-09	13:21	4	33.903031	-76.784230	SE	5	3	90°	1	Recreational fishing vessel
8-Jul-09	13:45	8	33.712955	-76.403130	NW	6	4	45°	1	Recreational fishing vessel
8-Jul-09	13:59	11	33.984725	-76.763776	NW	6	3	45°	1	Recreational fishing vessel
8-Jul-09	14:18	15	33.868063	-76.474205	SE	7	4	90°	1	Recreational fishing vessel
8-Jul-09	14:41	19	33.921571	-76.412839	NW	8	4	75°	1	Recreational fishing vessel
8-Jul-09	15:00	26	34.145006	-76.582109	SE	9	4	45°	1	Recreational fishing vessel
8-Jul-09	15:07	28	33.999245	-76.390907	SE	9	4	90°	1	Recreational fishing vessel
8-Jul-09	15:41	33	34.234025	-76.560308	NW	10	3	45°	1	Recreational fishing vessel
28-Jul-09	10:48	22	33.738554	-76.965035	SE	2	3	45°	1	Recreational fishing vessel
28-Jul-09	11:27	25	33.794171	-77.171117	NW	1	2	30°	1	Recreational fishing vessel
17-Aug-09	15:22	4	34.221355	-76.540983	SE	10	4	45°	1	Recreational fishing vessel
17-Aug-09	15:24	5	34.180638	-76.488416	SE	10	4	60°	1	Recreational fishing vessel
17-Aug-09	16:30	24	33.985369	-76.494534	SE	8	4	45°	1	Recreational fishing vessel
18-Aug-09	10:41	27	33.853226	-76.983572	SE	3	3	90°	1	Recreational fishing vessel
18-Aug-09	10:46	30	33.741818	-76.838174	SE	3	4	90°	1	Recreational fishing vessel
18-Aug-09	14:53	72	33.931610	-76.695561	NW	6	5	90°	1	Recreational fishing vessel
18-Aug-09	14:58	73	34.030196	-76.825629	NW	6	5	90°	1	Recreational fishing vessel
18-Aug-09	15:15	81	34.033156	-76.685535	SE	7	4	90°	1	Recreational fishing vessel
18-Aug-09	15:47	89	33.965977	-76.474503	NW	8	4	90°	1	Recreational fishing vessel
18-Aug-09	15:56	90	34.157910	-76.726133	NW	8	5	90°	1	Recreational fishing vessel
18-Aug-09	16:03	93	34.138721	-76.563979	SE	9	3	90°	1	Recreational fishing vessel
19-Aug-09	9:23	5	33.993859	-76.773218	SE	6	4	60°	1	Recreational fishing vessel
19-Aug-09	10:03	12	33.946407	-76.846248	NW	5	2	45°	1	Recreational fishing vessel
19-Aug-09	10:15	15	33.853115	-76.848154	SE	4	1	90°	1	Recreational fishing vessel
12-Sep-09	9:39	14	33.624181	-76.815500	NW	2	3	45°	1	Recreational fishing vessel
12-Sep-09	10:07	22	33.858532	-76.994410	SE	3	3	45°	3	Recreational fishing vessel
12-Sep-09	10:40	28	33.741381	-76.696402	NW	4	2	90°	1	Recreational fishing vessel
12-Sep-09	11:12	35	33.773610	-76.614443	SE	5	4	90°	1	Recreational fishing vessel
12-Sep-09	11:45	46	33.823078	-76.544594	NW	6	1	90°	1	Recreational fishing vessel
12-Sep-09	14:02	54	34.252442	-76.578587	SE	10	3	90°	3	Recreational fishing vessel
12-Sep-09	14:05	55	34.179842	-76.489362	SE	10	4	90°	2	Recreational fishing vessel
12-Sep-09	14:20	60	34.122264	-76.416959	SE	10	4	45°	1	Recreational fishing vessel
12-Sep-09	14:47	64	33.985111	-76.370760	NW	9	1	90°	1	Recreational fishing vessel
12-Sep-09	14:49	65	34.034121	-76.438878	NW	9	3	90°	2	Recreational fishing vessel
12-Sep-09	14:57	67	34.195669	-76.650002	NW	9	2	90°	1	Recreational fishing vessel
12-Sep-09	15:11	73	34.111594	-76.657957	SE	8	3	45°	1	Recreational fishing vessel
12-Sep-09	15:27	78	33.917983	-76.409206	SE	8	2	90°	2	Recreational fishing vessel
30-Sep-09	12:17	5	33.868752	-76.740742	SE	5	3	45°	1	Recreational fishing vessel
30-Sep-09	12:57	11	34.048547	-76.854716	NW	6	3	45°	1	Recreational fishing vessel
30-Sep-09	13:05	14	34.021984	-76.668950	SE	7	4	60°	1	Recreational fishing vessel
30-Sep-09	14:56	30	34.215755	-76.536258	NW	10	3	30°	1	Recreational fishing vessel
1-Oct-09	9:26	17	33.815811	-76.535134	NW	6	4	90°	1	Recreational fishing vessel
1-Oct-09	9:27	18	33.831359	-76.556799	NW	6	3	45°	2	Recreational fishing vessel
1-Oct-09	10:02	27	33.968296	-76.618305	SE	7	4	90°	1	Recreational fishing vessel
1-Oct-09	10:08	31	33.912704	-76.531404	SE	7	3	60°	1	Recreational fishing vessel
1-Oct-09	10:57	48	33.921838	-76.412976	NW	8	4	60°	1	Recreational fishing vessel
1-Oct-09	11:51	63	34.015358	-76.412727	SE	9	1	60°	1	Recreational fishing vessel
1-Oct-09	11:53	64	33.990264	-76.379563	SE	9	2	45°	5	Recreational fishing vessel

Table 24 (Continued). All other vessel sightings in the proposed USWTR site in Onslow Bay, North Carolina for surveys conducted from July 2009 - June 2010.

Date	Time	Way Point	Latitude	Longitude-1	Heading	Track Number	Angle out	Degree Forward	Best #	Comments
1-Oct-09	15:27	94	33.905149	-77.057523	SE	3	2	45°	1	Recreational fishing vessel
1-Oct-09	15:31	95	33.819169	-76.938700	SE	3	3	60°	1	Recreational fishing vessel
1-Oct-09	16:12	104	33.721730	-76.676554	NW	4	3	60°	1	Recreational fishing vessel
2-Oct-09	10:47	28	33.793941	-76.639202	SE	5	4	90°	2	Recreational fishing vessel
2-Oct-09	10:48	29	33.765307	-76.602686	SE	5	4	90°	1	Recreational fishing vessel
2-Oct-09	11:14	32	33.862128	-76.602003	NW	6	3	45°	1	Recreational fishing vessel
2-Oct-09	11:22	33	34.034930	-76.820432	NW	6	2	45°	1	Recreational fishing vessel
21-Oct-09	11:44	25	33.990904	-76.248549	NW	10	4	60°	2	Recreational fishing vessel
21-Oct-09	12:11	33	34.000393	-76.390572	SE	9	2	45°	2	Recreational fishing vessel
21-Oct-09	13:10	50	34.148064	-76.713061	NW	8	3	60°	1	Recreational fishing vessel
8-Nov-09	14:29	23	33.720940	-76.812234	SE	3	4	90°	1	Recreational fishing vessel
8-Nov-09	14:31	25	33.681905	-76.761587	SE	3	2	90°	2	Recreational fishing vessel
8-Nov-09	15:32	41	33.884612	-76.760520	SE	5	3	60°	1	Recreational fishing vessel
9-Nov-09	10:32	11	34.029348	-76.300830	NW	10	2	45°	1	Recreational fishing vessel
17-Dec-09	12:16	31	34.264324	-76.598056	NW	10	3	45°	1	Recreational fishing vessel
17-Dec-09	15:00	44	33.752071	-76.982417	SE	2	2	60°	1	Recreational fishing vessel
14-Jan-10	10:08	6	33.937554	-76.829710	SE	5	1	45°	1	Recreational fishing vessel
14-Jan-10	11:08	26	33.952933	-76.723269	NW	6	1	45°	1	Recreational fishing vessel
14-Jan-10	11:25	37	33.919871	-76.537203	SE	7	3	90°	1	Recreational fishing vessel
14-Jan-10	12:27	55	34.130329	-76.562921	SE	9	4	90°	3	Recreational fishing vessel
14-Jan-10	13:23	70	34.254288	-76.587917	NW	10	4	90°	2	Recreational fishing vessel
14-Jan-10	15:44	87	33.684421	-76.892168	SE	2	3	45°	1	Recreational fishing vessel
15-Jan-10	9:15	6	33.608461	-76.924504	SE	1	2	90°	1	Recreational fishing vessel
15-Jan-10	15:51	99	34.057010	-76.464885	SE	9	3	30°	1	Recreational fishing vessel
15-Jan-10	16:35	110	34.204371	-76.525126	NW	10	4	60°	1	Recreational fishing vessel
21-Feb-10	9:59	11	33.682249	-76.763384	SE	3	3	60°	1	Recreational fishing vessel
21-Feb-10	10:53	16	33.775289	-76.617123	SE	5	3	60°	1	Recreational fishing vessel
21-Feb-10	11:18	19	33.798440	-76.518820	NW	6	2	30°	4	Recreational fishing vessel
21-Feb-10	11:22	20	33.883488	-76.630159	NW	6	1	45°	1	Recreational fishing vessel
21-Feb-10	14:05	36	34.173588	-76.483401	SE	10	3	45°	1	Recreational fishing vessel
21-Feb-10	14:11	38	34.045154	-76.317222	SE	10	3	45°	2	Recreational fishing vessel
21-Feb-10	14:48	46	33.994168	-76.377537	NW	9	2	45°	1	Recreational fishing vessel
21-Feb-10	16:08	64	33.862979	-76.467564	NW	7	2	60°	2	Recreational fishing vessel
8-Mar-10	9:57	6	33.994247	-76.383612	NW	9	4	90°	1	Recreational fishing vessel
8-Mar-10	13:30	25	33.847824	-76.583313	SE	6	3	60°	2	Recreational fishing vessel
8-Mar-10	13:32	26	33.808812	-76.532083	SE	6	1	90°	1	Recreational fishing vessel
9-Mar-10	10:01	26	33.810028	-76.532960	NW	6	4	60°	1	Recreational fishing vessel
9-Mar-10	10:03	29	33.865038	-76.605269	NW	6	2	45°	1	Recreational fishing vessel
9-Mar-10	10:33	45	33.908722	-76.526039	SE	7	4	60°	2	Recreational fishing vessel
9-Mar-10	11:55	74	33.998573	-76.389829	SE	9	2	90°	2	Recreational fishing vessel
9-Mar-10	12:56	90	34.245547	-76.575446	NW	10	2	60°	1	Recreational fishing vessel
10-Mar-10	10:46	29	33.705424	-77.052438	NW	1	1	60°	1	Recreational fishing vessel
11-Apr-10	9:20	7	33.731019	-76.428427	SE	6	3	90°	7	Recreational fishing vessel
11-Apr-10	11:07	35	33.626623	-76.818046	SE	2	2	90°	1	Recreational fishing vessel
11-Apr-10	11:48	44	33.602722	-76.919639	NW	1	3	90°	1	Recreational fishing vessel
11-Apr-10	14:52	63	34.192540	-76.646320	SE	9	3	90°	3	Recreational fishing vessel
12-Apr-10	10:54	33	33.878453	-76.621898	SE	6	1	60°	1	Recreational fishing vessel
16-Jun-10	9:18	4	33.934333	-76.823601	SE	5	2	45°	1	Recreational fishing vessel

Table 24 (Continued). All other vessel sightings in the proposed USWTR site in Onslow Bay, North Carolina for surveys conducted from July 2009 - June 2010.

Date	Time	Way Point	Latitude	Longitude-1	Heading	Track Number	Angle out	Degree Forward	Best #	Comments
16-Jun-10	10:09	14	34.005391	-76.648062	SE	7	3	60°	1	Dive boat
16-Jun-10	10:26	17	33.673193	-76.214907	SE	7	1	60°	1	Recreational fishing vessel
16-Jun-10	10:56	24	34.176118	-76.610691	SE	9	3	90°	1	Recreational fishing vessel
16-Jun-10	11:42	35	34.228530	-76.558291	NW	10	1	60°	1	Recreational fishing vessel
17-Jun-10	9:53	13	33.853895	-76.977093	SE	3	3	30°	1	Recreational fishing vessel
17-Jun-10	9:56	14	33.790584	-76.892240	SE	3	4	90°	1	Recreational fishing vessel
17-Jun-10	10:00	15	33.703183	-76.786499	SE	3	3	45°	1	Recreational fishing vessel
17-Jun-10	10:36	25	33.823654	-76.815536	NW	4	3	30°	1	Recreational fishing vessel
17-Jun-10	11:21	30	33.844292	-76.581913	NW	6	4	60°	1	Recreational fishing vessel
17-Jun-10	11:28	31	33.983168	-76.764873	NW	6	2	90°	1	Recreational fishing vessel
17-Jun-10	13:30	38	34.114997	-76.789677	SE	7	1	90°	1	Recreational fishing vessel
17-Jun-10	13:33	39	34.035918	-76.687206	SE	7	3	45°	2	Recreational fishing vessel
17-Jun-10	13:35	40	33.998595	-76.638220	SE	7	3	45°	1	Recreational fishing vessel
17-Jun-10	15:22	53	34.247101	-76.582498	NW	10	1	90°	1	Recreational fishing vessel
18-Jun-10	9:54	16	33.696111	-76.785494	NW	3	2	60°	1	Recreational fishing vessel
18-Jun-10	10:52	27	33.608492	-76.929417	NW	1	3	60°	1	Recreational fishing vessel
8-Jul-09	13:31	6	33.697743	-76.516939	SE	5	3	30°	1	Recreational fishing vessel
8-Jul-09	14:02	10	34.045587	-76.844841	NW	6	4	30°	1	Recreational fishing vessel
8-Jul-09	15:33	25	34.073507	-76.354025	NW	10	2	45°	1	Recreational fishing vessel
17-Aug-09	15:23	6	34.204683	-76.519487	SE	10	3	45°	1	Recreational fishing vessel
17-Aug-09	16:56	36	33.906227	-76.525599	NW	7	4	90°	1	Recreational fishing vessel
17-Aug-09	16:57	37	33.934422	-76.562311	NW	7	3	90°	1	Recreational fishing vessel
18-Aug-09	10:46	19	33.741966	-76.838342	SE	3	4	90°	1	Recreational fishing vessel
18-Aug-09	10:55	21	33.554713	-76.595494	SE	3	1	90°	1	Recreational fishing vessel
18-Aug-09	14:13	44	33.880420	-76.753043	SE	5	4	90°	1	Recreational fishing vessel
18-Aug-09	14:14	45	33.857293	-76.722232	SE	5	3	60°	1	Recreational fishing vessel
18-Aug-09	14:51	50	33.868701	-76.612786	NW	6	3	45°	1	Headboat
18-Aug-09	16:04	61	34.124360	-76.545349	SE	9	4	45°	1	Recreational fishing vessel
19-Aug-09	9:23	5	33.996967	-76.777274	SE	6	4	90°	2	Recreational fishing vessel
19-Aug-09	11:45	29	33.746240	-76.971745	SE	2	5	60°	1	Recreational fishing vessel
12-Sep-09	8:47	4	33.746663	-77.111690	SE	1	3	45°	1	Recreational fishing vessel
12-Sep-09	10:38	21	33.709828	-76.656529	NW	4	4	60°	1	Recreational fishing vessel
12-Sep-09	11:05	28	33.921268	-76.810193	SE	5	3	30°	1	Recreational fishing vessel
12-Sep-09	11:11	29	33.791638	-76.637534	SE	5	3	60°	1	Head boat
12-Sep-09	11:44	38	33.808071	-76.525626	NW	6	3	60°	1	Recreational fishing vessel
12-Sep-09	14:01	45	34.257606	-76.583891	SE	10	4	60°	1	Recreational fishing vessel
12-Sep-09	14:47	53	33.990891	-76.377408	NW	9	3	60°	2	Recreational fishing vessel
12-Sep-09	14:49	54	34.020138	-76.421058	NW	9	3	90°	1	Recreational fishing vessel
12-Sep-09	14:53	55	34.124289	-76.555522	NW	9	4	45°	1	Recreational fishing vessel
12-Sep-09	15:24	64	33.983141	-76.491445	SE	8	2	60°	1	Recreational fishing vessel
12-Sep-09	15:53	70	33.886949	-76.497028	NW	7	4	90°	1	Recreational fishing vessel
30-Sep-09	13:10	12	33.921312	-76.540440	SE	7	2	90°	1	Recreational fishing vessel
30-Sep-09	13:12	14	33.877942	-76.482863	SE	7	3	90°	2	Recreational fishing vessel
30-Sep-09	13:39	19	33.982608	-76.497750	NW	8	3	90°	1	Recreational fishing vessel
1-Oct-09	9:26	13	33.828207	-76.552091	NW	6	3	90°	1	Recreational fishing vessel
1-Oct-09	9:27	14	33.844353	-76.576949	NW	6	1	90°	1	Recreational fishing vessel
1-Oct-09	9:28	15	33.850013	-76.585007	NW	6	3	90°	1	Recreational fishing vessel
1-Oct-09	10:08	22	33.904555	-76.521217	SE	7	3	90°	4	Recreational fishing vessel

Table 24 (Continued). All other vessel sightings in the proposed USWTR site in Onslow Bay, North Carolina for surveys conducted from July 2009 - June 2010.

Date	Time	Way Point	Latitude	Longitude-1	Heading	Track Number	Angle out	Degree Forward	Best #	Comments
1-Oct-09	10:44	30	33.739562	-76.175267	NW	8	2	45°	1	Recreational fishing vessel
1-Oct-09	10:57	33	33.916884	-76.407001	NW	8	4	90°	8	Recreational fishing vessel
1-Oct-09	11:52	43	33.999507	-76.392102	SE	9	2	45°	1	Recreational fishing vessel
1-Oct-09	11:53	44	33.975170	-76.360279	SE	9	1	90°	1	Recreational fishing vessel
1-Oct-09	14:42	60	33.713220	-77.066925	SE	1	4	90°	1	Recreational fishing vessel
1-Oct-09	15:13	65	33.627730	-76.821817	NW	2	4	90°	2	Recreational fishing vessel
1-Oct-09	15:19	66	33.766049	-76.994095	NW	2	4	90°	1	Recreational fishing vessel
1-Oct-09	15:37	69	33.684201	-76.765863	SE	3	4	90°	3	Recreational fishing vessel
1-Oct-09	16:12	78	33.717922	-76.670882	NW	4	4	90°	1	Recreational fishing vessel
1-Oct-09	16:21	79	33.919853	-76.939322	NW	4	4	90°	1	Recreational fishing vessel
1-Oct-09	16:23	80	33.958903	-76.986534	NW	4	3	45°	1	Recreational fishing vessel
2-Oct-09	8:33	4	33.670772	-77.004747	SE	1	2	45°	1	Recreational fishing vessel
2-Oct-09	9:27	12	33.690074	-76.771788	SE	3	4	60°	1	Recreational fishing vessel
2-Oct-09	10:20	19	33.724266	-76.676321	NW	4	2	45°	2	Recreational fishing vessel
2-Oct-09	10:47	25	33.783024	-76.626640	SE	5	4	90°	1	Recreational fishing vessel
21-Oct-09	11:46	24	34.025282	-76.292314	NW	10	1	90°	1	Recreational fishing vessel
21-Oct-09	12:03	31	34.176557	-76.622927	SE	9	2	45°	1	Yacht
21-Oct-09	13:25	53	33.879964	-76.486627	SE	7	1	90°	2	Recreational fishing vessel
8-Nov-09	13:26	3	33.692388	-77.033340	SE	1	3	90°	1	Recreational fishing vessel
8-Nov-09	14:31	17	33.692433	-76.775095	SE	3	3	60°	1	Recreational fishing vessel
8-Nov-09	15:26	29	34.000250	-76.916724	SE	5	2	90°	1	Recreational fishing vessel
8-Nov-09	15:27	30	33.980258	-76.884810	SE	5	1	90°	1	Sail boat
8-Nov-09	15:58	36	33.796669	-76.517070	NW	6	3	60°	1	Recreational fishing vessel
9-Nov-09	9:45	6	33.953035	-76.457110	NW	8	3	90°	1	Recreational fishing vessel
9-Nov-09	9:53	8	34.136193	-76.696950	NW	8	4	45°	1	Sailboat
17-Dec-09	12:15	29	34.225041	-76.548652	NW	10	3	90°	6	Recreational fishing vessel
17-Dec-09	12:16	30	34.257115	-76.590128	NW	10	3	90°	12	Recreational fishing vessel
17-Dec-09	15:35	44	33.729167	-77.084195	NW	1	3	45°	1	Recreational fishing vessel
14-Jan-10	11:00	13	33.793136	-76.513263	NW	6	3	60°	1	Recreational fishing vessel
14-Jan-10	11:11	22	34.020293	-76.812074	NW	6	3	45°	1	Recreational fishing vessel
14-Jan-10	11:27	30	33.877630	-76.482980	SE	7	2	45°	1	Recreational fishing vessel
14-Jan-10	13:14	52	34.068863	-76.350030	NW	10	4	60°	1	Recreational fishing vessel
14-Jan-10	13:23	57	34.256637	-76.590800	NW	10	2	60°	2	Recreational fishing vessel
14-Jan-10	14:57	65	33.789860	-76.763797	SE	4	3	45°	1	Recreational fishing vessel
15-Jan-10	12:09	41	33.850681	-76.586784	NW	6	4	90°	4	Recreational fishing vessel
21-Feb-10	9:04	4	33.591617	-76.903562	SE	1	4	90°	1	Recreational fishing vessel
21-Feb-10	10:25	11	33.720496	-76.675172	NW	4	4	45°	1	Recreational fishing vessel
21-Feb-10	11:17	19	33.786677	-76.503911	NW	6	3	60°	2	Recreational fishing vessel
21-Feb-10	14:10	34	34.050293	-76.323937	SE	10	2	45°	1	Recreational fishing vessel
21-Feb-10	14:13	35	34.004435	-76.269693	SE	10	4	90°	3	Recreational fishing vessel
21-Feb-10	14:47	41	33.958151	-76.330426	NW	9	4	90°	3	Recreational fishing vessel
21-Feb-10	14:50	42	34.028089	-76.423896	NW	9	3	45°	1	Recreational fishing vessel
8-Mar-10	9:33	7	34.049602	-76.324132	SE	10	3	90°	1	Recreational fishing vessel
8-Mar-10	9:55	10	33.958248	-76.336687	NW	9	3	30°	2	Recreational fishing vessel
8-Mar-10	10:22	15	33.909044	-76.397937	SE	8	3	45°	1	Recreational fishing vessel
8-Mar-10	10:43	19	33.851018	-76.450446	NW	7	4	60°	2	Recreational fishing vessel
8-Mar-10	15:58	54	33.571668	-76.876831	NW	1	4	45°	1	Recreational fishing vessel
9-Mar-10	9:59	24	33.775694	-76.487117	NW	6	4	45°	1	Recreational fishing vessel

Table 24 (Continued). All other vessel sightings in the proposed USWTR site in Onslow Bay, North Carolina for surveys conducted from July 2009 - June 2010.

Date	Time	Way Point	Latitude	Longitude-1	Heading	Track Number	Angle out	Degree Forward	Best #	Comments
9-Mar-10	10:00	25	33.802821	-76.523493	NW	6	4	45°	4	Recreational fishing vessel
9-Mar-10	11:32	57	33.934825	-76.431140	NW	8	3	90°	1	Recreational fishing vessel
9-Mar-10	11:56	66	33.975849	-76.360158	SE	9	2	45°	1	Recreational fishing vessel
10-Mar-10	10:43	38	33.646969	-76.975641	NW	1	4	60°	1	Recreational fishing vessel
11-Apr-10	10:24	18	33.597109	-76.510653	SE	4	3	60°	1	Recreational fishing vessel
11-Apr-10	14:06	41	34.055799	-76.716481	SE	7	2	45°	1	Recreational fishing vessel
11-Apr-10	14:15	42	33.866275	-76.469405	SE	7	2	60°	3	Recreational fishing vessel
11-Apr-10	14:15	43	33.855560	-76.455167	SE	7	3	90°	1	Recreational fishing vessel
11-Apr-10	14:38	50	33.966840	-76.474430	NW	8	4	60°	1	Recreational fishing vessel
11-Apr-10	14:48	52	34.160082	-76.728372	NW	8	3	90°	1	Headboat
11-Apr-10	14:52	55	34.192641	-76.646459	SE	9	3	60°	2	Recreational fishing vessel
12-Apr-10	9:24	12	33.925988	-76.163465	SE	10	3	90°	1	Recreational fishing vessel
12-Apr-10	9:43	15	33.988814	-76.378403	NW	9	3	45°	2	Recreational fishing vessel
12-Apr-10	10:23	28	33.726411	-76.289885	NW	7	3	60°	1	Recreationa fishing vessel
12-Apr-10	10:25	29	33.766740	-76.343326	NW	7	1	90°	1	Sailboat
16-Jun-10	9:26	4	33.774162	-76.612306	SE	5	3	45°	1	Recreational fishing vessel
16-Jun-10	10:12	10	33.945298	-76.569674	SE	7	3	45°	1	Recreational fishing vessel
16-Jun-10	10:39	15	33.941544	-76.444650	NW	8	3	60°	1	Recreational fishing vessel
17-Jun-10	9:07	4	33.700532	-77.041653	SE	1	4	90°	1	Recreational fishing vessel
17-Jun-10	9:51	9	33.888348	-77.028500	SE	3	3	45°	1	Recreational fishing vessel
17-Jun-10	9:55	10	33.811107	-76.913090	SE	3	2	60°	1	Recreational fishing vessel
17-Jun-10	11:18	19	33.785920	-76.505167	NW	6	3	45°	2	Recreational fishing vessel
17-Jun-10	14:08	27	34.036374	-76.568951	NW	8	3	45°	1	Recreational fishing vessel
17-Jun-10	14:18	30	34.210095	-76.656316	SE	9	2	60°	1	Recreational fishing vessel
17-Jun-10	14:22	31	34.130482	-76.550830	SE	9	2	60°	1	Dive boat
18-Jun-10	10:13	15	33.734326	-76.955065	SE	2	3	45°	1	Recreational fishing vessel
10-Mar-10	10:36	35	33.502317	-76.786673	NW	1	4	30°	1	Recreational fishing vessel

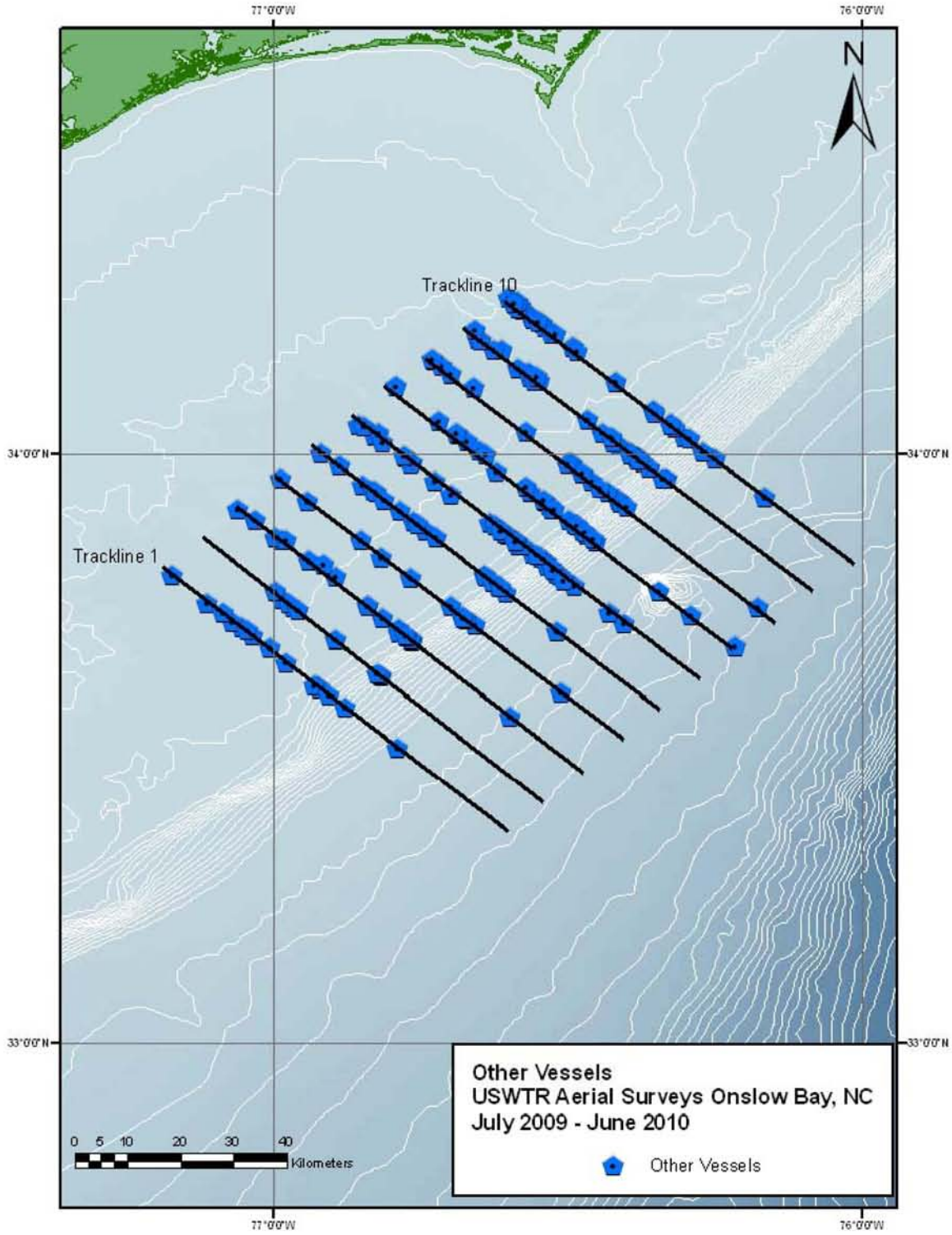

Figure 19. Other vessel sightings.

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Three Year Summary of Onslow Bay Aerial Survey Effort

This report summarizes the combined results of three years of aerial surveys in the proposed Onslow Bay USWTR site (Figure Appendix 1). Effort extended from July 2007 to July 2010 and included 81 flight days, covering 577 track lines, for a total survey effort of 41629 km flown. A total of 214 cetacean sightings, representing eight species, were recorded (Table Appendix 1 and Figure Appendix 2). The maximum species diversity observed during any single day survived occurred on August 18, 2009 when four species (*Tursiops truncatus, Stenella frontalis, Grampus griseus* and *Globicephala macrorhynchus*) were recorded over 10 tracklines. The contractual goal of flying a complete set of tracklines twice each month was accomplished in 22 of the 36 months (Table Appendix 2). There was only a single month (May 2010) in which no surveys could be flown due to continuously poor weather conditions. With the exception of May 2009, a maximum of 20 tracklines were flown during any given month. For the combined three year survey period at total of at least 30 tracklines were flown every calendar month with seven of the 12 months having 50 or more tracklines of coverage. While survey effort across all three years was concentrated (78%) in a Beaufort Sea State (BSS) 2 and 3 (Figure Appendix 3) cetacean sightings were predominantly (81%) recorded in BSS 1 or 2 (Figure Appendix 4a). Previous line transect survey work has show that the detection function for marine mammals is inversely proportional to the sea state. When we correct for effort sighting rates are highest in BSS 1 (Figure Appendix 4b).

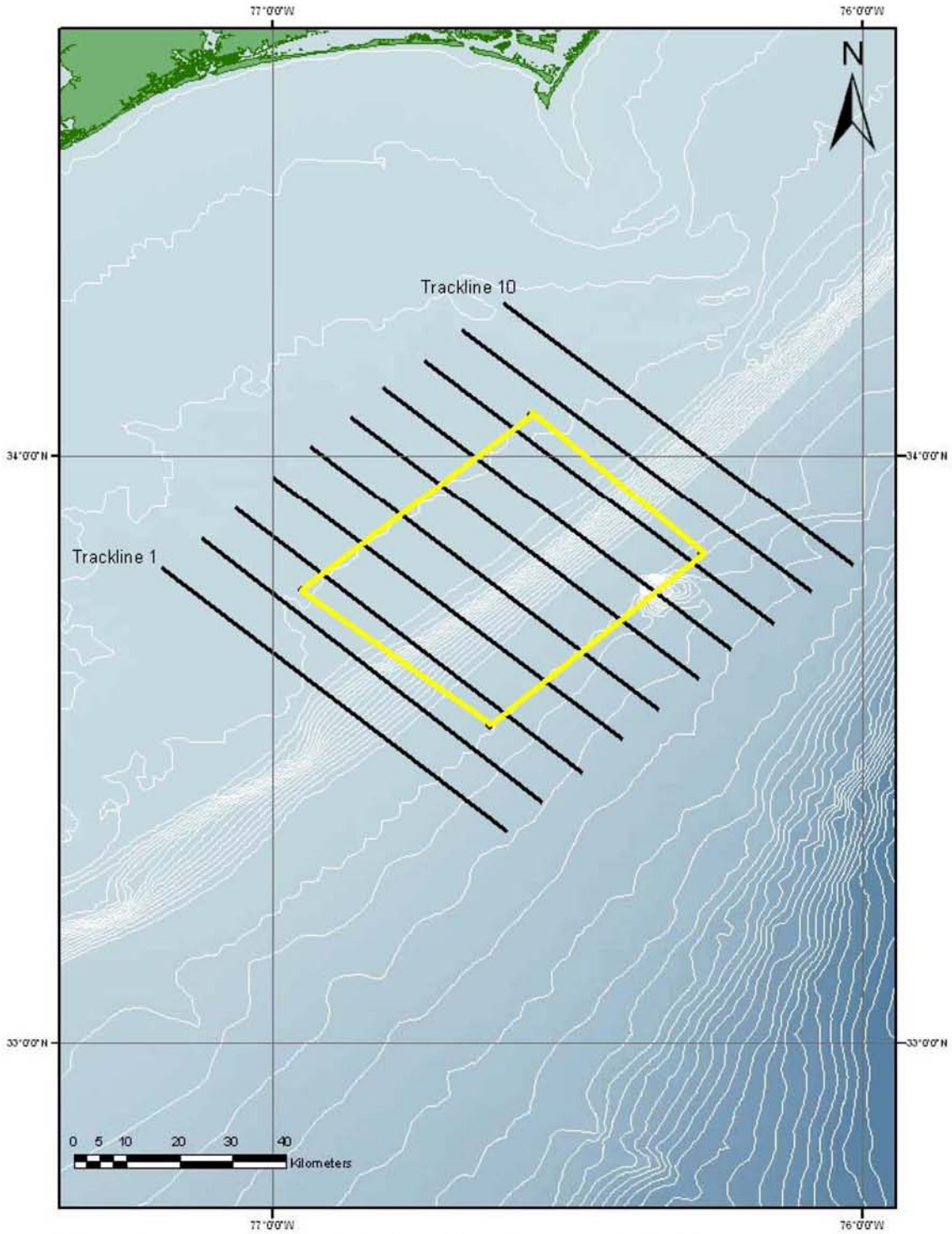


Figure Appendix 1. Survey tracklines 1-10 that cover and extend beyond the boundaries of the proposed USWTR site in Onslow Bay, North Carolina.

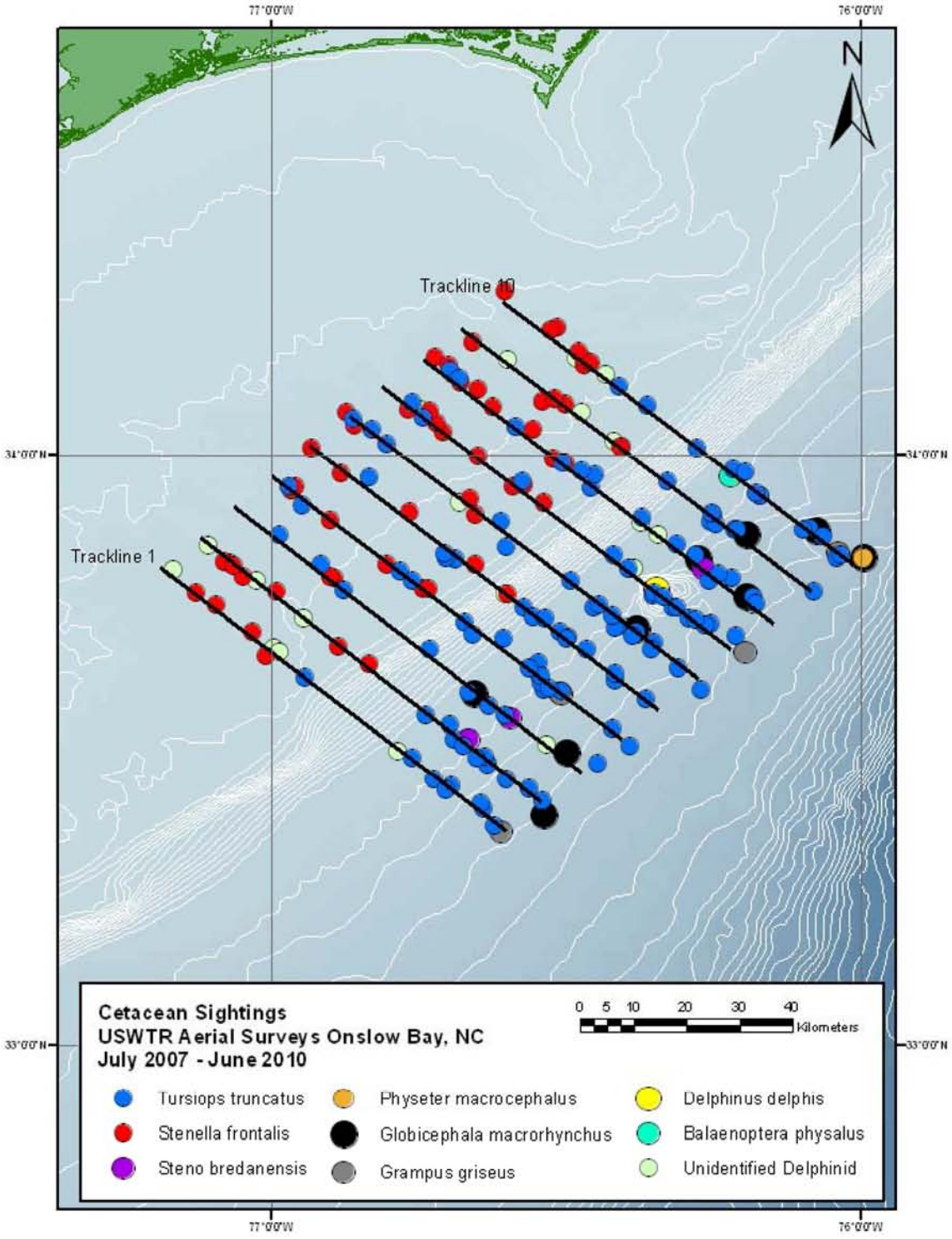


Figure Appendix 2. All cetacean sightings during the 2007 – 2010 aerial surveys of the proposed USWTR site in Onslow Bay, North Carolina. Off-effort sightings for year 3 are included as reported above.

Table Appendix 1. Total number of sightings and individuals for each species by month and year from July 2007 – June 2010 for the Onslow Bay, North Carolina USWTR survey site. Shaded areas indicate months that were not flown due to circumstances other than inclement weather. During the 2007 – 2008 reporting period there were thirteen survey months with June 2007 being a precursory survey month.

		2007							2008						
		June	July	August	September	October	November	December	January	February	March	April	May	June	Total
Tursiops truncatus	Sightings	1				1	9	1			3	5	5	8	**33**
	# of individuals	80				40	113	1			33	43	67	84	**461**
Stenella frontalis	Sightings				1					4	1		1	4	**11**
	# of individuals				4					68	36		11	58	**177**
Globicephala macrorhynchus	Sightings	1											2		**3**
	# of individuals	32											21		**53**
Steno bredanensis	Sightings											1		2	**3**
	# of individuals											26		14	**40**
Grampus griseus	Sightings												1	2	**3**
	# of individuals												5	15	**20**
Tursiops/ Stenella frontalis	Sightings										1			1	**2**
	# of individuals										3			2	**5**
Unidentified delphinid	Sightings		1	1	1		4			2	1			1	**11**
	# of individuals		6	3	6		56			20	5			1	**97**
	Total sightings	**2**	**1**	**1**	**2**	**1**	**13**	**1**	**0**	**6**	**6**	**6**	**9**	**18**	**66**
	Total individuals	**112**	**6**	**3**	**10**	**40**	**169**	**1**	**0**	**88**	**77**	**69**	**104**	**174**	**853**

		2008						2009						
		July	August	September	October	November	December	January	February	March	April	May	June	Total
Tursiops truncatus	Sightings	2	1		4	3			2	3	6	9	6	**36**
	# of individuals	42	9		48	79			80	11	78	186	101	**634**
Stenella frontalis	Sightings		1			1			3	8	5	1	3	**22**
	# of individuals		22			30			160	257	198	25	25	**717**
Globicephala macrorhynchus	Sightings	2												**2**
	# of individuals	30												**30**
Unidentified delphinid	Sightings									1		2	1	**4**
	# of individuals									3		27	11	**41**
	Total sightings	**4**	**2**	**0**	**4**	**4**	**0**	**0**	**5**	**12**	**11**	**12**	**10**	**64**
	Total individuals	**72**	**31**	**0**	**48**	**109**	**0**	**0**	**240**	**271**	**276**	**238**	**137**	**1422**

		2009						2010						
		July	August	September	October	November	December	January	February	March	April	May	June	Total
Tursiops truncatus	Sightings		5	4	11	2		12	1	11	2		5	**53**
	# of individuals		51	66	129	42		169	11	176	48		99	**791**
Stenella frontalis	Sightings		5	5	6			4	2		1		1	**24**
	# of individuals		115	41	70			142	26		18		55	**467**
Globicephala macrorhynchus	Sightings		1						1					**2**
	# of individuals		40						23					**63**
Steno bredanensis	Sightings													**0**
	# of individuals													**0**
Grampus griseus	Sightings		1											**1**
	# of individuals		6											**6**
Delphinus delphis	Sightings									1				**1**
	# of individuals									20				**20**
Physeter macrocephalus	Sightings													**0**
	# of individuals													**0**
Balaenoptera physalus	Sightings									1				**1**
	# of individuals									1				**1**
Unidentified delphinid	Sightings			1			2			1				**4**
	# of individuals			3			17			3				**23**
	Total sightings	**0**	**12**	**10**	**17**	**2**	**2**	**16**	**4**	**14**	**3**	**0**	**6**	**86**
	Total individuals	**0**	**212**	**110**	**199**	**42**	**17**	**311**	**60**	**200**	**66**	**0**	**154**	**1371**

Table Appendix 2. Survey effort given as tracklines flown in Onslow Bay, North Carolina during the July 2007 – June 2010 surveys. Shaded areas indicate months that were not flown due to circumstances other than inclement weather.

	July	August	September	October	November	December	January	February	March	April	May	June
07-08	20	20	20	20	20	10		10	15	20	20	20
08-09	20	20		20	16	10	10	20	20	10	30	20
09-10	20	20	16	20	10	10	20	10	20	20	0	20
Total	60	60	36	60	46	30	30	40	55	50	50	60

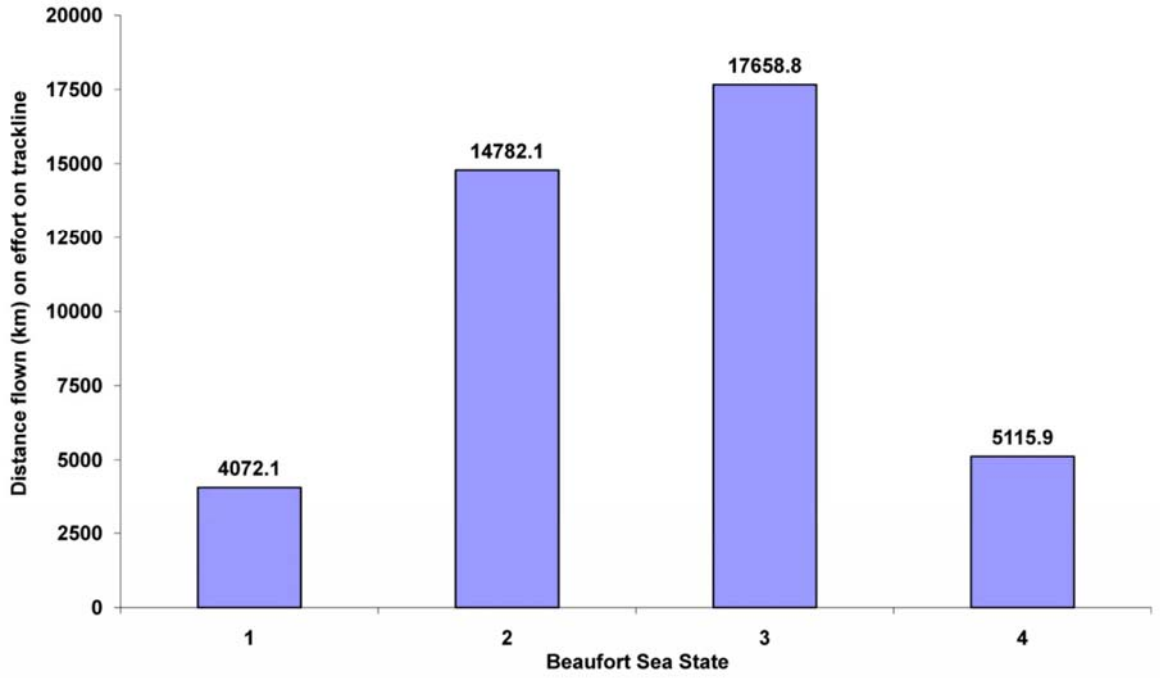


Figure Appendix 3. Total distance surveyed per Beaufort Sea State during the July 2007 – June 2010 USWTR aerial surveys in Onslow Bay, North Carolina.

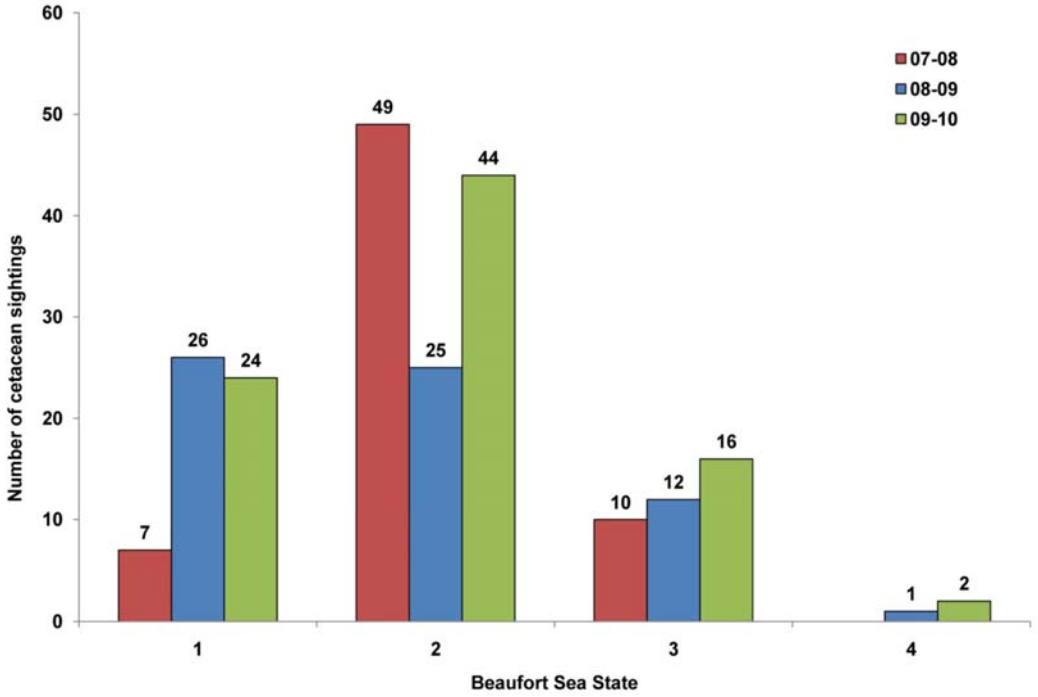


Figure Appendix 4a. Total number of cetacean sightings per Beaufort Sea State from July 2007 – June 2010 in the proposed USWTR site in Onslow Bay, North Carolina.

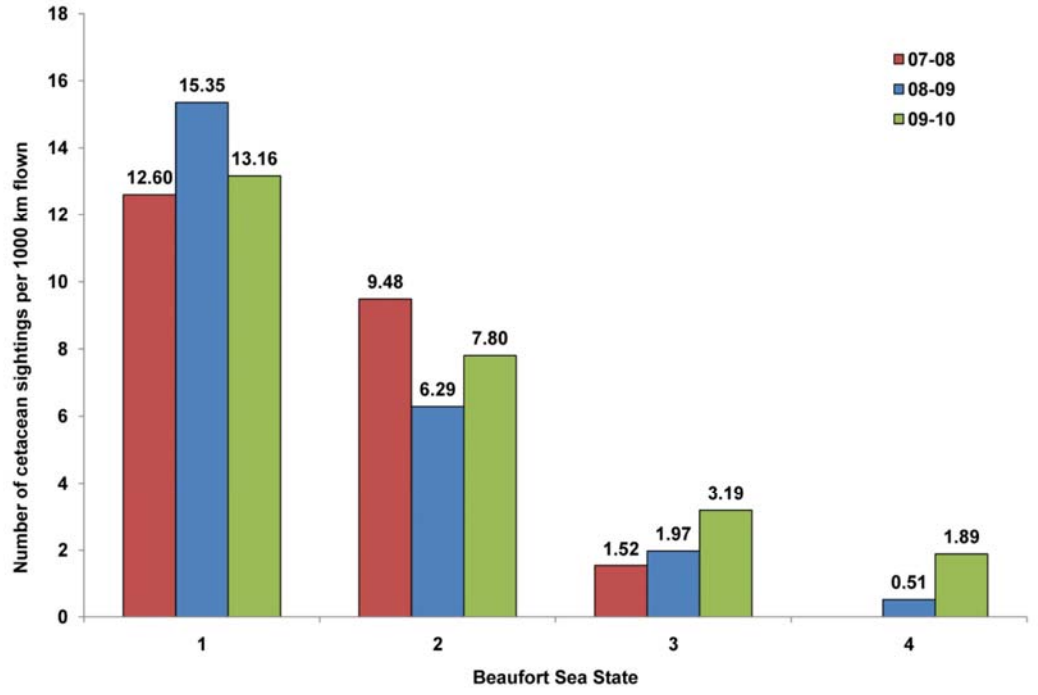


Figure Appendix 4b. Cetacean sightings per 1000 km flown by Beaufort Sea State from July 2007 – June 2010 in the proposed USWTR site in Onslow Bay, North Carolina.

Marine Mammal Sightings

Bottlenose dolphin (*Tursiops truncatus*) (*Figure Appendix 5*)

The bottlenose dolphin was the most commonly sighted and most abundant cetacean encountered during our surveys with 126 sightings (59% of all cetacean sightings) representing a total of 1806 individuals. Sightings of bottlenose dolphins during any single survey day ranged from no sightings made to a maximum of nine sightings of 167 individuals seen in 6 tracklines on March 9, 2010. While this species was found throughout the survey area, differences in the abundance and group size were observed between the inshore and offshore regions of the range. Sightings inside of the continental shelf break were more sparse and consisted of predominantly small groups containing less than 20 individuals. In contrast, offshore of the shelf break bottlenose dolphins occurred more frequently and group sizes ranged from single animals to groups containing 65 individuals. Seasonal patterns of sightings varied across years; some of this variation can be attributed to uncharacteristically low sea states during a particular month's survey as is the case in November 2007, October 2009, and January and March 2010 (Figure Appendix 6a-c). Over the three year combined survey period, though, there was at least one bottlenose dolphin sighting recorded in every calendar month (Figure Appendix 7).

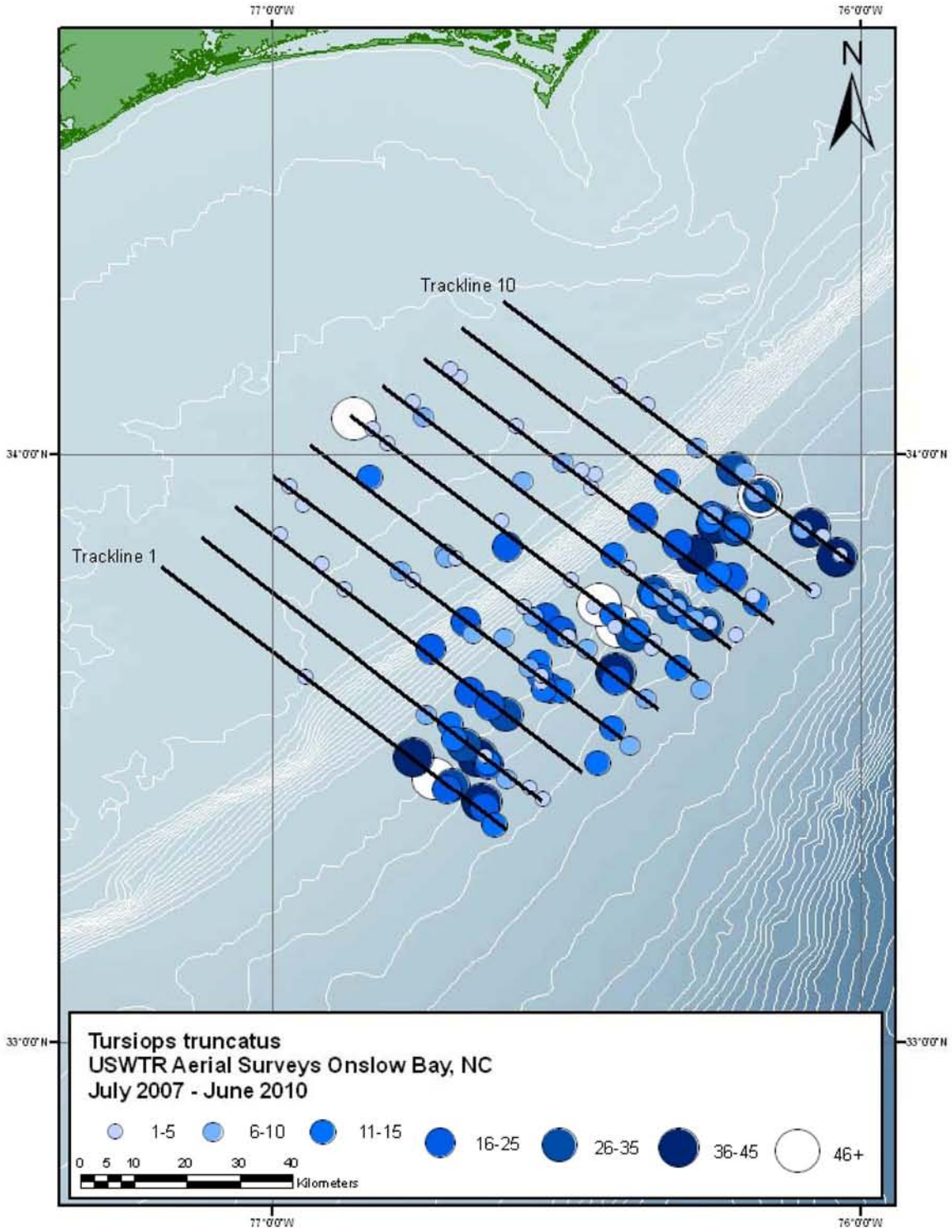


Figure Appendix 5. Bottlenose dolphin (*Tursiops truncatus*) sightings indicating group size during the 2007 – 2010 aerial surveys of the proposed USWTR site in Onslow Bay, North Carolina.

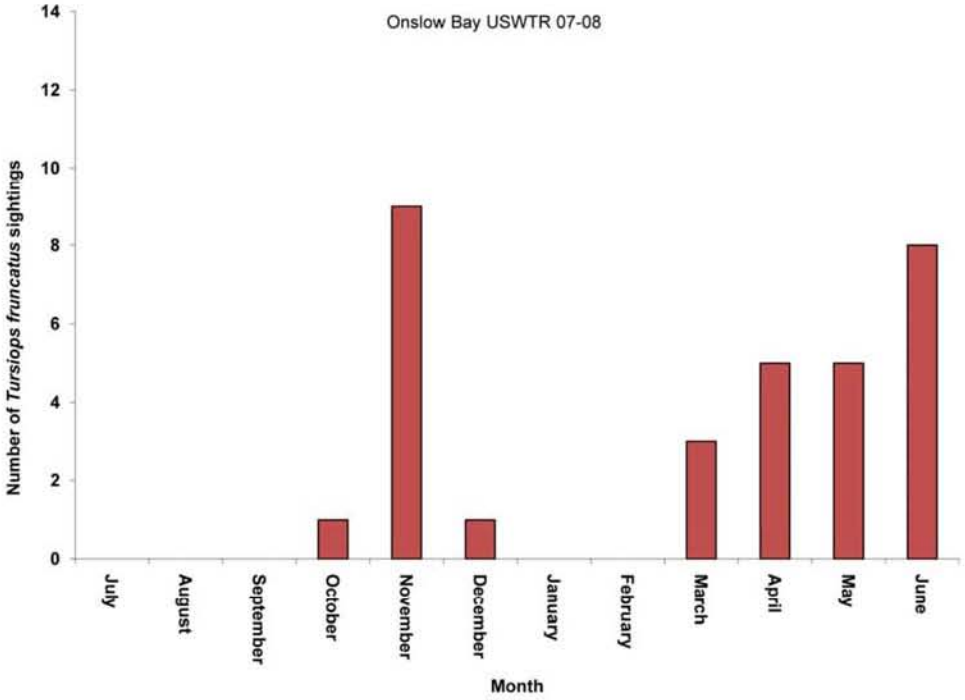


Figure Appendix 6a. Bottlenose dolphin (*Tursiops truncatus*) sightings by month in the proposed USWTR site in Onslow Bay, North Carolina during the July 2007 – June 2008 surveys.

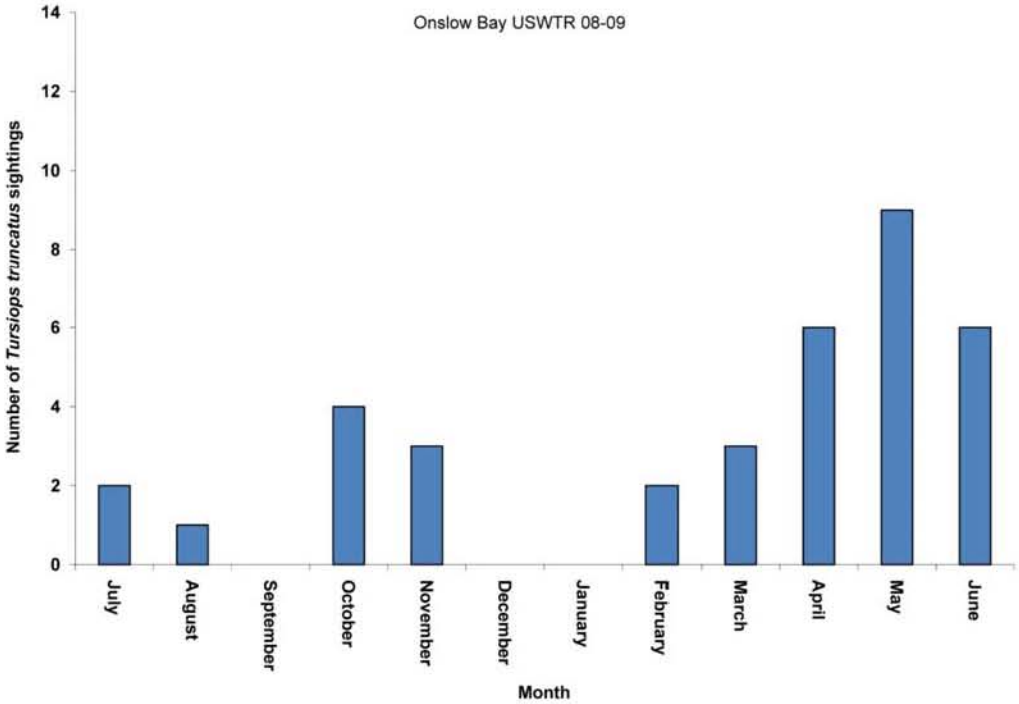


Figure Appendix 6b. Bottlenose dolphin (*Tursiops truncatus*) sightings by month in the proposed USWTR site in Onslow Bay, North Carolina during the July 2008 – June 2009 surveys.

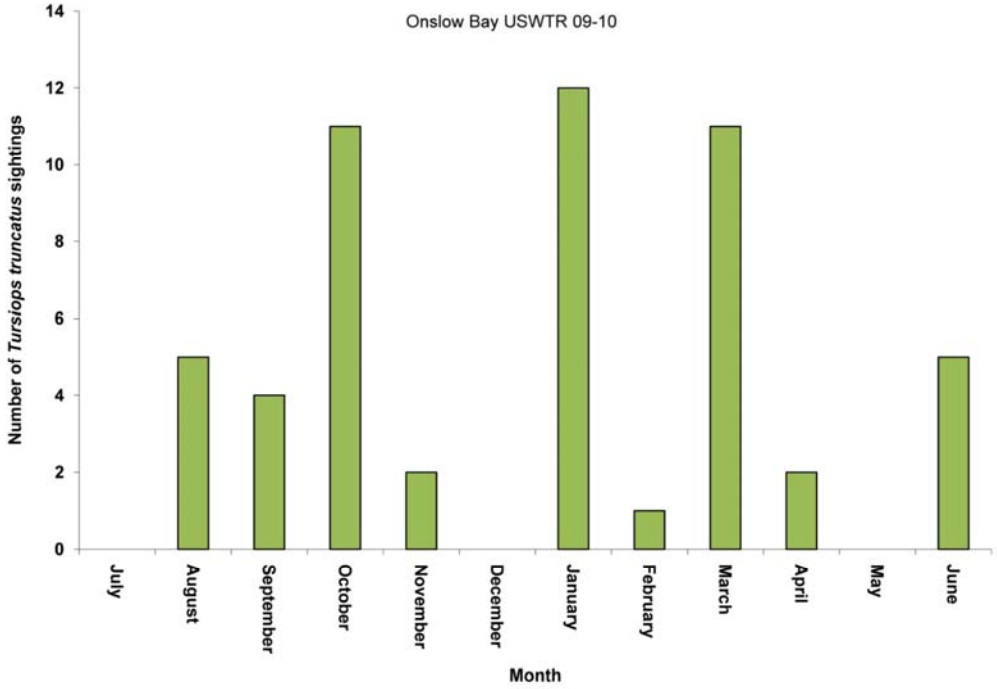


Figure Appendix 6c. Bottlenose dolphin (*Tursiops truncatus*) sightings by month in the proposed USWTR site in Onslow Bay, North Carolina during the July 2009 – June 2010 surveys.

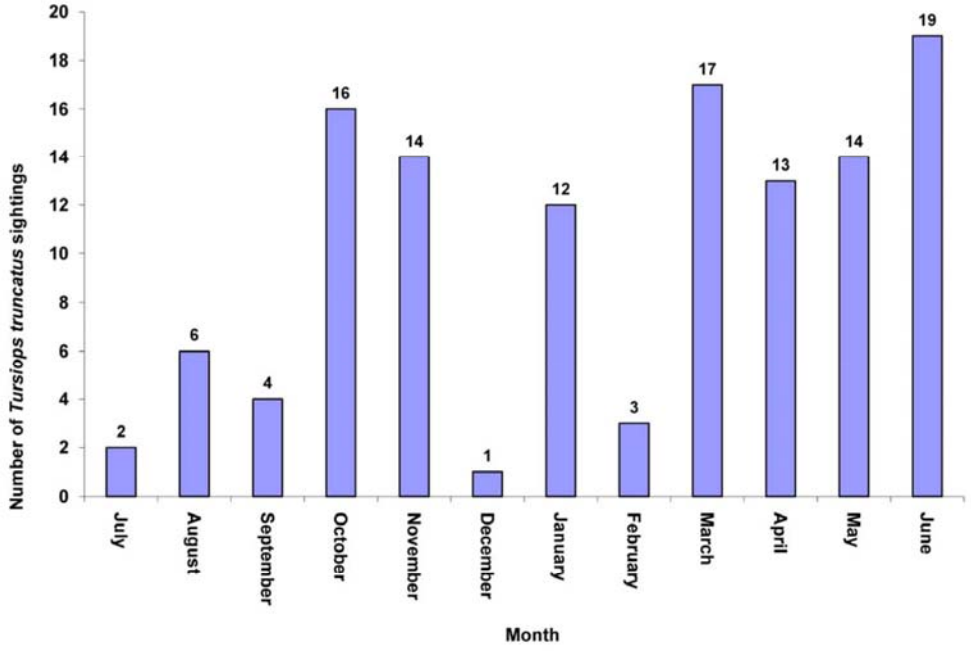


Figure Appendix 7. All bottlenose dolphin (*Tursiops truncatus*) sightings by month in the proposed USWTR site in Onslow Bay, North Carolina during the July 2007 – June 2010 surveys.

A review of all images of bottlenose dolphins sighted over the combined survey period resulted in the identification of two distinct pigmentation patterns. On the dorsal surface of the peduncle of some dolphins, there was an obvious white pigmentation pattern extending from just caudal of the dorsal fin to near the flukes. Other bottlenose dolphins sighted in the survey area lacked this pigmentation pattern and possessed a solid gray peduncle. We analyzed the distribution of dolphins that displayed the white peduncle markings, by both group size and distance from shore (Figure Appendix 8). Only sightings where conditions permitted clear observations of the peduncle were used in this analysis. Except for one sighting, only dolphins that were sighted on, or east, of the continental shelf break exhibited the white peduncle pigmentation pattern. These dolphins tend to reside in larger groups, while animals on the shelf were more uniform in color and reside in smaller groups. This analysis suggest there is separation of bottlenose dolphins by coloration pattern from the nearshore shelf and offshore of the shelf break.

In addition, on 17 June 2010, the team documented one animal within a group of 13 individuals on trackline 9 that had a bright white coloration extending from behind the dorsal fin down the peduncle and laterally forward of the dorsal fin on both sides (Figure Appendix 8). This coloration was more pronounced both among animal within the group (all had white peduncles) and as compared to all previous observations made inside the range. Examination of the photos collected, as well as comparison with images published in Rotstein *et al.* (2009) in the journal *Emerging Infectious Diseases*, suggests this animal had the fungus *Lacazia loboi* in the dorsal skin. Symptoms of this fungal infection appear as raised gray to white nodules on the epidermis. This disease is commonly called “lobo” in coastal bottlenose dolphin populations in the east and west coast of Florida. Rotstein *et al.* (2009) found the disease in offshore bottlenose dolphins north of Cape Hatteras. As the paper states, there have been recorded cases of this disease occurring in offshore bottlenose dolphins off North Carolina and this observation extends the presence of the disease south of Cape Hatteras. The sighting in the USWTR range was circulated to the colleagues who published this finding in stranded specimens in North Carolina.

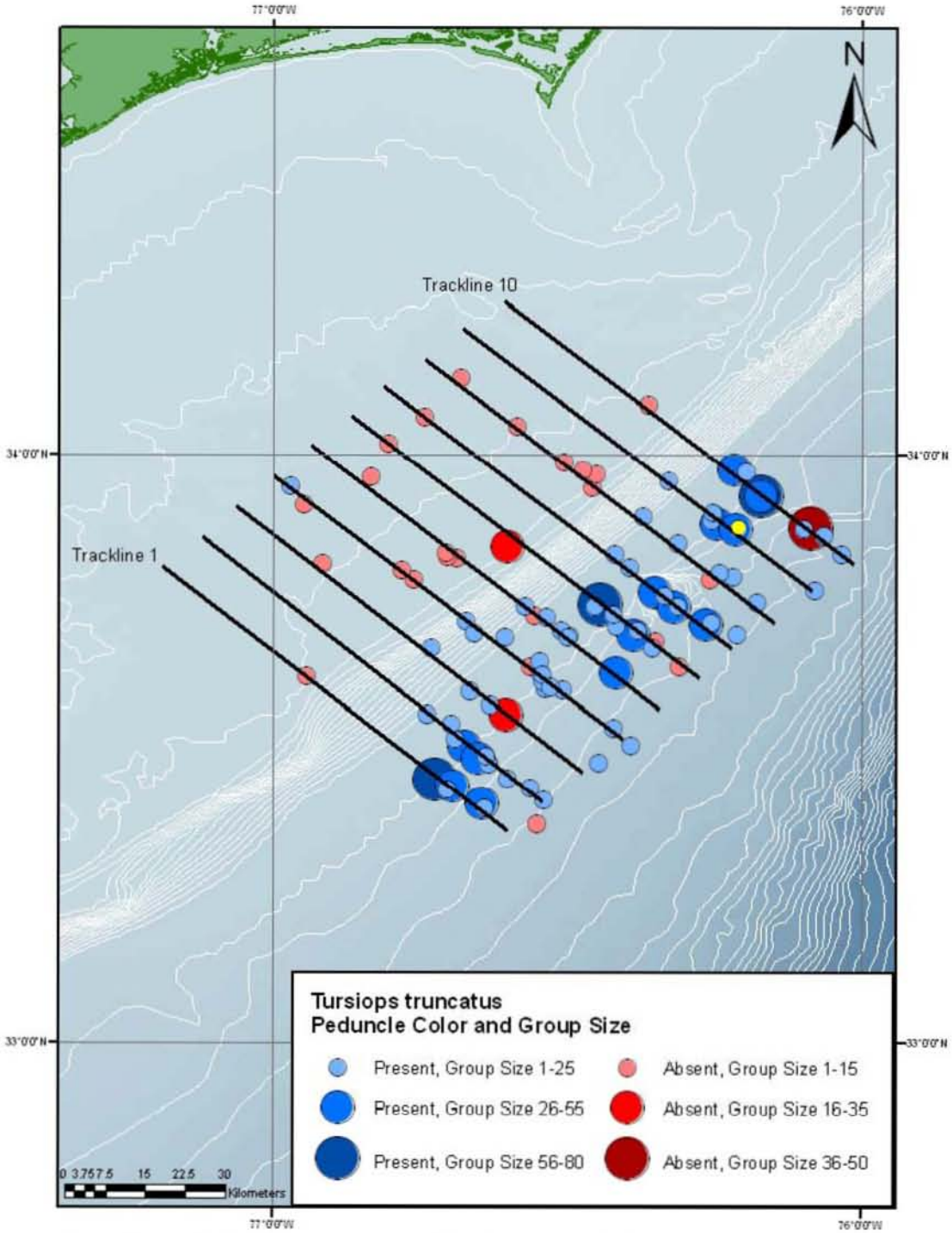


Figure Appendix 8. Bottlenose dolphin *(Tursiops truncatus)* sightings from July 2007 – June 2010. Sightings indicating group size and the presence or absence of a white pigmentation pattern on the peduncle. Photos where pigmentation was unclear or could not be determined were omitted. Yellow circle denotes a possible *Lacazia loboi* infected dolphin.

Spotted dolphin (*Stenella frontalis*) (Figure Appendix 9)

Spotted dolphins were the second most commonly sighted and abundant cetacean species with 57 sightings (26.5% of all sightings) representing 1361 individuals. During any one survey day spotted dolphins ranged from being absent in the USWTR site to a maximum of 6 sightings for 142 individuals across 10 tracklines that was recorded on March 5, 2008. Spotted dolphins were found only within the inshore portion of the USWTR site on the shelf, except for one group of 65 that was observed 7.7 km east past the continental shelf break. Their temporal distribution was highly variable across months and between years (Figure Appendix 10a-c). Spotted dolphins have been observed, though, in ten months of the year except December and July (Figure Appendix 11).

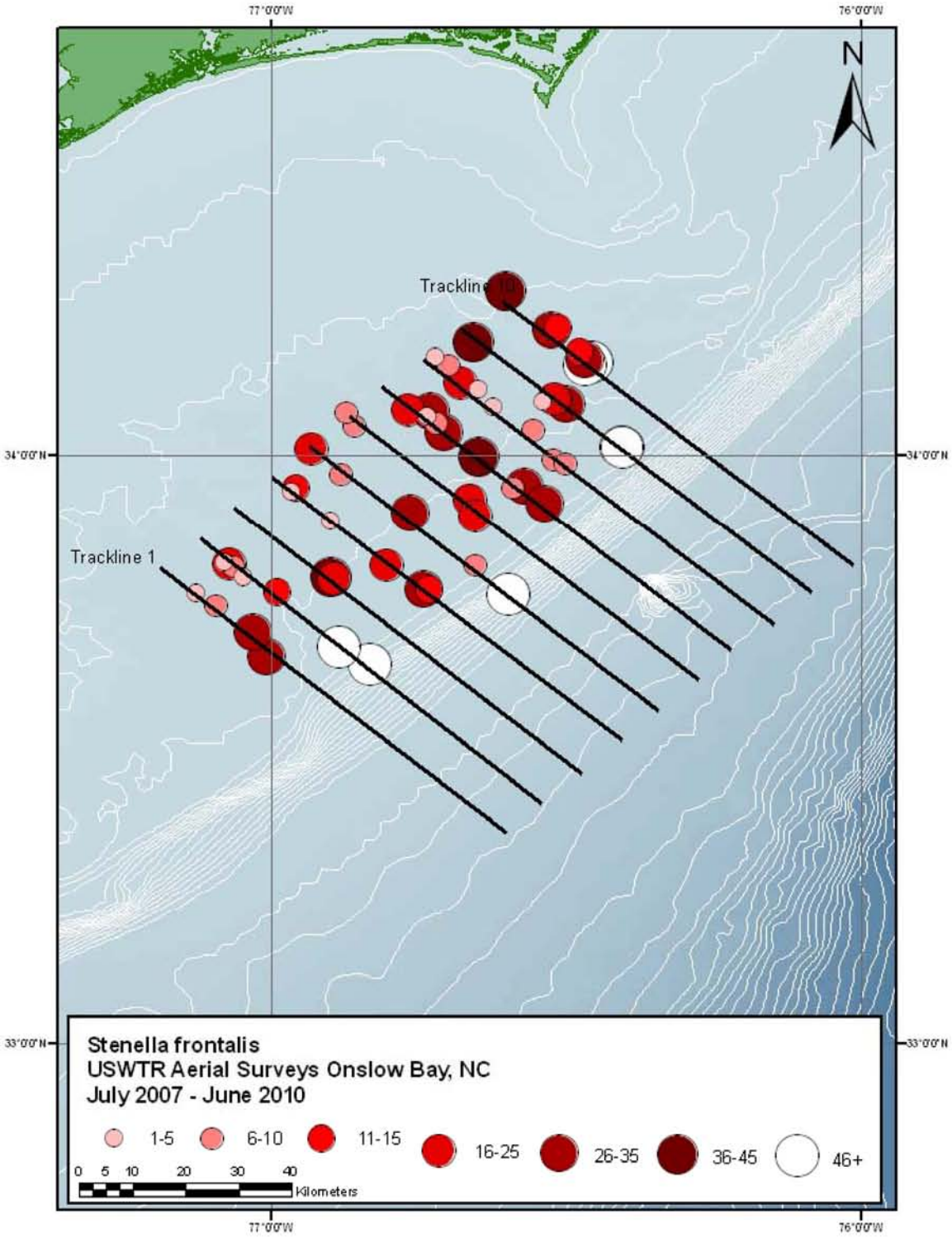


Figure Appendix 9. Spotted dolphin *(Stenella frontalis)* sightings indicating group size during the 2007 – 2010 aerial surveys of the proposed USWTR site in Onslow Bay, North Carolina.

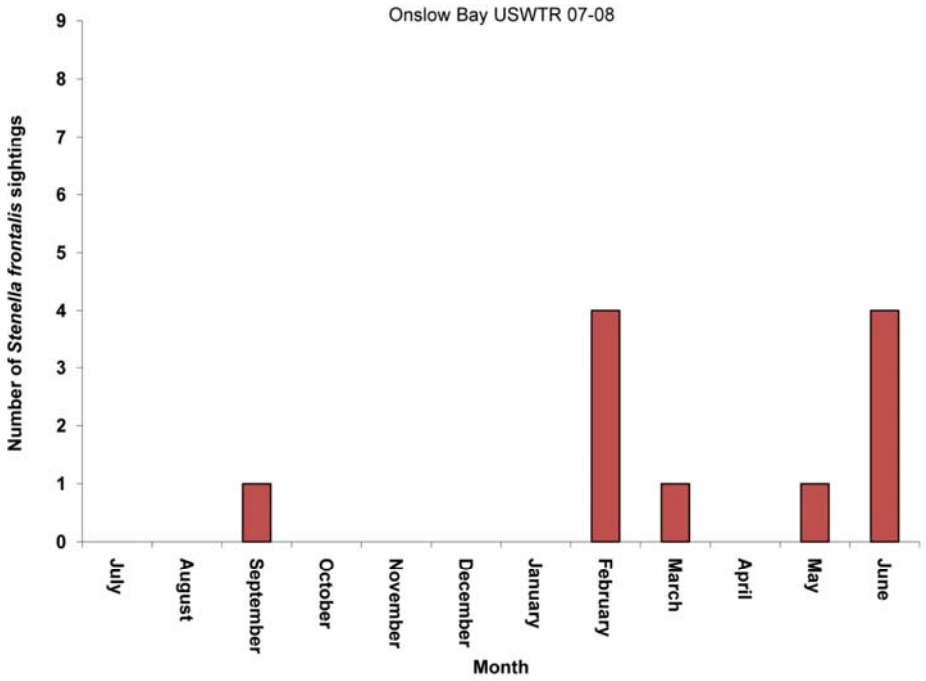


Figure Appendix 10a. Spotted dolphin (*Stenella frontalis*) sightings by month in the proposed USWTR site in Onslow Bay, North Carolina during the July 2007 – June 2008 surveys.

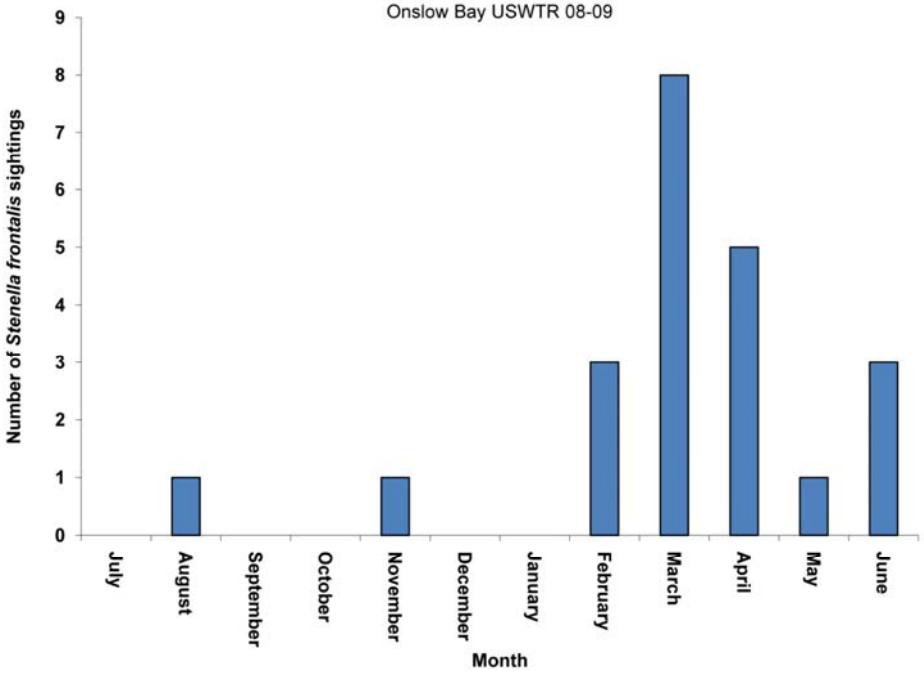


Figure Appendix 10b. Spotted dolphin (*Stenella frontalis*) sightings by month in the proposed USWTR site in Onslow Bay, North Carolina during the July 2008 – June 2009 surveys.

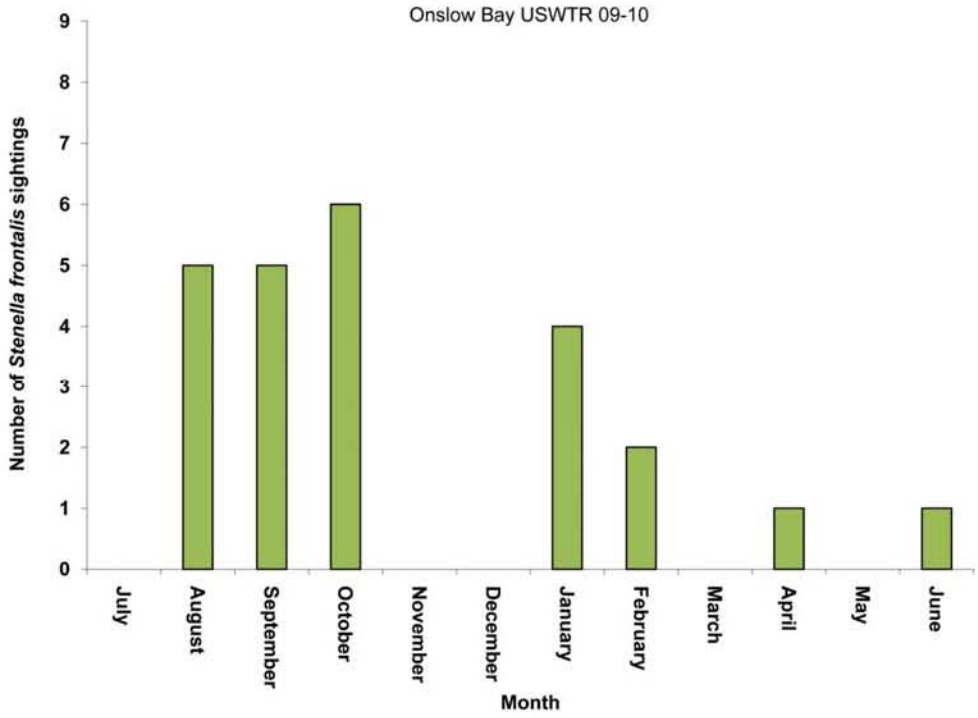


Figure Appendix 10c. Spotted dolphin (*Stenella frontalis*) sightings by month in the proposed USWTR site in Onslow Bay, North Carolina during the July 2009 – June 20010 surveys.

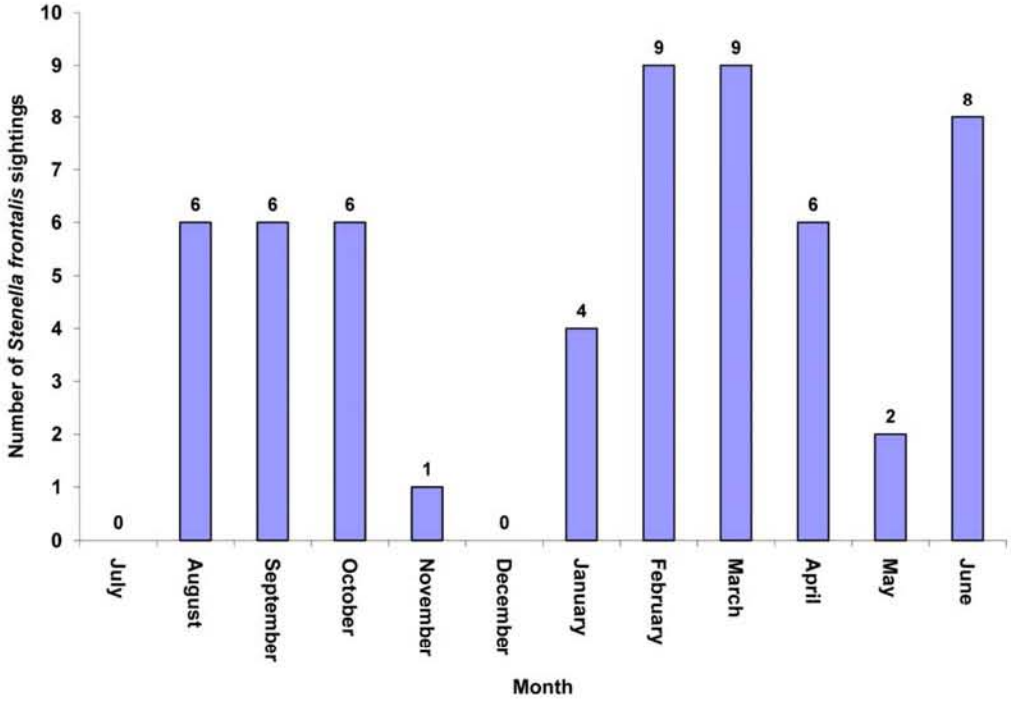


Figure Appendix 11. All spotted dolphin (*Stenella frontalis*) sightings by month in the proposed USWTR site in Onslow Bay, North Carolina during the July 2007 – June 2010 surveys.

Short-finned pilot whales (*Globicephala macrorhynchus*) (Figure Appendix 12)

Short-finned pilot whales were sighted nine times during the combined survey period; six sightings were on effort, two were off effort during offshore transit between tracklines, and a single sighting during a preliminary survey during June 2007. A single sighting was also made during the aerial surveys conducted in 1998-99. All sightings occurred offshore of the shelf break with most occurring in the eastern-most last quarter of a trackline in water depths of ~400m. A single sighting was made in both October and February with all other sightings occurring during the summer months from May to August. The sightings made inside the USWTR range along with those made during coastal right whale aerial surveys and directed pilot whale vessel surveys make up the entirety of short-finned pilot whale sightings made off North Carolina posted to OBIS Seamap.

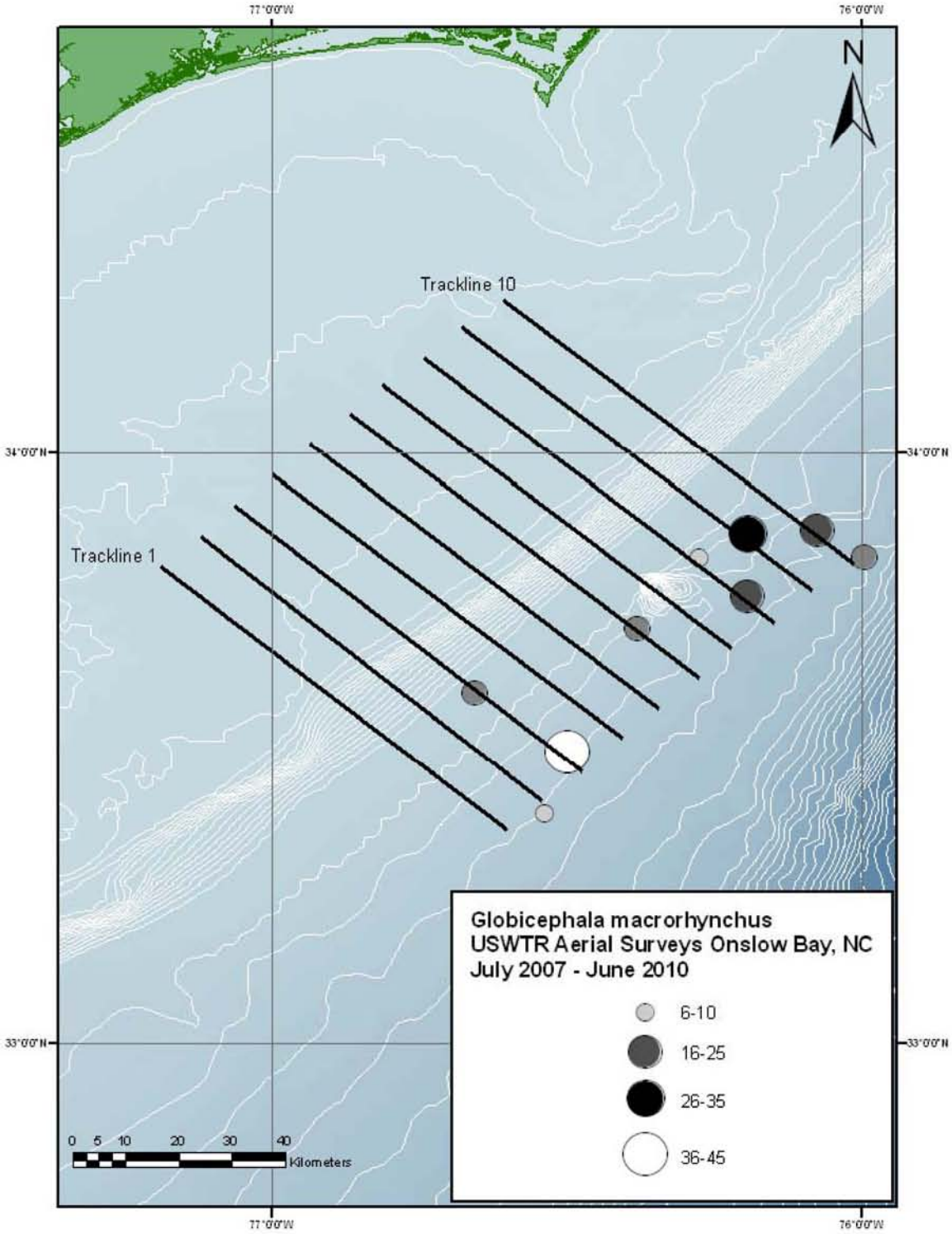


Figure Appendix 12. Short-finned pilot whales *(Globicephala macrorhynchus)* sightings indicating group size during the 2007 – 2010 aerial surveys of the proposed USWTR site in Onslow Bay, North Carolina.

Risso's dolphins (*Grampus griseus*) (Figure Appendix 13)

Risso's dolphins were seen three times during the first year of surveys and only once more in 2009-10. All sighting came in the summer months and were limited to the deep offshore waters of the range. Our sightings fit well with past surveys posted to OBIS Seamap in which all animals seen south of Cape Hatteras occurred west of the continental shelf break.

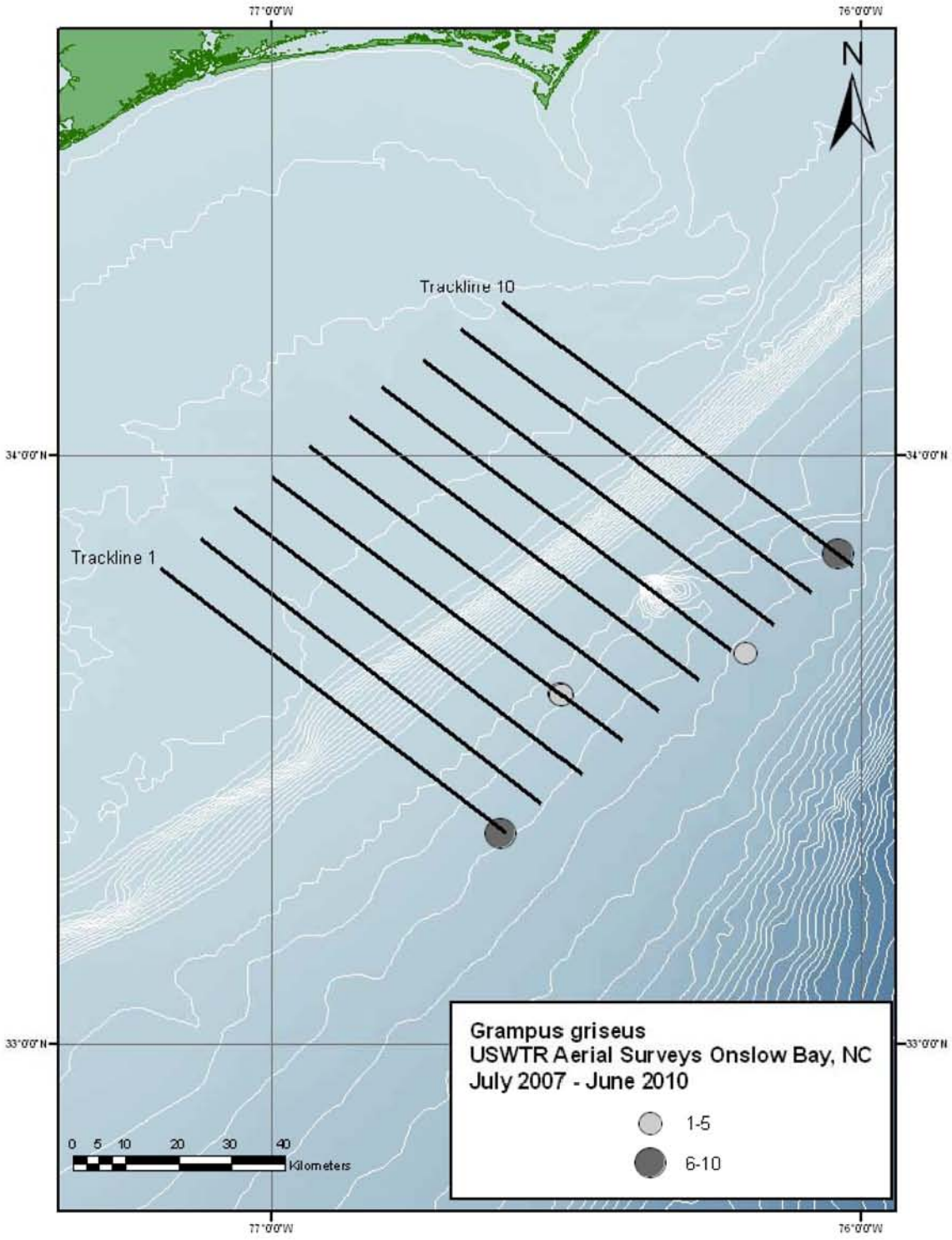


Figure Appendix 13. Risso's dolphin (*Grampus griseus*) sightings indicating group size during the 2007 – 2010 aerial surveys of the proposed USWTR site in Onslow Bay, North Carolina.

Rough-toothed dolphins (*Steno bredanensis*) (Figure Appendix 14)

Rough-toothed dolphins accounted for three sightings in our first year of surveys, but were not detected from the aerial platform during subsequent years. This species was also limited to the deep offshore waters of the range and occurred during April and June. These sightings make the Onslow Bay USWTR data set the second largest contributor of rough-toothed dolphin sightings posted to OBIS Seamap along the eastern United States, with NOAA's Southeast Fisheries Science Center leading with four.

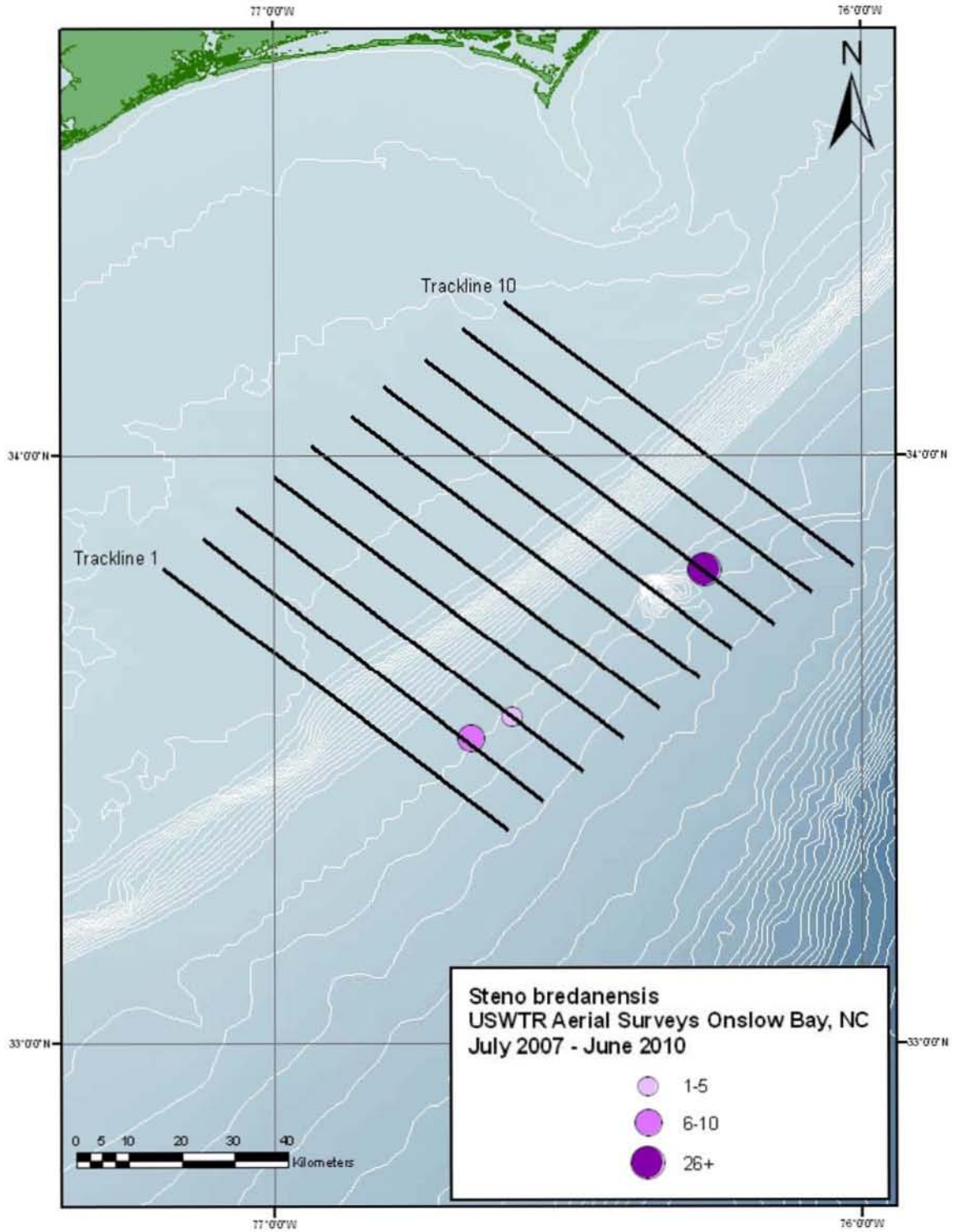


Figure Appendix 14. Rough-toothed dolphin (*Steno bredanensis*) sightings indicating group size during the 2007 – 2010 aerial surveys of the proposed USWTR site in Onslow Bay, North Carolina.

Common dolphin (*Delphinus delphis*) (Figure Appendix 15)

A herd of 20 common dolphins were observed once in March 2010 representing the only sighting of this species during the combined three years survey period. This species had been recorded a total of 13 times during the 1998-99 surveys in Onslow Bay. Although its range extends further south than North Carolina, sightings of this species posted to OBIS Seamap are more prevalent in cooler, northern waters. Our most recent sighting may have been a result of a mass of colder water moving south bringing with it more favorable conditions for this species.

Fin Whale *(Balaenoptera physalus)* (Figure Appendix 15)

A single fin whale was recorded in March 2010, the same day as the common dolphin sighting, and represents the first baleen whale seen in this range both in the current three year project and in the initial 1998-99 surveys. Along the eastern coast of the United States our recent sighting represents the farthest south this species has been recorded of those surveys posted to OBIS Seamap.

Sperm Whale (*Physeter macrocephalus*) (Figure Appendix 15)

On October 21, 2009 while transiting to the offshore end of trackline 10 a single sperm whale was observed just outside the USWTR survey area. The animal was observed as it began a dive which prevented collection of any photographs. Sperm whale vocalizations have been recovered from the HARPs deployed in Onslow Bay but this is the first visual confirmation of this species near the range. Sightings posted to OBIS Seamap have Sperm whales occurring predominantly north of Cape Lookout and in deeper waters past the 1000 fathom mark. This is a species of special concern as it is listed as endangered under the Endangered Species Act (MMPA Annual Report 1997).

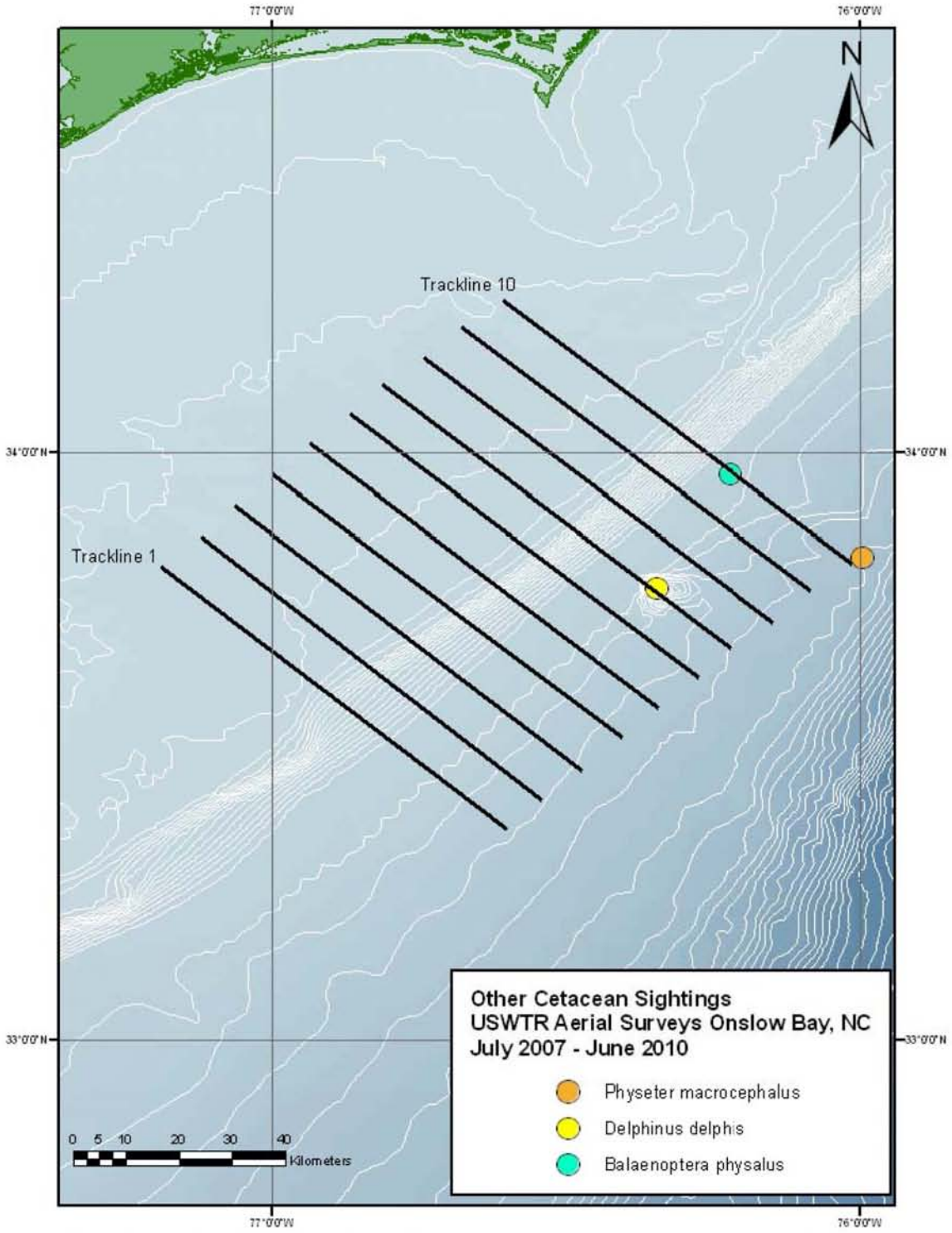


Figure Appendix 15. Sperm whale *(Physeter macrocephalus),* common dolphin *(Delphinus delphis)* and fin whale (*Balaenoptera physalus*) sightings during the 2007 – 2010 aerial surveys of the proposed USWTR site in Onslow Bay, North Carolina.

Sea Turtle Sightings (Figure Appendix 16)

Sea turtles were the most common sighting recorded in the USWTR range with a total of 1181 individuals seen during our three years of effort. Two species of turtles were observed, the loggerhead sea turtle (*Caretta caretta*) which made up the majority of the sightings with 936 individuals (79% of the sightings) and the leatherback sea turtle (*Dermochelys coriacea*) with 5 individuals. The remaining 240 sightings were of animals that could not be identified to species, typically because they were submerged too far below the surface obscuring any species specific diagnostic features, and are labeled as unidentified sea turtles. Like cetaceans, sightings of sea turtles were linked strongly to BSS with more animals recorded in a low sea state (BSS 1 or 2) as compared to higher sea states (BSS 3 or higher)(Figure Appendix 17a-b). Sea turtle sightings were highly variable between months and across years but over the three year survey period sightings were posted during every calendar month (Figure Appendix 18a-c and 19). The majority of sightings were made over the shelf in shallow water.

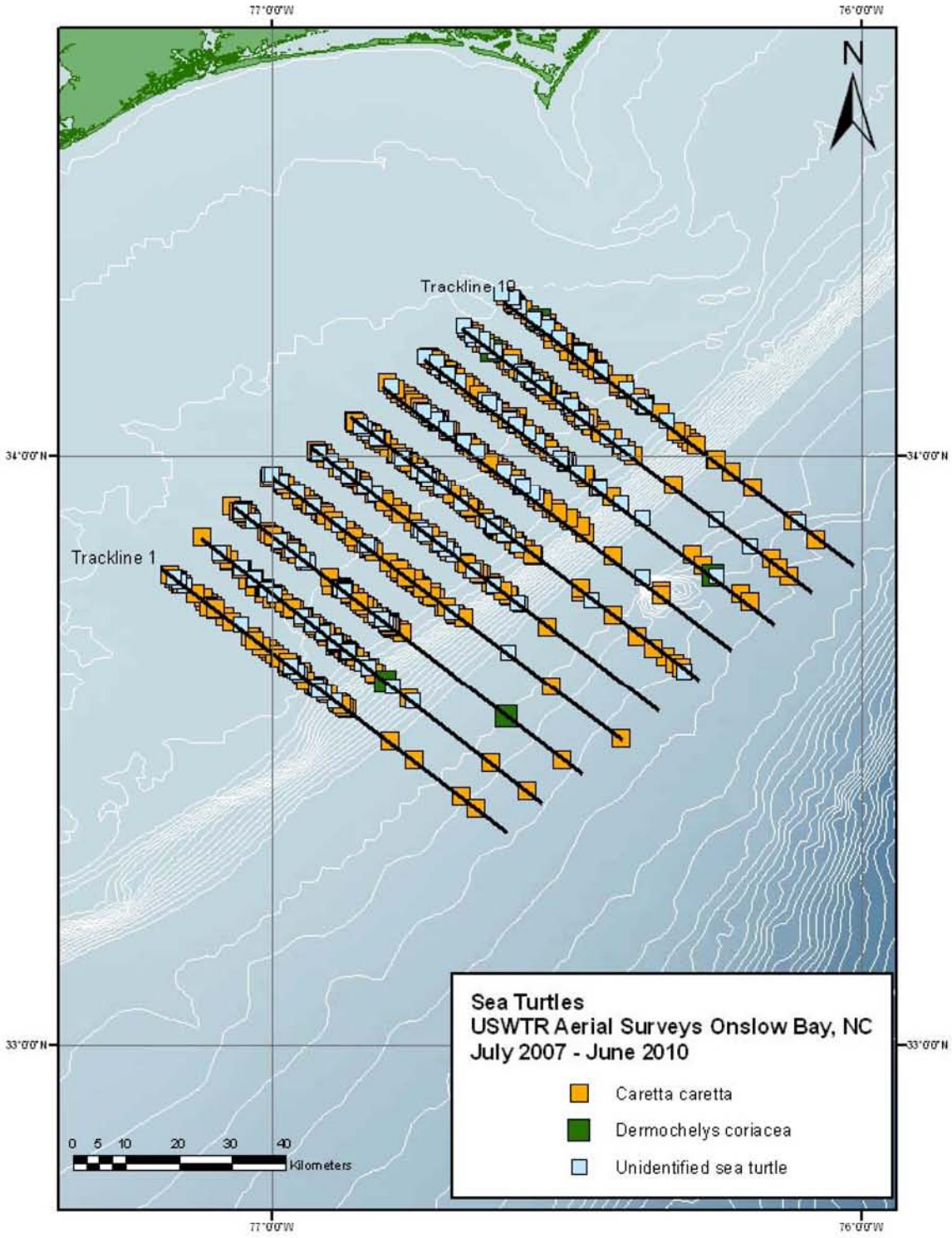


Figure Appendix 16. Loggerhead *(Caretta caretta),* leatherback *(Dermochelys coriacea)* and unidentified sea turtle sightings during the 2007 – 2010 aerial surveys of the proposed USWTR site in Onslow Bay, North Carolina.

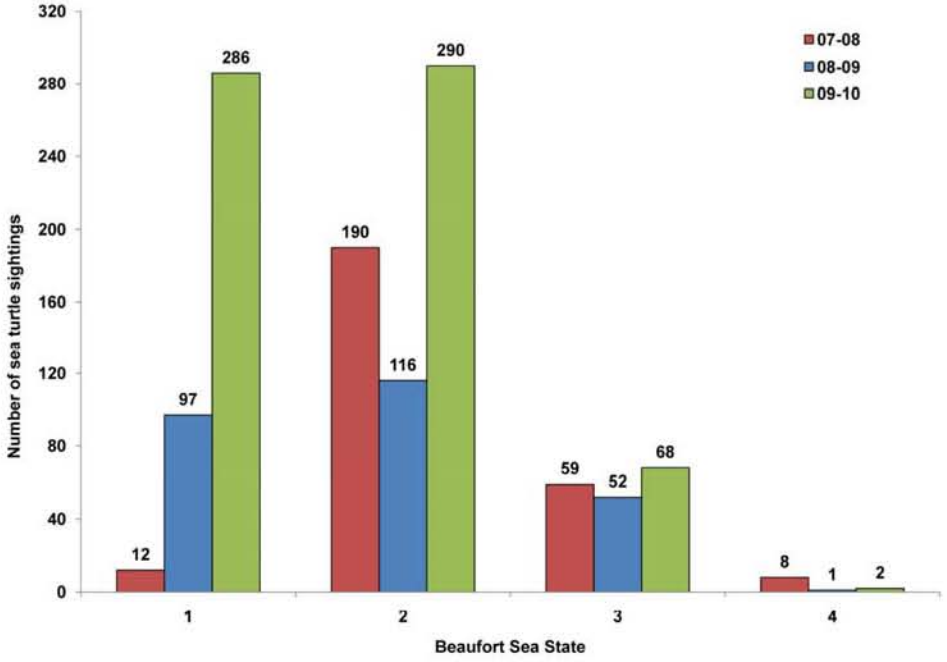


Figure Appendix 17a. Total number of sea turtle sightings by Beaufort Sea State in the proposed USWTR site in Onslow Bay, North Carolina during the July 2007 – June 2010 surveys.

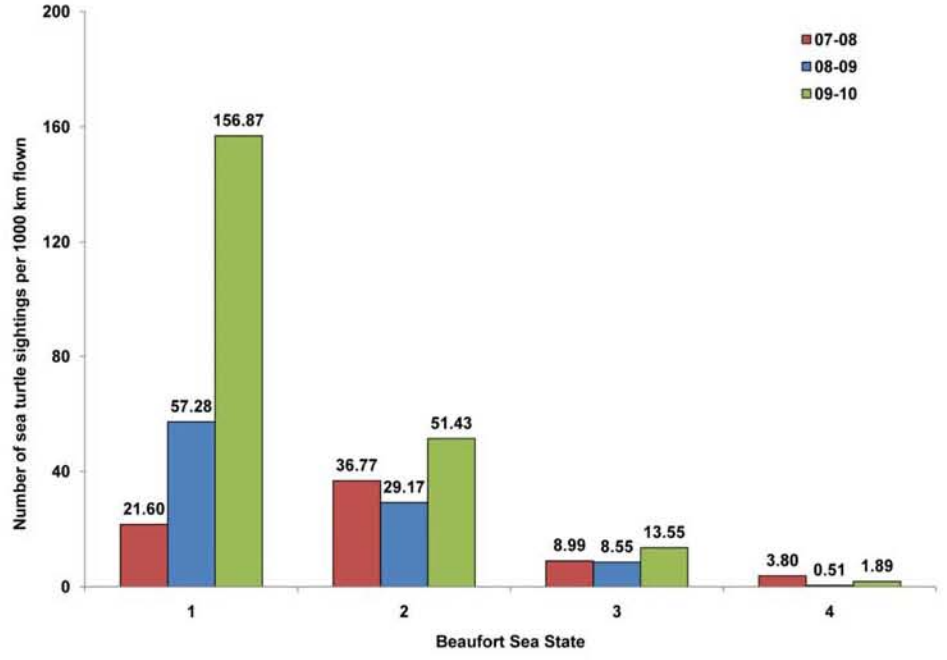


Figure Appendix 17b. Sea turtle sightings per 1000 km flown by Beaufort Sea State in the proposed USWTR site in Onslow Bay, North Carolina during the July 2007 – June 2010 surveys.

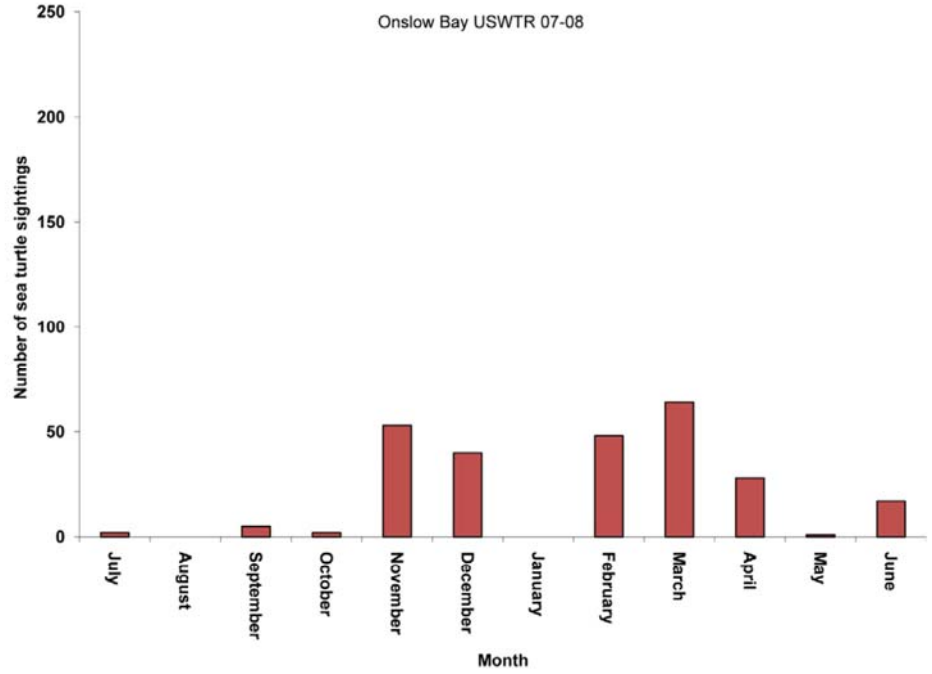


Figure Appendix 18a. Sea turtle sightings by month in the proposed USWTR site in Onslow Bay, North Carolina during the July 2007 – June 2008 surveys.

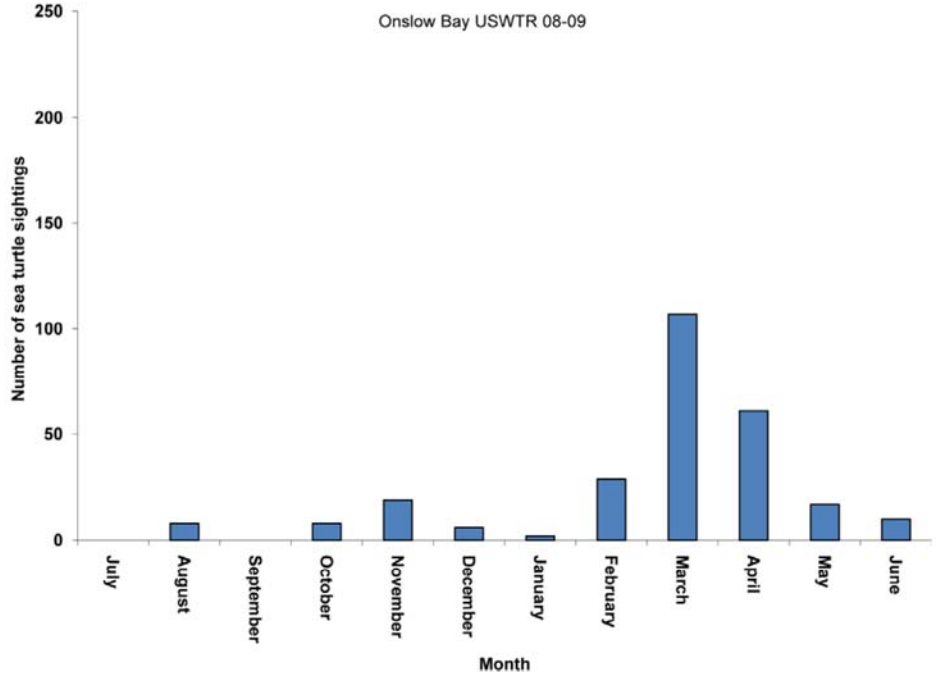


Figure Appendix 18b. Sea turtle sightings by month in the proposed USWTR site in Onslow Bay, North Carolina during the July 2008 – June 2009 surveys.

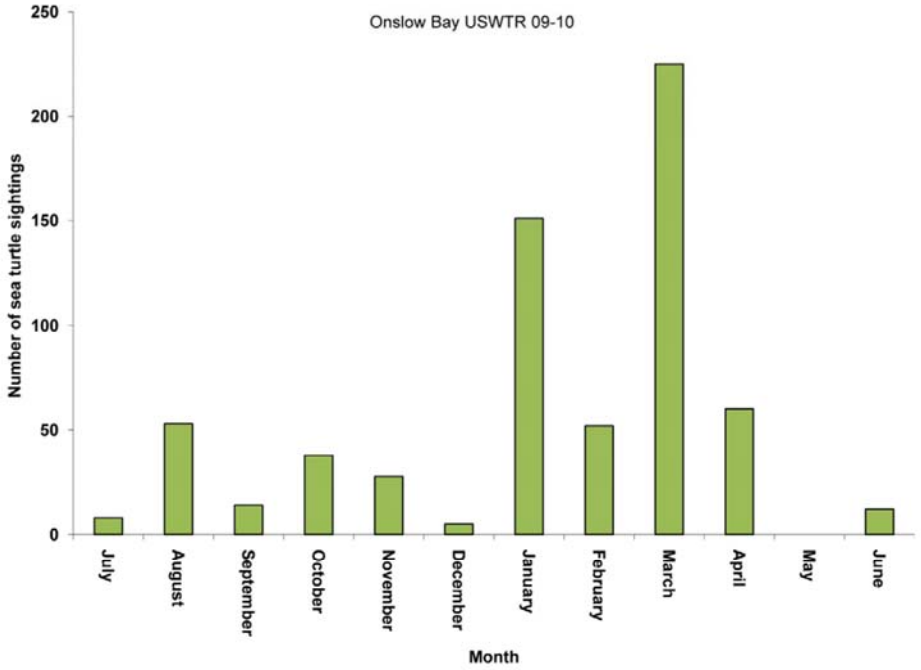


Figure Appendix 18c. Sea turtle sightings by month in the proposed USWTR site in Onslow Bay, North Carolina during the July 2009 – June 2010 surveys.

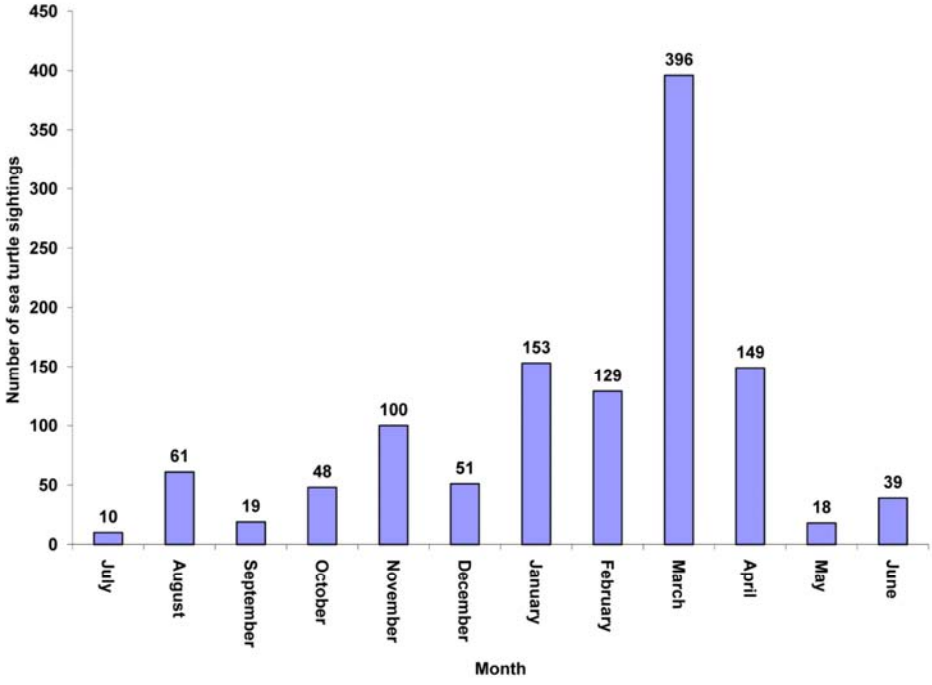


Figure Appendix 19. All sea turtle sightings by month in the proposed USWTR site in Onslow Bay, North Carolina during the July 2007 – June 2010 surveys.

USWTR AERIAL SURVEY DATA SHEET

Date:____________ **Observer Side:**__________ **GPS#:**___________ **Page**__ **of**___

Pilot/Co-Pilot________________ **Observers Left/Right:**_____________ **Hobbs:**__________________________

Time	Waypoint #	Event	Heading	Track #	Observer R / L	Visibility	BSS	Cloud	Glare L	Glare R	Vertical Angle	Horizontal degree	Sighting Cue	Species	Reliability	Min #	Max #	Best Est	Comments

Codes for Variables on USWTR Aerial Survey Data Sheet

Date: YYYYMMDD **Track#:** opportunistic track line=99

Event:

1.1 = On effort/on track
1.2 = Off effort

3.1 = Change in environmental conditions

10.0 = Opportunistic sighting(s)
PF = Preflight
XB = Cross Beach
WU = Wheels Up
WD = Wheels Down
TE = Transit Leg on Effort

2.0 = Sighting-breaking track/off effort (real time)
2.2 = Sighting of commercial fishing vessel
2.3 = Vessel sighting
2.4 = Sighting of marine mammal (real location)
2.41 = Location of Sighting Cue, No Animals sighted
2.42 = Break from sighting
2.7 = Sighting of sea turtle (real location)
2.8 = Sighting of large vessel (Military, commercial, etc.)
2.9 = Unidentified sighting, requires comments

Sighted by: 1= pilot 2= co-pilot 3= observer left side 4= observer right side

Confidence of cue
1 = definite
2 = probable
3 = possible/unsure

Visibility:
1 = clear to horizon
2 = half the distance to the horizon
3 = less than half the distance to the horizon

Sea State:
0 = slick, calm, mirror-like
1 = small waves
2 = whitecaps 0-33%, waves 1-2 feet
3 = whitecaps 33-50%, waves 2-3 feet
4 = whitecaps 50-65%, waves 3-5 feet
5 = whitecaps >65%, waves >5 feet
6 = too rough too survey

Sighting Cues:
1 = Blow
2 = Splash
3 = Body Part
4 = Breach
5 = Other (needs comments)

Cloud Cover:
01 = clear
02 = partly cloudy
03 = continuous layer of clouds
04 = rain
05 = haze
99 = other, requires comments

Vertical Angle is given in rough increments of 20 degrees with 1 being directly on the trackline and 4 being anything outside of survey wide to horizon

Horizontal Angle is given assuming the nose of the plane is 0 degrees and directly off the wing is 90 degrees – measurements are taken from 1-180 on each side of the plane.

Glare
0 = No glare 1 = 0-25 %
2 = 25 -50 % 3 = >50%

Appendix C

Species List for Aerial Surveys		
Common Name	**Scientific Name**	**Species Code**
Cetaceans		
North Atlantic right whale	*Eubalaena glacialis*	Egl
Minke whale	*Balaenoptera acutorostrata*	Bac
sei whale	*Balaenoptera borealis*	Bbo
fin whale	*Balaenoptera physalus*	Bph
Brydes whale	*Balaenoptera edeni*	Bed
humpback whale	*Megaptera novaeangliae*	Mno
unidentified balaenopterid	Family *Balaenopteridae*	BALA
sperm whale	*Physeter macrocephalus*	Pma
pygmy sperm whale	*Kogia breviceps*	Kbr
dwarf sperm whale	*Kogia sima*	Ksi
unidentified Kogia	*Kogia* spp.	KOGI
Northern bottlenose whale	*Hyperoodon ampullatus*	Ham
Cuvier's beaked whale	*Ziphius cavirostris*	Zca
Mesoplodon beaked whale	Genus *Mesoplodon*	MESO
unidentified beaked whale	Family *Ziphiidae*	ZIPH
harbor porpoise	*Phocoena phocoena*	Pph
killer whale	*Orcinus orca*	Oor
melon-headed whale	*Peponocephala electra*	Pel
pygmy killer whale	*Feresa attenuata*	Fat
false killer whale	*Pseudorca crassidens*	Pcr
Risso's dolphin	*Grampus griseus*	Ggr
long-finned pilot whale	*Globicephala melas*	Gme
short-finned pilot whale	*Globicephala macrorhynchus*	Gma
unidentified pilot whale	Genus *Globicephala*	GLOB
rough-toothed dolphin	*Steno bredanensis*	Sbr
Atlantic white-sided dolphin	*Lagenorhynchus acutus*	Lac
Fraser's dolphin	*Lagenodelphis hosei*	Lho
common dolphin	*Delphinus delphis*	Dde
bottlenose dolphin	*Tursiops truncatus*	Ttr
spotted dolphin	*Stenella frontalis*	Sfr
striped dolphin	*Stenella coeruleoalba*	Sco
spinner dolphin	*Stenella longirostris*	Scl
unidentified *Stenella*	Genus *Stenella*	STEN
unidentified delphinid	Family *Delphinidae*	DELP
unidentified cetacean		CETA
Pinnipeds		
gray seal	*Halichoerus grypus*	Hgr
harbor seal	*Phoca vitulina*	Pvi
harp seal	*Phoca groenlandica*	Pgr
hooded seal	*Cystophora cristata*	Ccr
unidentified phocid	Family *Phocidae*	PHOC
Sea Turtles		
loggerhead	*Caretta caretta*	Cca
leatherback	*Dermochelys coriacea*	Dco
green	*Chelonia mydas*	Cmy
Kemp's ridley	*Lepidochelys kempii*	Lke
hawksbill	*Eretmochelys imbricata*	Eim
unidentified sea turtle		TURT
Other interesting sightings		
basking shark	*Cetorhinus maximus*	Cma
manta ray	*Manta birostris*	Mbi
ocean sunfish	*Mola mola*	Mmo
spotted eagle-ray	*Aetobatus narinari*	Ana
Unidentified elasmobranch		CHON
Unidentified marine vertebrate		VERT

Date:_____ - UNCW USWTR Aerial Survey - Sighting #_____

Sighting Data Sheet

Initial Sighting on Track

Time:_____ WP:_____ Sighting Cue:_____

Confidence: 1 2 3 4 Vertical Angle: 1 2 3 4 Horizontal Bearing in Degrees:_____

Observer:_____ Observer Side: L R

Beaufort Sea State: _____ Track Line: _____

Actual Time and Position of Sighting

Time: _____ WP #:_____

Species: _____ Numbers: (Low/ High/ Best):____/____/____

Photographer:_____ Frame Numbers: _____ to _____ Spacer:_____

Final Time and Position of Sighting

Time: _____ WP#: _____

Behavior and Additional Comments:

Complete Cetacean Sighting Summaries.

Compiled here are all sighting summaries for cetaceans seen during the July 2009 - June 2010 USWTR Onslow Bay aerial surveys. Each of the 86 on effort sightings is represented along with nine additional off effort sightings. Seven of the off effort sightings occurred on the off shore end of the range while transiting between tracklines. One sighting, which was on trackline 1, was deemed off effort because it was reported by the pilot. Finally, a summary was included for the right whale sighting made on November 8, 2009. This sighting was made 3.4 miles off the coast of Fort Fisher (*i.e.* far from the USWTR site) and is included here because of its importance to the conservation of the species.

Monday, August 17, 2009 Sighting # 1

Initial sighting on Track

Time: 15:27 WP#: 6 Lat: 34.164764 Long: 76.467999
Vertical Angle: 3 Horizontal Bearing in Degrees: 90 Sighting Cue: Splash
On/Off Effort: On Trackline: 10 Beaufort Sea State: 2
Observer: Erin Observer side: Right

Actual Time and Position of Sighting

Time: 15:27 WP#: 7 Lat: 34.160575 Long: 76.468974
Species: *Stenella frontalis* Numbers (Low/High/Best): 30 / 40 / 35
Features used in Species ID: Alternating light and dark patterning along body, multiple animals with spots present on sides. Prominent shoulder blaze terminating near dorsal fin.
Representative images used for Species ID: 9692, 9699, 9702, 9711
Photographer: Erin Frame numbers: 9683 to 9727 Spacer: 9728
Calculated distance from Trackline: 0.4744 km

Final Time and Position of Sighting

Time: 15:37 WP#: 8 Lat: 34.159285 Long: 76.469067
Calculated Distance Traveled: 0.1437 km

Behavior and Additional Comments

Multiple sub-groups from single animals to groups of 5-6. Lots of distance between all the groups. Animals stayed just below the surface for much of the sighting with multiple pairs swimming belly to belly and tactile interactions. Alternating light and dark pattern along the animals body.

Tuesday, August 18, 2009 Sighting # 1

Initial sighting on Track

Time: 09:33 WP#: 5 Lat: 33.620025 Long: -76.938710
Vertical Angle: 1 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: Off Trackline: 1 Beaufort Sea State: 1
Observer: Ryan Observer side: Right

Actual Time and Position of Sighting

Time: 09:37 WP#: 6 Lat: 33.620708 Long: -76.942240
Species: *Tursiops truncatus* Numbers (Low/High/Best): 2/2/2
Features used in Species ID: Robust body appearance, uniform grey coloration along animals sides. Overall robust body appearance and a broad dorsal fin.
Representative images used for Species ID: 9. 17, 18, 19, and 26
Photographer: Ryan Frame numbers: 1 to 29 Spacer: 30
Calculated distance from Trackline: 0.3 km

Final Time and Position of Sighting

Time: 09:42 WP#: 7 Lat: 33.624153 Long: -76.944483
Calculated Distance Traveled: 0.4 km

Behavior and Additional Comments

Two individuals traveling at the surface. The animals had regular surfacing. Animals had uniform gray coloration.

Tuesday, August 18, 2009 Sighting # 2

Initial sighting on Track

Time: 09:56 WP#: 12 Lat: 33.362290 Long: -76.604256
Vertical Angle: 2 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Trackline: 1 Beaufort Sea State: 2
Observer: Ryan Observer side: Right

Actual Time and Position of Sighting

Time: 09:57 WP#: 13 Lat: 33.358769 Long: -76.610723
Species: *Grampus griseus* Numbers (Low/High/Best): 6/6/6
Features used in Species ID: Varied color pattern along lateral surface of animals consistent with scarring. Tall dorsal fin and long pectoral fins. Melon with clear central crease.
Representative images used for Species ID: 38, 73, 74, 76, and 83
Photographer: Ryan Frame numbers: 31 to 115 Spacer: 116
Calculated distance from Trackline: 0.7 km

Final Time and Position of Sighting

Time: 10:04 WP#: 14 Lat: 33.360732 Long: -76.614702
Calculated Distance Traveled: 0.4 km

Behavior and Additional Comments

Animals were traveling slowly just below the surface. Animals were traveling Southwest. They were lighter in color. Showed no avoidance behavior.

Tuesday, August 18, 2009 Sighting # 3

Initial sighting on Track

Time: 10:14 WP#: 18 Lat: 33.510644 Long: -76.683584
Vertical Angle: 4 Horizontal Bearing in Degrees: 90 Sighting Cue: splash
On/Off Effort: On Trackline: 2 Beaufort Sea State: 2
Observer: Erin Observer side: Left

Actual Time and Position of Sighting

Time: 10:15 WP#: 19 Lat: 33.504820 Long: -76.674391
Species: *Tursiops truncatus* Numbers (Low/High/Best): 25/40/35
Features used in Species ID: Robust body with a uniform grey coloration to animals body. Shoulder blaze trailing to behind the dorsal fin.
Representative images used for Species ID: 118, 133, 143, and 144
Photographer: Ryan Frame numbers: 117 to 154 Spacer: 155
Calculated distance from Trackline: 1.1 km

Final Time and Position of Sighting

Time: 10:19 WP#: 20 Lat: 33.503596 Long: -76.681915
Calculated Distance Traveled: 0.7 km

Behavior and Additional Comments

Groups ranging from 1 to 9 individuals. Animals were spread out and traveling southwest. Most of the time animals were traveling just below the surface with some doing deeper dives.

Tuesday, August 18, 2009 Sighting # 4

Initial sighting on Track

Time: 10:58 WP#: 32 Lat: 33.482176 Long: -76.495909
Vertical Angle: 1 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Trackline: 3 Beaufort Sea State: 2
Observer: Erin Observer side: Left

Actual Time and Position of Sighting

Time: 10:59 WP#: 33 Lat: 33.493955 Long: -76.498147
Species: *Globicephala macrorhynchus* Numbers (Low/High/Best): 30/50/40
Features used in Species ID: Dark bodied, large dorsal fin a third of the way down the body. Blunt head.
Representative images used for Species ID: 204, 219, 220, 247, 251, and 258
Photographer: Ryan Frame numbers: 156 to 258 Spacer: 259
Calculated distance from Trackline: 1.3 km

Final Time and Position of Sighting

Time: 11:09 WP#: 34 Lat: 33.490847 Long: -76.505077
Calculated Distance Traveled: 0.7 km

Behavior and Additional Comments

Three large groups, scattered and logging at the surface. Were not moving an any direction. No avoidance behavior. Calfs present.

Tuesday, August 18, 2009 Sighting # 5

Initial sighting on Track

Time: 11:19 WP#: 38 Lat: 33.616677 Long: -76.542725
Vertical Angle: 1 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Trackline: 4 Beaufort Sea State: 2
Observer: Erin Observer side: Left

Actual Time and Position of Sighting

Time: 11:22 WP#: 39 Lat: 33.611807 Long: -76.541171
Species: *Tursiops truncatus* Numbers (Low/High/Best): 2/2/2
Features used in Species ID: Uniform grey coloration and shoulder blaze to behind dorsal fin.

Representative images used for Species ID: 260 and 269
Photographer: Ryan Frame numbers: 260 to 283 Spacer: 284
Calculated distance from Trackline: 0.6 km

Final Time and Position of Sighting

Time: 11:26 WP#: 40 Lat: 33.620225 Long: -76.548453
Calculated Distance Traveled: 1.2 km

Behavior and Additional Comments

Animals traveling slowly to the west, just below the surface. Animals had a light peduncle region.

Tuesday, August 18, 2009 Sighting # 6

Initial sighting on Track

Time: 11:39 WP#: 47 Lat: 33.786418 Long: -76.764197
Vertical Angle: 1 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Trackline: 4 Beaufort Sea State: 1
Observer: Ryan Observer side: Right

Actual Time and Position of Sighting

Time: 11:40 WP#: 48 Lat: 33.784330 Long: -76.761268
Species: *Tursiops truncatus* Numbers (Low/High/Best): 3/3/3
Features used in Species ID: Uniform grey coloration, broad pectoral fins. There is a clear crease between the melon and rostrum.

Representative images used for Species ID: 300, 301, and 318
Photographer: Ryan Frame numbers: 285 to 322 Spacer: 323
Calculated distance from Trackline: 0.4 km

Final Time and Position of Sighting

Time: 11:43 WP#: 49 Lat: 33.777362 Long: -76.759709
Calculated Distance Traveled: 0.8 km

Behavior and Additional Comments

Animals had stocky bodies and large pectorals. Animals were traveling slowly just under the surface.

Tuesday, August 18, 2009 Sighting # 7

Initial sighting on Track

Time: 11:48 WP#: 52 Lat: 33.884851 Long: -76.894934
Vertical Angle: 1 Horizontal Bearing in Degrees: 2 Sighting Cue: Splash
On/Off Effort: On Trackline: 4 Beaufort Sea State: 1
Observer: Ryan Observer side: Right

Actual Time and Position of Sighting

Time: 11:50 WP#: 53 Lat: 33.886683 Long: -76.898185
Species: *Stenella frontalis* Numbers (Low/High/Best): 2/2/2
Features used in Species ID: Alternating light and dark pattern along the side of animals body. Clear white tip to rostrum. Clear light and dark line between dorsal and ventral surface.
Representative images used for Species ID: 326, 328, 334, and 338
Photographer: Ryan Frame numbers: 324 to 358 Spacer: 359
Calculated distance from Trackline: 0.4 km

Final Time and Position of Sighting

Time: 11:58 WP#: 54 Lat: 33.891388 Long: -76.891678
Calculated Distance Traveled: 0.8 km

Behavior and Additional Comments

A first the animals were diving deep then started surface swimming. Animals were traveling north and swimming belly up at times.

Tuesday, August 18, 2009 Sighting # 8

Initial sighting on Track

Time: 14:18 WP#: 63 Lat: 33.764864 Long: -76.601318
Vertical Angle: 3 Horizontal Bearing in Degrees: 60 Sighting Cue: Splash
On/Off Effort: On Trackline: 5 Beaufort Sea State: 1
Observer: Erin Observer side: Left

Actual Time and Position of Sighting

Time: 14:21 WP#: 64 Lat: 33.761505 Long: -76.599899
Species: *Stenella frontalis* Numbers (Low/High/Best): 50/70/65
Features used in Species ID: clear alternating light and dark coloration along animals body with clear spotting patterns present. White tip to the rostrum.
Representative images used for Species ID: 363, 373, 380, and 395
Photographer: Ryan Frame numbers: 360 to 412 Spacer: 413
Calculated distance from Trackline: 0.4 km

Final Time and Position of Sighting

Time: 14:27 WP#: 65 Lat: 33.764612 Long: -76.587170
Calculated Distance Traveled: 1.2 km

Behavior and Additional Comments

Large group of animals, space out. Animals were logging at the surface or just below. They had a leisurely travel moving west. Animals seemed to be playing and showing bellies.

Tuesday, August 18, 2009 Sighting # 9

Initial sighting on Track

Time: 15:00 WP#: 74 Lat: 34.066408 Long: -76.874048
Vertical Angle: 2 Horizontal Bearing in Degrees: 45 Sighting Cue: Body
On/Off Effort: On Trackline: 6 Beaufort Sea State: 1
Observer: Ryan Observer side: Right

Actual Time and Position of Sighting

Time: 15:02 WP#: 45 Lat: 34.070793 Long: -76.872859
Species: *Stenella frontalis* Numbers (Low/High/Best): 7/15/9
Features used in Species ID: Alternating light and dark body coloration with clear spotting pattern present. White tip to rostrum.
Representative images used for Species ID: 455 and 457
Photographer: Ryan Frame numbers: 414 to 458 Spacer: 459
Calculated distance from Trackline: 0.5 km

Final Time and Position of Sighting

Time: 15:02 WP#: 76 Lat: 34.068945 Long: -76.869925
Calculated Distance Traveled: 0.3 km

Behavior and Additional Comments

Animals were slowly traveling west. Most individuals were logging at the surface while some were deeper diving.

Wednesday, August 19, 2009 Sighting # 1

Initial sighting on Track

Time: 10:51 WP#: 19 Lat: 33.802839 Long: -76.92295
Vertical Angle: 1 Horizontal Bearing in Degrees: 100 Sighting Cue: Body
On/Off Effort: On Trackline: 3 Beaufort Sea State: 1
Observer: Erin Observer side: Right

Actual Time and Position of Sighting

Time: 11:04 WP#: 20 Lat: 33.811234 Long: -76.916236
Species: *Tursiops truncatus* Numbers (Low/High/Best): 3/3/3
Features used in Species ID: Uniform grey coloration along animals body, robust body.

Representative images used for Species ID: 194, 203, 210, and 211
Photographer: Erin Frame numbers: 189 to 211 Spacer: 212
Calculated distance from Trackline: 1.1 km

Final Time and Position of Sighting

Time: 11:15 WP#: 21 Lat: 33.810471 Long: -76.902408
Calculated Distance Traveled: 1.3 km

Behavior and Additional Comments

Initial observation of a single animal traveling across the trackline. Animal was hanging at the surface and surfacing frequently. Another 2 animals traveling slowly, close to one another were seen after circling. Animals showed possible avoidance by spending an increased amount of time below the surface traveling at an increased rate of speed.

Wednesday, August 19, 2009 Sighting # 2

Initial sighting on Track

Time: 11:27 WP#: 27 Lat: 33.821176 Long: -77.069429
Vertical Angle: 3 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Trackline: 2 Beaufort Sea State: 1
Observer: Erin Observer side: Right

Actual Time and Position of Sighting

Time: 11:28 WP#: 27 Lat: 33.815988 Long: -77.078934
Species: *Stenella frontalis* Numbers (Low/High/Best): 3/4/4
Features used in Species ID: Alternating light and dark patterning along animals body with spots present. White tip to the rostrum.
Representative images used for Species ID: 214, 226, 227, and 237
Photographer: Erin Frame numbers: 213 to 247 Spacer: 248
Calculated distance from Trackline: 1.1 km

Final Time and Position of Sighting

Time: 11:41 WP#: 28 Lat: 33.824734 Long: -77.070231
Calculated Distance Traveled: 1.3 km

Behavior and Additional Comments

Animals in a disperse group hanging at the surface.

Wednesday, August 19, 2009 Sighting # 3

Initial sighting on Track

Time: 11:59 WP#: 30 Lat: 33.447656 Long: -76.593333
Vertical Angle: 3 Horizontal Bearing in Degrees: 90 Sighting Cue: Splash
On/Off Effort: On Trackline: 2 Beaufort Sea State: 1
Observer: Erin Observer side: Right

Actual Time and Position of Sighting

Time: 12:00 WP#: 32 Lat: 33.449196 Long: -76.601237
Species: *Tursiops truncatus* Numbers (Low/High/Best): 8/8/8
Features used in Species ID: Uniform grey body coloration with a shoulder blaze ending behind dorsal fin. White caudal peduncle patch.
Representative images used for Species ID: 255, 257, 265, and 294
Photographer: Erin Frame numbers: 249 to 301 Spacer: 302
Calculated distance from Trackline: 0.8 km

Final Time and Position of Sighting

Time: 12:11 WP#: 33 Lat: 33.445177 Long: -76.604646
Calculated Distance Traveled: 0.5 km

Behavior and Additional Comments

Initially six animals seen traveling in a horizontal line. All animals stayed densely packed throughout the sighting. Additional animals joined group during our observations. All animals with robust body and uniform grey coloration except for lighter grey peduncle region.

Wednesday, August 19, 2009 Sighting # 4

Initial sighting on Track

Time: 12:15 WP#: 33 Lat: 33.385048 Long: -76.542506
Vertical Angle: 2 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: Off Trackline: between 1 & 2 Beaufort Sea State: 1
Observer: Erin Observer side: Right

Actual Time and Position of Sighting

Time: 12:20 WP#: 37 Lat: 33.385048 Long: -76.537104
Species: *Globicephala macrorhynchus* Numbers (Low/High/Best): 6/6/6
Features used in Species ID: Black body coloration, large blunt head, dorsal fin placed ~1/3 of way down animals body.
Representative images used for Species ID: 304, 309, 312, 314, and 326
Photographer: Erin Frame numbers: 303 to 328 Spacer: 329
Calculated distance from Trackline: 0.5 km

Final Time and Position of Sighting

Time: 12:26 WP#: 38 Lat: 33.389091 Long: -76.518081
Calculated Distance Traveled: 1.8 km

Behavior and Additional Comments

Slow travel to the entire group with animals surfacing frequently. Both adults and calves were observed

Saturday, September 12, 2009 Sighting # 1

Initial sighting on Track

Time: 8:59 WP#: 6 Lat: 33.484843 Long: -76.769353
Vertical Angle: 3 Horizontal Bearing in Degrees: 100 Sighting Cue: Body
On/Off Effort: On Trackline: 1 Beaufort Sea State: 2
Observer: Erin Observer side: Left

Actual Time and Position of Sighting

Time: 9:08 WP#: 7 Lat: 33.494854 Long: -76.785000
Species: *Unidentified Delphinid* Numbers (Low/High/Best): 3/3/3
Features used in Species ID: Animals coloration had traits of Tursiops or young Stenella frontalis because of limited photos due to animals evasive behavior sighting is listed as Unidentified
Representative images used for Species ID: 331, 333
Photographer: Ryan Frame numbers: 330 to 336 Spacer: 337
Calculated distance from Trackline: 1.829 km

Final Time and Position of Sighting

Time: 9:19 WP#: 8 Lat: 33.493120 Long: -76.792201
Calculated Distance Traveled: 0.695 km

Behavior and Additional Comments

Swimming close together, traveling at a fast pace just below the surface, heading NW. Difficult to photograph. May be showing signs of avoidance.

Saturday, September 12, 2009 Sighting # 2

Initial sighting on Track

Time: 9:49 WP#: 15 Lat: 33.817175 Long: -77.065780
Vertical Angle: 2 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Trackline: 2 Beaufort Sea State: 2
Observer: Erin Observer side: Left

Actual Time and Position of Sighting

Time: 9:51 WP#: 16 Lat: 33.811053 Long: -77.063150
Species: *Stenella frontalis* Numbers (Low/High/Best): 7/7/7
Features used in Species ID: Alternating light and dark pattern down the body.
Representative images used for Species ID: 338, 370 - 372
Photographer: Ryan Frame numbers: 338 to 409 Spacer: 410
Calculated distance from Trackline: 0.7228 km

Final Time and Position of Sighting

Time: 9:59 WP#: 17 Lat: 33.815577 Long: -77.065084
Calculated Distance Traveled: 0.5338

Behavior and Additional Comments

Moving slowly on the surface or just below. Animals were traveling in a NE direction. Three animals were swimming close together and one calf was present in the group.

Saturday, September 12, 2009 Sighting # 3

Initial sighting on Track

Time: 10:49 WP#: 29 Lat: 33.936691 Long: -76.961680
Vertical Angle: 3 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Trackline: 4 Beaufort Sea State: 2
Observer: Ryan Observer side: Right

Actual Time and Position of Sighting

Time: 10:50 WP#: 30 Lat: 33.943367 Long: -76.958318
Species: *Stenella frontalis* Numbers (Low/High/Best): 10/14/12
Features used in Species ID: Alternating light and dark pattern down the body. Rostrum has white tip.
Representative images used for Species ID: 430, 442
Photographer: Ryan Frame numbers: 411 to 473 Spacer: 474
Calculated distance from Trackline: 0.8045 km

Final Time and Position of Sighting

Time: 10:55 WP#: 31 Lat: 33.941145 Long: -76.956955
Calculated Distance Traveled: 0.2772 km

Behavior and Additional Comments

Animals displayed avoidance behavior. As soon as we got over them, they all scattered and dove deep. They surface in a tight group not heading any particular direction.

Saturday, September 12, 2009 Sighting # 4

Initial sighting on Track

Time: 11:28 WP#: 38 Lat: 33.684126 Long: -76.359407
Vertical Angle: 1 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Trackline: 6 Beaufort Sea State: 2
Observer: Erin Observer side: Left

Actual Time and Position of Sighting

Time: 11:29 WP#: 39 Lat: 33.681102 Long: -76.350511
Species: *Tursiops truncatus* Numbers (Low/High/Best): 1/1/1
Features used in Species ID: Robust animal, grey color throughout, with a light colored peduncle
Representative images used for Species ID: 476, 487, 497, 501
Photographer: Ryan Frame numbers: 475 to 506 Spacer: 507
Calculated distance from Trackline: 0.8892 km

Final Time and Position of Sighting

Time: 11:31 WP#: 40 Lat: 33.678555 Long: -76.355844
Calculated Distance Traveled: 0.569 km

Behavior and Additional Comments

Traveling at the surface or just below. Jumping out of the water occasionally. No avoidance behavior was noticed.

Saturday, September 12, 2009 Sighting # 5

Initial sighting on Track

Time: 11:34 WP#: 42 Lat: 33.716202 Long: -76.411922
Vertical Angle: 3 Horizontal Bearing in Degrees: 90 Sighting Cue: Splash
On/Off Effort: On Trackline: 6 Beaufort Sea State: 2
Observer: Erin Observer side: Left

Actual Time and Position of Sighting

Time: 11:36 WP#: 43 Lat: 33.705709 Long: -76.415980
Species: *Tursiops truncatus* Numbers (Low/High/Best): 3/3/3
Features used in Species ID: Robust animals, grey color throughout with a light colored peduncle

Representative images used for Species ID: 521, 531
Photographer: Ryan Frame numbers: 508 to 543 Spacer: 544
Calculated distance from Trackline: 1.226 km

Final Time and Position of Sighting

Time: 11:40 WP#: 44 Lat: 33.700694 Long: -76.417541
Calculated Distance Traveled: 0.576 km

Behavior and Additional Comments

Logging at the surface and splashing. Spread out and moving SW at a medium pace.

Saturday, September 12, 2009 Sighting # 6

Initial sighting on Track

Time: 14:05 WP#: 56 Lat: 34.166207 Long: -76.471789
Vertical Angle: 1 Horizontal Bearing in Degrees: 100 Sighting Cue: Body
On/Off Effort: On Trackline: 10 Beaufort Sea State: 2
Observer: Erin Observer side: Left

Actual Time and Position of Sighting

Time: 14:08 WP#: 57 Lat: 34.173510 Long: -76.478967
Species: *Stenella frontalis* Numbers (Low/High/Best): 6/14/14
Features used in Species ID: Alternating light and dark pattern down the body. White tip on rostrum.

Representative images used for Species ID: 587, 593, 597, 605, 617, 629
Photographer: Ryan Frame numbers: 545 - 583 and 585 - 634 Spacer: 584 to 635
Calculated distance from Trackline: 1.047 km

Final Time and Position of Sighting

Time: 14:14 WP#: 58 Lat: 34.172885 Long: -76.472194
Calculated Distance Traveled: 0.627 km

Behavior and Additional Comments

Logging at the surface not moving any given direction, mostly spread out. There were two groups one with 6 animals and one with 8 animals.

Saturday, September 12, 2009 Sighting # 7

Initial sighting on Track

Time: 15:01 WP#: 59 Lat: 34.154594 Long: -76.720716
Vertical Angle: 2 Horizontal Bearing in Degrees: 110 Sighting Cue: Body
On/Off Effort: On Trackline: 8 Beaufort Sea State: 2
Observer: Erin Observer side: Left

Actual Time and Position of Sighting

Time: 15:03 WP#: 70 Lat: 34.164627 Long: -76.722763
Species: *Stenella frontalis* Numbers (Low/High/Best): 4/4/4
Features used in Species ID: Alternating light and dark pattern down the body. White tip to the rostrum
Representative images used for Species ID: 636, 637, 641, 644, 645
Photographer: Ryan Frame numbers: 636 to 660 Spacer: 661
Calculated distance from Trackline: 1.131 km

Final Time and Position of Sighting

Time: 15:09 WP#: 71 Lat: 34.155826 Long: -76.723110
Calculated Distance Traveled: 0.9791 km

Behavior and Additional Comments

All animals were swimming close together, traveling slowly to the West. Some animals were doing some deeper dives. One calf was present.

Saturday, September 12, 2009 Sighting # 8

Initial sighting on Track

Time: 15:12 WP#: 74 Lat: 34.105455 Long: -76.649559
Vertical Angle: 2 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Trackline: 8 Beaufort Sea State: 2
Observer: Erin Observer side: Left

Actual Time and Position of Sighting

Time: 15:14 WP#: 75 Lat: 34.110018 Long: -76.648676
Species: *Stenella frontalis* Numbers (Low/High/Best): 1/4/4
Features used in Species ID: Alternating light and dark pattern down the body. White tip on the rostrum
Representative images used for Species ID: 669, 685, 686
Photographer: Ryan Frame numbers: 662 to 690 Spacer: 691
Calculated distance from Trackline: 5.139 km

Final Time and Position of Sighting

Time: 15:19 WP#: 76 Lat: 34.107573 Long: -76.649798
Calculated Distance Traveled: 0.2908 km

Behavior and Additional Comments

Some were logging at the surface with some doing deeper dives. Animals were spaced out and slowly moving in a NE direction.

Saturday, September 12, 2009 Sighting # 9

Initial sighting on Track

Time: 15:34 WP#: 79 Lat: 33.783156 Long: -76.227563
Vertical Angle: 3 Horizontal Bearing in Degrees: 45 Sighting Cue: Body
On/Off Effort: On Trackline: 8 Beaufort Sea State: 2
Observer: Erin Observer side: Left

Actual Time and Position of Sighting

Time: 15:35 WP#: 80 Lat: 33.788579 Long: -76.219790
Species: *Tursiops truncatus* Numbers (Low/High/Best): 15/19/19
Features used in Species ID: Robust animal with uniform grey color throughout. Light color on peduncle
Representative images used for Species ID: 716, 717, 722, 730, 733, 736, 741, 754
Photographer: Ryan Frame numbers: 692 to 765 Spacer: 766
Calculated distance from Trackline: 0.9379 km

Final Time and Position of Sighting

Time: 15:38 WP#: 81 Lat: 33.788291 Long: -76.223547
Calculated Distance Traveled: 0.3487 km

Behavior and Additional Comments

Animals were surface swimming and traveling slowly towards the SW. They were grouped pretty close together with 5 calves present.

Wednesday, September 30, 2009 Sighting # 1

Initial sighting on Track

Time: 14:07 WP#: 23 Lat: 33.880462 Long: -76.231674
Vertical Angle: 2 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Trackline: 9 Beaufort Sea State: 3
Observer: Ryan Observer side: Left

Actual Time and Position of Sighting

Time: 14:11 WP#: 24 Lat: 33.880390 Long: -76.242362
Species: *Tursiops truncatus* Numbers (Low/High/Best): 40/45/43
Features used in Species ID: Large robust animals, uniform grey color throughout.

Representative images used for Species ID: 1466, 1472, 1475, 1495, 1506
Photographer: Erin Frame numbers: 1455-1509 Spacer: 1510
Calculated distance from Trackline: 0.9867 km

Final Time and Position of Sighting

Time: 14:26 WP#: 25 Lat: 33.875912 Long: -76.250629
Calculated Distance Traveled: 0.9113 km

Behavior and Additional Comments

Initial sighting of 5 animals, upon resight large group of 30+ animals with slow travel near the surface. A few tight bunches of animals but most with a fair amount of space between them. Some calves present. Some doing tail slaps. Some spending time on deeper dives out of sight.

Thursday, October 1, 2009 Sighting # 1

Initial sighting on Track

Time: 8:41 WP#: 5 Lat: 33.736759 Long: -76.566984
Vertical Angle: 2 Horizontal Bearing in Degrees: 100 Sighting Cue: Splash
On/Off Effort: On Trackline: 5 Beaufort Sea State: 2
Observer: Erin Observer side: Right

Actual Time and Position of Sighting

Time: 8:42 WP#: 6 Lat: 33.739176 Long: -76.572540
Species: *Tursiops truncatus* Numbers (Low/High/Best): 2/4/4
Features used in Species ID: Robust animal with uniform grey color throughout. Light color on peduncles
Representative images used for Species ID: 1512, 1523, 1535, 1536, 1540
Photographer: Erin Frame numbers: 1511 to 1543 Spacer: 1544
Calculated distance from Trackline: 0.5798 km

Final Time and Position of Sighting

Time: 8:53 WP#: 7 Lat: 33.741642 Long: -76.598047
Calculated Distance Traveled: 2.374 km

Behavior and Additional Comments

Two animals traveling close together at a good rate of speed, just below the surface and creating large splashes when they surface. Frequent surfacing. After circling two other animal appeared far from pair. Other pair began to spread out. One calf present.

Thursday, October 1, 2009 Sighting # 2

Initial sighting on Track

Time: 8:54 WP#: 9 Lat: 33.724178 Long: -76.553179
Vertical Angle: 3 Horizontal Bearing in Degrees: 110 Sighting Cue: Splash
On/Off Effort: On Trackline: 5 Beaufort Sea State: 2
Observer: Ryan Observer side: Left

Actual Time and Position of Sighting

Time: 8:56 WP#: 10 Lat: 33.724444 Long: -76.555044
Species: *Tursiops truncatus* Numbers (Low/High/Best): 8/9/8
Features used in Species ID: Robust animals with uniform grey color throughout, light color peduncle
Representative images used for Species ID: 1545, 1562, 1572, 1580
Photographer: Erin Frame numbers: 1545 to 1586 Spacer: 1587
Calculated distance from Trackline: 0.175 km

Final Time and Position of Sighting

Time: 9:03 WP#: 11 Lat: 33.725550 Long: -76.556218
Calculated Distance Traveled: 0.1641 km

Behavior and Additional Comments

Group of 8 animals milling at surface causing some disturbance. Some diving and showing bellies and then surfacing again. Horizontal line of slow moving animals then bunching.

Thursday, October 1, 2009 Sighting # 3

Initial sighting on Track

Time: 9:44 WP#: 22 Lat: 34.081511 Long: -76.760356
Vertical Angle: 3 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Trackline: 7 Beaufort Sea State: 3
Observer: Erin Observer side: Right

Actual Time and Position of Sighting

Time: 9:45 WP#: 23 Lat: 34.076573 Long: -76.766611
Species: *Stenella frontalis* Numbers (Low/High/Best): 16/22/20
Features used in Species ID: Animals alternating color patter light and dark down body. White tip on rostrum
Representative images used for Species ID: 1626, 1628, 1634, 1637
Photographer: Erin Frame numbers: 1588 to 1665 Spacer: 1666
Calculated distance from Trackline: 0.7958 km

Final Time and Position of Sighting

Time: 9:45 WP#: 24 Lat: 34.076655 Long: -76.763090
Calculated Distance Traveled: 0.3244 km

Behavior and Additional Comments

Group swimming in pairs at a moderate pace just below the surface. "Easy" regular surfacing. Calfs present.

Thursday, October 1, 2009 Sighting # 4

Initial sighting on Track

Time: 10:12 WP#: 33 Lat: 33.824397 Long: -76.415549
Vertical Angle: 3 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Trackline: 7 Beaufort Sea State:
Observer: Ryan Observer side: Left

Actual Time and Position of Sighting

Time: 10:14 WP#: 34 Lat: 33.827829 Long: -76.418514
Species: *Tursiops truncatus* Numbers (Low/High/Best): 15/15/15
Features used in Species ID: Robust animals with uniform grey color throughout. Light color on peduncle.
Representative images used for Species ID: 1670, 1674, 1687, 1694, 1695, 1697, 1708
Photographer: Erin Frame numbers: 1667 to 1728 Spacer: 1729
Calculated distance from Trackline: 0.4697 km

Final Time and Position of Sighting

Time: 1018 WP#: 35 Lat: 33.822314 Long: -76.423457
Calculated Distance Traveled: 0.7646 km

Behavior and Additional Comments

Well spaced group some in bunches and others as singles. Slow travel close to surface, surfacing regularly. Calves present. Did deeper dive as a group while circling.

Thursday, October 1, 2009 Sighting # 5

Initial sighting on Track

Time: 10:23 WP#: 37 Lat: 33.745514 Long: -76.311765
Vertical Angle: 2 Horizontal Bearing in Degrees: 60 Sighting Cue: Body
On/Off Effort: On Trackline: 7 Beaufort Sea State: 2
Observer: Erin Observer side: Right

Actual Time and Position of Sighting

Time: 10:24 WP#: 38 Lat: 33.740108 Long: -76.312358
Species: *Tursiops truncatus* Numbers (Low/High/Best): 6/6/6
Features used in Species ID: Robust animals with uniform grey color throughout. Light color on peduncle.
Representative images used for Species ID: 1738, 1746
Photographer: Erin Frame numbers: 1730 to 1759 Spacer: 1760
Calculated distance from Trackline: 0.6036 km

Final Time and Position of Sighting

Time: 10:32 WP#: 39 Lat: 33.747684 Long: -76.310261
Calculated Distance Traveled: 0.8644 km

Behavior and Additional Comments

Well spaced groups with a calf present.

Thursday, October 1, 2009 Sighting # 6

Initial sighting on Track

Time: 11:00 WP#: 49 Lat: 33.974367 Long: -76.476265
Vertical Angle: 3 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Trackline: 8 Beaufort Sea State: 2
Observer: Ryan Observer side: Left

Actual Time and Position of Sighting

Time: 11:01 WP#: 50 Lat: 33.972348 Long: -76.473672
Species: *Tursiops truncatus* Numbers (Low/High/Best): 2/2/2
Features used in Species ID: Large robust animals with uniform grey color throughout, light color on peduncle.
Representative images used for Species ID: 1777, 1783, 1792, 1796
Photographer: Erin Frame numbers: 1775 to 1806 Spacer: 1807
Calculated distance from Trackline: 0.328 km

Final Time and Position of Sighting

Time: 11:05 WP#: 51 Lat: 33.968423 Long: -76.476450
Calculated Distance Traveled: 0.5061 km

Behavior and Additional Comments

Single pair with slow travel. Regular surfacing.

Thursday, October 1, 2009 Sighting # 7

Initial sighting on Track

Time: 11:09 WP#: 53 Lat: 34.040443 Long: -76.566163
Vertical Angle: 3 Horizontal Bearing in Degrees: 90 Sighting Cue: Splash
On/Off Effort: On Trackline: 8 Beaufort Sea State: 2
Observer: Erin Observer side: Right

Actual Time and Position of Sighting

Time: 11:11 WP#: 54 Lat: 34.042681 Long: -76.555923
Species: *Stenella frontalis* Numbers (Low/High/Best): 6/6/6
Features used in Species ID: Animals with alternating light and dark patterns down body. White tip on rostrum.
Representative images used for Species ID: 1813, 1827, 1833, 1835
Photographer: Erin Frame numbers: 1808 to 1843 Spacer: 1844
Calculated distance from Trackline: 0.9758 km

Final Time and Position of Sighting

Time: 11:22 WP#: 55 Lat: 34.043148 Long: -76.569154
Calculated Distance Traveled: 1.22 km

Behavior and Additional Comments

Animals swimming in close pairs or as a group, splashes at the surface with moderate rate of travel. Not a cooperative group. A couple of animals joined while on sighting.

Thursday, October 1, 2009 Sighting # 8

Initial sighting on Track

Time: 11:28 WP#: 57 Lat: 34.145184 Long: -76.700832
Vertical Angle: 2 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Trackline: 8 Beaufort Sea State: 2
Observer: Erin Observer side: Right

Actual Time and Position of Sighting

Time: 11:29 WP#: 58 Lat: 34.150825 Long: -76.699600
Species: *Stenella frontalis* Numbers (Low/High/Best): 8/10/9
Features used in Species ID: Alternating light and dark pattern down body. White tip on rostrum
Representative images used for Species ID: 1845, 1866, 1868, 1871, 1890, 1892
Photographer: Erin Frame numbers: 1845 to1922 Spacer: 1923
Calculated distance from Trackline: 0.6374 km

Final Time and Position of Sighting

Time: 11:37 WP#: 59 Lat: 34.149839 Long: -76.697322
Calculated Distance Traveled: 0.2366 km

Behavior and Additional Comments

Animals traveling at moderate pace. Two groups, lots of activity below the surface, bellies and bodies in a bunch. Milling behavior, tightly packed. Spending periods of time at surface followed by subsurface group.

Thursday, October 1, 2009 Sighting # 9

Initial sighting on Track

Time: 12:27 WP#: 72 Lat: 34.212643 Long: -76.533652
Vertical Angle: 2 Horizontal Bearing in Degrees: 90 Sighting Cue: Splash
On/Off Effort: On Trackline: 10 Beaufort Sea State: 2
Observer: Erin Observer side: Right

Actual Time and Position of Sighting

Time: 12:29 WP#: 73 Lat: 34.209822 Long: -76.525553
Species: *Stenella frontalis* Numbers (Low/High/Best): 25/30/27
Features used in Species ID: Alternating light and dark pattern down the body with white tip on rostrum
Representative images used for Species ID: 1944, 1994, 1997, 2001, 2005, 2006, 2001
Photographer: Frame numbers: 1924 to 2053 Spacer: 2054
Calculated distance from Trackline: 0.8081 km

Final Time and Position of Sighting

Time: 12:38 WP#: 74 Lat: 34.213151 Long: -76.526828
Calculated Distance Traveled: 0.3883 km

Behavior and Additional Comments

Slow travel and milling at the surface. Lots of underwater belly showing and animals piling up on one another. Central group with some outliers. Lots of splashing at the surface as animals rush one another. Three groups with at least 4 in each, heading towards main group after circling for a bit. Lots of big fish in group.

Thursday, October 1, 2009 Sighting # 10

Initial sighting on Track

Time: 14:23 WP#: 82 Lat: 33.765509 Long: -77.131241
Vertical Angle: 3 Horizontal Bearing in Degrees: 100 Sighting Cue: Body
On/Off Effort: On Trackline: 1 Beaufort Sea State: 2
Observer: Ryan Observer side: Left

Actual Time and Position of Sighting

Time: 14:29 WP#: 83 Lat: 33.765256 Long: -77.127123
Species: *Stenella frontalis* Numbers (Low/High/Best): 3/4/4
Features used in Species ID: Alternating light and dark pattern down the body with a white tip on rostrum
Representative images used for Species ID: 2080, 2091, 2098, 2102
Photographer: Erin Frame numbers: 2055 to 2108 Spacer: 2109
Calculated distance from Trackline: 0.3817 km

Final Time and Position of Sighting

Time: 14:39 WP#: 84 Lat: 33.775061 Long: -77.135756
Calculated Distance Traveled: 1.351 km

Behavior and Additional Comments

Animals moving at a moderate pace, surfacing and diving frequently. Dense group, one swimming belly up, lots of circling. Bunch of fish behind dolphins.

Thursday, October 1, 2009 Sighting # 11

Initial sighting on Track

Time: 15:41 WP#: 96 Lat: 33.605614 Long: -76.660022
Vertical Angle: 3 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Trackline: 3 Beaufort Sea State: 2
Observer: Erin Observer side: Right

Actual Time and Position of Sighting

Time: 15:42 WP#: 97 Lat: 33.596687 Long: -76.664434
Species: *Tursiops truncatus* Numbers (Low/High/Best): 19/19/19
Features used in Species ID: Large robust animals, uniform grey color throughout, with light color on peduncle
Representative images used for Species ID: 2116, 2120, 2136
Photographer: Erin Frame numbers: 2110 to 2136 Spacer: 2137
Calculated distance from Trackline: 1.073 km

Final Time and Position of Sighting

Time: 15:50 WP#: 98 Lat: 33.601462 Long: -76.650871
Calculated Distance Traveled: 1.364 km

Behavior and Additional Comments

Wide spread group, slow travel with lots of splashing at the surface. Calves present. Deep dives sometime.

Friday, October 2, 2009 Sighting # 1

Initial sighting on Track

Time: N/A WP#: N/A Lat: N/A Long: N/A
Vertical Angle: 1 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: Off Trackline: 3-4 Beaufort Sea State: 3
Observer: Erin Observer side: Left

Actual Time and Position of Sighting

Time: 9:50 WP#: 16 Lat: 33.475239 Long: -76.447250
Species: *Tursiops truncatus* Numbers (Low/High/Best): 10/15/11
Features used in Species ID: Large robust animals with uniform grey color throughout. Light color on peduncle.
Representative images used for Species ID: 2143, 2145, 2159, 2186, 2189, 2198, 2201, 2206-07
Photographer: Ryan Frame numbers: 2123 to 2223 Spacer: N/A
Calculated distance from Trackline: N/A

Final Time and Position of Sighting

Time: 9:57 WP#: 16 Lat: 33.477259 Long: -76.438536
Calculated Distance Traveled: 0.8388 km

Behavior and Additional Comments

Traveling just below the surface, staying in a fairly tight group. Calves present. Group traveling SE, moving at a fast pace. Some swimming belly up just below surface. No avoidance behavior shown.

Friday, October 2, 2009 Sighting # 2

Initial sighting on Track

Time: 9:58 WP#: 17 Lat: 33.503239 Long: -76.393519
Vertical Angle: 1 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: Off Trackline: 3-4 Beaufort Sea State: 3
Observer: Erin Observer side: Left

Actual Time and Position of Sighting

Time: 10:01 WP#: 18 Lat: 33.504595 Long: -76.392273
Species: *Tursiops truncatus* Numbers (Low/High/Best): 7/9/8
Features used in Species ID: Large robust animals with uniform grey color throughout, with light color on peduncle.
Representative images used for Species ID: 2231
Photographer: Ryan Frame numbers: 2224 to 2238 Spacer: N/A
Calculated distance from Trackline: 0.19 km

Final Time and Position of Sighting

Time: N/A WP#: N/A Lat: N/A Long: N/A
Calculated Distance Traveled: N/A

Behavior and Additional Comments

Animal traveling spread out, could have been a subgroup seen in the distance after circling. Animals not seen again for a final sighting and waypoint.

Friday, October 2, 2009 Sighting # 3

Initial sighting on Track

Time: 10:06 WP#: 20 Lat: 33.532137 Long: -76.424493
Vertical Angle: 3 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Trackline: 4 Beaufort Sea State: 3
Observer: Ryan Observer side: Right

Actual Time and Position of Sighting

Time: 10:07 WP#: 21 Lat: 33.535099 Long: -76.421927
Species: *Tursiops truncatus* Numbers (Low/High/Best): 10/20/15
Features used in Species ID: Large robust animals, uniform grey color throughout with light color on peduncle.
Representative images used for Species ID: 2244, 2261, 2262, 2267, 2273, 2291
Photographer: Ryan Frame numbers: 2239 to 2295 Spacer: 2296
Calculated distance from Trackline: 0.4063 km

Final Time and Position of Sighting

Time: 10:11 WP#: 22 Lat: 33.537519 Long: -76.426343
Calculated Distance Traveled: 0.4898 km

Behavior and Additional Comments

Some deeper diving animals while others are on the surface. Swimming spaced out and traveling west, some pairing, calves present.

Wednesday, October 21, 2009 Sighting # 1

Initial sighting on Track

Time: 11:05 WP#: 17 Lat: 33.82021 Long: -75.991577
Vertical Angle: 1 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: Off Trackline: Transit effort Beaufort Sea State: 3
Observer: Erin Observer side: Right

Actual Time and Position of Sighting

Time: 11:08 WP#: 18 Lat: 33.823938 Long: -75.995138
Species: *Physeter macrocephalus* Numbers (Low/High/Best): 1/1/1
Features used in Species ID: Large animal with a grey color. Blunt head with a large forward blow

Representative images used for Species ID: NA
Photographer: Erin Frame numbers: NA Spacer: NA
Calculated distance from Trackline: 0.5292 km

Final Time and Position of Sighting

Time: NA WP#: NA Lat: NA Long: NA
Calculated Distance Traveled: NA

Behavior and Additional Comments

Large light grey animal was seen logging at the surface, animal had large blunt head. As we were turning to circle, the animal gave a very large blow in the forward direction just before it started to head down. Animal was seen starting its dive. By the time the plane got over the initial sighting area the animal was no longer there. Animal was seen facing the NW.

Wednesday, October 21, 2009 Sighting # 2

Initial sighting on Track

Time: 11:05 WP#: 17 Lat: 33.82021 Long: -75.991577
Vertical Angle: 1 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: Off Trackline: Transit effort Beaufort Sea State: 3
Observer: Erin Observer side: Right

Actual Time and Position of Sighting

Time: 11:08 WP#: 18 Lat: 33.823938 Long: -75.995138
Species: *Globicephala macrorhynchus* Numbers (Low/High/Best): 10\12\12
Features used in Species ID: Large dark bodied animals with light suspenders and post dorsal fin region. Large blunt head and wide based dorsal fin. Pronounced curve to pectoral fins.
Representative images used for Species ID: 2304, 2316, 2334, 2354, 2362, 2365, and 2378
Photographer: Erin Frame numbers: 2297 to 2387 Spacer: 2388
Calculated distance from Trackline: 0.5 km

Final Time and Position of Sighting

Time: 11:23 WP#: 19 Lat: 33.822067 Long: -75.993267
Calculated Distance Traveled: 0.3 km

Behavior and Additional Comments

Animals were widely dispersed traveling singularly or in pairs with ~40m distance between each other. All animals moving at a slow rate of speed and hanging near the surface. Between 2 and 3 calves present swimming with larger animal.

Wednesday, October 21, 2009 Sighting # 3

Initial sighting on Track

Time: 11:31 WP#: 21 Lat: 33.936485 Long: -76.178056
Vertical Angle: 2 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Trackline: 10 Beaufort Sea State: 3
Observer: Ryan Observer side: Left

Actual Time and Position of Sighting

Time: 11:32 WP#: 22 Lat: 33.932099 Long: -76.176954
Species: *Tursiops truncatus* Numbers (Low/High/Best): 5/7/6
Features used in Species ID: Robust body appearance, uniform grey in coloration with white patch on peduncle.
Representative images used for Species ID: 2401 and 2406
Photographer: Erin Frame numbers: 2389 to 2413 Spacer: 2414
Calculated distance from Trackline: 0.5 km

Final Time and Position of Sighting

Time: 11:41 WP#: 23 Lat: 33.930748 Long: -76.170652
Calculated Distance Traveled: 0.6 km

Behavior and Additional Comments

Animals appear large with a uniform grey coloration except for white peduncle patch. Group was well dispersed and left abruptly during sighting.

Wednesday, October 21, 2009 Sighting # 4

Initial sighting on Track

Time: 12:27 WP#: 37 Lat: 33.747052 Long: -76.190284
Vertical Angle: 1 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Trackline: 8 Beaufort Sea State: 3
Observer: On Observer side: Right

Actual Time and Position of Sighting

Time: 12:37 WP#: 38 Lat: 33.756576 Long: -76.181401
Species: *Tursiops truncatus* Numbers (Low/High/Best): 2/2/2
Features used in Species ID: Uniform grey coloration with shoulder blaze to behind dorsal fin. Blunt rostrum with clear crease at insertion to melon.
Representative images used for Species ID: 2423, 2424, 2439, and 2459
Photographer: Erin Frame numbers: 2415 to 2469 Spacer: 2470
Calculated distance from Trackline: 1.3 km

Final Time and Position of Sighting

Time: NA WP#: NA Lat: NA Long: NA
Calculated Distance Traveled: NA

Behavior and Additional Comments

Two animals initially encountered chasing each other close to the surface. Lots of crossing over one another, swimming on their sides or belly up. Some slow travel as a pair between periods of "play".

Wednesday, October 21, 2009 Sighting # 5

Initial sighting on Track

Time: 12:41 WP#: 40 Lat: 33.822768 Long: -76.286738
Vertical Angle: 4 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Trackline: 8 Beaufort Sea State: 3
Observer: Erin Observer side: Left

Actual Time and Position of Sighting

Time: 12:43 WP#: 41 Lat: 33.829105 Long: -76.279533
Species: *Tursiops truncatus* Numbers (Low/High/Best): 35/40/40
Features used in Species ID: Uniform grey coloration with shoulder blaze trailing to behind dorsal fin. Robust body appearance and flukes.
Representative images used for Species ID: 2475, 2478, 2484, and 2515
Photographer: Erin Frame numbers: 2471 to 2515 Spacer: 2516
Calculated distance from Trackline: 1.0 km

Final Time and Position of Sighting

Time: 12:48 WP#: 42 Lat: 33.828935 Long: -76.276133
Calculated Distance Traveled: 0.3 km

Behavior and Additional Comments

Multiple sub groups of 5-6 animals surrounding main group of 30+ animals. Main group traveling slowly while subgroups moving at higher speed, moving away from and rejoining main group. Entire group would dive below the surface where flashes of bellies or sides could still be seen as the animals interacted.

Wednesday, October 21, 2009 Sighting # 6

Initial sighting on Track

Time: 13:00 WP#: 46 Lat: 34.080022 Long: -76.624487
Vertical Angle: 3 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Trackline: 8 Beaufort Sea State: 2
Observer: Erin Observer side: Right

Actual Time and Position of Sighting

Time: 13:02 WP#: 47 Lat: 34.079645 Long: -76.624388
Species: *Stenella frontalis* Numbers (Low/High/Best): 4/4/4
Features used in Species ID: Alternating light and dark coloration on dorsal surface. Shoulder blaze to level of dorsal fin with dark lateral blaze behind dorsal fin.
Representative images used for Species ID: 2546, 2554, and 2521
Photographer: Erin Frame numbers: 2517 to 2560 Spacer: 2561
Calculated distance from Trackline: 0.1 km

Final Time and Position of Sighting

Time: 13:06 WP#: 48 Lat: 34.083673 Long: -76.626463
Calculated Distance Traveled: 0.5 km

Behavior and Additional Comments

Animals traveling in a fairly close group at a slow rate of speed just below the surface.

Wednesday, October 21, 2009 Sighting # 7

Initial sighting on Track

Time: 13:33 WP#: 57 Lat: 33.726041 Long: -76.287453
Vertical Angle: 1 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Trackline: 7 Beaufort Sea State: 3
Observer: Erin Observer side: Right

Actual Time and Position of Sighting

Time: 13:47 WP#: 58 Lat: 33.720393 Long: -76.290826
Species: *Tursiops truncatus* Numbers (Low/High/Best): 10/15/12
Features used in Species ID: Uniform grey coloration with lighter grey peduncle patch.
Robust body of uniform grey coloration.
Representative images used for Species ID: 2576, 2577, 2583, and 2591
Photographer: Erin Frame numbers: 2562 to 2618 Spacer: 2619
Calculated distance from Trackline: 0.7 km

Final Time and Position of Sighting

Time: NA WP#: NA Lat: NA Long: NA
Calculated Distance Traveled: NA

Behavior and Additional Comments

Initial sighting of 10 to 15 animals traveling slowly at the surface in pairs or as single animals. After circling only a smaller group of 4 animals was seen. All animals with uniform grey coloration to their bodies.

Sunday, November 8, 2009 Sighting # 1

Initial sighting on Track

Time: 3:40 WP#: 9 Lat: 33.394250 Long: -76.652008
Vertical Angle: 3 Horizontal Bearing in Degrees: 90 Sighting Cue: Splash
On/Off Effort: On Trackline: 1 Beaufort Sea State: 2
Observer: Erin Observer side: Left

Actual Time and Position of Sighting

Time: 13:51 WP#: 10 Lat: 33.407155 Long: -76.643227
Species: *Tursiops truncatus* Numbers (Low/High/Best): 30/45/38
Features used in Species ID: Robust animals, uniform grey except white peduncle

Representative images used for Species ID: 2955, 2959, 2972, 2981, 2982, 2985, 2986, 3006
Photographer: Ryan Frame numbers: 2941-3030 Spacer: 3031
Calculated distance from Trackline: 1.65 km

Final Time and Position of Sighting

Time: N/A WP#: N/A Lat: N/A Long: N/A
Calculated Distance Traveled: N/A

Behavior and Additional Comments

Animals had a noticeably white peduncle. Animals were spread out, jumping, zig zagging and showing bellies. Animals had regular surfacing and lots of splashing, traveling SE, several sub-groups. Animals were not seen to get a final time and position. No calves present.

Sunday, November 8, 2009 Sighting # 2

Initial sighting on Track

Time: 14:52 WP#: 31 Lat: 33.626162 Long: -76.551936
Vertical Angle: 1 Horizontal Bearing in Degrees: 90 Sighting Cue: Splash
On/Off Effort: On Trackline: 4 Beaufort Sea State: 2
Observer: Erin Observer side: Left

Actual Time and Position of Sighting

Time: 14:55 WP#: 32 Lat: 33.623729 Long: -76.540808
Species: *Tursiops truncatus* Numbers (Low/High/Best): 4/4/4
Features used in Species ID: Robust animals with uniform grey color except for white peduncle

Representative images used for Species ID: 3045, 3051, 3058, 3059, 3061, 3062, 3070, 3076
Photographer: Ryan Frame numbers: 3032-3080 Spacer: 3081
Calculated distance from Trackline: 1.056 km

Final Time and Position of Sighting

Time: 15:06 WP#: 33 Lat: 33.626228 Long: -76.531504
Calculated Distance Traveled: 0.9052 km

Behavior and Additional Comments

Animals were seen jumping, darting and circling each other. They were not moving in any given direction. May have shown avoidance behavior. Swimming in pairs. No calves present.

Sunday, November 8, 2009 Sighting # 3

Initial sighting on Track

Time: N/A WP#: N/A Lat: N/A Long: N/A
Vertical Angle: 4 Horizontal Bearing in Degrees: 45 Sighting Cue: Body
On/Off Effort: Off Trackline: TE Beaufort Sea State: 1
Observer: Erin Observer side: Left

Actual Time and Position of Sighting

Time: 12:39 WP#: 3 Lat: 33.966810 Long: -77.875979
Species: *Eubalaena glacialis* Numbers (Low/High/Best): 3/3/3
Features used in Species ID: Very robust black animals, white callosities down rostrum

Representative images used for Species ID: all images
Photographer: Ryan Frame numbers: 2622-2939 Spacer: 2940
Calculated distance from Trackline:

Final Time and Position of Sighting

Time: 13:03 WP#: 4 Lat: 33.933764 Long: -77.891080
Calculated Distance Traveled: 3.93 km

Behavior and Additional Comments

Animals had regular surfacing, with one not surfacing as regularly. Staying close together in a line heading south, traveling at 4 knots. Seen 3.4 miles off the coast of Fort Fisher. No entanglements were seen. Report was sent to USCG with an updated location.

Thursday, December 17, 2009 Sighting # 1

Initial sighting on Track

Time: 10:49 WP#: 17 Lat: 33.868083 Long: -76.343578
Vertical Angle: 1 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Trackline: 8 Beaufort Sea State: 4
Observer: Erin Observer side: Right

Actual Time and Position of Sighting

Time: 10:56 WP#: 18 Lat: 33.862939 Long: -76.343101
Species: *Unidentified Delphinid* Numbers (Low/High/Best): 2 / 2 / 2
Features used in Species ID: Animals ~7-8 ft long grey coloration, pronounced rostrum and dorsal fin. Surfacing regularly to breath.
Representative images used for Species ID: N/A
Photographer: Erin Frame numbers: N/A Spacer: N/A
Calculated distance from Trackline: 0.5737 km

Final Time and Position of Sighting

Time: 10:57 WP#: 19 Lat: 33.865992 Long: -76.346368
Calculated Distance Traveled: 0.4541 km

Behavior and Additional Comments

A pair of animals were sighted directly under the plane. Attempts to relocate the animals were impeded by a high sea state and after ~10min with no sign of the animals.

Thursday, December 17, 2009 Sighting # 2

Initial sighting on Track

Time: 11:54 WP#: 27 Lat: 34.137144 Long: -76.435874
Vertical Angle: 3 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Trackline: 10 Beaufort Sea State: 4
Observer: Erin Observer side: Right

Actual Time and Position of Sighting

Time: 11:56 WP#: 28 Lat: 34.135101 Long: -76.433447
Species: *Unidentified Delphinid* Numbers (Low/High/Best): 10 / 15 / 15
Features used in Species ID: Animals traveling close together with lots of tactile interactions and showing of bellies and sides. No dedicated direction of travel.
Representative images used for Species ID: N/A
Photographer: Erin Frame numbers: N/A Spacer: N/A
Calculated distance from Trackline: 0.3186 km

Final Time and Position of Sighting

Time: 12:10 WP#: 29 Lat: 34.140698 Long: -76.435275
Calculated Distance Traveled: 0.6447 km

Behavior and Additional Comments

Animals very active at the surface interacting with one another. Due to the high sea states the animals were relocated once but we were unable to collect photographs of them.

Thursday, January 14, 2010 Sighting # 1

Initial sighting on Track

Time: 10:32 WP#: 14 Lat: 33.678573 Long: -76.362084
Vertical Angle: 3 Horizontal Bearing in Degrees: 90 Sighting Cue: Splash
On/Off Effort: On Trackline: 6 Beaufort Sea State: 2
Observer: Erin Observer side: Left

Actual Time and Position of Sighting

Time: 10:34 WP#: 15 Lat: 33.668686 Long: -76.355825
Species: *Tursiops truncatus* Numbers (Low/High/Best): 5/5/5
Features used in Species ID: Robust animals, uniform grey color throughout except for a white peduncle
Representative images used for Species ID: 3094, 3095, 3097
Photographer: Ryan Frame numbers: 3082 to 3132 Spacer: 3133
Calculated distance from Trackline: 1.243 km

Final Time and Position of Sighting

Time: 10:39 WP#: 16 Lat: 33.669678 Long: -76.357610
Calculated Distance Traveled: 0.1986 km

Behavior and Additional Comments

White peduncles, animals hanging just below surface. Regular surfacing, not traveling fast, just hanging out. Animals staying close together.

Thursday, January 14, 2010 Sighting # 2

Initial sighting on Track

Time: 10:43 WP#: 19 Lat: 33.748319 Long: -76.455140
Vertical Angle: 3 Horizontal Bearing in Degrees: 110 Sighting Cue: Splash
On/Off Effort: On Trackline: 6 Beaufort Sea State: 2
Observer: Erin Observer side: Left

Actual Time and Position of Sighting

Time: 10:44 WP#: 20 Lat: 33.740090 Long: -76.452193
Species: *Tursiops truncatus* Numbers (Low/High/Best): 4/5/5
Features used in Species ID: Large, robust animals with uniform grey color, throughout except for white peduncles
Representative images used for Species ID: 3142, 3143, 3144, 3170
Photographer: Ryan Frame numbers: 3133 to 3196 Spacer: 3197
Calculated distance from Trackline: 0.9547 km

Final Time and Position of Sighting

Time: 10:57 WP#: 21 Lat: 33.750234 Long: -76.464898
Calculated Distance Traveled: 1.629 km

Behavior and Additional Comments

White peduncles, animals darting in different directions. First sighted spaced out and then they came together and then they spaced out again. Regular surfacing, doing deeper dives. Showing some avoidance behavior. Animals were doing some jumping and moving very fast.

Thursday, January 14, 2010 Sighting # 3

Initial sighting on Track

Time: 11:31 WP#: 38 Lat: 33.806697 Long: -76.392061
Vertical Angle: 2 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Trackline: 7 Beaufort Sea State: 2
Observer: Erin Observer side: Left

Actual Time and Position of Sighting

Time: 11:33 WP#: 39 Lat: 33.805552 Long: -76.393617
Species: *Tursiops truncatus* Numbers (Low/High/Best): 2/3/3
Features used in Species ID: Large robust animals with uniform grey color throughout except for white peduncles
Representative images used for Species ID: 3237, 3238, 3239, 3275, 3277
Photographer: Ryan Frame numbers: 3198 to 3280 Spacer: 3281
Calculated distance from Trackline: 0.1920 km

Final Time and Position of Sighting

Time: 11:39 WP#: 40 Lat: 33.812085 Long: -76.388968
Calculated Distance Traveled: 0.8439 km

Behavior and Additional Comments

Animals were spread out with regular surfacing. Some animals were jumping and they were traveling in different directions, moving just below the surface then doing some deeper dives. Animals had white peduncles

Thursday, January 14, 2010 Sighting # 4

Initial sighting on Track

Time: 11:50 WP#: 44 Lat: 33.744101 Long: -76.184952
Vertical Angle: 2 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Trackline: 8 Beaufort Sea State: 2
Observer: Ryan Observer side: Right

Actual Time and Position of Sighting

Time: 11:51 WP#: 45 Lat: 33.746017 Long: -76.176662
Species: *Tursiops truncatus* Numbers (Low/High/Best): 9/18/15
Features used in Species ID: Large robust animals with uniform grey color throughout except for white peduncles
Representative images used for Species ID: 3305, 3328, 3329, 3330, 3376, 3378, 3379
Photographer: Ryan Frame numbers: 3282 to 3381 Spacer: 3382
Calculated distance from Trackline: 0.7956 km

Final Time and Position of Sighting

Time: 12:00 WP#: 46 Lat: 33.743483 Long: -76.188124
Calculated Distance Traveled: 1.097 km

Behavior and Additional Comments

Some animals swimming in pairs, swimming just below the surface, regular surfacing and not traveling very fast. Some animals jumping, traveling in two groups. Animals had white peduncles.

Thursday, January 14, 2010 Sighting # 5

Initial sighting on Track

Time: 12:28 WP#: 65 Lat: 33.831365 Long: -76.040427
Vertical Angle: 1 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Trackline: 10 Beaufort Sea State: 2
Observer: Erin Observer side: Left

Actual Time and Position of Sighting

Time: 13:01 WP#: 66 Lat: 33.829063 Long: -76.035037
Species: *Tursiops truncatus* Numbers (Low/High/Best): 1/1/1
Features used in Species ID: Large robust animal with uniform grey color throughout except for white peduncle
Representative images used for Species ID: 3477, 3478, 3481
Photographer: Ryan Frame numbers: 3451 to Spacer: 3483
Calculated distance from Trackline: 0.5598 km

Final Time and Position of Sighting

Time: 13:03 WP#: 67 Lat: 33.822784 Long: -76.033389
Calculated Distance Traveled: 0.7146 km

Behavior and Additional Comments

Animal doing some deeper dives, regular surfacing, not traveling very fast

Thursday, January 14, 2010 Sighting # 6

Initial sighting on Track

Time: 13:24 WP#: 71 Lat: 34.270316 Long: -76.608068
Vertical Angle: 3 Horizontal Bearing in Degrees: 90 Sighting Cue: Splash
On/Off Effort: On Trackline: 10 Beaufort Sea State: 2
Observer: Ryan Observer side: Right

Actual Time and Position of Sighting

Time: 13:25 WP#: 72 Lat: 34.276465 Long: -76.603520
Species: *Stenella frontalis* Numbers (Low/High/Best): 25/40/37
Features used in Species ID: Alternating light and dark pattern down the body, white tips on rostrum, well defined blaze on sides tapering off just before dorsal fin to the middle of the dorsal fin
Representative images used for Species ID: 3500, 3517, 3525, 3538, 3549, 3552, 3557, 3565
Photographer: Ryan Frame numbers: 3481 to 3612 Spacer: 3613
Calculated distance from Trackline: 0.8013 km

Final Time and Position of Sighting

Time: 13:30 WP#: 73 Lat: 34.279187 Long: -76.604144
Calculated Distance Traveled: 0.3081 km

Behavior and Additional Comments

Large group of animals all bunched up, lots of splashing, regular surfacing. Animals traveling just below the surface and darting back and fourth.

Friday, January 15, 2010 Sighting # 1

Initial sighting on Track

Time: 9:43 WP#: 15 Lat: 33.561615 Long: -76.736314
Vertical Angle: 1 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Trackline: 2 Beaufort Sea State: 3
Observer: Ryan Observer side: Left

Actual Time and Position of Sighting

Time: 9:45 WP#: 16 Lat: 33.558281 Long: -76.738722
Species: *Tursiops truncatus* Numbers (Low/High/Best): 7 / 9 / 8
Features used in Species ID: Robust body appearance, uniform grey coloration with slightly darker grey dorsal cape. Uniform rostrum color, broad flukes and white peduncle patch.
Representative images used for Species ID: 3630, 3646, 3649 and 3652
Photographer: Erin Frame numbers: 3617 to 3655 Spacer: 3655
Calculated distance from Trackline: 0.4 km

Final Time and Position of Sighting

Time: 9:52 WP#: 17 Lat: 33.556537 Long: -76.739997
Calculated Distance Traveled: 0.2 km

Behavior and Additional Comments

Group was traveling slowly just below the surface very close to one another. Animals appear to have a white peduncle patch.

Friday, January 15, 2010 Sighting # 2

Initial sighting on Track

Time: 10:38 WP#: 29 Lat: 33.608496 Long: -76.529525
Vertical Angle: 1 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Trackline: 4 Beaufort Sea State: 3
Observer: Ryan Observer side: Left

Actual Time and Position of Sighting

Time: 10:39 WP#: 30 Lat: 33.602597 Long: -76.529002
Species: *Tursiops truncatus* Numbers (Low/High/Best): 15 / 21 / 20
Features used in Species ID: Uniform grey body coloration, lighter grey blaze to region of dorsal fin. No spotting pattern on large adult animals.
Representative images used for Species ID: 3663, 3671, 3674, and 3678
Photographer: Erin Frame numbers: 3656 to 3695 Spacer: 3696
Calculated distance from Trackline: 0.65 km

Final Time and Position of Sighting

Time: 10:49 WP#: 31 Lat: 33.606813 Long: -76.535992
Calculated Distance Traveled: 0.8 km

Behavior and Additional Comments

Tightly grouped animals traveling slowly just below the surface moving in a definite direction. Animals moved into a wide string once plane began to circle them. Some animals rolling on their sides or showing belly, also appeared to be two calves in the group roughly 3/4 adult length. Some animals with appearance of white peduncle.

Friday, January 15, 2010 Sighting # 3

Initial sighting on Track

Time: 11:23 WP#: 43 Lat: 33.694585 Long: -76.511749
Vertical Angle: 3 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Trackline: 5 Beaufort Sea State: 3
Observer: Ryan Observer side: Left

Actual Time and Position of Sighting

Time: 11:25 WP#: 44 Lat: 33.698764 Long: -76.51107
Species: *Tursiops truncatus* Numbers (Low/High/Best): 12 / 24 / 22
Features used in Species ID: Uniform grey coloration of body, large robust dorsal fin and rostrum.

Representative images used for Species ID: 3704, 3709, 3714, 3722, 3724 and 3727
Photographer: Erin Frame numbers: 3697 to 3730 Spacer: 3731
Calculated distance from Trackline: 0.4 km

Final Time and Position of Sighting

Time: 11:33 WP#: 45 Lat: 33.70114 Long: -76.507911
Calculated Distance Traveled: 0.4 km

Behavior and Additional Comments

Another bunched group of animals traveling slowly just below the surface. Animals were split into two groups, the smaller of which was barely moving. Possible white peduncle patch.

Friday, January 15, 2010 Sighting # 4

Initial sighting on Track

Time: 11:42 WP#: 48 Lat: 33.605988 Long: -76.264493
Vertical Angle: 2 Horizontal Bearing in Degrees: 60 Sighting Cue: Body
On/Off Effort: Off Trackline: Between 5 & 6 Beaufort Sea State: 3
Observer: Erin Observer side: Left

Actual Time and Position of Sighting

Time: 11:44 WP#: 49 Lat: 33.601521 Long: -76.270769
Species: *Tursiops truncatus* Numbers (Low/High/Best): 8 / 8 / 8
Features used in Species ID: Robust animals with uniform grey coloration except for slightly darker cape on dorsal surface to area before dorsal fin. Large dorsal fin.

Representative images used for Species ID: 3765, 3775 and 3777
Photographer: Erin Frame numbers: 3732 to 3754 Spacer: 3755
Calculated distance from Trackline: 0.7 km

Final Time and Position of Sighting

Time: 11:50 WP#: 50 Lat: 33.607359 Long: -76.269571
Calculated Distance Traveled: 0.6 km

Behavior and Additional Comments

All animals traveling parallel to one another in a single line. Slow directional travel.
Animals appear to have white peduncle patch.

Friday, January 15, 2010 Sighting # 5

Initial sighting on Track

Time: 11:55 WP#: 53 Lat: 33.725211 Long: -76.421522
Vertical Angle: 2 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Trackline: 6 Beaufort Sea State: 3
Observer: Erin Observer side: Right

Actual Time and Position of Sighting

Time: 12:02 WP#: 54 Lat: 33.725468 Long: -76.420365
Species: *Tursiops truncatus* Numbers (Low/High/Best): 13 / 15 / 14
Features used in Species ID: Robust rostrum and large dorsal fin. Robust body with uniform grey coloration, lighter blaze to region of dorsal fin.
Representative images used for Species ID: 3765, 3775 and 3777
Photographer: Erin Frame numbers: 3756 to 3803 Spacer: 3804
Calculated distance from Trackline: 0.1 km

Final Time and Position of Sighting

Time: 12:03 WP#: 55 Lat: 33.730208 Long: -76.425060
Calculated Distance Traveled: 0.7 km

Behavior and Additional Comments

Two groups of densely packed animals - groups spread out a little as sighting continued, formed more of a nose to tail line. Groups would spend lots of time below the surface.

Friday, January 15, 2010 Sighting # 6

Initial sighting on Track

Time: 12:18 WP#: 61 Lat: 34.037598 Long: -76.833729
Vertical Angle: 1 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Trackline: 6 Beaufort Sea State: 2
Observer: Erin Observer side: Right

Actual Time and Position of Sighting

Time: 12:23 WP#: 62 Lat: 34.041882 Long: -76.828397
Species: *Tursiops truncatus* Numbers (Low/High/Best): 3 / 3 / 3
Features used in Species ID: Uniform grey coloration of body with no spotting on lateral surfaces Robust body, large dorsal fin
Representative images used for Species ID: 3828, 3834 and 3836
Photographer: Erin Frame numbers: 3805 to 3836 Spacer: 3837
Calculated distance from Trackline: 0.7 km

Final Time and Position of Sighting

Time: 12:29 WP#: 63 Lat: 34.035980 Long: -76.824297
Calculated Distance Traveled: 0.7 km

Behavior and Additional Comments

Single animal followed primarily with two additional animals joining and then leaving original animal. Documented feeding of one animal catching fish.

Friday, January 15, 2010 Sighting # 7

Initial sighting on Track

Time: 12:30 WP#: 65 Lat: 34.063128 Long: -76.863297
Vertical Angle: 3 Horizontal Bearing in Degrees: 60 Sighting Cue: Splash
On/Off Effort: On Trackline: 6 Beaufort Sea State: 2
Observer: Ryan Observer side: Left

Actual Time and Position of Sighting

Time: 12:35 WP#: 66 Lat: 34.061379 Long: -76.860277
Species: *Tursiops truncatus* Numbers (Low/High/Best): 45 / 50 / 46
Features used in Species ID: Large robust body, uniform grey body coloration.

Representative images used for Species ID: 3844, 3848, 3857, 3885, 3887 and 3890
Photographer: Erin Frame numbers: 3838 to 3891 Spacer: 3892
Calculated distance from Trackline: 0.3 km

Final Time and Position of Sighting

Time: 12:37 WP#: 67 Lat: 34.063698 Long: -76.865346
Calculated Distance Traveled: 0.5 km

Behavior and Additional Comments

Two large groups swimming fast and splashing at the surface.

Friday, January 15, 2010 Sighting # 8

Initial sighting on Track

Time: 14:26 WP#: 75 Lat: 34.070326 Long: -76.734718
Vertical Angle: 1 Horizontal Bearing in Degrees: 90 Sighting Cue: Bofy
On/Off Effort: On Trackline: 7 Beaufort Sea State: 2
Observer: Erin Observer side: Right

Actual Time and Position of Sighting

Time: 14:27 WP#: 76 Lat: 34.074558 Long: -76.731663
Species: *Stenella frontalis* Numbers (Low/High/Best): 28 / 35 / 30
Features used in Species ID: Alternating light and dark coloration along length of animal.
White tip to rostrum.

Representative images used for Species ID: 3895, 3905, 3907, 3920, 3932, 3937 and 3952
Photographer: Erin Frame numbers: 3893 to 3965 Spacer: 3966
Calculated distance from Trackline: 0.5 km

Final Time and Position of Sighting

Time: 14:35 WP#: 77 Lat: 34.071690 Long: -76.725560
Calculated Distance Traveled: 0.6 km

Behavior and Additional Comments

Slow moving group with some swimming at surface and some deep so only shadows are seen.

Friday, January 15, 2010 Sighting # 9

Initial sighting on Track

Time: 14:42 WP#: 82 Lat: 33.917797 Long: -76.535541
Vertical Angle: 1 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Trackline: 7 Beaufort Sea State: 2
Observer: Erin Observer side: Right

Actual Time and Position of Sighting

Time: 14:43 WP#: 83 Lat: 33.917354 Long: -76.538055
Species: *Stenella frontalis* Numbers (Low/High/Best): 23 / 30 / 28
Features used in Species ID: White tip to rostrum. Alternating light and dark coloration along the length of the animal. Light and dark blaze meeting at dorsal fin region.
Representative images used for Species ID: 3980, 3995 and 3999
Photographer: Erin Frame numbers: 3967 to 4017 Spacer: 4018
Calculated distance from Trackline: 0.2 km

Final Time and Position of Sighting

Time: 14:50 WP#: 84 Lat: 33.912765 Long: -76.530079
Calculated Distance Traveled: 0.9 km

Behavior and Additional Comments

Mixture of two groups of dolphins one with ~25 the other with ~3. Schools of good sized fish neaby both groups of dolphins.

Friday, January 15, 2010 Sighting # 10

Initial sighting on Track

Time: 14:59 WP#: 86 Lat: 33.711036 Long: -76.266830
Vertical Angle: 2 Horizontal Bearing in Degrees: 90 Sighting Cue: Blow
On/Off Effort: On Trackline: 7 Beaufort Sea State: 2
Observer: Erin Observer side: Right

Actual Time and Position of Sighting

Time: 15:02 WP#: 87 Lat: 33.709471 Long: -76.265296
Species: *Tursiops truncatus* Numbers (Low/High/Best): 25 / 27 / 27
Features used in Species ID: Uniform grey coloration with slightly darker grey cape on dorsal area before dorsal fin. Large dorsal fin and robust rostrum.
Representative images used for Species ID: 4024, 4036 and 4044
Photographer: Erin Frame numbers: 4019 to 4047 Spacer: 4048
Calculated distance from Trackline: 0.2 km

Final Time and Position of Sighting

Time: 15:07 WP#: 88 Lat: 33.706547 Long: -76.259007
Calculated Distance Traveled: 0.6 km

Behavior and Additional Comments

Large group with other animals trailing, lots of non-directional underwater (just shadows of animals) Later one central group with fewer smaller groups nearby.

Friday, January 15, 2010 Sighting # 11

Initial sighting on Track

Time: 15:15 WP#: 91 Lat: 33.659242 Long: -76.198512
Vertical Angle: 1 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: Off Trackline: Between 7 & 8 Beaufort Sea State: 2
Observer: Ryan Observer side: Left

Actual Time and Position of Sighting

Time: 15:16 WP#: 92 Lat: 33.664086 Long: -76.195214
Species: *Grampus griseus* Numbers (Low/High/Best): 5 / 5 / 5
Features used in Species ID: Light grey scarring patterns on animals sides, pointed melon with central crease. Large tall dorsal fin and pectoral fins.
Representative images used for Species ID: 4057, 4059, 4064, 4067, 4679 and 4089
Photographer: Erin Frame numbers: 4049 to 4092 Spacer: 4093
Calculated distance from Trackline: 0.6 km

Final Time and Position of Sighting

Time: 15:18 WP#: 93 Lat: 33.664600 Long: -76.196155
Calculated Distance Traveled: 0.1 km

Behavior and Additional Comments

Animals with blunt head. Only a single animal seen at first and photographed. After breaking from animal encountered a group of 3 and another single animal over a distance of ~2 miles.

Friday, January 15, 2010 Sighting # 12

Initial sighting on Track

Time: 16:23 WP#: 106 Lat: 34.152472 Long: -76.457880
Vertical Angle: 2 Horizontal Bearing in Degrees: 60 Sighting Cue: Body
On/Off Effort: On Trackline: 10 Beaufort Sea State: 2
Observer: Erin Observer side: Right

Actual Time and Position of Sighting

Time: 16:29 WP#: 107 Lat: 34.156027 Long: -76.457154
Species: *Stenella frontalis* Numbers (Low/High/Best): 40 / 48 / 47
Features used in Species ID: Alternating light and dark body coloration. White tip to rostrum and appearance os spotting on sides.
Representative images used for Species ID: 4147, 4151, 4156 and 4157
Photographer: Erin Frame numbers: 4094 to 4167 Spacer: 4168
Calculated distance from Trackline: 0.4 km

Final Time and Position of Sighting

Time: 16:32 WP#: 108 Lat: 34.162620 Long: -76.453377
Calculated Distance Traveled: 0.8 km

Behavior and Additional Comments

One large group made up of smaller groups of 8-15, totalling ~50 animals. Lots of belly showing and rolling on their sides. Lots of activity at the surface.

Sunday, February 21, 2010 Sighting # 1

Initial sighting on Track

Time: 11:24 WP#: 21 Lat: 33.917971 Long: -76.675536
Vertical Angle: 3 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Trackline: 6 Beaufort Sea State: 2
Observer: Erin Observer side: Right

Actual Time and Position of Sighting

Time: 11:26 WP#: 22 Lat: 33.924674 Long: -76.66271
Species: *Stenella frontalis* Numbers (Low/High/Best): 18 / 21 / 18
Features used in Species ID: White tip to rostrum, spotting pattern along sides, light shoulder blaze to dorsal fin with darker blaze from peduncle to below dorsal fin.
Representative images used for Species ID: 0032, 0034, 0050, 0056, and 0067
Photographer: Erin Frame numbers: 0030 - 0068 Spacer: 0069
Calculated distance from Trackline: 1.4 km

Final Time and Position of Sighting

Time: 11:53 WP#: 23 Lat: 33.930494 Long: -76.64368
Calculated Distance Traveled: 1.8 km

Behavior and Additional Comments

Two groups of animals, one with 12 individuals in it and the second with ~6 individuals tightly bunched together. Groups moving slowly at the surface but after a few circle groups picked up speed and fanned out. Third group of 5-6 seen after circling on initial group, all animals diving and interacting with one another below the surface.

Sunday, February 21, 2010 Sighting # 2

Initial sighting on Track

Time: 14:32 WP#: 42 Lat: 33.904141 Long: -76.263097
Vertical Angle: 2 Horizontal Bearing in Degrees: 90 Sighting Cue: Splash
On/Off Effort: On Trackline: 9 Beaufort Sea State: 3
Observer: Erin Observer side: Right

Actual Time and Position of Sighting

Time: 14:41 WP#: 43 Lat: 33.897988 Long: -76.253719
Species: *Tursiops truncatus* Numbers (Low/High/Best): 10 / 12 / 11
Features used in Species ID: Uniform grey coloration, robust dorsal fin and body appearance.
Representative images used for Species ID: 0072 - 0074
Photographer: Erin Frame numbers: 0070 - 0077 Spacer: 0078
Calculated distance from Trackline: 1.1 km

Final Time and Position of Sighting

Time: 14:44 WP#: 44 Lat: 33.8972 Long: -76.266149
Calculated Distance Traveled: 1.1 km

Behavior and Additional Comments

Lots of animals scattered over a wide area, mainly singles, one or two doubles. All animals have robust and were surfacing briefly before diving again. After circling group many of the animals separated from the rest so by the end of the sighting there were only 3-4 animals in the area.

Sunday, February 21, 2010 Sighting # 3

Initial sighting on Track

Time: 15:13 WP#: 53 Lat: 33.982184 Long: -76.501112
Vertical Angle: 1 Horizontal Bearing in Degrees: 90 Sighting Cue: Splash
On/Off Effort: On Trackline: 8 Beaufort Sea State: 1
Observer: Erin Observer side: Left

Actual Time and Position of Sighting

Time: 15:17 WP#: 54 Lat: 33.98478 Long: -76.500092
Species: *Stenella frontalis* Numbers (Low/High/Best): 8 / 9 / 8
Features used in Species ID: Clear spot pattern along sides of body, white tip to rostrum and light shoulder blaze to dorsal fin with dark coloration from peduncle to below white blaze.
Representative images used for Species ID: 0079, 0082 and 0113
Photographer: Erin Frame numbers: 0079 - 0115 Spacer: 0116
Calculated distance from Trackline: 0.3 km

Final Time and Position of Sighting

Time: 15:24 WP#: 55 Lat: 33.984625 Long: -76.507871
Calculated Distance Traveled: 0.7 km

Behavior and Additional Comments

Lots of activity at the surface. Animals showing slow milling behavior with no obvious direction of travel. Individuals widely spaced with no more than 3 in a group.

Sunday, February 21, 2010 Sighting # 4

Initial sighting on Track

Time: 15:36 WP#: 58 Lat: 33.757085 Long: -76.19298
Vertical Angle: 2 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Trackline: 8 Beaufort Sea State: 2
Observer: Ryan Observer side: Left

Actual Time and Position of Sighting

Time: 15:39 WP#: 59 Lat: 33.757085 Long: -76.19298
Species: *Globicephala macrorhynchus* Numbers (Low/High/Best): 20/25/23
Features used in Species ID: Large square heads, dark body coloration, large body size of ~20ft long, large dorsal fin roughly 1/3 of the way back on the animal.
Representative images used for Species ID: 0133 - 0135, 0137, 0141, 0162, 0167 and 0183
Photographer: Erin Frame numbers: 0117 to 0193 Spacer: 0194
Calculated distance from Trackline: 0 km

Final Time and Position of Sighting

Time: 15:54 WP#: 60 Lat: 33.750509 Long: -76.187337
Calculated Distance Traveled: 0.9 km

Behavior and Additional Comments

Animals hanging just below the surface traveling slowly side by side. Uniform dark body coloration with large dorsal fins. Calves present. Central group of ~18 animals and two smaller groups each containing 3-4 animals

Monday, March 8, 2010 Sighting # 1

Initial sighting on Track

Time: 15:17 WP#: 47 Lat: 33.497966 Long: -76.654189
Vertical Angle: 1 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Trackline: 2 Beaufort Sea State: 3
Observer: Erin Observer side: Left

Actual Time and Position of Sighting

Time: 15:30 WP#: 48 Lat: 33.487350 Long: -76.636780
Species: *Tursiops truncatus* Numbers (Low/High/Best): 3/4/4
Features used in Species ID: Dark grey colored, robust animals, light colored capes extending from rostrum to dorsal fin, white color on peduncle
Representative images used for Species ID: 4438, 4439
Photographer: Ryan Frame numbers: 4370 to 4440 Spacer: 4441
Calculated distance from Trackline: 2.0 km

Final Time and Position of Sighting

Time: 15:37 WP#: 49 Lat: 33.479525 Long: -76.629389
Calculated Distance Traveled: 1.108 km

Behavior and Additional Comments

Animals were traveling fast just below the surface and darting different directions. Animals had white peduncles. Animals were also doing deeper dives.

Monday, March 8, 2010 Sighting # 2

Initial sighting on Track

Time: 15:41 WP#: 51 Lat: 33.403629 Long: -76.534098
Vertical Angle: 3 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Trackline: 2 Beaufort Sea State: 3
Observer: Erin Observer side: Left

Actual Time and Position of Sighting

Time: 15:43 WP#: 52 Lat: 33.410814 Long: -76.538489
Species: *Tursiops truncatus* Numbers (Low/High/Best): 4/5/5
Features used in Species ID: Dark grey colored, robust animals, light colored cape extending from rostrum to dorsal fin, while peduncle
Representative images used for Species ID: 4452-4456
Photographer: Ryan Frame numbers: 4442 to 4457 Spacer: 4458
Calculated distance from Trackline: 0.897 km

Final Time and Position of Sighting

Time: 15:44 WP#: 53 Lat: 33.407768 Long: -76.533567
Calculated Distance Traveled: 0.569 km

Behavior and Additional Comments

Some animals were logging at the surface or just below. Animals had white peduncles.

Tuesday, March 9, 2010 Sighting # 1

Initial sighting on Track

Time: 9:01 WP#: 4 Lat: 33.946805 Long: -76.844542
Vertical Angle: 3 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Trackline: 5 Beaufort Sea State: 1
Observer: Ryan Observer side: Left

Actual Time and Position of Sighting

Time: 9:02 WP#: 5 Lat: 33.960739 Long: -76.832647
Species: *Tursiops truncatus* Numbers (Low/High/Best): 15 / 15 / 15
Features used in Species ID: Uniform light grey coloration across the animals body. Robust animal with a wide base to the dorsal fin and broad fluke blades.
Representative images used for Species ID: 4465, 4469 & 4489
Photographer: Erin Frame numbers: 4459 to 4508 Spacer: 4508
Calculated distance from Trackline: 1.9 km

Final Time and Position of Sighting

Time: 9:10 WP#: 6 Lat: 33.94881 Long: -76.848433
Calculated Distance Traveled: 2 km

Behavior and Additional Comments

Dolphins moving slowly at the surface in a horizontal line. Upon circling animals they began diving and staying submerged for longer periods of time either just below the surface or out of sight.

Tuesday, February 9, 2010 Sighting # 2

Initial sighting on Track

Time: 9:15 WP#: 10 Lat: 33.833809 Long: -76.695374
Vertical Angle: 2 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Trackline: 5 Beaufort Sea State: 1
Observer: Erin Observer side: Right

Actual Time and Position of Sighting

Time: 9:17 WP#: 11 Lat: 33.830343 Long: -76.706061
Species: *Tursiops truncatus* Numbers (Low/High/Best): 6 / 6 / 6
Features used in Species ID: Uniform body coloration to animals body, robust body, flukes and pectoral fins.
Representative images used for Species ID: 4509 to 4542
Photographer: Erin Frame numbers: 4509 to 4542 Spacer: 4543
Calculated distance from Trackline: 1 km

Final Time and Position of Sighting

Time: 9:23 WP#: 12 Lat: 33.826938 Long: -76.705278
Calculated Distance Traveled: 0.4 km

Behavior and Additional Comments

Initially 2 animals seen moving slowly at the surface with non-directional travel at surface. They would surface briefly then dive, swimming just below the surface. As sighting continued more animals appeared bring the total to 6 animals that were widely separated from one another. All animals had a robust body appearance. Calves were observed.

Tuesday, March 9, 2010 Sighting # 3

Initial sighting on Track

Time: 9:29 WP#: 16 Lat: 33.718742 Long: -76.544124
Vertical Angle: 3 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Trackline: 5 Beaufort Sea State: 1
Observer: Ryan Observer side: Left

Actual Time and Position of Sighting

Time: 9:32 WP#: 17 Lat: 33.720726 Long: -76.534367
Species: *Tursiops truncatus* Numbers (Low/High/Best): 20 / 20 / 20
Features used in Species ID: Robust bodied animals, broad fluke blades and pectoral fins. Presence of white peduncle patch.
Representative images used for Species ID: 4544, 4557 & 4574
Photographer: Erin Frame numbers: 4544 to 4584 Spacer: 4585
Calculated distance from Trackline: 0.9 km

Final Time and Position of Sighting

Time: 9:34 WP#: 18 Lat: 33.721457 Long: -76.535991
Calculated Distance Traveled: 0.2 km

Behavior and Additional Comments

A slow group of animals hanging out just below the surface within one body length of one another. White peduncles observed in the group.

Tuesday, March 9, 2010 Sighting # 4

Initial sighting on Track

Time: 9:51 WP#: 22 Lat: 33.742673 Long: -76.444336
Vertical Angle: 3 Horizontal Bearing in Degrees: 60 Sighting Cue: Body
On/Off Effort: On Trackline: 6 Beaufort Sea State: 1
Observer: Ryan Observer side: Left

Actual Time and Position of Sighting

Time: 9:52 WP#: 23 Lat: 33.743504 Long: -76.443130
Species: *Tursiops truncatus* Numbers (Low/High/Best): 60 / 70 /65
Features used in Species ID: Dark dorsal body coloration with a lighter shoulder stripe to the area of the dorsal fin. White coloration behind dorsal fin to region of peduncle.
Representative images used for Species ID: 4598, 4602 & 4606
Photographer: Erin Frame numbers: 4586 to 4638 Spacer: 4639
Calculated distance from Trackline: 0.1 km

Final Time and Position of Sighting

Time: 9:57 WP#: 24 Lat: 33.745405 Long: -76.439837
Calculated Distance Traveled: 0.3 km

Behavior and Additional Comments

A large diffuse group of dolphins splashing a lot at the surface while surfacing at regular intervals.

Tuesday, March 9, 2010 Sighting # 5

Initial sighting on Track

Time: 10:10 WP#: 34 Lat: 34.014712 Long: -76.803052
Vertical Angle: 2 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Trackline: 6 Beaufort Sea State: 1
Observer: Erin Observer side: Right

Actual Time and Position of Sighting

Time: 10:11 WP#: 35 Lat: 34.017554 Long: -76.803091
Species: *Tursiops truncatus* Numbers (Low/High/Best): 5/5/5
Features used in Species ID: Uniform light grey coloration to the body, broad based dorsal fin.

Representative images used for Species ID: 4643, 4645 & 4656
Photographer: Erin Frame numbers: 4640 to 4674 Spacer: 4675
Calculated distance from Trackline: 0.3 km

Final Time and Position of Sighting

Time: 10:18 WP#: 36 Lat: 34.023353 Long: -76.805641
Calculated Distance Traveled: 0.7 km

Behavior and Additional Comments

Animals traveling slowly right at the surface - they appear a more uniform grey coloration.
Two calves approximately 75% of adult size were observed in the group.

Tuesday, March 9, 2010 Sighting # 6

Initial sighting on Track

Time: 10:42 WP#: 45 Lat: 33.768898 Long: -76.344696
Vertical Angle: 1 Horizontal Bearing in Degrees: 110 Sighting Cue: Body
On/Off Effort: On Trackline: 7 Beaufort Sea State: 1
Observer: Erin Observer side: Right

Actual Time and Position of Sighting

Time: 10:42 WP#: 49 Lat: 33.770576 Long: -76.346663
Species: *Delphinus delphis* Numbers (Low/High/Best): 20 / 20 / 20
Features used in Species ID: Dark grey/black dorsal coloration with clear division from ventral cream color. Light peduncle coloration forms V behind dorsal fin. Dark tip & central crease to rostrum.
Representative images used for Species ID: 4679, 4686-87, 4690, 4695-96, 4702, 4732, 4755
Photographer: Erin Frame numbers: 4676 to 4766 Spacer: 4767
Calculated distance from Trackline: 0.2 km

Final Time and Position of Sighting

Time: 10:43 WP#: 50 Lat: 33.771246 Long: -76.353443
Calculated Distance Traveled: 0.6 km

Behavior and Additional Comments

Dense group traveling right at the surface, some showing bellies. Odd lateral coloration to body.
At least 3 calvres present.

Tuesday, March 9, 2010 Sighting # 7

Initial sighting on Track

Time: 10:57 WP#: 48 Lat: 33.719389 Long: -76.280639
Vertical Angle: 1 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Trackline: 7 Beaufort Sea State: 1
Observer: Erin Observer side: Right

Actual Time and Position of Sighting

Time: 10:57 WP#: 54 Lat: 33.719563 Long: -76.280838
Species: *Tursiops truncatus* Numbers (Low/High/Best): 9 / 9 / 9
Features used in Species ID: Robust animal , braod flukes, uniform grey coloration.

Representative images used for Species ID: 4770, 4780, 4787 & 4792
Photographer: Erin Frame numbers: 4768 to 4793 Spacer: 4793
Calculated distance from Trackline: 0.02670 km

Final Time and Position of Sighting

Time: 11:04 WP#: 55 Lat: 33.716324 Long: -76.273950
Calculated Distance Traveled: 0.07318 km

Behavior and Additional Comments

Groups of 2-3 animals widely spaced from one another. Surfacing regularly then spending much of the time traveling subsurface. White peduncles present. A few calves were observed.

Tuesday, March 9, 2010 Sighting # 8

Initial sighting on Track

Time: 11:12 WP#: 59 Lat: 33.795542 Long: -76.24935
Vertical Angle: 1 Horizontal Bearing in Degrees: 60 Sighting Cue: Body
On/Off Effort: On Trackline: 8 Beaufort Sea State: 1
Observer: Erin Observer side: Right

Actual Time and Position of Sighting

Time: 11:14 WP#: 60 Lat: 33.796304 Long: -76.241464
Species: *Tursiops truncatus* Numbers (Low/High/Best): 13/13/13
Features used in Species ID: Dark grey dorsal coloration with a lighter shoulder stripe to area of dorsal fin. Broad based dorsal fin and light peduncle region.
Representative images used for Species ID: 4794, 4800, 4804 & 4809
Photographer: Erin Frame numbers: 4794 to 4820 Spacer: 4821
Calculated distance from Trackline: 0.7336 km

Final Time and Position of Sighting

Time: 11:22 WP#: 61 Lat: 33.797223 Long: -76.240884
Calculated Distance Traveled: 0.1154 km

Behavior and Additional Comments

Initial sighting of a pair of animals traveling at a good rate of speed side by side. More animals arrived during sighting for a total of about 13 animals in groups of 2-4 spaced well apart from each other. White peduncle regions were observed.

Tuesday, March 9, 2010 Sighting # 9

Initial sighting on Track

Time: 12:01 WP#: 75 Lat: 33.864916 Long: -76.214671
Vertical Angle: 1 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Trackline: 9 Beaufort Sea State: 1
Observer: Ryan Observer side: Left

Actual Time and Position of Sighting

Time: 12:03 WP#: 76 Lat: 33.871443 Long: -76.213856
Species: *Tursiops truncatus* Numbers (Low/High/Best): 30/30/30
Features used in Species ID: Dark grey dorsal region with shoulder stripe to trailing edge of dorsal fin. Dark region just behind dorsal fin angling forward to pectoral fin.
Representative images used for Species ID: 4854, 4861 & 4869
Photographer: Erin Frame numbers: 4822 to 4874 Spacer: 4875
Calculated distance from Trackline: 0.7297 km

Final Time and Position of Sighting

Time: 12:08 WP#: 77 Lat: 33.881694 Long: -76.215087
Calculated Distance Traveled: 1.146 km

Behavior and Additional Comments

A diffuse group of dolphins that were hanging out at the surface interacting with one another. Lots of splashing. No direction to travel during our observation.

Tuesday, March 9, 2010 Sighting # 10

Initial sighting on Track

Time: 12:18 WP#: 81 Lat: 33.850651 Long: -76.070237
Vertical Angle: 3 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Trackline: 10 Beaufort Sea State: 1
Observer: Erin Observer side: Right

Actual Time and Position of Sighting

Time: 12:19 WP#: 82 Lat: 33.858932 Long: -76.064517
Species: *Tursiops truncatus* Numbers (Low/High/Best): 2 / 4 / 4
Features used in Species ID: Darker grey dorsal region with lighter shoulder blaze. White peduncle patch.
Representative images used for Species ID: 4881 & 4892
Photographer: Erin Frame numbers: 4876 to 4899 Spacer: 4900
Calculated distance from Trackline: 1.062 km

Final Time and Position of Sighting

Time: 12:24 WP#: 83 Lat: 33.860598 Long: -76.064861
Calculated Distance Traveled: 0.1880 km

Behavior and Additional Comments

Animals logging close to the surface with little directional movement. Very diffuse group with some white peduncle patches present.

Tuesday, March 9, 2010 Sighting # 11

Initial sighting on Track

Time: 12:29 WP#: 85 Lat: 33.966355 Long: -76.21616
Vertical Angle: 3 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Trackline: 10 Beaufort Sea State: 1
Observer: Ryan Observer side: Left

Actual Time and Position of Sighting

Time: 12:30 WP#: 86 Lat: 33.963446 Long: -76.22154
Species: *Balaenoptera physalis* Numbers (Low/High/Best): 1 / 1 / 1
Features used in Species ID: Large fusiform body shape, wide flukes, light coloration around head relatively small pectoral fins. Total body length ~60ft.
Representative images used for Species ID: 4940, 4942-44
Photographer: Erin Frame numbers: 4901 to 4945 Spacer: 4946
Calculated distance from Trackline: 0.6 km

Final Time and Position of Sighting

Time: 12:43 WP#: 87 Lat: 33.964796 Long: -76.221166
Calculated Distance Traveled: 0.2 km

Behavior and Additional Comments

Large animal logging just below the surface, could see a dark dorsal coloration with light coloration on head and pectoral flippers. Animals dove out of sight after initial sighting. It was relocated once where it surfaced for a breath before diving out of sight again.

Wednesday, March 10, 2010 Sighting # 1

Initial sighting on Track

Time: 9:56 WP#: 16 Lat: 33.845063 Long: -77.103378
Vertical Angle: 2 Horizontal Bearing in Degrees: 90 Sighting Cue: 2
On/Off Effort: On Trackline: 2 Beaufort Sea State: 1
Observer: Erin Observer side: Left

Actual Time and Position of Sighting

Time: 9:57 WP#: 17 Lat: 33.844501 Long: -77.105389
Species: *Unidentified Delphinid* Numbers (Low/High/Best): 3/3/3
Features used in Species ID: N/A

Representative images used for Species ID: N/A
Photographer: Ryan Frame numbers: 4946 to 4956 Spacer: 4957
Calculated distance from Trackline: 0.1960 km

Final Time and Position of Sighting

Time: 10:05 WP#: 18 Lat: 33.855759 Long: -77.096990
Calculated Distance Traveled: 1.473 km

Behavior and Additional Comments

One mom/calf pair traveling spaced out from another adult. Animals were traveling fast to the SW. They were swimming just below the surface and doing deeper dives but spending most of the time below the surface. Showing extreme avoidance behavior. Calf was relatively new, measuring less then 50% of the moms body size.

Sunday, April 11, 2010 Sighting # 1

Initial sighting on Track

Time: 9:50 WP#: 15 Lat: 34.012236 Long: -76.933173
Vertical Angle: 3 Horizontal Bearing in Degrees: 90 Sighting Cue: body
On/Off Effort: On Trackline: 5 Beaufort Sea State: 2
Observer: Erin Observer side: Left

Actual Time and Position of Sighting

Time: 9:53 WP#: 16 Lat: 34.010019 Long: -76.930714
Species: *Stenella frontalis* Numbers (Low/High/Best): 12/18/18
Features used in Species ID: Alternating light and dark pattern down the body. White tip on rostrum and spots present.
Representative images used for Species ID: 5244, 5231, 5226, 5218, 5216, 5212
Photographer: Ryan Frame numbers: 5179 to 5247 Spacer: 5248
Calculated distance from Trackline: 0.3349 km

Final Time and Position of Sighting

Time: 10:02 WP#: 17 Lat: 34.012325 Long: -76.931942
Calculated Distance Traveled: 0.2803 km

Behavior and Additional Comments

Animals were traveling in a tight group with a few stragglers. Most were staying just below the surface with some doing deeper dives and some jumping. Once we started circling they dispersed.

Sunday, April 11, 2010 Sighting # 2

Initial sighting on Track

Time: 11:13 WP#: 36 Lat: 33.489563 Long: -76.641621
Vertical Angle: 1 Horizontal Bearing in Degrees: 100 Sighting Cue: body
On/Off Effort: On Trackline: 2 Beaufort Sea State: 4
Observer: Erin Observer side: Left

Actual Time and Position of Sighting

Time: 11:15 WP#: 37 Lat: 33.484779 Long: -76.651031
Species: *Tursiops truncatus* Numbers (Low/High/Best): 37/41/40
Features used in Species ID: Robust animals with a uniform grey color throughout except for a white pattern on the peduncle.
Representative images used for Species ID: 5291, 5281, 5256, 5255
Photographer: Ryan Frame numbers: 5249 to 5310 Spacer: 5311
Calculated distance from Trackline: 1.022 km

Final Time and Position of Sighting

Time: 11:29 WP#: 38 Lat: 33.483916 Long: -76.645300
Calculated Distance Traveled: 0.5401 km

Behavior and Additional Comments

Animals had white peduncles, some were seen swimming on their sides. There were three groups of 4, 8, 25+ traveling and darting in different directions. There was some jumping and splashing . Possible avoidance behavior. Some were doing deeper dives.

Monday, April 12, 2010 Sighting # 1

Initial sighting on Track

Time: 11:15 WP#: 36 Lat: 33.685605 Long: -76.501951
Vertical Angle: 1 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Trackline: 5 Beaufort Sea State: 3
Observer: Erin Observer side: Left

Actual Time and Position of Sighting

Time: 11:17 WP#: 37 Lat: 33.685951 Long: -76.498036
Species: *Tursiops truncatus* Numbers (Low/High/Best): 7 / 9 / 8
Features used in Species ID: Robust body shape and white peduncle patch.

Representative images used for Species ID: 5321 & 5327
Photographer: Erin Frame numbers: 5312 - 5331 Spacer: 5332
Calculated distance from Trackline: 0.3 km

Final Time and Position of Sighting

Time: 11:30 WP#: 38 Lat: 33.677447 Long: -76.50565
Calculated Distance Traveled: 1.2 km

Behavior and Additional Comments

White peduncle patch observed. Initial sighting was of 2 animals, one on each side of the plane. Once we began circling more animals were seen. Disperse group traveling at moderate speed with no consistent direction. Difficult to photograph animals unless we were right on top of them because of the high Beaufort Sea State.

Wednesday, June 16, 2010 Sighting # 1

Initial sighting on Track

Time: 11:03 WP#: 25 Lat: 34.017047 Long: -76.403834
Vertical Angle: 1 Horizontal Bearing in Degrees: 90 Sighting Cue: body
On/Off Effort: On Trackline: 9 Beaufort Sea State: 2
Observer: Ryan Observer side: Right

Actual Time and Position of Sighting

Time: 11:04 WP#: 26 Lat: 34.013141 Long: -76.406738
Species: *Stenella frontalis* Numbers (Low/High/Best): 40/65/55
Features used in Species ID: Alternating light and dark pattern down the body, white tip on rostrum
Representative images used for Species ID: 5455, 5462-5464, 5488, 5490, 5491
Photographer: Ryan Frame numbers: 5428 to 5495 Spacer: 5495
Calculated distance from Trackline: 0.5102 km

Final Time and Position of Sighting

Time: 11:09 WP#: 27 Lat: 34.020554 Long: -76.414159
Calculated Distance Traveled: 1.071 km

Behavior and Additional Comments

Large group of animals traveling fairly close together, all milling around on the surface, flashing bellies, some belly to belly contact.

Thursday, June 17, 2010 Sighting # 1

Initial sighting on Track

Time: 10:05 WP#: 18 Lat: 33.578886 Long: -76.62527
Vertical Angle: 1 Horizontal Bearing in Degrees: 90 Sighting Cue: Splash
On/Off Effort: On Trackline: 3 Beaufort Sea State: 2
Observer: Erin Observer side: Right

Actual Time and Position of Sighting

Time: 10:07 WP#: 19 Lat: 33.574286 Long: -76.630432
Species: *Tursiops truncatus* Numbers (Low/High/Best): 20 / 23 / 21
Features used in Species ID: Robust animals, uniform grey color through out, except for a white color pattern on the peduncle
Representative images used for Species ID: 5498, 5505, 5508, 5511, 5519
Photographer: Erin Frame numbers: 5496 to 5530 Spacer: 5531
Calculated distance from Trackline: 0.7 km

Final Time and Position of Sighting

Time: 10:13 WP#: 20 Lat: 33.579754 Long: -76.625076
Calculated Distance Traveled: 0.8 km

Behavior and Additional Comments

Disperse group covering a wide area of approximately a half a mile. Group traveling at a moderate speed just below the surface in pair or singles. Some animals causing large splashes while surfacing. White peduncle patch present on animals. Possibly one calf in group.

Thursday, June 17, 2010 Sighting # 2

Initial sighting on Track

Time: 14:34 WP#: 46 Lat: 33.865240 Long: -76.20837
Vertical Angle: 2 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Trackline: 9 Beaufort Sea State: 2
Observer: Ryan Observer side: Left

Actual Time and Position of Sighting

Time: 14:37 WP#: 47 Lat: 33.871597 Long: -76.208675
Species: *Tursiops truncatus* Numbers (Low/High/Best): 9 / 13 / 13
Features used in Species ID: Robust animals, uniform grey color throughout, except for a white color pattern on the peduncle
Representative images used for Species ID: 5536, 5537, 5547, 5576, 5583, 5585
Photographer: Erin Frame numbers: 5532 to 5596 Spacer: 5597
Calculated distance from Trackline: 0.7 km

Final Time and Position of Sighting

Time: 14:55 WP#: 48 Lat: 33.875885 Long: -76.208729
Calculated Distance Traveled: 0.5 km

Behavior and Additional Comments

Animals traveling side by side just below the surface in groups of 4-5 with ~20 feet between groups. White peduncle present on most to all individuals with one animal with extremely white area behind dorsal fin. Animals formed into a tighter group while we were circling them.

Friday, June 18, 2010 Sighting # 1

Initial sighting on Track

Time: 9:16 WP#: 6 Lat: 33.631227 Long: -76.556895
Vertical Angle: 2 Horizontal Bearing in Degrees: 100 Sighting Cue: Splash
On/Off Effort: On Trackline: 4 Beaufort Sea State: 1
Observer: Erin Observer side: Left

Actual Time and Position of Sighting

Time: 9:20 WP#: 7 Lat: 33.637239 Long: -76.561817
Species: *Tursiops truncatus* Numbers (Low/High/Best): 5/8/8
Features used in Species ID: Robust animals, uniform grey color throughout except for a white color pattern on the peduncle
Representative images used for Species ID: 5642, 5670-5672
Photographer: Ryan Frame numbers: 5617 to 5676 Spacer: 5677
Calculated distance from Trackline: 0.8090 km

Final Time and Position of Sighting

Time: 9:23 WP#: 8 Lat: 33.639783 Long: -76.563793
Calculated Distance Traveled: 0.3369 km

Behavior and Additional Comments

Slow travel and staying on the surface or just below. Some doing deeper dives. There was one group of 5 animals and one group of 3. Animals have a white pattern on the peduncle, and regular surfacing. Some belly to belly swimming.

Friday, June 18, 2010 Sighting # 2

Initial sighting on Track

Time: 9:38 WP#: 12 Lat: 33.559194 Long: -76.607674
Vertical Angle: 1 Horizontal Bearing in Degrees: 60 Sighting Cue: Splash
On/Off Effort: On Trackline: 3 Beaufort Sea State: 1
Observer: Erin Observer side: Left

Actual Time and Position of Sighting

Time: 9:38 WP#: 13 Lat: 33.556626 Long: -76.603283
Species: *Tursiops truncatus* Numbers (Low/High/Best): 20/32/32
Features used in Species ID: Robust animals with uniform grey color throughout except for a white color pattern on the peduncle
Representative images used for Species ID: 5678, 5704, 5707, 5715
Photographer: Ryan Frame numbers: 5678 to 5731 Spacer: 5732
Calculated distance from Trackline: 0.4971 km

Final Time and Position of Sighting

Time: 9:47 WP#: 14 Lat: 33.552743 Long: -76.619753
Calculated Distance Traveled: 1.586 km

Behavior and Additional Comments

Animals traveling spaced out. At least one calf observed. Animals traveling just under the surface with regular surfacing. Some belly to belly swimming. Animals have white peduncles

Friday, June 18, 2010 Sighting # 3

Initial sighting on Track

Time: 10:36 WP#: 23 Lat: 33.437707 Long: -76.706675
Vertical Angle: 1 Horizontal Bearing in Degrees: 90 Sighting Cue: Splash
On/Off Effort: On Trackline: 1 Beaufort Sea State: 1
Observer: Erin Observer side: Left

Actual Time and Position of Sighting

Time: 10:36 WP#: 24 Lat: 33.430727 Long: -76.703646
Species: *Tursiops truncatus* Numbers (Low/High/Best): 25/25/25
Features used in Species ID: Robust animals with uniform grey color throughout except for a white color pattern on the peduncle
Representative images used for Species ID: 5741, 5749, 5758, 5776, 5778, 5779, 5800, 5803
Photographer: Ryan Frame numbers: 5733 to 5818 Spacer: 5819
Calculated distance from Trackline: 0.8255 km

Final Time and Position of Sighting

Time: 10:43 WP#: 25 Lat: 33.431798 Long: -76.717267
Calculated Distance Traveled: 1.270 km

Behavior and Additional Comments

Animals traveling very spaced out, not traveling in any particular direction. Most doing deeper dives and staying under for a while. Some belly to belly swimming. Possible calves, white peduncles present.

Notes on the Sighting Summary Sheet

The Sighting Summary, adapted from the Sighting Data Sheet used in the field (Fig. 3), integrates data gathered in the field with results from lab analyses to provide a full summary of each marine mammal sighting. A Sighting Summary was completed for all sightings, including sightings made while off-effort during transits between survey legs, as well as sighting cues which were never relocated.

The Sighting Summary sheet is broken into four sections; "Initial Sighting on Track", "Time and Position of Sighting", "Final Time and Position of Sighting", and "Behavior and Additional Comments". Each section and sub headings will be detailed below.

Initial Sighting on Track

Time*:* The time the break track GPS way-point was taken
WP#: GPS way-point number of the break track
Lat/Long: The latitude and longitude associated with the break track way-point
Track Line: The track line surveyed when the sighting was made
On/Off Effort: Whether the sighting was made during an active survey track line (i.e. On effort) or during transit BETWEEN track lines (i.e. off effort). Sightings made during off effort transit to and from the range are NOT included in the sighting summaries.
Sighting Cue: Whether the initial sighting was a splash, a breach or body part.
Vertical Angle: Vertical "angle" between 1 and 4, the lower edge of view ("1") to the horizon ("4"). A subjective and relative measure of how far away from the track line the initial sighting occurred.
Horizontal Bearing in Degrees: The horizontal degrees from front to back (0 to 180) at which the sighting occurred.
Observer: Three lettered initial of the observer who made the sighting
Observer Side: On which side of the plane in the direction of travel the sighting occurred.

Time and Position of Sighting

Time*:* The time the GPS way-point was taken while relocating animals and circling above
WP#: GPS way-point number of the sighting
Lat/Long: The latitude and longitude associated with the way point obtained while circling over animals
Beaufort Sea State: The sea state observed during the sighting
Species: Scientific binomial name of the marine mammal species involved in the sighting. When species identity could not be established unequivocally, the next higher taxonomic level to which identity could be established was used. If a cetacean was identified as a dolphin but images obtained during the encounter were not sufficient to establish species ID, the designation "unidentified delphinid" or "*T. truncatus/S. frontalis*" was used. The next higher level used was unidentified cetacean. If a large body was observed but it could not be established whether a cetacean, fish/shark or turtle was involved in the sighting, the designation "unidentified marine vertebrate" was used.
Criteria used to identify species: Which species specific diagnostic features were used in classifying a sighting to species.
Best images used for species ID: The images obtained during the sighting that best displayed the features used to establish species.

Numbers (Low/ High/ Best): Low, high, and best estimate of number of animals involved in the sighting.
Calves observed? Whether any calves were observed during the encounter. A conservative measure was used, in that only animals roughly half the size of the associated larger animal (the presumed mother) were designated as calves.
Calculated Distance from Track Line: The distance between the break track way-point and the initial sighting way-point. For more information on how distance was calculated and errors inherent in this method, refer to the "Methods" section.
Photographer: Three lettered initials of observer seated in the right camera seat.
Card #: Memory card on which the photos from the particular sighting was made.
Frame Numbers: Starting and ending frame number
Spacer: Image used to separate sighting to clarify when one sighting ends and the next begins. Image typically of interior of plane or a 45 degree angle shot of the horizon.

Final Time and Position of Sighting
Time: WP#: Lat: Long: Calculated Distance traveled: ➡see section above

Behavior and Additional Comments
Any behavioral notes obtained during the sighting (*e.g*. group formation, relative travel speed, feeding events or presumed copulation attempts, presence of other cetaceans or sharks in or around the animal(s) in the sighting, interaction with inanimate objects such marine debris). This section also includes notes on altitude of the survey plane during the encounter as well as any indications (or lack thereof) of the animal(s) reacting evasively to the presence of the plane.

Date: _____

USWTR Daily Plane Log Sheet

Pilot in Command: _____ Second in Command: _____ Plane: _____
Observers: _____
Time take off: _____ HOBBS Start: _____
Land for lunch: _____
Track Lines and Direction (e.g. N to S) Flown: _____

Take off after lunch: _____ HOBBS Stop: _____
Land: _____ HOBBS Total: _____
Track Lines and Direction (e.g. N to S) Flown: _____
Overall weather: _____

General Observations

_____
_____
_____
_____
_____
_____
_____Transit effort leg:_____

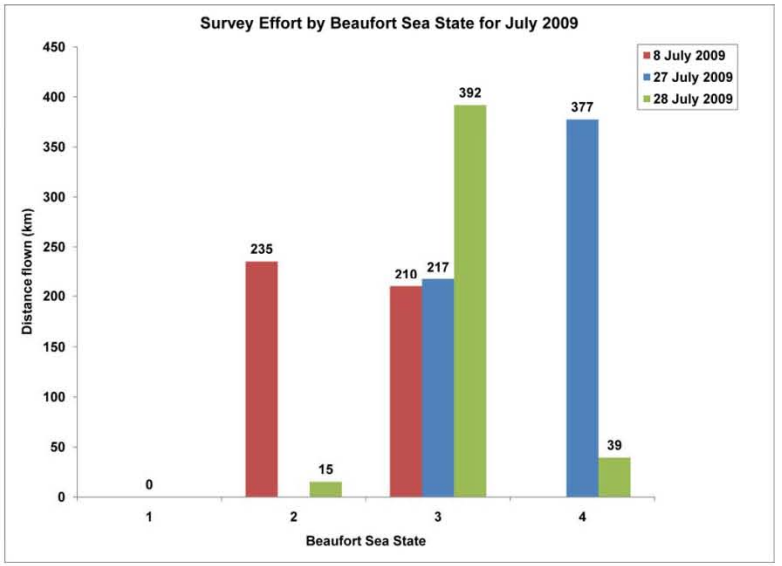
Appendix H

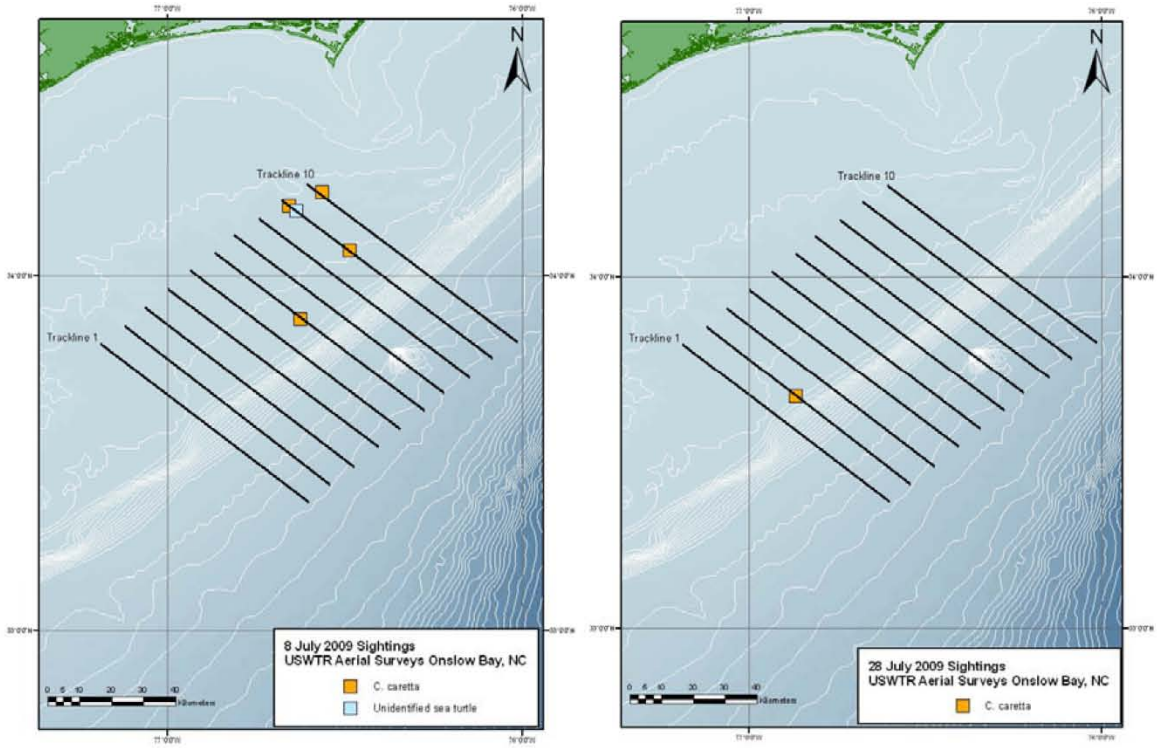
July 8, 2009

Species	Number of Sightings	Number of Individuals	Beaufort Sea State	Line number
Caretta caretta	4	5	3	-
Unidentified sea turtle	1	2	3	9

July 28, 2009

Species	Number of Sightings	Number of Individuals	Beaufort Sea State	Line number
Caretta caretta	1	1	3	2



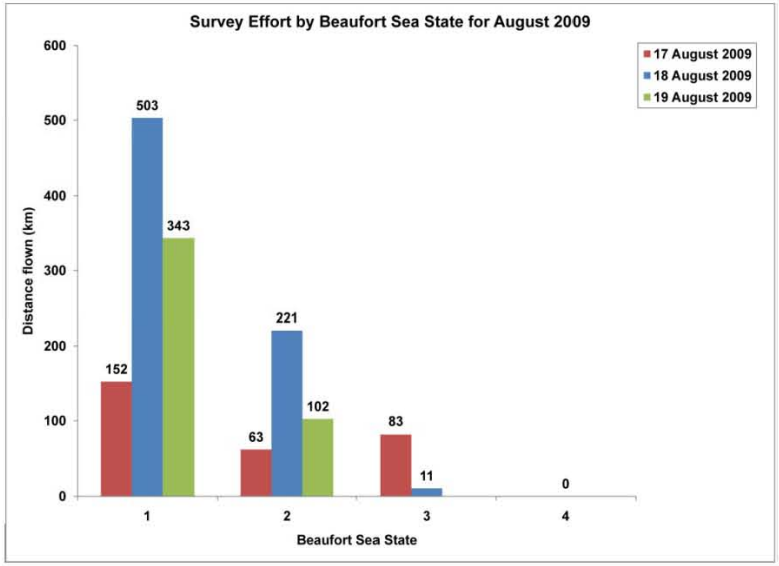


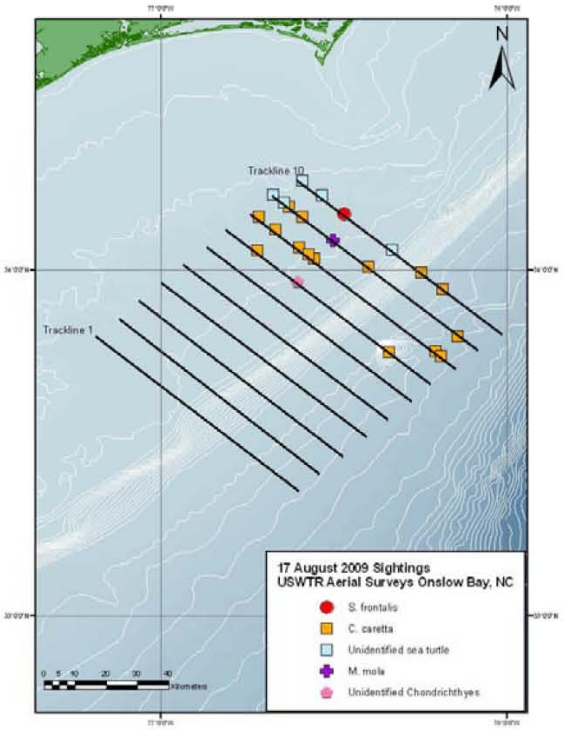
August 17, 2009

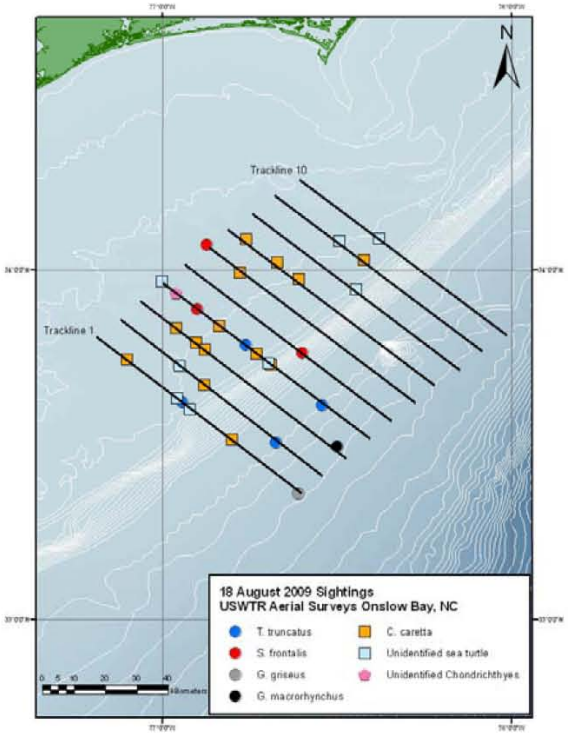
Species	Number of Sightings	Number of Individuals	Beaufort Sea State	Line number
Stenella frontalis	1	35	1	10
Caretta caretta	15	15	1 to 3	-
Unidentified sea turtle	5	7	1	-
Mola mola	1	1	1	9
Unidentified Chondrichthyes	1	1	1	7

August 18, 2009

Species	Number of Sightings	Number of Individuals	Beaufort Sea State	Line number
Grampus griseus	1	6	2	1
Globicephala macrorhynchus	1	40	2	3
Stenella frontalis	1	2	1	4
Stenella frontalis	1	65	1	5
Stenella frontalis	1	9	1	6
Tursiops truncatus	1	35	2	2
Tursiops truncatus	1	2	2	4
Tursiops truncatus	1	3	1	4
Tursiops truncatus	1	2	1	Off effort
Caretta caretta	14	14	1 to 2	-
Unidentified sea turtle	8	8	1 to 2	-
Unidentified Chondrichthyes	1	1	1	4

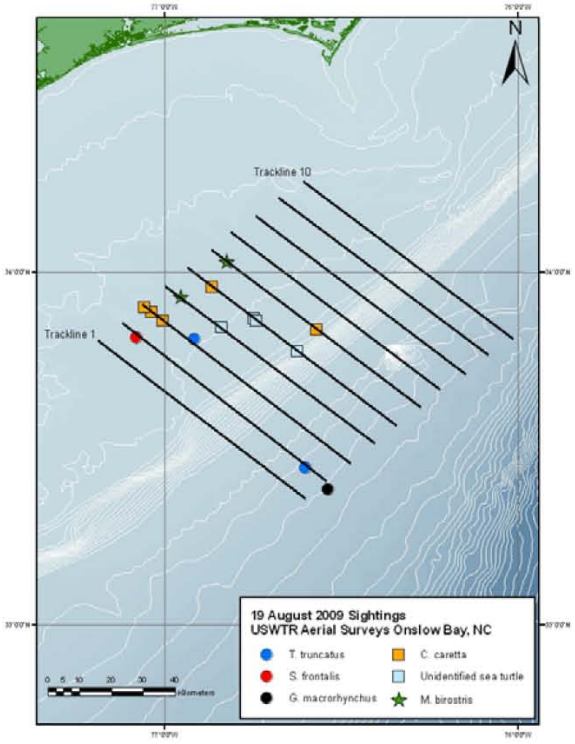


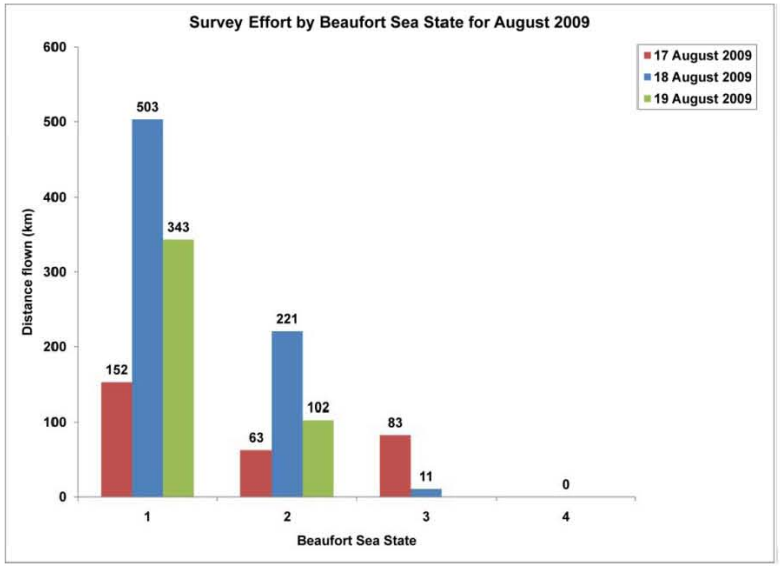




August 19, 2009

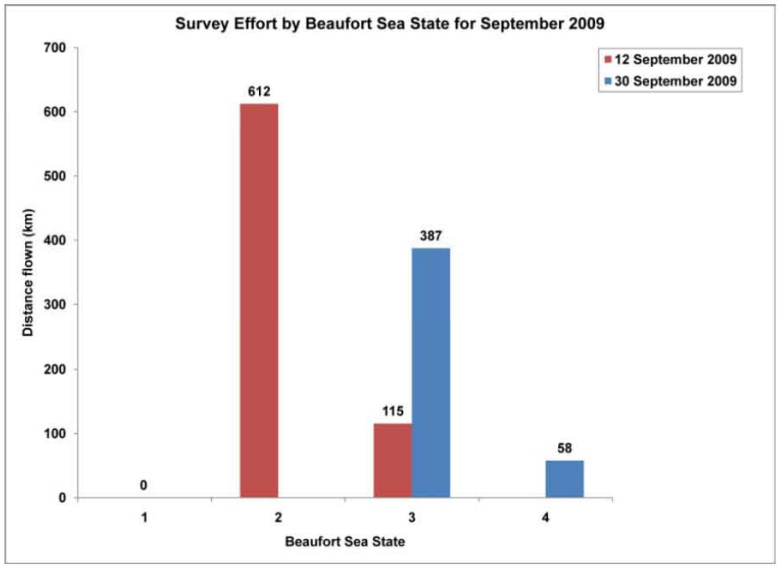
Species	Number of Sightings	Number of Individuals	Beaufort Sea State	Line number
Tursiops truncatus	1	3	1	3
Tursiops truncatus	1	8	1	2
Stenella frontalis	1	4	1	2
Globicephala macrorhynchus	1	6	-	Off effort
Caretta caretta	5	5	1 to 2	-
Unidentified sea turtle	4	4	1 to 2	-
Manta birostris	2	2	2	-





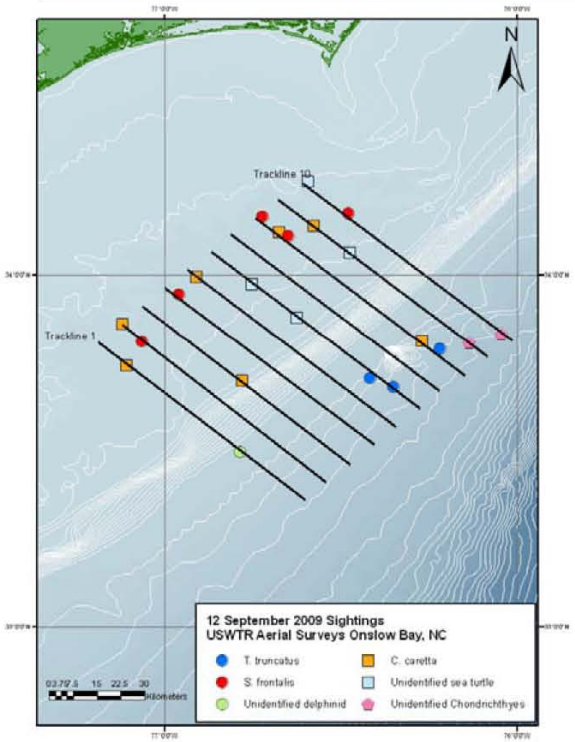
September 12, 2009

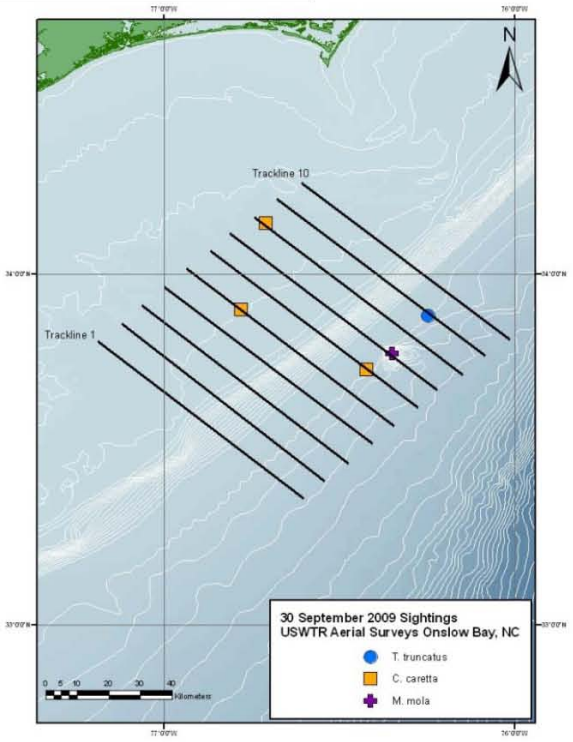
Species	Number of Sightings	Number of Individuals	Beaufort Sea State	Line number
Unidentified Delphinid	1	3	2	1
Tursiops truncatus	1	1	2	6
Tursiops truncatus	1	3	2	6
Tursiops truncatus	1	19	2	8
Stenella frontalis	1	7	2	2
Stenella frontalis	1	12	2	4
Stenella frontalis	1	14	2	10
Stenella frontalis	1	4	2	8
Stenella frontalis	1	4	2	8
Caretta caretta	7	7	2	-
Unidentified sea turtle	4	4	2	-
Unidentified Chondrichthyes	2	2	2	-



September 30, 2009

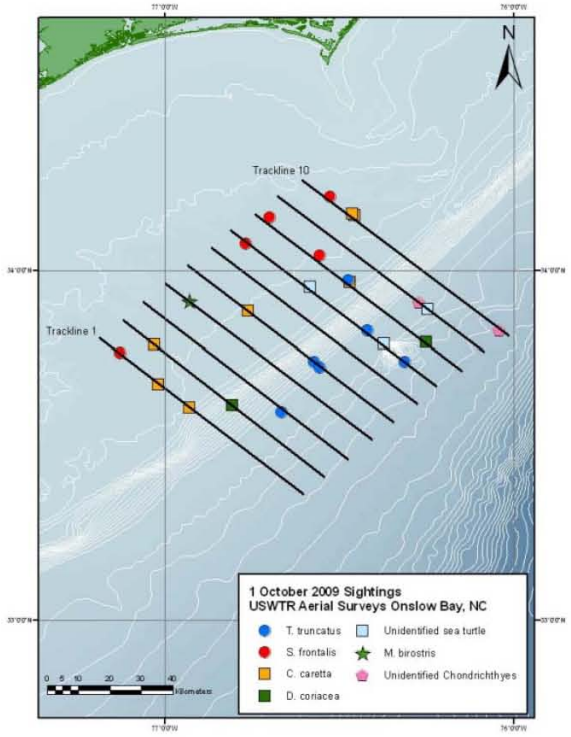
Species	Number of Sightings	Number of Individuals	Beaufort Sea State	Line number
Tursiops truncatus	1	43	3	9
Caretta caretta	3	3	3	-
Mola mola	1	1	3	7

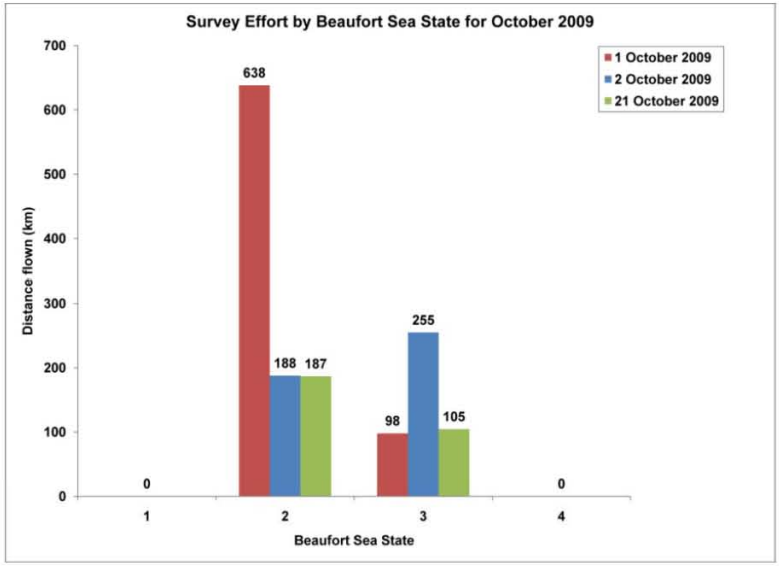




October 1, 2009

Species	Number of Sightings	Number of Individuals	Beaufort Sea State	Line number
Tursiops truncatus	1	4	2	5
Tursiops truncatus	1	6	2	7
Tursiops truncatus	1	19	2	3
Tursiops truncatus	1	8	2	5
Tursiops truncatus	1	15	2	7
Tursiops truncatus	1	2	2	8
Stenella frontalis	1	20	3	7
Stenella frontalis	1	6	2	8
Stenella frontalis	1	9	2	8
Stenella frontalis	1	27	2	10
Stenella frontalis	1	4	2	1
Caretta caretta	7	7	2	-
Dermochelys coriacea	2	2	2	-
Unidentified sea turtle	3	3	2	-
Manta birostris	1	1	2	4
Unidentified Chondrichthyes	2	2	2 to 3	-



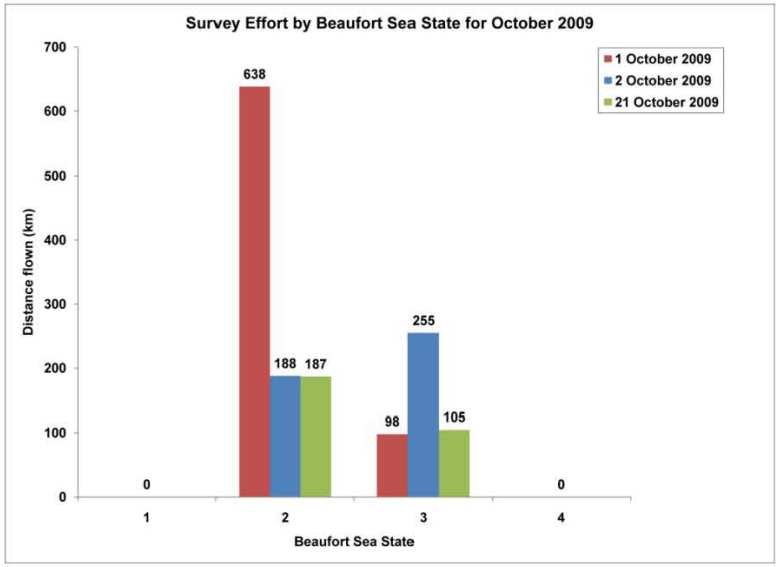


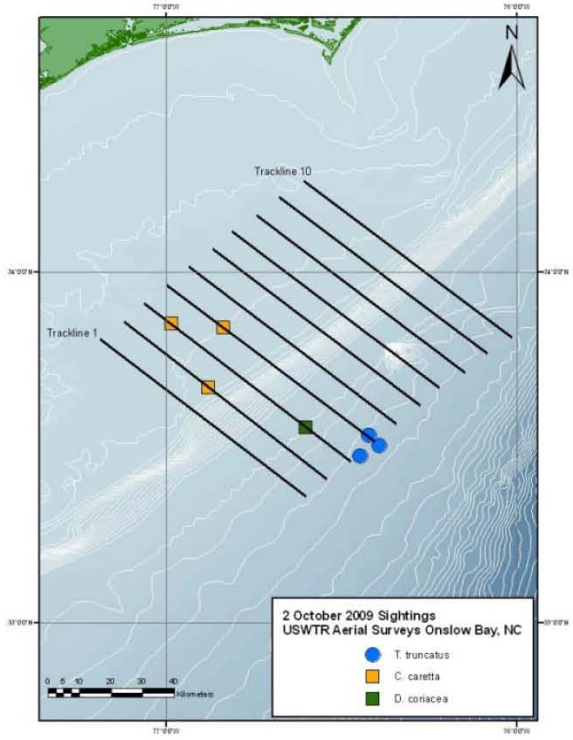
October 2, 2009

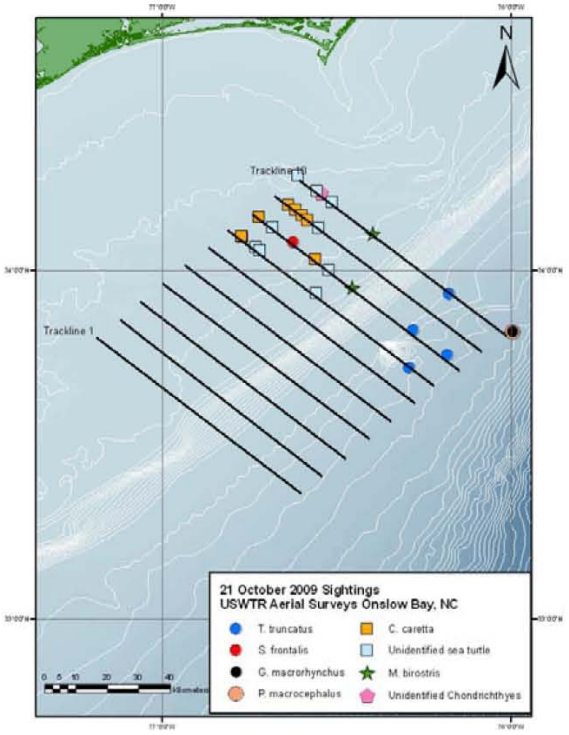
Species	Number of Sightings	Number of Individuals	Beaufort Sea State	Line number
Tursiops truncatus	1	15	3	4
Tursiops truncatus	1	11	2	Off effort
Tursiops truncatus	1	8	2	Off effort
Caretta caretta	3	3	2	-
Dermochelys coriacea	1	1	3	3

October 21, 2009

Species	Number of Sightings	Number of Individuals	Beaufort Sea State	Line number
Tursiops truncatus	1	6	3	10
Tursiops truncatus	1	2	3	8
Tursiops truncatus	1	40	3	8
Tursiops truncatus	1	12	3	7
Stenella frontalis	1	4	2	8
Globicephala macrorhynchus	1	12	3	Off effort
Physter macrocephalus	1	1	3	Off effort
Caretta caretta	8	11	2	-
Unidentified sea turtle	9	11	2	-
Manta birostris	2	3	2	-
Unidentified Chondrichthyes	1	1	2	10





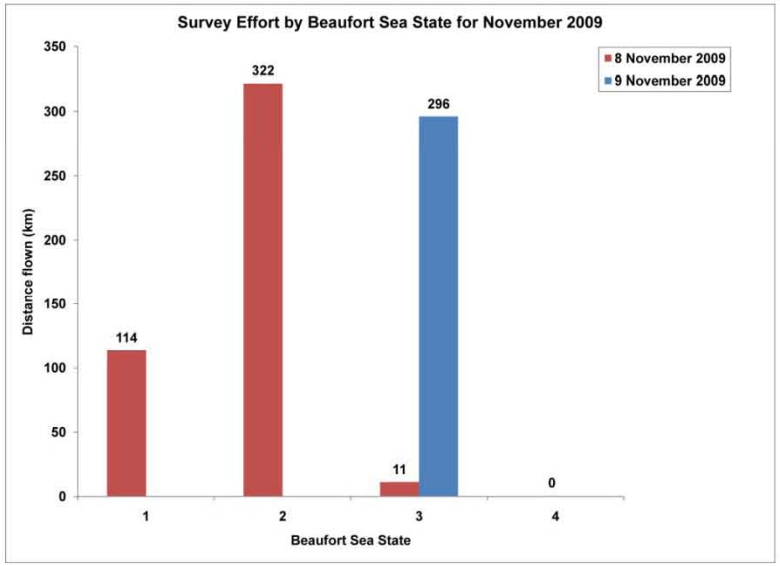


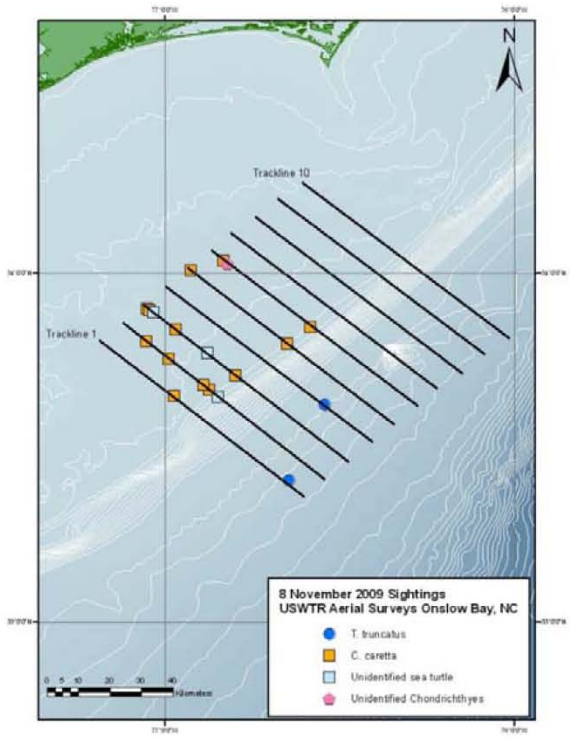
November 8, 2009

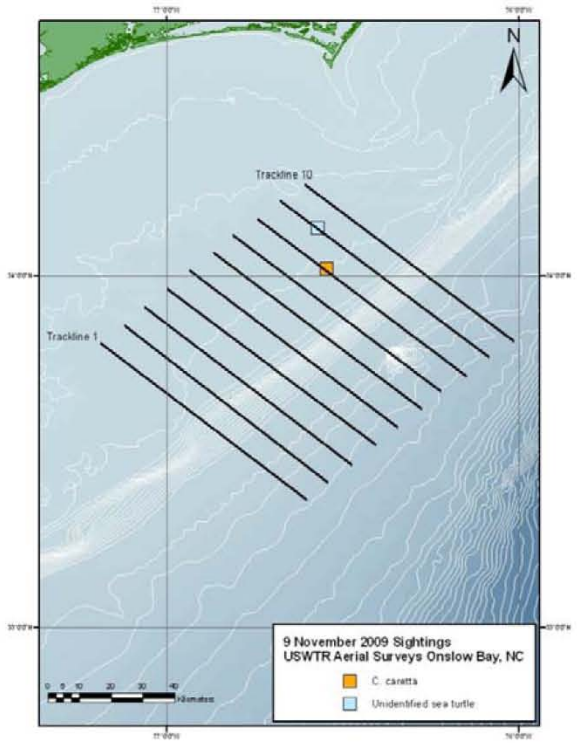
Species	Number of Sightings	Number of Individuals	Beaufort Sea State	Line number
Tursiops truncatus	1	38	2	1
Tursiops truncatus	1	4	2	4
Caretta caretta	13	23	1 to 2	-
Unidentified sea turtle	3	3	1 to 2	-
Unidentified Chondrichthyes	1	1	1	6

November 9, 2009

Species	Number of Sightings	Number of Individuals	Beaufort Sea State	Line number
Caretta caretta	1	1	3	-
Unidentified sea turtle	1	1	3	-

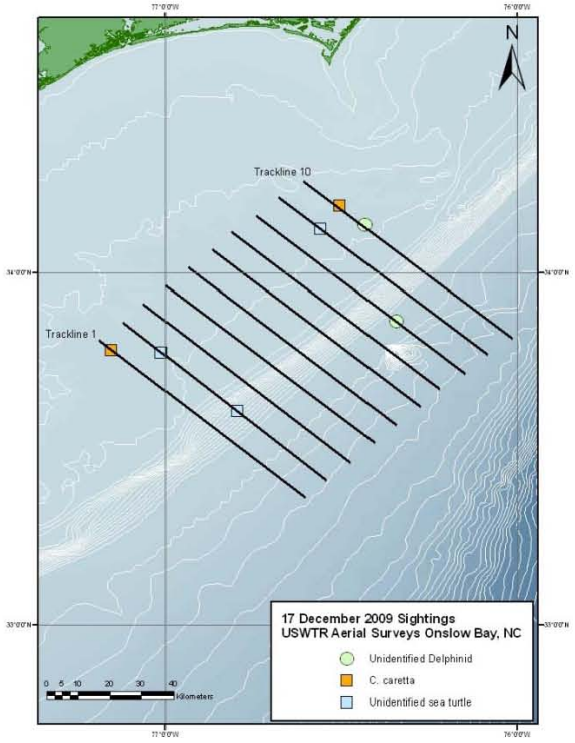


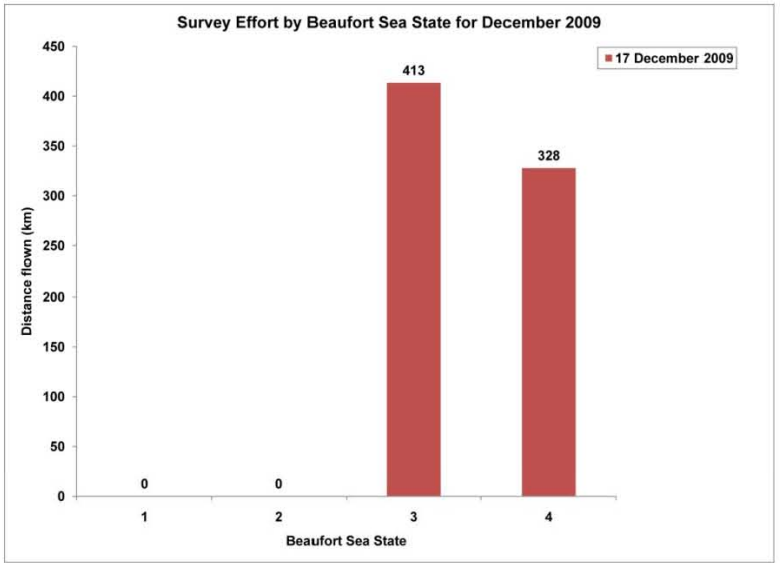




December 17, 2009

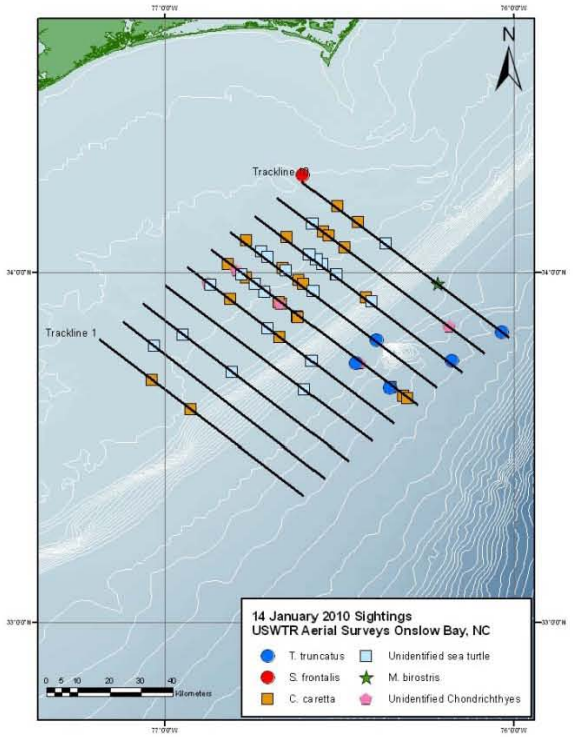
Species	Number of Sightings	Number of Individuals	Beaufort Sea State	Line number
Unidentified delphinid	1	2	3	8
Unidentified delphinid	1	15	4	10
Caretta caretta	2	2	3 to 4	-
Unidentified sea turtle	3	3	3 to 4	-

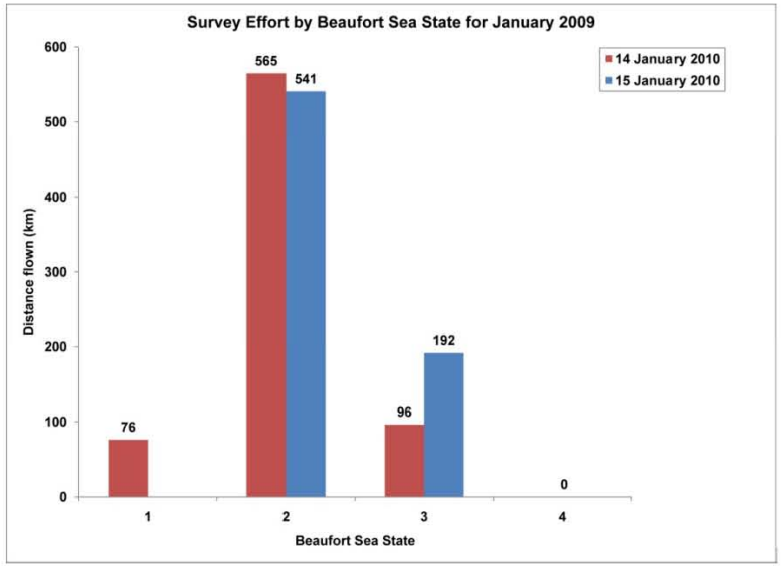




January 14, 2010

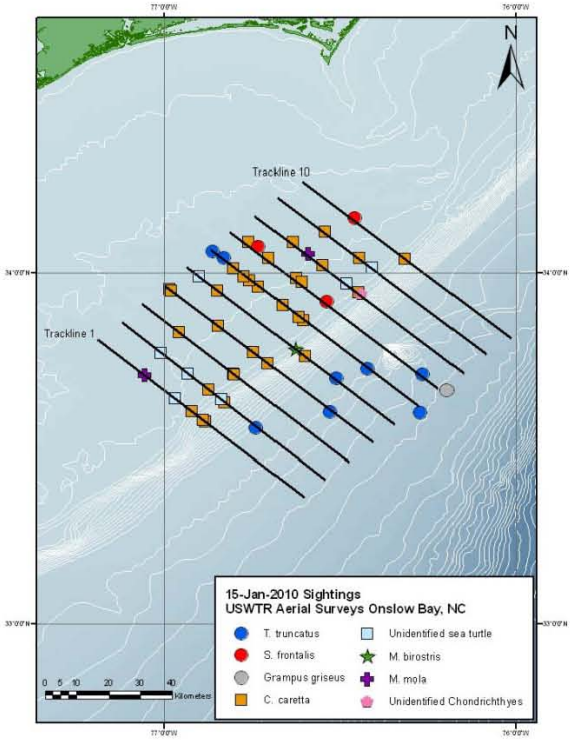
Species	Number of Sightings	Number of Individuals	Beaufort Sea State	Line number
Tursiops truncatus	1	5	2	6
Tursiops truncatus	1	5	2	6
Tursiops truncatus	1	3	2	7
Tursiops truncatus	1	15	2	8
Tursiops truncatus	1	1	2	10
Stenella frontalis	1	37	2	10
Caretta caretta	24	45	1 to 2	-
Unidentified sea turtle	22	40	1 to 3	-
Manta birostris	1	1	2	10
Unidentified Chondrichthyes	6	7	2	-

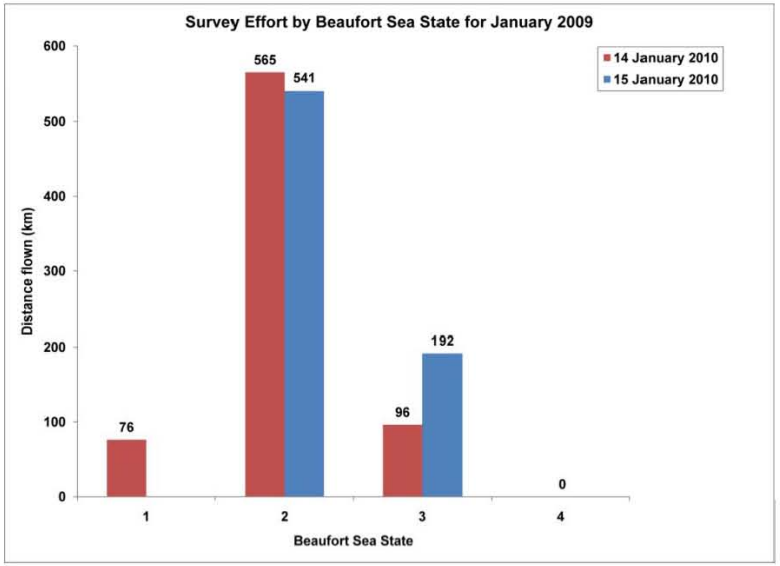




January 15, 2010

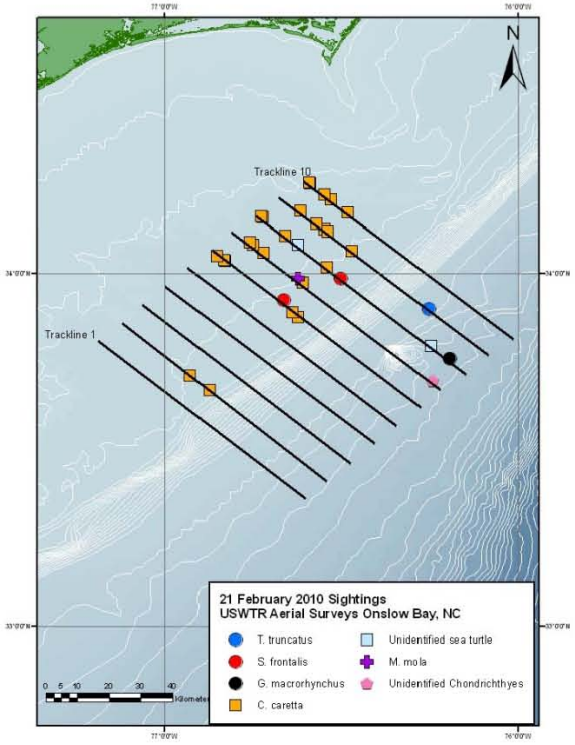
Species	Number of Sightings	Number of Individuals	Beaufort Sea State	Line number
Tursiops truncatus	1	20	3	4
Tursiops truncatus	1	22	3	5
Tursiops truncatus	1	8	3	-
Tursiops truncatus	1	14	3	6
Tursiops truncatus	1	3	2	6
Tursiops truncatus	1	27	2	7
Tursiops truncatus	1	8	3	2
Tursiops truncatus	1	46	2	6
Stenella frontalis	1	30	2	7
Stenella frontalis	1	28	2	7
Stenella frontalis	1	47	2	10
Grampus griseus	1	5	-	Off effort
Caretta caretta	32	57	2 to 3	-
Unidentified sea turtle	7	9	2 to 3	-
Manta birostris	1	1	2	5
Mola mola	2	2	2	-
Unidentified Chondrichthyes	1	1	2	8

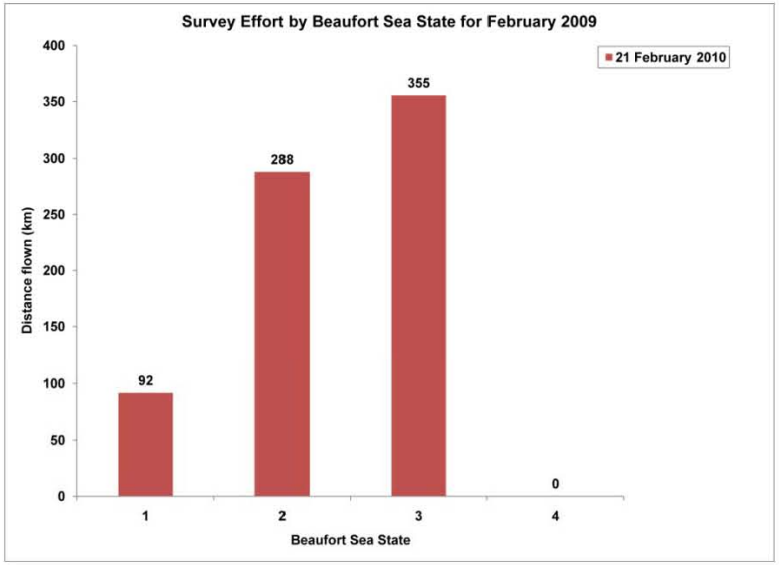




February 21, 2010

Species	Number of Sightings	Number of Individuals	Beaufort Sea State	Line number
Tursiops truncatus	1	11	3	9
Stenella frontalis	1	18	2	6
Stenella frontalis	1	8	1	8
Globicephala macrorhynchus	1	23	2	8
Caretta caretta	25	49	1 to 3	-
Unidentified sea turtle	2	3	1 to 2	-
Mola mola	1	1	1	7
Unidentified Chondrichthyes	1	1	2	7



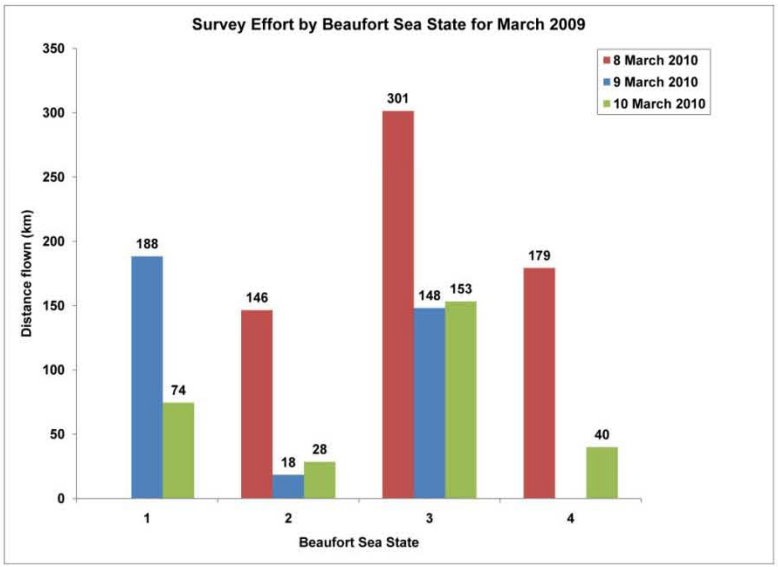


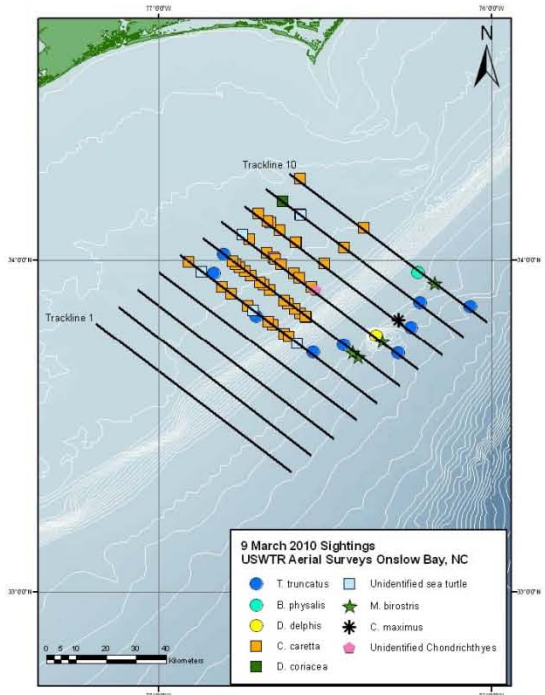
March 8, 2010

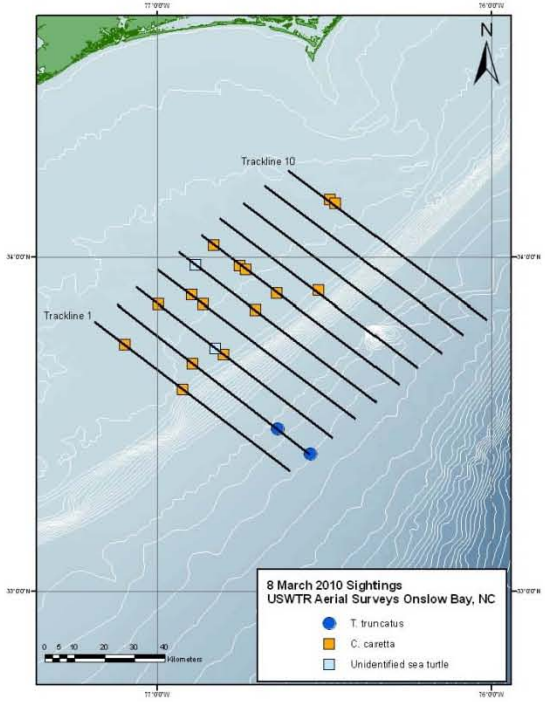
Species	Number of Sightings	Number of Individuals	Beaufort Sea State	Line number
Tursiops truncatus	1	4	3	2
Tursiops truncatus	1	5	3	2
Caretta caretta	15	21	2 to 3	-
Unidentified sea turtle	2	2	2 to 3	-

March 9, 2010

Species	Number of Sightings	Number of Individuals	Beaufort Sea State	Line number
Tursiops truncatus	1	15	1	5
Tursiops truncatus	1	20	1	5
Tursiops truncatus	1	65	1	6
Tursiops truncatus	1	30	1	9
Tursiops truncatus	1	6	1	5
Tursiops truncatus	1	5	1	9
Tursiops truncatus	1	9	1	7
Tursiops truncatus	1	13	1	8
Tursiops truncatus	1	4	1	10
Delphinus delphis	1	20	1	7
Balaenoptera physalis	1	1	1	10
Caretta caretta	41	158	1 to 2	-
Dermochelys coriacea	1	1	1	9
Unidentified sea turtle	5	11	1 to 2	-
Cetorhinus maximus	1	1	1	8
Manta birostris	4	4	1	-
Unidentified Chondrichthyes	1	1	1	7

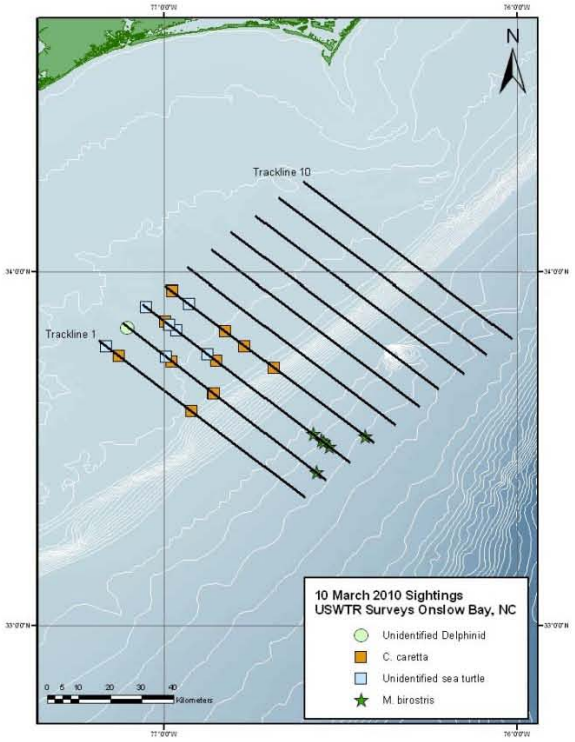


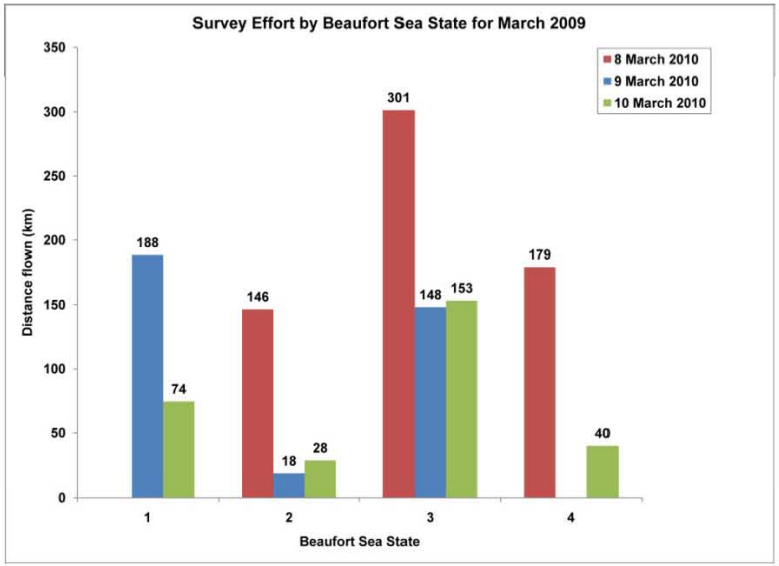




March 10, 2010

Species	Number of Sightings	Number of Individuals	Beaufort Sea State	Line number
Unidentified delphinid	1	3	1	2
Caretta caretta	12	19	1 to 3	-
Unidentified sea turtle	7	13	1 to 3	-
Manta birostris	6	6	3 to 4	-



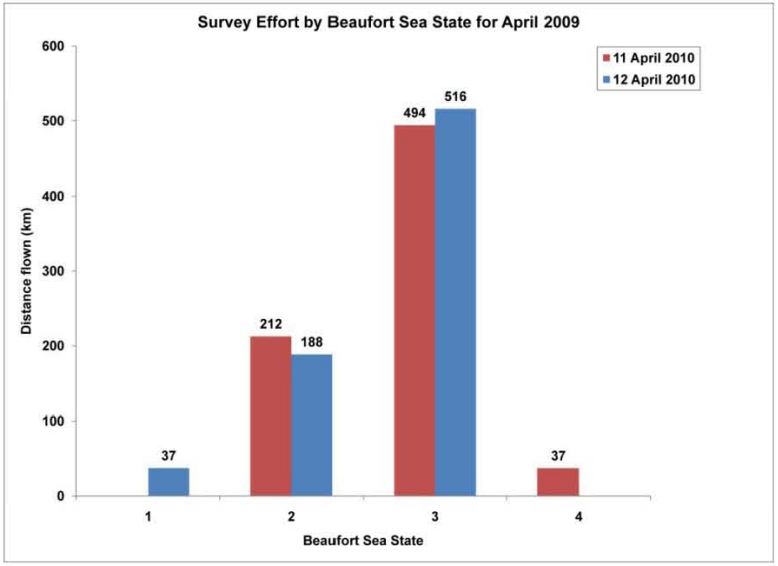


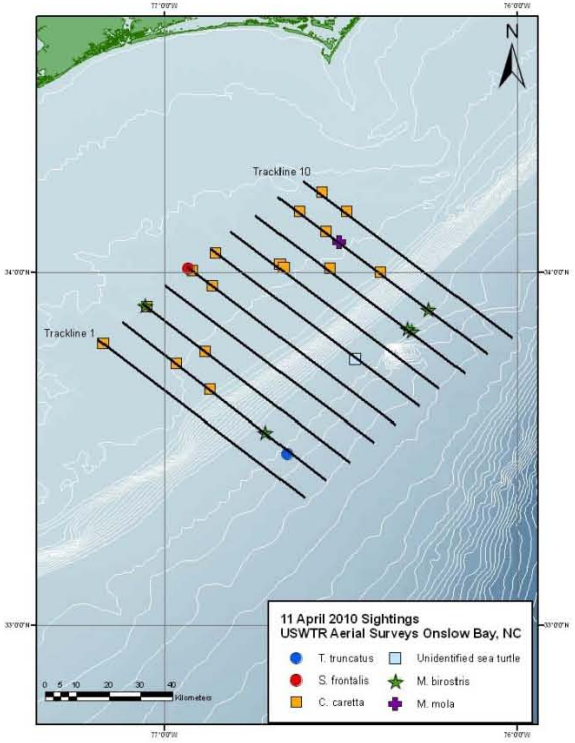
April 11, 2010

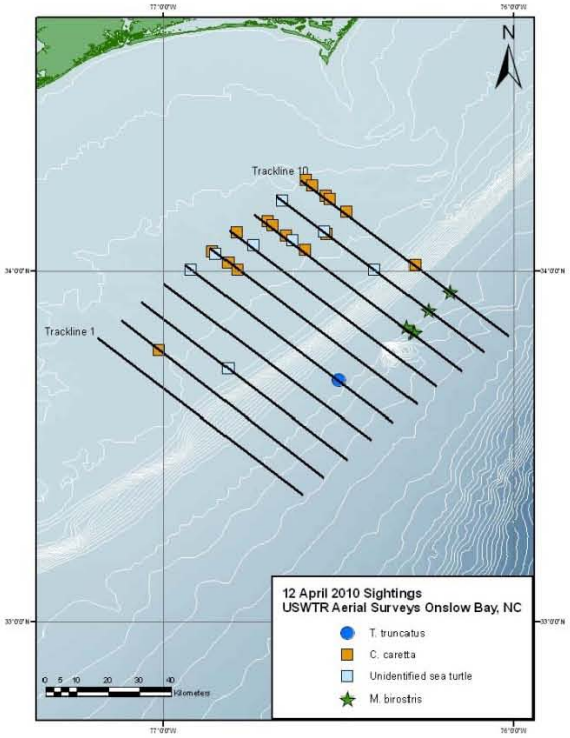
Species	Number of Sightings	Number of Individuals	Beaufort Sea State	Line number
Tursiops truncatus	1	40	4	2
Stenella frontalis	1	18	2	5
Caretta caretta	16	17	2 to 3	-
Unidentified sea turtle	1	1	3	6
Manta birostris	5	5	2 to 3	-
Mola mola	1	1	2	9

April 12, 2010

Species	Number of Sightings	Number of Individuals	Beaufort Sea State	Line number
Tursiops truncatus	1	9	3	5
Caretta caretta	16	27	1 to 3	-
Unidentified sea turtle	8	15	2 to 3	-
Manta birostris	5	7	3	-





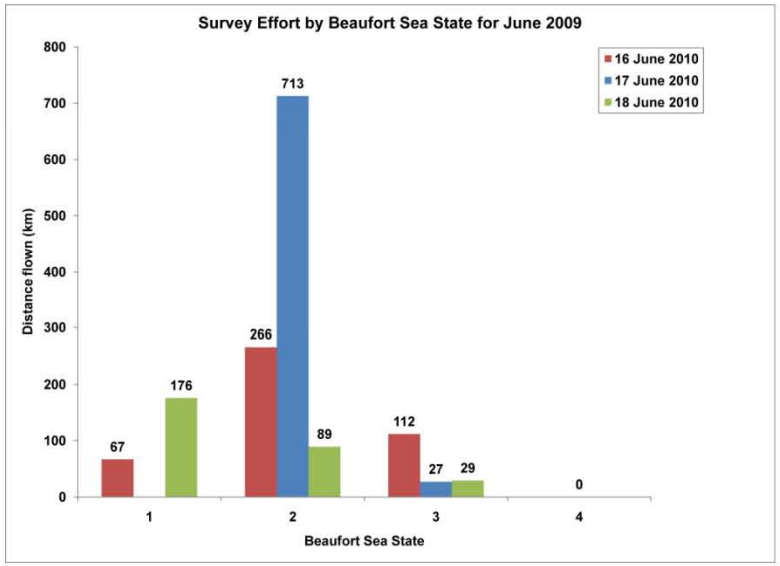


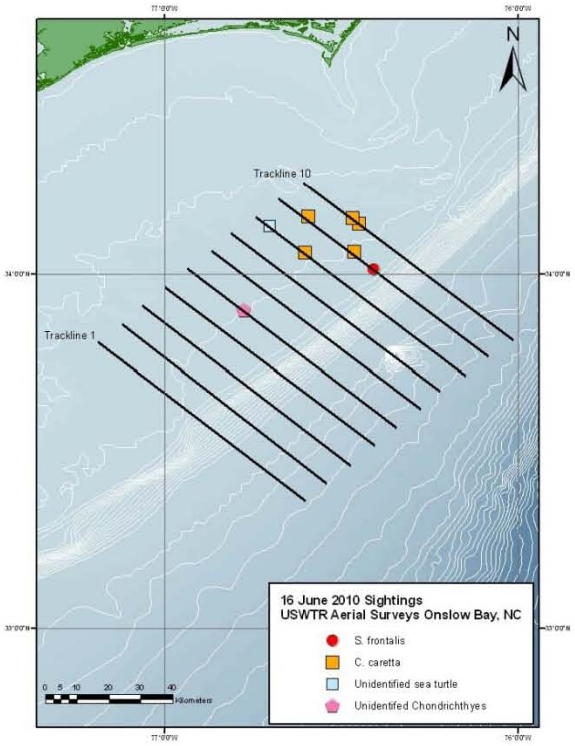
June 16, 2010

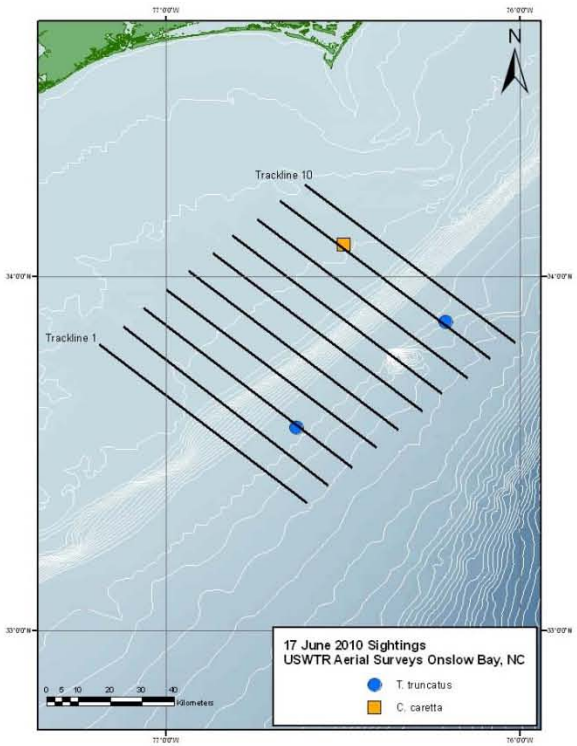
Species	Number of Sightings	Number of Individuals	Beaufort Sea State	Line number
Stenella frontalis	1	55	2	9
Caretta caretta	5	6	2 to 3	-
Unidentified sea turtle	1	1	2	8
Unidentified Chondrichthyes	1	1	1	5

June 17, 2010

Species	Number of Sightings	Number of Individuals	Beaufort Sea State	Line number
Tursiops truncatus	1	21	2	3
Tursiops truncatus	1	13	2	9
Caretta caretta	1	1	2	9

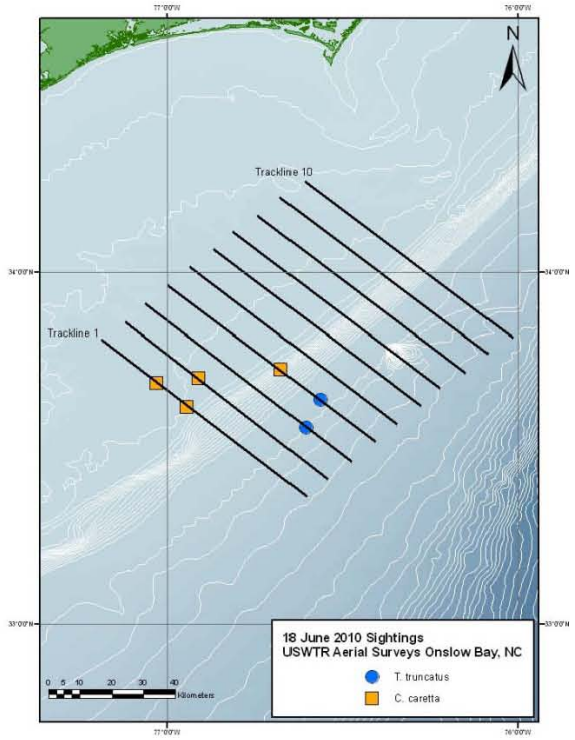


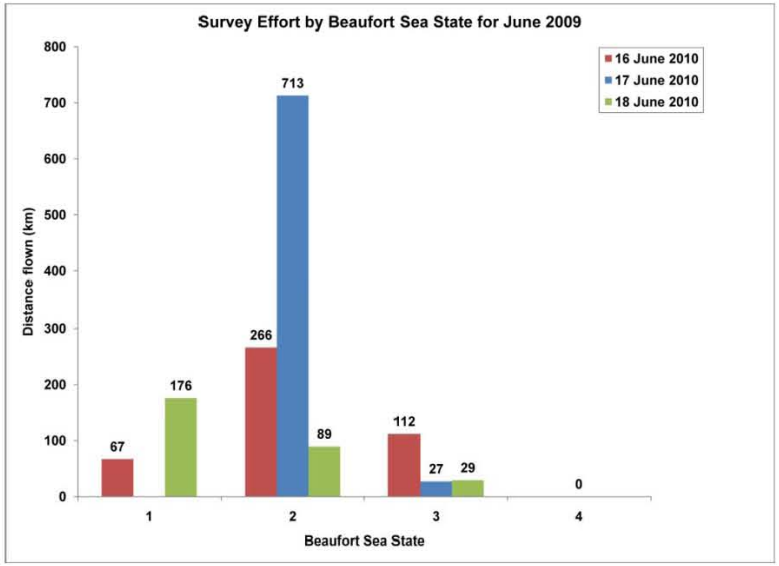




June 18, 2010

Species	Number of Sightings	Number of Individuals	Beaufort Sea State	Line number
Tursiops truncatus	1	8	1	4
Tursiops truncatus	1	32	1	3
Tursiops truncatus	1	25	1	1
Caretta caretta	4	4	1 to 2	-





VESSEL-BASED SURVEYS AND PASSIVE ACOUSTIC MONITORING OF THE PROPOSED UNDERSEA WARFARE TRAINING RANGE (USWTR) IN ONSLOW BAY, NORTH CAROLINA JULY 2009 THROUGH JUNE 2010

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Dave Johnston
Kim Urian
Danielle Waples
Lynne Williams
Lesley Thorne
Anna-Marie Laura
Jennifer Dunn
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The Department of the Navy
Norfolk, VA

Methodology

Study Area

The study area consists of a box approximately 37% larger than the proposed USWTR; the USWTR area itself is 25 nm (46 km) long and 20 nm (37 km) wide (approximately from NW to SE; Figure 1). We survey ten 40-nm (74-km) long transect lines oriented parallel to the short axis of the USWTR boundaries and perpendicular to the prevailing bathymetric and oceanographic features influencing the study area. The transect lines are spaced approximately 5 nm (9.3 km) apart. This design yields a total of 400 nm (741 km) of track line available for surveys; all ten transect lines were surveyed by both aerial and shipboard platforms.

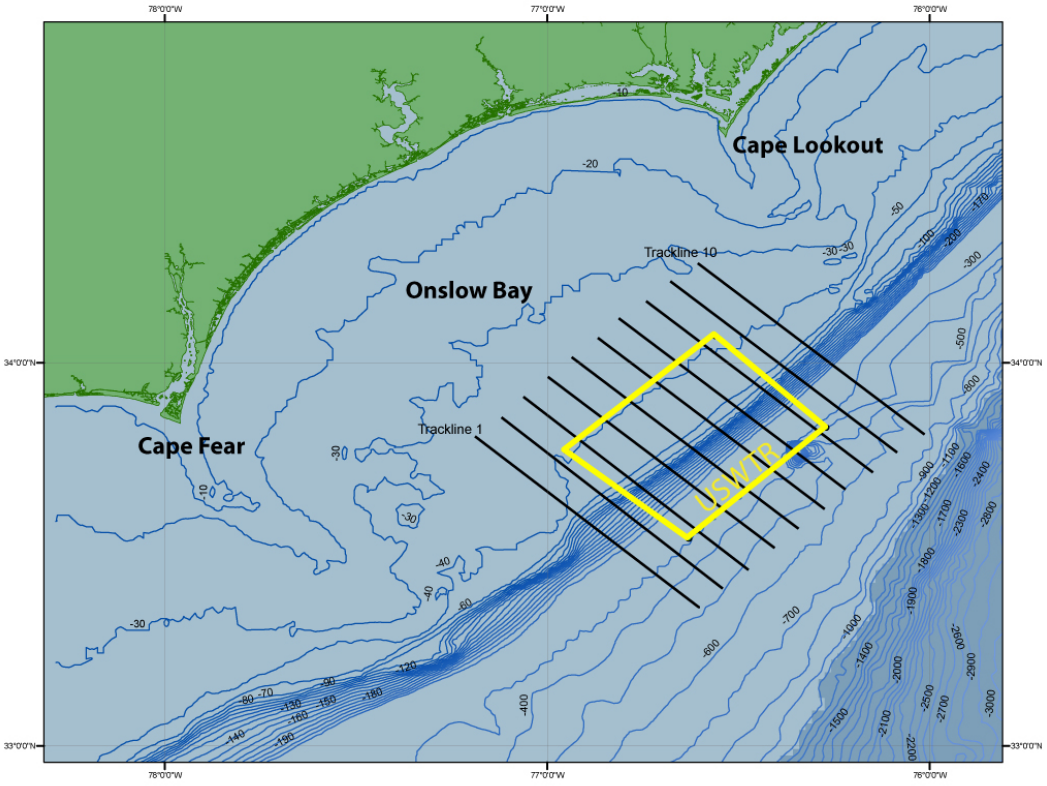


Figure 1. **Map of the study area, the proposed Undersea Warfare Training Range (USWTR; yellow box) and bathymetry of Onslow Bay.**

Vessel Survey Data Collection

Visual Surveys

Vessel-based survey platforms provide a greater probability of sighting deep-diving species than aerial surveys (Barlow and Gisiner 2006). Shipboard observers are also more likely to be able to confirm species identity, particularly for animals that are difficult to distinguish from the air. Additionally, vessel-based platforms allow for biopsy sampling and photographic identification.

To ensure maximum detection rates, we employed a traditional visual survey approach, supplemented by passive acoustic monitoring using a towed hydrophone array. We conducted these surveys at a speed of approximately 10 knots.

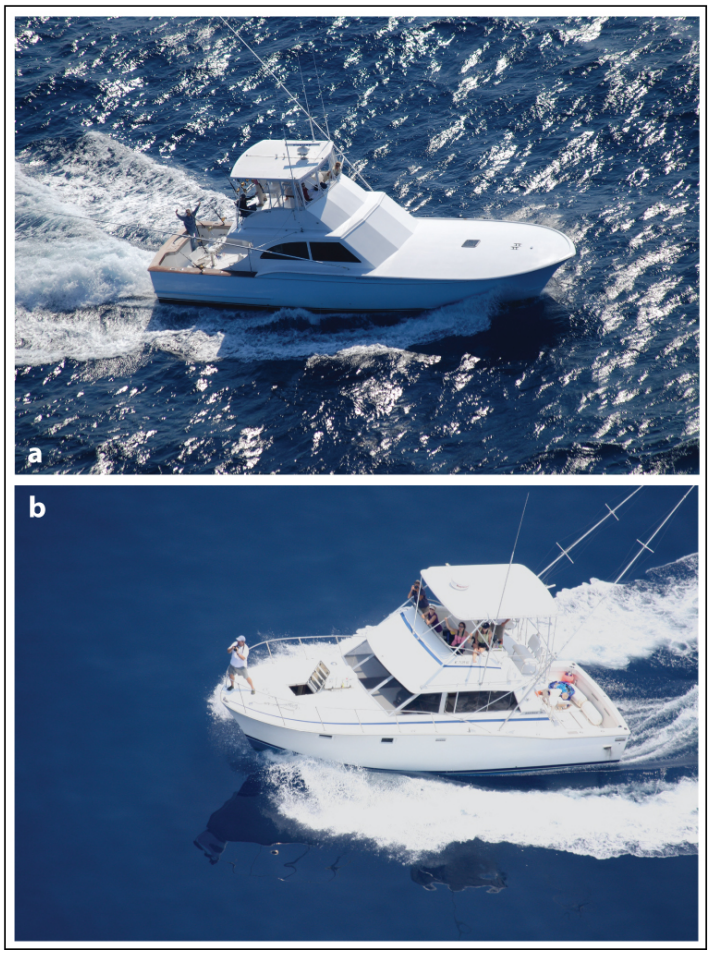


***Figure 2*. Aerial photographs of the F/V *Sensation* (a) and the R/V *Cetus* (b).**

Visual surveys for cetaceans and other marine megafauna were conducted from two survey platforms: the F/V *Sensation* (Fig. 2a), a 16-m offshore fishing vessel and the R/V *Cetus* (Fig. 2b), a modified 12-m offshore fishing vessel.

Observations were made from the flying bridge (5.0m and 4.2m above waterline for the *Sensation* and *Cetus*, respectively) by naked eye and 7x50 binoculars. At the start of our project we held a classroom training exercise for all marine mammal observers at the Duke University Marine Laboratory on

April 24th, 2007. Training of new observers in Year Three continued on an as-needed basis.

Two observers (one port and one starboard) scanned constantly from straight ahead to 90˚ abeam either side of the trackline. A center observer monitored the trackline, coordinated with the vessel skipper and acted as data recorder. Observations were conducted following standard distance sampling/line transect methods for cetaceans, similar to those employed in Barlow (2006). The location, species and behavior of each cetacean group were recorded. If turtles were encountered, the location and species were recorded. Each observer estimated group size independently and individual estimates were averaged at the end of the survey to generate an overall estimate of group size. Environmental conditions (weather, sea state, depth and sea surface temperature) were recorded every 30 minutes or whenever sighting conditions changed. Sighting and environmental data were entered into an at-sea data collection system (Vis-Survey, developed by Dr. Lance Garrison, NOAA/SEFSC) linked with the onboard GPS.

In addition, we monitored cetacean use of the USWTR and adjacent areas by individual animals using photo-identification techniques. This approach is feasible for sperm whales, beaked whales, humpback whales, bottlenose dolphins, spotted dolphins, pilot whales and Risso's dolphins. Thus, whenever possible, we obtained photographs of cetaceans for individual photo-identification (we also use these photographs to confirm species identification at each sighting and to compare identification features with those used by the aerial survey team). Photographs were taken with Canon or Nikon digital SLRs (equipped with 100-300 mm zoom lenses) in 24-bit color at a resolution of 3072 X 2048 pixels and saved in jpg format.

Finally, seabird counts were conducted by a single experienced observer who recorded seabirds in a 90-degree bow-beam arc in a 300-meter strip on the starboard side of the ship (Tasker *et al*. 1984). The observer recorded the time and location of each bird sighting. At each sighting the observer recorded species identification, abundance, general behavior (sitting, flying, or foraging), and associations with other marine species. The presence of ship-following birds was noted separately to avoid biases in quantitative analyses.

Passive Acoustic Monitoring

Passive acoustic data were collected in the proposed range using two methods: a towed hydrophone array and bottom-mounted recorders.

Towed Array

A four-element array was towed behind the survey vessel to allow acoustic detection of vocalizing cetaceans. The towed array (manufactured by Seiche Instruments, UK) consisted of four hydrophone elements with approximate linear sensitivity to frequencies between 1kHz and 100 kHz. The array was towed 150m behind the vessel and acoustic signals were routed to an analog-to-digital converter/mixer (MOTU Traveler, MOTU, Cambridge, MA) sampling at 192 kHz. These signals were then passed to two personal laptop computers equipped with software for real-time visualization/recording (*Ishmael* 1.0) and spatial localization (*WhalTrak* 2.0) of cetacean sounds. An acoustician (Lynne Williams) monitored the array and made recordings of all potential cetacean sounds detected and any other novel sounds. When possible, the acoustician attempted to localize cetacean vocalizations with time difference of arrival (TDOA) techniques involving two or more hydrophone elements and using *Ishmael* and *Whaltrak* software.

Bottom-mounted Recorders

To collect time-series of acoustic data in the Onslow Bay USWTR study area, autonomous High Frequency Acoustic Recording Packages (HARPs; Wiggins and Hildebrand 2007) were utilized. The HARP data-logging system includes a 16-bit A/D converter, up to 1.9 TB of storage capacity, a hydrophone suspended 10 m above the seafloor, an acoustic release system, ballast weights and flotation. The data-loggers are capable of sampling up to 200 kHz and can be set to record continuously or on a duty cycle to accommodate variable deployment durations. These instruments combine high and low frequency hydrophone elements to detect the vocalizations of both odontocete and mysticete whales. The units sample at rates high enough to capture the echolocation clicks of many odontocetes. We deployed the HARPs in the central region of the Onslow Bay USWTR survey area.

In Year Three, we retrieved the HARP from the third deployment (site A: 33.790°N and -76.519°W, in a depth of 174 m) on September 16, 2009. Also during Year Three, we

acquired an additional HARP was acquired, so we deployed both HARPs on November 8, 2009 (fourth deployment). One instrument was returned to site A (33.787°N and -76.524°W, 171 m depth) and one was deployed at a new, deeper site (site C 33.678°N and -76.477°W, 335 m depth; see Fig.3). We recovered both instruments on June 19, 2010. In the third deployment, the instrument was programmed to record at a sampling rate of 200 kHz for five-minute periods separated by an inactive interval of five minutes. For the fourth deployment, the instruments were programmed to record at a sampling rate of 200 kHz for five-minute periods separated by an inactive interval of 10 minutes (to further prolong the recording life of the unit).

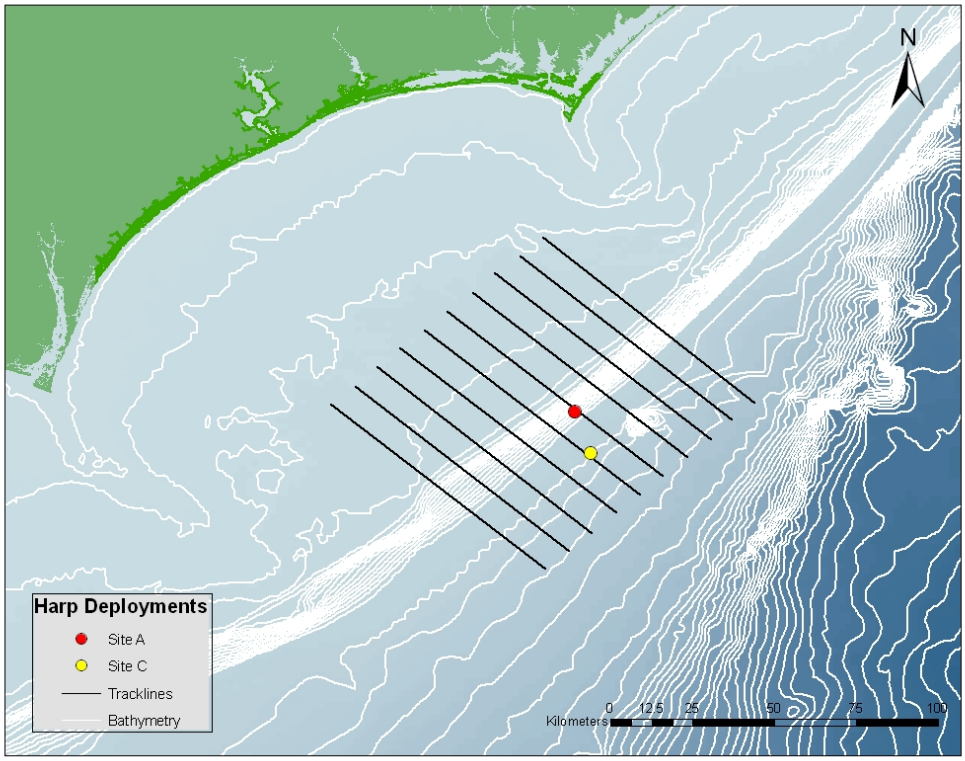


***Figure 3*. Location of HARP deployments in Onslow Bay, NC, for Year 3.**

Data Analysis

Vessel survey effort and sighting data were compiled and mapped using ArcGIS 9.2 to illustrate the location of effort and sightings within the study area. All sighting data (including radial distance and bearing estimates for each cue) were forwarded to our colleagues at CREEM at the University of St. Andrews, UK for density estimation. Vessel based survey tracks and sighting locations from June 2007 through June 2010 have been posted on OBIS-SEAMAP (http://seamap.env.duke.edu/).

Acoustic Analysis

Towed hydrophone array recordings were analyzed with the software program *Raven Pro 1.3*. Selections of whistles and clicks from sightings with positive species identifications were saved for future analysis of species-specific patterns. Discriminant function analyses (DFAs) will be performed to look for species-specificity in the whistles after measuring several parameters including: start, end, minimum and maximum frequency; duration; number of inflection points; and number of steps. This approach is similar to that used by Oswald *et al.* (2003). We also plan to look for species-specific patterns, such as consistent peaks and notches, in the recorded clicks using techniques, similar to those employed by Soldevilla *et al.* (2008). Analyses of variance (ANOVAs) will be used to examine species-specific frequency differences in peaks and notches of echolocation clicks. In addition, techniques that combine both whistles and clicks into a single classifying analysis will be explored, such as combining certain parameters of each call type in a single DFA. Inclusion of both call types (whistles and clicks) may help us to increase correct classification rates.

HARP data requires processing prior to analysis, including backing up data in original format, converting data to wav format, decimating wav data by factors of 10 and 100 to aid in baleen whale detection, and creating long-term spectral averages (LTSAs). LTSAs provide a way to examine hours to weeks of data on the same spectrogram, allowing for rapid review of large data sets. Each HARP deployment results approximately 2 TB of data, which is impractical to analyze manually in original form. Therefore, these data were compressed for visual overview by creating LTSAs from the wav files. LTSAs are effectively compressed spectrograms created using the Welch algorithm (Welch, 1967) by

coherently averaging 500 spectra created from 2000-point, 0%-overlapped, Hann-windowed data and displaying these averaged spectra sequentially over time. The resulting LTSAs had resolutions of 5 s in time and 100 Hz, 10 Hz and 1 Hz in frequency, for the original, decimation factor 10 and df 100 data, respectively. Using LTSAs, high energy acoustic events can easily be distinguished from background noise (*e.g.* Wiggins and Hildebrand, 2007), allowing an efficient review of these large data sets.

LTSAs made using a MATLAB-based acoustic program called *Triton* (Hildebrand Lab at Scripps Institution of Oceanography) were used to look for odontocete whistle and click events in the HARP data from the third deployment (24 April 2009 – 9 August 2009) and the fourth deployment at site C (8 November 2009 – 20 April 2010). (The HARP located at site A during the fourth deployment stopped recording early (24 February 2010) and had some timing errors which are currently being examined at Scripps. For these reasons, these data have not yet been processed.) We inspected these LTSAs in *Triton* for high-energy events representing whistles and clicks. Our analysis of diel patterns employed definitions of photoperiods obtained from the U.S. Naval Observatory website (http://aa.usno.navy.mil). A day or night-time designation was assigned to each one-hour bin that contained vocal events. Diel variation in the occurrence of vocal events was statistically tested using a Kruskal-Wallis.

In the upcoming months, we will choose loud and clear whistles with acceptable signal-to-noise ratios for further analysis. The same parameters used in determining species-specific differences will be measured in these newly selected whistles. These values will then be processed using a combination of DFAs and Classification and Regression Trees (CART) to determine to which species was responsible for the vocalization.

We also will select one click from each click train for further analysis. The selected clicks will be examined for peaks and notches that occur within frequency ranges determined by towed array data for different species. This examination will help to determine which species produced the echolocation clicks.

In addition, for those instances when both whistles and clicks are detected in a single vocal event, the predicted species identification for both the whistles and clicks from that same event will be compared to determine if the same species was selected. In addition to determining the likely vocalizing species in this way, we will explore techniques that combine both whistles and clicks into a single classifying analysis.

HARP data from all deployments has been decimated to look for baleen whale calls. Once we have determined which species is responsible for these calls, we will sort the vocal events by species and look for temporal patterns in their vocalizations.

Data Storage

All acoustic, visual survey and photographic data are archived on digital media and backed up on a Duke University network server.

Results

Vessel Survey Effort

Between 1 July 2009 and 30 June 2010, we surveyed 21 tracklines (Table 1) during approximately 115 hours of marine mammal surveys (109 hours on effort, 6 hours off effort). During this period we also completed 12 hours of on effort seabird surveys.

Surveys were conducted in Beaufort Sea States 0 to 4. Most survey effort was conducted in Beaufort 2 and 3 (69%); only 13% of effort was conducted in optimal (Beaufort 0 and 1) sighting conditions (Fig. 4).

Table 1. **Vessel survey effort in Onslow Bay. Number of tracklines completed per year. Year 1 includes June 2007 through June 2008. Year 2 includes July 2008 through June 2009. Year 3 includes July 2009 through June 2010. Survey effort is rounded to the nearest integer.**

Trackline	Year 1	Year 2	Year 3
1	1	1	2
2	2	2	1
3	3	3	2
4	4	2	2
5	4	4	1
6	3	2	1
7	4	1	4
8	2	2	3
9	3	4	2
10	4	2	3
Total	**29**	**22**	**21**

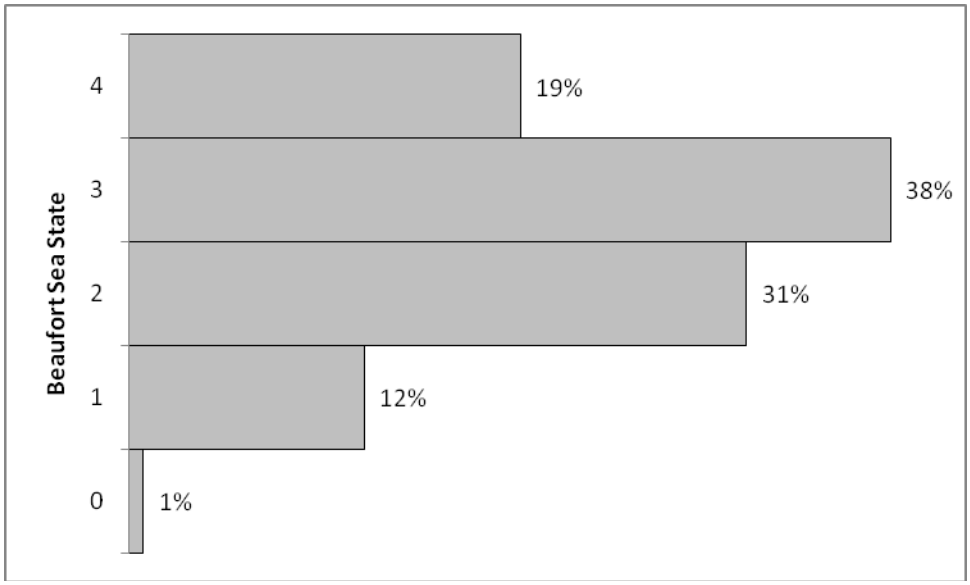


Figure 4. **Distribution of sea state conditions (% of total effort) for vessel surveys during Year Three in Onslow Bay.**

Marine Mammal and Sea Turtle Line Transect Sightings

We recorded 55 marine mammal sightings during vessel surveys (45 while on effort, 10 while off effort) in Year Three (Table 2). Five species of cetaceans were detected visually in the study area: bottlenose dolphins (*Tursiops truncatus*, n=29; 22 on effort), Atlantic spotted dolphins (*Stenella frontalis*, n=17; 16 on effort), Risso's dolphins (*Grampus griseus*, n=3; 2 on effort), pilot whales (*Globicephala macrorhynchus*, n=2; 1 on effort), and rough-toothed dolphins (*Steno bredanensis*, n=1; on effort). This was the first sighting of rough-toothed dolphins during vessel surveys in the Onslow Bay USWTR. In addition, the vessel survey team made one on effort sighting of a group of dolphins that were either bottlenose or spotted dolphins and two sightings of unidentified delphinids (one on effort). No mixed-species groups were observed (Table 3). Overall sightings per unit effort was, not surprisingly, highest in Beaufort Sea State 0, but sightings were made in all conditions (Figure 5).

We also recorded 50 sea turtle sightings during vessel surveys (34 while on effort, 16 while off effort) in Year Three (Tables 2 and 4). Two species of sea turtles were recorded in the study area: loggerheads (*Caretta caretta*, n=47 of 48 individuals; 33 on effort) and leatherbacks (*Dermochelys coriacea*, n=2; one on effort).

Table 2. **Vessel-based cetacean and sea turtle sightings made in the Onslow Bay USWTR study area during Year Three, July 2009 through June 2010.**

Date	Vessel	Trackline	Depth (m)	Temp (°C)	Species	Group Size	Effort
07/11/09	Cetus	8	36	29.7	*Tursiops truncatus*	6	On
07/11/09	Cetus	8	153	29.2	*Unidentified delphinid*	n/a	On
08/08/09	Sensation	1	38	27.1	*Stenella frontalis*	5	On
08/09/09	Sensation	4	41.1	28.8	*Stenella frontalis*	5	On
08/09/09	Sensation	4	36.6	27.9	*Caretta caretta*	1	On
08/09/09	Sensation	4	427.9	27.9	*Grampus griseus*	24	On
08/09/09	Sensation	4	39.5	28	*Tursiops truncatus*	3	On
08/16/09	Sensation	2	42.6	29.2	*Caretta caretta*	1	On
08/16/09	Sensation	2	504.7	30.2	*Grampus griseus*	36	Off
08/16/09	Sensation	2	457.2	30	*Grampus griseus*	16	On
08/16/09	Sensation	2	290.8	30.1	*Tursiops truncatus*	6	On
08/16/09	Sensation	2	267	30.1	*Tursiops truncatus*	16	On
08/16/09	Sensation	2	215.8	28.7	*Tursiops truncatus*	14	On
08/16/09	Sensation	2	42.1	28.8	*Tursiops truncatus*	4	On
08/17/09	Sensation	5	35.5	29.1	*Stenella frontalis*	10	On
08/17/09	Sensation	5	34.7	28.9	*Stenella frontalis*	5	On
08/17/09	Sensation	5	34.9	28.8	*Stenella frontalis*	5	On
08/17/09	Sensation	5	446.2	30	*Caretta caretta*	1	On
08/17/09	Sensation	5	305.4	29.9	*Tursiops truncatus*	41	On
08/18/09	Sensation	3	42.1	30.2	*Caretta caretta*	1	On
08/18/09	Sensation	3	40.4	30.8	*Caretta caretta*	1	On
08/18/09	Sensation	3	37.1	30.6	*Caretta caretta*	1	On
08/18/09	Sensation	3	42.6	29.4	*Dermochelys coriacea*	1	Off
08/18/09	Sensation	3	37.3	30.7	*Dermochelys coriacea*	1	On
08/18/09	Sensation	3	475.5	30	*Globicephala macrorhynchus*	8	Off
08/18/09	Sensation	3	464.5	29.9	*Globicephala macrorhynchus*	45	On
08/18/09	Sensation	3	168.2	30.3	*Steno bredanensis*	27	On
08/18/09	Sensation	3	48.6	29.4	*Tursiops truncatus*	10	Off
08/18/09	Sensation	3	41	31	*Tursiops truncatus*	2	On
08/18/09	Sensation	3	40.2	30.9	*Tursiops truncatus*	4	On
08/18/09	Sensation	3	38	30.6	*Tursiops truncatus*	12	On
08/18/09	Sensation	3	20.4	30.7	*Unidentified turtle*	1	Off
09/15/09	Sensation	8	39.9	28.8	*Caretta caretta*	1	Off
09/15/09	Sensation	8	36.9	28.8	*Caretta caretta*	1	Off
09/15/09	Sensation	8	406	27.1	*Tursiops truncatus*	9	Off
09/15/09	Sensation	8	442.6	27.6	*Tursiops truncatus*	5	On
09/16/09	Sensation	6	303.6	27.3	*Tursiops truncatus*	9	Off

09/16/09	Sensation	6	387.7	28.7	*Tursiops truncatus*	15	On
09/24/09	Sensation	10	40.4	29	*Caretta caretta*	1	On
09/24/09	Sensation	10	239.5	29.8	*Tursiops truncatus*	10	On
10/01/09	Sensation	7	41.7	27.6	*Stenella frontalis*	103	On
10/01/09	Sensation	7	41	27.9	*Stenella frontalis*	6	On
10/01/09	Sensation	7	37.3	27.4	*Stenella frontalis*	15	On
10/01/09	Sensation	7	592.5	27.5	*Tursiops truncatus*	5	On
10/01/09	Sensation	7	167.3	27.2	*Tursiops truncatus*	42	On
10/22/09	Sensation	9	38.8	27.3	*Caretta caretta*	1	On
10/22/09	Sensation	9	39	27.6	*Caretta caretta*	1	On
10/22/09	Sensation	9	20.8	27.8	*Caretta caretta*	1	On
10/22/09	Sensation	9	38.4	27.8	*Caretta caretta*	1	On
10/22/09	Sensation	9	550.5	28.2	*Tursiops truncatus*	2	Off
10/22/09	Sensation	9	33.8	25.7	*Tursiops truncatus*	1	On
10/22/09	Sensation	9	34.7	25.3	*Tursiops truncatus/Stenella frontalis*	1	On
01/15/10	Sensation	8	37.3	13.9	*Stenella frontalis*	143	On
01/15/10	Sensation	8	33.5	14	*Stenella frontalis*	24	On
01/15/10	Sensation	8	40.8	16.1	*Caretta caretta*	1	Off
01/15/10	Sensation	8	33.5	14	*Caretta caretta*	1	Off
01/15/10	Sensation	8	42.2	19.7	*Caretta caretta*	1	On
01/15/10	Sensation	8	42.6	17.6	*Caretta caretta*	1	On
01/15/10	Sensation	8	41	17.2	*Caretta caretta*	1	On
01/15/10	Sensation	8	41	16.6	*Caretta caretta*	1	On
01/15/10	Sensation	8	41	17.2	*Caretta caretta*	1	On
01/15/10	Sensation	8	38	14.1	*Caretta caretta*	1	On
01/15/10	Sensation	8	38	14.1	*Caretta caretta*	1	On
01/15/10	Sensation	8	248.7	22.2	*Tursiops truncatus*	3	On
01/16/10	Sensation	10	47.7	19.4	*Stenella frontalis*	8	On
01/16/10	Sensation	10	40.2	16.1	*Stenella frontalis*	127	On
01/16/10	Sensation	10	32.4	14.7	*Stenella frontalis*	10	On
01/16/10	Sensation	10	47.7	19.4	*Caretta caretta*	1	Off
03/09/10	Cetus	9	35.4	20.8	*Caretta caretta*	1	Off
03/09/10	Cetus	9	35.4	20.8	*Caretta caretta*	1	Off
03/09/10	Cetus	9	450	21.5	*Tursiops truncatus*	10	Off
03/09/10	Cetus	9	425	21.8	*Tursiops truncatus*	23	Off
04/02/10	Cetus	10	n/a	n/a	*Caretta caretta*	1	Off
04/02/10	Cetus	10	n/a	n/a	*Caretta caretta*	1	Off
04/02/10	Cetus	10	n/a	n/a	*Caretta caretta*	1	Off
04/02/10	Cetus	10	n/a	n/a	*Caretta caretta*	1	Off
04/02/10	Cetus	10	32.7	20.8	*Caretta caretta*	1	On

04/02/10	Cetus	10	n/a	n/a	*Caretta caretta*	1	On
04/02/10	Cetus	10	46	20.9	*Tursiops truncatus*	9	On
04/02/10	Cetus	10	n/a	n/a	*Tursiops truncatus*	36	On
04/11/10	Sensation	1	501.1	22.1	*Tursiops truncatus*	12	Off
04/12/10	Sensation	7	36.6	17.6	*Caretta caretta*	1	Off
04/12/10	Sensation	7	36.6	17.6	*Caretta caretta*	1	Off
04/12/10	Sensation	7	36.8	17.6	*Caretta caretta*	1	On
04/12/10	Sensation	7	35.8	17.6	*Caretta caretta*	1	On
04/12/10	Sensation	7	37.3	17.6	*Caretta caretta*	1	On
04/12/10	Sensation	7	35.1	17.6	*Caretta caretta*	1	On
04/20/10	Sensation	4	49.4	19.3	*Stenella frontalis*	6	On
04/20/10	Sensation	4	36.4	20.1	*Stenella frontalis*	12	On
04/20/10	Sensation	4	39.1	20.3	*Caretta caretta*	1	Off
04/20/10	Sensation	4	63.6	19.9	*Caretta caretta*	1	On
04/20/10	Sensation	4	35.8	19.8	*Caretta caretta*	1	On
04/20/10	Sensation	4	34.7	19.3	*Caretta caretta*	1	On
04/20/10	Sensation	4	35.8	19.7	*Caretta caretta*	1	On
04/20/10	Sensation	4	34.7	18.8	*Caretta caretta*	2	On
04/20/10	Sensation	4	36.4	18.8	*Caretta caretta*	1	On
04/20/10	Sensation	4	36.4	18.8	*Caretta caretta*	1	On
04/20/10	Sensation	3	36.4	18.8	*Caretta caretta*	1	On
04/20/10	Sensation	4	36.6	20.1	*Tursiops truncatus*	3	On
04/20/10	Sensation	4	39.1	20.3	*Tursiops truncatus*	6	On
05/07/10	Sensation	3	38.2	21.8	*Caretta caretta*	1	On
05/07/10	Sensation	3	38	22.5	*Unidentified delphinid*	2	Off
06/16/10	Cetus	7	34.38	28.7	*Stenella frontalis*	14	Off
06/16/10	Cetus	7	34.83	29.5	*Stenella frontalis*	8	On
06/16/10	Cetus	7	37.7	29.7	*Tursiops truncatus*	2	On

Table 3. **Number of sightings and mean group size for each species observed during Year 1, Year 2, and Year 3 of vessel surveys in the Onslow Bay USWTR area.**

	Sightings			
Species	**Year 1**	**Year 2**	**Year 3**	**Mean Group Size**
Globicephala sp.	1	0	2	**31.0**
Grampus griseus	3	0	3	**30.5**
Stenella frontalis	6	17	17	**17.7**
Tursiops truncatus	23	14	29	**10.9**
Steno bredanensis	0	0	1	**27.0**
Unid. Delphinid	3	2	3	**1.6**
Total:	**36**	**33**	**55**	

Table 4. **Number of sea turtle sightings for each species observed during Year 1, Year 2, and Year 3 of vessel surveys in the Onslow Bay USWTR area.**

	Sightings		
Species	**Year 1**	**Year 2**	**Year 3**
Caretta caretta	19	49	47
Dermochelys coriacea	0	0	2
Unid. Turtle	1	0	1
Total:	**20**	**49**	**50**

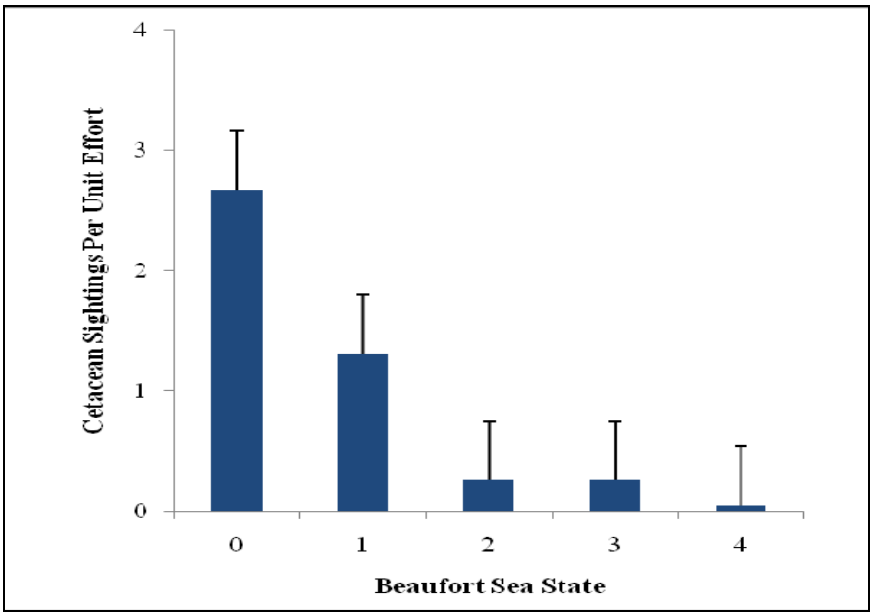


***Figure 5*. Number of cetacean sightings in the Onslow Bay USWTR area in Year Three corrected for hours on effort in each Beaufort sea state.**

Descriptive statistics for bottlenose dolphins and spotted dolphin sightings are presented in Figures 6 and 7 respectively. In general, bottlenose dolphins were detected in waters deeper than spotted dolphins (mean water depth of 224m *versus* 38m respectively) and in slightly warmer water (mean values of 26.9°C and 23.6°C, respectively). Mean group size for spotted dolphins was greater than for bottlenose dolphins (30 *versus* 11 individuals per group), but this difference was driven largely by a small number of very large (>100 individuals) groups of spotted dolphins. Both species exhibited a bi-modal distribution of group size, with similar median values (bottlenose dolphins 9 individuals; spotted dolphins 10 individuals).

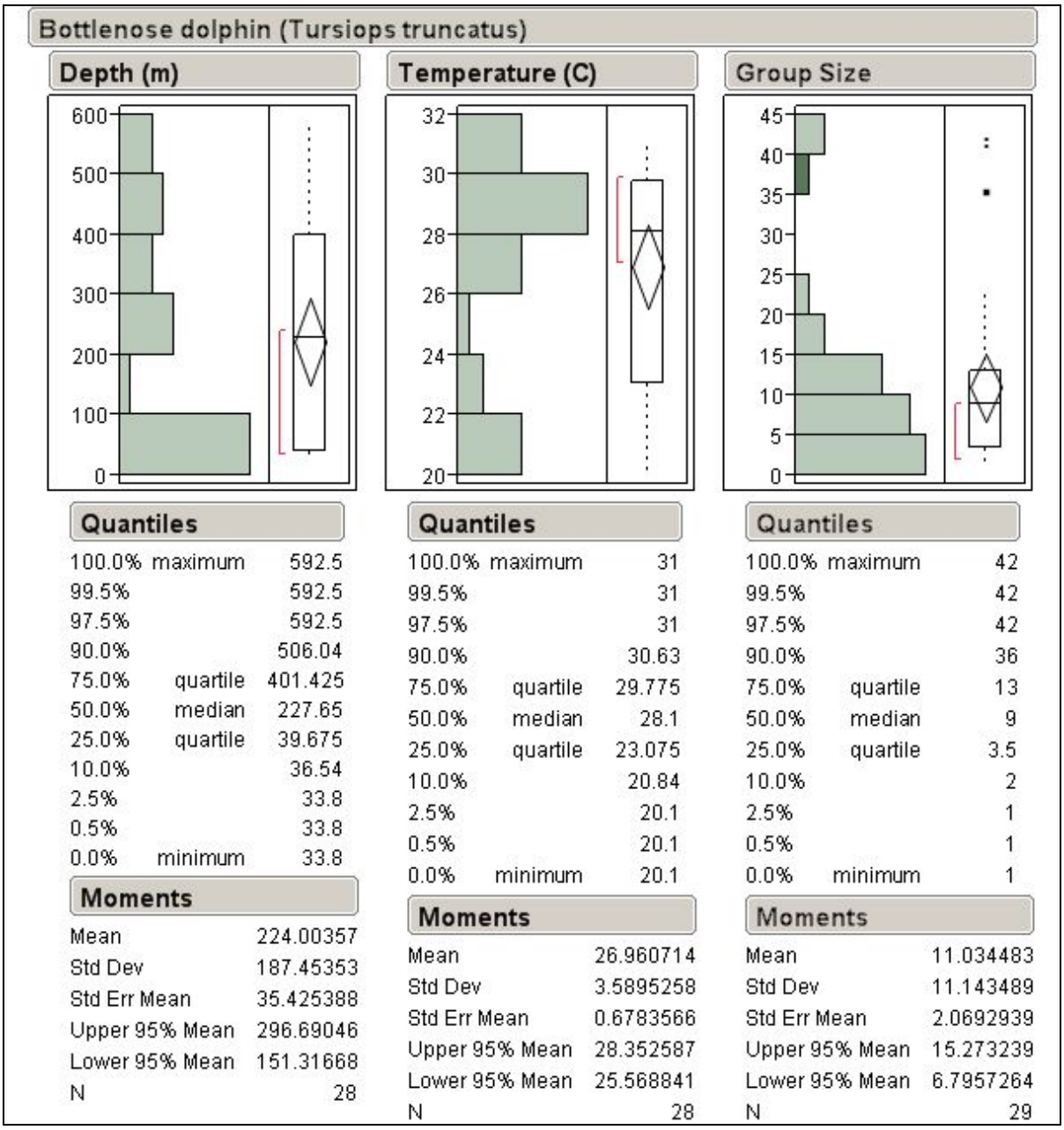


***Figure 6*. Descriptive statistics for depth, sea surface temperature, and group size estimates for bottlenose dolphin (*Tursiops truncatus*) sightings during vessel line transects surveys in the USWTR study area (July 2009 through June 2010).**

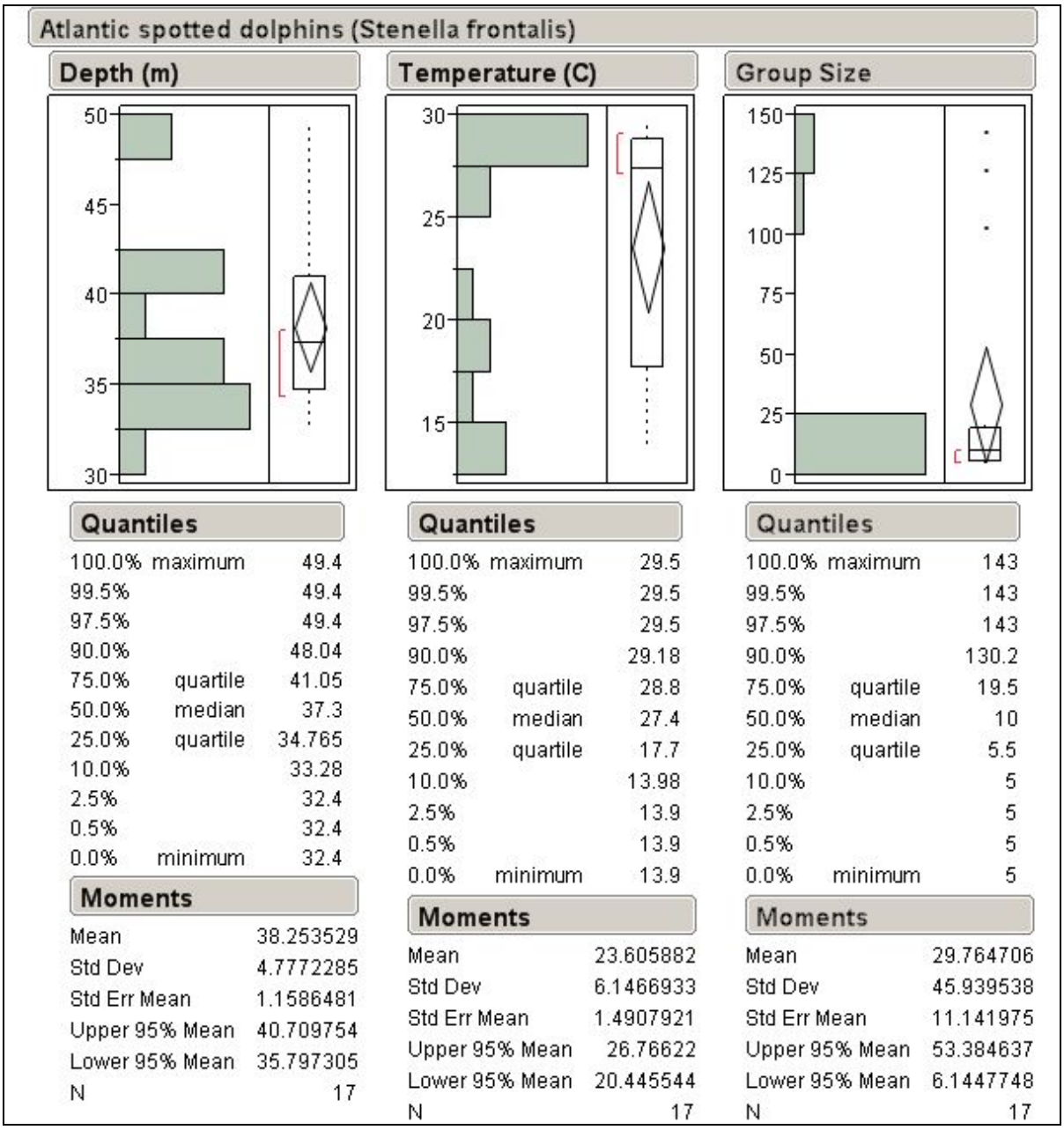


***Figure 7*. Descriptive statistics for depth, sea surface temperature, and group size estimates for Atlantic spotted dolphins (*Stenella frontalis*) sightings during vessel line transects surveys in the USWTR study area (July 2009 through June 2010).**

Distributions and Habitat Associations of Cetaceans

The distribution of marine mammal sightings, by species, are presented in Figures 8 through 10. As was the case in previous years, spotted dolphins were largely restricted to the relatively shallow shelf waters, whereas bottlenose dolphins ranged over a large area with many groups detected in deeper waters (this likely reflects the presence of both the coastal and offshore ecotypes of this species in the study area). The other species (pilot whales, Risso's dolphins and rough-toothed dolphins) are known to be relatively deep-water species and were all observed offshore of the 200-m isobath. This general inter-specific pattern of distribution has been consistent in all years of the monitoring program. The distribution of sea turtle sightings is depicted in Figure 11.

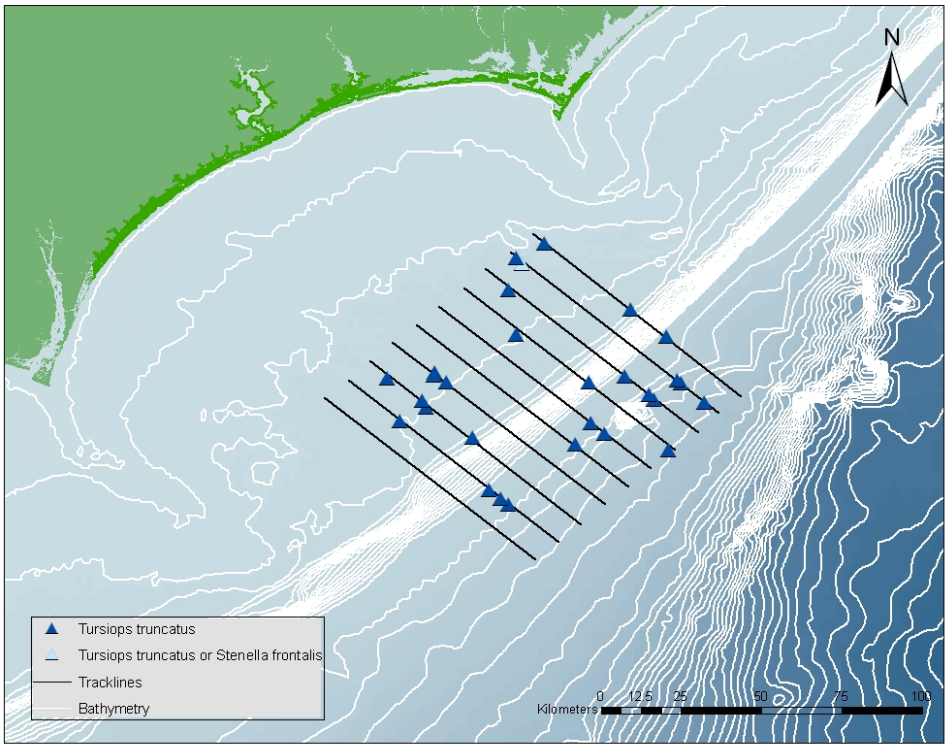


Figure 8. **Distribution of bottlenose dolphin (*Tursiops truncatus*) sightings made during vessel-based surveys in Onslow Bay, NC, July 2009 through June 2010.**

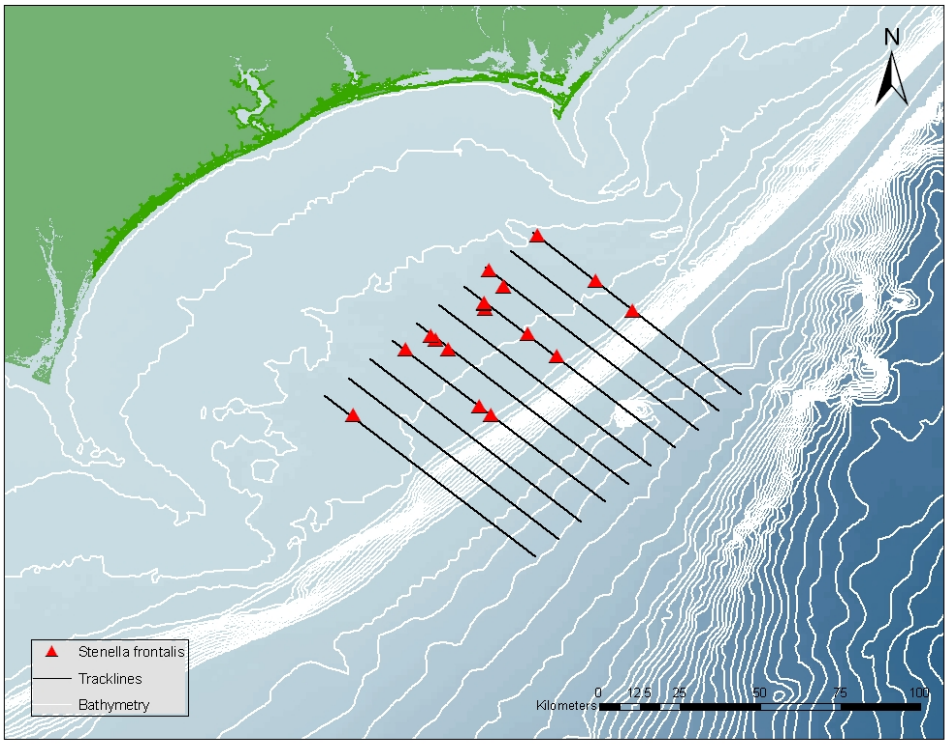


Figure 9. **Distribution of Atlantic spotted dolphin (*Stenella frontalis*) sightings made during vessel-based surveys in Onslow Bay, NC, July 2009 through June 2010.**

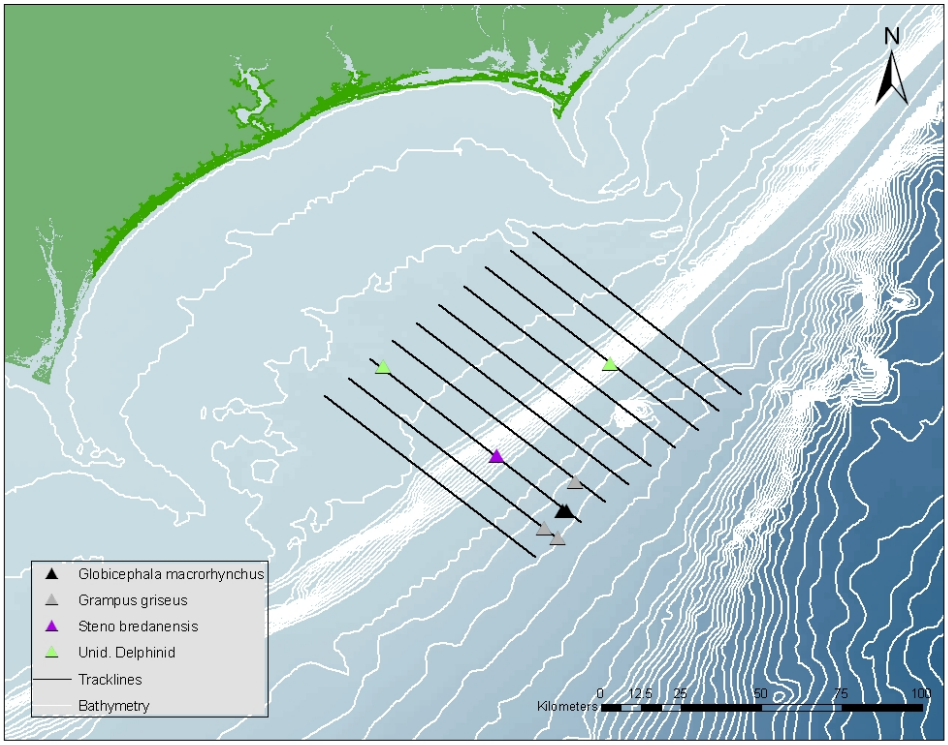


Figure 10. **Distribution of other cetacean sightings made during vessel-based surveys in Onslow Bay, NC, July 2009 through June 2010.**

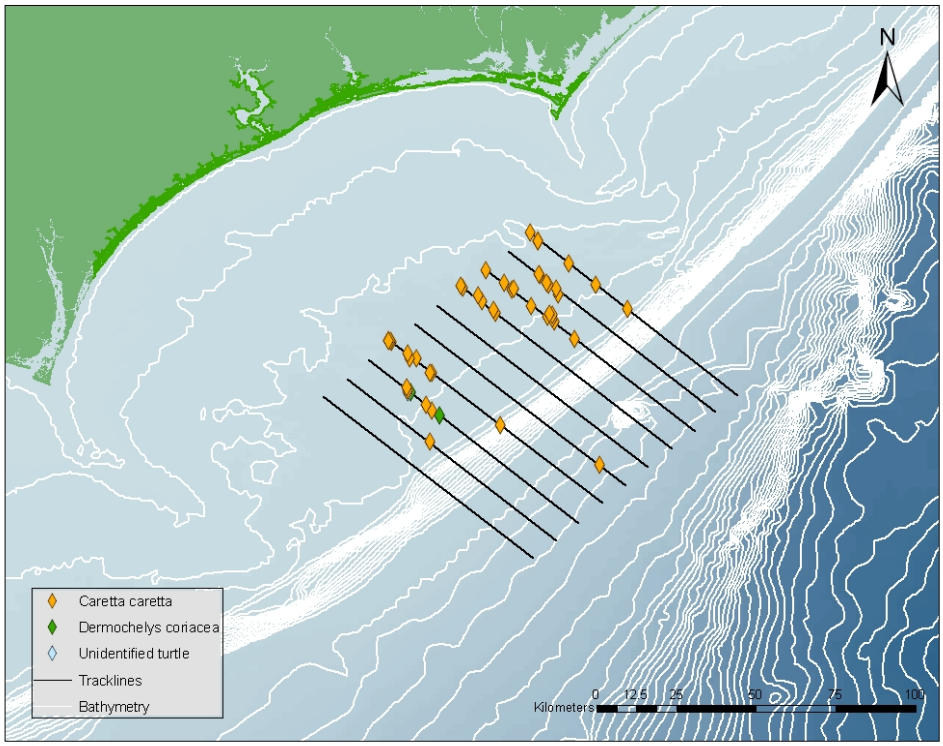


Figure 11. **Distribution of loggerhead (*Caretta caretta*) and leatherback (*Dermochelys coriacea*) sea turtle sightings made during vessel-based surveys in Onslow Bay, NC, July 2009 through June 2010.**

Seasonality of Effort and Sightings

Due to unfavorable survey conditions, there was no effort in three months and limited effort in several other months during Year Three. Trends in seasonality of cetacean sightings are, therefore, difficult to interpret (Figs. 12 and 13). Nevertheless, it is clear that both spotted and bottlenose dolphins are found year-round in the study area. The presence of other cetacean species appears to be more sporadic. Sea turtle presence appears to peak in April, however with no survey effort in February and little effort in March and May, this apparent peak may be exaggerated.

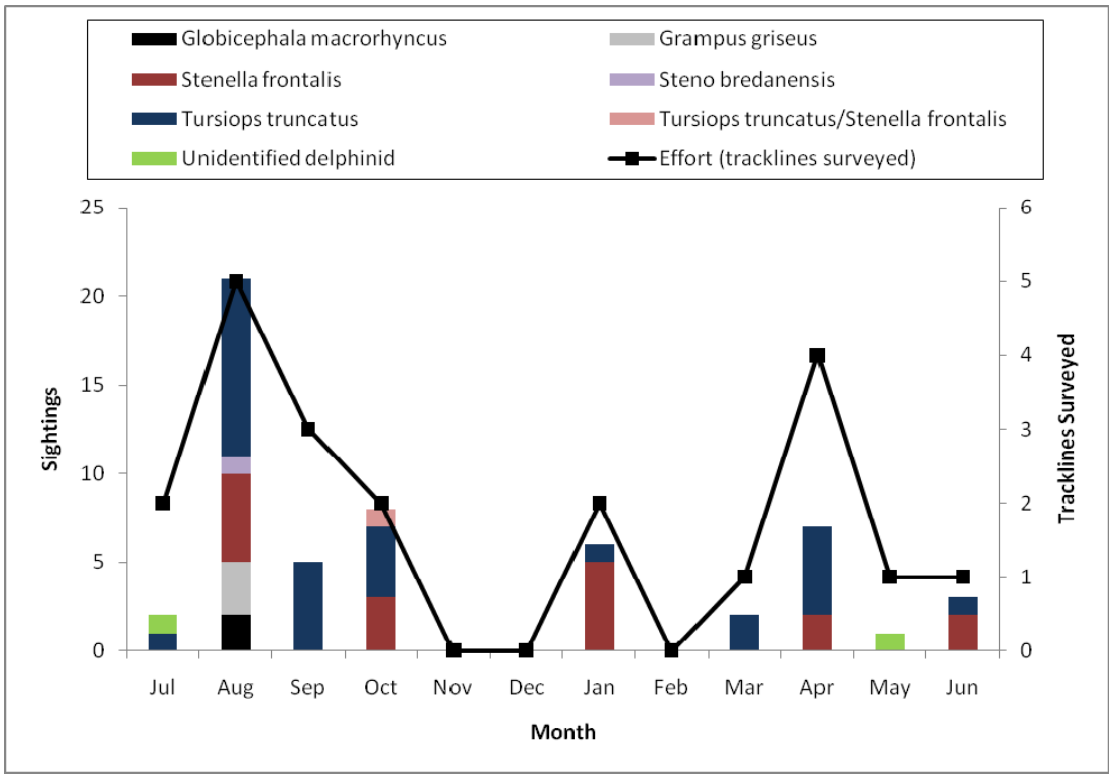


Figure 12. **Number of cetacean sightings by month and effort (number of tracklines surveyed) in Year Three.**

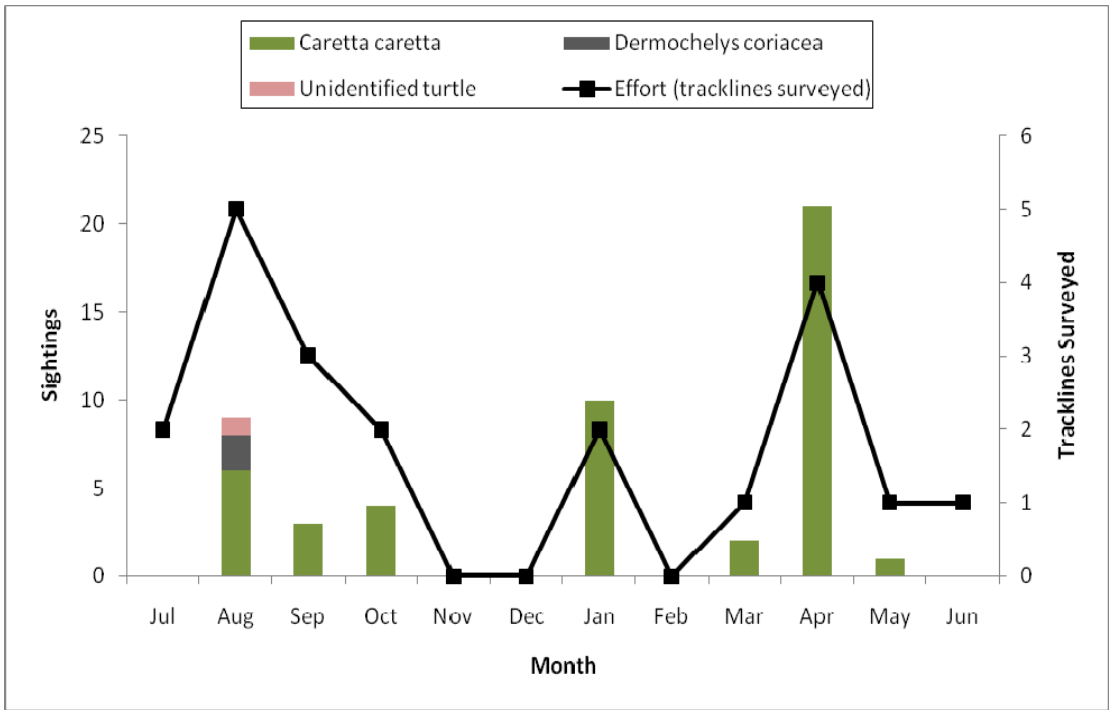


Figure 13. **Number of turtle sightings by month displayed with effort (number of tracklines surveyed) in Year Three.**

Cape Hatteras Surveys

In July 2009 we conducted a small number of surveys off Cape Hatteras, to the north of the Onslow Bay study area. The objective of these surveys was to generate a large number of sightings from one of our survey platforms (F/V *Sensation*). These additional sightings will allow us to improve the probability detection functions used to calculate marine mammal densities in Onslow Bay by. We recorded more than 30 sightings in four days of survey effort off Cape Hatteras, compared with 55 sightings in approximately 21 survey days in Onslow Bay. The results of the surveys off Cape Hatteras are presented in Tables 5 and 6 and Figure 14.

***Table 5*. Sightings from vessel surveys conducted off Cape Hatteras, July 2009**

Common Name	Scientific Name	# of Sightings	# of individuals
Bottlenose Dolphin	*Tursiops truncatus*	23	497
Risso's Dolphin	*Grampus griseus*	1	34
Unidentified Delphinid		1	2
Pilot Whale	*Globicephala sp.*	9	213
Loggerhead Sea Turtle	*Caretta caretta*	2	2

***Table 6*. Effort details for vessel surveys conducted off Cape Hatteras, July 2009.**

Number of Survey Days	4
Total Survey Hours	26.5
Hours On Effort	15.5
Total Tracklines Covered	N/A

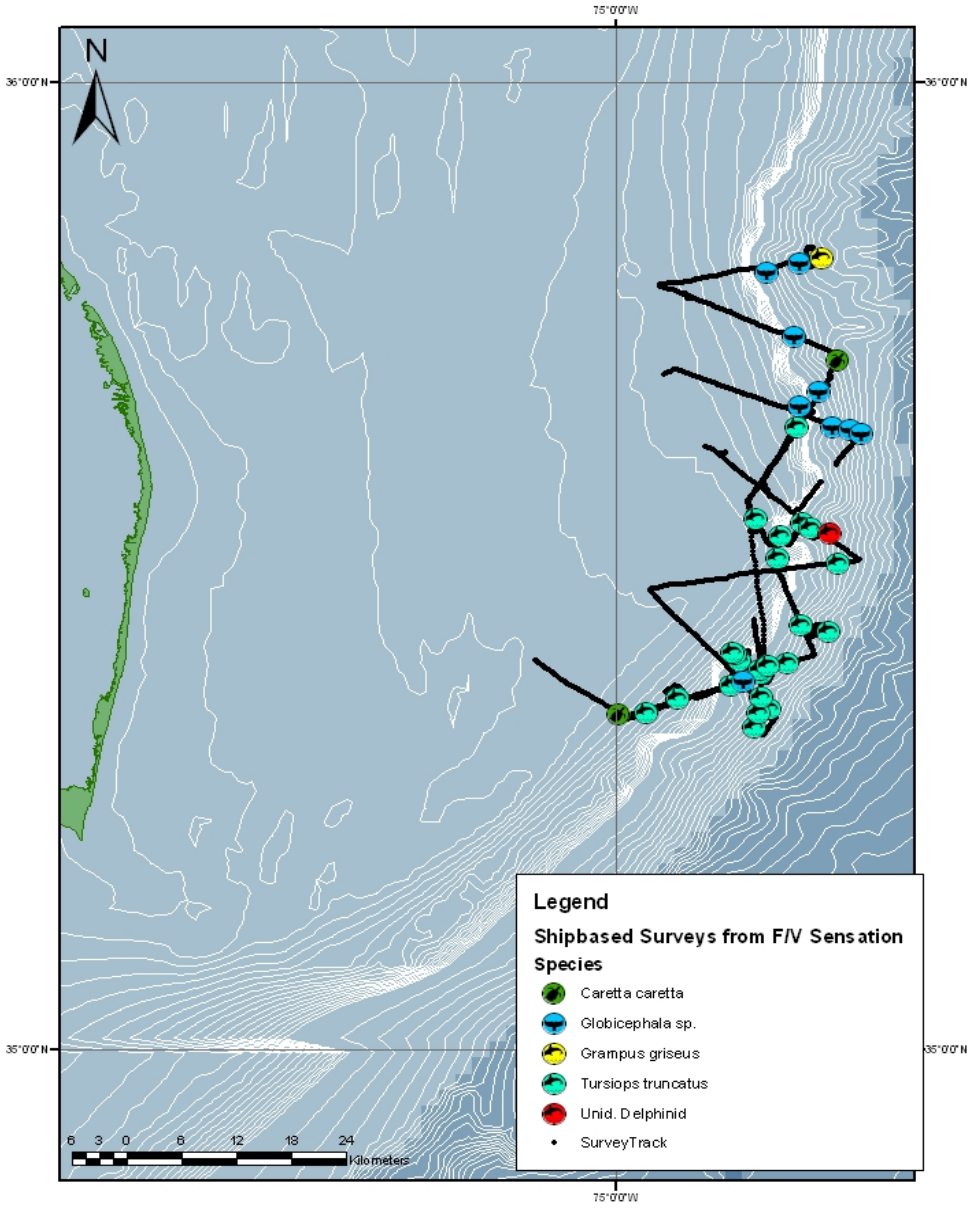


Figure 14. **Locations of cetacean sightings from vessel surveys conducted off Cape Hatteras, July 2009.**

Sea Turtle Satellite Tag Deployment

To refine our estimates of sea turtle abundance in the survey area we deployed a Wildlife Computer satellite-linked SPLASH tag on an adult nesting female loggerhead sea turtle in June 2010. In addition to providing location, SPLASH tags provide information on the time the animal spends at predefined depth and temperature bins, as well as the amount of time the tag is wet and dry. Data from these tags will allow us to refine our probability detection function for loggerhead sea turtles by determining the proportion of time they spend at, or very close to the surface where they can be sighted by visual observers. Wendy Dow, a Ph.D. student at the Duke Marine Laboratory, deployed tag 096290 (nicknamed *Pointe*) on 26 June 2010 on Emerald Isle, NC (Fig. 15). We have two more SPLASH tags to be deployed on loggerhead sea turtles in July 2010.

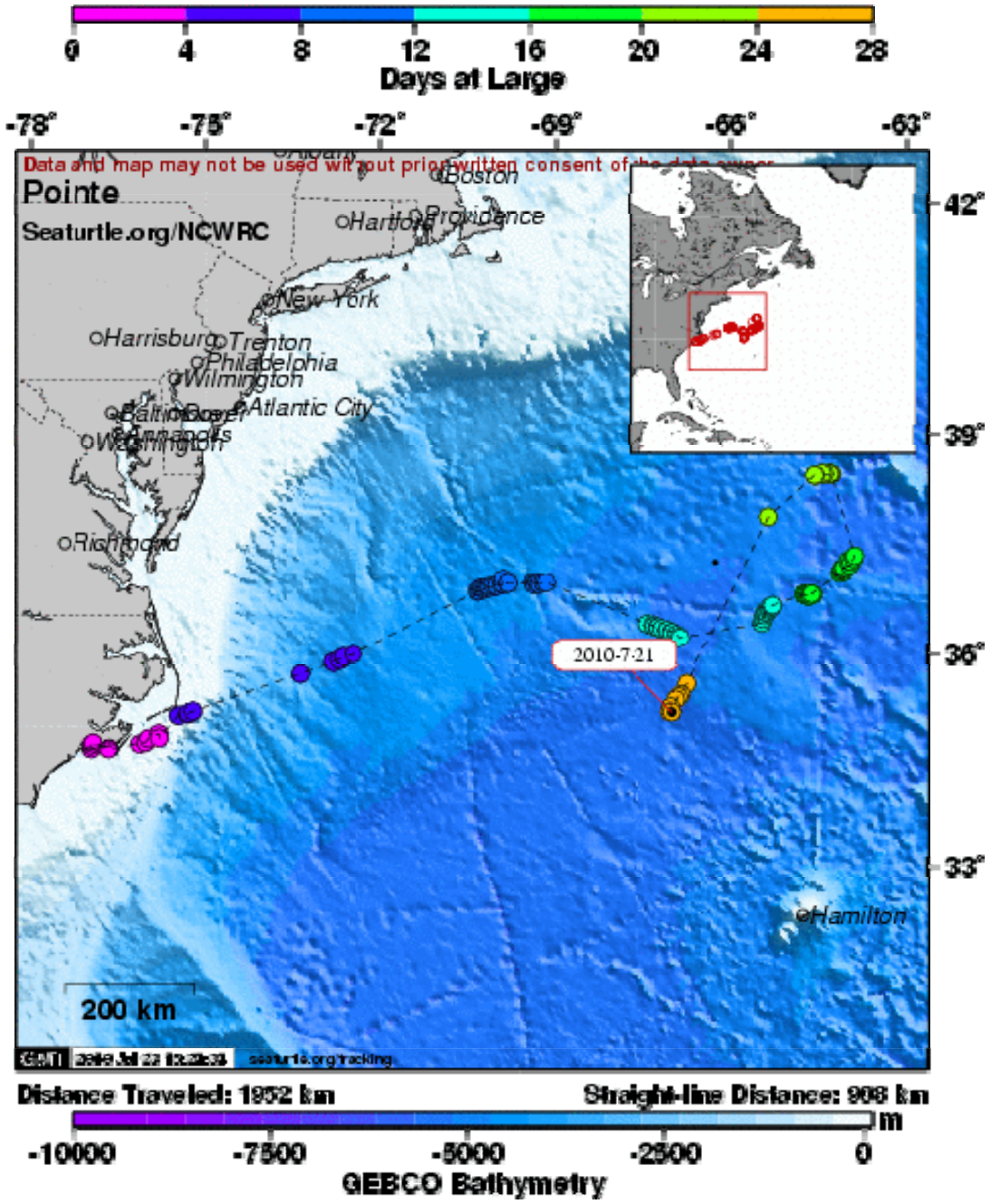


Figure 15. **A map of "Pointe", a loggerhead sea turtle equipped with a SPLASH tag on 26 June 2010**

(http://www.seaturtle.org/tracking/index.shtml?tag_id=96290&full=1&lang=).

Photographic Effort

In total, 1369 digital images were taken during Year Three for species identification and individual recognition purposes. Of the 55 cetacean sightings in Year 3, we obtained images from all but three encounters. Every attempt was made to photograph all animals encountered but our ability to sample each group completely was often hampered because it is difficult to maneuver the vessel to take good quality photo-identification images, especially while towing the passive acoustic array. Images taken during the vessel-based surveys have also been used to identify diagnostic species-specific features and for comparison with images taken during aerial surveys to improve our ability to discriminate among species (particularly spotted and bottlenose dolphins).

We continued to add to our photo-identification catalogs in Onslow Bay in Year Three (Table 7). Photo-identification analysis is now complete for all images taken through June 2010. Since the beginning of our monitoring program in 2007 we have re-sighted five bottlenose dolphins: (1) ID 9-016 on 25 July 2008 and 17 August 2009; (2) ID 4-002 on 15 September 2009 and 1 October 2009; (3) 1-004 on 1 October 2009 and 11 April 2010; (4) and (5) IDs 7-015 and 8-009, seen together on 28 April 2009, and both seen together again, nearly one year later, on 20 April 2010. We also matched one spotted dolphin, ID 9-013, seen on 9 August 2009 and then again on 1 October 2009 (Figure 16). We have now resighted approximately 5% of bottlenose dolphins (5 of 106) and 2% (1 of 49) of spotted dolphins identified in Onslow Bay, despite limited sampling effort. Several of these resightings span periods of a year or more, suggesting at least some residency in the study area. To date, we have not re-sighted any other species photographed, although the number of sightings and catalog sizes for these species are very small.

We will continue to take images to augment our existing catalogs (Table 7). We also compare images of the dorsal fins of stranded cetaceans in North Carolina to our photo-identification catalogs for Onslow Bay, but we have not found any matches to date.

We are planning to conduct dedicated photo-identification surveys and biopsy sampling in Year 4 to further examine the population structure of cetaceans in this area.

Table 7. **Comparison of photo-identification effort between Year 1 (2007-2008), Year 2 (2008-2009), and Year 3 (2009-2010), showing cumulative catalog sizes and the number of matches made over the three-year period.**

Species	Year 1			Year 2			Year 3		
	Images	Catalog Size	Matches	Images	Catalog Size	Matches	Images	Catalog Size	Matches
Tursiops truncatus	472	52	0	271	78	0	536	106	5
Stenella frontalis	76	3	0	698	29	0	542	49	1
Globicephala sp.	105	8	0	0	8	0	64	16	0
Grampus griseus	182	5	0	0	5	0	75	7	0
Steno bredanensis	0	0	0	0	0	0	148	12	0

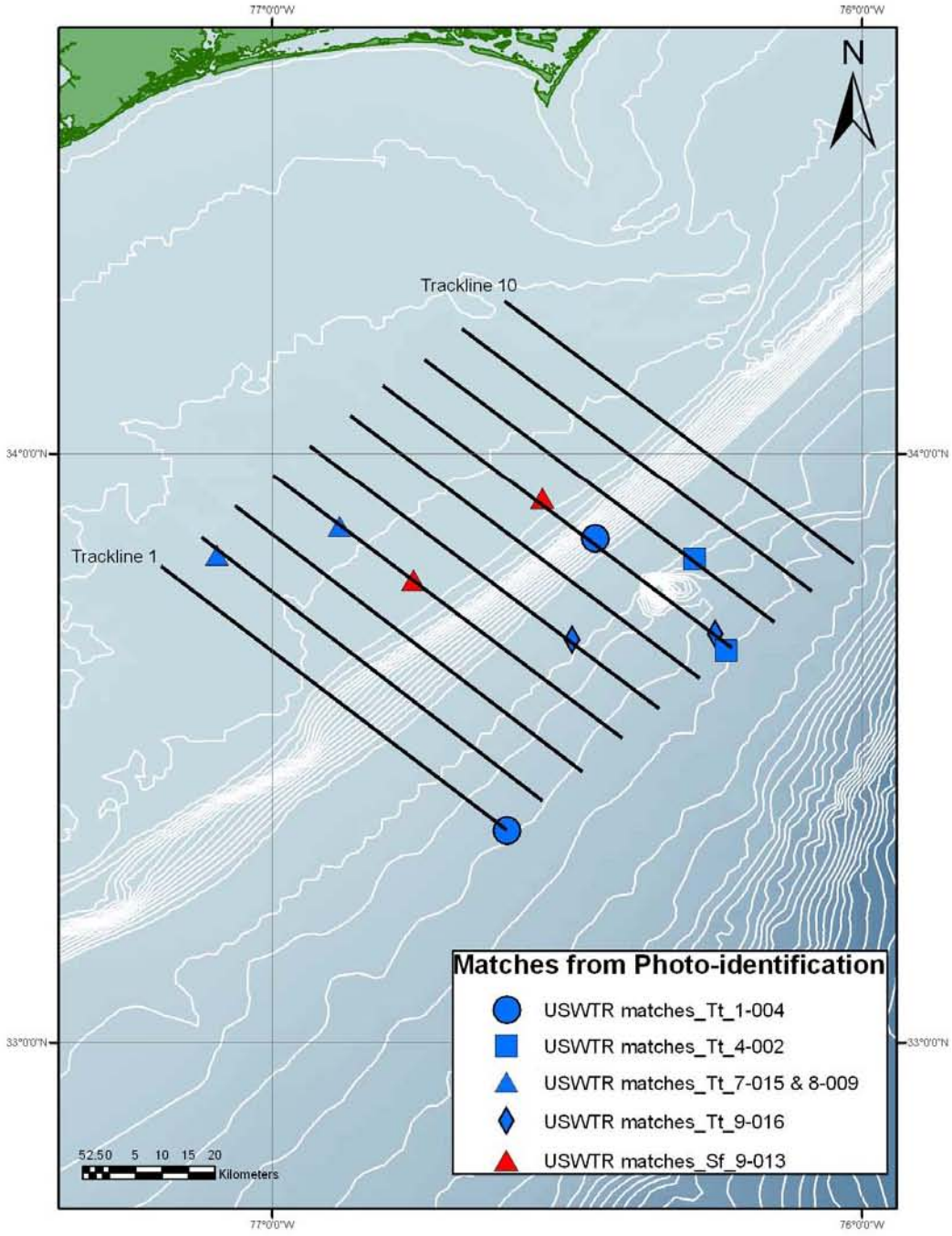


Figure 16a. **Plot of sighting locations of bottlenose and spotted dolphins. Each symbol represents the sighting location of matched dolphins.**

Figure 16b. **Dorsal fin images of matched dolphins.**

Passive Acoustic Monitoring

During Year Three we conducted 18 line transect surveys with the towed hydrophone array in Onslow Bay, resulting in 91.2 hours of passive acoustic monitoring. During these surveys, we obtained recordings from 40 groups of animals that were positively identified to species by the visual observers. Twenty-three of these 40 groups were identified as bottlenose dolphins, eleven were Atlantic spotted dolphins, three were identified as Risso's dolphins, two groups were pilot whales and there was a single group of rough-toothed dolphins (Table 8). As noted above, in July 2009 we also conducted four days of line transect surveys with the towed hydrophone array off Cape Hatteras; this resulted in additional 15.3 hours of passive acoustic monitoring. During the surveys off Cape Hatteras, we recorded 18 groups of animals that were positively identified by the visual observers. Twelve of these were bottlenose dolphins, four were pilot whales, one was as a mixed group of bottlenose dolphins and pilot whales, and one was a mixed group of Risso's dolphins and bottlenose dolphins (Table 9). Figure 17 shows the number of towed array detections per hour for each species by month in Onslow Bay and by survey day off Cape Hatteras. Further spectral analysis (measuring the parameters described above) of these data will be conducted in the upcoming months.

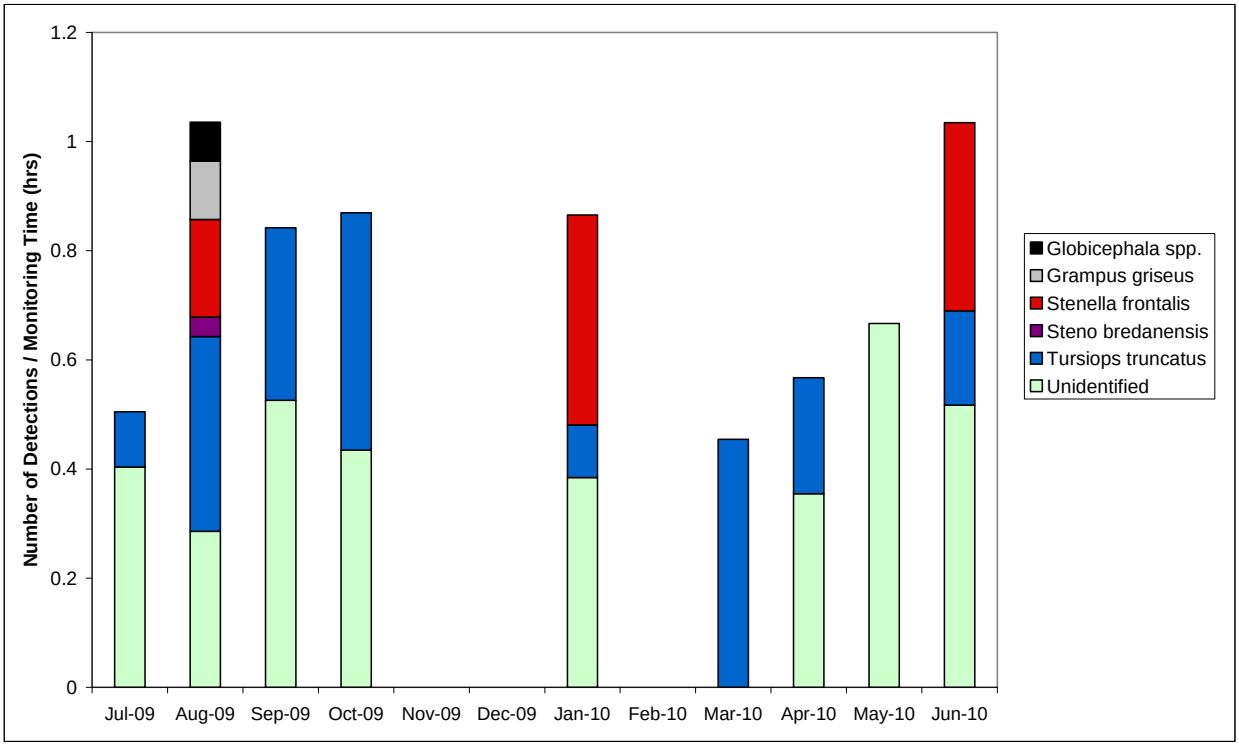
Table 8. **Number of recordings made using the towed hydrophone array in Onslow Bay between July 2009 and June 2010.**

Species	Total # of Days Detected	Total # of Detections	Total Duration of Recordings (h:mm)
Globicephala spp.	1	2	1:06
Grampus griseus	2	3	2:08
Stenella frontalis	6	11	4:53
Steno bredanensis	1	1	0:40
Tursiops truncatus	13	23	9:30
Unidentified	17	34	13:27

Table 9. **Number of recordings made using towed array off Cape Hatteras in July 2009.**

Species	Total # of Days Detected	Total # of Detections	Total Duration of Recordings (h:mm)
Globicephala spp.	2	5	2:19
Grampus griseus	1	1	0:25
Tursiops truncatus	3	13	5:41

(a)



(b)

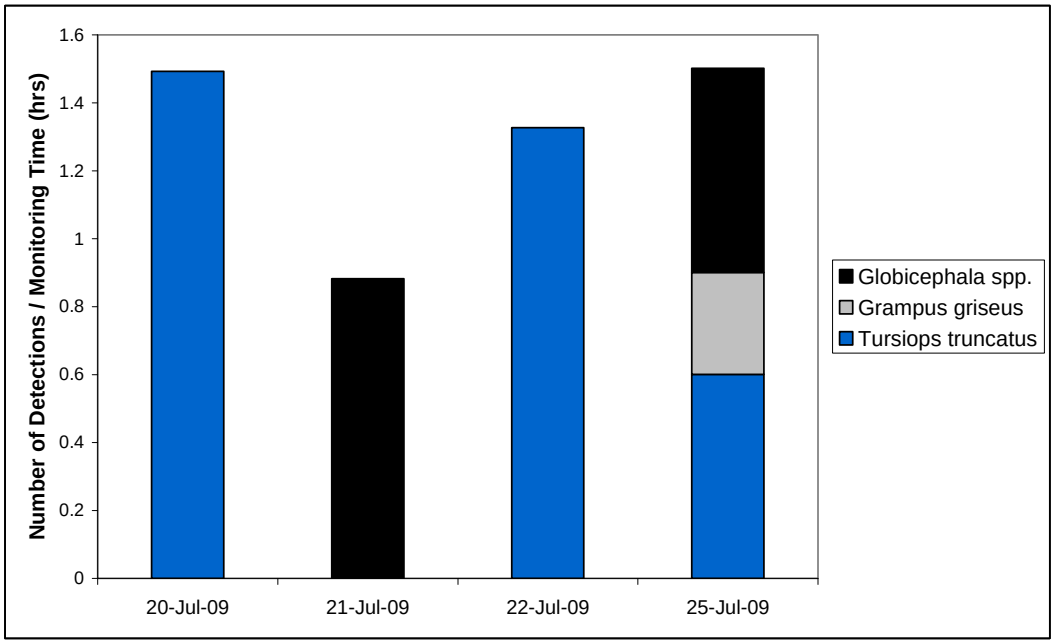


Figure 17. **(a) Number of detections in Onslow Bay from the towed array per hour by month and (b) number of detections off Cape Hatteras from the towed array per hour by day.**

We performed Kruskal-Wallis tests on HARP data from the first three deployments to determine whether the number of vocal events differed during the day and night. For the 1st HARP deployment, no significant difference was found between these two photoperiods; however, when the data were divided into four photoperiods (dawn, day, dusk, and night), a Kruskal-Wallis showed a significant increase in the number of vocal events at dawn ($p < 0.001$, Figure 18). A significant increase in the number of vocal events was found during night for both the second (Kruskal-Wallis, $p < 0.001$, Figure 19) and third HARP deployments (Kruskal-Wallis, $p < 0.001$, Figure 20). We cannot quantify seasonal or inter-annual differences in these data due to the presence of large gaps in the data and the use of multiple recording sites, but it is interesting to note that both summer data sets (the second and third deployments) showed a trend towards a greater number of vocal events at night whereas the fall/winter data (first deployment) exhibited a different trend.

We also conducted Kruskal-Wallis tests on the occurrence of Risso's dolphin and sperm whale clicks to test for diel variation in vocal activity. We concentrated on these two species, because their clicks are relatively easy to discern in the HARP acoustic records. With data from the first three deployments were combined, we observed a significant increase in the occurrence of Risso's dolphin click bouts at night (Kruskal-Wallis, $p < 0.001$, Figure 21). Similarly, when the sperm whale click data from the first three deployments were combined, we found a significant increase in the occurrence of sperm whale click bouts at night (Kruskal-Wallis, $p = 0.001$, Figure 22).

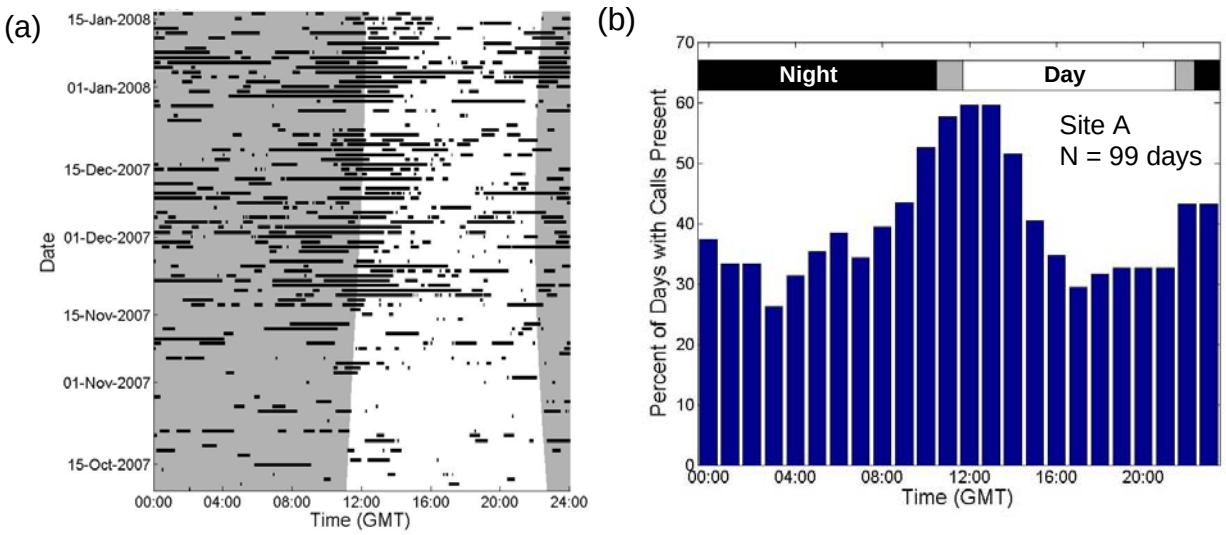


***Figure 18*. Data from the first HARP deployment showing (a) time of vocal events, with shading indicating periods of darkness and (b) number of days with calls (normalized by total number of hours recorded) by time of day (GMT). The gray bars represent periods that could be either day or night depending on the time of year.**

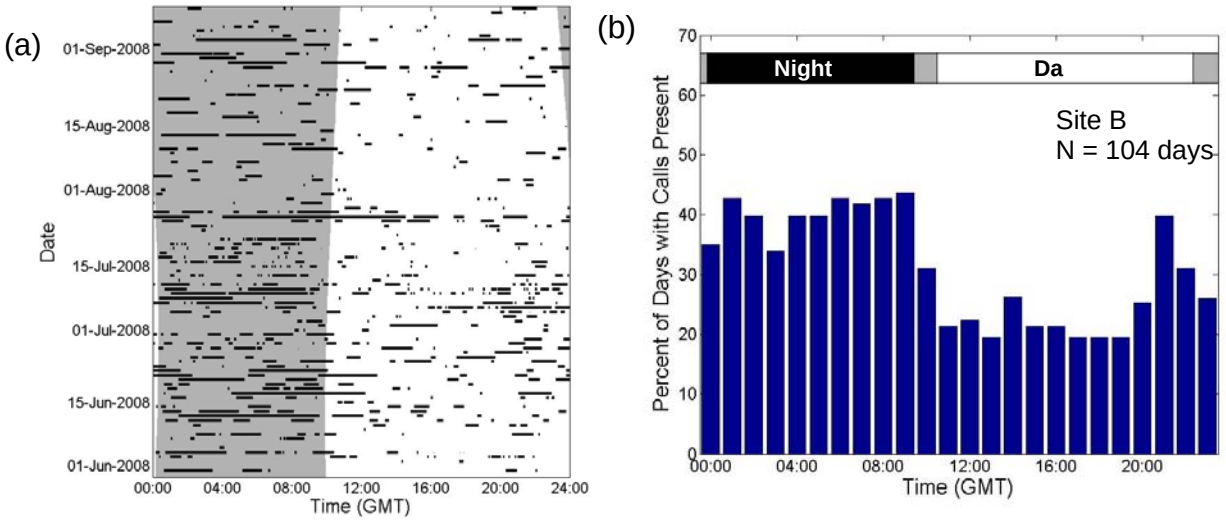


***Figure 19.* Data from the second HARP deployment showing (a) time of vocal events, with shading indicating periods of darkness and (b) number of days with calls (normalized by total number of hours recorded) by time of day (GMT). The gray bars represent periods that could be either day or night depending on the time of year.**

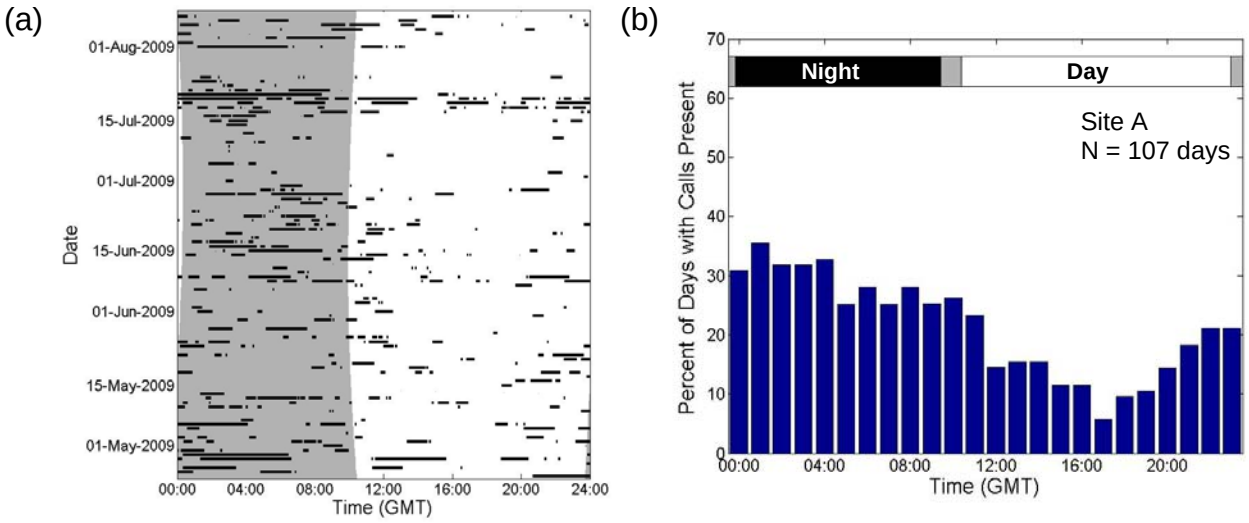


***Figure 20*. Data from the third HARP deployment showing (a) time of vocal events, with shading indicating periods of darkness and (b) number of days with calls (normalized by total number of hours recorded) by time of day (GMT). The gray bars represent periods that could be either day or night, depending on the time of year.**

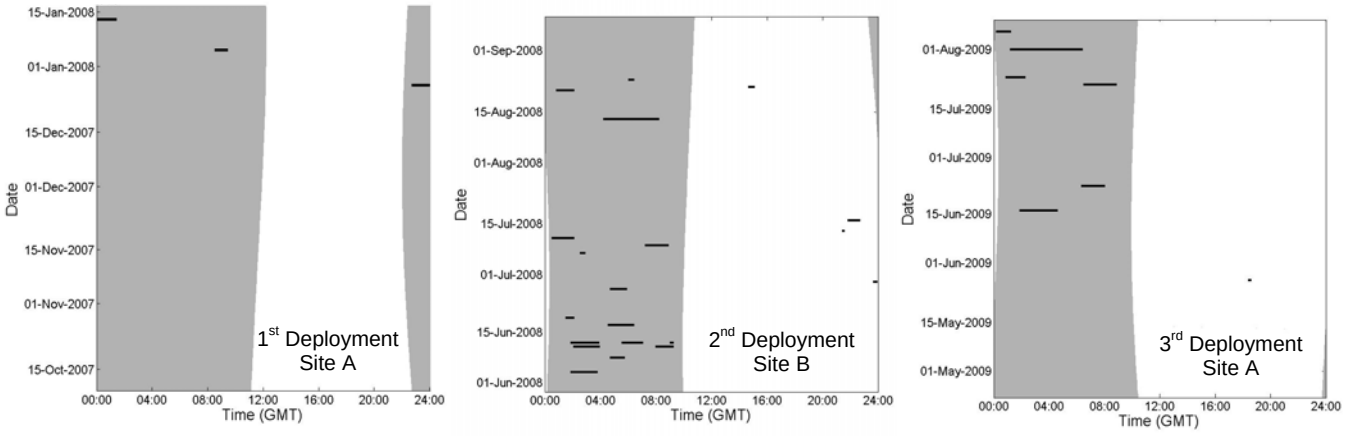


***Figure 21.* Data from the first three HARP deployments showing the time of Risso's dolphin click events. Shading indicates periods of darkness, determined from the U.S. Naval Observatory.**

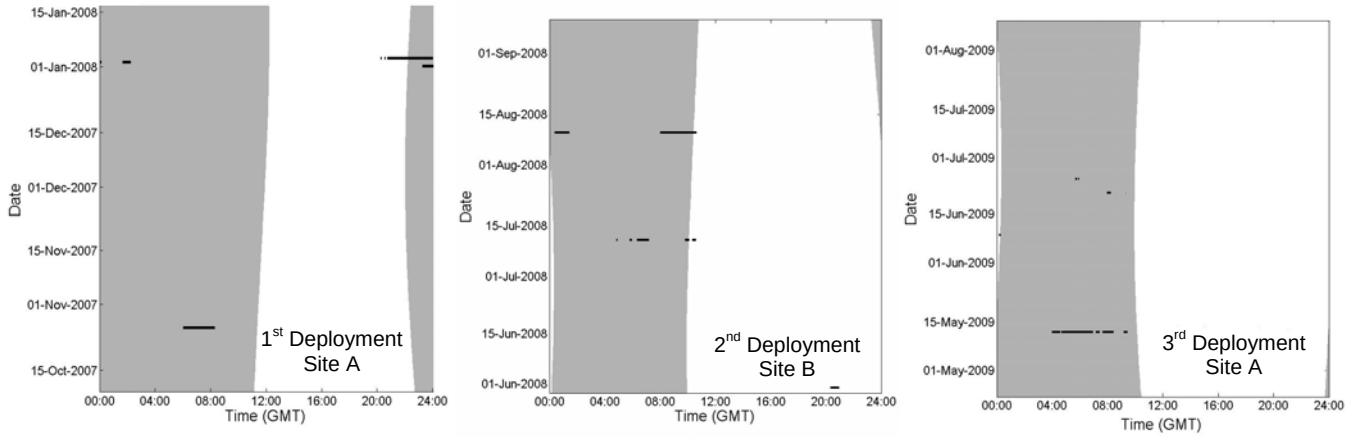


Figure 22. **Data from the first three HARP deployments showing the time of sperm whale click events. Shading indicates periods of darkness, determined from the U.S. Naval Observatory.**

The analysis of the data from the fourth HARP deployment at site C is currently underway, as is the analysis of the decimated data for all HARP deployments. A brief look through the decimated data of the HARP at site C during the fourth deployment revealed probable calls from sei whales (Figure 23) and calls from humpback whales (Figure 24).

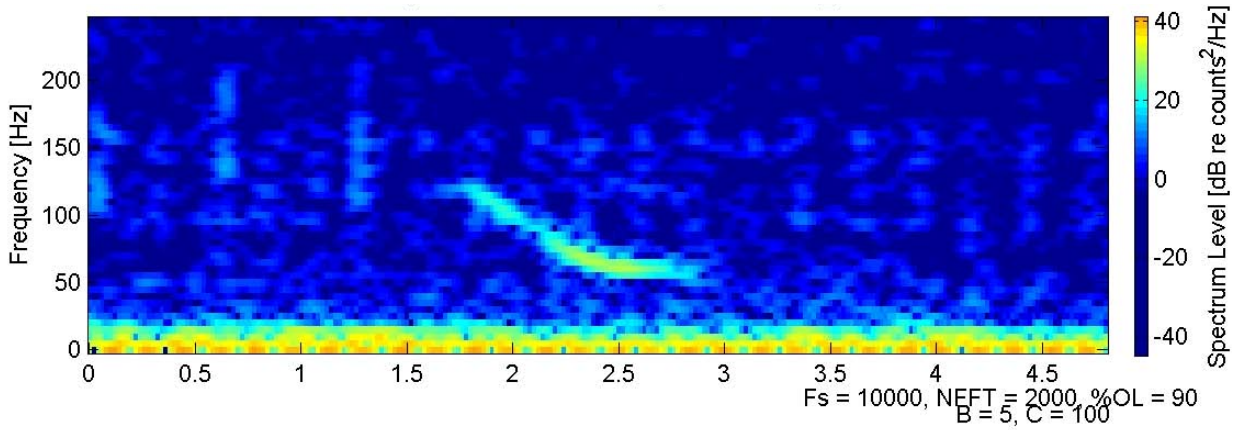


Figure 23. **Spectrogram showing a probable sei whale call on February 8, 2010, in the HARP data from the fourth deployment at Site C.**

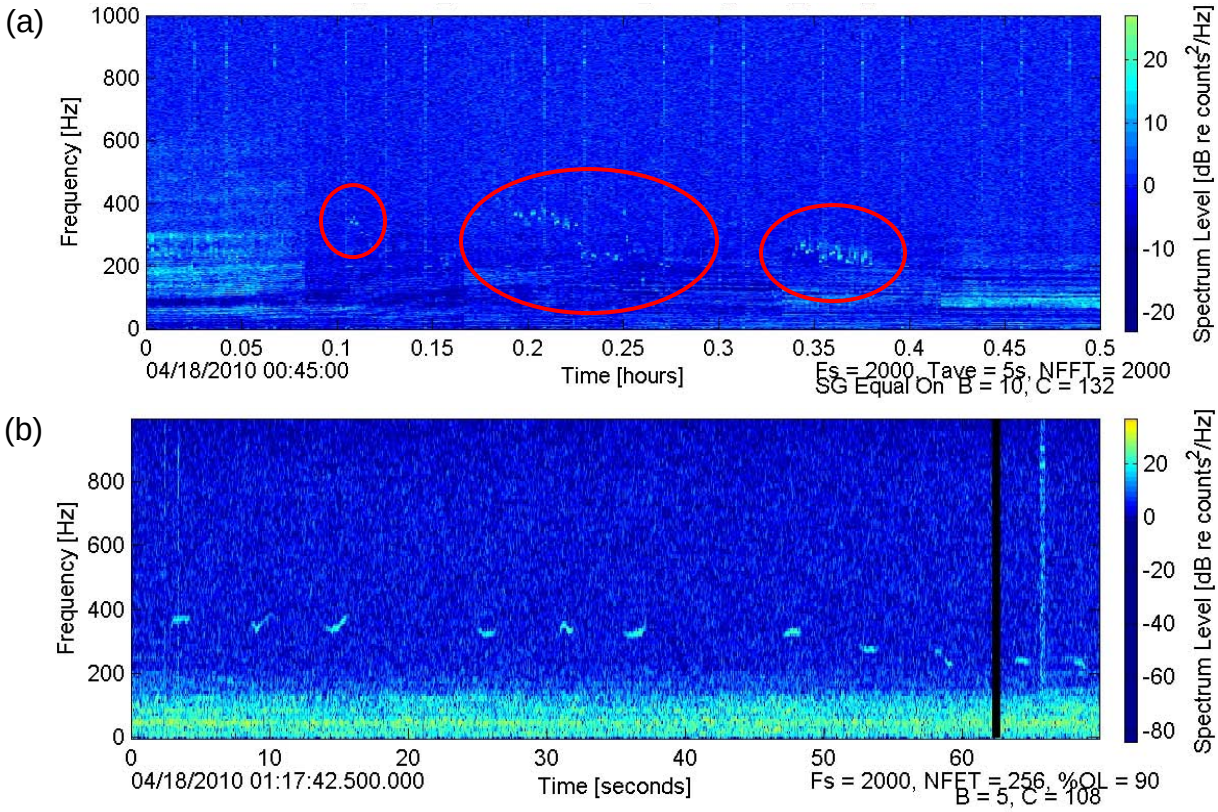


Figure 24. **(a) LTSA and (b) spectrogram showing humpback whale calls on April 18, 2010, in the HARP data from the fourth deployment at Site C.**

Seabird Observations

During Year Three of our surveys in Onslow Bay, we recorded a total of 61 birds over approximately 12 hours of seabird observations (Table 10). The sightings per unit effort (SPUE), or the number of seabirds recorded per hour of effort, ranged between 1.08 and 6.87, and was highest in September, although no seabird surveys were conducted during winter or spring months. The relatively low number of surveys in Year Three reflects the end of the data collection phase for Lesley Thorne's dissertation research. She is currently working up these data as part of her Ph.D. dissertation on the influence of oceanographic features on the distribution of seabirds.

Table 11 shows the species of seabird observed in each survey month. Cory's Shearwaters (*Calonectris diomedea*) were by far the most commonly sighted birds, while Greater Shearwaters (*Puffinus* gravis) and Wilson's Storm Petrels (*Oceanites oceanicus)* were also observed frequently.

Mean SPUE, depth, sea surface temperature (SST) and distance to continental shelf for each observed seabird species is shown in Table 12. The distributions of shearwater and storm petrel species during surveys in Onslow Bay are shown in Figures 23 and 24, respectively.

Table 10. **Seabird sighting statistics by month during surveys in Onslow Bay, NC from July 2009 through June 2010. The sighting per unit effort (SPUE) was calculated by dividing the number of birds observed by the number of hours surveyed.**

Month	Number of Species Observed	Total Number of Birds Observed	Total Hours Surveyed	SPUE
July 09	3	4	3.72	1.08
Aug 09	3	31	4.68	6.62
Sept 09	3	26	3.78	6.98
OVERALL	**4**	**61**	**12.18**	**5.01**

Table 11. **Seabird sightings by month from July 2009 through June 2010 during surveys in Onslow Bay, NC.**

Month	Jul-09	Aug-09	Sept-09	TOTAL
Audubon's Shearwaters	1	0	2	**3**
Cory's Shearwaters	2	21	8	**31**
Greater Shearwaters	1	2	5	**8**
Unidentified Shearwaters	0	0	8	**8**
Wilson's Storm Petrels	0	5	0	**5**
Unidentified Storm Petrels	0	2	0	**2**
Unidentifed seabird	0	0	1	**1**
Unidentified swallow	0	1	2	**3**
TOTAL	**4**	**31**	**26**	**61**

Table 12. **Mean depth, sea surface temperature (SST) and distance to continental shelf for commonly sighted seabird species from surveys in Onslow Bay, NC**

Species	Mean SPUE	Mean SST	Mean depth (m)	Mean distance to shelf (km)
Audubon's Shearwaters (*Puffinus lherminieri*)	0.25	82.15	-194.00	35781.91
Cory's Shearwaters (*Calonectris diomedea*)	2.55	85.28	-126.58	80989.71
Greater Shearwaters (*Puffinus gravis*)	0.66	82.87	-143.25	66475.05
Unidentified Shearwaters (*Puffinus* sp.)	0.66	81.96	-218.50	49203.78
Wilson's Storm Petrels (*Oceanites oceanicus)*	0.41	86.14	-202.60	62883.09
Unidentified Storm Petrels	0.16	86.35	-239.50	56942.94

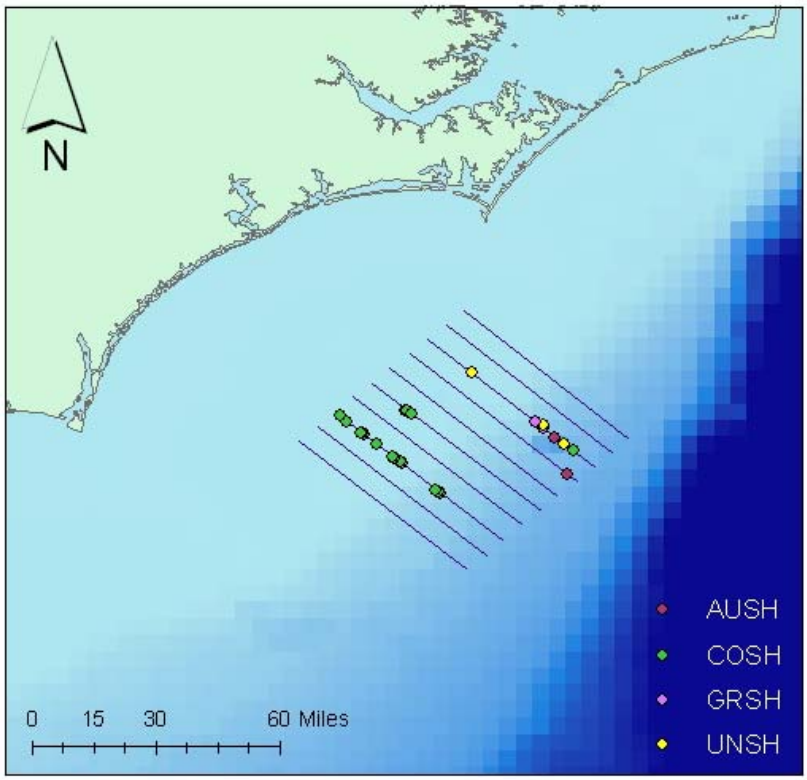


Figure 23. **Distribution of shearwater species observed during surveys in Onslow Bay, NC. Species codes are listed in Table 13.**

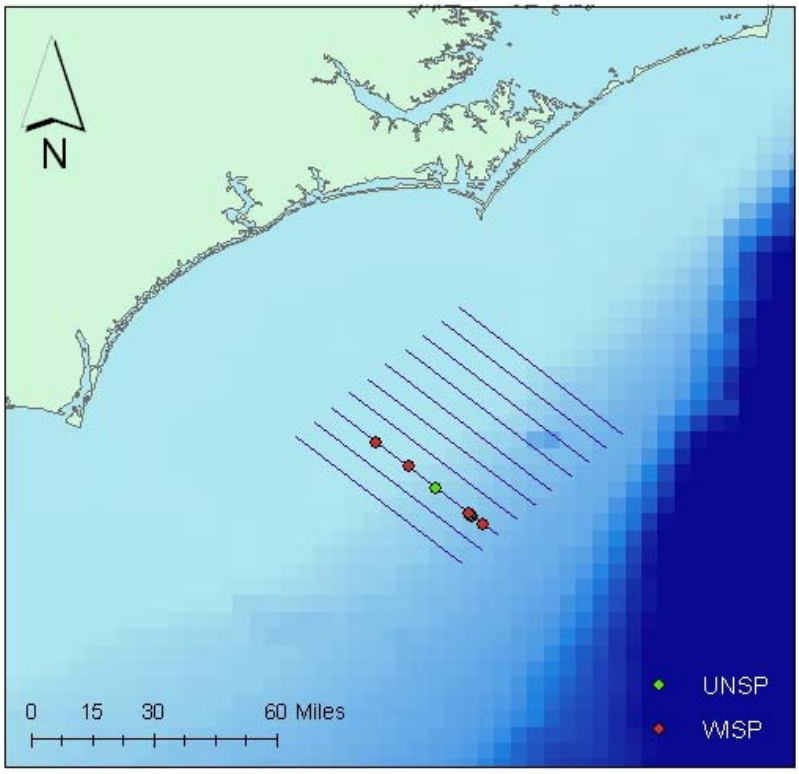


Figure 24. **Distribution of storm petrel species observed during surveys in Onslow Bay, NC. Species codes are listed in Table 13.**

Table 13. **Species codes for seabirds observed on Onslow Bay surveys**

Seabird Species	Species Code
Audubon's Shearwaters (*Puffinus lherminieri*)	AUSH
Cory's Shearwaters (*Calonectris diomedea*)	COSH
Greater Shearwaters (*Puffinus gravis*)	GRSH
Leach's Petrel (*Oceanodroma leucorhoa*)	LESP
Unidentified Shearwaters (*Puffinus* sp.)	UNSH
Unidentified Storm Petrels	UNSP
Wilson's Storm Petrels (*Oceanites oceanicus)*	WISP

Oceanographic surveys of Gulf Stream frontal eddies

We conducted oceanographic and fisheries acoustics surveys in Onslow Bay to better understand the influence of oceanographic features on the distribution of cetaceans, sea turtles and seabirds. In Year Three we focused our oceanographic sampling on Gulf Stream Frontal Eddies (GSFE) to examine the distribution of forage (prey) fish relative to oceanographic parameters and eddy water masses and the distribution of foraging seabirds. In particular, we were interested in comparing distributions of forage fish in the eddy cold core and warm filament relative to Gulf Stream waters (see Figure 25).

We sampled GSFEs on six days during the summer and fall of 2009 and also conducted surveys across Gulf Stream and shelf waters on three other days for comparative purposes. We located GSFEs using *in situ* sea surface temperature measurements and satellite images of sea surface temperature, along with depth profiles from expendable bathythermographs (XBTs). We measured ocean currents using an Acoustic Doppler Current Profiler (ADCP) and used a 38 kHz split-beam Simrad transducer to examine the synoptic distribution of forage fish. To date we have analyzed the upper 40 m of the eddies to describe the distribution of forage fish accessible to foraging seabirds; 40 m is the maximum recorded diving depth of Audubon's shearwaters, the deepest diving seabird observed in the study area when these surveys were conducted.

The cold core and warm filament of the GSFEs had a higher biomass of fish than Gulf Stream (Figure 26a). In addition, biomass within the eddy cold core and the warm filament

was closer to the surface in the warm filament and cold core than in the Gulf Stream (Figure 26b). The high biomass observed within the warm filament of the GSFEs was surprising as other studies have shown that seabirds are more abundant in the cold core of the eddies. Fronts within GSFEs likely play an important role in aggregating prey for foraging seabirds. An ongoing analysis examining distributions in fish biomass relative to eddy fronts (*e.g.* the front between the warm filament and the cold core) may provide further insight into seabird habitat use relative to prey biomass and GSFEs.

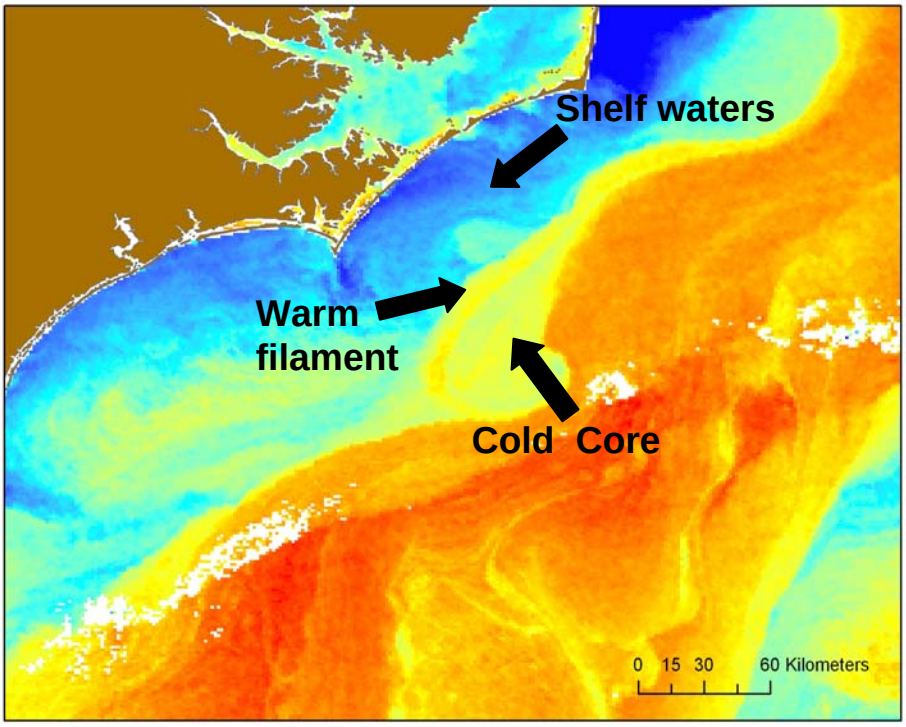


***Figure 25*. Example of water masses associated with a Gulf Stream frontal eddy in the Onslow Bay USWTR study area.**

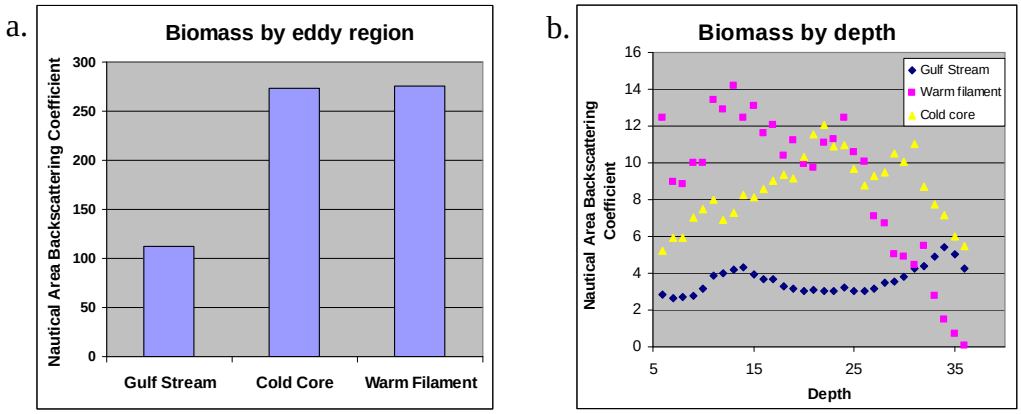


Figure 26. **Biomass by region (a) and depth (b) measured with a 38 kHz Simrad transducer within different water masses of Gulf Stream frontal eddies in Onslow Bay, NC.**

Vessel Sightings

A total of 92 vessels were encountered in the study area during vessel surveys, ranging from small recreational boats to large cargo vessels. The number of each category of vessels observed is presented in Figure 27.

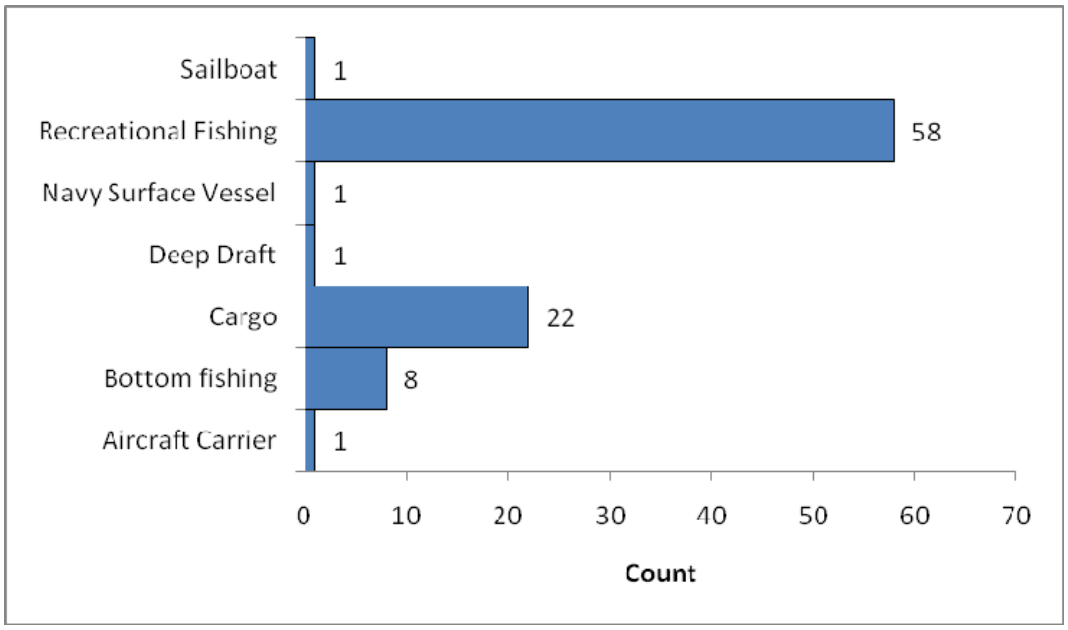


Figure 27. **Vessels observed during surveys in Onslow Bay, NC, July 2009 through June 2010.**

Acknowledgements

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AERIAL SURVEYS OF THE PROPOSED UNDER SEA WARFARE TRAINING RANGE (USWTR) OFF JACKSONVILLE, FLORIDA JANUARY 2009 TO JUNE 2010

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Rachel E. Hardee Richard C. Holt
Erin W. Cummings Ryan J. McAlarney
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Acknowledgements

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Summary of JAX Aerial Surveys

This document is an annual progress report to the U.S. Department of the Navy on aerial surveys at the proposed Under Sea Warfare Training Range (USWTR) off of Jacksonville, Florida between January 2009 and June 2010. Preliminary aerial surveys were performed from January through March 2009 for a total of 35 tracklines surveyed, and regularly scheduled aerial surveys commenced in June 2009. Beginning in June, the goal was to survey the entire USWTR site (10 tracklines) twice per calendar month, which was accomplished for eleven of thirteen months. In October 2009 and May 2010, only ten tracklines were covered. Survey coverage was intensified during North Atlantic right whale (*Eubalaena glacialis*) calving season (December 2009 through April 2010) during which time 143 tracklines were flown, for an average of 29 tracklines surveyed per month. In addition, upon request from the US Navy, extra survey coverage was provided during Navy exercises in September 2009 and June 2010. Thus, a total of 354 tracklines (29839.4 km) were surveyed during the reporting period. The majority of surveys were flown in Beaufort Sea State (BSS) 2 (41.3%).

A total of 323 sightings of 3718 cetaceans were observed while on effort in the study area (Table 1, Figure 1). Nine species of cetaceans were observed in the survey area while on effort including bottlenose dolphins (*Tursiops truncatus*; 132 sightings of 1179 individuals), Atlantic spotted dolphins (*Stenella frontalis*; 124 sightings of 2080 individuals), Risso's dolphins (*Grampus griseus*; 16 sightings of 228 individuals), short-finned pilot whales (*Globicephala macrorhynchus*; two sightings of 19 individuals), sperm whales (*Physeter macrocephalus*; one sighting of two individuals), dwarf or pygmy sperm whales (*Kogia* spp.; one sighting of one individual), rough-toothed dolphins (*Steno bredanensis*; one sighting of 50 individuals), minke whales (*Balaenoptera acutorostrata*; six sightings of eight individuals), and North Atlantic right whales (*Eubalaena glacialis*; two sightings of three individuals). A noteworthy encounter occurred on 20 March 2010 when the aerial survey team observed and documented the birth of a North Atlantic right whale calf in the survey area. It occurred outside of the designated Right Whale Critical Habitat and represents only the second time a right whale birth has been witnessed (see Zani *et al*. 2008). In addition, there were 38 sightings (148 individual dolphins) where species identity could not be established with 100 percent certainty (*i.e.* "unidentified delphinids"). There was also an off effort encounter of a mother/calf right whale pair approximately 3 km west of the survey area. In addition, there were four off effort sightings of

Atlantic spotted dolphins (n=2) and unidentified delphinids (n=2) that were observed in or near the survey area. Off effort sightings data are not included in maps, tables or density calculations. The number of cetacean sightings varied by month, with the highest number of encounters recorded from January through April 2010 and September 2009.

A total of 1543 sea turtles were recorded during the study period. Of these, 1169 were identified as loggerhead sea turtles (*Caretta caretta*), 50 as leatherback sea turtles (*Dermochelys coriacea*), one as a Kemp's Ridley sea turtle (*Lepidochelys kempii*), and 323 were labeled "unidentified sea turtles". Sea turtles were observed during each month surveyed, with an apparent general trend of higher densities during late spring and early summer.

As previously demonstrated in other aerial survey studies, sightings drop off dramatically as the Beaufort Sea State increases. In the present study, as BSS increased from 1 to 3, cetacean sighting rates decreased from 21.35 to 3.33 per 1000 km surveyed, and sea turtle sightings decreased from 91.31 to 23.23 per 1000 km surveyed respectively.

In addition to cetaceans and sea turtles, other pelagic marine vertebrates (*e.g*. multiple species of sharks, manta rays [*Manta birostris*], and ocean sunfish) were observed. Commercial, Navy and recreational vessels were encountered in the survey area, with the majority belonging to the latter category.

Table 1. Total number of sightings and individuals for each species by month from January 2009 – June 2010 for the Jacksonville, Florida USWTR survey site.

		2009						
		January	February	March	April	May	June	Total
Tursiops truncatus	# of Sightings	2	8				7	**17**
	# of Individuals	40	52				84	**176**
Stenella frontalis	# of Sightings	1	2				4	**7**
	# of Individuals	100	9				37	**146**
Grampus griseus	# of Sightings		1				2	**3**
	# of Individuals		5				46	**51**
Balaenoptera acutorostrata	# of Sightings	1	3					**4**
	# of Individuals	1	5					**6**
Unidentified delphinid	# of Sightings	1	3				2	**6**
	# of Individuals	5	3				6	**14**
	Total sightings	**5**	**17**	**0**	**0**	**0**	**15**	**37**
	Total individuals	**146**	**74**	**0**	**0**	**0**	**173**	**393**

		2009						2010						
		July	August	September	October	November	December	January	February	March	April	May	June	Total
Tursiops truncatus	# of Sightings	6	4	12	2		3	25	15	8	33	7		**115**
	# of Individuals	49	96	87	50		57	247	117	42	196	62		**1003**
Stenella frontalis	# of Sightings	2	6	29	8			7	18	17	20	7	3	**117**
	# of Individuals	28	68	483	72			84	446	293	237	161	62	**1934**
Steno bredanensis	# of Sightings			1										**1**
	# of Individuals			50										**50**
Grampus griseus	# of Sightings			4	1	2		1	1	3	1			**13**
	# of Individuals			71	4	60		7	7	17	11			**177**
Kogia spp.	# of Sightings					1								**1**
	# of Individuals					1								**1**
Globicephala macrorhynchus	# of Sightings										1		1	**2**
	# of Individuals										5		14	**19**
Balaenoptera acutorostrata	# of Sightings								2					**2**
	# of Individuals								2					**2**
Eubalaena glacialis	# of Sightings									2				**2**
	# of Individuals									3				**3**
Physeter macrocephalus	# of Sightings											1		**1**
	# of Individuals											2		**2**
Unidentified delphinid	# of Sightings	2	1	4		2	4	6	3	7	2	1		**32**
	# of Individuals	3	3	27		4	8	53	13	18	2	3		**134**
	Total sightings	**10**	**11**	**50**	**11**	**5**	**7**	**39**	**39**	**37**	**57**	**16**	**4**	**286**
	Total individuals	**80**	**167**	**718**	**126**	**65**	**65**	**391**	**585**	**373**	**451**	**228**	**76**	**3325**

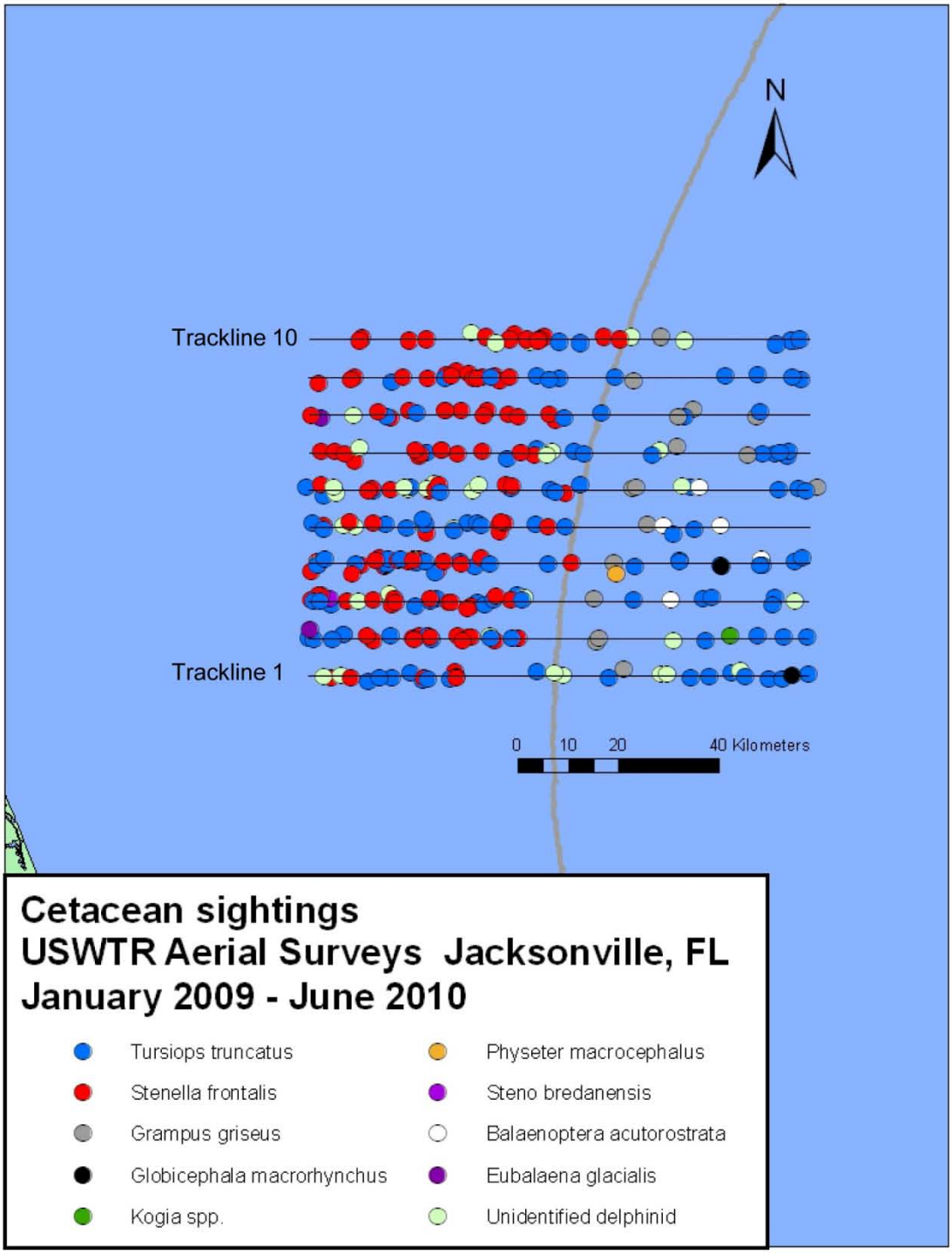

Figure 1. All cetacean sightings during aerial surveys of the proposed USWTR survey site off of Jacksonville, Florida during January 2009 – June 2010.

Methodology

Survey design and logistics

The JAX USWTR survey area consists of ten 86 km long tracklines spaced 7.4 km apart, which cover the proposed USWTR site and a 10 to 30 km boundary around the site offshore of Jacksonville (Table 2, Fig. 2). The corners of the core USWTR site are: N30.47°/W-80.37° (NW), N30.47°/W-80.00° (NE), N30.05°/W-80.47° (SW), N30.05°/W-80.10° (SE). The site sits offshore of the primary calving grounds for the highly endangered North Atlantic right whale (*Eubalaena glacialis*) which is located off the coast of the southeastern US (reviewed in Waring *et al.* 2009). The JAX USWTR tracklines begin 9.3 km east of the Early Warning Systems (EWS) eastern margin. Aerial EWS surveys have been conducted in northern Florida and southern Georgia for the past 15 years to warn mariners in real time about the presence of right whales in the region. These surveys are performed on a daily basis, weather permitting, from December through March. Another objective for the JAX USWTR surveys was to collect shoulder season data outside of the EWS survey period. Additional survey efforts, including on effort transits, were performed during November 2009 and April 2010.

In order to establish safety and communication protocols for transits through EWS areas, the USWTR team met with researchers from the New England Aquarium and Florida Wildlife Service prior to the start of EWS surveys. The protocols outlined coordination between survey team leaders on the morning of a survey, plane to plane communication at the start of an aerial survey and the maintenance of a 1000 m altitude for the USWTR survey plane transiting through the EWS area between December and March. The protocols also established the 9.3 km "buffer zone" between the western margin of the USWTR surveys and the eastern margin of the EWS surveys. This was done to safely maximize aerial coverage during right whale calving season.

All aerial surveys were based out of the local FBO in Fernandina Beach, FL, except for preliminary aerial surveys conducted during February and March 2009, which originated in St Augustine, Florida. Prior to an aerial survey, pilots with Orion aviation would contact SeaLord at FACFASJAX in Jacksonville, Florida, to get event codes for passage out of and into U.S. territorial waters.

Except for the geographic and logistical details described above, the JAX USWTR aerial surveys mirror those carried out at the Onslow Bay site. Please see the Survey design and

logistics section for Onslow Bay North Carolina USWTR site for complete description of survey methods.

Table 2. Coordinates for trackline endpoints of the Jacksonville, Florida survey site.

	Western Way Point		Eastern Way Point	
Transect Line	**Latitude**	**Longitude**	**Latitude**	**Longitude**
1	29.9650110	-80.7000000	29.9650110	-79.8014160
2	30.0312638	-80.7000000	30.0312638	-79.8014160
3	30.0996944	-80.7000000	30.0996944	-79.8014160
4	30.1657638	-80.7000000	30.1657638	-79.8014160
5	30.2322277	-80.7000000	30.2322277	-79.8014160
6	30.2994770	-80.7000000	30.2994770	-79.8014160
7	30.3651528	-80.7000000	30.3651528	-79.8014160
8	30.4327972	-80.7000000	30.4327972	-79.8014160
9	30.4988666	-80.7000000	30.4988666	-79.8014160
10	30.5662330	-80.7000000	30.5662330	-79.8014160

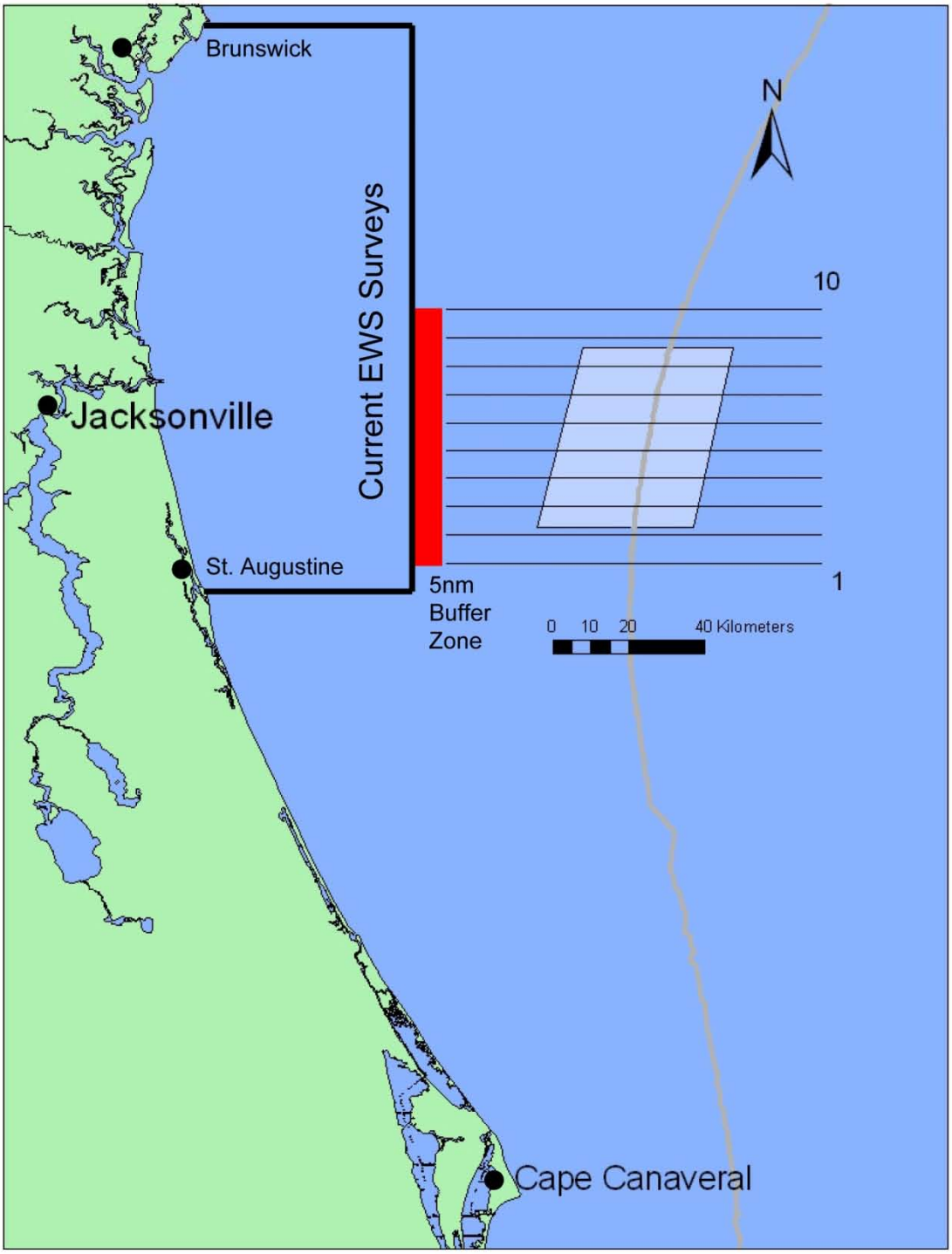

Figure 2. Survey tracklines 1 – 10 that cover and extend beyond the boundaries of the proposed USWTR site off of Jacksonville, Florida.

Results

Preliminary aerial surveys of the proposed USWTR site off of Jacksonville, Florida were performed in January, February and March 2009. During these initial surveys a total of 35 tracklines were flown (Table 3). Regularly scheduled aerial surveys commenced in June 2009. The aim of the aerial surveys was to cover the entire survey area twice (20 tracklines) during each calendar month. A minimum of two full sets of survey tracklines were flown each month between June 2009 and June 2010, except October 2009 and May 2010 (10 tracklines each). During the North Atlantic right whale (*Eubalaena glacialis*) calving season survey effort was increased for a total of 143 tracklines surveyed from December 2009 through April 2010, an average of 29 tracklines per calendar month. Upon request by the US Navy, aerial surveys were conducted to cover naval exercises in the USWTR area during September 2009 and June 2010 for a total of 76 tracklines surveyed during these two months. A total of 354 tracklines and 29839.4 km were surveyed from January 2009 through June 2010.

Table 3. Tracklines and km flown during aerial surveys of the proposed USWTR site off of Jacksonville, Florida between January 2009 – June 2010. Trackline numbers are listed in the order in which they were flown.

Date	Tracklines Flown AM	Tracklines Flown PM	Daily Total km Flown
27-Jan-2009	1 to 6		505.9
28-Jan-2009	7 to 10		345.5
26-Feb-2009	10 to 7	6 to 1	861.8
27-Feb-2009	1 to 6	7 to 10	842.8
31-Mar-2009	5 to 9		431.7
9-Jun-2009		10 to 5	514.3
10-Jun-2009	1 to 6	7 to 10	857.7
11-Jun-2009	4 to 1		318.7
15-Jul-2009		1 to 6	507.7
16-Jul-2009	10 to 5	4 to 1	857.1
17-Jul-2009	7 to 10		344.3
4-Aug-2009	10 to 5		507.2
5-Aug-2009	1 to 6	7 to 8	689.7
6-Aug-2009	1 to 4, 9, 10		513.2
14-Sep-2009	10 to 7		343.4
15-Sep-2009	1 to 6	7 to 10	854.0
16-Sep-2009	1 to 4	5 to 6	512.2
18-Sep-2009	10 to 5	4 to 1	856.9
30-Sep-2009	1 to 6	7, 8, 10, 9	763.5
1-Oct-2009	10 to 5	4 to 1	821.5
17-Nov-2009		10-5	517.5
18-Nov-2009	1 to 6	10 to 7	856.9
20-Nov-2009	1 to 4		345.1
8-Dec-2009	10 to 1		865.8
10-Dec-2009	1 to 2		86.1
22-Dec-2009	1 to 6	7 to 10	860.0
7-Jan-2010	1 to 6	7 to 10	862.4
19-Jan-2010	10 to 5	4 to 1	856.0
20-Jan-2010	1 to 6	7 to 10	832.9
27-Jan-2010	10 to 5	4 to 1	862.2
28-Jan-2010	1 to 4	5 to 6	507.5
19-Feb-2010	1 to 6	7 to 10	863.8
20-Feb-2010	10 to 5	4 to 1	846.6
21-Feb-2010	1 to 6	7 to 10	835.5
20-Mar-2010	1 to 2	3 to 8	681.7
24-Mar-2010	10 to 6		506.0
31-Mar-2010		1 to 4, 9, 10	497.6
1-Apr-2010	10 to 5	4 to 1	834.0
2-Apr-2010	1 to 6	7 to 10	822.0
3-Apr-2010	10 to 5		411.0
6-May-2010	1 to 2	3	184.3
7-May-2010	3 to 10		636.0
4-Jun-2010	1 to 6	7 to 10	858.8
5-Jun-2010	10 to 1		816.5
6-Jun-2010	1 to 6	7 to 10	832.3
7-Jun-2010	10 to 5		511.5
		Total	29839.4

Each survey month an average Beaufort Sea State (BSS) value was calculated as a way to compare conditions across time. This average was calculated by taking the distance flown at each sea state multiplied by the BSS number (*i.e.* BSS 1 distances would be multiplied by 1). These values were then summed and divided by the total distance flown that month. Survey effort was terminated at BSS greater than 4. Survey conditions ranged from a BSS 0 to 5, with the majority of the surveys flown in a BSS 2 [BSS 0: 80.5 km (0.3%), BSS 1: 6275.4 km (21.0%), BSS 2: 12315.6 km (41.3%), BSS 3: 9299.1 km (31.2%), BSS 4: 1782.6 km (6.0%), BSS 5: 86.1 km (0.3%)(Fig. 3a-c)]. Cetacean sighting rates dropped off dramatically as BSS increased, with 12.42 sightings/1000km surveyed in BSS 0, 21.35 sightings/1000km surveyed in BB1, 12.67 sightings/1000km surveyed in BSS 2, 3.33 sightings/1000 km surveyed in BSS 3, and 0.56 sightings/1000km surveyed in BSS 4 (Fig. 4a-c).

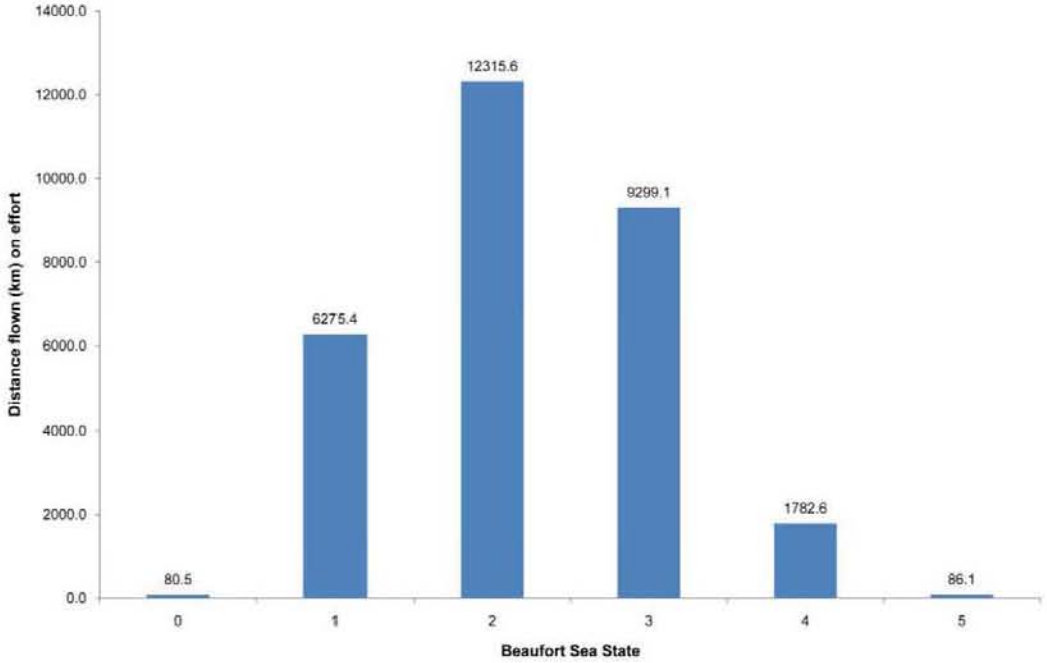

Figure 3a. Total distance surveyed per Beaufort Sea State during the January 2009 – June 2010 aerial surveys of the proposed USWTR survey site off Jacksonville, Florida.

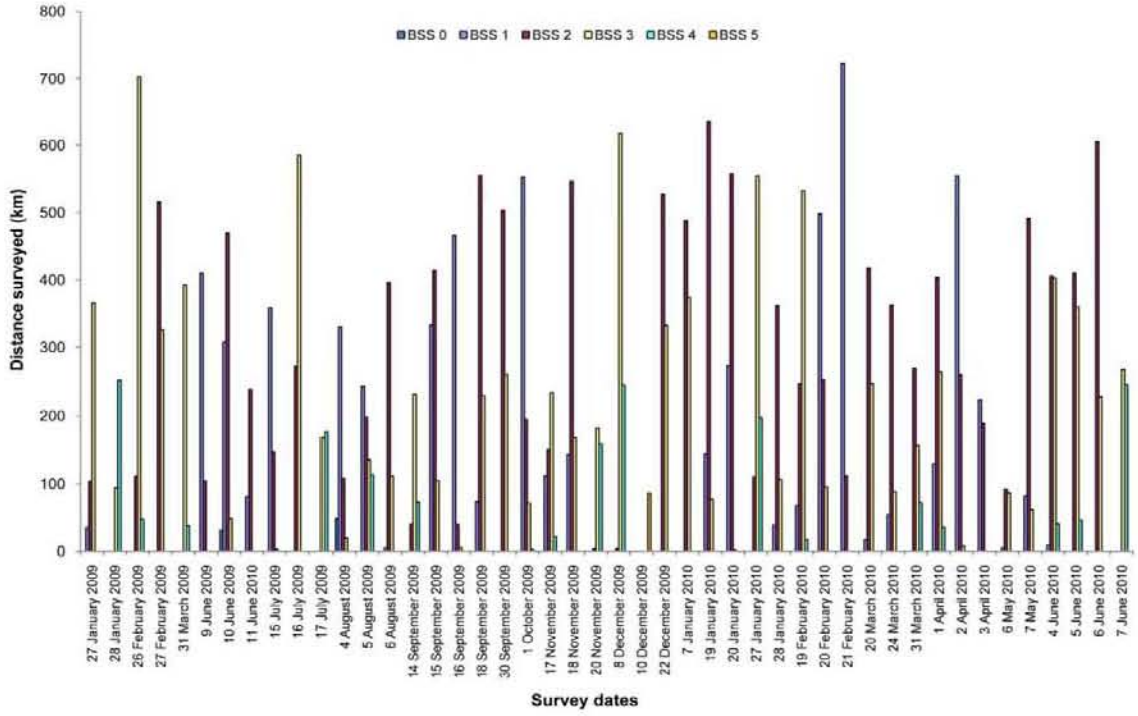

Figure 3b. Effort by Beaufort Sea State for each survey day during the January 2009 – June 2010 aerial surveys of the proposed USWTR site off of Jacksonville, Florida.

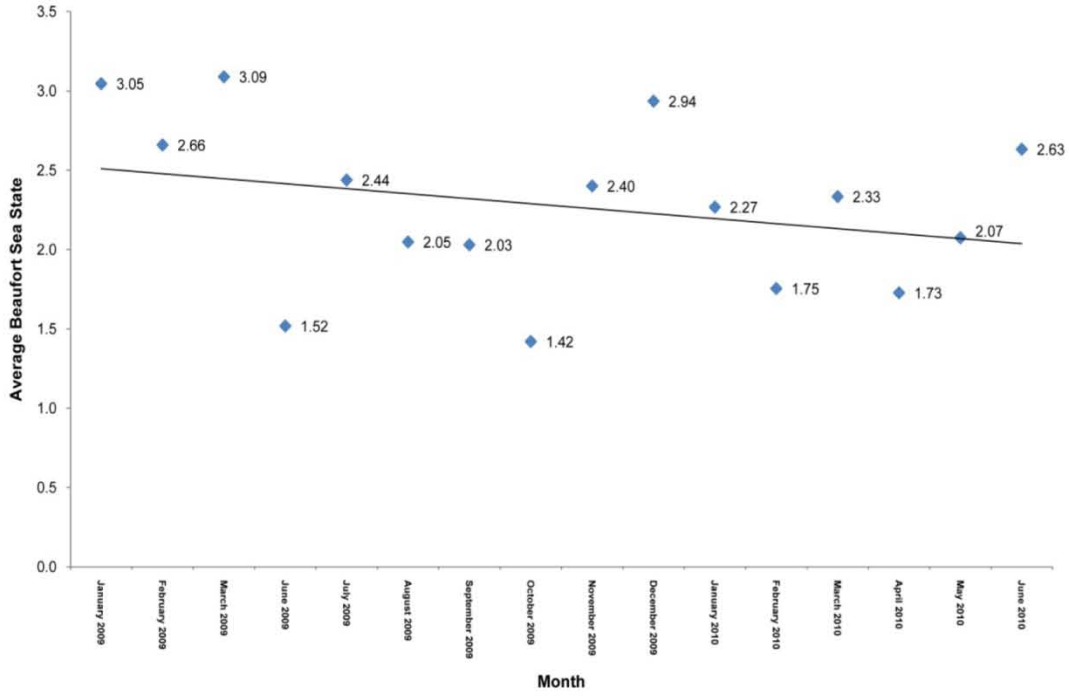

Figure 3c. Average Beaufort Sea State for each month during the January 2009 – June 2010 aerial surveys of the proposed USWTR site off of Jacksonville, Florida. Values were calculated using the formula AvgBSS=[(Distance @ BSS1*1)+(Distance @ BSS2*2)+ .../Total distance flown that day].

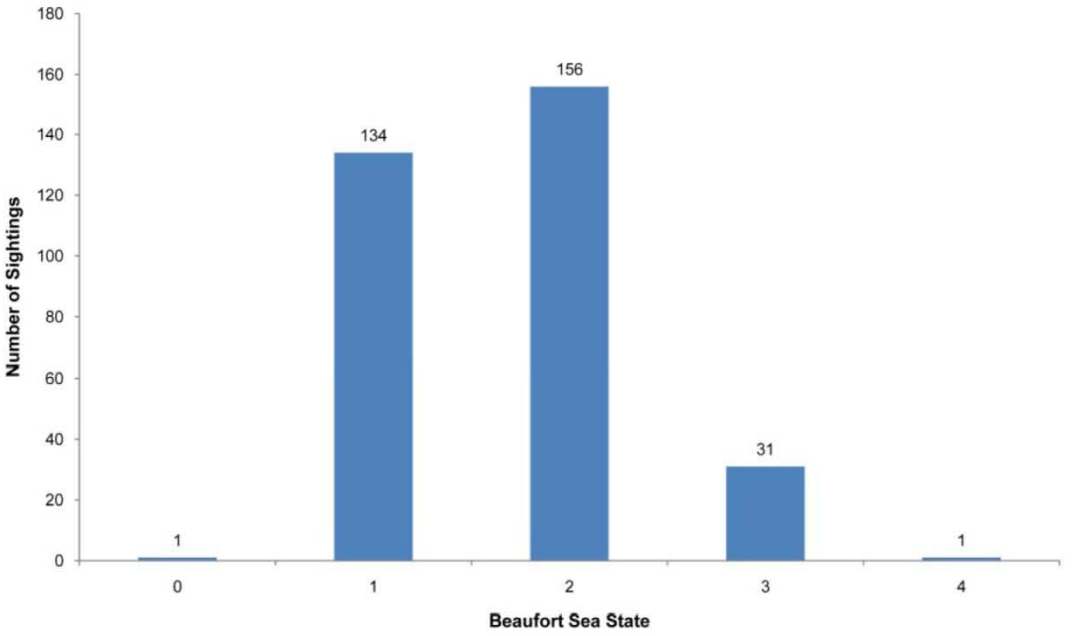

Figure 4a. Total number of cetacean sightings per Beaufort Sea State January 2009 – June 2010 for aerial surveys flown in the proposed USWTR site off of Jacksonville, Florida.

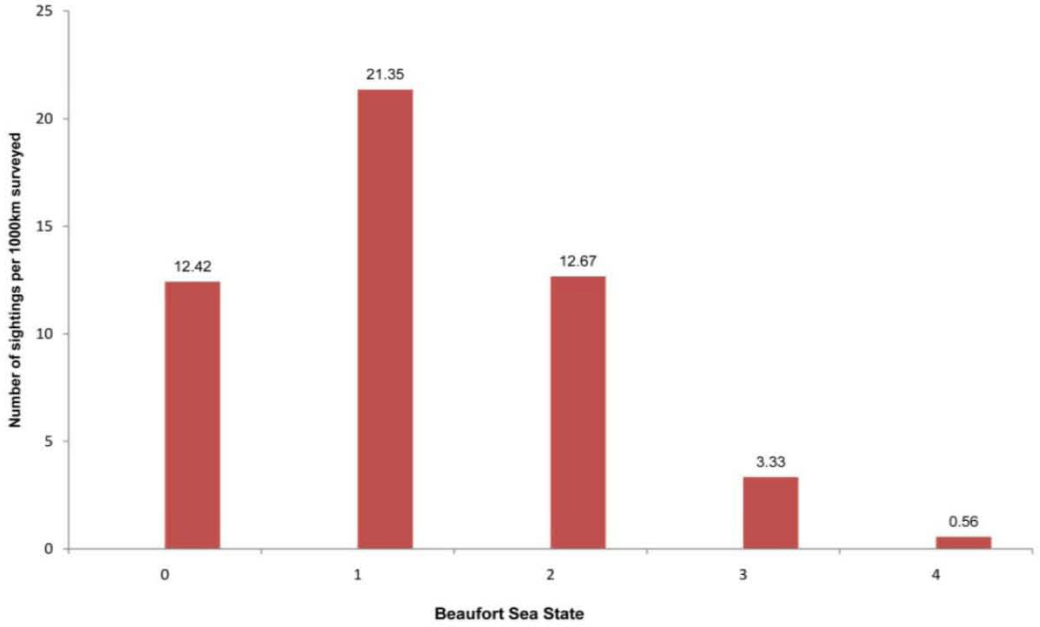

Figure 4b. Cetacean sightings per 1000 km flown by Beaufort Sea State from January 2009 – June 2010 during aerial surveys of the proposed USWTR site off of Jacksonville, Florida.

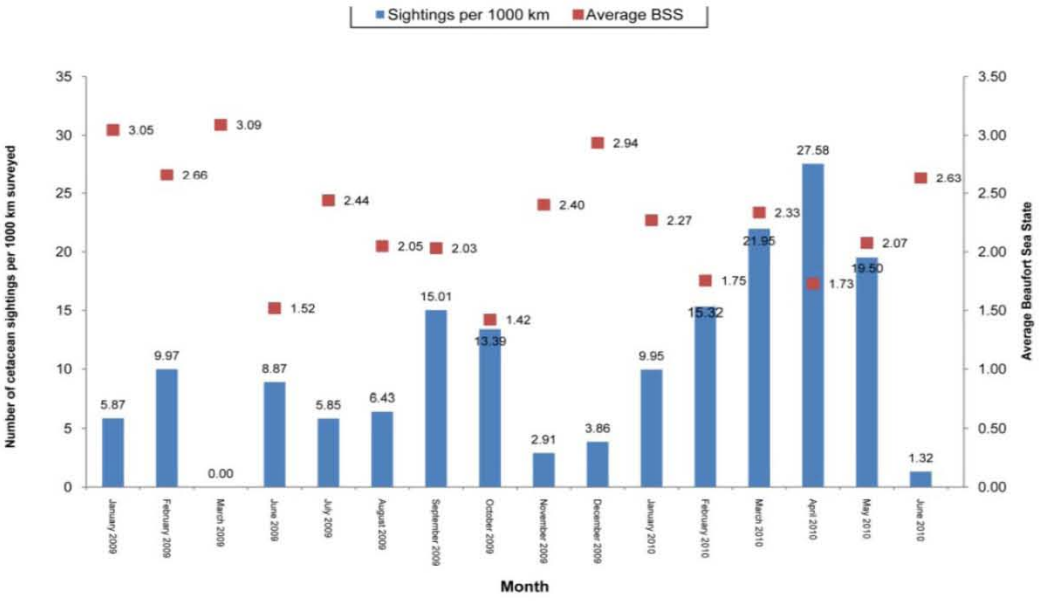

Figure 4c. Cetacean sightings per 1000 km surveyed and the average Beaufort Sea State per month from January 2009 – June 2010 during aerial surveys of the proposed USWTR site off of Jacksonville, Florida.

The mean sighting distance for all cetacean sightings was 0.72 km (SD=0.46) and most sightings were made within 1.2 km of the plane (Fig.5a). The mean sighting distance tended to decrease as BSS increased (Fig. 5b). Average sighting distances were calculated after removing outliers. An outlier was defined as a value in excess of three standard deviations from the mean. Six sighting distances were removed from these calculations as outliers (*i.e.* sighting distances calculated at 2.1, 2.1, 2.2, 2.5, 2.5 and 3.2 km from the trackline).

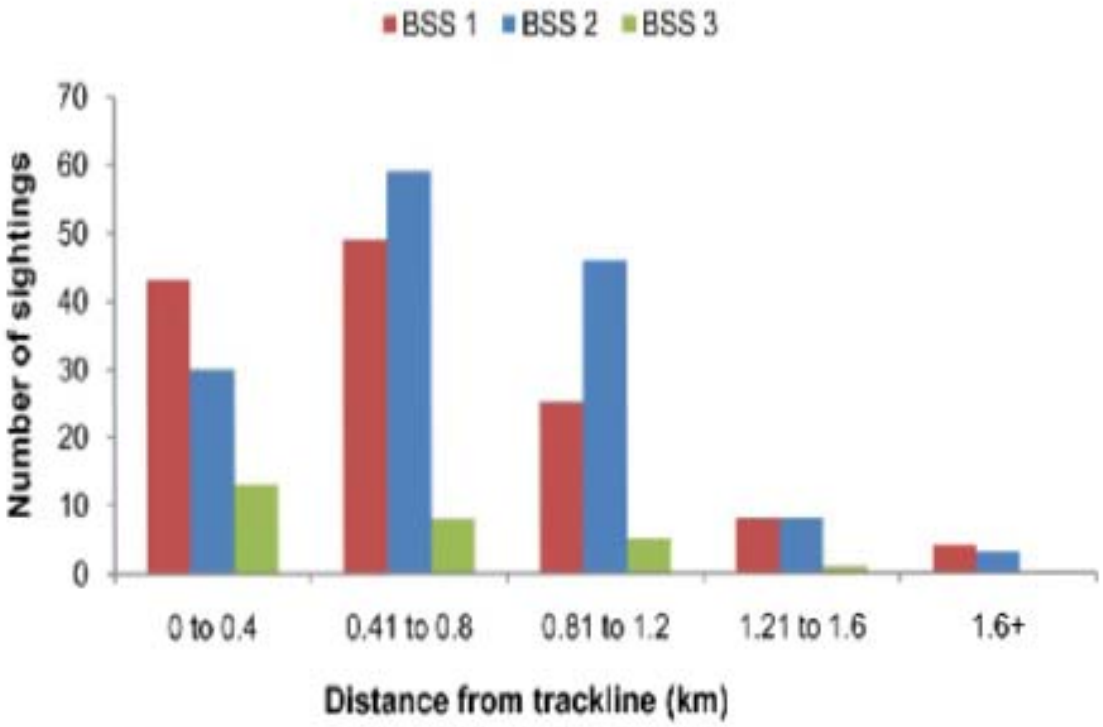

Figure 5a. Sighting distances by Beaufort Sea State for cetacean sightings from January 2009 – June 2010 in the proposed USWTR off of Jacksonville, Florida. A total of 323 sightings are plotted. Six outliers (distance > 3 standard deviations) were omitted from the calculations.

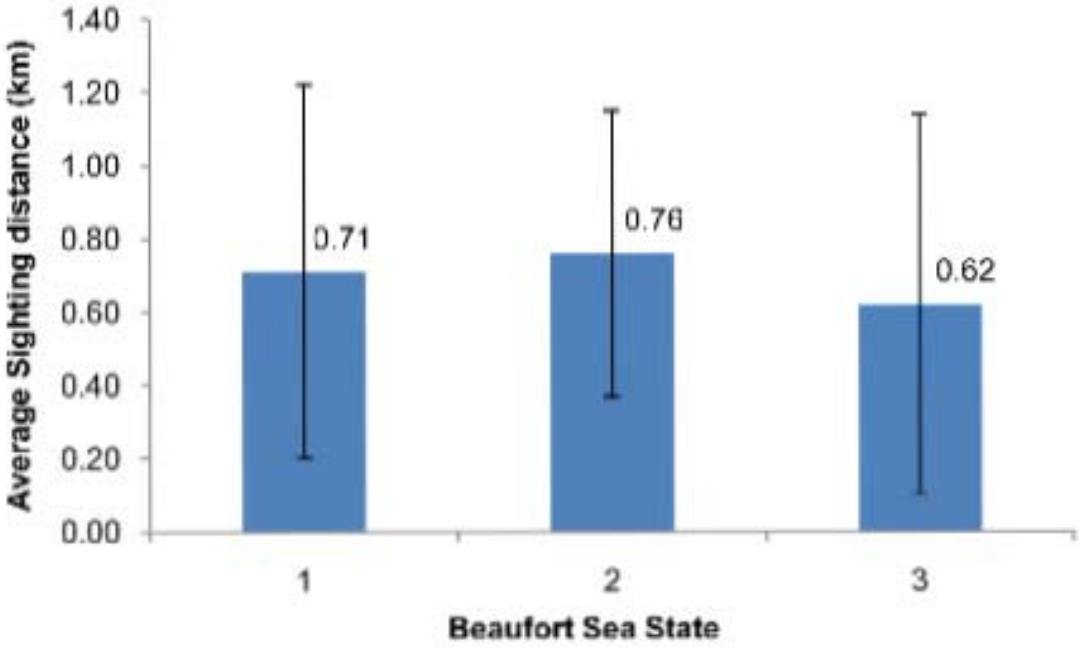

Figure 5b. Mean sighting distance by Beaufort Sea State for all cetacean sightings from January 2009 – June 2010 in the proposed USWTR site off of Jacksonville, Florida. Error bars denote standard deviation for each category.

Marine Mammal Sightings

A total of 323 sightings of 3718 individual cetaceans were observed while on effort during the reporting period. Nine species of cetaceans were observed in the study area while on effort. A rare event was witnessed by the aerial survey team on 20 March 2010 when a North Atlantic right whale (*Eubalaena glacialis*) was observed giving birth, 11 km west of the proposed USWTR site. This was only the second time such an event had been documented (see Zani *et al.* 2008). Species encountered on effort are listed below in decreasing number of sightings (*i.e.* most commonly sighted species first). Summaries for individual sightings are in Appendix I. Daily sightings are summarized in Appendix J.

Bottlenose dolphin (*Tursiops truncatus*) (Table 4, Fig. 6)

Bottlenose dolphins were the most frequently encountered cetaceans (132 sightings for a total of 1179 individuals). Group size ranged from 1 to 50 (mean = 8.92). The most common group size encountered was three (n=20), followed by sightings of a single animal (n=15). Based on the distance from shore (*e.g.* greater than 69 km), the bottlenose dolphins observed in this study most likely belonged to the offshore ecotype (Torres *et al.* 2003). Bottlenose dolphins were encountered throughout the study area, with an apparent zone of low density just offshore of the continental shelf (Fig. 6). In general, group size tended to be smaller inshore of the shelf break compared to groups encountered offshore, and almost all sightings of single bottlenose dolphins occurred inshore of the shelf-break (Fig. 6). This species was encountered during each month surveyed except November 2009 and June 2010. The current best estimate of offshore bottlenose dolphins in the Western Atlantic Ocean, between central Florida and Canada, is 81588 (CV = 0.17) (NOAA Stock Assessment Report; Waring *et al.* 2008).

Table 4. All bottlenose dolphin (*Tursiops truncatus*) sightings in the proposed USWTR site off of Jacksonville, Florida for aerial surveys conducted from January 2009 – June 2010.

Date	Time	Waypoint	Latitude	Longitude -1	Heading	Track Number	Angle Out	Degree Forward	Best Number
27-Jan-09	12:47	9	29.956440	-80.496258	E	1	2	90°	15
27-Jan-09	15:20	59	30.228130	-80.008412	E	5	1	90°	25
26-Feb-09	9:59	14	30.565175	-79.827772	E	10	1	90°	12
27-Feb-09	8:56	5	29.960482	-80.551935	E	1	3	90°	1
27-Feb-09	9:58	24	30.035786	-80.553049	W	2	2	90°	3
27-Feb-09	10:16	35	30.102491	-80.471207	E	3	1	90°	19
27-Feb-09	11:01	48	30.169046	-80.429190	W	4	3	90°	3
27-Feb-09	12:37	74	30.295815	-80.583819	W	6	1	120°	5
27-Feb-09	14:40	83	30.366118	-80.489115	E	7	2	90°	1
27-Feb-09	14:48	89	30.367579	-80.223930	E	7	3	90°	8
9-Jun-09	13:42	13	30.502732	-79.953532	W	9	2	90°	8
10-Jun-09	10:55	25	30.161913	-80.401118	W	4	1	90°	8
10-Jun-09	12:18	52	30.288698	-80.673378	W	6	2	100°	18
10-Jun-09	12:25	56	30.302670	-80.704548	W	6	2	60°	16
11-Jun-09	9:44	14	30.091657	-80.659760	W	3	2	75°	4
11-Jun-09	10:53	27	29.967194	-79.804484	W	1	1	90°	14
11-Jun-09	11:08	31	29.969022	-79.941584	W	1	2	90°	16
15-Jul-09	15:10	76	30.162002	-80.116169	W	4	2	90°	4
15-Jul-09	15:35	91	30.233127	-80.675794	E	5	1	90°	4
16-Jul-09	9:29	8	30.566033	-79.834290	E	10	2	120°	12
16-Jul-09	14:35	38	30.039753	-80.637413	E	2	2	110°	6
16-Jul-09	15:29	61	29.958990	-79.874340	W	1	1	110°	10
16-Jul-09	15:58	67	29.969852	-80.518172	W	1	1	100°	13
4-Aug-09	13:58	31	30.359854	-79.840649	W	7	2	110°	24
4-Aug-09	14:56	51	30.303775	-80.014142	E	6	2	75°	35
6-Aug-09	9:10	10	29.961709	-80.161598	E	1	1	90°	20
6-Aug-09	10:37	27	30.172326	-80.033970	W	4	1	90°	17
15-Sep-09	9:57	9	29.962785	-79.982730	E	1	1	90°	3
15-Sep-09	16:17	88	30.429269	-80.558831	W	8	1	100°	2
15-Sep-09	16:32	95	30.492564	-80.550183	E	9	1	90°	8
16-Sep-09	10:22	4	29.954849	-80.593794	E	1	2	120°	9
16-Sep-09	11:51	43	30.097543	-80.397718	E	3	2	110°	10
16-Sep-09	12:05	49	30.109295	-80.326179	E	3	3	110°	4
16-Sep-09	12:56	61	30.149300	-80.473643	W	4	3	90°	6
18-Sep-09	12:19	63	30.238101	-80.415326	W	5	3	90°	16
18-Sep-09	14:38	13	30.168336	-80.505832	E	4	1	90°	5
18-Sep-09	15:41	33	30.032023	-80.699443	E	2	1	90°	15
18-Sep-09	15:52	37	30.039557	-80.636833	E	2	2	100°	4
30-Sep-09	11:06	48	30.169024	-80.034752	W	4	2	45°	5

Table 4 (continued). All bottlenose dolphin (*Tursiops truncatus*) sightings in the proposed USWTR site off of Jacksonville, Florida for aerial surveys conducted from January 2009 – June 2010.

Date	Time	Waypoint	Latitude	Longitude -1	Heading	Track Number	Angle Out	Degree Forward	Best Number
1-Oct-09	14:04	83	30.163510	-80.562485	E	4	2	90°	10
1-Oct-09	14:34	95	30.169987	-79.828164	E	4	2	90°	40
22-Dec-09	14:16	54	30.363803	-80.206578	E	7	1	90°	50
22-Dec-09	15:23	70	30.499372	-80.249891	E	9	2	120°	4
22-Dec-09	15:45	74	30.497783	-79.816314	E	9	2	80°	3
7-Jan-10	10:50	10	30.028720	-80.690989	W	2	2	100°	1
7-Jan-10	12:02	22	30.164537	-80.559666	W	4	2	75°	2
7-Jan-10	15:54	48	30.439802	-79.890082	W	8	3	110°	45
19-Jan-10	10:18	16	30.368094	-79.839572	W	7	1	90°	10
19-Jan-10	10:23	20	30.362928	-79.864591	W	7	2	110°	5
19-Jan-10	11:20	27	30.300247	-79.821877	E	6	1	90°	11
19-Jan-10	14:26	46	30.091970	-80.385131	W	3	3	110°	4
19-Jan-10	14:54	53	30.035396	-80.486387	E	2	1	90°	24
19-Jan-10	15:02	57	30.034382	-80.374406	E	2	1	95°	2
19-Jan-10	15:23	62	30.026904	-79.988553	E	2	2	90°	5
20-Jan-10	10:03	27	30.030747	-80.479153	W	2	1	90°	3
20-Jan-10	10:26	34	30.098657	-80.691225	E	3	2	110°	3
20-Jan-10	10:48	42	30.101009	-80.116509	E	3	1	60°	40
20-Jan-10	10:57	45	30.104286	-79.992491	E	3	3	120°	5
20-Jan-10	12:07	66	30.298620	-79.858260	W	6	1	75°	29
20-Jan-10	14:23	96	30.372688	-80.289967	E	7	3	100°	3
20-Jan-10	14:34	102	30.361459	-80.084967	E	7	2	90°	14
20-Jan-10	15:06	114	30.436033	-80.506570	W	8	2	90°	7
20-Jan-10	15:48	133	30.567242	-79.818377	W	10	2	90°	16
28-Jan-10	9:32	6	29.959962	-80.573048	E	1	1	110°	5
28-Jan-10	11:18	38	30.030443	-80.658599	W	2	2	110°	2
28-Jan-10	12:59	70	30.163580	-80.684992	W	4	1	80°	2
28-Jan-10	15:08	81	30.230264	-80.524258	E	5	2	90°	3
28-Jan-10	15:23	86	30.238250	-80.398262	E	5	1	100°	3
28-Jan-10	16:14	103	30.300036	-80.337468	W	6	2	150°	3
20-Feb-10	12:27	52	30.303476	-80.516636	E	6	2	110°	12
20-Feb-10	13:45	85	30.238398	-80.693274	W	5	1	90°	1
20-Feb-10	15:46	106	30.163147	-79.885885	E	4	2	90°	3
21-Feb-10	9:00	13	30.034156	-79.805427	W	2	1	150°	4
21-Feb-10	9:10	17	30.033649	-79.848469	W	2	1	90°	20
21-Feb-10	9:55	28	30.090595	-80.509092	E	3	2	130°	8
21-Feb-10	10:23	37	30.104639	-79.864820	E	3	1	110°	26
21-Feb-10	11:01	51	30.175268	-80.557259	W	4	2	95°	6
21-Feb-10	11:18	60	30.228045	-80.672911	E	5	1	150°	1

Table 4 (continued). All bottlenose dolphin (*Tursiops truncatus*) sightings in the proposed USWTR site off of Jacksonville, Florida for aerial surveys conducted from January 2009 – June 2010.

Date	Time	Waypoint	Latitude	Longitude -1	Heading	Track Number	Angle Out	Degree Forward	Best Number
21-Feb-10	11:27	65	30.237415	-80.561136	E	5	1	90°	3
21-Feb-10	11:35	70	30.236873	-80.491644	E	5	3	90°	3
21-Feb-10	11:52	80	30.236288	-80.292178	E	5	2	90°	8
21-Feb-10	14:50	118	30.354268	-80.344896	E	7	2	120°	6
21-Feb-10	15:10	124	30.364399	-79.885563	E	7	2	110°	3
21-Feb-10	15:23	130	30.430170	-80.025826	W	8	1	120°	13
20-Mar-10	13:01	39	30.099889	-80.367558	W	3	2	90°	2
31-Mar-10	14:30	19	30.099076	-80.680099	E	3	2	110°	5
31-Mar-10	16:02	49	30.502046	-80.372564	E	9	2	110°	1
31-Mar-10	16:09	57	30.503607	-80.291330	E	9	1	90°	1
31-Mar-10	16:21	62	30.500793	-80.151141	E	9	2	100°	2
31-Mar-10	16:35	70	30.501375	-79.831675	E	9	1	90°	18
31-Mar-10	17:01	86	30.562104	-80.212544	W	10	1	90°	3
1-Apr-10	11:32	25	30.306852	-80.213772	E	6	2	140°	3
1-Apr-10	14:25	53	30.173926	-80.535763	E	4	2	130°	2
1-Apr-10	14:30	57	30.170693	-80.491403	E	4	3	70°	1
1-Apr-10	14:44	67	30.165493	-80.270584	E	4	3	90°	7
1-Apr-10	15:00	73	30.163185	-79.962582	E	4	1	80°	11
1-Apr-10	15:31	83	30.099932	-80.317157	W	3	2	110°	1
1-Apr-10	16:03	104	30.035986	-80.485707	E	2	1	90°	3
2-Apr-10	9:15	9	29.959600	-80.446274	E	1	3	100°	3
2-Apr-10	9:40	21	29.961503	-80.013987	E	1	2	120°	2
2-Apr-10	9:48	26	29.963709	-79.918157	E	1	2	130°	8
2-Apr-10	9:53	30	29.958657	-79.850725	E	1	2	90°	5
2-Apr-10	10:09	40	30.037085	-79.894317	W	2	2	90°	4
2-Apr-10	10:26	48	30.032868	-80.373894	W	2	1	110°	15
2-Apr-10	11:03	69	30.099114	-80.481895	E	3	1	100°	10
2-Apr-10	11:21	77	30.104917	-79.977374	E	3	1	90°	6
2-Apr-10	11:26	81	30.092008	-79.867933	E	3	2	100°	1
2-Apr-10	11:35	87	30.176137	-79.815244	W	4	2	100°	39
2-Apr-10	11:39	91	30.163063	-79.889926	W	4	1	90°	4
2-Apr-10	12:08	106	30.166215	-80.616192	W	4	2	90°	2
2-Apr-10	12:15	110	30.175159	-80.671960	W	4	2	100°	2
2-Apr-10	12:30	118	30.244618	-80.494633	E	5	3	110°	1
2-Apr-10	12:39	122	30.225323	-80.439020	E	5	2	100°	1
2-Apr-10	12:53	132	30.218106	-80.045485	E	5	3	92°	5
2-Apr-10	13:20	141	30.299055	-80.265751	W	6	1	90°	6
2-Apr-10	15:54	176	30.365067	-79.855610	E	7	1	90°	10
2-Apr-10	16:11	183	30.435725	-80.175345	W	8	3	80°	12

Table 4 (continued). All bottlenose dolphin (*Tursiops truncatus*) sightings in the proposed USWTR site off of Jacksonville, Florida for aerial surveys conducted from January 2009 – June 2010.

Date	Time	Waypoint	Latitude	Longitude -1	Heading	Track Number	Angle Out	Degree Forward	Best Number
2-Apr-10	16:44	199	30.498584	-80.456330	E	9	2	90°	4
3-Apr-10	8:37	8	30.563400	-80.250618	E	10	2	100°	1
3-Apr-10	8:55	13	30.558371	-79.861974	E	10	3	120°	1
3-Apr-10	9:57	47	30.428283	-80.241561	E	8	1	75°	10
3-Apr-10	11:01	68	30.293566	-80.463537	E	6	2	100°	1
3-Apr-10	11:10	72	30.294518	-80.257094	E	6	2	100°	3
3-Apr-10	11:30	76	30.296693	-79.808363	E	6	1	90°	12
6-May-10	9:53	7	29.958342	-80.487387	E	1	2	100°	10
6-May-10	10:05	12	29.972346	-80.290129	E	1	2	135°	24
6-May-10	10:41	23	30.031996	-80.336320	W	2	2	90°	6
7-May-10	10:19	21	30.164865	-80.375852	W	4	1	100°	4
7-May-10	10:51	35	30.234612	-80.389831	E	5	2	90°	5
7-May-10	11:01	41	30.231191	-80.239313	E	5	3	130°	8
7-May-10	14:39	85	30.496633	-80.267536	E	9	2	145°	5

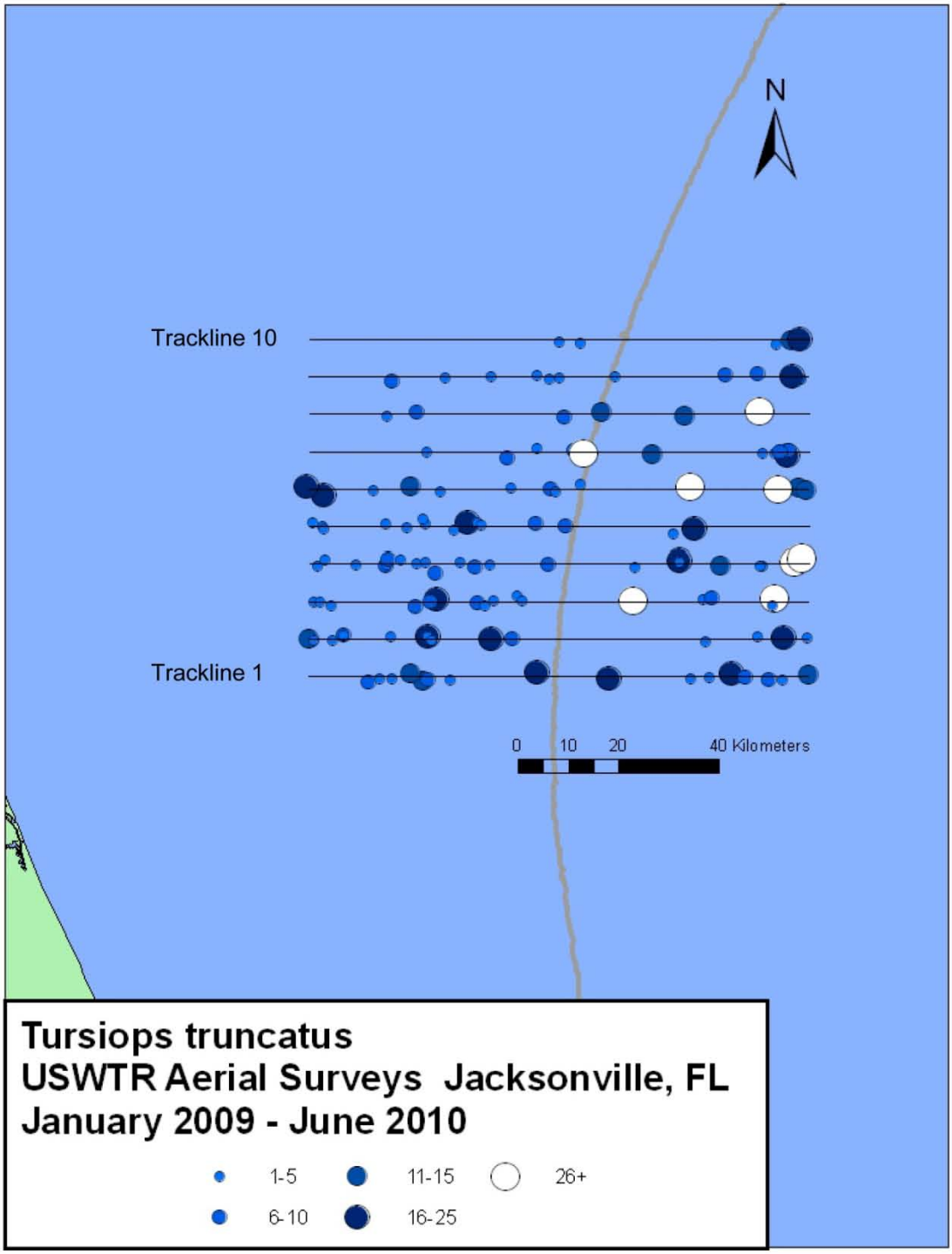

Figure 6. Bottlenose dolphin (*Tursiops truncatus)* sightings indicating group size.

Atlantic Spotted Dolphin (*Stenella frontalis*) (Table 5, Fig. 7)

While not the most commonly encountered, Atlantic spotted dolphins were the most numerous cetaceans (2080 individuals in 124 sightings) observed in the survey area. Group size ranged from 2 to 100 (mean = 16.77). Spotted dolphins were seen every month except November and December 2010. This species was encountered exclusively in shallow water over the continental shelf (Fig. 7). There are two distinct forms, or ecotypes, of the Atlantic spotted dolphin in the western North Atlantic: a heavily spotted form that typically occurs on the continental shelf and is most often encountered around the 200 m isobar or in shallower water, and a less spotted and smaller form which occurs farther offshore and around islands (Perrin *et al*. 1987, 1994). It is likely, based upon the features observed, that the spotted dolphins seen during the present study belong to the continental shelf variety. The abundance estimate for *S. frontalis* (both the inshore and the offshore forms) in the western north Atlantic is 50978 (CV = 0.42); the status of the stock(s) is/are unknown (Waring *et al.* 2007).

Table 5. All Atlantic spotted dolphin (*Stenella frontalis*) sightings in the proposed USWTR site off of Jacksonville, Florida for aerial surveys conducted from January 2009 – June 2010.

Date	Time	Waypoint	Latitude	Longitude -1	Heading	Track Number	Angle Out	Degree Forward	Best Number
27-Jan-09	14:40	44	30.176813	-80.572702	W	4	3	90°	100
26-Feb-09	10:53	26	30.489811	-80.682168	W	9	1	90°	2
27-Feb-09	11:13	52	30.167427	-80.509722	W	4	3	90°	7
9-Jun-09	14:02	20	30.505660	-80.452111	W	9	2	90°	14
9-Jun-09	14:27	32	30.434622	-80.341820	E	8	2	110°	6
10-Jun-09	15:32	87	30.428722	-80.554191	W	8	2	80°	10
10-Jun-09	15:51	99	30.511654	-80.435801	E	9	2	75°	7
15-Jul-09	16:54	115	30.307943	-80.677572	W	6	2	45°	16
16-Jul-09	14:54	47	30.037417	-80.432347	E	2	1	100°	12
4-Aug-09	12:05	5	30.570403	-80.603836	E	10	3	110°	4
4-Aug-09	13:03	17	30.507257	-80.413696	W	9	2	90°	25
4-Aug-09	13:23	24	30.440882	-80.520348	E	8	3	120°	6
4-Aug-09	14:38	44	30.297389	-80.483850	E	6	3	90°	7
6-Aug-09	8:37	5	29.960847	-80.659663	E	1	1	120°	20
6-Aug-09	12:08	40	30.577324	-80.330336	W	10	3	90°	6
14-Sep-09	12:51	10	30.502628	-80.365528	W	9	2	110°	8
15-Sep-09	10:40	18	30.028446	-80.584039	W	2	1	120°	7
15-Sep-09	11:56	37	30.155112	-80.468606	W	4	2	100°	40
15-Sep-09	12:27	49	30.235518	-80.357595	E	5	2	135°	36
15-Sep-09	13:13	57	30.302087	-80.586596	W	6	2	110°	10
15-Sep-09	15:21	70	30.358729	-80.501714	E	7	3	90°	6
16-Sep-09	10:37	9	29.972613	-80.436649	E	1	2	110°	25
16-Sep-09	11:26	26	30.036121	-80.595111	W	2	1	90°	12
16-Sep-09	11:40	37	30.098577	-80.630170	E	3	2	90°	48
16-Sep-09	12:52	57	30.164620	-80.426851	E	4	1	90°	12
16-Sep-09	13:12	65	30.174440	-80.501961	W	4	2	100°	7
16-Sep-09	13:26	69	30.170953	-80.685147	W	4	1	90°	16
16-Sep-09	15:18	85	30.223357	-80.357840	E	5	2	85°	23
16-Sep-09	16:07	101	30.298897	-80.554275	W	6	2	45°	36
18-Sep-09	8:56	6	30.564918	-80.519281	E	10	3	90°	17
18-Sep-09	9:10	11	30.571772	-80.382930	E	10	3	100°	24
18-Sep-09	9:51	22	30.500495	-80.387744	W	9	1	90°	12
18-Sep-09	10:22	35	30.441061	-80.427384	E	8	2	90°	50
18-Sep-09	14:33	8	30.160878	-80.563221	E	4	1	90°	5
18-Sep-09	15:29	27	30.100683	-80.694371	W	3	2	100°	7
30-Sep-09	9:12	6	29.960539	-80.492943	E	1	1	100°	5
30-Sep-09	10:00	19	30.034495	-80.412547	W	2	1	120°	10
30-Sep-09	10:19	25	30.109130	-80.676868	E	3	3	90°	12
30-Sep-09	10:33	34	30.095493	-80.448507	E	3	2	125°	5

Table 5 (continued). All Atlantic spotted dolphin (*Stenella frontalis*) sightings in the proposed USWTR site off of Jacksonville, Florida for aerial surveys conducted from January 2009 – June 2010.

Date	Time	Waypoint	Latitude	Longitude -1	Heading	Track Number	Angle Out	Degree Forward	Best Number
30-Sep-09	10:40	38	30.089326	-80.407715	E	3	2	100°	23
30-Sep-09	11:27	56	30.163869	-80.607505	W	4	1	80°	4
30-Sep-09	11:36	60	30.162798	-80.684799	W	4	1	90°	5
30-Sep-09	11:48	67	30.240264	-80.626807	E	5	3	100°	9
30-Sep-09	15:36	104	30.568879	-80.340131	E	10	2	75°	9
1-Oct-09	9:35	16	30.499122	-80.404954	W	9	2	90°	4
1-Oct-09	9:58	24	30.441838	-80.454912	E	8	3	90°	25
1-Oct-09	10:08	30	30.429398	-80.324880	E	8	1	80°	6
1-Oct-09	10:18	35	30.424412	-80.257176	E	8	3	110°	12
1-Oct-09	11:09	52	30.295678	-80.592304	E	6	2	120°	6
1-Oct-09	12:08	68	30.234899	-80.674308	W	5	3	100°	9
1-Oct-09	13:56	78	30.152214	-80.695794	E	4	3	90°	6
1-Oct-09	15:13	109	30.110079	-80.682445	W	3	2	90°	4
20-Jan-10	9:55	22	30.035027	-80.409063	W	2	2	120°	3
20-Jan-10	14:07	81	30.368279	-80.678521	E	7	1	90°	30
20-Jan-10	14:15	90	30.363624	-80.499746	E	7	2	90°	15
20-Jan-10	15:22	124	30.501224	-80.530414	E	9	3	135°	7
28-Jan-10	11:04	30	30.028005	-80.366154	W	2	1	150°	11
28-Jan-10	11:41	45	30.101081	-80.585021	E	3	2	100°	10
28-Jan-10	12:02	53	30.096646	-80.444014	E	3	1	80°	8
20-Feb-10	10:33	17	30.499955	-80.396613	W	9	1	90°	17
20-Feb-10	10:48	22	30.500891	-80.618709	W	9	2	120°	2
20-Feb-10	12:05	41	30.368241	-80.652563	W	7	3	90°	10
20-Feb-10	12:36	56	30.298273	-80.473435	E	6	1	165°	3
20-Feb-10	12:42	60	30.307844	-80.346851	E	6	3	100°	45
20-Feb-10	13:35	80	30.220544	-80.489406	W	5	2	140°	60
20-Feb-10	15:26	96	30.169151	-80.521569	E	4	2	150°	2
20-Feb-10	16:17	115	30.103998	-80.545810	W	3	1	90°	4
21-Feb-10	10:02	32	30.085494	-80.414333	E	3	3	110°	50
21-Feb-10	11:47	76	30.238243	-80.348145	E	5	3	110°	7
21-Feb-10	12:37	93	30.307680	-80.465500	W	6	3	120°	40
21-Feb-10	14:26	105	30.350682	-80.618624	E	7	3	120°	70
21-Feb-10	14:36	110	30.370790	-80.462578	E	7	3	90°	18
21-Feb-10	14:42	114	30.368036	-80.389323	E	7	1	75°	40
21-Feb-10	15:43	138	30.440175	-80.456014	W	8	2	75°	12
21-Feb-10	16:04	150	30.493992	-80.358464	E	9	1	80°	30
21-Feb-10	16:36	161	30.572472	-80.277572	W	10	2	90°	18
21-Feb-10	16:48	165	30.566559	-80.608603	W	10	1	80°	18
20-Mar-10	10:02	17	30.028323	-80.425266	E	2	1	90°	7

Table 5 (continued). All Atlantic spotted dolphin (*Stenella frontalis*) sightings in the proposed USWTR site off of Jacksonville, Florida for aerial surveys conducted from January 2009 – June 2010.

Date	Time	Waypoint	Latitude	Longitude -1	Heading	Track Number	Angle Out	Degree Forward	Best Number
20-Mar-10	10:08	22	30.036836	-80.502131	E	2	2	110°	4
20-Mar-10	13:12	44	30.100872	-80.336616	W	3	1	110°	29
20-Mar-10	14:14	67	30.232452	-80.270676	W	5	3	90°	34
20-Mar-10	14:41	78	30.292360	-80.240354	E	6	2	145°	19
20-Mar-10	15:10	95	30.362502	-80.432803	W	7	3	90°	20
20-Mar-10	15:55	116	30.434805	-80.269575	E	8	2	120°	21
20-Mar-10	15:58	120	30.442233	-80.378832	E	8	1	110°	2
24-Mar-10	10:16	23	30.431388	-80.386431	E	8	2	120°	10
24-Mar-10	11:14	40	30.362014	-80.294141	W	7	1	90°	12
24-Mar-10	11:25	44	30.370039	-80.461945	W	7	3	90°	6
31-Mar-10	14:08	11	30.032377	-80.325045	W	2	2	90°	18
31-Mar-10	15:26	33	30.169487	-80.458317	W	4	2	120°	2
31-Mar-10	15:36	39	30.171467	-80.540148	W	4	3	90°	2
31-Mar-10	16:06	53	30.502116	-80.340091	E	9	3	140°	80
31-Mar-10	16:54	82	30.572921	-80.169614	W	10	2	60°	25
31-Mar-10	17:05	90	30.568151	-80.309380	W	10	1	90°	2
1-Apr-10	12:21	35	30.240809	-80.355085	W	5	3	90°	11
1-Apr-10	12:36	40	30.239016	-80.583593	W	5	2	100°	3
1-Apr-10	14:36	63	30.175791	-80.389746	E	4	3	90°	6
1-Apr-10	15:37	87	30.107272	-80.363344	W	3	2	90°	6
1-Apr-10	16:47	117	29.962665	-80.435568	W	1	2	120°	4
2-Apr-10	9:09	5	29.961342	-80.623578	E	1	2	90°	8
2-Apr-10	10:36	54	30.033836	-80.482236	W	2	2	110°	3
2-Apr-10	10:42	58	30.032604	-80.513773	W	2	3	90°	12
2-Apr-10	10:58	65	30.092114	-80.551591	E	3	3	90°	11
2-Apr-10	12:03	102	30.172578	-80.512579	W	4	2	90°	25
2-Apr-10	13:26	145	30.306456	-80.335262	W	6	2	90°	18
2-Apr-10	15:30	162	30.365679	-80.319100	E	7	1	90°	28
2-Apr-10	17:21	212	30.567434	-80.140728	W	10	1	100°	18
2-Apr-10	17:26	218	30.567027	-80.285993	W	10	1	100°	22
2-Apr-10	17:36	222	30.567220	-80.489157	W	10	1	120°	4
3-Apr-10	9:27	26	30.502812	-80.443168	W	9	1	90°	12
3-Apr-10	9:32	30	30.498981	-80.486959	W	9	1	110°	9
3-Apr-10	9:38	35	30.496229	-80.624682	W	9	1	90°	10
3-Apr-10	10:37	54	30.370552	-80.507992	W	7	1	90°	3
3-Apr-10	10:47	59	30.364375	-80.636263	W	7	1	100°	24
6-May-10	10:49	27	30.030748	-80.510834	W	2	2	60°	40
6-May-10	13:42	39	30.096822	-80.544239	E	3	2	60°	4
6-May-10	13:52	42	30.102411	-80.481820	E	3	2	80°	4

Table 5 (continued). All Atlantic spotted dolphin (*Stenella frontalis*) sightings in the proposed USWTR site off of Jacksonville, Florida for aerial surveys conducted from January 2009 – June 2010.

Date	Time	Waypoint	Latitude	Longitude -1	Heading	Track Number	Angle Out	Degree Forward	Best Number
7-May-10	10:10	17	30.167974	-80.229344	W	4	2	45°	75
7-May-10	12:48	68	30.439407	-80.575846	W	8	3	75°	18
7-May-10	12:55	72	30.432984	-80.695540	W	8	1	90°	17
7-May-10	15:23	96	30.566378	-80.289206	W	10	2	75°	3
5-Jun-10	11:30	32	30.172613	-80.579141	W	4	3	110°	40
6-Jun-10	8:59	6	29.961922	-80.435265	E	1	2	110°	10
6-Jun-10	10:40	31	30.147797	-80.621601	W	4	3	100°	12

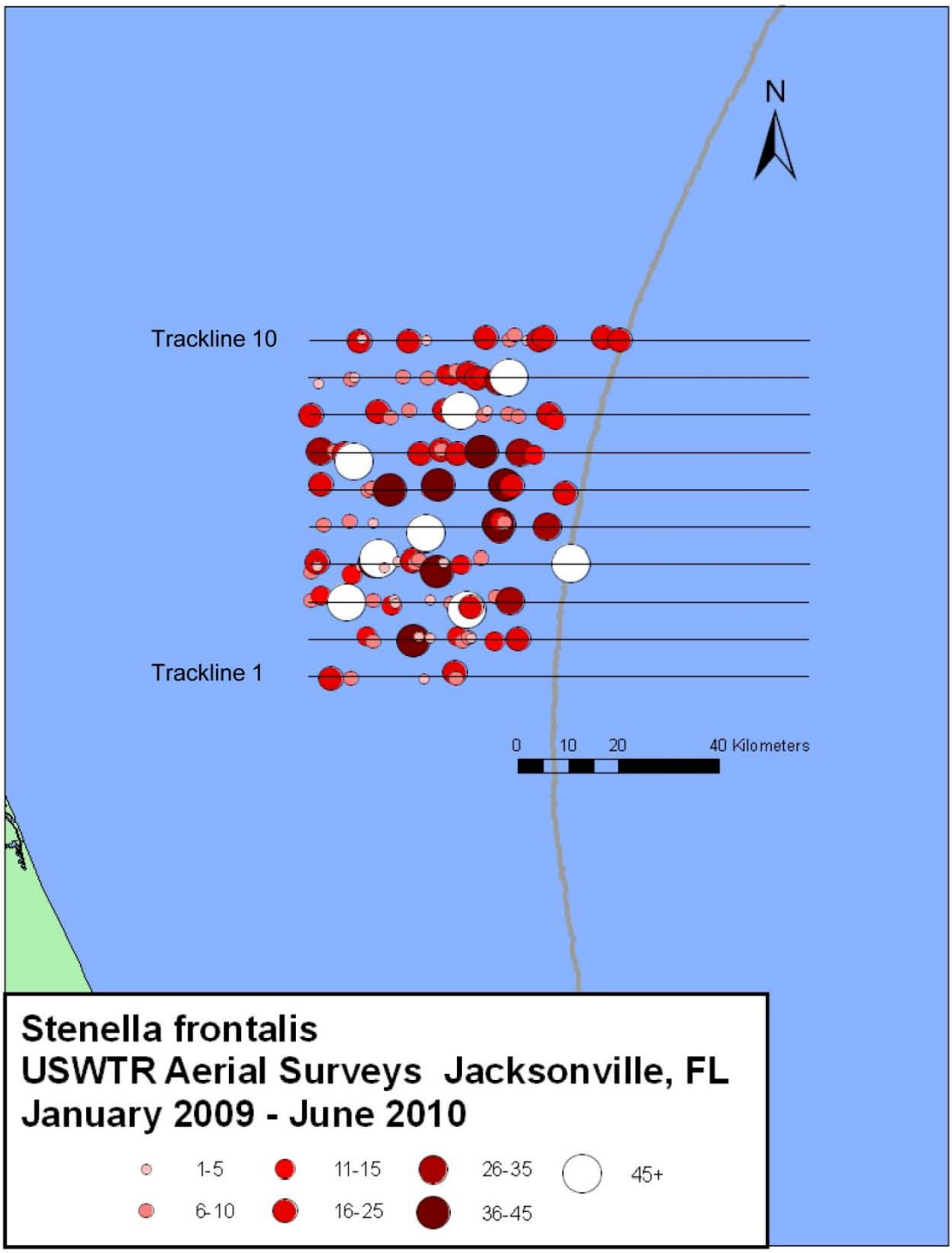

Figure 7. Atlantic spotted dolphin (*Stenella frontalis*) sightings indicating group size.

Risso's Dolphin (*Grampus griseus*) (Table 6, Fig. 8)

This species was encountered 16 times for a total of 228 individuals. Group size in this species ranged from 2 to 40 individuals (mean = 14.25). During surveys in 2009, this species was encountered in February, June, September, October, and November, and in 2010 it was observed in January, February, March, and April. Risso's dolphins were only recorded in deeper, offshore waters. *G. griseus* have been found to reside along the mid-Atlantic continental shelf edge year round, with some movement north during spring, summer and fall, and into the mid-Atlantic bight during winter (Waring *et al.* 2007). The best available estimate for Risso's dolphins, based on results from two US Atlantic surveys conducted in 2004, is 20479 (CV=0.59) (Waring *et al.* 2009). The status of this species in the western Atlantic is unknown (Waring *et al.* 2009).

Table 6. All Risso's dolphin (*Grampus griseus*) sightings in the proposed USWTR site off of Jacksonville, Florida for aerial surveys conducted from January 2009 – June 2010.

Date	Time	Waypoint	Latitude	Longitude -1	Heading	Track Number	Angle Out	Degree Forward	Best Number
27-Feb-09	9:18	12	29.975986	-80.134317	E	1	4	90°	5
10-Jun-09	14:50	72	30.376196	-80.040349	E	7	3	75°	14
10-Jun-09	16:07	104	30.493967	-80.117448	E	9	1	60°	32
15-Sep-09	17:12	109	30.571831	-80.067951	W	10	2	145°	36
16-Sep-09	15:42	94	30.303848	-79.787409	W	6	3	170°	4
18-Sep-09	16:10	43	30.026112	-80.183865	E	2	1	110°	5
30-Sep-09	14:55	92	30.443106	-80.010302	W	8	3	90°	26
1-Oct-09	11:48	61	30.237722	-80.092674	W	5	3	110°	4
18-Nov-09	15:02	82	30.429478	-79.897009	E	8	1	110°	40
20-Nov-09	9:48	13	30.031926	-80.179763	W	2	2	95°	20
28-Jan-10	16:02	97	30.302032	-80.120480	W	6	1	120°	7
21-Feb-10	10:43	45	30.168803	-80.153954	W	4	1	90°	7
20-Mar-10	15:33	108	30.361425	-79.911819	W	7	2	110°	6
24-Mar-10	10:36	32	30.429088	-80.037463	E	8	2	140°	2
24-Mar-10	12:11	57	30.302457	-80.113317	E	6	2	80°	9
1-Apr-10	15:24	79	30.102853	-80.187906	W	3	1	90°	11

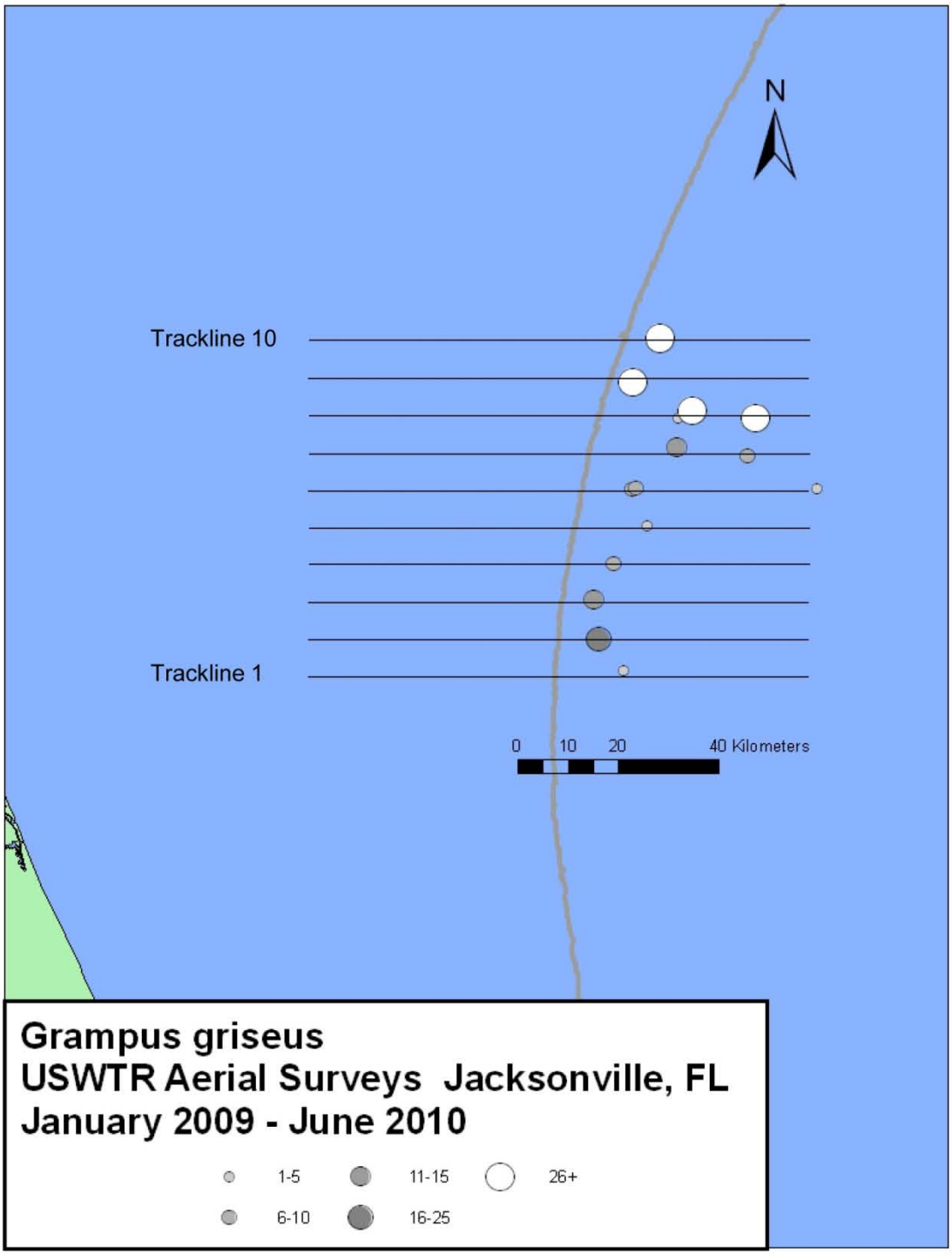

Figure 8. Risso's dolphin (*Grampus griseus*) sightings indicating group size.

Minke Whale (*Balaenoptera acutorostrata*) (Table 7, Fig. 9)

Minke whales were observed six times (eight individuals). All but one sighting was of an individual whale. A cow/calf pair and a second adult whale were encountered traveling together on 26 February 2009. This species was exclusively observed during the months of January and February. Minke whales inhabiting waters off the U.S. east coast are considered part of the Canadian East Coast stock, which occurs from to the western portion of the Davis Strait (45ºW) south to the Gulf of Mexico. The best available abundance estimate for this stock is 3312 (CV=0.74)(Waring *et al.* 2009).

Table 7. All minke whale (*Balaenoptera acutorostrata*) sightings in the proposed USWTR site off of Jacksonville, Florida for aerial surveys conducted from January 2009 – June 2010.

Date	Time	Waypoint	Latitude	Longitude -1	Heading	Track Number	Angle Out	Degree Forward	Best Number
27-Jan-09	14:22	37	30.173667	-79.887883	W	4	1	90°	1
26-Feb-09	10:06	15	30.565997	-79.830736	E	10	3	90°	1
26-Feb-09	14:13	54	30.235458	-79.960768	W	5	2	90°	3
26-Feb-09	15:26	67	30.101772	-80.051190	W	3	3	90°	1
20-Feb-10	13:15	73	30.234682	-80.064016	W	5	1	120°	1
21-Feb-10	12:16	86	30.303635	-79.999596	W	6	3	120°	1

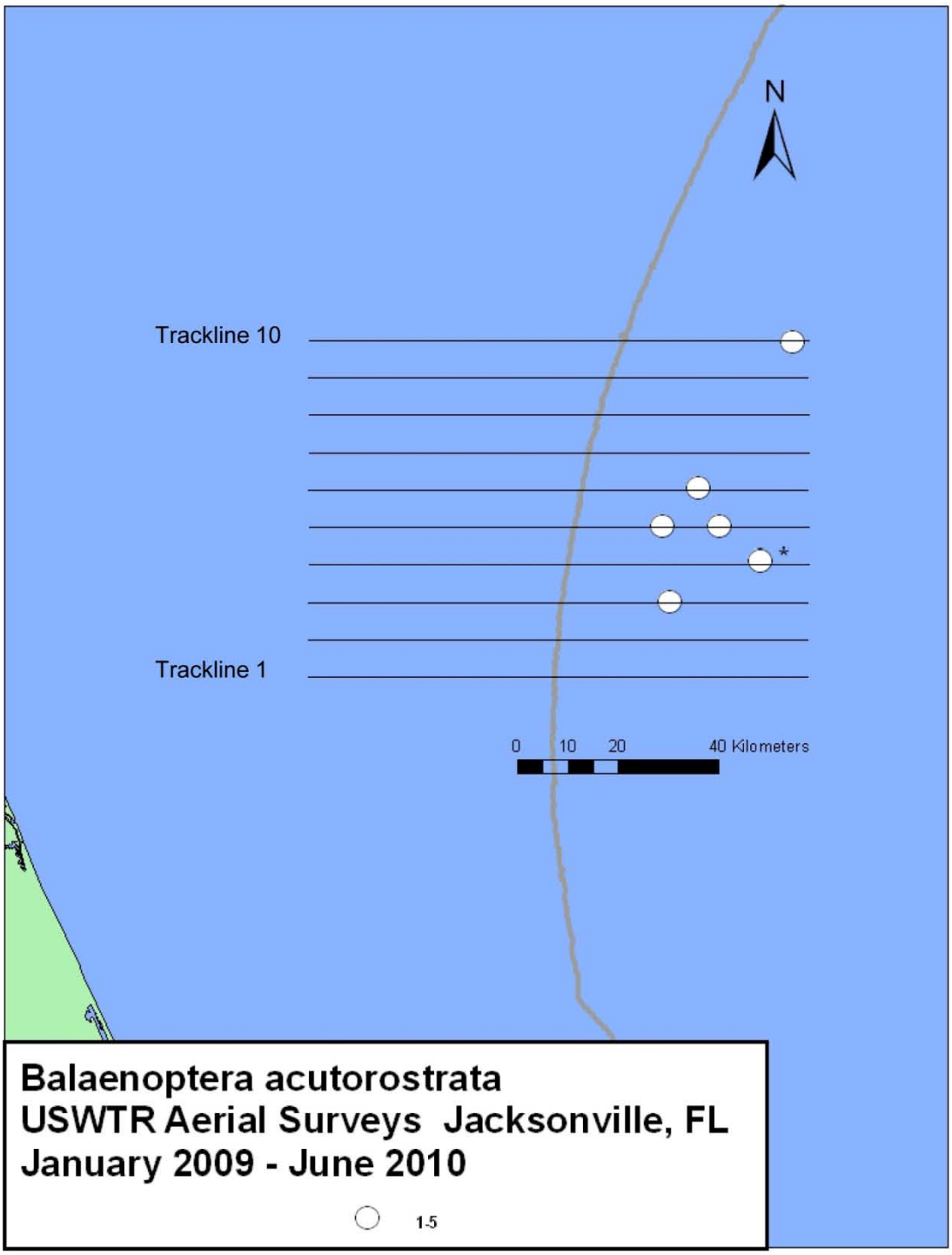

Figure 9. Minke whale (*Balaenoptera acutorostrata*) sightings indicating group size. Asterisk denotes assumed location of sighting that was not relocated.

North Atlantic Right Whale (*Eubalaena glacialis*) (Table 8, Fig. 10)

This species was encountered twice in the survey area on 20 March 2010. The first sighting involved a female right whale (Eg# 2360), which was observed for 15 minutes prior to giving birth. The second sighting that day was of a single adult male right whale (Eg# 2303). In addition, a right whale cow/calf pair was photographed on 2 April 2010 during transit to the range (*i.e*. off effort), approximately 3 km from the western edge of the survey area. The female was identified as Eg# 3360. The North Atlantic right whale is among the rarest of cetaceans and is listed as endangered under the Endangered Species Act. The best estimate of individually photographed whales that were still believed to be alive in 2007 was 415 (Pettis 2009).

Table 8. All North Atlantic right whale (*Eubalaena glacialis*) sightings in the proposed USWTR site off of Jacksonville, Florida for aerial surveys conducted from January 2009 – June 2010.

Date	Time	Waypoint	Latitude	Longitude -1	Heading	Track Number	Angle Out	Degree Forward	Best Number
20-Mar-10	10:20	26	30.047163	-80.697271	E	2	4	90°	2
20-Mar-10	16:11	129	30.428521	-80.677282	E	8	3	45°	1
2-Apr-10	15:09	154	30.365645	-80.727758	E		2	45°	2

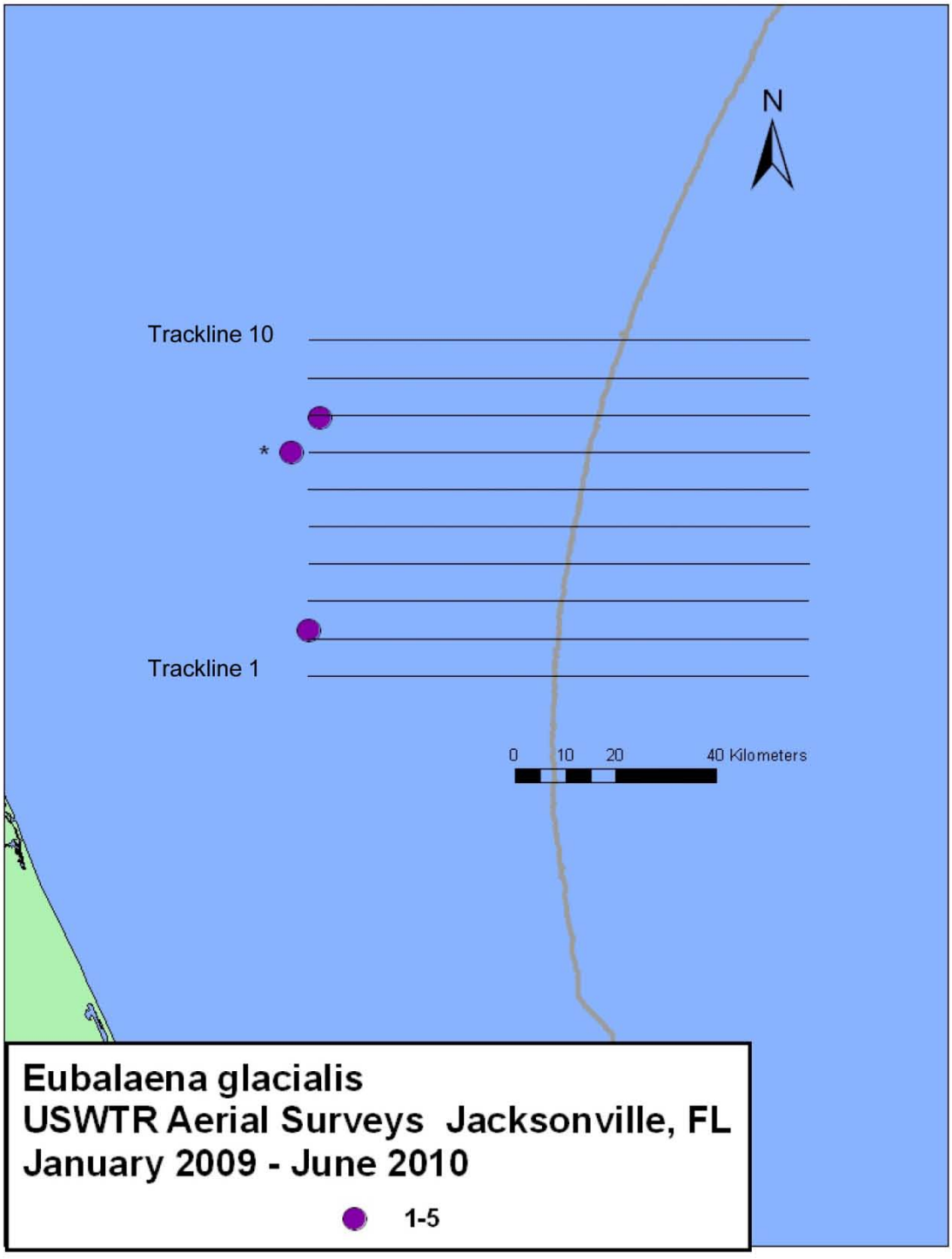

Figure 10. North Atlantic right whale (*Eubalaena glacialis*) sightings indicating group size. Asterisk denotes off effort sighting.

Short-finned Pilot Whale (*Globicephala macrorhynchus*) (Table 9, Fig. 11)

Short-finned pilot whales were encountered twice. On 2 April 2010, a group of five individuals was observed, and on 4 June 2010 a group of 14 individuals was encountered. Both encounters occurred offshore of the continental shelf. Due to the difficulty of differentiating short-finned and long-finned pilot whales (*Globicephala melas*) at sea, NMFS reports stock numbers and status as *Globicephala* spp. (Waring *et al.* 2009). The abundance estimate of *Globicephala* spp. (31139, CV=0.27) is based upon shipboard surveys along the outer continental shelf of the U.S. Atlantic between Florida and Maryland (Waring *et al*. 2009). The status of short-finned pilot whales in the U.S. Atlantic is currently unknown (Waring *et al.* 2009).

Table 9. All short-finned pilot whale (*Globicephala macrorhynchus*) sightings in the proposed USWTR site off of Jacksonville, Florida for aerial surveys conducted from January 2009 – June 2010.

Date	Time	Waypoint	Latitude	Longitude -1	Heading	Track Number	Angle Out	Degree Forward	Best Number
2-Apr-10	9:56	34	29.964526	-79.832764	E	1	2	120°	5
4-Jun-10	10:14	28	30.162127	-79.958743	W	4	3	115°	14

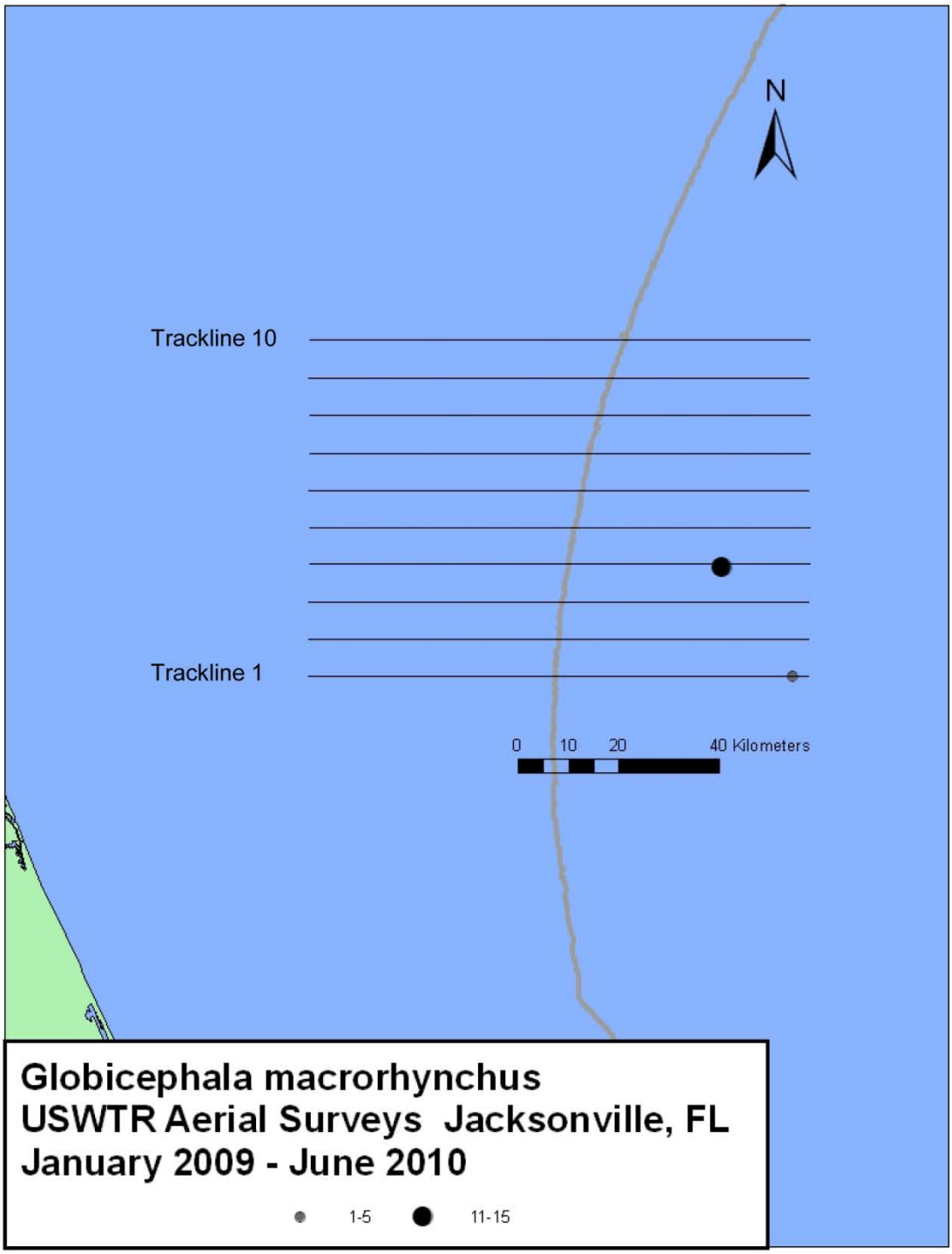

Figure 11. Short-finned pilot whale (*Globicephala macrorhynchus*) sightings indicating group size.

Sperm Whale (*Physeter macrocephalus*) (Table 10, Fig. 12)

Sperm whales were only encountered once. On 7 May 2010, two adult whales were observed offshore of the shelf break. The sperm whale is listed as endangered under the Endangered Species Act. The current best abundance estimate for sperm whales in the Atlantic Ocean is 4804 (CV=0.38) (Waring *et al*. 2007).

Table 10. The sperm whale (*Physeter macrocephalus*) sighting in the proposed USWTR site off of Jacksonville, Florida for aerial surveys conducted from January 2009 – June 2010.

Date	Time	Waypoint	Latitude	Longitude -1	Heading	Track Number	Angle Out	Degree Forward	Best Number
7-May-10	10:00	12	30.148260	-80.148623	W	4	3	120°	2

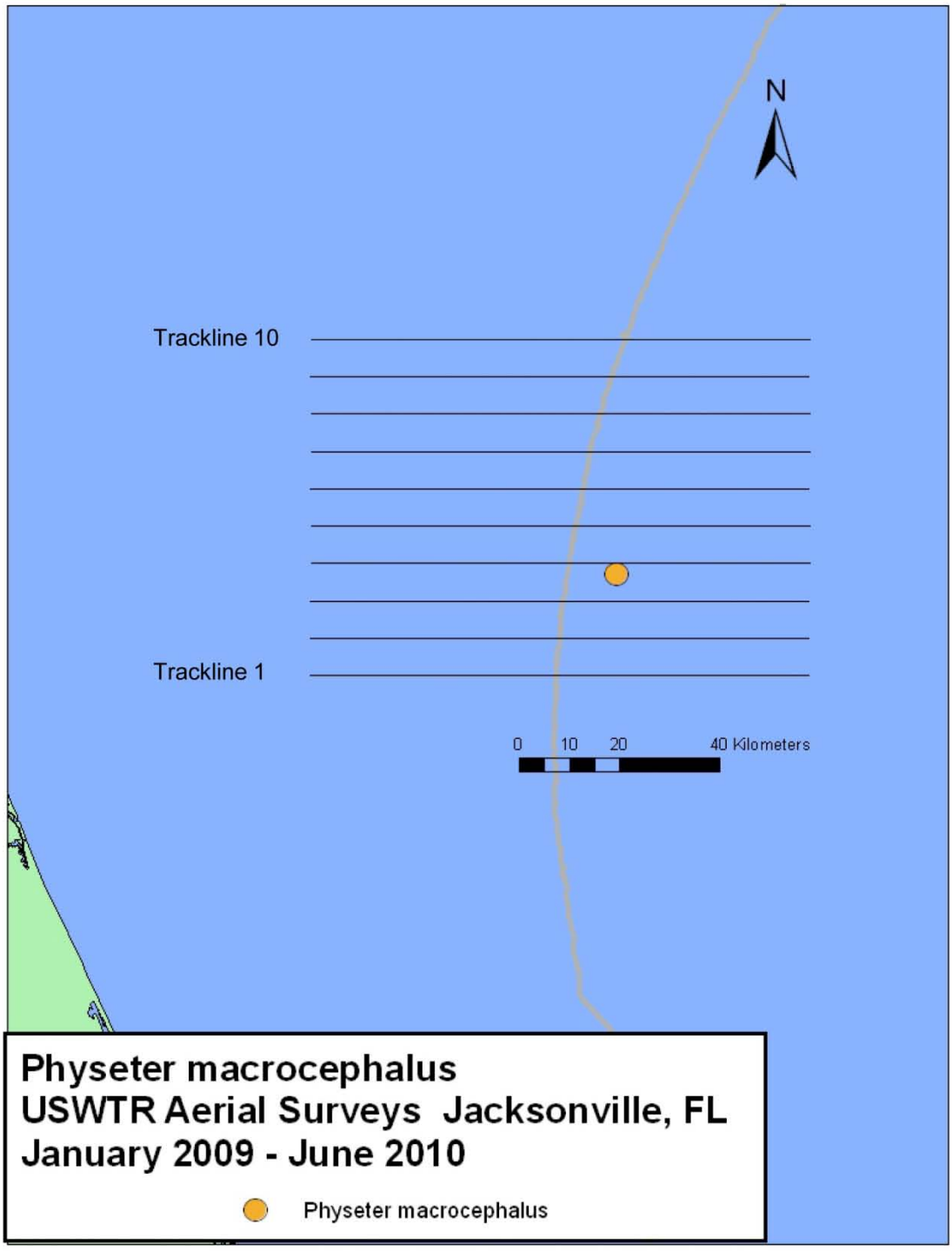

Figure 12. Sperm whale (*Physeter macrocephalus*) sighting.

Pygmy/Dwarf Sperm Whale (*Kogia* spp.) (Table 11, Fig. 13)

Pygmy (*Kogia breviceps*) and dwarf sperm whales (*Kogia sima*) are difficult to differentiate. A single *Kogia* spp. was encountered in deep, offshore waters on 18 November 2009. The best abundance estimate for *Kogia* spp. in the western North Atlantic is 395 (CV=0.40). The status of *Kogia* spp. is currently unknown (Waring *et al.* 2007).

Table 11. The dwarf or pygmy sperm whale (*Kogia* species) sighting in the proposed USWTR site off of Jacksonville, Florida for aerial surveys conducted from January 2009 – June 2010.

Date	Time	Waypoint	Latitude	Longitude -1	Heading	Track Number	Angle Out	Degree Forward	Best Number
18-Nov-09	9:13	15	30.037136	-79.943718	W	2	3	100°	1

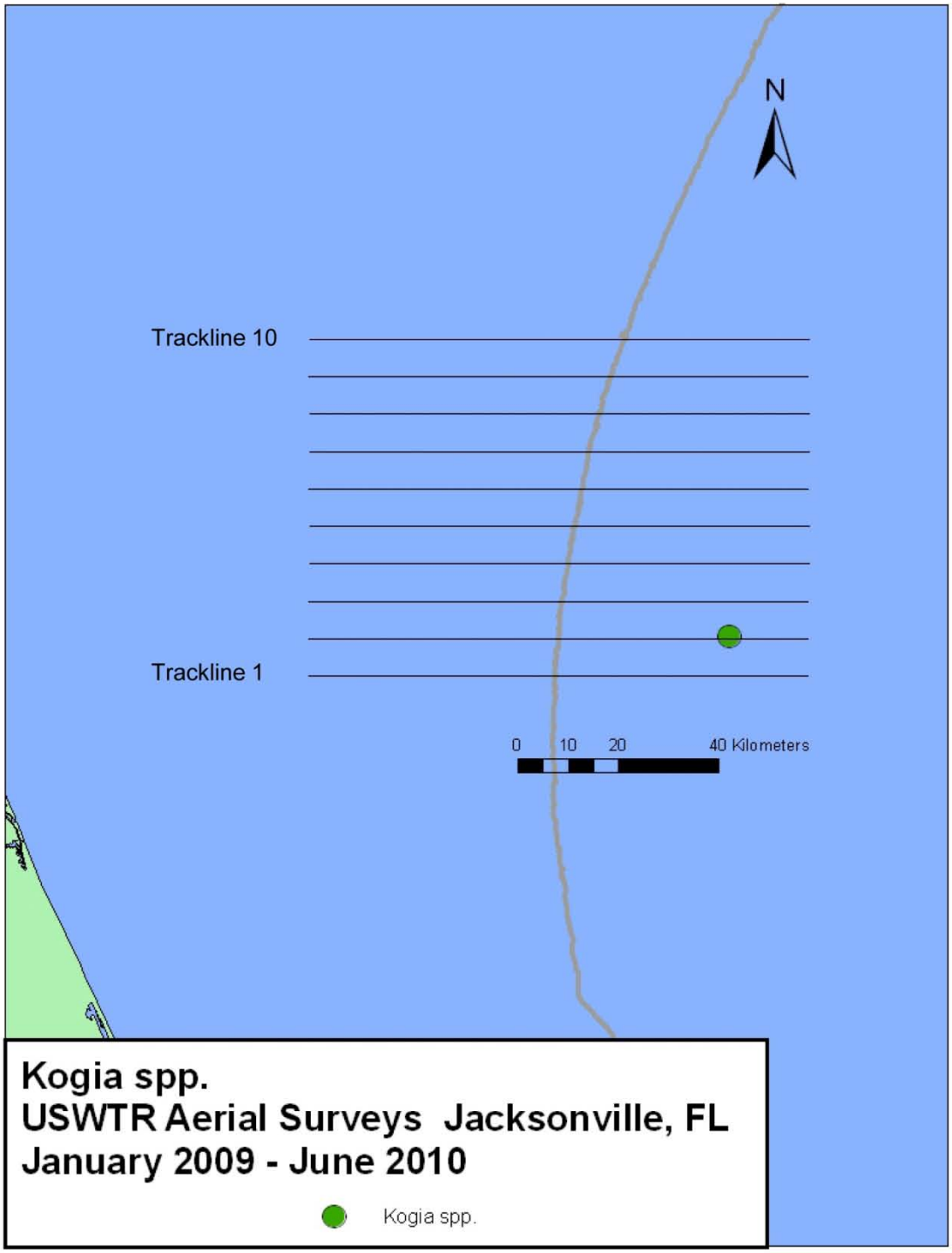

Figure 13. Dwarf or pygmy sperm whale (*Kogia* species) sighting.

Rough-toothed Dolphin (*Steno bredanensis*) (Table 12, Fig. 14)

This species was documented once during the reporting period, on 15 September 2009. The group encountered consisted of approximately 50 individuals. This species is rarely observed off the U.S. east coast and the current best abundance estimate (n = 274, CV = 1.03) is based on a ship board survey conducted in waters south of Maryland in 1998. The status of rough-toothed dolphins in the western North Atlantic is currently unknown (Waring *et al.* 2008).

Table 12. The rough-toothed dolphin (*Steno bredanensis*) sighting in the proposed USWTR site off of Jacksonville, Florida for aerial surveys conducted from January 2009 – June 2010.

Date	Time	Waypoint	Latitude	Longitude -1	Heading	Track Number	Angle Out	Degree Forward	Best Number
15-Sep-09	10:57	24	30.102567	-80.662731	m	3	2	90°	50

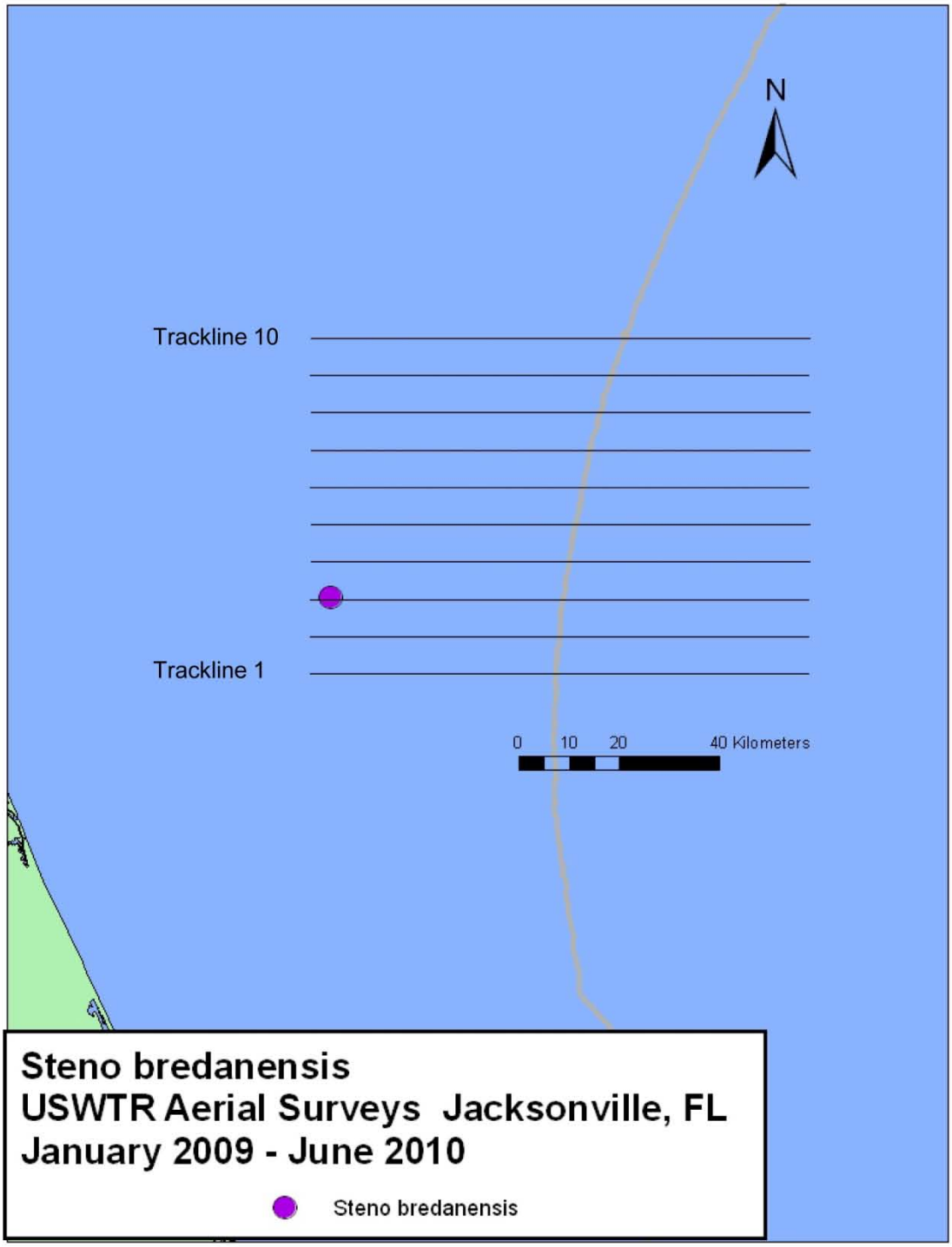

Figure 14. Rough-toothed dolphin (*Steno bredanensis*) sighting.

Unidentified delphinids (Table 13, Fig 15)

During sightings where animals could not be relocated after the initial sighting, no photos were taken or when a positive species identification could not be established from images obtained, the designation "unidentified delphinid" was used. A total of 38 groups of 148 unidentified delphinids were recorded.

Table 13. All unidentified dolphin sightings in the proposed USWTR site off of Jacksonville, Florida for aerial surveys conducted from January 2009-June 2010.

Date	Time	Waypoint	Latitude	Longitude -1	Heading	Track Number	Angle Out	Degree Forward	Best Number
27-Feb-09	11:34	58	30.231648	-80.618515	E	5	2	120°	1
10-Jun-09	12:04	47	30.297996	-80.520986	W	6	1	75°	3
11-Jun-09	10:27	20	30.027809	-80.045970	E	2	1	160°	3
15-Jul-09	13:36	41	29.967081	-80.067598	E	1	2	90°	1
14-Sep-09	13:46	23	30.370925	-80.071616	W	7	1	100°	9
16-Sep-09	14:59	75	30.234286	-80.638299	E	5	2	75°	11
18-Sep-09	11:20	51	30.291406	-80.650391	E	6	3	90°	2
18-Sep-09	16:51	54	29.962245	-80.672895	W	1	1	100°	5
18-Nov-09	9:44	24	30.112692	-80.556471	E	3	2	100°	3
18-Nov-09	11:46	52	30.308959	-80.475456	W	6	2	100°	1
22-Dec-09	11:17	28	30.166376	-80.683375	W	4	2	100°	3
22-Dec-09	12:12	42	30.297574	-80.405397	W	6	2	100°	3
22-Dec-09	16:13	82	30.564581	-80.305144	W	10	1	90°	1
20-Jan-10	12:26	72	30.301264	-80.488315	W	6	3	90°	1
20-Jan-10	16:08	139	30.562322	-80.363101	W	10	1	100°	14
27-Jan-10	15:26	40	30.099334	-79.828985	W	3	2	120°	18
27-Jan-10	17:02	54	29.965491	-80.641395	W	1	2	110°	9
28-Jan-10	10:17	20	29.968545	-80.057141	E	1	3	130°	3
20-Feb-10	10:56	27	30.432762	-80.620269	E	8	2	90°	5
20-Feb-10	16:35	120	30.037500	-80.374863	E	2	3	90°	5
20-Feb-10	16:59	129	29.973820	-79.925572	W	1	3	120°	3
20-Mar-10	14:48	82	30.308002	-80.395258	E	6	2	110°	4
20-Mar-10	15:16	101	30.367844	-80.264885	W	7	2	90°	3
24-Mar-10	11:49	51	30.302538	-80.655800	E	6	3	95°	2
24-Mar-10	12:18	62	30.304547	-80.030007	E	6	2	100°	1
31-Mar-10	14:50	26	30.106320	-80.313623	E	3	2	110°	3
31-Mar-10	16:48	77	30.572718	-80.122620	W	10	3	110°	1
1-Apr-10	11:01	20	30.303537	-80.529192	E	6	3	30°	1
2-Apr-10	15:34	166	30.361301	-80.274064	E	7	2	90°	3
7-May-10	11:59	56	30.375496	-80.608868	E	7	2	140°	3

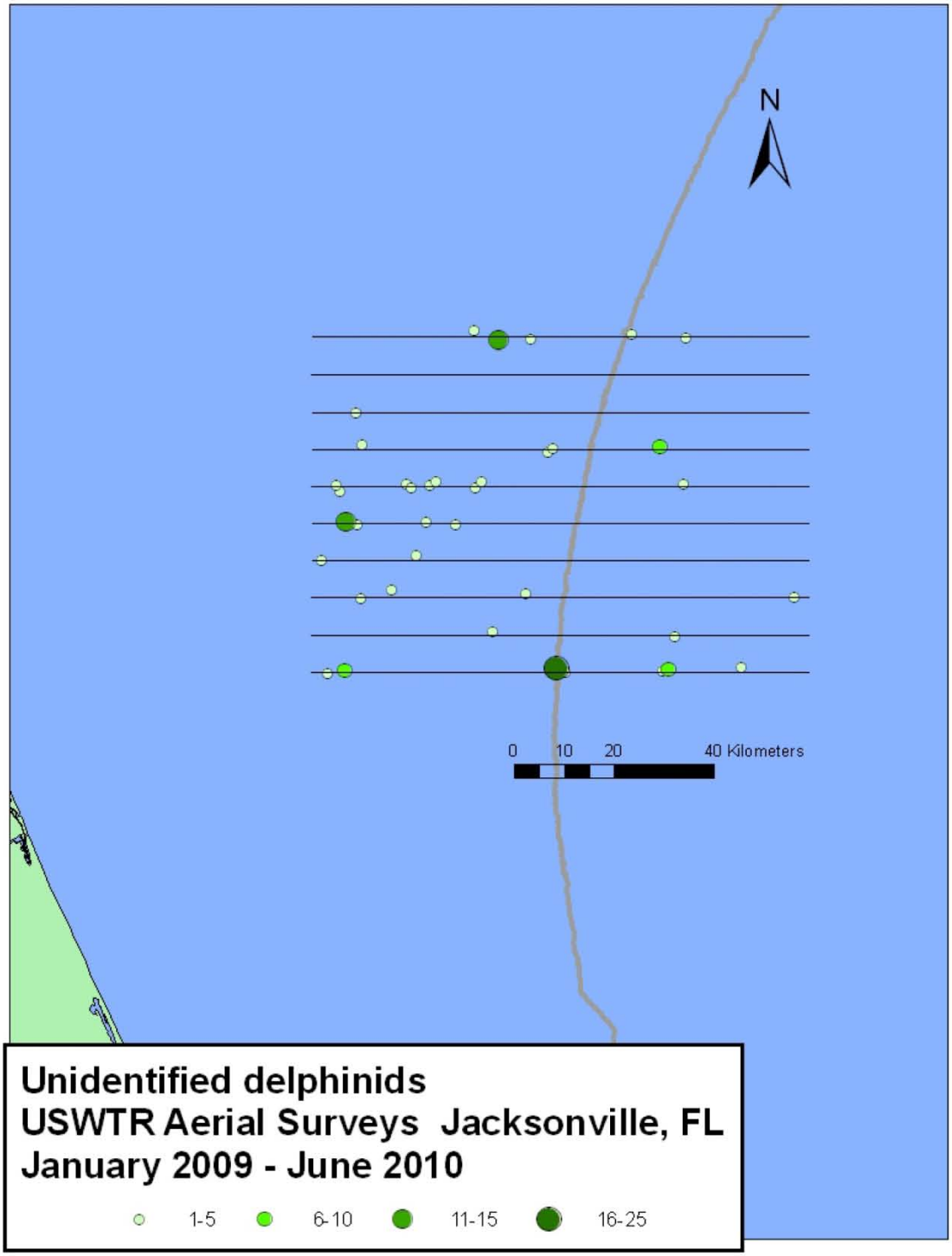

Figure 15. Unidentified delphinid sightings indicating group size.

Sea Turtles

A total of 1543 sea turtles were observed during the reporting period. Sighting rates were negatively correlated with Beaufort Sea State, with rates declining at higher sea states (Figs. 16a-b). The low sighting rate calculated for a Beaufort Sea State 0 is due to little survey coverage in this sea state (*i.e*. 80.5 km or 0.3% of 29839.4 total km surveyed). Sea turtles were recorded in every month surveyed with an apparent general trend of higher densities observed during late spring and early summer (Fig. 16c). Abundances fluctuated from 79.9 sea turtles/1000 km in June 2009 to 9.6 sea turtles/1000 km in June 2010 to (Fig 16c). Loggerhead sea turtles (*Caretta caretta*) constituted the majority of sea turtle sightings (75.7%), followed by unidentified sea turtles, leatherback sea turtles (*Dermochelys coriacea*), and the Kemp's Ridley sea turtle (*Lepidochelys kempii*). Turtles labeled as unidentified were typically either of small size, submerged, or too far away for the observers to make an accurate identification to species. Sea turtle species are listed below in decreasing number of sightings.

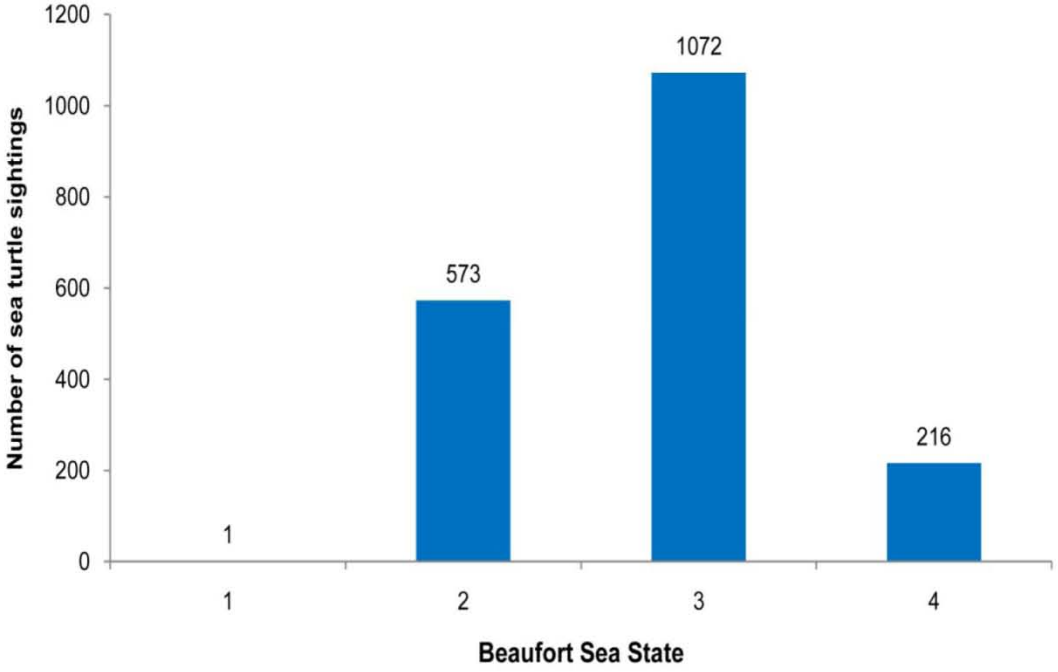

Figure 16a. Total number of sea turtle sightings by Beaufort Sea State in the proposed USWTR site off of Jacksonville, Florida during aerial surveys from January 2009 – June 2010.

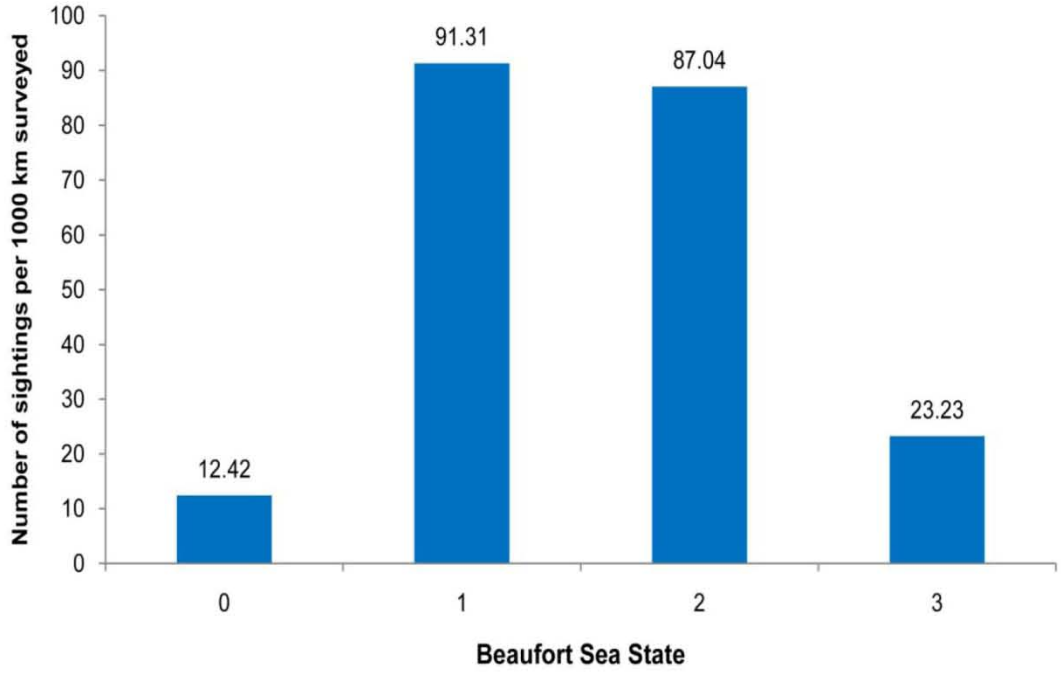

Figure 16b. Sea turtle sightings per 1000 km flown by Beaufort Sea State in the proposed USWTR site off of Jacksonville, Florida during aerial surveys from January 2009 – June 2010.

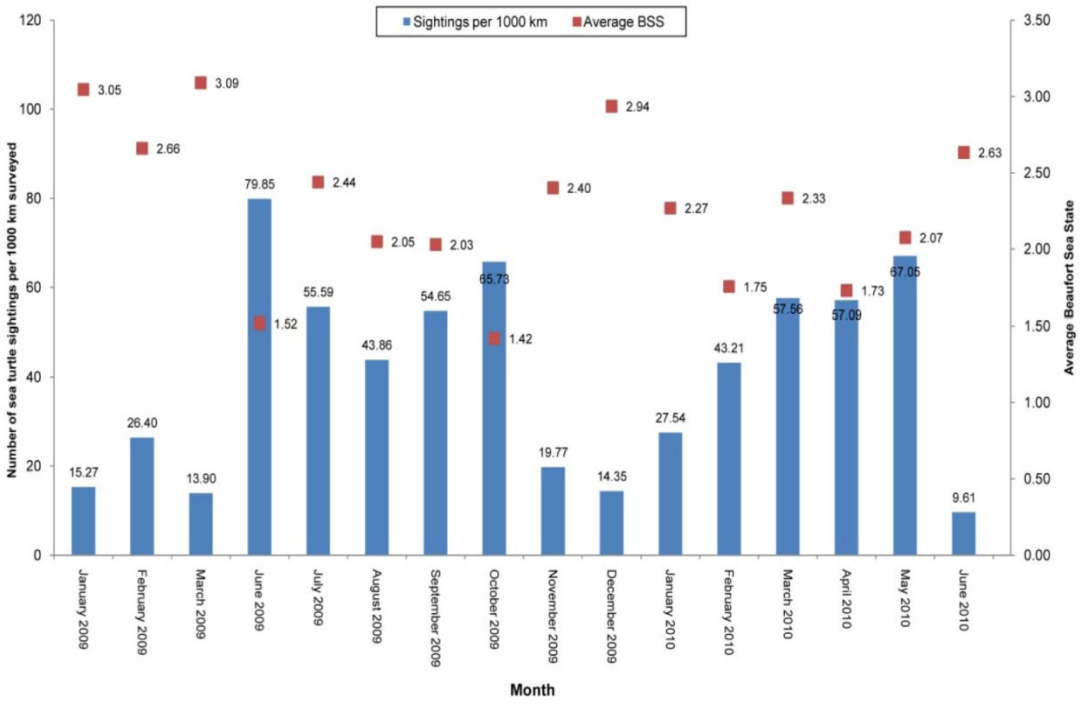

Figure 16c. Sea turtle sightings per 1000 km surveyed and the average Beaufort Sea State per month in the proposed USWTR site off of Jacksonville, Florida during aerial surveys from January 2009 – June 2010.

Loggerhead Sea Turtle (*Caretta caretta*) (Table 14, Fig.17)

A total of 1169 loggerhead sea turtles were observed. This species was observed every month during which aerial surveys were conducted. For management purposes, loggerheads along the U.S. Atlantic east coast are separated into five separate recovery units. The current best estimate for nests in the Peninsular Florida Recovery Unit (defined as loggerheads originating from nests between the Georgia/Florida border south to, but not including, the Florida keys) is 64513. Loggerhead sea turtles are currently listed as threatened under the Endangered Species Act (NMFS 2008).

Table 14. All loggerhead sea turtle (*Caretta caretta*) sightings in the proposed USWTR site off Jacksonville, Florida for aerial surveys conducted from January 2009 – June 2010.

Date	Time	Waypoint	Latitude	Longitude -1	Heading	Track Number	Angle Out	Degree Forward	Best Number
27-Jan-09	12:41	3	29.962717	-80.676670	E	1	1	90°	1
27-Jan-09	13:37	11	30.036203	-80.510090	W	2	1	90°	1
28-Jan-09	11:25	8	30.430300	-80.501035	W	8	2	90°	1
28-Jan-09	11:36	11	30.498540	-80.587838	E	9	2	90°	1
26-Feb-09	9:31	3	30.567629	-80.674304	E	10	2	100°	1
26-Feb-09	9:34	6	30.565524	-80.592060	E	10	2	90°	1
26-Feb-09	9:37	7	30.566645	-80.487691	E	10	1	90°	1
26-Feb-09	9:42	7	30.564760	-80.311825	E	10	1	90°	1
26-Feb-09	9:44	8	30.566594	-80.216860	E	10	3	90°	1
26-Feb-09	10:40	16	30.498498	80.258729	W	9	3	90°	1
26-Feb-09	10:48	19	30.500636	-80.535794	W	9	3	90°	1
26-Feb-09	10:50	21	30.498934	-80.588799	W	9	2	90°	3
26-Feb-09	10:50	21	30.499299	-80.576617	W	9	1	90°	1
26-Feb-09	10:51	22	30.497767	-80.632095	W	9	1	90°	1
26-Feb-09	10:51	22	30.498208	-80.620274	W	9	3	90°	1
26-Feb-09	10:52	23	30.497817	-80.659055	W	9	1	90°	1
26-Feb-09	10:52	24	30.498334	-80.678626	W	9	1	90°	1
26-Feb-09	10:52	23	30.498355	-80.671524	W	9	2	90°	1
26-Feb-09	11:22	34	30.432006	-80.434145	E	8	3	90°	1
26-Feb-09	11:24	32	30.433059	-80.367276	E	8	2	90°	1
26-Feb-09	13:45	48	30.299733	-80.445783	E	6	2	90°	1
26-Feb-09	14:38	47	30.231045	-80.315441	W	5	1	90°	1
26-Feb-09	15:52	61	30.030400	-80.520165	E	2	2	90°	1
27-Feb-09	8:54	4	29.965507	-80.606023	E	1	1	90°	1
27-Feb-09	8:54	5	29.965597	-80.591244	E	1	1	90°	1
27-Feb-09	9:03	8	29.967309	-80.533800	E	1	1	90°	1
27-Feb-09	9:05	9	29.966307	-80.434665	E	1	2	90°	1
27-Feb-09	9:51	21	30.030717	-80.341974	W	2	3	90°	1
27-Feb-09	9:52	22	30.030798	-80.352991	W	2	2	90°	2
27-Feb-09	9:52	23	30.031025	-80.376150	W	2	3	90°	1
27-Feb-09	9:55	22	30.031539	-80.475142	W	2	3	90°	1
27-Feb-09	9:55	25	30.031575	-80.464046	W	2	2	90°	1
27-Feb-09	9:56	26	30.031386	-80.517836	W	2	1	90°	1
27-Feb-09	10:02	29	30.032488	-80.600716	W	2	1	90°	1
27-Feb-09	10:04	30	30.030953	-80.660416	W	2	2	90°	1
27-Feb-09	10:13	31	30.098630	-80.557558	E	3	2	90°	1
27-Feb-09	10:14	32	30.098031	-80.522358	E	3	2	90°	2
27-Feb-09	10:59	48	30.166015	-80.376832	W	4	2	90°	1
27-Feb-09	11:42	61	30.233556	-80.555977	E	5	2	90°	1

Table 14 (continued). All loggerhead sea turtle (*Caretta caretta*) sightings in the proposed USWTR site off Jacksonville, Florida for aerial surveys conducted from January 2009 – June 2010.

Date	Time	Waypoint	Latitude	Longitude -1	Heading	Track Number	Angle Out	Degree Forward	Best Number
27-Feb-09	11:44	62	30.233023	-80.485332	E	5	3	90°	2
27-Feb-09	11:55	66	30.233576	-80.340514	E	5	3	90°	1
27-Feb-09	11:58	68	30.233309	-80.227378	E	5	1	90°	1
27-Feb-09	12:28	61	30.299835	-80.379989	W	6	2	90°	1
27-Feb-09	12:32	62	30.299525	-80.521068	W	6	2	90°	1
27-Feb-09	14:44	86	30.367283	-80.376814	E	7	3	90°	1
27-Feb-09	14:46	87	30.367331	-80.293846	E	7	1	90°	1
27-Feb-09	15:38	98	30.500127	-80.601115	E	9	3	90°	1
31-Mar-09	15:06	3	30.235758	-80.658041	E	5	2	90°	1
31-Mar-09	15:12	5	30.233255	-80.417950	E	5	2	90°	1
31-Mar-09	15:47	8	30.301403	-80.437063	W	6	3	90°	1
31-Mar-09	16:00	12	30.367652	-80.544145	E	7	3	90°	1
31-Mar-09	16:02	13	30.364211	-80.492083	E	7	1	90°	1
31-Mar-09	16:52	25	30.496036	-80.574488	E	9	2	60°	1
9-Jun-09	13:12	4	30.567156	-80.681325	E	10	2	90°	1
9-Jun-09	13:13	4	30.564338	-80.636044	E	10	3	90°	2
9-Jun-09	13:13	5	30.565601	-80.610332	E	10	1	90°	1
9-Jun-09	13:14	6	30.567262	-80.584025	E	10	2	90°	1
9-Jun-09	13:16	5	30.566849	-80.513951	E	10	2	75°	1
9-Jun-09	13:16	7	30.565785	-80.525539	E	10	3	90°	1
9-Jun-09	13:16	8	30.567798	-80.493986	E	10	3	100°	1
9-Jun-09	13:18	6	30.565513	-80.420685	E	10	2	110°	1
9-Jun-09	13:18	9	30.565562	-80.421626	E	10	2	110°	1
9-Jun-09	13:19	7	30.567071	-80.381122	E	10	2	120°	1
9-Jun-09	13:22	8	30.567722	-80.287245	E	10	2	90°	1
9-Jun-09	13:55	17	30.499843	-80.234397	W	9	2	110°	1
9-Jun-09	13:57	17	30.499435	-80.316440	W	9	1	90°	1
9-Jun-09	13:59	18	30.501223	-80.372094	W	9	1	90°	1
9-Jun-09	14:00	19	30.496762	-80.413666	W	9	2	90°	1
9-Jun-09	14:10	22	30.499667	-80.535624	W	9	1	90°	1
9-Jun-09	14:11	23	30.499578	-80.577725	W	9	1	90°	1
9-Jun-09	14:13	23	30.499470	-80.655752	W	9	2	90°	4
9-Jun-09	14:13	25	30.499403	-80.656840	W	9	2	90°	1
9-Jun-09	14:17	28	30.434048	-80.677442	E	8	2	90°	1
9-Jun-09	14:18	26	30.434062	-80.620432	E	8	2	90°	1
9-Jun-09	14:19	27	30.433756	-80.599135	E	8	2	90°	1
9-Jun-09	14:20	28	30.433391	-80.572292	E	8	2	90°	3
9-Jun-09	14:21	30	30.433951	-80.509602	E	8	2	60°	1
9-Jun-09	14:22	29	30.433175	-80.471567	E	8	2	90°	1

Table 14 (continued). All loggerhead sea turtle (*Caretta caretta*) sightings in the proposed USWTR site off Jacksonville, Florida for aerial surveys conducted from January 2009 – June 2010.

Date	Time	Waypoint	Latitude	Longitude -1	Heading	Track Number	Angle Out	Degree Forward	Best Number
9-Jun-09	14:23	33	30.433501	-80.434726	E	8	1	90°	1
9-Jun-09	14:24	30	30.434314	-80.418364	E	8	2	75°	1
9-Jun-09	14:24	34	30.435821	-80.386605	E	8	1	60°	1
9-Jun-09	14:35	37	30.431885	-80.255430	E	8	2	100°	1
9-Jun-09	15:03	37	30.366183	-80.399778	W	7	2	90°	1
9-Jun-09	15:04	38	30.366912	-80.437332	W	7	2	90°	1
9-Jun-09	15:04	44	30.366681	-80.446110	W	7	2	110°	1
9-Jun-09	15:06	39	30.367461	-80.516973	W	7	2	75°	1
9-Jun-09	15:06	45	30.367329	-80.501678	W	7	1	90°	1
9-Jun-09	15:06	46	30.365548	-80.534814	W	7	2	90°	1
9-Jun-09	15:07	47	30.364718	-80.568133	W	7	1	60°	1
9-Jun-09	15:08	40	30.364513	-80.617354	W	7	3	75°	1
9-Jun-09	15:08	48	30.364621	-80.613793	W	7	1	90°	2
9-Jun-09	15:09	41	30.365256	-80.642000	W	7	1	90°	2
9-Jun-09	15:09	49	30.365123	-80.638784	W	7	1	90°	1
9-Jun-09	15:10	50	30.366887	-80.674321	W	7	1	90°	1
9-Jun-09	15:11	51	30.364501	-80.702961	W	7	1	90°	1
9-Jun-09	15:13	54	30.301129	-80.689894	E	6	1	135°	1
9-Jun-09	15:15	44	30.299933	-80.618592	E	6	2	75°	1
9-Jun-09	15:15	55	30.300391	-80.631262	E	6	2	60°	1
9-Jun-09	15:17	45	30.298765	-80.540695	E	6	2	75°	1
9-Jun-09	15:17	57	30.298774	-80.537869	E	6	1	90°	1
9-Jun-09	15:18	46	30.299340	-80.508963	E	6	2	75°	2
9-Jun-09	15:19	47	30.299651	-80.472905	E	6	2	90°	1
9-Jun-09	15:22	49	30.301660	-80.342552	E	6	2	90°	1
9-Jun-09	15:51	61	30.238296	-80.321698	W	5	3	110°	1
9-Jun-09	15:52	62	30.238956	-80.379864	W	5	2	100°	1
9-Jun-09	15:54	64	30.238248	-80.464537	W	5	2	90°	1
9-Jun-09	15:56	55	30.232950	-80.531585	W	5	2	75°	2
9-Jun-09	15:56	65	30.234956	-80.519376	W	5	1	90°	1
9-Jun-09	15:58	56	30.234953	-80.629916	W	5	1	90°	2
9-Jun-09	15:58	67	30.233555	-80.606452	W	5	1	90°	1
10-Jun-09	9:21	4	29.964953	-80.614129	E	1	2	90°	1
10-Jun-09	9:26	4	29.965327	-80.404573	E	1	2	90°	1
10-Jun-09	9:59	11	30.032131	-80.352507	W	2	2	90°	1
10-Jun-09	10:02	10	30.030888	-80.450792	W	2	1	60°	1
10-Jun-09	10:03	12	30.029927	-80.479060	W	2	2	90°	1
10-Jun-09	10:04	13	30.029335	-80.526848	W	2	2	90°	1
10-Jun-09	10:06	14	30.029806	-80.599411	W	2	2	90°	1

Table 14 (continued). All loggerhead sea turtle (*Caretta caretta*) sightings in the proposed USWTR site off Jacksonville, Florida for aerial surveys conducted from January 2009 – June 2010.

Date	Time	Waypoint	Latitude	Longitude -1	Heading	Track Number	Angle Out	Degree Forward	Best Number
10-Jun-09	10:14	16	30.098968	-80.602294	E	3	1	90°	1
10-Jun-09	10:15	17	30.099808	-80.529924	E	3	1	100°	1
10-Jun-09	10:17	17	30.103878	-80.447898	E	3	2	90°	1
10-Jun-09	11:07	28	30.167155	-80.470628	W	4	1	90°	1
10-Jun-09	11:08	29	30.167166	-80.499885	W	4	1	75°	1
10-Jun-09	11:09	30	30.166382	-80.527662	W	4	1	75°	1
10-Jun-09	11:09	24	30.166121	-80.538992	W	4	2	90°	1
10-Jun-09	11:10	31	30.165179	-80.556454	W	4	2	60°	1
10-Jun-09	11:11	25	30.163960	-80.589377	W	4	2	90°	2
10-Jun-09	11:13	26	30.166544	-80.661509	W	4	2	90°	1
10-Jun-09	11:21	35	30.242948	-80.512343	E	5	1	100°	1
10-Jun-09	11:22	36	30.235576	-80.461142	E	5	1	100°	1
10-Jun-09	11:25	37	30.234017	-80.355132	E	5	1	80°	1
10-Jun-09	11:54	43	30.300452	-80.322588	W	6	2	75°	1
10-Jun-09	11:55	32	30.299488	-80.367682	W	6	3	90°	1
10-Jun-09	11:55	44	30.299935	-80.355562	W	6	1	90°	1
10-Jun-09	11:57	33	30.297258	-80.417669	W	6	2	75°	1
10-Jun-09	11:57	45	30.297850	-80.441585	W	6	1	90°	1
10-Jun-09	14:34	44	30.363275	-80.595480	E	7	3	90°	1
10-Jun-09	14:37	45	30.363567	-80.490323	E	7	2	75°	1
10-Jun-09	14:38	46	30.361263	-80.423257	E	7	2	90°	1
10-Jun-09	14:38	65	30.363986	-80.455658	E	7	1	100°	1
10-Jun-09	14:40	47	30.364026	-80.375654	E	7	3	100°	1
10-Jun-09	14:41	68	30.363423	-80.300225	E	7	1	100°	1
10-Jun-09	14:42	69	30.364019	-80.253230	E	7	1	90°	1
10-Jun-09	15:11	80	30.433236	-80.242099	W	8	1	90°	1
10-Jun-09	15:12	53	30.433286	-80.264880	W	8	2	75°	2
10-Jun-09	15:16	82	30.431321	-80.407921	W	8	1	75°	1
10-Jun-09	15:40	90	30.434702	-80.650537	W	8	1	110°	1
10-Jun-09	15:45	61	30.497844	-80.623834	E	9	2	100°	1
10-Jun-09	15:46	62	30.498748	-80.590676	E	9	1	70°	1
10-Jun-09	15:46	94	30.498133	-80.614377	E	9	1	90°	2
10-Jun-09	15:47	96	30.499923	-80.547867	E	9	1	90°	2
10-Jun-09	15:49	97	30.502352	-80.476434	E	9	1	60°	2
10-Jun-09	16:00	65	30.501760	-80.355807	E	9	2	70°	1
10-Jun-09	16:01	102	30.501102	-80.328871	E	9	1	90°	1
10-Jun-09	16:05	66	30.496205	-80.181637	E	9	3	70°	1
10-Jun-09	16:36	73	30.570119	-80.140188	W	10	1	90°	2
10-Jun-09	16:39	74	30.566927	-80.279606	W	10	1	100°	2

Table 14 (continued). All loggerhead sea turtle (*Caretta caretta*) sightings in the proposed USWTR site off Jacksonville, Florida for aerial surveys conducted from January 2009 – June 2010.

Date	Time	Waypoint	Latitude	Longitude -1	Heading	Track Number	Angle Out	Degree Forward	Best Number
10-Jun-09	16:41	112	30.567950	-80.379021	W	10	1	90°	1
10-Jun-09	16:43	113	30.568044	-80.462992	W	10	1	60°	3
10-Jun-09	16:44	75	30.568917	-80.504767	W	10	1	90°	2
10-Jun-09	16:44	114	30.567580	-80.486993	W	10	1	90°	3
10-Jun-09	16:45	115	30.568166	-80.521155	W	10	1	90°	1
10-Jun-09	16:46	117	30.568128	-80.582101	W	10	1	90°	2
10-Jun-09	16:46	116	30.566427	-80.557029	W	10	1	80°	1
11-Jun-09	8:57	4	30.161635	-80.569707	E	4	1	120°	1
11-Jun-09	8:58	5	30.163361	-80.540625	E	4	1	90°	1
11-Jun-09	8:59	4	30.166888	-80.472289	E	4	3	90°	1
11-Jun-09	9:01	5	30.167465	-80.422048	E	4	2	100°	1
11-Jun-09	9:36	10	30.099660	-80.545638	W	3	1	90°	1
11-Jun-09	9:37	9	30.101354	-80.568452	W	3	2	90°	1
11-Jun-09	10:09	17	30.036402	-80.616519	E	2	3	90°	1
11-Jun-09	11:32	26	29.964513	-80.528974	W	1	2	90°	1
11-Jun-09	11:32	27	29.965117	-80.561496	W	1	1	60°	1
11-Jun-09	11:35	36	29.966203	-80.669853	W	1	1	60°	1
11-Jun-09	11:36	37	29.966056	-80.689631	W	1	1	90°	3
15-Jul-09	13:18	28	29.967368	-80.649724	E	1	1	60°	1
15-Jul-09	13:18	37	29.967452	-80.645430	E	1	1	90°	1
15-Jul-09	13:19	29	29.965739	-80.630418	E	1	2	90°	1
15-Jul-09	13:19	30	29.964022	-80.604555	E	1	2	75°	1
15-Jul-09	13:19	38	29.966824	-80.637502	E	1	1	90°	1
15-Jul-09	13:19	39	29.964478	-80.618668	E	1	1	90°	1
15-Jul-09	13:20	40	29.965385	-80.590268	E	1	1	90°	1
15-Jul-09	13:20	41	29.967203	-80.577028	E	1	1	90°	1
15-Jul-09	13:21	32	29.969148	-80.557552	E	1	1	60°	1
15-Jul-09	13:21	42	29.968677	-80.565647	E	1	2	90°	1
15-Jul-09	13:22	43	29.964760	-80.520144	E	1	2	90°	1
15-Jul-09	13:24	45	29.966340	-80.450099	E	1	1	90°	1
15-Jul-09	13:25	46	29.966351	-80.409510	E	1	3	90°	1
15-Jul-09	13:27	35	29.966155	-80.321982	E	1	2	90°	1
15-Jul-09	13:27	48	29.966310	-80.314090	E	1	2	90°	1
15-Jul-09	13:32	38	29.967109	-80.157865	E	1	2	75°	1
15-Jul-09	14:16	50	30.032079	-80.280516	W	2	1	75°	1
15-Jul-09	14:17	51	30.031696	-80.344534	W	2	2	60°	1
15-Jul-09	14:17	57	30.032548	-80.325620	W	2	1	90°	1
15-Jul-09	14:17	58	30.031763	-80.340692	W	2	1	90°	1
15-Jul-09	14:20	59	30.031944	-80.452905	W	2	2	90°	1

Table 14 (continued). All loggerhead sea turtle (*Caretta caretta*) sightings in the proposed USWTR site off Jacksonville, Florida for aerial surveys conducted from January 2009 – June 2010.

Date	Time	Waypoint	Latitude	Longitude -1	Heading	Track Number	Angle Out	Degree Forward	Best Number
15-Jul-09	14:21	60	30.032042	-80.461970	W	2	2	90°	1
15-Jul-09	14:23	62	30.032878	-80.550123	W	2	2	90°	1
15-Jul-09	14:23	63	30.031269	-80.559502	W	2	2	90°	1
15-Jul-09	14:24	52	30.030146	-80.578839	W	2	1	90°	1
15-Jul-09	14:24	53	30.034083	-80.611373	W	2	2	90°	3
15-Jul-09	14:24	65	30.031163	-80.588983	W	2	1	90°	1
15-Jul-09	14:24	66	30.031824	-80.597445	W	2	1	90°	1
15-Jul-09	14:24	67	30.033875	-80.609214	W	2	1	90°	1
15-Jul-09	14:26	54	30.032807	-80.654042	W	2	2	90°	1
15-Jul-09	14:26	55	30.031230	-80.682173	W	2	1	90°	1
15-Jul-09	14:26	70	30.031206	-80.684923	W	2	1	90°	2
15-Jul-09	14:27	71	30.031944	-80.698539	W	2	1	90°	1
15-Jul-09	14:30	58	30.098847	-80.654708	E	3	1	90°	1
15-Jul-09	14:30	74	30.100310	-80.673173	E	3	1	90°	2
15-Jul-09	14:31	59	30.099432	-80.623825	E	3	2	90°	2
15-Jul-09	14:32	60	30.100945	-80.585137	E	3	2	90°	2
15-Jul-09	14:32	75	30.100186	-80.615472	E	3	1	90°	1
15-Jul-09	14:32	76	30.101525	-80.604712	E	3	2	90°	1
15-Jul-09	14:32	77	30.101695	-80.591899	E	3	1	90°	1
15-Jul-09	14:32	78	30.100298	-80.581210	E	3	1	90°	1
15-Jul-09	14:33	61	30.099352	-80.558739	E	3	2	90°	4
15-Jul-09	14:33	79	30.099286	-80.560168	E	3	1	90°	4
15-Jul-09	14:34	62	30.103049	-80.528851	E	3	2	60°	1
15-Jul-09	14:34	80	30.101230	-80.542859	E	3	1	90°	1
15-Jul-09	14:34	81	30.103523	-80.518905	E	3	1	90°	1
15-Jul-09	14:35	63	30.102778	-80.503844	E	3	2	90°	2
15-Jul-09	14:35	64	30.101889	-80.481675	E	3	2	90°	4
15-Jul-09	14:35	82	30.101917	-80.481955	E	3	1	90°	2
15-Jul-09	14:36	65	30.102441	-80.462503	E	3	1	75°	1
15-Jul-09	14:37	84	30.100271	-80.403669	E	3	1	90°	1
15-Jul-09	14:38	85	30.100676	-80.379872	E	3	2	90°	3
15-Jul-09	14:43	88	30.100729	-80.328100	E	3	1	90°	1
15-Jul-09	15:20	96	30.167207	-80.305056	W	4	1	90°	2
15-Jul-09	15:21	79	30.166186	-80.343439	W	4	2	90°	2
15-Jul-09	15:22	80	30.163681	-80.371858	W	4	2	110°	1
15-Jul-09	15:23	98	30.166150	-80.423454	W	4	1	90°	1
15-Jul-09	15:24	82	30.164338	-80.456457	W	4	2	75°	1
15-Jul-09	15:24	99	30.164390	-80.457202	W	4	3	90°	2
15-Jul-09	15:25	84	30.166370	-80.498522	W	4	1	90°	3

Table 14 (continued). All loggerhead sea turtle (*Caretta caretta*) sightings in the proposed USWTR site off Jacksonville, Florida for aerial surveys conducted from January 2009 – June 2010.

Date	Time	Waypoint	Latitude	Longitude -1	Heading	Track Number	Angle Out	Degree Forward	Best Number
15-Jul-09	15:25	85	30.166779	-80.520930	W	4	1	45°	1
15-Jul-09	15:25	100	30.166424	-80.488564	W	4	2	90°	4
15-Jul-09	15:28	86	30.165512	-80.611987	W	4	1	90°	1
15-Jul-09	15:28	101	30.165447	-80.606623	W	4	1	90°	1
15-Jul-09	15:29	87	30.166144	-80.670977	W	4	1	90°	1
15-Jul-09	16:09	108	30.233877	-80.416672	E	5	1	90°	1
15-Jul-09	16:14	101	30.234243	-80.345375	E	5	1	60°	1
15-Jul-09	16:44	110	30.299495	-80.321647	W	6	2	90°	1
15-Jul-09	16:45	111	30.303041	-80.369487	W	6	2	75°	1
15-Jul-09	16:45	116	30.303811	-80.369824	W	6	1	90°	1
15-Jul-09	16:47	112	30.301687	-80.448696	W	6	1	90°	2
15-Jul-09	16:47	117	30.302312	-80.432597	W	6	1	90°	1
15-Jul-09	16:48	119	30.301844	-80.481189	W	6	1	90°	2
15-Jul-09	16:51	120	30.302059	-80.607444	W	6	1	90°	1
15-Jul-09	16:52	113	30.300593	-80.630280	W	6	1	90°	2
16-Jul-09	13:41	26	30.166391	-80.489034	E	4	2	60°	2
16-Jul-09	14:18	31	30.099503	-80.378532	W	3	3	90°	2
16-Jul-09	14:21	32	30.100652	-80.486371	W	3	3	90°	1
16-Jul-09	14:23	33	30.098352	-80.564276	W	3	3	80°	2
16-Jul-09	14:30	36	30.031240	-80.646219	E	2	3	90°	1
16-Jul-09	14:50	44	30.033857	-80.476733	E	2	1	90°	1
16-Jul-09	15:03	50	30.031133	-80.392978	E	2	1	90°	1
16-Jul-09	15:04	51	30.027036	-80.342921	E	3	1	90°	1
16-Jul-09	15:49	65	29.968929	-80.383804	W	1	1	120°	1
16-Jul-09	16:09	71	29.967584	-80.550035	W	1	2	90°	2
16-Jul-09	16:11	73	29.962552	-80.629539	W	1	1	120°	1
17-Jul-09	9:51	11	30.434294	-80.636898	W	8	1	75°	1
17-Jul-09	10:38	20	30.566451	-80.575521	W	10	2	75°	1
4-Aug-09	11:58	3	30.567790	-80.647958	E	10	2	90°	2
4-Aug-09	12:24	8	30.566594	-80.316750	E	10	2	90°	3
4-Aug-09	12:33	8	30.560334	-80.167957	E	10	3	90°	1
4-Aug-09	12:56	14	30.502631	-80.224083	W	9	2	80°	1
4-Aug-09	12:57	13	30.500670	-80.271799	W	9	2	110°	1
4-Aug-09	12:59	15	30.501289	-80.325398	W	9	2	80°	1
4-Aug-09	13:01	15	30.504542	-80.409434	W	9	2	90°	1
4-Aug-09	13:02	16	30.510737	-80.427383	W	9	2	90°	1
4-Aug-09	13:10	18	30.500800	-80.518322	W	9	2	90°	1
4-Aug-09	13:12	19	30.501112	-80.598167	W	9	2	110°	1
4-Aug-09	13:20	22	30.438471	-80.560492	E	8	3	80°	3

Table 14 (continued). All loggerhead sea turtle (*Caretta caretta*) sightings in the proposed USWTR site off Jacksonville, Florida for aerial surveys conducted from January 2009 – June 2010.

Date	Time	Waypoint	Latitude	Longitude -1	Heading	Track Number	Angle Out	Degree Forward	Best Number
4-Aug-09	13:39	27	30.432193	-80.285353	E	8	3	100°	1
4-Aug-09	14:12	29	30.374500	-80.301723	W	7	3	90°	2
4-Aug-09	14:16	30	30.369755	-80.421294	W	7	1	90°	1
4-Aug-09	14:18	32	30.365380	-80.516626	W	7	3	90°	1
4-Aug-09	14:20	33	30.364738	-80.585105	W	7	1	90°	1
4-Aug-09	14:33	42	30.299321	-80.630179	E	6	1	90°	1
4-Aug-09	14:33	40	30.299621	-80.620791	E	6	3	90°	1
4-Aug-09	14:44	45	30.298889	-80.427273	E	6	2	90°	1
4-Aug-09	14:45	47	30.298179	-80.400124	E	6	2	110°	1
4-Aug-09	14:48	48	30.297485	-80.278407	E	6	3	80°	1
4-Aug-09	15:26	55	30.230947	-80.541866	W	5	1	90°	1
5-Aug-09	8:59	6	29.966658	-80.607427	E	1	1	90°	1
5-Aug-09	8:59	4	29.966624	-80.606248	E	1	2	100°	1
5-Aug-09	9:40	12	30.031052	-80.451696	W	2	1	90°	1
5-Aug-09	9:42	13	30.032194	-80.543009	W	2	1	90°	1
5-Aug-09	9:50	16	30.099232	-80.663013	E	3	1	90°	1
5-Aug-09	9:53	20	30.101678	-80.543657	E	3	2	90°	1
5-Aug-09	9:54	21	30.101754	-80.532500	E	3	1	90°	1
5-Aug-09	9:54	22	30.100723	-80.516654	E	3	2	130°	1
5-Aug-09	9:57	17	30.100903	-80.412442	E	3	2	110°	1
5-Aug-09	10:53	35	30.230984	-80.681895	E	5	1	90°	1
5-Aug-09	10:53	36	30.230914	-80.664922	E	5	2	90°	1
5-Aug-09	10:56	37	30.232822	-80.582348	E	5	1	90°	1
5-Aug-09	11:09	27	30.232308	-80.100197	E	5	2	75°	4
5-Aug-09	11:36	45	30.299509	-80.446844	W	6	2	90°	1
5-Aug-09	11:41	32	30.300757	-80.636146	W	6	2	75°	2
5-Aug-09	13:27	52	30.365963	-80.508112	E	7	1	90°	1
6-Aug-09	8:58	5	29.962288	-80.569651	E	1	1	75°	1
6-Aug-09	9:58	10	30.031892	-80.472325	W	2	1	60°	1
6-Aug-09	10:11	21	30.103335	-80.469843	E	3	2	120°	1
6-Aug-09	10:13	16	30.101228	-80.385927	E	3	1	75°	1
6-Aug-09	11:07	21	30.164081	-80.348063	W	4	1	75°	1
6-Aug-09	11:08	22	30.162811	-80.369395	W	4	2	90°	1
6-Aug-09	11:11	25	30.163070	-80.492969	W	4	1	90°	2
6-Aug-09	11:13	27	30.170337	-80.604644	W	4	1	75°	1
6-Aug-09	11:25	30	30.494894	-80.675080	E	9	1	90°	1
6-Aug-09	11:30	33	30.501326	-80.510776	E	9	2	90°	1
6-Aug-09	12:28	41	30.565246	-80.502121	W	10	2	90°	2
6-Aug-09	12:30	47	30.565444	-80.582338	W	10	2	90°	1

Table 14 (continued). All loggerhead sea turtle (*Caretta caretta*) sightings in the proposed USWTR site off Jacksonville, Florida for aerial surveys conducted from January 2009 – June 2010.

Date	Time	Waypoint	Latitude	Longitude -1	Heading	Track Number	Angle Out	Degree Forward	Best Number
6-Aug-09	12:31	44	30.566159	-80.606290	W	10	1	90°	2
6-Aug-09	12:32	45	30.567010	-80.635041	W	10	1	60°	1
14-Sep-09	12:16	4	30.565153	-80.070534	E	10	1	90°	1
15-Sep-09	9:38	4	29.966616	-80.608965	E	1	1	90°	1
15-Sep-09	9:38	2	29.966575	-80.612117	E	1	1	90°	1
15-Sep-09	9:40	4	29.966192	-80.518688	E	1	2	110°	1
15-Sep-09	10:29	15	30.033682	-80.363872	W	2	1	90°	1
15-Sep-09	10:35	16	30.031342	-80.554592	W	2	2	45°	1
15-Sep-09	10:35	12	30.031333	-80.555969	W	2	2	90°	1
15-Sep-09	11:13	19	30.101363	-80.512162	E	3	2	90°	1
15-Sep-09	11:54	24	30.162316	-80.437389	W	4	3	80°	1
15-Sep-09	12:16	42	30.232158	-80.649082	E	5	2	135°	1
15-Sep-09	12:20	29	30.233227	-80.522898	E	5	2	90°	1
15-Sep-09	12:24	45	30.231676	-80.388550	E	5	1	90°	1
15-Sep-09	12:24	30	30.231731	-80.386280	E	5	1	90°	1
15-Sep-09	12:25	46	30.232784	-80.363975	E	5	2	60°	1
15-Sep-09	13:07	35	30.300245	-80.436785	W	6	2	75°	2
15-Sep-09	15:18	67	30.365265	-80.567799	E	7	2	60°	1
15-Sep-09	15:18	40	30.365213	-80.565675	E	7	1	75°	1
15-Sep-09	15:32	73	30.365124	-80.418794	E	7	2	75°	1
15-Sep-09	15:32	74	30.364638	-80.394295	E	7	1	90°	1
15-Sep-09	15:32	44	30.364985	-80.411069	E	7	1	90°	1
15-Sep-09	16:29	54	30.496631	-80.605218	E	9	2	75°	1
15-Sep-09	16:41	99	30.501491	-80.458835	E	9	1	75°	1
15-Sep-09	17:40	119	30.547411	-80.633760	W	10	1	90°	1
16-Sep-09	10:18	4	29.962952	-80.679307	E	1	1	90°	1
16-Sep-09	10:19	5	29.963136	-80.640004	E	1	2	90°	1
16-Sep-09	10:32	8	29.964361	-80.527422	E	1	1	90°	1
16-Sep-09	10:33	9	29.963691	-80.482406	E	1	2	90°	3
16-Sep-09	10:34	11	29.963633	-80.442474	E	1	1	90°	1
16-Sep-09	10:42	14	29.965542	-80.386811	E	1	2	90°	4
16-Sep-09	10:43	15	29.965225	-80.349425	E	1	1	90°	1
16-Sep-09	10:45	17	29.964320	-80.274704	E	1	1	90°	1
16-Sep-09	11:16	24	30.033119	-80.293579	W	2	1	90°	1
16-Sep-09	11:18	25	30.033457	-80.352897	W	2	2	90°	2
16-Sep-09	11:19	26	30.032924	-80.396245	W	2	2	90°	1
16-Sep-09	11:20	27	30.032091	-80.424508	W	2	2	90°	1
16-Sep-09	11:20	28	30.031687	-80.436201	W	2	2	90°	3
16-Sep-09	11:21	29	30.031317	-80.452960	W	2	2	90°	1

Table 14 (continued). All loggerhead sea turtle (*Caretta caretta*) sightings in the proposed USWTR site off Jacksonville, Florida for aerial surveys conducted from January 2009 – June 2010.

Date	Time	Waypoint	Latitude	Longitude -1	Heading	Track Number	Angle Out	Degree Forward	Best Number
16-Sep-09	11:24	24	30.031128	-80.575448	W	2	1	90°	1
16-Sep-09	11:24	30	30.031034	-80.566742	W	2	1	90°	1
16-Sep-09	11:32	34	30.033978	-80.627837	W	2	2	90°	1
16-Sep-09	11:34	30	30.029878	-80.702953	W	2	2	90°	1
16-Sep-09	11:39	36	30.098525	-80.629402	E	3	1	110°	1
16-Sep-09	11:49	39	30.100532	-80.442080	E	3	2	90°	1
16-Sep-09	11:50	40	30.100228	-80.409473	E	3	2	90°	1
16-Sep-09	12:31	53	30.100315	-79.800106	E	3	3	110°	1
16-Sep-09	12:49	49	30.168093	-80.357524	W	4	1	90°	1
16-Sep-09	12:51	56	30.165650	-80.433371	E	4	2	75°	1
16-Sep-09	12:55	52	30.162456	-80.458258	W	4	1	90°	3
16-Sep-09	15:09	79	30.234530	-80.529314	E	5	3	90°	3
16-Sep-09	15:09	69	30.234497	-80.529988	E	5	2	90°	1
16-Sep-09	15:10	80	30.237682	-80.470385	E	5	2	90°	3
16-Sep-09	15:10	70	30.236559	-80.490840	E	5	1	90°	2
16-Sep-09	15:11	81	30.236684	-80.438196	E	5	1	90°	2
16-Sep-09	15:11	71	30.237844	-80.457926	E	5	2	90°	3
16-Sep-09	15:17	84	30.233124	-80.355071	E	5	1	90°	2
16-Sep-09	15:17	73	30.233735	-80.371003	E	5	2	90°	2
16-Sep-09	15:26	89	30.231630	-80.244055	E	5	3	110°	1
16-Sep-09	16:03	86	30.296087	-80.461053	W	6	2	90°	2
16-Sep-09	16:14	90	30.296617	-80.649919	W	6	1	90°	1
18-Sep-09	8:51	4	30.561739	-80.661433	E	10	1	100°	1
18-Sep-09	10:04	25	30.499988	-80.464967	W	9	3	90°	1
18-Sep-09	10:15	29	30.431682	-80.608594	E	8	1	90°	1
18-Sep-09	10:18	31	30.437069	-80.533298	E	8	2	90°	1
18-Sep-09	10:20	21	30.434250	-80.460581	E	8	3	90°	1
18-Sep-09	10:33	39	30.433431	-80.318742	E	8	3	90°	1
18-Sep-09	10:38	25	30.432652	-80.158687	E	8	2	60°	1
18-Sep-09	11:07	34	30.364844	-80.429390	W	7	2	60°	1
18-Sep-09	11:09	35	30.366865	-80.511661	W	7	1	45°	1
18-Sep-09	11:15	36	30.365529	-80.703672	W	7	1	60°	1
18-Sep-09	11:38	53	30.297314	-80.608639	E	6	2	90°	1
18-Sep-09	11:40	54	30.298683	-80.533877	E	6	2	90°	1
18-Sep-09	11:43	56	30.300722	-80.430700	E	6	1	90°	1
18-Sep-09	11:45	57	30.299695	-80.340926	E	6	3	90°	1
18-Sep-09	12:14	48	30.231522	-80.281195	W	5	2	90°	1
18-Sep-09	12:17	49	30.232775	-80.379031	W	5	3	60°	1
18-Sep-09	12:36	53	30.234353	-80.519232	W	5	2	60°	1

Table 14 (continued). All loggerhead sea turtle (*Caretta caretta*) sightings in the proposed USWTR site off Jacksonville, Florida for aerial surveys conducted from January 2009 – June 2010.

Date	Time	Waypoint	Latitude	Longitude -1	Heading	Track Number	Angle Out	Degree Forward	Best Number
18-Sep-09	14:26	4	30.165496	-80.683391	E	4	2	60°	1
18-Sep-09	14:27	4	30.164268	-80.639883	E	4	1	90°	1
18-Sep-09	14:27	5	30.164437	-80.658348	E	4	1	45°	2
18-Sep-09	14:29	6	30.162705	-80.591365	E	4	2	90°	2
18-Sep-09	14:29	6	30.162814	-80.596902	E	4	2	45°	1
18-Sep-09	14:36	11	30.166013	-80.532243	E	4	1	90°	2
18-Sep-09	14:37	9	30.165299	-80.524536	E	4	2	60°	2
18-Sep-09	14:42	16	30.167596	-80.431073	E	4	2	90°	5
18-Sep-09	14:42	12	30.167280	-80.424156	E	4	2	90°	3
18-Sep-09	14:44	18	30.164391	-80.358584	E	4	2	90°	1
18-Sep-09	14:45	19	30.166106	-80.330274	E	4	1	90°	2
18-Sep-09	15:22	24	30.101020	-80.546629	W	3	2	80°	1
18-Sep-09	15:22	25	30.100280	-80.569734	W	3	2	80°	1
18-Sep-09	15:24	26	30.097174	-80.610830	W	3	2	90°	1
18-Sep-09	15:25	28	30.098737	-80.649298	W	3	2	75°	1
18-Sep-09	15:57	40	30.029878	-80.578983	E	2	2	90°	1
18-Sep-09	16:02	41	30.035378	-80.394552	E	2	1	90°	1
18-Sep-09	16:04	42	30.034808	-80.346286	E	2	2	60°	1
18-Sep-09	16:41	53	29.964455	-80.388545	W	1	1	75°	1
18-Sep-09	16:42	54	29.963596	-80.428651	W	1	2	75°	1
18-Sep-09	16:44	56	29.964234	-80.527287	W	1	2	75°	1
18-Sep-09	16:46	51	29.960694	-80.608005	W	1	1	90°	1
18-Sep-09	16:46	58	29.962595	-80.590207	W	1	2	90°	1
18-Sep-09	16:47	52	29.960179	-80.624267	W	1	2	90°	1
30-Sep-09	9:06	4	29.966193	-80.637225	E	1	1	90°	1
30-Sep-09	9:21	9	29.963353	-80.462160	E	1	2	90°	1
30-Sep-09	9:22	10	29.966223	-80.423800	E	1	1	100°	1
30-Sep-09	9:23	11	29.964584	-80.374881	E	1	2	90°	1
30-Sep-09	9:24	12	29.961044	-80.334684	E	1	2	90°	1
30-Sep-09	10:26	28	30.098697	-80.639585	E	3	1	100°	1
30-Sep-09	10:27	29	30.099154	-80.616774	E	3	1	90°	1
30-Sep-09	10:30	31	30.100864	-80.510610	E	3	2	80°	1
30-Sep-09	10:43	41	30.097530	-80.324259	E	3	1	90°	2
30-Sep-09	11:16	32	30.167334	-80.266921	W	4	2	120°	1
30-Sep-09	11:19	53	30.168613	-80.378134	W	4	2	90°	1
30-Sep-09	11:20	54	30.168124	-80.428213	W	4	2	60°	1
30-Sep-09	11:20	33	30.168394	-80.420473	W	4	2	90°	1
30-Sep-09	11:20	34	30.167662	-80.439326	W	4	1	90°	1
30-Sep-09	11:21	35	30.166365	-80.466601	W	4	1	80°	1

Table 14 (continued). All loggerhead sea turtle (*Caretta caretta*) sightings in the proposed USWTR site off Jacksonville, Florida for aerial surveys conducted from January 2009 – June 2010.

Date	Time	Waypoint	Latitude	Longitude -1	Heading	Track Number	Angle Out	Degree Forward	Best Number
30-Sep-09	11:54	71	30.229963	-80.522791	E	5	1	90°	2
30-Sep-09	12:34	51	30.299750	-80.489402	W	6	1	90°	1
30-Sep-09	12:37	52	30.299627	-80.583138	W	6	1	90°	1
30-Sep-09	12:38	53	30.299259	-80.638597	W	6	2	90°	1
30-Sep-09	14:24	84	30.365876	-80.608795	E	7	2	100°	1
30-Sep-09	15:25	99	30.567214	-80.685050	E	10	2	90°	1
30-Sep-09	15:27	100	30.566844	-80.615918	E	10	1	90°	1
30-Sep-09	15:29	101	30.564384	-80.559871	E	10	2	100°	1
30-Sep-09	15:30	102	30.563252	-80.522808	E	10	2	90°	1
30-Sep-09	15:40	107	30.570568	-80.279988	E	10	1	90°	1
1-Oct-09	8:56	5	30.566280	-80.412261	E	10	2	90°	1
1-Oct-09	8:59	6	30.566459	-80.315808	E	10	2	90°	1
1-Oct-09	9:18	11	30.501690	-80.036327	W	9	2	90°	1
1-Oct-09	9:21	12	30.498908	-80.147221	W	9	1	90°	1
1-Oct-09	9:25	10	30.501110	-80.293383	W	9	2	90°	2
1-Oct-09	9:26	13	30.500256	-80.324201	W	9	1	90°	1
1-Oct-09	9:28	14	30.498443	-80.389524	W	9	2	90°	1
1-Oct-09	9:51	22	30.433829	-80.626541	E	8	1	90°	1
1-Oct-09	10:03	28	30.433167	-80.407868	E	8	1	90°	1
1-Oct-09	10:51	43	30.365082	-80.310985	W	7	1	90°	1
1-Oct-09	10:51	44	30.365015	-80.320297	W	7	2	90°	2
1-Oct-09	10:56	45	30.366736	-80.494618	W	7	1	90°	1
1-Oct-09	10:57	47	30.367452	-80.556508	W	7	1	90°	1
1-Oct-09	10:58	27	30.367006	-80.561171	W	7	3	90°	1
1-Oct-09	11:17	55	30.296286	-80.512807	E	6	1	90°	1
1-Oct-09	11:21	56	30.297207	-80.357373	E	6	1	90°	1
1-Oct-09	11:22	57	30.297206	-80.340285	E	6	1	90°	1
1-Oct-09	11:44	35	30.233482	-80.020490	W	5	1	90°	1
1-Oct-09	11:58	38	30.231068	-80.377144	W	5	1	90°	1
1-Oct-09	12:01	39	30.234393	-80.492413	W	5	1	90°	1
1-Oct-09	12:04	64	30.232671	-80.590933	W	5	1	90°	1
1-Oct-09	12:05	65	30.232120	-80.629150	W	5	3	90°	1
1-Oct-09	12:05	66	30.232097	-80.651418	W	5	2	90°	2
1-Oct-09	14:01	81	30.165305	-80.590182	E	4	2	90°	2
1-Oct-09	14:10	86	30.165406	-80.535760	E	4	1	90°	2
1-Oct-09	14:11	87	30.166143	-80.513385	E	4	2	90°	2
1-Oct-09	14:11	88	30.166431	-80.495764	E	4	1	90°	1
1-Oct-09	14:16	92	30.162858	-80.399396	E	4	3	90°	2
1-Oct-09	14:58	102	30.100513	-80.283820	W	3	2	90°	1

Table 14 (continued). All loggerhead sea turtle (*Caretta caretta*) sightings in the proposed USWTR site off Jacksonville, Florida for aerial surveys conducted from January 2009 – June 2010.

Date	Time	Waypoint	Latitude	Longitude -1	Heading	Track Number	Angle Out	Degree Forward	Best Number
1-Oct-09	15:04	67	30.101724	-80.481887	W	3	3	90°	1
1-Oct-09	15:05	104	30.101996	-80.502765	W	3	1	90°	1
1-Oct-09	15:06	105	30.102238	-80.553790	W	3	1	90°	1
1-Oct-09	15:09	106	30.101755	-80.635778	W	3	2	90°	2
1-Oct-09	15:10	107	30.102546	-80.677445	W	3	2	90°	1
1-Oct-09	15:20	115	30.031617	-80.664644	E	2	2	90°	4
1-Oct-09	15:23	117	30.028819	-80.539874	E	2	2	90°	1
1-Oct-09	15:30	118	30.032029	-80.280653	E	2	2	90°	1
1-Oct-09	15:33	78	30.031802	-80.192395	E	2	1	90°	1
1-Oct-09	16:05	126	29.966803	-80.486004	W	1	2	90°	1
1-Oct-09	16:06	84	29.967737	-80.528164	W	1	2	90°	1
1-Oct-09	16:08	85	29.964699	-80.609571	W	1	1	90°	1
17-Nov-09	13:46	14	30.497981	-80.608554	W	9	1	45°	1
18-Nov-09	9:24	18	30.031563	-80.281005	W	2	1	90°	1
18-Nov-09	9:25	19	30.031432	-80.320789	W	2	1	90°	1
18-Nov-09	9:40	22	30.100308	-80.632180	E	3	1	90°	1
18-Nov-09	9:41	21	30.100346	-80.599675	E	3	2	100°	1
18-Nov-09	9:57	27	30.099592	-80.480660	E	3	2	110°	2
18-Nov-09	10:10	29	30.100742	-79.994173	E	3	2	125°	4
18-Nov-09	10:12	30	30.100583	-79.916373	E	3	2	90°	2
18-Nov-09	10:57	41	30.233074	-80.496728	E	5	2	120°	2
18-Nov-09	13:46	66	30.567595	-80.606113	E	10	1	120°	2
18-Nov-09	14:32	74	30.498722	-80.549057	W	9	1	90°	1
18-Nov-09	14:33	75	30.498640	-80.584340	W	9	1	80°	2
18-Nov-09	14:42	79	30.433646	-80.579279	E	8	3	110°	3
20-Nov-09	9:11	7	29.966521	-80.601115	E	1	1	90°	1
8-Dec-09	12:35	25	30.166432	-80.261243	E	4	1	90°	1
8-Dec-09	13:10	31	30.100306	-80.534221	W	3	1	100°	1
8-Dec-09	13:47	38	29.965570	-79.823295	E	2	2	90°	1
22-Dec-09	8:54	3	29.965498	-80.401568	E	1	1	80°	1
22-Dec-09	8:58	4	29.965947	-80.244734	E	1	1	75°	1
22-Dec-09	9:18	8	30.031820	-79.988273	W	2	2	90°	1
22-Dec-09	9:32	10	30.031990	-80.516822	W	2	1	90°	1
22-Dec-09	9:35	11	30.031993	-80.622506	W	2	1	90°	1
22-Dec-09	10:35	21	30.100800	-80.324777	E	3	1	110°	1
22-Dec-09	10:36	22	30.100410	-80.283564	E	3	2	100°	1
22-Dec-09	11:31	33	30.232466	-80.545990	E	5	1	90°	1
22-Dec-09	11:33	34	30.232962	-80.468077	E	5	2	100°	1
22-Dec-09	11:36	35	30.233110	-80.332826	E	5	1	80°	1

Table 14 (continued). All loggerhead sea turtle (*Caretta caretta*) sightings in the proposed USWTR site off Jacksonville, Florida for aerial surveys conducted from January 2009 – June 2010.

Date	Time	Waypoint	Latitude	Longitude -1	Heading	Track Number	Angle Out	Degree Forward	Best Number
22-Dec-09	12:06	34	30.300584	-80.275585	W	6	2	90°	1
22-Dec-09	12:07	35	30.300488	-80.291179	W	6	1	90°	1
22-Dec-09	14:05	44	30.365169	-80.549155	E	7	2	60°	1
22-Dec-09	14:07	51	30.365643	-80.485548	E	7	1	90°	1
22-Dec-09	14:49	51	30.433780	-80.375603	W	8	2	90°	2
22-Dec-09	15:09	65	30.499047	-80.505264	E	9	1	90°	1
22-Dec-09	15:14	67	30.499460	-80.302333	E	9	1	90°	1
22-Dec-09	15:15	68	30.499046	-80.270865	E	9	1	100°	1
22-Dec-09	16:11	65	30.567508	-80.285777	W	10	2	90°	1
22-Dec-09	16:23	67	30.567339	-80.424851	W	10	3	120°	1
7-Jan-10	10:32	6	30.030968	-80.257298	W	2	1	80°	1
7-Jan-10	10:39	7	30.030648	-80.491165	W	2	1	60°	1
7-Jan-10	11:57	21	30.165740	-80.441015	W	4	1	90°	1
7-Jan-10	13:14	33	30.299153	-80.557557	W	6	1	90°	1
7-Jan-10	14:59	40	30.366124	-80.667015	E	7	1	75°	1
7-Jan-10	15:25	43	30.368561	-80.481447	E	7	1	75°	1
7-Jan-10	15:30	44	30.367835	-80.287313	E	7	2	90°	1
7-Jan-10	16:16	52	30.432587	-80.392421	W	8	1	90°	1
7-Jan-10	16:25	55	30.432106	-80.493542	W	8	1	90°	2
7-Jan-10	16:27	56	30.432251	-80.551611	W	8	1	80°	1
7-Jan-10	16:35	55	30.496968	-80.652018	E	9	2	90°	1
7-Jan-10	16:37	59	30.499347	-80.583876	E	9	1	100°	1
7-Jan-10	16:37	56	30.499251	-80.585836	E	9	1	90°	1
7-Jan-10	16:38	57	30.500025	-80.538136	E	9	1	90°	1
7-Jan-10	16:40	59	30.500468	-80.474392	E	9	2	90°	1
7-Jan-10	17:26	63	30.565993	-80.585532	W	10	1	110°	1
19-Jan-10	9:56	10	30.434127	-80.352844	E	8	1	90°	1
19-Jan-10	10:00	11	30.434214	-80.209340	E	8	1	90°	1
19-Jan-10	11:39	29	30.232290	-80.274277	W	5	2	90°	1
19-Jan-10	13:35	37	30.166912	-80.625587	E	4	2	90°	1
19-Jan-10	13:38	36	30.167246	-80.536419	E	4	1	90°	1
19-Jan-10	13:39	38	30.167453	-80.494497	E	4	2	90°	2
19-Jan-10	13:45	39	30.168020	-80.272495	E	4	2	90°	1
19-Jan-10	13:46	38	30.167973	-80.262807	E	4	1	90°	1
19-Jan-10	14:41	48	30.099499	-80.658473	W	3	2	90°	1
19-Jan-10	15:57	68	29.964911	-80.644896	W	1	1	90°	1
20-Jan-10	9:06	5	29.966060	-80.596401	E	1	2	75°	1
20-Jan-10	9:13	8	29.966369	-80.295468	E	1	1	90°	2
20-Jan-10	9:53	16	30.031389	-80.358517	W	2	2	110°	1

Table 14 (continued). All loggerhead sea turtle (*Caretta caretta*) sightings in the proposed USWTR site off Jacksonville, Florida for aerial surveys conducted from January 2009 – June 2010.

Date	Time	Waypoint	Latitude	Longitude -1	Heading	Track Number	Angle Out	Degree Forward	Best Number
20-Jan-10	10:20	24	30.030491	-80.694715	W	2	3	80°	1
20-Jan-10	10:20	25	30.030468	-80.697535	W	2	2	110°	1
20-Jan-10	10:40	32	30.100783	-80.408151	E	3	2	90°	1
20-Jan-10	10:43	40	30.100923	-80.321203	E	3	1	90°	1
20-Jan-10	10:44	33	30.100972	-80.272217	E	3	3	100°	1
20-Jan-10	10:44	34	30.100979	-80.270201	E	3	1	60°	1
20-Jan-10	11:32	54	30.165784	-80.588996	W	4	1	80°	1
20-Jan-10	11:33	47	30.165797	-80.615828	W	4	3	90°	1
20-Jan-10	11:50	61	30.233216	-80.289355	E	5	2	90°	1
20-Jan-10	14:12	85	30.364375	-80.602241	E	7	1	100°	1
20-Jan-10	14:13	86	30.367083	-80.571071	E	7	1	90°	1
20-Jan-10	14:18	93	30.366792	-80.434054	E	7	1	75°	1
20-Jan-10	14:18	74	30.366906	-80.421697	E	7	2	90°	1
20-Jan-10	14:19	75	30.366845	-80.383708	E	7	1	90°	1
20-Jan-10	14:58	109	30.432392	-80.231867	W	8	1	100°	1
20-Jan-10	15:00	110	30.432475	-80.324133	W	8	1	110°	1
20-Jan-10	15:03	84	30.432418	-80.412123	W	8	3	90°	2
20-Jan-10	15:04	85	30.431974	-80.464450	W	8	1	90°	1
20-Jan-10	15:10	88	30.431516	-80.586286	W	8	1	90°	2
20-Jan-10	15:17	119	30.499211	-80.645100	E	9	1	75°	1
27-Jan-10	10:50	8	30.497974	-80.588156	W	9	1	90°	1
27-Jan-10	11:41	17	30.365127	-80.337588	W	7	1	75°	1
27-Jan-10	14:58	33	30.167814	-80.655985	E	4	3	60°	1
27-Jan-10	15:03	34	30.167399	-80.480802	E	4	3	110°	1
27-Jan-10	16:56	51	29.964212	-80.519861	W	1	1	110°	1
27-Jan-10	16:58	52	29.963735	-80.612545	W	1	1	80°	1
28-Jan-10	9:44	9	29.966246	80.443662	E	1	1	90°	1
28-Jan-10	9:44	8	29.966243	-80.444693	E	1	2	90°	1
28-Jan-10	9:46	10	29.966443	-80.375928	E	1	3	90°	1
28-Jan-10	11:11	32	30.031393	-80.473511	W	2	2	100°	1
28-Jan-10	11:12	33	30.031482	-80.498770	W	2	2	90°	1
28-Jan-10	11:12	34	30.031421	-80.510538	W	2	2	90°	1
28-Jan-10	11:15	36	30.030842	-80.627892	W	2	1	90°	1
28-Jan-10	12:00	51	30.100546	-80.472517	E	3	2	80°	1
28-Jan-10	12:00	44	30.100648	-80.451952	E	3	2	90°	1
28-Jan-10	12:38	62	30.166299	-80.236667	W	4	1	75°	1
28-Jan-10	12:43	57	30.166211	-80.416667	W	4	2	90°	1
28-Jan-10	12:48	60	30.166066	-80.545775	W	4	2	90°	1
28-Jan-10	15:12	73	30.233323	-80.463677	E	5	2	90°	1

Table 14 (continued). All loggerhead sea turtle (*Caretta caretta*) sightings in the proposed USWTR site off Jacksonville, Florida for aerial surveys conducted from January 2009 – June 2010.

Date	Time	Waypoint	Latitude	Longitude -1	Heading	Track Number	Angle Out	Degree Forward	Best Number
28-Jan-10	15:13	74	30.233805	-80.436569	E	5	2	90°	1
28-Jan-10	15:14	75	30.233810	-80.407492	E	5	3	100°	1
28-Jan-10	15:29	89	30.233469	-80.350920	E	5	2	90°	2
28-Jan-10	15:31	90	30.234176	-80.287473	E	5	1	90°	1
28-Jan-10	15:31	78	30.233991	-80.276257	E	5	3	60°	1
28-Jan-10	16:22	92	30.299338	-80.402664	W	6	2	80°	1
28-Jan-10	16:29	93	30.299004	-80.637224	W	6	3	110°	1
19-Feb-10	10:18	10	30.099968	-80.614461	E	3	1	90°	1
19-Feb-10	11:58	22	30.300214	-80.500372	W	6	2	110°	1
19-Feb-10	12:02	24	30.300069	-80.611535	W	6	2	90°	1
19-Feb-10	13:44	25	30.365414	-80.562004	E	7	3	90°	1
19-Feb-10	13:47	26	30.365483	-80.477107	E	7	1	90°	1
19-Feb-10	13:54	29	30.366759	-80.328203	W	7	2	90°	1
19-Feb-10	14:38	43	30.433555	-80.472532	W	8	2	100°	2
19-Feb-10	14:49	40	30.498968	-80.626622	W	9	2	90°	1
19-Feb-10	14:51	42	30.499062	-80.577891	W	9	1	90°	1
19-Feb-10	14:52	43	30.499250	-80.514702	W	9	1	90°	1
19-Feb-10	15:31	50	30.567223	-80.365963	W	10	2	90°	2
19-Feb-10	15:37	53	30.566714	-80.603203	W	10	1	90°	1
19-Feb-10	15:39	55	30.566545	-80.666463	W	10	1	90°	2
20-Feb-10	9:44	5	30.565864	-80.625436	E	10	2	90°	3
20-Feb-10	9:44	6	30.565775	-80.623834	E	10	3	90°	1
20-Feb-10	9:45	7	30.566162	-80.585383	E	10	2	110°	1
20-Feb-10	9:53	8	30.566702	-80.321080	E	10	1	90°	1
20-Feb-10	9:54	9	30.566794	-80.266321	E	10	1	90°	1
20-Feb-10	10:22	10	30.499951	-80.217201	W	9	1	90°	1
20-Feb-10	10:23	21	30.499918	-80.260149	W	9	3	90°	2
20-Feb-10	10:24	13	30.499748	-80.303568	W	9	2	90°	2
20-Feb-10	10:24	22	30.499839	-80.278145	W	9	2	90°	1
20-Feb-10	10:30	26	30.499763	-80.377635	W	9	1	90°	1
20-Feb-10	10:31	27	30.499840	-80.399430	W	9	1	90°	1
20-Feb-10	10:39	31	30.499597	-80.485433	W	9	2	90°	1
20-Feb-10	10:40	32	30.499557	-80.537593	W	9	3	120°	1
20-Feb-10	10:41	33	30.499539	-80.580633	W	9	3	90°	5
20-Feb-10	10:41	34	30.499540	-80.585648	W	9	2	90°	2
20-Feb-10	10:42	20	30.499498	-80.595415	W	9	2	90°	3
20-Feb-10	10:49	37	30.499951	-80.646232	W	9	3	110°	2
20-Feb-10	10:50	38	30.499167	-80.684272	W	9	2	120°	1
20-Feb-10	11:17	29	30.433001	-80.498033	E	8	1	90°	3

Table 14 (continued). All loggerhead sea turtle (*Caretta caretta*) sightings in the proposed USWTR site off Jacksonville, Florida for aerial surveys conducted from January 2009 – June 2010.

Date	Time	Waypoint	Latitude	Longitude -1	Heading	Track Number	Angle Out	Degree Forward	Best Number
20-Feb-10	11:18	43	30.433422	-80.455525	E	8	1	110°	1
20-Feb-10	11:25	32	30.433512	-80.212100	E	8	2	90°	1
20-Feb-10	11:51	53	30.366200	-80.223566	W	7	1	90°	1
20-Feb-10	11:53	55	30.366056	-80.302827	W	7	1	30°	1
20-Feb-10	11:54	56	30.365928	-80.351623	W	7	3	90°	1
20-Feb-10	11:58	57	30.365756	-80.482424	W	7	3	130°	1
20-Feb-10	12:00	39	30.365752	-80.578061	W	7	2	90°	1
20-Feb-10	12:13	46	30.298076	-80.662381	E	6	1	90°	1
20-Feb-10	12:14	47	30.299376	-80.630461	E	6	2	90°	1
20-Feb-10	12:14	62	30.299111	-80.644859	E	6	2	145°	1
20-Feb-10	12:47	63	30.300131	-80.280769	E	6	2	90°	1
20-Feb-10	13:32	85	30.232779	-80.464949	W	5	3	90°	1
20-Feb-10	13:37	83	30.233441	-80.513720	W	5	2	90°	1
20-Feb-10	15:29	100	30.166229	-80.399973	E	4	1	90°	1
20-Feb-10	15:32	102	30.166474	-80.279310	E	4	1	90°	1
20-Feb-10	15:32	105	30.166356	-80.272266	E	4	1	90°	1
20-Feb-10	16:12	118	30.100528	-80.482959	W	3	2	100°	1
20-Feb-10	16:28	125	30.031373	-80.592192	E	2	2	110°	1
20-Feb-10	16:30	126	30.031640	-80.515057	E	2	2	90°	1
20-Feb-10	16:38	123	30.031639	-80.286655	E	2	2	90°	1
21-Feb-10	8:38	4	29.965243	-80.505803	E	1	2	90°	1
21-Feb-10	8:46	10	29.965437	-80.188799	E	1	1	90°	1
21-Feb-10	8:52	8	29.965144	-79.955871	E	1	3	90°	1
21-Feb-10	8:52	9	29.965056	-79.932900	E	1	2	90°	1
21-Feb-10	9:31	25	30.032338	-80.463837	W	2	1	75°	1
21-Feb-10	10:10	36	30.100339	-80.301111	E	3	1	80°	1
21-Feb-10	10:38	44	30.166338	-80.064786	W	4	1	60°	1
21-Feb-10	10:52	49	30.166730	-80.268801	W	4	2	90°	1
21-Feb-10	10:55	51	30.166745	-80.391231	W	4	2	80°	1
21-Feb-10	10:56	52	30.166688	-80.437198	W	4	1	90°	3
21-Feb-10	10:58	53	30.166491	-80.509623	W	4	1	90°	2
21-Feb-10	11:11	54	30.166056	-80.683378	W	4	2	90°	1
21-Feb-10	11:24	63	30.232575	-80.617937	E	5	1	90°	1
21-Feb-10	11:33	68	30.232177	-80.513457	E	5	1	90°	3
21-Feb-10	11:44	73	30.232581	-80.437825	E	5	2	90°	1
21-Feb-10	11:46	74	30.232836	-80.372772	E	5	2	90°	1
21-Feb-10	12:31	77	30.301000	-80.257254	W	6	2	90°	4
21-Feb-10	12:36	79	30.300284	-80.448465	W	6	1	90°	2
21-Feb-10	14:34	108	30.365615	-80.505194	E	7	1	90°	1

Table 14 (continued). All loggerhead sea turtle (*Caretta caretta*) sightings in the proposed USWTR site off Jacksonville, Florida for aerial surveys conducted from January 2009 – June 2010.

Date	Time	Waypoint	Latitude	Longitude -1	Heading	Track Number	Angle Out	Degree Forward	Best Number
21-Feb-10	14:55	102	30.365630	-80.296967	E	7	1	80°	1
21-Feb-10	15:37	134	30.433569	-80.207054	W	8	2	90°	3
21-Feb-10	15:38	135	30.433789	-80.278162	W	8	1	90°	1
21-Feb-10	15:47	141	30.433407	-80.490761	W	8	2	110°	1
21-Feb-10	15:47	119	30.433246	-80.484685	W	8	1	90°	1
21-Feb-10	15:55	144	30.497951	-80.666477	E	9	2	100°	1
21-Feb-10	15:57	146	30.498829	-80.609646	E	9	2	110°	1
21-Feb-10	15:58	147	30.499157	-80.574456	E	9	3	90°	3
21-Feb-10	15:59	148	30.498906	-80.508135	E	9	3	90°	2
21-Feb-10	16:08	153	30.499461	-80.268270	E	9	2	90°	1
21-Feb-10	16:10	154	30.499649	-80.219302	E	9	1	90°	1
21-Feb-10	16:11	129	30.499532	-80.188571	E	9	1	60°	1
21-Feb-10	16:32	157	30.567109	-80.165184	W	10	1	90°	1
21-Feb-10	16:34	158	30.567080	-80.230362	W	10	1	90°	1
21-Feb-10	16:35	159	30.567262	-80.254747	W	10	1	90°	2
21-Feb-10	16:40	164	30.567120	-80.341537	W	10	1	90°	1
21-Feb-10	16:47	140	30.566800	-80.579505	W	10	1	90°	1
20-Mar-10	9:26	4	29.965543	-80.373441	W	1	2	100°	1
20-Mar-10	9:26	5	29.965475	-80.386834	E	1	2	90°	1
20-Mar-10	9:57	13	30.032581	-80.274625	E	2	1	90°	1
20-Mar-10	10:05	17	30.032270	-80.466821	W	2	2	90°	1
20-Mar-10	10:18	20	30.031629	-80.649836	W	2	1	90°	1
20-Mar-10	12:52	34	30.099767	-80.626413	W	3	1	90°	1
20-Mar-10	13:37	34	30.166559	-80.206622	W	4	2	90°	1
20-Mar-10	13:38	35	30.166644	-80.221309	W	4	1	90°	1
20-Mar-10	13:45	40	30.166394	-80.353119	W	4	2	90°	1
20-Mar-10	13:47	41	30.166730	-80.430771	W	4	1	90°	1
20-Mar-10	13:48	42	30.166579	-80.471078	W	4	1	90°	1
20-Mar-10	13:57	45	30.166433	-80.565088	W	4	1	90°	1
20-Mar-10	14:00	58	30.166232	-80.679204	E	4	1	75°	1
20-Mar-10	14:00	46	30.166079	-80.663821	W	4	1	90°	1
20-Mar-10	14:05	49	30.232255	-80.621980	E	5	1	90°	1
20-Mar-10	14:07	61	30.232486	-80.522047	W	5	1	90°	3
20-Mar-10	14:09	62	30.232586	-80.460650	W	5	1	90°	3
20-Mar-10	14:11	64	30.232840	-80.347943	W	5	1	90°	1
20-Mar-10	14:39	57	30.300439	-80.216354	W	6	1	90°	1
20-Mar-10	14:55	63	30.301162	-80.439892	W	6	2	90°	1
20-Mar-10	14:56	85	30.300364	-80.474801	E	6	2	145°	1
20-Mar-10	14:59	87	30.300022	-80.601604	E	6	2	90°	2

Table 14 (continued). All loggerhead sea turtle (*Caretta caretta*) sightings in the proposed USWTR site off Jacksonville, Florida for aerial surveys conducted from January 2009 – June 2010.

Date	Time	Waypoint	Latitude	Longitude -1	Heading	Track Number	Angle Out	Degree Forward	Best Number
20-Mar-10	15:04	66	30.364085	-80.672022	E	7	1	90°	1
20-Mar-10	15:05	68	30.365132	-80.622735	E	7	2	90°	1
20-Mar-10	15:06	91	30.365252	-80.594722	W	7	2	90°	1
20-Mar-10	15:09	71	30.365471	-80.468543	E	7	2	90°	2
20-Mar-10	15:14	74	30.365686	-80.293390	E	7	2	90°	1
20-Mar-10	15:25	104	30.364523	-80.218230	W	7	2	90°	1
20-Mar-10	15:26	105	30.365535	-80.188521	W	7	2	90°	1
20-Mar-10	15:51	85	30.433802	-80.178189	W	8	2	90°	1
20-Mar-10	15:56	88	30.433446	-80.305929	W	8	1	90°	1
20-Mar-10	16:05	124	30.433720	-80.427749	E	8	1	90°	1
20-Mar-10	16:05	91	30.433679	-80.464695	W	8	3	90°	2
20-Mar-10	16:06	125	30.433523	-80.508589	E	8	2	90°	2
20-Mar-10	16:08	92	30.433309	-80.584302	W	8	2	90°	2
20-Mar-10	16:10	93	30.433423	-80.669506	W	8	1	90°	1
24-Mar-10	9:06	4	30.567294	-80.486973	E	10	2	90°	1
24-Mar-10	9:09	5	30.567326	-80.379917	E	10	2	100°	1
24-Mar-10	9:44	11	30.498713	-80.150725	W	9	2	110°	2
24-Mar-10	9:48	12	30.498978	-80.314899	W	9	1	90°	1
24-Mar-10	9:54	12	30.498803	-80.522280	W	9	2	110°	1
24-Mar-10	9:56	15	30.498500	-80.589576	W	9	1	80°	1
24-Mar-10	9:56	13	30.498499	-80.598616	W	9	1	75°	1
24-Mar-10	9:57	14	30.498289	-80.649904	W	9	2	90°	1
24-Mar-10	10:02	18	30.426862	-80.689727	E	8	1	100°	1
24-Mar-10	10:03	19	30.433451	-80.632588	E	8	1	90°	2
24-Mar-10	10:08	21	30.434016	-80.474235	E	8	2	90°	2
24-Mar-10	10:26	26	30.433955	-80.313701	E	8	1	100°	1
24-Mar-10	10:26	19	30.434115	-80.288908	E	8	1	110°	1
24-Mar-10	11:33	47	30.365562	-80.522841	W	7	1	60°	1
24-Mar-10	11:34	33	30.364885	-80.549990	W	7	1	90°	1
24-Mar-10	11:38	35	30.364613	-80.688866	W	7	2	90°	1
24-Mar-10	11:57	54	30.300623	-80.530066	E	6	2	75°	1
24-Mar-10	12:57	51	30.231972	-80.378059	W	5	1	90°	1
24-Mar-10	12:58	75	30.232259	-80.439790	W	5	1	75°	1
24-Mar-10	12:59	53	30.232141	-80.461687	W	5	1	90°	2
24-Mar-10	13:02	54	30.231948	-80.581830	W	5	1	75°	1
24-Mar-10	13:04	77	30.231922	-80.642595	W	5	2	60°	1
31-Mar-10	14:19	14	30.032073	-80.471281	W	2	2	90°	1
31-Mar-10	14:21	15	30.031944	-80.530676	W	2	2	110°	1
31-Mar-10	15:31	37	30.166325	-80.491997	W	4	1	90°	1

Table 14 (continued). All loggerhead sea turtle (*Caretta caretta*) sightings in the proposed USWTR site off Jacksonville, Florida for aerial surveys conducted from January 2009 – June 2010.

Date	Time	Waypoint	Latitude	Longitude -1	Heading	Track Number	Angle Out	Degree Forward	Best Number
31-Mar-10	15:40	31	30.166106	-80.655086	W	4	1	90°	1
31-Mar-10	15:40	32	30.166241	-80.673845	W	4	1	110°	1
31-Mar-10	15:52	44	30.498571	-80.656912	E	9	2	90°	2
31-Mar-10	15:52	35	30.498559	-80.656648	E	9	2	100°	1
31-Mar-10	15:53	36	30.498905	-80.631751	E	9	2	90°	3
31-Mar-10	15:54	45	30.499012	-80.597075	E	9	3	90°	3
31-Mar-10	15:54	46	30.499101	-80.573123	E	9	3	90°	3
31-Mar-10	15:54	37	30.499011	-80.592174	E	9	1	80°	2
31-Mar-10	15:55	47	30.499190	-80.531806	E	9	1	90°	3
31-Mar-10	16:17	48	30.499380	-80.221563	E	9	1	90°	1
31-Mar-10	17:13	93	30.566988	-80.502750	W	10	1	90°	1
31-Mar-10	17:13	68	30.567004	-80.499043	W	10	2	100°	1
31-Mar-10	17:15	70	30.566757	-80.597297	W	10	3	90°	1
31-Mar-10	17:16	94	30.566684	-80.619658	W	10	2	90°	5
31-Mar-10	17:16	71	30.566666	-80.648355	W	10	2	90°	2
31-Mar-10	17:17	95	30.566536	-80.685169	W	10	2	90°	5
31-Mar-10	17:17	72	30.566599	-80.675692	W	10	2	90°	1
1-Apr-10	10:42	18	30.366136	-80.366103	W	7	1	90°	1
1-Apr-10	10:46	21	30.365953	-80.516308	W	7	1	80°	1
1-Apr-10	12:29	35	30.233081	-80.444576	W	5	1	80°	1
1-Apr-10	14:17	48	30.165302	-80.697645	E	4	2	90°	1
1-Apr-10	14:19	49	30.165708	-80.644909	E	4	2	60°	1
1-Apr-10	14:33	60	30.166213	-80.433398	E	4	2	110°	1
1-Apr-10	15:47	90	30.100436	-80.498892	W	3	2	90°	1
1-Apr-10	15:48	91	30.100358	-80.529854	W	3	3	90°	1
1-Apr-10	15:49	92	30.100327	-80.550423	W	3	1	90°	1
1-Apr-10	15:52	95	30.100071	-80.682629	W	3	1	120°	1
1-Apr-10	15:57	98	30.031726	-80.668162	E	2	1	90°	1
1-Apr-10	15:58	99	30.031326	-80.635289	E	2	2	110°	1
1-Apr-10	15:58	100	30.031349	-80.610825	E	2	2	90°	1
1-Apr-10	15:59	101	30.031457	-80.595225	E	2	1	100°	1
1-Apr-10	15:59	102	30.031493	-80.569883	E	2	1	60°	1
1-Apr-10	16:00	74	30.031445	-80.554016	E	2	1	90°	1
1-Apr-10	16:01	75	30.031608	-80.505776	E	2	1	75°	1
1-Apr-10	16:12	107	30.031868	-80.275036	E	2	3	90°	1
1-Apr-10	16:43	87	29.965921	-80.370883	W	1	1	90°	1
1-Apr-10	16:55	91	29.965346	-80.649167	W	1	1	90°	1
2-Apr-10	9:12	6	29.965215	-80.545697	E	1	1	90°	1
2-Apr-10	9:21	9	29.965105	-80.419148	E	1	1	90°	1

Table 14 (continued). All loggerhead sea turtle (*Caretta caretta*) sightings in the proposed USWTR site off Jacksonville, Florida for aerial surveys conducted from January 2009 – June 2010.

Date	Time	Waypoint	Latitude	Longitude -1	Heading	Track Number	Angle Out	Degree Forward	Best Number
2-Apr-10	10:48	39	30.031734	-80.610540	W	2	2	90°	2
2-Apr-10	11:01	44	30.100746	-80.532937	E	3	2	90°	1
2-Apr-10	11:01	45	30.100106	-80.507810	E	3	1	90°	2
2-Apr-10	11:53	64	30.167511	-80.259354	W	4	2	90°	1
2-Apr-10	11:59	66	30.166671	-80.399993	W	4	2	90°	1
2-Apr-10	12:00	100	30.166586	-80.454301	W	4	1	90°	1
2-Apr-10	12:01	68	30.166542	-80.482073	W	4	3	90°	1
2-Apr-10	12:23	78	30.232389	-80.671304	E	5	2	90°	2
2-Apr-10	12:24	79	30.232254	-80.650172	E	5	1	90°	2
2-Apr-10	12:24	80	30.232279	-80.627037	E	5	1	90°	2
2-Apr-10	12:26	115	30.232537	-80.561596	E	5	2	90°	2
2-Apr-10	13:18	99	30.300425	-80.218023	W	6	3	90°	1
2-Apr-10	13:26	103	30.304767	-80.309144	W	6	2	90°	1
2-Apr-10	13:37	148	30.299726	-80.674536	W	6	1	90°	1
2-Apr-10	13:37	109	30.299710	-80.678288	W	6	1	90°	1
2-Apr-10	15:21	156	30.365127	-80.652659	E	7	2	90°	2
2-Apr-10	15:21	116	30.365109	-80.650647	E	7	2	90°	3
2-Apr-10	15:22	157	30.365242	-80.611985	E	7	2	90°	1
2-Apr-10	15:23	158	30.365276	-80.590156	E	7	2	90°	3
2-Apr-10	15:24	159	30.365401	-80.545544	E	7	1	90°	1
2-Apr-10	15:24	117	30.365395	-80.528076	E	7	2	90°	3
2-Apr-10	15:25	160	30.365447	-80.515283	E	7	1	90°	1
2-Apr-10	15:26	118	30.365470	-80.474578	E	7	2	90°	1
2-Apr-10	15:28	119	30.365683	-80.384327	E	7	1	90°	2
2-Apr-10	15:29	120	30.365692	-80.365171	E	7	1	90°	1
2-Apr-10	16:22	133	30.433736	-80.248053	W	8	1	90°	1
2-Apr-10	16:23	134	30.433720	-80.269359	W	8	2	90°	1
2-Apr-10	16:25	136	30.433697	-80.339620	W	8	1	90°	3
2-Apr-10	16:26	187	30.433605	-80.395444	W	8	1	90°	2
2-Apr-10	16:26	137	30.433623	-80.388464	W	8	2	90°	2
2-Apr-10	16:27	138	30.433650	-80.420986	W	8	1	90°	2
2-Apr-10	16:30	140	30.433431	-80.536213	W	8	1	90°	2
2-Apr-10	16:30	141	30.433361	-80.560756	W	8	1	90°	3
2-Apr-10	16:32	189	30.433118	-80.640198	W	8	2	90°	1
2-Apr-10	16:32	142	30.433261	-80.609786	W	8	1	90°	2
2-Apr-10	16:32	143	30.433150	-80.638273	W	8	2	90°	2
2-Apr-10	16:34	190	30.433202	-80.690055	W	8	2	90°	1
2-Apr-10	16:41	196	30.499229	-80.547945	E	9	1	90°	4
2-Apr-10	16:41	146	30.499196	-80.551560	E	9	2	90°	6

Table 14 (continued). All loggerhead sea turtle (*Caretta caretta*) sightings in the proposed USWTR site off Jacksonville, Florida for aerial surveys conducted from January 2009 – June 2010.

Date	Time	Waypoint	Latitude	Longitude -1	Heading	Track Number	Angle Out	Degree Forward	Best Number
2-Apr-10	16:52	149	30.499454	-80.318959	E	9	1	90°	1
2-Apr-10	17:00	205	30.499030	-80.133132	E	9	2	90°	1
2-Apr-10	17:18	156	30.567302	-80.085730	W	10	1	90°	1
2-Apr-10	17:23	215	30.567321	-80.195202	W	10	2	90°	1
2-Apr-10	17:25	216	30.567201	-80.262607	W	10	2	90°	2
2-Apr-10	17:30	162	30.567440	-80.336212	W	10	1	90°	1
2-Apr-10	17:43	225	30.566593	-80.645813	W	10	1	90°	1
2-Apr-10	17:43	165	30.566664	-80.642479	W	10	1	90°	1
2-Apr-10	17:43	166	30.566515	-80.655792	W	10	1	90°	3
3-Apr-10	10:44	57	30.365786	-80.559614	W	7	2	90°	1
3-Apr-10	10:51	55	30.367550	-80.693420	W	7	1	90°	1
3-Apr-10	10:55	58	30.299524	-80.644651	E	6	1	80°	1
3-Apr-10	10:58	65	30.299737	-80.535776	E	6	2	90°	1
6-May-10	9:50	5	29.965885	-80.522465	E	1	1	100°	1
6-May-10	10:46	15	30.031116	-80.454175	W	2	1	90°	1
6-May-10	13:39	37	30.099887	-80.572043	E	3	3	90°	1
6-May-10	13:40	24	30.099512	-80.565715	E	3	2	90°	1
6-May-10	13:54	44	30.101082	-80.418631	E	3	1	90°	1
6-May-10	13:56	45	30.100996	-80.343180	E	3	2	90°	1
7-May-10	9:25	4	30.101754	-80.286554	E	3	2	90°	1
7-May-10	10:32	24	30.165829	-80.465372	W	4	1	90°	1
7-May-10	10:32	18	30.166542	-80.443867	W	4	1	90°	2
7-May-10	10:35	25	30.165405	-80.563304	W	4	2	100°	1
7-May-10	10:38	20	30.165221	-80.666783	W	4	1	90°	1
7-May-10	10:44	28	30.233067	-80.615095	E	5	2	90°	1
7-May-10	10:46	30	30.233455	-80.537231	E	5	2	100°	1
7-May-10	10:48	31	30.233389	-80.485648	E	5	1	90°	1
7-May-10	10:48	23	30.233457	-80.461223	E	5	2	90°	1
7-May-10	10:49	32	30.233446	-80.441127	E	5	2	100°	2
7-May-10	10:50	33	30.233445	-80.417063	E	5	2	100°	1
7-May-10	10:50	24	30.233379	-80.420766	E	5	2	90°	1
7-May-10	10:59	38	30.233808	-80.292253	E	5	2	90°	1
7-May-10	11:00	28	30.233489	-80.242494	E	5	1	90°	1
7-May-10	11:33	36	30.299813	-80.208193	W	6	2	90°	1
7-May-10	11:43	40	30.299471	-80.527219	W	6	1	90°	1
7-May-10	11:44	52	30.299361	-80.563232	W	6	2	100°	1
7-May-10	11:45	42	30.298997	-80.626740	W	6	2	90°	2
7-May-10	12:03	59	30.366215	-80.554721	E	7	1	90°	1
7-May-10	12:07	60	30.366723	-80.386513	E	7	2	100°	1

Table 14 (continued). All loggerhead sea turtle (*Caretta caretta*) sightings in the proposed USWTR site off Jacksonville, Florida for aerial surveys conducted from January 2009 – June 2010.

Date	Time	Waypoint	Latitude	Longitude -1	Heading	Track Number	Angle Out	Degree Forward	Best Number
7-May-10	12:09	62	30.366819	-80.333428	E	7	1	90°	1
7-May-10	12:40	53	30.433003	-80.336979	W	8	1	90°	1
7-May-10	12:45	54	30.432697	-80.500829	W	8	2	90°	1
7-May-10	14:28	82	30.500233	-80.618054	E	9	2	75°	2
7-May-10	14:30	83	30.500817	-80.539733	E	9	1	90°	1
7-May-10	14:33	66	30.500596	-80.449497	E	9	2	90°	1
7-May-10	14:57	69	30.500220	-80.055240	E	9	1	90°	1
7-May-10	15:16	71	30.566161	-80.131508	W	10	2	90°	1
7-May-10	15:33	100	30.565925	-80.500304	W	10	1	80°	1
7-May-10	15:34	76	30.565911	-80.506358	W	10	1	90°	2
7-May-10	15:36	78	30.565856	-80.597138	W	10	2	90°	1
7-May-10	15:37	79	30.565699	-80.632902	W	10	2	90°	2
4-Jun-10	10:32	25	30.168068	-80.422343	W	4	1	90°	1
4-Jun-10	10:37	34	30.166255	-80.589124	W	4	1	90°	1
4-Jun-10	13:38	47	30.366644	-80.565255	E	7	2	90°	1
4-Jun-10	14:34	66	30.500298	-80.500771	E	9	1	100°	1
4-Jun-10	15:12	63	30.566295	-80.423006	W	10	2	90°	1
5-Jun-10	11:20	28	30.231795	-80.617223	E	5	2	110°	1
5-Jun-10	13:12	47	29.964643	-80.549199	E	1	1	90°	1
5-Jun-10	13:14	41	29.964585	-80.605190	W	1	1	90°	1
5-Jun-10	13:14	48	29.964566	-80.605058	E	1	2	90°	1
6-Jun-10	9:52	16	30.100435	-80.642929	E	3	1	100°	1
6-Jun-10	9:53	17	30.100593	-80.601563	E	3	1	80°	1
6-Jun-10	9:55	18	30.100951	-80.514581	E	3	1	90°	2
6-Jun-10	10:33	28	30.165782	-80.421135	W	4	1	90°	2
6-Jun-10	10:34	17	30.165717	-80.445309	W	4	2	90°	1
6-Jun-10	10:36	18	30.165588	-80.531980	W	4	2	90°	1
6-Jun-10	10:49	21	30.165678	-80.672380	W	4	2	90°	1
6-Jun-10	11:37	31	30.299496	-80.484935	W	6	2	75°	1
6-Jun-10	11:37	32	30.299996	-80.492729	W	6	2	75°	1
6-Jun-10	11:40	33	30.304315	-80.598426	W	6	2	75°	1
6-Jun-10	11:41	42	30.300370	-80.639157	W	6	1	80°	1
6-Jun-10	13:38	49	30.366622	-80.290970	E	7	2	120°	1
7-Jun-10	11:17	21	30.233158	-80.307193	W	5	2	90°	1
7-Jun-10	11:19	22	30.233131	-80.391554	W	5	3	120°	1

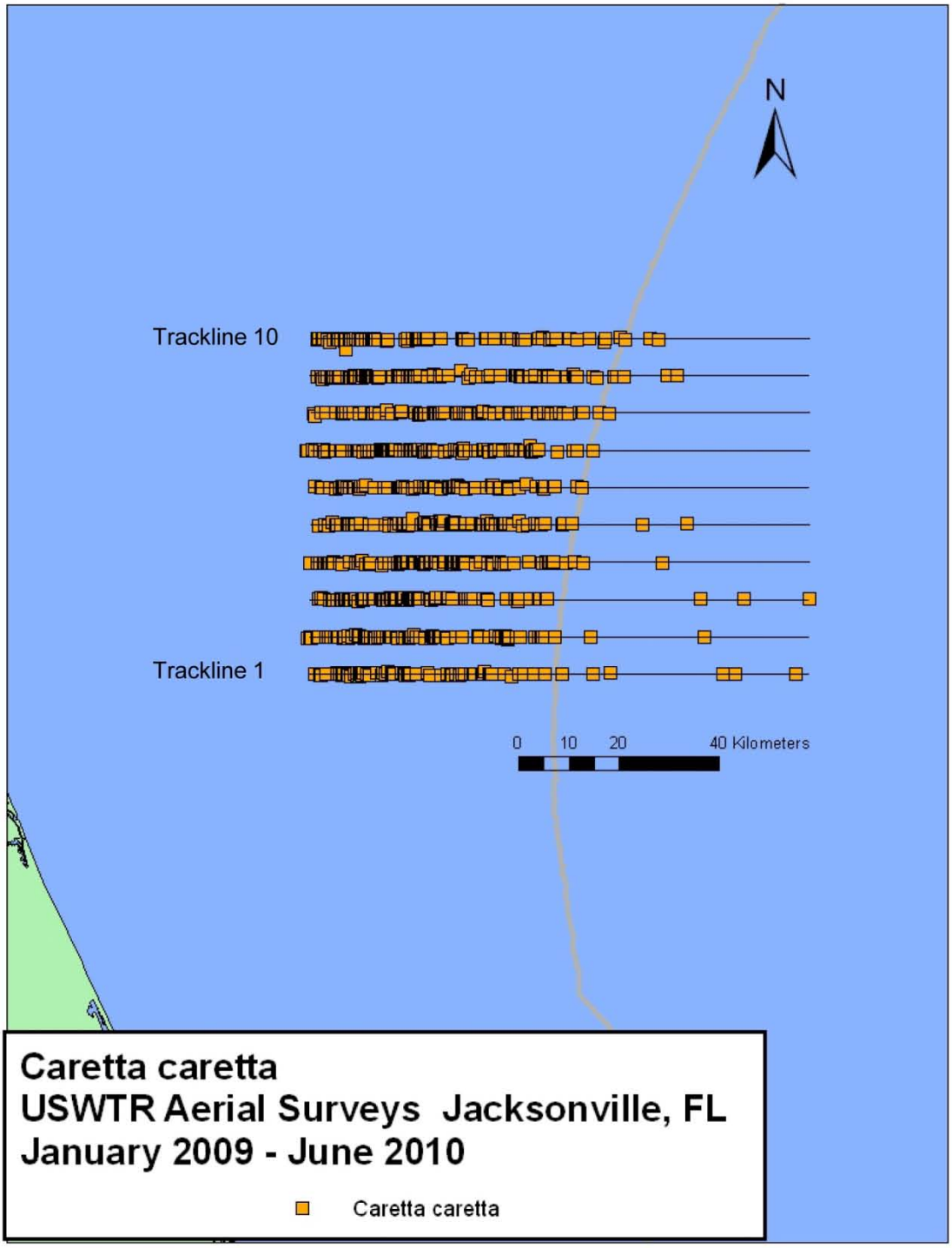

Figure 17. Loggerhead sea turtle (*Caretta caretta*) sightings.

Leatherback Sea Turtle (*Dermochelys coriacea*) (Table 15, Fig. 18)

A total of 50 leatherback sea turtles were recorded. This species was observed in February, September, October, and November of 2009, and in January, February, May and June of 2010. Leatherback nesting beaches in the Atlantic, as well as worldwide, have experienced severe to moderate declines the past several decades and this species is listed as endangered under the Endangered Species Act (NMFS 1992).

Table 15. All leatherback sea turtle (*Dermochelys coriacea*) sightings in the proposed USWTR site off Jacksonville, Florida for aerial surveys conducted from January 2009 – June 2010.

Date	Time	Waypoint	Latitude	Longitude -1	Heading	Track Number	Angle Out	Degree Forward	Best Number
26-Feb-09	11:10	32	30.432594	-80.567253	E	8	1	90°	1
15-Sep-09	11:24	31	30.102473	-80.141565	E	3	2	90°	1
15-Sep-09	15:19	68	30.365253	-80.547139	E	7	1	90°	1
15-Sep-09	15:35	45	30.364647	-80.307711	E	7	1	90°	1
15-Sep-09	15:40	47	30.362933	-80.223799	E	7	1	90°	1
15-Sep-09	15:43	78	30.366484	-80.114936	E	7	1	90°	1
15-Sep-09	16:07	83	30.431987	-80.319924	W	8	1	75°	1
15-Sep-09	16:10	85	30.433524	-80.427422	W	8	2	90°	1
15-Sep-09	16:44	57	30.501598	-80.331004	E	9	2	110°	1
15-Sep-09	16:53	59	30.499167	-80.131070	E	9	2	80°	1
15-Sep-09	17:10	107	30.570570	-80.041129	W	10	2	90°	1
16-Sep-09	10:35	8	29.964026	-80.427463	E	1	3	75°	1
16-Sep-09	10:47	14	29.966112	-80.189186	E	1	3	110°	1
16-Sep-09	11:19	21	30.032525	-80.403183	W	2	1	90°	1
16-Sep-09	11:22	22	30.030559	-80.494821	W	2	2	45°	1
16-Sep-09	11:25	25	30.031977	-80.595213	W	2	2	90°	1
16-Sep-09	15:33	90	30.231419	-79.996132	E	5	2	90°	1
16-Sep-09	16:03	99	30.296061	-80.461976	W	6	2	120°	1
16-Sep-09	16:06	100	30.300613	-80.565902	W	6	2	90°	1
18-Sep-09	10:14	20	30.434453	-80.661408	E	8	2	110°	1
18-Sep-09	10:16	30	30.430317	-80.584241	E	8	3	90°	1
18-Sep-09	10:39	41	30.432713	-80.128712	E	8	3	90°	1
18-Sep-09	12:13	47	30.231750	-80.209874	W	5	3	60°	1
18-Sep-09	14:44	13	30.164822	-80.363408	E	4	1	75°	1
18-Sep-09	15:59	41	30.030705	-80.501454	E	2	2	45°	1
18-Sep-09	16:40	52	29.964603	-80.366836	W	1	2	90°	1
30-Sep-09	11:46	65	30.231798	-80.681592	E	5	1	100°	1
1-Oct-09	10:58	28	30.363842	-80.597710	W	7	3	90°	1
1-Oct-09	11:00	48	30.360800	-80.648262	W	7	2	90°	1
1-Oct-09	12:05	40	30.232225	-80.619627	W	5	1	90°	1
1-Oct-09	12:12	43	30.234498	-80.693697	W	5	1	90°	1
1-Oct-09	14:13	55	30.166979	-80.446214	E	4	1	90°	1
1-Oct-09	15:08	69	30.101718	-80.615030	W	3	1	90°	1
1-Oct-09	15:20	74	30.031704	-80.650425	E	2	3	90°	1
1-Oct-09	15:21	75	30.031577	-80.617114	E	2	2	90°	1
1-Oct-09	15:22	116	30.029015	-80.561634	E	2	1	90°	1
1-Oct-09	15:26	76	30.031049	-80.432883	E	2	2	90°	1
1-Oct-09	15:28	77	30.031237	-80.374363	E	2	1	90°	1
1-Oct-09	16:09	86	29.963225	-80.651804	W	1	1	90°	1

Table 15 (continued). All leatherback sea turtle (*Dermochelys coriacea*) sightings in the proposed USWTR site off Jacksonville, Florida for aerial surveys conducted from January 2009 – June 2010.

Date	Time	Waypoint	Latitude	Longitude -1	Heading	Track Number	Angle Out	Degree Forward	Best Number
18-Nov-09	9:41	20	30.100327	-80.621817	E	3	3	130°	1
18-Nov-09	14:40	78	30.433853	-80.649288	E	8	1	130°	1
18-Nov-09	15:36	99	30.364511	-80.705937	W	7	3	110°	1
19-Jan-10	14:46	51	30.032010	-80.643162	E	2	1	90°	1
20-Jan-10	11:26	45	30.168326	-80.424652	W	4	3	90°	2
20-Jan-10	14:13	87	30.366684	-80.540792	E	7	1	80°	1
19-Feb-10	14:29	40	30.433916	-80.255053	W	8	3	95°	1
7-May-10	10:15	15	30.165886	-80.286109	W	4	3	90°	1
4-Jun-10	15:15	72	30.566087	-80.509882	W	10	1	120°	1

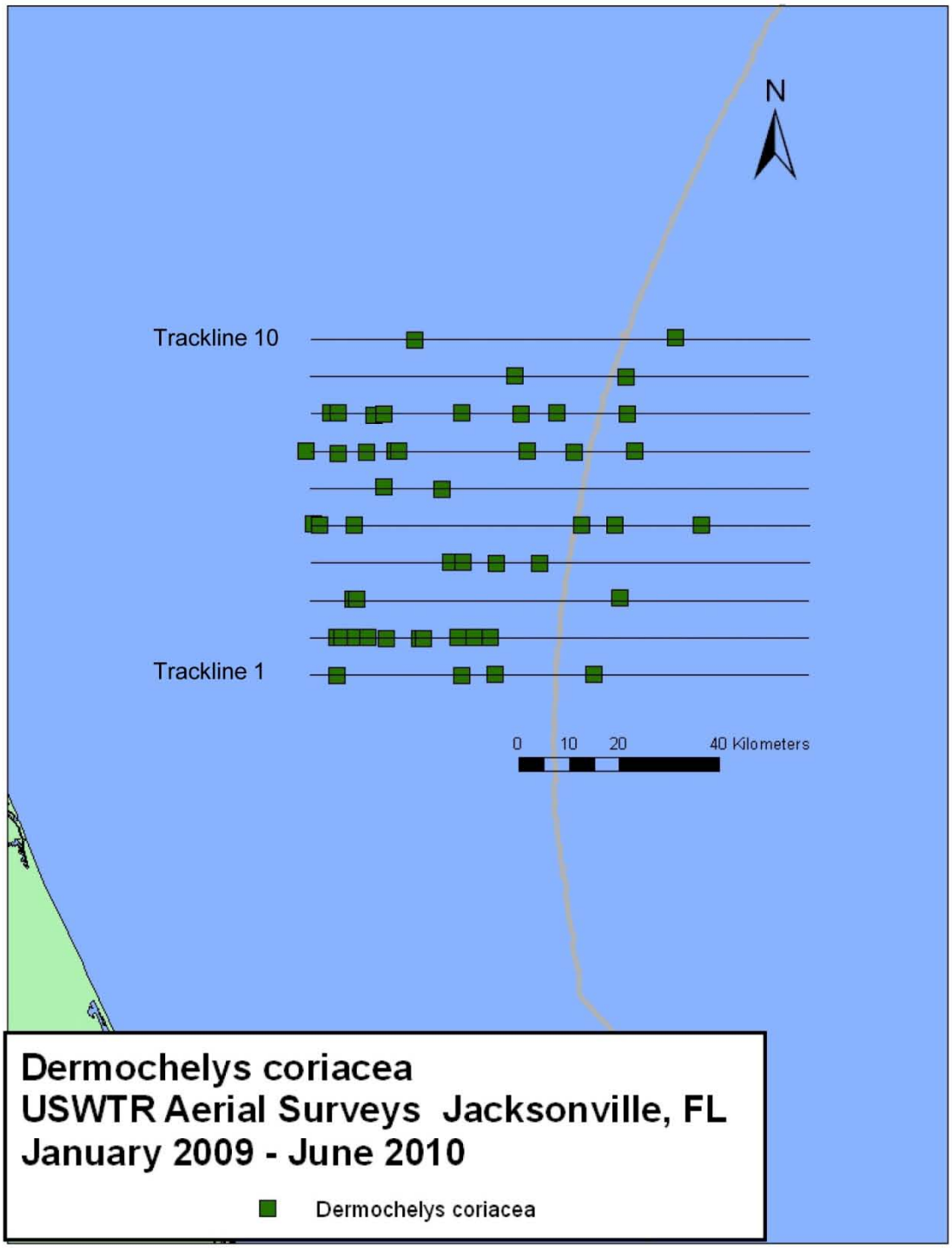

Figure 18. Leatherback sea turtle (*Dermochelys coriacea*) sightings.

Kemp's Ridley Sea Turtle (*Lepidochelys kempii*) (Table 16, Fig. 19)

A single Kemp's Ridley sea turtle was recorded while on effort on 20 March 2010. Another Kemp's Ridley was photographed opportunistically while off effort for a dolphin sighting on 3 April 2010. It is suspected that a certain portion of sea turtles labeled as unidentified may be Kemp's Ridley sea turtles due to the prominence of smaller, lighter colored turtles with round carapaces in the former category. This species nests almost exclusively on a single beach on the Mexican Gulf coast, with an estimated total of 1100 nests in the 1991 nesting season (NMFS 1992). The Kemp's Ridley sea turtle is listed as endangered under the Endangered Species Act (NMFS 1992).

Table 16. The Kemp's ridley sea turtle (*Lepidochelys kempii*) sighting in the proposed USWTR site off Jacksonville, Florida for aerial surveys conducted from January 2009 – June 2010.

Date	Time	Waypoint	Latitude	Longitude -1	Heading	Track Number	Angle Out	Degree Forward	Best Number
20-Mar-10	16:03	123	30.433872	-80.380367	E	8	1	90°	1

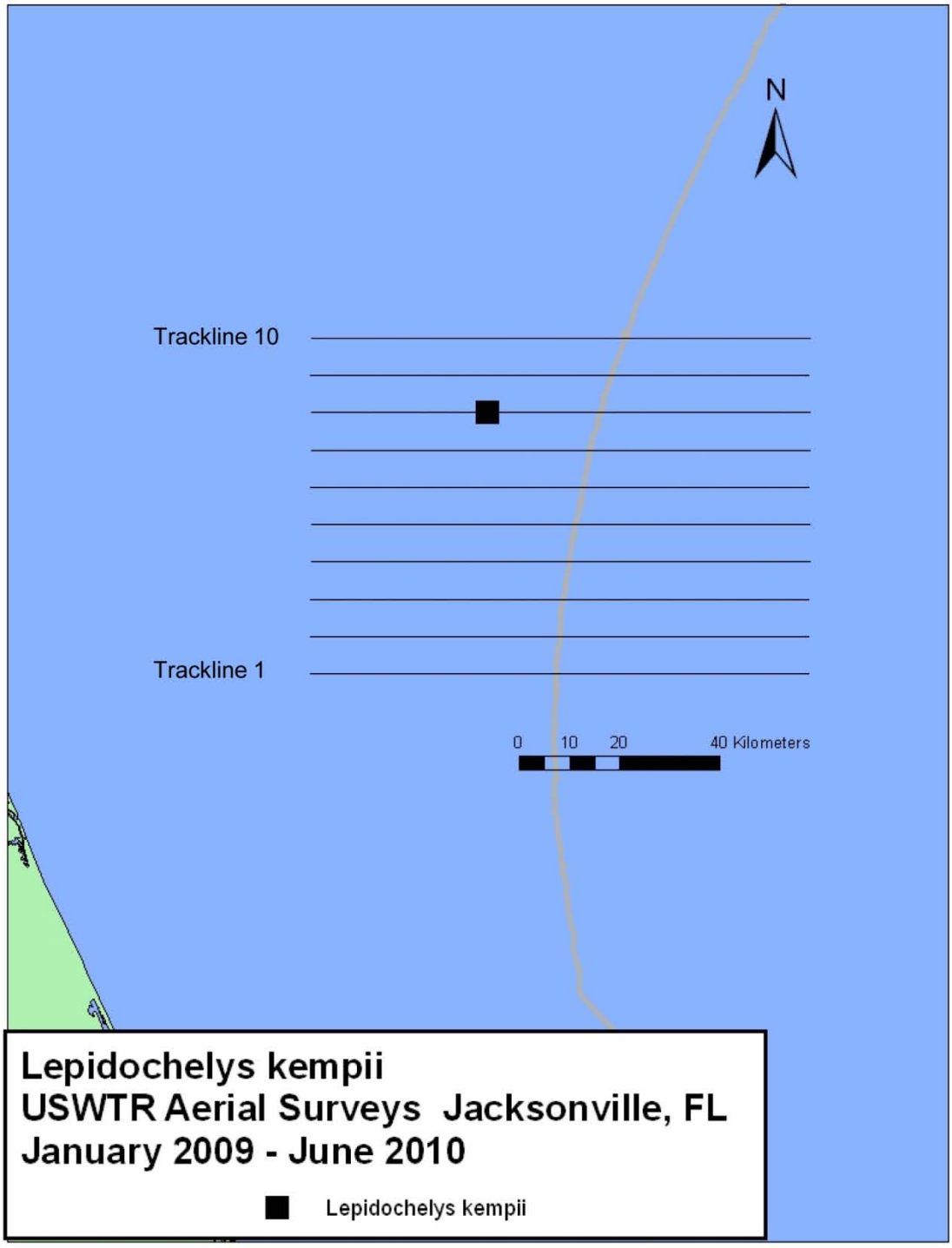

Figure 19. Kemp's Ridley sea turtle (*Lepidochelys kempii*) sighting.

Unidentified sea turtles (Table 17, Fig. 20)

A total of 323 unidentified sea turtles were observed during the reporting period. Unidentified sea turtles were recorded during every survey month except March and October 2009.

Table 17. All unidentified sea turtle sightings in the proposed USWTR site off Jacksonville, Florida for aerial surveys conducted from January 2009 – June 2010.

Date	Time	Waypoint	Latitude	Longitude -1	Heading	Track Number	Angle Out	Degree Forward	Best Number
27-Jan-09	12:42	4	29.963703	-80.639777	E	1	2	90°	1
27-Jan-09	12:43	5	29.963145	-80.622678	E	1	2	90°	2
27-Jan-09	12:45	6	29.963928	-80.559498	E	1	1	90°	1
27-Jan-09	12:53	12	29.961885	-80.470028	E	1	1	90°	1
27-Jan-09	13:34	10	30.035048	-80.377003	W	2	1	90°	1
27-Jan-09	13:46	29	30.095317	-80.655945	E	3	1	90°	1
27-Jan-09	13:50	31	30.099132	-80.501400	E	3	2	90°	1
27-Jan-09	15:04	53	30.216962	-80.594047	E	5	3	90°	1
27-Jan-09	15:51	36	30.301543	-80.483648	W	6	2	90°	1
27-Feb-09	10:10	33	30.100157	-80.620321	E	3	2	90°	1
9-Jun-09	14:12	24	30.500239	-80.615830	W	9	1	90°	1
9-Jun-09	14:20	29	30.434013	-80.542311	E	8	2	90°	1
9-Jun-09	14:23	32	30.433348	-80.457472	E	8	1	130°	1
9-Jun-09	15:20	58	30.295107	-80.408161	E	6	2	135°	1
9-Jun-09	15:54	63	30.237318	-80.450577	W	5	1	135°	1
10-Jun-09	10:20	18	30.103098	-80.334260	E	3	1	90°	1
10-Jun-09	10:20	18	30.103098	-80.334260	E	3	1	90°	1
10-Jun-09	11:19	34	30.232778	-80.588997	E	5	1	80°	1
10-Jun-09	14:35	63	30.366263	-80.548797	E	7	1	90°	1
10-Jun-09	14:40	67	30.363603	-80.363192	E	7	2	110°	1
10-Jun-09	15:18	54	30.434846	-80.487527	W	8	1	100°	1
10-Jun-09	16:38	111	30.567353	-80.256643	W	10	2	80°	1
11-Jun-09	9:01	7	30.169294	-80.388163	E	4	2	90°	1
15-Jul-09	13:20	31	29.966174	-80.584901	E	1	2	90°	2
15-Jul-09	13:22	33	29.964844	-80.522382	E	1	2	45°	1
15-Jul-09	14:22	61	30.032122	-80.532001	W	2	1	90°	1
15-Jul-09	14:23	64	30.030218	-80.569081	W	2	2	90°	3
15-Jul-09	14:39	66	30.099504	-80.343922	E	3	2	45°	1
15-Jul-09	15:23	81	30.165170	-80.430593	W	4	2	90°	2
15-Jul-09	15:24	83	30.166441	-80.480618	W	4	1	90°	1
4-Aug-09	13:12	20	30.503147	-80.624101	W	9	1	90°	1
4-Aug-09	14:35	41	30.301272	-80.572978	E	6	1	90°	1
4-Aug-09	14:36	42	30.303321	-80.525158	E	6	1	90°	1
4-Aug-09	15:20	51	30.236193	-80.302727	W	5	2	90°	1
4-Aug-09	15:21	52	30.233527	-80.360478	W	5	3	135°	1
4-Aug-09	15:25	54	30.230677	-80.519806	W	5	1	90°	1
4-Aug-09	15:28	57	30.230294	-80.624343	W	5	2	90°	1
4-Aug-09	15:29	58	30.229411	-80.667231	W	5	1	90°	1
5-Aug-09	9:37	11	30.032263	-80.360320	W	2	2	90°	1

Table 17 (continued). All unidentified sea turtle sightings in the proposed USWTR site off Jacksonville, Florida for aerial surveys conducted from January 2009 – June 2010.

Date	Time	Waypoint	Latitude	Longitude -1	Heading	Track Number	Angle Out	Degree Forward	Best Number
5-Aug-09	9:45	13	30.031985	-80.645809	W	2	3	90°	1
6-Aug-09	9:02	6	29.965529	-80.419336	E	1	2	90°	1
6-Aug-09	10:01	12	30.031778	-80.567179	W	2	2	60°	1
6-Aug-09	10:01	13	30.029295	-80.602454	W	2	2	75°	1
6-Aug-09	10:13	22	30.102396	-80.391621	E	3	1	90°	1
6-Aug-09	11:13	30	30.171472	-80.578094	W	4	3	110°	1
6-Aug-09	11:26	33	30.496919	-80.667802	E	9	1	90°	1
6-Aug-09	11:26	34	30.497821	-80.633398	E	9	2	90°	1
6-Aug-09	11:26	31	30.496165	-80.628339	E	9	2	110°	1
6-Aug-09	11:30	34	30.503659	-80.474301	E	9	2	110°	1
6-Aug-09	11:35	36	30.502688	-80.292746	E	9	2	90°	1
6-Aug-09	12:29	42	30.564465	-80.537486	W	10	1	75°	1
14-Sep-09	14:16	23	30.365129	-80.600418	W	7	2	90°	1
15-Sep-09	11:14	27	30.105616	-80.473886	E	3	1	90°	1
15-Sep-09	11:18	29	30.104384	-80.337510	E	3	2	110°	1
15-Sep-09	15:31	43	30.365664	-80.459110	E	7	1	100°	1
15-Sep-09	16:10	84	30.433175	-80.401972	W	8	2	90°	1
15-Sep-09	17:25	112	30.566566	-80.132323	W	10	2	110°	1
15-Sep-09	17:32	116	30.551724	-80.335036	W	10	2	90°	1
15-Sep-09	17:41	120	30.547037	-80.677651	W	10	2	90°	1
16-Sep-09	16:14	89	30.299006	-80.619675	W	6	2	90°	1
18-Sep-09	9:43	19	30.501625	-80.113564	W	9	1	90°	1
18-Sep-09	10:10	26	30.496916	-80.695673	W	9	2	90°	1
18-Sep-09	10:33	38	30.433761	-80.342940	E	8	2	90°	1
18-Sep-09	11:13	47	30.366308	-80.651260	W	7	1	90°	1
18-Sep-09	11:41	55	30.300876	-80.486997	E	6	1	90°	1
18-Sep-09	14:28	5	30.163966	-80.626539	E	4	1	90°	2
18-Sep-09	14:45	14	30.166101	-80.329726	E	4	1	90°	1
18-Sep-09	15:20	20	30.101937	-80.460164	W	3	2	75°	1
18-Sep-09	15:21	22	30.101097	-80.502033	W	3	3	90°	1
18-Sep-09	15:21	23	30.102618	-80.529827	W	3	2	90°	1
18-Sep-09	15:46	35	30.032513	-80.645667	E	2	2	90°	1
18-Sep-09	15:58	38	30.029101	-80.558675	E	2	1	75°	1
18-Sep-09	16:42	55	29.964730	-80.454091	W	1	1	90°	1
18-Sep-09	16:45	57	29.963995	-80.566872	W	1	3	110°	1
18-Sep-09	16:48	59	29.961944	-80.678821	W	1	3	90°	2
30-Sep-09	10:14	13	30.032227	-80.658381	W	2	1	2°	1
30-Sep-09	10:28	30	30.099107	-80.567206	E	3	2	90°	1
30-Sep-09	10:31	32	30.101734	-80.460286	E	3	3	100°	1

Table 17 (continued). All unidentified sea turtle sightings in the proposed USWTR site off Jacksonville, Florida for aerial surveys conducted from January 2009 – June 2010.

Date	Time	Waypoint	Latitude	Longitude -1	Heading	Track Number	Angle Out	Degree Forward	Best Number
30-Sep-09	11:54	45	30.229693	-80.530337	E	5	2	140°	1
18-Nov-09	9:03	11	29.965742	-79.895195	E	1	2	90°	1
18-Nov-09	9:29	14	30.031389	-80.449454	W	2	2	90°	1
18-Nov-09	9:33	15	30.031155	-80.597250	W	2	2	110°	1
18-Nov-09	10:02	25	30.101027	-80.273826	E	3	2	110°	1
18-Nov-09	10:11	27	30.100415	-79.927603	E	3	1	90°	1
18-Nov-09	10:41	34	30.165983	-80.535203	W	4	2	90°	1
18-Nov-09	13:48	70	30.567611	-80.552910	E	10	3	100°	1
18-Nov-09	13:49	71	30.567788	-80.494182	E	10	2	90°	1
18-Nov-09	13:51	72	30.567852	-80.447954	E	10	1	80°	1
18-Nov-09	13:51	73	30.567862	-80.426204	E	10	2	90°	1
18-Nov-09	14:28	80	30.498835	-80.394840	W	9	3	90°	1
18-Nov-09	14:29	81	30.498963	-80.436781	W	9	2	60°	1
18-Nov-09	14:31	82	30.498782	-80.502024	W	9	1	110°	1
18-Nov-09	14:33	84	30.498675	-80.589073	W	9	1	90°	1
18-Nov-09	14:34	85	30.498559	-80.622809	W	9	2	90°	1
18-Nov-09	15:31	98	30.365115	-80.516913	W	7	2	90°	1
22-Dec-09	15:11	66	30.499153	-80.430882	E	9	2	100°	1
22-Dec-09	16:28	68	30.566978	-80.598099	W	10	3	90°	1
7-Jan-10	16:09	50	30.431476	-80.159948	W	8	1	90°	1
7-Jan-10	16:12	51	30.432876	-80.266783	W	8	2	100°	1
20-Jan-10	9:11	6	29.966406	-80.371544	E	1	2	90°	1
20-Jan-10	9:50	19	30.030892	-80.271656	W	2	1	90°	1
20-Jan-10	9:53	20	30.031303	-80.368874	W	2	2	60°	1
20-Jan-10	9:53	17	30.031389	-80.385767	W	2	2	90°	1
20-Jan-10	10:35	31	30.100388	-80.625006	E	3	2	100°	1
20-Jan-10	10:37	38	30.100492	-80.548021	E	3	2	90°	2
20-Jan-10	11:24	43	30.166170	-80.355583	W	4	1	90°	1
20-Jan-10	11:25	51	30.166121	-80.409776	W	4	1	80°	1
20-Jan-10	11:45	58	30.233285	-80.401017	E	5	2	90°	1
20-Jan-10	12:23	70	30.299760	-80.405974	W	6	1	80°	1
20-Jan-10	14:14	88	30.366801	-80.512023	E	7	2	75°	1
20-Jan-10	15:18	120	30.500477	-80.614815	E	9	2	90°	2
20-Jan-10	15:18	121	30.500534	-80.595852	E	9	2	90°	4
27-Jan-10	15:04	34	30.167142	-80.434641	E	4	2	75°	1
27-Jan-10	16:12	45	30.033084	-80.504018	E	2	2	100°	1
28-Jan-10	9:28	4	29.965874	-80.645810	E	1	2	90°	1
28-Jan-10	9:46	10	29.966357	-80.387729	E	1	2	110°	1
28-Jan-10	11:09	33	30.031518	-80.408018	W	2	1	90°	1

Table 17 (continued). All unidentified sea turtle sightings in the proposed USWTR site off Jacksonville, Florida for aerial surveys conducted from January 2009 – June 2010.

Date	Time	Waypoint	Latitude	Longitude -1	Heading	Track Number	Angle Out	Degree Forward	Best Number
28-Jan-10	11:12	35	30.031395	-80.514661	W	2	1	90°	1
28-Jan-10	11:14	35	30.031067	-80.570732	W	2	1	90°	1
28-Jan-10	11:39	43	30.100337	-80.608193	E	3	2	90°	3
28-Jan-10	11:58	50	30.098813	-80.523909	E	3	2	75°	1
28-Jan-10	16:11	101	30.299000	-80.283856	W	6	2	100°	1
28-Jan-10	16:25	106	30.299149	-80.527143	W	6	2	90°	1
20-Feb-10	10:22	20	30.499932	-80.225575	W	9	2	90°	1
20-Feb-10	11:22	46	30.433410	-80.311014	E	8	3	100°	1
20-Feb-10	16:42	130	30.031465	-80.158169	E	2	1	90°	1
21-Feb-10	8:38	5	29.965257	-80.507573	E	1	1	90°	1
21-Feb-10	8:42	7	29.965443	-80.350439	E	1	2	100°	1
21-Feb-10	9:29	24	30.032120	-80.389601	W	2	2	100°	1
21-Feb-10	9:31	21	30.032181	-80.492934	W	2	1	90°	1
21-Feb-10	9:40	28	30.099365	-80.658357	E	3	2	90°	2
21-Feb-10	12:34	78	30.300402	-80.372948	W	6	2	90°	3
21-Feb-10	14:33	93	30.365226	-80.547975	E	7	2	80°	1
21-Feb-10	14:35	95	30.365147	-80.466082	E	7	1	80°	1
21-Feb-10	14:57	104	30.365819	-80.227714	E	7	2	90°	3
21-Feb-10	15:41	136	30.433950	-80.390762	W	8	3	90°	1
21-Feb-10	15:41	116	30.433978	-80.396392	W	8	2	90°	2
21-Feb-10	15:50	121	30.433055	-80.626976	W	8	1	90°	1
21-Feb-10	15:51	122	30.433280	-80.660645	W	8	2	90°	3
21-Feb-10	16:01	126	30.499395	-80.435228	E	9	2	80°	1
21-Feb-10	16:32	133	30.567108	-80.143254	W	10	1	90°	1
21-Feb-10	16:34	135	30.567175	-80.218925	W	10	1	110°	1
20-Mar-10	14:45	60	30.300431	-80.340154	W	6	3	90°	1
20-Mar-10	14:58	86	30.300091	-80.536718	E	6	2	110°	1
20-Mar-10	15:08	92	30.365387	-80.522324	W	7	4	90°	1
20-Mar-10	15:12	98	30.365617	-80.392292	W	7	3	90°	1
20-Mar-10	15:46	82	30.433636	-79.940230	W	8	2	90°	1
20-Mar-10	16:08	126	30.433315	-80.594983	E	8	3	100°	3
20-Mar-10	16:09	127	30.433194	-80.637071	E	8	3	90°	4
24-Mar-10	10:04	20	30.433766	-80.601294	E	8	2	90°	1
24-Mar-10	10:29	27	30.434117	-80.202388	E	8	2	90°	2
24-Mar-10	11:36	34	30.364837	-80.626302	W	7	3	75°	2
24-Mar-10	12:01	55	30.300728	-80.401245	E	6	1	100°	1
24-Mar-10	12:58	52	30.232154	-80.443375	W	5	3	90°	3
31-Mar-10	15:55	39	30.499158	-80.537305	E	9	1	100°	1
31-Mar-10	15:57	41	30.499302	-80.456003	E	9	2	90°	1

Table 17 (continued). All unidentified sea turtle sightings in the proposed USWTR site off Jacksonville, Florida for aerial surveys conducted from January 2009 – June 2010.

Date	Time	Waypoint	Latitude	Longitude -1	Heading	Track Number	Angle Out	Degree Forward	Best Number
31-Mar-10	17:14	69	30.566836	-80.570466	W	10	2	130°	1
1-Apr-10	10:43	19	30.366155	-80.404105	W	7	2	100°	1
1-Apr-10	10:55	18	30.297457	-80.674508	E	6	2	90°	1
1-Apr-10	11:21	22	30.299970	-80.383497	E	6	2	90°	1
1-Apr-10	14:18	44	30.165732	-80.668910	E	4	2	80°	1
1-Apr-10	14:20	50	30.165861	-80.583087	E	4	3	90°	1
1-Apr-10	14:41	53	30.166421	-80.311689	E	4	2	90°	1
1-Apr-10	15:47	69	30.100480	-80.474476	W	3	2	80°	1
1-Apr-10	15:52	94	30.099968	-80.671037	W	3	1	90°	1
1-Apr-10	15:58	72	30.031340	-80.604619	E	2	2	90°	3
2-Apr-10	11:08	72	30.100360	-80.433341	E	3	2	110°	1
2-Apr-10	11:12	73	30.100262	-80.274858	E	3	2	90°	3
2-Apr-10	12:27	116	30.232617	-80.510335	E	5	3	75°	1
2-Apr-10	16:23	186	30.433681	-80.289136	W	8	2	90°	3
2-Apr-10	16:38	193	30.498598	-80.660643	E	9	2	110°	1
2-Apr-10	16:40	194	30.499023	-80.604308	E	9	1	90°	4
2-Apr-10	16:40	195	30.499147	-80.571885	E	9	1	90°	5
3-Apr-10	8:25	4	30.565911	-80.681409	E	10	2	90°	3
3-Apr-10	8:25	4	30.566042	-80.670227	E	10	1	90°	2
3-Apr-10	8:26	5	30.566182	-80.643714	E	10	1	80°	1
3-Apr-10	8:27	5	30.566382	-80.608878	E	10	3	90°	2
3-Apr-10	8:27	6	30.566249	-80.619345	E	10	2	90°	3
3-Apr-10	8:30	6	30.566609	-80.497587	E	10	1	90°	2
3-Apr-10	9:35	30	30.499595	-80.545578	W	9	2	90°	4
3-Apr-10	9:36	33	30.499414	-80.583656	W	9	2	90°	4
3-Apr-10	9:36	31	30.499438	-80.590211	W	9	2	90°	6
3-Apr-10	9:37	32	30.499323	-80.623452	W	9	2	90°	4
3-Apr-10	9:40	38	30.499813	-80.661395	W	9	2	100°	2
3-Apr-10	9:45	41	30.433353	-80.670301	E	8	3	90°	2
3-Apr-10	9:46	42	30.432876	-80.628565	E	8	2	110°	2
3-Apr-10	9:46	37	30.432850	-80.642903	E	8	1	90°	2
3-Apr-10	9:47	43	30.432965	-80.581628	E	8	3	90°	2
3-Apr-10	9:50	44	30.433172	-80.496739	E	8	1	90°	2
3-Apr-10	9:50	38	30.433160	-80.482546	E	8	2	90°	4
3-Apr-10	9:55	39	30.433354	-80.312309	E	8	2	90°	3
3-Apr-10	10:35	47	30.365981	-80.425846	W	7	2	90°	2
3-Apr-10	10:46	52	30.365598	-80.619618	W	7	1	80°	1
3-Apr-10	10:56	59	30.299539	-80.615208	E	6	2	90°	4
3-Apr-10	10:58	64	30.299651	-80.563760	E	6	2	90°	1

Table 17 (continued). All unidentified sea turtle sightings in the proposed USWTR site off Jacksonville, Florida for aerial surveys conducted from January 2009 – June 2010.

Date	Time	Waypoint	Latitude	Longitude -1	Heading	Track Number	Angle Out	Degree Forward	Best Number
3-Apr-10	10:59	66	30.299811	-80.492393	E	6	2	90°	1
3-Apr-10	11:00	62	30.299817	-80.480669	E	6	2	90°	3
3-Apr-10	11:08	65	30.300065	-80.315070	E	6	2	90°	3
6-May-10	9:46	4	29.965177	-80.668963	E	1	1	145°	1
6-May-10	10:04	10	29.966334	-80.299699	E	1	1	110°	1
7-May-10	10:34	19	30.165508	-80.532059	W	4	2	90°	1
7-May-10	10:45	29	30.233375	-80.591664	E	5	1	90°	1
7-May-10	14:54	89	30.500558	-80.174878	E	9	1	90°	2
7-May-10	15:16	93	30.566103	-80.128995	W	10	2	90°	2
7-May-10	15:31	74	30.565963	-80.421856	W	10	1	90°	1
7-May-10	15:33	99	30.565990	-80.485165	W	10	2	90°	2
7-May-10	15:33	75	30.566031	-80.482399	W	10	2	90°	2
7-May-10	15:34	101	30.565842	-80.528303	W	10	2	90°	3
7-May-10	15:35	102	30.565793	-80.573770	W	10	2	90°	3
7-May-10	15:35	77	30.565837	-80.539089	W	10	2	90°	4
7-May-10	15:38	103	30.565552	-80.661221	W	10	2	90°	4
7-May-10	15:38	80	30.565496	-80.685179	W	10	3	90°	1
7-May-10	15:39	81	30.565429	-80.698184	W	10	3	90°	3
4-Jun-10	9:46	15	30.102523	-80.514510	E	3	2	110°	1
4-Jun-10	15:11	71	30.566360	-80.359100	W	10	1	110°	1
6-Jun-10	9:46	13	30.030629	-80.634998	W	2	2	75°	1
6-Jun-10	9:58	19	30.101044	-80.387801	E	3	1	100°	1
6-Jun-10	10:37	29	30.165447	-80.562730	W	4	1	80°	1

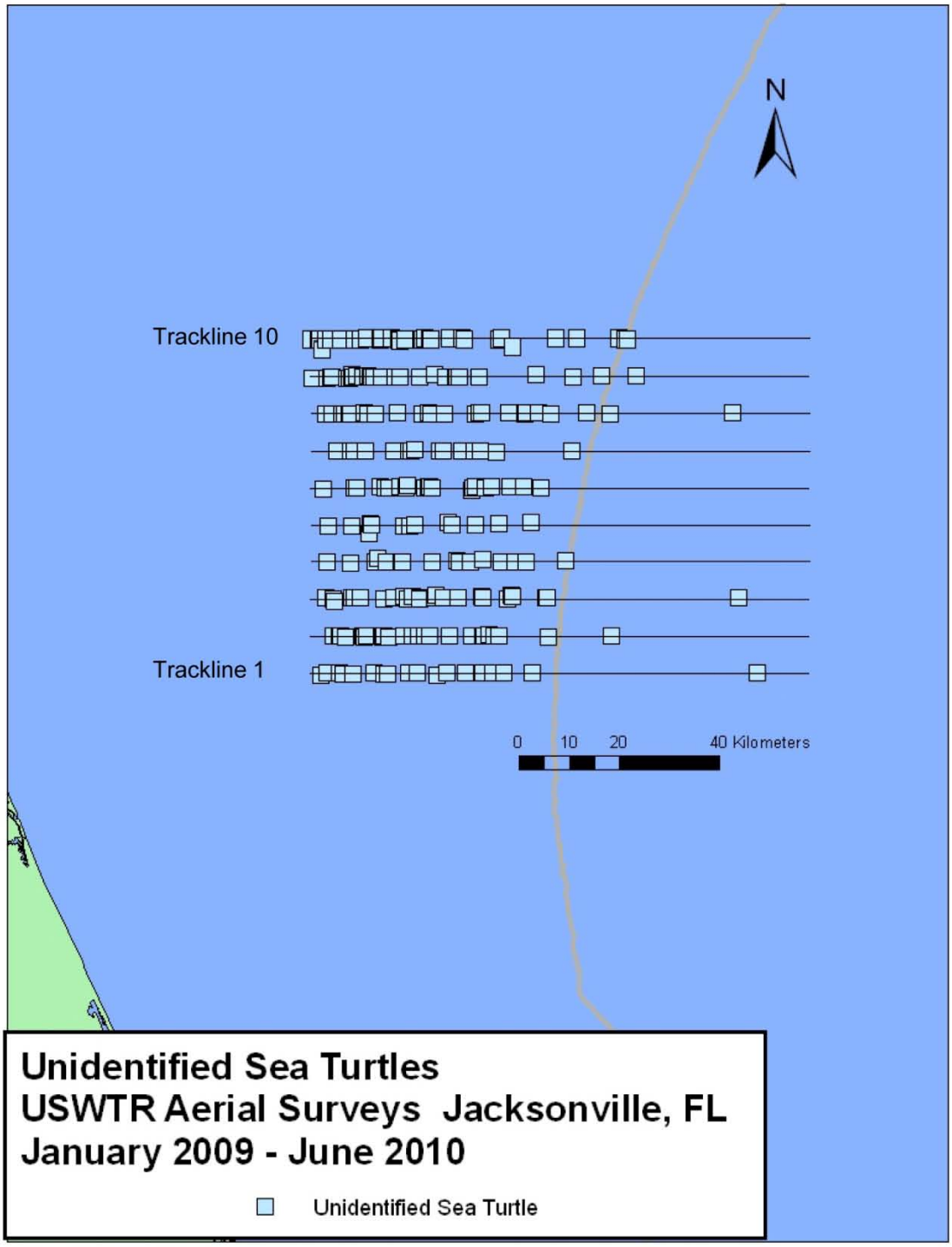

Figure 20. Unidentified sea turtle sightings.

Other Marine Vertebrate Sightings (Tables 18-22, Fig. 21)

Chondrichthyan fishes

A total of 129 sharks were recorded during the reporting period. Of these, 67 were identified as hammerhead sharks (*Sphyrna* spp.) and two as whale sharks (*Rhincodon typus*) (Tables 18 and 19). The whale shark sightings (both identified as juveniles) occurred in November 2009 and January 2010. Sharks were seen throughout the study period with no discernable spatial or temporal trends. Thirty-eight manta rays (*Manta birostris*) were observed during the study period (Table 20). Manta rays were observed in February, June, July, September, and October of 2009 and in March, April and May of 2010. There were also three sightings of rays that could not be identified to species and are listed as unidentified rays (Table 21).

Other fishes

Eleven ocean sunfish (*Mola mola)* were recorded during the survey period and were exclusively encountered during winter months (February 2009 and January 2010 through March 2010)(Table 22).

Table 18. All whale shark (*Rhincodon typus*) sightings in the proposed USWTR site off Jacksonville, Florida for aerial surveys conducted from January 2009 – June 2010.

Date	Time	Waypoint	Latitude	Longitude -1	Heading	Track Number	Angle Out	Degree Forward	Best Number
18-Nov-09	10:49	39	30.241048	-80.687149	E	5	2	110°	1
20-Jan-10	9:43	12	30.040573	-80.014061	W	2	3	90°	1

Table 19. All other shark sightings in the proposed USWTR site off Jacksonville, Florida for aerial surveys conducted from January 2009 – June 2010.

Date	Time	Waypoint	Latitude	Longitude -1	Heading	Track Number	Angle Out	Degree Forward	Best Number	Comments
27-Jan-09	13:09	17	29.960837	-80.099062	E	1	3	90°	1	Hammerhead
27-Jan-09	13:41	25	30.035085	-80.660795	W	2	1	90°	1	Hammerhead
27-Jan-09	15:05	54	30.212053	-80.549643	E	5	2	90°	1	Hammerhead
26-Feb-09	10:39	15	30.498671	-80.217854	W	9	2	90°	2	Hammerhead
27-Feb-09	9:06	10	29.966275	-80.425425	E	1	1	90°	1	Hammerhead
27-Feb-09	9:54	21	30.031347	-80.426560	W	2	3	90°	1	Hammerhead
27-Feb-09	10:12	35	30.099726	-80.571221	E	3	3	90°	1	Hammerhead
27-Feb-09	12:31	72	30.299713	-80.480397	W	6	2	90°	1	Hammerhead
9-Jun-09	14:22	31	30.433962	-80.486791	E	8	1	90°	1	Shark
9-Jun-09	15:16	56	30.298663	-80.559160	E	6	2	90°	1	Hammerhead
10-Jun-09	14:39	66	30.364164	-80.388544	E	7	2	90°	1	Shark
10-Jun-09	15:11	79	30.432995	-80.210113	W	8	1	90°	1	Hammerhead
10-Jun-09	16:49	118	30.566841	-80.686788	W	10	2	120°	1	Shark
15-Jul-09	13:23	34	29.963394	-80.480515	E	1	1	90°	1	Hammerhead
15-Jul-09	13:30	37	29.965093	-80.233078	E	1	2	90°	1	Shark
15-Jul-09	14:43	68	30.092841	-80.335504	E	3	2	45°	1	Hammerhead
15-Jul-09	14:50	71	30.101122	-80.082333	E	3	1	90°	1	Shark
15-Jul-09	16:23	102	30.232822	-80.006014	E	5	2	75°	1	Shark
15-Jul-09	16:27	105	30.232133	-79.859534	E	5	2	75°	1	Hammerhead
17-Jul-09	9:57	14	30.500535	-80.541540	E	9	2	110°	1	Shark
14-Sep-09	14:03	21	30.369352	-80.134905	W	7	1	90°	1	Shark
15-Sep-09	16:29	93	30.497733	-80.584060	E	9	1	90°	1	Shark
15-Sep-09	17:32	117	30.551285	-80.363941	W	10	2	100°	1	Shark
18-Sep-09	10:19	33	30.434360	-80.469909	E	8	1	90°	1	Hammerhead
18-Sep-09	14:43	17	30.166390	-80.406620	E	4	1	90°	1	
18-Sep-09	15:58	39	30.029255	-80.541755	E	2	2	90°	1	Shark
18-Sep-09	16:16	48	30.032810	-80.061160	E	2	1	90°	1	
30-Sep-09	10:27	29	30.099154	-80.616774	E	3	1	90°	1	Shark
1-Oct-09	10:37	23	30.367474	-79.828007	W	7	1	90°	2	Hammerhead
1-Oct-09	16:03	83	29.964775	-80.404166	W	1	2	90°	1	
18-Nov-09	8:45	10	29.965679	-80.595431	E	1	1	90°	1	Hammerhead
18-Nov-09	10:36	32	30.166074	-80.486014	W	4	3	110°	1	Shark
18-Nov-09	13:44	65	30.567134	-80.698263	E	10	2	110°	1	
18-Nov-09	14:49	90	30.434038	-80.320301	E	8	1	110°	1	Shark
20-Jan-10	11:26	45	30.168326	-80.424652	W	4	3	90°	1	Shark
20-Jan-10	11:42	57	30.232948	-80.543803	E	5	2	100°	1	
20-Jan-10	12:36	63	30.299250	-80.674193	W	6	2	90°	1	Shark
20-Jan-10	14:19	94	30.366829	-80.401901	E	7	2	90°	1	Hammerhead
20-Jan-10	14:30	99	30.367190	-80.192083	E	7	2	75°	1	Hammerhead

Table 19 (continued). All other shark sightings in the proposed USWTR site off Jacksonville, Florida for aerial surveys conducted from January 2009 – June 2010.

Date	Time	Waypoint	Latitude	Longitude -1	Heading	Track Number	Angle Out	Degree Forward	Best Number	Comments
20-Jan-10	14:44	106	30.366336	-79.849591	E	7	2	100°	1	Hammerhead
28-Jan-10	9:51	14	29.967287	-80.283523	E	1	1	90°	1	Hammerhead
28-Jan-10	12:37	53	30.166490	-80.195832	W	4	2	110°	1	Hammerhead
28-Jan-10	12:42	56	30.166075	-80.386968	W	4	1	90°	1	Hammerhead
28-Jan-10	15:35	92	30.238195	-80.227962	E	5	1	100°	2	Hammerhead
28-Jan-10	16:30	108	30.301754	-80.638881	W	6	1	90°	1	Hammerhead
19-Feb-10	13:57	31	30.365905	-80.230392	W	7	2	90°	1	
19-Feb-10	15:35	52	30.566945	-80.529065	W	10	2	90°	1	
20-Feb-10	15:21	95	30.165867	-80.604040	E	4	2	90°	1	Hammerhead
20-Feb-10	15:30	101	30.166461	-80.348523	E	4	1	90°	1	
21-Feb-10	8:41	6	29.965306	-80.397385	E	1	1	100°	1	Shark
21-Feb-10	8:44	9	29.965250	-80.272447	E	1	1	90°	3	Hammerhead
21-Feb-10	9:16	18	30.033024	-79.884179	W	2	1	90°	1	
21-Feb-10	9:26	22	30.032469	-80.278211	W	2	2	100°	1	
21-Feb-10	12:12	72	30.299430	-79.876829	W	6	1	90°	1	Hammerhead
21-Feb-10	14:24	90	30.365063	-80.683588	E	7	1	90°	1	Hammerhead
21-Feb-10	14:57	122	30.365749	-80.249128	E	7	2	100°	1	
21-Feb-10	15:22	109	30.433346	-79.989605	W	8	1	90°	1	Hammerhead
21-Feb-10	15:35	133	30.434166	-80.156189	W	8	3	100°	1	
21-Feb-10	15:36	112	30.433960	-80.176926	W	8	1	90°	1	Hammerhead
21-Feb-10	15:38	114	30.433817	-80.281250	W	8	2	80°	1	
21-Feb-10	15:40	115	30.433776	-80.340839	W	8	2	110°	1	
21-Feb-10	15:48	120	30.433224	-80.548422	W	8	1	80°	1	Hammerhead
21-Feb-10	15:56	145	30.498718	-80.647647	E	9	2	110°	1	
21-Feb-10	16:45	139	30.566956	-80.523883	W	10	1	100°	1	Hammerhead
20-Mar-10	9:59	14	30.032347	-80.333172	E	2	1	90°	1	Hammerhead
20-Mar-10	10:01	15	30.032041	-80.402757	E	2	1	90°	1	
20-Mar-10	12:59	37	30.100124	-80.409043	W	3	2	130°	1	
20-Mar-10	13:38	36	30.166751	-80.248666	W	4	1	90°	1	Hammerhead
20-Mar-10	14:10	63	30.232757	-80.407625	W	5	1	90°	1	Hammerhead
20-Mar-10	14:12	65	30.232875	-80.316913	W	5	1	90°	1	
20-Mar-10	14:26	73	30.231156	-79.817503	W	5	2	110°	1	Hammerhead
20-Mar-10	15:08	70	30.365376	-80.522126	E	7	2	90°	1	
20-Mar-10	15:09	93	30.365534	-80.452204	W	7	3	110°	1	
20-Mar-10	15:50	84	30.433841	-80.151278	W	8	2	90°	5	
20-Mar-10	15:51	114	30.433742	-80.162415	E	8	2	110°	1	Hammerhead
24-Mar-10	10:30	28	30.434149	-80.146452	E	8	2	110°	1	Hammerhead
24-Mar-10	12:51	72	30.232347	-80.182280	W	5	1	60°	1	Hammerhead
24-Mar-10	12:52	73	30.232332	-80.222611	W	5	1	90°	2	Hammerhead

Table 19 (continued). All other shark sightings in the proposed USWTR site off Jacksonville, Florida for aerial surveys conducted from January 2009 – June 2010.

Date	Time	Waypoint	Latitude	Longitude -1	Heading	Track Number	Angle Out	Degree Forward	Best Number	Comments
24-Mar-10	12:53	74	30.232385	-80.239014	W	5	1	75°	1	Hammerhead
24-Mar-10	12:53	50	30.232292	-80.245659	W	5	1	90°	2	Hammerhead
31-Mar-10	16:45	58	30.566988	-80.028211	W	10	2	90°	1	Hammerhead
1-Apr-10	16:12	78	30.031823	-80.276984	E	2	1	80°	1	Hammerhead
1-Apr-10	16:13	79	30.031871	-80.236616	E	2	1	90°	1	Hammerhead
1-Apr-10	16:40	86	29.965974	-80.253023	W	1	1	100°	1	Hammerhead
2-Apr-10	9:29	12	29.965547	-80.301701	E	1	2	90°	1	
2-Apr-10	9:30	17	29.965675	-80.257460	E	1	2	90°	8	Shark
2-Apr-10	10:18	28	30.032207	-80.221115	W	2	2	90°	1	
2-Apr-10	11:12	48	30.100369	-80.270877	E	3	2	90°	1	
2-Apr-10	11:13	74	30.100241	-80.248708	E	3	1	90°	1	Hammerhead
2-Apr-10	12:02	69	30.166487	-80.509732	W	4	2	90°	1	
2-Apr-10	13:29	108	30.301586	-80.366606	W	6	1	90°	1	
2-Apr-10	15:43	170	30.365702	-80.201346	E	7	3	90°	1	Hammerhead
2-Apr-10	15:46	173	30.365720	-80.111840	E	7	3	90°	1	Hammerhead
2-Apr-10	16:28	188	30.433575	-80.452593	W	8	2	90°	1	Hammerhead
2-Apr-10	16:57	202	30.499388	-80.168936	E	9	3	90°	1	Hammerhead
2-Apr-10	17:19	210	30.567207	-80.114085	W	10	3	90°	1	Hammerhead
3-Apr-10	10:59	61	30.299799	-80.492787	E	6	1	90°	1	Hammerhead
6-May-10	10:39	21	30.031226	-80.333485	W	2	2	90°	1	Hammerhead
7-May-10	11:36	37	30.300733	-80.308945	W	6	1	90°	1	Shark
7-May-10	12:22	63	30.366674	-79.800378	E	7	1	120°	1	Hammerhead
7-May-10	14:53	88	30.500746	-80.207887	E	9	2	100°	1	Shark
7-May-10	15:19	94	30.566305	-80.222107	W	10	1	80°	1	Hammerhead

Table 20. All manta ray (*Manta birostris*) sightings in the proposed USWTR site off Jacksonville, Florida for aerial surveys conducted from January 2009 – June 2010.

Date	Time	Waypoint	Latitude	Longitude -1	Heading	Track Number	Angle Out	Degree Forward	Best Number	Comments
26-Feb-09	10:42	17	30.499065	-80.296745	W	9	2	90°	1	
9-Jun-09	15:48	52	30.234641	-80.194249	W	5	2	120°	1	Dark manta ray
9-Jun-09	15:51	53	30.237790	-80.314794	W	5	2	120°	1	Dark manta ray
9-Jun-09	15:56	66	30.231994	-80.553703	W	5	2	90°	1	Large black manta ray
10-Jun-09	14:41	48	30.363599	-80.313477	E	7	2	90°	1	
10-Jun-09	16:06	67	30.497121	-80.138479	E	9	2	90°	1	
15-Jul-09	13:25	47	29.965157	-80.400766	E	1	1	90°	1	Black Manta
15-Jul-09	16:09	97	30.232875	-80.439084	E	5	1	90°	1	Large, dark gray manta
15-Jul-09	16:12	99	30.234760	-80.417826	E	5	2	75°	1	Large, submerged Manta
18-Sep-09	11:52	58	30.299940	-80.096086	E	6	2	90°	1	
18-Sep-09	12:04	61	30.235119	-79.864736	W	5	3	90°	1	
18-Sep-09	15:24	27	30.098325	-80.634902	W	3	1	90°	1	
20-Mar-10	9:54	10	30.032015	-80.169610	E	2	2	100°	1	
20-Mar-10	15:14	99	30.365660	-80.314292	W	7	2	110°	4	
24-Mar-10	11:12	27	30.365259	-80.268316	W	7	3	90°	4	
31-Mar-10	14:38	20	30.099803	-80.506598	E	3	1	90°	4	Manta rays circling
2-Apr-10	12:45	126	30.223377	-80.286922	E	5	3	110°	1	
2-Apr-10	12:49	88	30.232777	-80.183837	E	5	2	90°	1	dark grey manta
3-Apr-10	8:35	7	30.566792	-80.293604	E	10	1	90°	1	
3-Apr-10	8:36	8	30.566796	-80.270851	E	10	1	80°	1	
3-Apr-10	9:25	25	30.499780	-80.378204	W	9	1	75°	1	
7-May-10	10:59	27	30.233773	-80.282447	E	5	1	90°	1	Black with white lobes
7-May-10	11:00	29	30.233592	-80.230105	E	5	2	90°	2	
7-May-10	11:33	49	30.299685	-80.223928	W	6	2	90°	1	
7-May-10	12:37	52	30.433038	-80.221988	W	8	3	90°	1	
4-Jun-10	9:49	16	30.101423	-80.415602	E	3	2	145°	1	
4-Jun-10	10:03	22	30.096668	-79.922225	E	3	2	90°	1	
6-Jun-10	10:54	36	30.233030	-80.634104	E	5	2	100°	1	

Table 21. All unidentified ray sightings in the proposed USWTR site off Jacksonville, Florida for aerial surveys conducted from January 2009 – June 2010.

Date	Time	Waypoint	Latitude	Longitude -1	Heading	Track Number	Angle Out	Degree Forward	Best Number	Comments
11-Jun-09	10:48	23	30.033369	-79.892559	E	2	1	90°	1	Large ray
17-Jul-09	9:41	10	30.435083	-80.259841	W	8	1	90°	1	Dark gray ray
30-Sep-09	15:13	67	30.435873	-80.463483	W	8	2	90°	1	Unidentified large ray

Table 22. All ocean sunfish (*Mola mola*) sightings in the proposed USWTR site off Jacksonville, Florida for aerial surveys conducted from January 2009 – June 2010.

Date	Time	Waypoint	Latitude	Longitude -1	Heading	Track Number	Angle Out	Degree Forward	Best Number
26-Feb-09	10:59	27	30.486672	-80.683150	W	9	1	90°	1
27-Feb-09	9:06	8	29.966273	-80.407648	E	1	1	90°	1
27-Feb-09	9:07	9	29.966460	-80.365878	E	1	2	90°	1
20-Jan-10	14:11	84	30.361730	-80.624073	E	7	1	45°	1
20-Jan-10	14:39	105	30.367115	-80.037087	E	7	1	80°	1
28-Jan-10	16:08	88	30.299346	-80.205478	W	6	3	130°	1
20-Feb-10	13:04	75	30.232685	-79.859932	W	5	2	90°	2
20-Feb-10	16:51	132	30.031664	-79.806622	E	2	2	120°	2
24-Mar-10	9:02	4	30.567286	-80.651946	E	10	1	90°	1

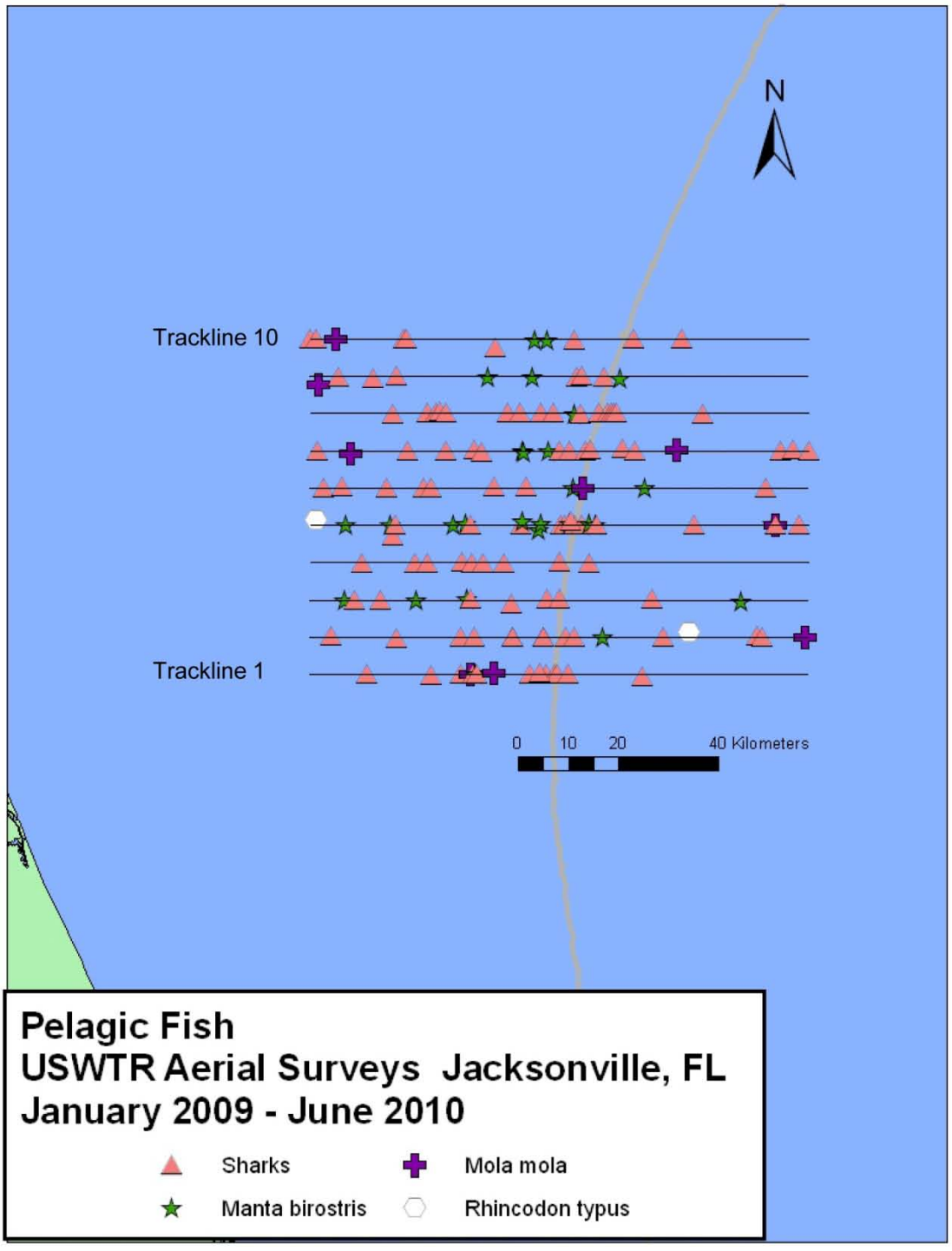

Figure 21. Whale shark (*Rhincodon typus*), unidentified sharks, manta ray (*Manta birostris*), ocean sunfish (*Mola mola*), and unidentified ray sightings.

Vessel Sightings

Commercial (Table 23, Fig. 22)

A total of 60 commercial vessels (*e.g*. tankers, car carriers, and container vessels) were observed in the study site.

Table 23. All commercial vessel sightings in the proposed USWTR site off of Jacksonville, Florida for aerial surveys conducted from January 2009 – June 2010.

Date	Time	Waypoint	Latitude	Longitude -1	Heading	Track Number	Angle Out	Degree Forward	Best Number	Comments
27-Jan-09	12:45	4	29.963798	-80.556400	E	1	2	45°	1	Large tanker
27-Jan-09	13:45	28	30.098463	-80.681908	E	3	4	90°	1	Large container vessel
28-Jan-09	11:09	6	30.432567	-79.876427	W	8	4	30°	1	Large tanker heading south
26-Feb-09	15:48	60	30.030124	-80.681861	E	2	2	90°	1	Large cargo vessel
27-Feb-09	9:52	20	30.030728	-80.346591	W	2	3	30°	1	Large container heading south
31-Mar-09	15:08	4	30.232947	-80.588500	E	5	4	60°	1	Large container heading south
31-Mar-09	15:17	6	30.233000	-80.242817	E	5	4	45°	1	Large cargo vessel
10-Jun-09	14:53	75	30.365392	-80.004638	E	7	3	60°	1	Container ship
10-Jun-09	14:53	75	30.365392	-80.004638	E	7	3	60°	1	Container ship
11-Jun-09	9:00	6	30.167750	-80.428494	E	4	4	30°	1	Container vessel
15-Jul-09	16:22	111	30.235932	-80.077337	E	5	3	90°	1	Car carrier
5-Aug-09	9:04	6	29.966581	-80.406933	E	1	4	70°	1	Freighter
5-Aug-09	9:29	10	30.032215	-80.034982	W	2	3	60°	1	Cargo ship
5-Aug-09	9:41	12	30.031998	-80.503427	W	2	2	45°	1	Freighter
5-Aug-09	10:06	18	30.100922	-80.058129	E	3	3	90°	1	Cargo ship
5-Aug-09	10:17	28	30.166734	-79.851350	W	4	1	90°	1	Container ship
5-Aug-09	11:34	44	30.298831	-80.367626	W	6	3	90°	1	Cargo ship
15-Sep-09	10:08	8	29.964560	-79.925177	E	1	4	70°	1	Cargo
15-Sep-09	15:33	75	30.364940	-80.366937	E	7	4	15°	1	Container ship
16-Sep-09	10:18	2	29.963075	-80.682160	E	1	4	75°	1	Container ship
16-Sep-09	10:53	15	29.965683	-79.965953	E	1	4	25°	1	Cargo vessel
16-Sep-09	11:05	21	30.034551	-79.969488	W	2	3	90°	1	Cargo
16-Sep-09	12:39	47	30.161139	-80.000668	W	4	2	90°	1	Container ship
16-Sep-09	13:22	57	30.168243	-80.576439	W	4	3	90°	1	Container ship
16-Sep-09	14:58	66	30.234373	-80.648730	E	5	3	90°	1	Cargo ship
18-Sep-09	9:06	9	30.563600	-80.436510	E	10	4	90°	1	Cargo vessel
18-Sep-09	11:58	43	30.298896	-79.891329	E	6	1	30°	1	Large cargo vessel
30-Sep-09	10:52	44	30.102760	-79.954743	E	3	4	30°	1	Container vessel
30-Sep-09	14:23	83	30.368508	-80.631045	E	7	4	45°	1	Car carrier
30-Sep-09	14:37	87	30.363830	-80.058769	E	7	4	30°	1	Container ship
30-Sep-09	15:47	74	30.567011	-80.045292	E	10	3	90°	1	Tanker
20-Nov-09	10:50	20	30.166036	-80.143074	W	4	4	30°	1	Container vessel
8-Dec-09	10:11	7	30.500235	-79.989431	W	9	4	30°	2	Tug pulling barge
8-Dec-09	10:55	13	30.432783	-79.932671	E	8	2	20°	1	Car carrier
8-Dec-09	11:09	14	30.365831	-80.078456	W	7	3	90°	2	Oilers
8-Dec-09	11:47	20	30.299860	-80.019687	E	6	4	30°	1	Cargo
7-Jan-10	13:17	33	30.298657	-80.668845	W	6	4	60°	1	Large tug and tow
19-Jan-10	9:58	12	30.434071	-80.305804	E	8	2	30°	1	Freighter
19-Jan-10	10:03	12	30.434162	-80.107336	E	8	4	90°	1	Tug and barge

Table 23 (*continued*). All commercial vessel sightings in the proposed USWTR site off of Jacksonville, Florida for aerial surveys conducted from January 2009 – June 2010.

Date	Time	Waypoint	Latitude	Longitude -1	Heading	Track Number	Angle Out	Degree Forward	Best Number	Comments
19-Jan-10	13:44	37	30.167740	-80.327292	E	4	2	45°	1	Freighter
20-Jan-10	10:18	30	30.030946	-80.595166	W	2	3	30°	1	Container vessel
27-Jan-10	10:07	4	30.567683	-80.415632	E	10	4	10°	1	Tanker
27-Jan-10	10:10	5	30.567987	-80.316677	E	10	4	20°	1	Car carrier
28-Jan-10	12:08	56	30.100663	-80.352112	E	3	4	45°	1	Tanker
19-Feb-10	9:23	4	29.965202	-80.596727	E	1	4	100°	1	Tug and barge
20-Feb-10	12:58	65	30.299496	-79.890352	E	6	4	90°	1	Container ship
20-Feb-10	17:17	138	29.965548	-80.627177	W	1	2	90°	1	Large unidentified vessel
21-Feb-10	11:15	58	30.231589	-80.668332	E	5	4	30°	1	Tug and barge
20-Mar-10	13:34	33	30.166608	-80.079551	W	4	2	90°	1	Car carrier
24-Mar-10	12:34	67	30.232138	-79.831643	W	5	2	20°	1	Cargo vessel
1-Apr-10	14:40	52	30.166835	-80.328405	E	4	4	60°	1	Cargo vessel
1-Apr-10	16:16	81	30.031777	-80.119178	E	2	2	45°	1	Trawler
3-Apr-10	9:57	45	30.433357	-80.253190	E	8	3	90°	1	Large vessel
7-May-10	14:27	81	30.500010	-80.679132	E	9	4	60°	1	Cargo vessel
4-Jun-10	10:00	20	30.101010	-80.022094	E	3	4	75°	1	Cargo
4-Jun-10	11:24	39	30.300039	-80.119386	W	6	4	45°	1	Cargo vessel
5-Jun-10	10:48	19	30.300641	-79.996361	E	6	3	90°	1	Container ship
6-Jun-10	11:30	29	30.299723	-80.223580	W	6	4	30°	1	Cargo
6-Jun-10	13:44	40	30.366023	-80.038662	E	7	4	30°	1	Cargo vessel

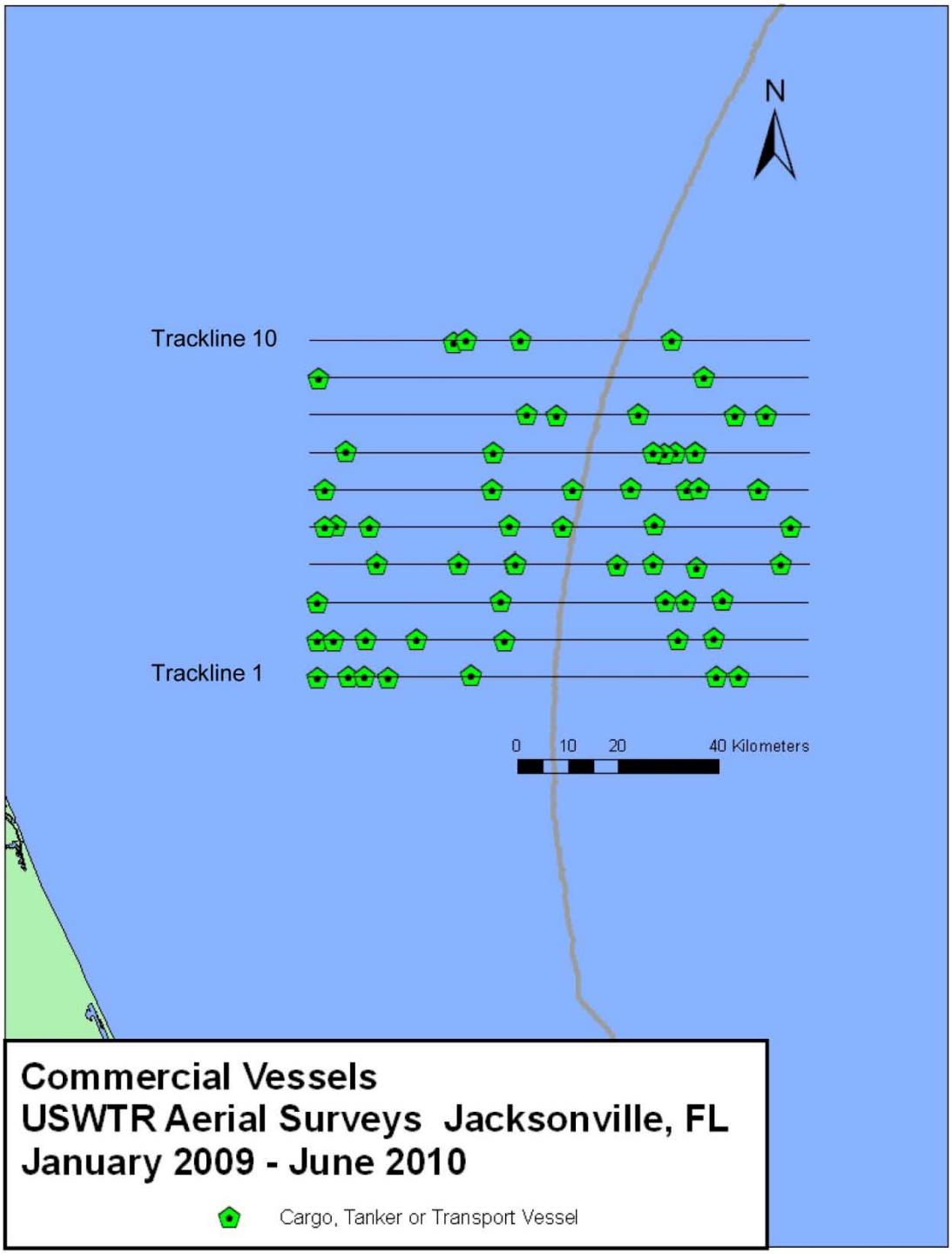

Figure 22. Large commercial shipping vessel sightings.

Military (Table 24, Fig, 23)

A total of 37 U.S. military vessels were seen during the study.

Table 24. All military vessel sightings in the proposed USWTR site off of Jacksonville, Florida for aerial surveys conducted from January 2009 – June 2010.

Date	Time	Waypoint	Latitude	Longitude -1	Heading	Track Number	Angle Out	Degree Forward	Best Number	Comments
26-Feb-09	9:32	4	30.567374	-80.644477	E	10	4	90°	1	Navy frigate
26-Feb-09	12:01	36	30.364356	-80.430649	W	7	3	90°	1	Military vessel
27-Feb-09	15:00	78	30.368447	-80.020384	E	7	4	45°	1	Navy sub
31-Mar-09	16:42	19	30.431989	-80.583450	W	8	3	60°	1	Navy vessel with helicopter
9-Jun-09	15:19	48	30.299475	-80.449055	E	6	4	110°	1	Navy vessel
10-Jun-09	11:19	29	30.233370	-80.576034	E	5	4	30°	1	Warship
10-Jun-09	12:15	50	30.303484	-80.647134	W	6	4	45°	1	Large Navy vessel
10-Jun-09	12:15	50	30.303484	-80.647134	W	6	4	45°	1	Large Navy vessel
11-Jun-09	11:28	35	29.968349	-80.351004	W	1	4	30°	1	Warship
4-Aug-09	15:10	56	30.232750	-79.883809	W	5	3	45°	1	Navy frigate
6-Aug-09	9:31	12	29.962389	-80.089341	E	1	4	90°	1	Large Navy Vessel
14-Sep-09	14:18	28	30.364917	-80.692134	W	7	4	70°	1	Navy frigate
15-Sep-09	9:39	3	29.967259	-80.576767	E	1	3	45°	1	Frigate
16-Sep-09	10:47	14	29.966112	-80.189186	E	1	3	110°	1	Military vessel
16-Sep-09	11:08	22	30.034720	-80.092276	W	2	3	90°	1	Navy warship
18-Sep-09	12:00	44	30.294765	-79.801784	E	6	4	30°	1	Military vessel
18-Sep-09	12:38	66	30.232710	-80.586087	W	5	4	90°	1	Military vessel
18-Sep-09	14:48	15	30.163718	-80.214488	E	4	4	60°	1	Frigate
18-Sep-09	15:13	25	30.100653	-80.229399	W	3	3	90°	1	Frigate
18-Sep-09	16:33	50	29.963708	-80.102831	W	1	4	15°	1	Frigate
1-Oct-09	9:13	9	30.493002	-79.835457	W	9	4	75°	1	Aircraft carrier
17-Nov-09	13:34	16	30.498678	-80.149788	W	9	4	30°	3	Navy vessels - destroyers
17-Nov-09	13:57	21	30.434621	-80.484953	E	8	4	10°	1	Navy vessel - destroyer
17-Nov-09	15:28	40	30.231829	-80.253751	W	5	4	45°	1	Navy vessel
20-Nov-09	10:59	21	30.165755	-80.483740	W	4	4	45°	1	Aircraft carrier
20-Nov-09	11:00	23	30.165965	-80.542110	W	4	4	60°	1	Frigate
28-Jan-10	12:28	51	30.165555	-79.874844	W	4	4	80°	1	Aircraft carrier
24-Mar-10	13:01	76	30.232172	-80.535759	W	5	4	30°	1	Frigate
4-Jun-10	11:39	47	30.298669	-80.645588	W	6	3	90°	2	Frigates
6-Jun-10	10:26	25	30.165963	-80.177322	W	4	4	30°	1	Large Navy vessel
6-Jun-10	14:06	43	30.433820	-80.269354	W	8	3	30°	1	Frigate
6-Jun-10	14:11	55	30.433281	-80.444991	W	8	4	80°	1	Navy ship
6-Jun-10	14:12	56	30.433961	-80.493500	W	8	4	60°	1	Navy ship
6-Jun-10	14:26	60	30.499914	-80.491165	E	9	4	45°	1	Navy ship

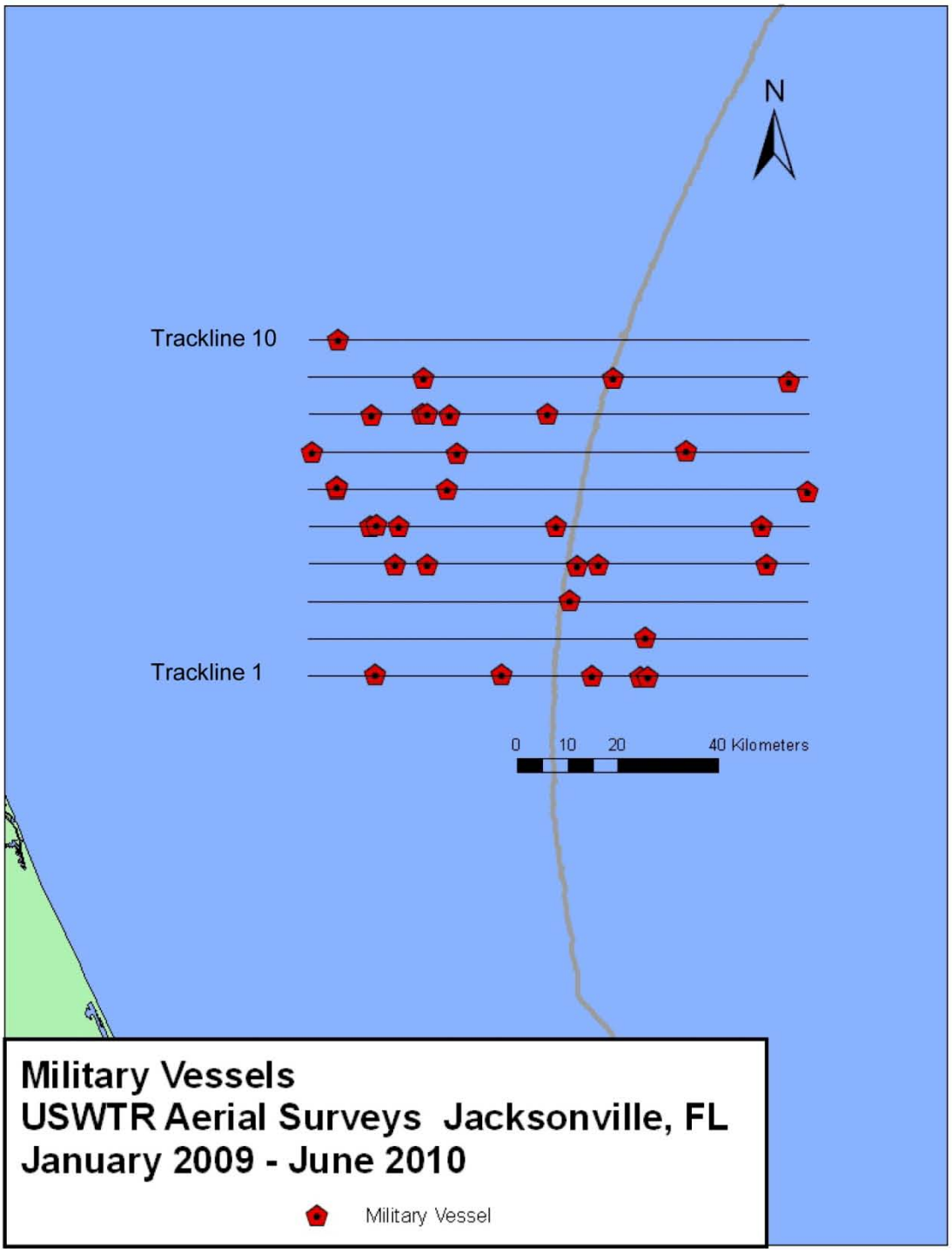

Figure 23. Military vessel sightings.

Other Vessels (Table 25, Fig. 24)

A total of 479 other vessels were recorded in the survey area. Recreational sport fishing vessels constituted the majority of these sightings (n=440). This category also included head boats, sailing vessels and yachts.

Table 25. All other vessel sightings in the proposed USWTR site off of Jacksonville, Florida for aerial surveys conducted from January 2009 – June 2010.

Date	Time	Waypoint	Latitude	Longitude -1	Heading	Track Number	Angle Out	Degree Forward	Best Number	Comments
27-Jan-09	12:57	13	29.963762	-80.314313	E	1	4	30°	1	Recreational fishing vessel
27-Jan-09	13:37	22	30.035443	-80.483597	W	2	4	45°	1	Recreational fishing vessel
27-Jan-09	15:02	52	30.227535	-80.662528	E	5	2	45°	1	Recreational fishing vessel
27-Jan-09	15:07	55	30.224100	-80.475308	E	5	2	45°	1	Recreational fishing vessel
27-Jan-09	15:09	31	30.234702	-80.415827	E	5	3	45°	1	Recreational fishing vessel
27-Jan-09	15:11	57	30.232040	-80.326377	E	5	2	60°	1	Recreational fishing vessel
28-Jan-09	11:18	6	30.432370	-80.221080	W	8	3	90°	1	Recreational fishing vessel
28-Jan-09	11:38	12	30.498375	-80.527993	E	9	2	45°	1	Research vessel
28-Jan-09	11:40	14	30.501470	-80.440618	E	9	1	90°	1	Research vessel
26-Feb-09	9:39	6	30.565872	-80.382674	E	10	2	90°	1	Large anchored fishing vessel
26-Feb-09	9:40	9	30.565324	-80.353256	E	10	2	90°	1	Head boat
26-Feb-09	9:46	10	30.566923	-80.159474	E	10	4	90°	1	Head boat
26-Feb-09	10:46	18	30.498749	-80.443653	W	9	3	90°	1	Head boat
26-Feb-09	15:03	51	30.167652	-80.262537	E	4	1	90°	1	Fishing vessel dragging object
26-Feb-09	15:03	62	30.167643	-80.259759	E	4	2	90°	1	Recreational fishing vessel
26-Feb-09	15:34	69	30.098577	-80.286986	W	3	4	90°	1	Unidentified small vessel
26-Feb-09	15:41	71	30.098177	-80.560501	W	3	4	90°	1	Recreational fishing vessel
26-Feb-09	15:58	76	30.033672	-80.305812	E	2	4	90°	1	Unidentified small vessel
27-Feb-09	8:53	3	29.965466	-80.631919	E	1	4	90°	2	Recreational fishing vessel
27-Feb-09	10:15	33	30.100738	-80.486576	E	3	4	30°	1	Recreational fishing vessel
27-Feb-09	10:57	47	30.166222	-80.332909	W	4	1	90°	1	Recreational fishing vessel
27-Feb-09	11:56	58	30.233341	-80.315722	E	5	3	60°	1	Recreational fishing vessel
27-Feb-09	14:31	71	30.366403	-80.638759	E	7	3	90°	1	Recreational fishing vessel
27-Feb-09	15:39	99	30.500169	-80.577866	E	9	3	90°	1	Recreational fishing vessel
27-Feb-09	15:39	85	30.500227	-80.552455	E	9	1	30°	1	Recreational fishing vessel
31-Mar-09	15:09	3	30.232464	-80.547458	E	5	4	90°	1	Recreational fishing vessel
31-Mar-09	15:15	4	30.235166	-80.317295	E	5	3	90°	1	Recreational fishing vessel
31-Mar-09	15:50	9	30.297021	-80.567776	W	6	2	60°	1	Recreational fishing vessel
31-Mar-09	16:00	14	30.367080	-80.557741	E	7	4	90°	1	Recreational fishing vessel
31-Mar-09	16:04	14	30.366341	-80.431640	E	7	2	60°	1	Recreational vessel
31-Mar-09	16:35	21	30.429681	-80.283188	W	8	3	60°	1	Recreational vessel
31-Mar-09	16:39	22	30.436926	-80.449472	W	8	2	60°	1	Recreational vessel
31-Mar-09	16:54	22	30.501739	-80.485719	E	9	2	90°	1	Recreational fishing vessel
31-Mar-09	16:55	26	30.502630	-80.473051	E	9	3	90°	1	Recreational fishing vessel
9-Jun-09	13:54	16	30.500298	-80.183687	W	9	3	45°	1	Recreational fishing vessel
9-Jun-09	15:54	54	30.237455	-80.452866	W	5	2	60°	2	Two recreational fishing vessels
10-Jun-09	9:44	8	30.030036	-79.820384	W	2	2	75°	1	Catamaran
10-Jun-09	9:48	9	30.030200	-79.981689	W	2	4	75°	1	Sailboat
10-Jun-09	10:01	9	30.030754	-80.429301	W	2	2	30°	1	Recreational fishing vessel

Table 25 (continued). All other vessel sightings in the proposed USWTR site off of Jacksonville, Florida for aerial surveys conducted from January 2009 – June 2010.

Date	Time	Waypoint	Latitude	Longitude -1	Heading	Track Number	Angle Out	Degree Forward	Best Number	Comments
10-Jun-09	10:12	14	30.097061	-80.671979	E	3	1	75°	1	Recreational fishing vessel
10-Jun-09	10:12	14	30.097061	-80.671979	E	3	1	75°	1	Recreational fishing vessel
10-Jun-09	10:36	22	30.164653	-79.819635	W	4	4	75°	1	Small sailboat
10-Jun-09	10:36	22	30.164653	-79.819635	W	4	4	75°	1	Small sailboat
10-Jun-09	11:52	42	30.300278	-80.244008	W	6	1	60°	1	Recreational fishing vessel
10-Jun-09	11:52	42	30.300278	-80.244008	W	6	1	60°	1	Recreational fishing vessel
10-Jun-09	14:36	64	30.365295	-80.505891	E	7	4	45°	2	Recreational fishing vessel
10-Jun-09	14:36	64	30.365295	-80.505891	E	7	4	45°	2	Recreational fishing vessel
10-Jun-09	15:44	93	30.498112	-80.663010	E	9	1	30°	1	Recreational fishing vessel
10-Jun-09	15:44	93	30.498112	-80.663010	E	9	1	30°	1	Recreational fishing vessel
10-Jun-09	15:47	95	30.499101	-80.580287	E	9	1	60°	1	Recreational fishing vessel
10-Jun-09	15:47	95	30.499101	-80.580287	E	9	1	60°	1	Recreational fishing vessel
11-Jun-09	10:10	18	30.031475	-80.538536	E	2	3	60°	1	Recreational fishing vessel
11-Jun-09	11:26	34	29.967494	-80.285588	W	1	1	90°	1	Recreational fishing vessel
11-Jun-09	11:34	28	29.966270	-80.636657	W	1	3	45°	1	Recreational fishing vessel
15-Jul-09	13:28	36	29.967006	-80.276804	E	1	4	90°	1	Recreational fishing vessel
15-Jul-09	14:25	69	30.033116	-80.625140	W	2	3	90°	1	Head boat
15-Jul-09	14:25	68	30.034123	-80.615770	W	2	3	90°	1	Sport fishing vessel
15-Jul-09	14:36	83	30.103399	-80.448777	E	3	1	90°	1	Sport fishing vessel
15-Jul-09	14:49	70	30.101071	-80.122180	E	3	1	30°	1	Recreational fishing vessel
15-Jul-09	16:47	118	30.302578	-80.443221	W	6	4	90°	1	Sport fishing vessel
16-Jul-09	10:09	10	30.499394	-80.552078	W	9	3	45°	1	Recreational fishing vessel
16-Jul-09	10:09	15	30.499331	-80.541828	W	9	2	90°	1	Sport fishing vessel
16-Jul-09	10:09	14	30.498638	-80.523033	W	9	2	90°	1	Sport fishing vessel
16-Jul-09	10:12	11	30.497065	-80.641479	W	9	3	45°	1	Recreational fishing vessel
16-Jul-09	14:29	37	30.031651	-80.681815	E	2	3	90°	1	Sport fishing vessel
16-Jul-09	16:10	72	29.964087	-80.594572	W	1	3	90°	1	Sport fishing vessel
17-Jul-09	9:58	15	30.500868	-80.509779	E	9	3	90°	1	Recreational fishing vessel
5-Aug-09	9:44	14	30.032061	-80.603551	W	2	4	90°	1	Sport fishing vessel
5-Aug-09	14:06	43	30.435000	-80.460162	W	8	1	80°	1	Recreational fishing vessel
5-Aug-09	14:06	57	30.432749	-80.480753	W	8	2	90°	1	Sport fishing vessel
6-Aug-09	9:57	16	30.034216	-80.418158	W	2	3	60°	1	Recreational fishing vessel
6-Aug-09	9:59	17	30.033202	-80.524021	W	2	3	90°	1	Head boat
6-Aug-09	9:59	11	30.032313	-80.509984	W	2	2	30°	1	Recreational fishing vessel
6-Aug-09	10:03	18	30.030871	-80.653959	W	2	2	90°	1	Unidentified vessel - research?
6-Aug-09	11:28	35	30.501677	-80.555969	E	9	2	90°	1	Recreational fishing vessel
6-Aug-09	12:27	46	30.565642	-80.456062	W	10	4	80°	1	Recreational fishing vessel
14-Sep-09	12:07	4	30.563890	-80.408703	E	10	4	60°	1	Recreational fishing vessel
14-Sep-09	13:13	13	30.429299	-80.505859	E	8	4	30°	1	Small fishing vessel, longliner?

Table 25 (continued). All other vessel sightings in the proposed USWTR site off of Jacksonville, Florida for aerial surveys conducted from January 2009 – June 2010.

Date	Time	Waypoint	Latitude	Longitude -1	Heading	Track Number	Angle Out	Degree Forward	Best Number	Comments
14-Sep-09	13:18	14	30.432004	-80.344827	E	8	4	45°	1	Recreational fishing vessel
14-Sep-09	13:18	16	30.432072	-80.347129	E	8	2	90°	1	Sport fishing vessel
14-Sep-09	14:05	27	30.368534	-80.224342	W	7	2	90°	1	Sport fishing vessel
14-Sep-09	14:11	22	30.367768	-80.429426	W	7	4	75°	1	Recreational fishing vessel
15-Sep-09	10:35	16	30.031342	-80.554592	W	2	2	45°	1	Recreational vessel
15-Sep-09	12:22	44	30.232272	-80.459481	E	5	1	90°	1	Recreational fishing vessel
15-Sep-09	12:34	52	30.234347	-80.259052	E	5	2	60°	1	Recreational fishing vessel
15-Sep-09	16:11	86	30.434124	-80.449872	W	8	3	60°	1	Recreational fishing vessel
15-Sep-09	16:39	98	30.502168	-80.524264	E	9	4	45°	1	Yacht
15-Sep-09	16:41	100	30.501451	-80.442957	E	9	4	30°	1	Recreational fishing vessel
15-Sep-09	17:34	118	30.551233	-80.406314	W	10	4	60°	1	Recreational fishing vessel
16-Sep-09	11:24	31	30.031108	-80.580216	W	2	2	90°	1	Sport fishing vessel
18-Sep-09	9:25	15	30.565033	-80.061632	E	10	3	45°	1	Sailboat
18-Sep-09	12:38	67	30.231665	-80.619274	W	5	4	90°	1	Large yacht
18-Sep-09	14:54	20	30.163518	-80.013086	E	4	3	90°	1	Sport fishing vessel
18-Sep-09	15:07	18	30.100904	-79.976464	W	3	4	60°	1	Yacht
18-Sep-09	15:59	40	30.029575	-80.518140	E	2	3	30°	1	Recreational fishing vessel
30-Sep-09	10:43	42	30.096864	-80.299236	E	3	2	15°	1	Recreational fishing vessel
30-Sep-09	10:43	23	30.096548	-80.308223	E	3	3	100°	3	3 recreational fishing vessels
1-Oct-09	8:59	7	30.567569	-80.289698	E	10	2	90°	1	Sport fishing vessel
1-Oct-09	10:30	38	30.434730	-79.946425	E	8	3	90°	1	Sport fishing vessel
1-Oct-09	10:42	25	30.365830	-79.966230	W	7	2	45°	1	Sport fishing vessel
1-Oct-09	10:56	26	30.366773	-80.498649	W	7	3	45°	1	Sport fishing vessel
1-Oct-09	14:12	54	30.166652	-80.487206	E	4	3	70°	1	Sport fishing vessel
1-Oct-09	14:15	91	30.162928	-80.420625	E	4	3	110°	1	Sport fishing vessel
1-Oct-09	14:25	59	30.166030	-80.063784	E	4	2	60°	1	Sport fishing vessel
1-Oct-09	15:06	68	30.102284	-80.547681	W	3	1	90°	1	Sport fishing vessel
1-Oct-09	15:10	107	30.102546	-80.677445	W	3	2	90°	1	Sport fishing vessel
17-Nov-09	14:42	30	30.364591	-80.573681	W	7	3	60°	1	Recreational fishing vessel
17-Nov-09	15:37	43	30.231670	-80.588373	W	5	4	75°	1	Sailboat
18-Nov-09	9:33	16	30.031073	-80.614887	W	2	4	30°	1	Recreational fishing vessel
18-Nov-09	10:29	30	30.166131	-80.224617	W	4	4	45°	1	Recreational fishing vessel
18-Nov-09	10:34	31	30.165845	-80.423977	W	4	4	60°	2	2 recreational fishing vessels
18-Nov-09	10:56	39	30.232820	-80.546164	E	5	3	90°	1	Sailing vessel
18-Nov-09	10:58	40	30.233139	-80.486137	E	5	4	70°	1	Recreational fishing vessel
18-Nov-09	11:20	46	30.299016	-79.859384	W	6	4	30°	1	Recreational fishing vessel
18-Nov-09	11:33	50	30.299885	-80.228210	W	6	2	90°	1	Recreational fishing vessel
18-Nov-09	14:26	79	30.498677	-80.326960	W	9	2	60°	1	Recreational fishing vessel
18-Nov-09	14:35	86	30.498581	-80.647906	W	9	1	30°	1	Recreational fishing vessel

Table 25 (continued). All other vessel sightings in the proposed USWTR site off of Jacksonville, Florida for aerial surveys conducted from January 2009 – June 2010.

Date	Time	Waypoint	Latitude	Longitude -1	Heading	Track Number	Angle Out	Degree Forward	Best Number	Comments
20-Nov-09	9:16	7	29.966762	-80.410461	E	1	2	100°	1	Sport fishing vessel
20-Nov-09	9:38	10	30.030813	-79.900999	W	2	4	90°	1	Sport fishing vessel
20-Nov-09	10:08	13	30.030882	-80.580102	W	2	4	15°	1	Long liner
20-Nov-09	10:15	18	30.099740	-80.682098	E	3	4	90°	1	Sport fishing vessel
20-Nov-09	10:59	22	30.165887	-80.509999	W	4	1	60°	1	Long liner
8-Dec-09	11:12	17	30.366223	-80.223648	W	7	3	45°	1	Long liner
8-Dec-09	13:29	34	30.031909	-80.306354	E	2	3	90°	1	Sport fishing vessel
22-Dec-09	9:25	10	30.032059	-80.233439	W	2	4	60°	1	Fishing vessel
22-Dec-09	12:09	36	30.300357	-80.369392	W	6	2	90°	1	Sport fishing vessel
22-Dec-09	14:14	52	30.365908	-80.217778	E	7	4	30°	1	Recreational fishing vessel
22-Dec-09	15:05	64	30.498699	-80.651004	E	9	1	45°	1	Recreational fishing vessel
7-Jan-10	9:52	4	29.966108	-80.602799	E	1	3	60°	1	Recreational fishing vessel
7-Jan-10	10:01	5	29.966391	-80.302119	E	1	4	45°	1	Recreational fishing vessel
7-Jan-10	11:14	12	30.102339	-80.329161	E	3	2	30°	1	Recreational fishing vessel
7-Jan-10	11:48	17	30.166060	-80.309542	W	4	3	30°	1	R/V Volute
7-Jan-10	12:27	27	30.233886	-80.285684	E	5	3	30°	1	Recreational fishing vessel
7-Jan-10	15:32	44	30.367541	-80.241315	E	7	2	45°	1	Fishing vessel
7-Jan-10	15:34	45	30.368866	-80.147815	E	7	4	30°	1	R/V Volute
7-Jan-10	16:39	58	30.500473	-80.521120	E	9	4	45°	1	Recreational fishing vessel
19-Jan-10	9:07	4	30.567735	-80.153580	E	10	2	90°	1	Sport fishing vessel
19-Jan-10	9:31	7	30.498916	-80.194212	W	9	2	90°	1	Sport fishing vessel
19-Jan-10	9:32	7	30.498756	-80.245317	W	9	3	45°	2	Recreational fishing vessel
19-Jan-10	9:41	9	30.498725	-80.560927	W	9	2	45°	1	Recreational fishing vessel
19-Jan-10	10:38	21	30.365371	-80.199827	W	7	3	45°	6	Recreational fishing vessel
19-Jan-10	14:20	44	30.099934	-80.262465	W	3	3	45°	1	Recreational fishing vessel
19-Jan-10	15:49	62	29.964877	-80.384324	W	1	2	30°	1	Recreational fishing vessel
20-Jan-10	9:03	4	29.965534	-80.681012	E	1	4	60°	1	Recreational fishing vessel
20-Jan-10	9:12	7	29.966356	-80.342831	E	1	4	80°	1	Recreational fishing vessel
20-Jan-10	9:13	4	29.966296	-80.299834	E	1	3	110°	1	Recreational fishing vessel
20-Jan-10	9:14	5	29.966485	-80.269966	E	1	2	90°	1	Recreational fishing vessel
20-Jan-10	9:15	9	29.966360	-80.246742	E	1	4	90°	3	Fishing vessels
20-Jan-10	9:51	15	30.031040	-80.279908	W	2	3	60°	1	Recreational fishing vessel
20-Jan-10	10:02	20	30.031628	-80.451808	W	2	4	90°	1	Recreational fishing vessel
20-Jan-10	10:38	39	30.100508	-80.487656	E	3	4	75°	1	Recreational fishing vessel
20-Jan-10	10:44	41	30.100957	-80.253611	E	3	4	60°	1	Recreational fishing vessel
20-Jan-10	11:20	49	30.166030	-80.226508	W	4	3	20°	1	Recreational fishing vessel
20-Jan-10	11:21	42	30.166098	-80.255511	W	4	4	60°	1	Recreational fishing vessel
20-Jan-10	11:49	52	30.233458	-80.338097	E	5	4	60°	1	Unidentified mid-sized vessel
20-Jan-10	11:50	53	30.233382	-80.280425	E	5	4	90°	1	Recreational fishing vessel

Table 25 (continued). All other vessel sightings in the proposed USWTR site off of Jacksonville, Florida for aerial surveys conducted from January 2009 – June 2010.

Date	Time	Waypoint	Latitude	Longitude -1	Heading	Track Number	Angle Out	Degree Forward	Best Number	Comments
20-Jan-10	15:04	112	30.432201	-80.477579	W	8	2	30°	1	Long liner
20-Jan-10	15:17	91	30.498198	-80.663331	E	9	2	90°	1	Yacht
20-Jan-10	15:19	122	30.500110	-80.565464	E	9	3	90°	2	Recreational fishing vessel
20-Jan-10	15:34	95	30.501025	-80.260058	E	9	2	90°	1	Recreational fishing vessel
27-Jan-10	11:06	13	30.434425	-80.359564	E	8	3	60°	1	Head boat
27-Jan-10	11:45	18	30.364432	-80.488151	W	7	4	30°	1	Long liner
27-Jan-10	12:42	26	30.231813	-80.398660	W	5	4	20°	1	Unidentified vessel
28-Jan-10	9:45	9	29.966230	-80.397776	E	1	4	90°	1	Recreational fishing vessel
28-Jan-10	9:46	11	29.966509	-80.359401	E	1	4	80°	1	Recreational fishing vessel
28-Jan-10	9:47	11	29.966570	-80.354634	E	1	4	30°	1	Recreational fishing vessel
28-Jan-10	9:50	14	29.967164	-80.296979	E	1	4	90°	3	3 recreational fishing vessels
28-Jan-10	10:13	19	29.964481	-80.211326	E	1	3	90°	3	Recreational fishing vessels
28-Jan-10	10:13	17	29.965387	-80.201084	E	1	4	90°	3	3 recreational fishing vessels
28-Jan-10	10:56	25	30.031573	-80.168782	W	2	4	90°	1	Recreational fishing vessel
28-Jan-10	10:57	28	30.031622	-80.199476	W	2	4	90°	1	Recreational fishing vessel
28-Jan-10	11:00	27	30.031496	-80.279421	W	2	4	90°	4	4 recreational fishing vessels
28-Jan-10	11:16	37	30.030857	-80.643838	W	2	4	90°	1	Recreational fishing vessel
28-Jan-10	12:09	47	30.100955	-80.318533	E	3	4	60°	3	Recreational fishing vessel
28-Jan-10	12:09	57	30.100983	-80.313937	E	3	3	30°	4	Recreational fishing vessels
28-Jan-10	12:14	59	30.101098	-80.148774	E	3	2	45°	1	Recreational fishing vessel
28-Jan-10	12:38	54	30.166182	-80.248065	W	4	4	90°	4	4 recreational fishing vessels
28-Jan-10	15:31	79	30.233959	-80.263940	E	5	4	90°	2	3 recreational fishing vessels
28-Jan-10	16:09	89	30.299074	-80.228467	W	6	4	90°	1	Recreational fishing vessel
19-Feb-10	9:31	4	29.965920	-80.293741	E	1	2	90°	1	Sport fishing vessel
19-Feb-10	10:01	7	30.031911	-80.296459	W	2	2	45°	1	Recreational fishing vessel
19-Feb-10	10:01	9	30.032119	-80.291237	W	2	3	90°	1	Sport fishing vessel
19-Feb-10	10:27	12	30.100370	-80.274202	E	3	2	90°	1	Sport fishing vessel
19-Feb-10	10:58	15	30.166571	-80.341002	W	4	3	90°	1	Sport fishing vessel
19-Feb-10	11:01	16	30.166727	-80.462567	W	4	4	90°	1	Sport fishing vessel
19-Feb-10	11:51	21	30.300606	-80.241793	W	6	1	90°	1	Sport fishing vessel
19-Feb-10	13:55	30	30.365627	-80.290494	W	7	2	45°	1	Recreational fishing vessel
19-Feb-10	14:50	41	30.499080	-80.607919	W	9	2	45°	1	Recreational fishing vessel
20-Feb-10	9:55	10	30.566785	-80.249336	E	10	3	60°	1	Recreational fishing vessel
20-Feb-10	9:55	6	30.566730	-80.244786	E	10	1	90°	2	Sport fishing vessels
20-Feb-10	9:56	11	30.566841	-80.190108	E	10	4	45°	3	3 recreational fishing vessels
20-Feb-10	10:00	13	30.566450	-80.076616	E	10	3	80°	1	Recreational fishing vessel
20-Feb-10	10:19	17	30.499805	-80.104982	W	9	3	45°	1	Recreational fishing vessel
20-Feb-10	10:21	18	30.499711	-80.166025	W	9	3	70°	2	Recreational fishing vessels
20-Feb-10	10:23	12	30.499951	-80.257601	W	9	3	90°	1	Sport fishing vessel

Table 25 (continued). All other vessel sightings in the proposed USWTR site off of Jacksonville, Florida for aerial surveys conducted from January 2009 – June 2010.

Date	Time	Waypoint	Latitude	Longitude -1	Heading	Track Number	Angle Out	Degree Forward	Best Number	Comments
20-Feb-10	11:19	44	30.433284	-80.422050	E	8	3	90°	1	Recreational fishing vessel
20-Feb-10	11:20	45	30.433369	-80.378408	E	8	1	90°	1	Unidentified vessel
20-Feb-10	11:22	47	30.433353	-80.298532	E	8	4	90°	1	Recreational fishing vessel
20-Feb-10	11:22	31	30.433389	-80.316924	E	8	1	90°	1	Sport fishing vessel
20-Feb-10	11:25	49	30.433492	-80.210262	E	8	1	90°	1	Recreational fishing vessel
20-Feb-10	11:25	33	30.433442	-80.198276	E	8	3	90°	1	Sport fishing vessel
20-Feb-10	11:26	50	30.433354	-80.168364	E	8	4	120°	1	Recreational fishing vessel
20-Feb-10	11:51	54	30.366062	-80.238532	W	7	3	25°	1	Recreational fishing vessel
20-Feb-10	11:51	37	30.366165	-80.224784	W	7	2	90°	1	Sport fishing vessel
20-Feb-10	12:46	70	30.299948	-80.298509	E	6	3	60°	1	Recreational fishing vessel
20-Feb-10	13:22	80	30.233586	-80.219858	W	5	1	60°	1	Recreational fishing vessel
20-Feb-10	13:23	81	30.233046	-80.246810	W	5	3	45°	2	Recreational fishing vessel
20-Feb-10	13:24	82	30.233236	-80.301142	W	5	2	90°	1	Recreational fishing vessel
20-Feb-10	15:29	103	30.166348	-80.412457	E	4	3	80°	1	Recreational fishing vessel
20-Feb-10	15:30	104	30.166488	-80.367434	E	4	4	60°	1	Recreational fishing vessel
20-Feb-10	15:33	106	30.166402	-80.261071	E	4	4	150°	1	Recreational fishing vessel
20-Feb-10	16:07	115	30.100649	-80.293715	W	3	4	70°	1	Recreational fishing vessel
20-Feb-10	16:10	117	30.100760	-80.408612	W	3	2	90°	1	Recreational fishing vessel
20-Feb-10	16:26	123	30.031242	-80.636736	E	2	3	90°	1	Recreational fishing vessel
20-Feb-10	16:28	124	30.031370	-80.594105	E	2	4	90°	1	Recreational fishing vessel
20-Feb-10	16:30	127	30.031659	-80.513103	E	2	3	90°	1	Recreational fishing vessel
20-Feb-10	17:19	139	29.965007	-80.705210	W	1	4	45°	1	Sailing vessel
21-Feb-10	8:36	4	29.965085	-80.570923	E	1	3	75°	1	Recreational fishing vessel
21-Feb-10	8:40	5	29.965363	-80.416248	E	1	4	45°	1	Recreational fishing vessel
21-Feb-10	8:43	6	29.965442	-80.303850	E	1	4	60°	1	Recreational fishing vessel
21-Feb-10	8:43	8	29.965428	-80.302501	E	1	2	90°	2	Recreational fishing vessel
21-Feb-10	8:45	7	29.965650	-80.242056	E	1	2	75°	1	Recreational fishing vessel
21-Feb-10	9:23	20	30.029313	-80.170863	W	2	3	90°	7	Recreational fishing vessels
21-Feb-10	9:29	20	30.032129	-80.388044	W	2	3	75°	2	Recreational fishing vessel
21-Feb-10	9:32	22	30.031998	-80.509835	W	2	3	75°	2	Recreational fishing vessel
21-Feb-10	10:10	35	30.100138	-80.326096	E	3	3	60°	2	Recreational fishing vessel
21-Feb-10	10:10	35	30.100165	-80.329679	E	3	3	90°	4	Recreational fishing vessels
21-Feb-10	10:12	37	30.100438	-80.244495	E	3	2	90°	4	Recreational fishing vessels
21-Feb-10	10:51	48	30.166867	-80.233026	W	4	2	60°	2	Recreational fishing vessel
21-Feb-10	10:52	50	30.166818	-80.250277	W	4	3	60°	1	Recreational fishing vessel
21-Feb-10	11:55	69	30.233233	-80.254824	E	5	2	90°	3	Recreational fishing vessel
21-Feb-10	11:56	83	30.232906	-80.209035	E	5	2	45°	2	Recreational fishing vessel
21-Feb-10	12:31	91	30.300450	-80.282578	W	6	3	45°	1	Recreational fishing vessel
21-Feb-10	14:34	94	30.365595	-80.507666	E	7	1	75°	1	Recreational fishing vessel

Table 25 (continued). All other vessel sightings in the proposed USWTR site off of Jacksonville, Florida for aerial surveys conducted from January 2009 – June 2010.

Date	Time	Waypoint	Latitude	Longitude -1	Heading	Track Number	Angle Out	Degree Forward	Best Number	Comments
21-Feb-10	15:37	113	30.433661	-80.211039	W	8	1	80°	1	Recreational fishing vessel
21-Feb-10	15:59	125	30.498949	-80.526624	E	9	2	45°	1	Recreational fishing vessel
21-Feb-10	16:32	134	30.567136	-80.164595	W	10	3	60°	1	Recreational fishing vessel
20-Mar-10	9:24	4	29.965405	-80.442936	E	1	2	90°	1	Sport fishing vessel
20-Mar-10	9:28	5	29.965618	-80.320747	W	1	3	85°	5	Recreational fishing vessel
20-Mar-10	9:28	6	29.965630	-80.318289	E	1	2	90°	2	Sport fishing vessel
20-Mar-10	9:28	7	29.965657	-80.299516	E	1	2	90°	2	Sport fishing vessel
20-Mar-10	9:28	8	29.965489	-80.289174	E	1	4	90°	1	Sport fishing vessel
20-Mar-10	9:30	6	29.966034	-80.227038	W	1	3	75°	1	Recreational fishing vessel
20-Mar-10	9:57	12	30.032618	-80.252962	E	2	3	75°	6	Recreational fishing vessel
20-Mar-10	10:00	14	30.032215	-80.370052	W	2	3	90°	1	Sport fishing vessel
20-Mar-10	10:06	20	30.032039	-80.494857	E	2	2	60°	3	Recreational fishing vessel
20-Mar-10	10:19	21	30.031535	-80.677812	W	2	3	90°	1	Sport fishing vessel
20-Mar-10	13:14	46	30.098707	-80.283797	W	3	2	75°	5	Recreational fishing vessel
20-Mar-10	13:37	51	30.166580	-80.186105	E	4	3	60°	3	Recreational fishing vessel
20-Mar-10	14:11	50	30.232641	-80.373472	E	5	2	90°	1	Sport fishing vessel
20-Mar-10	15:05	67	30.365093	-80.628397	E	7	4	90°	1	Sport fishing vessel
20-Mar-10	15:07	69	30.365349	-80.540195	E	7	3	90°	1	Sport fishing vessel
24-Mar-10	9:51	13	30.498885	-80.409094	W	9	4	90°	12	Fishing vessels (12)
24-Mar-10	9:54	14	30.498806	-80.529135	W	9	3	45°	1	Long liner
24-Mar-10	11:11	26	30.365469	-80.217044	W	7	2	75°	1	Recreational fishing vessel
24-Mar-10	11:21	30	30.365337	-80.384316	W	7	3	45°	1	Sailing vessel
31-Mar-10	13:37	7	29.965578	-80.259123	E	1	1	90°	1	Recreational fishing vessel
31-Mar-10	14:06	11	30.032225	-80.282244	W	2	4	90°	1	Recreational fishing vessel
31-Mar-10	14:21	15	30.031936	-80.521611	W	2	2	90°	1	Sport fishing vessel
31-Mar-10	14:37	22	30.100032	-80.516402	E	3	3	90°	1	Sport fishing vessel
31-Mar-10	14:51	28	30.099921	-80.270551	E	3	3	90°	2	Sport fishing vessel
31-Mar-10	15:54	38	30.499068	-80.579337	E	9	1	90°	1	Recreational fishing vessel
31-Mar-10	15:57	40	30.499239	-80.470925	E	9	3	60°	13	Recreational fishing vessels
1-Apr-10	9:20	4	30.566769	-80.137010	E	10	3	90°	1	Recreational fishing vessel
1-Apr-10	9:49	7	30.499743	-80.402926	W	9	4	90°	1	Recreational fishing vessel
1-Apr-10	9:49	8	30.499763	-80.391555	W	9	4	45°	1	Recreational fishing vessel
1-Apr-10	9:51	9	30.499692	-80.457930	W	9	4	60°	1	Long liner
1-Apr-10	10:07	12	30.433207	-80.437235	E	8	4	80°	1	Long liner
1-Apr-10	10:38	17	30.366132	-80.208367	W	7	2	60°	1	Recreational fishing vessel
1-Apr-10	10:45	20	30.365992	-80.483667	W	7	4	45°	1	Recreational fishing vessel
1-Apr-10	10:47	15	30.365772	-80.554187	W	7	3	90°	1	Sailboat
1-Apr-10	12:10	32	30.233194	-80.182214	W	5	4	45°	1	Recreational fishing vessel
1-Apr-10	14:33	61	30.166222	-80.416000	E	4	4	60°	1	Recreational fishing vessel

Table 25 (continued). All other vessel sightings in the proposed USWTR site off of Jacksonville, Florida for aerial surveys conducted from January 2009 – June 2010.

Date	Time	Waypoint	Latitude	Longitude -1	Heading	Track Number	Angle Out	Degree Forward	Best Number	Comments
1-Apr-10	15:59	73	30.031416	-80.593560	E	2	4	60°	1	Recreational fishing vessel
2-Apr-10	9:22	10	29.965367	-80.405667	E	1	4	90°	2	Sport fishing vessel
2-Apr-10	9:28	15	29.965308	-80.327660	E	1	4	60°	1	Recreational fishing vessel
2-Apr-10	9:30	16	29.965589	-80.277965	E	1	2	90°	1	Recreational fishing vessel
2-Apr-10	10:15	43	30.032075	-80.093375	W	2	3	60°	1	Recreational fishing vessel
2-Apr-10	10:20	44	30.032208	-80.271337	W	2	2	60°	3	Recreational fishing vessel
2-Apr-10	11:24	52	30.099895	-79.918006	E	3	2	90°	1	Sport fishing vessel
2-Apr-10	11:53	97	30.167718	-80.254790	W	4	2	110°	2	Recreational fishing vessel
2-Apr-10	12:47	87	30.232937	-80.253059	E	5	2	90°	1	Sport fishing vessel
2-Apr-10	13:18	139	30.300408	-80.226106	W	6	1	75°	2	Recreational fishing vessel
2-Apr-10	13:18	100	30.300430	-80.226481	W	6	1	90°	1	Sport fishing vessel
2-Apr-10	13:26	104	30.304581	-80.317527	W	6	3	90°	1	Sport fishing vessel
2-Apr-10	15:41	169	30.365492	-80.242065	E	7	3	45°	1	Recreational fishing vessel
2-Apr-10	16:27	139	30.433605	-80.445163	W	8	3	130°	14	Sport fishing vessel
3-Apr-10	8:44	11	30.566752	-80.138561	E	10	3	60°	1	Recreational fishing vessel
3-Apr-10	8:45	12	30.566716	-80.112627	E	10	1	45°	1	Recreational fishing vessel
3-Apr-10	8:47	13	30.566691	-80.057854	E	10	3	90°	1	Recreational fishing vessel
3-Apr-10	9:15	20	30.499522	-80.067695	W	9	3	30°	1	Recreational fishing vessel
3-Apr-10	9:15	21	30.499577	-80.054118	W	9	3	60°	1	Recreational fishing vessel
3-Apr-10	9:26	24	30.499684	-80.420212	W	9	4	75°	24	Recreational fishing vessels(24)
3-Apr-10	10:04	42	30.433344	-80.166197	E	8	4	60°	1	Recreational fishing vessel
3-Apr-10	10:43	51	30.366282	-80.534787	W	7	4	75°	1	Recreational fishing vessel
7-May-10	9:25	4	30.101751	-80.281256	E	3	1	90°	1	2 recreational fishing vessels
7-May-10	9:29	6	30.101469	-80.139285	E	3	3	60°	1	Recreational fishing vessel
7-May-10	10:07	15	30.166003	-80.199334	W	4	3	90°	1	Recreational fishing vessel
7-May-10	10:59	39	30.233735	-80.269463	E	5	1	90°	1	Recreational fishing vessel
7-May-10	11:07	44	30.233837	-80.200552	E	5	3	90°	1	Recreational fishing vessel
7-May-10	12:14	49	30.366633	-80.119975	E	7	3	45°	1	Recreational fishing vessel
7-May-10	12:36	66	30.432908	-80.203905	W	8	3	90°	1	Recreational fishing vessel
7-May-10	14:30	65	30.500784	-80.531937	E	9	2	45°	1	Recreational fishing vessel
7-May-10	15:19	94	30.566305	-80.222107	W	10	3	45°	1	Recreational fishing vessel
4-Jun-10	8:49	4	29.966655	-80.552596	E	1	2	70°	1	Recreational fishing vessel
4-Jun-10	9:32	11	30.034070	-80.487975	W	2	4	60°	1	Recreational fishing vessel
4-Jun-10	9:53	18	30.099590	-80.282795	E	3	2	45°	1	Recreational fishing vessel
4-Jun-10	9:53	16	30.098859	-80.259753	E	3	4	75°	1	Recreational fishing vessel
4-Jun-10	13:41	55	30.366378	-80.440425	E	7	4	30°	1	Recreational fishing vessel
4-Jun-10	15:10	62	30.566346	-80.344892	W	10	4	45°	1	Recreational fishing vessel
5-Jun-10	9:01	5	30.567699	-80.150017	E	10	3	75°	1	Recreational fishing vessel
5-Jun-10	9:05	7	30.567319	-80.005364	E	10	2	90°	1	Recreational fishing vessel

Table 25 (continued). All other vessel sightings in the proposed USWTR site off of Jacksonville, Florida for aerial surveys conducted from January 2009 – June 2010.

Date	Time	Waypoint	Latitude	Longitude -1	Heading	Track Number	Angle Out	Degree Forward	Best Number	Comments
5-Jun-10	12:08	30	30.099784	-80.238805	W	3	1	90°	1	Sport fishing vessel
5-Jun-10	12:33	40	30.032601	-80.295307	W	2	3	30°	1	Recreational fishing vessel
5-Jun-10	12:34	33	30.032581	-80.277238	E	2	2	90°	1	Sport fishing vessel
5-Jun-10	13:03	38	29.965037	-80.228200	W	1	3	90°	1	Sport fishing vessel
5-Jun-10	13:04	46	29.964941	-80.272221	E	1	3	30°	1	Recreational fishing vessel
5-Jun-10	13:04	39	29.965006	-80.280635	W	1	4	90°		Sport fishing vessel
6-Jun-10	8:50	4	29.964159	-80.684290	E	1	2	30°	1	Recreational fishing vessel
6-Jun-10	10:01	20	30.101086	-80.307451	E	3	3	60°	1	Recreational fishing vessel
6-Jun-10	10:28	26	30.165926	-80.237026	W	4	4	45°	1	Recreational fishing vessel
6-Jun-10	10:32	27	30.165871	-80.373154	W	4	4	75°	1	Recreational fishing vessel
6-Jun-10	14:24	59	30.497019	-80.555517	E	9	1	90°	1	Head boat
6-Jun-10	14:29	61	30.500118	-80.368344	E	9	4	30°	1	Recreational fishing vessel
6-Jun-10	15:08	50	30.565992	-80.581742	W	10	2	75°	1	Recreational fishing vessel
7-Jun-10	8:51	4	30.567734	-80.320032	E	10	3	90°	1	Sailing vessel

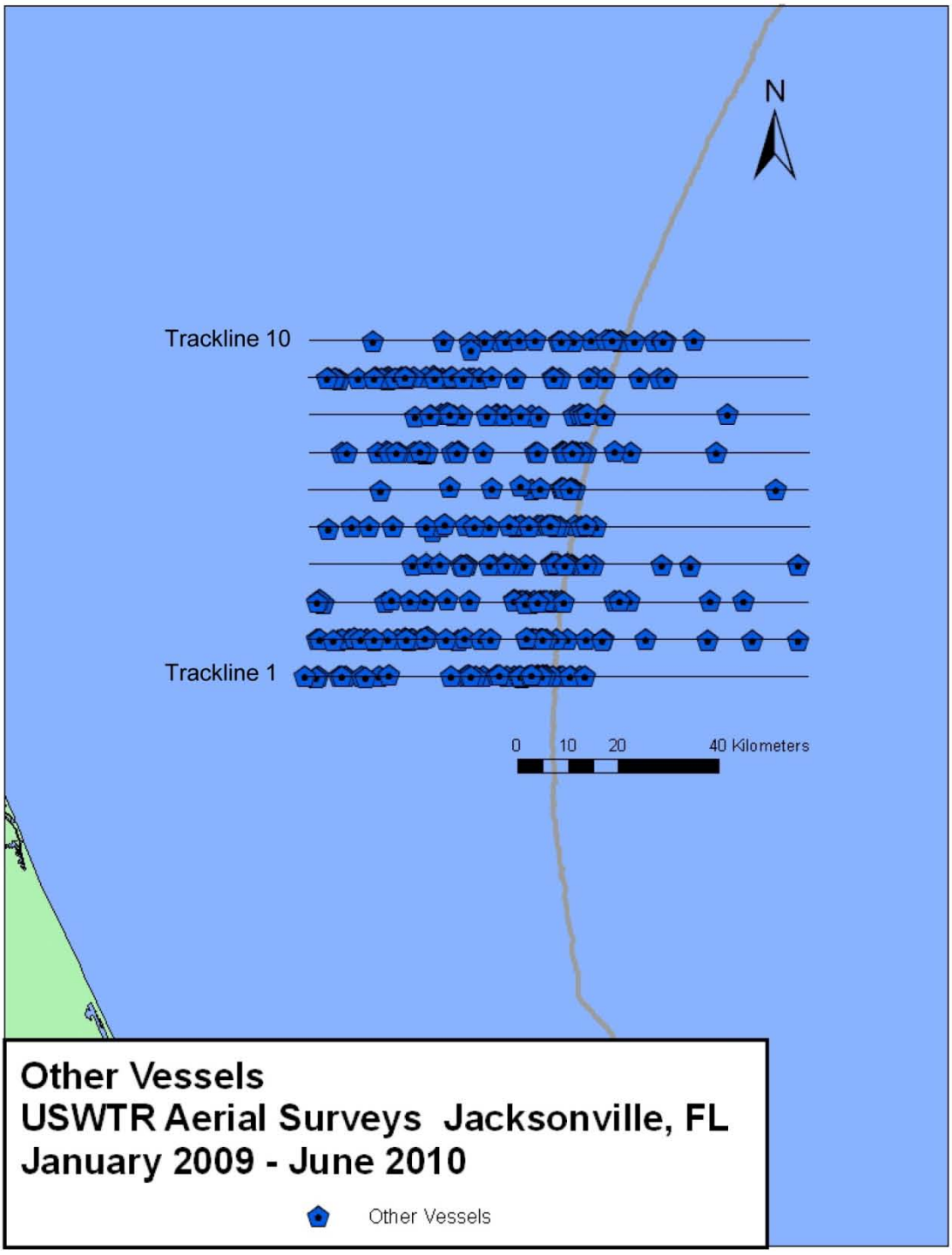

Figure 24. Other vessel sightings.

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Tuesday, January 27, 2009 Sighting # 1

Initial Sighting on Track

Time: 12:46 WP#: 8 Lat: 29.96406 Long: -80.496005
Vertical Angle: 2 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Track Line: 1 Beaufort Sea State: 2
Observer: PBN Observer Side: Right

Actual Time and Position of Sighting

Time: 12:47 WP#: 9 Lat: 29.95344 Long: -80.496258
Species: *Tursiops truncatus* Numbers (Low/High/Best): 12/15/15
Features used in Species ID: Robust dolphins with blunt snouts, gray overall coloration with darker gray cape
Representative images used for Species ID: 2773, 2774, 2778, 2779, 2785, 2789, 2791, 2792
Photographer: PBN Frame Numbers: 2766-2803 Spacer: 2804
Calculated Distance from Track Line: 1.2 km

Final Time and Position of Sighting

Time: 12:52 WP#: 10 Lat: 29.95503 Long: -80.493835
Calculated Distance Traveled: 0.3 km

Behavior and Additional Comments

Animals were widely spaced and traveling slowly at the surface. Group had varied direction of travel, animals spent little time at the surface, but when they did surface they created a lot of disturbance

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Tuesday, January 27, 2009 Sighting # 2

Initial Sighting on Track

Time: 13:00 WP#: 14 Lat: 29.963691 Long: -80.270123
Vertical Angle: 1 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Track Line: 3 Beaufort Sea State: 3
Observer: RJM Observer Side: Left

Actual Time and Position of Sighting

Time: 13:05 WP#: 15 Lat: 29.964498 Long: -80.243931
Species: *Unidentified Delphinid* Numbers (Low/High/Best): 4/5/5
Features used in Species ID: N/A
Representative images used for Species ID: No images obtained
Photographer: N/A Frame Numbers: N/A Spacer: N/A
Calculated Distance from Track Line: 2.5 km

Final Time and Position of Sighting

Time: None WP#: N/A Lat: N/A Long: N/A
Calculated Distance Traveled: N/A

Behavior and Additional Comments

Four animals swimming belly to belly near the surface with a fifth animal trailing. Animals were not relocated after initial sighting

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Tuesday, January 27, 2009 Sighting # 3

Initial Sighting on Track

Time: 14:12 WP#: 36 Lat: 30.167443 Long: -79.901763
Vertical Angle: 1 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Track Line: 4 Beaufort Sea State: 3
Observer: PBN Observer Side: Right

Actual Time and Position of Sighting

Time: 14:22 WP#: 37 Lat: 30.173666 Long: -79.887883
Species: *Balaenoptera acutorostrata* Numbers (Low/High/Best): 1/1/1
Features used in Species ID: Elongated, slender looking cetacean with pointed rostrum. Distinct band on pectoral flippers
Representative images used for Species ID: None obtained
Photographer: N/A Frame Numbers: N/A Spacer: N/A
Calculated Distance from Track Line: 1.5 km

Final Time and Position of Sighting

Time: N/A WP#: N/A Lat: N/A Long: N/A
Calculated Distance Traveled: N/A

Behavior and Additional Comments

Plane broke track but was unable to relocate animal. Animal was seen motionless just under the surface, with head tilted up towards the surface

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Tuesday, January 27, 2009 Sighting # 4

Initial Sighting on Track

Time: 14:40 WP#: 43 Lat: 30.164866 Long: -80.572730
Vertical Angle: 3 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Track Line: 4 Beaufort Sea State: 2
Observer: PBN Observer Side: Right

Actual Time and Position of Sighting

Time: 14:40 WP#: 44 Lat: 30.176813 Long: -80.572701
Species: *Stenella frontalis* Numbers (Low/High/Best): 80/100/100
Features used in Species ID: Alternating dorsal bands of light and dark coloration, white rostrum tips, some individuals with obvious spotted pattern, light flank blaze
Representative images used for Species ID: 2857, 2865, 2866, 2867, 2908, 2911
Photographer: PBN Frame Numbers: 2805 - 2911 Spacer: 2912
Calculated Distance from Track Line: 1.3 km

Final Time and Position of Sighting

Time: 14:53 WP#: 45 Lat: 30.177178 Long: -80.569800
Calculated Distance Traveled: 0.3 km

Behavior and Additional Comments

Multiple groups of 20-30 dolphins, some tight groups traveling fast in mutiple directions, others engaged in milling. Some animals appeared to be engaged in foraging.

Tuesday, January 27, 2009 Sighting # 5

Initial Sighting on Track

Time: 15:20 WP#: 58 Lat: 30.233941 Long: -80.008966
Vertical Angle: 1 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Track Line: 5 Beaufort Sea State: 3
Observer: PBN Observer Side: Right

Actual Time and Position of Sighting

Time: 15:21 WP#: 60 Lat: 30.228130 Long: -80.008411
Species: *Tursiops truncatus* Numbers (Low/High/Best): 18/25/25
Features used in Species ID: Sturdy gray animal with short rostrums

Representative images used for Species ID: 2937, 2981, 2993
Photographer: PBN Frame Numbers: 2928 - 2994 Spacer: 2995
Calculated Distance from Track Line: 0.6 km

Final Time and Position of Sighting

Time: 15:25 WP#: 61 Lat: 30.239593 Long: -80.005026
Calculated Distance Traveled: 0.7 km

Behavior and Additional Comments

Group traveling at slow to moderate speed at the surface causing some splash when surfacing. Uniform gray coloration. The entire group was made up of 2-3 smaller sub groups.

Thursday, February 26, 2009 Sighting # 1

Initial Sighting on Track

Time: 09:59 WP#: 13 Lat: 30.564943 Long: -79.829102
Vertical Angle: 1 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Track Line: 10 Beaufort Sea State: 3
Observer: PBN Observer Side: Left

Actual Time and Position of Sighting

Time: 09:59 WP#: 14 Lat: 30.565175 Long: -79.827777
Species: *Tursiops truncatus* Numbers (Low/High/Best): 11/15/12
Features used in Species ID: Stocky bodies, short rostrums, distinct cape, and overall gray coloration.
Representative images used for Species ID: 4271, 4316, 4317,
Photographer: RJM Frame Numbers: 4258 - 4319 Spacer: 4320
Calculated Distance from Track Line: 0.1 km

Final Time and Position of Sighting

Time: 10:18 WP#: 16 Lat: 30.571697 Long: -79.841274
Calculated Distance Traveled: 1.5 km

Behavior and Additional Comments

Socializing, chasing, non-directional movement, 10-12 animals in small sub-groups, a couple of pairs swimming belly to belly.

Thursday, February 26, 2009 Sighting # 2

Initial Sighting on Track

Time: N/A WP#: N/A Lat: N/A Long: N/A
Vertical Angle: 2 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: Off Track Line: 10 Beaufort Sea State: 3
Observer: RJM Observer Side: Right

Actual Time and Position of Sighting

Time: 10:06 WP#: 15 Lat: 30.565997 Long: -79.830736
Species: *Balaenoptera acutorostrata* Numbers (Low/High/Best): 1/1/1
Features used in Species ID: Small to medium sized (7-8m) whale, slender, dark grayish coloration with prominent white band on pectoral fins.
Representative images used for Species ID: None
Photographer: N/A Frame Numbers: N/A Spacer: N/A
Calculated Distance from Track Line: N/A

Final Time and Position of Sighting

Time: None WP#: N/A Lat: N/A Long: N/A
Calculated Distance Traveled: N/A

Behavior and Additional Comments

Animal spotted while circling on a group of bottlenose dolphins traveling fast just beneath the surface. Whale seen twice then not relocated despite searching for 10 minutes.

Thursday, February 26, 2009 Sighting # 3

Initial Sighting on Track

Time: 10:53 WP#: 25 Lat: 30.498278 Long: -80.688160
Vertical Angle: 2 Horizontal Bearing in Degrees: 90 Sighting Cue: Splash
On/Off Effort: On Track Line: 9 Beaufort Sea State: 2
Observer: PBN Observer Side: Left

Actual Time and Position of Sighting

Time: 10:53 WP#: 26 Lat: 30.489811 Long: -80.682168
Species: *Stenella frontalis* Numbers (Low/High/Best): 2/2/2
Features used in Species ID: Light flank blaze to caudal edge of dorsal fin, white rostrum tip, alternating light and dark pattern dorsally
Representative images used for Species ID: 4336, 4340, 4349
Photographer: RJM Frame Numbers: 4320 - 4354 Spacer: 4355
Calculated Distance from Track Line: 1.1 km

Final Time and Position of Sighting

Time: None WP#: N/A Lat: N/A Long: N/A
Calculated Distance Traveled: N/A

Behavior and Additional Comments

Slow travel, animals not relocated for a final position

Thursday, February 26, 2009 Sighting # 4

Initial Sighting on Track

Time: 14:08 WP#: 53 Lat: 30.231874 Long: -79.957889
Vertical Angle: 3 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Track Line: 5 Beaufort Sea State: 3
Observer: RJM Observer Side: Right

Actual Time and Position of Sighting

Time: 14:08 WP#: 54 Lat: 30.235458 Long: -79.960768
Species: *Balaenoptera acutorostrata* Numbers (Low/High/Best): 3/3/3
Features used in Species ID: Small baleen whales (7-8 m) somewhat slender, dark gray body with distinctive white flipper bands
Representative images used for Species ID: 4376, 4403, 4411, 4412, 4413, 4418, 4419, 4431
Photographer: RJM Frame Numbers: 4320 - 4354 Spacer: 4355
Calculated Distance from Track Line: 0.5 km

Final Time and Position of Sighting

Time: 14:29 WP#: 56 Lat: 30.242482 Long: -79.996356
Calculated Distance Traveled: 3.5 km

Behavior and Additional Comments

Mother/calf pair with a third adult animal traveling slightly behind the pair. The calf performed several low breaches reminiscent of leaping in dolphins. The trio traveled a few meters below the surface in a westerly direction.

Thursday, February 26, 2009 Sighting # 5

Initial Sighting on Track

Time: 15:25 WP#: 66 Lat: 30.098636 Long: -80.048278
Vertical Angle: 2 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Track Line: 3 Beaufort Sea State: 3
Observer: RJM Observer Side: Right

Actual Time and Position of Sighting

Time: 15:26 WP#: 67 Lat: 30.101772 Long: -80.051190
Species: *Balaenoptera acutorostrata* Numbers (Low/High/Best): 1/1/1
Features used in Species ID: Small baleen whale (7-8m), dark gray coloration with white flipper marks
Representative images used for Species ID: None obtained
Photographer: N/A Frame Numbers: N/A Spacer: N/A
Calculated Distance from Track Line: 0.4 km

Final Time and Position of Sighting

Time: N/A WP#: N/A Lat: N/A Long: N/A
Calculated Distance Traveled: N/A

Behavior and Additional Comments

Animal travelling very fast in a westerly direction

Friday, February 27, 2009 Sighting # 1

Initial Sighting on Track

Time: 8:56 WP#: 4 Lat: 29.966110 Long: -80.54550
Vertical Angle: 3 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Track Line: 1 Beaufort Sea State: 2
Observer: PBN Observer Side: Right

Actual Time and Position of Sighting

Time: 8:56 WP#: 5 Lat: 29.960482 Long: -80.551935
Species: *Tursiops truncatus* Numbers (Low/High/Best): 1/1/1
Features used in Species ID: Bulky thoracic region of body, stubby rostrum, dorsal fin placed further back on body, uniformly grey body coloration with darker gray dorsal cape
Representative images used for Species ID: 4510, 4515, 4516, 4518-4523, 4525, 4527, 4528
Photographer: PBN Frame Numbers: 4503-4533 Spacer: 4534
Calculated Distance from Track Line: 0.9 km

Final Time and Position of Sighting

Time: 9:01 WP#: 6 Lat: 29.960601 Long: -80.543797
Calculated Distance Traveled: 0.8

Behavior and Additional Comments

Single animal traveling at moderate speed close to the surface with occasional fast surfacings. Would occasionally mill at the surface before moving quicker again. Many dives out of view to deeper water.

Friday, February 27, 2009 Sighting # 2

Initial Sighting on Track

Time: 9:14 WP#: 11 Lat: 29.96619 Long: -80.143372
Vertical Angle: 4 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Track Line: 1 Beaufort Sea State: 3
Observer: RJM Observer Side: Left

Actual Time and Position of Sighting

Time: 9:18 WP#: 12 Lat: 29.975986 Long: -80.134317
Species: *Grampus griseus* Numbers (Low/High/Best): 5/5/5
Features used in Species ID: Blunt melon with no external rostrum, long sharply curved pectoral fins, tall dorsal fin, dark dorsal coloration and lighter side coloration, narrow peduncle.
Representative images used for Species ID: 4538, 4539, 4546, 4548, 4555, 4565 – 4570, 4587
Photographer: PBN Frame Numbers: 4535-4624 Spacer: 4625
Calculated Distance from Track Line: 1.4 km

Final Time and Position of Sighting

Time: 9:25 WP#: 13 Lat: 29.981299 Long: -80.141176
Calculated Distance Traveled: 0.9 km

Behavior and Additional Comments

Animals were sharply changing directions underwater. Group made up of single animal or pairs traveling at moderate speed mostly deep underwater.

Friday, February 27, 2009 Sighting # 3

Initial Sighting on Track

Time: 9:58 WP#: 23 Lat: 30.031278 Long: -80.55348
Vertical Angle: 2 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Track Line: 2 Beaufort Sea State: 2
Observer: PBN Observer Side: Right

Actual Time and Position of Sighting

Time: 9:58 WP#: 24 Lat: 30.035786 Long: -80.553049
Species: *Tursiops truncatus* Numbers (Low/High/Best): 3/3/3
Features used in Species ID: Uniform grey coloration, sturdy body with blunt rostrum. Dorsal fin placed further back on body.
Representative images used for Species ID: 4627, 4628, 4632, 4633, 4639, 4641, 4645
Photographer: PBN Frame Numbers: 4626-4652 Spacer: 4654
Calculated Distance from Track Line: 0.5 km

Final Time and Position of Sighting

Time: 10:01 WP#: 25 Lat: 30.038902 Long: -80.55499
Calculated Distance Traveled: 0.4 km

Behavior and Additional Comments

Animals spaced well apart from one another traveling at a moderate rate of speed with frequent surfacing. Animals would occasionally hang at the surface leisurely then diving out of sight to deeper water before reappearing

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Friday, February 27, 2009 Sighting # 4

Initial Sighting on Track

Time: 10:14 WP#: 34 Lat: 30.100584 Long: : -80.468352
Vertical Angle: 1 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Track Line: 3 Beaufort Sea State: 2
Observer: RJM Observer Side: Left

Actual Time and Position of Sighting

Time: 10:16 WP#: 35 Lat: 30.102491 Long: -80.471207
Species: *Tursiops truncatus* Numbers (Low/High/Best): 19/21/19
Features used in Species ID: Animals evenly spaced not interacting much with one another. Uniform grey coloration, short stubby rostrum, stocky body.
Representative images used for Species ID: 4655, 4656, 4658 - 4660, 4672, 4673, 4681 - 4683
Photographer: PBN Frame Numbers: 4655-4697 Spacer: 4698
Calculated Distance from Track Line: 0.3 km

Final Time and Position of Sighting

Time: 10:20 WP#: 36 Lat: 30.098243 Long: -80.463881
Calculated Distance Traveled: 0.8

Behavior and Additional Comments

A few groups of 3-4 animals and some single animals on the purifier, group spent most of their time near the surface with frequently surfacing. Animals were slow traveling at first but then most formed into a closer group but continued same rate of travel.

Friday, February 27, 2009 Sighting # 5

Initial Sighting on Track

Time: 11:00 WP#: 47 Lat: 30.166043 Long: -80.42729
Vertical Angle: 2 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Track Line: 4 Beaufort Sea State: 2
Observer: PBN Observer Side: Right

Actual Time and Position of Sighting

Time: 11:01 WP#: 48 Lat: 30.169046 Long: -80.42919
Species: *Tursiops truncatus* Numbers (Low/High/Best): 3/3/3
Features used in Species ID: White peduncle region, stubby rostrum and thick body with broad pectoral flippers.
Representative images used for Species ID: 4713 - 4716
Photographer: PBN Frame Numbers: 4699-4721 Spacer: 4722
Calculated Distance from Track Line: 0.4 km

Final Time and Position of Sighting

Time: 11:09 WP#: 49 Lat: 30.177095 Long: -80.425155
Calculated Distance Traveled: 1.0 km

Behavior and Additional Comments

Three animals seen in a tight group traveling at moderate speed with most of their time spent below the surface. Animals surfacings followed by periods of traveling at depth. Animals spent more time further below surface once circling began.

Friday, February 27, 2009 Sighting # 6

Initial Sighting on Track

Time: 11:21 WP#: 51 Lat: 30.16608 Long: -80.50916
Vertical Angle: 2 Horizontal Bearing in Degrees: 90 Sighting Cue: 3
On/Off Effort: On Track Line: 3 Beaufort Sea State: 2
Observer: PBN Observer Side: Right

Actual Time and Position of Sighting

Time: 11:13 WP#: 52 Lat: 30.167427 Long: -80.509722
Species: *Stenella frontalis* Numbers (Low/High/Best): 7/7/7
Features used in Species ID: Animals with alternating light, dark, light, dark pattern on body. Light coloration on tip of rostrum. Sharper curve to dorsal fin.
Representative images used for Species ID: 4723, 4727 – 4734, 4741 – 4743, 4750, 4751, 4753
Photographer: PBN Frame Numbers: 4723-4761 Spacer: 4762
Calculated Distance from Track Line: 0.2 km

Final Time and Position of Sighting

Time: 11:17 WP#: 54 Lat: 30.173383 Long: -80.506422
Calculated Distance Traveled: 0.7 km

Behavior and Additional Comments

Animals milling and hanging close to the surface traveling at a very slow rate of speed. A second group was seen just off the main group containing 3-4 animals. Both groups showed some animals swimming belly to belly with one another.

Friday, February 27, 2009 Sighting # 7

Initial Sighting on Track

Time: 11:29 WP#: 57 Lat: 30.232767 Long: -80.61212
Vertical Angle: 2 Horizontal Bearing in Degrees: 120 Sighting Cue: Body
On/Off Effort: On Track Line: 5 Beaufort Sea State: 2
Observer: PBN Observer Side: Right

Actual Time and Position of Sighting

Time: 11:34 WP#: 58 Lat: 30.231678 Long: -80.618515
Species: *Unidentified Delphinid* Numbers (Low/High/Best): 1/1/1
Features used in Species ID: N/A

Representative images used for Species ID: N/A
Photographer: PBN Frame Numbers: 4763 to 4770 Spacer: 4771
Calculated Distance from Track Line: 0.6 km

Final Time and Position of Sighting

Time: 11:40 WP#: 59 Lat: 30.223551 Long: -80.622452
Calculated Distance Traveled: 1.0 km

Behavior and Additional Comments

The animal was difficult to locate because it was traveling deep to the surface and diving out of sight. Exhibited elusive behavior -possibly avoidance of plane?

Friday, February 27, 2009 Sighting # 8

Initial Sighting on Track

Time: 11:46 WP#: 63 Lat: 30.233359 Long: -80.447931
Vertical Angle: 1 Horizontal Bearing in Degrees: 120 Sighting Cue: Body
On/Off Effort: On Track Line: 5 Beaufort Sea State: 2
Observer: RJM Observer Side: Left

Actual Time and Position of Sighting

Time: 11:51 WP#: 64 Lat: 30.230772 Long: -80.440394
Species: *Unidentified Delphinid* Numbers (Low/High/Best): 1/1/1
Features used in Species ID: N/A

Representative images used for Species ID: N/A
Photographer: N/A Frame Numbers: No Photos obtained Spacer: N/A
Calculated Distance from Track Line: N/A

Final Time and Position of Sighting

Time: N/A WP#: N/A Lat: N/A Long: N/A
Calculated Distance Traveled: N/A

Behavior and Additional Comments

Unable to locate single animal after initial sighting.

Friday, February 27, 2009 Sighting # 9

Initial Sighting on Track

Time: 12:23 WP#: 73 Lat: 30.299344 Long: -80.589066
Vertical Angle: 1 Horizontal Bearing in Degrees: 120 Sighting Cue: Body
On/Off Effort: On Track Line: 6 Beaufort Sea State: 2
Observer: PBN Observer Side: Right

Actual Time and Position of Sighting

Time: 12:37 WP#: 74 Lat: 30.295815 Long: -80.583819
Species: *Tursiops truncatus* Numbers (Low/High/Best): 5/5/5
Features used in Species ID: : Evenly spaced animals. Animals body uniform grey with lighter coloration on caudal peduncle. All animals had stocky body and short rostrum.
Representative images used for Species ID: 4776 – 4781, 4785, 4790, and 4795
Photographer: PBN Frame Numbers: 4775 to 4795 Spacer: 4797
Calculated Distance from Track Line: 0.6 km

Final Time and Position of Sighting

Time: 12:39 WP#: 75 Lat: 30.2989 Long: -80.584954
Calculated Distance Traveled: 0.4 km

Behavior and Additional Comments

A group of 4 animals were seen in a tight bunch with a single animal trailing behind.

Friday, February 27, 2009 Sighting # 10

Initial Sighting on Track

Time: 14:35 WP#: 82 Lat: 30.366772 Long: -80.47939
Vertical Angle: 2 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Track Line: 7 Beaufort Sea State: 3
Observer: RJM Observer Side: Left

Actual Time and Position of Sighting

Time: 14:40 WP#: 83 Lat: 30.366118 Long: -80.489115
Species: *Tursiops truncatus* Numbers (Low/High/Best): 1/1/1
Features used in Species ID: Animal had lighter blaze that trailed to middle or posterior portion of dorsal fin. Animal had a stocky body, short rostrum and nearly uniform grey body.
Representative images used for Species ID: 4815, 4816, 4828, 4829, 4834, and 4835
Photographer: PBN Frame Numbers: 4814- 4838 Spacer: 4839
Calculated Distance from Track Line: 0.9 km

Final Time and Position of Sighting

Time: 14:41 WP#: 84 Lat: 30.366604 Long: -80.479999
Calculated Distance Traveled: 0.9 km

Behavior and Additional Comments

Single animal traveling slowly at surface and surfacing regularly.

Friday, February 27, 2009 Sighting # 11

Initial Sighting on Track

Time: 14:48 WP#: 88 Lat: 30.367626 Long: -80.231613
Vertical Angle: 3 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Track Line: 7 Beaufort Sea State: 3
Observer: PBN Observer Side: Right

Actual Time and Position of Sighting

Time: 14:48 WP#: 89 Lat: 30.367579 Long: -80.22393
Species: *Tursiops truncatus* Numbers (Low/High/Best): 8/8/8
Features used in Species ID: All animals had uniform grey body coloration with stocky bodies and short rostrums. Animals had little interactions with one another while traveling.
Representative images used for Species ID: 4840 - 4843, 4854, 4855, 4856, 4862, 4863, 4868
Photographer: PBN Frame Numbers: 4840 - 4881 Spacer: 4882
Calculated Distance from Track Line: 0.7 km

Final Time and Position of Sighting

Time: 14:55 WP#: 90 Lat: 30.357853 Long: -80.220953
Calculated Distance Traveled: 1.1 km

Behavior and Additional Comments

Eight animals sighted at the surface in a fairly tight group traveling slowly at surface and milling about. A single animal breaching and a single calf present.

Friday, February 27, 2009 Sighting # 12

Initial Sighting on Track

Time: 16:08 WP#: 104 Lat: 30.565576 Long: 80.026118
Vertical Angle: 2 Horizontal Bearing in Degrees: 90 Sighting Cue: 3
On/Off Effort: On Track Line: 10 Beaufort Sea State: 2
Observer: PBN Observer Side: PBN

Actual Time and Position of Sighting

Time: None WP#: N/A Lat: N/A Long: N/A
Species: *Unidentified Delphinid* Numbers (Low/High/Best): 1/1/1
Features used in Species ID: N/A
Representative images used for Species ID: None obtained
Photographer: PBN Frame Numbers: N/A Spacer: N/A
Calculated Distance from Track Line: N/A

Final Time and Position of Sighting

Time: N/A WP#: N/A Lat: N/A Long: N/A
Calculated Distance Traveled: N/A

Behavior and Additional Comments

Unable to relocate animal.

Tuesday, June 9, 2009 Sighting # 1

Initial Sighting on Track

Time: 13:41 WP#: 12 Lat: 30.499885 Long: -79.963026
Vertical Angle: 2 Horizontal Bearing in Degrees: 90 Sighting Cue: Splash
On/Off Effort: On Track Line: 9 Beaufort Sea State: 3
Observer: PBN Observer Side: Right

Actual Time and Position of Sighting

Time: 13:42 WP#: 13 Lat: 30.502732 Long: -79.953532
Species: *Tursiops truncatus* Numbers (Low/High/Best): 7/10/8
Features used in Species ID: dark gray cape narrowing to sharp point rostrally of blow hole, light caudal peduncle, robust body
Representative images used for Species ID: 0142, 0164-0166, 0170-0172
Photographer: PBN Frame Numbers: 0126 - 0174 Spacer: 0175
Calculated Distance from Track Line: 1.0 km

Final Time and Position of Sighting

Time: 13:48 WP#: 14 Lat: 30.497689 Long: -79.951248
Calculated Distance Traveled: 0.6 km

Behavior and Additional Comments

Scattered, three sub-groups with 2-3 animals in each, travel at moderate pace

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Tuesday, June 9, 2009 Sighting # 2

Initial Sighting on Track

Time: 14:01 WP#: 19 Lat: 30.501601 Long: -80.456263
Vertical Angle: 2 Horizontal Bearing in Degrees: 90 Sighting Cue: Splash
On/Off Effort: On Track Line: 9 Beaufort Sea State: 2
Observer: PBN Observer Side: Right

Actual Time and Position of Sighting

Time: 14:02 WP#: 20 Lat: 30.50566 Long: -80.452111
Species: *Stenella frontalis* Numbers (Low/High/Best): 13/15/14
Features used in Species ID: white rostrum tip, alternating light and dark coloration dorsally, light blaze continuing to posterior of dorsal fin, visible spotting pattern
Representative images used for Species ID: 0189-0191, 0196, 0206, 0210
Photographer: PBN Frame Numbers: 0176-0222 Spacer: 223
Calculated Distance from Track Line: 0.6 km

Final Time and Position of Sighting

Time: _____ WP#: _____ Lat: 30.506304 Long: -80.453673
Calculated Distance Traveled: 0.2 km

Behavior and Additional Comments

One group in close association travelling slowly; milling

Tuesday, June 9, 2009 Sighting # 3

Initial Sighting on Track

Time: 14:26 WP#: 31 Lat: 30.433695 Long: -80.339951
Vertical Angle: 2 Horizontal Bearing in Degrees: 110 Sighting Cue: Body
On/Off Effort: On Track Line: 8 Beaufort Sea State: 1
Observer: RCH Observer Side: Left

Actual Time and Position of Sighting

Time: 14:27 WP#: 32 Lat: 30.434622 Long: -80.341820
Species: *Stenella frontalis* Numbers (Low/High/Best): 3/6/6
Features used in Species ID: white rostrum tip, alternating light and dark coloration dorsally, brownish, mottled appearance
Representative images used for Species ID: 0224-0227, 0238, 0239, 0241
Photographer: PBN Frame Numbers: 0224-0252 Spacer: 253
Calculated Distance from Track Line: 0.2 km

Final Time and Position of Sighting

Time: n/a WP#: n/a Lat: n/a Long: n/a
Calculated Distance Traveled: n/a

Behavior and Additional Comments

Spread out

Wednesday, June 10, 2009 Sighting # 1

Initial Sighting on Track

Time: 10:54 WP#: 24 Lat: 30.166286 Long: -80.402954
Vertical Angle: 1 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Track Line: 4 Beaufort Sea State: 2
Observer: REH Observer Side: Left

Actual Time and Position of Sighting

Time: 10:55 WP#: 25 Lat: 30.161913 Long: -80.401118
Species: *Tursiops truncatus* Numbers (Low/High/Best): 4/12/8
Features used in Species ID: Uniform gray coloration with darker gray cape, light-colored peduncle, short rostrum with well-defined crease at melon
Representative images used for Species ID: 0285, 0286, 0293, 0294
Photographer: RCH Frame Numbers: 0254 to 0297 Spacer: 299
Calculated Distance from Track Line: 0.5 km

Final Time and Position of Sighting

Time: 11:05 WP#: 26 Lat: 30.160568 Long: -80.394812
Calculated Distance Traveled: 0.6 km

Behavior and Additional Comments

Three to four small sub-groups, porpoising quickly and coming out of the water a lot, no calves observed

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Wednesday, June 10, 2009 Sighting # 2

Initial Sighting on Track

Time: 11:59 WP#: 46 Lat: 30.298401 Long: -80.522205
Vertical Angle: 1 Horizontal Bearing in Degrees: 75 Sighting Cue: Body
On/Off Effort: On Track Line: 6 Beaufort Sea State: 1
Observer: REH Observer Side: Left

Actual Time and Position of Sighting

Time: 12:04 WP#: 47 Lat: 30.297996 Long: -80.520986
Species: *Unidentified Delphinid* Numbers (Low/High/Best): 2/4/3
Features used in Species ID: Due to the elusive nature of the animals near the surface a definitive ID was not possible
Representative images used for Species ID: 0304, 0305, 0306, 0307, 0308
Photographer: RCH Frame Numbers: 0300 to 0308 Spacer: 309
Calculated Distance from Track Line: 0.1km

Final Time and Position of Sighting

Time: 12:11 WP#: 48 Lat: 30.295621 Long: -80.510295
Calculated Distance Traveled: 1.1 km

Behavior and Additional Comments

Animals were elusive and did not surface frequently. The animals dove often and too deeply to easily track

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Wednesday, June 10, 2009 Sighting # 3

Initial Sighting on Track

Time: 12:16 WP#: 51 Lat: 30.300569 Long: -80.683864
Vertical Angle: 2 Horizontal Bearing in Degrees: 100 Sighting Cue: Splash
On/Off Effort: On Track Line: 6 Beaufort Sea State: 2
Observer: REH Observer Side: Left

Actual Time and Position of Sighting

Time: 12:18 WP#: 52 Lat: 30.288698 Long: -80.673378
Species: *Tursiops truncatus* Numbers (Low/High/Best): 15/22/18
Features used in Species ID: Broad-based dorsal fin, light-colored peduncle, short rostrum with well-defined crease at melon, uniform gray coloration with darker gray cap
Representative images used for Species ID: 0347, 0348, 0353, 0372, 0375
Photographer: RCH Frame Numbers: 0310 to 0398 Spacer: 399
Calculated Distance from Track Line: 1.7 km

Final Time and Position of Sighting

Time: 12:22 WP#: 53 Lat: 30.292229 Long: -80.673454
Calculated Distance Traveled: 0.4 km

Behavior and Additional Comments

One group of eight animals, including one calf, and three to four smaller sub-groups of two to five animals. Animals spent a lot of time at the surface and were porpoising energetically.

Wednesday, June 10, 2009 Sighting # 4

Initial Sighting on Track

Time: 12:24 WP#: 55 Lat: 30.305039 Long: -80.706595
Vertical Angle: 2 Horizontal Bearing in Degrees: 60 Sighting Cue: Body
On/Off Effort: On Track Line: 6 Beaufort Sea State: 2
Observer: REH Observer Side: Left

Actual Time and Position of Sighting

Time: 12:25 WP#: 56 Lat: 30.30267 Long: -80.704548
Species: *Tursiops truncatus* Numbers (Low/High/Best): 12/18/16
Features used in Species ID: Broad-based dorsal fin, light-colored peduncle, short rostrum with well-defined crease at melon, uniform gray coloration with darker gray cape
Representative images used for Species ID: 0416, 0417, 0418, 0430
Photographer: RCH Frame Numbers: 0400 to 0443 Spacer: 444
Calculated Distance from Track Line: 0.3 km

Final Time and Position of Sighting

Time: 12:28 WP#: 57 Lat: 30.296539 Long: -80.707018
Calculated Distance Traveled: 0.7 km

Behavior and Additional Comments

Small, tight group, surfacing often, straight line travel, later noticed several lone animals separate from the main group

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Wednesday, June 10, 2009 Sighting # 5

Initial Sighting on Track

Time: 14:47 WP#: 70 Lat: 30.366990 Long: -80.04106
Vertical Angle: 3 Horizontal Bearing in Degrees: 75 Sighting Cue: Body
On/Off Effort: On Track Line: 7 Beaufort Sea State: 1
Observer: REH Observer Side: Left

Actual Time and Position of Sighting

Time: 14:50 WP#: 72 Lat: 30.376196 Long: -80.040349
Species: *Grampus griseus* Numbers (Low/High/Best): 14/14/14
Features used in Species ID: Large, tall dorsal fin, long pectoral fins, blunt head with cleft in melon, visible scarring patterns, Highly variable coloration
Representative images used for Species ID: 0445, 0454, 0456, 0459, 0474
Photographer: RCH Frame Numbers: 0445 to 0493 Spacer: 0494
Calculated Distance from Track Line: 1.0 km

Final Time and Position of Sighting

Time: 14:52 WP#: 73 Lat: 30.376078 Long: -80.045071
Calculated Distance Traveled: 0.5 km

Behavior and Additional Comments

One, tight, slow-moving group of 14, surfacing frequently.

Wednesday, June 10, 2009 Sighting # 6

Initial Sighting on Track

Time: 15:30 WP#: 86 Lat: 30.432861 Long: -80.557906
Vertical Angle: 2 Horizontal Bearing in Degrees: 80 Sighting Cue: Splash
On/Off Effort: On Track Line: 8 Beaufort Sea State: 1
Observer: REH Observer Side: Left

Actual Time and Position of Sighting

Time: 15:32 WP#: 87 Lat: 30.428722 Long: -80.554191
Species: *Stenella frontalis* Numbers (Low/High/Best): 10/10/10
Features used in Species ID: White-tipped rostrum, spinal blaze, small, falcate dorsal fin with narrow base
Representative images used for Species ID: 0498,0499,0520,0561,0562
Photographer: RCH Frame Numbers: 0495 to 0572 Spacer: 0573
Calculated Distance from Track Line: 0.6 km

Final Time and Position of Sighting

Time: 15:37 WP#: 88 Lat: 30.421615 Long: -80.558491
Calculated Distance Traveled: 0.9 km

Behavior and Additional Comments

Single group of 10 animals travelling slowly at surface.

Wednesday, June 10, 2009 Sighting # 7

Initial Sighting on Track

Time: 15:50 WP#: 98 Lat: 30.503369 Long: -80.432152
Vertical Angle: 2 Horizontal Bearing in Degrees: 75 Sighting Cue: Splash
On/Off Effort: On Track Line: 9 Beaufort Sea State: 1
Observer: REH Observer Side: Left

Actual Time and Position of Sighting

Time: 15:51 WP#: 99 Lat: 30.511654 Long: -80.435801
Species: *Stenella frontalis* Numbers (Low/High/Best): 7/7/7
Features used in Species ID: white-tipped rostrum, spinal blaze, small, falcate dorsal fin with narrow base, variable spotting
Representative images used for Species ID: 0577, 0578, 0584, 0612, 0618
Photographer: RCH Frame Numbers: 0574 to 0628 Spacer: 0629
Calculated Distance from Track Line: 1.0 km

Final Time and Position of Sighting

Time: 15:58 WP#: 100 Lat: 30.507906 Long: -80.436733
Calculated Distance Traveled: 0.4 km

Behavior and Additional Comments

Seven animals were observed in association with probable Scombridae species, very active and surfacing often, frequent changes in direction. One sub-adult was present (and photographed) with no discernible spotting.

Wednesday, June 10, 2009 Sighting # 8

Initial Sighting on Track

Time: 16:06 WP#: 103 Lat: 30.496511 Long: -80.119075
Vertical Angle: 1 Horizontal Bearing in Degrees: 60 Sighting Cue: Body
On/Off Effort: On Track Line: 9 Beaufort Sea State: 1
Observer: REH Observer Side: Left

Actual Time and Position of Sighting

Time: 16:07 WP#: 104 Lat: 30.493967 Long: -80.117448
Species: *Grampus griseus* Numbers (Low/High/Best): 28/33/32
Features used in Species ID: Large, tall dorsal fin, blunt head with a cleft in melon, long, narrow pectoral fins, variable scarring and coloration from dark to light and mottled
Representative images used for Species ID: 0634, 0655, 0659, 0664, 0715, 0717, 0737
Photographer: RCH Frame Numbers: 0630 to 0743 Spacer: 0744
Calculated Distance from Track Line: 0.3 km

Final Time and Position of Sighting

Time: 16:17 WP#: 106 Lat: 30.492623 Long: -80.117227
Calculated Distance Traveled: 0.2 km

Behavior and Additional Comments

Three sub-groups present, a group of four, a group of 11, & a group of 17-18. The group of 17-18 had at least 5 mother calf pairs. Largest group in front, group of 11 in middle, 4 in rear. All were traveling slowly in the same general direction. One calf still had visible fetal folds(0655)

Thursday, June 11, 2009 Sighting # 1

Initial Sighting on Track

Time: 9:42 WP#: 13 Lat: 30.095770 Long: -80.662581
Vertical Angle: 2 Horizontal Bearing in Degrees: 75 Sighting Cue: Body
On/Off Effort: On Track Line: 3 Beaufort Sea State: 2
Observer: REH Observer Side: Left

Actual Time and Position of Sighting

Time: 9:44 WP#: 14 Lat: 30.091657 Long: -80.659760
Species: *Tursiops truncatus* Numbers (Low/High/Best): 4/4/4
Features used in Species ID: Uniform gray coloration, broad-based dorsal fin, robust cranial region
Representative images used for Species ID: 0747, 0748, 0749, 0750, 0751
Photographer: RCH Frame Numbers: 0745 to 0782 Spacer: 0783
Calculated Distance from Track Line: 0.5 km

Final Time and Position of Sighting

Time: 10:02 WP#: 15 Lat: 30.100131 Long: -80.670581
Calculated Distance Traveled: 1.4 km

Behavior and Additional Comments

Animals were elusive and spent little time at the surface; only one animal was able to be tracked after initial sighting of all four animals. There were two sub-groups, one with three animals and one lone animal.

Thursday, June 11, 2009 Sighting # 2

Initial Sighting on Track

Time: 10:22 WP#: 19 Lat: 30.028040 Long: -80.040539
Vertical Angle: 1 Horizontal Bearing in Degrees: 160 Sighting Cue: Body
On/Off Effort: On Track Line: 2 Beaufort Sea State: 2
Observer: RCH Observer Side: Right

Actual Time and Position of Sighting

Time: 10:27 WP#: 20 Lat: 30.027809 Long: -80.045970
Species: *Unidentified Delphinid* Numbers (Low/High/Best): 2/3/3
Features used in Species ID: Due to elusive nature and severe glare, photos sufficient for identification were not obtained
Representative images used for Species ID: 0804
Photographer: RCH Frame Numbers: 0784 to 0828 Spacer: 0829
Calculated Distance from Track Line: 0.5 km

Final Time and Position of Sighting

Time: 10:45 WP#: 21 Lat: 30.031700 Long: -80.031444
Calculated Distance Traveled: 1.5 km

Behavior and Additional Comments

Animals were elusive and spent little time at the surface. The animals were difficult to re-sight and glare was a severe hindrance to tracking the animals.

Thursday, June 11, 2009 Sighting # 3

Initial Sighting on Track

Time: 10:52 WP#: 26 Lat: 29.968391 Long: -79.816046
Vertical Angle: 1 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Track Line: 1 Beaufort Sea State: 2
Observer: RCH Observer Side: Right

Actual Time and Position of Sighting

Time: 10:53 WP#: 27 Lat: 29.967194 Long: -79.804484
Species: *Tursiops truncatus* Numbers (Low/High/Best): 12/15/14
Features used in Species ID: Light-colored peduncle, blunt rostrum with well-defined crease at melon, broad-based dorsal fin
Representative images used for Species ID: 0837, 0839, 0880, 0936, 0938
Photographer: RCH Frame Numbers: 0830 to 0967 Spacer: 0967
Calculated Distance from Track Line: 1.1 km

Final Time and Position of Sighting

Time: 10:59 WP#: 28 Lat: 29.969052 Long: -79.802684
Calculated Distance Traveled: 0.3 km

Behavior and Additional Comments

At least one mother / calf pair were present. Animals were swimming energetically and surfacing frequently.

Thursday, June 11, 2009 Sighting # 4

Initial Sighting on Track

Time: 11:04 WP#: 30 Lat: 29.964809 Long: -79.946595
Vertical Angle: 2 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Track Line: 1 Beaufort Sea State: 2
Observer: RCH Observer Side: Right

Actual Time and Position of Sighting

Time: 11:08 WP#: 31 Lat: 29.969022 Long: -79.941584
Species: *Tursiops truncatus* Numbers (Low/High/Best): 14/18/16
Features used in Species ID: Light-colored peduncle with otherwise fairly uniform darker gray coloration, short rostrum and well-defined crease at melon, broad-based dorsal fin
Representative images used for Species ID: 0982, 1022, 1045, 1069, 1075, 1084
Photographer: RCH Frame Numbers: 0968 to 1104 Spacer: 1105
Calculated Distance from Track Line: 0.7 km

Final Time and Position of Sighting

Time: 11:18 WP#: 32 Lat: 29.975404 Long: -79.957692
Calculated Distance Traveled: 1.7 km

Behavior and Additional Comments

Animals were quite energetic at the surface, porpoising quickly, breaching and showing their bellies. Blows were quite visible and enduring.

Wednesday, July 15, 2009 Sighting # 1

Initial Sighting on Track

Time: 13:34 WP#: 40 Lat: 29.965550 Long: -80.061841
Vertical Angle: 2 Horizontal Bearing in Degrees: 90 Sighting Cue: Splash
On/Off Effort: On Track Line: 1 Beaufort Sea State: 2
Observer: REH Observer Side: Left

Actual Time and Position of Sighting

Time: 13:36 WP#: 41 Lat: 29.967081 Long: -80.067598
Species: *Unidentified Delphinid* Numbers (Low/High/Best): 1/1/1
Features used in Species ID: Animal was elusive and hard to track and photograph. Species identification was not possible.
Representative images used for Species ID: None
Photographer: HJF Frame Numbers: 1323 to 1325 Spacer: 1326
Calculated Distance from Track Line: 0.6 km

Final Time and Position of Sighting

Time: 13:50 WP#: 42 Lat: 29.961542 Long: -80.064672
Calculated Distance Traveled: 0.7 km

Behavior and Additional Comments

One animal, fairly large, surfacing briefly while porpoising quickly in a single direction of travel. Animal was elusive and difficult to track and photograph. The animal appeared to have broad flukes, large dorsal fin, and uniform gray coloration.

Wednesday, July 15, 2009 Sighting # 2

Initial Sighting on Track

Time: 15:09 WP#: 75 Lat: 30.166654 Long: -80.121267
Vertical Angle: 2 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Track Line: 4 Beaufort Sea State: 2
Observer: REH Observer Side: Left

Actual Time and Position of Sighting

Time: 15:10 WP#: 76 Lat: 30.162002 Long: -80.116169
Species: *Tursiops truncatus* Numbers (Low/High/Best): 4/4/4
Features used in Species ID: Short, robust rostrum with well-defined crease, light-colored peduncle, broad flukes, blaze extending to posterior of large, falcate dorsal fin
Representative images used for Species ID: 1348, 1352, 1353, 1354, 1356, 1363
Photographer: HJF Frame Numbers: 1327 to 1371 Spacer: 1372
Calculated Distance from Track Line: 0.7 km

Final Time and Position of Sighting

Time: 15:14 WP#: 77 Lat: 30.164936 Long: -80.116744
Calculated Distance Traveled: 0.3 km

Behavior and Additional Comments

Four animals in a line, milling at the surface, minimal disturbance to the water when porpoising, animals generally surfaced in pairs

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Wednesday, July 15, 2009 Sighting # 3

Initial Sighting on Track

Time: 15:33 WP#: 90 Lat: 30.232068 Long: -80.674435
Vertical Angle: 1 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Track Line: 5 Beaufort Sea State: 1
Observer: REH Observer Side: Left

Actual Time and Position of Sighting

Time: 15:35 WP#: 91 Lat: 30.233127 Long: -80.675794
Species: *Tursiops truncatus* Numbers (Low/High/Best): 3/6/4
Features used in Species ID: Short, robust rostrum with well-defined crease, broad flukes, dark gray cape with blaze terminating at posterior of large, falcate dorsal fin
Representative images used for Species ID: 1373, 1385, 1387, 1414,
Photographer: HJF Frame Numbers: 1373 to 1419 Spacer: 1420
Calculated Distance from Track Line: 0.2 km

Final Time and Position of Sighting

Time: 15:55 WP#: 92 Lat: 30.230589 Long: -80.643397
Calculated Distance Traveled: 3.1 km

Behavior and Additional Comments

Two animals seen initially at surface in loose association, on re-sight, two were close together and one further behind. Animals were porpoising quickly and coming mostly out of the water when surfacing. Animals separated and moved very quickly.

Wednesday, July 15, 2009 Sighting # 4

Initial Sighting on Track

Time: 16:53 WP#: 114 Lat: 30.299564 Long: -80.671078
Vertical Angle: 2 Horizontal Bearing in Degrees: 45 Sighting Cue: Bodies
On/Off Effort: On Track Line: 6 Beaufort Sea State: 1
Observer: HJF Observer Side: Right

Actual Time and Position of Sighting

Time: 16:54 WP#: 115 Lat: 30.307943 Long: -80.677572
Species: *Stenella frontalis* Numbers (Low/High/Best): 12/18/16
Features used in Species ID: Short, white-tipped rostrum, small, falcate dorsal fin, dark gray cape with blaze terminating mid-dorsal area, slender pectoral fins, some were heavily spotted.
Representative images used for Species ID: 1424, 1440, 1444,
Photographer: HJF Frame Numbers: 1421 to 1480 Spacer: n/a
Calculated Distance from Track Line: 1.1 km

Final Time and Position of Sighting

Time: 17:00 WP#: 116 Lat: 30.307195 Long: -80.663111
Calculated Distance Traveled: 1.4 km

Behavior and Additional Comments

One large, tightly grouped school with at least one smaller sub-group and one individual. Animals were active swimmers, porpoising with spray and some showing their bellies.

Thursday, July 16, 2009 Sighting # 1

Initial Sighting on Track

Time: 9:23 WP#: 7 Lat: 30.568348 Long: -79.834768
Vertical Angle: 2 Horizontal Bearing in Degrees: 120 Sighting Cue: Body
On/Off Effort: On Track Line: 10 Beaufort Sea State: 3
Observer: RCH Observer Side: Right

Actual Time and Position of Sighting

Time: 9:29 WP#: 8 Lat: 30.566033 Long: -79.834290
Species: *Tursiops truncatus* Numbers (Low/High/Best): 9/15/12
Features used in Species ID: blunt rostrum, broad dorsal fluke, dark gray cape, light coloration of caudal peduncle
Representative images used for Species ID: 1493, 1512, 1517, 1534
Photographer: RCH Frame Numbers: 1481 - 1567 Spacer: 1568
Calculated Distance from Track Line: 0.3 km

Final Time and Position of Sighting

Time: 9:41 WP#: 9 Lat: 30.573235 Long: -79.836365
Calculated Distance Traveled: 0.8 km

Behavior and Additional Comments

Originally sighted as a single large group, individuals began to spread apart with the largest congregation comprised of 9 animals. Moderate swimming was observed, with little time spent at the surface of the water. Final position was estimated from last known position.

Thursday, July 16, 2009 Sighting # 2

Initial Sighting on Track

Time: 14:30 WP#: 37 Lat: 30.031883 Long: -80.638464
Vertical Angle: 2 Horizontal Bearing in Degrees: 110 Sighting Cue: Body
On/Off Effort: On Track Line: 2 Beaufort Sea State: 2
Observer: HJF Observer Side: Left

Actual Time and Position of Sighting

Time: 14:35 WP#: 38 Lat: 30.039753 Long: -80.637413
Species: *Tursiops truncatus* Numbers (Low/High/Best): 6/6/6
Features used in Species ID: dark gray cape with blaze extending to posterior of falcate dorsal fin, blunt rostrum, broad fluke, light peduncle
Representative images used for Species ID: 1578, 1596, 1607
Photographer: RCH Frame Numbers: 1569 - 1650 Spacer: 1651
Calculated Distance from Track Line: 0.9 km

Final Time and Position of Sighting

Time: 14:44 WP#: 39 Lat: 30.040069 Long: -80.631538
Calculated Distance Traveled: 0.6 km

Behavior and Additional Comments

Two subgroups of 3 individuals each observed for majority of sighting. Groups were tightly packed and traveling together

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Thursday, July 16, 2009 Sighting # 3

Initial Sighting on Track

Time: 14:52 WP#: 46 Lat: 30.034825 Long: -80.428645
Vertical Angle: 1 Horizontal Bearing in Degrees: 100 Sighting Cue: Body
On/Off Effort: On Track Line: 2 Beaufort Sea State: 2
Observer: HJF Observer Side: Left

Actual Time and Position of Sighting

Time: 14:54 WP#: 47 Lat: 30.037417 Long: -80.432347
Species: *Stenella frontalis* Numbers (Low/High/Best): 10/15/12
Features used in Species ID: alternating dark and light banding commencing with white tipped rostrum, visible spotting patterns, small dorsal fins with narrow base
Representative images used for Species ID: 1674, 1716, 1717, 1755, 1757,
Photographer: RCH Frame Numbers: 1652 - 1758 Spacer: 1759
Calculated Distance from Track Line: 0.5 km

Final Time and Position of Sighting

Time: 15:01 WP#: 48 Lat: 30.041698 Long: -80.424853
Calculated Distance Traveled: 0.9 km

Behavior and Additional Comments

One large cluster of 5-6 individuals observed with several outliers present.

Thursday, July 16, 2009 Sighting # 4

Initial Sighting on Track

Time: 15:23 WP#: 58 Lat: 29.966717 Long: -79.872952
Vertical Angle: 1 Horizontal Bearing in Degrees: 110 Sighting Cue: Body
On/Off Effort: On Track Line: 1 Beaufort Sea State: 2
Observer: HJF Observer Side: Left

Actual Time and Position of Sighting

Time: 15:30 WP#: 61 Lat: 29.95899 Long: -79.87434
Species: *Tursiops truncatus* Numbers (Low/High/Best): 8/12/10
Features used in Species ID: light peduncle, short, robust rostrum, dark gray cape, falcate dorsal fin
Representative images used for Species ID: 1781, 1827, 1830, 1846
Photographer: RCH Frame Numbers: 1760 - 1879 Spacer: 1880
Calculated Distance from Track Line: 0.9 km

Final Time and Position of Sighting

Time: 15:35 WP#: 62 Lat: 29.954412 Long: -79.875597
Calculated Distance Traveled: 1.4 km

Behavior and Additional Comments

Animals were very widely separated, with approximately 5 individuals in a close unit and a few outliers.

Thursday, July 16, 2009 Sighting # 5

Initial Sighting on Track

Time: 15:54 WP#: 66 Lat: 29.96511 Long: -80.529185
Vertical Angle: 1 Horizontal Bearing in Degrees: 100 Sighting Cue: Body
On/Off Effort: On Track Line: 1 Beaufort Sea State: 1
Observer: HJF Observer Side: Left

Actual Time and Position of Sighting

Time: 15:58 WP#: 67 Lat: 29.969852 Long: -80.518172
Species: *Tursiops truncatus* Numbers (Low/High/Best): 11/15/13
Features used in Species ID: dark gray cape with blaze terminating posterior to falcate dorsal fin, broad flukes, robust body, light coloration of peduncle
Representative images used for Species ID: 1919, 1920, 1924, 1942 - 1945, 1947, 1948, 1952
Photographer: RCH Frame Numbers: 1881 - 1956 Spacer: 1957
Calculated Distance from Track Line: 1.2 km

Final Time and Position of Sighting

Time: 16:08 WP#: 68 Lat: 29.963819 Long: -80.520687
Calculated Distance Traveled: 0.7 km

Behavior and Additional Comments

One main group of 7-10 individuals observed porpoising in synchrony, with a few individuals on outskirts of group. Calves observed.

Tuesday, August 4, 2009 Sighting # 1

Initial Sighting on Track

Time: 12.00 WP#: 4 Lat: 30.564040 Long: -80.590190
Vertical Angle: 3 Horizontal Bearing in Degrees: 110 Sighting Cue: Body
On/Off Effort: On Track Line: 10 Beaufort Sea State: 1
Observer: PBN Observer Side: Right

Actual Time and Position of Sighting

Time: 12.05 WP#: 5 Lat: 30.570400 Long: -80.603840
Species: *Stenella frontalis* Numbers (Low/High/Best): 3/4/4
Features used in Species ID: Short, white-tipped rostrum, small, falcate dorsal fin, dark gray cape with blaze terminating mid-dorsal area, slender pectoral fins, some were heavily spotted.
Representative images used for Species ID: 2002-2020, 2025,2026
Photographer: PBN Frame Numbers: 2002-2030 Spacer: 2031
Calculated Distance from Track Line: 1.5 km

Final Time and Position of Sighting

Time: 12.16 WP#: 6 Lat: 30.565730 Long: -80.600240
Calculated Distance Traveled: 0.6 km

Behavior and Additional Comments

Loose group travelling at surface, elusive

Tuesday, August 4, 2009 Sighting # 2

Initial Sighting on Track

Time: 13.01 WP#: 16 Lat: 30.505030 Long: -80.423980
Vertical Angle: 2 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Track Line: 9 Beaufort Sea State: 1
Observer: PBN Observer Side: Right

Actual Time and Position of Sighting

Time: 13.03 WP#: 17 Lat: 30.507260 Long: -80.413700
Species: *Stenella frontalis* Numbers (Low/High/Best): 17/30/25
Features used in Species ID: Short, white-tipped rostrum, dark gray cape with blaze terminating mid-dorsal area, some were heavily spotted, slender pectoral fins, .
Representative images used for Species ID: 2038,2044,2045,2047,2049,2050,2052,2053,2059
Photographer: PBN Frame Numbers: 2032-2073 Spacer: 2074
Calculated Distance from Track Line: 1.0 km

Final Time and Position of Sighting

Time: 13.07 WP#: 18 Lat: 30.503790 Long: -80.414620
Calculated Distance Traveled: 0.4 km

Behavior and Additional Comments

Travelling at surface, very active, tight pod with 2 - 3 sub-groups

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Tuesday, August 4, 2009 Sighting # 3

Initial Sighting on Track

Time: 13.21 WP#: 23 Lat: 30.439310 Long: -80.509190
Vertical Angle: 3 Horizontal Bearing in Degrees: 120 Sighting Cue: Body
On/Off Effort: On Track Line: 8 Beaufort Sea State: 1
Observer: RCH Observer Side: Left

Actual Time and Position of Sighting

Time: 13.23 WP#: 24 Lat: 30.440880 Long: -80.520350
Species: *Stenella frontalis* Numbers (Low/High/Best): 4/7/6
Features used in Species ID: Short, white-tipped rostrum, small, falcate dorsal fin, dark gray cape with blaze terminating mid-dorsal area, slender pectoral fins, some were heavily spotted.
Representative images used for Species ID: 2080-2083,2065,2086,2092-2094,2096,2097
Photographer: PBN Frame Numbers: 2075-2097 Spacer: 2098
Calculated Distance from Track Line: 1.1 km

Final Time and Position of Sighting

Time: 14:00 WP#: 25 Lat: 30.438040 Long: -80.514440
Calculated Distance Traveled: 0.6 km

Behavior and Additional Comments

Two or three groups travelling at surface with single mother and calf sub-group. Loosely grouped. Appeared to be two mother and calf pairs

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Tuesday, August 4, 2009 Sighting # 4

Initial Sighting on Track

Time: 13.56 WP#: 30 Lat: 30.363450 Long: -79.862210
Vertical Angle: 2 Horizontal Bearing in Degrees: 110 Sighting Cue: Body
On/Off Effort: On Track Line: 7 Beaufort Sea State: 1
Observer: RCH Observer Side: Left

Actual Time and Position of Sighting

Time: 13.58 WP#: 31 Lat: 30.359850 Long: -79.840650
Species: *Stenella frontalis* Numbers (Low/High/Best): 23/25/24
Features used in Species ID: Short, white-tipped rostrum, small, falcate dorsal fin, dark gray cape with blaze terminating mid-dorsal area, slender pectoral fins, some were heavily spotted.
Representative images used for Species ID: 2102,2104,2107,2117,2125,2126,2128-2132,2136
Photographer: PBN Frame Numbers: 2099-2137 Spacer: 2138
Calculated Distance from Track Line: 2.1 km

Final Time and Position of Sighting

Time: 14.00 WP#: 32 Lat: 30.359130 Long: -79.844040
Calculated Distance Traveled: 0.3 km

Behavior and Additional Comments

Travelling slowly, tight group. No sub-groups

Tuesday, August 4, 2009 Sighting # 5

Initial Sighting on Track

Time: 14.37 WP#: 43 Lat: 30.302250 Long: -80.486440
Vertical Angle: 3 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Track Line: 6 Beaufort Sea State: 1
Observer: PBN Observer Side: Right

Actual Time and Position of Sighting

Time: 14.38 WP#: 44 Lat: 30.297390 Long: -80.483850
Species: *Stenella frontalis* Numbers (Low/High/Best): 6/8/7
Features used in Species ID: Short, white-tipped rostrum, small, falcate dorsal fin, some heavily spotted.
Representative images used for Species ID: 2139,2153-2156
Photographer: PBN Frame Numbers: 2139-2158 Spacer: 2159
Calculated Distance from Track Line: 0.6 km

Final Time and Position of Sighting

Time: 14.42 WP#: 45 Lat: 30.296410 Long: -80.476740
Calculated Distance Traveled: 0.7 km

Behavior and Additional Comments

Travelling quickly at surface, One group of 3/4 animals with 2 single loosely associated with main group

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Tuesday, August 4, 2009 Sighting # 6

Initial Sighting on Track

Time: 14.54 WP#: 50 Lat: 30.303310 Long: -80.021940
Vertical Angle: 2 Horizontal Bearing in Degrees: 75 Sighting Cue: Body
On/Off Effort: On Track Line: 6 Beaufort Sea State: 0
Observer: PBN Observer Side: Right

Actual Time and Position of Sighting

Time: 14.56 WP#: 51 Lat: 30.303780 Long: -80.014140
Species: *Tursiops truncatus* Numbers (Low/High/Best): 29/40/35
Features used in Species ID: Short, robust rostrum with well-defined crease, broad flukes, dark gray cape with blaze terminating at posterior of large, falcate dorsal fin
Representative images used for Species ID: 2171,2172,2175,2179,2180,2188,2189,2195,2196
Photographer: PBN Frame Numbers: 2160-2197 Spacer: 2198
Calculated Distance from Track Line: 0.8 km

Final Time and Position of Sighting

Time: 15.00 WP#: 52 Lat: 30.300570 Long: -80.024140
Calculated Distance Traveled: 1.0 km

Behavior and Additional Comments

Very active at surface travelling quickly, One large group of 30 animals with 2 smaller groups

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Thursday, August 6, 2009 Sighting # 1

Initial Sighting on Track

Time: 8:35 WP#: 4 Lat: 29.962723 Long: -80.651867
Vertical Angle: 1 Horizontal Bearing in Degrees: 120 Sighting Cue: Splash
On/Off Effort: On Track Line: 1 Beaufort Sea State: 3
Observer: PBN Observer Side: Left

Actual Time and Position of Sighting

Time: 8:37 WP#: 5 Lat: 29.960847 Long: -80.659663
Species: *Stenella frontalis* Numbers (Low/High/Best): 15/25/20
Features used in Species ID: Short, white-tipped rostrum, small, falcate dorsal fin, dark gray cape with blaze terminating mid-dorsal area, slender pectoral fins, some were heavily spotted.
Representative images used for Species ID: 2313, 2343, 2394, 2406, 2464
Photographer: REH Frame Numbers: 2199-2469 Spacer: 2470
Calculated Distance from Track Line: 0.8 km

Final Time and Position of Sighting

Time: 8:55 WP#: 6 Lat: 29.957501 Long: -80.656626
Calculated Distance Traveled: 0.5 km

Behavior and Additional Comments

Multiple groups with lots of leaps observed. Several individuals observed interacting with octopii.

Thursday, August 6, 2009 Sighting # 2

Initial Sighting on Track

Time: 9:09 WP#: 9 Lat: 29.966408 Long: -80.162451
Vertical Angle: 1 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Track Line: 1 Beaufort Sea State: 3
Observer: REH Observer Side: Right

Actual Time and Position of Sighting

Time: 9:10 WP#: 10 Lat: 29.961709 Long: -80.161598
Species: *Tursiops truncatus* Numbers (Low/High/Best): 18/22/20
Features used in Species ID: Short, robust rostrum with well-defined crease, broad flukes, dark gray cape with blaze terminating at posterior of large, falcate dorsal fin
Representative images used for Species ID: 2471, 2475, 2477 - 2479, 2488, 2504, 2513
Photographer: REH Frame Numbers: 2471 - 2525 Spacer: 2526
Calculated Distance from Track Line: 0.5 km

Final Time and Position of Sighting

Time: n/a WP#: n/a Lat: n/a Long: n/a
Calculated Distance Traveled: n/a

Behavior and Additional Comments

Two groups of tightly-bunched animals observed, one with 8-10 individuals and another with 10-12.

Thursday, August 6, 2009 Sighting # 3

Initial Sighting on Track

Time: 10:37 WP#: 26 Lat: 30.172955 Long: -80.022675
Vertical Angle: 1 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Track Line: 4 Beaufort Sea State: 3
Observer: PBN Observer Side: Left

Actual Time and Position of Sighting

Time: 10:37 WP#: 27 Lat: 30.172326 Long: -80.033970
Species: *Tursiops truncatus* Numbers (Low/High/Best): 15/20/17
Features used in Species ID: Short, robust rostrum with well-defined crease, broad flukes, dark gray cape with blaze terminating at posterior of large, falcate dorsal fin
Representative images used for Species ID: 2542, 2589, 2630 - 2632, 2647 - 2650
Photographer: REH Frame Numbers: 2527 - 2659 Spacer: 2660
Calculated Distance from Track Line: 1.1 km

Final Time and Position of Sighting

Time: 10:58 WP#: 28 Lat: 30.174719 Long: -80.045581
Calculated Distance Traveled: 1.2 km

Behavior and Additional Comments

Animals observed in several small subgroups of 2-3 individuals and one large group, which had approximately 10 individuals.

Thursday, August 6, 2009 Sighting # 4

Initial Sighting on Track

Time: 12:03 WP#: 39 Lat: 30.570891 Long: -80.342161
Vertical Angle: 3 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Track Line: 10 Beaufort Sea State: 2
Observer: PBN Observer Side: Left

Actual Time and Position of Sighting

Time: 12:08 WP#: 40 Lat: 30.577324 Long: -80.330336
Species: *Stenella frontalis* Numbers (Low/High/Best): 4/8/6
Features used in Species ID: Short, white-tipped rostrum, small, falcate dorsal fin, dark gray cape with blaze terminating mid-dorsal area, slender pectoral fins, some were heavily spotted.
Representative images used for Species ID: 2677 - 2681, 2716 - 2721
Photographer: REH Frame Numbers: 2661 - 2723 Spacer: 2724
Calculated Distance from Track Line: 1.3 km

Final Time and Position of Sighting

Time: 12:15 WP#: 41 Lat: 30.579387 Long: -80.320378
Calculated Distance Traveled: 1.0 km

Behavior and Additional Comments

Animals observed in a couple of small sub-groups, with approximately 2-3 individuals per group

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Thursday, August 6, 2009 Sighting # 5

Initial Sighting on Track

Time: 12:18 WP#: 43 Lat: 30.573597 Long: -80.406978
Vertical Angle: 2 Horizontal Bearing in Degrees: 110 Sighting Cue: Splash
On/Off Effort: On Track Line: 10 Beaufort Sea State: 2
Observer: REH Observer Side: Right

Actual Time and Position of Sighting

Time: 12:25 WP#: 44 Lat: 30.579529 Long: -80.408211
Species: *Unidentified Delphinid* Numbers (Low/High/Best): 2/3/3
Features used in Species ID:

Representative images used for Species ID: n/a
Photographer: n/a Frame Numbers: n/a Spacer: n/a
Calculated Distance from Track Line: 0.7 km

Final Time and Position of Sighting

Time: n/a WP#: n/a Lat: n/a Long: n/a
Calculated Distance Traveled: n/a

Behavior and Additional Comments

Animals were never relocated after initially sighted from the trackline. Actual time and position of animals is assumed.

Monday, September 14, 2009 Sighting # 1

Initial Sighting on Track

Time: 12:42 WP#: 9 Lat: 30.500930 Long: -80.371000
Vertical Angle: 2 Horizontal Bearing in Degrees: 110 Sighting Cue: Body
On/Off Effort: On Track Line: 9 Beaufort Sea State: 3
Observer: REH Observer Side: Right

Actual Time and Position of Sighting

Time: 12:51 WP#: 10 Lat: 30.502628 Long: -80.365528
Species: *Stenella frontalis* Numbers (Low/High/Best): 7/10/8
Features used in Species ID: White-tipped rostrum, slender pectoral fins, slender body, dark cape with blaze terminating at dorsal fin
Representative images used for Species ID: 3106, 3112, 3117
Photographer: REH Frame Numbers: 3091 - 3141 Spacer: 3142
Calculated Distance from Track Line: 0.6 km

Final Time and Position of Sighting

Time: 12:54 WP#: 11 Lat: 30.507498 Long: -80.371294
Calculated Distance Traveled: 0.8 km

Behavior and Additional Comments

Tightly packed group of approx. 8 individuals. Dolphins were evasive and difficult to relocate.

Monday, September 14, 2009 Sighting # 2

Initial Sighting on Track

Time: 13:43 WP#: 22 Lat: 30.376649 Long: -80.071964
Vertical Angle: 1 Horizontal Bearing in Degrees: 100 Sighting Cue: Body
On/Off Effort: On Track Line: 7 Beaufort Sea State: 3
Observer: REH Observer Side: Right

Actual Time and Position of Sighting

Time: 13:46 WP#: 23 Lat: 30.370925 Long: -80.071616
Species: *Unidentified Delphinid* Numbers (Low/High/Best): 8/10/9
Features used in Species ID: Photographs were not good enough for a definitive identification
Representative images used for Species ID: 3152, 3153
Photographer: REH Frame Numbers: 3143-3212 Spacer: 3213
Calculated Distance from Track Line: 0.6 km

Final Time and Position of Sighting

Time: 14:00 WP#: 24 Lat: 30.378394 Long: -80.067467
Calculated Distance Traveled: 1.0 km

Behavior and Additional Comments

Animals were actively jumping and leaping out of water. Sighting consisted of distinct subgroups that were swimming quickly in a variety of directions.

Tuesday, September 15, 2009 Sighting # 1

Initial Sighting on Track

Time: 09:56 WP#: 8 Lat: 29.965909 Long: -79.974323
Vertical Angle: 1 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Track Line: 1 Beaufort Sea State: 2
Observer: PBN Observer Side: Left

Actual Time and Position of Sighting

Time: 09:57 WP#: 9 Lat: 29.962785 Long: -79.982730
Species: *Tursiops truncatus* Numbers (Low/High/Best): 2/3/3
Features used in Species ID: Short "stubby" rostrum, grey coloration with dark gray cape, light colored dorsal caudal peduncle, relatively broad flukes
Representative images used for Species ID: 3235, 3259, 3260, 3269 to 3273, 3289
Photographer: RCH Frame Numbers: 3214 to 3295 Spacer: 3296
Calculated Distance from Track Line: 0.9 km

Final Time and Position of Sighting

Time: 10:05 WP#: 10 Lat: 29.956203 Long: -79.984944
Calculated Distance Traveled: 0.8 km

Behavior and Additional Comments

Fast travel, two dolphins "stacking" vertically (m/c pair). Fast surfacings, fairly long dive times, extended travel just sub-subsurface, looks like T. truncatus through binoculars. Behavior seem to indicate evasiveness in response to the plane - count as a "take".

Tuesday, September 15, 2009 Sighting # 2

Initial Sighting on Track

Time: 10:36 WP#: 17 Lat: 30.030769 Long: -80.596084
Vertical Angle: 1 Horizontal Bearing in Degrees: 120 Sighting Cue: Body
On/Off Effort: On Track Line: 2 Beaufort Sea State: 2
Observer: PBN Observer Side: Left

Actual Time and Position of Sighting

Time: 10:40 WP#: 18 Lat: 30.028446 Long: -80.584039
Species: *Stenella frontalis* Numbers (Low/High/Best): 6/8/7
Features used in Species ID: Long, white-tipped rostrum. light flank blaze
Representative images used for Species ID: 3314, 3339, 3340, 3346 - 3348, 3350, 3362
Photographer: RCH Frame Numbers: 3297 to 3366 Spacer: 3367
Calculated Distance from Track Line: 1.2 km

Final Time and Position of Sighting

Time: 10:49 WP#: 19 Lat: 30.028226 Long: -80.594661
Calculated Distance Traveled: 1.0 km

Behavior and Additional Comments

Group consisted of smaller, sub -groups with 2 to 3 individuals each. Short surface times.

Tuesday, September 15, 2009 Sighting # 3

Initial Sighting on Track

Time: 10:56 WP#: 23 Lat: 30.101813 Long: -80.668628
Vertical Angle: 2 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Track Line: 3 Beaufort Sea State: 1
Observer: PBN Observer Side: Left

Actual Time and Position of Sighting

Time: 10:57 WP#: 23 Lat: 30.102567 Long: -80.662731
Species: *Steno bredanensis* Numbers (Low/High/Best): 45/60/50
Features used in Species ID: Long snout, absence of pronounced melon, white lower jaw. Large triangular pectoral fins, pronounced "erect" dorsal fin, distinctive cape shape.
Representative images used for Species ID: 3396-3399, 3402, 3418, 3430, 3438, 3467
Photographer: RCH Frame Numbers: 3368 to 3560 Spacer: 3561
Calculated Distance from Track Line: 0.6 km

Final Time and Position of Sighting

Time: 11:09 WP#: 25 Lat: 30.089881 Long: -80.656334
Calculated Distance Traveled: 1.5 km

Behavior and Additional Comments

Dolphins in 3-4 sub-groups, one of which contained the majority of animals. One group of closely packed group (n~8) seemed to stay by themselves. A multitude of fish and birds as well as a manta ray were seen in the immediate vicinity of dolphins - feeding on same food source?

Tuesday, September 15, 2009 Sighting # 4

Initial Sighting on Track

Time: 11:54 WP#: 36 Lat: 30.160677 Long: -80.468741
Vertical Angle: 2 Horizontal Bearing in Degrees: 100 Sighting Cue: Body
On/Off Effort: On Track Line: 4 Beaufort Sea State: 2
Observer: PBN Observer Side: Left

Actual Time and Position of Sighting

Time: 11:56 WP#: 37 Lat: 30.155112 Long: -80.468606
Species: *Stenella frontalis* Numbers (Low/High/Best): 30/45/40
Features used in Species ID: White beak tip, long rostrum, light dark dorsal "banding" pattern. Distinctive light flank blaze
Representative images used for Species ID: 3587, 3603, 3368, 3681, 3686, 3689, 3690, 3714
Photographer: RCH Frame Numbers: 3562 to 3735 Spacer: 3736
Calculated Distance from Track Line: 0.6 km

Final Time and Position of Sighting

Time: 12:05 WP#: 38 Lat: 30.158009 Long: -80.472135
Calculated Distance Traveled: 0.5 km

Behavior and Additional Comments

Several sub-groups, leisurely/slow travel. Several dolphins swimming on their backs showing white bellies. One dolphin photographed "feeding" on an octopus at the surface. Bull shark (?) circling a loggerhead sea turtle with several remora in tow.

Tuesday, September 15, 2009 Sighting # 5

Initial Sighting on Track

Time: 12:25 WP#: 48 Lat: 30.233541 Long: -80.350833
Vertical Angle: 2 Horizontal Bearing in Degrees: 135 Sighting Cue: Body
On/Off Effort: On Track Line: 5 Beaufort Sea State: 2
Observer: PBN Observer Side: Left

Actual Time and Position of Sighting

Time: 12:27 WP#: 49 Lat: 30.235518 Long: -80.357595
Species: *Stenella frontalis* Numbers (Low/High/Best): 33/40/36
Features used in Species ID: White beak tip, relatively long rostrum, visible spotted pattern. Light flank blaze and overall coloration pattern.
Representative images used for Species ID: 3740, 3781, 3788, 3796, 3802, 3831
Photographer: RCH Frame Numbers: 3737 to 3831 Spacer: 3832
Calculated Distance from Track Line: 0.7 km

Final Time and Position of Sighting

Time: 12:31 WP#: 50 Lat: 30.237456 Long: -80.353966
Calculated Distance Traveled: 0.4 km

Behavior and Additional Comments

One group. Slow travel in a patch of sargassum. At least one calf observed.

Tuesday, September 15, 2009 Sighting # 6

Initial Sighting on Track

Time: 13:11 WP#: 56 Lat: 30.299069 Long: -80.586644
Vertical Angle: 2 Horizontal Bearing in Degrees: 110 Sighting Cue: Body
On/Off Effort: On Track Line: 6 Beaufort Sea State: 1
Observer: RCH Observer Side: Right

Actual Time and Position of Sighting

Time: 13:13 WP#: 57 Lat: 30.302087 Long: -80.586596
Species: *Stenella frontalis* Numbers (Low/High/Best): 8/12/10
Features used in Species ID: Alternating light and dark "banding pattern" on dorsal surface. Light tipped beak, elongated rostrum. Spots visible.
Representative images used for Species ID: 3836 - 3838, 3844 - 3846, 3861, 3904, 3905
Photographer: RCH Frame Numbers: 3833 to 3915 Spacer: 3916
Calculated Distance from Track Line: 0.3 km

Final Time and Position of Sighting

Time: 13:23 WP#: 58 Lat: 30.309339 Long: -80.580128
Calculated Distance Traveled: 1.0 km

Behavior and Additional Comments

Spread out into smaller groups. Medium to fast travel - difficult to photograph.

Tuesday, September 15, 2009 Sighting # 7

Initial Sighting on Track

Time: 15:20 WP#: 69 Lat: 30.363320 Long: -80.497555
Vertical Angle: 3 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Track Line: 7 Beaufort Sea State: 1
Observer: RCH Observer Side: Right

Actual Time and Position of Sighting

Time: 15:21 WP#: 70 Lat: 30.358729 Long: -80.501714
Species: *Stenella frontalis* Numbers (Low/High/Best): 6/6/6
Features used in Species ID: white-tipped rostrum, bark cape with blaze terminating at dorsal fin, visible spots that are variable among individuals
Representative images used for Species ID: 3930, 3941, 3944, 3972, 3973
Photographer: RCH Frame Numbers: 3917 to 3974 Spacer: 3975
Calculated Distance from Track Line: 0.6 km

Final Time and Position of Sighting

Time: 15:27 WP#: 71 Lat: -30.360309 Long: -80.505196
Calculated Distance Traveled: 0.4 km

Behavior and Additional Comments

Animals were porpoising through the water in a generally straight line. One mother and calf pair was present.

Tuesday, September 15, 2009 Sighting # 8

Initial Sighting on Track

Time: 16:14 WP#: 87 Lat: 30.431906 Long: -80.561818
Vertical Angle: 1 Horizontal Bearing in Degrees: 100 Sighting Cue: Body
On/Off Effort: On Track Line: 8 Beaufort Sea State: 1
Observer: RCH Observer Side: Right

Actual Time and Position of Sighting

Time: 16:17 WP#: 88 Lat: 30.429269 Long: -80.558831
Species: *Tursiops truncatus* Numbers (Low/High/Best): 2/2/2
Features used in Species ID: Short, heavy rostrum, robust body with uniform gray coloration, broad flukes
Representative images used for Species ID: 4006, 4014, 4015, 4016
Photographer: RCH Frame Numbers: 3976 to 4021 Spacer: 4022/4023
Calculated Distance from Track Line: 0.4 km

Final Time and Position of Sighting

Time: 16:20 WP#: 89 Lat: 30.431404 Long: -80.565099
Calculated Distance Traveled: 0.6 km

Behavior and Additional Comments

Tuesday, September 15, 2009 Sighting # 9

Initial Sighting on Track

Time: 16:31 WP#: 94 Lat: 30.497570 Long: -80.546267
Vertical Angle: 1 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Track Line: 9 Beaufort Sea State: 1
Observer: RCH Observer Side: Right

Actual Time and Position of Sighting

Time: 16:32 WP#: 95 Lat: 30.492564 Long: -80.550183
Species: *Tursiops truncatus* Numbers (Low/High/Best): 5/9/8
Features used in Species ID: Short, robust rostrum with well-defined crease at melon, broad flukes, uniform gray coloration
Representative images used for Species ID: 4029, 4041, 4064, 4093, 4119
Photographer: RCH Frame Numbers: 4024 to 4121 Spacer: 4122
Calculated Distance from Track Line: 0.70 km

Final Time and Position of Sighting

Time: 16:38 WP#: 96 Lat: 30.499530 Long: -80.546738
Calculated Distance Traveled: 0.80 km

Behavior and Additional Comments

Animals were porpoising quickly and often, blows were sometimes visible. Three small sub-groups were present - a single animal, three to four animals and four or more animals.

Tuesday, September 15, 2009 Sighting # 10

Initial Sighting on Track

Time: 17:11 WP#: 108 Lat: N 30.570448 Long: W 80.059358
Vertical Angle: 2 Horizontal Bearing in Degrees: 145 Sighting Cue: Body
On/Off Effort: On Track Line: 10 Beaufort Sea State: 1
Observer: RCH Observer Side: Right

Actual Time and Position of Sighting

Time: 17:12 WP#: 109 Lat: N 30.571831 Long: W 80.067951
Species: *Grampus griseus* Numbers (Low/High/Best): 30/40/36
Features used in Species ID: Square melon with vertical crease, tall dorsal fin, varying dark and light coloration with scarring, some animals with dark cape
Representative images used for Species ID: 4212, 4215, 4228, 4243, 4280, 4324, 4398
Photographer: RCH Frame Numbers: 4155 to 4427 Spacer: 4428
Calculated Distance from Track Line: 0.80 km

Final Time and Position of Sighting

Time: 17:22 WP#: 110 Lat: N 30.570990 Long: W 80.078707
Calculated Distance Traveled: 1.00 km

Behavior and Additional Comments

Multiple mother/calf pairs, photos show eight calves. Varying degrees of white with gray and black. At least four sub-groups present. The largest group of at least 16 animals was the only group with calves.

Wednesday, September 16, 2009 Sighting # 1

Initial Sighting on Track

Time: 10:20 WP#: 3 Lat: 29.961589 Long: -80.585552
Vertical Angle: 2 Horizontal Bearing in Degrees: 120 Sighting Cue: Body
On/Off Effort: On Track Line: 1 Beaufort Sea State: 1
Observer: HJF Observer Side: Right

Actual Time and Position of Sighting

Time: 10:22 WP#: 4 Lat: 29.954849 Long: -80.593794
Species: *Tursiops truncatus* Numbers (Low/High/Best): 7/9/9
Features used in Species ID: Short, robust rostrum with well-defined crease, broad flukes, dark gray cape with blaze terminating at posterior of large, falcate dorsal fin
Representative images used for Species ID: 4472-4484,4505-4509,4522
Photographer: HJF Frame Numbers: 4429-4522 Spacer: 4523
Calculated Distance from Track Line: 1.1 km

Final Time and Position of Sighting

Time: 10:28 WP#: 5 Lat: 29.959222 Long: -80.597073
Calculated Distance Traveled: 0.6 km

Behavior and Additional Comments

Some acrobatic activity observed, animals were diving deeper and spending less time at the surface, no calves visible

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Wednesday, September 16, 2009 Sighting # 2

Initial Sighting on Track

Time: 10:35 WP#: 8 Lat: 29.964026 Long: -80.427463
Vertical Angle: 3 Horizontal Bearing in Degrees: 75 Sighting Cue: Body
On/Off Effort: On Track Line: 1 Beaufort Sea State: 1
Observer: RCH Observer Side: Left

Actual Time and Position of Sighting

Time: 10:37 WP#: 9 Lat: 29.972613 Long: -80.436649
Species: *Stenella frontalis* Numbers (Low/High/Best): 20/25/25
Features used in Species ID: Short, white-tipped rostrum, small, falcate dorsal fin, dark gray cape with blaze terminating mid-dorsal area, slender pectoral fins, some were heavily spotted.
Representative images used for Species ID: 4534,4538,4541,4554,4569,4571
Photographer: HJF Frame Numbers: 4524-4605 Spacer: 4606
Calculated Distance from Track Line: 1.3 km

Final Time and Position of Sighting

Time: 10:40 WP#: 10 Lat: 29.973252 Long: -80.437525
Calculated Distance Traveled: 0.1 km

Behavior and Additional Comments

Slow moving closely associated group, one animal was noticed to be particularly acrobatic

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Wednesday, September 16, 2009 Sighting # 3

Initial Sighting on Track

Time: 11:25 WP#: 25 Lat: 30.031977 Long: -80.595213
Vertical Angle: 1 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Track Line: 2 Beaufort Sea State: 1
Observer: HJF Observer Side: Right

Actual Time and Position of Sighting

Time: 10:26 WP#: 26 Lat: 30.036121 Long: -80.595111
Species: *Stenella frontalis* Numbers (Low/High/Best): 12/12/12
Features used in Species ID: Some animals displayed heavy spotting, slender pectoral fins, long, white-tipped rostrum, alternating dark/light "banding" dorsally
Representative images used for Species ID: 4607-4614,4623
Photographer: HJF Frame Numbers: 4607-4672 Spacer: 4673
Calculated Distance from Track Line: 0.5 km

Final Time and Position of Sighting

Time: 10:28 WP#: 27 Lat: 30.035291 Long: -80.597056
Calculated Distance Traveled: 0.2 km

Behavior and Additional Comments

Travelling in one group, no calves observed

Wednesday, September 16, 2009 Sighting # 4

Initial Sighting on Track

Time: 11:39 WP#: 36 Lat: 30.098525 Long: -80.629402
Vertical Angle: 2 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Track Line: 2 Beaufort Sea State: 1
Observer: HJF Observer Side: Right

Actual Time and Position of Sighting

Time: 11:40 WP#: 37 Lat: 30.098577 Long: -80.630170
Species: *Stenella frontalis* Numbers (Low/High/Best): 46/50/48
Features used in Species ID: Long, white-tipped rostrum, small, falcate dorsal fin, dark gray cape with blaze terminating mid-dorsal area, slender pectoral fins, some were heavily spotted.
Representative images used for Species ID: 4681,4684,4695-4700,4703-4708,4729
Photographer: HJF Frame Numbers: 4674-4747 Spacer: 4748
Calculated Distance from Track Line: 0.1 km

Final Time and Position of Sighting

Time: 11:42 WP#: 38 Lat: 30.094688 Long: -80.629736
Calculated Distance Traveled: 0.4

Behavior and Additional Comments

One large group with several smaller groups travelling close by, some animals observed swimming belly up, calves present

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Wednesday, September 16, 2009 Sighting # 5

Initial Sighting on Track

Time: 11:50 WP#: 42 Lat: 30.100187 Long: -80.394185
Vertical Angle: 2 Horizontal Bearing in Degrees: 110 Sighting Cue: Body
On/Off Effort: On Track Line: 3 Beaufort Sea State: 1
Observer: HJF Observer Side: Right

Actual Time and Position of Sighting

Time: 11:51 WP#: 43 Lat: 30.097543 Long: -80.397718
Species: *Tursiops truncatus* Numbers (Low/High/Best): 8/12/10
Features used in Species ID: Short, robust rostrum with well-defined crease, broad flukes, dark gray cape with blaze terminating at posterior of large, falcate dorsal fin
Representative images used for Species ID: 4764,4770,4771,4781,4813,4822-4824
Photographer: HJF Frame Numbers: 4749-4828 Spacer: 4829
Calculated Distance from Track Line: 0.5 km

Final Time and Position of Sighting

Time: 11:58 WP#: 45 Lat: 30.093080 Long: -80.398887
Calculated Distance Traveled: 0.5 km

Behavior and Additional Comments

One group of 7 animals with a smaller group of 3 and several single animals. Loosely associated group. Some deeper diving observed. Calves present

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Wednesday, September 16, 2009 Sighting # 6

Initial Sighting on Track

Time: 12:01 WP#: 48 Lat: 30.101249 Long: -80.312913
Vertical Angle: 3 Horizontal Bearing in Degrees: 110 Sighting Cue: Body
On/Off Effort: On Track Line: 3 Beaufort Sea State: 1
Observer: RCH Observer Side: Left

Actual Time and Position of Sighting

Time: 12:05 WP#: 49 Lat: 30.109295 Long: -80.326179
Species: *Tursiops truncatus* Numbers (Low/High/Best): 4/4/4
Features used in Species ID: Broad flukes, dark gray cape with blaze terminating at posterior of large, falcate dorsal fin. Short, robust rostrum with well-defined crease at base of melon.
Representative images used for Species ID:
Photographer: HJF Frame Numbers: 4830-4884 Spacer: 4885
Calculated Distance from Track Line: 1.6 km

Final Time and Position of Sighting

Time: 12:17 WP#: 50 Lat: 30.105837 Long: -80.332837
Calculated Distance Traveled: 0.8 km

Behavior and Additional Comments

Travelling in one group with calves present

Wednesday, September 16, 2009 Sighting # 7

Initial Sighting on Track

Time: 12:51 WP#: 56 Lat: 30.165650 Long: -80.433371
Vertical Angle: 1 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Track Line: 4 Beaufort Sea State: 1
Observer: RCH Observer Side: Left

Actual Time and Position of Sighting

Time: 12:52 WP#: 57 Lat: 30.164620 Long: -80.426851
Species: *Stenella frontalis* Numbers (Low/High/Best): 12/12/12
Features used in Species ID: Short, white-tipped rostrum, small, falcate dorsal fin, dark gray cape with blaze terminating mid-dorsal area, slender pectoral fins, some were heavily spotted.
Representative images used for Species ID: 4888-4900,4911-4916
Photographer: HJF Frame Numbers: 4886-4925 Spacer: 4926
Calculated Distance from Track Line: 0.6 km

Final Time and Position of Sighting

Time: 12:54 WP#: 58 Lat: 30.166512 Long: -80.426013
Calculated Distance Traveled: 0.2 km

Behavior and Additional Comments

One group travelling slowly, some inverted swimming observed.

Wednesday, September 16, 2009 Sighting # 8

Initial Sighting on Track

Time: 12:55 WP#: 60 Lat: 30.163212 Long: -80.468417
Vertical Angle: 3 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Track Line: 4 Beaufort Sea State: 1
Observer: RCH Observer Side: Left

Actual Time and Position of Sighting

Time: 12:56 WP#: 61 Lat: 30.149300 Long: -80.473643
Species: *Tursiops truncatus* Numbers (Low/High/Best): 6/6/6
Features used in Species ID: Short, robust rostrum with well-defined crease, broad flukes, dark gray cape with blaze terminating at posterior of large, falcate dorsal fin
Representative images used for Species ID: 4940,4953,4954,4960,4962-4964,4967
Photographer: HJF Frame Numbers: 4927-4969 Spacer: 4970
Calculated Distance from Track Line: 1.6 km

Final Time and Position of Sighting

Time: 13:06 WP#: 62 Lat: 30.151633 Long: -80.470262
Calculated Distance Traveled: 1.6 km

Behavior and Additional Comments

Travelling rapidly, elusive. Originally observed as two small groups which later joined into one group.

Wednesday, September 16, 2009 Sighting # 9

Initial Sighting on Track

Time: 13:11 WP#: 64 Lat: 30.169747 Long: -80.510894
Vertical Angle: 2 Horizontal Bearing in Degrees: 100 Sighting Cue: Body
On/Off Effort: On Track Line: 4 Beaufort Sea State: 1
Observer: HJF Observer Side: Right

Actual Time and Position of Sighting

Time: 13:12 WP#: 65 Lat: 30.174440 Long: -80.501961
Species: *Stenella frontalis* Numbers (Low/High/Best): 6/7/7
Features used in Species ID: Short, white-tipped rostrum, small, falcate dorsal fin, dark gray cape with blaze terminating mid-dorsal area, slender pectoral fins, some were heavily spotted.
Representative images used for Species ID: 4984,5004,5006,5008,5022,5041-5043
Photographer: HJF Frame Numbers: 4871-5043 Spacer: 5044
Calculated Distance from Track Line: 1.0 km

Final Time and Position of Sighting

Time: 13:19 WP#: 66 Lat: 30.177922 Long: -80.507244
Calculated Distance Traveled: 0.6 km

Behavior and Additional Comments

Observed throwing fish out of the water repeatedly, loose grouping with several single animals at the edges, fast travelling. A shark was observed and photographed close to the group

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Wednesday, September 16, 2009 Sighting # 10

Initial Sighting on Track

Time: 13:25 WP#: 68 Lat: 30.166367 Long: -80.688584
Vertical Angle: 1 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Track Line: 4 Beaufort Sea State: 1
Observer: HJF Observer Side: Right

Actual Time and Position of Sighting

Time: 13:26 WP#: 69 Lat: 30.170953 Long: -80.685147
Species: *Stenella frontalis* Numbers (Low/High/Best): 16/16/16
Features used in Species ID: Short, white-tipped rostrum, small, falcate dorsal fin, dark gray cape with blaze terminating mid-dorsal area, slender pectoral fins, some were heavily spotted.
Representative images used for Species ID: 5114,5120,5124,5134,5141-5167
Photographer: HJF Frame Numbers: 5045-5213 Spacer: 5214
Calculated Distance from Track Line: 0.6 km

Final Time and Position of Sighting

Time: 13:35 WP#: 70 Lat: 30.166820 Long: -80.686157
Calculated Distance Traveled: 0.5 km

Behavior and Additional Comments

A leatherback turtle was observed with a dense cloud of small fish surrounding it. Larger fish were attracted and the dolphins followed. Vigorous feeding activity was observed during the entire encounter. Calves were present.

Wednesday, September 16, 2009 Sighting # 11

Initial Sighting on Track

Time: 14:58 WP#: 74 Lat: 30.235062 Long: -80.632629
Vertical Angle: 2 Horizontal Bearing in Degrees: 75 Sighting Cue: Body
On/Off Effort: On Track Line: 5 Beaufort Sea State: 1
Observer: RCH Observer Side: Left

Actual Time and Position of Sighting

Time: 14:59 WP#: 75 Lat: 30.234286 Long: -80.638299
Species: *Unidentified Delphinid* Numbers (Low/High/Best): 8/12/11
Features used in Species ID: N/A

Representative images used for Species ID: 5220,5240,5448,5253-5255,5263
Photographer: HJF Frame Numbers: 5215-5263 Spacer: 5264
Calculated Distance from Track Line: 0.6 km

Final Time and Position of Sighting

Time: 15:05 WP#: 76 Lat: 30.243345 Long: -80.636864
Calculated Distance Traveled: 1.0 km

Behavior and Additional Comments

Tight group travelling quickly, most animals were observed swimming in pairs

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Wednesday, September 16, 2009 Sighting # 12

Initial Sighting on Track

Time: 15:17 WP#: 84 Lat: 30.233124 Long: -80.355071
Vertical Angle: 2 Horizontal Bearing in Degrees: 85 Sighting Cue: Body
On/Off Effort: On Track Line: 5 Beaufort Sea State: 1
Observer: HJF Observer Side: Right

Actual Time and Position of Sighting

Time: 15:18 WP#: 85 Lat: 30.223357 Long: -80.357840
Species: *Stenella frontalis* Numbers (Low/High/Best): 22/24/23
Features used in Species ID: Short, white-tipped rostrum, small, falcate dorsal fin, dark gray cape with blaze terminating mid-dorsal area, slender pectoral fins, some were heavily spotted.
Representative images used for Species ID: 854,0855,0856,0859,0867,0869
Photographer: HJF Frame Numbers: 0820-0871 Spacer: 0872
Calculated Distance from Track Line: 1.1 km

Final Time and Position of Sighting

Time: 15:22 WP#: 86 Lat: 30.225622 Long: -80.355513
Calculated Distance Traveled: 0.4 km

Behavior and Additional Comments

Travelling in close group, no calves observed

Wednesday, September 16, 2009 Sighting # 13

Initial Sighting on Track

Time: 15:41 WP#: 93 Lat: 30.300652 Long: -79.802603
Vertical Angle: 3 Horizontal Bearing in Degrees: 170 Sighting Cue: Body
On/Off Effort: On Track Line: 6 Beaufort Sea State: 1
Observer: HJF Observer Side: Right

Actual Time and Position of Sighting

Time: 15:42 WP#: 94 Lat: 30.303848 Long: -79.787409
Species: *Grampus griseus* Numbers (Low/High/Best): 4/4/4
Features used in Species ID: Large, tall dorsal fin, long pectoral fins, blunt head with cleft in melon, visible scarring patterns
Representative images used for Species ID: 879,0880,0889,0888
Photographer: HJF Frame Numbers: 0872-0913 Spacer: 0914
Calculated Distance from Track Line: 1.5 km

Final Time and Position of Sighting

Time: 15:44 WP#: 95 Lat: 30.301772 Long: -79.789834
Calculated Distance Traveled: 0.3 km

Behavior and Additional Comments

Two mother calf pairs were observed with no other animals observed.

Wednesday, September 16, 2009 Sighting # 14

Initial Sighting on Track

Time: 16:06 WP#: 100 Lat: 30.300613 Long: -80.565902
Vertical Angle: 2 Horizontal Bearing in Degrees: 45 Sighting Cue: Body
On/Off Effort: On Track Line: 6 Beaufort Sea State: 1
Observer: RCH Observer Side: Left

Actual Time and Position of Sighting

Time: 16:07 WP#: 101 Lat: 30.298897 Long: -80.554275
Species: *Stenella frontalis* Numbers (Low/High/Best): 33/38/36
Features used in Species ID: Short, white-tipped rostrum, small, falcate dorsal fin, dark gray cape with blaze terminating mid-dorsal area, slender pectoral fins, some were heavily spotted.
Representative images used for Species ID: 0915,0921,0925,0933,0949,0963,0972,0995
Photographer: HJF Frame Numbers: 1914-1000 Spacer: 1001
Calculated Distance from Track Line: 1.1 km

Final Time and Position of Sighting

Time: 16:11 WP#: 102 Lat: 30.301012 Long: -80.552611
Calculated Distance Traveled: 0.3 km

Behavior and Additional Comments

Observed a large group with several smaller groups at the edges, travelling quickly possibly chasing fish, calves present

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Friday, September 18, 2009 Sighting # 1

Initial Sighting on Track

Time: 8:55 WP#: 5 Lat: 30.564449 Long: -80.513042
Vertical Angle: 3 Horizontal Bearing in Degrees: 90 Sighting Cue: Splash
On/Off Effort: On Track Line: 10 Beaufort Sea State: 3
Observer: RJM Observer Side: Right

Actual Time and Position of Sighting

Time: 8:56 WP#: 6 Lat: 30.564918 Long: -80.519281
Species: *Stenella frontalis* Numbers (Low/High/Best): 10/20/17
Features used in Species ID: Alternating light and dark pattern down the body, white tip on the rostrum, white flank blaze terminates mid-dorsally
Representative images used for Species ID: 023, 024, 033
Photographer: RJM Frame Numbers: 1 to 88 Spacer: 89
Calculated Distance from Track Line: 0.6 km

Final Time and Position of Sighting

Time: 9:03 WP#: 7 Lat: 30.560970 Long: -80.520047
Calculated Distance Traveled: 0.5 km

Behavior and Additional Comments

Animals were spread out, moving fast, jumping and splashing, active at the surface.

Friday, September 18, 2009 Sighting # 2

Initial Sighting on Track

Time: 9:08 WP#: 11 Lat: 30.562775 Long: -80.377244
Vertical Angle: 3 Horizontal Bearing in Degrees: 100 Sighting Cue: Splash
On/Off Effort: On Track Line: 10 Beaufort Sea State: 3
Observer: EWC Observer Side: Left

Actual Time and Position of Sighting

Time: 9:10 WP#: 11 Lat: 30.571772 Long: -80.382930
Species: *Stenella frontalis* Numbers (Low/High/Best): 19/30/24
Features used in Species ID: Alternating light and dark pattern down the body, white tip on the rostrum, light colored flank blaze terminating mid-dorsally
Representative images used for Species ID: 121, 128, 129, 207
Photographer: RJM Frame Numbers: 90 to 238 Spacer: 239
Calculated Distance from Track Line: 1.1 km

Final Time and Position of Sighting

Time: 9:16 WP#: 12 Lat: 30.566977 Long: -80.375850
Calculated Distance Traveled: 0.8 km

Behavior and Additional Comments

Sub-group of six individuals. All moving east as a tight group, hanging at the surface or just below. Some doing deeper dives.

Friday, September 18, 2009 Sighting # 3

Initial Sighting on Track

Time: 9:50 WP#: 21 Lat: 30.497510 Long: -80.389473
Vertical Angle: 1 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Track Line: 9 Beaufort Sea State: 2
Observer: EWC Observer Side: Left

Actual Time and Position of Sighting

Time: 9:51 WP#: 22 Lat: 30.500495 Long: -80.387744
Species: *Stenella frontalis* Numbers (Low/High/Best): 10/12/12
Features used in Species ID: Alternating light and dark pattern down the body. White tip on the rostrum, light flank blaze terminating mid-dorsally
Representative images used for Species ID: 248, 252, 256, 260, 261, 263, 277, 296
Photographer: RJM Frame Numbers: 240 - 386 Spacer: 387
Calculated Distance from Track Line: 0.4 km

Final Time and Position of Sighting

Time: 10:00 WP#: 23 Lat: 30.490680 Long: -80.387463
Calculated Distance Traveled: 1.1 km

Behavior and Additional Comments

One group of 8 and one group of 4 individuals. Both travelling at surface or just beneath. Moving South, and some belly to belly swimming.

Friday, September 18, 2009 Sighting # 4

Initial Sighting on Track

Time: 10:21 WP#: 34 Lat: 30.434675 Long: -80.426475
Vertical Angle: 2 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Track Line: 8 Beaufort Sea State: 2
Observer: EWC Observer Side: Left

Actual Time and Position of Sighting

Time: 10:22 WP#: 35 Lat: 30.441061 Long: -80.427384
Species: *Stenella frontalis* Numbers (Low/High/Best): 40/50/50
Features used in Species ID: Alternating light and dark pattern down the body. White tip on the rostrum, visible spotting
Representative images used for Species ID: 404, 423, 430, 482
Photographer: RJM Frame Numbers: 388 - 558 Spacer: 559
Calculated Distance from Track Line: 0.7 km

Final Time and Position of Sighting

Time: 10:30 WP#: 36 Lat: 30.431570 Long: -80.427382
Calculated Distance Traveled: 1.1 km

Behavior and Additional Comments

Surface to just below surface swimming. Calves present. There were two groups with at least 20 in each group. Traveling east in a tight formation, some doing deeper dives and some belly to belly swimming.

Friday, September 18, 2009 Sighting # 5

Initial Sighting on Track

Time: 11:19 WP#: 50 Lat: 30.299226 Long: -80.649428
Vertical Angle: 3 Horizontal Bearing in Degrees: 90 Sighting Cue: Splash
On/Off Effort: On Track Line: 6 Beaufort Sea State: 2
Observer: RJM Observer Side: Right

Actual Time and Position of Sighting

Time: 11:20 WP#: 51 Lat: 30.291406 Long: -80.650391
Species: *Unidentified Delphinid* Numbers (Low/High/Best): 2/2/2
Features used in Species ID: Most likely Stenella frontalis, but pictures are inconclusive.

Representative images used for Species ID: N/A (best images 565, 566)
Photographer: RJM Frame Numbers: 560 - 568 Spacer: 569
Calculated Distance from Track Line: 0.9 km

Final Time and Position of Sighting

Time: None WP#: N/A Lat: N/A Long: N/A
Calculated Distance Traveled: N/A

Behavior and Additional Comments

The animals were not sighted again for a final waypoint. Animals were traveling spread out, followed by a deep dive. They may have been showing some avoidance behavior.

Friday, September 18, 2009 Sighting # 6

Initial Sighting on Track

Time: 12:18 WP#: 62 Lat: 30.233594 Long: -80.419848
Vertical Angle: 3 Horizontal Bearing in Degrees: 90 Sighting Cue: Splash
On/Off Effort: On Track Line: 5 Beaufort Sea State: 2
Observer: RJM Observer Side: Right

Actual Time and Position of Sighting

Time: 12:19 WP#: 63 Lat: 30.238101 Long: -80.415326
Species: *Tursiops truncatus* Numbers (Low/High/Best): 10/18/16
Features used in Species ID: Robust animals with a uniform grey color throughout, short rostrum

Representative images used for Species ID: 570, 574, 575, 609, 626
Photographer: RJM Frame Numbers: 570 - 684 Spacer: 685
Calculated Distance from Track Line: 0.7 km

Final Time and Position of Sighting

Time: 12:33 WP#: 64 Lat: 30.231760 Long: -80.410858
Calculated Distance Traveled: 0.8 km

Behavior and Additional Comments

Animals were jumping high out of the water, playing, darting different directions, some were swimming belly to belly. Most were swimming just below the surface moving southeast.

Friday, September 18, 2009 Sighting # 7

Initial Sighting on Track

Time: 14:30 WP#: 7 Lat: 30.163411 Long: -80.555860
Vertical Angle: 1 Horizontal Bearing in Degrees: 90 Sighting Cue: Splash
On/Off Effort: On Track Line: 4 Beaufort Sea State: 2
Observer: REH Observer Side: Right

Actual Time and Position of Sighting

Time: 14:33 WP#: 8 Lat: 30.160878 Long: -80.563221
Species: *Stenella frontalis* Numbers (Low/High/Best): 5/5/5
Features used in Species ID: White-tipped rostrum, dark cape with blaze terminating near dorsal fin, variable spotting present between individuals
Representative images used for Species ID: 5367, 5368, 5369, 5370
Photographer: REH Frame Numbers: 5349-5382 Spacer: 5383
Calculated Distance from Track Line: 0.8 km

Final Time and Position of Sighting

Time: 14:35 WP#: 9 Lat: 30.156092 Long: -80.562976
Calculated Distance Traveled: 0.5 km

Behavior and Additional Comments

Animals swimming consistently in one direction. Sighting consisted of several separate individuals who did not form a cohesive group.

Friday, September 18, 2009 Sighting # 8

Initial Sighting on Track

Time: 14:37 WP#: 12 Lat: 30.164431 Long: -80.502899
Vertical Angle: 1 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Track Line: 4 Beaufort Sea State: 2
Observer: HJF Observer Side: Left

Actual Time and Position of Sighting

Time: 14:38 WP#: 13 Lat: 30.168336 Long: -80.505832
Species: *Tursiops truncatus* Numbers (Low/High/Best): 5/5/5
Features used in Species ID: robust rostrum and well-defined crease between melon and rostrum, uniform gray coloration, broad flukes
Representative images used for Species ID: 5394, 5396, 5398, 5402
Photographer: REH Frame Numbers: 5384 - 5407 Spacer: 5408
Calculated Distance from Track Line: 0.5 km

Final Time and Position of Sighting

Time: 14:40 WP#: 14 Lat: 30.164341 Long: -80.507410
Calculated Distance Traveled: 0.5 km

Behavior and Additional Comments

Animals were tightly grouped and swimming together.

Friday, September 18, 2009 Sighting # 9

Initial Sighting on Track

Time: 15:26 WP#: 26 Lat: 30.099408 Long: -80.694116
Vertical Angle: 2 Horizontal Bearing in Degrees: 100 Sighting Cue: Body
On/Off Effort: On Track Line: 3 Beaufort Sea State: 2
Observer: REH Observer Side: Right

Actual Time and Position of Sighting

Time: 15:26 WP#: 27 Lat: 30.100683 Long: -80.694371
Species: *Stenella frontalis* Numbers (Low/High/Best): 5/8/7
Features used in Species ID: white-tipped rostrum, dark cape, some with blaze terminating near dorsal fin, variable spotting among individuals
Representative images used for Species ID: 5423, 5448, 5456
Photographer: REH Frame Numbers: 5409 - 5480 Spacer: 5481
Calculated Distance from Track Line: 0.1 km

Final Time and Position of Sighting

Time: 15:34 WP#: 28 Lat: 30.096741 Long: -80.689057
Calculated Distance Traveled: 0.7 km

Behavior and Additional Comments

Sighting consisted of one group of three individuals with several outliers. Animals were swimming consistently in one direction. At least one individual photographed with an octopus.

Friday, September 18, 2009 Sighting # 10

Initial Sighting on Track

Time: 15:38 WP#: 32 Lat: 30.031971 Long: -80.690751
Vertical Angle: 1 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Track Line: 2 Beaufort Sea State: 2
Observer: REH Observer Side: Right

Actual Time and Position of Sighting

Time: 15:41 WP#: 33 Lat: 30.032023 Long: -80.699443
Species: *Tursiops truncatus* Numbers (Low/High/Best): 12/17/15
Features used in Species ID: short, robust rostrum, fairly uniform gray coloration with darker gray cape, well-defined crease at melon, broad flukes
Representative images used for Species ID: 5503, 5514, 5518
Photographer: REH Frame Numbers: 5482 - 5520 Spacer: 5521
Calculated Distance from Track Line: 0.8 km

Final Time and Position of Sighting

Time: 15:44 WP#: 34 Lat: 30.029037 Long: -80.701106
Calculated Distance Traveled: 0.4 km

Behavior and Additional Comments

Sighting consisted of several groups of approximately four individuals each.

Friday, September 18, 2009 Sighting # 11

Initial Sighting on Track

Time: 15:47 WP#: 36 Lat: 30.031929 Long: -80.628495
Vertical Angle: 2 Horizontal Bearing in Degrees: 100 Sighting Cue: Body
On/Off Effort: On Track Line: 2 Beaufort Sea State: 2
Observer: HJF Observer Side: Left

Actual Time and Position of Sighting

Time: 15:52 WP#: 37 Lat: 30.039557 Long: -80.636833
Species: *Tursiops truncatus* Numbers (Low/High/Best): 4/4/4
Features used in Species ID: Robust rostrum with well-defined crease at melon, broad flukes, fairly uniform gray coloration
Representative images used for Species ID: 5536, 5538, 5549, 5550
Photographer: REH Frame Numbers: 5522 - 5557 Spacer: 5558
Calculated Distance from Track Line: 1.2 km

Final Time and Position of Sighting

Time: 15:55 WP#: 38 Lat: 30.036280 Long: -80.636358
Calculated Distance Traveled: 0.4 km

Behavior and Additional Comments

Individuals were swimming tightly together.

Friday, September 18, 2009 Sighting # 12

Initial Sighting on Track

Time: 16:08 WP#: 42 Lat: 30.032582 Long: -80.177934
Vertical Angle: 1 Horizontal Bearing in Degrees: 110 Sighting Cue: Body
On/Off Effort: On Track Line: 2 Beaufort Sea State: 2
Observer: REH Observer Side: Right

Actual Time and Position of Sighting

Time: 16:10 WP#: 43 Lat: 30.026112 Long: -80.183865
Species: *Grampus griseus* Numbers (Low/High/Best): 5/5/5
Features used in Species ID: Square melon with vertical crease, tall dorsal fin, robust body and large flukes, some with dark, straight cape, variable dark and light coloration and scarring
Representative images used for Species ID: 5574, 5596, 5597, 5599, 5601, 5605
Photographer: REH Frame Numbers: 5559 - 5611 Spacer: 5612
Calculated Distance from Track Line: 0.9 km

Final Time and Position of Sighting

Time: 16:12 WP#: 44 Lat: 30.026529 Long: -80.185354
Calculated Distance Traveled: 0.2 km

Behavior and Additional Comments

Animals were swimming in close proximity to each other.

Wednesday, September 30, 2009 Sighting # 1

Initial Sighting on Track

Time: 9:10 WP#: 5 Lat: 29.966322 Long: -80.488793
Vertical Angle: 1 Horizontal Bearing in Degrees: 100 Sighting Cue: Body
On/Off Effort: On Track Line: 1 Beaufort Sea State: 2
Observer: PBN Observer Side: Right

Actual Time and Position of Sighting

Time: 9:12 WP#: 6 Lat: 29.960539 Long: -80.492943
Species: *Stenella frontalis* Numbers (Low/High/Best): 3/5/5
Features used in Species ID: White-tipped rostrum, cape with blaze terminating at the dorsal fin, spotting on some animals
Representative images used for Species ID: 6635, 6642, 6681, 6682, 6710, 6711
Photographer: PBN Frame Numbers: 6619 to 6749 Spacer: 6750
Calculated Distance from Track Line: 0.8 km

Final Time and Position of Sighting

Time: 9:19 WP#: 7 Lat: 29.960620 Long: -80.495537
Calculated Distance Traveled: 0.3 km

Behavior and Additional Comments

One group, jumping from water when porpoising, rapid rate of travel, one mother / calf pair, one animal was showing its belly

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Wednesday, September 30, 2009 Sighting # 2

Initial Sighting on Track

Time: 9:59 WP#: 18 Lat: 30.031530 Long: -80.410441
Vertical Angle: 1 Horizontal Bearing in Degrees: 120 Sighting Cue: Body
On/Off Effort: On Track Line: 2 Beaufort Sea State: 2
Observer: PBN Observer Side: Right

Actual Time and Position of Sighting

Time: 10:00 WP#: 19 Lat: 30.034495 Long: -80.412547
Species: *Stenella frontalis* Numbers (Low/High/Best): 8/12/10
Features used in Species ID: White-tipped rostrum, dark cape with blaze terminating at dorsal fin, variable spotting among individuals
Representative images used for Species ID: 6795, 6796
Photographer: PBN Frame Numbers: 6751 to 6798 Spacer: 6799
Calculated Distance from Track Line: 0.4 km

Final Time and Position of Sighting

Time: 10:08 WP#: 20 Lat: 30.039895 Long: -80.424291
Calculated Distance Traveled: 1.3 km

Behavior and Additional Comments

One main group, traveling in a tight group, at least one individual and one pair traveling further from the group, one animal photographed throwing an octopus from the water

Wednesday, September 30, 2009 Sighting # 3

Initial Sighting on Track

Time: 10:19 WP#: 24 Lat: 30.099785 Long: -80.670942
Vertical Angle: 3 Horizontal Bearing in Degrees: 90 Sighting Cue: Splash
On/Off Effort: On Track Line: 3 Beaufort Sea State: 2
Observer: REH Observer Side: Left

Actual Time and Position of Sighting

Time: 10:19 WP#: 25 Lat: 30.109130 Long: -80.676868
Species: *Stenella frontalis* Numbers (Low/High/Best): 8/15/12
Features used in Species ID: White-tipped rostrum, dark cape with lighter blaze terminating at dorsal fin, variable spotting among individuals
Representative images used for Species ID: 6813, 6820, 6824, 6856
Photographer: PBN Frame Numbers: 6800 to 6860 Spacer: 6861
Calculated Distance from Track Line: 1.2 km

Final Time and Position of Sighting

Time: 10:25 WP#: 26 Lat: 30.105128 Long: -80.677213
Calculated Distance Traveled: 0.4 km

Behavior and Additional Comments

Animals were very active at the surface, group was spread out, at least one mother / calf pair

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Wednesday, September 30, 2009 Sighting # 4

Initial Sighting on Track

Time: 10:31 WP#: 33 Lat: 30.101382 Long: -80.445833
Vertical Angle: 2 Horizontal Bearing in Degrees: 125 Sighting Cue: Body
On/Off Effort: On Track Line: 3 Beaufort Sea State: 2
Observer: PBN Observer Side: Right

Actual Time and Position of Sighting

Time: 10:33 WP#: 34 Lat: 30.095493 Long: -80.448507
Species: *Stenella frontalis* Numbers (Low/High/Best): 5/5/5
Features used in Species ID: White-tipped rostrum, dark cape with lighter blaze terminating at the dorsal fin, some individuals are heavily spotted
Representative images used for Species ID: 6874, 6889, 6895, 6896
Photographer: PBN Frame Numbers: 6862 to 6945 Spacer: 6946
Calculated Distance from Track Line: 0.7 km

Final Time and Position of Sighting

Time: 10:36 WP#: 35 Lat: 30.095637 Long: -80.445367
Calculated Distance Traveled: 0.3 km

Behavior and Additional Comments

Animals were traveling very quickly, jumping clear of the water when porpoising, a school of fairly large fish present as well

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Wednesday, September 30, 2009 Sighting # 5

Initial Sighting on Track

Time: 10:38 WP#: 37 Lat: 30.098520 Long: -80.397580
Vertical Angle: 2 Horizontal Bearing in Degrees: 100 Sighting Cue: Body
On/Off Effort: On Track Line: 3 Beaufort Sea State: 2
Observer: PBN Observer Side: Right

Actual Time and Position of Sighting

Time: 10:40 WP#: 38 Lat: 30.089326 Long: -80.407715
Species: *Stenella frontalis* Numbers (Low/High/Best): 20/26/23
Features used in Species ID: White-tipped, slender rostrum, alternate light/dark banding on dorsal side, light-colored blaze terminating mid-dorsal
Representative images used for Species ID: 6958, 6975, 6983, 6990, 6991
Photographer: PBN Frame Numbers: 6947 to 6996 Spacer: 6997
Calculated Distance from Track Line: 1.4 km

Final Time and Position of Sighting

Time: 10:41 WP#: 39 Lat: 30.090463 Long: -80.406134
Calculated Distance Traveled: 0.2 km

Behavior and Additional Comments

4-5 subgroups, 16 in one group and then smaller numbers in surrounding groups, at least two mother / calf pairs

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Wednesday, September 30, 2009 Sighting # 6

Initial Sighting on Track

Time: 11:05 WP#: 47 Lat: 30.165561 Long: -80.035880
Vertical Angle: 2 Horizontal Bearing in Degrees: 45 Sighting Cue: Body
On/Off Effort: On Track Line: 4 Beaufort Sea State: 3
Observer: PBN Observer Side: Right

Actual Time and Position of Sighting

Time: 11:06 WP#: 48 Lat: 30.169024 Long: -80.034752
Species: *Tursiops truncatus* Numbers (Low/High/Best): 4/5/5
Features used in Species ID: Robust bodies, short rostrum, well-defined crease at melon, light-colored peduncle, large flukes, mostly uniform gray coloration
Representative images used for Species ID: 7026, 7027, 7038, 2039, 7046
Photographer: PBN Frame Numbers: 6998 to 7055 Spacer: 7056
Calculated Distance from Track Line: 0.4 km

Final Time and Position of Sighting

Time: 11:09 WP#: 49 Lat: 30.170270 Long: -80.030787
Calculated Distance Traveled: 0.4 km

Behavior and Additional Comments

Animals were leaping and traveling quickly

Wednesday, September 30, 2009 Sighting # 7

Initial Sighting on Track

Time: 11:25 WP#: 55 Lat: 30.167374 Long: -80.605349
Vertical Angle: 1 Horizontal Bearing in Degrees: 80 Sighting Cue: Body
On/Off Effort: On Track Line: 4 Beaufort Sea State: 2
Observer: REH Observer Side: Left

Actual Time and Position of Sighting

Time: 11:27 WP#: 56 Lat: 30.163869 Long: -80.607505
Species: *Stenella frontalis* Numbers (Low/High/Best): 3/4/4
Features used in Species ID: White-tipped rostrum, light-colored blaze terminating mid-dorsal, spotted pattern visible on some individuals
Representative images used for Species ID: 7064, 7066, 7082, 7109
Photographer: PBN Frame Numbers: 7057 to 7155 Spacer: 7156
Calculated Distance from Track Line: 0.4 km

Final Time and Position of Sighting

Time: 11:32 WP#: 57 Lat: 30.163285 Long: -80.600294
Calculated Distance Traveled: 0.7 km

Behavior and Additional Comments

One small group, porpoising quickly, moving in one direction, then changing direction and swimming more erratically- possible foraging observed, at least one mother/calf pair present

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Wednesday, September 30, 2009 Sighting # 8

Initial Sighting on Track

Time: 11:35 WP#: 59 Lat: 30.166125 Long: -80.696189
Vertical Angle: 1 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Track Line: 4 Beaufort Sea State: 2
Observer: PBN Observer Side: Right

Actual Time and Position of Sighting

Time: 11:36 WP#: 60 Lat: 30.162798 Long: -80.684799
Species: *Stenella frontalis* Numbers (Low/High/Best): 4/5/5
Features used in Species ID: White-tipped, long rostrum, light-colored blaze terminating mid-dorsal
Representative images used for Species ID: 7172, 7173, 7179, 7025
Photographer: PBN Frame Numbers: 7157 to 7210 Spacer: 7211
Calculated Distance from Track Line: 1.2 km

Final Time and Position of Sighting

Time: 11:42 WP#: 61 Lat: 30.169959 Long: -80.698699
Calculated Distance Traveled: 1.6 km

Behavior and Additional Comments

Animals were porpoising quickly, lots of splashing, one dolphin in the vicinity of a large school of fish, birds circling, possibly foraging

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Wednesday, September 30, 2009 Sighting # 9

Initial Sighting on Track

Time: 11:48 WP#: 66 Lat: 30.229897 Long: -80.627199
Vertical Angle: 3 Horizontal Bearing in Degrees: 100 Sighting Cue: Splash
On/Off Effort: On Track Line: 5 Beaufort Sea State: 2
Observer: REH Observer Side: Left

Actual Time and Position of Sighting

Time: 11:48 WP#: 67 Lat: 30.240264 Long: -80.626807
Species: *Stenella frontalis* Numbers (Low/High/Best): 8/10/9
Features used in Species ID: Light-colored blaze terminating mid-dorsal, white-tipped rostrum, very narrow peduncle at fluke insertion, variable spotting among individuals
Representative images used for Species ID: 7229, 7245, 7251, 7256, 7260, 7268
Photographer: PBN Frame Numbers: 7212 to 7278 Spacer: 7279
Calculated Distance from Track Line: 1.2 km

Final Time and Position of Sighting

Time: 11:52 WP#: 68 Lat: 30.239559 Long: -80.634311
Calculated Distance Traveled: 0.7 km

Behavior and Additional Comments

One group of animals tightly grouped together, swimming rapidly in the same direction

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Wednesday, September 30, 2009 Sighting # 10

Initial Sighting on Track

Time: 14:52 WP#: 91 Lat: 30.435534 Long: -80.014199
Vertical Angle: 3 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Track Line: 8 Beaufort Sea State: 2
Observer: PBN Observer Side: Right

Actual Time and Position of Sighting

Time: 14:55 WP#: 92 Lat: 30.443106 Long: -80.010302
Species: *Grampus griseus* Numbers (Low/High/Best): 24/30/26
Features used in Species ID: Vertical crease in blunt melon, tall, dark dorsal fin, varying color patterns of black, gray, and white- some with dark cape, some mottled, variable scarring
Representative images used for Species ID: 7306, 7310, 7316, 7326, 7357
Photographer: PBN Frame Numbers: 7289 to 7361 Spacer: 7362
Calculated Distance from Track Line: 0.9 km

Final Time and Position of Sighting

Time: 14:59 WP#: 93 Lat: 30.442096 Long: -80.017633
Calculated Distance Traveled: 0.7 km

Behavior and Additional Comments

Large group, closely grouped with a few individuals more widely dispersed on the fringe. One direction of travel, surfacing frequently, no calves present (first of the large pods of Grampus we have seen with no calves present).

Wednesday, September 30, 2009 Sighting # 11

Initial Sighting on Track

Time: 15:35 WP#: 103 Lat: 30.564806 Long: -80.336784
Vertical Angle: 2 Horizontal Bearing in Degrees: 75 Sighting Cue: Body
On/Off Effort: On Track Line: 10 Beaufort Sea State: 2
Observer: REH Observer Side: Left

Actual Time and Position of Sighting

Time: 15:36 WP#: 104 Lat: 30.568879 Long: -80.340131
Species: *Stenella frontalis* Numbers (Low/High/Best): 8/10/9
Features used in Species ID: White-tipped rostrum, variable spotting among individuals, light-colored blaze terminating mid-dorsal
Representative images used for Species ID: 7369, 7375, 7422
Photographer: PBN Frame Numbers: 7363 to 7429 Spacer: 7430
Calculated Distance from Track Line: 0.6 km

Final Time and Position of Sighting

Time: 15:38 WP#: 105 Lat: 30.567619 Long: -80.336968
Calculated Distance Traveled: 0.3 km

Behavior and Additional Comments

Animals were moving quickly in one tight group, seemed to be a lot of rolling and tactile interaction

Thursday, October 1, 2009 Sighting # 1

Initial Sighting on Track

Time: 9:28 WP#: 15 Lat: 30.498309 Long: -80.396071
Vertical Angle: 2 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Track Line: 9 Beaufort Sea State: 2
Observer: RCH Observer Side: Right

Actual Time and Position of Sighting

Time: 9:35 WP#: 16 Lat: 30.499122 Long: -80.404954
Species: *Stenella frontalis* Numbers (Low/High/Best): 4/4/4
Features used in Species ID: White rostum tip, visible spotting pattern, light blaze continuing to posterior of dorsal fin
Representative images used for Species ID: 7462-7464,7467,7468,775
Photographer: RCH Frame Numbers: 7431-7480 Spacer: 7481
Calculated Distance from Track Line: 0.9 km

Final Time and Position of Sighting

Time: 9:28 WP#: 17 Lat: 30.494907 Long: -80.402497
Calculated Distance Traveled: 0.5 km

Behavior and Additional Comments

Two sets of two animals, swimming in unison

Thursday, October 1, 2009 Sighting # 2

Initial Sighting on Track

Time: 9:57 WP#: 15 Lat: 30.436015 Long: -80.451151
Vertical Angle: 3 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Track Line: 8 Beaufort Sea State: 2
Observer: HJF Observer Side: Left

Actual Time and Position of Sighting

Time: 9:58 WP#: 25 Lat: 30.441838 Long: -80.454912
Species: *Stenella frontalis* Numbers (Low/High/Best): 20/30/25
Features used in Species ID: White rostum tip, visible spotting pattern, light blaze continuing to posterior of dorsal fin, Alternating light and dark coloration dorsally
Representative images used for Species ID: 7488,7490,7523,7526,7538,7539,7541,7544,7546
Photographer: RCH Frame Numbers: 7482-7551 Spacer: 7552
Calculated Distance from Track Line: 0.7 km

Final Time and Position of Sighting

Time: 10:01 WP#: 25 Lat: 30.433327 Long: -80.450960
Calculated Distance Traveled: 1.0 km

Behavior and Additional Comments

One large group of approximately 20 animals with several individuals at fringes, numerous calves in group.

Thursday, October 1, 2009 Sighting # 3

Initial Sighting on Track

Time: 10:06 WP#: 29 Lat: 30.432057 Long: -80.318377
Vertical Angle: 1 Horizontal Bearing in Degrees: 80 Sighting Cue: Body
On/Off Effort: On Track Line: 8 Beaufort Sea State: 2
Observer: RCH Observer Side: Right

Actual Time and Position of Sighting

Time: 10:08 WP#: 30 Lat: 30.429398 Long: -80.324880
Species: *Stenella frontalis* Numbers (Low/High/Best): 6/6/6
Features used in Species ID: White rostrum tip, visible spotting pattern, light blaze continuing to posterior of dorsal fin, alternating light and dark coloration dorsally
Representative images used for Species ID: 7555,7567,7569,7586,7587,7588,7604
Photographer: RCH Frame Numbers: 7553-7613 Spacer: 7614
Calculated Distance from Track Line: 0.7 km

Final Time and Position of Sighting

Time: 31 WP#: 31 Lat: 30.430156 Long: -80.319189
Calculated Distance Traveled: 0.6 km

Behavior and Additional Comments

One group of 5 individuals including a mother/calf pair, one individual on fringe of group

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Thursday, October 1, 2009 Sighting # 4

Initial Sighting on Track

Time: 10:17 WP#: 34 Lat: 30.431388 Long: -80.250943
Vertical Angle: 3 Horizontal Bearing in Degrees: 110 Sighting Cue: Body
On/Off Effort: On Track Line: 8 Beaufort Sea State: 2
Observer: RCH Observer Side: Right

Actual Time and Position of Sighting

Time: 10:18 WP#: 35 Lat: 30.424412 Long: -80.257176
Species: *Stenella frontalis* Numbers (Low/High/Best): 10/15/12
Features used in Species ID: White rostrum tip, visible spotting pattern, dark and light bands visible on dorsal surface
Representative images used for Species ID: 7632-7635,7640,7646,7662,7667,7669,7684
Photographer: RCH Frame Numbers: 7615-7685 Spacer: 7686
Calculated Distance from Track Line: 1.0 km

Final Time and Position of Sighting

Time: 10:21 WP#: 36 Lat: 30.426360 Long: -80.254575
Calculated Distance Traveled: 0.3 km

Behavior and Additional Comments

One large group with several individuals at fringe, one mother/calf pair

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Thursday, October 1, 2009 Sighting # 5

Initial Sighting on Track

Time: 11:07 WP#: 51 Lat: 30.301451 Long: -80.587053
Vertical Angle: 2 Horizontal Bearing in Degrees: 120 Sighting Cue: Body
On/Off Effort: On Track Line: 6 Beaufort Sea State: 2
Observer: RCH Observer Side: Right

Actual Time and Position of Sighting

Time: 11:09 WP#: 52 Lat: 30.295678 Long: -80.592304
Species: *Stenella frontalis* Numbers (Low/High/Best): 6/6/6
Features used in Species ID: White rostrum tip, visible spotting pattern, light blaze continuing to posterior of dorsal fin, alternating light and dark coloration dorsally
Representative images used for Species ID: 7708,7710,7722,7730,7746,7750,7751
Photographer: RCH Frame Numbers: 7687-7778 Spacer: 7779
Calculated Distance from Track Line: 0.8 km

Final Time and Position of Sighting

Time: 11:12 WP#: 53 Lat: 30.297804 Long: -80.587380
Calculated Distance Traveled: 0.5 km

Behavior and Additional Comments

Two spaced groups of three individuals, no calves observed

Thursday, October 1, 2009 Sighting # 6

Initial Sighting on Track

Time: 11:46 WP#: 60 Lat: 30.235327 Long: -80.095845
Vertical Angle: 3 Horizontal Bearing in Degrees: 110 Sighting Cue: Body
On/Off Effort: On Track Line: 5 Beaufort Sea State: 1
Observer: RCH Observer Side: Right

Actual Time and Position of Sighting

Time: 11:48 WP#: 61 Lat: 30.237722 Long: -80.092674
Species: *Grampus griseus* Numbers (Low/High/Best): 4/4/4
Features used in Species ID: Large erect dorsal, blunt head with no beak, visible crease in forehead, visible scarring
Representative images used for Species ID: 7780,7781,7791,7792,7801,7802,7804,7805,7806
Photographer: RCH Frame Numbers: 7780-7825 Spacer: 7826
Calculated Distance from Track Line: 0.4 km

Final Time and Position of Sighting

Time: 11:50 WP#: 62 Lat: 30.236170 Long: -80.087619
Calculated Distance Traveled: 0.5 km

Behavior and Additional Comments

Widely spaced group, no calves observed

Thursday, October 1, 2009 Sighting # 7

Initial Sighting on Track

Time: 12:06 WP#: 67 Lat: 30.232311 Long: -80.676261
Vertical Angle: 3 Horizontal Bearing in Degrees: 100 Sighting Cue: Body
On/Off Effort: On Track Line: 5 Beaufort Sea State: 1
Observer: RCH Observer Side: Right

Actual Time and Position of Sighting

Time: 12:08 WP#: 68 Lat: 30.234899 Long: -80.674308
Species: *Stenella frontalis* Numbers (Low/High/Best): 9/9/9
Features used in Species ID: White rostum tip, Visible spotting pattern, Light blaze continuing to posterior of dorsal fin, Alternating light and dark coloration dorsally
Representative images used for Species ID: 7827,7828,7830,7832,7843,7849,7851,7856,7857
Photographer: RCH Frame Numbers: 7828-7893 Spacer: 7894
Calculated Distance from Track Line: 0.3 km

Final Time and Position of Sighting

Time: 12:11 WP#: 69 Lat: 30.230637 Long: -80.673126
Calculated Distance Traveled: 0.5 km

Behavior and Additional Comments

One group of seven individual with subgroup of two individuals, very tight group, actively feeding

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Thursday, October 1, 2009 Sighting # 8

Initial Sighting on Track

Time: 13:53 WP#: 77 Lat: 30.161284 Long: -80.692937
Vertical Angle: 3 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Track Line: 4 Beaufort Sea State: 1
Observer: RCH Observer Side: Right

Actual Time and Position of Sighting

Time: 13:56 WP#: 78 Lat: 30.152214 Long: -80.695794
Species: *Stenella frontalis* Numbers (Low/High/Best): 6/6/6
Features used in Species ID: White rostum tip, Visible spotting pattern, Light blaze continuing to posterior of dorsal fin, Alternating light and dark coloration dorsally
Representative images used for Species ID: 7897,7899,7915,7916,7923-7925
Photographer: RCH Frame Numbers: 7895-7961 Spacer: 7962
Calculated Distance from Track Line: 1.1 km

Final Time and Position of Sighting

Time: 13:57 WP#: 79 Lat: 30.151990 Long: -80.694249
Calculated Distance Traveled: 0.2 km

Behavior and Additional Comments

Two groups of three individuals, two mother/calf pairs, actively feeding

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Thursday, October 1, 2009 Sighting # 9

Initial Sighting on Track

Time: 14:01 WP#: 82 Lat: 30.163849 Long: -80.561371
Vertical Angle: 2 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Track Line: 4 Beaufort Sea State: 1
Observer: HJF Observer Side: Left

Actual Time and Position of Sighting

Time: 14:04 WP#: 83 Lat: 30.163510 Long: -80.562485
Species: *Tursiops truncatus* Numbers (Low/High/Best): 7/10/10
Features used in Species ID: Overall gray coloration, broad flukes, Broad based dorsal fin

Representative images used for Species ID: 7970,7982,7983,7986
Photographer: RCH Frame Numbers: 7964-7997 Spacer: 7998
Calculated Distance from Track Line: 0.1 km

Final Time and Position of Sighting

Time: 14:06 WP#: 84 Lat: 30.165968 Long: -80.568529
Calculated Distance Traveled: 0.6 km

Behavior and Additional Comments

Very little time spent at surface, deep dives, three mother/calf pairs

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Thursday, October 1, 2009 Sighting # 10

Initial Sighting on Track

Time: 14:32 WP#: 94 Lat: 30.166305 Long: -79.821608
Vertical Angle: 2 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Track Line: 4 Beaufort Sea State: 2
Observer: HJF Observer Side: Left

Actual Time and Position of Sighting

Time: 14:34 WP#: 95 Lat: 30.169987 Long: -79.828164
Species: *Tursiops truncatus* Numbers (Low/High/Best): 35/45/40
Features used in Species ID: Overall gray coloration, broad flukes, visible crease between melon and beak

Representative images used for Species ID: 8008, 8009,8018,8020,8023,8030,8031,8043,8068
Photographer: RCH Frame Numbers: 7999-8081 Spacer: 8082
Calculated Distance from Track Line: 0.8 km

Final Time and Position of Sighting

Time: 14:38 WP#: 96 Lat: 30.173389 Long: -79.828432
Calculated Distance Traveled: 0.4 km

Behavior and Additional Comments

Large loosely associated group, numerous calves observed

Thursday, October 1, 2009 Sighting # 11

Initial Sighting on Track

Time: 15:10 WP#: 108 Lat: 30.102525 Long: -80.679810
Vertical Angle: 2 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Track Line: 4 Beaufort Sea State: 1
Observer: RCH Observer Side: Right

Actual Time and Position of Sighting

Time: 15:13 WP#: 109 Lat: 30.110079 Long: -80.682445
Species: *Stenella frontalis* Numbers (Low/High/Best): 4/4/4
Features used in Species ID: White rostum tip, Visible spotting pattern, Light blaze continuing to posterior of dorsal fin, Alternating light and dark coloration dorsally
Representative images used for Species ID: 8102,8104,8106
Photographer: RCH Frame Numbers: 8083-8107 Spacer: 8108
Calculated Distance from Track Line: 0.9 km

Final Time and Position of Sighting

Time: 15:16 WP#: 110 Lat: 30.104370 Long: -80.681425
Calculated Distance Traveled: 0.6 km

Behavior and Additional Comments

Loosely associated group, No calves observed

Tuesday, November 17, 2009 Sighting # 1

Initial Sighting on Track

Time: 12:40 WP#: 3 Lat: 30.600043 Long: -81.207447
Vertical Angle: 1 Horizontal Bearing in Degrees: 75 Sighting Cue: Body
On/Off Effort: On Track Line: Transit leg Beaufort Sea State: 2
Observer: REH Observer Side: Left

Actual Time and Position of Sighting

Time: 12:42 WP#: 4 Lat: 30.605846 Long: -81.209670
Species: *Tursiops truncatus* Numbers (Low/High/Best): 38/54/50
Features used in Species ID: Slate gray coloration, short rostrum, robust body, broad flukes

Representative images used for Species ID: 8170, 8173, 8190
Photographer: HJF Frame Numbers: 8162 to 8198 Spacer: 8199
Calculated Distance from Track Line: 0.7 km

Final Time and Position of Sighting

Time: 12:45 WP#: 6 Lat: 30.604350 Long: -81.211078
Calculated Distance Traveled: 0.2 km

Behavior and Additional Comments

Tightly packed group that was very active at the surface; one individual was seen tail-slapping on its back for most of the sighting. Some mother/calf pairs present.

Tuesday, November 17, 2009 Sighting # 2

Initial Sighting on Track

Time: 15:54 WP#: 48 Lat: 30.199932 Long: -81.232597
Vertical Angle: 3 Horizontal Bearing in Degrees: 100 Sighting Cue: Breach
On/Off Effort: On Track Line: Transit leg Beaufort Sea State: 1
Observer: HJF Observer Side: Right

Actual Time and Position of Sighting

Time: 15:56 WP#: 49 Lat: 30.219379 Long: -81.242952
Species: *Tursiops truncatus* Numbers (Low/High/Best): 17/21/19
Features used in Species ID: broad flukes, dark gray cape, and overall robust shape

Representative images used for Species ID: 8231, 8252, 8265
Photographer: HJF Frame Numbers: 8220 to 8277 Spacer: 8278
Calculated Distance from Track Line: 2.4 km

Final Time and Position of Sighting

Time: 16:04 WP#: 50 Lat: 30.200150 Long: -81.237419
Calculated Distance Traveled: 2.2 km

Behavior and Additional Comments

Animals were traveling quickly and were active at the surface. Two tightly packed sub-groups. One group had 5-7 animals, the other had 12-14 animals. Some animals breaching. At least one mom/calf. Due to turbidity and lack of sunlight penetration the animals were hard to follow.

Wednesday, November 18, 2009 Sighting # 1

Initial Sighting on Track

Time: 9:12 WP#: 14 Lat: 30.031187 Long: -79.942816
Vertical Angle: 3 Horizontal Bearing in Degrees: 100 Sighting Cue: Body
On/Off Effort: On Track Line: 2 Beaufort Sea State: 1
Observer: PBN Observer Side: Right

Actual Time and Position of Sighting

Time: 9:13 WP#: 15 Lat: 30.037136 Long: -79.943718
Species: *Unidentified Kogia* Numbers (Low/High/Best): 1/1/1
Features used in Species ID: Single blowhole located to the left of centerline. Overall grey body with lighter ventral surface, large flukes, flippers located far forward, pointed, shark-like head
Representative images used for Species ID: 8280-8284
Photographer: PBN Frame Numbers: 8279-8323 Spacer: 8324
Calculated Distance from Track Line: 0.7 km

Final Time and Position of Sighting

Time: 9:15 WP#: 16 Lat: 30.039294 Long: -79.939205
Calculated Distance Traveled: 0.5 km

Behavior and Additional Comments

Initially observed logging at surface, animal dove while circling for photographs - it may have been disturbed by presence of aircraft - count as a take

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Wednesday, November 18, 2009 Sighting # 2

Initial Sighting on Track

Time: 9:43 WP#: 23 Lat: 30.102677 Long: -80.538514
Vertical Angle: 2 Horizontal Bearing in Degrees: 100 Sighting Cue: Body
On/Off Effort: On Track Line: 3 Beaufort Sea State: 1
Observer: RCH Observer Side: Left

Actual Time and Position of Sighting

Time: 9:44 WP#: 24 Lat: 30.112692 Long: -80.556471
Species: *Unidentified Delphinid* Numbers (Low/High/Best): 3/3/3
Features used in Species ID: Images inconclusive as to species identity
Representative images used for Species ID: 8325,8327,8335-8337
Photographer: PBN Frame Numbers: 8325-8340 Spacer: 8341
Calculated Distance from Track Line: 2.0 km

Final Time and Position of Sighting

Time: 9:55 WP#: 25 Lat: 30.103868 Long: -80.556621
Calculated Distance Traveled: 1.0 km

Behavior and Additional Comments

Difficult to track due to turbidity of water

Wednesday, November 18, 2009 Sighting # 3

Initial Sighting on Track

Time: 11:40 WP#: 51 Lat: 30.299799 Long: -80.476741
Vertical Angle: 2 Horizontal Bearing in Degrees: 100 Sighting Cue: Body
On/Off Effort: On Track Line: 6 Beaufort Sea State: 2
Observer: PBN Observer Side: Right

Actual Time and Position of Sighting

Time: 11:46 WP#: 52 Lat: 30.308959 Long: -80.475456
Species: *Unidentified Delphinid* Numbers (Low/High/Best): 1/1/1
Features used in Species ID: No images obtained
Representative images used for Species ID: No images obtained
Photographer: N/A Frame Numbers: N/A Spacer: N/A
Calculated Distance from Track Line: 1.0 km

Final Time and Position of Sighting

Time: 11:46 WP#: 53 Lat: 30.312744 Long: -80.471680
Calculated Distance Traveled: 0.6 km

Behavior and Additional Comments

Single animal that was never located, travelling quickly, no photos taken

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Wednesday, November 18, 2009 Sighting # 4

Initial Sighting on Track

Time: 15:01 WP#: 81 Lat: 30.433983 Long: -79.899666
Vertical Angle: 1 Horizontal Bearing in Degrees: 110 Sighting Cue: Body
On/Off Effort: On Track Line: 8 Beaufort Sea State: 3
Observer: PBN Observer Side: Right

Actual Time and Position of Sighting

Time: 15:02 WP#: 82 Lat: 30.429478 Long: -79.897009
Species: *Grampus griseus* Numbers (Low/High/Best): 25/45/40
Features used in Species ID: Large, tall dorsal fin, long pectoral fins, blunt head with cleft in melon, visible scarring patterns
Representative images used for Species ID: 8375,8376,8389,8413
Photographer: PBN Frame Numbers: 8346-8419 Spacer: 8420
Calculated Distance from Track Line: 0.6 km

Final Time and Position of Sighting

Time: 15:07 WP#: 83 Lat: 30.433962 Long: -79.882567
Calculated Distance Traveled: 1.5 km

Behavior and Additional Comments

Numerous sub-groups, travelling quickly

Wednesday, November 18, 2009 Sighting # 5

Initial Sighting on Track

Time: 15:58 WP#: 96 Lat: 30.403655 Long: -81.297067
Vertical Angle: 2 Horizontal Bearing in Degrees: 120 Sighting Cue: Body
On/Off Effort: On Track Line: Transit Beaufort Sea State: 2
Observer: PBN Observer Side: Right

Actual Time and Position of Sighting

Time: 15:59 WP#: 97 Lat: 30.402734 Long: -81.294347
Species: *Tursiops truncatus* Numbers (Low/High/Best): 10/15/15
Features used in Species ID: Broad flukes, overall gray coloration, short stubby rostrum, stout body
Representative images used for Species ID: 8431,8435,8436
Photographer: PBN Frame Numbers: 8421-8449 Spacer: 8450
Calculated Distance from Track Line: 0.3 km

Final Time and Position of Sighting

Time: 16:01 WP#: 98 Lat: 30.407699 Long: -81.295668
Calculated Distance Traveled: 0.6 km

Behavior and Additional Comments

One group of 4 to 5 animals with two smaller sub-groups and several singletons

Friday, November 20, 2009 Sighting # 1

Initial Sighting on Track

Time: 9:46 WP#: 12 Lat: 30.031023 Long: -80.175930
Vertical Angle: 2 Horizontal Bearing in Degrees: 95 Sighting Cue: Body
On/Off Effort: On Track Line: 2 Beaufort Sea State: 3
Observer: REH Observer Side: Right

Actual Time and Position of Sighting

Time: 9:48 WP#: 13 Lat: 30.031926 Long: -80.179763
Species: *Grampus griseus* Numbers (Low/High/Best): 11/30/20
Features used in Species ID: Vertical crease in distinctly square melon, varying coloration on bodies, scarring observed, tall dorsal fin.
Representative images used for Species ID: 8463, 8464, 8475
Photographer: REH Frame Numbers: 8452-8477 Spacer: 8478
Calculated Distance from Track Line: 0.4 km

Final Time and Position of Sighting

Time: 9:55 WP#: 14 Lat: 30.016391 Long: -80.179660
Calculated Distance Traveled: 1.7 km

Behavior and Additional Comments

Several distinct subgroups of 2-9 individuals, widely spaced and moving to the southwest.

Tuesday, December 22, 2009 Sighting # 1

Initial Sighting on Track

Time: 10:22 WP#: 17 Lat: 30.099674 Long: -80.615172
Vertical Angle: 1 Horizontal Bearing in Degrees: 100 Sighting Cue: Body
On/Off Effort: On Track Line: 3 Beaufort Sea State: 2
Observer: REH Observer Side: Left

Actual Time and Position of Sighting

Time: 10:27 WP#: 18 Lat: 30.097936 Long: -80.611650
Species: *Unidentified Delphinid* Numbers (Low/High/Best): 1/1/1
Features used in Species ID: None

Representative images used for Species ID: No images obtained
Photographer: N/A Frame Numbers: None Spacer: None
Calculated Distance from Track Line: N/A

Final Time and Position of Sighting

Time: N/A WP#: N/A Lat: N/A Long: N/A
Calculated Distance Traveled: N/A

Behavior and Additional Comments

Lone delphinid spotted but was not relocated or photographed.
Note that actual time and position is estimated.

Tuesday, December 22, 2009 Sighting # 2

Initial Sighting on Track

Time: 11:15 WP#: 27 Lat: 30.166579 Long: -80.683433
Vertical Angle: 2 Horizontal Bearing in Degrees: 100 Sighting Cue: Body
On/Off Effort: On Track Line: 4 Beaufort Sea State: 2
Observer: HJF Observer Side: Right

Actual Time and Position of Sighting

Time: 11:17 WP#: 28 Lat: 30.166376 Long: -80.683375
Species: *Unidentified Delphinid* Numbers (Low/High/Best): 2/3/3
Features used in Species ID: No images obtained

Representative images used for Species ID: No images obtained
Photographer: N/A Frame Numbers: N/A Spacer: N/A
Calculated Distance from Track Line: 0.02 km

Final Time and Position of Sighting

Time: 11:23 WP#: 29 Lat: 30.165143 Long: -80.684029
Calculated Distance Traveled: 0.2 km

Behavior and Additional Comments

Very elusive. Resighted only 2-3 times and unable to line up for photographs. Animals dove deeply and spent little time at the surface.

Tuesday, December 22, 2009 Sighting # 3

Initial Sighting on Track

Time: 12:10 WP#: 41 Lat: 30.300499 Long: -80.408532
Vertical Angle: 2 Horizontal Bearing in Degrees: 100 Sighting Cue: Body
On/Off Effort: On Track Line: 6 Beaufort Sea State: 2
Observer: HJF Observer Side: Right

Actual Time and Position of Sighting

Time: 12:12 WP#: 42 Lat: 30.297574 Long: -80.405397
Species: *Unidentified Delphinid* Numbers (Low/High/Best): 2/3/3
Features used in Species ID: No images obtained

Representative images used for Species ID: No images obtained
Photographer: N/A Frame Numbers: None Spacer: None
Calculated Distance from Track Line: 0.4 km

Final Time and Position of Sighting

Time: 12:20 WP#: 43 Lat: 30.299542 Long: -80.397155
Calculated Distance Traveled: 0.8 km

Behavior and Additional Comments

Elusive. Not spotted while lined up for photographs. Only spotted 3-4 times. Dove deeply and spent little time at the surface.

Tuesday, December 22, 2009 Sighting # 4

Initial Sighting on Track

Time: 14:15 WP#: 53 Lat: 30.365891 Long: -80.199956
Vertical Angle: 1 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Track Line: 7 Beaufort Sea State: 2
Observer: REH Observer Side: Left

Actual Time and Position of Sighting

Time: 14:16 WP#: 54 Lat: 30.363803 Long: -80.206578
Species: *Tursiops truncatus* Numbers (Low/High/Best): 40/60/50
Features used in Species ID: Large, robust animals, light-colored peduncle, broad flukes, stubby rostrum, fairly uniform gray color
Representative images used for Species ID: 8553, 8575, 8578, 8579, 8588, 8592
Photographer: PBN Frame Numbers: 8541 to 8629 Spacer: 8630
Calculated Distance from Track Line: 0.7

Final Time and Position of Sighting

Time: 14:19 WP#: 55 Lat: 30.360186 Long: -80.197431
Calculated Distance Traveled: 1.0 km

Behavior and Additional Comments

Large group, very spread out and traveling quickly. One large hammerhead shark in the vicinity of the dolphins (image numbers: 8583-8585).

Tuesday, December 22, 2009 Sighting # 5

Initial Sighting on Track

Time: 15:16 WP#: 69 Lat: 30.499201 Long: -80.226864
Vertical Angle: 2 Horizontal Bearing in Degrees: 120 Sighting Cue: Body
On/Off Effort: On Track Line: 9 Beaufort Sea State: 2
Observer: REH Observer Side: Left

Actual Time and Position of Sighting

Time: 15:23 WP#: 70 Lat: 30.499372 Long: -80.249891
Species: *Tursiops truncatus* Numbers (Low/High/Best): 1/5/4
Features used in Species ID: Broad, large flukes, stubby rostrum, uniform gray coloration with darker cape
Representative images used for Species ID: 8642, 8674
Photographer: PBN Frame Numbers: 8631 to 8674 Spacer: 8675
Calculated Distance from Track Line: 2.2 km

Final Time and Position of Sighting

Time: 15:33 WP#: 71 Lat: 30.495354 Long: -80.253988
Calculated Distance Traveled: 0.6 km

Behavior and Additional Comments

Animals were elusive and hard to track or re-sight. Little opportunity to clearly photograph.

Tuesday, December 22, 2009 Sighting # 6

Initial Sighting on Track

Time: 15:44 WP#: 73 Lat: 30.503751 Long: -79.810167
Vertical Angle: 2 Horizontal Bearing in Degrees: 80 Sighting Cue: Body
On/Off Effort: On Track Line: 9 Beaufort Sea State: 2
Observer: REH Observer Side: Left

Actual Time and Position of Sighting

Time: 15:45 WP#: 74 Lat: 30.497783 Long: -79.816314
Species: *Tursiops truncatus* Numbers (Low/High/Best): 2/4/3
Features used in Species ID: Light-colored peduncle, large, broad flukes, stubby rostrum, uniform gray coloration
Representative images used for Species ID: 8690, 8705, 8706, 8713, 8758, 8773
Photographer: PBN Frame Numbers: 8676 to 8774 Spacer: 8775
Calculated Distance from Track Line: 0.9 km

Final Time and Position of Sighting

Time: 15:53 WP#: 76 Lat: 30.498453 Long: -79.803403
Calculated Distance Traveled: 1.2 km

Behavior and Additional Comments

Animals were traveling slowly at first and diving deeply. They then began swimming more erratically and began making more white-water and splashing more. Generally spent little time at the surface for clear photography and observation.

Tuesday, December 22, 2009 Sighting # 7

Initial Sighting on Track

Time: 16:11 WP#: 81 Lat: 30.567497 Long: -80.305570
Vertical Angle: 1 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Track Line: 10 Beaufort Sea State: 2
Observer: PBN Observer Side: Right

Actual Time and Position of Sighting

Time: 16:13 WP#: 82 Lat: 30.564581 Long: -80.305144
Species: *Unidentified Delphinid* Numbers (Low/High/Best): 1/1/1
Features used in Species ID: Images not conclusive as to species identity

Representative images used for Species ID: No usable images
Photographer: PBN Frame Numbers: 8776 to 8777 Spacer: 8778
Calculated Distance from Track Line: 0.3 km

Final Time and Position of Sighting

Time: 16:20 WP#: 83 Lat: 30.566848 Long: -80.313099
Calculated Distance Traveled: 0.8 km

Behavior and Additional Comments

Single animal surfacing infrequently and was very elusive to re-sight despite few whitecaps.
Animal was definitely a delphinid but could not be identified to species.

Thursday, January 7, 2010 Sighting # 1

Initial Sighting on Track

Time: 10:45 WP#: 9 Lat: 30.030693 Long: -80.694178
Vertical Angle: 2 Horizontal Bearing in Degrees: 100 Sighting Cue: Body
On/Off Effort: On Track Line: 2 Beaufort Sea State: 3
Observer: REH Observer Side: Right

Actual Time and Position of Sighting

Time: 10:50 WP#: 10 Lat: 30.028720 Long: -80.690989
Species: *Tursiops truncatus* Numbers (Low/High/Best): 1/1/1
Features used in Species ID: Distinct dark cape, short and stubby rostrum, elongated body

Representative images used for Species ID: 8779, 8782, 8783, 8792, 8793
Photographer: REH Frame Numbers: 8779 to 8797 Spacer: 8798/8799
Calculated Distance from Track Line: 0.4 km

Final Time and Position of Sighting

Time: n/a WP#: n/a Lat: n/a Long: n/a
Calculated Distance Traveled: n/a

Behavior and Additional Comments

Single animal, slow travel, surfaced several times. Animal not re-sighted for final position

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Thursday, January 7, 2010 Sighting # 2

Initial Sighting on Track

Time: 12:01 WP#: 22 Lat: 30.165146 Long: -80.560350
Vertical Angle: 3 Horizontal Bearing in Degrees: 75 Sighting Cue: Body
On/Off Effort: On Track Line: 4 Beaufort Sea State: 3
Observer: REH Observer Side: Right

Actual Time and Position of Sighting

Time: 12:02 WP#: 22 Lat: 30.164537 Long: -80.559666
Species: *Tursiops truncatus* Numbers (Low/High/Best): 2/3/2
Features used in Species ID: Broad flukes, distinctly darker cape, short and stubby rostrum
Robust body
Representative images used for Species ID: 8816-8819, 8821, 8827-8829
Photographer: REH Frame Numbers: 8814 to 8846 Spacer: 8847
Calculated Distance from Track Line: 0.1 km

Final Time and Position of Sighting

Time: 12:06 WP#: 23 Lat: 30.170049 Long: -80.564328
Calculated Distance Traveled: 0.6 km

Behavior and Additional Comments

Low angled leaps, one mother/juvenile pair

Thursday, January 7, 2010 Sighting # 3

Initial Sighting on Track

Time: n/a WP#: n/a Lat: n/a Long: n/a
Vertical Angle: 1 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: Off Track Line: n/a Beaufort Sea State: 2
Observer: REH Observer Side: Right

Actual Time and Position of Sighting

Time: 15:17 WP#: 41 Lat: 30.349972 Long: -80.619776
Species: *Stenella frontalis* Numbers (Low/High/Best): 52/70/65
Features used in Species ID: White rostrum tips, obvious spotting, light flank blaze very narrow caudal peduncle
Representative images used for Species ID: 8886, 8867_2c, 8882_2c, 8884
Photographer: REH Frame Numbers: 8848 to 8892 Spacer: 8893
Calculated Distance from Track Line: n/a

Final Time and Position of Sighting

Time: 15:20 WP#: 42 Lat: 30.351625 Long: -80.626263
Calculated Distance Traveled: 0.6 km

Behavior and Additional Comments

Off effort sighting while investigating large splash in the distance. Fairly large, cohesive main group, with a couple of smaller "outlier" groups.

Thursday, January 7, 2010 Sighting # 4

Initial Sighting on Track

Time: 15:50 WP#: 48 Lat: 30.432042 Long: -79.895859
Vertical Angle: 3 Horizontal Bearing in Degrees: 110 Sighting Cue: Splash
On/Off Effort: On Track Line: 8 Beaufort Sea State: 2
Observer: REH Observer Side: Right

Actual Time and Position of Sighting

Time: 15:54 WP#: 48 Lat: 30.439802 Long: -79.890082
Species: *Tursiops truncatus* Numbers (Low/High/Best): 40/55/45
Features used in Species ID: Robust animals w/ elongated bodies and short, stubby rostrums. Gray color with distinct darker gray dorsal cape
Representative images used for Species ID:
Photographer: REH Frame Numbers: 8894 to 8955 Spacer: 8956
Calculated Distance from Track Line: 1.0 km

Final Time and Position of Sighting

Time: 16:00 WP#: 49 Lat: 30.440173 Long: -79.882488
Calculated Distance Traveled: 0.7 km

Behavior and Additional Comments

Large, spread out group with multiple cohesive sub-groups. Some splashes, lots of activity Fairly intense social interactions including chasing etc

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Tuesday, January 19, 2010 Sighting # 1

Initial Sighting on Track

Time: 10:15 WP#: 15 Lat: 30.365439 Long: -79.839967
Vertical Angle: 1 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Track Line: 7 Beaufort Sea State: 2
Observer: RCH Observer Side: Right

Actual Time and Position of Sighting

Time: 10:18 WP#: 16 Lat: 30.368094 Long: -79.839572
Species: *Tursiops truncatus* Numbers (Low/High/Best): 8/11/10
Features used in Species ID: Slate gray coloration with dark cape, broad flukes, well-defined crease between rostrum and melon, robust body shape
Representative images used for Species ID: 9101, 9117 - 9119
Photographer: RCH Frame Numbers: 9083-9131 Spacer: 9132
Calculated Distance from Track Line: 0.3 km

Final Time and Position of Sighting

Time: 10:19 WP#: 17 Lat: 30.367087 Long: -79.835676
Calculated Distance Traveled: 0.4 km

Behavior and Additional Comments

One widely distributed, evenly spaced group which stayed mostly subsurface. One individual observed on its back for majority of the sighting

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Tuesday, January 19, 2010 Sighting # 2

Initial Sighting on Track

Time: 10:22 WP#: 19 Lat: 30.366181 Long: -79.881100
Vertical Angle: 2 Horizontal Bearing in Degrees: 110 Sighting Cue: Body
On/Off Effort: On Track Line: 7 Beaufort Sea State: 2
Observer: HJF Observer Side: Left

Actual Time and Position of Sighting

Time: 10:23 WP#: 20 Lat: 30.362928 Long: -79.864591
Species: *Tursiops truncatus* Numbers (Low/High/Best): 5/5/5
Features used in Species ID: broad flukes, short, stubby rostrum, dark grey cape, robust bodies
Representative images used for Species ID: 9141, 9171, 9173
Photographer: RCH Frame Numbers: 9133-9176 Spacer: 9177
Calculated Distance from Track Line: 1.6 km

Final Time and Position of Sighting

Time: 10:28 WP#: 21 Lat: 30.362837 Long: -79.860984
Calculated Distance Traveled: 0.4 km

Behavior and Additional Comments

Two small groups observed approximately 1 mile from Sighting 1, north of the trackline. Moving in tightly packed groups of few individuals.

Tuesday, January 19, 2010 Sighting # 3

Initial Sighting on Track

Time: 11:17 WP#: 26 Lat: 30.299393 Long: -79.818627
Vertical Angle: 1 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Track Line: 6 Beaufort Sea State: 2
Observer: HJF Observer Side: Left

Actual Time and Position of Sighting

Time: 11:20 WP#: 27 Lat: 30.300247 Long: -79.821877
Species: *Tursiops truncatus* Numbers (Low/High/Best): 11/12/11
Features used in Species ID: Robust bodies, grey coloration with darker cape, short rostrums

Representative images used for Species ID: 9186, 9187, 9196, 9212
Photographer: RCH Frame Numbers: 9178-9243 Spacer: 9244
Calculated Distance from Track Line: 0.3 km

Final Time and Position of Sighting

Time: 11:21 WP#: 28 Lat: 30.303125 Long: -79.825200
Calculated Distance Traveled: 0.5 km

Behavior and Additional Comments

Densely packed group

Tuesday, January 19, 2010 Sighting # 4

Initial Sighting on Track

Time: 14:23 WP#: 44 Lat: 30.099598 Long: -80.392198
Vertical Angle: 3 Horizontal Bearing in Degrees: 110 Sighting Cue: Splash
On/Off Effort: On Track Line: 3 Beaufort Sea State: 2
Observer: HJF Observer Side: Left

Actual Time and Position of Sighting

Time: 14:27 WP#: 46 Lat: 30.091970 Long: -80.385131
Species: *Tursiops truncatus* Numbers (Low/High/Best): 4/4/4
Features used in Species ID: grey coloration on robust bodies, short rostrum with definition before melon

Representative images used for Species ID: 9252, 9264, 9265, 9278
Photographer: RCH Frame Numbers: 9245 - 9281 Spacer: 9282
Calculated Distance from Track Line: 1.1 km

Final Time and Position of Sighting

Time: 14:32 WP#: 47 Lat: 30.085366 Long: -80.387523
Calculated Distance Traveled: 0.8 km

Behavior and Additional Comments

One mom/calf pair and two individuals observed. Possible avoidance behavior observed; animals were originally acrobatic at the water's surface, but after circling to photograph, all of the time was spent below the surface and animals only came to the surface to breathe.

Tuesday, January 19, 2010 Sighting # 5

Initial Sighting on Track

Time: 14:51 WP#: 52 Lat: 30.038072 Long: -80.486643
Vertical Angle: 1 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Track Line: 2 Beaufort Sea State: 2
Observer: HJF Observer Side: Left

Actual Time and Position of Sighting

Time: 14:54 WP#: 53 Lat: 30.035396 Long: -80.486387
Species: *Tursiops truncatus* Numbers (Low/High/Best): 24/24/24
Features used in Species ID: robust bodies with short, well-defined rostrum, broad flukes, slate gray coloration with darker cape
Representative images used for Species ID: 9285, 9301, 9311, 9316, 9329
Photographer: RCH Frame Numbers: 9283 - 9334 Spacer: 9335
Calculated Distance from Track Line: 0.3 km

Final Time and Position of Sighting

Time: 14:56 WP#: 54 Lat: 30.029278 Long: -80.486280
Calculated Distance Traveled: 0.7 km

Behavior and Additional Comments

Several tightly packed groups observed

Tuesday, January 19, 2010 Sighting # 6

Initial Sighting on Track

Time: 15:00 WP#: 56 Lat: 30.033356 Long: -80.364352
Vertical Angle: 1 Horizontal Bearing in Degrees: 95 Sighting Cue: Body
On/Off Effort: On Track Line: 2 Beaufort Sea State: 2
Observer: HJF Observer Side: Left

Actual Time and Position of Sighting

Time: 15:02 WP#: 57 Lat: 30.034382 Long: -80.374406
Species: *Tursiops truncatus* Numbers (Low/High/Best): 2/2/2
Features used in Species ID: Overall gray color, broad flukes, and robust bodies
Representative images used for Species ID: 9344, 9351
Photographer: RCH Frame Numbers: 9336 - 9358 Spacer: 9359
Calculated Distance from Track Line: 1.0 km

Final Time and Position of Sighting

Time: 15:05 WP#: 58 Lat: 30.033985 Long: -80.366418
Calculated Distance Traveled: 0.8 km

Behavior and Additional Comments

Two lone individuals spending lots of time at the surface of the water with frequent breaths.

Tuesday, January 19, 2010 Sighting # 7

Initial Sighting on Track

Time: 15:17 WP#: 61 Lat: 30.034243 Long: -79.980957
Vertical Angle: 2 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Track Line: 2 Beaufort Sea State: 3
Observer: HJF Observer Side: Left

Actual Time and Position of Sighting

Time: 15:23 WP#: 62 Lat: 30.026904 Long: -79.988553
Species: *Tursiops truncatus* Numbers (Low/High/Best): 5/6/5
Features used in Species ID: Robust bodies with broad flukes and overall grey coloration

Representative images used for Species ID: 9362, 9365, 9377
Photographer: RCH Frame Numbers: 9360 - 9378 Spacer: 9379
Calculated Distance from Track Line: 1.1 km

Final Time and Position of Sighting

Time: 15:24 WP#: 63 Lat: 30.030125 Long: -79.988356
Calculated Distance Traveled: 0.4 km

Behavior and Additional Comments

Mom/calf pairs observed in group. Individuals were in groups of 1-2 and evenly spaced out.

Wednesday, January 20, 2010 Sighting # 1

Initial Sighting on Track

Time: 9:54 WP#: 21 Lat: 30.031437 Long: -80.406705
Vertical Angle: 2 Horizontal Bearing in Degrees: 120 Sighting Cue: Body
On/Off Effort: On Track Line: 2 Beaufort Sea State: 2
Observer: PBN Observer Side: Right

Actual Time and Position of Sighting

Time: 9:55 WP#: 22 Lat: 30.035027 Long: -80.409063
Species: *Stenella frontalis* Numbers (Low/High/Best): 3/3/3
Features used in Species ID: Obvious spotting, long, white-tipped rostrum, very narrow peduncle
Representative images used for Species ID: 9401, 9403, 9414, 9416, 9417, 9420, 9434, 9435
Photographer: PBN Frame Numbers: 9397-9456 Spacer: 9457
Calculated Distance from Track Line: 0.5 km

Final Time and Position of Sighting

Time: 10:00 WP#: 24 Lat: 30.031832 Long: -80.409156
Calculated Distance Traveled: 0.4 km

Behavior and Additional Comments

Animals were traveling slowly, surfacing fairly often

Wednesday, January 20, 2010 Sighting # 2

Initial Sighting on Track

Time: 10:02 WP#: 26 Lat: 30.031087 Long: -80.477814
Vertical Angle: 1 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Track Line: 2 Beaufort Sea State: 2
Observer: PBN Observer Side: Right

Actual Time and Position of Sighting

Time: 10:03 WP#: 27 Lat: 30.030747 Long: -80.479153
Species: *Tursiops truncatus* Numbers (Low/High/Best): 2/4/3
Features used in Species ID: Short, stubby rostrum with well-defined crease at melon, broad flukes
Representative images used for Species ID: 9462-9465, 9477, 9491, 9492
Photographer: PBN Frame Numbers: 9458-9493 Spacer: 9494
Calculated Distance from Track Line: 0.1 km

Final Time and Position of Sighting

Time: 10:14 WP#: 28 Lat: 30.039095 Long: -80.473002
Calculated Distance Traveled: 1.1 km

Behavior and Additional Comments

Elusive, mom/calf pair, two sub-groups possible, possible plane avoidance behavior- animals began surfacing quickly and swimming was explosive and erratic, at least one animal with atypical coloration

Wednesday, January 20, 2010 Sighting # 3

Initial Sighting on Track

Time: 10:23 WP#: 33 Lat: 30.099497 Long: -80.685493
Vertical Angle: 2 Horizontal Bearing in Degrees: 110 Sighting Cue: Body
On/Off Effort: On Track Line: 3 Beaufort Sea State: 2
Observer: REH Observer Side: Left

Actual Time and Position of Sighting

Time: 10:26 WP#: 34 Lat: 30.098657 Long: -80.691225
Species: *Tursiops truncatus* Numbers (Low/High/Best): 3/3/3
Features used in Species ID: Broad flukes, uniform gray coloration w/ lighter colored peduncle, long, robust body
Representative images used for Species ID: 9501-9504, 9508, 9510, 9517
Photographer: PBN Frame Numbers: 9495-9417 Spacer: 9518
Calculated Distance from Track Line: 0.6 km

Final Time and Position of Sighting

Time: 10:32 WP#: 36 Lat: 30.106567 Long: -80.686708
Calculated Distance Traveled: 1.0 km

Behavior and Additional Comments

Elusive animals even with great conditions, possible mom/calf pair

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Wednesday, January 20, 2010 Sighting # 4

Initial Sighting on Track

Time: 10:48 WP#: 42 Lat: 30.101009 Long: -80.116509
Vertical Angle: 1 Horizontal Bearing in Degrees: 60 Sighting Cue: Splash
On/Off Effort: On Track Line: 3 Beaufort Sea State: 2
Observer: REH Observer Side: Left

Actual Time and Position of Sighting

Time: 10:48 WP#: 42 Lat: 30.101009 Long: -80.116509
Species: *Tursiops truncatus* Numbers (Low/High/Best): 35/45/40
Features used in Species ID: Short, stubby rostrum with well-defined crease at melon, light-colored peduncle, robust bodies
Representative images used for Species ID: 9522, 9532-9536, 9544, 9561, 9568-9571
Photographer: PBN Frame Numbers: 9519-9578 Spacer: 9579
Calculated Distance from Track Line: <0.1 km

Final Time and Position of Sighting

Time: 10:52 WP#: 43 Lat: 30.101381 Long: -80.116344
Calculated Distance Traveled: <0.1 km

Behavior and Additional Comments

Multiple sub-groups, some animals tightly grouped and interacting, mom/calf pairs present

Wednesday, January 20, 2010 Sighting # 5

Initial Sighting on Track

Time: 10:56 WP#: 37 Lat: 30.100560 Long: -79.983744
Vertical Angle: 3 Horizontal Bearing in Degrees: 120 Sighting Cue: Body
On/Off Effort: On Track Line: 3 Beaufort Sea State: 2
Observer: REH Observer Side: Left

Actual Time and Position of Sighting

Time: 10:57 WP#: 45L Lat: 30.104286 Long: -79.992491
Species: *Tursiops truncatus* Numbers (Low/High/Best): 4/6/5
Features used in Species ID: Short, stubby rostrum with well-defined crease at melon, light-colored peduncle
Representative images used for Species ID: 9596, 9597, 9608, 9611, 9620, 9637, 9646
Photographer: PBN Frame Numbers: 9580-9652 Spacer: 9653
Calculated Distance from Track Line: 0.9 km

Final Time and Position of Sighting

Time: 11:01 WP#: 46 Lat: 30.104868 Long: -79.992841
Calculated Distance Traveled: <0.1 km

Behavior and Additional Comments

Slow travel, animals spending a lot of time at the surface, At least two pairs of animals, possible single animals as well

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Wednesday, January 20, 2010 Sighting # 6

Initial Sighting on Track

Time: 12:06 WP#: 65 Lat: 30.299165 Long: -79.860069
Vertical Angle: 1 Horizontal Bearing in Degrees: 75 Sighting Cue: Body
On/Off Effort: On Track Line: 6 Beaufort Sea State: 2
Observer: REH Observer Side: Left

Actual Time and Position of Sighting

Time: 12:07 WP#: 66 Lat: 30.298620 Long: -79.858260
Species: *Tursiops truncatus* Numbers (Low/High/Best): 13/32/29
Features used in Species ID: Broad flukes and light-colored peduncle, short, stubby rostrum and well-defined crease at melon, some animals had sharp, clear 'widow's peak' dorsal cape
Representative images used for Species ID: 9696-9701, 9707, 9709, 9710
Photographer: PBN Frame Numbers: 9666-9712 Spacer: 9713
Calculated Distance from Track Line: 0.2 km

Final Time and Position of Sighting

Time: 12:09 WP#: 67 Lat: 30.301300 Long: -79.859943
Calculated Distance Traveled: 0.3 km

Behavior and Additional Comments

Tightly packed group with at least one outlier, one direction of travel, Another large sub-group found on final circle

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Wednesday, January 20, 2010 Sighting # 7

Initial Sighting on Track

Time: 12:25 WP#: 71 Lat: 30.299726 Long: -80.487497
Vertical Angle: 3 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Track Line: 6 Beaufort Sea State: 1
Observer: PBN Observer Side: Right

Actual Time and Position of Sighting

Time: 12:26 WP#: 72 Lat: 30.301264 Long: -80.488315
Species: *Unidentified Delphinid* Numbers (Low/High/Best): 1/1/1
Features used in Species ID: Species ID not possible from images obtained

Representative images used for Species ID: 9716-9721
Photographer: PBN Frame Numbers: 9714-9723 Spacer: 9724
Calculated Distance from Track Line: 0.2 km

Final Time and Position of Sighting

Time: N/A WP#: N/A Lat: N/A Long: N/A
Calculated Distance Traveled: N/A

Behavior and Additional Comments

Lone animal that was elusive, animals was lost without a final position
Most likely Tursiops, but animal was not resighted often enough for definite id

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Wednesday, January 20, 2010 Sighting # 8

Initial Sighting on Track

Time: 14:06 WP#: 80 Lat: 30.367373 Long: -80.678038
Vertical Angle: 1 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Track Line: 7 Beaufort Sea State: 1
Observer: HJF Observer Side: Right

Actual Time and Position of Sighting

Time: 14:07 WP#: 81 Lat: 30.368279 Long: -80.678521
Species: *Stenella frontalis* Numbers (Low/High/Best): 20/40/30
Features used in Species ID: Some animals obviously spotted, overhead alternate light/dark banding, white-tipped rostrum, blaze terminating mid-dorsal
Representative images used for Species ID: 9729-9731, 9736, 9739, 9742, 9744, 9745, 9752
Photographer: HJF Frame Numbers: 9725-9760 Spacer: 9761
Calculated Distance from Track Line: 0.1 km

Final Time and Position of Sighting

Time: 14:09 WP#: 82 Lat: 30.360224 Long: -80.676308
Calculated Distance Traveled: 0.9 km

Behavior and Additional Comments

Animals were porpoising quickly and were quite spread out

Wednesday, January 20, 2010 Sighting # 9

Initial Sighting on Track

Time: 14:14 WP#: 89 Lat: 30.366820 Long: -80.496756
Vertical Angle: 2 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Track Line: 7 Beaufort Sea State: 1
Observer: HJF Observer Side: Right

Actual Time and Position of Sighting

Time: 14:15 WP#: 90 Lat: 30.363624 Long: -80.499746
Species: *Stenella frontalis* Numbers (Low/High/Best): 15/15/15
Features used in Species ID: Overhead alternate light/dark banding, some animals with obvious spotting, blaze terminating mid-dorsal, white-tipped rostrum
Representative images used for Species ID: 9762, 9763, 9767, 9768, 9770, 9776, 9780
Photographer: HJF Frame Numbers: 9762-9790 Spacer: 9791
Calculated Distance from Track Line: 0.5 km

Final Time and Position of Sighting

Time: 14:16 WP#: 91 Lat: 30.365745 Long: -80.496426
Calculated Distance Traveled: 0.4 km

Behavior and Additional Comments

One main group of animals, tightly grouped, few stragglers before and after main group.
Mom/calf pair present

Wednesday, January 20, 2010 Sighting # 10

Initial Sighting on Track

Time: 14:22 WP#: 95 Lat: 30.366983 Long: -80.280246
Vertical Angle: 3 Horizontal Bearing in Degrees: 100 Sighting Cue: Splash
On/Off Effort: On Track Line: 7 Beaufort Sea State: 1
Observer: REH Observer Side: Left

Actual Time and Position of Sighting

Time: 14:23 WP#: 96 Lat: 30.372688 Long: -80.289967
Species: *Tursiops truncatus* Numbers (Low/High/Best): 2/3/3
Features used in Species ID: Broad flukes, broad melon with well-defined crease before short, stubby rostrum
Representative images used for Species ID: 9795, 9796, 9800, 9801, 9803-9806
Photographer: HJF Frame Numbers: 9792-9809 Spacer: 9810
Calculated Distance from Track Line: 1.1 km

Final Time and Position of Sighting

Time: 14:28 WP#: 97 Lat: 30.375008 Long: -80.283027
Calculated Distance Traveled: 0.7 km

Behavior and Additional Comments

Slow, lazy travel

Wednesday, January 20, 2010 Sighting # 11

Initial Sighting on Track

Time: 14:33 WP#: 101 Lat: 30.367087 Long: -80.080392
Vertical Angle: 2 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Track Line: 7 Beaufort Sea State: 2
Observer: HJF Observer Side: Right

Actual Time and Position of Sighting

Time: 14:34 WP#: 102 Lat: 30.361459 Long: -80.084967
Species: *Tursiops truncatus* Numbers (Low/High/Best): 12/16/14
Features used in Species ID: Stubby, short beak, broad flukes, long, robust body

Representative images used for Species ID: 9811-9816, 9820-9822, 9824-9826
Photographer: HJF Frame Numbers: 9811-9831 Spacer: 9832
Calculated Distance from Track Line: 0.7 km

Final Time and Position of Sighting

Time: 14:38 WP#: 103 Lat: 30.362634 Long: -80.085675
Calculated Distance Traveled: 0.1 km

Behavior and Additional Comments

One large group, two small groups, one group had mom/calf pair, large group tightly packed initially and then began to spread out

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Wednesday, January 20, 2010 Sighting # 12

Initial Sighting on Track

Time: 15:05 WP#: 113 Lat: 30.432054 Long: -80.498414
Vertical Angle: 2 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Track Line: 8 Beaufort Sea State: 2
Observer: HJF Observer Side: Right

Actual Time and Position of Sighting

Time: 15:06 WP#: 114 Lat: 30.436033 Long: -80.506570
Species: *Tursiops truncatus* Numbers (Low/High/Best): 6/8/8
Features used in Species ID: Dark, distinct cape with 'widow's peak', broad flukes, short, stubby rostrum, light-colored peduncle

Representative images used for Species ID: 9833-9836
Photographer: HJF Frame Numbers: 9833-9844 Spacer: 9845
Calculated Distance from Track Line: 0.9 km

Final Time and Position of Sighting

Time: 15:08 WP#: 115 Lat: 30.438059 Long: -80.510754
Calculated Distance Traveled: 0.5 km

Behavior and Additional Comments

Some animals were tightly grouped, others were more spread out over a wide area
Mom/calf pair present

Wednesday, January 20, 2010 Sighting # 13

Initial Sighting on Track

Time: 15:20 WP#: 123 Lat: 30.500388 Long: -80.530440
Vertical Angle: 3 Horizontal Bearing in Degrees: 135 Sighting Cue: Body
On/Off Effort: On Track Line: 9 Beaufort Sea State: 1
Observer: REH Observer Side: Left

Actual Time and Position of Sighting

Time: 15:22 WP#: 124 Lat: 30.501224 Long: -80.530414
Species: *Stenella frontalis* Numbers (Low/High/Best): 4/8/7
Features used in Species ID: White-tipped rostrum, blaze on flank terminating mid-dorsal, obvious spotting on some animals
Representative images used for Species ID: 9847, 9852-9855, 9863, 9864, 9868
Photographer: HJF Frame Numbers: 9846-9871 Spacer: 9872
Calculated Distance from Track Line: 0.1 km

Final Time and Position of Sighting

Time: 15:27 WP#: 125 Lat: -30.511561 Long: -80.532564
Calculated Distance Traveled: 1.2 km

Behavior and Additional Comments

Splashing from fish in the area also, possible interaction or foraging, some animals were porpoising clear of the water, some animals in pairs but very spread out

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Wednesday, January 20, 2010 Sighting # 14

Initial Sighting on Track

Time: 15:47 WP#: 132 Lat: 30.565638 Long: -79.821924
Vertical Angle: 2 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Track Line: 10 Beaufort Sea State: 1
Observer: HJF Observer Side: Right

Actual Time and Position of Sighting

Time: 15:48 WP#: 133 Lat: 30.567242 Long: -79.818377
Species: *Tursiops truncatus* Numbers (Low/High/Best): 13/16/15
Features used in Species ID: Broad flukes, light-colored peduncle, uniform gray coloration with distinct cape, short, stubby rostrum
Representative images used for Species ID: 9876-9879, 9885, 9886, 9892, 9895-9897
Photographer: HJF Frame Numbers: 9873-9902 Spacer: 9903
Calculated Distance from Track Line: 0.4 km

Final Time and Position of Sighting

Time: 15:53 WP#: 135 Lat: 30.566981 Long: -79.821218
Calculated Distance Traveled: 0.3 km

Behavior and Additional Comments

Some animals energetically porpoising, fairly spread out in groups of two to three, some swimming really rapidly underwater, animals were more grouped at the conclusion of sighting

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Wednesday, January 20, 2010 Sighting # 15

Initial Sighting on Track

Time: 16:07 WP#: 138 Lat: 30.565741 Long: -80.363439
Vertical Angle: 1 Horizontal Bearing in Degrees: 100 Sighting Cue: Body
On/Off Effort: On Track Line: 10 Beaufort Sea State: 2
Observer: REH Observer Side: Left

Actual Time and Position of Sighting

Time: 16:08 WP#: 139 Lat: 30.562322 Long: -80.363101
Species: *Unidentified Delphinid* Numbers (Low/High/Best): 10/16/14
Features used in Species ID: Images not conclusive as to species identity

Representative images used for Species ID: 9908-9910, 9913, 9915, 9917
Photographer: HJF Frame Numbers: 9904-9917 Spacer: 9918
Calculated Distance from Track Line: 0.4 km

Final Time and Position of Sighting

Time: 16:17 WP#: 140 Lat: 30.555459 Long: -80.364618
Calculated Distance Traveled: 0.8 km

Behavior and Additional Comments

Animals were very spread out and elusive, afternoon glare was a severe hindrance to tracking, fish were in the area, animals were moving quickly, possibly foraging, porpoising clear of the water at times. Most likely S. frontalis but images are not conclusive

Wednesday, January 27, 2010 Sighting # 1

Initial Sighting on Track

Time: 15:26 WP#: 40 Lat: 30.099334 Long: -79.828985
Vertical Angle: 2 Horizontal Bearing in Degrees: 120 Sighting Cue: Body
On/Off Effort: On Track Line: 3 Beaufort Sea State: 3
Observer: REH Observer Side: Right

Actual Time and Position of Sighting

Time: N/A WP#: N/A Lat: N/A Long: N/A
Species: *Unidentified Delphinid* Numbers (Low/High/Best): 1/1/1
Features used in Species ID: N/A (unidentified delphinid)

Representative images used for Species ID: None taken
Photographer: N/A Frame Numbers: N/A Spacer: N/A
Calculated Distance from Track Line: N/A

Final Time and Position of Sighting

Time: N/A WP#: N/A Lat: N/A Long: N/A
Calculated Distance Traveled: N/A

Behavior and Additional Comments

Unable to relocate after initial sighting

Wednesday, January 27, 2010 Sighting # 2

Initial Sighting on Track

Time: 16:59 WP#: 53 Lat: 29.963628 Long: -80.643552
Vertical Angle: 2 Horizontal Bearing in Degrees: 110 Sighting Cue: Bodies
On/Off Effort: On Track Line: 1 Beaufort Sea State: 2
Observer: REH Observer Side: Right

Actual Time and Position of Sighting

Time: 17:02 WP#: 54 Lat: 29.965491 Long: -80.641395
Species: *Unidentified Delphinid* Numbers (Low/High/Best): 7/9/10
Features used in Species ID: Overall small body, Stenella like appearance

Representative images used for Species ID:
Photographer: REH Frame Numbers: 9919 to 9940 Spacer: 9941
Calculated Distance from Track Line: 0.3 km

Final Time and Position of Sighting

Time: 17:20 WP#: 55 Lat: 29.955820 Long: -80.635997
Calculated Distance Traveled: 1.2 km

Behavior and Additional Comments

Very small and fast animals in a loose aggregation, spread out. Fast travel with little time close to the surface. Difficult to work.

Thursday, January 28, 2010 Sighting # 1

Initial Sighting on Track

Time: 9:30 WP#: 5 Lat: 29.965918 Long: -80.584850
Vertical Angle: 1 Horizontal Bearing in Degrees: 110 Sighting Cue: Body
On/Off Effort: On Track Line: 1 Beaufort Sea State:
Observer: REH Observer Side: Left

Actual Time and Position of Sighting

Time: 9:32 WP#: 6 Lat: 29.959962 Long: -80.573048
Species: *Tursiops truncatus* Numbers (Low/High/Best): 4/5/5
Features used in Species ID: Short, stubby rostrum, with marked crease at base of melon. Robust, sturdy looking animals. Light colored dorsal peduncle, broad flukes
Representative images used for Species ID: 9952, 9973, 9974, 9975
Photographer: PBN Frame Numbers: 9942 to 9980 Spacer: 9981
Calculated Distance from Track Line: 1.3 km

Final Time and Position of Sighting

Time: 9:40 WP#: 7 Lat: 29.959584 Long: -80.571333
Calculated Distance Traveled: 1.3 km

Behavior and Additional Comments

Small group, somewhat spread out, possible mom/calf pair in group. Surfacing often and slowly.

Thursday, January 28, 2010 Sighting # 2

Initial Sighting on Track

Time: 9:51 WP#: 15 Lat: 29.966740 Long: -80.256365
Vertical Angle: 3 Horizontal Bearing in Degrees: 120 Sighting Cue: Body
On/Off Effort: On Track Line: 1 Beaufort Sea State: 2
Observer: REH Observer Side: Left

Actual Time and Position of Sighting

Time: 9:52 WP#: 16 Lat: 29.970192 Long: -80.259753
Species: *Stenella frontalis* Numbers (Low/High/Best): 16/20/18
Features used in Species ID: Narrow peduncle, alternating dark/light dorsal banding, longer, white-tipped rostrum
Representative images used for Species ID: 0004, 0010, 0021, 0025, 0026
Photographer: PBN Frame Numbers: 9982 to 0029 Spacer: 0030
Calculated Distance from Track Line: 0.5 km

Final Time and Position of Sighting

Time: 10:11 WP#: 17 Lat: 29.959212 Long: -80.264583
Calculated Distance Traveled: 1.3 km

Behavior and Additional Comments

Two sub-groups, each with 7 - 10 animals. Fish in area - possible foraging. Mother/calf pair present.

Thursday, January 28, 2010 Sighting # 3

Initial Sighting on Track

Time: 10:17 WP#: 220 Lat: 29.968545 Long: -80.057141
Vertical Angle: 3 Horizontal Bearing in Degrees: 130 Sighting Cue: Body
On/Off Effort: On Track Line: 1 Beaufort Sea State: 2
Observer: REH Observer Side: Left

Actual Time and Position of Sighting

Time: N/A WP#: N/A Lat: N/A Long: N/A
Species: *Unidentified Delphinid* Numbers (Low/High/Best): 8/12/10
Features used in Species ID: N/A

Representative images used for Species ID: N/A
Photographer: N/A Frame Numbers: N/A Spacer: N/A
Calculated Distance from Track Line: N/A

Final Time and Position of Sighting

Time: N/A WP#: N/A Lat: N/A Long: N/A
Calculated Distance Traveled: N/A

Behavior and Additional Comments

Pod of dolphins spotted twice but unable to relocate for another waypoint or for photographs.

Thursday, January 28, 2010 Sighting # 4

Initial Sighting on Track

Time: 11:02 WP#: 29 Lat: 30.031582 Long: -80.368702
Vertical Angle: 1 Horizontal Bearing in Degrees: 150 Sighting Cue: Body
On/Off Effort: On Track Line: 2 Beaufort Sea State: 2
Observer: PBN Observer Side: Right

Actual Time and Position of Sighting

Time: 11:04 WP#: 30 Lat: 30.028005 Long: -80.366154
Species: *Stenella frontalis* Numbers (Low/High/Best): 10/12/11
Features used in Species ID: Relatively short flank blaze terminating mid-dorsal fin, spotted appearance, white rostrum tip, light/dark dorsal "banding".
Representative images used for Species ID: 0057, 0058, 0072, 0075, 0076
Photographer: PBN Frame Numbers: 0031 to 0077 Spacer: 0078
Calculated Distance from Track Line: 0.5 km

Final Time and Position of Sighting

Time: 11:07 WP#: 31 Lat: 30.030288 Long: -80.368683
Calculated Distance Traveled: 0.4 km

Behavior and Additional Comments

Tight group spending lots of time at surface

Thursday, January 28, 2010 Sighting # 5

Initial Sighting on Track

Time: 11:16 WP#: 37 Lat: 30.030943 Long: -80.663225
Vertical Angle: 2 Horizontal Bearing in Degrees: 110 Sighting Cue: Body
On/Off Effort: On Track Line: 2 Beaufort Sea State: 1
Observer: REH Observer Side: Left

Actual Time and Position of Sighting

Time: 11:18 WP#: 38 Lat: 30.030443 Long: -80.658599
Species: *Tursiops truncatus* Numbers (Low/High/Best): 2/2/2
Features used in Species ID: Short, stubby rostrum and well-defined crease at melon, overall gray coloration with darker dorsal cape
Representative images used for Species ID: 0082-0085, 0099, 0100
Photographer: PBN Frame Numbers: 0079 to 0104 Spacer: 0105
Calculated Distance from Track Line: 0.4 km

Final Time and Position of Sighting

Time: 11:31 WP#: 39 Lat: 30.029608 Long: -80.659774
Calculated Distance Traveled: 0.1 km

Behavior and Additional Comments

Two animals- mother/calf pair, visible blow from larger animal at times. Elusive, not at the surface often. Traveling slowly.

Thursday, January 28, 2010 Sighting # 6

Initial Sighting on Track

Time: 11:39 WP#: 44 Lat: 30.100404 Long: -80.584374
Vertical Angle: 2 Horizontal Bearing in Degrees: 100 Sighting Cue: Body
On/Off Effort: On Track Line: 3 Beaufort Sea State: 1
Observer: REH Observer Side: Left

Actual Time and Position of Sighting

Time: 11:41 WP#: 45 Lat: 30.101081 Long: -80.585021
Species: *Stenella frontalis* Numbers (Low/High/Best): 17/22/20
Features used in Species ID: Long, dark, white tipped beak, spotting apparent, light/dark "banding" dorsally
Representative images used for Species ID: 0115, 0116, 0170, 0171
Photographer: PBN Frame Numbers: 0106 to 0172 Spacer: 0173
Calculated Distance from Track Line: 0.1 km

Final Time and Position of Sighting

Time: 11:57 WP#: 48 Lat: 30.101601 Long: -80.579077
Calculated Distance Traveled: 0.6 km

Behavior and Additional Comments

Traveling slowly, diving deep. Found two more sub-groups after first 2.42. Large shark in area. Shark was photographed.

Thursday, January 28, 2010 Sighting # 7

Initial Sighting on Track

Time: 12:01 WP#: 52 Lat: 30.100475 Long: -80.441549
Vertical Angle: 1 Horizontal Bearing in Degrees: 80 Sighting Cue: Body
On/Off Effort: On Track Line: 3 Beaufort Sea State: 1
Observer: REH Observer Side: Left

Actual Time and Position of Sighting

Time: 12:02 WP#: 53 Lat: 30.096646 Long: -80.444014
Species: *Stenella frontalis* Numbers (Low/High/Best): 4/6/5
Features used in Species ID: Long, white-tipped rostrum, alternating light/dark dorsal banding, variable spotting among individuals
Representative images used for Species ID: 0176, 0200, 0220, 0221
Photographer: PBN Frame Numbers: 0174 to 0224 Spacer: 0225
Calculated Distance from Track Line: 0.5 km

Final Time and Position of Sighting

Time: 12:05 WP#: 54 Lat: 30.099430 Long: -80.442883
Calculated Distance Traveled: 0.3 km

Behavior and Additional Comments

Very rapid bursts of extremely fast swimming

Thursday, January 28, 2010 Sighting # 8

Initial Sighting on Track

Time: 12:54 WP#: 69 Lat: 30.165613 Long: -80.683999
Vertical Angle: 1 Horizontal Bearing in Degrees: 80 Sighting Cue: Body
On/Off Effort: On Track Line: 4 Beaufort Sea State: 1
Observer: Reh Observer Side: Left

Actual Time and Position of Sighting

Time: 12:59 WP#: 70 Lat: 30.163580 Long: -80.684992
Species: *Tursiops truncatus* Numbers (Low/High/Best): 2/2/2
Features used in Species ID: Short, stubby rostrum, well defined crease at base of melon, broad flukes, overall light gray color
Representative images used for Species ID: 0252, 0267, 0284, 0286
Photographer: PBN Frame Numbers: 0226 to 0289 Spacer: 0290
Calculated Distance from Track Line: 0.2 km

Final Time and Position of Sighting

Time: 13:03 WP#: 71 Lat: 30.158925 Long: -80.683062
Calculated Distance Traveled: 0.5 km

Behavior and Additional Comments

Pair of animals surfacing slowly

Thursday, January 28, 2010 Sighting # 9

Initial Sighting on Track

Time: 15:05 WP#: 80 Lat: 30.233756 Long: -80.521093
Vertical Angle: 2 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Track Line: 5 Beaufort Sea State: 2
Observer: PBN Observer Side: Right

Actual Time and Position of Sighting

Time: 15:08 WP#: 81 Lat: 30.230264 Long: -80.524258
Species: *Tursiops truncatus* Numbers (Low/High/Best): 1/1/1
Features used in Species ID: Short, stubby rostrum with well-defined crease at melon, robust bodies, overall gray coloration with darker dorsal cape
Representative images used for Species ID: 0302, 0304, 0310-0313
Photographer: PBN Frame Numbers: 0291 to 0321 Spacer: 0322
Calculated Distance from Track Line: 0.5 km

Final Time and Position of Sighting

Time: 15:10 WP#: 82 Lat: 30.229053 Long: -80.523290
Calculated Distance Traveled: 0.2 km

Behavior and Additional Comments

Thursday, January 28, 2010 Sighting # 10

Initial Sighting on Track

Time: 15:14 WP#: 85 Lat: 30.233964 Long: -80.389692
Vertical Angle: 1 Horizontal Bearing in Degrees: 100 Sighting Cue: Body
On/Off Effort: On Track Line: 5 Beaufort Sea State: 2
Observer: REH Observer Side: Left

Actual Time and Position of Sighting

Time: 15:23 WP#: 86 Lat: 30.238250 Long: -80.398262
Species: *Tursiops truncatus* Numbers (Low/High/Best): 3/3/3
Features used in Species ID: Long, robust body shape, gray color with darker gray dorsal cape, short, stubby rostrum with well-defined crease at base of melon
Representative images used for Species ID: 0323, 0324, 0330
Photographer: PBN Frame Numbers: 0323 to 0335 Spacer: 0336
Calculated Distance from Track Line: 1.0 km

Final Time and Position of Sighting

Time: 15:27 WP#: 87 Lat: 30.242828 Long: -80.397685
Calculated Distance Traveled: 0.5 km

Behavior and Additional Comments

Three animals, elusive, one pair pretty far from one another

Thursday, January 28, 2010 Sighting # 11

Initial Sighting on Track

Time: 16:01 WP#: 96 Lat: 30.298516 Long: -80.120912
Vertical Angle: 1 Horizontal Bearing in Degrees: 120 Sighting Cue: Body
On/Off Effort: On Track Line: 6 Beaufort Sea State: 2
Observer: PBN Observer Side: Right

Actual Time and Position of Sighting

Time: 16:02 WP#: 97 Lat: 30.302032 Long: -80.120480
Species: *Grampus griseus* Numbers (Low/High/Best): 5/8/7
Features used in Species ID: Blunt rostrum with visible cleft, variable dark to lightest gray color with visible scarring, tall dorsal fins
Representative images used for Species ID: 0369, 0374, 0388, 0398
Photographer: PBN Frame Numbers: 0361 to 0400 Spacer: 0401
Calculated Distance from Track Line: 0.4 km

Final Time and Position of Sighting

Time: 16:05 WP#: 99 Lat: N 30.295333 Long: W 80.119047
Calculated Distance Traveled: 0.8 km

Behavior and Additional Comments

Large animals, most in a chorus line, equally spaced and one direction of travel

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Thursday, January 28, 2010 Sighting # 12

Initial Sighting on Track

Time: 16:12 WP#: 102 Lat: 30.299355 Long: -80.339597
Vertical Angle: 2 Horizontal Bearing in Degrees: 150 Sighting Cue: Body
On/Off Effort: On Track Line: 6 Beaufort Sea State: 2
Observer: PBN Observer Side: Right

Actual Time and Position of Sighting

Time: 16:14 WP#: 103 Lat: 30.300036 Long: -80.337468
Species: *Tursiops truncatus* Numbers (Low/High/Best): 2/4/3
Features used in Species ID: Short, stubby rostrum, robust bodies, broad flukes, overall gray coloration, well-defined crease at melon
Representative images used for Species ID: 0418, 0419, 0421
Photographer: PBN Frame Numbers: 0402 to 0436 Spacer: 0437
Calculated Distance from Track Line: 0.2 km

Final Time and Position of Sighting

Time: 16:20 WP#: 104 Lat: 30.296256 Long: -80.341635
Calculated Distance Traveled: 0.6 km

Behavior and Additional Comments

Saturday, February 20, 2010 Sighting # 1

Initial Sighting on Track

Time: 10:31 WP#: 28 Lat: 30.500295 Long: -80.402576
Vertical Angle: 1 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Track Line: 9 Beaufort Sea State: 1
Observer: PBN Observer Side: Right

Actual Time and Position of Sighting

Time: 10:33 WP#: 17 Lat: 30.499955 Long: -80.396613
Species: *Stenella frontalis* Numbers (Low/High/Best): 16/18/17
Features used in Species ID: white rostrum tip, banding pattern alternating light and dark, spotted pattern
Representative images used for Species ID: 2844, 2848, 2856, 2858
Photographer: PBN Frame Numbers: 2843 - 2880 Spacer: 2881
Calculated Distance from Track Line: 0.6 km

Final Time and Position of Sighting

Time: 10:35 WP#: 18 Lat: 30.502578 Long: -80.393409
Calculated Distance Traveled: 0.4 km

Behavior and Additional Comments

A large, tightly-packed group traveling mostly at the surface of the water

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Saturday, February 20, 2010 Sighting # 2

Initial Sighting on Track

Time: 10:42 WP#: 35 Lat: 30.499366 Long: -80.620985
Vertical Angle: 2 Horizontal Bearing in Degrees: 120 Sighting Cue: Body
On/Off Effort: On Track Line: 9 Beaufort Sea State: 1
Observer: PBN Observer Side: Right

Actual Time and Position of Sighting

Time: 10:48 WP#: 22 Lat: 30.500891 Long: -80.618709
Species: *Stenella frontalis* Numbers (Low/High/Best): 2/2/2
Features used in Species ID: white rostrum tip, light and dark alternating pattern, and spotted pattern
Representative images used for Species ID: 2888, 2893, 2912
Photographer: PBN Frame Numbers: 2882 - 2921 Spacer: 2922
Calculated Distance from Track Line: 0.3 km

Final Time and Position of Sighting

Time: 10:48 WP#: 23 Lat: 30.501595 Long: -80.618999
Calculated Distance Traveled: 0.1 km

Behavior and Additional Comments

Saturday, February 20, 2010 Sighting # 3

Initial Sighting on Track

Time: 10:56 WP#: 27 Lat: 30.432762 Long: -80.620269
Vertical Angle: 1 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Track Line: 8 Beaufort Sea State: 1
Observer: HJF Observer Side: Left

Actual Time and Position of Sighting

Time: N/A WP#: N/A Lat: N/A Long: N/A
Species: *Unidentified Delphinid* Numbers (Low/High/Best): 3/3/3
Features used in Species ID: N/A

Representative images used for Species ID: None obtained
Photographer: N/A Frame Numbers: N/A Spacer: N/A
Calculated Distance from Track Line: N/A

Final Time and Position of Sighting

Time: N/A WP#: N/A Lat: N/A Long: N/A
Calculated Distance Traveled: N/A

Behavior and Additional Comments

At least 2 subgroups, never resighted

Saturday, February 20, 2010 Sighting # 4

Initial Sighting on Track

Time: 12:02 WP#: 40 Lat: 30.365463 Long: -80.655332
Vertical Angle: 3 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Track Line: 7 Beaufort Sea State: 1
Observer: PBN Observer Side: Right

Actual Time and Position of Sighting

Time: 12:05 WP#: 41 Lat: 30.368241 Long: -80.652563
Species: *Stenella frontalis* Numbers (Low/High/Best): 8/12/10
Features used in Species ID: small pectoral fins, white rostrum tip, banding and spotted pattern

Representative images used for Species ID: 2925, 2926, 2944, 2965
Photographer: PBN Frame Numbers: 2923-2995 Spacer: 2996
Calculated Distance from Track Line: 0.4 km

Final Time and Position of Sighting

Time: 42 WP#: 42 Lat: 30.368857 Long: -80.655225
Calculated Distance Traveled: 0.3 km

Behavior and Additional Comments

Two small subgroups

Saturday, February 20, 2010 Sighting # 5

Initial Sighting on Track

Time: 12:18 WP#: 49 Lat: 30.295976 Long: -80.599638
Vertical Angle: _____ Horizontal Bearing in Degrees: _____ Sighting Cue: N/A
On/Off Effort: Off Track Line: N/A Beaufort Sea State: 1
Observer: PBN Observer Side: Right

Actual Time and Position of Sighting

Time: N/A WP#: N/A Lat: N/A Long: N/A
Species: *Stenella frontalis* Numbers (Low/High/Best): 3/3/3
Features used in Species ID: white rostrum tip, spotted pattern

Representative images used for Species ID: 3019, 3023, 3025
Photographer: PBN Frame Numbers: 2997-3028 Spacer: 3029
Calculated Distance from Track Line: N/A

Final Time and Position of Sighting

Time: N/A WP#: N/A Lat: N/A Long: N/A
Calculated Distance Traveled: N/A

Behavior and Additional Comments

Off track investigating what turned out to be trash when dolphins were spotted;
one mom/calf pair with a singleton.

Saturday, March 20, 2010 Sighting # 6

Initial Sighting on Track

Time: 12:26 WP#: 51 Lat: 30.298931 Long: -80.506767
Vertical Angle: 2 Horizontal Bearing in Degrees: 110 Sighting Cue: Body
On/Off Effort: On Track Line: 6 Beaufort Sea State: 1
Observer: HJF Observer Side: Left

Actual Time and Position of Sighting

Time: 12:27 WP#: 52 Lat: 30.303476 Long: -80.516636
Species: *Tursiops truncatus* Numbers (Low/High/Best): 8/12/10
Features used in Species ID: Overall gray coloration, broad flukes, white peduncle

Representative images used for Species ID: 3032, 3039, 3060 - 3064
Photographer: PBN Frame Numbers: 3030-3069 Spacer: 3070
Calculated Distance from Track Line: 1.1 km

Final Time and Position of Sighting

Time: 12:31 WP#: 53 Lat: 30.301707 Long: -80.511194
Calculated Distance Traveled: 0.6 km

Behavior and Additional Comments

Traveling in groups of two and three animals

Saturday, February 20, 2010 Sighting # 7

Initial Sighting on Track

Time: 12:33 WP#: 55 Lat: 30.298252 Long: -80.461393
Vertical Angle: 1 Horizontal Bearing in Degrees: 165 Sighting Cue: Body
On/Off Effort: On Track Line: 6 Beaufort Sea State: 1
Observer: HJF Observer Side: Left

Actual Time and Position of Sighting

Time: 12:36 WP#: 56 Lat: 30.298273 Long: -80.473435
Species: *Stenella frontalis* Numbers (Low/High/Best): 3/3/3
Features used in Species ID: white rostrum tip, spotted pattern, alternating light and dark banding.
Representative images used for Species ID: 3084, 3089, 3115 - 3119, 3134
Photographer: PBN Frame Numbers: 3071-3136 Spacer: 3137
Calculated Distance from Track Line: 1.2 km

Final Time and Position of Sighting

Time: 12:36 WP#: 57 Lat: 30.301503 Long: -80.476442
Calculated Distance Traveled: 0.5 km

Behavior and Additional Comments

Saturday, February 20, 2010 Sighting # 8

Initial Sighting on Track

Time: 12:40 WP#: 59 Lat: 30.300218 Long: -80.347526
Vertical Angle: 3 Horizontal Bearing in Degrees: 100 Sighting Cue: Body
On/Off Effort: On Track Line: 6 Beaufort Sea State: 1
Observer: HJF Observer Side: Left

Actual Time and Position of Sighting

Time: 12:42 WP#: 60 Lat: 30.307844 Long: -80.346851
Species: *Stenella frontalis* Numbers (Low/High/Best): 40/50/45
Features used in Species ID: Slender, white tipped rostrum, Banding pattern visible on dorsal surface
Representative images used for Species ID: 3152 - 3159, 3177 - 3186, 3213
Photographer: PBN Frame Numbers: 3138-3237 Spacer: 3238
Calculated Distance from Track Line: 0.9 km

Final Time and Position of Sighting

Time: 12:45 WP#: 61 Lat: 30.312041 Long: -80.348847
Calculated Distance Traveled: 0.5 km

Behavior and Additional Comments

Large, cohesive group chasing large schools of fish

Saturday, February 20, 2010 Sighting # 9

Initial Sighting on Track

Time: 13:13 WP#: 72 Lat: 30.233169 Long: -80.067443
Vertical Angle: 1 Horizontal Bearing in Degrees: 120 Sighting Cue: Body
On/Off Effort: On Track Line: 56 Beaufort Sea State: 2
Observer: PBN Observer Side: Right

Actual Time and Position of Sighting

Time: 13:15 WP#: 73 Lat: 30.234682 Long: -80.064016
Species: *Balaenoptera acutorostrata* Numbers (Low/High/Best): 1/1/1
Features used in Species ID: large, long, slim dark body with short, white banded pectoral fins

Representative images used for Species ID: 3260, 3275
Photographer: PBN Frame Numbers: 3260-3290 Spacer: 3291
Calculated Distance from Track Line: 0.4 km

Final Time and Position of Sighting

Time: 13:18 WP#: 74 Lat: 30.242601 Long: -80.065392
Calculated Distance Traveled: 0.9 km

Behavior and Additional Comments

Lone individual who remained subsurface for majority of sighting

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Saturday, February 20, 2010 Sighting # 10

Initial Sighting on Track

Time: 13:33 WP#: 79 Lat: 30.233016 Long: -80.492936
Vertical Angle: 3 Horizontal Bearing in Degrees: 100 Sighting Cue: Body
On/Off Effort: On Track Line: 5 Beaufort Sea State: 2
Observer: HJF Observer Side: Left

Actual Time and Position of Sighting

Time: 13:35 WP#: 80 Lat: 30.220544 Long: -80.489406
Species: *Stenella frontalis* Numbers (Low/High/Best): 50/70/60
Features used in Species ID: spotted pattern, alternating banding pattern on dorsal surface, white rostrum tip

Representative images used for Species ID: 3299, 3303, 3309
Photographer: PBN Frame Numbers: 3292-3226 Spacer: 3327
Calculated Distance from Track Line: 1.4 km

Final Time and Position of Sighting

Time: 13:36 WP#: 81 Lat: 30.230403 Long: -80.481872
Calculated Distance Traveled: 1.3 km

Behavior and Additional Comments

At least 4 groups with 10-12 individuals in each group

Saturday, February 20, 2010 Sighting # 11

Initial Sighting on Track

Time: 13:42 WP#: 91 Lat: 30.233946 Long: -80.697610
Vertical Angle: 1 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Track Line: 5 Beaufort Sea State: 1
Observer: PBN Observer Side: Right

Actual Time and Position of Sighting

Time: 13:45 WP#: 85 Lat: 30.238398 Long: -80.693274
Species: *Tursiops truncatus* Numbers (Low/High/Best): 1/1/1
Features used in Species ID: broad fluke, slate gray coloration, defined crease between melon and rostrum
Representative images used for Species ID: 3330 - 3334
Photographer: PBN Frame Numbers: 3328 - 3336 Spacer: 3337
Calculated Distance from Track Line: 0.7 km

Final Time and Position of Sighting

Time: 13:45 WP#: 86 Lat: 30.238925 Long: -80.693226
Calculated Distance Traveled: <0.1 km

Behavior and Additional Comments

One lone individual.

Saturday, February 20, 2010 Sighting # 12

Initial Sighting on Track

Time: 15:23 WP#: 101 Lat: 30.166299 Long: -80.510827
Vertical Angle: 2 Horizontal Bearing in Degrees: 150 Sighting Cue: bodies
On/Off Effort: On Track Line: 4 Beaufort Sea State: 1
Observer: HJF Observer Side: Left

Actual Time and Position of Sighting

Time: 15:26 WP#: 96 Lat: 30.169151 Long: -80.521569
Species: *Stenella frontalis* Numbers (Low/High/Best): 2/2/2
Features used in Species ID: long rostrum, white beak tip, spotted pattern, blaze
Representative images used for Species ID: 3348, 3377 - 3379
Photographer: PBN Frame Numbers: 3338 - 3382 Spacer: 3383
Calculated Distance from Track Line: 1.1 km

Final Time and Position of Sighting

Time: 15.26 WP#: 97 Lat: 30.173604 Long: -80.517800
Calculated Distance Traveled: 0.6 km

Behavior and Additional Comments

Saturday, February 20, 2010 Sighting # 13

Initial Sighting on Track

Time: 15:43 WP#: 109 Lat: 30.165113 Long: -79.880627
Vertical Angle: 2 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Track Line: 4 Beaufort Sea State: 1
Observer: PBN Observer Side: Right

Actual Time and Position of Sighting

Time: 15:46 WP#: 106 Lat: 30.163147 Long: -79.885885
Species: *Tursiops truncatus* Numbers (Low/High/Best): 3/3/3
Features used in Species ID: stubby rostrum, peak on dorsal melon, robust body

Representative images used for Species ID: 3399, 3411
Photographer: PBN Frame Numbers: 3384 - 3417 Spacer: 3418
Calculated Distance from Track Line: 0.6 km

Final Time and Position of Sighting

Time: 15:49 WP#: 107 Lat: 30.164940 Long: -79.887226
Calculated Distance Traveled: 0.2 km

Behavior and Additional Comments

Three individual traveling together as a group.

Saturday, February 20, 2010 Sighting # 14

Initial Sighting on Track

Time: 16:14 WP#: 119 Lat: 30.100308 Long: -80.545387
Vertical Angle: 1 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Track Line: 3 Beaufort Sea State: 1
Observer: PBN Observer Side: Right

Actual Time and Position of Sighting

Time: 16:17 WP#: 115 Lat: 30.103998 Long: -80.545810
Species: *Stenella frontalis* Numbers (Low/High/Best): 4/4/4
Features used in Species ID: long, white-tipped rostrum and spotted pattern

Representative images used for Species ID: 3442, 3443, 3444
Photographer: PBN Frame Numbers: 3419 - 3450 Spacer: 3451
Calculated Distance from Track Line: 0.4 km

Final Time and Position of Sighting

Time: n/a WP#: n/a Lat: Long:
Calculated Distance Traveled: n/a

Behavior and Additional Comments

Saturday, February 20, 2010 Sighting # 15

Initial Sighting on Track

Time: 16:34 WP#: 119 Lat: 30.031684 Long: -80.374122
Vertical Angle: 3 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Track Line: 2 Beaufort Sea State: 1
Observer: HJF Observer Side: Left

Actual Time and Position of Sighting

Time: 16:35 WP#: 120 Lat: 30.037500 Long: -80.374863
Species: *Unidentified Delphinid* Numbers (Low/High/Best): 4/6/5
Features used in Species ID: Imagines not conclusive as to species identity

Representative images used for Species ID: 3454, 3484 - 3485
Photographer: PBN Frame Numbers: 3452 - 3490 Spacer: 3491
Calculated Distance from Track Line: 0.7 km

Final Time and Position of Sighting

Time: 16:36 WP#: 121 Lat: 30.035351 Long: -80.376998
Calculated Distance Traveled: 0.3 km

Behavior and Additional Comments

traveling together in a loose group.

Saturday, February 20, 2010 Sighting # 16

Initial Sighting on Track

Time: 16:57 WP#: 135 Lat: 29.966141 Long: -79.935040
Vertical Angle: 3 Horizontal Bearing in Degrees: 120 Sighting Cue: Body
On/Off Effort: On Track Line: 1 Beaufort Sea State: 1
Observer: PBN Observer Side: Right

Actual Time and Position of Sighting

Time: 16:59 WP#: 129 Lat: 29.973820 Long: -79.925572
Species: *Unidentified Delphinid* Numbers (Low/High/Best): 5/7/6
Features used in Species ID: Images not conclusive as to species identity

Representative images used for Species ID: 3507
Photographer: PBN Frame Numbers: 3492 - 3521 Spacer: 3522
Calculated Distance from Track Line: 1.3 km

Final Time and Position of Sighting

Time: n/a WP#: n/a Lat: Long:
Calculated Distance Traveled: n/a

Behavior and Additional Comments

Sunday, February 21, 2010 Sighting # 1

Initial Sighting on Track

Time: 8:59 WP#: 12 Lat: 30.032506 Long: -79.809163
Vertical Angle: 1 Horizontal Bearing in Degrees: 150 Sighting Cue: Body
On/Off Effort: On Track Line: 2 Beaufort Sea State: 1
Observer: REH Observer Side: Right

Actual Time and Position of Sighting

Time: 9:00 WP#: 13 Lat: 30.034156 Long: -79.805427
Species: *Tursiops truncatus* Numbers (Low/High/Best): 4/4/4
Features used in Species ID: Light colored peduncle, robust bodies with broad flukes, uniform gray coloration with darker dorsal cape
Representative images used for Species ID: 0476, 0477, 0481
Photographer: REH Frame Numbers: 0469 to 0482 Spacer: 0483
Calculated Distance from Track Line: 0.4 km

Final Time and Position of Sighting

Time: 9:06 WP#: 14 Lat: 30.034990 Long: -79.801969
Calculated Distance Traveled: 0.3 km

Behavior and Additional Comments

Two mother/calf pairs, traveling slowly at the surface.

Sunday, February 21, 2010 Sighting # 2

Initial Sighting on Track

Time: 9:09 WP#: 16 Lat: 30.032988 Long: -79.853577
Vertical Angle: 1 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Track Line: 2 Beaufort Sea State: 1
Observer: RCH Observer Side: Left

Actual Time and Position of Sighting

Time: 9:10 WP#: 17 Lat: 30.033649 Long: -79.848469
Species: *Tursiops truncatus* Numbers (Low/High/Best): 13/18/15
Features used in Species ID: Broad based dorsal fin, light colored peduncle, short, stubby rostrum, broad flukes, robust body, dark gray cape
Representative images used for Species ID: 0486-0488, 0500, 0503, 0504
Photographer: RCH Frame Numbers: 0484 to 0507 Spacer: 0508
Calculated Distance from Track Line: 0.5 km

Final Time and Position of Sighting

Time: 9:14 WP#: 18 Lat: 30.034585 Long: -79.854841
Calculated Distance Traveled: 0.6 km

Behavior and Additional Comments

Three groups of 5-6 animals each, at least two calves present

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Sunday, February 21, 2010 Sighting # 3

Initial Sighting on Track

Time: 9:52 WP#: 27 Lat: 30.100155 Long: -80.498271
Vertical Angle: 2 Horizontal Bearing in Degrees: 130 Sighting Cue: Body
On/Off Effort: On Track Line: 3 Beaufort Sea State: 1
Observer: REH Observer Side: Right

Actual Time and Position of Sighting

Time: 9:55 WP#: 28 Lat: 30.090595 Long: -80.509092
Species: *Tursiops truncatus* Numbers (Low/High/Best): 8/8/8
Features used in Species ID: Broad flukes, robust body, short, stubby rostrum with well-defined crease at melon, broad base dorsal fin
Representative images used for Species ID: 0510, 0511, 0514
Photographer: REH Frame Numbers: 0509 to 0516 Spacer: 0517
Calculated Distance from Track Line: 1.5 km

Final Time and Position of Sighting

Time: 9:58 WP#: 29 Lat: 30.086212 Long: -80.506268
Calculated Distance Traveled: 0.6 km

Behavior and Additional Comments

Mother/calf pair present

Sunday, February 21, 2010 Sighting # 4

Initial Sighting on Track

Time: 10:01 WP#: 31 Lat: 30.100044 Long: -80.411441
Vertical Angle: 3 Horizontal Bearing in Degrees: 110 Sighting Cue: Body
On/Off Effort: On Track Line: 3 Beaufort Sea State: 1
Observer: REH Observer Side: Right

Actual Time and Position of Sighting

Time: 10:02 WP#: 32 Lat: 30.085494 Long: -80.414333
Species: *Stenella frontalis* Numbers (Low/High/Best): 40/60/50
Features used in Species ID: White-tipped rostrum, light/dark dorsal banding, some animals heavily spotted
Representative images used for Species ID: 0520, 0521, 0531, 0535
Photographer: REH Frame Numbers: 0518 to 0539 Spacer: 0540
Calculated Distance from Track Line: 1.6 km

Final Time and Position of Sighting

Time: 10:06 WP#: 33 Lat: 30.085057 Long: -80.420573
Calculated Distance Traveled: 0.6 km

Behavior and Additional Comments

Two large sub-groups, rapid travel, groups merged somewhat while the plane circled.

Sunday, February 21, 2010 Sighting # 5

Initial Sighting on Track

Time: 10:22 WP#: 36 Lat: 30.099297 Long: -79.859953
Vertical Angle: 1 Horizontal Bearing in Degrees: 110 Sighting Cue: Body
On/Off Effort: On Track Line: 3 Beaufort Sea State: 1
Observer: RCH Observer Side: Left

Actual Time and Position of Sighting

Time: 10:23 WP#: 37 Lat: 30.104639 Long: -79.864820
Species: *Tursiops truncatus* Numbers (Low/High/Best): 20/30/26
Features used in Species ID: Broad flukes, short stubby rostrum, overall gray coloration with darker cape
Representative images used for Species ID: 0543, 0547, 0561
Photographer: REH Frame Numbers: 0541 to 0561 Spacer: 0562
Calculated Distance from Track Line: 0.8 km

Final Time and Position of Sighting

Time: 10:26 WP#: 38 Lat: 30.107189 Long: -79.859710
Calculated Distance Traveled: 0.6 km

Behavior and Additional Comments

Lots of fish were present in the area. Loose group of animals traveling slowly.

Sunday, February 21, 2010 Sighting # 6

Initial Sighting on Track

Time: 10:42 WP#: 44 Lat: 30.167341 Long: -80.154404
Vertical Angle: 1 Horizontal Bearing in Degrees: 80 Sighting Cue: Body
On/Off Effort: On Track Line: 4 Beaufort Sea State: 1
Observer: REH Observer Side: Right

Actual Time and Position of Sighting

Time: 10:43 WP#: 45 Lat: 30.168803 Long: -80.153954
Species: *Grampus griseus* Numbers (Low/High/Best): 7/7/7
Features used in Species ID: Blunt rostrum with cleft, some animals heavily scarred, tall dorsal fin
Representative images used for Species ID: 0573, 0574, 0576, 0578
Photographer: REH Frame Numbers: 0563 to 0578 Spacer: 0579
Calculated Distance from Track Line: 0.2 km

Final Time and Position of Sighting

Time: 10:48 WP#: 46 Lat: 30.182060 Long: -80.145738
Calculated Distance Traveled: 1.8 km

Behavior and Additional Comments

Tight group swimming leisurely.

Sunday, February 21, 2010 Sighting # 7

Initial Sighting on Track

Time: 10:59 WP#: 50 Lat: 30.166656 Long: -80.559801
Vertical Angle: 2 Horizontal Bearing in Degrees: 95 Sighting Cue: Body
On/Off Effort: On Track Line: 4 Beaufort Sea State: 1
Observer: REH Observer Side: Right

Actual Time and Position of Sighting

Time: 11:01 WP#: 51 Lat: 30.175268 Long: -80.557259
Species: *Tursiops truncatus* Numbers (Low/High/Best): 6/6/6
Features used in Species ID: Broad flukes, robust body, broad base dorsal fin, short, stubby rostrum with well defined crease at melon
Representative images used for Species ID: 0581, 0585, 0586, 0588, 0589
Photographer: REH Frame Numbers: 0580 to 0590 Spacer: 0591
Calculated Distance from Track Line: 1.0 km

Final Time and Position of Sighting

Time: 11:07 WP#: 52 Lat: 30.178033 Long: -80.550563
Calculated Distance Traveled: 0.7 km

Behavior and Additional Comments

Elusive, tight group. Diving deep.

Sunday, February 21, 2010 Sighting # 8

Initial Sighting on Track

Time: 11:16 WP#: 59 Lat: 30.234183 Long: -80.671958
Vertical Angle: 1 Horizontal Bearing in Degrees: 150 Sighting Cue: Body
On/Off Effort: On Track Line: 5 Beaufort Sea State: 1
Observer: REH Observer Side: Right

Actual Time and Position of Sighting

Time: 11:18 WP#: 60 Lat: 30.228045 Long: -80.672911
Species: *Tursiops truncatus* Numbers (Low/High/Best): 1/1/1
Features used in Species ID: Broad flukes, uniform gray coloration, darker cape with clean lines
Representative images used for Species ID: 0592, 0595, 0596, 0597
Photographer: REH Frame Numbers: 0592 to 0598 Spacer: 0599
Calculated Distance from Track Line: 0.7 km

Final Time and Position of Sighting

Time: 11:22 WP#: 61 Lat: 30.228885 Long: -80.676582
Calculated Distance Traveled: 0.4 km

Behavior and Additional Comments

Single elusive animal. Diving deep.

Sunday, February 21, 2010 Sighting # 9

Initial Sighting on Track

Time: 11:26 WP#: 64 Lat: 30.232520 Long: -80.555330
Vertical Angle: 1 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Track Line: 5 Beaufort Sea State: 1
Observer: RCH Observer Side: Left

Actual Time and Position of Sighting

Time: 11:27 WP#: 65 Lat: 30.237415 Long: -80.561136
Species: *Tursiops truncatus* Numbers (Low/High/Best): 2/3/3
Features used in Species ID: Broad flukes, broad based dorsal fin, robust body, short, stubby rostrum
Representative images used for Species ID: 0600, 0602, 0606-0609
Photographer: REH Frame Numbers: 0600 to 0611 Spacer: 0612
Calculated Distance from Track Line: 0.8 km

Final Time and Position of Sighting

Time: 11:32 WP#: 66 Lat: 30.235902 Long: -80.557079
Calculated Distance Traveled: 0.4 km

Behavior and Additional Comments

Loose group, widely spaced

Sunday, February 21, 2010 Sighting # 10

Initial Sighting on Track

Time: 11:34 WP#: 69 Lat: 30.232544 Long: -80.483504
Vertical Angle: 3 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Track Line: 5 Beaufort Sea State: 1
Observer: RCH Observer Side: Left

Actual Time and Position of Sighting

Time: 11:35 WP#: 70 Lat: 30.236873 Long: -80.491644
Species: *Tursiops truncatus* Numbers (Low/High/Best): 3/3/3
Features used in Species ID: Broad flukes, robust body, broad base dorsal fin, uniform gray coloration
Representative images used for Species ID: 0614, 0615, 0620
Photographer: REH Frame Numbers: 0613 to 0625 Spacer: 0626
Calculated Distance from Track Line: 0.9 km

Final Time and Position of Sighting

Time: 11:42 WP#: 71 Lat: 30.246719 Long: -80.493520
Calculated Distance Traveled: 1.1 km

Behavior and Additional Comments

Loosely grouped animals.

Sunday, February 21, 2010 Sighting # 11

Initial Sighting on Track

Time: 11:47 WP#: 76 Lat: 30.231106 Long: -80.349880
Vertical Angle: 3 Horizontal Bearing in Degrees: 110 Sighting Cue: Body
On/Off Effort: On Track Line: 5 Beaufort Sea State: 1
Observer: RCH Observer Side: Left

Actual Time and Position of Sighting

Time: 11:47 WP#: 77 Lat: 30.238243 Long: -80.348145
Species: *Stenella frontalis* Numbers (Low/High/Best): 6/7/7
Features used in Species ID: White-tipped rostrum, alternate light/dark dorsal banding, some animals heavily spotted
Representative images used for Species ID: 0628, 0632, 0634, 0640, 0642
Photographer: REH Frame Numbers: 0627-0645 Spacer: 646
Calculated Distance from Track Line: 0.3 km

Final Time and Position of Sighting

Time: 11:49 WP#: 78 Lat: 30.232268 Long: -80.347060
Calculated Distance Traveled: 0.7 km

Behavior and Additional Comments

Tight group

Sunday, February 21, 2010 Sighting # 12

Initial Sighting on Track

Time: 11:51 WP#: 79 Lat: 30.232149 Long: -80.287397
Vertical Angle: 2 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Track Line: 5 Beaufort Sea State: 1
Observer: RCH Observer Side: Left

Actual Time and Position of Sighting

Time: 11:52 WP#: 80 Lat: 30.236288 Long: -80.292178
Species: *Tursiops truncatus* Numbers (Low/High/Best): 8/8/8
Features used in Species ID: Broad flukes, robust bodies, uniform gray coloration with darker dorsal cape
Representative images used for Species ID:
Photographer: REH Frame Numbers: 0647-0666 Spacer: 0667
Calculated Distance from Track Line: 0.7 km

Final Time and Position of Sighting

Time: 11:54 WP#: 81 Lat: 30.235332 Long: -80.292371
Calculated Distance Traveled: 0.1 km

Behavior and Additional Comments

Elusive tight pod, deep diving, mother/calf pair observed

Sunday, February 21, 2010 Sighting # 13

Initial Sighting on Track

Time: 12:16 WP#: 86 Lat: 30.302437 Long: -80.011553
Vertical Angle: 3 Horizontal Bearing in Degrees: 120 Sighting Cue: Body
On/Off Effort: On Track Line: 6 Beaufort Sea State: 1
Observer: REH Observer Side: Right

Actual Time and Position of Sighting

Time: 12:16 WP#: 87 Lat: 30.303635 Long: -79.999596
Species: *Balaenoptera acutorostrata* Numbers (Low/High/Best): 1/1/1
Features used in Species ID: Sharply pointed head, vivid white bands on both pectoral flippers
Representative images used for Species ID: 0672, 0673
Photographer: REH Frame Numbers: 0668-0675 Spacer: 0676
Calculated Distance from Track Line: 1.1 km

Final Time and Position of Sighting

Time: 12:20 WP#: 88 Lat: 30.310825 Long: -79.996581
Calculated Distance Traveled: 0.9 km

Behavior and Additional Comments

Whale "hanging" just below surface

Sunday, February 21, 2010 Sighting # 14

Initial Sighting on Track

Time: 12:36 WP#: 92 Lat: 30.300264 Long: -80.467628
Vertical Angle: 4 Horizontal Bearing in Degrees: 120 Sighting Cue: Body
On/Off Effort: On Track Line: 6 Beaufort Sea State: 1
Observer: REH Observer Side: Right

Actual Time and Position of Sighting

Time: 12:37 WP#: 93 Lat: 30.307680 Long: -80.465500
Species: *Stenella frontalis* Numbers (Low/High/Best): 40/60/50
Features used in Species ID: White-tipped rostrum, alternate light/dark dorsal banding, some animals heavily spotted
Representative images used for Species ID:
Photographer: REH Frame Numbers: 0691-0702 Spacer: 0703
Calculated Distance from Track Line: 0.8 km

Final Time and Position of Sighting

Time: 12:39 WP#: 94 Lat: 30.304954 Long: -80.462959
Calculated Distance Traveled: 0.4 km

Behavior and Additional Comments

Tight group of 20 with numerous subgroups of 2-4 animals, several mother/calf pairs noted

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Sunday, February 21, 2010 Sighting # 15

Initial Sighting on Track

Time: 14:26 WP#: 104 Lat: 30.365291 Long: -80.611492
Vertical Angle: 3 Horizontal Bearing in Degrees: 120 Sighting Cue: Body
On/Off Effort: On Track Line: 7 Beaufort Sea State: 1
Observer: REH Observer Side: Right

Actual Time and Position of Sighting

Time: 14:26 WP#: 105 Lat: 30.350682 Long: -80.618624
Species: *Stenella frontalis* Numbers (Low/High/Best): 60/70/70
Features used in Species ID: Light/dark alternating dorsal banding, white-tipped rostrum, some animals heavily spotted
Representative images used for Species ID: 0714, 0717, 0718, 0719
Photographer: REH Frame Numbers: 0704-720 Spacer: 0721
Calculated Distance from Track Line: 1.7 km

Final Time and Position of Sighting

Time: 14:31 WP#: 106 Lat: 30.353518 Long: -80.620754
Calculated Distance Traveled: 0.4 km

Behavior and Additional Comments

Large pod of 30-40 with two smaller groups and several singletons, very active

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Sunday, February 21, 2010 Sighting # 16

Initial Sighting on Track

Time: 14:36 WP#: 109 Lat: 30.365422 Long: -80.458395
Vertical Angle: 3 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Track Line: 7 Beaufort Sea State: 1
Observer: RCH Observer Side: Left

Actual Time and Position of Sighting

Time: 14:36 WP#: 110 Lat: 30.370790 Long: -80.462578
Species: *Stenella frontalis* Numbers (Low/High/Best): 18/20/18
Features used in Species ID: Light/dark alternating dorsal banding, white-tipped rostrum, some animals heavily spotted
Representative images used for Species ID: 0726, 0729, 0730, 0733, 0734, 0736
Photographer: REH Frame Numbers: 0722-0736 Spacer: 0737
Calculated Distance from Track Line: 0.7 km

Final Time and Position of Sighting

Time: 14:39 WP#: 111 Lat: 30.375524 Long: -80.459766
Calculated Distance Traveled: 0.6 km

Behavior and Additional Comments

Moving rapidly

Sunday, February 21, 2010 Sighting # 17

Initial Sighting on Track

Time: 14:42 WP#: 113 Lat: 30.365357 Long: -80.390477
Vertical Angle: 1 Horizontal Bearing in Degrees: 75 Sighting Cue: Body
On/Off Effort: On Track Line: 7 Beaufort Sea State: 1
Observer: RCH Observer Side: Left

Actual Time and Position of Sighting

Time: 14:42 WP#: 114 Lat: 30.368036 Long: -80.389323
Species: *Stenella frontalis* Numbers (Low/High/Best): 13/50/50
Features used in Species ID: White-tipped rostrum, alternating light/dark dorsal banding, some animals heavily spotted
Representative images used for Species ID: 0745, 0746, 0747, 0748
Photographer: REH Frame Numbers: 0738-0762 Spacer: 0763
Calculated Distance from Track Line: 0.3 km

Final Time and Position of Sighting

Time: 14:47 WP#: 115 Lat: 30.365462 Long: -80.383327
Calculated Distance Traveled: 0.6 km

Behavior and Additional Comments

Large group of 20, two groups of 15 animals with several 1-2 animal outliers, Foraging behavior noted

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Sunday, February 21, 2010 Sighting # 18

Initial Sighting on Track

Time: 14:48 WP#: 117 Lat: 30.364417 Long: -80.367672
Vertical Angle: 2 Horizontal Bearing in Degrees: 120 Sighting Cue: Splash
On/Off Effort: On Track Line: 7 Beaufort Sea State: 1
Observer: REH Observer Side: Right

Actual Time and Position of Sighting

Time: 14:50 WP#: 118 Lat: 30.354268 Long: -80.344896
Species: *Tursiops truncatus* Numbers (Low/High/Best): 6/6/6
Features used in Species ID: Short rostrum with well defined crease at melon, broad flukes, robust bodies, uniform gray color with darker, sharply defined cape
Representative images used for Species ID: 0769, 0773, 0774
Photographer: REH Frame Numbers: 0764-0776 Spacer: 0777
Calculated Distance from Track Line: 2.5 km

Final Time and Position of Sighting

Time: 14:54 WP#: 119 Lat: 30.354235 Long: -80.339222
Calculated Distance Traveled: 0.5 km

Behavior and Additional Comments

Slow surface movement

Sunday, February 21, 2010 Sighting # 19

Initial Sighting on Track

Time: 15:06 WP#: 123 Lat: 30.364179 Long: -79.887461
Vertical Angle: 2 Horizontal Bearing in Degrees: 110 Sighting Cue: Body
On/Off Effort: On Track Line: 7 Beaufort Sea State: 1
Observer: RCH Observer Side: Left

Actual Time and Position of Sighting

Time: 15:10 WP#: 124 Lat: 30.364399 Long: -79.885563
Species: *Tursiops truncatus* Numbers (Low/High/Best): 3/3/3
Features used in Species ID: Short, stubby rostrum, broad flukes, robust body, light colored peduncle
Representative images used for Species ID: 0778, 0779, 0783, 0784, 0786
Photographer: REH Frame Numbers: 0778-0788 Spacer: 0789
Calculated Distance from Track Line: 0.2 km

Final Time and Position of Sighting

Time: 15:12 WP#: 125 Lat: 30.368331 Long: -79.894240
Calculated Distance Traveled: 0.9 km

Behavior and Additional Comments

Elusive

Sunday, February 21, 2010 Sighting # 20

Initial Sighting on Track

Time: 15:23 WP#: 129 Lat: 30.433631 Long: -80.030979
Vertical Angle: 1 Horizontal Bearing in Degrees: 120 Sighting Cue: Body
On/Off Effort: On Track Line: 8 Beaufort Sea State: 1
Observer: RCH Observer Side: Left

Actual Time and Position of Sighting

Time: 15:23 WP#: 130 Lat: 30.430170 Long: -80.025826
Species: *None* Numbers (Low/High/Best): 10/15/13
Features used in Species ID: Short, stubby rostrum, broad flukes, overall gray coloration, light coloration on dorsal part of caudal peduncle
Representative images used for Species ID: 0833, 0838, 0839, 0840
Photographer: REH Frame Numbers: 0790-0842 Spacer: 0843
Calculated Distance from Track Line: 0.6 km

Final Time and Position of Sighting

Time: 15:31 WP#: 131 Lat: 30.432907 Long: -80.027751
Calculated Distance Traveled: 0.4 km

Behavior and Additional Comments

Group of 7 or 8 animals with several 1-2 animal outliers

Sunday, February 21, 2010 Sighting # 21

Initial Sighting on Track

Time: 15:43 WP#: 137 Lat: 30.433545 Long: -80.455094
Vertical Angle: 2 Horizontal Bearing in Degrees: 75 Sighting Cue: Body
On/Off Effort: On Track Line: 8 Beaufort Sea State: 1
Observer: REH Observer Side: Right

Actual Time and Position of Sighting

Time: 15:43 WP#: 138 Lat: 30.440175 Long: -80.456014
Species: *Stenella frontalis* Numbers (Low/High/Best): 12/12/12
Features used in Species ID: White-tipped rostrum, dark cape w/ blaze terminating mid-dorsal, narrow peduncle, some animals heavily spotted
Representative images used for Species ID: 0847, 0852, 0854 - 0857
Photographer: REH Frame Numbers: 0844-0865 Spacer: 0866
Calculated Distance from Track Line: 0.7 km

Final Time and Position of Sighting

Time: 15:43 WP#: 139 Lat: 30.434356 Long: -80.456176
Calculated Distance Traveled: 0.6 km

Behavior and Additional Comments

Very tight group

Sunday, February 21, 2010 Sighting # 22

Initial Sighting on Track

Time: 16:03 WP#: 149 Lat: 30.499141 Long: -80.355864
Vertical Angle: 1 Horizontal Bearing in Degrees: 80 Sighting Cue: Body
On/Off Effort: On Track Line: 9 Beaufort Sea State: 1
Observer: REH Observer Side: Right

Actual Time and Position of Sighting

Time: 16:04 WP#: 150 Lat: 30.493992 Long: -80.358464
Species: *Stenella frontalis* Numbers (Low/High/Best): 22/35/30
Features used in Species ID: Alternate light/dark dorsal banding, white-tipped rostrum, some animals heavily spotted, narrow peduncle
Representative images used for Species ID: 0873, 0877, 0878, 0881, 0882, 0885
Photographer: REH Frame Numbers: 0867-0900 Spacer: 0901
Calculated Distance from Track Line: 0.6 km

Final Time and Position of Sighting

Time: 16:06 WP#: 151 Lat: 30.494698 Long: -80.355353
Calculated Distance Traveled: 0.3 km

Behavior and Additional Comments

Group of 15 animals travelling slowly at surface with a smaller group of 5 animals and several singletons

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Sunday, February 21, 2010 Sighting # 23

Initial Sighting on Track

Time: 16:35 WP#: 160 Lat: 30.567408 Long: -80.274241
Vertical Angle: 2 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Track Line: 10 Beaufort Sea State: 1
Observer: REH Observer Side: Right

Actual Time and Position of Sighting

Time: 16:36 WP#: 161 Lat: 30.572472 Long: -80.277572
Species: *Stenella frontalis* Numbers (Low/High/Best): 17/20/18
Features used in Species ID: Slender, white-tipped rostrum, narrow peduncle, alternate light/dark dorsal banding
Representative images used for Species ID: 906, 910 - 912, 915
Photographer: REH Frame Numbers: 0867-0900 Spacer: 0901
Calculated Distance from Track Line: 0.6 km

Final Time and Position of Sighting

Time: 16:38 WP#: 162 Lat: 30.566447 Long: -80.274396
Calculated Distance Traveled: 0.7 km

Behavior and Additional Comments

Tight group travelling quickly at surface with some surface activity noted

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Sunday, February 21, 2010 Sighting # 24

Initial Sighting on Track

Time: 16:48 WP#: 165 Lat: 30.566582 Long: -80.605385
Vertical Angle: 1 Horizontal Bearing in Degrees: 80 Sighting Cue: Body
On/Off Effort: On Track Line: 10 Beaufort Sea State: 1
Observer: REH Observer Side: Right

Actual Time and Position of Sighting

Time: 16:51 WP#: 166 Lat: 30.566559 Long: -80.608603
Species: *Stenella frontalis* Numbers (Low/High/Best): 10/20/18
Features used in Species ID: Slender, white-tipped rostrum, alternate light/dark banding, narrow peduncle, some animals heavily spotted
Representative images used for Species ID: 0936, 0946 - 0949
Photographer: REH Frame Numbers: 0927-0952 Spacer: 0953
Calculated Distance from Track Line: 0.3 km

Final Time and Position of Sighting

Time: 16:52 WP#: 167 Lat: 30.569156 Long: -80.605979
Calculated Distance Traveled: 0.4 km

Behavior and Additional Comments

One loose group of 12 animals with numerous outliers.

Saturday, March 20, 2010 Sighting # 1

Initial Sighting on Track

Time: 10:01 WP#: 16 Lat: 30.032158 Long: -80.429973
Vertical Angle: 1 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Track Line: 2 Beaufort Sea State: 2
Observer: RCH Observer Side: Left

Actual Time and Position of Sighting

Time: 10:02 WP#: 17 Lat: 30.028323 Long: -80.425266
Species: *Stenella frontalis* Numbers (Low/High/Best): 6/7/7
Features used in Species ID: White tipped rostrum, Dark and light banding on dorsal surface, Visible spotting pattern
Representative images used for Species ID: 0997,0999,1004,1007
Photographer: HJF Frame Numbers: 0995-1007 Spacer: 1008
Calculated Distance from Track Line: 0.6 km

Final Time and Position of Sighting

Time: 10:04 WP#: 18 Lat: 30.034822 Long: -80.428173
Calculated Distance Traveled: 0.8 km

Behavior and Additional Comments

Travelling at surface, tight group

Saturday, March 20, 2010 Sighting # 2

Initial Sighting on Track

Time: 10:06 WP#: 21 Lat: 30.031966 Long: -80.506810
Vertical Angle: 2 Horizontal Bearing in Degrees: 110 Sighting Cue: Body
On/Off Effort: On Track Line: 2 Beaufort Sea State: 2
Observer: HJF Observer Side: Right

Actual Time and Position of Sighting

Time: 10:08 WP#: 22 Lat: 30.036836 Long: -80.502131
Species: *Stenella frontalis* Numbers (Low/High/Best): 4/4/4/
Features used in Species ID: White tipped rostrum, Dark and light banding on dorsal surface, Visible spotting pattern
Representative images used for Species ID: 1009,1013,1015
Photographer: HJF Frame Numbers: 1009-1016 Spacer: 1017
Calculated Distance from Track Line: 0.7 km

Final Time and Position of Sighting

Time: 10:14 WP#: 23 Lat: 30.039551 Long: -80.503568
Calculated Distance Traveled: 0.3 km

Behavior and Additional Comments

Two groups of two animals travelling at surface

Saturday, March 20, 2010 Sighting # 3

Initial Sighting on Track

Time: 10:19 WP#: 25 Lat: 30.031790 Long: -80.700264
Vertical Angle: 4 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Track Line: 2 Beaufort Sea State: 2
Observer: HJF Observer Side: Right

Actual Time and Position of Sighting

Time: 10:20 WP#: 26 Lat: 30.047163 Long: -80.697271
Species: *Eubalaena glacialis* Numbers (Low/High/Best): 2/2/2
Features used in Species ID: Large black cetacean, No dorsal fin observed, Large paddle-like flipper, Visible callosities observed
Representative images used for Species ID: 1086,1210,1273,1306
Photographer: HJF Frame Numbers: 1018-1415 Spacer: 1416
Calculated Distance from Track Line: 1.7 km

Final Time and Position of Sighting

Time: 11:06 WP#: 28 Lat: 30.049637 Long: -80.705735
Calculated Distance Traveled: 0.9 km

Behavior and Additional Comments

Animal was observed at surface travelling slowly. During encounter animal gave birth.

Tuesday, April 20, 2010 Sighting # 4

Initial Sighting on Track

Time: 13:00 WP#: 38 Lat: 30.100191 Long: -80.365508
Vertical Angle: 2 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Track Line: 3 Beaufort Sea State: 1
Observer: RCH Observer Side: Left

Actual Time and Position of Sighting

Time: 13:01 WP#: 39 Lat: 30.099889 Long: -80.367558
Species: *Tursiops truncatus* Numbers (Low/High/Best): 2/3/2
Features used in Species ID: Robust body with overall gray coloration, Short rostrum with visible crease at melon, Broad flukes
Representative images used for Species ID: 8498,8499,8504,8508,8509
Photographer: HJF Frame Numbers: 8491-8510 Spacer: 8511
Calculated Distance from Track Line: 0.2 km

Final Time and Position of Sighting

Time: _____ WP#: 40 Lat: 30.100018 Long: -80.371707
Calculated Distance Traveled: 0.4 km

Behavior and Additional Comments

Very slow travel at surface, somewhat elusive

Saturday, March 20, 2010 Sighting # 5

Initial Sighting on Track

Time: 13:08 WP#: 42 Lat: 30.100229 Long: -80.343489
Vertical Angle: 1 Horizontal Bearing in Degrees: 110 Sighting Cue: Body
On/Off Effort: On Track Line: 3 Beaufort Sea State: 1
Observer: RCH Observer Side: Left

Actual Time and Position of Sighting

Time: 13:10 WP#: 43 Lat: 30.100872 Long: -80.336616
Species: *Stenella frontalis* Numbers (Low/High/Best): 29/31/29
Features used in Species ID: Visible spotting pattern, Dark and light banding pattern on dorsal surface, Light rostrum
Representative images used for Species ID: 8519,8520,8525,8526
Photographer: HJF Frame Numbers: 8512-8532 Spacer: 8533
Calculated Distance from Track Line: 0.7 km

Final Time and Position of Sighting

Time: 13:12 WP#: 44 Lat: 30.099451 Long: -80.324375
Calculated Distance Traveled: 1.2 km

Behavior and Additional Comments

One main group with two smaller groups

Saturday, March 20, 2010 Sighting # 6

Initial Sighting on Track

Time: 13:40 WP#: 52 Lat: 30.166452 Long: -80.330322
Vertical Angle: 2 Horizontal Bearing in Degrees: 130 Sighting Cue: Body
On/Off Effort: On Track Line: 4 Beaufort Sea State: 2
Observer: HJF Observer Side: Right

Actual Time and Position of Sighting

Time: N/A WP#: N/A Lat: N/A Long: N/A
Species: *None* Numbers (Low/High/Best):
Features used in Species ID: No photos taken
Representative images used for Species ID: N/A
Photographer: N/A Frame Numbers: N/A Spacer: N/A
Calculated Distance from Track Line: N/A

Final Time and Position of Sighting

Time: N/A WP#: N/A Lat: N/A Long: N/A
Calculated Distance Traveled: N/A

Behavior and Additional Comments

Animals never aquired

Saturday, March 20, 2010 Sighting # 7

Initial Sighting on Track

Time: 13:49 WP#: 54 Lat: 30.166525 Long: -80.514394
Vertical Angle: 2 Horizontal Bearing in Degrees: 110 Sighting Cue: Body
On/Off Effort: On Track Line: 4 Beaufort Sea State: 2
Observer: HJF Observer Side: Right

Actual Time and Position of Sighting

Time: 13:49 WP#: 55 Lat: 30.174741 Long: -80.512669
Species: *Unidentified Delphinid* Numbers (Low/High/Best): 2/2/2
Features used in Species ID: Unable to identify to species with images obtained

Representative images used for Species ID: 8534,8535,8536
Photographer: HJF Frame Numbers: 8534-8538 Spacer: 8539
Calculated Distance from Track Line: 0.9 km

Final Time and Position of Sighting

Time: 13:56 WP#: 56 Lat: 30.176956 Long: -80.509506
Calculated Distance Traveled: 0.4 km

Behavior and Additional Comments

Deep diving and elusive

Saturday, March 20, 2010 Sighting # 8

Initial Sighting on Track

Time: 14:13 WP#: 66 Lat: 30.232665 Long: -80.273324
Vertical Angle: 3 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Track Line: 5 Beaufort Sea State: 2
Observer: HJF Observer Side: Right

Actual Time and Position of Sighting

Time: 14:14 WP#: 67 Lat: 30.232452 Long: -80.270676
Species: *Stenella frontalis* Numbers (Low/High/Best): 34/40/34
Features used in Species ID: White rostrum tip, Dark and light banding pattern on dorsal surface, Visible spotting pattern

Representative images used for Species ID: 8556,8557,8560,8562
Photographer: HJF Frame Numbers: 8540-8565 Spacer: 8566
Calculated Distance from Track Line: 0.3 km

Final Time and Position of Sighting

Time: 14:15 WP#: 68 Lat: 30.229928 Long: -80.267443
Calculated Distance Traveled: 0.4 km

Behavior and Additional Comments

Two large groups

Saturday, March 20, 2010 Sighting # 9

Initial Sighting on Track

Time: 14:40 WP#: 77 Lat: 30.300645 Long: -80.251263
Vertical Angle: 2 Horizontal Bearing in Degrees: 145 Sighting Cue: Body
On/Off Effort: On Track Line: 6 Beaufort Sea State: 2
Observer: RCH Observer Side: Left

Actual Time and Position of Sighting

Time: 14:41 WP#: 78 Lat: 30.292360 Long: -80.240354
Species: *Stenella frontalis* Numbers (Low/High/Best): 19/22/19
Features used in Species ID: Visible spotting pattern, White tipped rostrum, Flank blaze below dorsal fin, Dark and light banding pattern on dorsal surface
Representative images used for Species ID: 8567,8569,8572,8583
Photographer: HJF Frame Numbers: 8567-8584 Spacer: 8585
Calculated Distance from Track Line: 1.4 km

Final Time and Position of Sighting

Time: 14:43 WP#: 79 Lat: 30.296899 Long: -80.243474
Calculated Distance Traveled: 0.6 km

Behavior and Additional Comments

One large group travelling quickly at surface

Saturday, March 20, 2010 Sighting # 10

Initial Sighting on Track

Time: 14:47 WP#: 81 Lat: 30.300432 Long: -80.397569
Vertical Angle: 2 Horizontal Bearing in Degrees: 110 Sighting Cue: Body
On/Off Effort: On Track Line: 6 Beaufort Sea State: 2
Observer: HJF Observer Side: Right

Actual Time and Position of Sighting

Time: 14:48 WP#: 82 Lat: 30.308002 Long: -80.395258
Species: *Unidentified Delphinid* Numbers (Low/High/Best): 3/3/3
Features used in Species ID: Unable to identify to species with images obtained
Representative images used for Species ID: 8586,8589
Photographer: HJF Frame Numbers: 8586-8599 Spacer: 8600
Calculated Distance from Track Line: 0.9 km

Final Time and Position of Sighting

Time: 14:53 WP#: 83 Lat: 30.311724 Long: -80.391741
Calculated Distance Traveled: 0.5 km

Behavior and Additional Comments

Tight group travelling at surface, elusive and deep diving

Saturday, March 20, 2010 Sighting # 11

Initial Sighting on Track

Time: 15:10 WP#: 94 Lat: 30.365365 Long: -80.437196
Vertical Angle: 3 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Track Line: 7 Beaufort Sea State: 2
Observer: HJF Observer Side: Right

Actual Time and Position of Sighting

Time: 15:10 WP#: 95 Lat: 30.362502 Long: -80.432803
Species: *Stenella frontalis* Numbers (Low/High/Best): 13/22/20
Features used in Species ID: White tipped rostrum, Visible banding pattern on dorsal surface, Visible spotting pattern
Representative images used for Species ID: 8601.8602,8603,8604
Photographer: HJF Frame Numbers: 8601-8605 Spacer: 8606
Calculated Distance from Track Line: 0.5 km

Final Time and Position of Sighting

Time: 15:11 WP#: 96 Lat: 30.366401 Long: -80.434135
Calculated Distance Traveled: 0.5 km

Behavior and Additional Comments

Saturday, March 20, 2010 Sighting # 12

Initial Sighting on Track

Time: 15:15 WP#: 100 Lat: 30.365659 Long: -80.257279
Vertical Angle: 2 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Track Line: 7 Beaufort Sea State: 2
Observer: Rch Observer Side: Left

Actual Time and Position of Sighting

Time: 15:16 WP#: 101 Lat: 30.367844 Long: -80.264885
Species: *Unidentified Delphinid* Numbers (Low/High/Best): 4/5/4
Features used in Species ID: Unable to identify to species with images obtained
Representative images used for Species ID: 8610
Photographer: HJF Frame Numbers: 8607-8612 Spacer: 8613
Calculated Distance from Track Line: 0.8 km

Final Time and Position of Sighting

Time: 15:20 WP#: 102 Lat: 30.372629 Long: -80.265724
Calculated Distance Traveled: 0.5 km

Behavior and Additional Comments

Elusive and spread out, two groups

Saturday, March 20, 2010 Sighting # 13

Initial Sighting on Track

Time: 15:32 WP#: 107 Lat: 30.365482 Long: -79.906029
Vertical Angle: 2 Horizontal Bearing in Degrees: 110 Sighting Cue: Body
On/Off Effort: On Track Line: 7 Beaufort Sea State: 3
Observer: HJF Observer Side: Right

Actual Time and Position of Sighting

Time: 15:33 WP#: 108 Lat: 30.361425 Long: -79.911819
Species: *Grampus griseus* Numbers (Low/High/Best): 3/6/6
Features used in Species ID: Large head with no visible rostrum, Visible cleft in melon
Representative images used for Species ID: 8617,8618,8619
Photographer: HJF Frame Numbers: 8614-8621 Spacer: 8622
Calculated Distance from Track Line: 0.7 km

Final Time and Position of Sighting

Time: 15:38 WP#: 109 Lat: 30.365566 Long: -79.913909
Calculated Distance Traveled: 0.5 km

Behavior and Additional Comments

Calves present

Saturday, March 20, 2010 Sighting # 14

Initial Sighting on Track

Time: 15:53 WP#: 115 Lat: 30.433849 Long: -80.278499
Vertical Angle: 2 Horizontal Bearing in Degrees: 120 Sighting Cue: Body
On/Off Effort: On Track Line: 8 Beaufort Sea State: 2
Observer: RCH Observer Side: Left

Actual Time and Position of Sighting

Time: 15:55 WP#: 116 Lat: 30.434805 Long: -80.269575
Species: *Stenella frontalis* Numbers (Low/High/Best): 21/21/21
Features used in Species ID: Visible spotting pattern, Banding pattern on dorsal surface, White tipped rostrum
Representative images used for Species ID: 8629,8638
Photographer: HJF Frame Numbers: 8623-8638 Spacer: 8639
Calculated Distance from Track Line: 0.9 km

Final Time and Position of Sighting

Time: 15:55 WP#: 117 Lat: 30.435032 Long: -80.266839
Calculated Distance Traveled: 0.3 km

Behavior and Additional Comments

One large group with smaller group, calves present

Saturday, March 20, 2010 Sighting # 15

Initial Sighting on Track

Time: 15:58 WP#: 119 Lat: 30.433805 Long: -80.373572
Vertical Angle: 1 Horizontal Bearing in Degrees: 110 Sighting Cue: Body
On/Off Effort: On Track Line: 8 Beaufort Sea State: 2
Observer: HJF Observer Side: Right

Actual Time and Position of Sighting

Time: 15:59 WP#: 120 Lat: 30.442233 Long: -80.378832
Species: *Stenella frontalis* Numbers (Low/High/Best): 2/3/2
Features used in Species ID: White tipped rostrum, Visible blaze below dorsal fin, Visible spotting pattern, Banding along dorsal surface
Representative images used for Species ID: 8642,8647,8662,8663
Photographer: HJF Frame Numbers: 8640-8663 Spacer: 8664
Calculated Distance from Track Line: 1.1 km

Final Time and Position of Sighting

Time: 16:02 WP#: 121 Lat: 30.436685 Long: -80.364039
Calculated Distance Traveled: 1.6 km

Behavior and Additional Comments

Group of two with a singleton, somewhat elusive

Saturday, March 20, 2010 Sighting # 16

Initial Sighting on Track

Time: 16:10 WP#: 128 Lat: 30.433815 Long: -80.678146
Vertical Angle: 3 Horizontal Bearing in Degrees: 45 Sighting Cue: Body
On/Off Effort: On Track Line: 8 Beaufort Sea State: 2
Observer: RCH Observer Side: Left

Actual Time and Position of Sighting

Time: 16:11 WP#: 129 Lat: 30.428521 Long: -80.677282
Species: *Eubalaena glacialis* Numbers (Low/High/Best): 1/1/1
Features used in Species ID: No dorsal fin visible, Callosities visible on head, Large black cetacean with paddle like flippers
Representative images used for Species ID: 8667,8668,8674
Photographer: HJF Frame Numbers: 8665-8683 Spacer: 8684
Calculated Distance from Track Line: 0.6 km

Final Time and Position of Sighting

Time: 16:28 WP#: 130 Lat: 30.436285 Long: -80.665533
Calculated Distance Traveled: 1.4 km

Behavior and Additional Comments

Single animal travelling at surface

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24 March 2010 Sighting # 1

Initial Sighting on Track

Time: 10:11 WP#: 22 Lat: 30.434226 Long: -80.377119
Vertical Angle: 2 Horizontal Bearing in Degrees: 120 Sighting Cue: Body
On/Off Effort: On Track Line: 8 Beaufort Sea State: 2
Observer: RCH Observer Side: Right

Actual Time and Position of Sighting

Time: 10:16 WP#: 23 Lat: 30.431388 Long: -80.386431
Species: *Stenella frontalis* Numbers (Low/High/Best): 8/12/10
Features used in Species ID: Alternate light/dark banding from above, dark cape w/ blaze terminating mid-dorsal, white-tipped beak, some animals heavily spotted
Representative images used for Species ID: 8711, 8712, 8715, 8720, 8724
Photographer: RCH Frame Numbers: 8686 - 8724 Spacer: 8725
Calculated Distance from Track Line: 0.9 km

Final Time and Position of Sighting

Time: 10:23 WP#: 24 Lat: 30.435645 Long: -80.393807
Calculated Distance Traveled: 1.7 km

Behavior and Additional Comments

Tightly grouped; swimming quickly at surface. One single away from the group.

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24 March 2010 Sighting # 2

Initial Sighting on Track

Time: 10:33 WP#: 31 Lat: 30.433920 Long: -80.037715
Vertical Angle: 2 Horizontal Bearing in Degrees: 140 Sighting Cue: Body
On/Off Effort: On Track Line: 8 Beaufort Sea State: 2
Observer: RCH Observer Side: Right

Actual Time and Position of Sighting

Time: 10:36 WP#: 32 Lat: 30.429088 Long: -80.037463
Species: *Grampus griseus* Numbers (Low/High/Best): 2/2/2
Features used in Species ID: Variable dark and light gray coloration, blunt melon, tall dorsal fin, broad flukes
Representative images used for Species ID: 8726, 8727
Photographer: RCH Frame Numbers: 8726-8730 Spacer: 8731
Calculated Distance from Track Line: 0.5 km

Final Time and Position of Sighting

Time: 10:49 WP#: 34 Lat: 30.433398 Long: -80.035460
Calculated Distance Traveled: 0.5 km

Behavior and Additional Comments

Spread out, not elusive but hard to keep with glare. Very few photos.

24 March 2010 Sighting # 3

Initial Sighting on Track

Time: 11:13 WP#: 39 Lat: 30.365240 Long: -80.293025
Vertical Angle: 1 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Track Line: 7 Beaufort Sea State: 1
Observer: REH Observer Side: Left

Actual Time and Position of Sighting

Time: 11:14 WP#: 40 Lat: 30.362014 Long: -80.294141
Species: *Stenella frontalis* Numbers (Low/High/Best): 9/11/10
Features used in Species ID: White-tipped rostrum, dark cape with blaze terminating mid-dorsal, some animals heavily spotted
Representative images used for Species ID: 8734-35, 8746-47, 8744, 8741, 8775-76
Photographer: RCH Frame Numbers: 8732-8779 Spacer: 8780
Calculated Distance from Track Line: 0.4 km

Final Time and Position of Sighting

Time: 11:19 WP#: 41 Lat: 30.358830 Long: -80.292275
Calculated Distance Traveled: 0.4 km

Behavior and Additional Comments

Tight group, surfacing frequently, mom/calf pair (at least one) split away from the group.

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24 March 2010 Sighting # 4

Initial Sighting on Track

Time: 11:23 WP#: 43 Lat: 30.365268 Long: -80.461788
Vertical Angle: 3 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Track Line: 7 Beaufort Sea State: 1
Observer: RCH Observer Side: Right

Actual Time and Position of Sighting

Time: 11:25 WP#: 44 Lat: 30.370039 Long: -80.461945
Species: *Stenella frontalis* Numbers (Low/High/Best): 5/7/7
Features used in Species ID: White-tipped rostrum, dark cape with blaze terminating mid-dorsal, some animals heavily spotted
Representative images used for Species ID: 8798-8801, 8804,8807, 8809, 8817-20
Photographer: RCH Frame Numbers: 8781-8820 Spacer: 8821
Calculated Distance from Track Line: 0.5 km

Final Time and Position of Sighting

Time: 11:31 WP#: 45 Lat: 30.370116 Long: -80.460610
Calculated Distance Traveled: 0.1 km

Behavior and Additional Comments

One group of 3, two groups of 2

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24 March 2010 Sighting # 5

Initial Sighting on Track

Time: 11:42 WP#: 50 Lat: 30.300304 Long: -80.649542
Vertical Angle: 3 Horizontal Bearing in Degrees: 95 Sighting Cue: Body
On/Off Effort: On Track Line: 6 Beaufort Sea State: 1
Observer: REH Observer Side: Left

Actual Time and Position of Sighting

Time: 11:49 WP#: 51 Lat: 30.302538 Long: -80.655800
Species: *Unidentified Delphinid* Numbers (Low/High/Best): 3/3/3
Features used in Species ID: N/A

Representative images used for Species ID: No photos
Photographer: RCH Frame Numbers: No photos Spacer: No photos
Calculated Distance from Track Line: 0.7 km

Final Time and Position of Sighting

Time: 11:54 WP#: 52 Lat: 30.300817 Long: -80.647341
Calculated Distance Traveled: 0.8 km est

Behavior and Additional Comments

Mom/calf pair. Elusive, no photos, surfaced rarely. Note: final time and position is the best estimate, not actual (2.41).

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24 March 2010 Sighting # 6

Initial Sighting on Track

Time: 12:10 WP#: 56 Lat: 30.300709 Long: -80.113288
Vertical Angle: 2 Horizontal Bearing in Degrees: 80 Sighting Cue: Body
On/Off Effort: On Track Line: 6 Beaufort Sea State: 1
Observer: REH Observer Side: Left

Actual Time and Position of Sighting

Time: 12:11 WP#: 57 Lat: 30.302457 Long: -80.113317
Species: *Grampus griseus* Numbers (Low/High/Best): 7/9/9
Features used in Species ID: Blunt melon with cleft, variable dark/light gray coloration, tall dorsal fin, wide flukes, extensive scarring on some individuals
Representative images used for Species ID: 8848-50, 8854-55, 8858
Photographer: RCH Frame Numbers: 8822-8872 Spacer: 8873
Calculated Distance from Track Line: 0.2 km

Final Time and Position of Sighting

Time: 12:14 WP#: 58 Lat: 30.303329 Long: -80.113967
Calculated Distance Traveled: 0.1

Behavior and Additional Comments

Grouped together, mother/calf pair- calf is almost all black

Wednesday, March 24, 2010 Sighting # 7

Initial Sighting on Track

Time: 12:17 WP#: 61 Lat: 30.300631 Long: -80.026045
Vertical Angle: 2 Horizontal Bearing in Degrees: 100 Sighting Cue: Body
On/Off Effort: On Track Line: 6 Beaufort Sea State: 2
Observer: REH Observer Side: Left

Actual Time and Position of Sighting

Time: 12:18 WP#: 62 Lat: 30.304547 Long: -80.030007
Species: *Unidentified Delphinid* Numbers (Low/High/Best): 2/2/2
Features used in Species ID:

Representative images used for Species ID: No photos
Photographer: RCH Frame Numbers: No photos Spacer: No photos
Calculated Distance from Track Line: 0.6 km

Final Time and Position of Sighting

Time: 12:23 WP#: 63 Lat: 30.301248 Long: -80.027332
Calculated Distance Traveled: 0.4 km est

Behavior and Additional Comments

Animals were very elusive, only sighted a few times in persistent glare, surfaced infrequently.
No photos.

Wednesday, March 31, 2010 Sighting # 1

Initial Sighting on Track

Time: 14:07 WP#: 12 Lat: 30.032243 Long: -80.325486
Vertical Angle: 2 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Track Line: 2 Beaufort Sea State: 3
Observer: PBN Observer Side: Right

Actual Time and Position of Sighting

Time: 14:08 WP#: 11 Lat: 30.032377 Long: -80.325045
Species: *Stenella frontalis* Numbers (Low/High/Best): 16/20/18
Features used in Species ID: visible spotting pattern, long, white-tipped rostrum, small fluke

Representative images used for Species ID: 8894, 8895, 8924
Photographer: PBN Frame Numbers: 8874 - 8936 Spacer: 8937
Calculated Distance from Track Line: 0.04 km

Final Time and Position of Sighting

Time: 14:15 WP#: 12 Lat: 30.027919 Long: -80.317858
Calculated Distance Traveled: 0.85 km

Behavior and Additional Comments

Two distinct groups: one with approx. 10 individuals and one with about 8. Slow subsurface travel and at least one mother/calf pair was observed.

Wednesday, March 31, 2010 Sighting # 2

Initial Sighting on Track

Time: 14:29 WP#: 18 Lat: 30.093329 Long: -80.672633
Vertical Angle: 2 Horizontal Bearing in Degrees: 110 Sighting Cue: Body
On/Off Effort: On Track Line: 3 Beaufort Sea State: 2
Observer: HJF Observer Side: Left

Actual Time and Position of Sighting

Time: 14:30 WP#: 19 Lat: 30.099076 Long: -80.680099
Species: *Tursiops truncatus* Numbers (Low/High/Best): 4/6/5
Features used in Species ID: broad dorsal flukes, overall grey coloration, short rostrum,

Representative images used for Species ID: 8969, 8970, 9028, 9030
Photographer: PBN Frame Numbers: 8938 - 9031 Spacer: 9032
Calculated Distance from Track Line: 0.96 km

Final Time and Position of Sighting

Time: 14:33 WP#: 20 Lat: 30.097612 Long: -80.680876
Calculated Distance Traveled: 0.18 km

Behavior and Additional Comments

Several individuals widely spaced out over a large area. Possible feeding observed.

Wednesday, March 31, 2010 Sighting # 3

Initial Sighting on Track

Time: 14:44 WP#: 25 Lat: 30.100282 Long: -80.310850
Vertical Angle: 2 Horizontal Bearing in Degrees: 110 Sighting Cue: Body
On/Off Effort: On Track Line: 3 Beaufort Sea State: 2
Observer: HJF Observer Side: Left

Actual Time and Position of Sighting

Time: 14:50 WP#: 26 Lat: 30.106320 Long: -80.313623
Species: *Unidentified Delphinid* Numbers (Low/High/Best): n/a
Features used in Species ID: n/a

Representative images used for Species ID: n/a
Photographer: n/a Frame Numbers: n/a Spacer: n/a
Calculated Distance from Track Line: n/a

Final Time and Position of Sighting

Time: n/a WP#: n/a Lat: n/a Long: n/a
Calculated Distance Traveled: n/a

Behavior and Additional Comments

2.41 taken for presumed location - animals were never relocated

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Wednesday, March 31, 2010 Sighting # 4

Initial Sighting on Track

Time: 15:25 WP#: 27 Lat: 30.166595 Long: -80.453439
Vertical Angle: 2 Horizontal Bearing in Degrees: 120 Sighting Cue: Body
On/Off Effort: On Track Line: 4 Beaufort Sea State: 2
Observer: PBN Observer Side: Right

Actual Time and Position of Sighting

Time: 15:26 WP#: 33 Lat: 30.169487 Long: -80.458317
Species: *Stenella frontalis* Numbers (Low/High/Best): 2/2/2
Features used in Species ID: long, white-tipped rostrum with visible spotting pattern

Representative images used for Species ID: 9060, 9061,
Photographer: PBN Frame Numbers: 9057 - 9068 Spacer: 9069
Calculated Distance from Track Line: 0.57 km

Final Time and Position of Sighting

Time: 15:29 WP#: 34 Lat: 30.170463 Long: -80.457100
Calculated Distance Traveled: 0.16 km

Behavior and Additional Comments

Somewhat evasive individuals which were difficult to relocated and photograph.
Dolphins spend very little time at the surface of the water.

Wednesday, March 31, 2010 Sighting # 5

Initial Sighting on Track

Time: 15:32 WP#: 38 Lat: 30.166349 Long: -80.541524
Vertical Angle: 3 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Track Line: 4 Beaufort Sea State: 2
Observer: PBN Observer Side: Right

Actual Time and Position of Sighting

Time: 15:36 WP#: 39 Lat: 30.171467 Long: -80.540148
Species: *Stenella frontalis* Numbers (Low/High/Best): 2/2/2
Features used in Species ID: long white-tipped rostrum, visible spotting pattern, alternating pattern of light and dark coloration.
Representative images used for Species ID: 9082 - 9084
Photographer: PBN Frame Numbers: 9070 - 9089 Spacer: 9090
Calculated Distance from Track Line: 0.58 km

Final Time and Position of Sighting

Time: 15:36 WP#: 40 Lat: 30.174907 Long: -80.535907
Calculated Distance Traveled: 0.56 km

Behavior and Additional Comments

Quick sighting in which little to no behavior was observed

Wednesday, March 31, 2010 Sighting # 6

Initial Sighting on Track

Time: 15:59 WP#: 48 Lat: 30.499367 Long: -80.365051
Vertical Angle: 2 Horizontal Bearing in Degrees: 110 Sighting Cue: Body
On/Off Effort: On Track Line: 9 Beaufort Sea State: 2
Observer: HJF Observer Side: Left

Actual Time and Position of Sighting

Time: 16:02 WP#: 49 Lat: 30.502046 Long: -80.372564
Species: *Tursiops truncatus* Numbers (Low/High/Best): 1/1/1
Features used in Species ID: short, stubby rostrum, overall grey coloration and broad dorsal flukes
Representative images used for Species ID: 9101 - 9104
Photographer: PBN Frame Numbers: 9091 - 9107 Spacer: 9108
Calculated Distance from Track Line: 0.78 km

Final Time and Position of Sighting

Time: 16:03 WP#: 50 Lat: 30.503715 Long: -80.375254
Calculated Distance Traveled: 0.32 km

Behavior and Additional Comments

Single individual

Wednesday, March 31, 2010 Sighting # 7

Initial Sighting on Track

Time: 16:04 WP#: 52 Lat: 30.498666 Long: -80.331542
Vertical Angle: 3 Horizontal Bearing in Degrees: 140 Sighting Cue: Body
On/Off Effort: On Track Line: 9 Beaufort Sea State: 2
Observer: HJF Observer Side: Left

Actual Time and Position of Sighting

Time: 16:06 WP#: 53 Lat: 30.502116 Long: -80.340091
Species: *Stenella frontalis* Numbers (Low/High/Best): 60/100/80
Features used in Species ID: alternating light and dark banding, long, white-tipped rostrum, visible spotting patterns
Representative images used for Species ID: 9117, 9118, 9124, 9126 - 9128, 9139
Photographer: PBN Frame Numbers: 9109 - 9041 Spacer: 9142
Calculated Distance from Track Line: 0.90 km

Final Time and Position of Sighting

Time: 16:07 WP#: 54 Lat: 30.501800 Long: -80.340231
Calculated Distance Traveled: 0.04 km

Behavior and Additional Comments

Three very large groups with juveniles present.

Wednesday, March 31, 2010 Sighting # 8

Initial Sighting on Track

Time: 16:08 WP#: 56 Lat: 30.499312 Long: -80.289172
Vertical Angle: 1 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Track Line: 9 Beaufort Sea State: 2
Observer: HJF Observer Side: Left

Actual Time and Position of Sighting

Time: 16:09 WP#: 57 Lat: 30.503607 Long: -80.291330
Species: *Tursiops truncatus* Numbers (Low/High/Best): 1/1/1
Features used in Species ID: short, stubby rostrum, broad flukes and overall slate grey coloration
Representative images used for Species ID: 9158 - 9161
Photographer: PBN Frame Numbers: 9143 - 9166 Spacer: 9167
Calculated Distance from Track Line: 0.52 km

Final Time and Position of Sighting

Time: 16:15 WP#: 59 Lat: 30.504148 Long: -80.296535
Calculated Distance Traveled: 0.50 km

Behavior and Additional Comments

Lone individual observed essentially on trackline. Very little time was spent at the surface of the water, but lots of subsurface traveling observed.

Wednesday, March 31, 2010 Sighting # 9

Initial Sighting on Track

Time: 16:19 WP#: 61 Lat: 30.499413 Long: -80.144164
Vertical Angle: 2 Horizontal Bearing in Degrees: 100 Sighting Cue: Body
On/Off Effort: On Track Line: 9 Beaufort Sea State: 2
Observer: HJF Observer Side: Left

Actual Time and Position of Sighting

Time: 16:21 WP#: 62 Lat: 30.500793 Long: -80.151141
Species: *Tursiops truncatus* Numbers (Low/High/Best): 2/2/2
Features used in Species ID: wide flukes, short rostrum with defined crease between melon, grey coloration
Representative images used for Species ID: 9169, 9199, 9200, 9202
Photographer: PBN Frame Numbers: 9168 - 9206 Spacer: 9207
Calculated Distance from Track Line: 0.69 km

Final Time and Position of Sighting

Time: 16:21 WP#: 63 Lat: 30.504673 Long: -80.148242
Calculated Distance Traveled: 0.51 km

Behavior and Additional Comments

Wednesday, March 31, 2010 Sighting # 10

Initial Sighting on Track

Time: 16:27 WP#: 65 Lat: 30.498996 Long: -79.891956
Vertical Angle: 1 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Track Line: 9 Beaufort Sea State: 2
Observer: HJF Observer Side: Left

Actual Time and Position of Sighting

Time: 16:29 WP#: 66 Lat: 30.504652 Long: -79.895241
Species: *Tursiops truncatus* Numbers (Low/High/Best): 10/10/10
Features used in Species ID: robust body, broad flukes, dark grey cape over light grey coloration, short rostrum
Representative images used for Species ID: 9218 - 9220, 9225 - 9230
Photographer: PBN Frame Numbers: 9208 - 9232 Spacer: n/a
Calculated Distance from Track Line: 0.70 km

Final Time and Position of Sighting

Time: 16:32 WP#: 67 Lat: 30.505887 Long: -79.896958
Calculated Distance Traveled: 0.21 km

Behavior and Additional Comments

One tightly packed group.

Wednesday, March 31, 2010 Sighting # 11

Initial Sighting on Track

Time: 16:33 WP#: 69 Lat: 30.498702 Long: -79.827256
Vertical Angle: 1 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Track Line: 9 Beaufort Sea State: 2
Observer: HJF Observer Side: Left

Actual Time and Position of Sighting

Time: 16:35 WP#: 70 Lat: 30.501375 Long: -79.831675
Species: *Tursiops truncatus* Numbers (Low/High/Best): 18/20/18
Features used in Species ID: robust body size, white coloration on caudal peduncle, dark grey cape over lighter grey coloration, distinct blaze, short rostrum
Representative images used for Species ID: 9244, 9247, 9251
Photographer: PBN Frame Numbers: 9233 - 9255 Spacer: 9256
Calculated Distance from Track Line: 0.52 km

Final Time and Position of Sighting

Time: 16:36 WP#: 71 Lat: 30.503796 Long: -79.827822
Calculated Distance Traveled: 0.46 km

Behavior and Additional Comments

One large group with several outliers. Located on the very eastern-most point of trackline 9.

Wednesday, March 31, 2010 Sighting # 12

Initial Sighting on Track

Time: 16:48 WP#: 59 Lat: 30.574687 Long: -80.127042
Vertical Angle: 3 Horizontal Bearing in Degrees: 110 Sighting Cue: Body
On/Off Effort: On Track Line: 10 Beaufort Sea State: 2
Observer: PBN Observer Side: Right

Actual Time and Position of Sighting

Time: 16:48 WP#: 77 Lat: 30.572718 Long: -80.122620
Species: *Unidentified Delphinid* Numbers (Low/High/Best): 3/3/3
Features used in Species ID: While photos were obtained, identification to species level was not possible
Representative images used for Species ID: N/A
Photographer: PBN Frame Numbers: 9257 - 9300 Spacer: 9301
Calculated Distance from Track Line: 0.48 km

Final Time and Position of Sighting

Time: 16:51 WP#: 78 Lat: 30.572430 Long: -80.123914
Calculated Distance Traveled: 0.13 km

Behavior and Additional Comments

A few individuals spaced widely apart throughout area.

Wednesday, March 31, 2010 Sighting # 13

Initial Sighting on Track

Time: 16:52 WP#: 61 Lat: 30.568623 Long: -80.170132
Vertical Angle: 2 Horizontal Bearing in Degrees: 60 Sighting Cue: Body
On/Off Effort: On Track Line: 10 Beaufort Sea State: 2
Observer: PBN Observer Side: Right

Actual Time and Position of Sighting

Time: 16:54 WP#: 82 Lat: 30.572921 Long: -80.169614
Species: *Stenella frontalis* Numbers (Low/High/Best): 22/30/25
Features used in Species ID: alternating pattern of light and dark coloration beginning with long white-tipped rostrum, visible spotting pattern
Representative images used for Species ID: 9307, 9310, 9311, 9314
Photographer: PBN Frame Numbers: 9302 - 9322 Spacer: 9323
Calculated Distance from Track Line: 0.48 km

Final Time and Position of Sighting

Time: 16:55 WP#: 83 Lat: 30.577859 Long: -80.170213
Calculated Distance Traveled: 0.55 km

Behavior and Additional Comments

One large group widely spaced apart.

Wednesday, March 31, 2010 Sighting # 14

Initial Sighting on Track

Time: 16:57 WP#: 85 Lat: 30.567832 Long: -80.216843
Vertical Angle: 1 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Track Line: 10 Beaufort Sea State: 2
Observer: HJF Observer Side: Left

Actual Time and Position of Sighting

Time: 17:01 WP#: 86 Lat: 30.562104 Long: -80.212544
Species: *Tursiops truncatus* Numbers (Low/High/Best): 3/3/3
Features used in Species ID: uniform grey coloration, robust body with broad flukes, short rostrum with well-defined crease at melon
Representative images used for Species ID: 9331, 9342, 9343, 9349
Photographer: PBN Frame Numbers: 9324 - 9352 Spacer: 9353
Calculated Distance from Track Line: 0.76 km

Final Time and Position of Sighting

Time: 17:01 WP#: 87 Lat: 30.560459 Long: -80.216937
Calculated Distance Traveled: 0.46 km

Behavior and Additional Comments

Small tightly-packed group traveling together. Defecation observed.

Wednesday, March 31, 2010 Sighting # 15

Initial Sighting on Track

Time: 17:04 WP#: 65 Lat: 30.567280 Long: -80.316056
Vertical Angle: 1 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Track Line: 10 Beaufort Sea State: 2
Observer: PBN Observer Side: Right

Actual Time and Position of Sighting

Time: 17:05 WP#: 90 Lat: 30.568151 Long: -80.309380
Species: *Stenella frontalis* Numbers (Low/High/Best): 2/2/2
Features used in Species ID: long, white-tipped rostrum, alternating banding pattern of light and dark coloration, small flukes and relatively small body size
Representative images used for Species ID: 9361, 9375, 9378, 9380
Photographer: PBN Frame Numbers: 9354 - 9393 Spacer: 9394
Calculated Distance from Track Line: 0.65 km

Final Time and Position of Sighting

Time: 17:07 WP#: 91 Lat: 30.569304 Long: -80.316714
Calculated Distance Traveled: 0.71 km

Behavior and Additional Comments

1 April 2010 Sighting # 1

Initial Sighting on Track

Time: 10:59 WP#: 19 Lat: 30.298797 Long: -80.522242
Vertical Angle: 3 Horizontal Bearing in Degrees: 30 Sighting Cue: Body
On/Off Effort: On Track Line: 6 Beaufort Sea State: 2
Observer: REH Observer Side: Right

Actual Time and Position of Sighting

Time: 11:01 WP#: 20 Lat: 30.303537 Long: -80.529192
Species: *Unidentified Delphinid* Numbers (Low/High/Best): 1/1/1
Features used in Species ID: Images not clcnlusive as to species ID

Representative images used for Species ID: 9395, 9396, 9400
Photographer: REH Frame Numbers: 9395-9407 Spacer: 9408
Calculated Distance from Track Line: 0.9 km

Final Time and Position of Sighting

Time: None WP#: N/A Lat: N/A Long: N/A
Calculated Distance Traveled: N/A

Behavior and Additional Comments

Single dolphin, "weird" looking cape. Note: no final location was obtained for this sighting
Possible unidentified Stenella spp.

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1 April 2010 Sighting # 2

Initial Sighting on Track

Time: 11:27 WP#: 24 Lat: 30.309072 Long: -80.212149
Vertical Angle: 2 Horizontal Bearing in Degrees: 140 Sighting Cue: Body
On/Off Effort: On Track Line: 6 Beaufort Sea State: 3
Observer: PBN Observer Side: Left

Actual Time and Position of Sighting

Time: 11:32 WP#: 25 Lat: 30.306852 Long: -80.213772
Species: *Tursiops truncatus* Numbers (Low/High/Best): 3/3/3
Features used in Species ID: Short, stubby rostrum, well-defined crease at melon, broad flukes, uniform gray coloration

Representative images used for Species ID: 9414, 9418, 9419
Photographer: REH Frame Numbers: 9409-9422 Spacer: 9423
Calculated Distance from Track Line: 0.3 km

Final Time and Position of Sighting

Time: 11:44 WP#: 26 Lat: 30.296740 Long: -80.219131
Calculated Distance Traveled: 1.2 km

Behavior and Additional Comments

Mother/juvenile and a single animal

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1 April 2010 Sighting # 3

Initial Sighting on Track

Time: 12:15 WP#: 34 Lat: 30.233211 Long: -80.369598
Vertical Angle: 3 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Track Line: 5 Beaufort Sea State: 2
Observer: REH Observer Side: Right

Actual Time and Position of Sighting

Time: 12:21 WP#: 35 Lat: 30.240809 Long: -80.355085
Species: *Stenella frontalis* Numbers (Low/High/Best): 9/12/11
Features used in Species ID: Alternating light/dark banding from above, white-tipped rostrum, some animals heavily spotted, narrow peduncle
Representative images used for Species ID: 9426-9428
Photographer: REH Frame Numbers: 9424-9428 Spacer: 9429
Calculated Distance from Track Line: 1.6 km

Final Time and Position of Sighting

Time: 12:27 WP#: 36 Lat: 30.244484 Long: -80.366442
Calculated Distance Traveled: 1.2 km

Behavior and Additional Comments

Semi-tight group, lots of interaction, showing bellies

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1 April 2010 Sighting # 4

Initial Sighting on Track

Time: 12:33 WP#: 38 Lat: 30.232801 Long: -80.583697
Vertical Angle: 2 Horizontal Bearing in Degrees: 100 Sighting Cue: Body
On/Off Effort: On Track Line: 5 Beaufort Sea State: 2
Observer: REH Observer Side: Right

Actual Time and Position of Sighting

Time: 12:36 WP#: 40 Lat: 30.239016 Long: -80.583593
Species: *Stenella frontalis* Numbers (Low/High/Best): 3/3/3
Features used in Species ID: Alternate light/dark banding from above, white-tipped, slender rostrum, narrow peduncle
Representative images used for Species ID: 9430-9432, 9434
Photographer: REH Frame Numbers: 9430-9436 Spacer: 9437
Calculated Distance from Track Line: 0.7 km

Final Time and Position of Sighting

Time: 12:39 WP#: 41 Lat: 30.238345 Long: -80.576273
Calculated Distance Traveled: 0.7 km

Behavior and Additional Comments

Medium-paced travel

1 April 2010 Sighting # 5

Initial Sighting on Track

Time: 14:21 WP#: 51 Lat: 30.165911 Long: -80.567348
Vertical Angle: 2 Horizontal Bearing in Degrees: 130 Sighting Cue: Body
On/Off Effort: On Track Line: 4 Beaufort Sea State: 1
Observer: PBN Observer Side: Left

Actual Time and Position of Sighting

Time: 14:25 WP#: 53 Lat: 30.173926 Long: -80.535763
Species: *Tursiops truncatus* Numbers (Low/High/Best): 2/2/2
Features used in Species ID: Short, stubby rostrum, well-defined crease at melon, broad flukes, sharp dark gray cape over lighter gray coloration, sharp blaze
Representative images used for Species ID: 9439-9441, 9444
Photographer: REH Frame Numbers: 9438-9447 Spacer: 9448
Calculated Distance from Track Line: 3.2 km

Final Time and Position of Sighting

Time: 14:26 WP#: 54 Lat: 30.168311 Long: -80.527317
Calculated Distance Traveled: 1.0 km

Behavior and Additional Comments

Leisurely travel

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1 April 2010 Sighting # 6

Initial Sighting on Track

Time: 14:28 WP#: 56 Lat: 30.166503 Long: -80.488016
Vertical Angle: 3 Horizontal Bearing in Degrees: 70 Sighting Cue: Body
On/Off Effort: On Track Line: 4 Beaufort Sea State: 1
Observer: PBN Observer Side: Left

Actual Time and Position of Sighting

Time: 14:30 WP#: 57 Lat: 30.170693 Long: -80.491403
Species: *Tursiops truncatus* Numbers (Low/High/Best): 1/1/1
Features used in Species ID: Broad flukes, large, falcate dorsal fin, sharp, dark cape over lighter gray coloration, short, stubby rostrum
Representative images used for Species ID: 9452, 9454, 9456, 9458
Photographer: REH Frame Numbers: 9449-9458 Spacer: 9459
Calculated Distance from Track Line: 0.6 km

Final Time and Position of Sighting

Time: 14:31 WP#: 58 Lat: 30.170266 Long: -80.492578
Calculated Distance Traveled: 0.1 km

Behavior and Additional Comments

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1 April 2010 Sighting # 7

Initial Sighting on Track

Time: 14:34 WP#: 62 Lat: 30.166219 Long: -80.383962
Vertical Angle: 3 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Track Line: 4 Beaufort Sea State: 1
Observer: PBN Observer Side: Left

Actual Time and Position of Sighting

Time: 14:36 WP#: 63 Lat: 30.175791 Long: -80.389746
Species: *Stenella frontalis* Numbers (Low/High/Best): 6/6/6
Features used in Species ID: White-tipped rostrum, alternate light/dark banding from above, adults were spotted, narrow peduncle
Representative images used for Species ID: 9463, 9468, 9472, 9473
Photographer: REH Frame Numbers: 9460-9477 Spacer: 9478
Calculated Distance from Track Line: 1.2 km

Final Time and Position of Sighting

Time: 14:39 WP#: 64 Lat: 30.178466 Long: -80.389631
Calculated Distance Traveled: 0.3 km

Behavior and Additional Comments

Two mother/calf pairs and two singletons, one joined the group of two pairs

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1 April 2010 Sighting # 8

Initial Sighting on Track

Time: 14:42 WP#: 66 Lat: 30.166332 Long: -80.269480
Vertical Angle: 3 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Track Line: 4 Beaufort Sea State: 1
Observer: PBN Observer Side: Left

Actual Time and Position of Sighting

Time: 14:44 WP#: 67 Lat: 30.165493 Long: -80.270584
Species: *Tursiops truncatus* Numbers (Low/High/Best): 7/7/7
Features used in Species ID: Short, stubby rostrum, broad flukes, robust bodies, sharp, dark cape over lighter gray coloration
Representative images used for Species ID: 9488, 9491, 9492, 9494, 9500
Photographer: REH Frame Numbers: 9479-9504 Spacer: 9505
Calculated Distance from Track Line: 0.1 km

Final Time and Position of Sighting

Time: 14:50 WP#: 68 Lat: 30.164606 Long: -80.273329
Calculated Distance Traveled: 0.3 km

Behavior and Additional Comments

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1 April 2010 Sighting # 9

Initial Sighting on Track

Time: 14:58 WP#: 72 Lat: 30.166080 Long: -79.962957
Vertical Angle: 1 Horizontal Bearing in Degrees: 80 Sighting Cue: Body
On/Off Effort: On Track Line: 4 Beaufort Sea State: 3
Observer: REH Observer Side: Right

Actual Time and Position of Sighting

Time: 15:00 WP#: 73 Lat: 30.163185 Long: -79.962582
Species: *Tursiops truncatus* Numbers (Low/High/Best): 10/12/11
Features used in Species ID: Sharply defined dark cape over lighter gray coloration, lighter gray peduncle, short, stubby rostrum with well-defined crease at melon
Representative images used for Species ID: 9507-9510, 9513
Photographer: REH Frame Numbers: 9506-9514 Spacer: 9515
Calculated Distance from Track Line: 0.3 km

Final Time and Position of Sighting

Time: 15:03 WP#: 74 Lat: 30.162102 Long: -79.944084
Calculated Distance Traveled: 1.8 km

Behavior and Additional Comments

Spread-out group

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1 April 2010 Sighting # 10

Initial Sighting on Track

Time: 15:22 WP#: 78 Lat: 30.100598 Long: -80.187572
Vertical Angle: 1 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Track Line: 3 Beaufort Sea State: 2
Observer: REH Observer Side: Right

Actual Time and Position of Sighting

Time: 15:24 WP#: 79 Lat: 30.102853 Long: -80.187906
Species: *Grampus griseus* Numbers (Low/High/Best): 10/12/11
Features used in Species ID: Blunt head with creased melon, tall dorsal fin, ample scarring and rake marks, variable dark gray to light gray coloration
Representative images used for Species ID: 9516, 9520, 9522, 9531
Photographer: REH Frame Numbers: 9516-9535 Spacer: 9536
Calculated Distance from Track Line: 0.3 km

Final Time and Position of Sighting

Time: 15:26 WP#: 80 Lat: 30.102102 Long: -80.189447
Calculated Distance Traveled: 0.2 km

Behavior and Additional Comments

Group in "chorus-line" formation

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1 April 2010 Sighting # 11

Initial Sighting on Track

Time: 15:29 WP#: 82 Lat: 30.100606 Long: -80.314324
Vertical Angle: 2 Horizontal Bearing in Degrees: 110 Sighting Cue: Body
On/Off Effort: On Track Line: 3 Beaufort Sea State: 2
Observer: REH Observer Side: Right

Actual Time and Position of Sighting

Time: 15:31 WP#: 83 Lat: 30.099932 Long: -80.317157
Species: *Tursiops truncatus* Numbers (Low/High/Best): 1/1/1
Features used in Species ID: Short, stubby rostrum, overall gray coloration, robust body and broad flukes
Representative images used for Species ID: 9539, 9540, 9545, 9548
Photographer: REH Frame Numbers: 9537-9550 Spacer: 9551
Calculated Distance from Track Line: 0.3 km

Final Time and Position of Sighting

Time: 15:34 WP#: 84 Lat: 30.096442 Long: -80.314747
Calculated Distance Traveled: 0.5 km

Behavior and Additional Comments

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1 April 2010 Sighting # 12

Initial Sighting on Track

Time: 15:35 WP#: 86 Lat: 30.100799 Long: -80.365531
Vertical Angle: 2 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Track Line: 3 Beaufort Sea State: 2
Observer: REH Observer Side: Right

Actual Time and Position of Sighting

Time: 15:37 WP#: 87 Lat: 30.107272 Long: -80.363344
Species: *Stenella frontalis* Numbers (Low/High/Best): 5/6/6
Features used in Species ID: Slender, white-tipped rostrum, wide, prominent blaze terminating mid-dorsal, narrow peduncle
Representative images used for Species ID: 9562, 9564, 9565
Photographer: REH Frame Numbers: 9552-9587 Spacer: 9588
Calculated Distance from Track Line: 0.8 km

Final Time and Position of Sighting

Time: 15:43 WP#: 88 Lat: 30.100386 Long: -80.365163
Calculated Distance Traveled: 0.8 km

Behavior and Additional Comments

Scattered group, languid at surface

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1 April 2010 Sighting # 13

Initial Sighting on Track

Time: 16:02 WP#: 103 Lat: 30.031666 Long: -80.485093
Vertical Angle: 1 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Track Line: 2 Beaufort Sea State: 1
Observer: PBN Observer Side: Left

Actual Time and Position of Sighting

Time: 16:03 WP#: 104 Lat: 30.035986 Long: -80.485707
Species: *Tursiops truncatus* Numbers (Low/High/Best): 3/3/3
Features used in Species ID: Broad flukes, short, stubby rostrum, overall gray coloration, robust body
Representative images used for Species ID: 9593, 9594, 9596, 9604, 9605
Photographer: REH Frame Numbers: 9589-9605 Spacer: 9606
Calculated Distance from Track Line: 0.5 km

Final Time and Position of Sighting

Time: 16:07 WP#: 105 Lat: 30.035323 Long: -80.482034
Calculated Distance Traveled: 0.4 km

Behavior and Additional Comments

Mother / calf pair

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1 April 2010 Sighting # 14

Initial Sighting on Track

Time: 16:45 WP#: 116 Lat: 29.965765 Long: -80.435832
Vertical Angle: 2 Horizontal Bearing in Degrees: 120 Sighting Cue: Body
On/Off Effort: On1 Track Line: 1 Beaufort Sea State: 2
Observer: PBN Observer Side: Left

Actual Time and Position of Sighting

Time: 16:47 WP#: 117 Lat: 29.962665 Long: -80.435568
Species: *Stenella frontalis* Numbers (Low/High/Best): 4/4/4
Features used in Species ID: Alternate light/dark banding from above, white-tipped rostrum, narrow peduncle, some animals heavily spotted
Representative images used for Species ID: 9608, 9615, 9619, 9638
Photographer: REH Frame Numbers: 9607-9640 Spacer: 9641
Calculated Distance from Track Line: 0.3 km

Final Time and Position of Sighting

Time: 16:49 WP#: 118 Lat: 29.961485 Long: -80.428432
Calculated Distance Traveled: 0.7 km

Behavior and Additional Comments

Dolphins and a school of fish. Dolphins may be herding the fish, possible foraging behavior

Friday, April 2, 2010 Sighting # 1

Initial Sighting on Track

Time: 9:08 WP#: 4 Lat: 29.965040 Long: -80.624709
Vertical Angle: 2 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Track Line: 1 Beaufort Sea State: 1
Observer: HJF Observer Side: Right

Actual Time and Position of Sighting

Time: 9:09 WP#: 5 Lat: 29.961342 Long: -80.623578
Species: *Stenella frontalis* Numbers (Low/High/Best): 8/8/8
Features used in Species ID: White tipped rostrum, Visible spotting on some individuals, Dark dorsal surface with pale blaze along flanks
Representative images used for Species ID: 9648,9657,9658
Photographer: HJF Frame Numbers: 9642-9658 Spacer: 9659
Calculated Distance from Track Line: 0.4 km

Final Time and Position of Sighting

Time: 9:10 WP#: 6 Lat: 29.962838 Long: -80.633078
Calculated Distance Traveled: 1.0 km

Behavior and Additional Comments

Juveniles present

Friday, April 2, 2010 Sighting # 2

Initial Sighting on Track

Time: 9:15 WP#: 8 Lat: 29.965402 Long: -80.449753
Vertical Angle: 3 Horizontal Bearing in Degrees: 100 Sighting Cue: Body
On/Off Effort: On Track Line: 1 Beaufort Sea State: 1
Observer: HJF Observer Side: Right

Actual Time and Position of Sighting

Time: 9:15 WP#: 9 Lat: 29.959600 Long: -80.446274
Species: *Tursiops truncatus* Numbers (Low/High/Best): 2/3/3
Features used in Species ID: Robust body, overall grey coloration, visible crease at rostrum and melon
Representative images used for Species ID: 9669,9673,9675
Photographer: HJF Frame Numbers: 9660-9676 Spacer: 9677
Calculated Distance from Track Line: 0.7 km

Final Time and Position of Sighting

Time: 9:20 WP#: 10 Lat: 29.959404 Long: -80.453037
Calculated Distance Traveled: 0.7 km

Behavior and Additional Comments

Widely spaced, elusive

Friday, April 2, 2010 Sighting # 3

Initial Sighting on Track

Time: 9:40 WP#: 20 Lat: 29.965272 Long: -80.010595
Vertical Angle: 2 Horizontal Bearing in Degrees: 120 Sighting Cue: Body
On/Off Effort: On Track Line: 1 Beaufort Sea State: 2
Observer: HJF Observer Side: Right

Actual Time and Position of Sighting

Time: 9:40 WP#: 21 Lat: 29.961503 Long: -80.013987
Species: *Tursiops truncatus* Numbers (Low/High/Best): 2/2/2
Features used in Species ID: Robust body with overall grey coloration, short think rostrum, large flukes
Representative images used for Species ID: 9733,9734,9735
Photographer: HJF Frame Numbers: 9706-9741 Spacer: 9742
Calculated Distance from Track Line: 0.5 km

Final Time and Position of Sighting

Time: 9:45 WP#: 22 Lat: 29.962368 Long: -80.014319
Calculated Distance Traveled: 0.1 km

Behavior and Additional Comments

Slow travel in tight group

Friday, April 2, 2010 Sighting # 4

Initial Sighting on Track

Time: 9:48 WP#: 25 Lat: 29.965170 Long: -79.913647
Vertical Angle: 2 Horizontal Bearing in Degrees: 130 Sighting Cue: Body
On/Off Effort: On Track Line: 1 Beaufort Sea State: 1
Observer: HJF Observer Side: Right

Actual Time and Position of Sighting

Time: 9:48 WP#: 26 Lat: 29.963709 Long: -79.918157
Species: *Tursiops truncatus* Numbers (Low/High/Best): 6/10/8
Features used in Species ID: Visible crease at rostrum and melon, Robust body with overall grey coloration, Short thick rostrum
Representative images used for Species ID: 9752,9769,9772
Photographer: HJF Frame Numbers: 9743-9772 Spacer: 9773
Calculated Distance from Track Line: 0.5 km

Final Time and Position of Sighting

Time: 9:51 WP#: 27 Lat: 29.968893 Long: -79.919120
Calculated Distance Traveled: 0.6 km

Behavior and Additional Comments

Travelling in sets of two, lots of surface activity, one calf observed

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Friday, April 2, 2010 Sighting # 5

Initial Sighting on Track

Time: 9:53 WP#: 29 Lat: 29.965018 Long: -79.848911
Vertical Angle: 2 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Track Line: 1 Beaufort Sea State: 1
Observer: HJF Observer Side: Right

Actual Time and Position of Sighting

Time: 9:53 WP#: 30 Lat: 29.958657 Long: -79.850725
Species: *Tursiops truncatus* Numbers (Low/High/Best): 5/5/5
Features used in Species ID: Broad flukes, short heavy beak

Representative images used for Species ID: 9776,9779,9781,9788
Photographer: HJF Frame Numbers: 9774-9792 Spacer: 9793
Calculated Distance from Track Line: 0.7 km

Final Time and Position of Sighting

Time: 9:55 WP#: 31 Lat: 29.960253 Long: -79.846540
Calculated Distance Traveled: 0.4 km

Behavior and Additional Comments

Friday, April 2, 2010 Sighting # 6

Initial Sighting on Track

Time: 9:56 WP#: 33 Lat: 29.965447 Long: -79.826545
Vertical Angle: 2 Horizontal Bearing in Degrees: 120 Sighting Cue: Body
On/Off Effort: On Track Line: 1 Beaufort Sea State: 1
Observer: HJF Observer Side: Right

Actual Time and Position of Sighting

Time: 9:56 WP#: 34 Lat: 29.964526 Long: -79.832764
Species: *Globicephala macrorhynchus* Numbers (Low/High/Best): 5/5/5
Features used in Species ID: Overall black body, rounded and falcate dorsal, blunt head

Representative images used for Species ID: 9801, 9814,9815,9822,9823
Photographer: HJF Frame Numbers: 9794-9823 Spacer: 9824
Calculated Distance from Track Line: 0.6 km

Final Time and Position of Sighting

Time: 10:01 WP#: 35 Lat: 29.967561 Long: -79.827742
Calculated Distance Traveled: 0.6 km

Behavior and Additional Comments

Surface active

Friday, April 2, 2010 Sighting # 7

Initial Sighting on Track

Time: 10:08 WP#: 39 Lat: 30.031793 Long: -79.896664
Vertical Angle: 2 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Track Line: 2 Beaufort Sea State: 1
Observer: HJF Observer Side: Right

Actual Time and Position of Sighting

Time: 10:09 WP#: 40 Lat: 30.037085 Long: -79.894317
Species: *Tursiops truncatus* Numbers (Low/High/Best): 4/4/4
Features used in Species ID: Overall grey coloration, short heavy rostrum, broad flukes

Representative images used for Species ID: 9831,9821, 9839-9845
Photographer: HJF Frame Numbers: 9825-9848 Spacer: 9849
Calculated Distance from Track Line: 0.6 km

Final Time and Position of Sighting

Time: 10:10 WP#: 41 Lat: 30.033557 Long: -79.898570
Calculated Distance Traveled: 0.6 km

Behavior and Additional Comments

Juvenile present

Friday, April 2, 2010 Sighting # 8

Initial Sighting on Track

Time: 10:26 WP#: 47 Lat: 30.032179 Long: -80.376694
Vertical Angle: 1 Horizontal Bearing in Degrees: 110 Sighting Cue: Body
On/Off Effort: On Track Line: 2 Beaufort Sea State: 1
Observer: RCH Observer Side: Left

Actual Time and Position of Sighting

Time: 10:26 WP#: 48 Lat: 30.032868 Long: -80.373894
Species: *Tursiops truncatus* Numbers (Low/High/Best): 9/20/15
Features used in Species ID: Overall grey coloration, short heavy rostrum, broad flukes

Representative images used for Species ID: 9863-9866
Photographer: HJF Frame Numbers: 9850-9871 Spacer: 9872
Calculated Distance from Track Line: 0.3 km

Final Time and Position of Sighting

Time: 10:29 WP#: 49 Lat: 30.026895 Long: -80.376175
Calculated Distance Traveled: 0.7 km

Behavior and Additional Comments

Loose grouping with surface activity

Friday, April 2, 2010 Sighting # 9

Initial Sighting on Track

Time: 10:35 WP#: 53 Lat: 30.035649 Long: -80.489070
Vertical Angle: 2 Horizontal Bearing in Degrees: 110 Sighting Cue: Body
On/Off Effort: On Track Line: 2 Beaufort Sea State: 1
Observer: RCH Observer Side: Left

Actual Time and Position of Sighting

Time: 10:36 WP#: 54 Lat: 30.033836 Long: -80.482236
Species: *Stenella frontalis* Numbers (Low/High/Best): 3/3/3
Features used in Species ID: Visible spotting, Dark and light banding pattern on dorsal surface, White tipped rostrum
Representative images used for Species ID: 9881,9883,9885
Photographer: HJF Frame Numbers: 9873-9892 Spacer: 9893
Calculated Distance from Track Line: 0.7 km

Final Time and Position of Sighting

Time: 10:39 WP#: 55 Lat: 30.037609 Long: -80.489286
Calculated Distance Traveled: 0.8 km

Behavior and Additional Comments

Elusive

Friday, April 2, 2010 Sighting # 10

Initial Sighting on Track

Time: 10:41 WP#: 57 Lat: 30.032033 Long: -80.520688
Vertical Angle: 3 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Track Line: 2 Beaufort Sea State: 1
Observer: RCH Observer Side: Left

Actual Time and Position of Sighting

Time: 10:42 WP#: 58 Lat: 30.032604 Long: -80.513773
Species: *Stenella frontalis* Numbers (Low/High/Best): 10/15/12
Features used in Species ID: Visible spotting, Dark and light banding pattern on dorsal surface, White tipped rostrum
Representative images used for Species ID: 0894,9897,9905
Photographer: HJF Frame Numbers: 9894-9915 Spacer: 9916
Calculated Distance from Track Line: 0.7 km

Final Time and Position of Sighting

Time: 10:44 WP#: 59 Lat: 30.025139 Long: -80.519687
Calculated Distance Traveled: 1.0 km

Behavior and Additional Comments

Several groups with singletons

Friday, April 2, 2010 Sighting # 11

Initial Sighting on Track

Time: 10:57 WP#: 64 Lat: 30.099912 Long: -80.551487
Vertical Angle: 3 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Track Line: 3 Beaufort Sea State: 1
Observer: HJF Observer Side: Right

Actual Time and Position of Sighting

Time: 10:58 WP#: 65 Lat: 30.092114 Long: -80.551591
Species: *Stenella frontalis* Numbers (Low/High/Best): 10/12/11
Features used in Species ID: Visible spotting, dark and light banding on dorsal surface, white tipped rostrum
Representative images used for Species ID: 9918,9929,9930
Photographer: HJF Frame Numbers: 9917-9935 Spacer: 9936
Calculated Distance from Track Line: 0.9 km

Final Time and Position of Sighting

Time: 11:00 WP#: 66 Lat: 30.090001 Long: -80.550873
Calculated Distance Traveled: 0.2 km

Behavior and Additional Comments

All travelling in sets of two, Juveniles present

Friday, April 2, 2010 Sighting # 12

Initial Sighting on Track

Time: 11:02 WP#: 68 Lat: 30.099760 Long: -80.475294
Vertical Angle: 1 Horizontal Bearing in Degrees: 100 Sighting Cue: Body
On/Off Effort: On Track Line: 3 Beaufort Sea State: 1
Observer: RCH Observer Side: Left

Actual Time and Position of Sighting

Time: 11:03 WP#: 69 Lat: 30.099114 Long: -80.481895
Species: *Tursiops truncatus* Numbers (Low/High/Best): 7/12/10
Features used in Species ID: Visible crease at rostrum and melon, broad flukes, overall grey coloration
Representative images used for Species ID: 9947,9949,9950
Photographer: HJF Frame Numbers: 9937-9952 Spacer: 9947
Calculated Distance from Track Line: 0.3 km

Final Time and Position of Sighting

Time: 11:06 WP#: 70 Lat: 30.102349 Long: -80.477691
Calculated Distance Traveled: 0.5 km

Behavior and Additional Comments

Diving out of sight, elusive, calf present

Friday, April 2, 2010 Sighting # 13

Initial Sighting on Track

Time: 11:20 WP#: 76 Lat: 30.099872 Long: -79.979997
Vertical Angle: 1 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Track Line: 3 Beaufort Sea State: 2
Observer: RCH Observer Side: Left

Actual Time and Position of Sighting

Time: 11:21 WP#: 77 Lat: 30.104917 Long: -79.977374
Species: *Tursiops truncatus* Numbers (Low/High/Best): 6/6/6
Features used in Species ID: Overall grey coloration, short heavy rostrum, broad flukes

Representative images used for Species ID: 9956,9959,9961,9966
Photographer: HJF Frame Numbers: 9954-9969 Spacer: 9970
Calculated Distance from Track Line: 0.6 km

Final Time and Position of Sighting

Time: 11:22 WP#: 78 Lat: 30.104888 Long: -79.983667
Calculated Distance Traveled: 0.6 km

Behavior and Additional Comments

Two small groups

Friday, April 2, 2010 Sighting # 14

Initial Sighting on Track

Time: 11:25 WP#: 80 Lat: 30.099596 Long: -79.869164
Vertical Angle: 2 Horizontal Bearing in Degrees: 100 Sighting Cue: Body
On/Off Effort: On Track Line: 3 Beaufort Sea State: 2
Observer: HJF Observer Side: Right

Actual Time and Position of Sighting

Time: 11:26 WP#: 81 Lat: 30.092008 Long: -79.867933
Species: *Tursiops truncatus* Numbers (Low/High/Best): 1/2/1
Features used in Species ID: Overall grey coloration, short heavy rostrum, broad flukes, visible crease between rostrum and melon

Representative images used for Species ID: 9974,9977,9983,9986
Photographer: HJF Frame Numbers: 9971-9988 Spacer: 9989
Calculated Distance from Track Line: 0.9 km

Final Time and Position of Sighting

Time: 11:29 WP#: 82 Lat: 30.094371 Long: -79.873833
Calculated Distance Traveled: 0.6 km

Behavior and Additional Comments

Friday, April 2, 2010 Sighting # 15

Initial Sighting on Track

Time: 11:34 WP#: 86 Lat: 30.166832 Long: -79.813857
Vertical Angle: 2 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Track Line: 4 Beaufort Sea State: 2
Observer: HJF Observer Side: Right

Actual Time and Position of Sighting

Time: 11:35 WP#: 87 Lat: 30.176137 Long: -79.815244
Species: *Tursiops truncatus* Numbers (Low/High/Best): 35/40/38
Features used in Species ID: Overall grey coloration, short heavy rostrum, broad flukes, visible crease between rostrum and melon
Representative images used for Species ID: 0006,0006,0008,0010,0011
Photographer: HJF Frame Numbers: 9990-0011 Spacer: 0012
Calculated Distance from Track Line: 1.04 km

Final Time and Position of Sighting

Time: 11:36 WP#: 88 Lat: 30.171829 Long: -79.812558
Calculated Distance Traveled: 0.54 km

Behavior and Additional Comments

One large group with several smaller groups of 2-3 animals, juveniles present

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Friday, April 2, 2010 Sighting # 16

Initial Sighting on Track

Time: 11:38 WP#: 90 Lat: 30.166338 Long: -79.893500
Vertical Angle: 1 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Track Line: 4 Beaufort Sea State: 2
Observer: RCH Observer Side: Left

Actual Time and Position of Sighting

Time: 11:39 WP#: 91 Lat: 30.163063 Long: -79.889926
Species: *Tursiops truncatus* Numbers (Low/High/Best): 4/4/4
Features used in Species ID: Overall grey coloration, short heavy rostrum, broad flukes, visible crease between rostrum and melon
Representative images used for Species ID: 0015,0016,0025.0017,0021
Photographer: HJF Frame Numbers: 0013-0026 Spacer: 0027
Calculated Distance from Track Line: 0.5 km

Final Time and Position of Sighting

Time: 11:41 WP#: 91 Lat: 30.166505 Long: -79.888697
Calculated Distance Traveled: 0.4 km

Behavior and Additional Comments

Friday, April 2, 2010 Sighting # 17

Initial Sighting on Track

Time: 12:02 WP#: 101 Lat: 30.166468 Long: -80.513411
Vertical Angle: 2 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Track Line: 4 Beaufort Sea State: 2
Observer: HJF Observer Side: Left

Actual Time and Position of Sighting

Time: 12:03 WP#: 102 Lat: 30.172578 Long: -80.512579
Species: *Stenella frontalis* Numbers (Low/High/Best): 23/25/25
Features used in Species ID: White tipped rostrum, visible spotting, dark and light banding pattern on dorsal surface
Representative images used for Species ID: 0032, 0037, 0044
Photographer: HJF Frame Numbers: 0028-0046 Spacer: 0047
Calculated Distance from Track Line: 0.7 km

Final Time and Position of Sighting

Time: 12:04 WP#: 103 Lat: 30.169508 Long: -80.519265
Calculated Distance Traveled: 0.7 km

Behavior and Additional Comments

One large group with several sub-groups of four individuals each

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Friday, April 2, 2010 Sighting # 18

Initial Sighting on Track

Time: 12:06 WP#: 105 Lat: 30.166242 Long: -80.616661
Vertical Angle: 2 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Track Line: 4 Beaufort Sea State: 1
Observer: HJF Observer Side: Right

Actual Time and Position of Sighting

Time: 12:08 WP#: 106 Lat: 30.166215 Long: -80.616192
Species: *Tursiops truncatus* Numbers (Low/High/Best): 2/2/2
Features used in Species ID: Broad flukes, short heavy rostrum, overall grey coloration
Representative images used for Species ID: 0048,0055,0056,0057,0060
Photographer: HJF Frame Numbers: 0048-0061 Spacer: 0062
Calculated Distance from Track Line: 0.1 km

Final Time and Position of Sighting

Time: 12:12 WP#: 107 Lat: 30.167117 Long: -80.613435
Calculated Distance Traveled: 0.3 km

Behavior and Additional Comments

Travelling singly, elusive

Friday, April 2, 2010 Sighting # 19

Initial Sighting on Track

Time: 12:15 WP#: 109 Lat: 30.166118 Long: -80.669611
Vertical Angle: 2 Horizontal Bearing in Degrees: 100 Sighting Cue: Body
On/Off Effort: On Track Line: 4 Beaufort Sea State: 1
Observer: HJF Observer Side: Right

Actual Time and Position of Sighting

Time: 12:15 WP#: 110 Lat: 30.175159 Long: -80.671960
Species: *Tursiops truncatus* Numbers (Low/High/Best): 2/2/2
Features used in Species ID: Broad flukes, short heavy beak, overall grey coloration

Representative images used for Species ID: 0066,0067,0068
Photographer: HJF Frame Numbers: 0063-0070 Spacer: 0071
Calculated Distance from Track Line: 1.0 km

Final Time and Position of Sighting

Time: 12:18 WP#: 111 Lat: 30.167693 Long: -80.664375
Calculated Distance Traveled: 1.1 km

Behavior and Additional Comments

Mom and calf travelling rapidly at surface

Friday, April 2, 2010 Sighting # 20

Initial Sighting on Track

Time: 12:28 WP#: 117 Lat: 30.232694 Long: -80.481851
Vertical Angle: 3 Horizontal Bearing in Degrees: 110 Sighting Cue: Body
On/Off Effort: On Track Line: 5 Beaufort Sea State: 1
Observer: RCH Observer Side: Left

Actual Time and Position of Sighting

Time: 12:30 WP#: 118 Lat: 30.244618 Long: -80.494633
Species: *Tursiops truncatus* Numbers (Low/High/Best): 1/1/1
Features used in Species ID: Broad flukes, short heavy beak, overall grey coloration

Representative images used for Species ID: 0087,0091,0094,0095,0101
Photographer: HJF Frame Numbers: 0072-0105 Spacer: 0106
Calculated Distance from Track Line: 1.8 km

Final Time and Position of Sighting

Time: 12:33 WP#: 119 Lat: 30.250412 Long: -80.491135
Calculated Distance Traveled: 0.7 km

Behavior and Additional Comments

Elusive and deep diving

Friday, April 2, 2010 Sighting # 21

Initial Sighting on Track

Time: 12:38 WP#: 121 Lat: 30.232706 Long: -80.438851
Vertical Angle: 2 Horizontal Bearing in Degrees: 100 Sighting Cue: Body
On/Off Effort: On Track Line: 5 Beaufort Sea State: 1
Observer: HJF Observer Side: Right

Actual Time and Position of Sighting

Time: 12:39 WP#: 122 Lat: 30.225323 Long: -80.439020
Species: *Tursiops truncatus* Numbers (Low/High/Best): 1/1/1
Features used in Species ID: Broad flukes, short heavy beak, overall grey coloration

Representative images used for Species ID: 0109,0114
Photographer: HJF Frame Numbers: 0107-0116 Spacer: 0117
Calculated Distance from Track Line: 0.8 km

Final Time and Position of Sighting

Time: 12:40 WP#: 123 Lat: 30.231430 Long: -80.445105
Calculated Distance Traveled: 0.9 km

Behavior and Additional Comments

Friday, April 2, 2010 Sighting # 22

Initial Sighting on Track

Time: 12:53 WP#: 131 Lat: 30.232665 Long: -80.043291
Vertical Angle: 3 Horizontal Bearing in Degrees: 92 Sighting Cue: Splash
On/Off Effort: On Track Line: 5 Beaufort Sea State: 2
Observer: HJF Observer Side: Right

Actual Time and Position of Sighting

Time: 12:53 WP#: 132 Lat: 30.218106 Long: -80.045485
Species: *Tursiops truncatus* Numbers (Low/High/Best): 3/5/5
Features used in Species ID: Broad flukes, short heavy beak, overall grey coloration

Representative images used for Species ID: 0146,0147
Photographer: HJF Frame Numbers: 0127-0147 Spacer: 0148
Calculated Distance from Track Line: 1.6 km

Final Time and Position of Sighting

Time: 12:56 WP#: 133 Lat: 30.219690 Long: -80.049919
Calculated Distance Traveled: 0.5 km

Behavior and Additional Comments

Friday, April 2, 2010 Sighting # 23

Initial Sighting on Track

Time: 13:19 WP#: 140 Lat: 30.300428 Long: -80.268661
Vertical Angle: 1 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Track Line: 6 Beaufort Sea State: 2
Observer: RCH Observer Side: Left

Actual Time and Position of Sighting

Time: 13:20 WP#: 141 Lat: 30.299055 Long: -80.265751
Species: *Tursiops truncatus* Numbers (Low/High/Best): 6/6/6
Features used in Species ID: Broad flukes, short heavy beak, overall grey coloration

Representative images used for Species ID: 0152,0160-0164
Photographer: HJF Frame Numbers: 0149-0165 Spacer: 0166
Calculated Distance from Track Line: 0.3 km

Final Time and Position of Sighting

Time: 13:24 WP#: 142 Lat: 30.295519 Long: -80.274482
Calculated Distance Traveled: 0.9 km

Behavior and Additional Comments

Elusive and deep diving

Friday, April 2, 2010 Sighting # 24

Initial Sighting on Track

Time: 13:26 WP#: 144 Lat: 30.300506 Long: -80.328149
Vertical Angle: 2 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Track Line: 6 Beaufort Sea State: 1
Observer: HJF Observer Side: Right

Actual Time and Position of Sighting

Time: 13:26 WP#: 145 Lat: 30.306456 Long: -80.335262
Species: *Stenella frontalis* Numbers (Low/High/Best): 17/18/18
Features used in Species ID: White tipped rostrum, visible spotting, dark and light banding pattern visible on dorsal surface

Representative images used for Species ID: 0177,0180,0181,0182
Photographer: HJF Frame Numbers: 0167-0186 Spacer: 0187
Calculated Distance from Track Line: 1.0 km

Final Time and Position of Sighting

Time: 13:28 WP#: 146 Lat: 30.306701 Long: -80.332838
Calculated Distance Traveled: 0.2 km

Behavior and Additional Comments

Two large groups

Friday, April 2, 2010 Sighting # 25

Initial Sighting on Track

Time: 15:30 WP#: 161 Lat: 30.365682 Long: -80.320392
Vertical Angle: 1 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Track Line: 7 Beaufort Sea State: 1
Observer: HJF Observer Side: Right

Actual Time and Position of Sighting

Time: 15:30 WP#: 162 Lat: 30.365679 Long: -80.319100
Species: *Stenella frontalis* Numbers (Low/High/Best): 20/30/28
Features used in Species ID: White tipped rostrum, visible spotting, dark and light banding pattern on dorsal surface
Representative images used for Species ID: 0249,0257,0262
Photographer: HJF Frame Numbers: 0249-0265 Spacer: 0266
Calculated Distance from Track Line: 0.1 km

Final Time and Position of Sighting

Time: 15:32 WP#: 163 Lat: 30.363160 Long: -80.322536
Calculated Distance Traveled: 0.4 km

Behavior and Additional Comments

Several groups of 5-6 individuals

Friday, April 2, 2010 Sighting # 26

Initial Sighting on Track

Time: 15:33 WP#: 165 Lat: 30.365713 Long: -80.272585
Vertical Angle: 2 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Track Line: 7 Beaufort Sea State: 1
Observer: HJF Observer Side: Right

Actual Time and Position of Sighting

Time: 15:34 WP#: 166 Lat: 30.361301 Long: -80.274064
Species: *Unidentified Delphinid* Numbers (Low/High/Best): 1/1/1
Features used in Species ID: Images not conclusive
Representative images used for Species ID: 0267
Photographer: HJF Frame Numbers: 0267 Spacer: 0276
Calculated Distance from Track Line: 0.5 km

Final Time and Position of Sighting

Time: 15:38 WP#: 167 Lat: 30.363760 Long: -80.278163
Calculated Distance Traveled: 0.5 km

Behavior and Additional Comments

Elusive and deep diving, Frames 0268-0275 all are of Hammerhead shark

Friday, April 2, 2010 Sighting # 27

Initial Sighting on Track

Time: 15:53 WP#: 175 Lat: 30.365142 Long: -79.853165
Vertical Angle: 1 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Track Line: 7 Beaufort Sea State: 2
Observer: HJF Observer Side: Right

Actual Time and Position of Sighting

Time: 15:54 WP#: 176 Lat: 30.365067 Long: -79.855610
Species: *Tursiops truncatus* Numbers (Low/High/Best): 11/22/18
Features used in Species ID: Short heavy rostrum, heavy flukes, overall grey coloration

Representative images used for Species ID: 0281,0282,0296,0297
Photographer: HJF Frame Numbers: 0277-0306 Spacer: 0307
Calculated Distance from Track Line: 0.2 km

Final Time and Position of Sighting

Time: 15:56 WP#: 177 Lat: 30.365598 Long: -79.858090
Calculated Distance Traveled: 0.2 km

Behavior and Additional Comments

Large group with several smaller sub-groups, juveniles present

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Friday, April 2, 2010 Sighting # 28

Initial Sighting on Track

Time: 16:10 WP#: 182 Lat: 30.434085 Long: -80.174373
Vertical Angle: 3 Horizontal Bearing in Degrees: 80 Sighting Cue: Body
On/Off Effort: On Track Line: 8 Beaufort Sea State: 1
Observer: RCH Observer Side: Left

Actual Time and Position of Sighting

Time: 16:11 WP#: 183 Lat: 30.435725 Long: -80.175345
Species: *Tursiops truncatus* Numbers (Low/High/Best): 3/3/3
Features used in Species ID: Short heavy rostrum, heavy flukes, overall grey coloration

Representative images used for Species ID: 0308,0315,0321,0326,0324
Photographer: HJF Frame Numbers: 0306-0355 Spacer: 0356
Calculated Distance from Track Line: 0.2 km

Final Time and Position of Sighting

Time: 16:17 WP#: 184 Lat: 30.434550 Long: -80.178424
Calculated Distance Traveled: 0.3 km

Behavior and Additional Comments

Deep diving and elusive, numerous sharks present

Friday, April 2, 2010 Sighting # 29

Initial Sighting on Track

Time: 16:44 WP#: 198 Lat: 30.499346 Long: -80.454873
Vertical Angle: 2 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Track Line: 9 Beaufort Sea State: 1
Observer: HJF Observer Side: Right

Actual Time and Position of Sighting

Time: 16:44 WP#: 199 Lat: 30.498584 Long: -80.456330
Species: *Tursiops truncatus* Numbers (Low/High/Best): 4/4/4
Features used in Species ID: Short heavy rostrum, heavy flukes, overall grey coloration

Representative images used for Species ID: 0360,0361,0363
Photographer: HJF Frame Numbers: 0357-0365 Spacer: 0366
Calculated Distance from Track Line: 0.2 km

Final Time and Position of Sighting

Time: 16:49 WP#: 200 Lat: 30.501016 Long: -80.456751
Calculated Distance Traveled: 0.3 km

Behavior and Additional Comments

Juveniles present

Friday, April 2, 2010 Sighting # 30

Initial Sighting on Track

Time: 17:20 WP#: 211 Lat: 30.566897 Long: -80.140693
Vertical Angle: 1 Horizontal Bearing in Degrees: 100 Sighting Cue: Body
On/Off Effort: On Track Line: 10 Beaufort Sea State: 1
Observer: RCH Observer Side: Left

Actual Time and Position of Sighting

Time: 17:21 WP#: 212 Lat: 30.567434 Long: -80.140728
Species: *Stenella frontalis* Numbers (Low/High/Best): 17/20/18
Features used in Species ID: White tipped rostrum, visible spotting, dark and light banding pattern visible on dorsal surface

Representative images used for Species ID: 0373,0374,0375
Photographer: HJF Frame Numbers: 0367-0382 Spacer: 0383
Calculated Distance from Track Line: 0.1 km

Final Time and Position of Sighting

Time: 17:21 WP#: 213 Lat: 30.561438 Long: -80.141277
Calculated Distance Traveled: 0.7 km

Behavior and Additional Comments

Friday, April 2, 2010 Sighting # 31

Initial Sighting on Track

Time: 17:25 WP#: 217 Lat: 30.567197 Long: -80.278616
Vertical Angle: 1 Horizontal Bearing in Degrees: 100 Sighting Cue: Body
On/Off Effort: On Track Line: 10 Beaufort Sea State: 1
Observer: HJF Observer Side: Right

Actual Time and Position of Sighting

Time: 17:26 WP#: 218 Lat: 30.567027 Long: -80.285993
Species: *Stenella frontalis* Numbers (Low/High/Best): 20/25/22
Features used in Species ID: White tipped rostrum, visible spotting, dark and light banding pattern on dorsal surface
Representative images used for Species ID: 0386,0387,0396,0414
Photographer: HJF Frame Numbers: 0384-0419 Spacer: 0420
Calculated Distance from Track Line: 0.7 km

Final Time and Position of Sighting

Time: 17:28 WP#: 219 Lat: 30.566551 Long: -80.278425
Calculated Distance Traveled: 0.7 km

Behavior and Additional Comments

Friday, April 2, 2010 Sighting # 32

Initial Sighting on Track

Time: 17:34 WP#: 221 Lat: 30.566906 Long: -80.496152
Vertical Angle: 1 Horizontal Bearing in Degrees: 120 Sighting Cue: Body
On/Off Effort: On Track Line: 10 Beaufort Sea State: 1
Observer: HJF Observer Side: Right

Actual Time and Position of Sighting

Time: 17:36 WP#: 222 Lat: 30.567220 Long: -80.489157
Species: *Stenella frontalis* Numbers (Low/High/Best): 4/4/4
Features used in Species ID: White tipped rostrum, visible spotting, dark and light banding pattern on dorsal surface
Representative images used for Species ID: 0429,0439,0440,0447,0448
Photographer: HJF Frame Numbers: 0421-0454 Spacer: 0455
Calculated Distance from Track Line: 0.7 km

Final Time and Position of Sighting

Time: 17:39 WP#: 223 Lat: 30.570876 Long: -80.497685
Calculated Distance Traveled: 0.9 km

Behavior and Additional Comments

Elusive and deep diving

Saturday, April 3, 2010 Sighting # 1

Initial Sighting on Track

Time: 8:36 WP#: 7 Lat: 30.566823 Long: -80.251450
Vertical Angle: 2 Horizontal Bearing in Degrees: 100 Sighting Cue: Body
On/Off Effort: On Track Line: 10 Beaufort Sea State: 1
Observer: REH Observer Side: Right

Actual Time and Position of Sighting

Time: 8:37 WP#: 8 Lat: 30.563400 Long: -80.250618
Species: *Tursiops truncatus* Numbers (Low/High/Best): 1/1/1
Features used in Species ID: Overall grey coloration, short heavy rostrum, broad flukes

Representative images used for Species ID: 0456,0457,0458,0459,0460
Photographer: REH Frame Numbers: 0456-0462 Spacer: 0463
Calculated Distance from Track Line: 0.4 km

Final Time and Position of Sighting

Time: 8:40 WP#: 9 Lat: 30.559192 Long: -80.254905
Calculated Distance Traveled: 0.6 km

Behavior and Additional Comments

Fast surface travel

Saturday, April 3, 2010 Sighting # 2

Initial Sighting on Track

Time: 8:53 WP#: 12 Lat: 30.566140 Long: -79.848942
Vertical Angle: 3 Horizontal Bearing in Degrees: 120 Sighting Cue: Body
On/Off Effort: On Track Line: 10 Beaufort Sea State: 3
Observer: REH Observer Side: Right

Actual Time and Position of Sighting

Time: 8:55 WP#: 13 Lat: 30.558371 Long: -79.861974
Species: *Tursiops truncatus* Numbers (Low/High/Best): 1/1/1
Features used in Species ID: Overall grey coloration, short heavy rostrum, broad flukes

Representative images used for Species ID: 0466,0467,0468,0470,0471-0473
Photographer: REH Frame Numbers: 0464-0474 Spacer: 0475
Calculated Distance from Track Line: 1.5 km

Final Time and Position of Sighting

Time: 8:59 WP#: 14 Lat: 30.552875 Long: -79.860827
Calculated Distance Traveled: 0.6 km

Behavior and Additional Comments

Saturday, April 3, 2010 Sighting # 3

Initial Sighting on Track

Time: 9:26 WP#: 25 Lat: 30.499663 Long: -80.447011
Vertical Angle: 1 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Track Line: 9 Beaufort Sea State: 1
Observer: REH Observer Side: Right

Actual Time and Position of Sighting

Time: 9:27 WP#: 26 Lat: 30.502812 Long: -80.443168
Species: *Stenella frontalis* Numbers (Low/High/Best): 10/12/12
Features used in Species ID: White tipped rostrum, visible spotting, dark and light banding pattern on dorsal surface
Representative images used for Species ID: 0478, 0479, 0485, 0486
Photographer: REH Frame Numbers: 0476-0486 Spacer: 0487
Calculated Distance from Track Line: 0.5 km

Final Time and Position of Sighting

Time: 9:29 WP#: 27 Lat: 30.504082 Long: -80.443493
Calculated Distance Traveled: 0.1 km

Behavior and Additional Comments

Slow travel at surface, travelling in a line, mom/calf pairs

Saturday, April 3, 2010 Sighting # 4

Initial Sighting on Track

Time: 9:31 WP#: 29 Lat: 30.499296 Long: -80.489091
Vertical Angle: 1 Horizontal Bearing in Degrees: 110 Sighting Cue: Body
On/Off Effort: On Track Line: 9 Beaufort Sea State: 1
Observer: RCH Observer Side: Left

Actual Time and Position of Sighting

Time: 9:32 WP#: 30 Lat: 30.498981 Long: -80.486959
Species: *Stenella frontalis* Numbers (Low/High/Best): 9/9/9
Features used in Species ID: White tipped rostrum, visible spotting, dark and light banding pattern on dorsal surface
Representative images used for Species ID: 0488, 0489, 0494, 0496
Photographer: REH Frame Numbers: 0488-0497 Spacer: 0498
Calculated Distance from Track Line: 0.2 km

Final Time and Position of Sighting

Time: 9:33 WP#: 31 Lat: 30.498327 Long: -80.485859
Calculated Distance Traveled: 0.1 km

Behavior and Additional Comments

Tight fast group, mom/calf Pair

Saturday, April 3, 2010 Sighting # 5

Initial Sighting on Track

Time: 9:37 WP#: 34 Lat: 30.499282 Long: -80.628019
Vertical Angle: 1 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Track Line: 9 Beaufort Sea State: 1
Observer: RCH Observer Side: Left

Actual Time and Position of Sighting

Time: 9:38 WP#: 35 Lat: 30.496229 Long: -80.624682
Species: *Stenella frontalis* Numbers (Low/High/Best): 10/10/10
Features used in Species ID: White tipped rostrum, visible spotting, dark and light banding pattern on dorsal surface
Representative images used for Species ID: 0500, 0502, 0510,0511
Photographer: REH Frame Numbers: 0499-0514 Spacer: 0515
Calculated Distance from Track Line: 0.5 km

Final Time and Position of Sighting

Time: 9:39 WP#: 36 Lat: 30.498798 Long: -80.625765
Calculated Distance Traveled: 0.3 km

Behavior and Additional Comments

Saturday, April 3, 2010 Sighting # 6

Initial Sighting on Track

Time: 9:57 WP#: 46 Lat: 30.433382 Long: -80.241031
Vertical Angle: 1 Horizontal Bearing in Degrees: 75 Sighting Cue: Body
On/Off Effort: On Track Line: 8 Beaufort Sea State: 1
Observer: REH Observer Side: Right

Actual Time and Position of Sighting

Time: 9:57 WP#: 47 Lat: 30.428283 Long: -80.241561
Species: *Tursiops truncatus* Numbers (Low/High/Best): 10/10/10
Features used in Species ID: Overall grey coloration, broad flukes, broad based dorsal, short heavy rostrum
Representative images used for Species ID: 0518, 0521, 0526, 0528. 0530
Photographer: REH Frame Numbers: 0516-0542 Spacer: 0543
Calculated Distance from Track Line: 0.6 km

Final Time and Position of Sighting

Time: 10:01 WP#: 48 Lat: 30.429643 Long: -80.238361
Calculated Distance Traveled: 0.3 km

Behavior and Additional Comments

Elusive, two groups of five

Saturday, April 3, 2010 Sighting # 7

Initial Sighting on Track

Time: 10:37 WP#: 53 Lat: 30.365836 Long: -80.501559
Vertical Angle: 1 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Track Line: 7 Beaufort Sea State: 1
Observer: REH Observer Side: Right

Actual Time and Position of Sighting

Time: 10:37 WP#: 54 Lat: 30.370552 Long: -80.507992
Species: *Stenella frontalis* Numbers (Low/High/Best): 3/3/3
Features used in Species ID: Elongated rostrum with white tip, slender flippers

Representative images used for Species ID: 0555, 0559, 0562
Photographer: REH Frame Numbers: 0544-0562 Spacer: 0563
Calculated Distance from Track Line: 0.8 km

Final Time and Position of Sighting

Time: 10:42 WP#: 55 Lat: 30.369183 Long: -80.508131
Calculated Distance Traveled: 0.2 km

Behavior and Additional Comments

Large fish visible in some photos

Saturday, April 3, 2010 Sighting # 8

Initial Sighting on Track

Time: 10:46 WP#: 58 Lat: 30.365524 Long: -80.639441
Vertical Angle: 1 Horizontal Bearing in Degrees: 100 Sighting Cue: Body
On/Off Effort: On Track Line: 7 Beaufort Sea State: 1
Observer: RCH Observer Side: Left

Actual Time and Position of Sighting

Time: 10:47 WP#: 59 Lat: 30.364375 Long: -80.636263
Species: *Stenella frontalis* Numbers (Low/High/Best): 24/24/24
Features used in Species ID: White tipped rostrum, visible spotting, dark and light banding pattern on dorsal surface

Representative images used for Species ID: 0564, 0673, 0576, 0581, 0589, 0590
Photographer: REH Frame Numbers: 0564-0594 Spacer: 0595
Calculated Distance from Track Line: 0.3 km

Final Time and Position of Sighting

Time: 10:49 WP#: 60 Lat: 30.365535 Long: -80.637906
Calculated Distance Traveled: 0.2 km

Behavior and Additional Comments

Four mom/calf pairs

Saturday, April 3, 2010 Sighting # 9

Initial Sighting on Track

Time: 11:00 WP#: 67 Lat: 30.299814 Long: -80.455537
Vertical Angle: 2 Horizontal Bearing in Degrees: 100 Sighting Cue: Body
On/Off Effort: On Track Line: 6 Beaufort Sea State: 1
Observer: REH Observer Side: Right

Actual Time and Position of Sighting

Time: 11:01 WP#: 68 Lat: 30.293566 Long: -80.463537
Species: *Tursiops truncatus* Numbers (Low/High/Best): 1/1/1
Features used in Species ID: Overall grey coloration, short heavy rostrum, broad flukes

Representative images used for Species ID: 0598, 0600, 0601, 0604, 0605
Photographer: REH Frame Numbers: 0596-0614 Spacer: 0615
Calculated Distance from Track Line: 1.1 km

Final Time and Position of Sighting

Time: 11:04 WP#: 69 Lat: 30.292965 Long: -80.464025
Calculated Distance Traveled: 0.1 km

Behavior and Additional Comments

Saturday, April 3, 2010 Sighting # 10

Initial Sighting on Track

Time: 11:09 WP#: 71 Lat: 30.300084 Long: -80.261358
Vertical Angle: 2 Horizontal Bearing in Degrees: 100 Sighting Cue: Body
On/Off Effort: On Track Line: 6 Beaufort Sea State: 1
Observer: REH Observer Side: Right

Actual Time and Position of Sighting

Time: 11:10 WP#: 72 Lat: 30.294518 Long: -80.257094
Species: *Tursiops truncatus* Numbers (Low/High/Best): 3/3/3
Features used in Species ID: Overall grey coloration, short heavy rostrum, broad flukes,
Visible crease between rostrum and melon
Representative images used for Species ID: 0616, 0617, 0618
Photographer: REH Frame Numbers: 0616-0631 Spacer: 0632
Calculated Distance from Track Line: 0.7 km

Final Time and Position of Sighting

Time: 11:18 WP#: 73 Lat: 30.302511 Long: -80.268706
Calculated Distance Traveled: 1.4 km

Behavior and Additional Comments

Numerous sharks present

Saturday, April 3, 2010 Sighting # 11

Initial Sighting on Track

Time: 11:30 WP#: 75 Lat: 30.299422 Long: -79.799405
Vertical Angle: 1 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Track Line: 6 Beaufort Sea State: 1
Observer: REH Observer Side: Right

Actual Time and Position of Sighting

Time: 11:30 WP#: 76 Lat: 30.296693 Long: -79.808363
Species: *Tursiops truncatus* Numbers (Low/High/Best): 8/15/12
Features used in Species ID: Overall grey coloration, broad flukes, short heavy rostrum

Representative images used for Species ID: 0633, 0641, 0642, 0643, 0651, 0656
Photographer: REH Frame Numbers: 0633-0668 Spacer: 0669
Calculated Distance from Track Line: 0.9 km

Final Time and Position of Sighting

Time: 11:34 WP#: 77 Lat: 30.297999 Long: -79.809178
Calculated Distance Traveled: 0.2 km

Behavior and Additional Comments

Thursday, May 6, 2010 Sighting # 1

Initial Sighting on Track

Time: 9:51 WP#: 6 Lat: N 29.966025 Long: W 80.493724
Vertical Angle: 2 Horizontal Bearing in Degrees: 100 Sighting Cue: Body
On/Off Effort: On Track Line: 1 Beaufort Sea State: 2
Observer: HJF Observer Side: Right

Actual Time and Position of Sighting

Time: 9:53 WP#: 7 Lat: N 29.958342 Long: W 80.487387
Species: *Tursiops truncatus* Numbers (Low/High/Best): 8/12/10
Features used in Species ID: Broad flukes, slate gray, defined crease at base of melon, short rostrum
Representative images used for Species ID: 0674, 0678, 0679, 0681
Photographer: HJF Frame Numbers: 0672 to 0683 Spacer: 0684
Calculated Distance from Track Line: 1.1 km

Final Time and Position of Sighting

Time: 9:58 WP#: 8 Lat: N 29.962182 Long: W 80.486394
Calculated Distance Traveled: 0.4 km

Behavior and Additional Comments

Multiple sub-groups of duos and trios, animals were elusive and frequently dove out of sight. Mom/calf pair observed.

Thursday, May 6, 2010 Sighting # 2

Initial Sighting on Track

Time: 10:04 WP#: 11 Lat: N 29.966377 Long: W 80.282685
Vertical Angle: 2 Horizontal Bearing in Degrees: 135 Sighting Cue: Body
On/Off Effort: On Track Line: 1 Beaufort Sea State: 2
Observer: REH Observer Side: Left

Actual Time and Position of Sighting

Time: 10:05 WP#: 12 Lat: N 29.972346 Long: W 80.290129
Species: *Tursiops truncatus* Numbers (Low/High/Best): 18/26/24
Features used in Species ID: Slate gray, broad flukes, defined crease at base of melon
Representative images used for Species ID: 0686, 0692, 0706, 0709, 0714
Photographer: HJF Frame Numbers: 0685 to 0726 Spacer: 0727
Calculated Distance from Track Line: 1.0 km

Final Time and Position of Sighting

Time: 10:09 WP#: 14 Lat: N 29.974630 Long: W 80.282202
Calculated Distance Traveled: 0.3 km

Behavior and Additional Comments

One large group and one pair, at least one mom/calf pair present

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Thursday, May 6, 2010 Sighting # 3

Initial Sighting on Track

Time: 10:36 WP#: 22 Lat: N 30.031217 Long: W 80.339161
Vertical Angle: 2 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Track Line: 2 Beaufort Sea State: 2
Observer: HJF Observer Side: Right

Actual Time and Position of Sighting

Time: 10:41 WP#: 23 Lat: N 30.031996 Long: W 80.336320
Species: *Tursiops truncatus* Numbers (Low/High/Best): 6/6/6
Features used in Species ID: Robust body, broad flukes, overall gray coloration

Representative images used for Species ID: 0740, 0750, 0751
Photographer: HJF Frame Numbers: 0728 to 0763 Spacer: 0764
Calculated Distance from Track Line: 0.3 km

Final Time and Position of Sighting

Time: 10:43 WP#: 24 Lat: N 30.034157 Long: W 80.336828
Calculated Distance Traveled: 0.3 km

Behavior and Additional Comments

Very active, showing bellies and rolling, some animals were breaching. At least two sub-groups with one mom/calf pair observed.

Thursday, May 6, 2010 Sighting # 4

Initial Sighting on Track

Time: 10:47 WP#: 26 Lat: N 30.030981 Long: W 80.513239
Vertical Angle: 2 Horizontal Bearing in Degrees: 60 Sighting Cue: Body
On/Off Effort: On Track Line: 2 Beaufort Sea State: 2
Observer: Observer Side:

Actual Time and Position of Sighting

Time: 10:49 WP#: 27 Lat: N 30.030748 Long: W 80.510834
Species: *Stenella frontalis* Numbers (Low/High/Best): 20/50/40
Features used in Species ID: Alternating light and dark "banding", visible spotted pattern, long, white-tipped rostrum
Representative images used for Species ID: 0773, 0793, 0804, 0805
Photographer: HJF Frame Numbers: 0765 to 0808 Spacer: 0809
Calculated Distance from Track Line: 0.2 km

Final Time and Position of Sighting

Time: 10:52 WP#: 28 Lat: N 30.029568 Long: W 80.518337
Calculated Distance Traveled: 0.7 km

Behavior and Additional Comments

5 sub-groups with 8-10 animals per group, several outlying single animals, at least one mom/calf pair, energetic porpoising, directional travel, possibly foraging

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Thursday, May 6, 2010 Sighting # 5

Initial Sighting on Track

Time: 13:40 WP#: 38 Lat: 30.097735 Long: -80.546461
Vertical Angle: 2 Horizontal Bearing in Degrees: 60 Sighting Cue: Body
On/Off Effort: On Track Line: 3 Beaufort Sea State: 2
Observer: HJF Observer Side: Right

Actual Time and Position of Sighting

Time: 13:42 WP#: 39 Lat: 30.096822 Long: -80.544239
Species: *Stenella frontalis* Numbers (Low/High/Best): 4/4/4
Features used in Species ID: Long, white-tipped ristrum, visible spotted pattern

Representative images used for Species ID: 0810, 0813
Photographer: HJF Frame Numbers: 0810-0816 Spacer: 0817
Calculated Distance from Track Line: 0.2 km

Final Time and Position of Sighting

Time: N/A WP#: N/A Lat: N/A Long: N/A
Calculated Distance Traveled: N/A

Behavior and Additional Comments

Some surface activity, looks like S. frontalis from the plane. Mom/calf pair observed.

Thursday, May 6, 2010 Sighting # 6

Initial Sighting on Track

Time: 13:46 WP#: 41 Lat: 30.101141 Long: -80.488933
Vertical Angle: 2 Horizontal Bearing in Degrees: 80 Sighting Cue: Body
On/Off Effort: On Track Line: 3 Beaufort Sea State: 2
Observer: HJF Observer Side: Right

Actual Time and Position of Sighting

Time: 13:52 WP#: 42 Lat: 30.102411 Long: -80.481820
Species: *Stenella frontalis* Numbers (Low/High/Best): 4/4/4
Features used in Species ID: Visible spots, long and white-tipped rostrum, alternating light and dark "banding".

Representative images used for Species ID: 0821, 0829, 0840
Photographer: HJF Frame Numbers: 0818-0830 Spacer: 831
Calculated Distance from Track Line: 0.7 km

Final Time and Position of Sighting

Time: N/A WP#: N/A Lat: N/A Long: N/A
Calculated Distance Traveled: N/A

Behavior and Additional Comments

Surface travel. Two mom/calf (or mom/juvenile) pairs.

Friday, May 7, 2010 Sighting # 1

Initial Sighting on Track

Time: 09:41 WP#: 9 Lat: 30.167105 Long: -79.811998
Vertical Angle: 2 Horizontal Bearing in Degrees: 120 Sighting Cue: Body
On/Off Effort: On Track Line: 4 Beaufort Sea State: 3
Observer: PBN Observer Side: Left

Actual Time and Position of Sighting

Time: None WP#: Lat: N/A Long: N/A
Species: *Unidentified Delphinid* Numbers (Low/High/Best): 5/6/5
Features used in Species ID: Could not establish species identity due to brevity of the encounter.
Representative images used for Species ID: N/A
Photographer: N/A Frame Numbers: N/A Spacer: N/A
Calculated Distance from Track Line: N/A

Final Time and Position of Sighting

Time: N/A WP#: N/A Lat: N/A Long: N/A
Calculated Distance Traveled: N/A

Behavior and Additional Comments

Group observed once after breaking track, however the animals could not be relocated a second time to confirm species.

Friday, May 7, 2010 Sighting # 2

Initial Sighting on Track

Time: 10:00 WP#: 11 Lat: 30.146586 Long: -80.150290
Vertical Angle: 3 Horizontal Bearing in Degrees: 120 Sighting Cue: Body
On/Off Effort: On Track Line: 4 Beaufort Sea State: 3
Observer: PBN Observer Side: Left

Actual Time and Position of Sighting

Time: 10:00 WP#: 12 Lat: 30.148260 Long: -80.148623
Species: *Physeter macrocephalus* Numbers (Low/High/Best): 2/2/2
Features used in Species ID: Large, dark gray whale, with large triangular flukes, large, square head, wrinkled appearance to the caudal 2/3 of body. Angled blow from single blowhole.
Representative images used for Species ID: 0866, 0867, 0877, 0888
Photographer: RCH Frame Numbers: 0832-0895 Spacer: 0896
Calculated Distance from Track Line: 0.2 km

Final Time and Position of Sighting

Time: 10:06 WP#: 13 Lat: 30.153845 Long: -80.145834
Calculated Distance Traveled: 0.7 km

Behavior and Additional Comments

Initially encountered two sperm whales traveling in a southerly direction at the surface, one animal was lost after breaking track. The remaining whale traveled at the surface, with short and shallow "dives" or sub-surface travel.

Friday, May 7, 2010 Sighting # 3

Initial Sighting on Track

Time: 10:08 WP#: 16 Lat: 30.165909 Long: -80.226561
Vertical Angle: 2 Horizontal Bearing in Degrees: 45 Sighting Cue: Body
On/Off Effort: On Track Line: 4 Beaufort Sea State: 2
Observer: RCH Observer Side: Right

Actual Time and Position of Sighting

Time: 10:10 WP#: 17 Lat: 30.167974 Long: -80.229344
Species: *None* Numbers (Low/High/Best): 70/80/75
Features used in Species ID: Spotted appearance, long, white-tipped beak, dorsal light and dark "banding".
Representative images used for Species ID: 0913, 0914, 0927, 0929, 0932
Photographer: RCH Frame Numbers: 0897 - 0931 Spacer: 0932
Calculated Distance from Track Line: 0.4 km

Final Time and Position of Sighting

Time: _____ WP#: 18 Lat: 30.167487 Long: -80.225958
Calculated Distance Traveled: 0.3 km

Behavior and Additional Comments

Large, very spread out group. Slow travel, milling. Two hammerhead sharks in close vicinity of the group.

Friday, May 7, 2010 Sighting # 4

Initial Sighting on Track

Time: 10:18 WP#: 20 Lat: 30.165726 Long: -80.378162
Vertical Angle: 1 Horizontal Bearing in Degrees: 100 Sighting Cue: Body
On/Off Effort: On Track Line: 4 Beaufort Sea State: 2
Observer: PBN Observer Side: Left

Actual Time and Position of Sighting

Time: 10:19 WP#: 21 Lat: 30.164865 Long: -80.375852
Species: *None* Numbers (Low/High/Best): 4/4/4
Features used in Species ID: Robust, gray dolphins with darker gray cape, broad flukes, short stubby rostrum.
Representative images used for Species ID: 0954, 0966, 0967, 0974
Photographer: RCH Frame Numbers: 0933 - 0975 Spacer: 0976
Calculated Distance from Track Line: 0.2 km

Final Time and Position of Sighting

Time: 10:29 WP#: 22 Lat: 30.162396 Long: -80.385546
Calculated Distance Traveled: 1.0 km

Behavior and Additional Comments

Fast travel, with synchronized leaping.

Friday, May 7, 2010 Sighting # 5

Initial Sighting on Track

Time: 10:51 WP#: 34 Lat: 30.233727 Long: -80.386614
Vertical Angle: 2 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Track Line: 5 Beaufort Sea State: 2
Observer: PBN Observer Side: Left

Actual Time and Position of Sighting

Time: 10:51 WP#: 35 Lat: 30.234612 Long: -80.389831
Species: *Tursiops truncatus* Numbers (Low/High/Best): 5/5/5
Features used in Species ID: Gray dolphins with darker gray cape, robust bodies, broad flukes

Representative images used for Species ID: 0977, 0978, 0984
Photographer: RCH Frame Numbers: 0977 - 0987 Spacer: 0988
Calculated Distance from Track Line: 0.3 km

Final Time and Position of Sighting

Time: 10:55 WP#: 36 Lat: 30.237201 Long: -80.390477
Calculated Distance Traveled: 0.3 km

Behavior and Additional Comments

Friday, May 7, 2010 Sighting # 6

Initial Sighting on Track

Time: 11:01 WP#: 40 Lat: 30.234844 Long: -80.227206
Vertical Angle: 3 Horizontal Bearing in Degrees: 130 Sighting Cue: Body
On/Off Effort: On Track Line: 4 Beaufort Sea State: 2
Observer: PBN Observer Side: Left

Actual Time and Position of Sighting

Time: 11:01 WP#: 41 Lat: 30.231191 Long: -80.239313
Species: *Tursiops truncatus* Numbers (Low/High/Best): 8/8/8
Features used in Species ID: Short, stubby rostrum, with well defined melon, gray overall color with darker gray cape, broad flukes

Representative images used for Species ID: 0992, 0998, 1005, 1006
Photographer: RCH Frame Numbers: 0989 - 1008 Spacer: 1009
Calculated Distance from Track Line: 1.2 km

Final Time and Position of Sighting

Time: 11:05 WP#: 42 Lat: 30.228963 Long: -80.235403
Calculated Distance Traveled: 0.5 km

Behavior and Additional Comments

Three groups (3, 2, 3). Medium paced surface travel.

Friday, May 7, 2010 Sighting # 7

Initial Sighting on Track

Time: 11:53 WP#: 55 Lat: 30.366279 Long: -80.601871
Vertical Angle: 2 Horizontal Bearing in Degrees: 140 Sighting Cue: Body
On/Off Effort: On Track Line: 7 Beaufort Sea State: 2
Observer: PBN Observer Side: Left

Actual Time and Position of Sighting

Time: 11:59 WP#: 56 Lat: 30.375496 Long: -80.608868
Species: *Unidentified Delphinid* Numbers (Low/High/Best): 3/3/3
Features used in Species ID: Most likely S. frontalis, but pictures inconclusive.

Representative images used for Species ID: 1016, 1021
Photographer: RCH Frame Numbers: 1010 - 1025 Spacer: 1026
Calculated Distance from Track Line: 1.2 km

Final Time and Position of Sighting

Time: 12:01 WP#: 57 Lat: 30.376343 Long: -80.605169
Calculated Distance Traveled: 0.4 km

Behavior and Additional Comments

Non-directional travel, milling.

Friday, May 7, 2010 Sighting # 8

Initial Sighting on Track

Time: 12:47 WP#: 67 Lat: 30.432619 Long: -80.576658
Vertical Angle: 3 Horizontal Bearing in Degrees: 75 Sighting Cue: Body
On/Off Effort: On Track Line: 8 Beaufort Sea State: 2
Observer: RCH Observer Side: Right

Actual Time and Position of Sighting

Time: 12:48 WP#: 68 Lat: 30.439407 Long: -80.575846
Species: *Stenella frontalis* Numbers (Low/High/Best): 17/20/18
Features used in Species ID: Alternating light and dark dorsal "banding", long, white-tipped rostrum, visible spotted pattern on some animals
Representative images used for Species ID: 1027, 1028, 1029, 1031
Photographer: RCH Frame Numbers: 1027 - 1054 Spacer: 1055
Calculated Distance from Track Line: 0.8 km

Final Time and Position of Sighting

Time: 12:50 WP#: 69 Lat: 30.439824 Long: -80.576365
Calculated Distance Traveled: <0.1 km

Behavior and Additional Comments

Fairly tight group, leisurely travel.

Friday, May 7, 2010 Sighting # 9

Initial Sighting on Track

Time: 12:55 WP#: 71 Lat: 30.432248 Long: -80.693197
Vertical Angle: 1 Horizontal Bearing in Degrees: 90 Sighting Cue: Body
On/Off Effort: On Track Line: 8 Beaufort Sea State: 2
Observer: RCH Observer Side: Right

Actual Time and Position of Sighting

Time: 12:55 WP#: 72 Lat: 30.432984 Long: -80.695540
Species: *Stenella frontalis* Numbers (Low/High/Best): 15/20/17
Features used in Species ID: Long, white-tipped beaks, alternating dark and light dorsal "banding"
Representative images used for Species ID: 1058, 1059, 1060, 1075
Photographer: RCH Frame Numbers: 1056 - 1086 Spacer: 1087
Calculated Distance from Track Line: 0.2 km

Final Time and Position of Sighting

Time: 12:58 WP#: 73 Lat: 30.434105 Long: -80.695353
Calculated Distance Traveled: 0.1 km

Behavior and Additional Comments

Semi-tight group with one or two outliers. Both adults and juveniles in group.

Friday, May 7, 2010 Sighting # 10

Initial Sighting on Track

Time: 14:38 WP#: 84 Lat: 30.500499 Long: -80.259762
Vertical Angle: 2 Horizontal Bearing in Degrees: 145 Sighting Cue: Body
On/Off Effort: On Track Line: 9 Beaufort Sea State: 2
Observer: RCH Observer Side: Right

Actual Time and Position of Sighting

Time: 14:39 WP#: 85 Lat: 30.496633 Long: -80.267536
Species: *Tursiops truncatus* Numbers (Low/High/Best): 5/5/5
Features used in Species ID: Short rostrum with well-defined crease at base of melon, robust body, overall gray coloration, darker cape over lighter gray sides
Representative images used for Species ID: 1105, 1106, 1116, 1118, 1119
Photographer: RCH Frame Numbers: 1088 to 1124 Spacer: 1125
Calculated Distance from Track Line: 0.9 km

Final Time and Position of Sighting

Time: 14:50 WP#: 86 Lat: 30.491949 Long: -80.265479
Calculated Distance Traveled: 0.6 km

Behavior and Additional Comments

Animals were a bit elusive and difficult to photograph well.

Friday, May 7, 2010 Sighting # 11

Initial Sighting on Track

Time: 15:21 WP#: 95 Lat: 30.566262 Long: -80.292462
Vertical Angle: 2 Horizontal Bearing in Degrees: 75 Sighting Cue: Body
On/Off Effort: On Track Line: 10 Beaufort Sea State: 1
Observer: RCH Observer Side: Right

Actual Time and Position of Sighting

Time: 15:23 WP#: 96 Lat: 30.566378 Long: -80.289206
Species: *Stenella frontalis* Numbers (Low/High/Best): 3/3/3
Features used in Species ID: White-tipped rostrum, narrow peduncle, dark cape with blaze and heavily spotted
Representative images used for Species ID: 1135, 1136
Photographer: RCH Frame Numbers: 1126 to 1138 Spacer: 1139
Calculated Distance from Track Line: 0.3 km

Final Time and Position of Sighting

Time: 15:27 WP#: 97 Lat: 30.572313 Long: -80.289317
Calculated Distance Traveled: 0.7 km

Behavior and Additional Comments

Friday, June 4, 2010 Sighting # 1

Initial Sighting on Track

Time: 10:13 WP#: 27 Lat: 30.168007 Long: -79.964207
Vertical Angle: 3 Horizontal Bearing in Degrees: 115 Sighting Cue: Body
On/Off Effort: On Track Line: 4 Beaufort Sea State: 2
Observer: RCH Observer Side: Left

Actual Time and Position of Sighting

Time: 10:14 WP#: 28 Lat: 30.162127 Long: -79.958743
Species: *Globicephala macrorhynchus* Numbers (Low/High/Best): 13/15/14
Features used in Species ID: Big, black animals with bulbous melons. Elongated flippers. Broad-based dorsal fins.
Representative images used for Species ID: 1207, 1212 to1216, 1218, 1230
Photographer: PBN Frame Numbers: 1198 - 1237 Spacer: 1238
Calculated Distance from Track Line: 0.8 km

Final Time and Position of Sighting

Time: 10:18 WP#: 29 Lat: 30.166125 Long: -79.962299
Calculated Distance Traveled: 0.6 km

Behavior and Additional Comments

Slow travel, with several small groups of individuals in a line

Saturday, June 5, 2010 Sighting # 1

Initial Sighting on Track

Time: 11:29 WP#: 31 Lat: 30.166886 Long: -80.571309
Vertical Angle: 3 Horizontal Bearing in Degrees: 110 Sighting Cue: Body
On/Off Effort: On Track Line: 4 Beaufort Sea State: 2
Observer: RCH Observer Side: Left

Actual Time and Position of Sighting

Time: 11:30 WP#: 32 Lat: 30.172613 Long: -80.579141
Species: *Stenella frontalis* Numbers (Low/High/Best): 30/50/40
Features used in Species ID: distinct alternating banding pattern, white-tipped, long rostrum, obvious spotting pattern
Representative images used for Species ID: 1260
Photographer: HJF Frame Numbers: 1249 - 1274 Spacer: 1275
Calculated Distance from Track Line: 1.0 km

Final Time and Position of Sighting

Time: 11:32 WP#: 33 Lat: 30.171619 Long: -80.577003
Calculated Distance Traveled: 0.2 km

Behavior and Additional Comments

Two - three large groups of at least 10-15 individuals were observed with innumerable outlying individuals. Dolphins were engaging in fast, energetic travel and swimming

Sunday, June 6, 2010 Sighting # 1

Initial Sighting on Track

Time: 8:57 WP#: 5 Lat: 29.966164 Long: -80.430339
Vertical Angle: 2 Horizontal Bearing in Degrees: 110 Sighting Cue: Body
On/Off Effort: On Track Line: 1 Beaufort Sea State: 2
Observer: RCH Observer Side: Right

Actual Time and Position of Sighting

Time: 8:59 WP#: 6 Lat: 29.961922 Long: -80.435265
Species: *Stenella frontalis* Numbers (Low/High/Best): 10/10/10
Features used in Species ID: Alternating dark/light dorsal banding pattern, white-tipped rostrum some animals spotted
Representative images used for Species ID: 1291,1292,1295,1303,1308
Photographer: RCH Frame Numbers: 1276-1319 Spacer: 1320
Calculated Distance from Track Line: 0.7 km

Final Time and Position of Sighting

Time: 9:04 WP#: 7 Lat: 29.957164 Long: -80.434890
Calculated Distance Traveled: 0.5 km

Behavior and Additional Comments

Surfacing frequently, slow, single direction of travel, 1-2 animals showing their bellies, possible mother/calf pair

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Sunday, June 6, 2010 Sighting # 2

Initial Sighting on Track

Time: 10:39 WP#: 30 Lat: 30.165367 Long: -80.628664
Vertical Angle: 3 Horizontal Bearing in Degrees: 100 Sighting Cue: Body
On/Off Effort: On Track Line: 4 Beaufort Sea State: 2
Observer: REH Observer Side: Left

Actual Time and Position of Sighting

Time: 10:40 WP#: 31 Lat: 30.147797 Long: -80.621601
Species: *Stenella frontalis* Numbers (Low/High/Best): 10/14/12
Features used in Species ID: Dark cape with 'smudgy' blaze, white-tipped rostrum, some animals heavily spotted
Representative images used for Species ID: 1361,1360,1357,1358
Photographer: RCH Frame Numbers: 1321-1363 Spacer: 1363
Calculated Distance from Track Line: 2.1 km

Final Time and Position of Sighting

Time: 10:47 WP#: 32 Lat: 30.152503 Long: -80.624714
Calculated Distance Traveled: 0.6 km

Behavior and Additional Comments

Tight group with at least one straggler, possible mother/calf pair, multi-directional travel, possibly foraging

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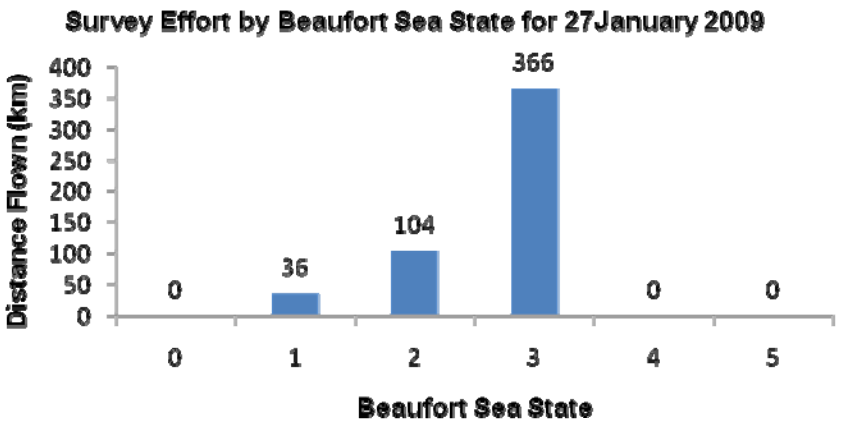
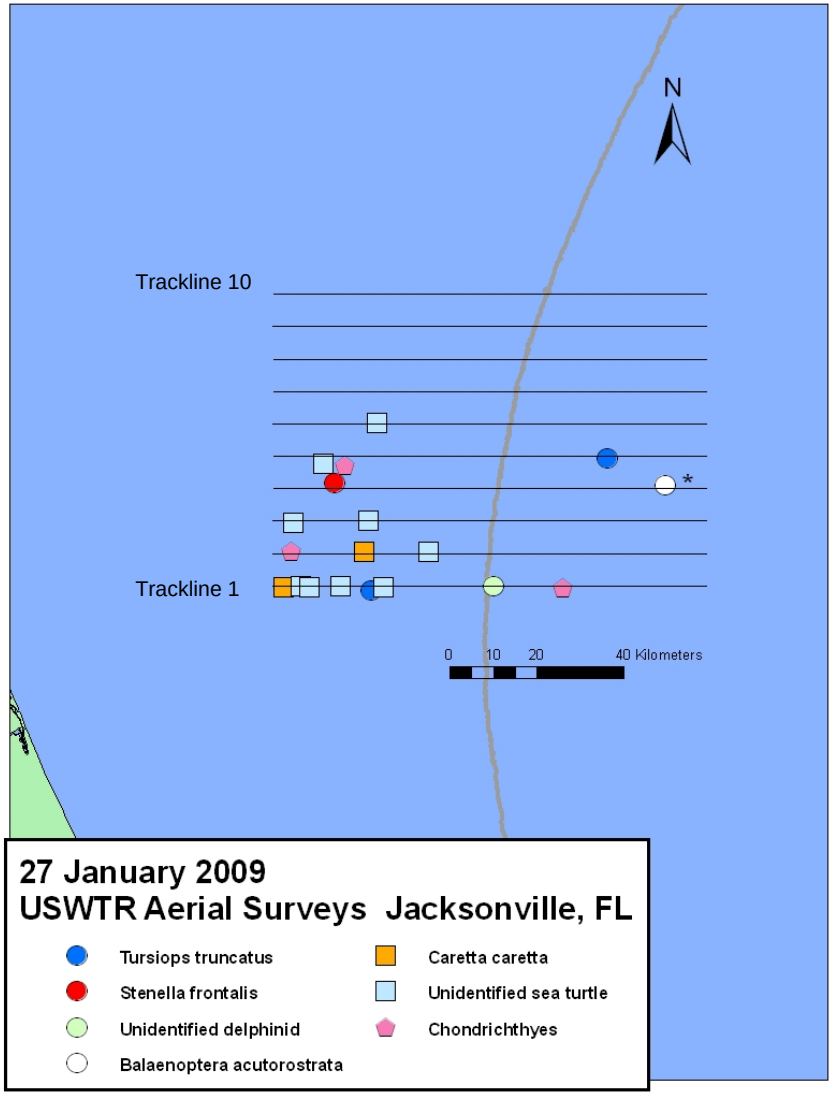
Appendix I

27 January 2009

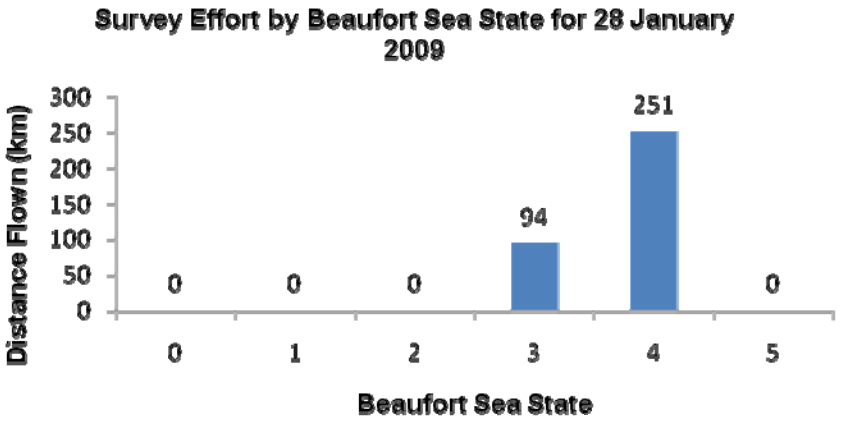
Species	Number of Sightings	Number of Individuals	Beaufort Sea State	Line Number
Tursiops truncatus	1	15	2	1
Tursiops truncatus	1	25	3	5
Stenella frontalis	1	100	2	4
Unidentified delphinid	1	5	3	1
Balaenoptera acutorostrata	1	1	3	4
Caretta caretta	2	2	1-2	-
Unidentified sea turtle	9	10	1-3	-
Chondrichthyes	3	3	1-3	-

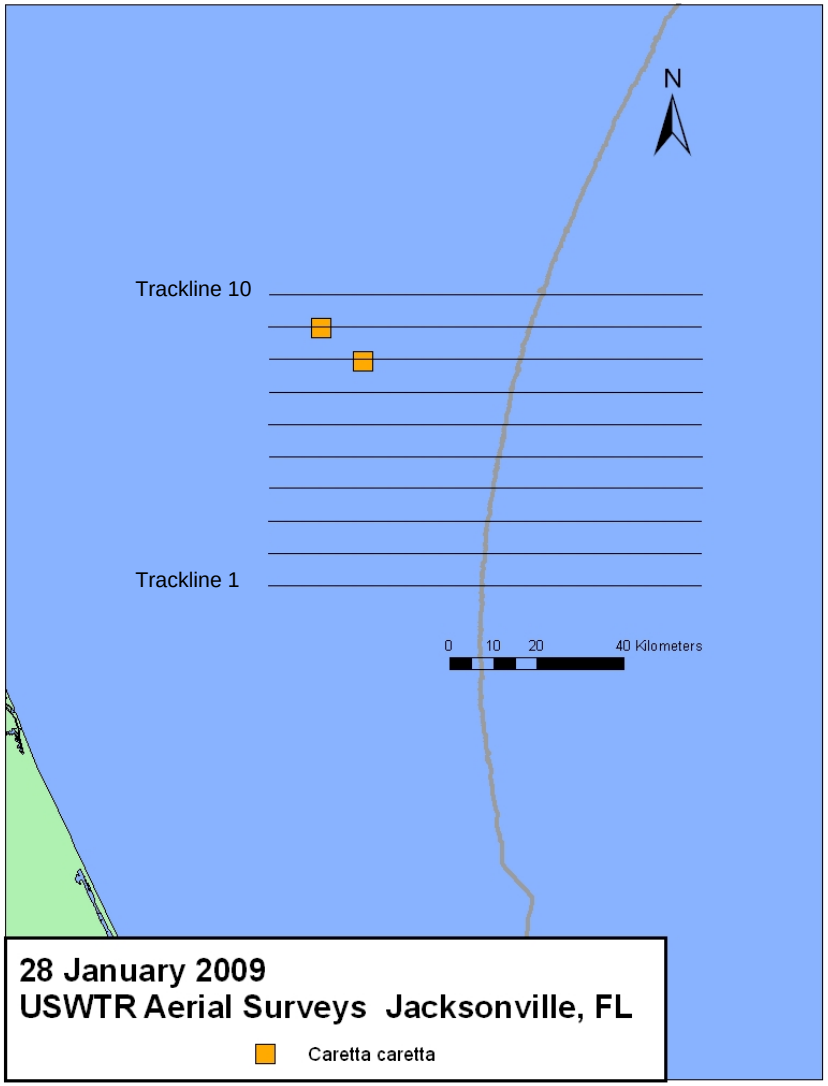




28 January 2009

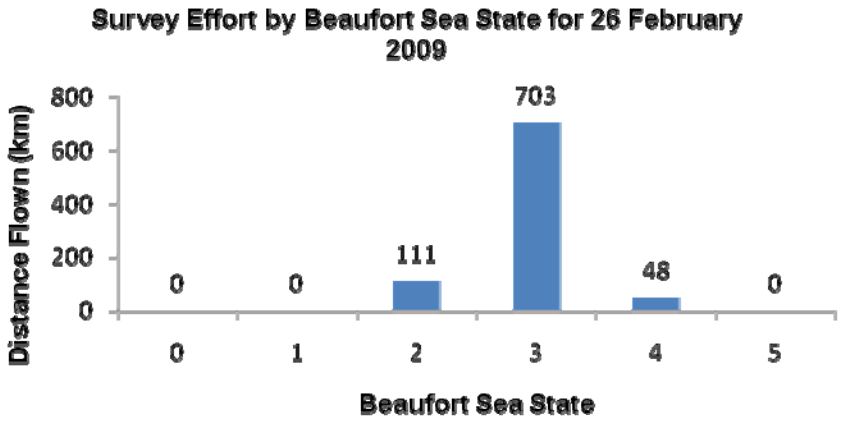
Species	Number of Sightings	Number of Individuals	Beaufort Sea State	Line Number
Caretta caretta	2	2	3	-

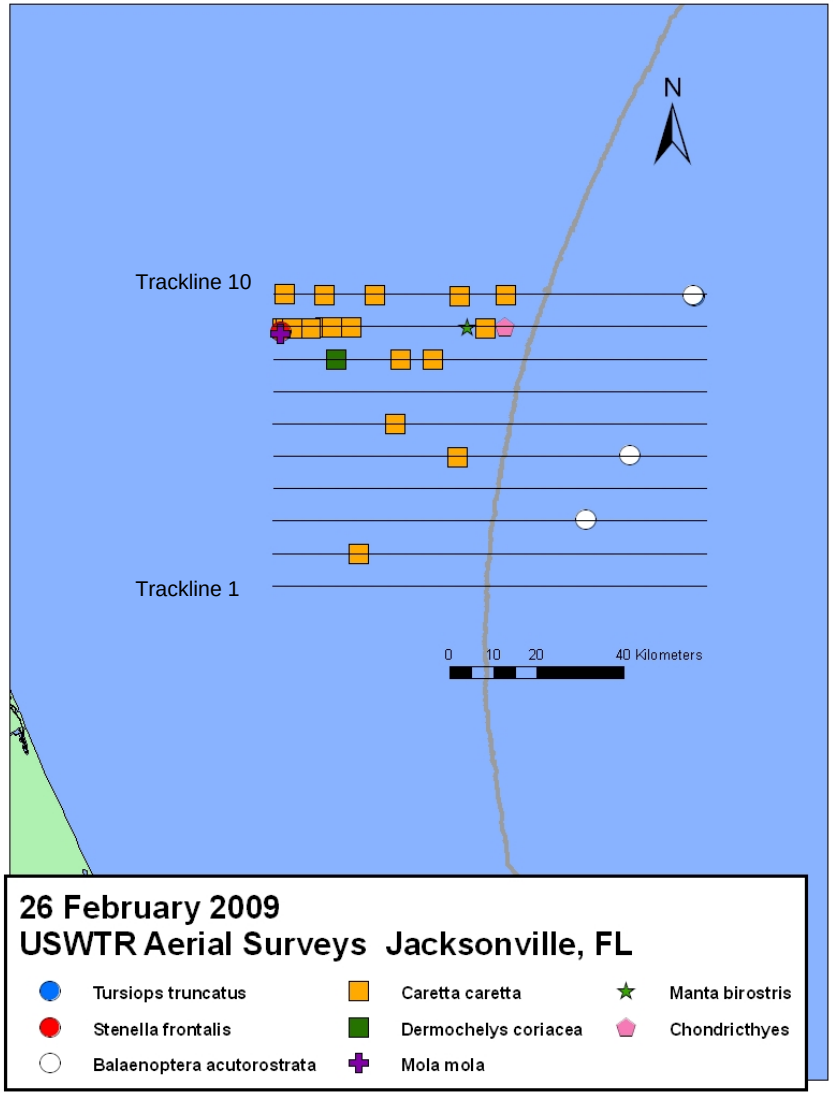




26 February 2009

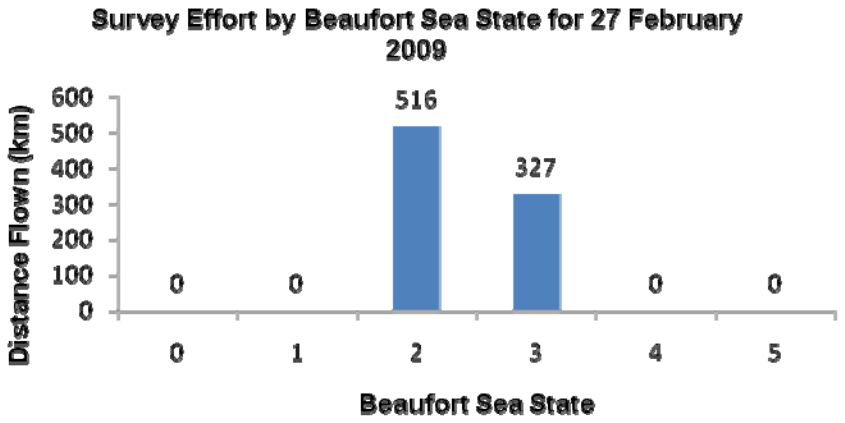
Species	Number of Sightings	Number of Individuals	Beaufort Sea State	Line Number
Tursiops truncatus	1	12	3	10
Stenella frontalis	1	2	2	9
Balaenoptera acutorostrata	1	1	3	10
Balaenoptera acutorostrata	1	3	3	5
Balaenoptera acutorostrata	1	1	3	3
Caretta caretta	19	21	2-3	-
Dermochelys coriacea	1	1	2	-
Manta birostris	1	1	3	-
Chondrichthyes	1	2	3	-

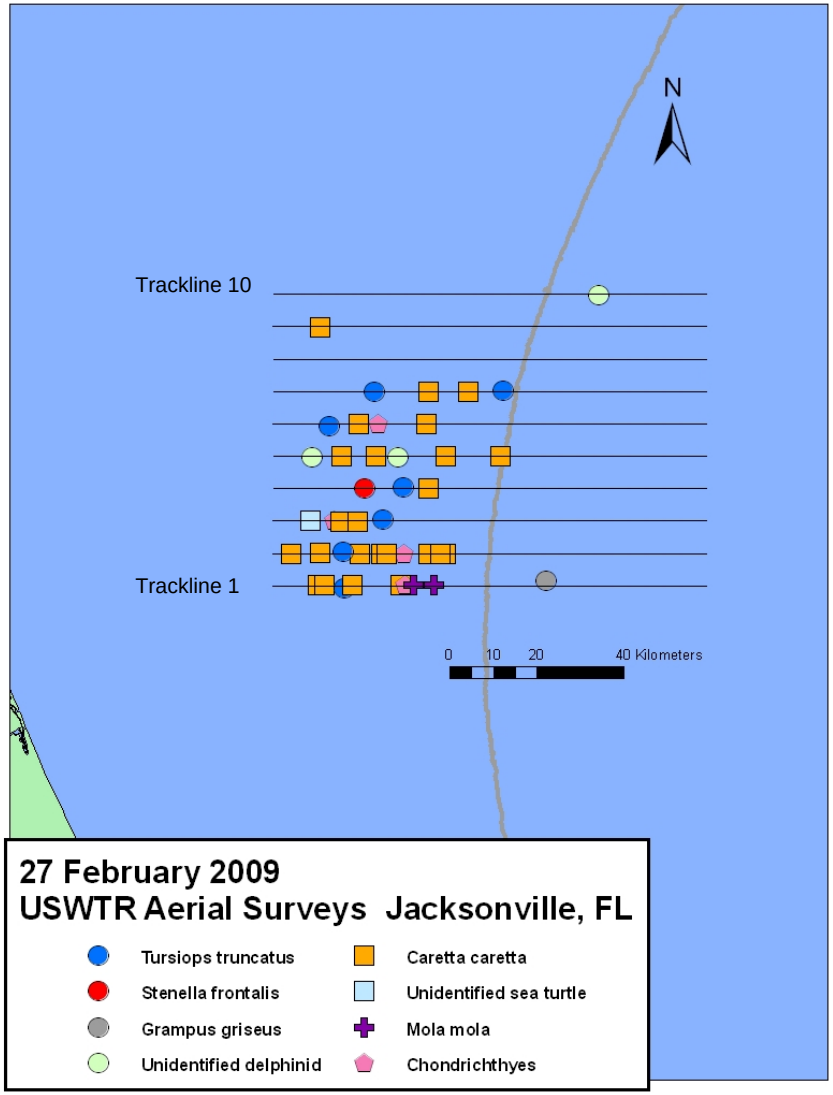




27 February 2009

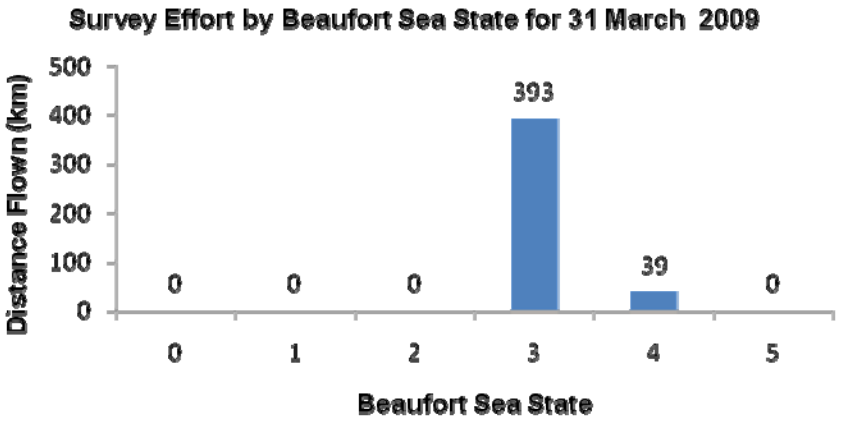
Species	Number of Sightings	Number of Individuals	Beaufort Sea State	Line Number
Tursiops truncatus	1	3	2	2
Tursiops truncatus	1	19	2	3
Tursiops truncatus	1	3	2	4
Tursiops truncatus	1	5	2	6
Tursiops truncatus	2	9	3	7
Stenella frontalis	1	7	2	4
Grampus griseus	1	5	3	1
Unidentified delphinid	2	2	2	5
Unidentified delphinid	1	1	2	10
Caretta caretta	24	27	2-3	-
Unidentified sea turtle	1	1	2	-
Mola mola	2	2	2	-
Chondrichthyes	4	4	2	-

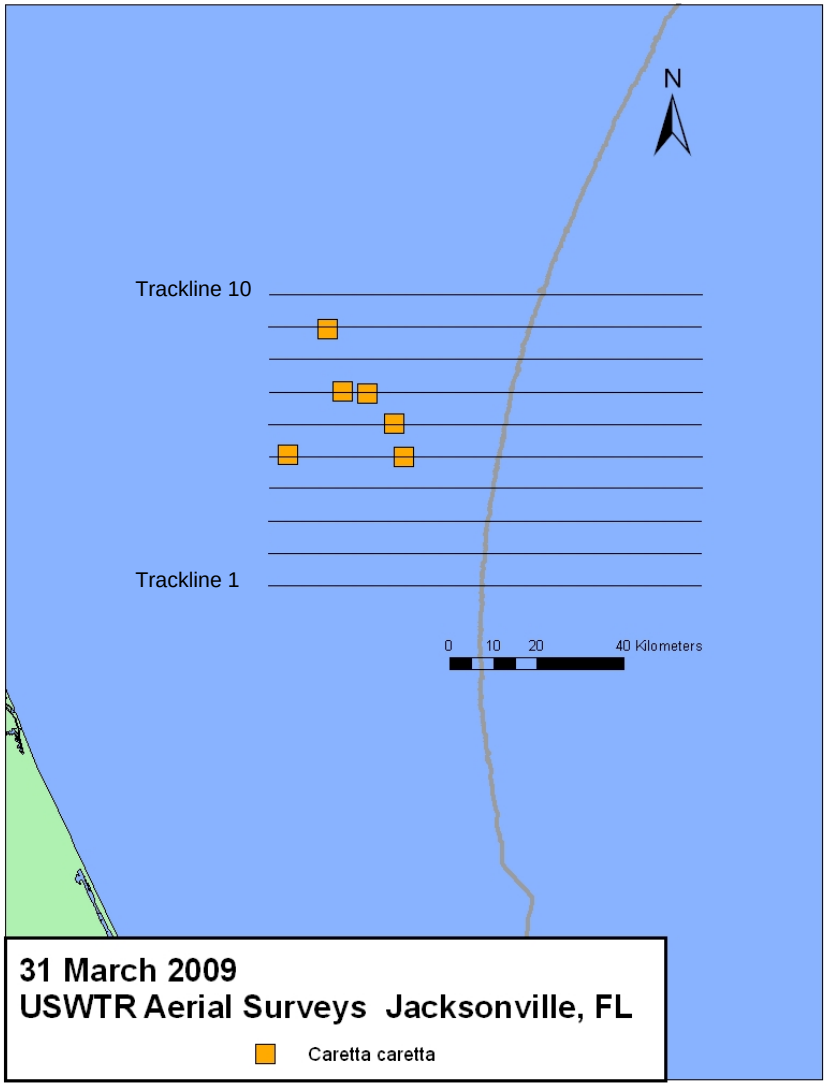




31 March 2009

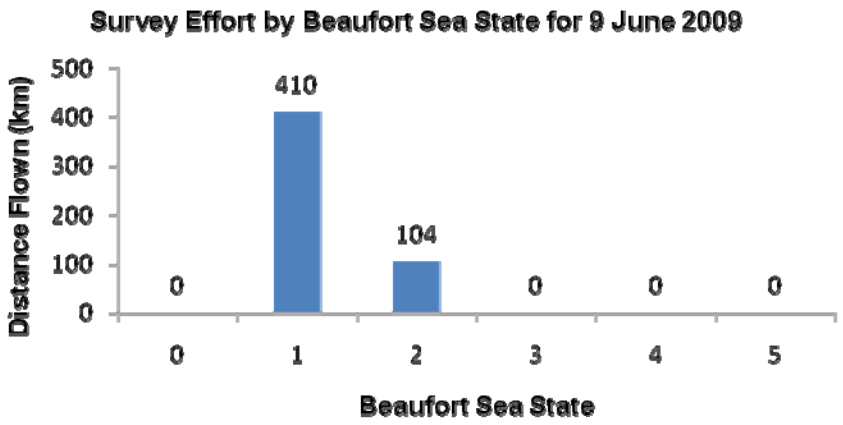
Species	Number of Sightings	Number of Individuals	Beaufort Sea State	Line Number
Caretta caretta	6	6	3	-

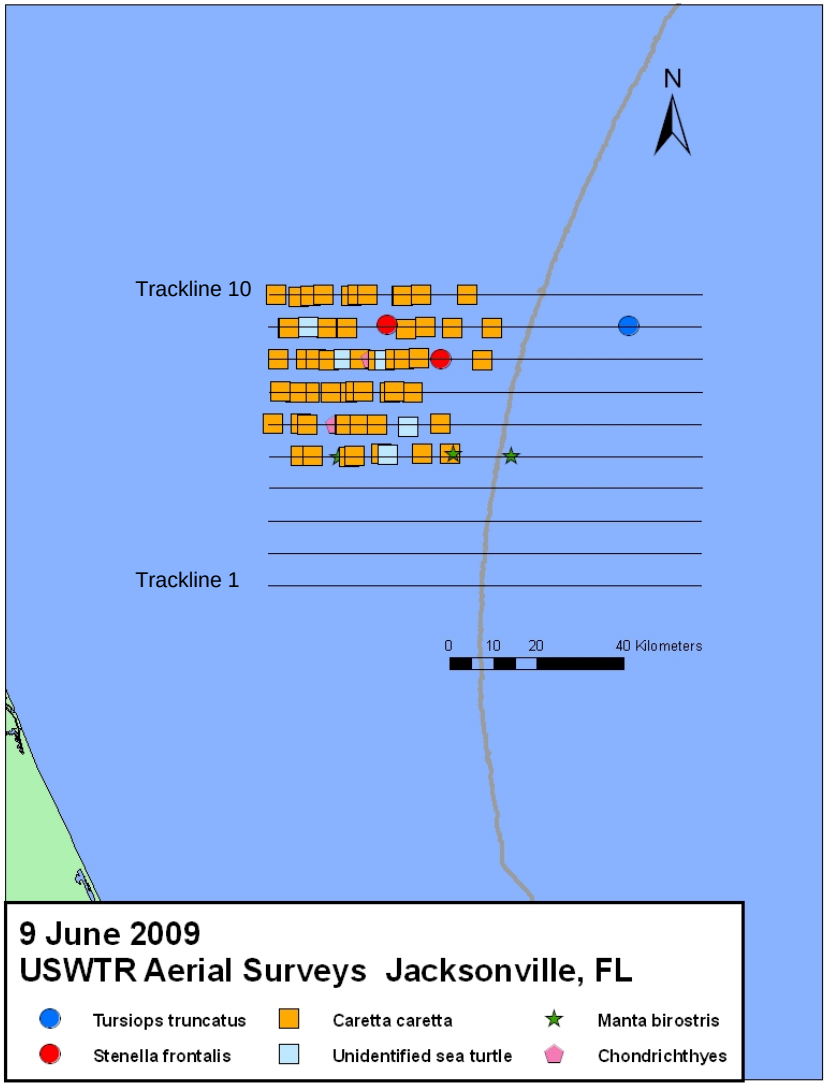




9 June 2009

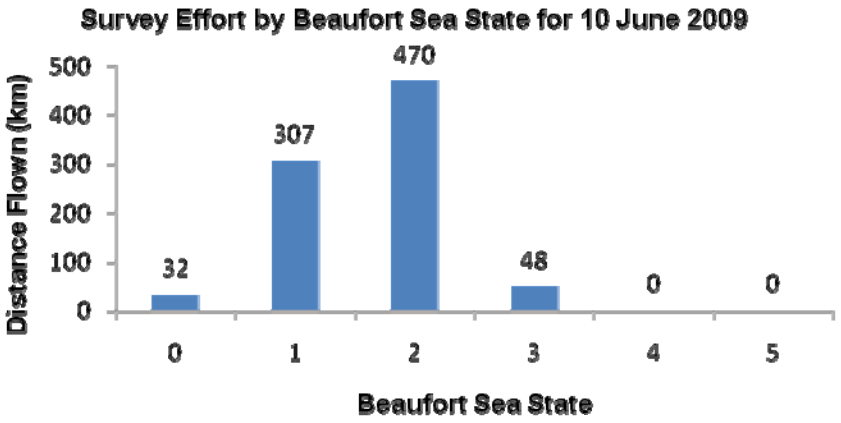
Species	Number of Sightings	Number of Individuals	Beaufort Sea State	Line Number
Tursiops truncatus	1	8	2	9
Stenella frontalis	1	14	1	9
Stenella frontalis	1	6	1	8
Caretta caretta	57	69	1-2	-
Unidentified sea turtle	5	5	1	-
Chondrichthyes	2	2	1	-

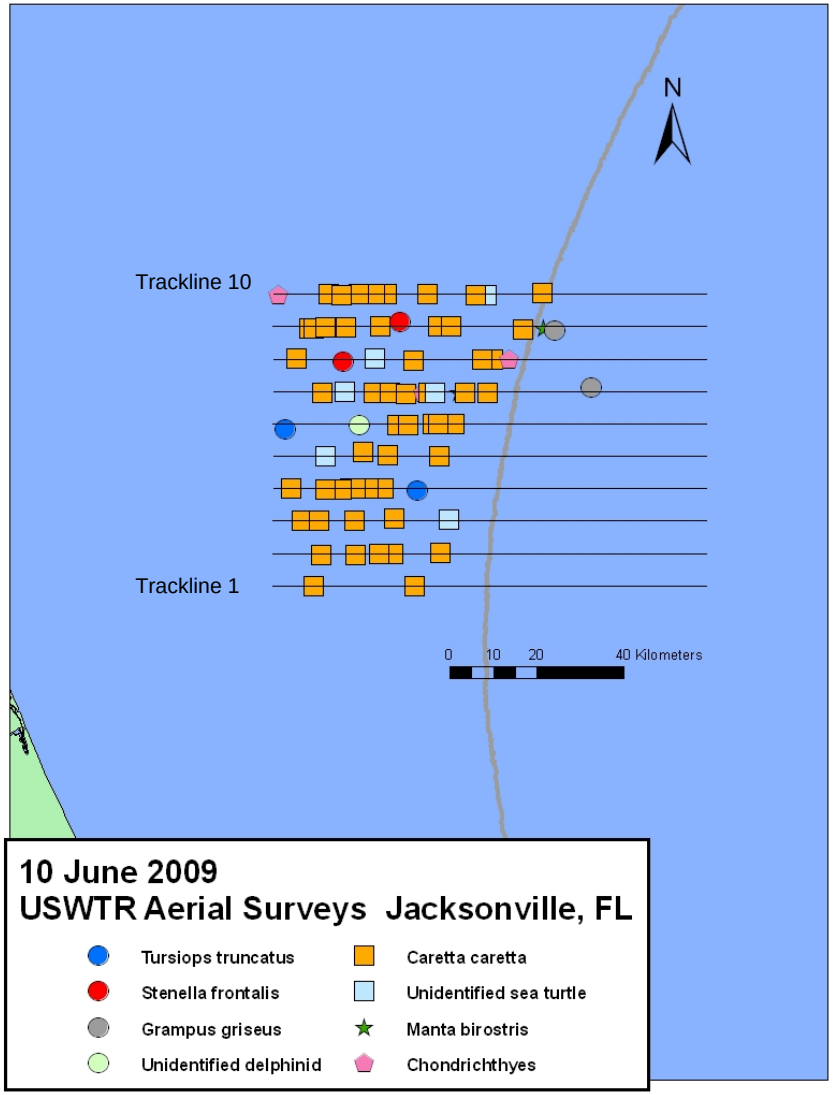




10 June 2009

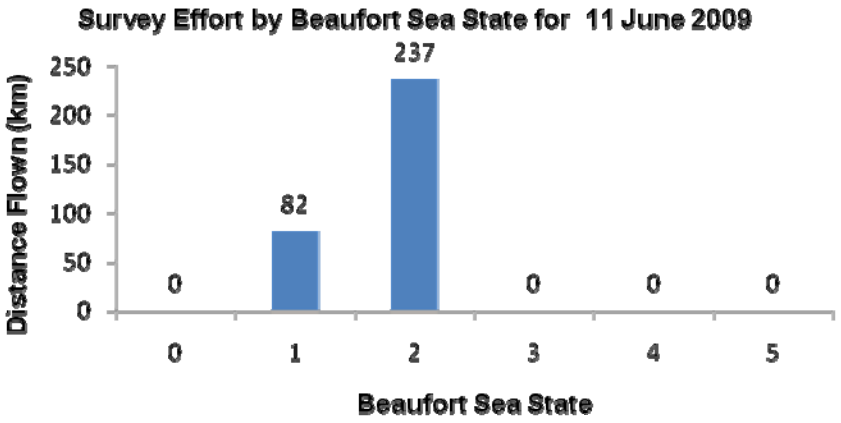
Species	Number of Sightings	Number of Individuals	Beaufort Sea State	Line Number
Tursiops truncatus	1	8	2	4
Tursiops truncatus	2	34	2	6
Stenella frontalis	1	10	1	8
Stenella frontalis	1	7	1	9
Grampus griseus	1	14	1	7
Grampus griseus	1	32	1	9
Unidentified delphinid	1	3	1-2	6
Caretta caretta	54	67	0-3	-
Unidentified sea turtle	7	7	1-2	-
Manta birostris	3	3	1	-
Chondrichthyes	2	2	1-2	-

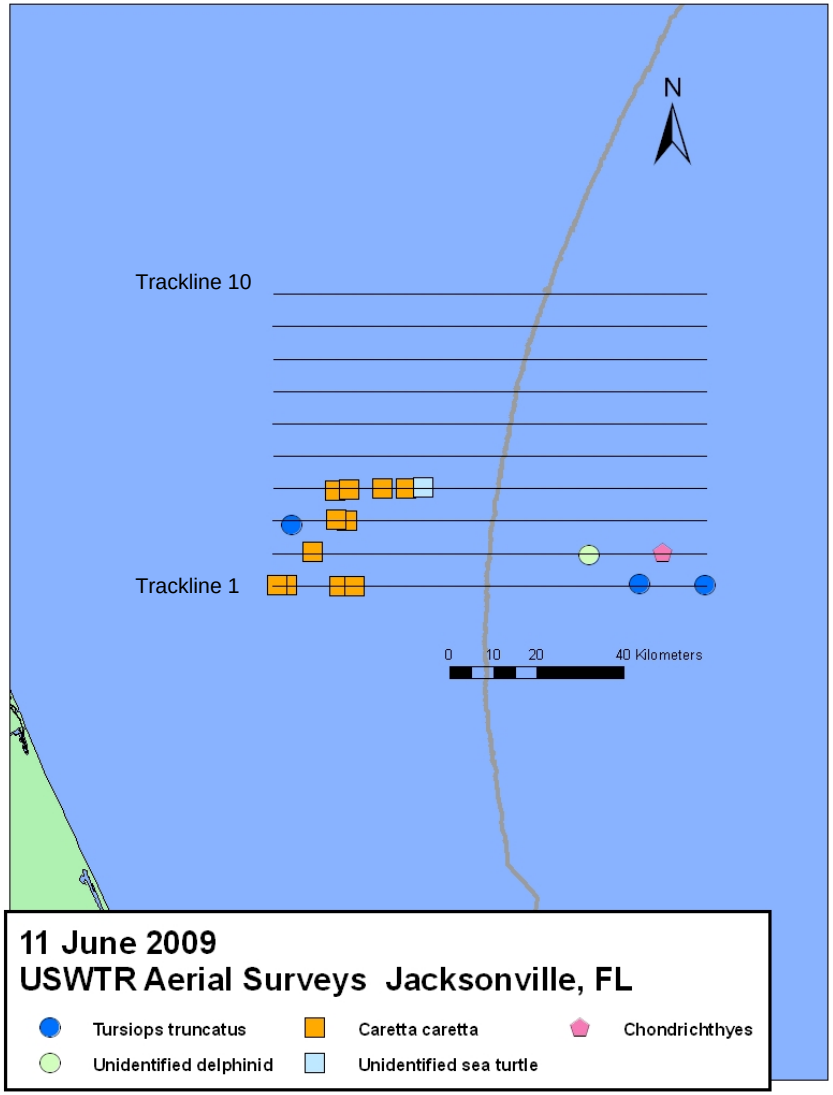




11 June 2009

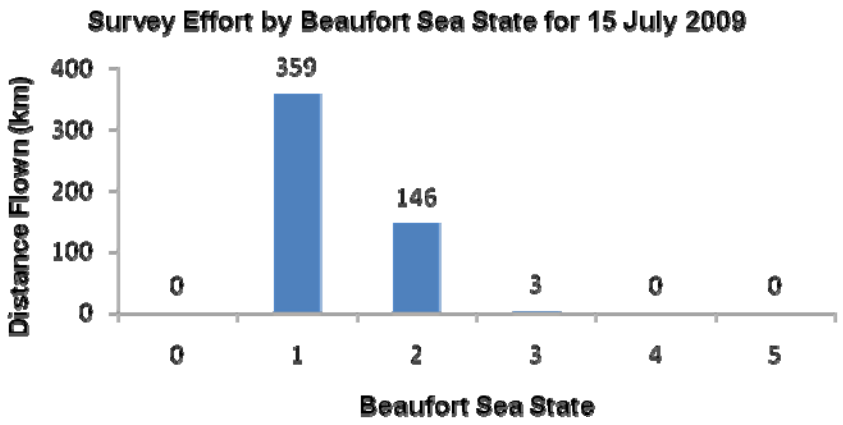
Species	Number of Sightings	Number of Individuals	Beaufort Sea State	Line Number
Tursiops truncatus	1	4	2	3
Tursiops truncatus	2	30	2	1
Unidentified delphinid	1	3	2	2
Caretta caretta	11	13	1-2	-
Unidentified sea turtle	1	1	2	-
Chondrichthyes	1	1	2	-

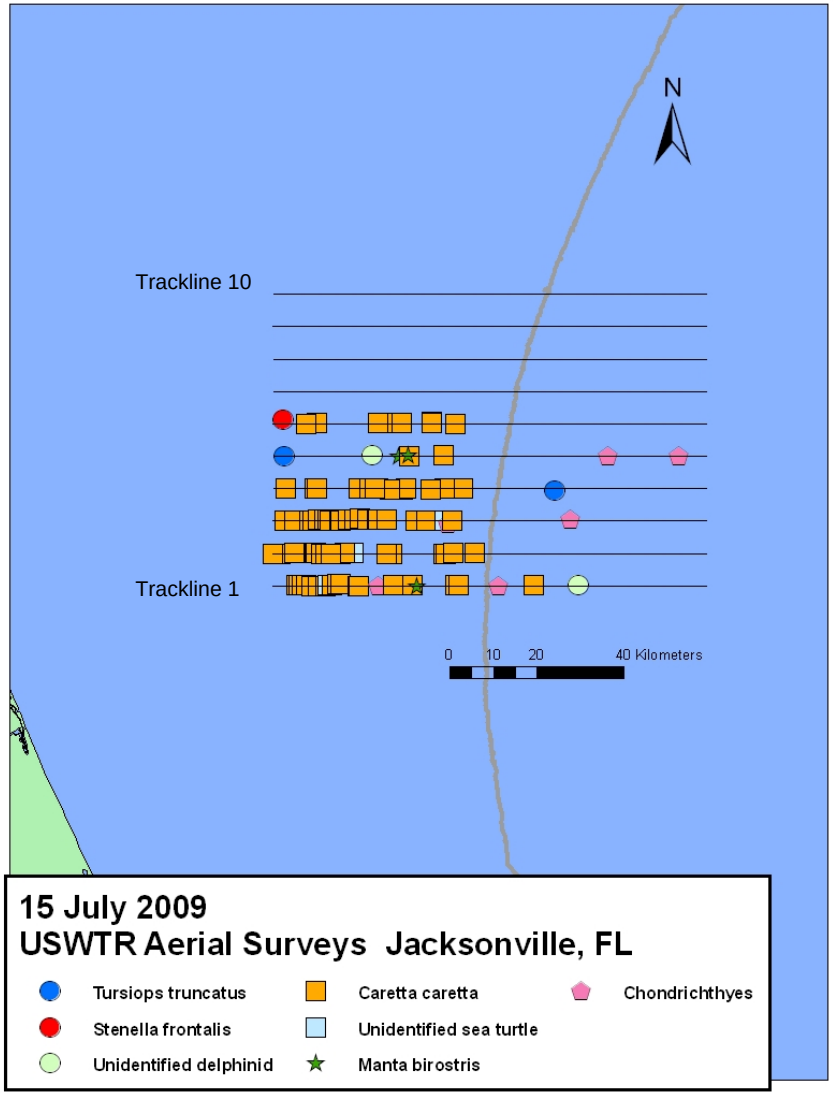




15 July 2009

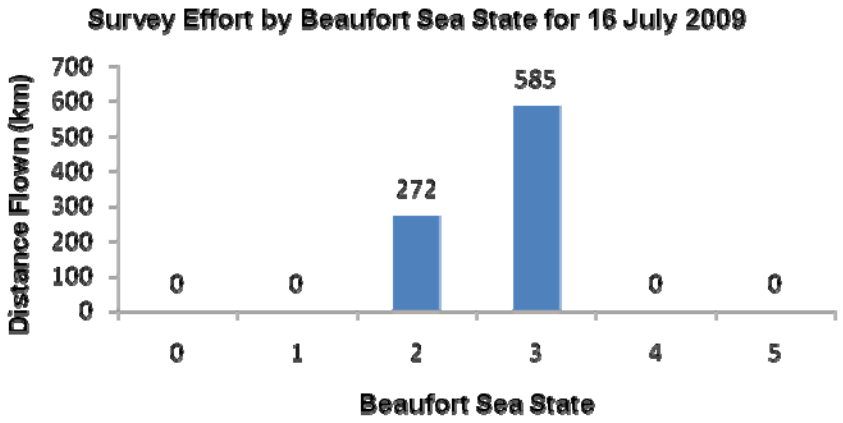
Species	Number of Sightings	Number of Individuals	Beaufort Sea State	Line Number
Tursiops truncatus	1	4	2	4
Tursiops truncatus	1	4	1	5
Stenella frontalis	1	16	1	6
Unidentified delphinid	1	1	2	1
Unidentified delphinid	1	2	1	5
Caretta caretta	75	106	1-2	-
Unidentified sea turtle	7	7	1	-
Manta birostris	3	3	1	-
Chondrichthyes	6	6	1	-

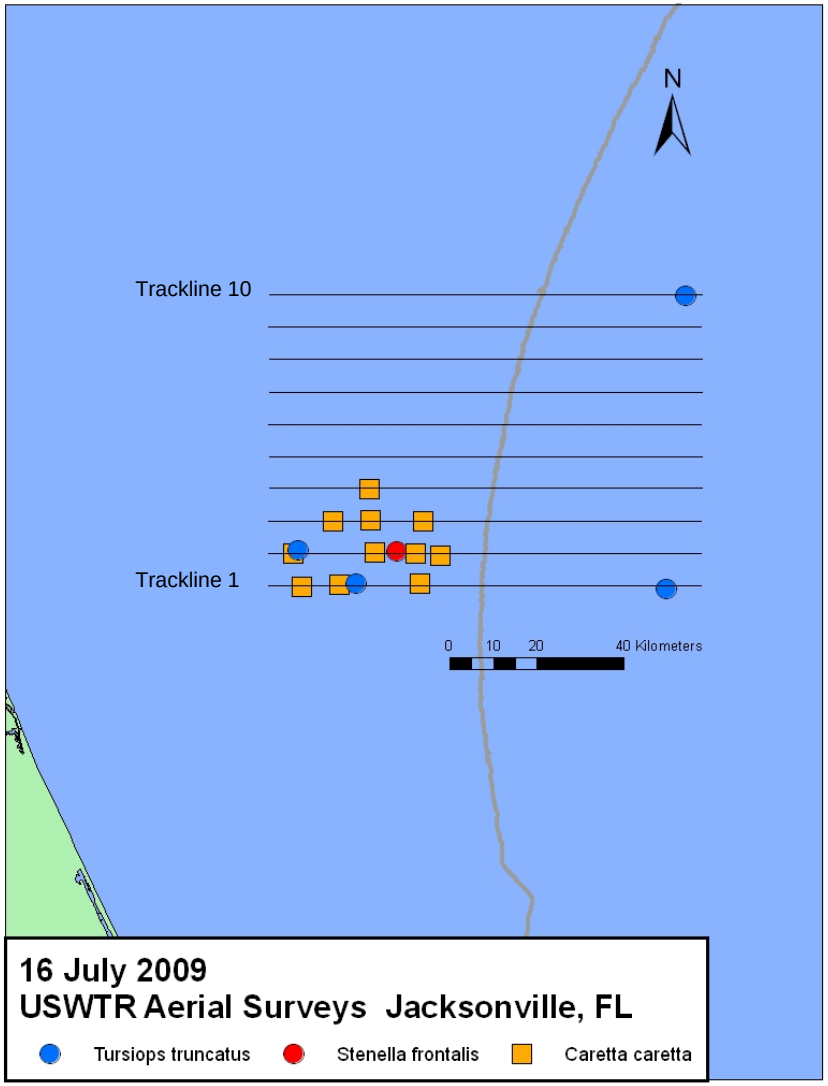




16 July 2009

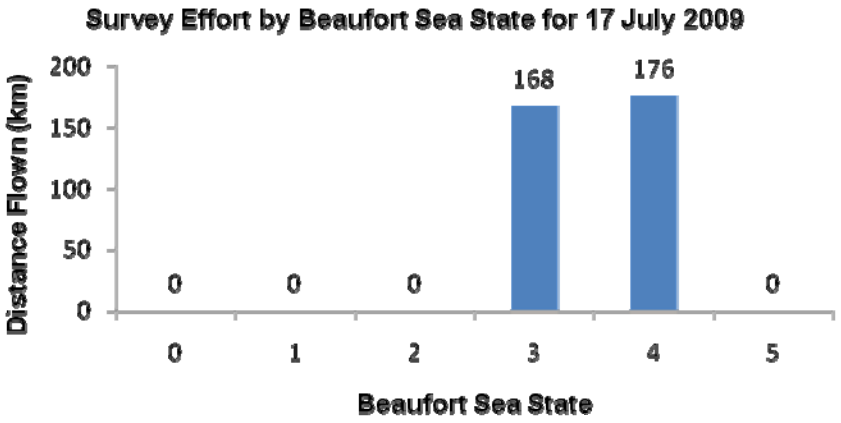
Species	Number of Sightings	Number of Individuals	Beaufort Sea State	Line Number
Tursiops truncatus	1	12	3	10
Tursiops truncatus	1	6	2	2
Tursiops truncatus	2	23	1-2	1
Stenella frontalis	1	12	2	2
Caretta caretta	11	15	1-2	-

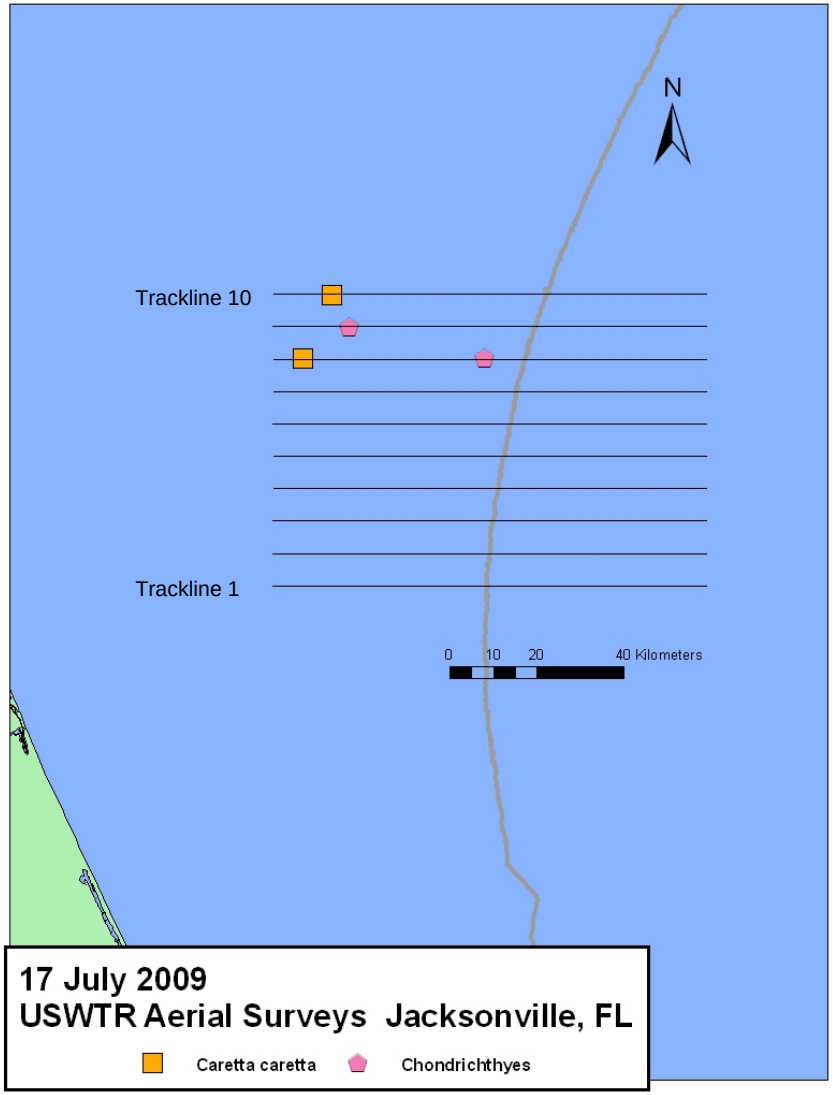




17 July 2009

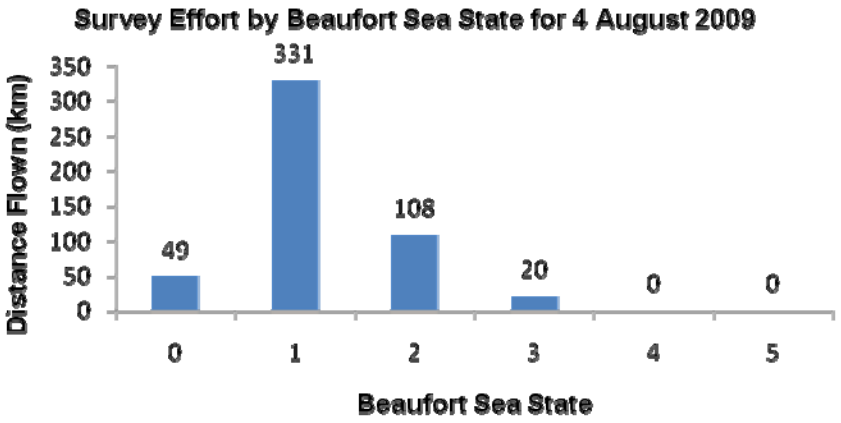
Species	Number of Sightings	Number of Individuals	Beaufort Sea State	Line Number
Caretta caretta	2	2	3	-
Chondrichthyes	2	2	3	-

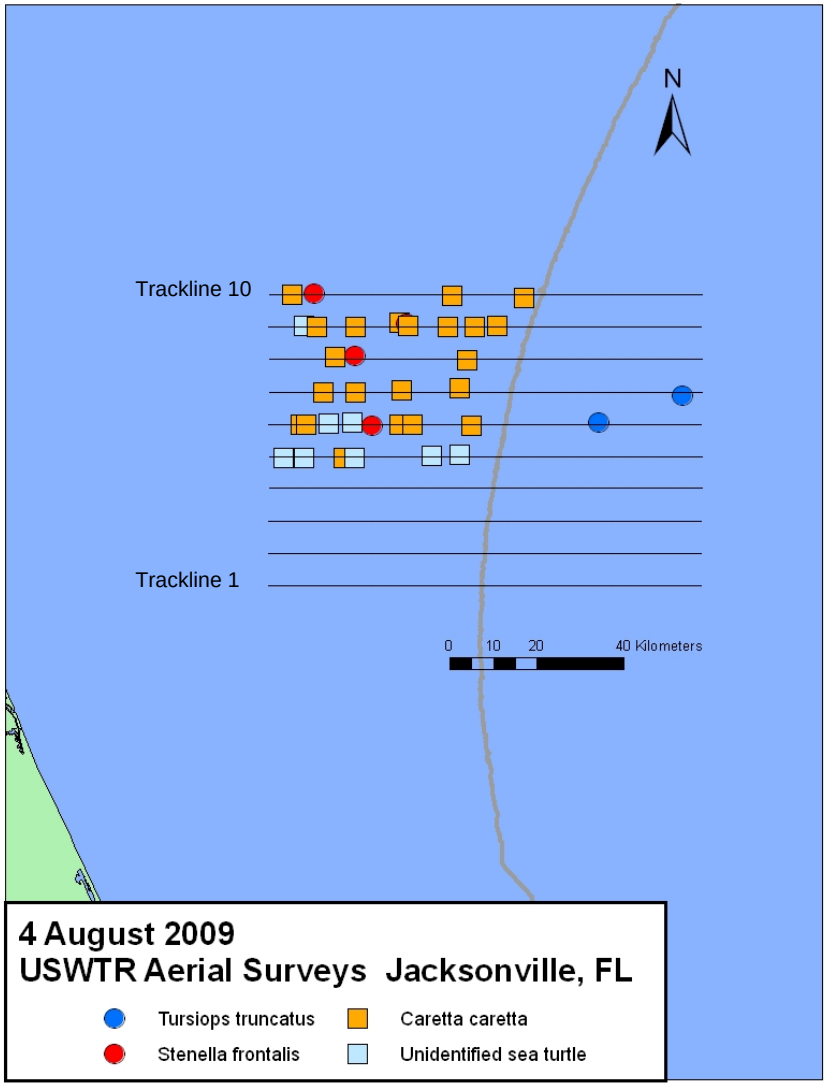




4 August 2009

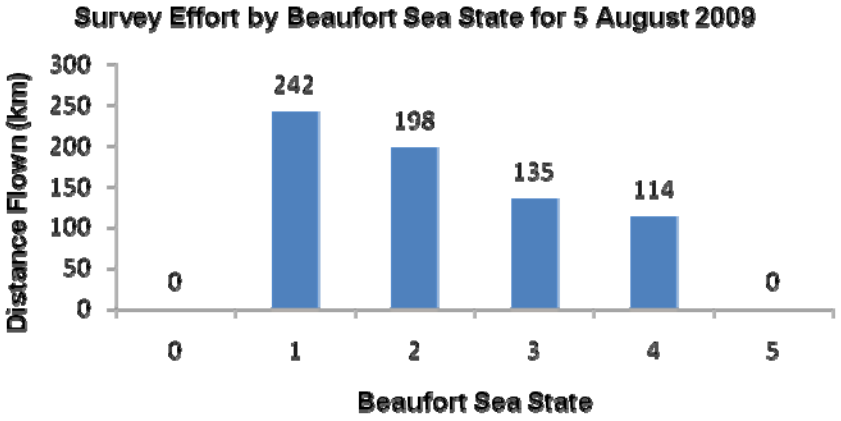
Species	Number of Sightings	Number of Individuals	Beaufort Sea State	Line Number
Tursiops truncatus	1	24	1	7
Tursiops truncatus	1	35	0	6
Stenella frontalis	1	4	1	10
Stenella frontalis	1	25	1	9
Stenella frontalis	1	6	1	8
Stenella frontalis	1	7	1	6
Caretta caretta	22	28	1-3	-
Unidentified sea turtle	8	8	1-3	-

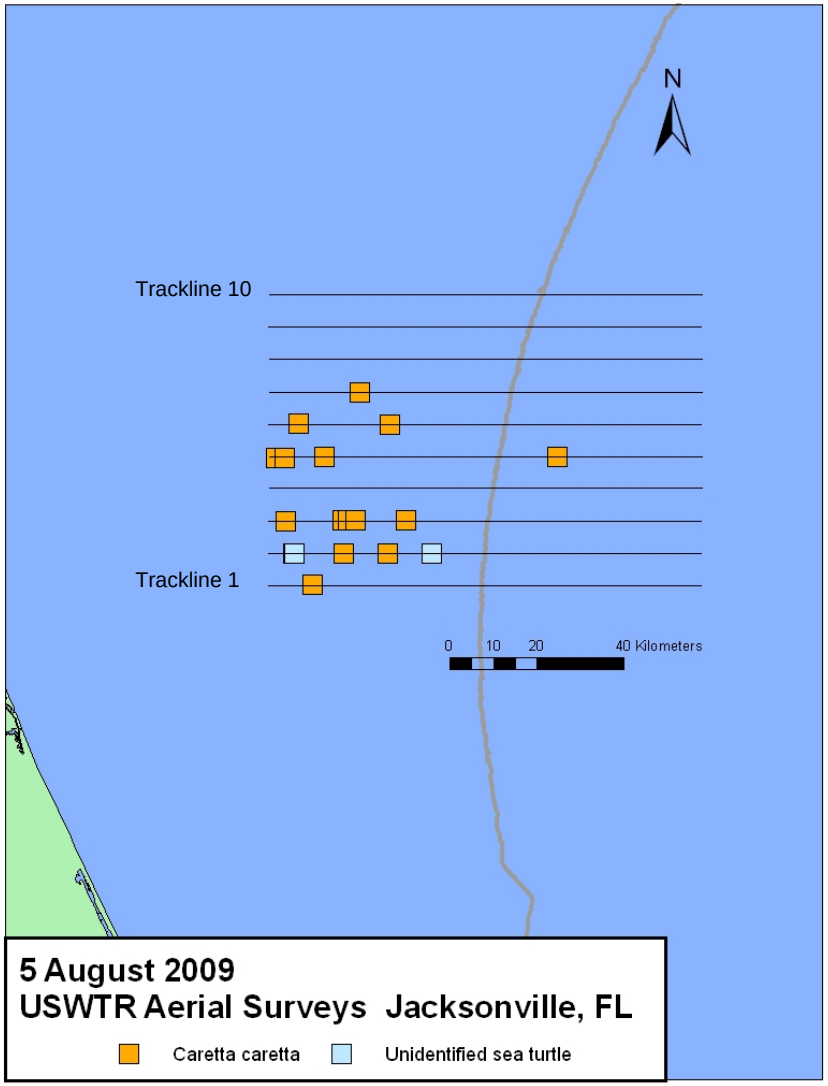




5 August 2009

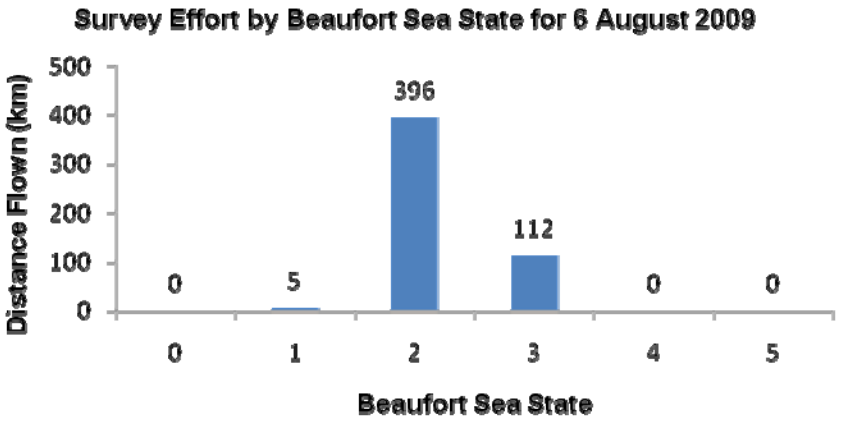
Species	Number of Sightings	Number of Individuals	Beaufort Sea State	Line Number
Caretta caretta	16	20	1-3	-
Unidentified sea turtle	3	3	1-2	-

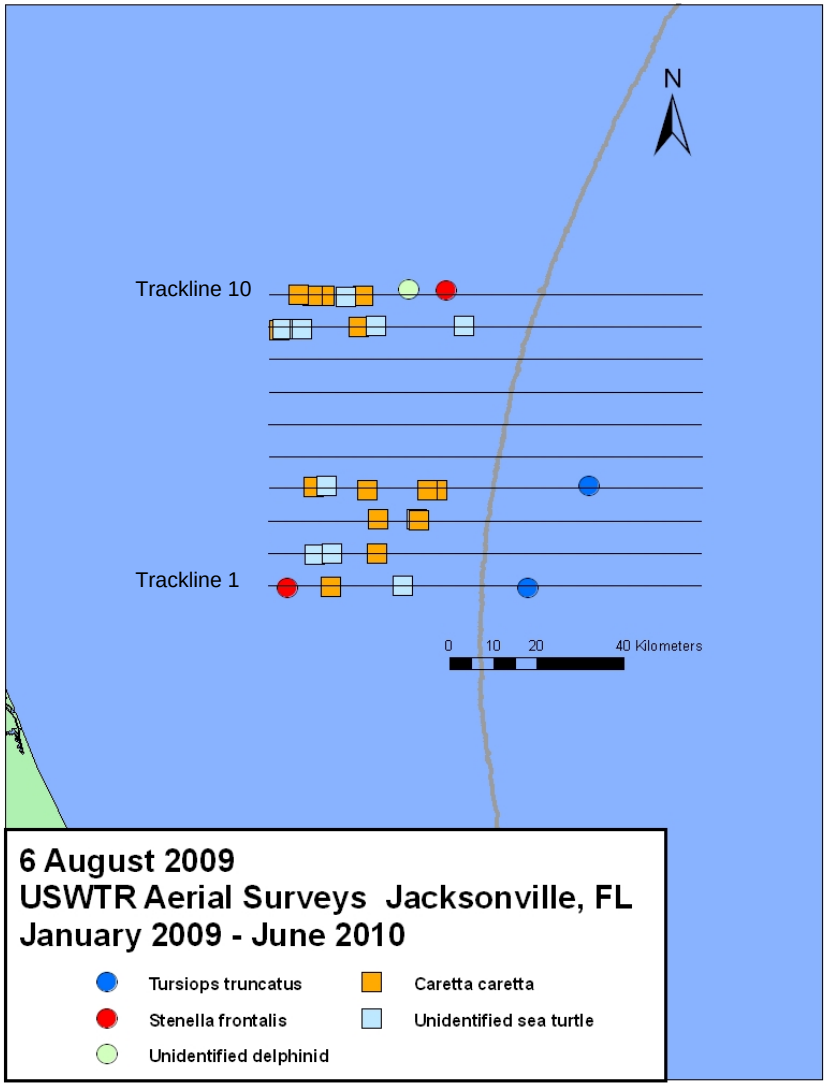




6 August 2009

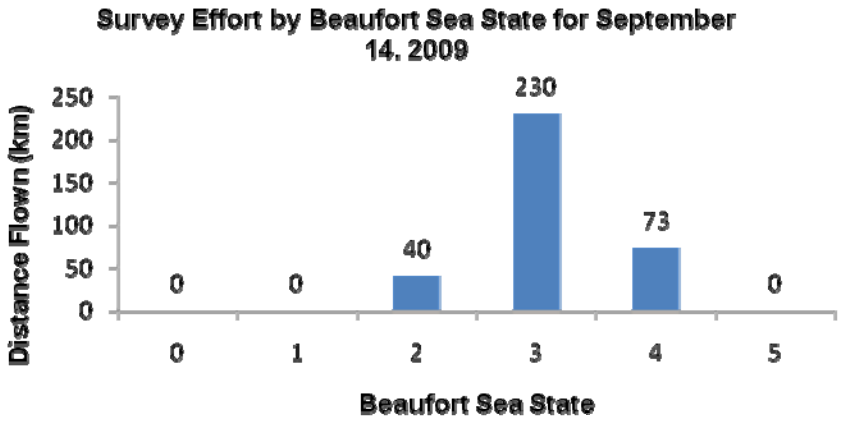
Species	Number of Sightings	Number of Individuals	Beaufort Sea State	Line Number
Tursiops truncatus	1	20	2	1
Tursiops truncatus	1	17	3	4
Stenella frontalis	1	20	2	1
Stenella frontalis	1	6	2	10
Unidentified delphinid	1	3	2	10
Caretta caretta	15	20	1-2	-
Unidentified sea turtle	10	10	2	-

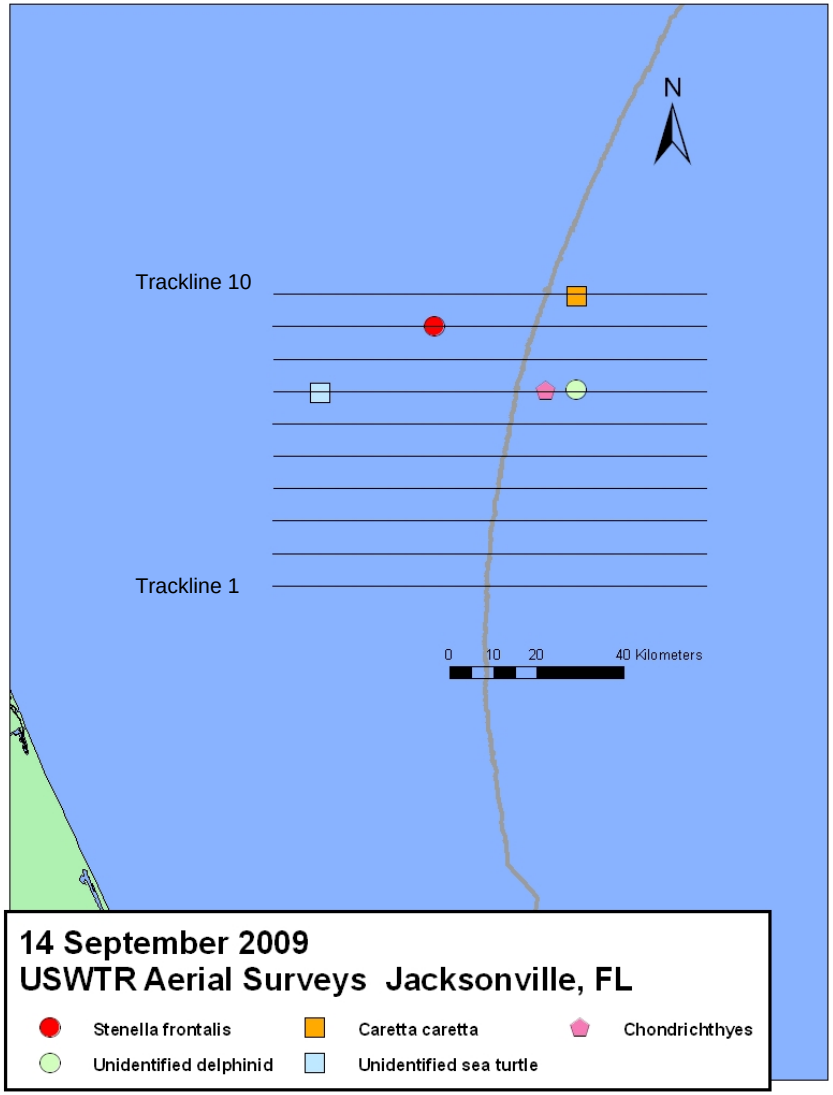




14 September 2009

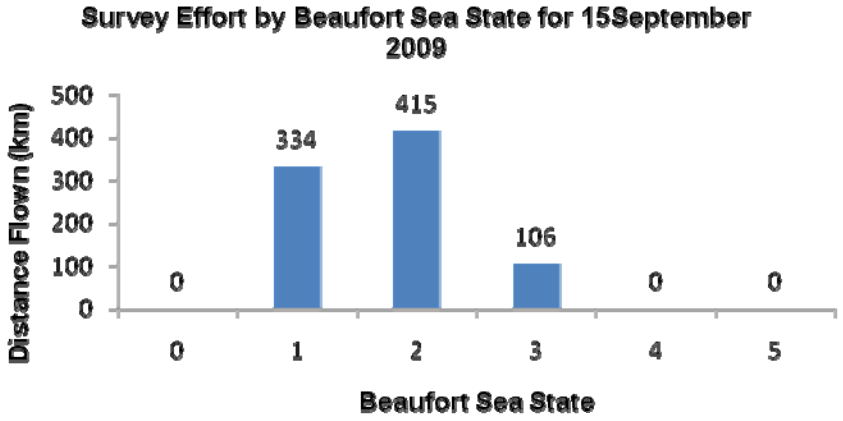
Species	Number of Sightings	Number of Individuals	Beaufort Sea State	Line Number
Stenella frontalis	1	8	3	9
Unidentified delphinid	1	9	3	7
Caretta caretta	1	1	3	-
Unidentified sea turtle	1	1	3	-
Chondrichthyes	1	1	3	-

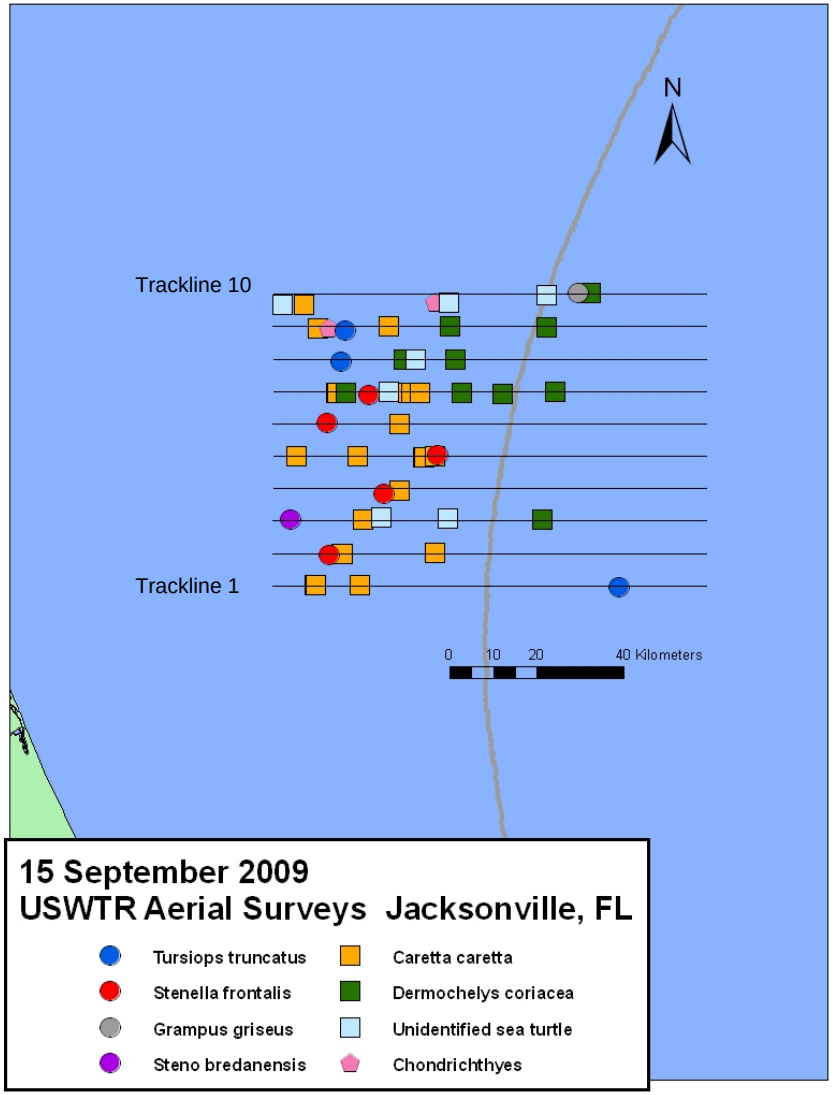




15 September 2009

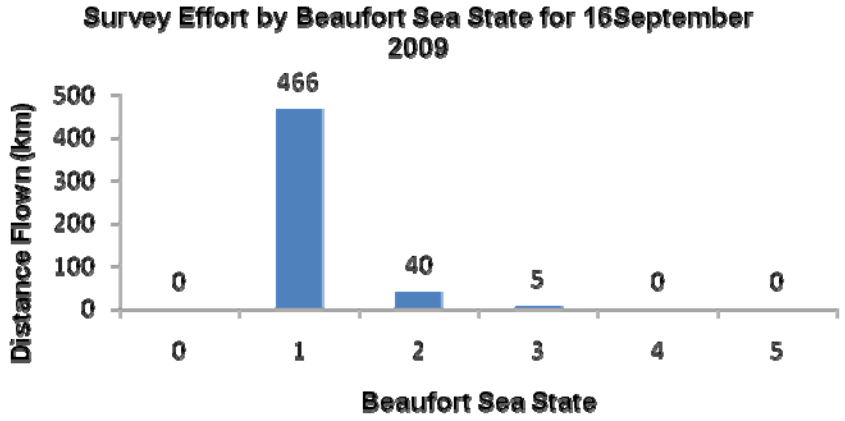
Species	Number of Sightings	Number of Individuals	Beaufort Sea State	Line Number
Tursiops truncatus	1	3	2	1
Tursiops truncatus	1	2	1	8
Tursiops truncatus	1	8	1	9
Stenella frontalis	1	7	2	2
Stenella frontalis	1	40	2	4
Stenella frontalis	1	36	2	5
Stenella frontalis	1	10	1	6
Stenella frontalis	1	36	1	7
Grampus griseus	1	36	1	10
Steno bredanensis	1	50	1	3
Caretta caretta	22	23	1-3	-
Dermochelys coriacea	10	10	1-3	-
Unidentified sea turtle	7	7	1-2	-
Chondrichthyes	2	2	1	-

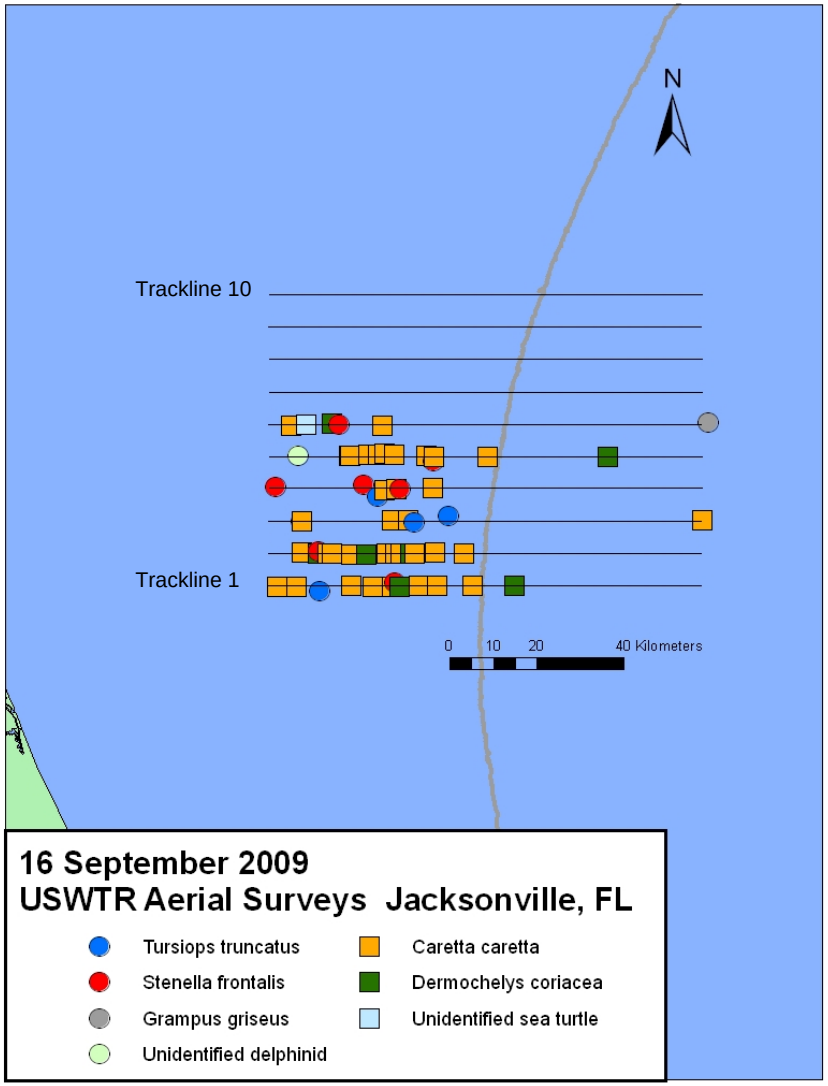




16 September 2009

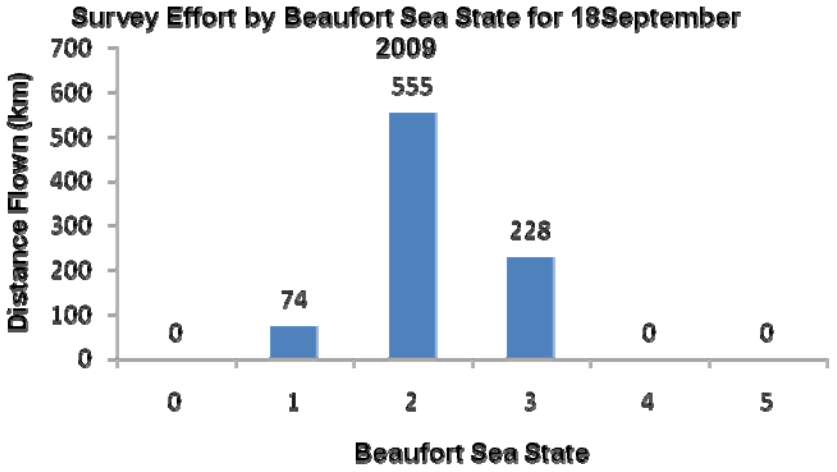
Species	Number of Sightings	Number of Individuals	Beaufort Sea State	Line Number
Tursiops truncatus	1	9	1	1
Tursiops truncatus	2	14	1	3
Tursiops truncatus	1	6	1	4
Stenella frontalis	1	25	1	1
Stenella frontalis	1	12	1	2
Stenella frontalis	1	48	1	3
Stenella frontalis	3	35	1	4
Stenella frontalis	1	23	1	5
Stenella frontalis	1	36	1	6
Grampus griseus	1	4	1	6
Unidentified delphinid	1	11	1	5
Caretta caretta	37	58	1	-
Dermochelys coriacea	8	8	1	-
Unidentified sea turtle	1	1	1	-

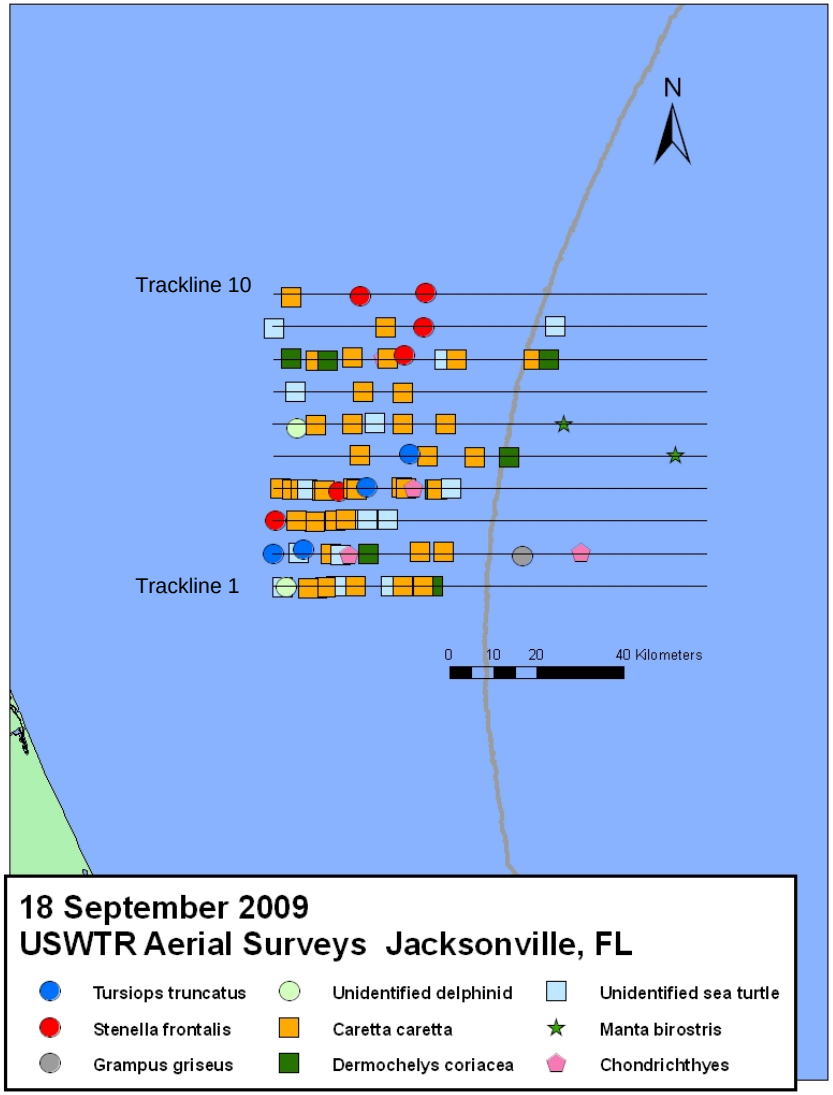




18 September 2009

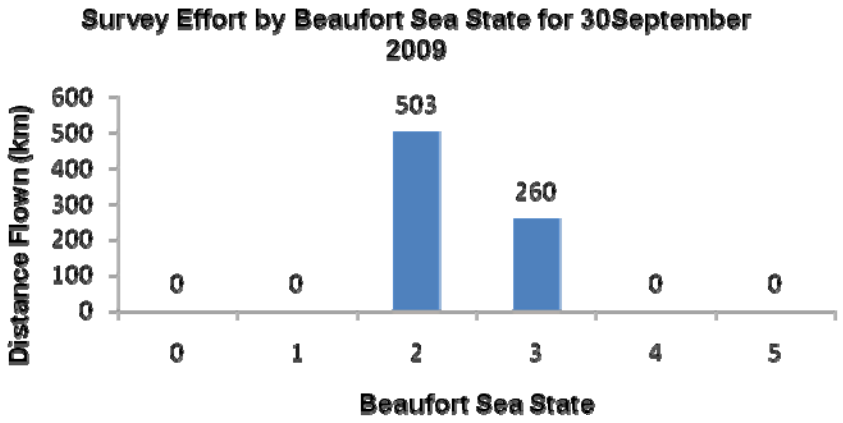
Species	Number of Sightings	Number of Individuals	Beaufort Sea State	Line Number
Tursiops truncatus	1	16	2	5
Tursiops truncatus	1	5	2	4
Tursiops truncatus	2	19	2	2
Stenella frontalis	2	41	3	10
Stenella frontalis	1	12	2	9
Stenella frontalis	1	50	2	8
Stenella frontalis	1	5	2	4
Stenella frontalis	1	7	2	3
Grampus griseus	1	5	2	2
Unidentified delphinid	1	2	2	6
Unidentified delphinid	1	5	2	1
Caretta caretta	41	52	1-3	-
Dermochelys coriacea	7	7	1-3	-
Unidentified sea turtle	15	16	1-3	-
Manta birostris	3	3	1-2	-
Chondrichthyes	4	4	1-2	-

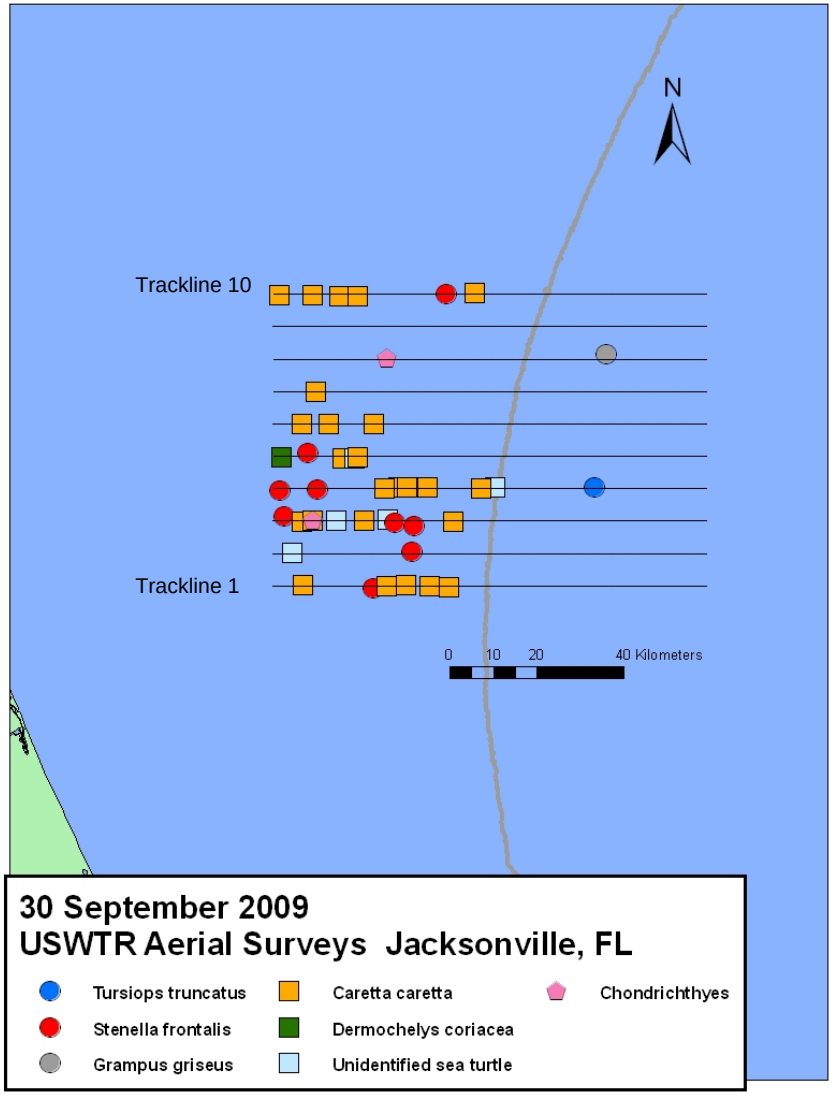




30 September 2009

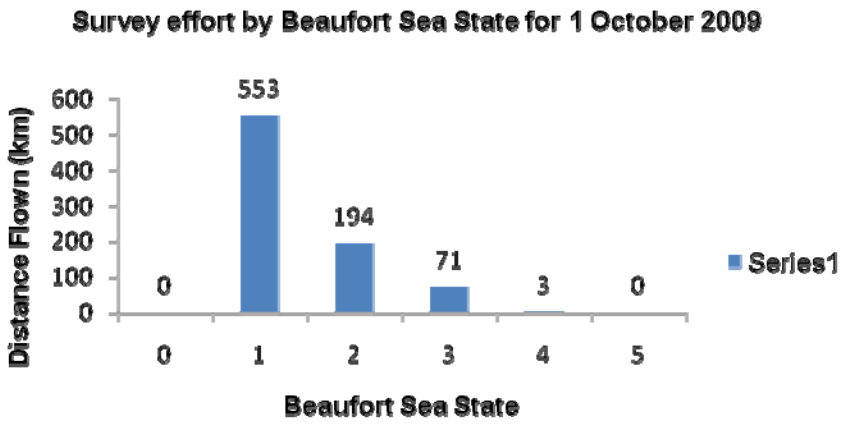
Species	Number of Sightings	Number of Individuals	Beaufort Sea State	Line Number
Tursiops truncatus	1	5	3	4
Stenella frontalis	1	5	2	1
Stenella frontalis	1	10	2	2
Stenella frontalis	3	40	2	3
Stenella frontalis	2	9	2	4
Stenella frontalis	1	9	2	5
Stenella frontalis	1	9	2	10
Grampus griseus	1	26	2	8
Caretta caretta	26	30	1-3	-
Dermochelys coriacea	1	1	2	-
Unidentified Sea Turtle	5	5	2	-
Chondrichthyes	2	2	2-3	-

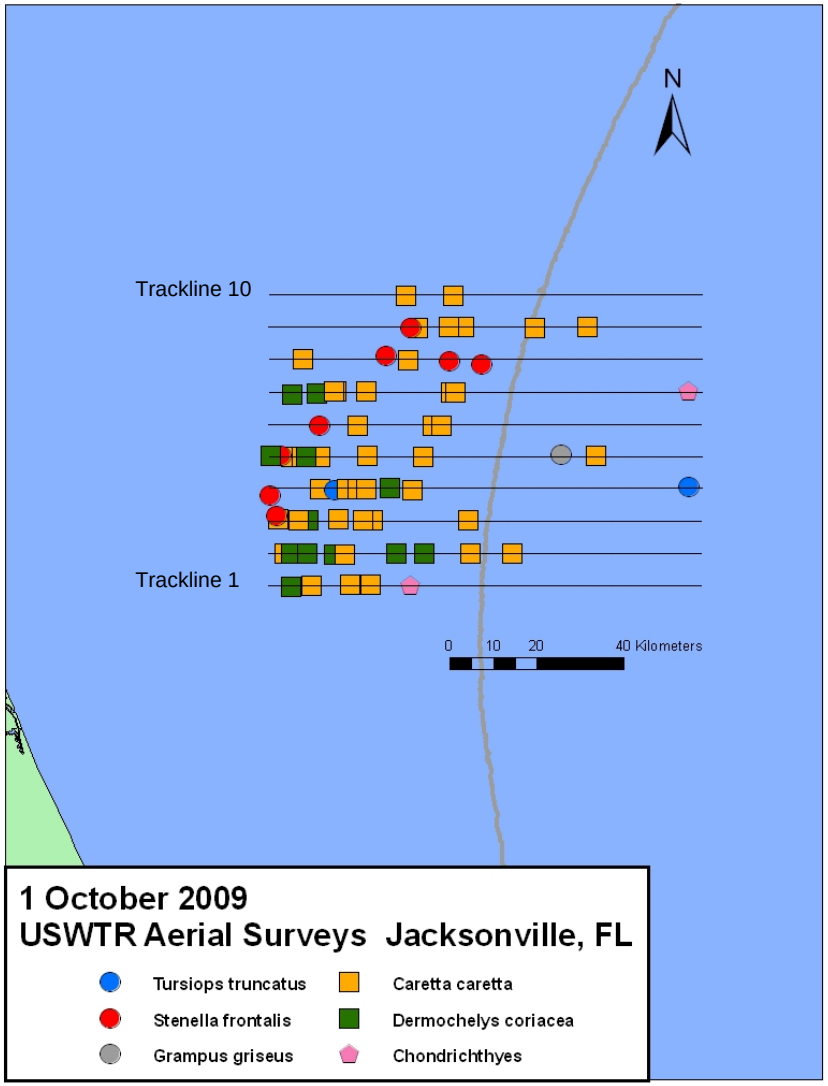




1 October 2009

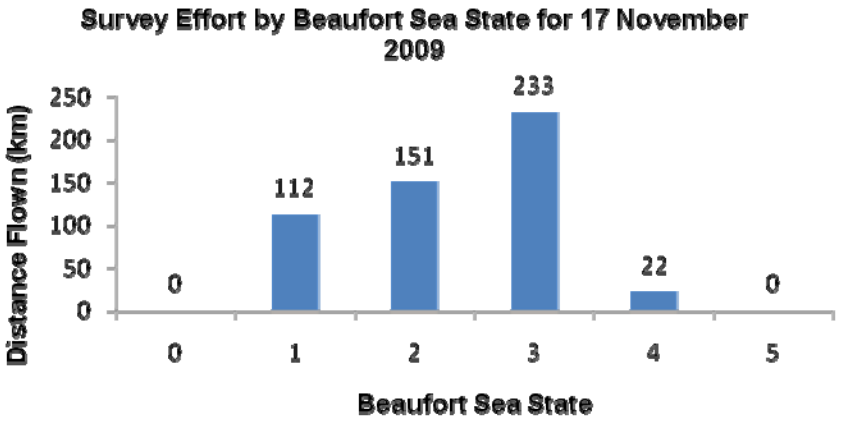
Species	Number of Sightings	Number of Individuals	Beaufort Sea State	Line Number
Tursiops truncatus	2	50	1-2	4
Stenella frontalis	1	4	2	9
Stenella frontalis	3	43	2	8
Stenella frontalis	1	6	2	6
Stenella frontalis	1	9	1	5
Stenella frontalis	1	6	1	4
Stenella frontalis	1	4	1	3
Grampus griseus	1	4	1	5
Caretta caretta	42	53	1-3	-
Dermochelys coriacea	12	12	1	-
Chondrichthyes	2	2	1	-

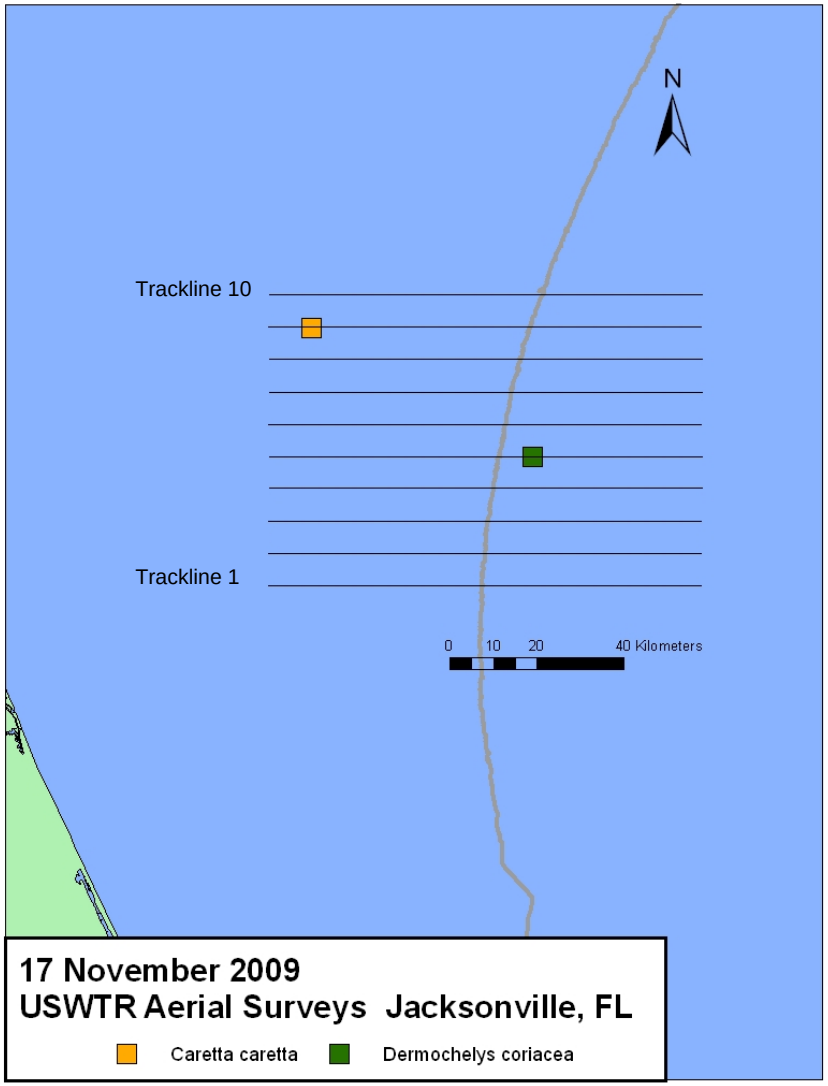




17 November 2009

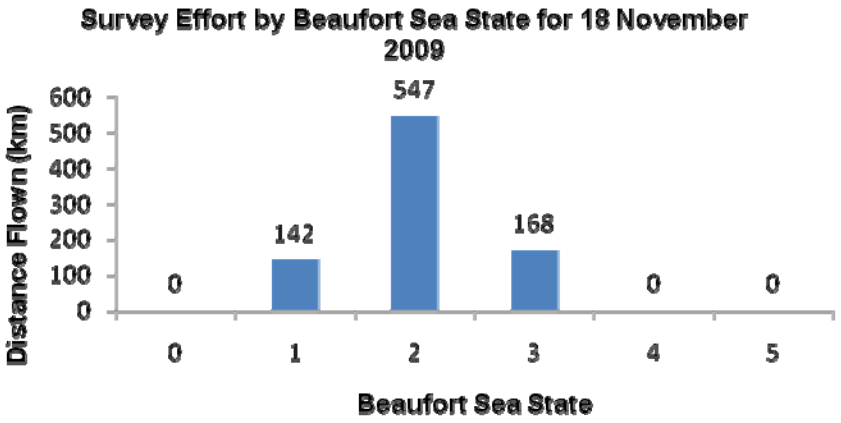
Species	Number of Sightings	Number of Individuals	Beaufort Sea State	Line Number
Caretta caretta	1	1	2	-
Dermochelys coriacea	1	1	1	-

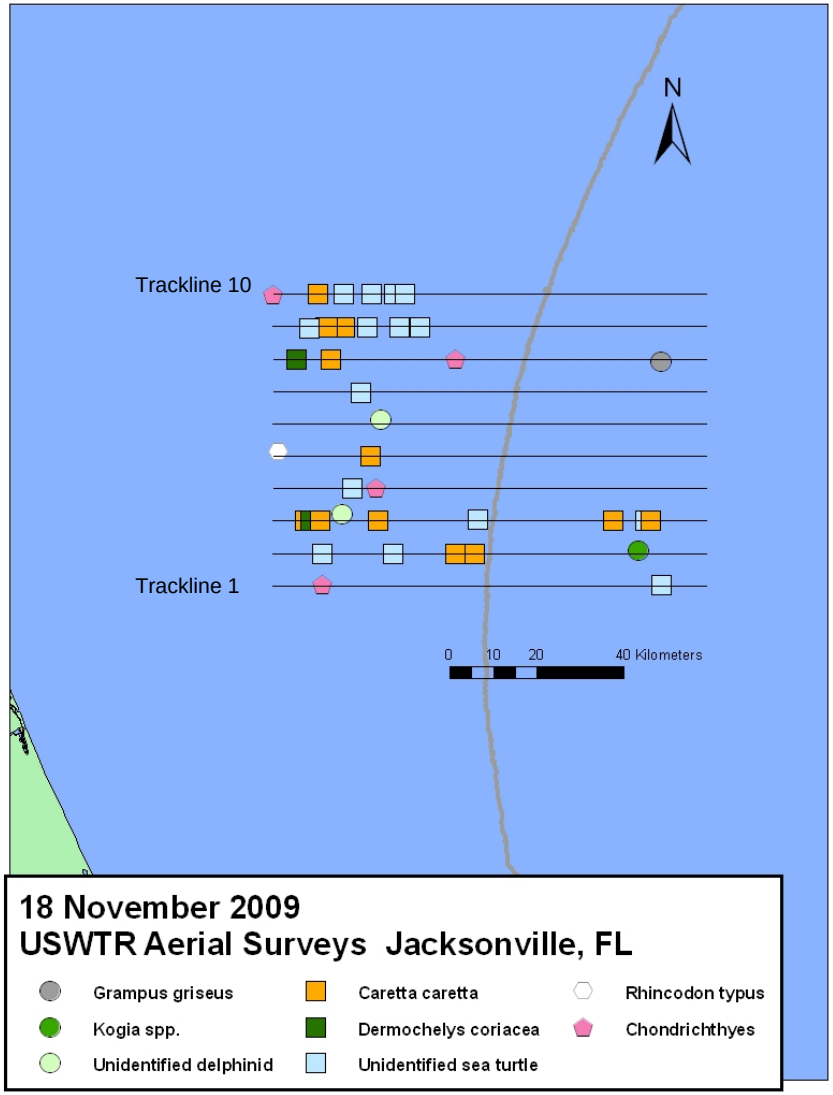




18 November 2009

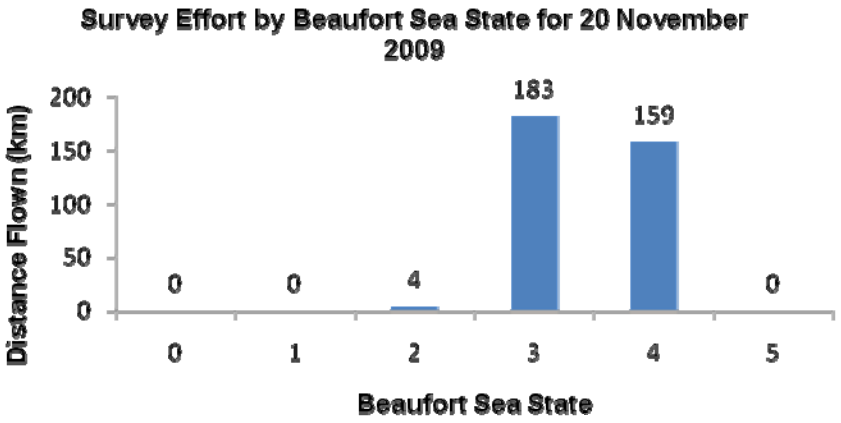
Species	Number of Sightings	Number of Individuals	Beaufort Sea State	Line Number
Grampus griseus	1	40	3	8
Kogia spp.	1	1	1	2
Unidentified delphinid	1	3	1	3
Unidentified delphinid	1	1	2	6
Caretta caretta	12	22	1-2	-
Dermochelys coriacea	3	3	1-2	-
Unidentified sea turtle	16	16	1-2	-
Rhincodon typus	1	1	2	-
Chondrichthyes	4	4	1-2	-

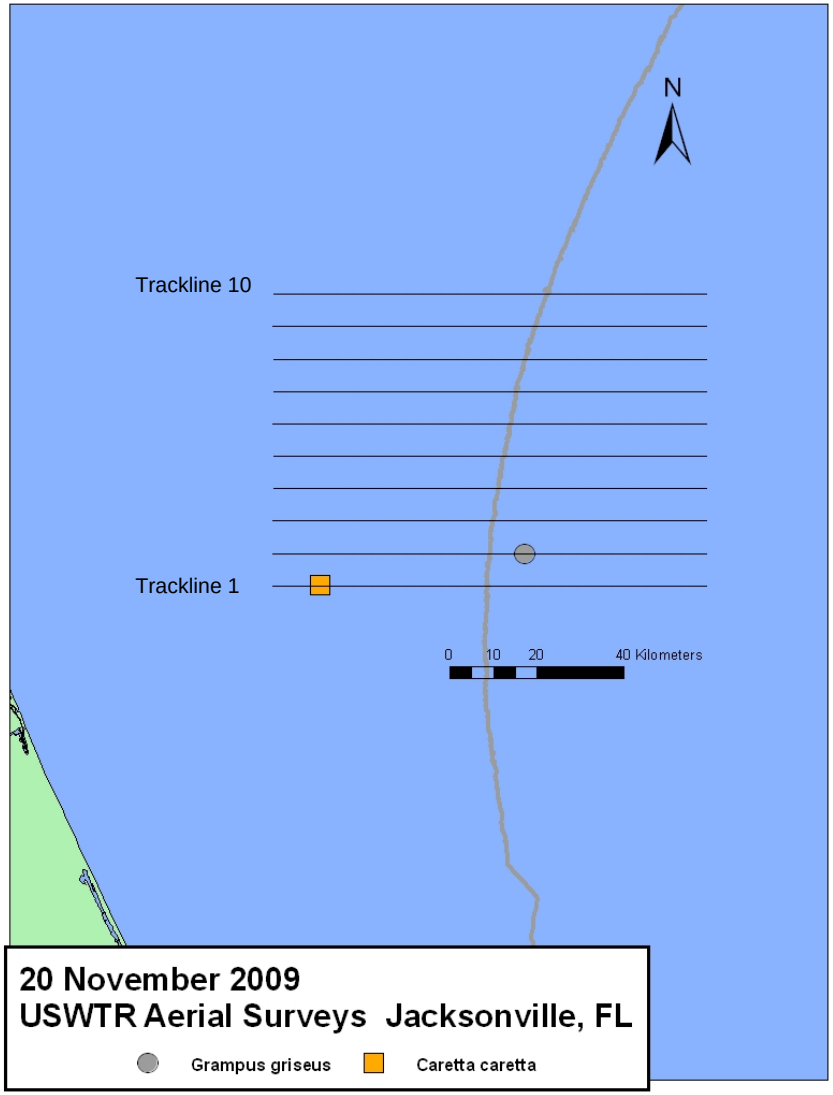




20 November 2009

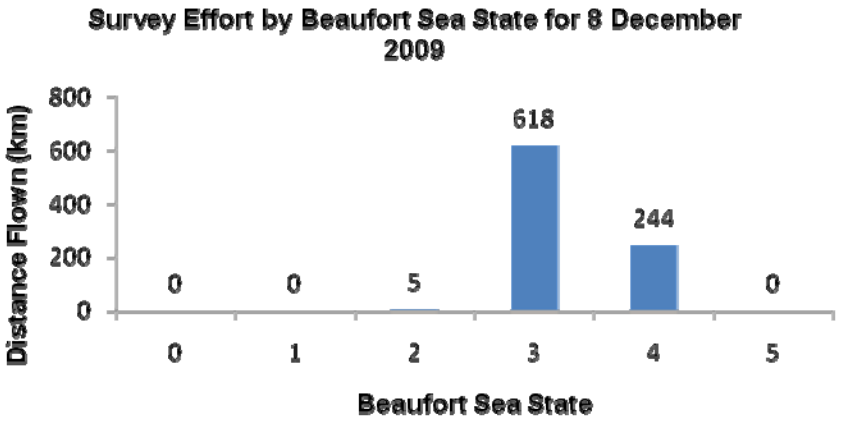
Species	Number of Sightings	Number of Individuals	Beaufort Sea State	Line Number
Grampus griseus	1	20	4	2
Caretta caretta	1	1	3	-

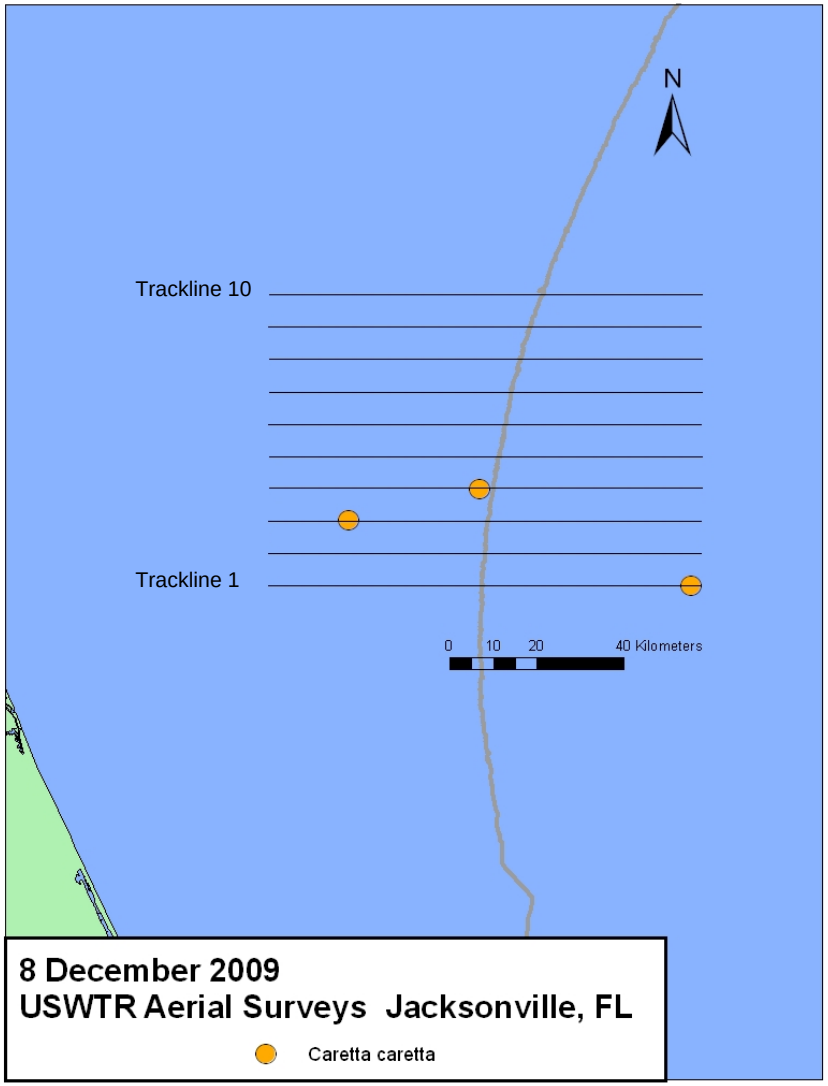




8 December 2009

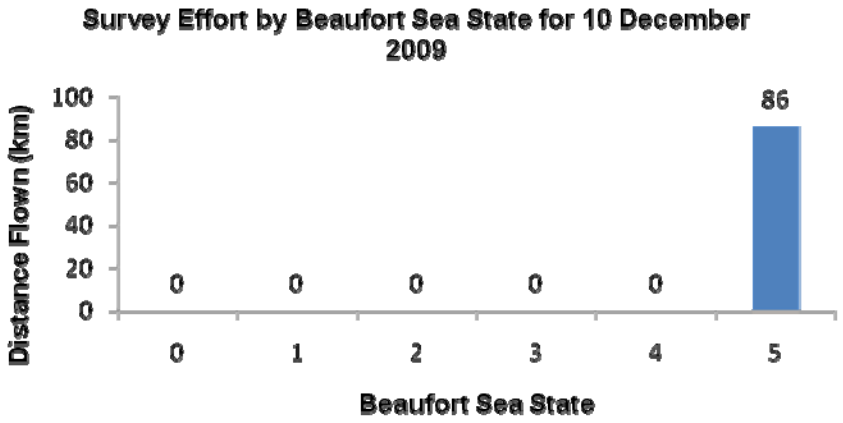
Species	Number of Sightings	Number of Individuals	Beaufort Sea State	Line Number
Caretta caretta	3	3	3	-

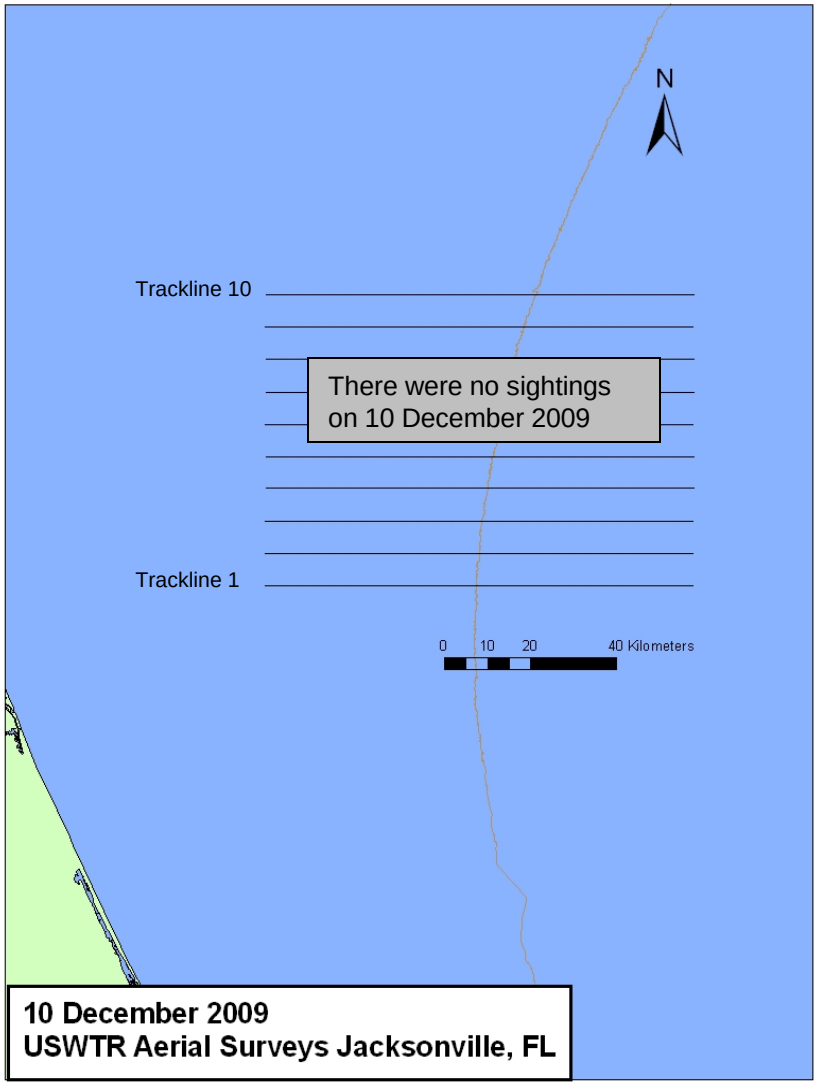




10 December 2009

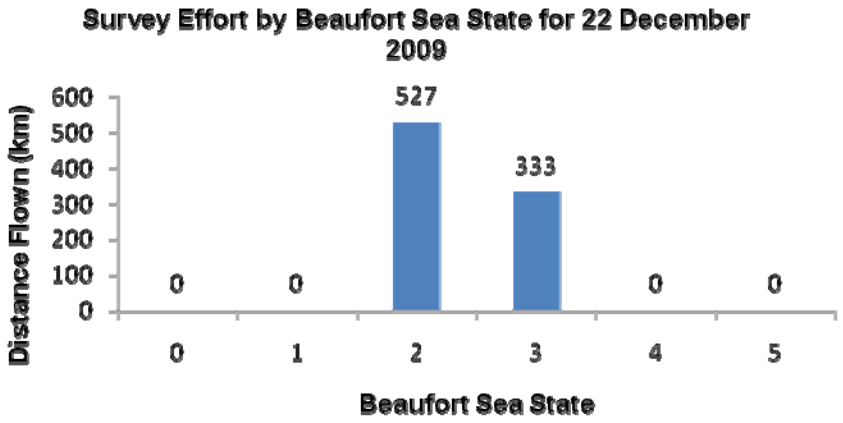
Species	Number of Sightings	Number of Individuals	Beaufort Sea State	Line Number
N/A				
N/A				
N/A	No sighting for 10/12/09			
N/A				
N/A				
N/A				

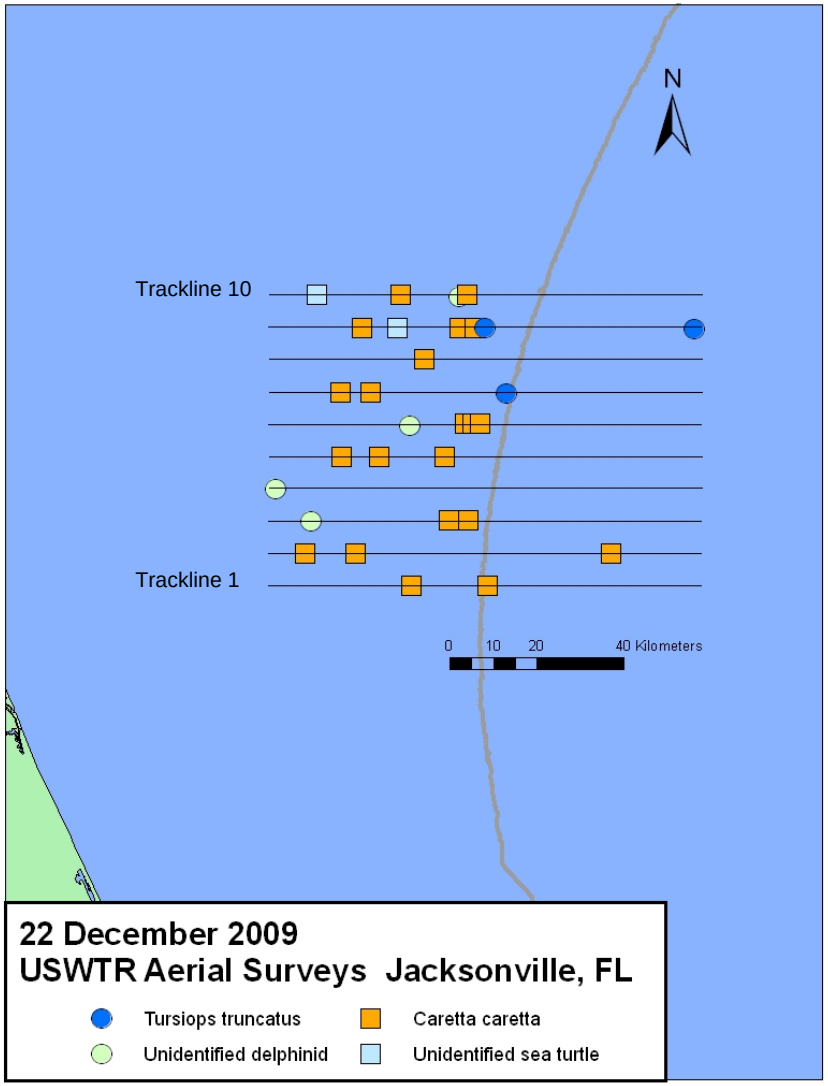




22 December 2009

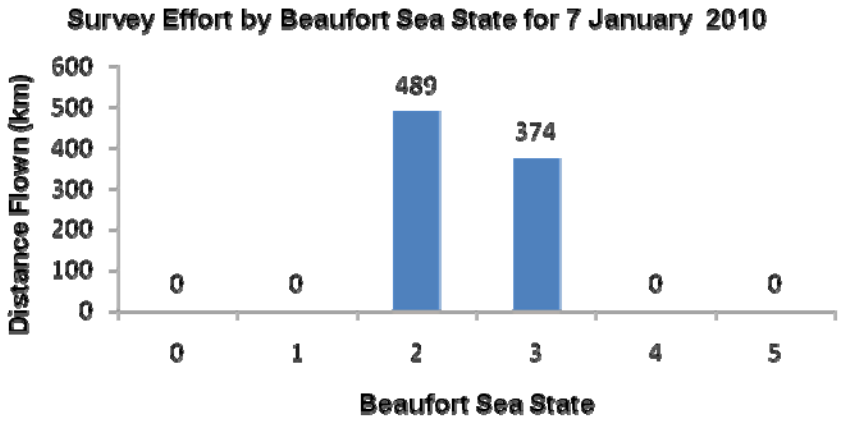
Species	Number of Sightings	Number of Individuals	Beaufort Sea State	Line Number
Tursiops truncatus	1	50	2	7
Tursiops truncatus	2	7	2	9
Unidentified delphinid	1	1	2	3
Unidentified delphinid	1	3	2	4
Unidentified delphinid	1	3	2	6
Unidentified delphinid	1	1	2	10
Caretta caretta	21	22	2-3	-
Unidentified sea turtle	2	2	2	-

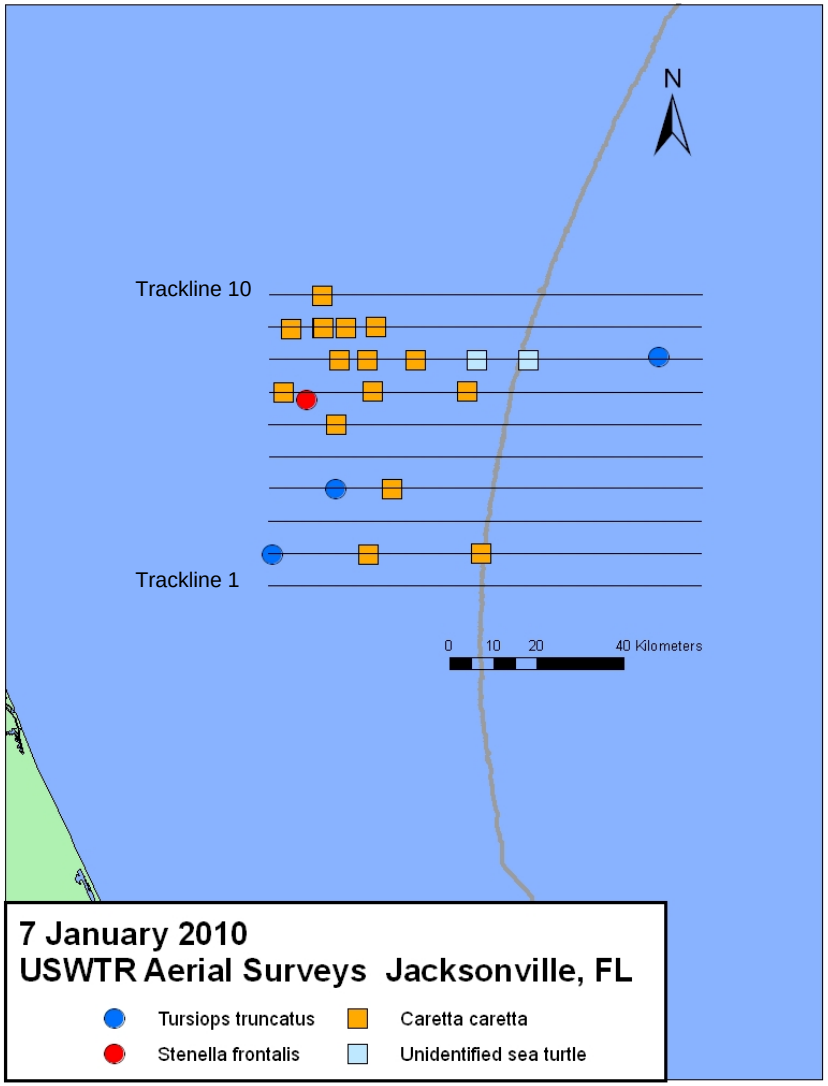




7 January 2010

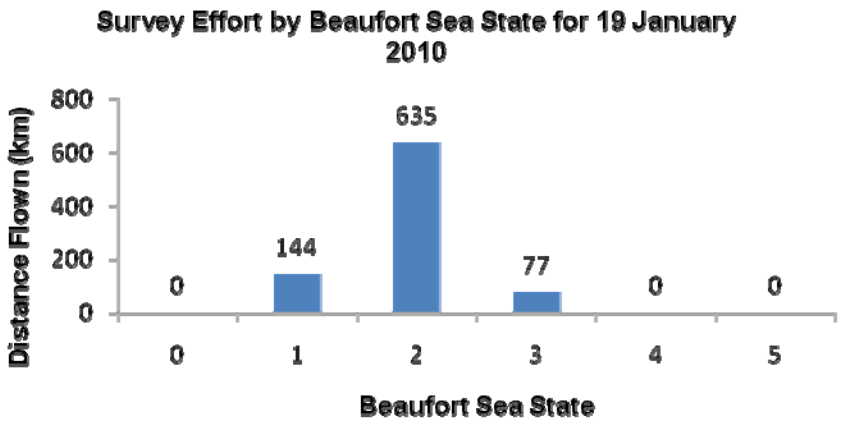
Species	Number of Sightings	Number of Individuals	Beaufort Sea State	Line Number
Tursiops truncatus	1	1	3	2
Tursiops truncatus	1	2	3	4
Tursiops truncatus	1	45	2	8
Stenella frontalis	1	65	2	7
Caretta caretta	16	17	2-3	-
Unidentified Sea Turtle	2	2	2	-

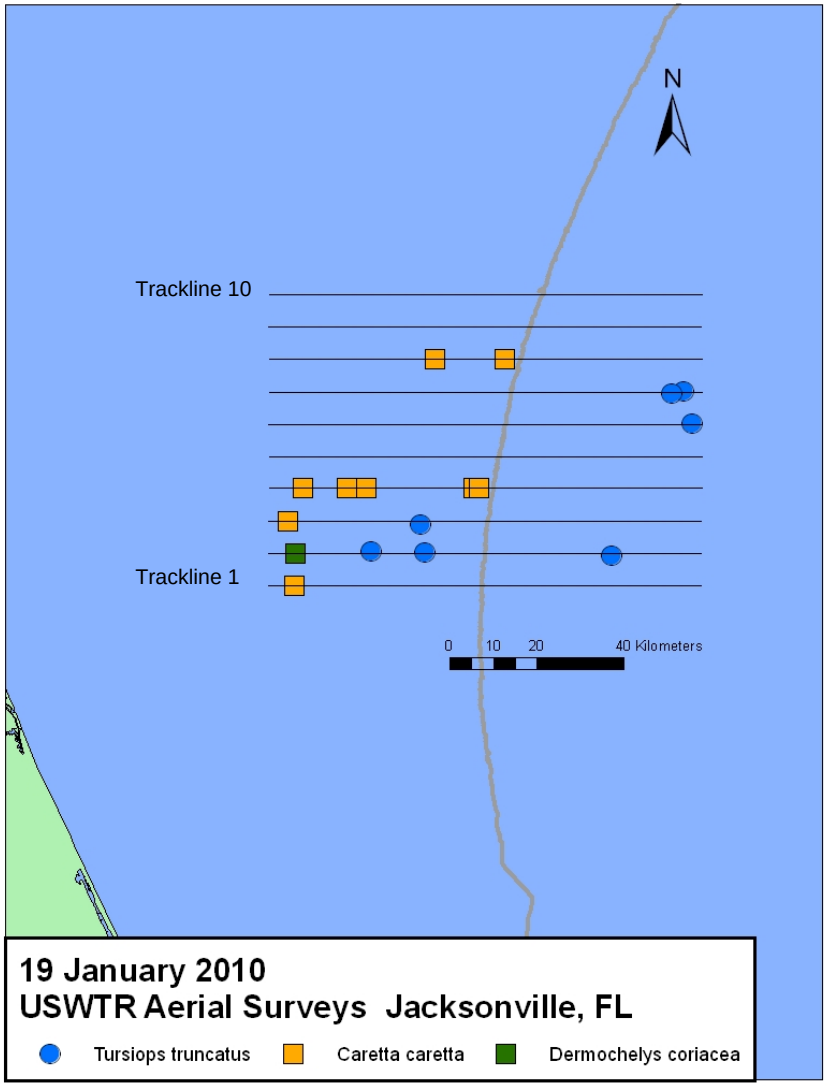




19 January 2010

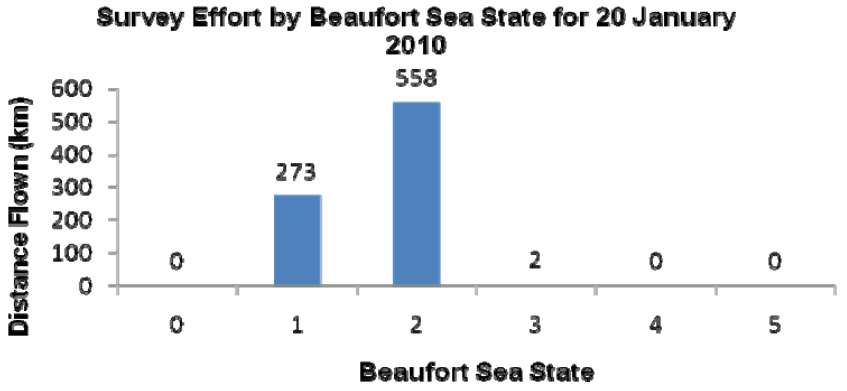
Species	Number of Sightings	Number of Individuals	Beaufort Sea State	Line Number
Tursiops truncatus	2	15	2	7
Tursiops truncatus	1	11	2	6
Tursiops truncatus	1	4	2	3
Tursiops truncatus	3	31	2-3	2
Caretta caretta	11	12	1-2	-
Dermochelys coriacea	1	1	2	-

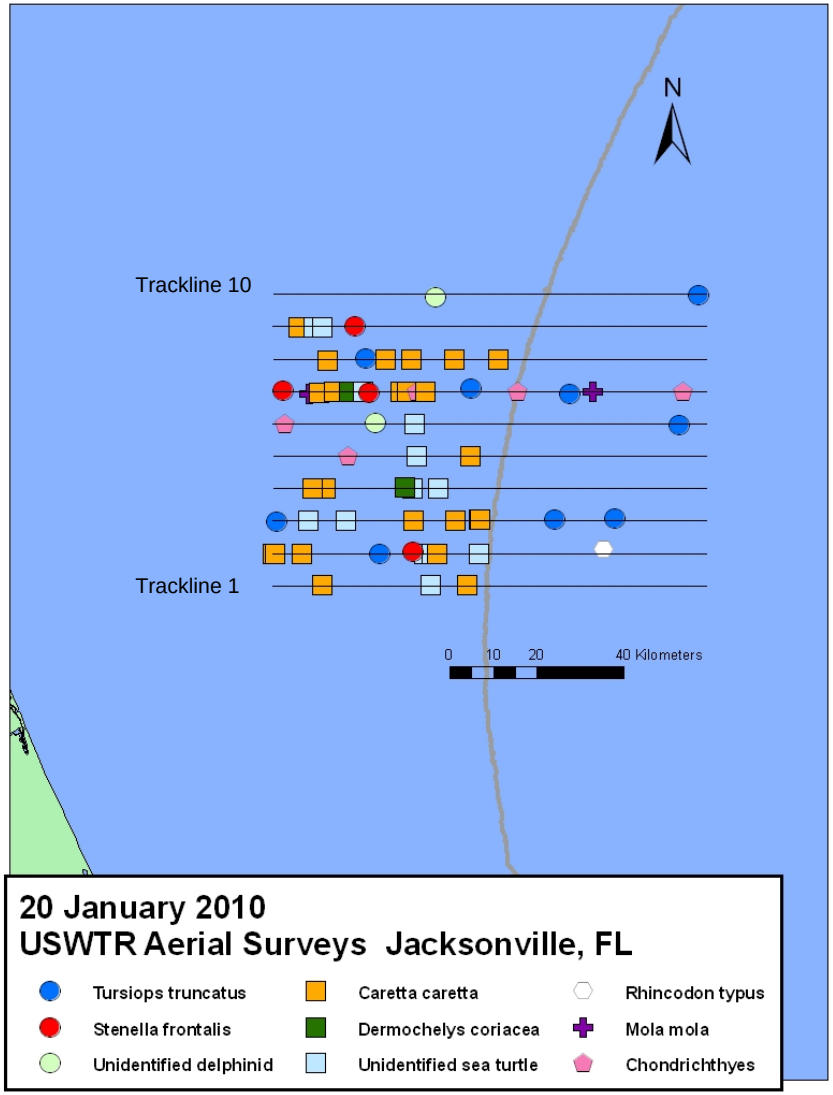




20 January 2010

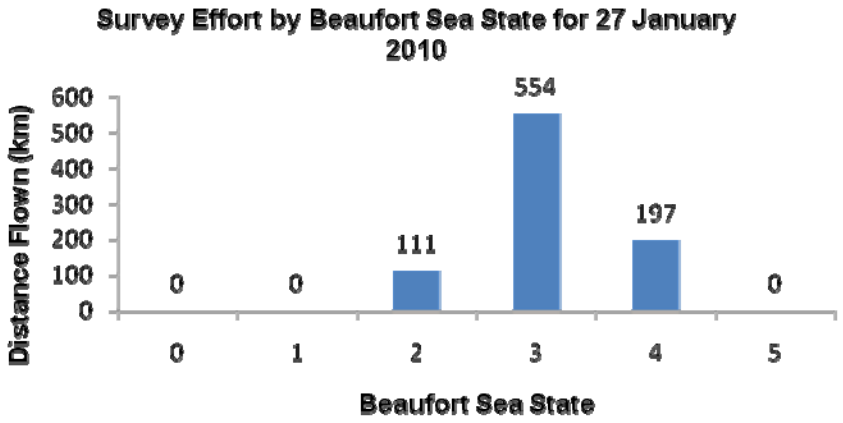
Species	Number of Sightings	Number of Individuals	Beaufort Sea State	Line Number
Tursiops truncatus	1	3	2	2
Tursiops truncatus	3	48	2	3
Tursiops truncatus	1	29	2	6
Tursiops truncatus	2	17	1-2	7
Tursiops truncatus	1	7	2	8
Tursiops truncatus	1	16	1	10
Stenella frontalis	1	3	2	2
Stenella frontalis	2	45	1	7
Stenella frontalis	1	7	1	9
Unidentified delphinid	1	1	1	6
Unidentified delphinid	1	14	2	10
Caretta caretta	24	27	1-2	-
Dermochelys coriacea	2	3	1-2	-
Unidentified sea turtle	13	18	1-2	-
Mola mola	2	2	1-2	-
Rhincodon typus	1	1	2	-
Chondrichthyes	6	6	1-2	-

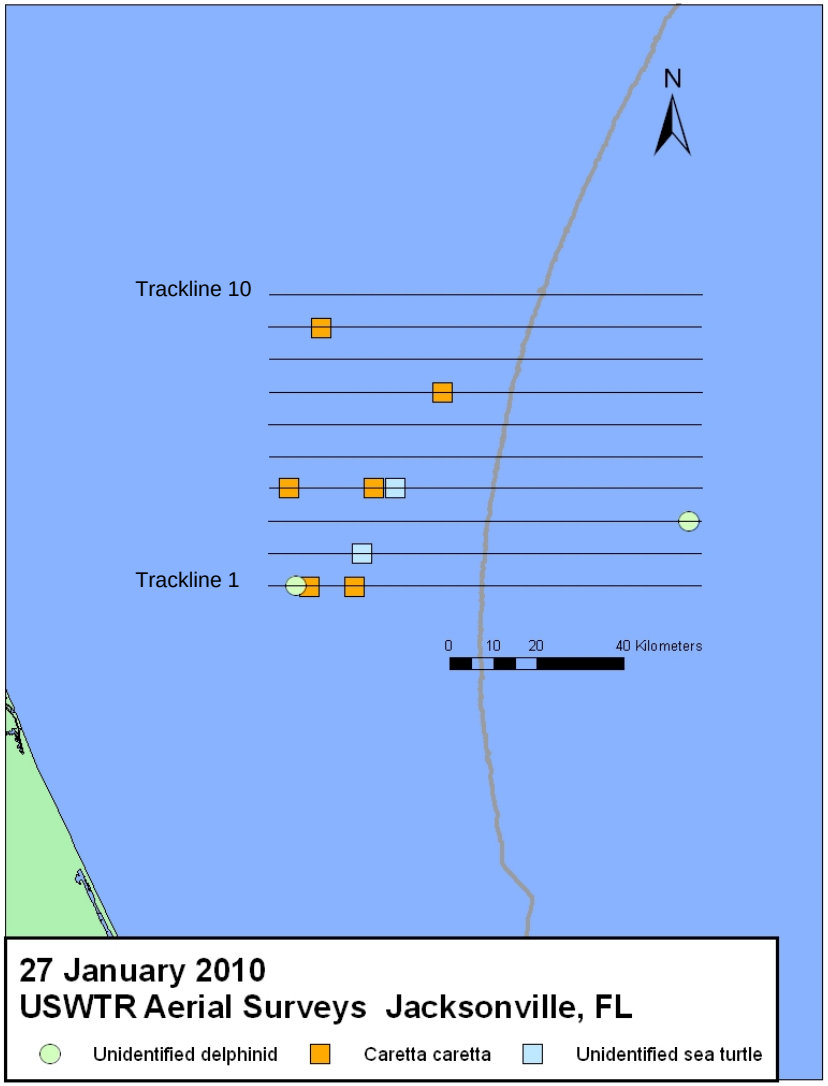




27 January 2010

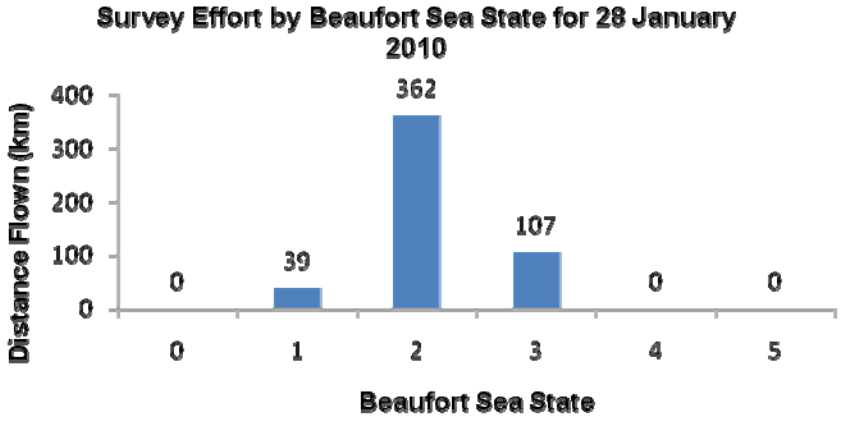
Species	Number of Sightings	Number of Individuals	Beaufort Sea State	Line Number
Unidentified delphinid	1	9	3	1
Unidentified delphinid	1	1	2	3
Caretta caretta	6	6	2-3	-
Unidentified sea turtle	2	2	2	-

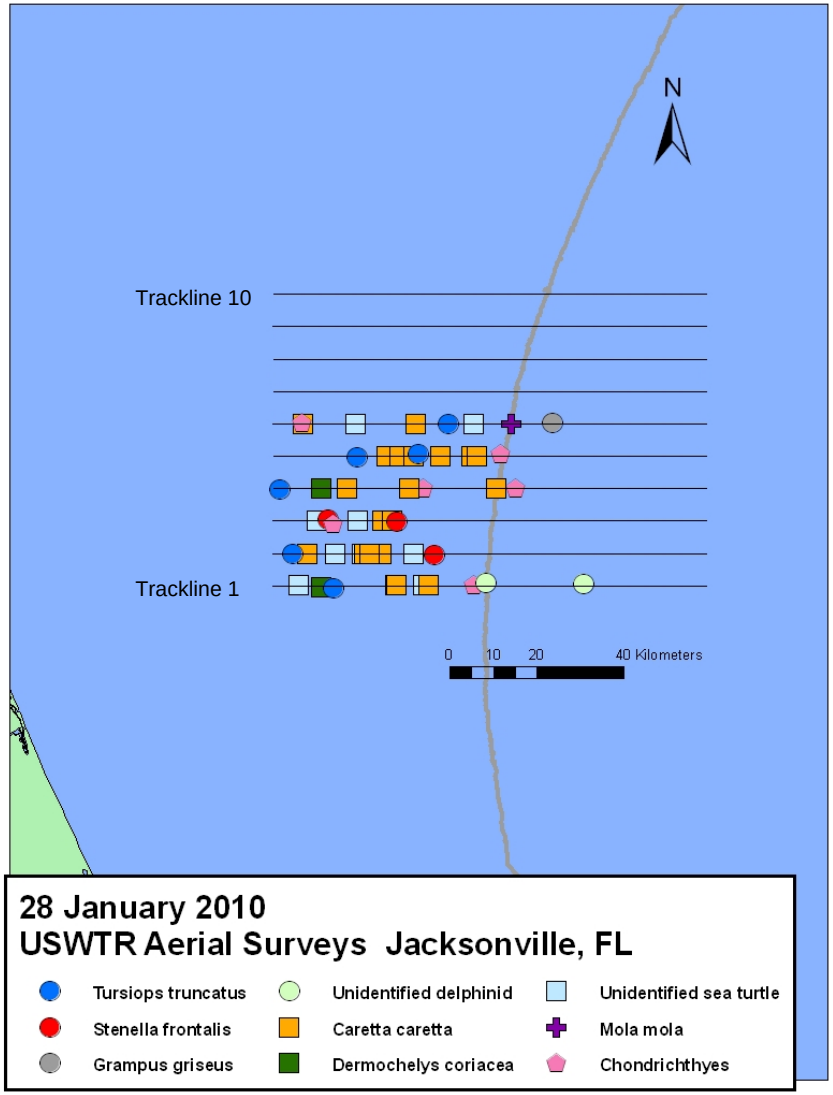




28 January 2010

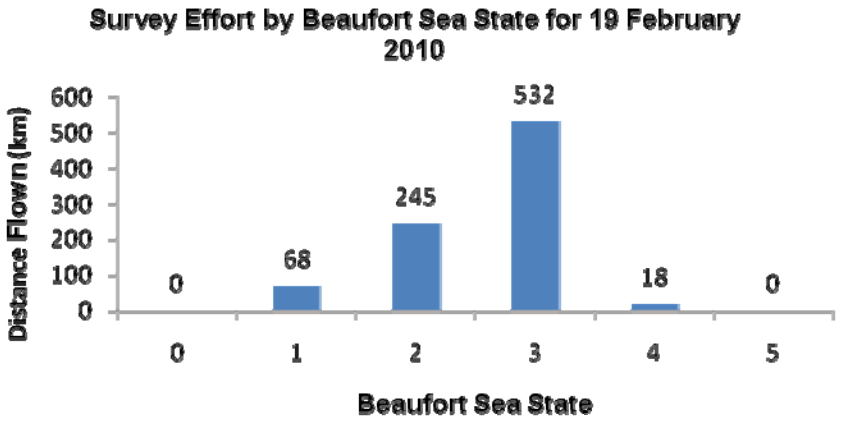
Species	Number of Sightings	Number of Individuals	Beaufort Sea State	Line Number
Tursiops truncatus	1	5	2	1
Tursiops truncatus	1	2	1	2
Tursiops truncatus	1	2	1	4
Tursiops truncatus	2	6	2	5
Tursiops truncatus	1	3	2	6
Stenella frontalis	1	11	2	2
Stenella frontalis	2	18	1	3
Grampus griseus	1	7	2	6
Unidentified delphinid	2	28	2	1
Caretta caretta	21	23	1-2	-
Unidentified sea turtle	10	12	1-2	-
Mola mola	1	1	2	-
Chondrichthyes	5	6	1-2	-

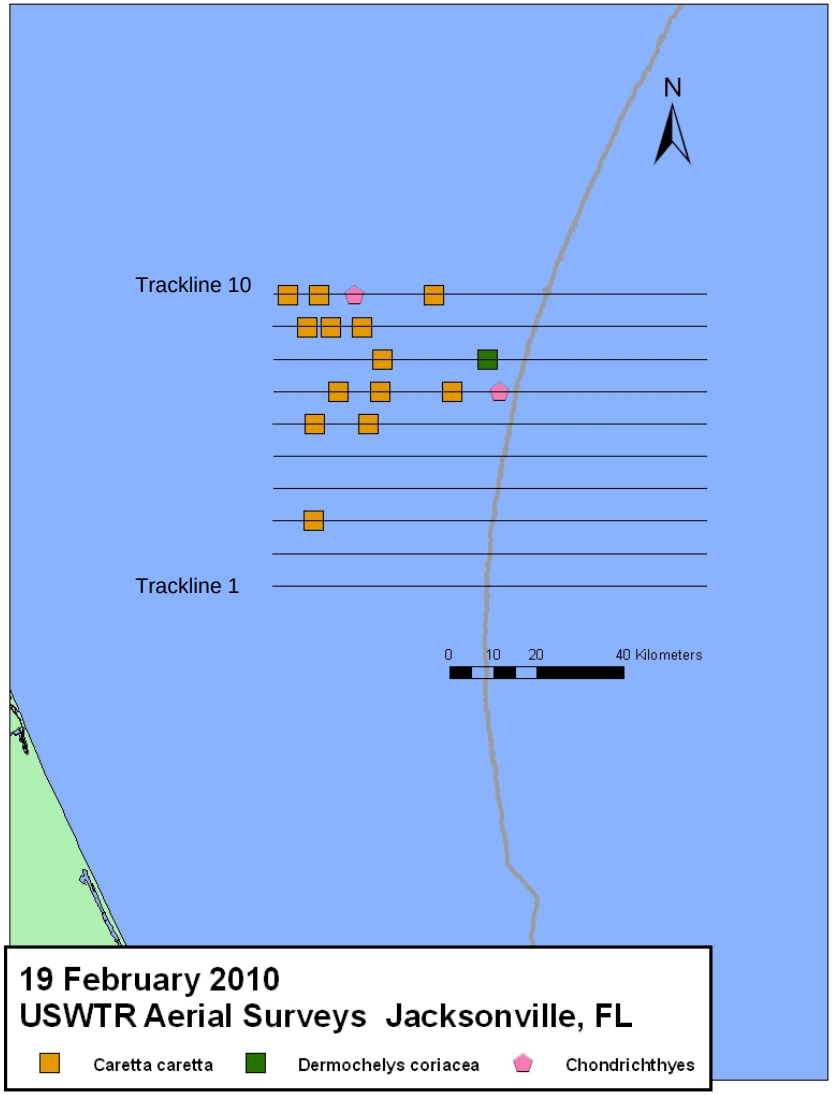




19 February 2010

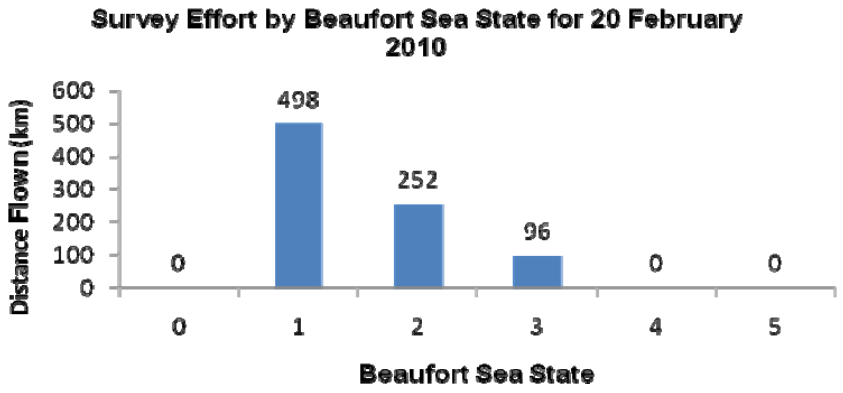
Species	Number of Sightings	Number of Individuals	Beaufort Sea State	Line Number
Caretta caretta	13	16	1-3	-
Dermochelys coriacea	1	1	2	-
Chondrichthyes	2	2	2	-

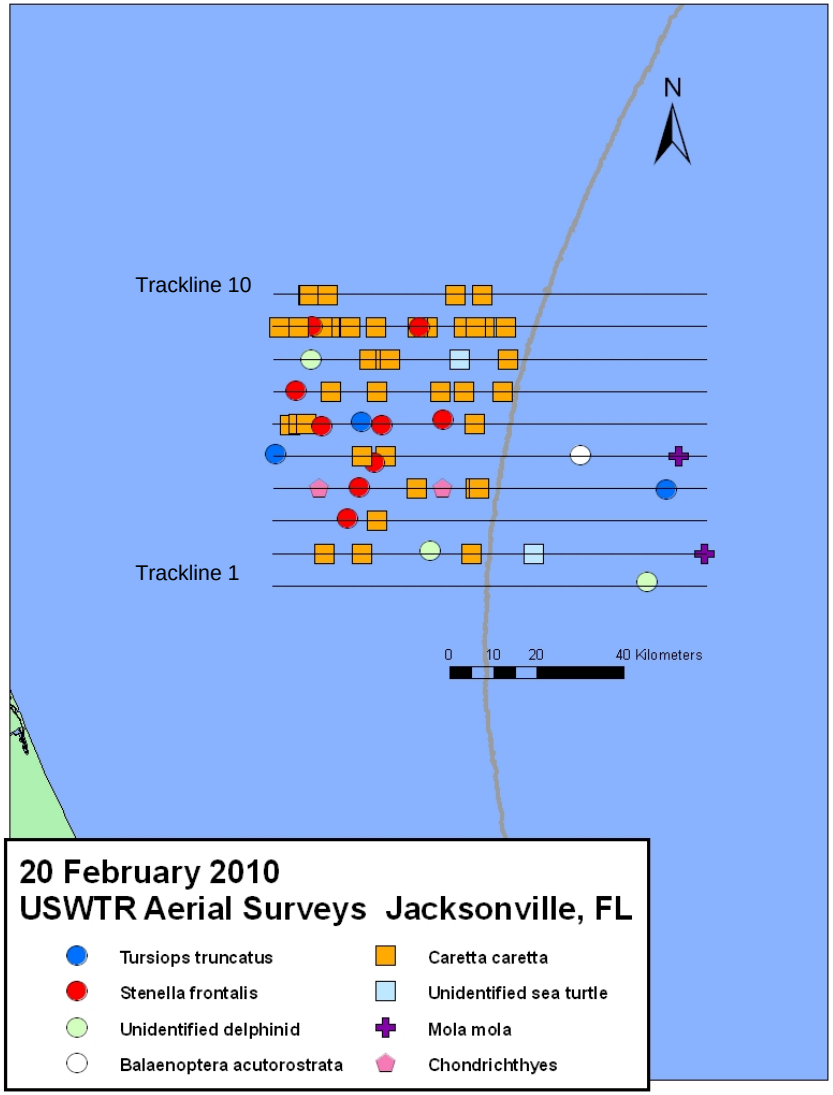




20 February 2010

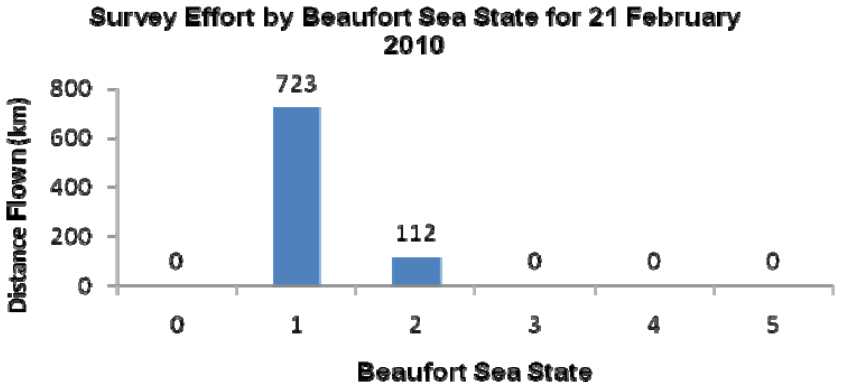
Species	Number of Sightings	Number of Individuals	Beaufort Sea State	Line Number
Tursiops truncatus	1	12	1	6
Tursiops truncatus	1	1	1	5
Tursiops truncatus	1	3	1	4
Stenella frontalis	2	19	1	9
Stenella frontalis	1	10	1	7
Stenella frontalis	2	48	1	6
Stenella frontalis	1	60	1	5
Stenella frontalis	1	2	1	4
Stenella frontalis	1	4	1	3
Balaenoptera acutorostrata	1	1	3	5
Unidentified delphinid	1	3	1	8
Unidentified delphinid	1	5	1	2
Unidentified delphinid	1	5	1	1
Caretta caretta	40	56	1-2	-
Unidentified sea turtles	3	3	1-2	-
Mola mola	2	2	1-2	-
Chondrichthyes	2	2	1	-

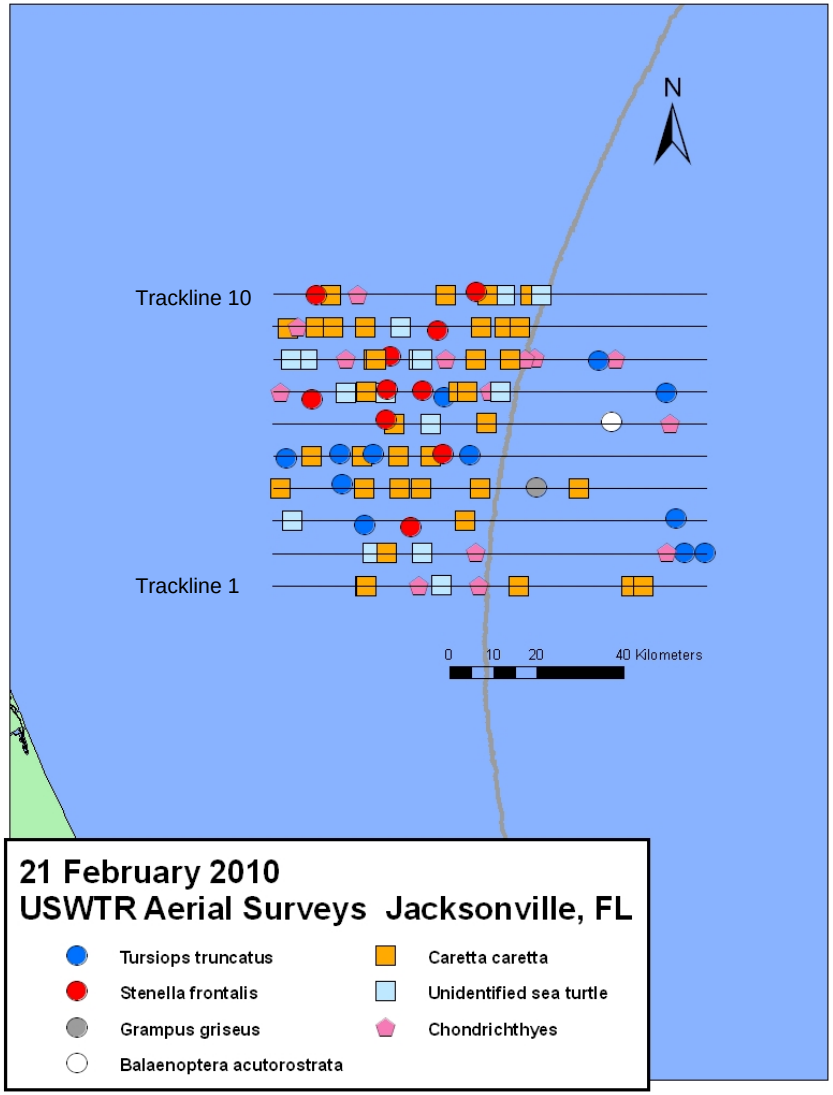




21 February 2010

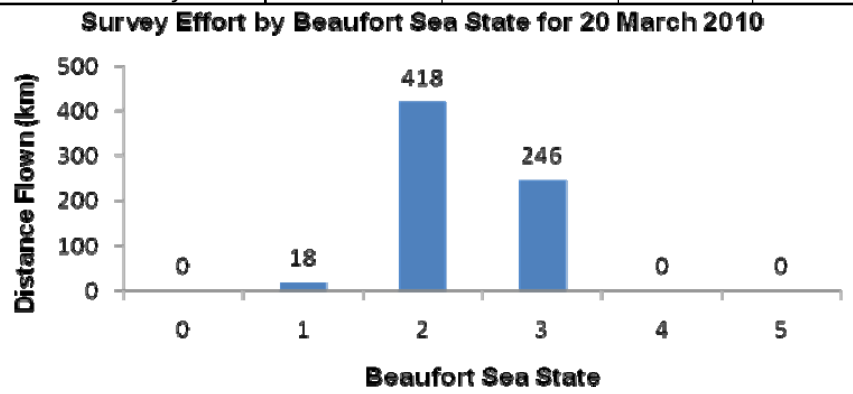
Species	Number of Sightings	Number of Individuals	Beaufort Sea State	Line Number
Tursiops truncatus	2	24	1	2
Tursiops truncatus	2	34	1	3
Tursiops truncatus	1	6	1	4
Tursiops truncatus	4	15	1	5
Tursiops truncatus	2	9	1	7
Tursiops truncatus	1	13	1	8
Stenella frontalis	1	50	1	3
Stenella frontalis	1	7	1	5
Stenella frontalis	1	40	1	6
Stenella frontalis	3	128	1	7
Stenella frontalis	1	12	1	8
Stenella frontalis	1	30	1	9
Stenella frontalis	2	36	1	10
Grampus griseus	1	7	1	1
Balaenoptera acutorostrata	1	1	1	6
Caretta caretta	37	52	1-2	-
Unidentified sea turtle	16	25	1-2	-
Chondrichthyes	15	17	1-2	-

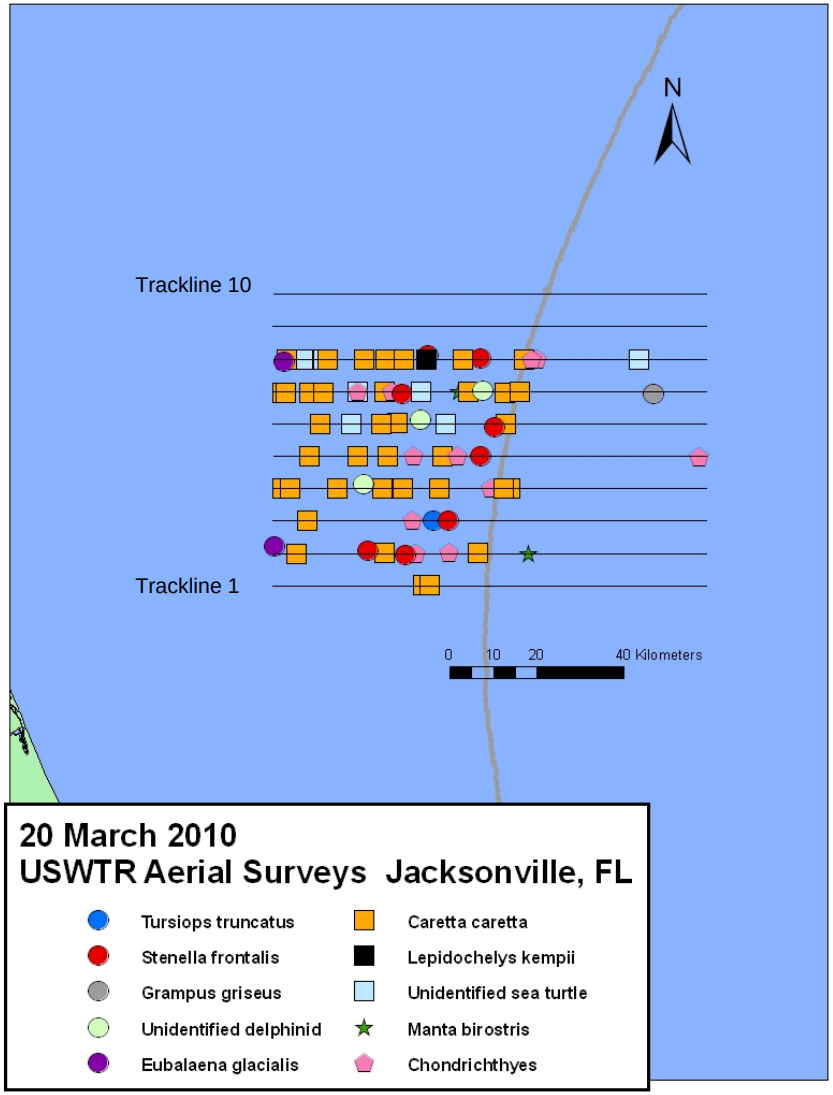




20 March 2010

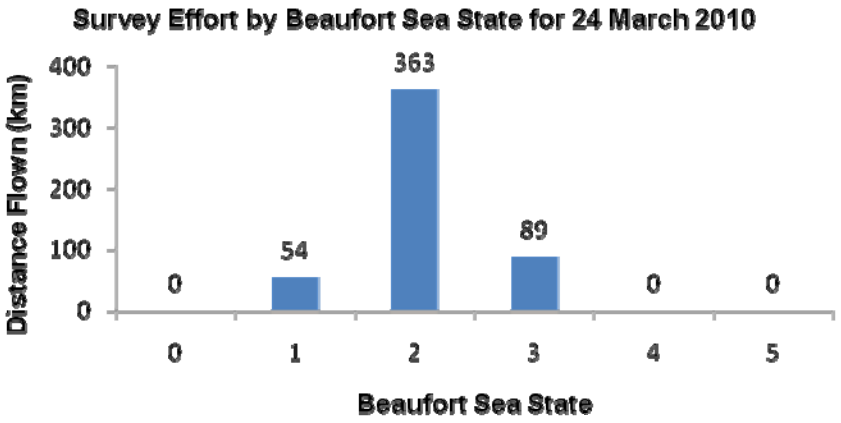
Species	Number of Sightings	Number of Individuals	Beaufort Sea State	Line Number
Tursiops truncatus	1	2	1	3
Stenella frontalis	2	11	2	2
Stenella frontalis	1	29	2	3
Stenella frontalis	1	34	2	5
Stenella frontalis	1	19	2	6
Stenella frontalis	1	20	2	7
Stenella frontalis	2	23	2	8
Grampus griseus	1	6	3	7
Eubalaena glacialis	1	2	2	2
Eubalaena glacialis	1	1	2	8
Unidentified delphinid	1	2	2	4
Unidentified delphinid	1	3	2	6
Unidentified delphinid	1	4	2	7
Caretta caretta	37	48	1-3	-
Lepidochelys kempii	1	1	2	-
Unidentified sea turtles	7	12	2-3	-
Manta birostris	2	5	2-3	-
Chondrichthyes	11	15	1-3	-

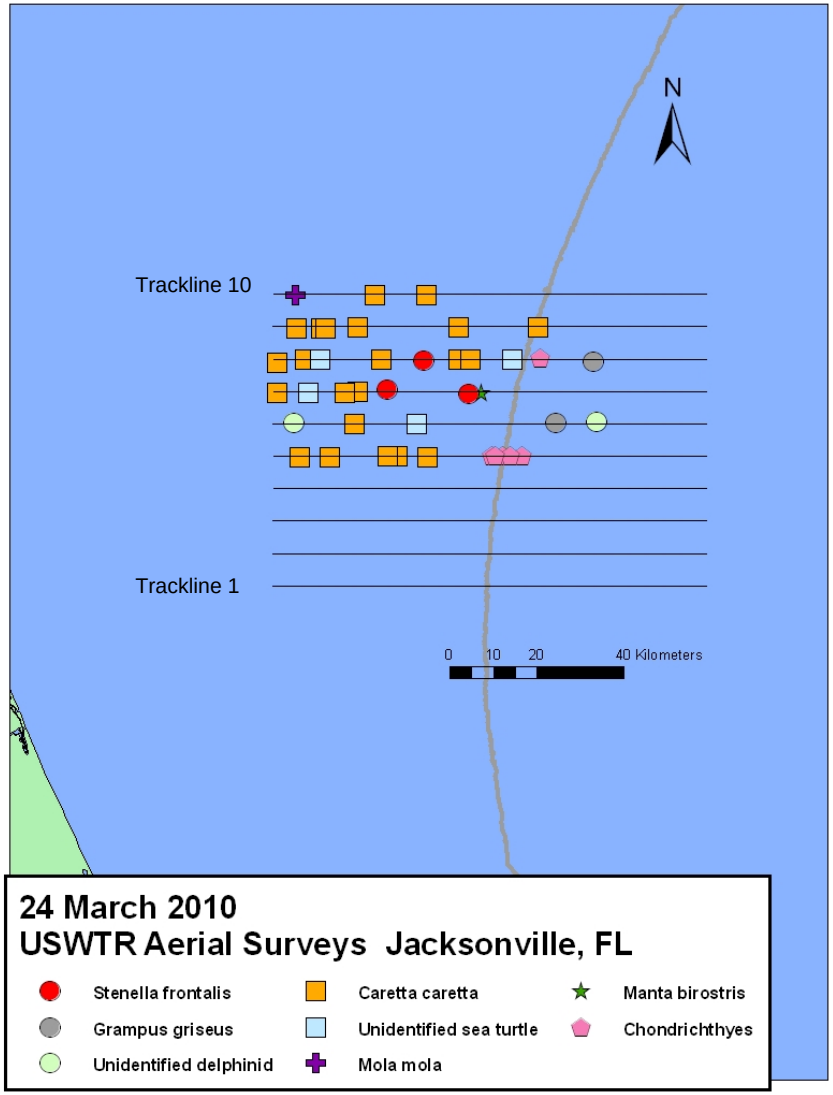




24 March 2010

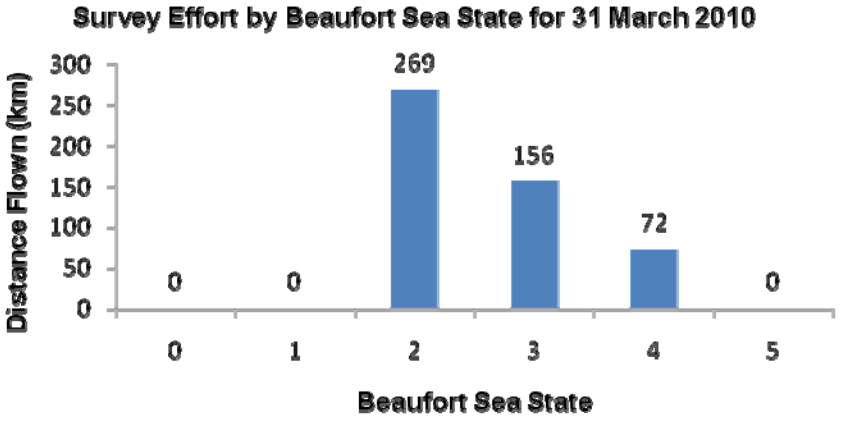
Species	Number of Sightings	Number of Individuals	Beaufort Sea State	Line Number
Stenella frontalis	1	10	1	8
Stenella frontalis	2	18	2	7
Grampus griseus	1	2	1	8
Grampus griseus	1	9	2	6
Unidentified delphinid	2	5	1-2	6
Caretta caretta	22	26	1-2	-
Unidentified sea turtle	5	9	1-2	-
Mola mola	1	1	2	-
Manta birostris	1	4	2	-
Chondrichthyes	6	11	1-2	-

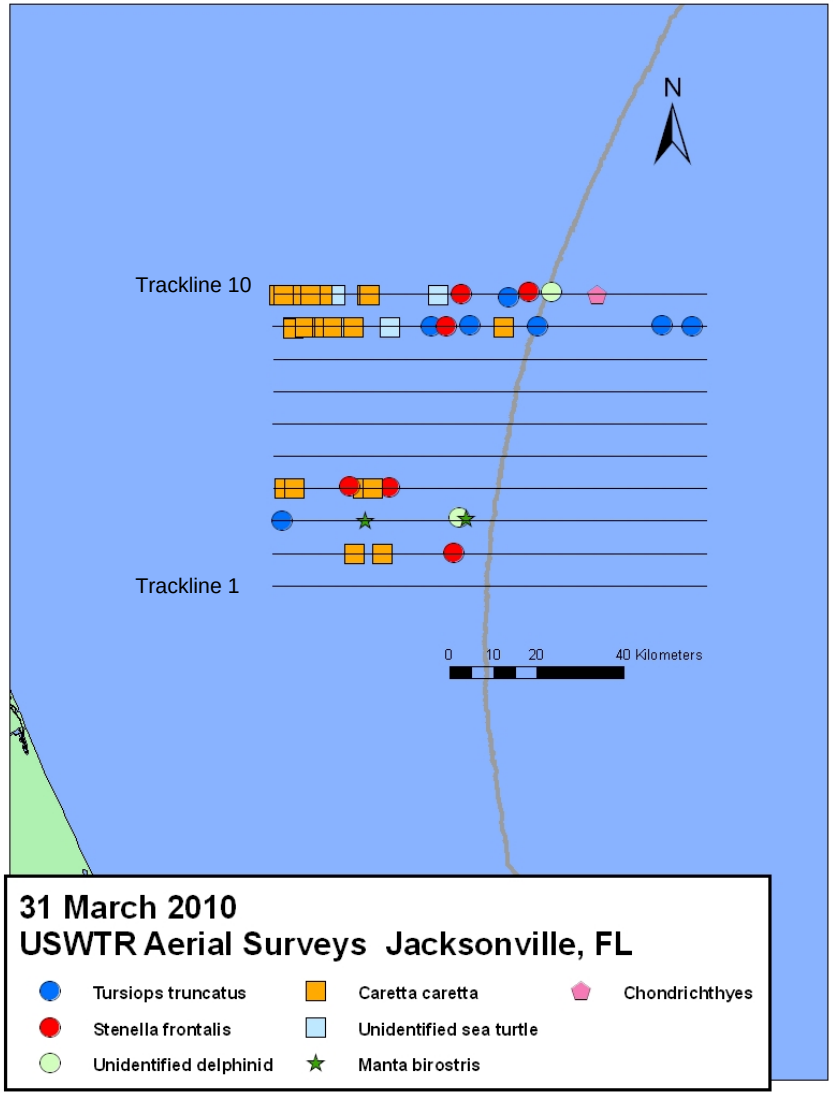




31 March 2010

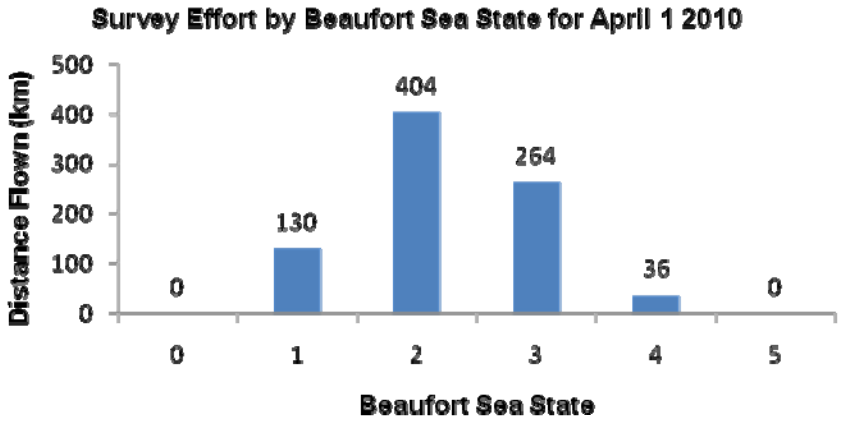
Species	Number of Sightings	Number of Individuals	Beaufort Sea State	Line Number
Tursiops truncatus	1	5	2	3
Tursiops truncatus	5	32	2	9
Tursiops truncatus	1	3	2	10
Stenella frontalis	1	18	3	2
Stenella frontalis	2	4	2	4
Stenella frontalis	1	80	2	9
Stenella frontalis	2	27	2	10
Unidentified delphinid	1	1	2	3
Unidentified delphinid	1	3	2	10
Caretta caretta	21	40	2	-
Unidentified sea turtle	4	4	2	-
Manta birostris	1	1	2	-
Chondrichthyes	1	4	2	-

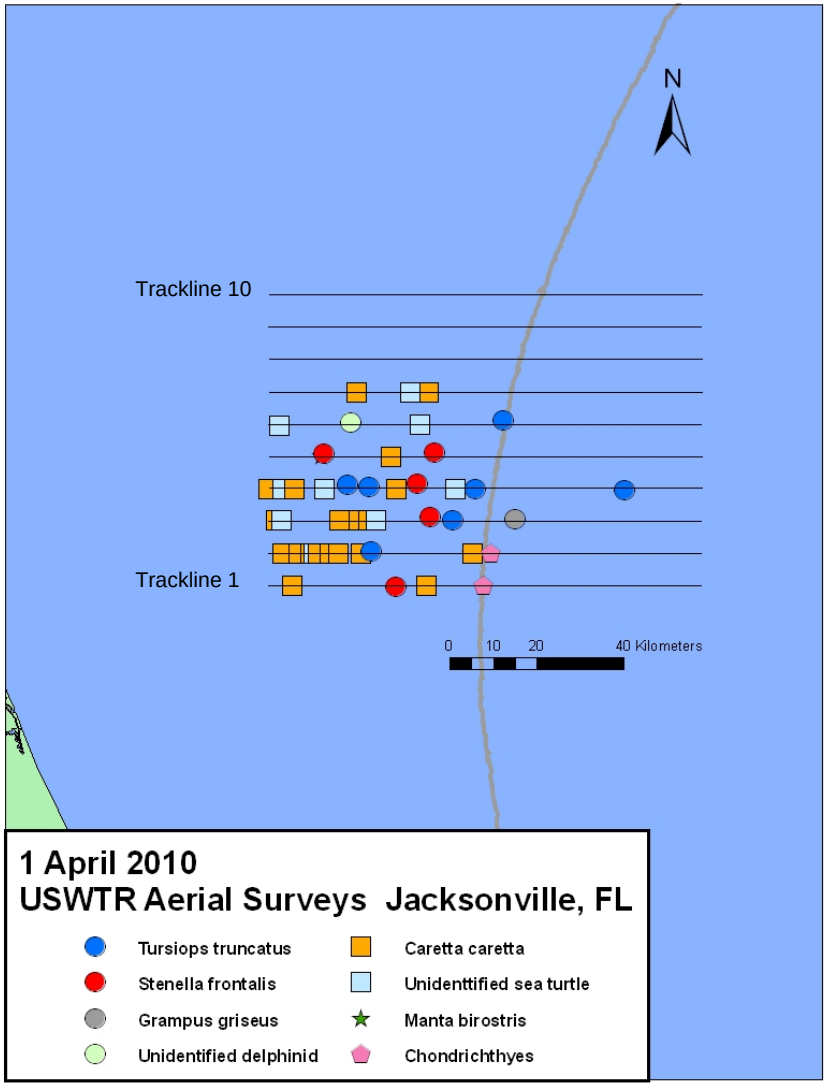




1 April 2010

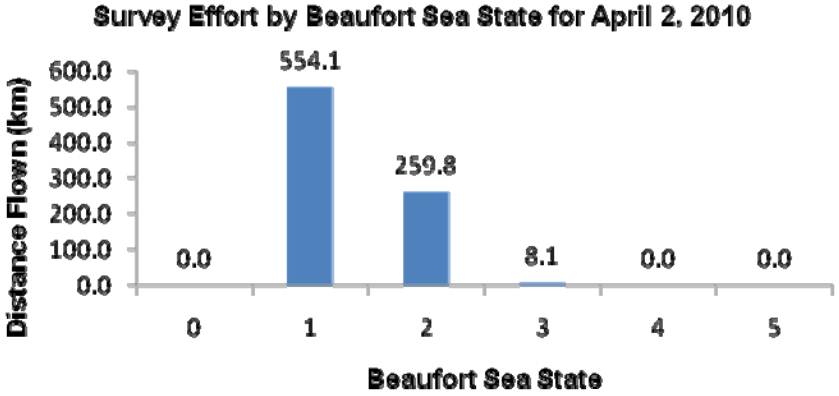
Species	Number of Sightings	Number of Individuals	Beaufort Sea State	Line Number
Tursiops truncatus	1	3	3	6
Tursiops truncatus	4	21	1-3	4
Tursiops truncatus	1	1	2	3
Tursiops truncatus	1	3	1	2
Stenella frontalis	2	14	2	5
Stenella frontalis	1	6	1	4
Stenella frontalis	1	6	2	3
Stenella frontalis	1	4	2	1
Grampus griseus	1	11	2	3
Unidentified delphinid	1	1	2	6
Caretta caretta	20	20	1-2	-
Unidentified sea turtle	9	11	1-2	-
Manta birostris	1	1	2	-
Chondrichthyes	3	3	1-2	-

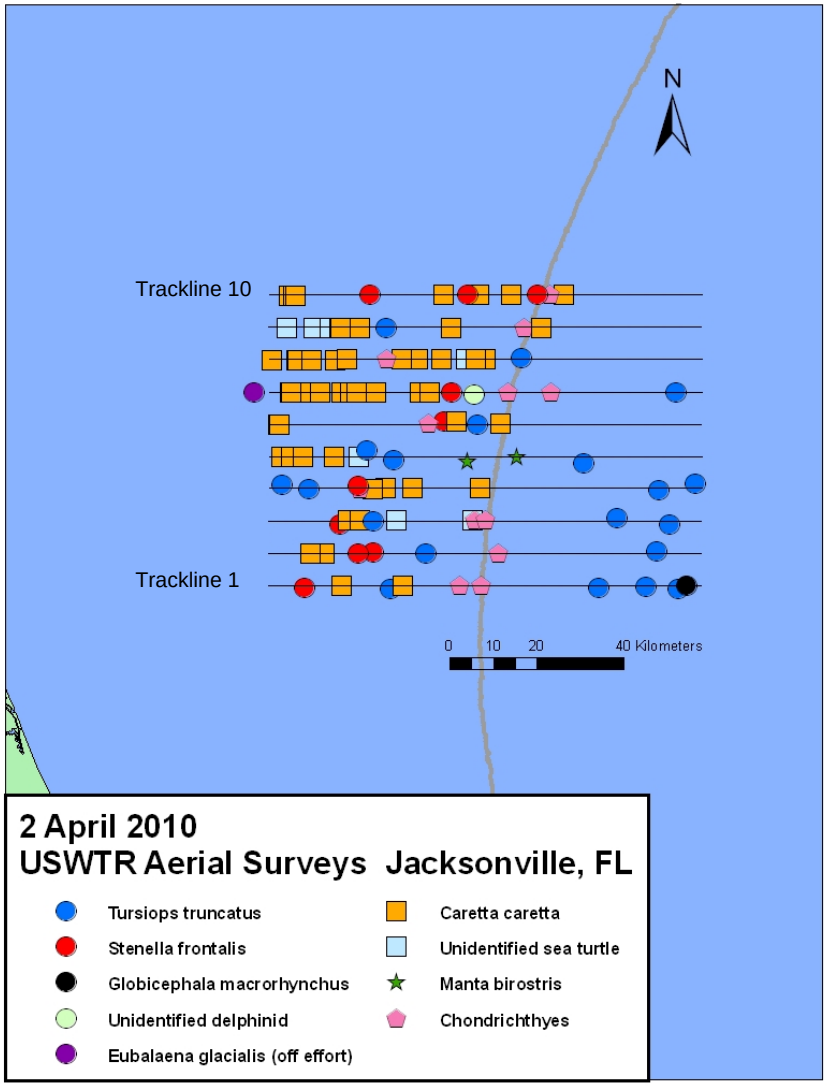




2 April 2010

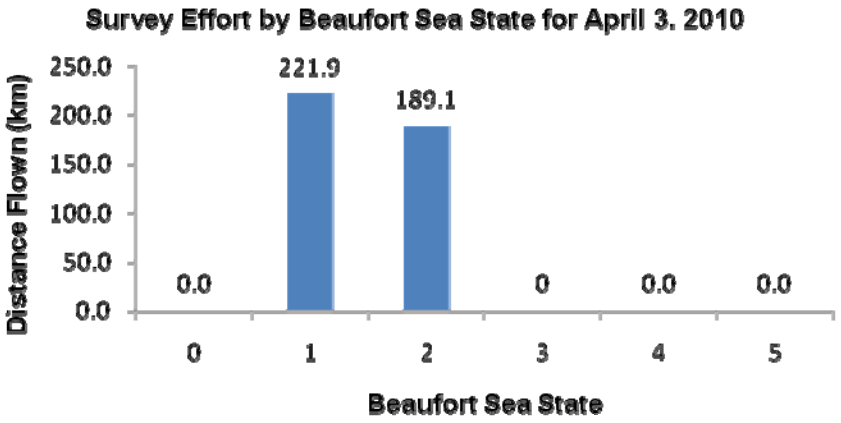
Species	Number of Sightings	Number of Individuals	Beaufort Sea State	Line Number
Tursiops truncatus	4	18	1-2	1
Tursiops truncatus	2	19	1	2
Tursiops truncatus	3	17	1-2	3
Tursiops truncatus	4	47	1-2	4
Tursiops truncatus	3	7	1-2	5
Tursiops truncatus	1	6	2	6
Tursiops truncatus	1	10	2	7
Tursiops truncatus	1	12	1	8
Tursiops truncatus	1	4	1	9
Stenella frontalis	1	8	1	1
Stenella frontalis	2	15	1	2
Stenella frontalis	1	11	1	3
Stenella frontalis	1	25	1	4
Stenella frontalis	1	18	1	5
Stenella frontalis	1	28	2	6
Stenella frontalis	3	44	1	10
Globicephala macrorhynchus	1	5	1	1
Eubalaena glacialis(off effort)	1	2	1	N/A
Unidentified delphinid	1	1	1	7
Caretta caretta	52	89	1-2	-
Unidentified sea turtle	7	18	1	-
Manta birostris	2	2	1	-
Chondrichthyes	12	19	1-2	-

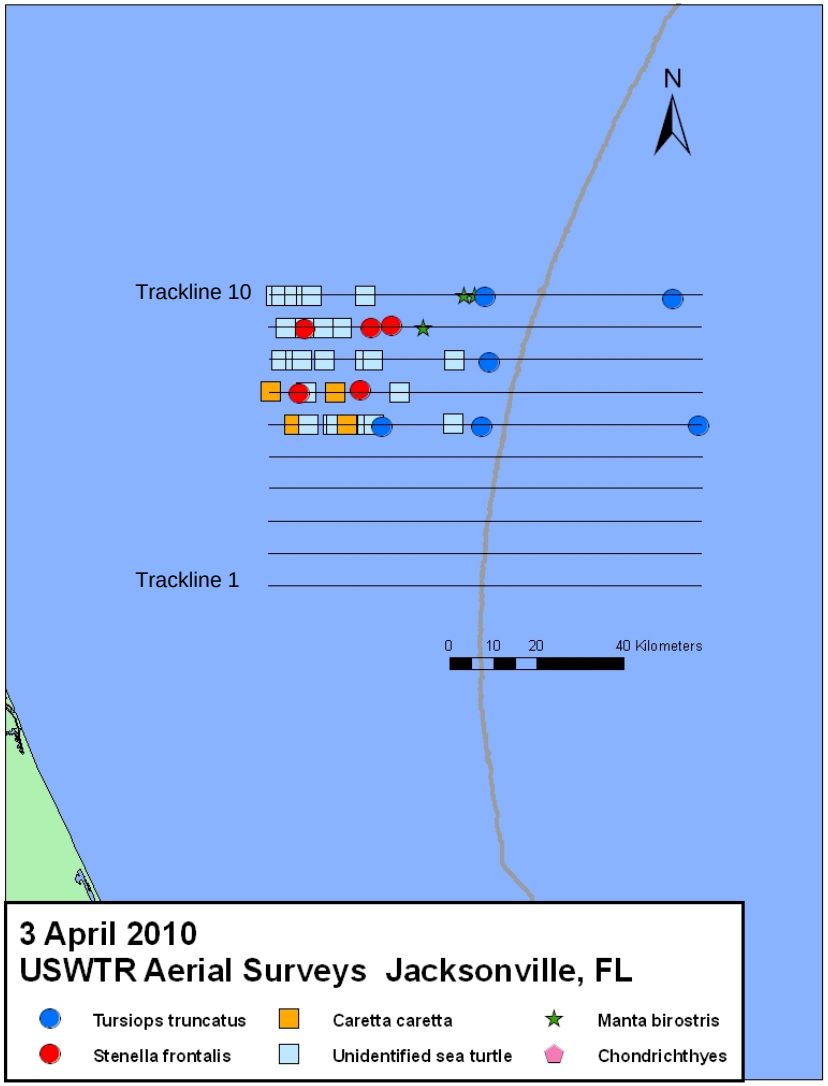




3 April 2010

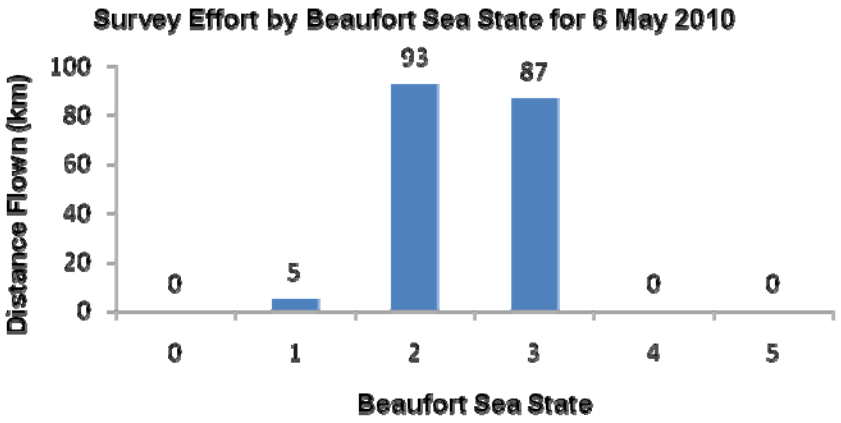
Species	Number of Sightings	Number of Individuals	Beaufort Sea State	Line Number
Tursiops truncatus	2	20	1-2	10
Tursiops truncatus	1	10	1	8
Tursiops truncatus	3	16	1-2	6
Stenella frontalis	3	31	1	9
Stenella frontalis	2	27	1	7
Caretta caretta	11	4	1	-
Unidentified sea turtle	26	66	1-2	-
Manta birostris	3	3	1	-
Chondrichthyes	1	1	1	-

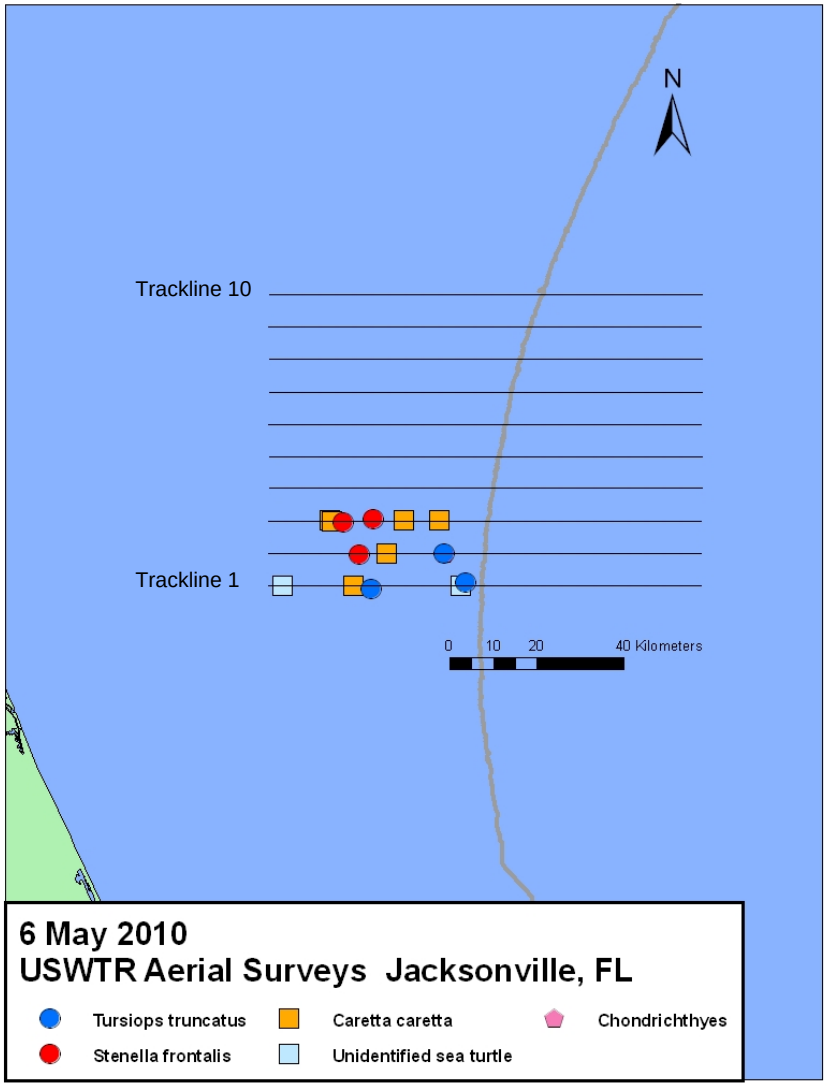




6 May 2010

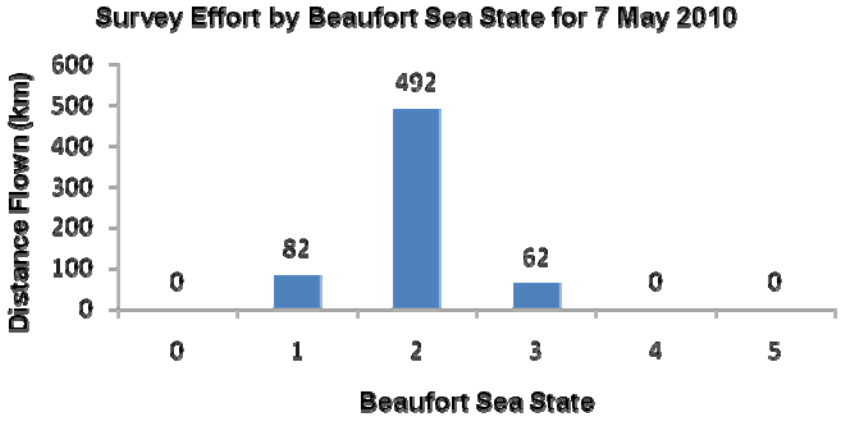
Species	Number of Sightings	Number of Individuals	Beaufort Sea State	Line Number
Tursiops truncatus	2	34	2	1
Tursiops truncatus	1	6	3	2
Stenella frontalis	1	40	2	2
Stenella frontalis	2	7	2	3
Caretta caretta	6	6	2	-
Unidentified sea turtles	2	2	2	-
Chondrichthyes	1	1	3	-

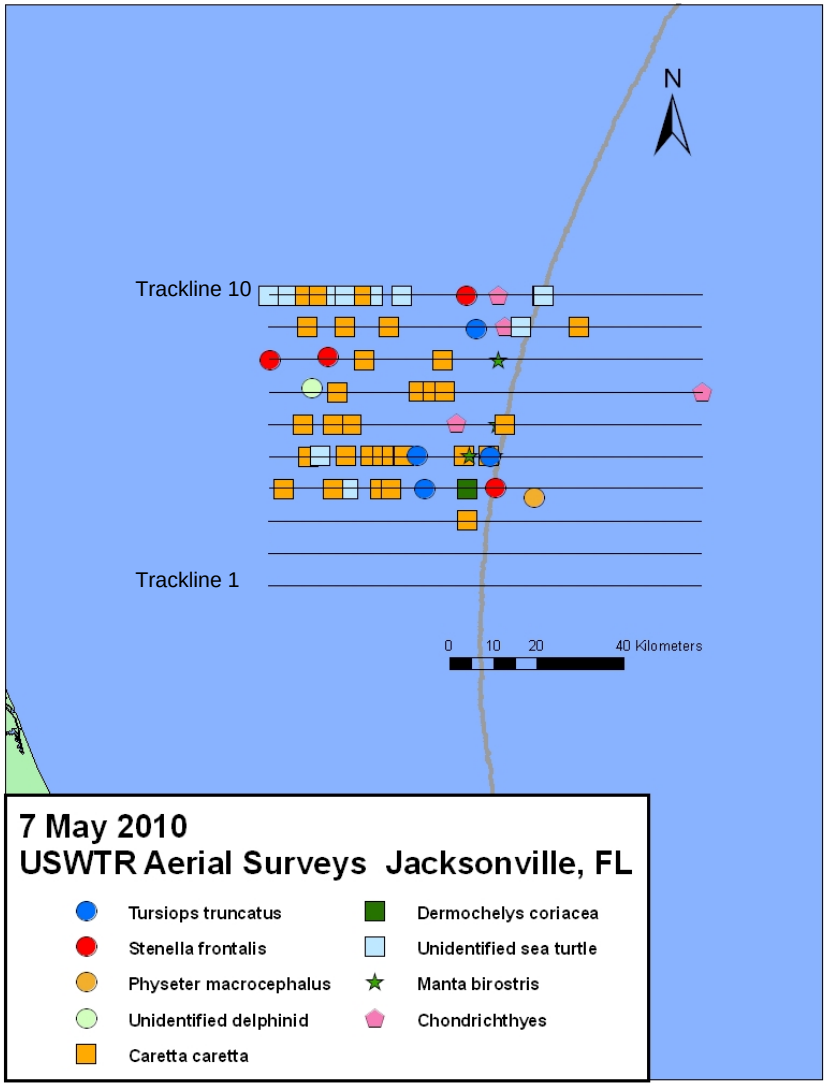




7 May 2010

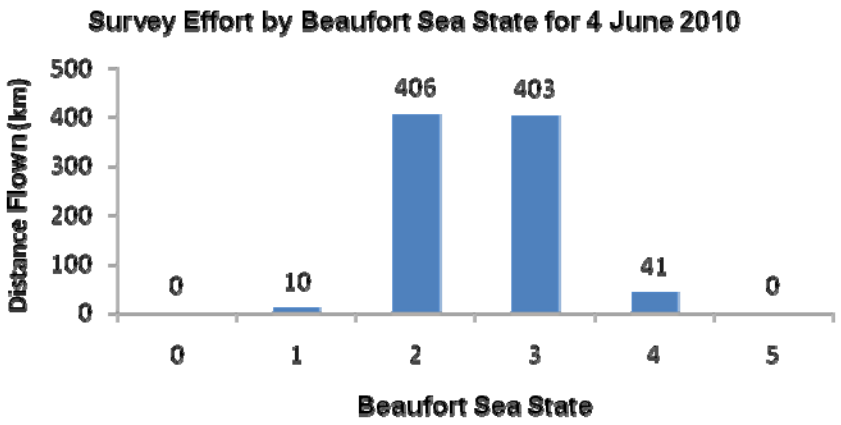
Species	Number of Sightings	Number of Individuals	Beaufort Sea State	Line Number
Tursiops truncatus	1	4	3	4
Tursiops truncatus	2	13	2	5
Tursiops truncatus	1	5	2	9
Stenella frontalis	1	75	2	4
Stenella frontalis	2	35	2	8
Stenella frontalis	1	3	1	10
Physeter macrocephalus	1	2	3	4
Unidentified delphinid	1	3	2	7
Caretta caretta	33	39	2	-
Dermochelys coriacea	1	1	2	-
Unidentified sea turtle	13	29	1-2	-
Manta birostris	4	5	2	-
Chondrichthyes	5	5	1-2	-

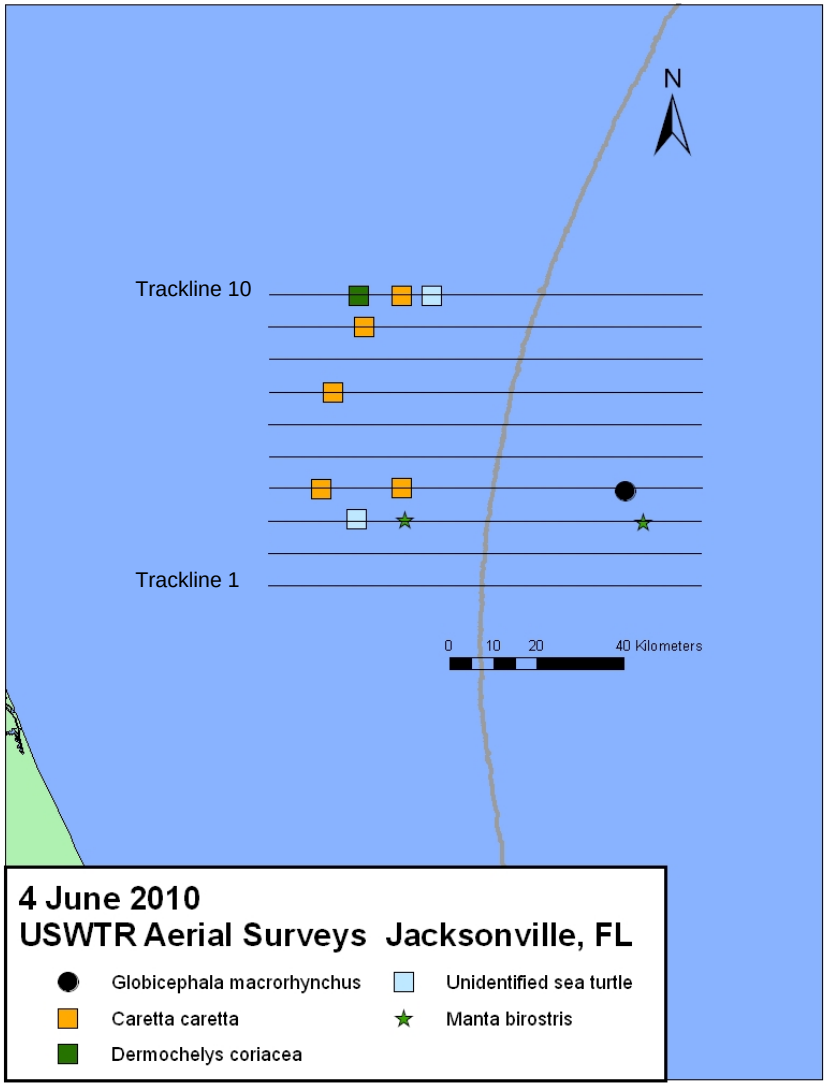




4 June 2010

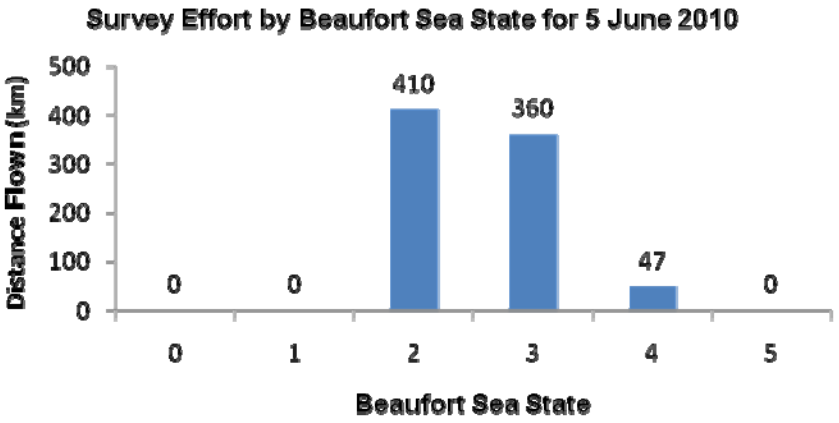
Species	Number of Sightings	Number of Individuals	Beaufort Sea State	Line Number
Globicephala macrorhynchus	1	14	2	4
Caretta caretta	5	5	2-3	-
Dermochelys coriacea	1	1	2	-
Unidentified sea turtle	2	2	2	-
Manta birostris	2	2	2	-

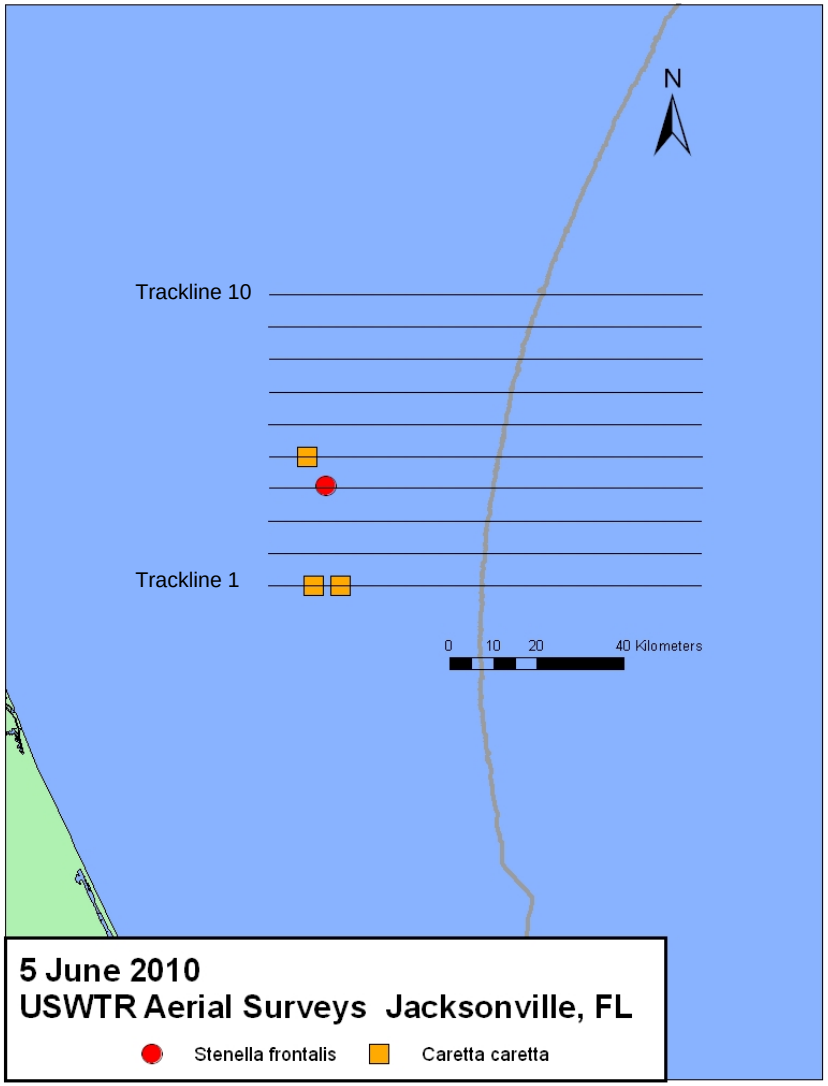




5 June 2010

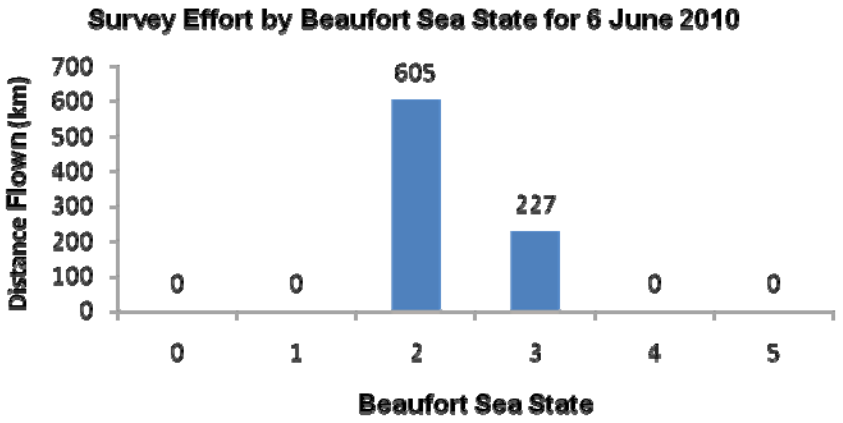
Species	Number of Sightings	Number of Individuals	Beaufort Sea State	Line Number
Stenella frontalis	1	40	2	4
Caretta caretta	4	4	2	-

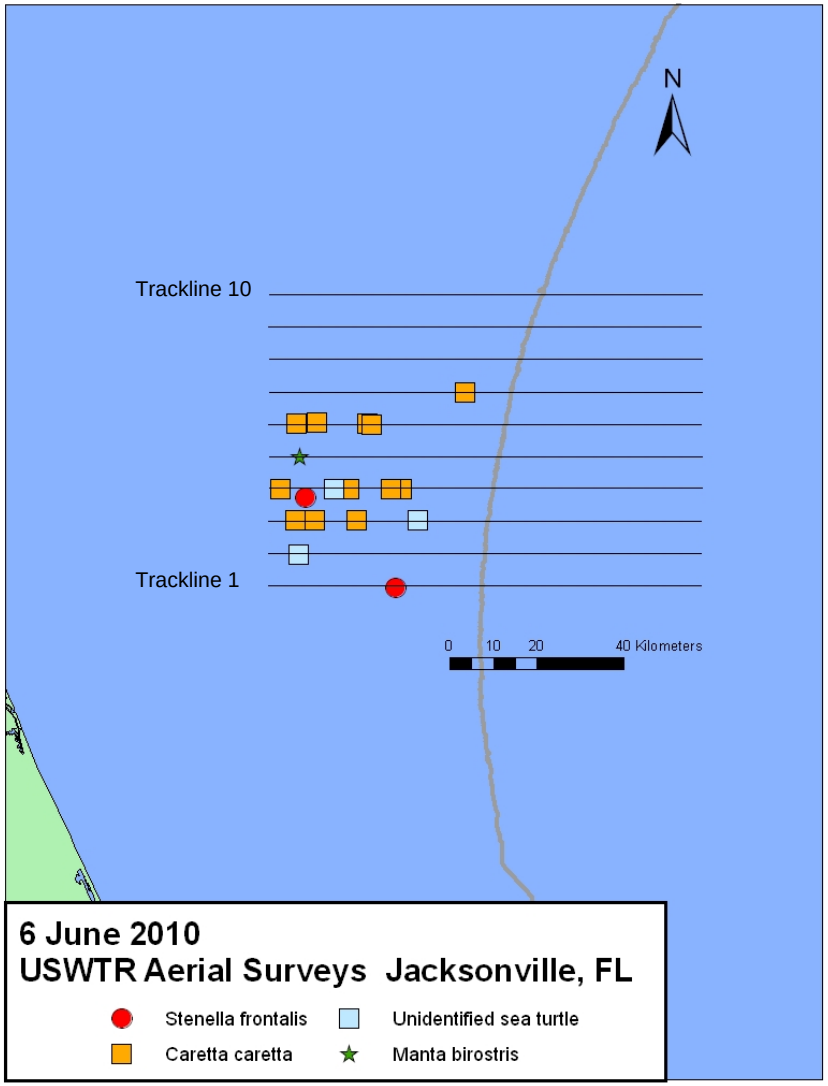




6 June 2010

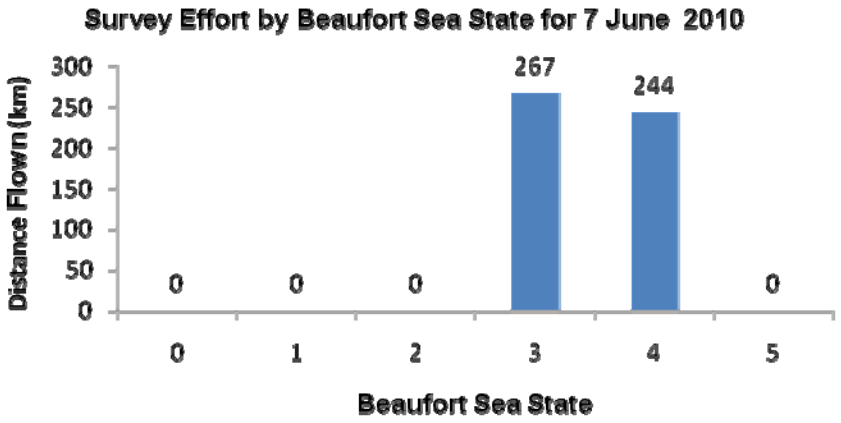
Species	Number of Sightings	Number of Individuals	Beaufort Sea State	Line Number
Stenella frontalis	1	10	2	1
Stenella frontalis	1	12	2	4
Caretta caretta	12	14	2-3	-
Unidentified sea turtle	3	3	2	-
Manta birostris	1	1	2	-

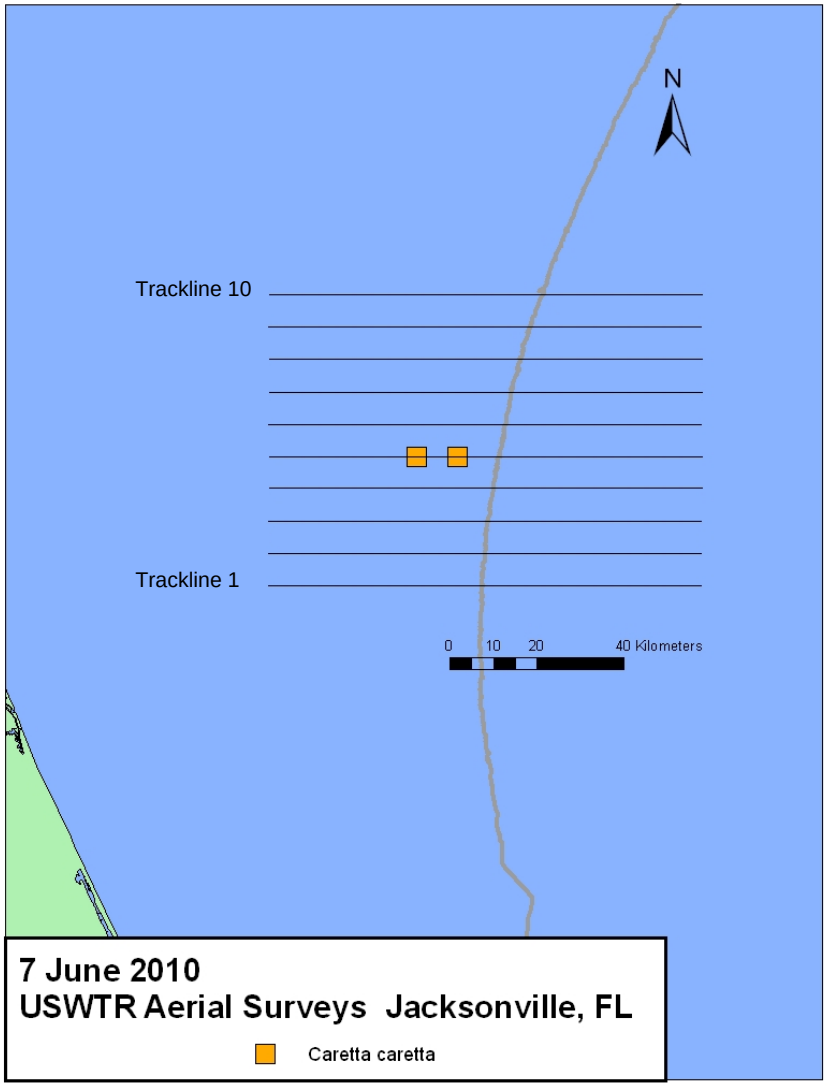




7 June 2010

Species	Number of Sightings	Number of Individuals	Beaufort Sea State	Line Number
Caretta caretta	2	2	3-4	-





VESSEL-BASED SURVEYS AND PASSIVE ACOUSTIC MONITORING OF THE PROPOSED UNDERSEA WARFARE TRAINING RANGE (USWTR) OFF OF JACKSONVILLE, FLORIDA JULY 2009 THROUGH JUNE 2010

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Submitted to:
The Department of the Navy
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Jacksonville Vessel Surveys

Methodology

Study Area

The proposed Jacksonville (JAX) USWTR area is 25 nm (46 km) long and 20 nm (37 km) wide (approximately 1700 km^2) (Fig. 1). The study area consists of ten 39 nm (72.5 km) long tracklines, spaced 4 nm (7.4 km) apart, which transect the USWTR area and cover approximately 2675 nm^2 (4960 km^2). The survey area straddles the continental shelf and Blake Plateau and include both neritic, shelf waters and more pelagic, off shore waters (Fig. 1). Aerial survey tracklines in this study area were longer (86km) than those flown in the Onslow Bay study area to minimize the area without aerial coverage between the USWTR surveys and Early Warning System (EWS) aerial surveys for North Atlantic right whales (*Eubalaena glacialis*). Whenever possible, the extended 86 km tracklines were attempted during vessel surveys.

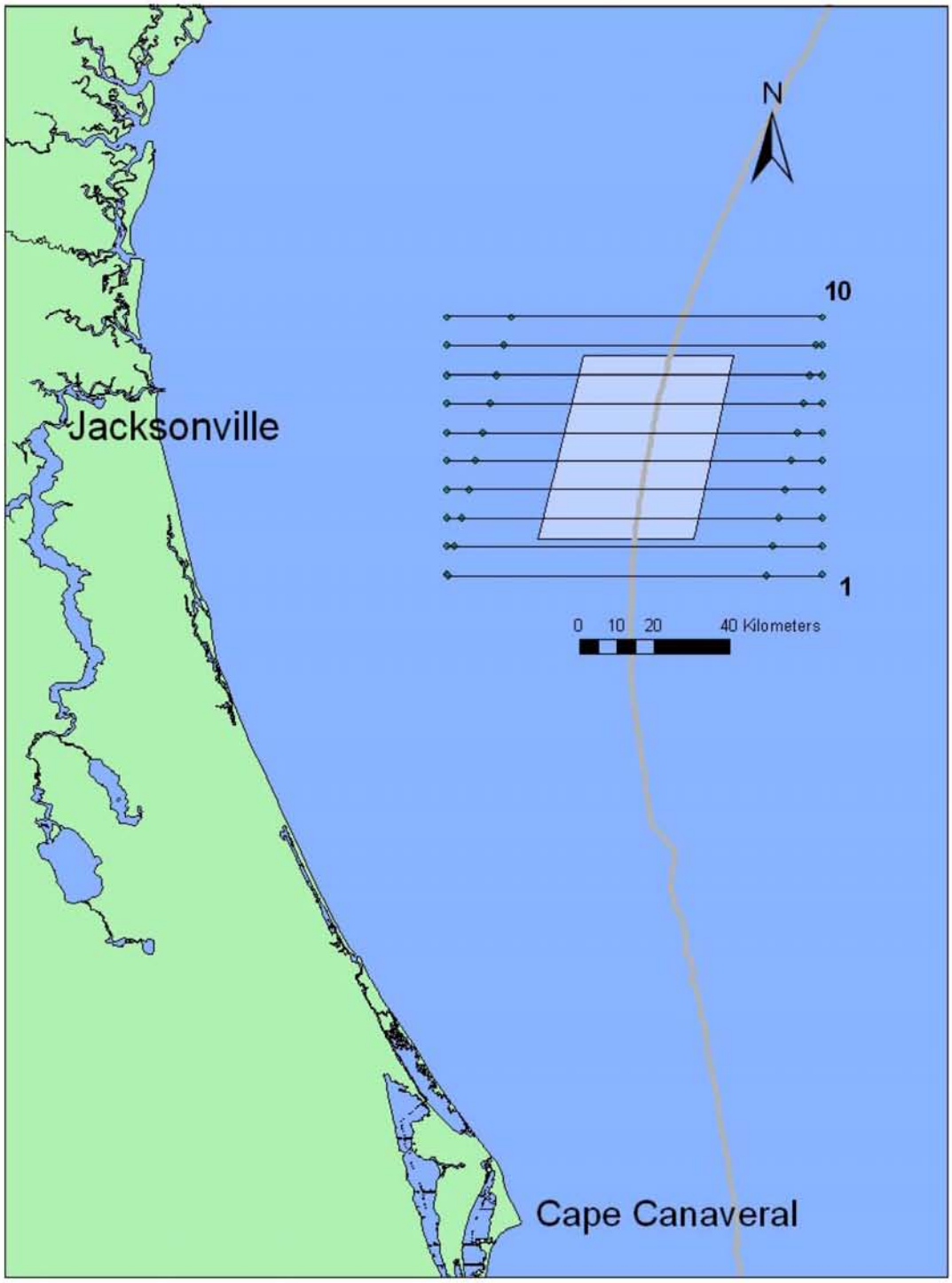


Figure 1. Map of the study area, the proposed USWTR site (shaded box).

Vessel Survey Data Collection

Visual Surveys

Vessel-based survey platforms provide a greater probability of sighting deep-diving species than aerial surveys (Barlow and Gisiner 2006). Shipboard observers are also more likely to be able to confirm species identity, particularly for animals that are difficult to distinguish from the air. Additionally, vessel-based platforms allow for photographic identification.

To ensure maximum detection rates, we employed a traditional visual survey approach, supplemented by passive acoustic monitoring using a towed hydrophone array. Visual surveys for marine mammals and sea turtles were conducted from the R/V Volute, a 13 m modified Duffy sport fishing vessel (Figure 2).

Figure 2. Photograph of the R/V Volute, taken during aerial surveys of the proposed USWTR site off of Jacksonville, Florida.

Observations were made from the flying bridge (4.0 m above water line) by naked eye and 7x50 binoculars. Two observers (one port and one starboard) scanned constantly from straight ahead to 90˚ abeam either side of the trackline. A center observer monitored the trackline, coordinated with the vessel skipper and acted as data recorder. Observations were conducted following standard distance sampling/line transect methods for cetaceans, similar to those employed in Barlow (2006). The location, species and behavior of each cetacean group were recorded. If turtles were encountered, the location and species were recorded. Each observer estimated group size independently and individual estimates were averaged at the end of the survey to generate an

overall estimate of group size. Environmental conditions (weather, sea state, depth and sea surface temperature) were recorded every 30 minutes or whenever sighting conditions changed. Sighting and environmental data were entered into an at-sea data collection system (Vis-Survey, developed by Dr. Lance Garrison, NOAA/SEFSC) linked with the onboard GPS.

In addition, we monitored cetacean use of the USWTR and adjacent areas by individual animals using photo-identification techniques. This approach is used frequently to identify individual sperm whales, beaked whales, humpback whales, bottlenose dolphins, spotted dolphins, pilot whales and Risso's dolphins through unique patterns in pigmentation and scarring. Thus, whenever possible, we obtained photographs of cetaceans for individual photo-identification (we also use these photographs to confirm species identification at each sighting and to compare identification features with those used by the aerial survey team). Photographs were taken with Canon or Nikon digital SLRs (equipped with 100-400 mm zoom lenses) in 24-bit color at a resolution of 3072 X 2048 pixels and saved in jpg format.

Passive Acoustic Monitoring

Passive acoustic data were collected in the proposed Jacksonville USWTR range using two methods: a towed hydrophone array and autonomous bottom-mounted recorders.

Towed Array

A four-element hydrophone array was towed behind the survey vessel to allow acoustic detection of nearby cetaceans. The towed array (Seiche Instruments, UK) consisted of four hydrophone elements with approximate linear sensitivity to frequencies between 1 and 100 kHz (this is the same model of hydrophone array we employ in Onslow Bay). The array was towed 150 m behind the vessel and acoustic signals were routed to an analog-to-digital converter/mixer (MOTU Traveler, MOTU, Cambridge, MA) sampling at 192 kHz. These signals were then passed to a personal computer outfitted with software for real-time visualization/recording (*Ishmael* 1.0) of cetacean sounds. Acoustic monitoring was conducted by members of the Jacksonville survey team as part of their monitoring rotation. Survey team members monitored the array over half-hour periods and made recordings of all potential cetacean sounds detected, as well as other novel sounds.

Bottom-mounted Recorders

To collect time-series of acoustic data in the Jacksonville USWTR study area, autonomous High Frequency Acoustic Recording Packages (HARPs; Wiggins and Hildebrand 2007) were utilized. The HARP moored data-logging system includes a 16-bit A/D converter, up to 1.9 TB of storage capacity, a hydrophone suspended 10 m above the seafloor, an acoustic release system, ballast weights and flotation. The data-loggers are capable of sampling up to 200 kHz and can be set to record continuously or on a duty cycle to accommodate variable deployment durations. A combination of high and low frequency hydrophone elements allow detection of both odontocete and mysticete whale vocalizations and sample rates are high enough to capture the echolocation clicks of many odontocetes.

HARPs were deployed at two sites between lines 5 and 6 in the middle of the proposed Jacksonville USWTR range over three deployment periods (Table 1). The first site (B) is at the western edge of the USWTR study area at 80^{o}26' W and 30^{o}15'N at 40 m depth while the second site (A) is near the center of the USWTR study area at 80^{o}13' W and 30^{o}17'N at 85 m depth (Figure 3). In all deployments, the instruments were programmed to record at a sample rate of 200 kHz for five-minute periods separated by an inactive interval of ten minutes, resulting in data with a 0.01-100 kHz bandwidth and a 1/3 duty cycle.

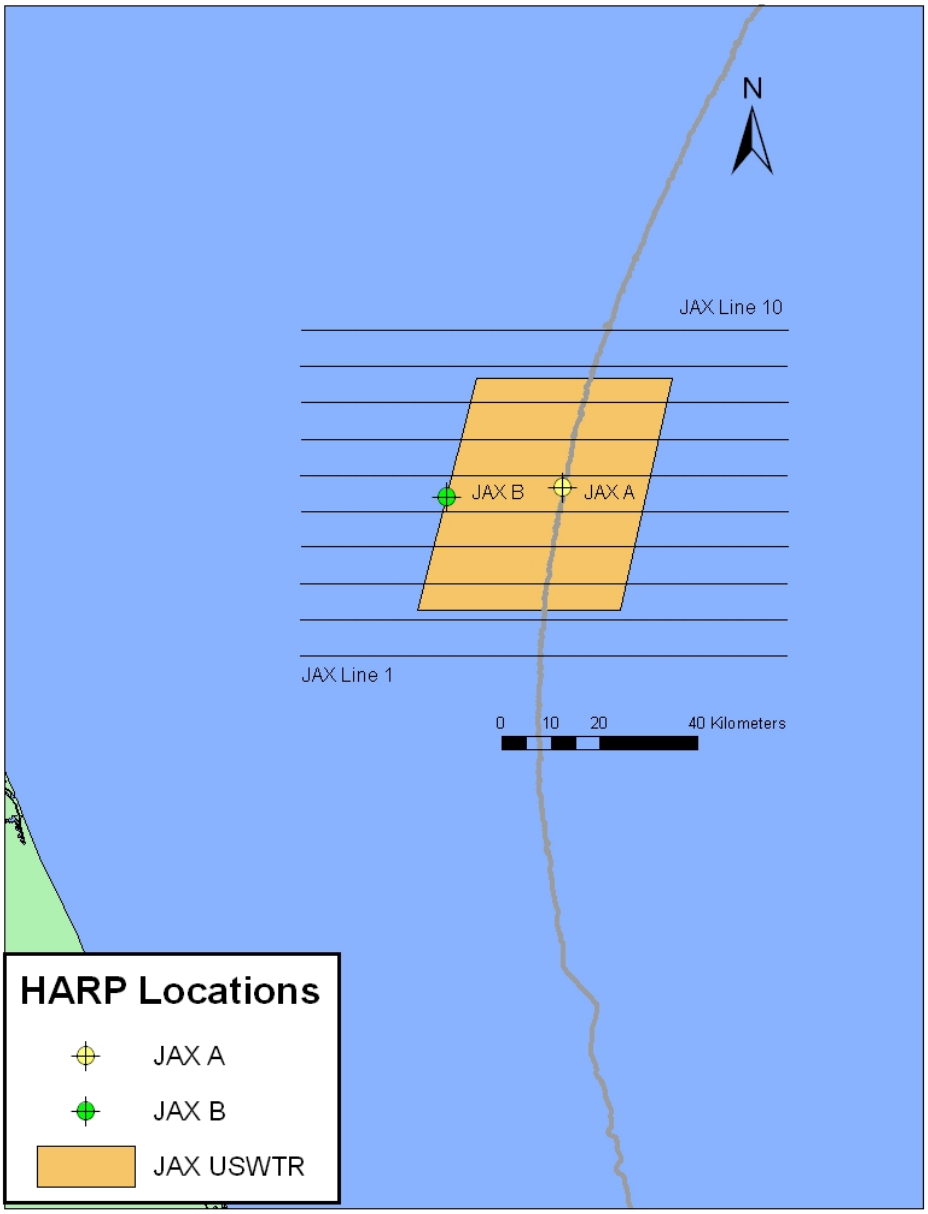


***Figure 3*. Location of HARP deployments off Jacksonville, FL.**

Table 1. **HARP deployments in proposed Jacksonville USWTR range**

	Deployment Date	Recovery Date	Latitude	Longitude	Depth	Available Data (TB)
JAX01 B	30-Mar-09	16-Sep-09	30.258	-80.428	40m	2
JAX01 A	30-Mar-09	16-Sep-09	30.277	-80.216	80m	0.8
JAX02 B	23-Sep-09	21-Feb-10	30.258	-80.428	40m	0
JAX02 A	16-Sep-09	21-Feb-10	30.281	-80.216	85m	1.3
JAX04 B	9-Mar-10	Aug 23-27	30.259	-80.426	40m	--
JAX03 A	21-Feb-10	Aug 23-27	30.281	-80.215	90m	--

Data Analysis

Vessel survey effort and sighting data were compiled and mapped using ArcGIS 9.2 to illustrate the location of effort and sightings within the study area. All sighting data (including radial distance and bearing estimates for each cue) were forwarded to our colleagues at CREEM at the University of St. Andrews, UK for density estimation. Vessel based survey tracks and sighting locations from July 2009 through June 2010 have been posted on OBIS-SEAMAP (http://seamap.env.duke.edu/).

Acoustic Analysis

Towed hydrophone array recordings were analyzed with custom programs written in Matlab (Mathworks, Natick MA, USA). Selections of whistles and clicks with positive species identifications from concurrent visual observations were saved for future analysis of species-specific patterns. Statistical algorithms, including Gaussian mixture models (GMMs), hidden Markov models (HMMs) and autoregression techniques, will be compared to determine the best species classifier for clicks, whistles, and mixed call types (*e.g.* Roch *et al.* 2009). We also plan to look for species-specific patterns, such as consistent peaks and notches, in the recorded clicks using techniques similar to those employed by Soldevilla *et al.* (2008). Analyses of variance (ANOVAs) will be used to determine if there are species-specific frequency differences in peaks and notches of echolocation clicks.

HARP data requires processing prior to analysis, including backing up data in original format, converting data to wav format, decimating wav data by factors of 10 and 100 to aid in baleen whale detection, and creating long-term spectral averages (LTSAs) (described below). Data from deployments JAX01A, JAX01B and JAX02A have all been processed. Each HARP deployment results approximately 2 TB of data, which is impractical to analyze manually in original form. Therefore, these data were compressed for visual overview by creating LTSAs (Wiggins and Hildebrand, 2007) from the wav files. LTSAs are effectively compressed spectrograms created using the Welch algorithm (Welch, 1967) by coherently averaging 500 spectra created from 2000-point, 0%-overlapped, Hann-windowed data and displaying these averaged spectra sequentially over time. The resulting LTSAs had resolutions of 5 s in time and 100 Hz, 10 Hz and 1 Hz in frequency, for the original, decimation factor (df) 10 and df 100 data,

respectively. Using LTSAs, high energy acoustic events can easily be distinguished from background noise (e.g., Wiggins and Hildebrand, 2007), allowing an efficient review of these large data sets.

To date, all original high-frequency LTSAs and df 100 low-frequency LTSAs have been reviewed for JAX01B and JAX02A deployments, and the df 10 mid-frequency LTSAs from these deployments have been partially reviewed. Detected acoustic events include odontocete whistles, odontocete echolocation clicks, shipping noise, sonar, weather events (rain, wind or waves) and an unidentified low-frequency stereotyped call. Sonar includes mid-frequency active sonar, 12 kHz, 28 kHz, and 50 kHz fish- and depth-sounders, and 75 kHz ADCP sources. Diel and longer term trends in occurrence are presented for all acoustic events, and calling bout durations and inter-bout intervals are presented for odontocete whistles and clicks.

To extract whistle and click features for use in automated species classification algorithms, individual clicks and whistles must be detected. A custom MATLAB-based spectral domain whistle and click detector was run on all JAX01B data. This detector had poor performance (high false alarm rates) due to high noise in the shallow water environment, possibly caused by snapping shrimp and proximity to the sea-surface. A time domain click train detector is currently being developed. Once individual whistles and click trains have been detected, spectral or cepstral features will be extracted. These will then be processed using the classifiers developed on towed array data to determine to which species the sounds most likely belong

Data Storage

All acoustic and visual data are archived on digital media at the field office in Fernandina Beach, FL, and backed up on a Duke University network server.

Results

Vessel Survey Effort

Between 1 July 2009 and 30 June 2010, 22 vessel surveys were performed (1570 km) totaling approximately 96 hours of marine mammal and sea turtle surveys (86 hours on effort, 10 hours off effort)(Table 2). Vessel surveys were conducted in Beaufort Sea States 1 to 4, with most

survey effort (78%) performed in a Beaufort 2 to 3 and 22 % in optimal (Beaufort 0 to 1) sighting conditions (Fig. 4a-b).

Table 2. Tracklines and km surveyed during vessel surveys of the proposed USWTR site off of Jacksonville, Florida from July 2009 – June 2010.

Date	Trackline	Total (km)	Survey time
19-Jul-09	10	80.2	4:50
20-Jul-09	9	85.4	4:39
14-Aug-09	6	61.0	3:24
16-Aug-09	8	84.7	5:15
18-Aug-09	5	30.4	2:35
19-Aug-09	7	79.5	4:44
17-Sep-09	9	79.0	4:47
20-Sep-09	2	18.8	4:36
20-Sep-09	1	32.2	
26-Sep-09	4	80.0	4:54
4-Oct-09	3	78.2	4:55
6-Oct-09	1	58.7	3:31
13-Jan-10	10	79.9	4:49
14-Jan-10	8	69.5	3:57
28-Jan-10	6	58.4	3:42
1-Mar-10	4	67.3	4:15
10-Mar-10	2	74.0	4:39
20-May-10	9	64.8	4:07
23-May-10	7	80.5	4:36
10-Jun-10	5	78.2	4:06
12-Jun-10	3	75.9	4:53
14-Jun-10	1	78.2	4:12
16-Jun-10	10	77.0	4:50

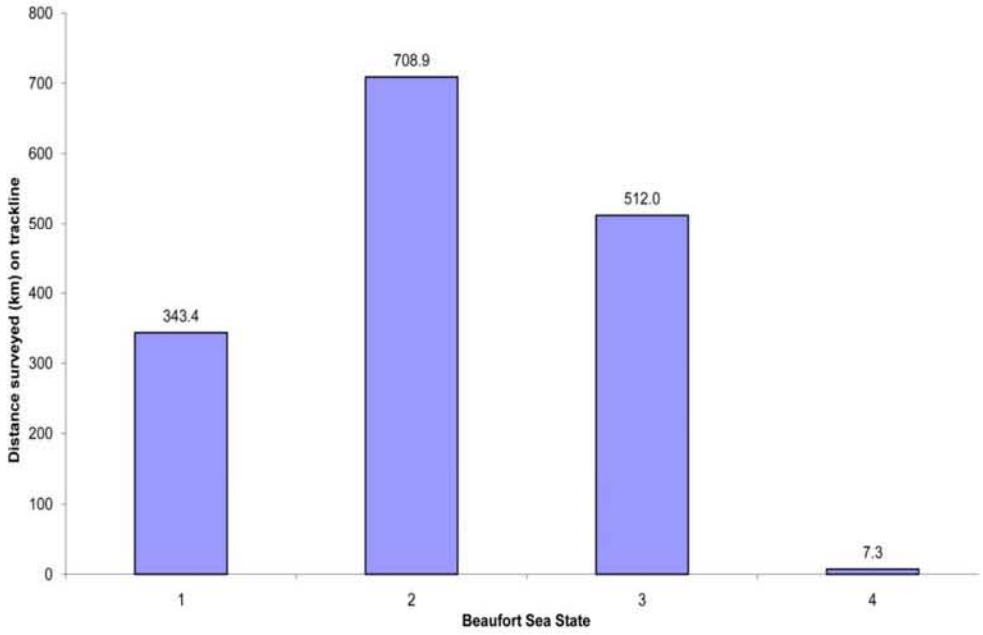


Figure 4a. Total distance surveyed per Beaufort Sea State during the January 2009 – June 2010 vessel surveys of the proposed USWTR survey site off Jacksonville, Florida.

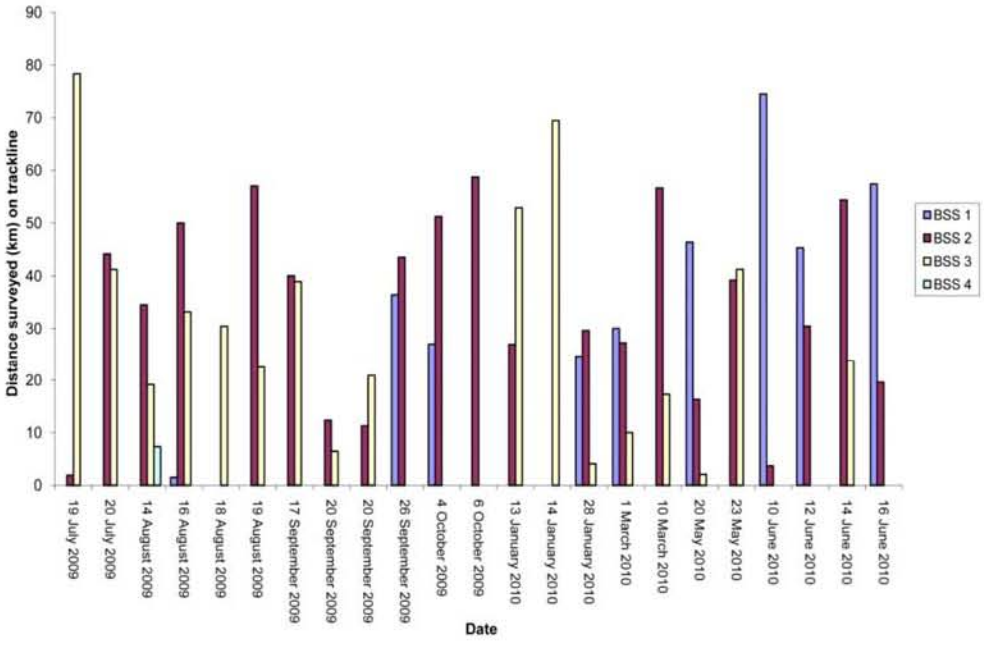


Figure 4b. Effort by Beaufort Sea State for each survey day during the July 2009 – June 2010 vessel surveys of the proposed USWTR site off of Jacksonville, Florida.

Marine Mammal and Sea Turtle Line Transect Sightings (Table 3)

Fifty-six cetacean sightings were made during the reporting period (48 on effort, 8 off effort)(Table 4). Four cetacean species were encountered in the study area: bottlenose dolphins (*Tursiops truncatus*; n=15; all on effort)(Figure 5), Atlantic spotted dolphins (*Stenella frontalis*; n=24; 21 on effort)(Figure 6), short-finned pilot whales (*Globicephala macrorhynchus*; n=3; all off effort), and Risso's dolphins (*Grampus griseus*; n=2; all on effort). In addition unidentified delphinids were recorded 12 times (10 on effort)(Figure 7). No mixed species groups were observed (Table 4). Sightings per unit effort were highest in a Beaufort Sea State of 1, with rates declining with increasing sea state (Figure 8).

A total of 57 sea turtles were observed in the study area (53 on effort; 4 off effort)(Table 5 and Figure 9). Loggerhead sea turtles (*Caretta caretta*, n=48; 45 on effort) were most frequently sighted, followed by leatherback sea turtles (*Dermochelys coriacea*; n=5; all on effort). We sighted one Kemp's Ridley sea turtle (*Lepidochelys kempii*) off effort. In addition, 3 sea turtles where species identity could not be determined were recorded (all on effort).

In general, bottlenose dolphins were found in deeper (mean water depth of 144 m versus 43 m) and slightly warmer waters (25.8°C versus 24.8°C) than Atlantic spotted dolphins (Figures 10 and 11). The majority of spotted dolphins were encountered in 30-42 m depth (23 out of 24 sightings), with one encounter in waters 181 m deep. Group size averages were slightly larger for bottlenose dolphins (6.5 versus 5.5 in spotted dolphins)(Table 5).

Mean water depth and temperature for loggerhead sea turtles were 37 m and 27.4°C (Figure 12).

Table 3. Cetacean and sea turtle sightings made in the proposed USWTR site off of Jacksonville, Florida during vessel surveys from July 2009 – June 2010.

Date	Time	Latitude	Longitude -1	Line	Depth (m)	Temp (C°)	Common Name	Group Size	Effort
19-Jul-09	14:13	30.568363	-80.299465	10	40	29.7	Loggerhead sea turtle	1	On
19-Jul-09	14:52	30.571995	-80.422180	10	37	27.0	Atlantic spotted dolphin	10	On
19-Jul-09	15:26	30.567469	-80.526572	10	No data	No data	Bottlenose dolphin	6	On
19-Jul-09	15:59	30.571028	-80.594118	10	31	29.0	Unidentified delphinid	3	On
20-Jul-09	11:50	30.500307	-80.576753	9	37	28.4	Unidentified delphinid	2	On
20-Jul-09	13:22	30.500282	-80.283378	9	42	28.4	Loggerhead sea turtle	1	On
16-Aug-09	9:58	30.422987	-80.705815	8	29	25.0	Kemp's Ridley sea turtle	1	Off
16-Aug-09	10:08	30.425092	-80.699873	8	30	25.0	Atlantic spotted dolphin	5	Off
16-Aug-09	10:31	30.427164	-80.634801	8	30	25.0	Leatherback sea turtle	1	On
16-Aug-09	10:54	30.427785	-80.563746	8	33	28.1	Loggerhead sea turtle	1	On
16-Aug-09	11:47	30.430309	-80.404033	8	36	26.5	Loggerhead sea turtle	1	On
18-Aug-09	11:23	30.285429	-80.348503	5	41	27.0	Loggerhead sea turtle	1	On
18-Aug-09	12:12	30.288574	-80.480643	5	No data	No data	Loggerhead sea turtle	1	On
18-Aug-09	12:14	30.287930	-80.486021	5	37	27.0	Loggerhead sea turtle	1	On
18-Aug-09	12:15	30.288535	-80.488625	5	37	27.0	Loggerhead sea turtle	1	On
18-Aug-09	12:23	30.287994	-80.492955	5	37	27.0	Atlantic spotted dolphin	3	On
18-Aug-09	13:26	30.242230	-80.658233	5	31	27.4	Atlantic spotted dolphin	6	On
19-Aug-09	16:29	30.369685	-80.406607	7	41	27.1	Atlantic spotted dolphin	4	Off
19-Aug-09	17:23	30.359725	-80.589176	7	36	26.2	Bottlenose dolphin	4	On
17-Sep-09	10:44	30.506465	-80.607440	9	33	28.4	Atlantic spotted dolphin	2	On
17-Sep-09	12:44	30.506844	-80.237128	9	No data	No data	Loggerhead sea turtle	1	On
17-Sep-09	12:53	30.505059	-80.210338	9	No data	No data	Leatherback sea turtle	1	On
17-Sep-09	13:10	30.506082	-80.157305	9	88	29.7	Leatherback sea turtle	1	On
17-Sep-09	14:03	30.506904	-80.012645	9	303	31.0	Risso's dolphin	35	On
20-Sep-09	11:41	30.015321	-80.598513	2	39	29.0	Atlantic spotted dolphin	4	On
20-Sep-09	11:43	30.016014	-80.594325	2	39	29.0	Loggerhead sea turtle	1	Off
20-Sep-09	11:56	30.017311	-80.552788	2	41	28.3	Unidentified delphinid	1	On
20-Sep-09	12:07	30.017009	-80.522811	2	No data	No data	Loggerhead sea turtle	1	On
20-Sep-09	12:10	30.018587	-80.513920	2	41	28.3	Loggerhead sea turtle	1	Off
20-Sep-09	13:05	30.021941	-80.364973	2	44	27.8	Loggerhead sea turtle	1	On
20-Sep-09	15:10	29.967412	-80.586441	1	36	27.2	Unidentified delphinid	2	On
20-Sep-09	15:40	29.968891	-80.678701	1	34	28.1	Loggerhead sea turtle	1	On
26-Sep-09	10:39	30.161727	-80.616101	4	33	28.1	Atlantic spotted dolphin	1	On
26-Sep-09	12:31	30.160432	-80.318435	4	45	30.7	Bottlenose dolphin	20	On
26-Sep-09	15:24	30.182111	-79.955000		No data	No data	Short-finned pilot whale	35	Off
26-Sep-09	16:06	30.208278	-80.023972		No data	No data	Short-finned pilot whale	50	Off
04-Oct-09	14:43	30.098851	-80.029564	3	400	28.4	Bottlenose dolphin	9	On
04-Oct-09	16:23	30.099172	-80.325845	3	42	29.9	Atlantic spotted dolphin	3	On
04-Oct-09	16:40	30.101447	-80.350797	3	41	29.8	Unidentified delphinid	2	On
04-Oct-09	16:50	30.101266	-80.373382	3	44	29.8	Unidentified delphinid	1	On
04-Oct-09	17:18	30.104809	-80.464366	3	40	29.3	Loggerhead sea turtle	1	On
04-Oct-09	17:32	30.104019	-80.514553	3	39	24.1	Loggerhead sea turtle	1	On
04-Oct-09	17:46	30.102039	-80.561501	3	37	25.1	Loggerhead sea turtle	1	On
04-Oct-09	17:55	30.101092	-80.590033	3	37	27.6	Loggerhead sea turtle	1	On
04-Oct-09	18:01	30.100714	-80.610691	3	37	29.3	Loggerhead sea turtle	1	On
04-Oct-09	18:04	30.101071	-80.621400	3	36	29.3	Loggerhead sea turtle	1	On
04-Oct-09	18:05	30.101216	-80.624046	3	36	29.3	Loggerhead sea turtle	2	On
04-Oct-09	18:13	30.101586	-80.650825	3	33	29.3	Loggerhead sea turtle	1	On
04-Oct-09	18:16	30.100502	-80.663343	3	33	29.1	Loggerhead sea turtle	1	On

Table 3 (*continued*). Cetacean and sea turtle sightings made in the proposed USWTR site off of Jacksonville, Florida during vessel surveys from July 2009 – June 2010.

Date	Time	Latitude	Longitude -1	Line	Depth (m)	Temp (C°)	Common Name	Group Size	Effort
04-Oct-09	18:20	30.099064	-80.675898	3	33	29.1	Unidentified delphinid	2	On
06-Oct-09	11:08	29.966821	-80.555040	1	38	29.2	Bottlenose dolphin	2	On
06-Oct-09	11:35	29.967867	-80.465110	1	41	29.0	Atlantic spotted dolphin	1	On
06-Oct-09	12:02	29.968554	-80.409355	1	43	29.3	Bottlenose dolphin	1	On
13-Jan-10	10:29	30.567982	-80.628400	10	30	18.0	Bottlenose dolphin	5	On
13-Jan-10	11:06	30.564430	-80.512458	10	33	17.4	Loggerhead sea turtle	1	On
13-Jan-10	11:35	30.564930	-80.432060	10	36	17.2	Bottlenose dolphin	2	On
13-Jan-10	11:53	30.569257	-80.395757	10	37	18.5	Bottlenose dolphin	2	On
13-Jan-10	12:45	30.572975	-80.254310	10	44	17.7	Unidentified delphinid	1	Off
13-Jan-10	13:05	30.573375	-80.194413	10	46	22.1	Leatherback sea turtle	1	On
13-Jan-10	14:51	30.569478	-79.858819	10	232	24.7	Unidentified delphinid	1	On
14-Jan-10	13:47	30.441682	-80.398922	8	36	22.0	Unidentified delphinid	3	On
14-Jan-10	13:52	30.441505	-80.379987	8	37	22.1	Loggerhead sea turtle	1	On
14-Jan-10	14:13	30.430632	-80.362470	8	38	22.9	Atlantic spotted dolphin	8	On
14-Jan-10	14:25	30.427455	-80.338912	8	40	22.9	Atlantic spotted dolphin	7	On
14-Jan-10	15:04	30.441954	-80.205903	8	51	22.1	Loggerhead sea turtle	1	On
28-Jan-10	14:16	30.302944	-80.353822	6	42	20.8	Atlantic spotted dolphin	5	On
28-Jan-10	14:24	30.302467	-80.377815	6	No data	No data	Loggerhead sea turtle	1	On
28-Jan-10	14:27	30.302740	-80.389045	6	No data	No data	Leatherback sea turtle	1	On
28-Jan-10	14:39	30.300664	-80.406183	6	38	20.7	Bottlenose dolphin	3	On
28-Jan-10	15:11	30.300260	-80.486600	6	37	21.1	Unidentified delphinid	3	On
28-Jan-10	15:44	30.297800	-80.587080	6	No data	No data	Loggerhead sea turtle	1	On
01-Mar-10	14:44	30.171021	-80.277950	4	48	21.0	Loggerhead sea turtle	1	On
01-Mar-10	15:05	30.169377	-80.349359	4	No data	No data	Atlantic spotted dolphin	2	On
01-Mar-10	16:33	30.166664	-80.589490	4	34	23.0	Atlantic spotted dolphin	2	On
01-Mar-10	16:45	30.166619	-80.608868	4	33	23.0	Atlantic spotted dolphin	3	On
01-Mar-10	17:03	30.165464	-80.648855	4	31	23.0	Atlantic spotted dolphin	9	On
01-Mar-10	17:16	30.165281	-80.679358	4	32	21.8	Atlantic spotted dolphin	17	On
01-Mar-10	17:17	30.164639	-80.684001	4	No data	No data	Atlantic spotted dolphin	5	On
10-Mar-10	14:29	30.032257	-80.223955	2	181	20.6	Atlantic spotted dolphin	4	On
10-Mar-10	15:44	30.036257	-80.442362	2	42	17.0	Atlantic spotted dolphin	4	On
10-Mar-10	16:42	30.029437	-80.586483	2	38	20.6	Atlantic spotted dolphin	13	Off
20-May-10	14:12	30.506195	-80.295272	9	42	26.6	Atlantic spotted dolphin	1	On
20-May-10	14:23	30.505725	-80.330123	9	41	26.6	Loggerhead sea turtle	1	On
20-May-10	15:01	30.509397	-80.450341	9	37	26.6	Loggerhead sea turtle	1	On
20-May-10	15:26	30.513175	-80.484023	9	37	24.9	Atlantic spotted dolphin	16	On
20-May-10	15:45	30.510552	-80.542606	9	35	26.4	Loggerhead sea turtle	1	On
20-May-10	15:52	30.511185	-80.563626	9	34	26.5	Loggerhead sea turtle	1	On
20-May-10	15:56	30.511745	-80.579101	9	32	26.6	Loggerhead sea turtle	1	On
20-May-10	16:19	30.507112	-80.620221	9	31	26.0	Bottlenose dolphin	2	On
23-May-10	15:34	30.367712	-80.319432	7	42	27.0	Bottlenose dolphin	8	On
23-May-10	16:58	30.368032	-80.587025	7	38	27.0	Loggerhead sea turtle	1	On
23-May-10	17:03	30.368362	-80.603263	7	37	27.0	Loggerhead sea turtle	1	On
23-May-10	17:04	30.368954	-80.609633	7	31	27.0	Loggerhead sea turtle	1	On
10-Jun-10	12:22	30.245583	-79.901683		No data	No data	Short-finned pilot whale	15	Off
10-Jun-10	15:18	30.243697	-80.367558	5	42	30.4	Loggerhead sea turtle	1	On
10-Jun-10	15:41	30.243932	-80.450660	5	39	30.7	Loggerhead sea turtle	1	On
10-Jun-10	15:45	30.243774	-80.465003	5	37	30.7	Loggerhead sea turtle	1	On
10-Jun-10	16:01	30.239685	-80.522905	5	16	30.5	Loggerhead sea turtle	1	On

Table 3 (*continued*). Cetacean and sea turtle sightings made in the proposed USWTR site off of Jacksonville, Florida during vessel surveys from July 2009 – June 2010.

Date	Time	Latitude	Longitude -1	Line	Depth (m)	Temp (C°)	Common Name	Group Size	Effort
10-Jun-10	16:05	30.238952	-80.535578	5	13	30.5	Loggerhead sea turtle	1	On
12-Jun-10	12:37	30.111181	-79.944292	3	600	30.4	Bottlenose dolphin	16	On
12-Jun-10	13:01	30.110376	-80.002467	3	600	30.7	Bottlenose dolphin	15	On
12-Jun-10	16:21	30.103611	-80.563661	3	36	29.0	Bottlenose dolphin	4	On
12-Jun-10	16:40	30.104279	-80.630623	3	34	29.5	Unidentified turtle	1	On
12-Jun-10	16:40	30.104277	-80.634041	3	35	29.5	Unidentified turtle	1	On
14-Jun-10	14:52	29.974706	-80.405760	1	43	28.5	Loggerhead sea turtle	1	Off
14-Jun-10	14:54	29.974656	-80.410498	1	43	28.5	Loggerhead sea turtle	1	On
14-Jun-10	16:01	29.971806	-80.643988	1	37	29.4	Loggerhead sea turtle	1	On
16-Jun-10	12:59	30.587273	-79.910252	10	350	31.2	Risso's dolphin	8	On
16-Jun-10	16:24	30.575813	-80.536796	10	32	27.6	Loggerhead sea turtle	1	On
16-Jun-10	16:35	30.572567	-80.576375	10	29	29.9	Loggerhead sea turtle	1	On
16-Jun-10	17:08	30.567690	-80.667065	10	29	31.0	Unidentified delphinid	1	Off
16-Jun-10	17:14	30.567735	-80.686223	10	27	31.0	Unidentified turtle	1	On

Table 4. Number of cetacean sightings and mean group size by species during vessel surveys of the proposed USWTR site off of Jacksonville, Florida, July 2009 – June 2010.

Species	Common Name	Sightings	Mean Group Size
Globicephala macrorhynchus	Short-finned pilot whale	3	**33.3**
Grampus griseus	Risso's dolphin	2	**21.5**
Stenella frontalis	Atlantic spotted dolphin	24	**5.6**
Tursiops truncatus	Bottlenose dolphin	15	**6.6**
Unidentified delphinid	Unidentified delphinid	12	**1.8**
	Total:	**56**	

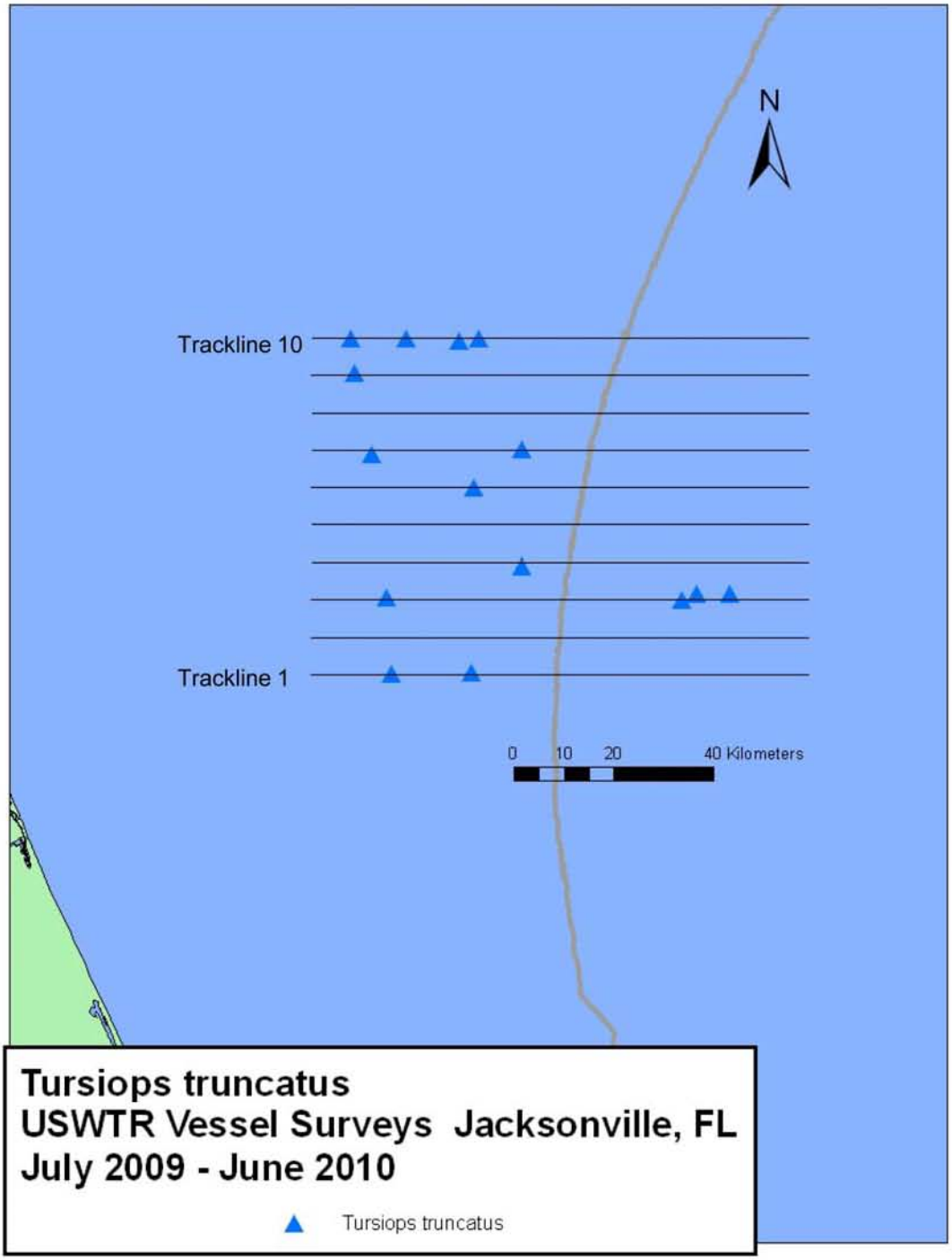


Figure 5. Distribution of bottlenose dolphin (*Tursiops truncatus*) sightings made during vessel surveys of the proposed USWTR site off of Jacksonville, Florida, July 2009 – June 2010.

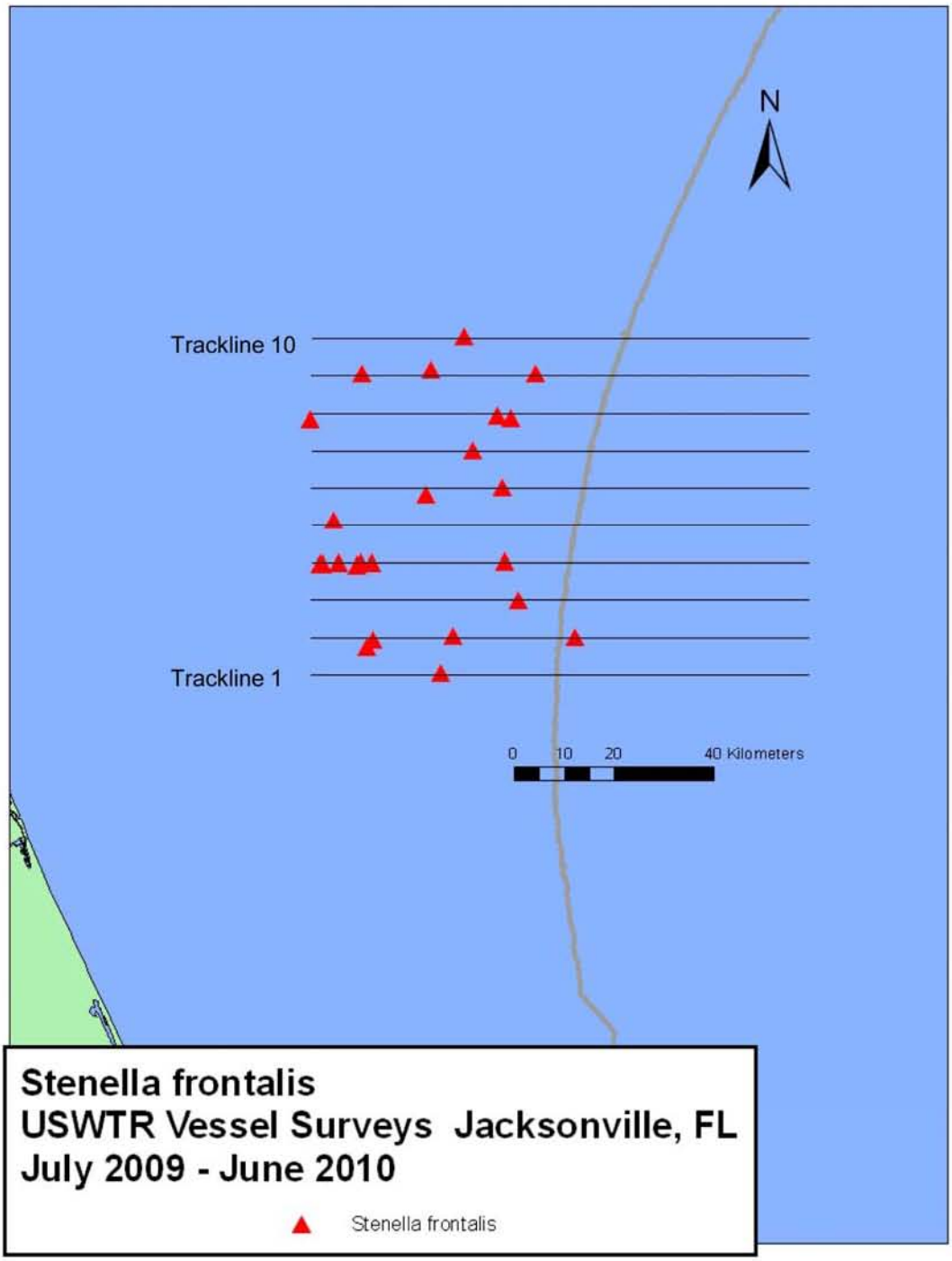


Figure 6. Distribution of Atlantic spotted dolphin (*Stenella frontalis*) sightings made during vessel surveys of the proposed USWTR site off of Jacksonville, Florida, July 2009 – June 2010.

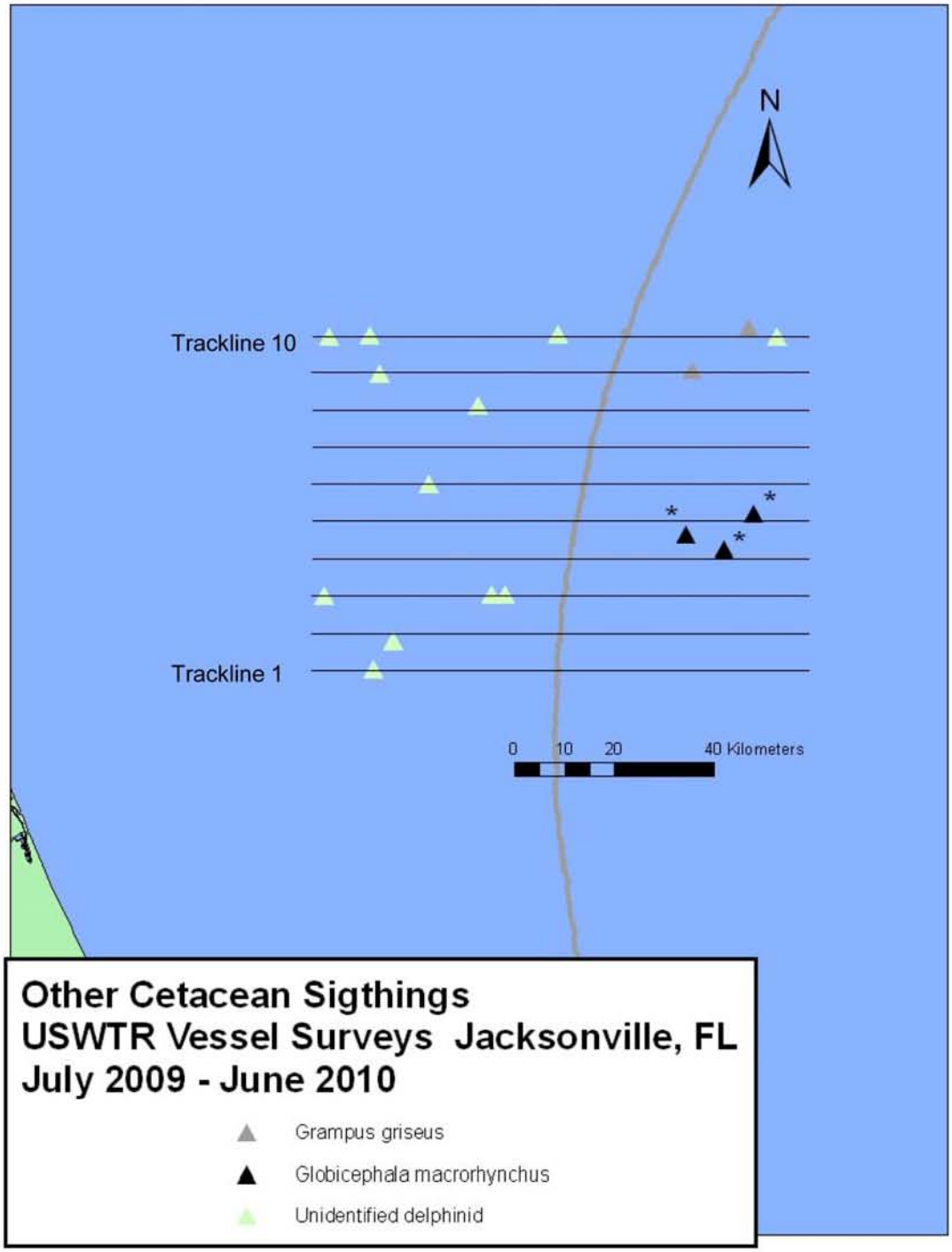


Figure 7. Distribution of all other cetacean sightings made during vessel surveys of the proposed USWTR site off of Jacksonville, Florida, July 2009 – June 2010. Asterisk denotes off effort sighting.

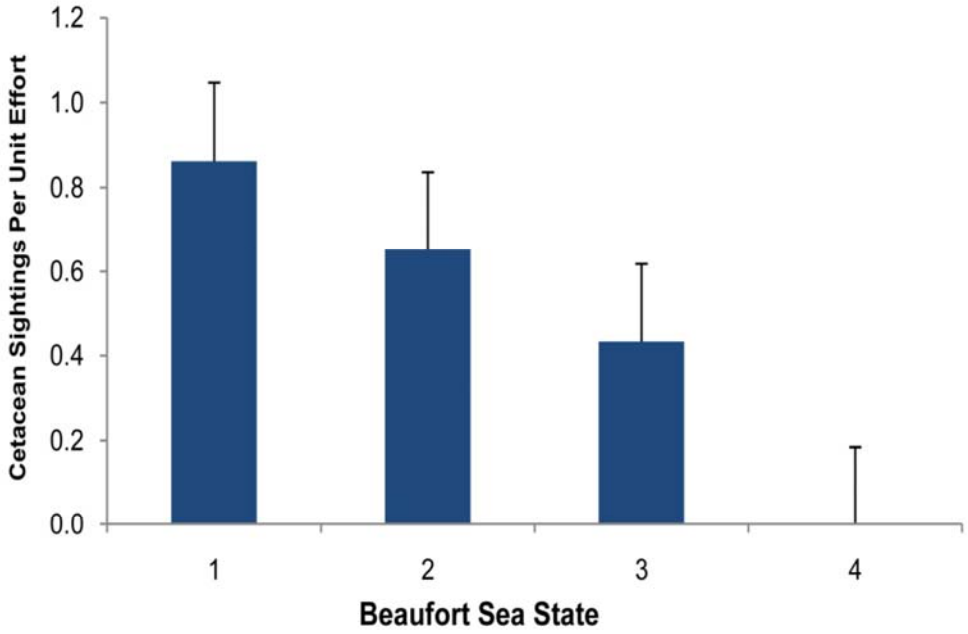


Figure 8. Number of cetacean sightings corrected for hours on effort in each Beaufort Sea State for July 2009 – June 2010 vessel surveys of the proposed USWTR site off of Jacksonville, Florida.

Table 5. Number of sea turtles seen by species during vessel surveys of the proposed USWTR site off of Jacksonville, Florida, July 2009 – June 2010..

Species	Common Name	Turtles Observed
Caretta caretta	Loggerhead sea turtle	48
Dermochelys coriacea	Leatherback sea turtle	5
Lepidochelys kempii	Kemp's Ridley sea turtle	1
Unidentified Sea Turtle	Unidentified Sea Turtle	3
	Total:	**57**

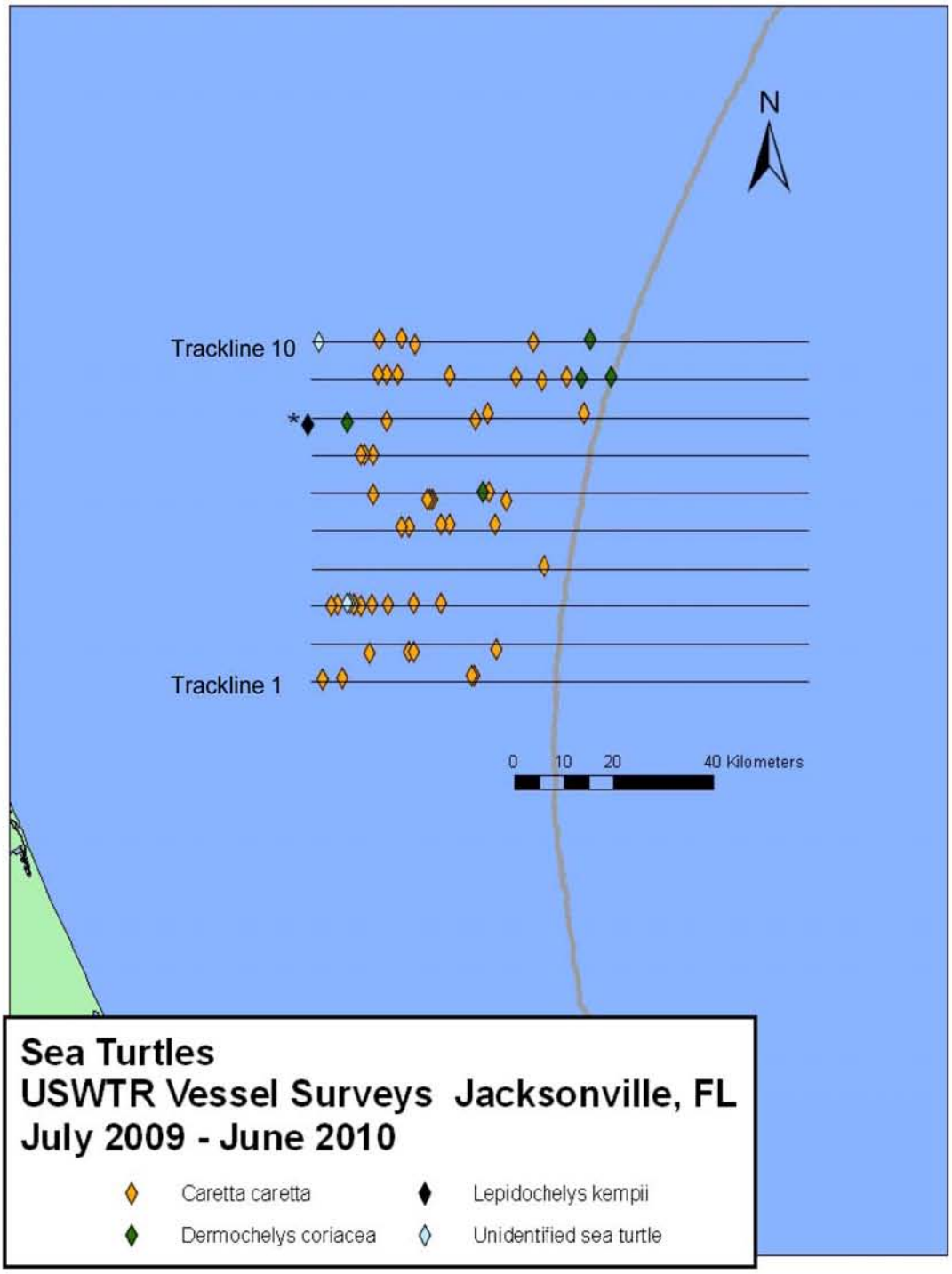
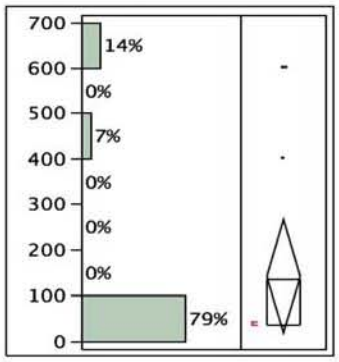


Figure 9. Distribution of all sea turtle sightings made during vessel surveys of the proposed USWTR site off of Jacksonville, Florida, July 2009 – June 2010.

Bottlenose dolphin *(Tursiops truncatus)*

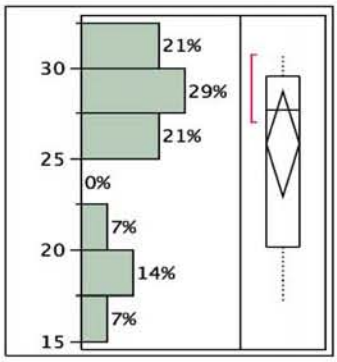
Depth (m)



Quantiles		
100.00%	maximum	600.00
99.50%		600.00
97.50%		600.00
90.00%		600.00
75.00%	quartile	133.75
50.00%	median	38.00
25.00%	quartile	36.00
10.00%		30.50
2.50%		30.00
0.50%		30.00
0.00%	minimum	30.00

Moments	
Mean	143.70
Std Dev	216.00
Std Err Mean	57.70
Upper 95% Mean	268.40
Lower 95% Mean	19.00
N	14.00
Sum Wgt	14.00
Sum	2012.00
Variance	46653.10
Skewness	1.70
Kurtosis	1.40
CV	150.30
N Missing	1.00

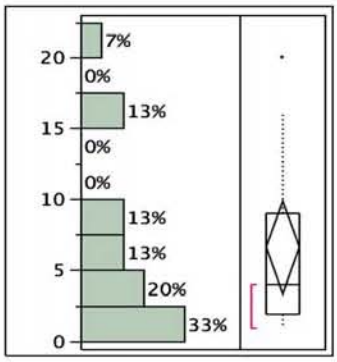
Temperature (C)



Quantiles		
100.00%	maximum	30.70
99.50%		30.70
97.50%		30.70
90.00%		30.70
75.00%	quartile	29.58
50.00%	median	27.70
25.00%	quartile	20.14
10.00%		17.60
2.50%		17.20
0.50%		17.20
0.00%	minimum	17.20

Moments	
Mean	25.80
Std Dev	5.00
Std Err Mean	1.30
Upper 95% Mean	28.70
Lower 95% Mean	22.90
N	14.00
Sum Wgt	14.00
Sum	361.30
Variance	25.10
Skewness	-0.80
Kurtosis	-1.00
CV	19.40
N Missing	1.00

Group Size

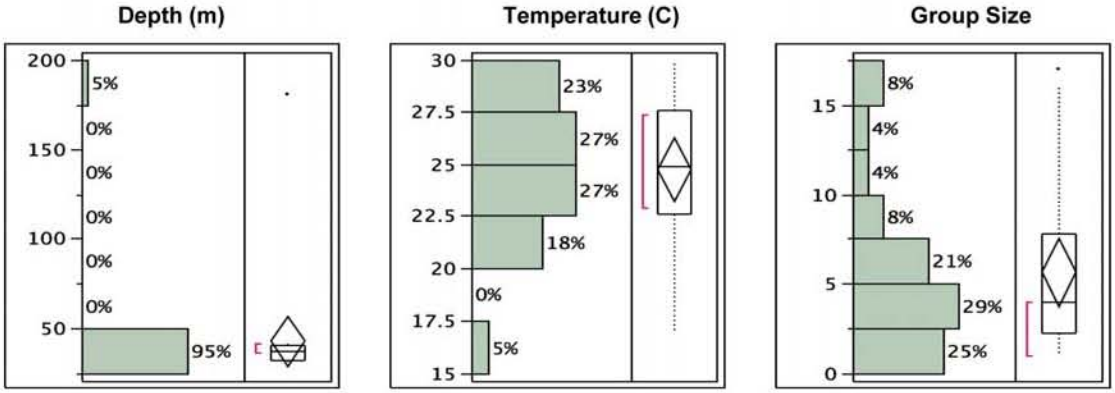


Quantiles		
100.00%	maximum	20.00
99.50%		20.00
97.50%		20.00
90.00%		17.60
75.00%	quartile	9.00
50.00%	median	4.00
25.00%	quartile	2.00
10.00%		1.60
2.50%		1.00
0.50%		1.00
0.00%	minimum	1.00

Moments	
Mean	6.60
Std Dev	5.90
Std Err Mean	1.50
Upper 95% Mean	9.90
Lower 95% Mean	3.30
N	15.00
Sum Wgt	15.00
Sum	99.00
Variance	35.10
Skewness	1.30
Kurtosis	0.50
CV	89.80
N Missing	0.00

Figure 10. Descriptive statistics for depth, sea surface temperature, and group size estimates for bottlenose dolphin (Tursiops truncatus) sightings during vessel surveys of the proposed USWTR survey site off of Jacksonville, Florida, July 2009 – June 2010 .

Atlantic spotted dolphin *(Stenella frontalis)*



Quantiles		
100.00%	maximum	181.00
99.50%		181.00
97.50%		181.00
90.00%		42.00
75.00%	quartile	41.25
50.00%	median	37.50
25.00%	quartile	33.00
10.00%		31.00
2.50%		30.00
0.50%		30.00
0.00%	minimum	30.00

Moments	
Mean	43.40
Std Dev	31.00
Std Err Mean	6.60
Upper 95% Mean	57.10
Lower 95% Mean	29.60
N	22.00
Sum Wgt	22.00
Sum	954.00
Variance	961.70
Skewness	4.60
Kurtosis	21.10
CV	71.50
N Missing	2.00

Quantiles		
100.00%	maximum	29.90
99.50%		29.90
97.50%		29.90
90.00%		29.00
75.00%	quartile	27.58
50.00%	median	24.95
25.00%	quartile	22.63
10.00%		20.60
2.50%		17.00
0.50%		17.00
0.00%	minimum	17.00

Moments	
Mean	24.80
Std Dev	3.40
Std Err Mean	0.70
Upper 95% Mean	26.30
Lower 95% Mean	23.20
N	22.00
Sum Wgt	22.00
Sum	545.00
Variance	11.80
Skewness	-0.40
Kurtosis	-0.60
CV	13.90
N Missing	2.00

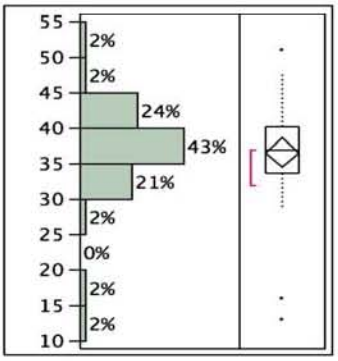
Quantiles		
100.00%	maximum	17.00
99.50%		17.00
97.50%		17.00
90.00%		14.50
75.00%	quartile	7.75
50.00%	median	4.00
25.00%	quartile	2.25
10.00%		1.00
2.50%		1.00
0.50%		1.00
0.00%	minimum	1.00

Moments	
Mean	5.60
Std Dev	4.50
Std Err Mean	0.90
Upper 95% Mean	7.50
Lower 95% Mean	3.70
N	24.00
Sum Wgt	24.00
Sum	135.00
Variance	20.20
Skewness	1.40
Kurtosis	1.20
CV	80.00
N Missing	0.00

Figure 11. Descriptive statistics for depth, sea surface temperature, and group size estimates for Atlantic spotted dolphin (*Stenella frontalis*) sightings during vessel surveys of the proposed USWTR survey site off of Jacksonville, Florida, July 2009 – June 2010 .

Loggerhead sea turtle *(Caretta caretta)*

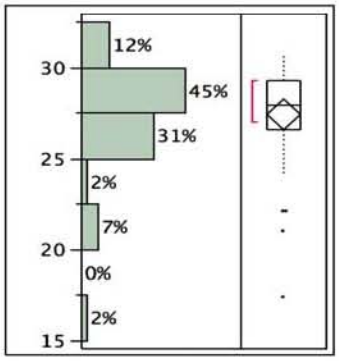
Depth (m)



Quantiles		
100.00%	maximum	51.00
99.50%		51.00
97.50%		50.77
90.00%		43.00
75.00%	quartile	40.25
50.00%	median	37.00
25.00%	quartile	33.75
10.00%		31.30
2.50%		13.22
0.50%		13.00
0.00%	minimum	13.00

Moments	
Mean	36.60
Std Dev	6.70
Std Err Mean	1.00
Upper 95% Mean	38.70
Lower 95% Mean	34.50
N	42.00
Sum Wgt	42.00
Sum	1537.00
Variance	44.30
Skewness	-1.50
Kurtosis	4.90
CV	18.20
N Missing	5.00

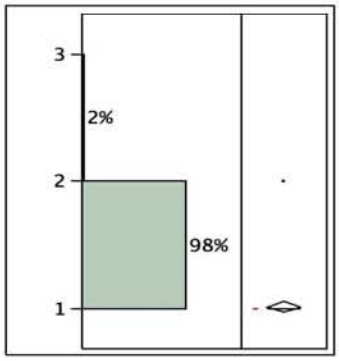
Temperature (C)



Quantiles		
100.00%	maximum	30.70
99.50%		30.70
97.50%		30.70
90.00%		30.47
75.00%	quartile	29.30
50.00%	median	27.95
25.00%	quartile	26.60
10.00%		22.70
2.50%		17.67
0.50%		17.40
0.00%	minimum	17.40

Moments	
Mean	27.40
Std Dev	2.80
Std Err Mean	0.40
Upper 95% Mean	28.30
Lower 95% Mean	26.60
N	42.00
Sum Wgt	42.00
Sum	1152.30
Variance	7.60
Skewness	-1.70
Kurtosis	3.70
CV	10.10
N Missing	5.00

Group Size



Quantiles		
100.00%	maximum	2.00
99.50%		2.00
97.50%		1.80
90.00%		1.00
75.00%	quartile	1.00
50.00%	median	1.00
25.00%	quartile	1.00
10.00%		1.00
2.50%		1.00
0.50%		1.00
0.00%	minimum	1.00

Moments	
Mean	1.00
Std Dev	0.10
Std Err Mean	0.00
Upper 95% Mean	1.10
Lower 95% Mean	1.00
N	47.00
Sum Wgt	47.00
Sum	48.00
Variance	0.00
Skewness	6.90
Kurtosis	47.00
CV	14.30
N Missing	0.00

Figure 12. Descriptive statistics for depth, sea surface temperature, and group size estimates for loggerhead sea turtle (*Caretta caretta*) sightings during vessel surveys of the proposed USWTR survey site off of Jacksonville, Florida, July 2009 – June 2010 .

Distributions and Habitat Associations of Cetaceans

The distribution of marine mammals and sea turtles are presented in Figures 5, 6, 7, and 9. Atlantic spotted dolphins were largely restricted to the relatively shallow shelf waters, whereas bottlenose dolphins were encountered throughout the survey area with some groups detected in deep, offshore waters. Risso's dolphins and short-finned pilot whales, which are known to be deep diving species, were all exclusively encountered in waters off shore of the shelf break. Loggerhead sea turtles were only observed in shallower waters over the continental shelf.

Seasonality of Effort and Sightings

Due to unfavorable survey conditions, there was no survey effort in four months of the reporting period. Any seasonal trends in cetacean or sea turtle distribution are, therefore, difficult to establish at this point. The number of sightings were graphed by species for both cetaceans and sea turtles during each month surveyed (Figure 13a and b).

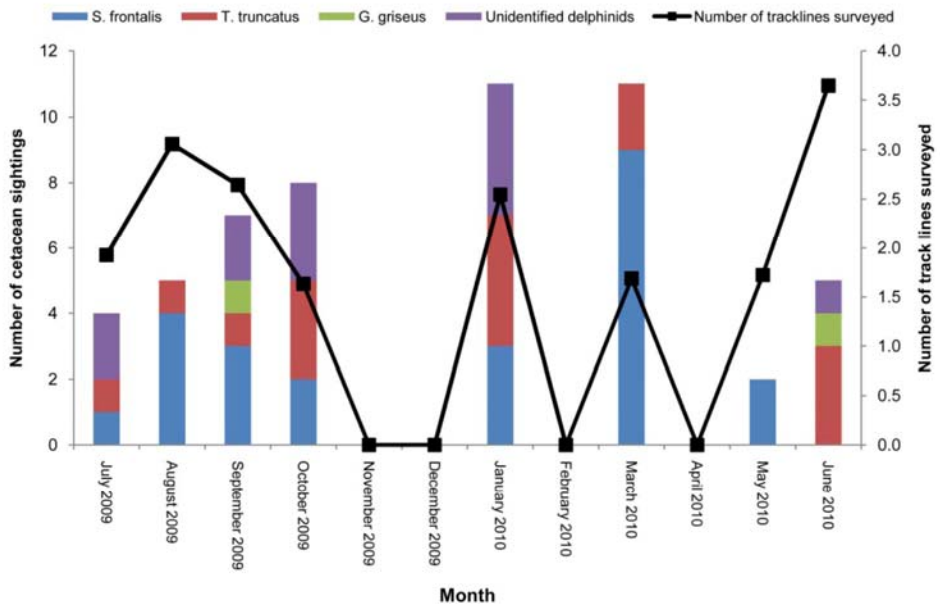


Figure 13a. Number of cetacean sightings by month and effort (number of tracklines surveyed) for July 2009 – June 2010 vessel surveys conducted in the proposed USWTR site off of Jacksonville, Florida.

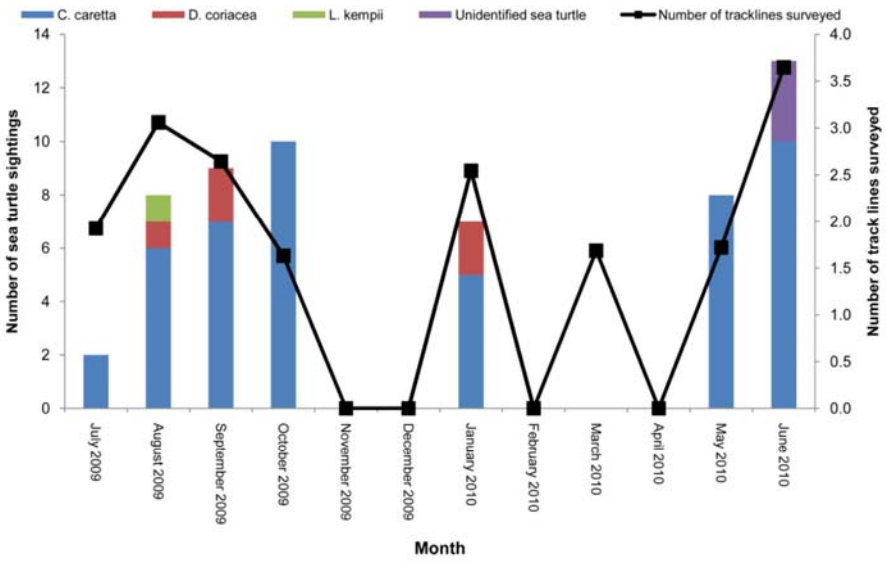


Figure 13b. Number of sea turtle sightings by month and effort (number of tracklines surveyed) for July 2009 – June 2010 vessel surveys conducted in the proposed USWTR site off of Jacksonville, Florida.

Photographic Efforts

Approximately 3300 digital images were taken for species confirmation and individual identification (Table 6). The goal is to develop a photo-identification catalogue for cetacean species encountered in the survey area to investigate a variety of ecological parameters (*e.g.* residency patterns and population size). Future efforts will include comparison of photo identification catalogues between the USWTR sites in Onslow Bay, NC and the USWTR site off of Jacksonville, FL, to look for re-sightings between sites. This type of data may help elucidate the poorly known residency and migration patterns of offshore delphinids in the western Atlantic.

Table 6. Number of images taken per species during vessel surveys of the proposed USWTR site off of Jacksonville, Florida, July 2009 – June 2010.

Species	Common Name	Sightings	Images
Grampus griseus	Risso's dolphin	2	405
Globicephala macrorhynchus	Short-finned pilot whale	3	1368
Tursiops truncatus	Bottlenose dolphin	15	779
Stenella frontalis	Atlantic spotted dolphin	24	781
	Total:	**44**	**3333**

Passive Acoustic Monitoring

From 1 January 2009 to 30 June 2010, 19 USWTR line-transect surveys were conducted with the towed hydrophone array off Jacksonville, FL. Fourteen of these surveys were conducted with dedicated acoustic monitoring, while the remaining five included recordings only during sightings. During these surveys, a total of 54 odontocete groups were acoustically detected and recorded, 19 of which were positively identified to species by the visual observers. These 19 visually identified groups included 8 bottlenose dolphin groups, 8 Atlantic spotted dolphin groups, 2 Risso's dolphin groups and 1 pilot whale group (Table 7). One of the 15 recordings of animals that were not sighted featured echolocation click spectral patterns similar to those recorded in the presence of Risso's dolphins (Figure 14). Figure 15 shows the number of towed array detections per monitoring time for each species by month. Future work includes reviewing recordings to confirm species identification by localizing cetacean vocalizations using time difference of arrival (TDOA) techniques involving two or more hydrophone elements and using *Ishmael* and *Whaltrak* software. Acoustic species identification algorithms (described above) utilizing these recordings will be developed and tested over the next few months.

Table 7. **Number of recordings made using towed array between 1 January 2009 – 30 June 2010 off Jacksonville FL.** Total dedicated monitoring time was 58.4 hours and an additional 4.2 hours of recordings were made during sightings only.

Species	Total # of Days Detected	Total # of Detections	Total Duration of Recordings (hh:mm)
Stenella frontalis	8	17	3:16
Tursiops truncatus	8	12	2:57
Grampus griseus	2	2	0:40
Globicephala macrorhynchus	1	1	0:10
Unidentified delphinid	6	7	2:49
Not sighted	10	15	1:29

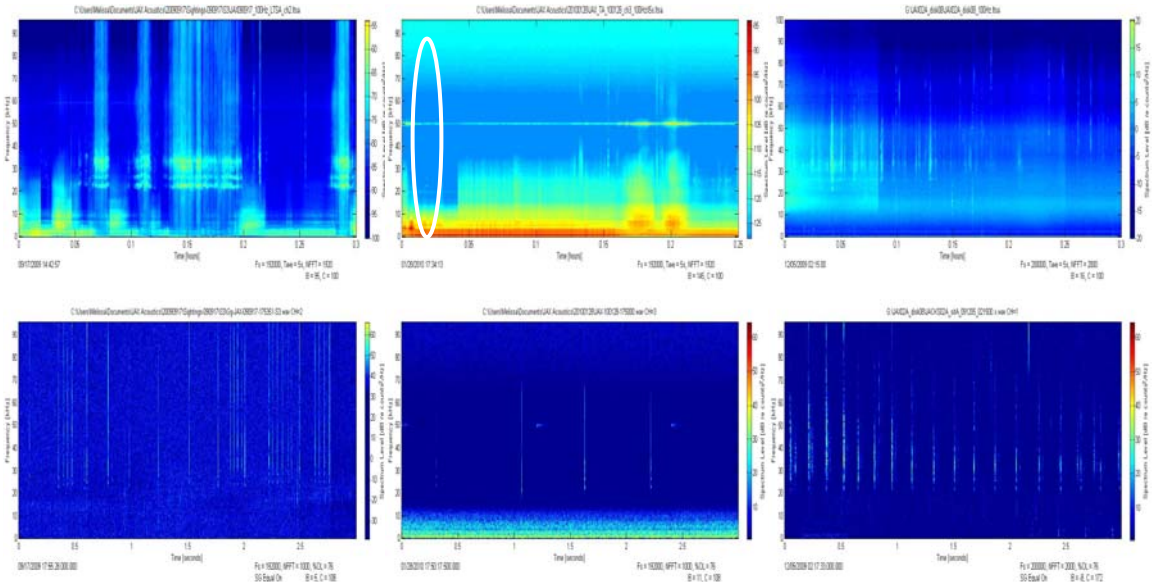


Figure 14. **Echolocation clicks in LTSAs and spectrograms illustrating similar spectral patterns with peaks and notches, as has been described for North Pacific Risso's dolphins (Soldevilla *et al*., 2008). Clicks from Risso's dolphins during visually verified towed array recording (A), clicks with same pattern in towed array recording with no sighting (B) and clicks with same pattern in autonomous HARP recording (C).**

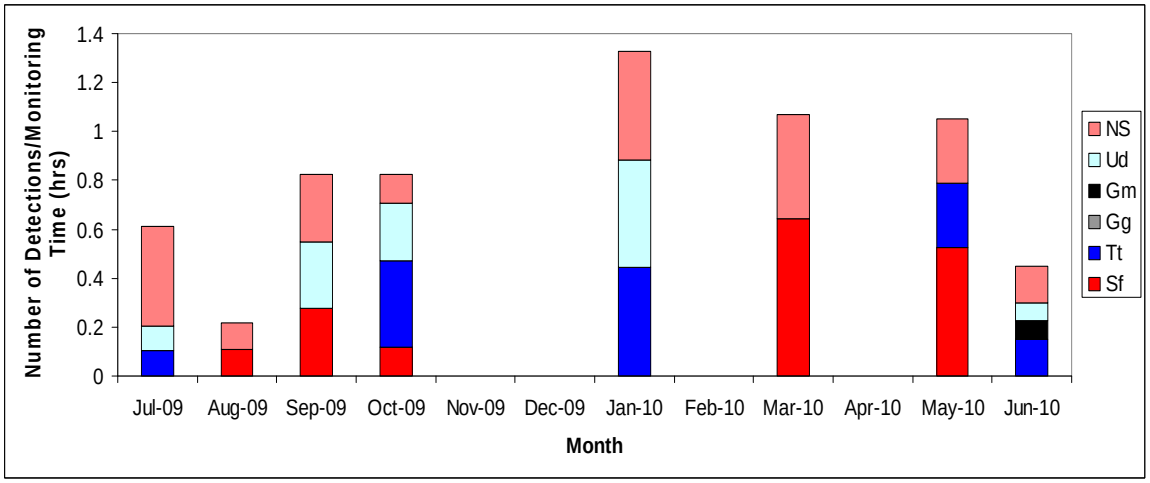


Figure 15. **Number of monthly towed array detections off Jacksonville FL per monitoring time for each species. No detections occurred in Nov 09, Dec 09, Feb 10 and Apr 10 because there was no monitoring effort due to rough weather. Only data from days with dedicated acoustic monitoring are included.**

The first round of HARP deployments resulted in good quality data from 2 April 2009 to 4 September 2009 at site B (JAX01B). High-frequency data analysis has been performed and the results are described below. Low-frequency data have also been analyzed. Many fish calls are evident, but no known baleen whale calls were detected. Mid-frequency data analysis is in

progress. The HARP deployed at site A during this period (JAX01A) had a bad chip on the RAM board which resulted in timing errors and some failures in writing the data. These errors became progressively worse during the course of the deployment. The timing errors have been corrected and the JAX01A data appear usable from 2 April 2009 to 25 May 2009 despite the writing errors. These will be analyzed over the next few months. HARPs from the second round of deployments resulted in good quality data at site A (JAX02A) from 14 September 2009 to 15 December 2009. The high- and low-frequency data have been analyzed and results are presented below. Mid-frequency data analysis is still in progress. On 13 December 2009, the oil-filled hydrophone was bitten by a shark or marine mammal, and data quality progressively deteriorated over the next two days until salt water intrusion shorted out the pre-amplifier board. The HARP at site B (JAX02B) did not record any data over this period due to an unknown error.

During the JAX01B deployment, 161 days of data recordings were made and odontocete whistles and clicks were detected on 146 days (90%) and 154 days (96%), respectively (Table 6). During the JAX02A deployment, 91 days of data recordings were made and odontocete whistles and clicks were detected on 79 days (86%) and 91 days (100%), respectively (Table 6). Shipping was the most frequently heard non-biological noise, heard on 131 and 77 days at sites B and A, respectively. The detailed timing of acoustic events as a function of date and time of day are presented in Figure 16. The frequent occurrence of short duration whistle and echolocation click bouts is evident. Further analyses confirm that whistle and click bout durations are typically short (Table 7), with 90% lasting less than 30 and 45 minutes, respectively (Figure 17 a, c). Clustering in duration histograms is due to use of 1/3 duty cycle during recording. Whistle and click inter-bout intervals are also short (Table 7), with 90% occurring within 12 and 6 hours of a previous bout, respectively (Figure 17 b, d). The short duration of whistle bouts, which often occur as a single whistle, make them difficult to detect in LTSAs, particularly at the noisy, shallow water site B. A summary of hourly occurrence per day illustrates the continual occurrence of odontocetes in the area over several months at both sites and suggests a possible cyclical pattern to odontocete whistle and click bout occurrence or detectability at site B (Figure 18). Weather events are sporadic and appear to mask the detection of odontocete calls (Figure 18). A summary of diel occurrence of acoustic events suggests differences in occurrence patterns across call types and deployments (Figure 19). During the

JAX01B deployment, echolocation clicks are uniformly distributed throughout the day and night, while whistles increase in occurrence diurnally (Figure 19 a, c). Conversely, during the JAX02A deployment, both echolocation clicks and whistles exhibit nocturnal increases in occurrence (Figure 19 b, d). These differences may represent differences in call usage or detectability (*e.g.* due to ambient noise masking) and may reflect site-specific, season-specific, or species-specific differences. Future work analyzing data from continuing deployments, species classification results and trends in ambient noise levels should provide insights to causes of these diel differences. One detection of probable Risso's dolphin clicks occurred on Dec. 5, 2009 at Site A (Figure 14c).

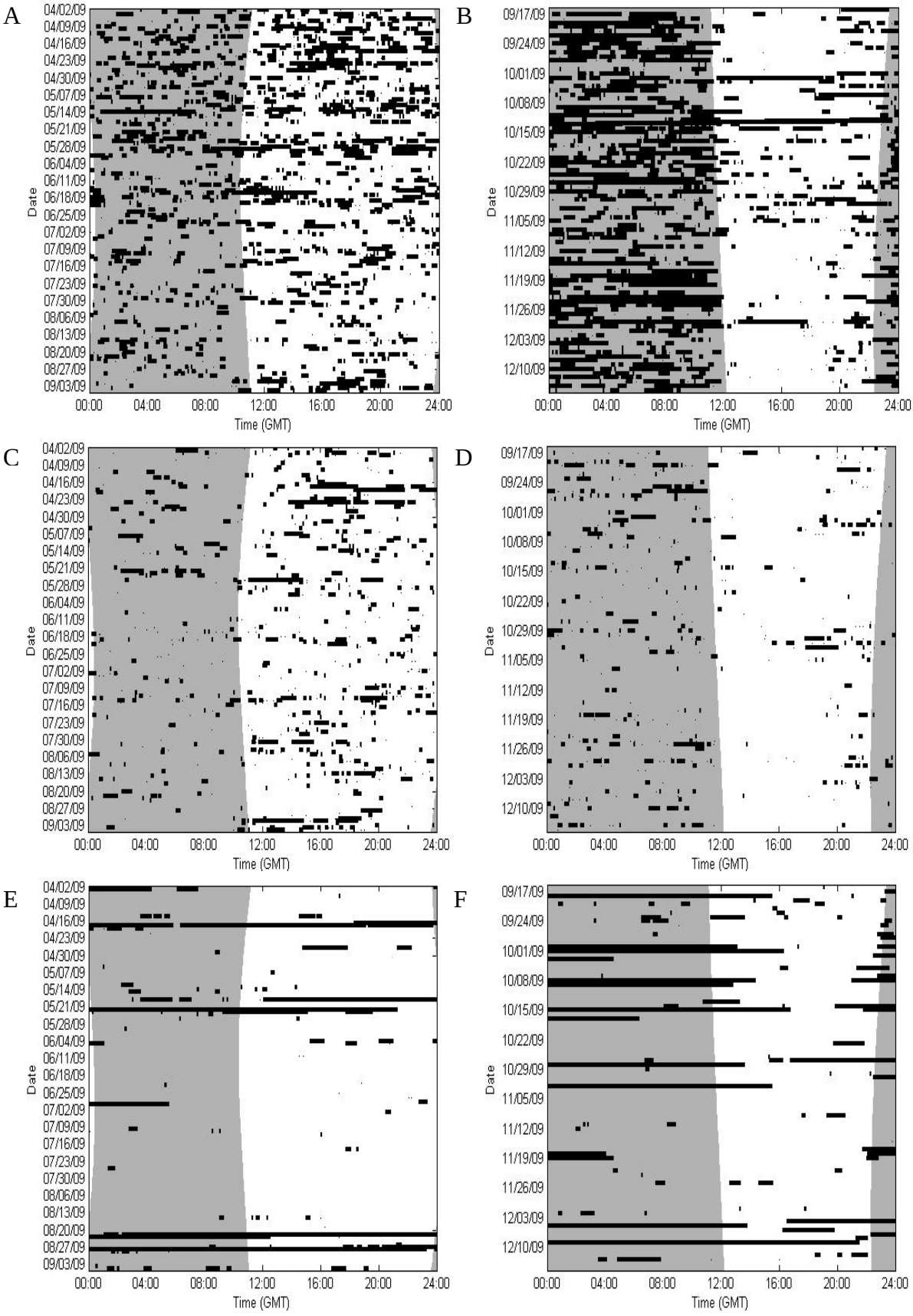
Analysis of the low-frequency data for baleen whales during the JAX02A deployment revealed the presence of many fish sounds and an unusual stereotyped call of unknown source (Figure 20a). The latter call appears to have a pulsed nature with amplitude modulation, pulse-rate modulation, and non-linear frequency jumps and it may exhibit formant structure. Additionally, a chorusing pattern is evident (Figure 20b). The call occurs regularly throughout the recording period and exhibits a trend toward increased nocturnal occurrence (Figure 20). Further analysis of the 6 weeks of JAX01A data and future HARPs will allow seasonal occurrence of this call to be examined. This call could be made by fish, baleen whales or odontocetes. No other known baleen whale calls were identified, though an unidentified call which appears to exhibit shallow-water modal frequency dispersion (Figure 21) merits further analysis.

Table 6. **Number of days and hours recorded and total number of, number of days with, and number of hours with vocal events for JAX01B and JAX02A HARP deployments.**

	JAX01B	JAX02A
# Days Recorded	161	91
# Days with Click Detections	146	79
# Days with Whistle Detections	154	91
# Hours Recorded	3837	2152
# 1-hr Bins with Click Detections	640	387
# 1-hr Bins with Whistle Detections	1376	1097
Total # of Whistle Bouts	687	437
Total # of Click Bouts	1401	778

Table 7. **Odontocete acoustic event durations (min) and inter-bout intervals (min) for HARP deployments off Jacksonville, FL.**

	JAX01B		JAX02A	
	median	range	median	range
Whistle bout durations	4.3	0.2 - 255.0	2.3	0.2 - 167.3
Whistle interbout intervals	1.7	0.2 - 72.0	1.3	0.4 - 88.8
Click bout durations	14.4	0.1 - 391.2	16.0	0.1 - 754.5
Click interbout intervals	0.9	0.9 - 40.0	0.7	0.9 - 24.0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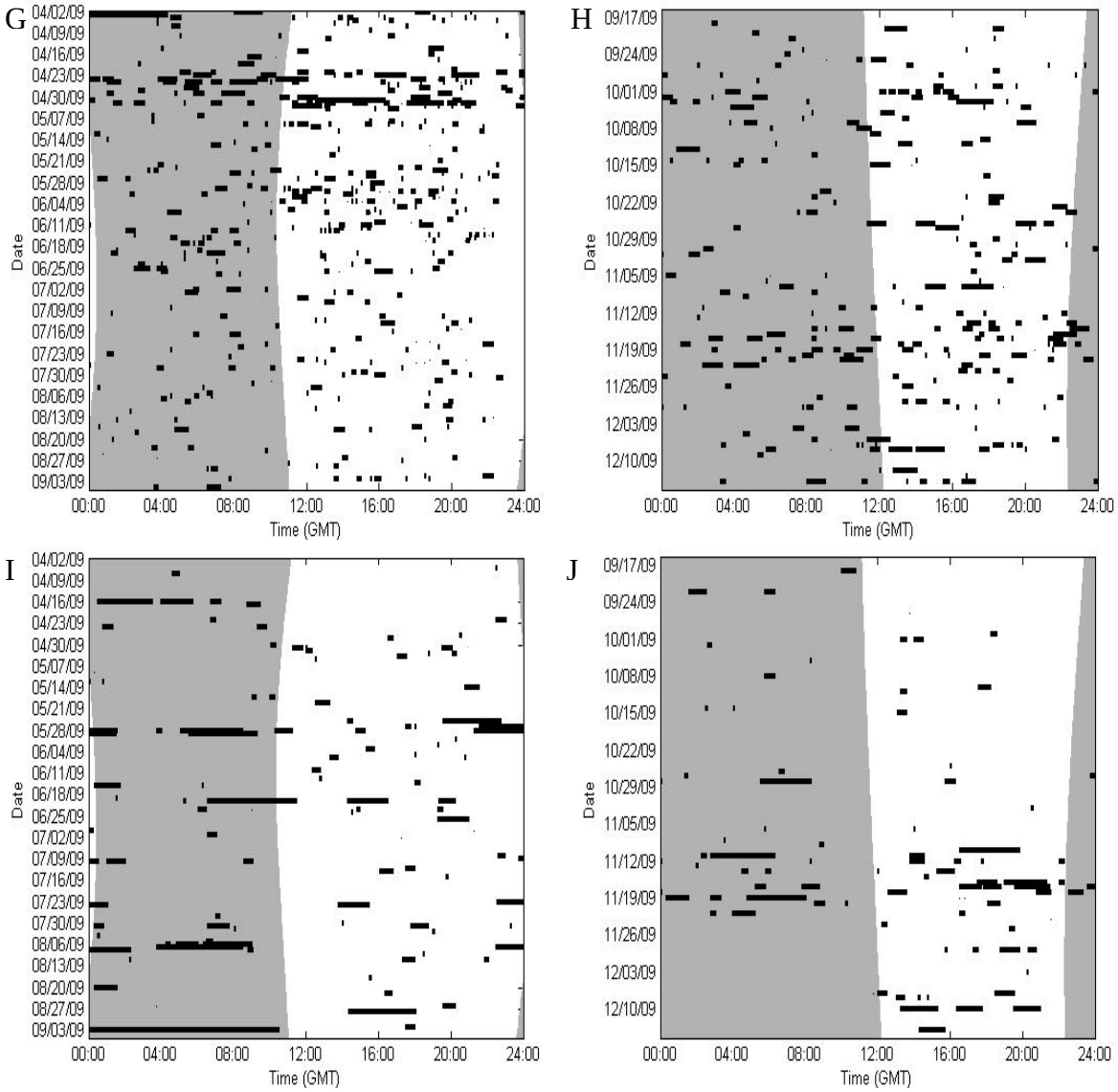

Figure 16. **Acoustic event occurrence by date and time. Odontocete click events during JAX02B (A) and JAX01A (B); odontocete whistle events during JAX02B (C) and JAX01A (D); weather events during JAX02B (E) and JAX01A (F); ship noise events during JAX02B (G) and JAX01A (H); and sonar events during JAX02B (I) and JAX01A (J). Shading indicates periods of darkness, determined from the U.S. Naval Observatory (http://aa.usno.navy.mil).**

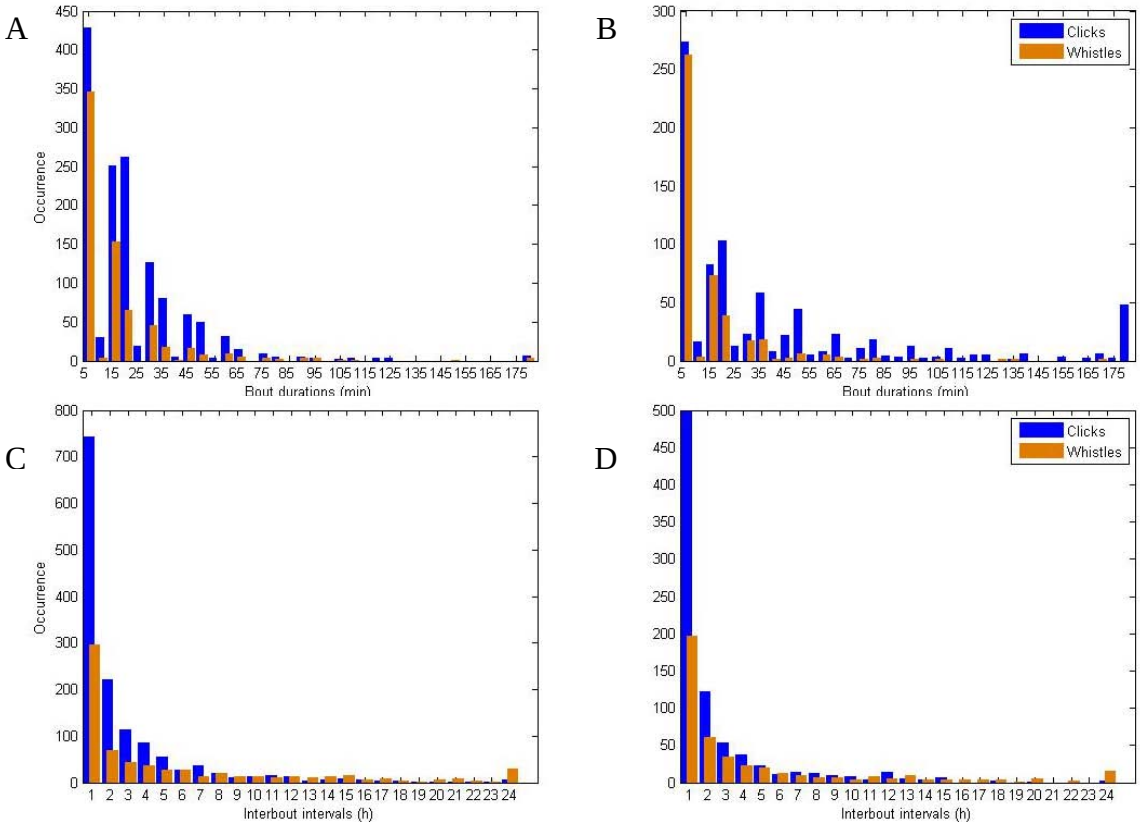

***Figure 17*. Odontocete acoustic event (whistle and click bouts) durations during JAX01B (A) and JAX02A (B) and interbout intervals during JAX01B (C) and JAX02A (D). Due to the long tail in these histograms, durations greater than 180 min or interbout intervals greater than 24 h are lumped into the final histogram bins.**

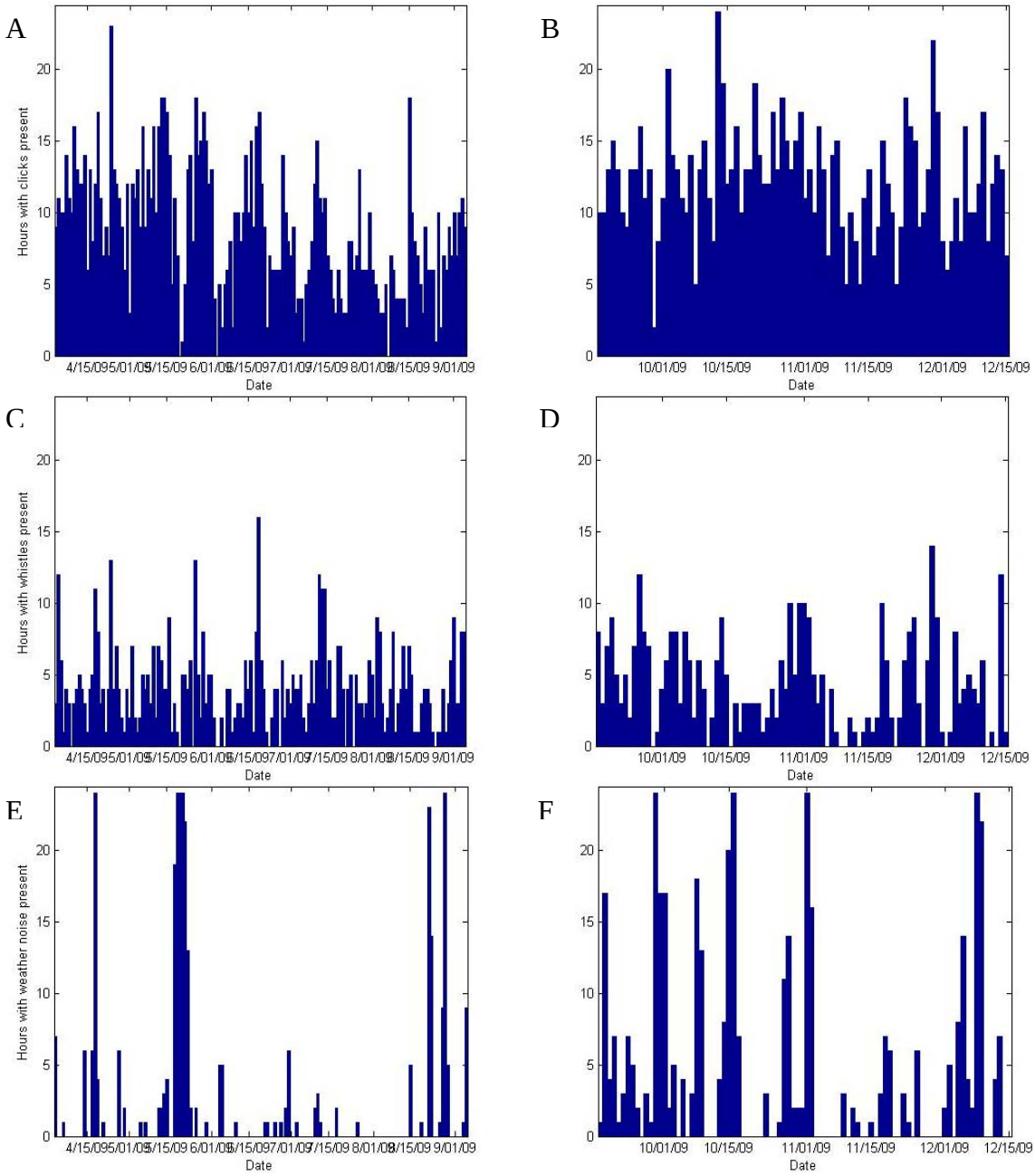

Figure 18. **Hours with acoustic event detections for each day during the HARP deployments. Odontocete click events during JAX02B (A) and JAX01A (B); odontocete whistle events during JAX02B (C) and JAX01A (D); and weather events during JAX02B (E) and JAX01A (F). Acoustic events were found using LTSAs.**

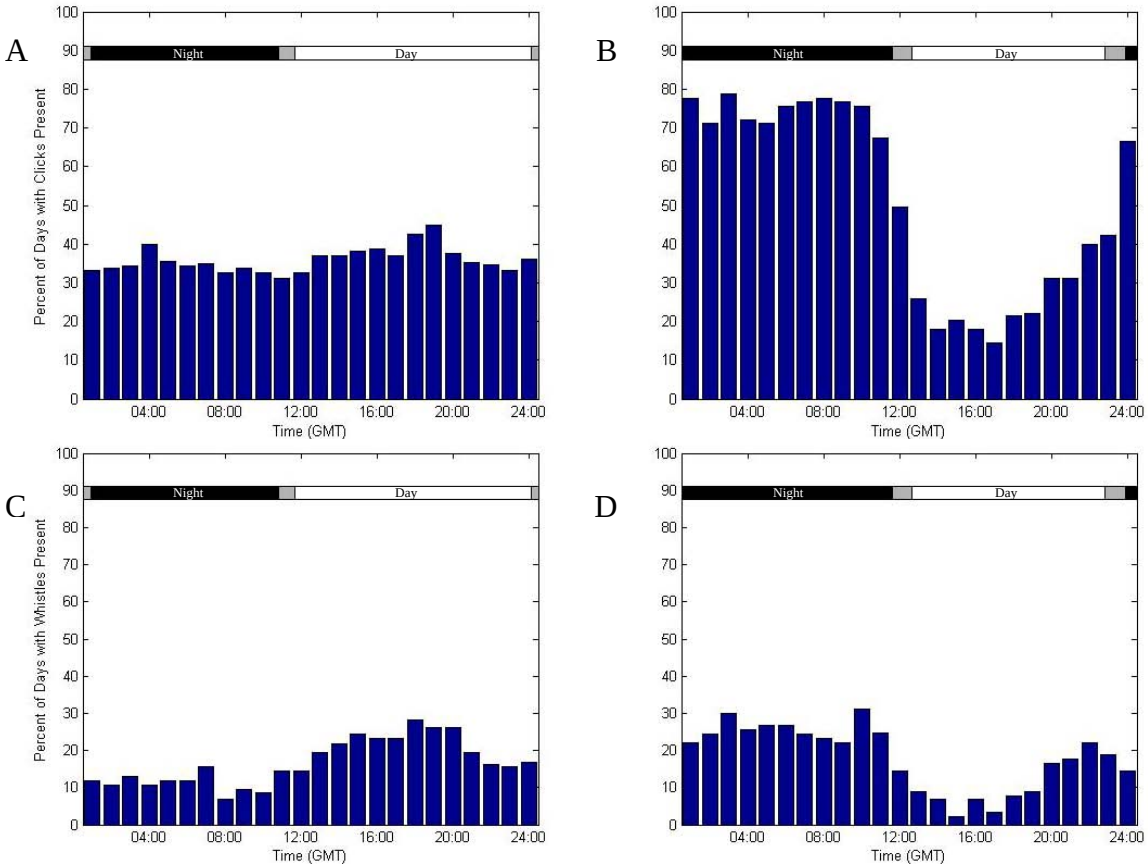

***Figure 19*. Percent of days with calls by time of day. Odontocete click events during JAX02B (A) and JAX01A (B); odontocete whistle events during JAX02B (C) and JAX01A (D).**

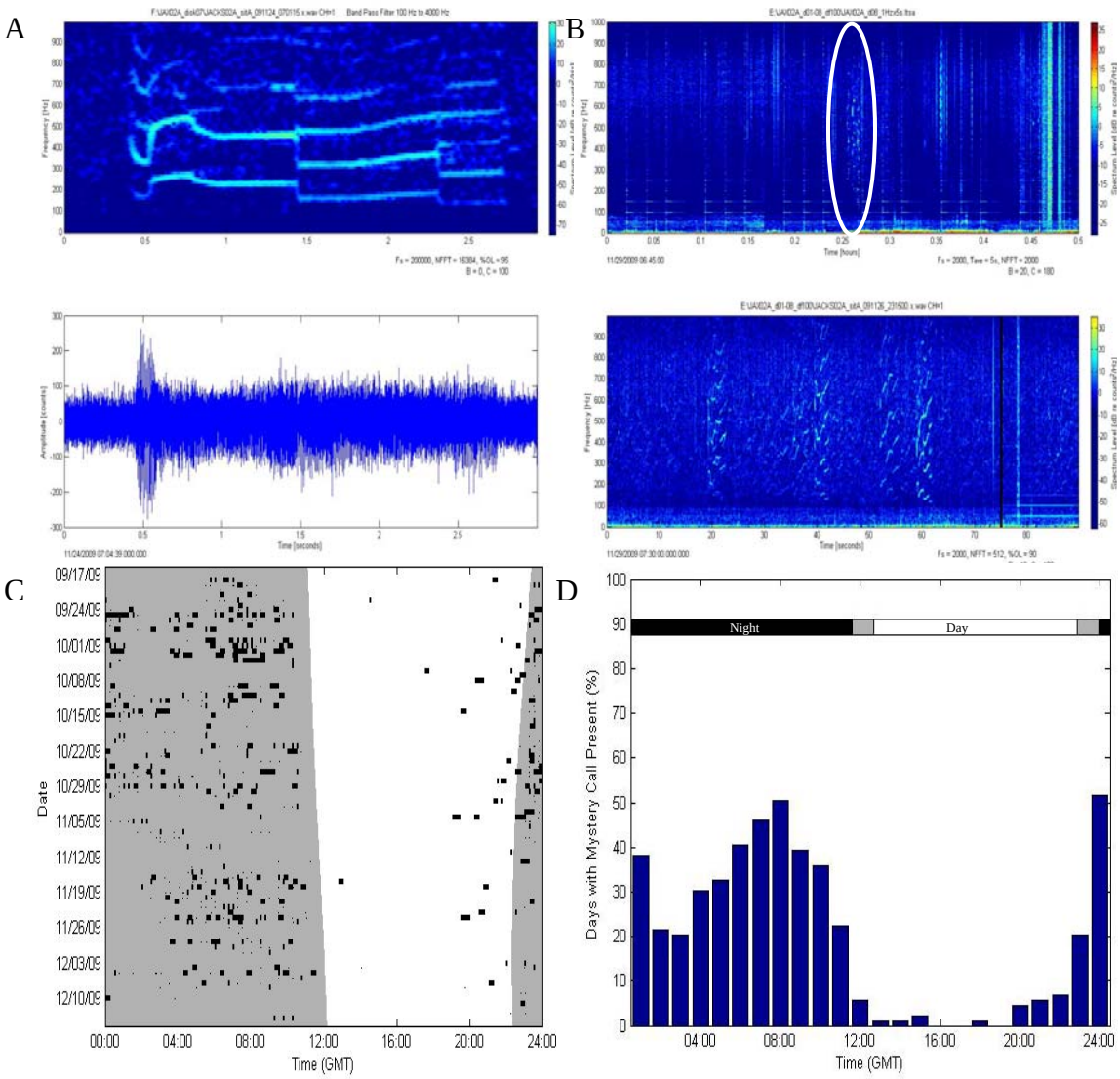

Figure 20. **Low frequency stereotyped call spectrogram and time-series (A), calling bout LTSA and spectrogram (B), call bout timing (C) and diel occurrence (D) during JAX02A deployment.**

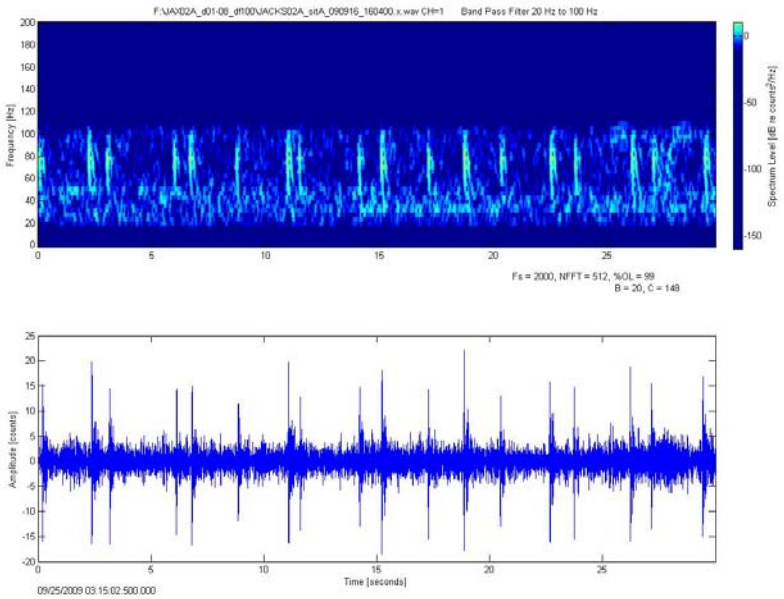

Figure 21. **Spectrogram and time-series of low-frequency call that may exhibit shallow-water modal frequency dispersion.**

Vessel Sightings

A total of 45 vessels were observed in the study area during vessel surveys, including cargo, commercial fishing and recreational fishing vessels (Figure 22).

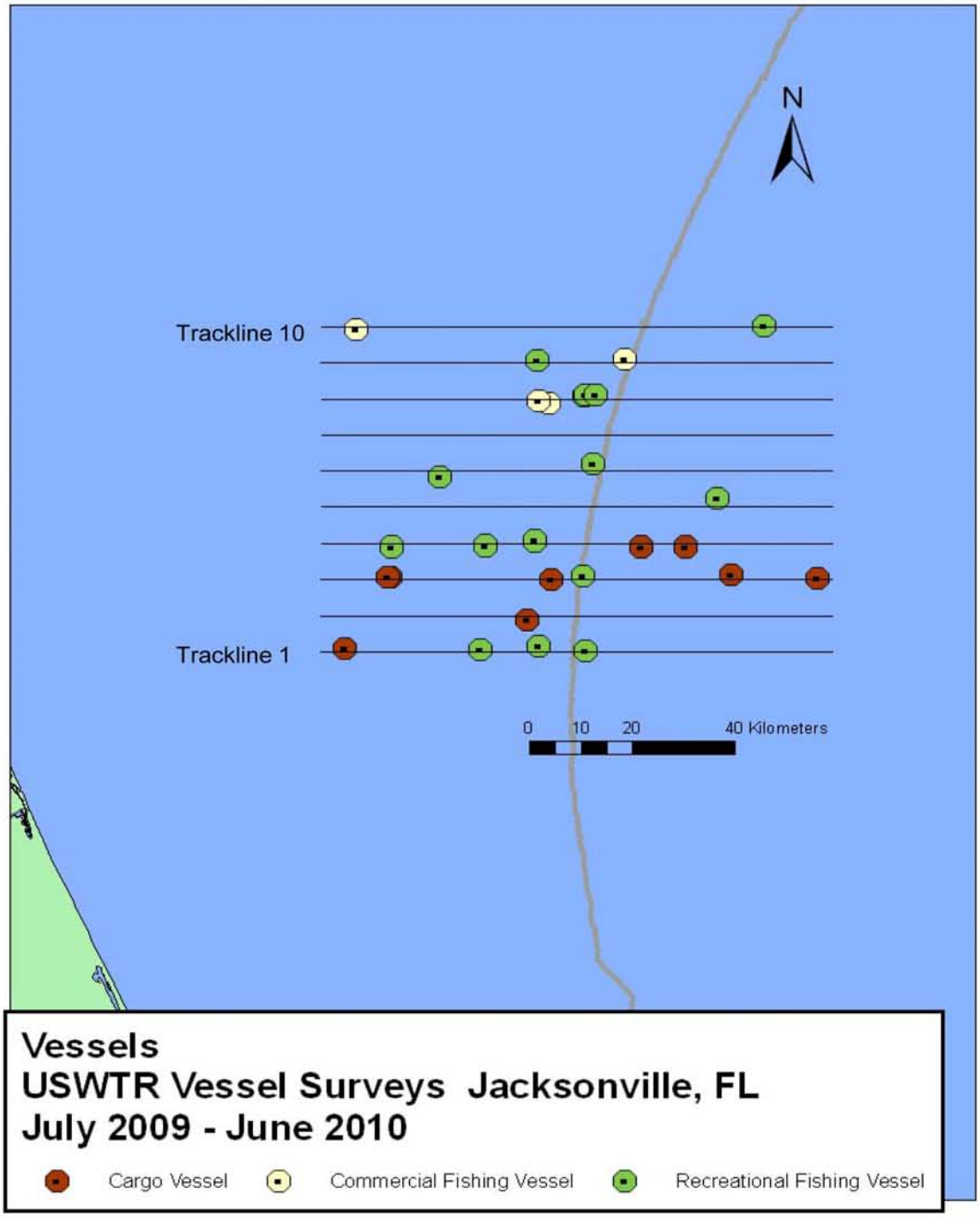

Figure 22. Distribution of all vessels seen during vessel surveys of the proposed USWTR site off of Jacksonville, Florida, July 2009 – June 2010.

Acknowledgements

We thank Joel Bell (Naval Facilities Engineering Command Atlantic) for support and guidance. Dr. Lance Garrison modified VisSurvey for our use. For assistance with the HARP we thank Dr. John Hildebrand, Chris Garsha and Tim Boynton. Special thanks goes to captain Alex Loer. We would also like to thank Kelly Slivka for assistance with vessel surveys. Surveys were conducted under NOAA Scientific Permit No. 948-1692-00, held by the UNCW.

Analysis of the UNCW and Duke University aerial and shipboard surveys of the USWTR on the Atlantic Coast of the USA for the period June 2007 to June 2010 (also including the UNCW aerial survey data 1998 –1999)

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Abstract

Analysis of data from aerial and shipboard surveys of the USWTR, undertaken by Duke University and the University of North Carolina at Wilmington, for the period June 2007 to June 2010, combined with that of earlier aerial surveys of the UNCW for Onslow Bay 1998 and 1999, allowed maps of animal density to be estimated. The species of interest were bottlenose dolphins (*Tursiops truncatus),* spotted dolphins *(Stenella frontalis),* pilot and beaked whales combined and loggerhead turtles *(Caretta caretta)*. As well as estimating abundance, the statistical models developed also provided some evidence of the environmental correlates of the animals distributions.

Detection functions were estimated from the multi-platform, multi-year USWTR survey data with additional data from the UNCW right whale surveys, the 1998/1999 UNCW aerial surveys of Wallop Island and additional sightings data from the shipboard surveys that took place off Cape Hatteras. Detection functions were not fitted to all of the detected species owing to a paucity of data (namely shipboard whale sightings) but fitted to a species group. Estimates of species abundance were obtained for the core USWTR region and an outer region, using the estimated detection probabilities and then separately estimating (a) animal presence/absence using a logistic general additive model and (b) density given presence.

Depending on the spatial models chosen, estimates were obtained either as an average for the entire time period, for each year or for each month. At the highest resolution, separate estimates were obtained for the USWTR core region and the outer region for the time period September 1998 to July 1999 and June 2007 to June 2010. Estimated bottlenose dolphin numbers varied between 29 (95% CI: 16 - 137, July 2008) and 100 (32 - 202, April 1999) for the core USWTR region and from 77 (43 - 380, July 2008) to 264 (84 – 540, April 1999) for the outer region. Estimated spotted dolphin numbers varied from 0 (0 – 0) in 1998/1999 to 344 (125 - 660, October 2009) in the core region and from 0 (0 – 0) in 1998/1999 to 854 (361 - 1548, in October 2009) in the outer region. Spotted dolphins only appeared in the region of interest from 2007. Pilot and beaked whale numbers were very low; 5 (1 – 9) in the inner region and 8 (1 – 18) in the outer region throughout the survey period. Estimated loggerhead turtle numbers varied from 2 (1 – 4; July 1999) to 176 (41 – 390; March 2009) in the core USWTR region and from 4 (1 – 8; July 1999) to 350 (82 – 775; March 2009) in the outside region.

These abundance estimates are based on the assumption that detection is certain on the trackline. Small sample sizes result in very little power to detect trend in abundance but there was no evidence of a systematic decline in any species in the last ten years and evidence for an increase in spotted dolphin numbers.

There was evidence that the abundance of bottlenose dolphins, spotted dolphins and loggerhead turtles fluctuated throughout the year, perhaps in response to sea surface temperature.

Introduction

The USWTR aerial and shipboard surveys for 2007 – 2010 were carried out by the University of North Carolina at Wilmington (UNCW) and Duke University, respectively. The aim of these surveys was to establish baseline data on the density of marine mammals in the USWTR region (Fig. 1). This document describes the analysis of this data to develop a density surface of animals in the region of interest and potentially identify environmental predictors of marine animal density as well as any trends in abundance. Given the paucity of actual sightings within the region of interest such an analysis can supply only a preliminary investigation of animal numbers and all conclusions from this analysis should be regarded as tentative. Fortunately, additional survey data for the region of interest was available from the aerial surveys conducted by UNCW off Onslow Bay from September 1998 to July 1999. Additionally sightings data undertaken from the same aerial platform was available from ongoing right whale surveys carried out by UNCW closer to the coastline and the surveys undertaken near Wallop Island in 1998 and 1999. Additional shipboard sightings data was also available from a dedicated survey off Cape Hatteras in 2007.

The analysis undertaken here integrated the sightings and effort data from the 1998-1999 Onslow Bay survey (hereafter "Onslow survey"), the current ongoing aerial survey by UNCW ("USWTR aerial") and the ongoing shipboard survey by Duke University ("USWTR ship" survey). The sightings data are augmented with data from the 1998 – 1999 Wallop Island surveys ("Wallop"), ship sightings data from Cape Hatteras ("Hatteras") and the ongoing aerial right whale surveys ("right whale") to increase to precision associated with the estimation of the detection functions and ultimately abundance.

Survey methods

Region of interest and survey area

The USWTR core region of interest is shown in Figure 1. The boundaries are approximately 25nm long (SW to NE) by 20nm wide (NW to SE). The survey region extended beyond the USWTR core region by 20nm (see grey transect lines in Fig. 2) so the total survey area is 1,800nm^2, with 500nm^2 of this (28%) within the USWTR core region. Abundance estimates were obtained for both the core USWTR region and the outer region separately.

Survey effort

The realised aerial survey effort consisted of 12,821km in 1998 and 1999 and 42,676km from June 2007 to June 2010 (Figure 2).

The region covered by the shipboard survey was almost identical to that of the USWTR aerial survey (Fig. 3) except there was no realised effort from the shore to the region of interest. Two vessels were used (*Sensation* and *Cetus*) and there was no evidence that detection varied between them (see results). The total realized effort for these shipboards surveys was 5,209km.

The temporal coverage of the surveys is given in Table 1 and realised effort is shown in Table 2.

Statistical methods

Overview

To generate an estimated density map for each species/taxa of interest, and where possible identify environmental variables driving animal abundance, the data were analysed by first estimating the probability of detection associated with each sighting and then estimating abundance per segment of realised trackline within the truncation distance. The detection probabilities were estimated assuming that detection of an animal on the trackline was certain (see later for discussion). The estimated densities were obtained from a two stage modelling process: firstly, probability of presence was

modelled (as a logistic generalized additive model (GAM)) and secondly, estimated density, given animals were present, was modelled. Predictions were obtained from these two models for the region of interest and the product of these two prediction surfaces gives an estimated relative density surface for the region. Abundance for the region of interest was obtained by numerically integrating under these surfaces. Note that the resulting abundances are relative (rather than absolute) because they do not take into account the amount of time animals are submerged (and therefore unavailable for detection) and imperfect detection on the trackline.

All animal species were considered initially but small sample sizes meant that only four taxa were modelled in detail; bottlenose dolphins (*Tursiops truncatus*), spotted dolphins (*Stenella frontalis*), medium sizes whales (i.e. pilot whales *Globicephala* sp. and ziphids) and loggerhead turtles (*Caretta caretta*). It may be that with future surveys data for other species will become adequate for analysis.

Estimation of detection probabilities

In conventional line transect sampling, the probability of detection depends only on the perpendicular distance of the sighting to the transect and at zero perpendicular distance this is assumed to be one (denoted by $g(0)=1$). Either a hazard-rate $(1-\exp(-y/\sigma)^{-b})$ or half-normal form $(\exp(-y^2/2\sigma^2))$ was used for the detection function (σ is the scale parameter) (Buckland et al. 2001). The effects of covariates, other than perpendicular distance, were incorporated into the detection function model by setting the scale parameter in the model to be an exponential function of the covariates (Marques 2001). Thus, the probability of detection becomes a multivariate function, $g(y,\boldsymbol{v})$, representing the probability of detection at perpendicular distance y and covariates $\boldsymbol{v}$ ($\boldsymbol{v} = v_1,..,v_Q$ where Q is the number of covariates). The scale term, σ, has the form:

$$\sigma_k = \exp\left(\beta_0 + \sum_{q=1}^{Q}(\beta_q v_{kq})\right)$$

and β_0 and β_q ($q=1,\ldots,Q$) are parameters to be estimated. With this formulation, it is assumed that the covariates may affect the rate at which detection probability decreases as a function of distance, but not the shape of the detection function.

A backward, stepwise selection procedure was used (starting from the previous best models) to decide which covariates to include in the model, with a minimum Akaike's Information Criterion (AIC) inclusion criterion. All model selection was performed in the program *Distance* (v5.0; Thomas *et al*. 2002), and then the final selected models were re-fitted using a set of customised functions (mrds v.1.3.9) in the statistical programming package *R* (*R* Developmental Core Team, 2002). This facilitated estimation of variance within *R* (see below).

This procedure was used to estimate detection probability for dolphins and aerial sightings of whales. The paucity of turtle sightings and shipboard whale sightings required a slightly different approach: here sightings were considered as coming from narrow strip transects and detection within the strip was assumed to be certain.

Estimation of density surfaces

A modified version of the 'count model' of Hedley et al. (1999) was implemented to model the trend in spatial distribution of the different species. The response variable for this model is the estimated number of individuals for a small segment i of trackline, $\hat{N}_i$, calculated using an estimator similar to the Horvitz-Thompson estimator (Horvitz and Thompson 1952), as follows:

$$\hat{N}_i = \sum_{j=1}^{n_i} \frac{s_{ij}}{\int_o^w \hat{g}(y, v_{ij})\pi(y)dy}, \qquad i = 1,\ldots,T,$$

where, for segment *i*, $\int_0^w \hat{g}(y, v_{ij})\pi(y)dy$ is the estimated probability of detection of the *j*th detected pod, n_i is the number of detected pods in the segment and s_{ij} is the size of the *j*th pod. The total number of transect segments is denoted by *T*. By assumption, $\pi(y)$, the probability density function of actual (not necessarily observed) perpendicular distances is uniform up to the truncation distance; this is satisfied by locating transects randomly.

Having obtained the estimated number of individuals in each segment, the density in segment *i*, $\hat{D}_i$, was estimated from $\hat{N}_i / a_i$ where a_i is the area of segment *i*. Segment area was calculated as the length of the segment multiplied by twice the truncation distance used to model the detection function. The survey tracklines were initially divided up into distinct segments based on when vessels had gone on or off effort and whether there was a change in environmental characteristics. A variety of segment lengths were tried in the range of 5km to 13km; 10km was selected as an appropriate compromise between maximising the ratio of non-zero to zero segments, maintaining environmental resolution and giving some measure of spatial independence (see results).

In most cases, the number of segments where detections occurred was extremely low (Table 7) which made fitting of models difficult and so a variety of modelling approaches were undertaken. Attempts to model density directly (as in the approach described above) were unsuccessful because of the high frequency of zeros and so zero-inflated methods were tried, however, these proved impossible to implement successfully for data upto August 2009 (Paxton and Borchers, 2009). Therefore, a two-stage process was implemented: the presence or absence of animals in a particular segment was modelled using a logistic GAM and then non-zero density in a segment was modelled. The predicted probability of presence of animals in a segment was multiplied by the predicted non-zero density in a segment to obtain the predicted density of animals in a segment. Again because of the paucity of the data attempts to model varying non-zero density proved unsuccessful so in all cases the mean of the non-zero density was used. This two-stage process may introduce a potential bias, in that zeros are over represented because some zeros are not true zeros (no animals present) but simply segments of low density where the animals though present were not observed.

The covariates considered for inclusion in the models were longitude (*Lon*) and latitude (*Lat*), sea surface temperature (*Temp*) and depth (*Depth*), day of the year (*Dayofyear*) and year of survey (*Year)*. *Dayofyear* was considered as a cyclic cubic spline so the second derivative of the curve for *Dayofyear* would meet at the beginning and end of the year. Sea surface temperatures were collected during the shipboard survey but for the aerial survey and the prediction grid they were obtained from the National Oceanic and Atmospheric Administration (NOAA, http://dss.ucar.edu/datasets/ds277.0/data/oiv2/) at one degree and weekly resolution and were an updated set (based on the analysis of Reynolds et al. 2002). Depths were obtained from the ETOPO2 2 minute resolution relief data available from National Oceanographic and Atmospheric Administration (http://www.ngdc.noaa.gov/mgg/image/2minrelief.html). Temperatures and depths were associated with effort segments by finding the closest point in the temperature and bathymetry data to the midpoint of the effort segments using great circle distances (and additionally, time for temperature). Finally, *Survey* was a factor variable which indicated the survey platform used (either a plane, *Cetus* or *Sensation*) but this was only considered in a model if the estimated value of the regression coefficient associated the plane was lower than those associated with the ships i.e. the use of *Survey* reflected differences in $g(0)$ between aerial and shipboard surveys.

Scatterplots of the explanatory variables are shown in Figure 3. Unsurprisingly, *Temp* and *Dayofyear* were strongly correlated with each other as were *Lon, Lat* and *Depth*, thus, the inclusion of only one of these correlated variables in the final models should not be interpreted as necessarily precluding the influence of others. As *Temp* and *Dayofyear* were correlated, *Dayofyear* was used in the abundance analyses.

Unbiased risk estimation implemented in the *mgcv* package (v. 1.5-2, Wood 2009) in *R* (v. 2.9.0) was used for covariate selection in the logistic model, augmented with diagnostic plots, using the principles described in Wood (2001). All covariates were considered for inclusion in the model as 1D smooths of untransformed covariate values. In addition, 2D smooths of *Lat* and *Lon* (but transformed as kilometre deviations from the equator and longitude 77W , respectively) were considered for inclusion into the GAM. A maximum of 4 degrees of freedom (5 knots) were allowed in the selection of 1D smooths for *Depth, Temp* and *Dayofyear*. In the case of *Lat* and *Lon,* 6 degrees of freedom (7 knots) and up to 13 degrees of freedom (14 knots) were allowed in the case of 2D smooths, thus allowing moderate flexibility but reducing the possibility of overfitting. The presence of unexplained spatial variation was checked by inspection of semivariograms of the residuals of the models. Models were fitted to all data across all years.

Due to gaps in search effort, changes in direction and changes in environmental conditions along transects, effort could not always be split into segments of the desired length (see later). Therefore, the size of each segment varied and so the model was weighted by segment area.

The presence only data was modelled in the same way as above although sometimes models were simplified in order not generate spuriously high results in the bootstrap.

The aim of all the modelling process described above was to estimate a density surface (see below) and estimate abundance. To investigate the underlying biological basis of the distributions of the animals, model selection for the presence-absence models for bottlenose dolphins, spotted dolphins and loggerhead turtles was repeated without considering *Lon* and *Lat* and *Temp* was considered as a replacement for *Dayofyear*.

Prediction

The final models were used to predict density of marine animals in the core USWTR region and the outer region using a 2 minute resolution prediction grid. Animal abundance was estimated by numerically integrating under this predicted density surface. If survey platform was included in the model, abundance was predicted assuming the survey mode with the largest coefficient value in the model as this would reflect the best detection on the trackline. Predictions were made for June for each of the survey years (although June was not surveyed in 1998) to allow comparison between years. Obviously, models that did not contain temporal covariates (*Dayofyear, Temp* or *Year*) produced identical predictions for all years and months.

Variance estimation

Variance was estimated by repeating (a large number of times) the entire abundance estimation process on samples, drawn at random from the data, to obtain a distribution of abundance estimates. Confidence intervals were obtained from this distribution using the 2.5% and 97.5% percentiles to obtain the upper and lower limits. Samples were obtained by sampling transects, with replacement, such that the selected effort reflected the effort in the original sample. Sometimes, extreme samples could result in unrealistically high abundance estimates and so models were simplified to avoid this problem.

Results

Aerial survey sightings

The USWTR and right whale aerial surveys were carried out from the observation plane flying at a height of 305m (1000ft). The aerial surveys in 1998 and 1999 were carried out with a similar protocol, except that the plane flew at 230m (750ft). Thus, the sightings data from the earlier and ongoing surveys could be combined. Sightings were grouped together based on the *a priori* similarity of form of the species seen. The numbers of sightings that could be assigned to reasonably specific taxonomic categories are shown in Table 3. There were three morphologically similar groups; dolphins (all species

commonly referred to as dolphins), turtles (all turtles species) and whales (baleanopterids, pilot whales and beaked whales). Increased sample sizes obtained from future surveys may allow splitting of these groups.

Shipboard survey sightings

There were fewer sightings from the shipboard surveys, even when complemented by the additional sightings off Cape Hatteras (Table 3).

Aerial survey detection functions

Estimates of perpendicular distance were obtained either by reference to direct estimates of distance by observers, trigonometry from the declination angle of the plane to the observed animals or by trigonometry from the position of the plane at first observation of the animals and subsequent location directly above the animals. However for some sightings (primarily turtles) distance estimates were not available or could not be calculated. It was assumed that such sightings occurred at random so detection probabilities (and hence estimated numbers, see below) were allocated to these sightings after estimation of the detection function with a proportion assumed lost due to being beyond the truncation distance (as in the sample with known distance sightings). Table 3 gives the number of sightings before and after truncation, for taxa where there were sufficient numbers to allow further investigation.

The detection functions fitted to aerial sightings are summarised in Table 6. In the case of dolphins and turtles, sightings data were initially fitted in *Distance* (Thomas et al. 2009), to aid in model selection, and then integrated into the whole analysis. Dolphin sightings were binned into 150m widths and right truncated at 1.5km and the best fit detection function was a half normal function with Beaufort sea state as a covariate (in addition to perpendicular distance) (Figure 4). Medium whale sightings were binned into 100m intervals and the best fit detection function was a hazard rate function with Beaufort sea state as a covariate (Figure 4).

The perpendicular distance distribution of turtle detections did not conform to the usual assumption of monotonically declining detection probability with increasing distance and so detection was assumed to be certain out to 500m (corresponding to a strip transect survey with a strip of 1000m width). The reasons for the unusual distribution are not known but it may have been caused in part by rounding of distances.

Ship survey detection functions

Sightings were combined to determine shipboard detection functions for each species group. The number of sightings with distances are given in Table 5.

Detection functions fitted to the shipboard sightings are summarised in Table 6. Dolphin sightings were binned into 100m widths and right truncated at 300m. The best fit detection function was a half-normal with Beaufort sea state and weather as covariates (Figure 5). Turtles were assumed to have constant (and certain) detectability in a strip transect with half-width 80m. Medium size whales were also assumed to be in a strip transect with a half-width of 200m.

Estimation of density surfaces

The realised trackline for both aerial and shipboard surveys was divided into 7,180 segments (5,873 aerial and 1,307 s hipboard). The final fitted models for predicting density and for biological explanation are given in Table 7.

Bottlenose dolphins

Bottlenose dolphins were detected in 178 segments (2.5%). Figure 6 shows monthly predicted abundances and their confidence intervals. Estimated bottlenose dolphin numbers varied between 29 (95% CI: 16 - 137, July 2008) and 100 (32 - 202, April 1999) for the core USWTR region and from 77 (43 - 380, July 2008) to 264 (84 – 540, April 1999) for the outer region. Note that the upper limit of the 95% CI of the estimates are high especially for the outer zone. This is probably caused by edge effects in the bootstrap.

A depth association can possibly be discerned (Figure 7) but the pattern probably reflects depth describing the data spatially rather than a real preference for 300-400m depths. Differences occur both across and within years (Figure 6) with numbers peaking in spring and to a lesser extent in autumn (Figure 7) presumably as a response to temperature changes.

Spotted dolphin

Spotted dolphins were detected in 71 segments (1%). A predictive model was fitted consisting of smooths of *Depth* and *Dayofyear* with *Year* and *Survey* as factors. Given the small numbers detected, the estimates were, unsurprisingly, associated with a wide confidence interval. Figure 8 gives the predicted abundances for each month of interest. Spotted dolphins were not seen in the region during the UNCW 1997 – 1998 surveys and only appeared in 2007 since then its predicted numbers have increased considerably. Estimated spotted dolphin numbers varied from 0 (0 – 0) in 1998/1999 to 344 (125 - 660, October 2009) in the core region and from 0 (0 – 0) in 1998/1999 to 854 (361 - 1548, in October 2009) in the outer region. Although year was selected as a covariate in the model, the resultant jump in numbers between December and January look unrealistic.

For the explanatory model, replacing *Dayofyear* with *Temp* gave a slight improvement in model fit. Spotted dolphins appear to be associated with shallower water (Figure 9).

Ziphids and pilot whales

In the case of the ziphids and pilot whales only 11 segments had non-zero estimates of density, thus no attempt was made to model density spatially or temporally. As the estimates were not based on temporal variables the values did not vary. The best average estimate of these whales abundance is 5 (1 - 9) in the inner zone and 8 (1 – 18) in the outer zone. Little interpretation can be made of these results at this stage but it should be stressed that these abundance estimates represent animals at the surface only.

Loggerhead turtles

In the case of loggerhead turtles there were 413 non-zero segments. Presence/absence was modelled with smooths of *Depth* and *Dayofyear* with *Year* and *Survey* as factors. Figure 10 shows the estimates by month. Loggerhead numbers varied from 2 (1 – 4; July 1999) to 176 (41 – 390; March 2009) in the core USWTR region and from 4 (1 – 8; July 1999) to 350 (82 – 775; March 2009) in the outside region.

Explanatory model selection suggested that both *Depth* and *Dayofyear* were significant with turtles more likely to be present in shallower waters (Figure 11). Replacing *Dayofyear* with *Temp* did not improve the model fit and the relationship corresponded to a decrease in numbers in July.

Discussion

Given the lack of sightings any conclusions about the reasons for the estimated distributions in the region should be regarded as extremely tentative. The lack of sightings for species other than those analysed above precluded analysis. Nonetheless, it seems reasonable to conclude that the region as a whole has few large marine fauna (save perhaps turtles, see below), data are inadequate to estimate trend except perhaps rather crudely for spotted dolphins and there is no evidence that any species has reduced in numbers over the time period considered. However, the above results are all based on single

observers with $g(0)$ (detection probability on the trackline) assumed to be one for the species of interest.

There are two reasons that $g(0)$ may be less than one. Firstly, there is an availability bias associated with the presence of species at the surface. Cetaceans and turtles can spend only a small proportion of their time at the surface (see below). This bias was ameliorated in models that contained survey type by only predicting with the factor coefficient associated with ships (this effectively makes the $g(0)$ estimate for aircraft no more negatively biased than that for ships). The second reason for $g(0)<1$ is perception bias: animals are missed on the trackline even if they are at the surface. Smaller cetaceans that do not form highly detectable pods and some of the more cryptic species may not be detected even when on the trackline. Both availability bias and perception bias tend to be greater for fast-moving observers and are therefore greater for aircraft than for ships (see comparisons of $g(0)$ in Palka 2005a and 2005b)

It might be expected that *Survey* platform should always appear in the models as $g(0)$ should generally be higher for a ship than a plane. This was not always the case here - due in part to the low power to detect this effect because of the low number of sightings. In the case of bottlenose dolphins, a higher density was associated with aerial surveys! *Survey* was not included in the final models if this was the case.

A correction for availability bias can be obtained if the expected times of availability and unavailability are known, as well as the transit speed of the observation vessel (e.g. Laake et al. 1997, Hedley and Bannister 2004, Paxton et al. submitted). These correction methods are less reliable if the speed of the survey platform is similar to that of the animals. Therefore, they may not work well for shipboard surveys but are likely to be adequate for aerial surveys. They do, however, depend on having reliable estimates of mean times of availability and unavailability. We have not used them here because mean times were not available for all species, they may differ within the species groups used in our analysis (groups determined in part by small sample size) and mean times may be location-dependent. We corrected perception bias for aircraft to be no greater than that from ships and accepted that density and abundance estimates are likely negatively biased by some unknown amount.

Where it has been investigated *Mesoplodon densirostris* has been found to spend c. 26% of the time underwater (Baird *et al.* 2004) and Barlow (1999) estimated g(0)s of 0.45 and 0.23 for *Mesoplodon* and *Ziphius* respectively.

Forney et al. (1995) estimated $g(0)$ to be 0.67 for smaller dolphin groups and Palka (2005a and b) estimated $g(0)$ for small cetaceans to be in the range 0.58 – 0.95 depending on the craft used.

Where investigated loggerhead turtles have been found to spend c. 90% of their time diving (Houghton et al. 2002) but animals who are just submerged (which can be 60% of the time, Polovina *et al.* 2003) may be amenable to detection especially from air dependent on water opaqueness. Perception bias for this species could vary considerably and the abundance estimates given here could be severely biased. No attempt was made (at this stage) to include sightings of animals recorded only as 'unspecified' turtles.

Numbers in the core and outer regions were clearly correlated suggesting that there is no reason to believe animals were being displaced from the USWTR core region.

The limited tentative biological conclusions that can be drawn reflect existing knowledge in the literature. The bottlenose dolphins prefer deeper water compared to spotted dolphins and there appears to be a cyclic nature to the animals presence, possibly associated to temperature.

Recommendations for the future

Assuming the USWTR survey work is ongoing, issues of potential interest in the future work might include:

1. Improving detection function and density estimates by supplementing existing detections with those from future surveys.

2. Investigation of reliable methods for estimating $g(0)$ without double-observer survey. Options include cue-based methods and use of appropriate availability correction methods based on data on availability patterns for each species.
3. Further elucidation of the environmental drivers of cetacean density in the area of interest, perhaps by the use of additional variables.
4. Records of water opaqueness may be useful in the generation of detection functions of turtles.

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Table 1. Temporal coverage of surveys (*A*=Aerial, *S*=Shipboard).

Month	**1998**	**1999**	**2007**	**2008**	**2009**	**2010**
January		*A*			*A,S*	*A, S*
February				*A*	*A,S*	*A*
March		*A*		*A,S*	*A,S*	*A, S*
April		*A*		*A*	*A,S*	*A, S*
May		*A*		*A,S*	*A*	*S*
June		*A*	*A,S*	*A,S*	*A, S*	*A, S*
July		*A*	*A,S*	*A,S*	*A, S*	
August			*A,S*	*A,S*	*A, S*	
September	*A*		*A,S*	*A,S*	*A, S*	
October	*A*		*A,S*	*A*	*A, S*	
November	*A*		*A,S*	*A,S*	*A*	
December	*A*		*A*	*A*	*A*	

Table 2. Survey effort (km) by year.

Year	Aerial	Shipboard	Total
1998	6063		6063
1999	6758		6758
2007	8306	1812	10118
2008	12464	1263	13727
2009	15219	1570	16789
2010	6688	563	7251
Total	55497	5209	60706

Table 3. Numbers of sightings by survey.

Type	Survey	Turtles	Dolphins	Whales	Total
Aerial	Onslow	73	59	3	135
	Right whale	806	666	19	1491
	Wallop	53	90	29	172
	USWTR	851	196	8	1055
Ship	Ship	93	113	11	217

Table 4. Numbers of aerial sightings by species group used for detection function modelling (ie. those with perpendicular distances).

Sightings group	**Species within group (where identified)**	**Number of sightings before truncation**	**Truncation distance**	**Number of sightings after truncation**
Dolphins	Bottlenose, common, Risso's, spotted, rough toothed and unidentified dolphins	285	1500 m	273
Whales	Beaked whales, pilot whales, other whales	42	1500 m	37
Turtles	Loggerhead, Leatherback, Kemp's ridley and unidentified turtles	852	500 m	632

Table 5. Numbers of shipboard sightings by species group used for detection function modelling (includes sightings from aerial surveys off Wallop Island and right whale surveys as well as shipboard surveys off Cape Hatteras).

Sightings group	**Species within group (where identified)**	**Number of sightings before truncation**	**Truncation distance**	**Number of sightings after truncation**
Dolphins	Bottlenose, common, Risso's, spotted, rough toothed and unidentified dolphins	109	300 m	76
Whales	Beaked whales and pilot whales	10	200 m	6
Turtles	Loggerhead, Leatherback, Kemp's ridley and unidentified turtles	89	80 m	58

Table 6. Detection functions for both aerial and shipboard sightings: HN indicates a half normal form was chosen and HR a hazard rate form. The covariates included (in additional to perpendicular distance) are Beaufort sea state (BSS) and weather (fitted as a factor variable with 5 levels). 'Strip' indicates that a strip transect methodology was used.

Sightings group	Aerial surveys	Shipboard surveys
Dolphins	HN: BSS	HN: BSS + Weather_5
Whales	HR: BSS	Strip
Turtles	Strip	Strip

Table 7. Predictive and explanatory biological models for each species. The term *s*() indicates a smoothed function of the variable of interest. The final column gives the number of the relevant figure.

Species	**Number of non-zero segments**	**Model**	**Terms in model**	**Figure**
Tursiops truncatus	178	Predictive, logistic component	*s(Depth) + s(Dayofyear) + Year*	6
		Explanatory logistic component.	*s(Depth) + s(Dayofyear) + Year*	7
		Non-zero density component	*Year*	6
Stenella frontalis	71	Predictive, logistic component	*Survey + s(Depth) + s(Dayofyear) + Year*	8
		Explanatory logistic component	*Survey + s(Depth) + s(Temp) + Year*	9
		Non-zero density component	*Year*	8
Collective medium sized whales	11	Predictive, logistic component.	None	
		Explanatory logistic component	None	
		Non-zero density component	None	
Caretta caretta	413	Predictive, logistic component.	*s(Depth) + s(Dayofyear) + Year*	10
		Explanatory logistic component	*s(Depth) + s(Dayofyear) + Year*	11
		Non-zero density component	*Year*	10

Figure 1. The core USWTR region (box) and depths (m) at 2 minute intervals. Each colour represents 200m intervals up to 4200m depth (violet in lower right hand corner).

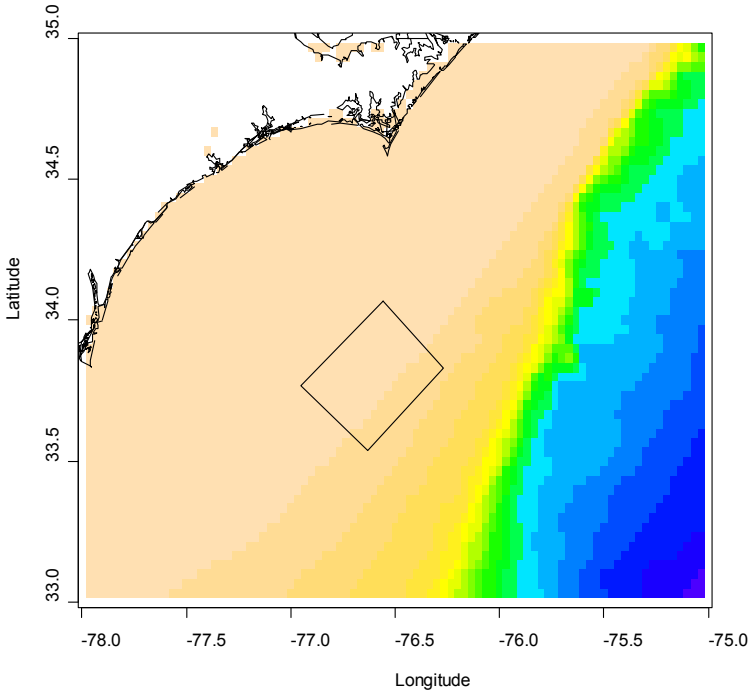


Figure 2. Realised effort segments for a) Aerial surveys, USWTR (grey) and Onslow 1998/1999 (blue) and b) Shipboard surveys USWTR (grey). Individual points represent the midpoints of each segment. The boxed indicate the boundaries of the core USWTR region and the outer region.

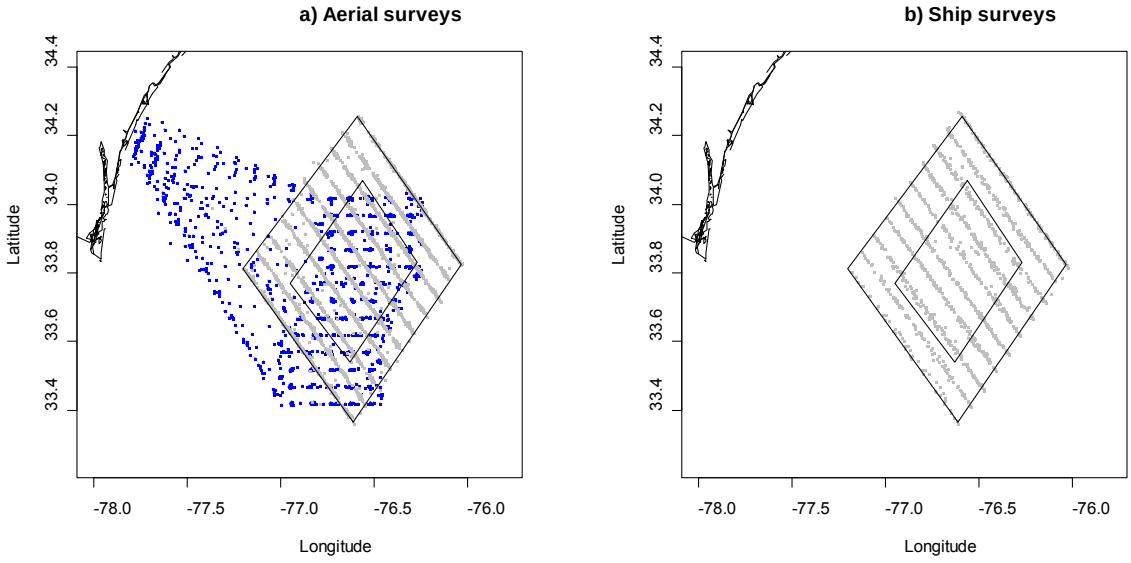


Figure 3. Relationship of potential, explanatory, continuous variables used in density surface modelling.

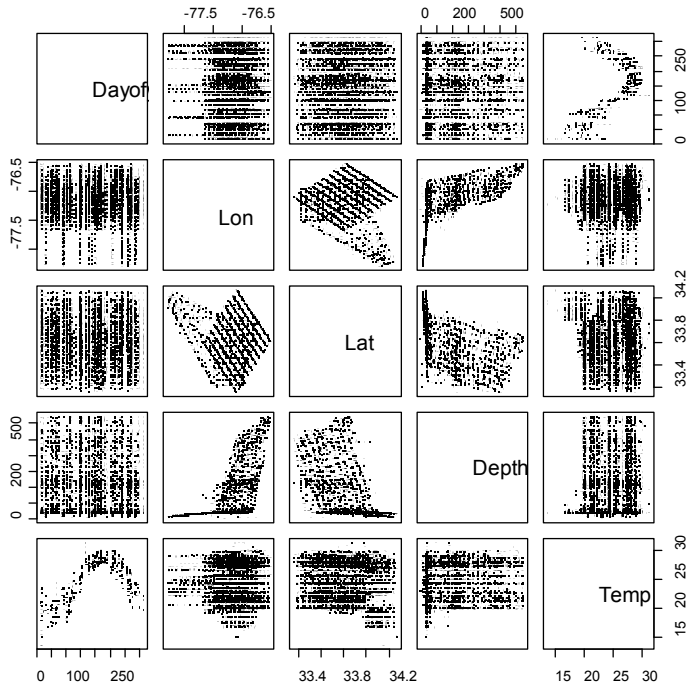


Figure 4. Aerial survey detection functions for a) dolphins (data binned into 150m intervals) and b) whales (binned into 300m intervals).

a) b)

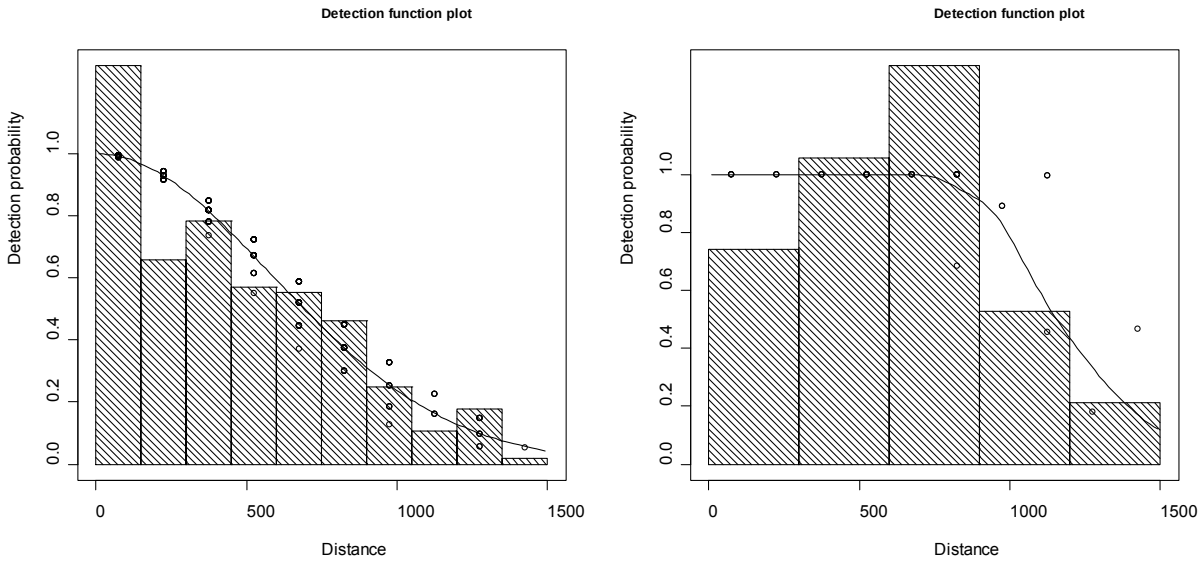


Figure 5. Ship survey detection functions for dolphins (binned into 100m intervals).

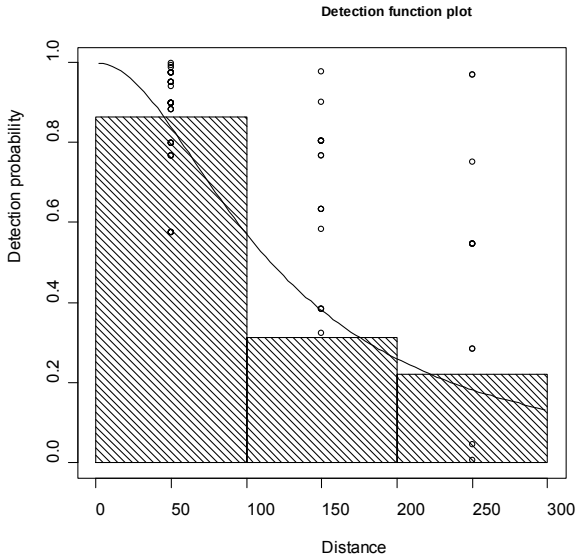


Figure 6. Estimated abundance of bottlenose dolphins: a) inside core USWTR region (black) and immediately outside (red) (error bars are not shown for clarity); b) abundances inside core region with 95% confidence intervals (blue).

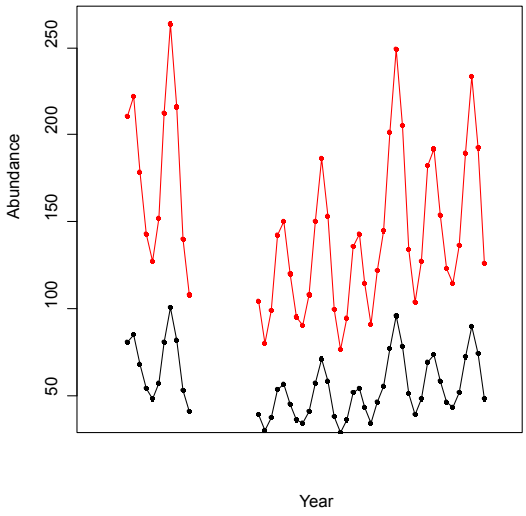


Figure 8. Estimated abundance of spotted dolphins: a) inside core USWTR region (black) and immediately outside (red) (error bars are not shown for clarity); b) abundances inside core region with 95% confidence intervals (blue).

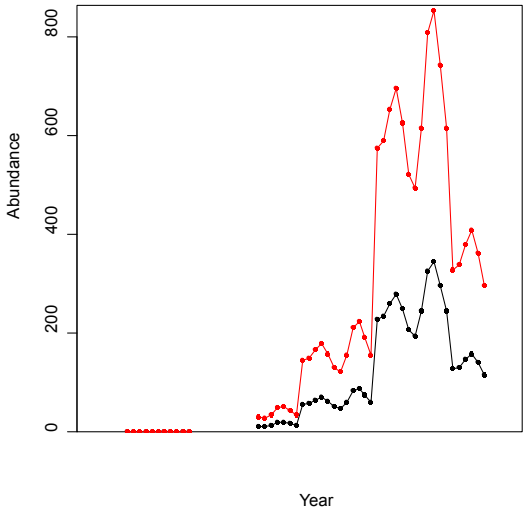
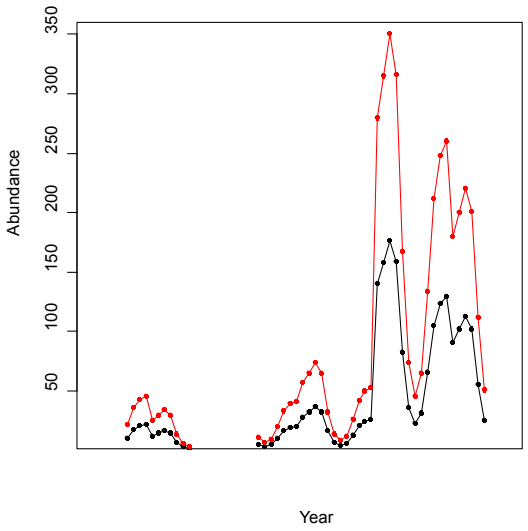


Figure 10. Estimated abundance of loggerhead turtles a. inside (black) and immediately outside (red) the USWTR region (no error bars shown for clarity, b. the inside abundances with 95% confidence intervals (in blue).



Preliminary analysis of aerial and shipboard surveys of the Jacksonville USWTR from June 2009 to June 2010

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Abstract

This report contains an analysis of data from aerial and shipboard surveys of the Jacksonville USWTR, undertaken by Duke University and the University of North Carolina at Wilmington, for the period June 2009 to June 2010. The species for which were sufficient numbers to generate detection functions were bottlenose dolphins (*Tursiops truncatus)*, spotted dolphins *(Stenella frontalis)*, leatherback (*Dermochelys coriacea)* and loggerhead turtles *(Caretta caretta)*. Detection functions were not fitted to other species owing to a paucity of data. Estimates of abundance were obtained for both the core USWTR region and the outer region. The results from the aerial and shipboard surveys were generally similar. Estimates of abundance of *Tursiops* in the core USWTR region varied from 20 to 90 (maximum CV 40%) depending on season, *Stenella* varied from 20 to 180 (maximum CV 99%) perhaps again depending on season. For sea turtle abundance, *Dermochelys* were strongly seasonal with a peak in the autumn whereas *Caretta* peaked in summer.

Introduction

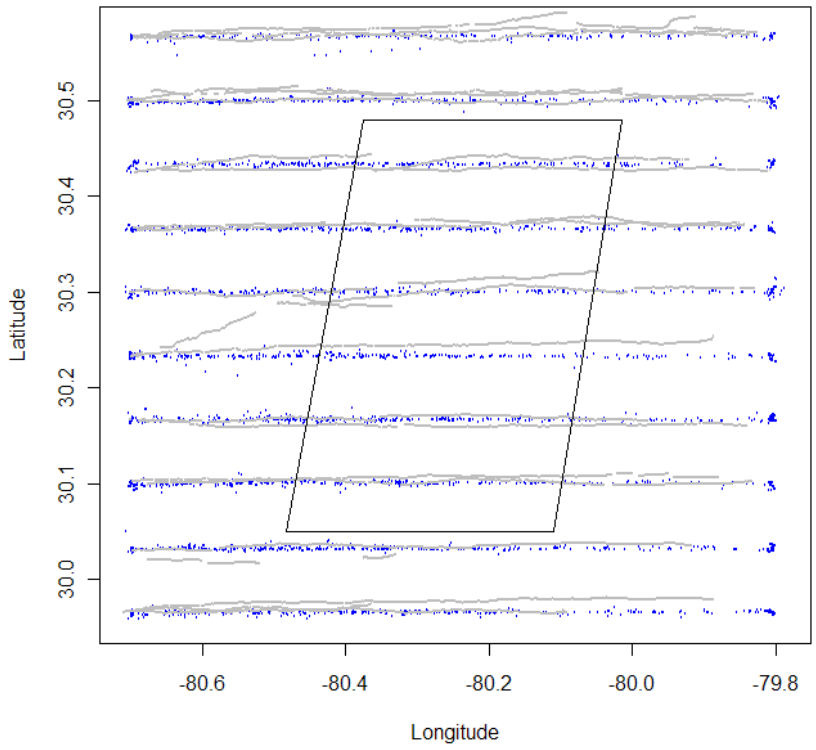
The Jacksonville USWTR aerial and shipboard surveys for 2009 – 2010 were carried out by the University of North Carolina at Wilmington (UNCW) and Duke University. The objective of these surveys is to establish baseline data on the density of marine mammals in the Jacksonville USWTR region. This document describes the analysis of this data set to develop initial quarterly abundance estimates for the region of interest, prior to more detailed analysis using density surface models in the future. Because of the large number of sightings, detection functions were generated from the data alone and not augmented (unlike the Onslow USWTR analyses) with additional data.

Survey methods

Region of interest and survey area

The Jacksonville USWTR core region of interest (hereafter "inner" region is shown in Figure 1 with an outer survey zone (hereafter "outer") as well. The aerial of the core region is 1717 km^2 and the area of the outer region is 4024 km^2. Abundance estimates were obtained for both the core USWTR region and the outer region separately.

Figure 1. Survey effort (aerial – blue, ship – grey) for the Jacksonville USWTR and its environs. USWTR core region is lined in black



Survey effort

The realised aerial survey effort consisted of 6,047 km in the inner region and 20,118 km of effort in the outer region (Figure 1). The realized ship effort was 1,243 km in the outer area and 528 km in the inner area. Data was grouped where possible into quarters to provide a first hint as to seasonal fluctuations in abundance (although as only one year is under consideration any fluctuations by season may not reflect actual seasonal changes).

Statistical methods

Overview

A conventional distance analysis was undertaken (Buckland et al. 1991). Detection probabilities were estimated by fitting to the distribution of perpendicular distances and the resultant detection probabilities and encounter rates were then used to infer density and abundance. Taxonomic groups (in this case dolphins and turtles) were amalgamated into visually similar species groups to estimate robust detection functions. Only seven whales were seen (all on the aerial survey), so density could not be estimated for these species. The abundance of specific species was then estimated using the detection probabilities from the generic functions. Where possible abundance estimates were made for the inner and outer regions and for each season, but for some species this was not possible owing to the paucity of data.

Estimation of detection probabilities

In conventional line transect sampling, the probability of detection depends only on the perpendicular distance of the sighting to the transect and at zero perpendicular distance this is assumed to be one (denoted by $g(0)=1$). Either a hazard-rate ($1-\exp(-y/\sigma)^{-b}$) or half-normal form ($\exp(-y^2/2\sigma^2)$) was used for the detection function (σ is the scale parameter) (Buckland et al. 2001). The effects of covariates, other than perpendicular distance, were incorporated into the detection function model by setting the scale parameter in the model to be an exponential function of the covariates (Marques 2001). Thus, the probability of detection becomes a multivariate function, $g(y,\boldsymbol{\nu})$, representing the probability of detection at perpendicular distance y and covariates $\boldsymbol{\nu}$ ($\boldsymbol{\nu} = \nu_1,..,\nu_Q$ where Q is the number of covariates). The scale term, σ, has the form:

$$\sigma_k = \exp\left(\beta_0 + \sum_{q=1}^{Q}(\beta_q \nu_{kq})\right)$$

and β_0 and β_q ($q=1,\ldots,Q$) are parameters to be estimated. With this formulation, it is assumed that the covariates may affect the rate at which detection probability decreases as a function of distance, but not the shape of the detection function. A backward, stepwise selection procedure was used (starting from the previous best models) to decide whether to include *Sea State* in the model, with a minimum Akaike's Information Criterion (AIC) inclusion criterion. All model selection was performed in the program *Distance* (v6.0; Thomas *et al*. 2002).

Results

Aerial survey sightings

Only dolphins (n = 97) and turtles (n = 617) had sufficient realized numbers to allow formal estimation of detection probabilities.

Shipboard survey sightings

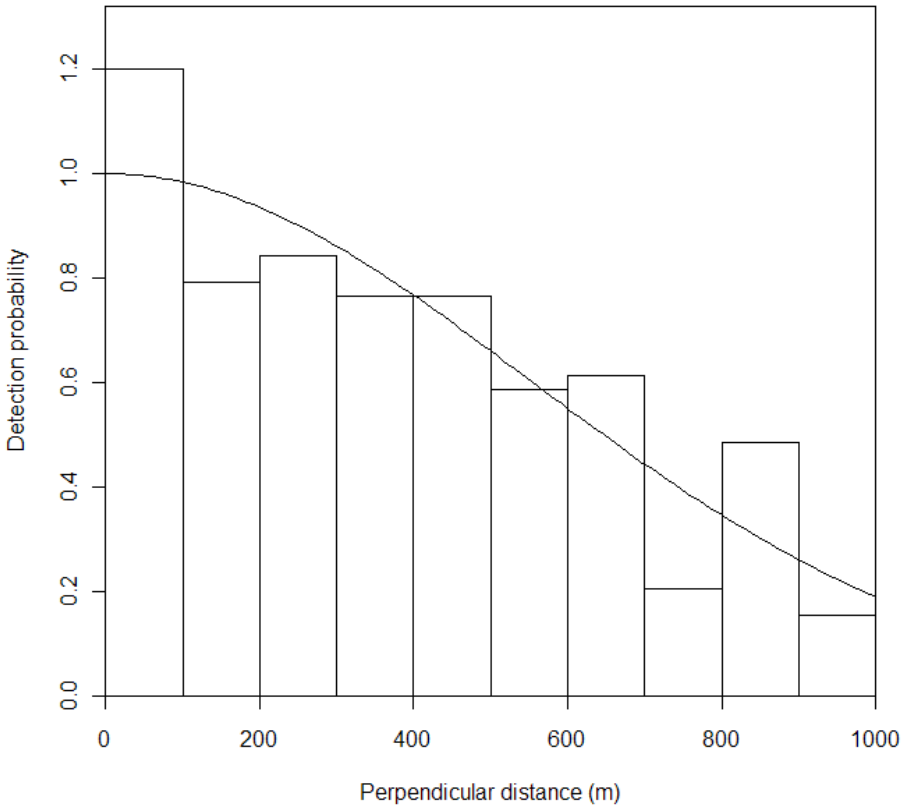
Again only turtles (n = 48) and dolphins (n = 47) had sufficient realized numbers to have formal estimation of detection probabilities.

Aerial survey detection functions

Estimates of perpendicular distance were obtained either by reference to direct estimates of distance by observers, trigonometry from the declination angle of the plane to the observed animals or by trigonometry from the position of the plane at first observation of the animals and subsequent location directly above the animals. Sightings data were fitted in *Distance* v6 (Thomas et al. 2009). Dolphin

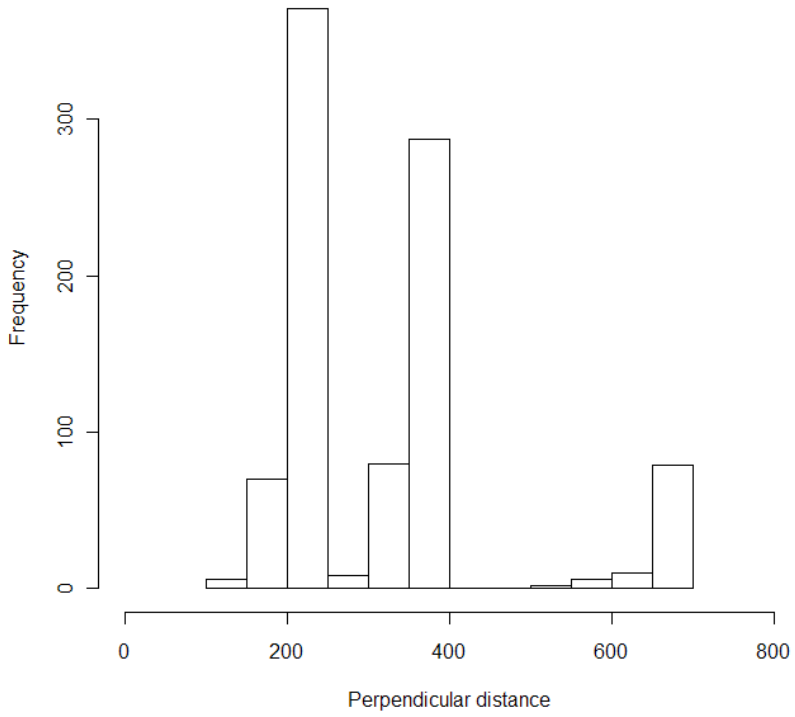
sightings were right truncated at 1.0 km and the best fit detection function was a half normal function (Figure 2). Strangely the inclusion of *Sea State* did not produce a better model

Figure 2. Histogram of perpendicular distances in dolphin sightings. Solid line is the detection function.



The perpendicular distance distribution of turtle detections did not conform to the usual assumption of monotonically declining detection probability with increasing distance (Figure 3). In the latter case the odd distribution of the distances caused the decision to be made to treat the data as a strip transect from 150 to 350 m.

Figure 3. Histogram of perpendicular distances in turtle aerial sightings.

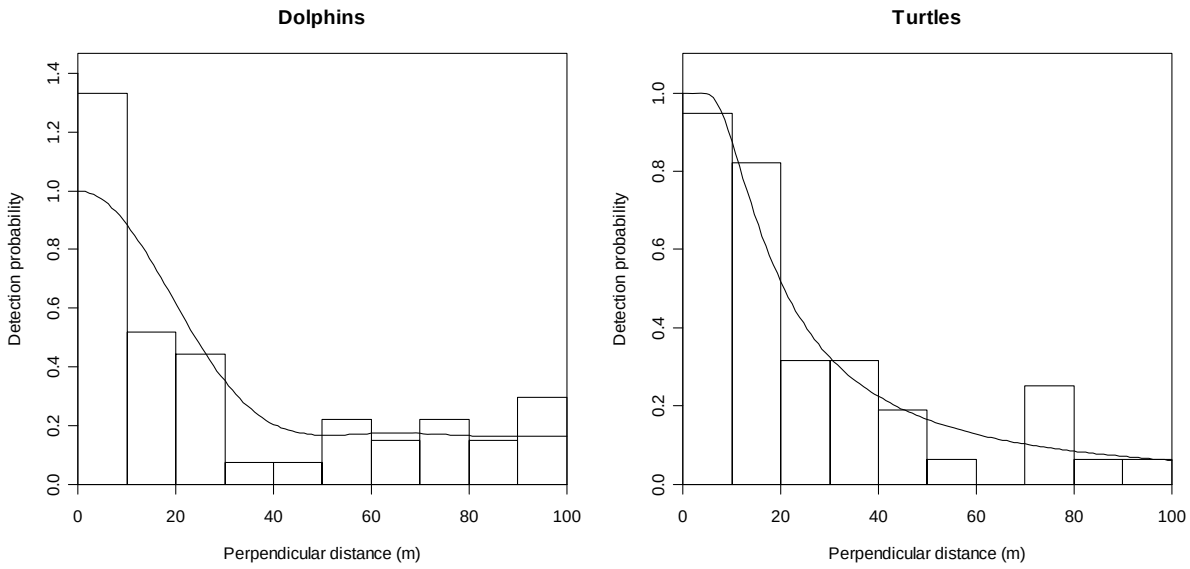


The reasons for the unusual distribution are not known and worthy of further investigation but it may have been caused in part by rounding of distances.

Ship survey detection functions

Sightings were combined to determine shipboard detection functions for each species group. The dolphin detection function is half-normal and truncation was at 100 m. No covariates were found to be important and there was no evidence for a size bias in detection. Turtles also had right truncation at 100 m but were fitted with a hazard rate function (Figure 4). No covariates were found to be important and there was no evidence for a size bias in detection.

Figure 4 *Shipboard detection functions*



Estimation of density – individual species

In the case of the aerial survey *Tursiops, Stenella, Dermochelys* and *Caretta* had sufficient numbers to generate estimates of abundance. Encounter rates and other critical statistics are given in Table 1. In the case of the shipboard survey *Tursiops, Stenella* and *Caretta* had sufficient numbers to generate estimates of abundance. Encounter rates and other critical statistics are given in Table 2.

Table 1. Line transect density (D) estimates for the aerial survey. Coefficients of variation are in parentheses. esw - effective strip width; s - mean pod size; n/L - encounter rate, animals per nautical mile.

Species	Block	*esw* (m)	*s*	n	*n/L*	*D (% CV)* (no/ km^2)	*Abundance*
Tursiops	Inner Spring	640.75 (5.7)	11.7 (8.1)	6	0.006	0.0529 (40)	90
	Outer Spring			47	0.015	0.1400 (31)	560
	Inner Summer			12	0.012	0.1057 (99)	180
	Outer Summer			47	0.012	0.1049 (32)	420
	Inner Autumn			2	0.002	0.0135 (69)	20
	Outer Autum			9	0.002	0.0185 (38)	70
	Inner Winter			11	0.004	0.0380 (32)	70
	Outer Winter			36	0.004	0.0384 (24)	160
Stenella	Inner Spring	640.75 (5.7)	11.7 (8.1)	12	0.012	0.106 (26)	180
	Outer Spring			22	0.007	0.066 (24)	260
	Inner Summer			1	0.001	0.009 (98)	20
	Outer Summer			11	0.003	0.025 (32)	100
	Inner Autumn			5	0.004	0.034 (54)	60
	Outer Autum			24	0.005	0.049 (22)	200
	Inner Winter			4	0.002	0.014 (42)	20
	Outer Winter			18	0.002	0.019 (29)	80
Caretta	Inner Spring	200	1.2 (1.8)	14	0.014	0.040 (31)	70
	Outer Spring			47	0.015	0.046 (14)	180
	Inner Summer			30	0.029	0.086 (30)	150
	Outer Summer			165	0.040	0.120 (15)	480
	Inner Autumn			17	0.013	0.037 (28)	60
	Outer Autum			84	0.019	0.056 (15)	230
	Inner Winter			28	0.011	0.032 (28)	50
	Outer Winter			91	0.011	0.032 (13)	130
Dermochelys	Inner Spring	200	1.2 (1.8)	0	0	0	0
	Outer Spring			0	0	0	0
	Inner Summer			0	0	0	0
	Outer Summer			0	0	0	0
	Inner Autumn			8	0.006	0.018 (30)	30
	Outer Autumn			14	0.003	0.009 (38)	40
	Inner Winter			0	0	0	0
	Outer Winter			3	<0.001	0.001	0

Table 2. Line transect density (D) estimates for the ship survey. Coefficients of variation are in parentheses.. esw - effective strip width; s - mean pod size; n/L - encounter rate, animals per km.

Species	Block	*esw* (m)	*s*	n	*n/L*	*D (% CV)* (no/ km^2)	*Abundance*
Tursiops	Inner	34.83	4.2	3	0.006	0.34 (40)	580
	Outer	(19.8)	(14.6)	8	0.006	0.39 (70)	1560
Stenella	Inner	34.83	4.2	6	0.011	0.68 (52)	1170
	Outer	(19.8)	(14.6)	17	0.014	0.85(50)	3300
Caretta	Inner	33.50	1.0	7	0.027	0.22 (52)	370
	Outer	(19.8)	(14.6)	34	0.031	0.45(50)	1830

Discussion

Numbers were generally comparable across surveys, although the encounter rate for *Stenella* was on average higher than sea from the planes, presumably because of the greater availability to be detected. There was no evidence of any seasonal changes in the abundance of *T. truncatus* or *S. frontalis*.
C. caretta numbers seem to peak in summer whereas *D. coriacea* primarily appears in the autumn, although some were seen in the outer region in winter.

Recommendations for the future

Assuming the USWTR survey work is ongoing, issues of potential interest in the future work might include:

1. Improving detection function and density estimates by supplementing existing detections with those from future surveys.
2. Investigation of the strange pattern of reported distances for turtles
3. Investigation of reliable methods for estimating $g(0)$ without double-observer survey. Options include cue-based methods and use of appropriate availability correction methods based on data on availability patterns for each species.
4. Further elucidation of the environmental drivers of cetacean density in the area of interest, perhaps by the use of additional variables.
5. Records of water clarity may be useful in the generation of detection functions of turtles.

References

Buckland, S.T., Anderson, D.R., Burnham, K.P., Laake, J.L., Borchers, D.L. and Thomas, L. 2001. *Introduction to distance sampling: estimating abundance of biological populations.* Oxford University Press, London. 432pp.

Appendix E - Onslow/JAX Monthly Trip Reports

PROJECT STATUS REPORT

REPORT DATE:	1 September 2009	**REPORT PERIOD:**	August 2009
BOA NO:	743586-60049	**TASK ORDER:**	746192-60007
GMI NUMBER:	30217.01.07	**GMI PROJECT MGR:**	Jason See
CLIENT NAME:	Parsons Infrastructure and Technology Group, Inc.	**PARSONS MGR:**	Stephen Buss
PROJECT NAME:	Marine protected species monitoring for the Proposed UnderSea Warfare Training Range (USWTR)		

1.0 WORK PERFORMED THIS REPORT PERIOD

During the month of August both shipboard and aerial surveys were conducted in Onslow Bay. The aerial team surveyed all tracklines twice, and favorable weather conditions allowed the shipboard team to survey five days in Onslow Bay. On August 18th and 19th aerial and shipboard surveys were conducted concurrently.

A. Aerial Surveys

Survey Effort

The UNCW aerial survey team conducted observations on August 17th, 18th, and 19th; covering tracklines 1 through 10 twice. Table 1 summarizes the track lines surveyed and sea state conditions. Table 2 summarizes the sightings made during these aerial surveys. The aerial team observed bottlenose (*Tursiops truncatus*), spotted (*Stenella frontalis*), and Risso's (*Grampus griseus*) dolphins, as well as pilot whales (*Globicephala macrorhynchus*), loggerhead sea turtles (*Caretta caretta*), manta ray and several unidentified sharks. Figure 1 shows the locations of the sightings made during the aerial surveys.

Table 1. Effort summary table for UNCW aerial surveys.

Date	Line	Sea State	Kilometers flown
17-Aug-09	10	1 to 3	74.5
17-Aug-09	9	1 to 3	73.6
17-Aug-09	8	1 to 3	74.9
17-Aug-09	7	1 to 3	74.7
18-Aug-09	1	1 to 3	75.0
18-Aug-09	2	1 to 3	73.6
18-Aug-09	3	1 to 2	73.5
18-Aug-09	4	1 to 2	68.4
18-Aug-09	5	1 to 2	72.9
18-Aug-09	6	1 to 2	74.3
18-Aug-09	7	1 to 2	74.3
18-Aug-09	8	1 to 2	75.0
18-Aug-09	9	1 to 2	73.5
18-Aug-09	10	1 to 2	73.7
19-Aug-09	6	1 to 2	74.5
19-Aug-09	5	1 to 2	74.2
19-Aug-09	4	1 to 2	74.8

19-Aug-09	3	1	74.5
19-Aug-09	2	1	72.9
19-Aug-09	1	1	74.9

Table 2. Sighting summary table for UNCW aerial surveys.

Date	Time	Effort	Latitude	Longitude	Track	Species	Group Size
17-Aug-09	15:21	On	34.258671	-76.589011	10	*Unid. Sea Turtle*	1
17-Aug-09	15:23	On	34.215023	-76.532874	10	*Unid. Sea Turtle*	1
17-Aug-09	15:27	On	34.160575	-76.468974	10	*Stenella frontalis*	35
17-Aug-09	15:43	On	34.057868	-76.330946	10	*Unid. Sea Turtle*	1
17-Aug-09	15:46	On	33.991071	-76.245475	10	*Caretta caretta*	1
17-Aug-09	15:48	On	33.943945	-76.185304	10	*Caretta caretta*	1
17-Aug-09	16:00	On	33.808016	-76.141633	9	*Caretta caretta*	1
17-Aug-09	16:08	On	34.006983	-76.398432	9	*Caretta caretta*	1
17-Aug-09	16:12	On	34.085993	-76.500693	9	*Mola mola*	1
17-Aug-09	16:15	On	34.154200	-76.589502	9	*Caretta caretta*	1
17-Aug-09	16:16	On	34.183486	-76.627424	9	*Caretta caretta*	1
17-Aug-09	16:17	On	34.193935	-76.641233	9	*Unid. Sea Turtle*	2
17-Aug-09	16:18	On	34.216918	-76.673388	9	*Unid. Sea Turtle*	2
17-Aug-09	16:22	On	34.152674	-76.714152	8	*Caretta caretta*	1
17-Aug-09	16:23	On	34.117362	-76.668036	8	*Caretta caretta*	1
17-Aug-09	16:26	On	34.065601	-76.599661	8	*Caretta caretta*	1
17-Aug-09	16:27	On	34.032553	-76.556431	8	*Caretta caretta*	1
17-Aug-09	16:27	On	34.043280	-76.570644	8	*Caretta caretta*	1
17-Aug-09	16:40	On	33.764413	-76.205987	8	*Caretta caretta*	1
17-Aug-09	16:40	On	33.751701	-76.189365	8	*Caretta caretta*	1
17-Aug-09	16:49	On	33.762449	-76.338879	7	*Caretta caretta*	1
17-Aug-09	16:58	On	33.965171	-76.602357	7	*Unid. Shark*	1
17-Aug-09	17:03	On	34.055212	-76.719894	7	*Caretta caretta*	1
18-Aug-09	9:27	On	33.743025	-77.099780	1	*Caretta caretta*	1
18-Aug-09	9:33	On	33.632870	-76.955154	1	*Unid. Sea Turtle*	1
18-Aug-09	9:37	Off	33.620708	-76.942240	1	*Tursiops truncatus*	1
18-Aug-09	9:44	On	33.600015	-76.919668	1	*Unid. Sea Turtle*	1
18-Aug-09	9:49	On	33.513235	-76.798926	1	*Caretta caretta*	1
18-Aug-09	9:57	On	33.358769	-76.610723	1	*Grampus griseus*	6
18-Aug-09	10:15	On	33.504820	-76.674391	2	*Tursiops truncatus*	35
18-Aug-09	10:27	On	33.671233	-76.879581	2	*Caretta caretta*	1
18-Aug-09	10:30	On	33.725727	-76.950003	2	*Unid. Sea Turtle*	1
18-Aug-09	10:42	On	33.833583	-76.957856	3	*Caretta caretta*	1
18-Aug-09	10:44	On	33.791287	-76.902571	3	*Caretta caretta*	1
18-Aug-09	10:45	On	33.770614	-76.875567	3	*Caretta caretta*	1
18-Aug-09	10:59	On	33.493955	-76.498147	3	*Globicephala macrorhynchus*	40
18-Aug-09	11:22	On	33.611807	-76.541171	4	*Tursiops truncatus*	2
18-Aug-09	11:37	On	33.727864	-76.687137	4	*Caretta caretta*	1
18-Aug-09	11:37	On	33.733042	-76.693974	4	*Unid. Sea Turtle*	1
18-Aug-09	11:38	On	33.759375	-76.728531	4	*Caretta caretta*	1

18-Aug-09	11:40	On	33.784330	-76.761268	4	*Tursiops truncatus*	3
18-Aug-09	11:46	On	33.840069	-76.835571	4	*Caretta caretta*	1
18-Aug-09	11:50	On	33.886683	-76.898185	4	*Stenella frontalis*	2
18-Aug-09	12:00	On	33.931810	-76.957381	4	*Unid. Shark*	1
18-Aug-09	12:02	On	33.966525	-76.999787	4	*Unid. Sea Turtle*	1
18-Aug-09	14:21	On	33.761505	-76.599899	5	*Stenella frontalis*	65
18-Aug-09	14:56	On	33.991932	-76.775291	6	*Caretta caretta*	1
18-Aug-09	15:02	On	34.070793	-76.872859	6	*Stenella frontalis*	9
18-Aug-09	15:13	On	34.088615	-76.758118	7	*Caretta caretta*	1
18-Aug-09	15:16	On	34.020482	-76.668820	7	*Caretta caretta*	1
18-Aug-09	15:18	On	33.974456	-76.608827	7	*Caretta caretta*	1
18-Aug-09	15:46	On	33.943606	-76.445136	8	*Unid. Sea Turtle*	1
18-Aug-09	16:06	On	34.082670	-76.491323	9	*Unid. Sea Turtle*	1
18-Aug-09	16:09	On	34.028738	-76.421312	9	*Caretta caretta*	1
18-Aug-09	16:36	On	34.089557	-76.377171	10	*Unid. Sea Turtle*	1
19-Aug-09	9:22	On	34.031991	-76.823887	6	*Manta birostris*	1
19-Aug-09	9:31	On	33.839874	-76.570116	6	*Caretta caretta*	1
19-Aug-09	9:55	On	33.777906	-76.624098	5	*Unid. Sea Turtle*	1
19-Aug-09	9:59	On	33.870794	-76.746317	5	*Unid. Sea Turtle*	1
19-Aug-09	9:59	On	33.865322	-76.739106	5	*Unid. Sea Turtle*	1
19-Aug-09	10:03	On	33.960298	-76.864501	5	*Caretta caretta*	1
19-Aug-09	10:11	On	33.933344	-76.954704	4	*Manta birostris*	1
19-Aug-09	10:15	On	33.845945	-76.838537	4	*Unid. Sea Turtle*	1
19-Aug-09	11:04	On	33.811234	-76.916236	3	*Tursiops truncatus*	3
19-Aug-09	11:20	On	33.864351	-77.003550	3	*Caretta caretta*	1
19-Aug-09	11:21	On	33.889617	-77.036512	3	*Caretta caretta*	1
19-Aug-09	11:22	On	33.904012	-77.055396	3	*Caretta caretta*	1
19-Aug-09	11:28	On	33.815988	-77.078934	2	*Stenella frontalis*	4
19-Aug-09	12:00	On	33.449196	-76.601237	2	*Tursiops truncatus*	8
19-Aug-09	12:20	Off	33.386885	-76.537104	n/a	*Globicephala macrorhynchus*	6

B. Shipboard surveys

Survey Effort

Shipboard surveys in Onslow bay occurred on August 8th, 9th, 16th, 17th, and 18th resulting in 30 total survey hours and 20.5 hours on effort. All tracklines in August were surveyed aboard the *R/V Sensation* and we surveyed tracklines 1, 4, 2, 5, and 3 respectively. In August we saw bottlenose (*Tursiops truncatus*), spotted (*Stenella frontalis*), and Risso's (*Grampus griseus*) dolphins, as well as pilot whales (*Globicephala macrorhynchus*), and loggerhead (*Caretta caretta*) and leatherback (*Dermochelys coriacea*) sea turtles. On August 18th we had the first shipboard sighting of Rough-toothed (*Steno bredanensis*) dolphins in Onslow Bay. Table 3 provides the details for these sightings and the locations of the sightings are presented in Figure 2.

We conducted strip transect seabird counts concurrent with the marine mammal surveys. For the month of August, 2009, 31 seabirds were observed during 4.68 hours of survey effort and the total sightings per unit effort (SPUE), or the number of seabirds recorded per hour of effort, was 6.62. Cory's Shearwaters (*Calonectris diomedea*) were the most frequently observed

seabirds, while Wilson's Storm Petrels (*Oceanites oceanicus*) and Greater Shearwaters (*Puffinus gravis*) were also observed during August surveys. Table 4 provides the details for these sightings.

Table 3: Sighting summary table for Duke vessel-based surveys.

Date	Trackline	Time	Latitude	Longitude	Species	Group Size	Effort
08-Aug-09	1	13:13:24	33.7590872	-77.11195124	Stenella frontalis	5	On
09-Aug-09	4	9:53:11	33.57024922	-76.48994458	Grampus griseus	24	On
09-Aug-09	4	13:53:37	33.7836684	-76.7598082	Stenella frontalis	5	On
09-Aug-09	4	14:44:45	33.85633223	-76.85193528	Tursiops truncatus	3	On
09-Aug-09	4	15:06:09	33.87853944	-76.88491823	Caretta caretta	1	On
16-Aug-09	2	9:20:00	33.41227852	-76.53991096	Grampus griseus	36	Off
16-Aug-09	2	10:11:21	33.44150215	-76.57722479	Grampus griseus	16	On
16-Aug-09	2	11:34:51	33.5131182	-76.67708118	Tursiops truncatus	6	On
16-Aug-09	2	11:59:14	33.52882185	-76.6979236	Tursiops truncatus	16	On
16-Aug-09	2	12:21:46	33.55464716	-76.73227968	Tursiops truncatus	14	On
16-Aug-09	2	13:35:08	33.68509835	-76.89152413	Caretta caretta	1	On
16-Aug-09	2	14:09:30	33.74745277	-76.98215858	Tursiops truncatus	4	On
17-Aug-09	5	9:28:45	33.61890397	-76.41385011	Caretta caretta	1	On
17-Aug-09	5	10:04:17	33.68321091	-76.49100768	Tursiops truncatus	41	On
17-Aug-09	5	13:07:38	33.94399414	-76.84646221	Stenella frontalis	10	On
17-Aug-09	5	13:43:04	33.96852911	-76.88216205	Stenella frontalis	5	On
17-Aug-09	5	14:00:26	33.98048169	-76.89331526	Stenella frontalis	5	On
18-Aug-09	3	9:26:43	33.48861981	-76.5129594	Globicephala *macrorhynchus*	8	Off
18-Aug-09	3	9:53:59	33.48819428	-76.52507199	Globicephala *macrorhynchus*	45	On
18-Aug-09	3	11:43:25	33.64312898	-76.70932698	Steno bredanensis	27	On
18-Aug-09	3	12:57:26	33.70219441	-76.77720551	Tursiops truncatus	10	Off
18-Aug-09	3	13:55:16	33.75787551	-76.86369747	Dermochelys coriacea	1	Off
18-Aug-09	3	14:06:00	33.77026033	-76.8861296	Caretta caretta	1	On
18-Aug-09	3	14:13:10	33.7865562	-76.90339209	Caretta caretta	1	On
18-Aug-09	3	14:15:04	33.78615372	-76.90853087	Tursiops truncatus	2	On
18-Aug-09	3	14:29:14	33.8048905	-76.9178252	Tursiops truncatus	4	On
18-Aug-09	3	14:48:32	33.82305646	-76.94720713	Dermochelys coriacea	1	On
18-Aug-09	3	14:49:42	33.8241655	-76.95326855	Unid. dolphin	1	Off
18-Aug-09	3	14:51:10	33.82750355	-76.95489798	Caretta caretta	1	On
18-Aug-09	3	15:13:28	33.867231	-77.01693993	Tursiops truncatus	12	On

Table 4: Seabird sightings by date during August 2009 surveys in Onslow Bay

Date	**August 18, 2009**
Total Birds	**31**
Hours Effort	**4.68**

Total SPUE (all birds)	**6.62**
Cory's Shearwaters (*Calonectris diomedea*)	21
Greater Shearwaters (*Puffinus gravis*)	2
Wilson's Storm Petrels (*Oceanites oceanicus)*	5
Unidentified Storm Petrels	2
Unidentified Swallow	1

C. Passive Acoustics

We deployed the towed array from the *F/V Sensation* on five days during August 2009. On August 8th, we deployed the hydrophone array for 4.4 hours of combined visual and acoustic survey. During this time, we made two acoustic detections. The visual team cued one group (*Stenella frontalis*), and the other was unobserved. On August 9th, we deployed the hydrophone array for 5.64 hours of combined visual and acoustic survey. During this time, we made six acoustic detections and detected three visually. Two groups (*Grampus griseus*, *Tursiops truncatus*) were cued. During the *Grampus griseus* sighting, we detected clicks with characteristics similar to those of *Physeter macrocephalus* but the species was not observed. The final group that we also detected visually was a group of *Stenella frontalis*. On August 16th, we deployed the hydrophone array for 5.77 hours of combined visual and acoustic survey and made nine acoustic detections. The visual team cued two groups (*Grampus griseus*, *Tursiops truncatus*). The remaining acoustic detections included *Grampus griseus*, *Tursiops truncatus*, two unidentified cetacean groups, and one unidentified source. On August 17th, we deployed the hydrophone array for 5.53 hours of combined visual and acoustic survey. We made five acoustic detections and the visual team cued one group (*Stenella frontalis*). The four remaining acoustic detections included one group of *Tursiops truncatus*, two groups of *Stenella frontalis*, and one unobserved group. On August 18th, we deployed the hydrophone array for 6.65 hours of combined visual and acoustic survey and detected eight groups acoustically. The visual team cued two groups (*Steno bredanensis*,*Tursiops truncatus*). The other detections consisted of two groups of *Globicephala spp.*, three groups of *Tursiops truncatus*, and one unobserved group.

D. Oceanographic Sampling

We conducted one day of preliminary oceanographic sampling in August 2009 to examine physical regimes and distributions of marine mammal and seabird prey at depth. We conducted surveys on shelf waters on August 5, 2009 to calibrate and sync acoustic equipment (an acoustic Doppler current profiler (ADCP) and a 38 kHz fisheries acoustics transducer).

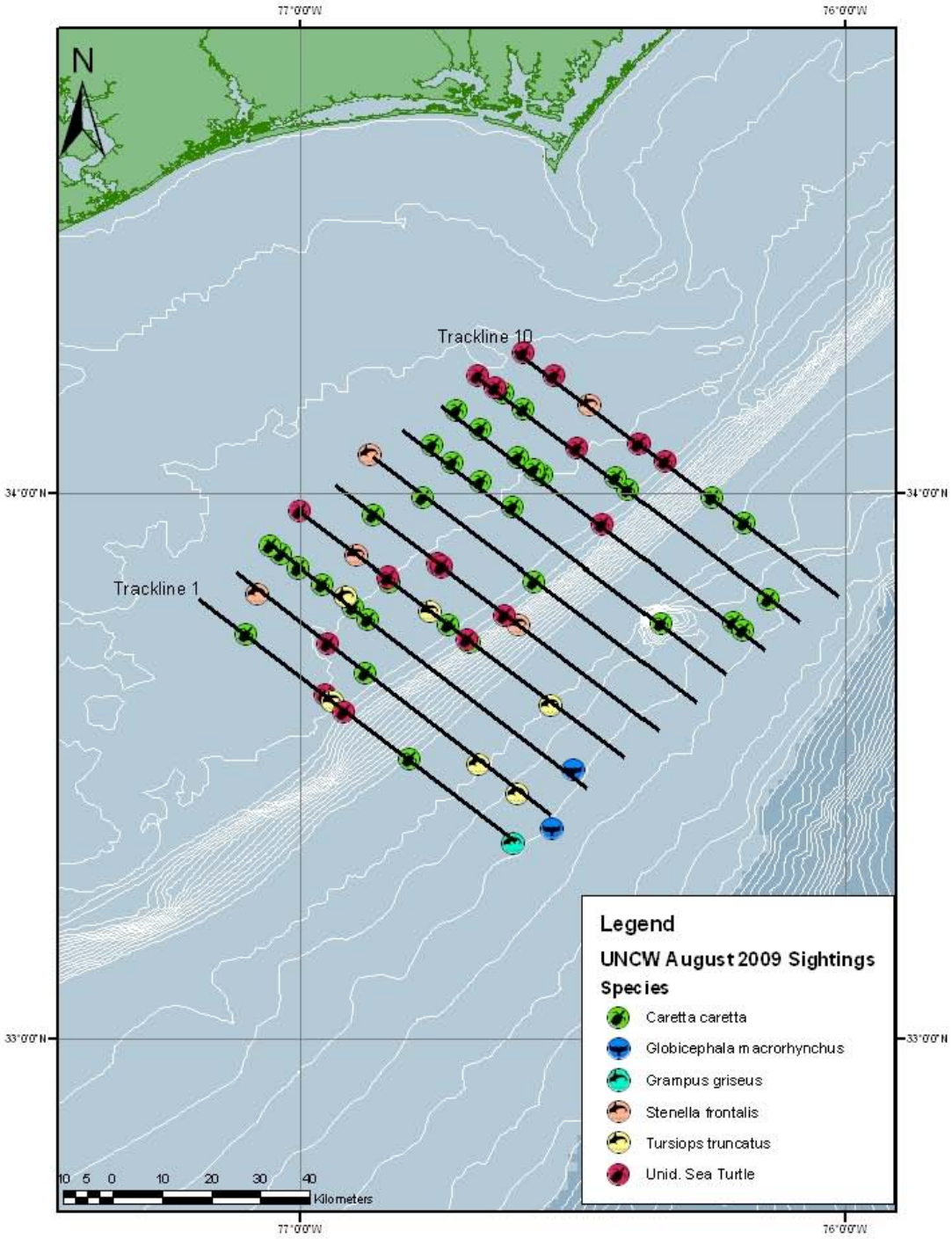


Figure 1. Location of sightings made during aerial surveys in August 2009. Refer to Tables 1 and 2.

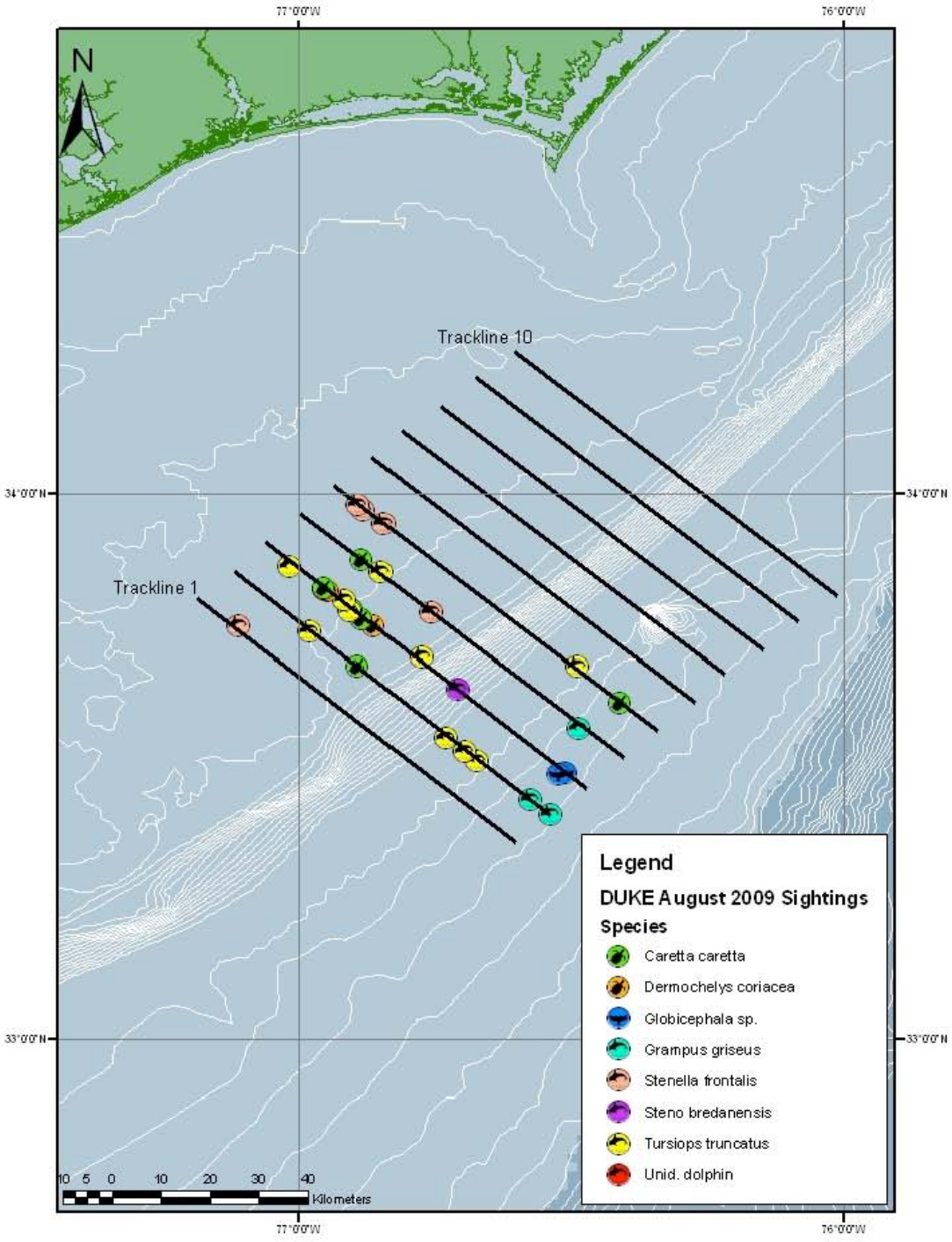


Figure 2. Location of sightings made during vessel surveys in August 2009. Refer to Table 3.

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Survey activity (Task 2)

Aerial Surveys

Two full sets of track lines (20 track lines) were flown for the month of August. Six lines were flown on 4 August, eight lines were flown on 5 August, and six lines were flown on 6 August. Survey conditions were acceptable (Table 1); however, survey effort was suspended on the afternoon of 5 August due to deteriorating weather conditions in the afternoon. There were eleven cetacean sightings during aerial survey effort: six encounters with *Stenella frontalis*, four encounters with *Tursiops truncatus*, and one sighting of unidentified delphinids (Table 2). Two of the encounters with *S. frontalis* yielded photo documentation of dolphins feeding on octopi as well. Multiple dolphins were documented repeatedly throwing octopi from the water. An abundance of sea turtles were seen during this survey period. *Caretta caretta* were the predominant species, along with a number of unidentified sea turtles. Turtles were most often encountered on the nearshore ends of the track lines (Table 3). The locations of cetacean encountered during aerial surveys are presented in Figure 1. Sea turtle locations are plotted in Figure 2.

Vessel Surveys

Three and a half track lines were surveyed on 14, 16, 18 and 19 August 2009 on the *R/V 2 Angels* – a modified 38 ft Duffy commercial/ sport fishing vessel (Table 4). There were five cetacean sightings and seven sea turtle sightings (Table 5). Four groups of *S. frontalis* and one group of *T. truncatus* were observed during survey effort. One *Lepidochelys kempii* turtle and one *Dermochelys coriacea* turtle were seen. The remaining sea turtle sightings were of *C. caretta*. The locations of cetaceans and turtles sighted during vessel surveys are presented in Figure 3.

Towed Passive Acoustics

The towed acoustic array was deployed from the *R/V 2 Angels* on 14, 16, and 19 August 2009. On 14 and 16 August the acoustic array was deployed for a total of 9 hours 31 minutes of simultaneous visual and acoustic detection. A total of 2 hours 42 minutes of acoustic recordings were collected, including recordings obtained during a sighting of *S. frontalis* on 16 August. On 18 August the hydrophone array was not deployed due to being short one observer. On 19 August the array was deployed with recordings collected during visual sighting events. A total of 28 minutes of acoustic recordings were taken encompassing two visual sighting events: one of *S. frontalis* and one of *T. truncatus*.

Travel (Task 1 & 3)
Co-PI William McLellan traveled to Fernandina Beach on August 8 & 9 to assist with the set-up effort. Observer Rachel Hardee traveled to UNC Wilmington to assist is surveys conducted in Onslow Bay. This cross-pollination of observers between teams will continue in the future.

Purchasing (Task 1)
A new satellite phone was purchased for the JAX survey team during this reporting period. Supplies to redeploy the JAX HARPs (chain, shackles and wire rope) were purchased during this report period.

Planning (Task 1)
A Navy exercise is scheduled to occur in the JAX USWTR survey area during September 2009. As such, PI Johnston and Post-doc Soldevilla initiated planning for the deployment of Cornell pop-up buoys and also planned the redeployment of HARPs in September. Pop-ups will be deployed in the JAX USWTR during the 1st week of September and recovered at the end of the month. We plan on recovering and redeploying the HARPs during 14-24 September (except the 17th, when no access to the HARP locations is permitted). PI Johnston also coordinated with Navy officials to establish proper authorization to access the JAX USWTR for the survey and HARP recovery team during the September exercises.

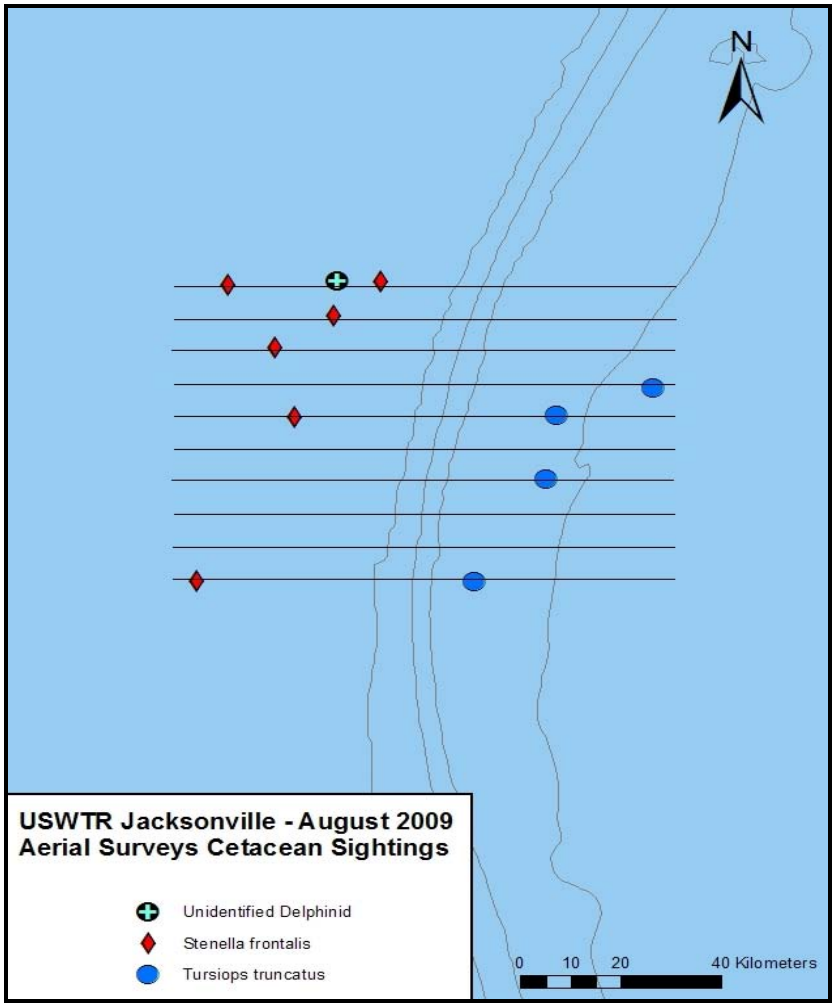

Figure 1. The locations of cetaceans sighted during aerial surveys of the JAX USWTR study region during 24 July through 23 August, 2009. Distribution represents each track line flown two times over the entire length of the line.

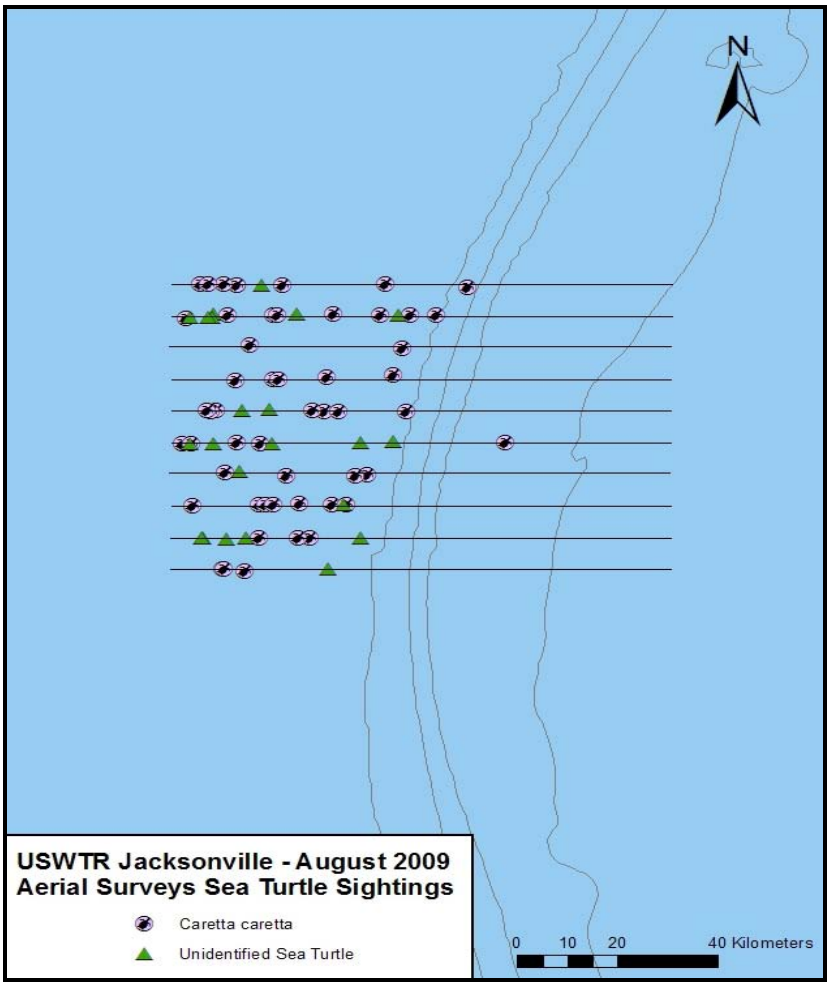

Figure 2. The locations of sea turtles sighted during aerial surveys of the JAX USWTR study region during 24 July through 23 August, 2009. Distribution represents each track line flown two times over the entire length of the line.

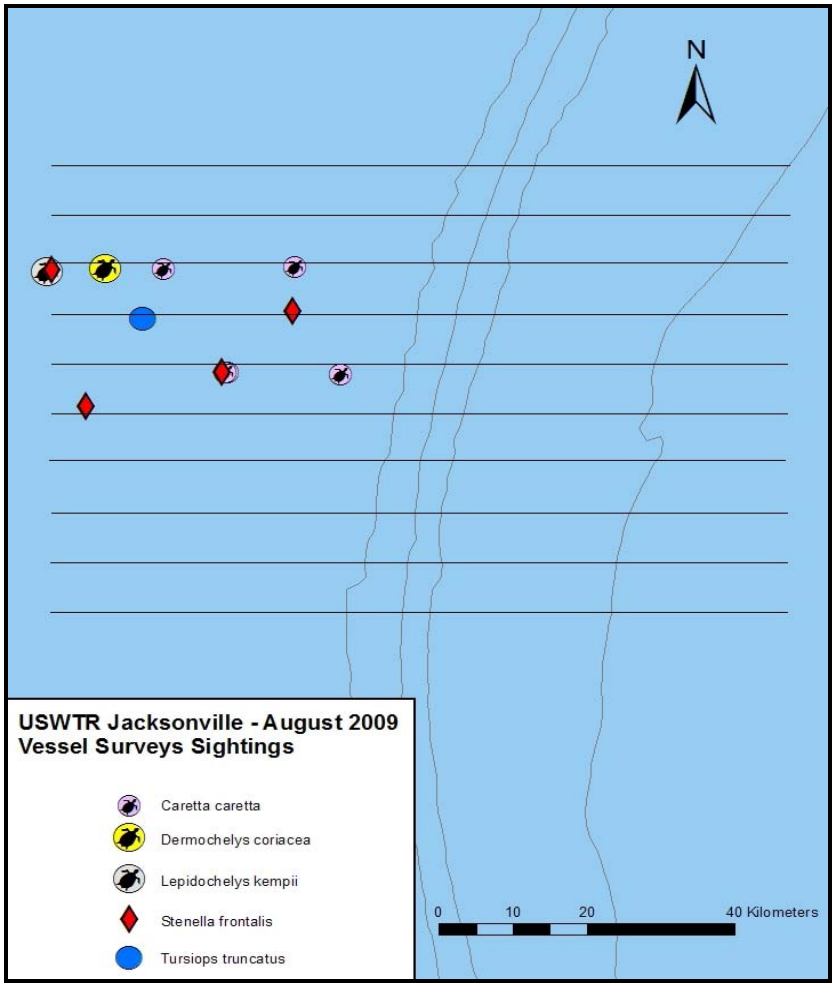

Figure 3. The locations of cetaceans and sea turtles sighted during vessel surveys of the JAX USWTR study region during 24July through 23 August, 2009. Distribution represents surveys of track lines 8, 7, 6, and the nearshore half of track line 5.

Table 1. Aerial survey effort for the Jacksonville, FL USWTR site in August 2009.

Date	Line	Sea State	Kilometers Flown
4-Aug-09	10	1-2	86.1
4-Aug-09	9	1-2	85.5
4-Aug-09	8	1-2	80.8
4-Aug-09	7	1-3	83.4
4-Aug-09	6	0-3	84.7
4-Aug-09	5	0-3	86.6
5-Aug-09	1	1-3	86.2
5-Aug-09	2	1-3	86.6
5-Aug-09	3	1-3	86.3
5-Aug-09	4	1-3	86.3
5-Aug-09	5	1,3	86.4
5-Aug-09	6	1-3	86.3
5-Aug-09	7	3-4	86
5-Aug-09	8	2-4	85.9
6-Aug-09	1	2-3	85.7
6-Aug-09	2	2-3	86.6
6-Aug-09	3	2-3	85.8
6-Aug-09	4	1-3	82.8
6-Aug-09	9	2	86
6-Aug-09	10	2	86.5

Table 2. Cetacean sightings during aerial surveys in the JAX USWTR site in August 2009.

Date	Time	On/Off Effort	Latitude	Longitude	Track Number	Species	Group Size
4-Aug-09	12:05	On Effort	30.57040	-80.60384	10	*S. frontalis*	4
4-Aug-09	13:03	On Effort	30.50726	-80.41370	9	*S. frontalis*	25
4-Aug-09	13:23	On Effort	30.44088	-80.52035	8	*S. frontalis*	6
4-Aug-09	13:58	On Effort	30.35985	-79.84065	7	*T. truncatus*	24
4-Aug-09	14:38	On Effort	30.29739	-80.48385	6	*S. frontalis*	7
4-Aug-09	14:56	On Effort	30.30378	-80.01414	6	*T. truncatus*	35
6-Aug-09	8:37	On Effort	29.960847	-80.659663	1	*S. frontalis*	20
6-Aug-09	9:10	On Effort	29.961709	-80.161598	1	*T. truncatus*	20
6-Aug-09	10:37	On Effort	30.172326	-80.033970	4	*T. truncatus*	17
6-Aug-09	12:08	On Effort	30.577324	-80.330336	10	*S. frontalis*	6
6-Aug-09	12:25	On Effort	30.579529	-80.408211	10	Unidentified delphinid	3

Table 3. Sea turtle sightings during aerial surveys in the JAX USWTR site in August 2009.

Date	Time	On/Off Effort	Latitude	Longitude	Track Number	Species	Group Size
4-Aug-09	11:58	On Effort	30.567790	-80.647958	10	*C. caretta*	2
4-Aug-09	12:24	On Effort	30.566594	-80.316750	10	*C. caretta*	3
4-Aug-09	12:33	On Effort	30.560334	-80.167957	10	*C. caretta*	1
4-Aug-09	12:56	On Effort	30.502631	-80.224083	9	*C. caretta*	1
4-Aug-09	12:57	On Effort	30.500670	-80.271799	9	*C. caretta*	1
4-Aug-09	12:59	On Effort	30.501289	-80.325398	9	*C. caretta*	1
4-Aug-09	13:01	On Effort	30.504542	-80.409434	9	*C. caretta*	1
4-Aug-09	13:10	On Effort	30.500800	-80.518322	9	*C. caretta*	1
4-Aug-09	13:12	On Effort	30.501112	-80.598167	9	*C. caretta*	1
4-Aug-09	13:12	On Effort	30.503147	-80.624101	9	Uniden. turtle	1
4-Aug-09	13:20	On Effort	30.438471	-80.560492	8	*C. caretta*	3
4-Aug-09	13:39	On Effort	30.432193	-80.285353	8	*C. caretta*	1
4-Aug-09	14:12	On Effort	30.374500	-80.301723	7	*C. caretta*	2
4-Aug-09	14:16	On Effort	30.369755	-80.421294	7	*C. caretta*	1
4-Aug-09	14:18	On Effort	30.365380	-80.516626	7	*C. caretta*	1
4-Aug-09	14:20	On Effort	30.364738	-80.585105	7	*C. caretta*	1
4-Aug-09	14:33	On Effort	30.299621	-80.620791	6	*C. caretta*	1
4-Aug-09	14:33	On Effort	30.299321	-80.630179	6	*C. caretta*	1
4-Aug-09	14:35	On Effort	30.301272	-80.572978	6	Uniden. turtle	1
4-Aug-09	14:36	On Effort	30.303321	-80.525158	6	Uniden. turtle	1
4-Aug-09	14:44	On Effort	30.298889	-80.427273	6	*C. caretta*	1
4-Aug-09	14:45	On Effort	30.298179	-80.400124	6	*C. caretta*	1
4-Aug-09	14:48	On Effort	30.297485	-80.278407	6	*C. caretta*	1
4-Aug-09	15:20	On Effort	30.236193	-80.302727	5	Uniden. turtle	1
4-Aug-09	15:21	On Effort	30.233527	-80.360478	5	Uniden. turtle	1
4-Aug-09	15:25	On Effort	30.230677	-80.519806	5	Uniden. turtle	1
4-Aug-09	15:26	On Effort	30.230947	-80.541866	5	*C. caretta*	1
4-Aug-09	15:28	On Effort	30.230294	-80.624343	5	Uniden. turtle	1
4-Aug-09	15:29	On Effort	30.229411	-80.667231	5	Uniden. turtle	1
5-Aug-09	8:59	On Effort	29.966658	-80.607427	1	*C. caretta*	1
5-Aug-09	8:59	On Effort	29.966624	-80.606248	1	*C. caretta*	1
5-Aug-09	9:37	On Effort	30.032263	-80.360320	2	Uniden. turtle	1
5-Aug-09	9:40	On Effort	30.031052	-80.451696	2	*C. caretta*	1
5-Aug-09	9:42	On Effort	30.032194	-80.543009	2	*C. caretta*	1
5-Aug-09	9:45	On Effort	30.032028	-80.643513	2	Uniden. turtle	1
5-Aug-09	9:45	On Effort	30.031985	-80.645809	2	Uniden. turtle	1
5-Aug-09	9:50	On Effort	30.099232	-80.663013	3	*C. caretta*	1
5-Aug-09	9:53	On Effort	30.101678	-80.543657	3	*C. caretta*	1
5-Aug-09	9:54	On Effort	30.101754	-80.532500	3	*C. caretta*	1
5-Aug-09	9:54	On Effort	30.100723	-80.516654	3	*C. caretta*	1
5-Aug-09	9:57	On Effort	30.100903	-80.412442	3	*C. caretta*	1
5-Aug-09	10:53	On Effort	30.230984	-80.681895	5	*C. caretta*	1
5-Aug-09	10:53	On Effort	30.230914	-80.664922	5	*C. caretta*	1
5-Aug-09	10:56	On Effort	30.232822	-80.582348	5	*C. caretta*	1
5-Aug-09	11:09	On Effort	30.232308	-80.100197	5	*C. caretta*	4
5-Aug-09	11:36	On Effort	30.299509	-80.446844	6	*C. caretta*	1
5-Aug-09	11:41	On Effort	30.300757	-80.636146	6	*C. caretta*	2
5-Aug-09	13:27	On Effort	30.365963	-80.508112	7	*C. caretta*	1

6-Aug-09	8:58	On Effort	29.962288	-80.569651	1	*C. caretta*	1
6-Aug-09	9:02	On Effort	29.965529	-80.419336	1	Uniden. turtle	1
6-Aug-09	9:58	On Effort	30.031892	-80.472325	2	*C. caretta*	1
6-Aug-09	10:01	On Effort	30.031778	-80.567179	2	Uniden. turtle	1
6-Aug-09	10:01	On Effort	30.029295	-80.602454	2	Uniden. turtle	1
6-Aug-09	10:11	On Effort	30.103335	-80.469843	3	*C. caretta*	1
6-Aug-09	10:13	On Effort	30.101228	-80.385927	3	*C. caretta*	1
6-Aug-09	10:13	On Effort	30.102396	-80.391621	3	Uniden. turtle	1
6-Aug-09	11:07	On Effort	30.164081	-80.348063	4	*C. caretta*	1
6-Aug-09	11:08	On Effort	30.162811	-80.369395	4	*C. caretta*	1
6-Aug-09	11:11	On Effort	30.163070	-80.492969	4	*C. caretta*	2
6-Aug-09	11:13	On Effort	30.170337	-80.604644	4	*C. caretta*	1
6-Aug-09	11:13	On Effort	30.171472	-80.578094	4	Uniden. turtle	1
6-Aug-09	11:25	On Effort	30.494894	-80.675080	9	*C. caretta*	1
6-Aug-09	11:26	On Effort	30.496165	-80.628339	9	Uniden. turtle	1
6-Aug-09	11:26	On Effort	30.496919	-80.667802	9	Uniden. turtle	1
6-Aug-09	11:26	On Effort	30.497821	-80.633398	9	Uniden. turtle	1
6-Aug-09	11:30	On Effort	30.501326	-80.510776	9	*C. caretta*	1
6-Aug-09	11:30	On Effort	30.503659	-80.474301	9	Uniden. turtle	1
6-Aug-09	11:35	On Effort	30.502688	-80.292746	9	Uniden. turtle	1
6-Aug-09	12:28	On Effort	30.565246	-80.502121	10	*C. caretta*	2
6-Aug-09	12:29	On Effort	30.564465	-80.537486	10	Uniden. turtle	1
6-Aug-09	12:30	On Effort	30.565472	-80.582332	10	*C. caretta*	3
6-Aug-09	12:30	On Effort	30.565444	-80.582338	10	*C. caretta*	1
6-Aug-09	12:31	On Effort	30.566159	-80.606290	10	*C. caretta*	2
6-Aug-09	12:32	On Effort	30.567010	-80.635041	10	*C. caretta*	1

Table 4. Effort for vessel surveys in the JAX USWTR site during August 2009.

Date	Line	Sea State	Kilometers Surveyed
14-Aug-09	6	2-4	61.9
16-Aug-09	8	2-3	85.3
18-Aug-09	5	3	34.4
19-Aug-09	7	1-3	81.5

Table 5. Cetacean and sea turtle sightings during vessel surveys in the JAX USWTR site during August 2009.

Date	Time	On/Off Effort	Latitude	Longitude	Line	Species	Group Size
16-Aug-09	9:58	Off effort	30.422987	-80.705815	8	*L. kempii*	1
16-Aug-09	10:08	On effort	30.425092	-80.699873	8	*S. frontalis*	5
16-Aug-09	10:31	On effort	30.427164	-80.634801	8	*D. coriacea*	1
16-Aug-09	10:54	On effort	30.427785	-80.563746	8	*C. caretta*	1
16-Aug-09	11:47	On effort	30.430309	-80.404033	8	*C. caretta*	1
18-Aug-09	11:23	On effort	30.285429	-80.348503	5	*C. caretta*	1
18-Aug-09	12:14	On effort	30.287930	-80.486021	5	*C. caretta*	1

18-Aug-09	12:15	On effort	30.288535	-80.488625	5	*C. caretta*	1
18-Aug-09	12:23	On effort	30.287994	-80.492955	5	*S. frontalis*	3
18-Aug-09	13:26	On effort	30.242230	-80.658233	5	*S. frontalis*	6
19-Aug-09	16:29	On effort	30.369685	-80.406607	7	*S. frontalis*	4
19-Aug-09	17:23	On effort	30.359725	-80.589176	7	*T. truncatus*	4

Approximately 80 hours of actual in field time was conducted in August 2009.

No injuries occurred during the reporting period.

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Planning (for Task 1, 2 & 3)
Co-PIs Johnston and McLellan and the JAX USWTR team, at the request of the Navy, planned a series of surveys to coincide with military exercises in the JAX USWTR study region during the week of September 14, 2009. This included coordinating with Navy personnel by phone and email to obtain event codes for each survey operation that would occur during the period. Event codes were provided by Ron Filipowicz (U.S. Fleet Forces Command) for aerial surveys during September 14-16 and 18, as well as for vessel surveys on September 17.

Purchasing (Task 1)
During this reporting period we purchased supplies to redeploy HARPs in the Onslow Bay and JAX USWTR study regions. A satellite phone for JAX (waited to purchase current model) and added minutes were purchased for Onslow. Monthly observer station bills were paid.

Travel (Task 1 & 3)
Co-PI David Johnston and post-doctoral fellow Melissa Soldevilla traveled to Fernandina Beach during Sept 14-17 to recover and redeploy 2 HARPs in the JAX USWTR Study region. Co-PI Johnston returned to Fernandina Beach during September 22-24 to redeploy the remaining JAX HARP. Ryan McAlarney and Erin Walters of the Onslow Bay USWTR team traveled to Fernandina Beach on September 17th 2009 to conduct aerial surveys on September 18th 2009. This movement of personnel was helpful given the late night return scheduled for vessel survey team on September 17th.

JAX Survey activity (Task 2)
Aerial Surveys
Three full sets (30 track lines) of tracklines were flown during September (Table 1). The survey plane, N1275M, arrived midday on 14 September and four tracklines were flown that afternoon. A full set of ten tracklines was flown on 15 September and six lines were flown 16 September. Another full set of lines were flown on 18 September. Weather conditions for the surveys were good with the exception of 14 September when conditions were fair. There were a total of 39 encounters with cetaceans during aerial survey effort. Species encountered during aerial surveys were *Stenella frontalis* (20 sightings), *Tursiops truncatus* (10 sightings), *Grampus griseus* (3 sightings), *Steno bredanensis* (1 sighting), and 5 sightings of unidentified delphinids (Table 2). September aerial surveys also yielded high numbers of sea turtle sightings (Table 3). *Caretta caretta* and *Dermochelys coriacea* were the most observed. In addition several unidentified sea turtles were observed and recorded. As in previous months, sea turtles were encountered predominantly in relatively shallow shelf waters on the nearshore

end of the track lines. Refer to Figure 1 for the location of cetacean sightings during aerial survey effort and Figure 2 for locations of sea turtle sightings.

Vessel Surveys

One full track line (9) was surveyed on 17 September. On 20 September tracklines 1and 2 were attempted; however, due to rain and increasing sea state only about 32 and 33 kilometers respectively were surveyed on the inshore portion of each line. A vessel survey was attempted on 9 September but was called off after engine trouble forced a return to the dock. Another survey was attempted the following day but increasing winds and sea state caused the vessel to turn back after about a two hour transit offshore. The *R/V Volute* (formerly *R/V 2 Angels*) was used for all survey effort (Table 4). There were five cetacean sightings and eight sea turtle sightings during vessel survey effort (Table 5). Cetacean sightings include *S. frontalis*, *G. griseus*, as well as two brief encounters with unidentified delphinids. Sea turtle sightings included seven *C. caretta* and one *D. coriacea* (Table 5). Cetacean and sea turtle sighting locations are plotted on Figure 3.

On 13 September two members of the Jacksonville USWTR team conducted off effort visual surveys from the *R/V Stellwagen* during the deployment of nine pop-up buoys on the JAX USWTR site. Visual surveys commenced at 7:30 and ended off of the study area at 19:30. Observation occurred primarily from the top of the wheelhouse except for brief periods inside the wheelhouse due to passing rain squalls. There were five cetacean sightings and no sea turtle sightings during the survey. Cetaceans seen were *S. frontalis*, *T. truncatus*, and one encounter with unidentified delphinids (Appendix 1).

Towed Passive Acoustics

On 17 and 20 September 2009 the towed acoustic array was deployed from the *R/V Volute.* On 17 September the array was deployed without dedicated acoustic monitoring. During periods of visual encounters with marine mammals the acoustic system was set to record mode for the entire duration of the encounter. Twenty-five minutes of recordings were acquired encompassing two sighting events, *S. frontalis* and *G. griseus*. On 20 September the array was deployed for a total of 4 hours and 36 minutes. This includes a 25 minute period where visual observation was not possible due to poor survey conditions. A total of 58 minutes of recordings were collected which included three sightings*, S. frontalis* and two unidentified delphinids.

JAX HARPs (Task 3)

Both HARPs deployed in the JAX USWTR study area were retrieved during September 15 and 16 from the *R/V Stellwagen*. Both recovered HARPs had full hard disks and appeared to have finished recording sometime on September 10th. One HARP was redeployed at the offshore location during this time (Figure 4). One of the recovered HARP units suffered a failure in a memory board sometime during the deployment. The data from this unit are being assessed by

Scripps scientists to determine if any data were lost. Because of this equipment failure, the second unit was not redeployed during September 15-16, but instead will be redeployed September 23 with a new memory board at the inshore location (Figure 4).

Onslow Bay Survey activity (Task 5)

Aerial Surveys

A single set of tracklines was completed on September 12th 2009 during a period of low Beaufort Sea State resulting in good survey conditions for most of the survey period (Table 6). A total of nine cetacean sightings were made consisting of five groups of *S. frontalis*, three sightings of *T. truncatus* and one group of animals where clear photographs could not be collected and are listed as unidentified delphinids (Figure 5, Table 7). Other sightings included 11 sea turtles, seven of which were identified as *C. caretta* (Figure 5, Table 8). The Onslow Bay USWTR team also assisted in aerial surveys in Jacksonville, FL flying six lines on September 18th 2009.

Vessel Surveys

Two track lines were completed on September 15th and September 16th 2009 on the *R/V Sensation* – a 53' sport fishing vessel (Table 9). Cetacean encounters consisted of four groups of *T. truncatus*. Additionally, two *C. caretta* were sighted (Table 10). The locations of cetaceans and turtles sighted during vessel surveys are presented in Figure 6.

Towed Passive Acoustics

The towed acoustic array was deployed from the *F/V Sensation* on the 15th of September 2009 for 5.0 hours of simultaneous visual and acoustic survey. During that time, a total of 1.9 hours of acoustic recordings were taken. Two visual sightings occurred during the acquisition of acoustic data; both were identified as *T. truncatus*. Numerous vocalizations including clicks, burst-pulses, and whistles were recorded. Two other acoustic detections were made that day without visual observation to confirm the species.

Onslow Bay HARPs (Task 6)

The HARP deployed in the Onslow Bay USWTR study area was retrieved on September 16th from the *R/V Cape Fear*. The recovered HARP had full hard disks and appeared to have finished recording on August 9th. Upon retrieval, damage was done to the hydrophone and so it was immediately shipped back to Scripps for repair. After doing a quick check of the data, it appears that the low frequency component of the hydrophone went bad sometime while writing to Disk 6, as a 2 kHz continuous tone was produced in all of the data from that point forward. Fortunately, we will be able to filter out this noise and still look for vocalizing odontocetes in the recorded data. As we are expecting our 2nd HARP for the Onslow Bay USWTR study area to be shipped sometime during the last two weeks of September, and since we also are waiting for a new CPU board (an upgraded one that will allow us to record for 6 months on a different duty cycle)

and a repaired hydrophone for our HARP we have currently, we plan on deploying both units at the same time in early October 2009.

Exercise Monitoring (Task 7)

A set of 9 pop-up acoustic recorders were deployed by Cornell University scientists for exercise monitoring purposes in the JAX USWTR study area during September 11-13, 2009 from the *R/V Stellwagen* (Figure 7). All 9 units were dropped without incident and they are slated for retrieval around the 6th of October. The array of 9 instruments was deployed to provide greatest coverage in the southern portion of the JAX USWTR box (Figure 7). Three pop-up units have enhanced sampling rate capabilities (32kHz) to record higher frequencies, two of which were deployed in the outer regions of the pop-up array in the JAX USWTR box (Figure 7). The last high frequency unit was deployed centrally in the pop-up array (Figure 7).

Table 1. Aerial survey effort for the JAX USWTR study region during Aug 24-Sept 23, 2009.

Date	Line	Sea State	Kilometers Flown	Hobbs Hours
14-Sep-09	10	3 to 4	86.1	3.2
14-Sep-09	9	3 to 4	85.7	
14-Sep-09	8	2 to 4	85.5	
14-Sep-09	7	2 to 4	86.2	
15-Sep-09	1	2 to 3	86.4	8
15-Sep-09	2	2 to 3	85.5	
15-Sep-09	3	1 to 3	84.8	
15-Sep-09	4	2	83.3	
15-Sep-09	5	2 to 3	85.7	
15-Sep-09	6	1 to 2	86.2	
15-Sep-09	7	1 to 2	87.7	
15-Sep-09	8	1 to 2	85.4	
15-Sep-09	9	1 to 2	85.4	
15-Sep-09	10	1 to 2	83.6	
16-Sep-09	1	1	87.0	6.4
16-Sep-09	2	1	89.2	
16-Sep-09	3	1	85.3	
16-Sep-09	4	1	83.3	
16-Sep-09	5	1 to 3	83.0	
16-Sep-09	6	1 to 2	84.4	
18-Sep-09	10	2 to 3	85.5	8.1
18-Sep-09	9	2 to 3	85.8	
18-Sep-09	8	2 to 3	84.5	
18-Sep-09	7	2 to 3	86.4	
18-Sep-09	6	2 to 3	87.0	
18-Sep-09	5	2	85.8	
18-Sep-09	4	2	84.6	
18-Sep-09	3	1 to 2	86.5	
18-Sep-09	2	1 to 2	85.3	
18-Sep-09	1	1 to 2	85.4	

Table 2. Cetacean sightings during aerial surveys in the JAX USWTR study region during Aug 24-Sept 23, 2009.

Date	Time	On/Off Effort	Latitute	Longitude	Track Number	Species	Group Size
14-Sep-09	12:51	On effort	30.502628	80.365528	9	*S. frontalis*	9
14-Sep-09	13:46	On effort	30.370925	-80.071616	7	Unidertified delphinids	4
15-Sep-09	9:57	On effort	29.962785	-79.982730	1	*T. truncatus*	3
15-Sep-09	10:40	On effort	30.028446	-80.584039	2	Unidertified delphinids	7
15-Sep-09	10:57	On effort	30.102567	-80.662731	3	*S. bredanensis*	50
15-Sep-09	11:56	On effort	30.155112	-80.468606	4	*S. frontalis*	45
15-Sep-09	12:27	On effort	30.235518	-80.357595	5	*S. frontalis*	36
15-Sep-09	13:13	On effort	30.302087	-80.586596	6	*S. frontalis*	10
15-Sep-09	15:21	On effort	30.358729	-80.501714	7	*S. frontalis*	6
15-Sep-09	16:17	On effort	30.429269	-80.558831	8	*T. truncatus*	2
15-Sep-09	16:32	On effort	30.492564	-80.550183	9	*T. truncatus*	8
15-Sep-09	17:12	On effort	30.571831	-80.067951	10	*G. griseus*	36
16-Sep-09	10:22	On effort	29.954849	-80.593794	1	*T. truncatus*	9
16-Sep-09	10:37	On effort	29.972613	-80.436649	1	*S. frontalis*	25
16-Sep-09	11:26	On effort	30.036121	-80.595111	2	*S. frontalis*	12
16-Sep-09	11:40	On effort	30.098577	-80.630170	3	*S. frontalis*	37
16-Sep-09	11:51	On effort	30.097543	-80.397718	3	*T. truncatus*	10
16-Sep-09	12:05	On effort	30.109295	-80.326179	3	*T. truncatus*	4
16-Sep-09	12:52	On effort	30.164620	-80.426851	4	*S. frontalis*	12
16-Sep-09	12:56	On effort	30.149300	-80.473643	4	*T. truncatus*	6
16-Sep-09	13:12	On effort	30.174440	-80.501961	4	*S. frontalis*	7
16-Sep-09	13:26	On effort	30.170953	-80.685147	4	*S. frontalis*	16
16-Sep-09	14:59	On effort	30.234286	-80.638299	5	Unidertified delphinids	11
16-Sep-09	15:18	On effort	30.223357	-80.357840	5	*S. frontalis*	23
16-Sep-09	15:42	On effort	30.303848	-79.787409	6	*G. griseus*	4
16-Sep-09	16:07	On effort	30.298897	-80.554275	6	*S. frontalis*	36
18-Sep-09	8:56	On effort	30.564918	-80.519281	10	*S. frontalis*	17
18-Sep-09	9:10	On effort	30.571772	-80.382930	10	*S. frontalis*	24
18-Sep-09	9:51	On effort	30.500495	-80.387744	9	*S. frontalis*	12
18-Sep-09	10:22	On effort	30.441061	-80.427384	8	*S. frontalis*	50
18-Sep-09	11:20	On effort	30.291406	-80.650391	6	Unidertified delphinids	2
18-Sep-09	12:19	On effort	30.238101	-80.415326	5	*T. truncatus*	16
18-Sep-09	14:33	On effort	30.160878	-80.563221	4	*S. frontalis*	5
18-Sep-09	14:38	On effort	30.168336	-80.505832	4	*T. truncatus*	5
18-Sep-09	15:29	On effort	30.100683	-80.694371	3	*S. frontalis*	7
18-Sep-09	15:41	On effort	30.032023	-80.699443	2	*T. truncatus*	15
18-Sep-09	15:52	On effort	30.039557	-80.636833	2	*T. truncatus*	4
18-Sep-09	16:10	On effort	30.026112	-80.183865	2	*G. griseus*	5
18-Sep-09	16:51	On effort	29.962245	-80.672895	1	Unidertified delphinids	5

Table 3. Sea turtle sightings during aerial surveys in the JAX USWTR study region during Aug 24-Sept 23, 2009.

Date	Time	On/Off Effort	Latitude	Longitude	Track Number	Species	Group Size
14-Sep-09	12:16	On effort	30.565153	-80.070534	10	*C. caretta*	1
14-Sep-09	14:16	On effort	30.365129	-80.600418	7	TURT	1
15-Sep-09	9:38	On effort	29.966616	-80.608965	1	*C. caretta*	1
15-Sep-09	9:38	On effort	29.966575	-80.612117	1	*C. caretta*	1
15-Sep-09	9:40	On effort	29.966192	-80.518688	1	*C. caretta*	1
15-Sep-09	10:29	On effort	30.033682	-80.363872	2	*C. caretta*	1
15-Sep-09	10:35	On effort	30.031333	-80.555969	2	*C. caretta*	1
15-Sep-09	11:13	On effort	30.101363	-80.512162	3	*C. caretta*	1
15-Sep-09	11:14	On effort	30.105616	-80.473886	3	TURT	1
15-Sep-09	11:18	On effort	30.104384	-80.337510	3	TURT	1
15-Sep-09	11:24	On effort	30.102473	-80.141565	3	*D. coriacea*	1
15-Sep-09	11:54	On effort	30.162316	-80.437389	4	*C. caretta*	1
15-Sep-09	12:16	On effort	30.232158	-80.649082	5	*C. caretta*	1
15-Sep-09	12:20	On effort	30.233227	-80.522898	5	*C. caretta*	1
15-Sep-09	12:24	On effort	30.231676	-80.388550	5	*C. caretta*	1
15-Sep-09	12:24	On effort	30.231731	-80.386280	5	*C. caretta*	1
15-Sep-09	12:25	On effort	30.232784	-80.363975	5	*C. caretta*	1
15-Sep-09	13:07	On effort	30.300245	-80.436785	6	*C. caretta*	2
15-Sep-09	15:18	On effort	30.365265	-80.567799	7	*C. caretta*	1
15-Sep-09	15:18	On effort	30.365213	-80.565675	7	*C. caretta*	1
15-Sep-09	15:19	On effort	30.365253	-80.547139	7	*D. coriacea*	1
15-Sep-09	15:31	On effort	30.365664	-80.459110	7	TURT	1
15-Sep-09	15:32	On effort	30.365124	-80.418794	7	*C. caretta*	1
15-Sep-09	15:32	On effort	30.364638	-80.394295	7	*C. caretta*	1
15-Sep-09	15:32	On effort	30.364985	-80.411069	7	*C. caretta*	1
15-Sep-09	15:35	On effort	30.364647	-80.307711	7	*D. coriacea*	1
15-Sep-09	15:40	On effort	30.362933	-80.223799	7	*D. coriacea*	1
15-Sep-09	15:43	On effort	30.366484	-80.114936	7	*D. coriacea*	1
15-Sep-09	16:07	On effort	30.431987	-80.319924	8	*D. coriacea*	1
15-Sep-09	16:10	On effort	30.433524	-80.427422	8	*D. coriacea*	1
15-Sep-09	16:10	On effort	30.433175	-80.401972	8	TURT	1
15-Sep-09	16:29	On effort	30.496631	-80.605218	9	*C. caretta*	1
15-Sep-09	16:41	On effort	30.501491	-80.458835	9	*C. caretta*	1
15-Sep-09	16:44	On effort	30.501598	-80.331004	9	*D. coriacea*	1
15-Sep-09	16:53	On effort	30.499167	-80.131070	9	*D. coriacea*	1
15-Sep-09	17:10	On effort	30.570570	-80.041129	10	*D. coriacea*	1
15-Sep-09	17:25	On effort	30.566566	-80.132323	10	TURT	1
15-Sep-09	17:32	On effort	30.551724	-80.335036	10	TURT	1
15-Sep-09	17:40	On effort	30.547411	-80.633760	10	*C. caretta*	1
15-Sep-09	17:41	On effort	30.547037	-80.677651	10	TURT	1
16-Sep-09	10:18	On effort	29.962952	-80.679307	1	*C. caretta*	1
16-Sep-09	10:19	On effort	29.963136	-80.640004	1	*C. caretta*	1
16-Sep-09	10:32	On effort	29.964361	-80.527422	1	*C. caretta*	1
16-Sep-09	10:33	On effort	29.963691	-80.482406	1	*C. caretta*	3
16-Sep-09	10:34	On effort	29.963633	-80.442474	1	*C. caretta*	1
16-Sep-09	10:35	On effort	29.964026	-80.427463	1	*D. coriacea*	1

16-Sep-09	10:42	On effort	29.965542	-80.386811	1	*C. caretta*	4
16-Sep-09	10:43	On effort	29.965225	-80.349425	1	*C. caretta*	1
16-Sep-09	10:45	On effort	29.964320	-80.274704	1	*C. caretta*	1
16-Sep-09	10:47	On effort	29.966112	-80.189186	1	*D. coriacea*	1
16-Sep-09	11:16	On effort	30.033119	-80.293579	2	*C. caretta*	1
16-Sep-09	11:18	On effort	30.033457	-80.352897	2	*C. caretta*	2
16-Sep-09	11:19	On effort	30.032924	-80.396245	2	*C. caretta*	1
16-Sep-09	11:19	On effort	30.032525	-80.403183	2	*D. coriacea*	1
16-Sep-09	11:20	On effort	30.032091	-80.424508	2	*C. caretta*	1
16-Sep-09	11:20	On effort	30.031687	-80.436201	2	*C. caretta*	3
16-Sep-09	11:21	On effort	30.031317	-80.452960	2	*C. caretta*	1
16-Sep-09	11:22	On effort	30.030559	-80.494821	2	*D. coriacea*	1
16-Sep-09	11:23	On effort	30.030109	-80.526666	2	*C. caretta*	1
16-Sep-09	11:24	On effort	30.031128	-80.575448	2	*C. caretta*	1
16-Sep-09	11:24	On effort	30.031034	-80.566742	2	*C. caretta*	1
16-Sep-09	11:25	On effort	30.031977	-80.595213	2	*D. coriacea*	1
16-Sep-09	11:32	On effort	30.033978	-80.627837	2	*C. caretta*	1
16-Sep-09	11:34	On effort	30.029878	-80.702953	2	*C. caretta*	1
16-Sep-09	11:39	On effort	30.098525	-80.629402	3	*C. caretta*	1
16-Sep-09	11:49	On effort	30.100532	-80.442080	3	*C. caretta*	1
16-Sep-09	11:50	On effort	30.100228	-80.409473	3	*C. caretta*	1
16-Sep-09	12:31	On effort	30.100315	-79.800106	3	*C. caretta*	1
16-Sep-09	12:49	On effort	30.168093	-80.357524	4	*C. caretta*	1
16-Sep-09	12:51	On effort	30.165650	-80.433371	4	*C. caretta*	1
16-Sep-09	12:55	On effort	30.162456	-80.458258	4	*C. caretta*	3
16-Sep-09	15:09	On effort	30.234530	-80.529314	5	*C. caretta*	3
16-Sep-09	15:09	On effort	30.234497	-80.529988	5	*C. caretta*	1
16-Sep-09	15:10	On effort	30.237682	-80.470385	5	*C. caretta*	3
16-Sep-09	15:10	On effort	30.236559	-80.490840	5	*C. caretta*	2
16-Sep-09	15:11	On effort	30.236684	-80.438196	5	*C. caretta*	2
16-Sep-09	15:11	On effort	30.237844	-80.457926	5	*C. caretta*	3
16-Sep-09	15:17	On effort	30.233124	-80.355071	5	*C. caretta*	2
16-Sep-09	15:17	On effort	30.233735	-80.371003	5	*C. caretta*	2
16-Sep-09	15:26	On effort	30.231630	-80.244055	5	*C. caretta*	1
16-Sep-09	15:33	On effort	30.231419	-79.996132	5	*D. coriacea*	1
16-Sep-09	16:03	On effort	30.296087	-80.461053	6	*C. caretta*	2
16-Sep-09	16:03	On effort	30.296061	-80.461976	6	*D. coriacea*	1
16-Sep-09	16:06	On effort	30.300613	-80.565902	6	*D. coriacea*	1
16-Sep-09	16:14	On effort	30.296617	-80.649919	6	*C. caretta*	1
16-Sep-09	16:14	On effort	30.299006	-80.619675	6	TURT	1
18-Sep-09	8:51	On effort	30.561739	-80.661433	10	*C. caretta*	1
18-Sep-09	9:43	On effort	30.501625	-80.113564	9	TURT	1
18-Sep-09	10:04	On effort	30.499988	-80.464967	9	*C. caretta*	1
18-Sep-09	10:10	On effort	30.496916	-80.695673	9	TURT	1
18-Sep-09	10:14	On effort	30.434453	-80.661408	8	*D. coriacea*	1
18-Sep-09	10:15	On effort	30.431682	-80.608594	8	*C. caretta*	1
18-Sep-09	10:16	On effort	30.430317	-80.584241	8	*D. coriacea*	1

18-Sep-09	10:18	On effort	30.437069	-80.533298	8	*C. caretta*	1
18-Sep-09	10:20	On effort	30.43425	-80.460581	8	*C. caretta*	1
18-Sep-09	10:33	On effort	30.433431	-80.318742	8	*C. caretta*	1
18-Sep-09	10:33	On effort	30.433761	-80.342940	8	TURT	1
18-Sep-09	10:38	On effort	30.432652	-80.158687	8	*C. caretta*	1
18-Sep-09	10:39	On effort	30.432713	-80.128712	8	*D. coriacea*	1
18-Sep-09	11:07	On effort	30.364844	-80.42939	7	*C. caretta*	1
18-Sep-09	11:09	On effort	30.366865	-80.511661	7	*C. caretta*	1
18-Sep-09	11:13	On effort	30.366308	-80.651260	7	TURT	1
18-Sep-09	11:15	On effort	30.365529	-80.703672	7	*C. caretta*	1
18-Sep-09	11:38	On effort	30.297314	-80.608639	6	*C. caretta*	1
18-Sep-09	11:40	On effort	30.298683	-80.533877	6	*C. caretta*	1
18-Sep-09	11:41	On effort	30.300876	-80.486997	6	TURT	1
18-Sep-09	11:43	On effort	30.300722	-80.430700	6	*C. caretta*	1
18-Sep-09	11:45	On effort	30.299695	-80.340926	6	*C. caretta*	1
18-Sep-09	12:13	On effort	30.23175	-80.209874	5	*D. coriacea*	1
18-Sep-09	12:14	On effort	30.231522	-80.281195	5	*C. caretta*	1
18-Sep-09	12:17	On effort	30.232775	-80.379031	5	*C. caretta*	1
18-Sep-09	12:36	On effort	30.234353	-80.519232	5	*C. caretta*	1
18-Sep-09	14:26	On effort	30.165496	-80.683391	4	*C. caretta*	1
18-Sep-09	14:27	On effort	30.164268	-80.639883	4	*C. caretta*	1
18-Sep-09	14:27	On effort	30.164437	-80.658348	4	*C. caretta*	2
18-Sep-09	14:28	On effort	30.163966	-80.626539	4	TURT	2
18-Sep-09	14:29	On effort	30.162705	-80.591365	4	*C. caretta*	2
18-Sep-09	14:29	On effort	30.162814	-80.596902	4	*C. caretta*	1
18-Sep-09	14:36	On effort	30.166013	-80.532243	4	*C. caretta*	2
18-Sep-09	14:37	On effort	30.165299	-80.524536	4	*C. caretta*	2
18-Sep-09	14:42	On effort	30.167596	-80.431073	4	*C. caretta*	5
18-Sep-09	14:42	On effort	30.167280	-80.424156	4	*C. caretta*	3
18-Sep-09	14:44	On effort	30.164391	-80.358584	4	*C. caretta*	1
18-Sep-09	14:44	On effort	30.164822	-80.363408	4	*D. coriacea*	1
18-Sep-09	14:45	On effort	30.166106	-80.330274	4	*C. caretta*	2
18-Sep-09	14:45	On effort	30.166101	-80.329726	4	TURT	1
18-Sep-09	15:20	On effort	30.101937	-80.460164	3	TURT	1
18-Sep-09	15:21	On effort	30.101097	-80.502033	3	TURT	1
18-Sep-09	15:21	On effort	30.102618	-80.529827	3	TURT	1
18-Sep-09	15:22	On effort	30.101020	-80.546629	3	*C. caretta*	1
18-Sep-09	15:22	On effort	30.100280	-80.569734	3	*C. caretta*	1
18-Sep-09	15:24	On effort	30.097174	-80.610830	3	*C. caretta*	1
18-Sep-09	15:25	On effort	30.098737	-80.649298	3	*C. caretta*	1
18-Sep-09	15:46	On effort	30.032513	-80.645667	2	TURT	1
18-Sep-09	15:57	On effort	30.029878	-80.578983	2	*C. caretta*	1
18-Sep-09	15:58	On effort	30.029101	-80.558675	2	TURT	1
18-Sep-09	15:59	On effort	30.030705	-80.501454	2	*D. coriacea*	1
18-Sep-09	16:02	On effort	30.035378	-80.394552	2	*C. caretta*	1
18-Sep-09	16:04	On effort	30.034808	-80.346286	2	*C. caretta*	1
18-Sep-09	16:40	On effort	29.964603	-80.366836	1	*D. coriacea*	1

18-Sep-09	16:41	On effort	29.964455	-80.388545	1	*C. caretta*	1
18-Sep-09	16:42	On effort	29.963596	-80.428651	1	*C. caretta*	1
18-Sep-09	16:42	On effort	29.964730	-80.454091	1	TURT	1
18-Sep-09	16:44	On effort	29.964234	-80.527287	1	*C. caretta*	1
18-Sep-09	16:45	On effort	29.963995	-80.566872	1	TURT	1
18-Sep-09	16:46	On effort	29.960694	-80.608005	1	*C. caretta*	1
18-Sep-09	16:46	On effort	29.962595	-80.590207	1	*C. caretta*	1
18-Sep-09	16:47	On effort	29.960179	-80.624267	1	*C. caretta*	1
18-Sep-09	16:48	On effort	29.961944	-80.678821	1	TURT	2

Table 4. Effort for vessel surveys in the JAX USWTR study region during Aug 24-Sept 23, 2009.

Date	Line	Sea State	Kilometers surveyed
17-Sep-09	9	2 to 3	80.4
20-Sep-09	2	2 to 3	33.3
20-Sep-09	1	2 to 3	32.4

Table 5. Cetacean and sea turtle sightings during vessel surveys in the JAX USWTR site during Aug 24-Sept 23, 2009.

Date	Time	On/Off Effort	Latitude	Longitude	Line	Species	Group Size
17-Sep-09	10:44	On effort	30.506465	-80.607440	9	*S. frontalis*	2
17-Sep-09	12:44	On effort	30.506844	-80.237128	9	*C. caretta*	1
17-Sep-09	12:53	On effort	30.505059	-80.210338	9	*C. caretta*	1
17-Sep-09	13:10	On effort	30.506082	-80.157305	9	*D. coriacea*	1
17-Sep-09	14:03	On effort	30.506904	-80.012645	9	*G. griseus*	35
20-Sep-09	11:41	On effort	30.015321	-80.598513	2	*S. frontalis*	4
20-Sep-09	11:43	Off effort	30.016014	-80.594325	2	*C. caretta*	1
20-Sep-09	11:56	On effort	30.017311	-80.552788	2	Unidentified delphinids	1
20-Sep-09	12:07	On effort	30.017009	-80.522811	2	*C. caretta*	1
20-Sep-09	12:10	Off effort	30.018587	-80.513920	2	*C. caretta*	1
20-Sep-09	13:05	On effort	30.021941	-80.364973	2	*C. caretta*	1
20-Sep-09	15:10	On effort	29.967412	-80.586441	1	Unidentified delphinids	2
20-Sep-09	15:40	On effort	29.968891	-80.678701	1	C. caretta	1

Table 6. Aerial survey effort for the Onslow Bay USWTR study region during Aug 24-Sept 23, 2009.

Date	Line	Sea State	Kilometers Flown	Hobbs Hours
12-Sep-09	1	2 to 3	70.2	7.3
12-Sep-09	2	2 to 3	72.7	
12-Sep-09	3	2 to 3	74.3	
12-Sep-09	4	2 to 3	74.8	
12-Sep-09	5	2 to 3	74.5	
12-Sep-09	6	2	73.1	
12-Sep-09	10	2	72.5	
12-Sep-09	9	2	73.0	
12-Sep-09	8	2	68.2	
12-Sep-09	7	2	74.7	

Table7. Cetacean sightings during aerial surveys in the Onslow Bay USWTR study region during Aug 24-Sept 23, 2009.

Date	Time	On/Off Effort	Latitute	Longitude	Track Number	Species	Group Size
12-Sep-09	9:08	On	33.494854	-76.785000	1	Unidentified delphinids	3
12-Sep-09	9:51	On	33.811053	-77.063150	2	*S. frontalis*	7
12-Sep-09	10:50	On	33.943367	-76.958318	4	*S. frontalis*	12
12-Sep-09	11:29	On	33.681102	-76.350511	6	*T. truncatus*	1
12-Sep-09	11:36	On	33.705709	-76.415980	6	*T. truncatus*	3
12-Sep-09	14:08	On	34.173510	-76.478967	10	*S. frontalis*	14
12-Sep-09	15:03	On	34.164627	-76.722763	8	*S. frontalis*	4
12-Sep-09	15:14	On	34.110018	-76.648676	8	*S. frontalis*	4
12-Sep-09	15:35	On	33.788579	-76.219790	8	*T. truncatus*	19

Table 8. Sea turtle sightings during aerial surveys in the Onslow Bay USWTR study region during Aug 24-Sept 23, 2009.

Date	Time	On/Off Effort	Latitude	Longitude	Track Number	Species	Group Size
12-Sep-09	8:47	On	33.742486	-77.106245	1	*C. caretta*	1
12-Sep-09	10:02	On	33.859967	-77.118067	2	*C. caretta*	1
12-Sep-09	10:15	On	33.698725	-76.779526	3	*C. caretta*	1
12-Sep-09	11:01	On	33.994148	-76.908442	5	*C. caretta*	1
12-Sep-09	11:48	On	33.877798	-76.623473	6	TURT	1
12-Sep-09	11:52	On	33.973903	-76.750209	6	TURT	1
12-Sep-09	14:01	On	34.265715	-76.593059	10	TURT	1
12-Sep-09	14:50	On	34.061652	-76.474511	9	TURT	1
12-Sep-09	14:54	On	34.139652	-76.576097	9	*C. caretta*	1
12-Sep-09	15:11	On	34.122552	-76.674267	8	*C. caretta*	1
12-Sep-09	15:32	On	33.811576	-76.267942	8	*C. caretta*	1

Table 9. Effort for vessel surveys in the Onslow Bay USWTR study region during Aug 24-Sept 23, 2009.

Date	Line	Sea State	Kilometers Surveyed
15-Sep-09	8	0 to 3	64.4
16-Sep-09	6	2 to 3	62.8

Table 10. Cetacean and sea turtle sightings during vessel surveys in the Onslow Bay USWTR study region during Aug 24-Sept 23, 2009.

Date	Time	On/Off Effort	Latitute	Longitude	Track Number	Species	Group Size
15-Sep-09	10:17	On	33.80749	-76.26993	8	*T.truncatus*	5
15-Sep-09	10:43	Off	33.81972	-76.28296	8	*T.truncatus*	9
15-Sep-09	13:25	Off	34.06463	-76.60540	8	*C. caretta*	1
15-Sep-09	14:04	Off	34.12994	-76.68276	8	*C. caretta*	1
16-Sep-09	10:26	On	33.71166	-76.40773	6	*T.truncatus*	15
16-Sep-09	11:04	Off	33.74195	-76.44634	6	*T.truncatus*	9

Figure 1. The locations of cetaceans sighted during aerial surveys of the JAX USWTR study region during Aug 24-Sept 23, 2009.

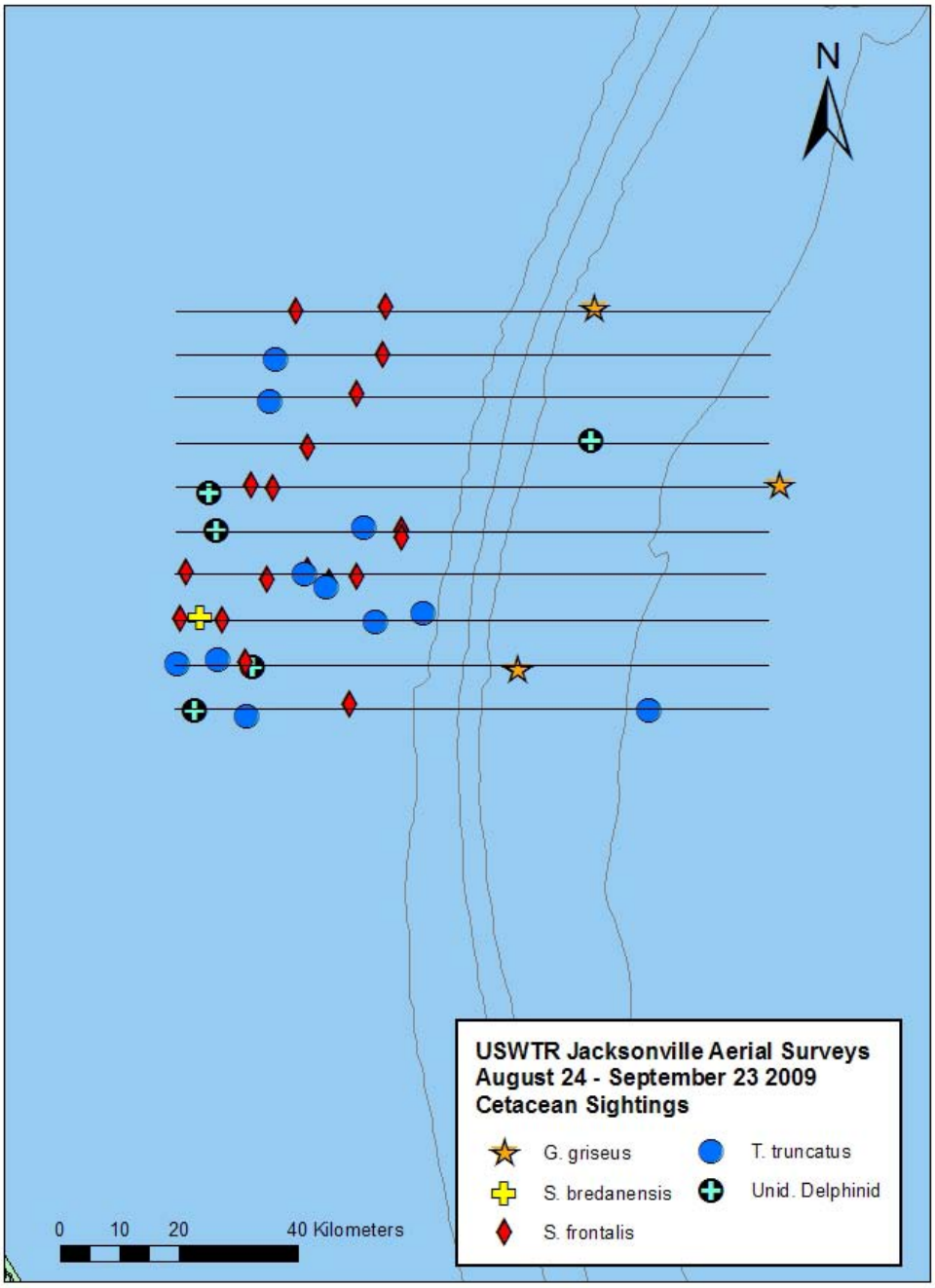


Figure 2. The locations of sea turtles sighted during aerial surveys of the JAX USWTR study region during Aug 24-Sept 23, 2009.

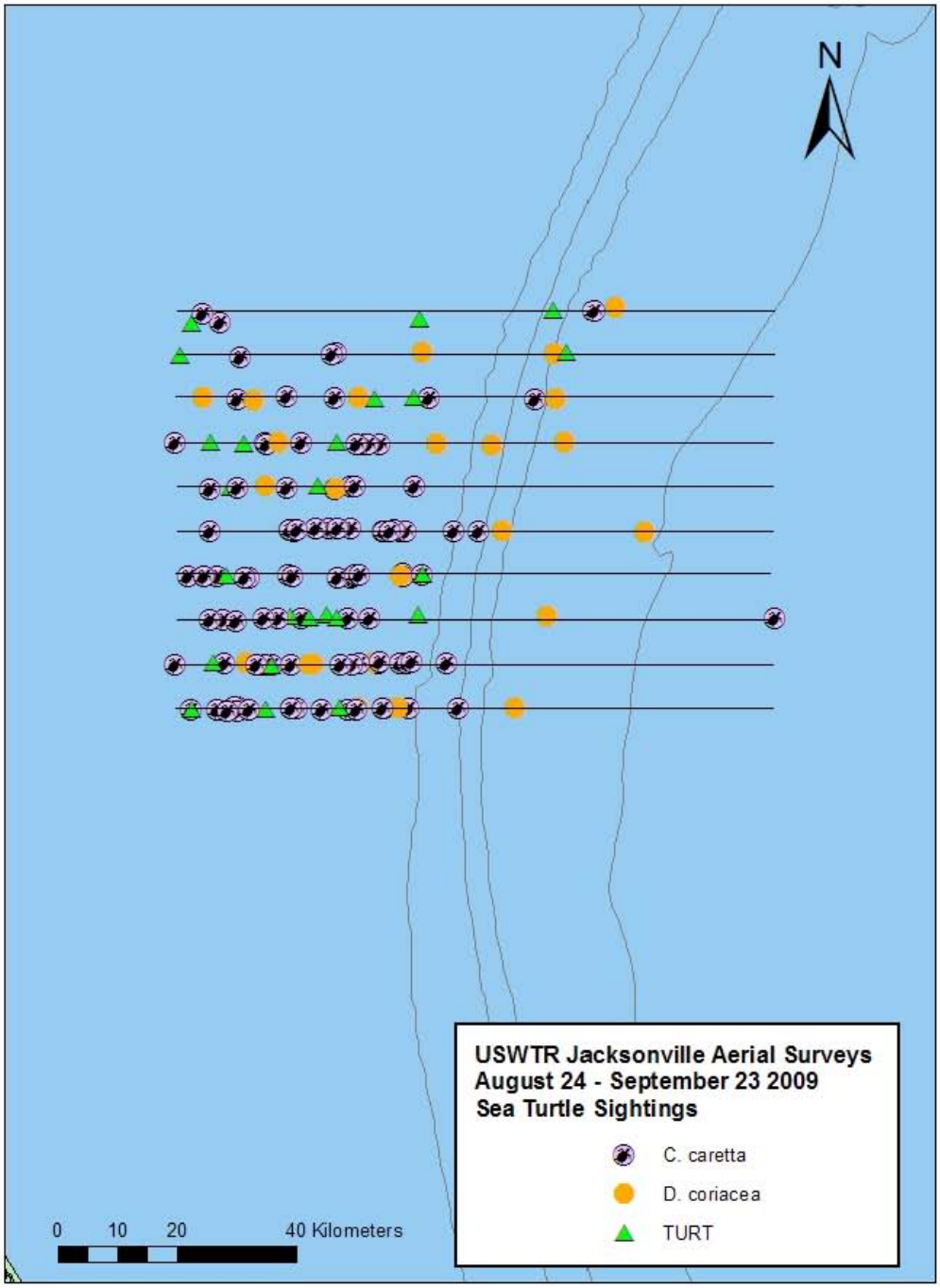


Figure 3. The locations of cetaceans and turtles sighted during vessel surveys of the JAX USWTR study region during Aug 24-Sept 23, 2009.

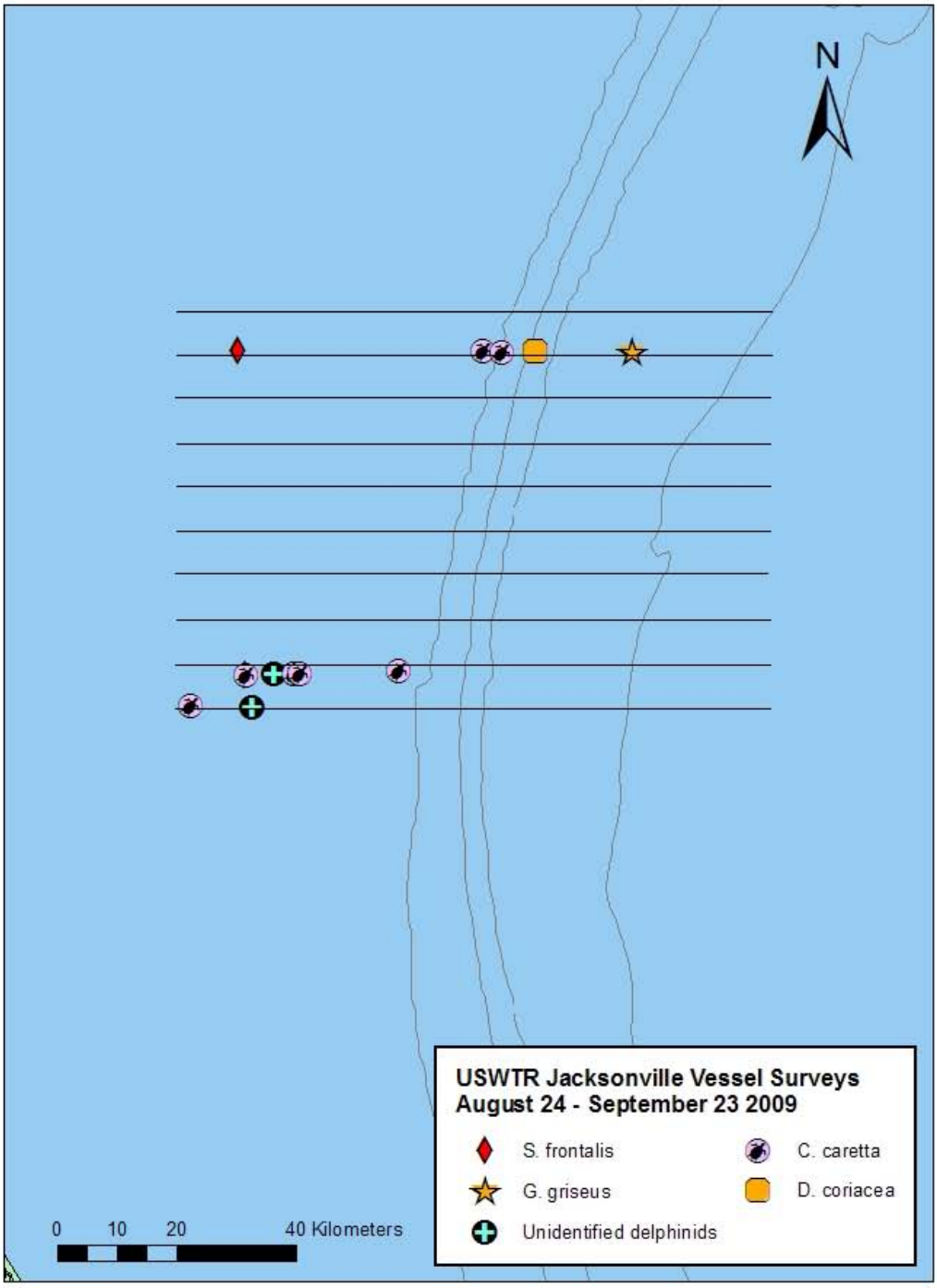


Figure 4. Location of HARP redeployments in JAX USWTR study region during Aug 24-Sept 23, 2009.

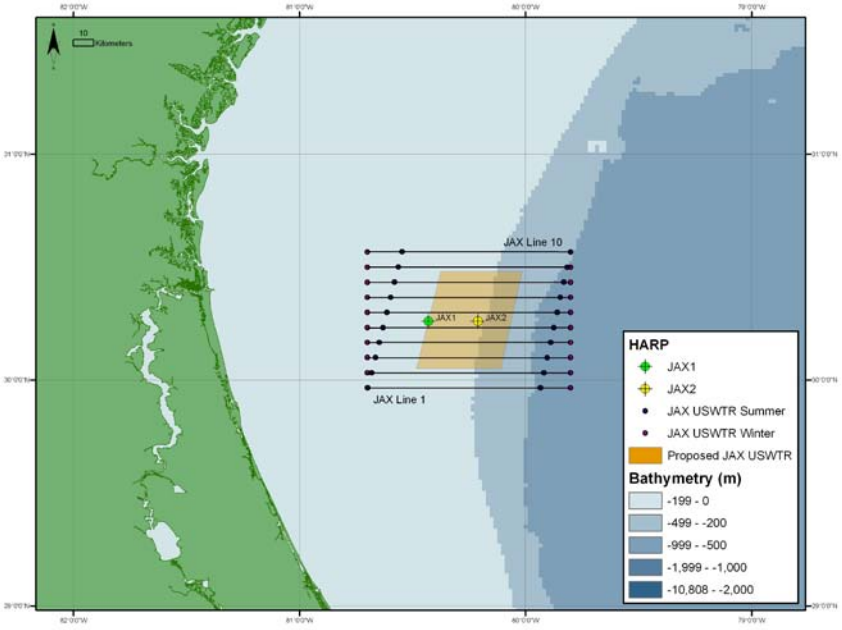


Figure 5. The locations of cetaceans and turtles sighted during aerial surveys of the Onslow USWTR study region during Aug 24-Sept 23, 2009.

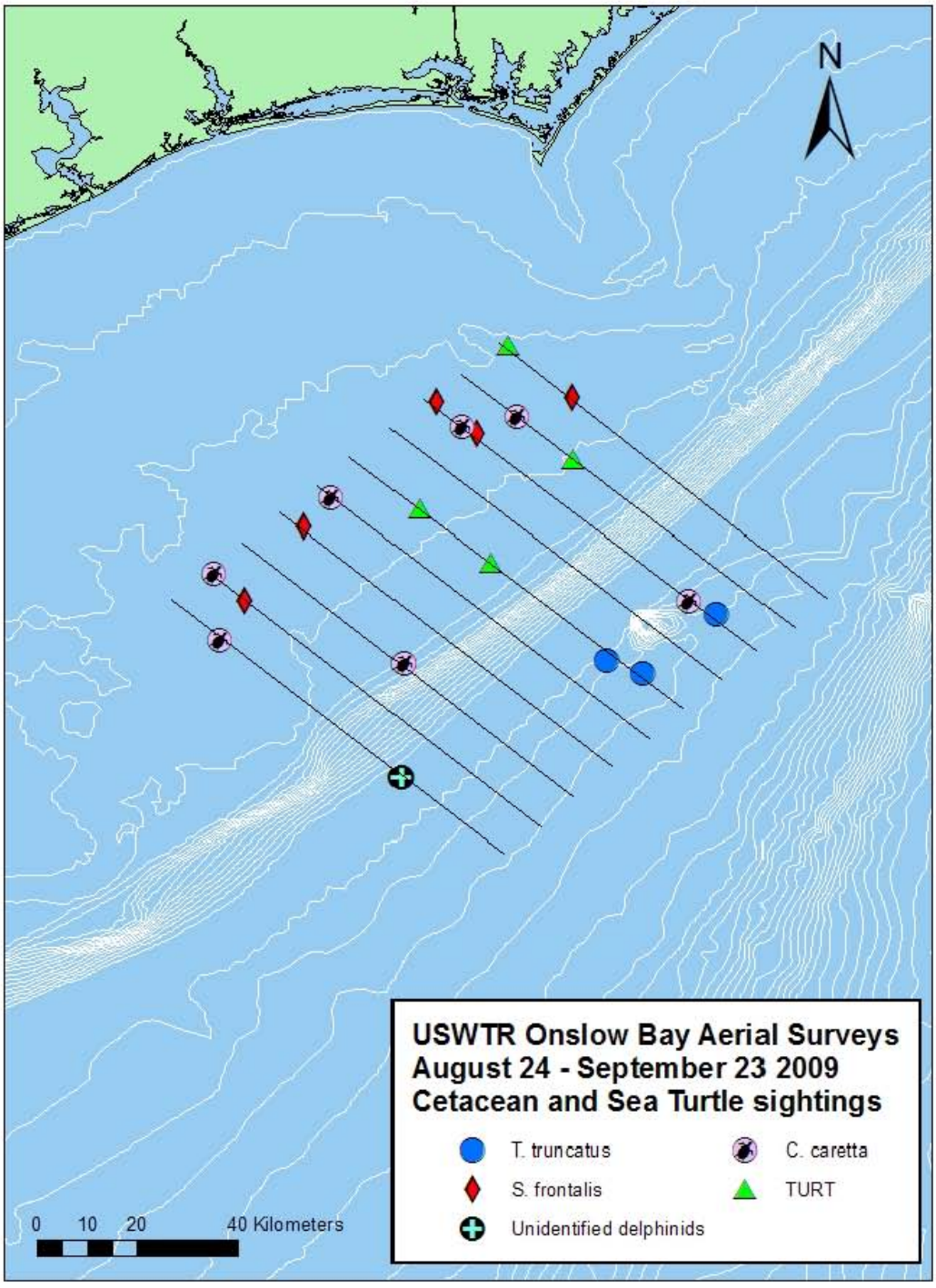


Figure 6. The locations of cetaceans and turtles sighted during vessel surveys of the Onslow Bay USWTR study region during Aug 24-Sept 23, 2009.

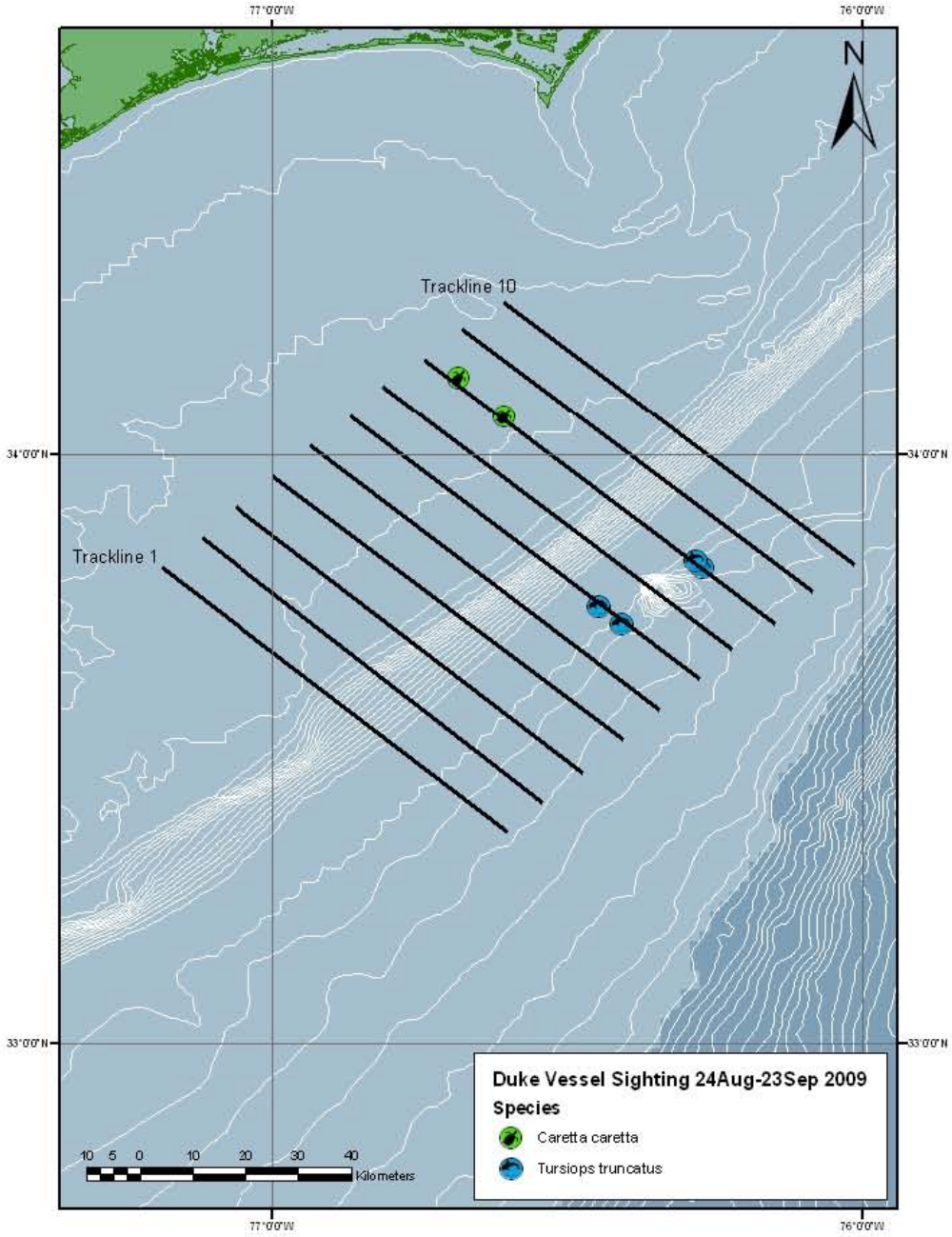
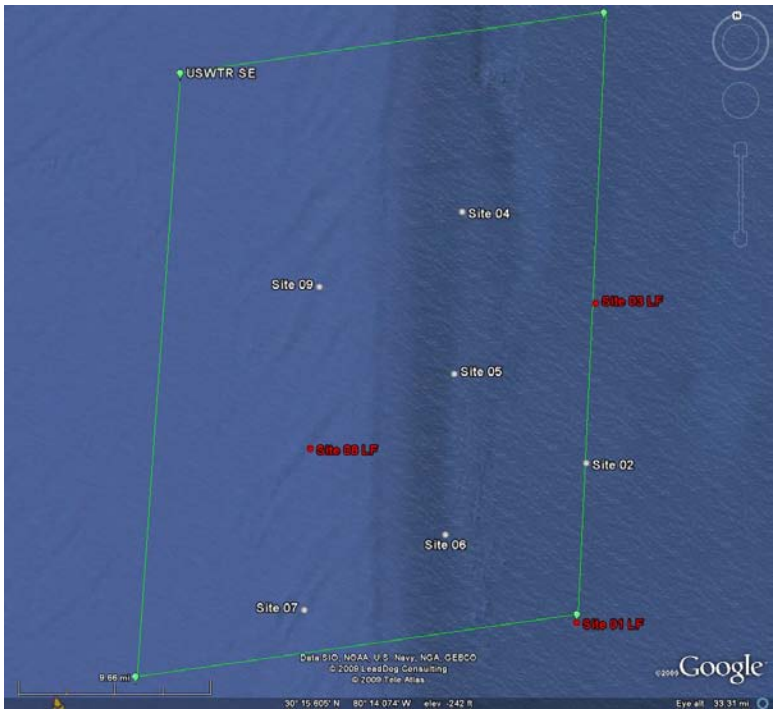


Figure 7. Locations of pop-up acoustic recorders deployed during exercise monitoring in the JAX USWTR study region during Aug 24-Sept 23, 2009.



Appendix 1. Pop-up deployment on *R/V Stellwagen* off effort sightings on September 13, 2009.

Date	Time	On/Off Effort	Latitude	Longitude	Line	Species	Group Size
13-Sep-09	9:21	Off Effort	30.280952	-80.056225	N/A	*T. truncatus*	4
13-Sep-09	15:47	Off Effort	30.326319	-80.304850	N/A	*S. frontalis*	3
13-Sep-09	17:11	Off Effort	30.405833	-80.510833	N/A	Unidentified delphinids	2
13-Sep-09	17:26	Off Effort	30.413401	-80.532626	N/A	*S. frontalis*	3
13-Sep-09	19:04	Off Effort	30.498930	-80.778985	N/A	*S. frontalis*	10

Monitoring of Protected Species in the Proposed Onslow Bay and Jacksonville USWTRs
Progress Report: September 24 through October 23, 2009

Planning (Task 1, 2 & 3)
Project Co-PI Johnston and postdoctoral fellow Soldevilla began planning the recovery and redeployment of both JAX HARPs for early January. This includes refining the protocol used for a single recovery and redeployment cruise, and establishing methods to address the significant biofouling that occurs at this location.

Purchasing (Task 1)
The final pieces of JAX oceanographic survey equipment were purchased and installed during this reporting period. Funding for aerial survey vendor has been extended through Feb 2010. JAX housing and utilities were paid for this month.

Travel (Task 1 & 3)
Peter Nilsson and Ryan McAlarney had support for travel to the Marine Mammal Society meetings in Quebec City, Canada and presented results of the aerial and vessel surveys conducted in Onslow Bay from June 2007 through March 2009.

JAX Survey activity (Task 2)

Aerial Surveys
Aerial surveys were conducted on 30 September and 1 October, with all ten tracklines attempted each day. Weather conditions during survey effort were fair to good (Table 1). Due to aircraft carrier flight exercises in the survey area, four lines were truncated to avoid interference. There were 11 cetacean encounters each day for a total of 22 sightings. *Stenella frontalis* was observed 17 times, *Grampus griseus* two times, *Tursiops truncatus* twice, along with a pod of unidentified delphinids (Table 2; Figure 1). Sea turtles were plentiful on the USWTR range during this survey period. *Caretta caretta* was the most prevalent species, accounting for 79 of the 97 sightings. *Dermochelys coriacea* was spotted on 13 instances, as well as five turtles that could not be identified definitively (Table 3; Figure 2).

Vessel Surveys
Vessel surveys were conducted on 26 September, 4 October, and 6 October onboard the *R/V Volute*. Tracklines 4 and 3 were surveyed for the entire length of the line with good weather conditions; trackline 1 was cut short by approximately 22 kilometers due to concerns over deteriorating weather conditions (Table 4). There were ten encounters with delphinids during vessel surveys while on effort, along with nine sightings of turtles (Table 5; Figure 3). Four of the delphinid sightings were of *T. truncatus* and three were of *S. frontalis*. The remaining sightings were delphinids that could not be identified. Nine *C. caretta* were seen during survey effort for this reporting period. Cetacean and marine turtle sightings are illustrated in Figure 3. On 26 September, following the conclusion of a west to east survey of trackline 4, two separate pods of *Globicephala macrorhynchus* were observed during the transit back to shore. This is a new species to the

Jacksonville USWTR site. These animals were photographed extensively, both for species and individual identification.

Towed Passive Acoustics

On 4 and 6 October 2009 the towed acoustic array was deployed from the *R/V Volute* during visual survey effort. There were 24 acoustic files recorded on 4 October totaling 114 minutes. These recordings encompass five visual sighting events, including *T. truncatus, S. frontalis*, and three sightings of unidentified delphinids. Twenty acoustic files were obtained on 6 October totaling 71 minutes of recordings. These recording spanned three visual sighting events including two sightings of *T. truncatus* and one sighting of *S.frontalis*. Vessel surveys were conducted on 26 September; however, no acoustic survey was conducted due to technical problems with the generator powering the system.

JAX HARPs (Task 3)

Both JAX HARPs are deployed and recording data.

Onslow Bay Survey activity (Task 5)

Aerial Surveys

A total of four survey days were flown in the Onslow Bay USWTR range during the September 24 to October 23 reporting period (Table 6). On September 30th six lines were flown under fair survey conditions and resulted in one on effort *T. truncatus* sighting and 3 sea turtle sightings. On October 1st a full set of 10 tracklines were flown in good survey conditions, which resulted in 11 cetacean sightings (6 *T. truncatus* and 5 *S. frontalis*) and 12 turtle sightings including two leatherbacks (*D. coriacea*). An additional 6 tracklines were flown on October 2nd under similar survey conditions, which resulted in one on effort sighting of T. truncatus, and four sea turtles (including another leatherback). In addition, two off effort sightings were made of *T.truncatus* between the offshore ends of tracklines 3 and 4. For our final survey day on October 21st we began our survey effort on the offshore end of our trackline 10. This allowed us to conduct an off effort transit survey both to and from the range covering the west side of Cape Lookout Shoals. During the morning transit survey we encountered a group of pilot whales *G. macrorhynchus* and a sperm whale *P. macrocephalus* just north of the offshore end of trackline 10. Beginning and final location were obtained as well as photographs for the pilot whale sighting. The sperm whale's initial location was taken after the animal dove and was not resighted. These sightings, while off effort, represent the first visual detection of a sperm whale near the Onslow Bay USWTR range and first time pilot whales were detected outside of the summer months. The remaining 4 tracklines were conducted which resulting in 5 on effort cetacean sightings (4 *T. truncatus* and 1 *S. frontalis*) and 17 sea turtle sightings. The locations of sightings from aerial surveys are presented in Tables 7 and 8 and Figure 4. A total of 20 tracklines were flown in this reporting period fulfilling the contract requirements.

Vessel Surveys

Three track lines were surveyed on September 24th, October 1st, October 22nd 2009 on the *R/V Sensation*, a 53' sport fishing vessel (Table 9). Cetacean encounters consisted of six groups of bottlenose dolphins (*Tursiops truncatus*), three groups of spotted dolphins (*Stenella frontalis*), and one group which was either bottlenose or spotted dolphins (could not be identified to species; Table 10). Five loggerhead sea turtles (*Caretta caretta*) also were sighted (Table 10). The locations of cetaceans and sea turtles sighted during vessel surveys are presented in Figure 5.

Towed Passive Acoustics

The towed acoustic array was deployed from the *F/V Sensation* on the 24th of September, 2009, for 4.5 hours of simultaneous visual and acoustic survey. During that time, a total of 2.6 hours of acoustic recordings were taken. One visual sighting occurred during the acquisition of acoustic data; the group was identified as *Tursiops truncatus*. Numerous vocalizations including clicks and whistles were recorded. Three other acoustic detections were made that day without visual observation to confirm the species. The towed array also was deployed from the F/V Sensation on the 22nd of October, 2009, for 4.6 hours of simultaneous visual and acoustic survey. During that time, a total of 1.3 hours of acoustic recordings were taken. Four visual sightings (one off-effort, three on-effort) occurred during the acquisition of acoustic data; two groups were identified as *Tursiops truncatus* and two groups were not identified. Numerous vocalizations including clicks, burst-pulses, and whistles were recorded.

Onslow Bay HARPs (Task 6)

On 7 October, we received the repaired hydrophone from our 1st HARP. We also received the 2nd HARP for Onslow Bay. We successfully performed the week-long test recommended by Scripps to ensure the new instrument would write to multiple disks. We are now waiting on a new CPU board for the 1st HARP so that it can remain in the field for longer durations. Once this new board arrives, we will deploy both HARPs as soon as the weather is favorable.

Exercise Monitoring (Task 7)

All nine Cornell pop-up buoys were recovered on October 8, 2009 using the R/V Volute.

Table 1. Aerial survey effort table for the JAX USWTR study region during Sept 24-Oct 23 2009

Date	Line	Sea State	Kilometers Flown	Hobbs Hours
30-Sep-09	1	2 to 3	62.9	7.3
30-Sep-09	2	2 to 3	81.9	
30-Sep-09	3	2 to 3	81.3	
30-Sep-09	4	2 to 3	82.6	
30-Sep-09	5	2 to 3	84.9	
30-Sep-09	6	2 to 3	88.0	
30-Sep-09	7	2 to 3	86.0	
30-Sep-09	8	2 to 3	62.1	
30-Sep-09	10	2 to 3	85.1	
30-Sep-09	9	2 to 3	48.7	
1-Oct-09	10	2 to 4	52.1	7.6
1-Oct-09	9	1 to 3	84.1	
1-Oct-09	8	1 to 3	82.6	
1-Oct-09	7	1 to 2	85.8	
1-Oct-09	6	1 to 2	84.9	
1-Oct-09	5	1	87.2	
1-Oct-09	4	1 to 2	85.6	
1-Oct-09	3	1 to 3	86.2	
1-Oct-09	2	1 to 3	86.6	
1-Oct-09	1	1 to 3	86.5	

Table 2. Cetacean sightings during aerial surveys in the JAX USWTR study region during Sept 24-Oct 23 2009.

Date	Time	On/Off Effort	Latitude	Longitude	Track Number	Species	Group Size
30-Sep-09	9:12	On effort	29.960539	-80.492943	1	*S. frontalis*	5
30-Sep-09	10:00	On effort	30.034495	-80.412547	2	*S. frontalis*	10
30-Sep-09	10:19	On effort	30.109130	-80.676868	3	*S. frontalis*	12
30-Sep-09	10:33	On effort	30.095493	-80.448507	3	*S. frontalis*	5
30-Sep-09	10:40	On effort	30.089326	-80.407715	3	*S. frontalis*	24
30-Sep-09	11:06	On effort	30.169024	-80.034752	4	Unid. Del.	5
30-Sep-09	11:27	On effort	30.163869	-80.607505	4	*S. frontalis*	4
30-Sep-09	11:36	On effort	30.162798	-80.684799	4	*S. frontalis*	5
30-Sep-09	11:48	On effort	30.240264	-80.626807	5	*S. frontalis*	9
30-Sep-09	14:55	On effort	30.443106	-80.010302	8	*G. griseus*	28
30-Sep-09	15:36	On effort	30.568879	-80.340131	10	*S. frontalis*	9
1-Oct-09	9:35	On effort	30.499122	-80.404954	9	*S. frontalis*	4
1-Oct-09	9:58	On effort	30.441838	-80.454912	8	*S. frontalis*	25
1-Oct-09	10:08	On effort	30.429398	-80.324880	8	*S. frontalis*	6
1-Oct-09	10:18	On effort	30.424412	-80.257176	8	*S. frontalis*	12
1-Oct-09	11:09	On effort	30.295678	-80.592304	6	*S. frontalis*	6
1-Oct-09	11:48	On effort	30.237722	-80.092674	5	*G. griseus*	4
1-Oct-09	12:08	On effort	30.234899	-80.674308	5	*S. frontalis*	9
1-Oct-09	13:56	On effort	30.152214	-80.695794	4	*S. frontalis*	6
1-Oct-09	14:04	On effort	30.163510	-80.562485	4	*T. truncatus*	10
1-Oct-09	14:34	On effort	30.169987	-79.828164	4	*T. truncatus*	40
1-Oct-09	15:13	On effort	30.110079	-80.682445	3	*S. frontalis*	4

Table 3. Sea turtle sightings during aerial surveys in the JAX USWTR study region during Sept 24-Oct 23 2009.

Date	Time	On/Off Effort	Latitude	Longitude	Track Number	Species	Group Size
30-Sep-09	9:06	On effort	29.966193	-80.637225	1	*C. caretta*	1
30-Sep-09	9:21	On effort	29.963353	-80.462160	1	*C. caretta*	1
30-Sep-09	9:22	On effort	29.966223	-80.423800	1	*C. caretta*	1
30-Sep-09	9:23	On effort	29.964584	-80.374881	1	*C. caretta*	1
30-Sep-09	9:24	On effort	29.961044	-80.334684	1	*C. caretta*	1
30-Sep-09	10:14	On effort	30.032227	-80.658381	2	Unid. turtle	1
30-Sep-09	10:26	On effort	30.098697	-80.639585	3	*C. caretta*	1
30-Sep-09	10:27	On effort	30.099154	-80.616774	3	*C. caretta*	1
30-Sep-09	10:28	On effort	30.099107	-80.567206	3	Unid. turtle	1
30-Sep-09	10:30	On effort	30.100864	-80.510610	3	*C. caretta*	1
30-Sep-09	10:31	On effort	30.101734	-80.460286	3	Unid. turtle	1
30-Sep-09	10:43	On effort	30.097530	-80.324259	3	*C. caretta*	2
30-Sep-09	11:15	On effort	30.168170	-80.239718	4	Unid. turtle	1
30-Sep-09	11:16	On effort	30.167334	-80.266921	4	*C. caretta*	1
30-Sep-09	11:19	On effort	30.168613	-80.378134	4	*C. caretta*	1
30-Sep-09	11:20	On effort	30.168124	-80.428213	4	*C. caretta*	1
30-Sep-09	11:20	On effort	30.168394	-80.420473	4	*C. caretta*	1
30-Sep-09	11:20	On effort	30.167662	-80.439326	4	*C. caretta*	1
30-Sep-09	11:21	On effort	30.166365	-80.466601	4	*C. caretta*	1
30-Sep-09	11:46	On effort	30.231798	-80.681592	5	*D. coriacea*	1
30-Sep-09	11:54	On effort	30.229693	-80.555072	5	*C. caretta*	2
30-Sep-09	11:54	On effort	30.229963	-80.522791	5	*C. caretta*	2
30-Sep-09	11:54	On effort	30.229693	-80.530337	5	Unid. turtle	1
30-Sep-09	12:34	On effort	30.299750	-80.489402	6	*C. caretta*	1
30-Sep-09	12:37	On effort	30.299627	-80.583138	6	*C. caretta*	1
30-Sep-09	12:38	On effort	30.299259	-80.638597	6	*C. caretta*	1
30-Sep-09	14:24	On effort	30.365876	-80.608795	7	*C. caretta*	1
30-Sep-09	15:25	On effort	30.567214	-80.685050	10	*C. caretta*	1
30-Sep-09	15:27	On effort	30.566844	-80.615918	10	*C. caretta*	1
30-Sep-09	15:29	On effort	30.564384	-80.559871	10	*C. caretta*	1
30-Sep-09	15:30	On effort	30.563252	-80.522808	10	*C. caretta*	1
30-Sep-09	15:40	On effort	30.570568	-80.279988	10	*C. caretta*	1
1-Oct-09	8:56	On effort	30.566280	-80.412261	10	*C. caretta*	1
1-Oct-09	8:59	On effort	30.566459	-80.315808	10	*C. caretta*	1
1-Oct-09	9:18	On effort	30.501690	-80.036327	9	*C. caretta*	1
1-Oct-09	9:21	On effort	30.498908	-80.147221	9	*C. caretta*	1
1-Oct-09	9:25	On effort	30.501110	-80.293383	9	*C. caretta*	2
1-Oct-09	9:26	On effort	30.500256	-80.324201	9	*C. caretta*	1
1-Oct-09	9:28	On effort	30.498443	-80.389524	9	*C. caretta*	1

1-Oct-09	9:51	On effort	30.433829	-80.626541	8	*C. caretta*	1
1-Oct-09	10:03	On effort	30.433167	-80.407868	8	*C. caretta*	1
1-Oct-09	10:51	On effort	30.365082	-80.310985	7	*C. caretta*	1
1-Oct-09	10:51	On effort	30.365015	-80.320297	7	*C. caretta*	2
1-Oct-09	10:56	On effort	30.366736	-80.494618	7	*C. caretta*	1
1-Oct-09	10:57	On effort	30.367452	-80.556508	7	*C. caretta*	1
1-Oct-09	10:58	On effort	30.367006	-80.561171	7	*C. caretta*	1
1-Oct-09	10:58	On effort	30.363842	-80.597710	7	*D. coriacea*	1
1-Oct-09	11:00	On effort	30.360800	-80.648262	7	*D. coriacea*	1
1-Oct-09	11:17	On effort	30.296286	-80.512807	6	*C. caretta*	1
1-Oct-09	11:21	On effort	30.297207	-80.357373	6	*C. caretta*	1
1-Oct-09	11:22	On effort	30.297206	-80.340285	6	*C. caretta*	1
1-Oct-09	11:44	On effort	30.233482	-80.020490	5	*C. caretta*	1
1-Oct-09	11:58	On effort	30.231068	-80.377144	5	*C. caretta*	1
1-Oct-09	12:01	On effort	30.234393	-80.492413	5	*C. caretta*	1
1-Oct-09	12:04	On effort	30.232671	-80.590933	5	*C. caretta*	1
1-Oct-09	12:05	On effort	30.232120	-80.629150	5	*C. caretta*	1
1-Oct-09	12:05	On effort	30.232097	-80.651418	5	*C. caretta*	2
1-Oct-09	12:05	On effort	30.232225	-80.619627	5	*D. coriacea*	1
1-Oct-09	12:12	On effort	30.234498	-80.693697	5	*D. coriacea*	1
1-Oct-09	14:01	On effort	30.165305	-80.590182	4	*C. caretta*	2
1-Oct-09	14:10	On effort	30.165406	-80.535760	4	*C. caretta*	1
1-Oct-09	14:11	On effort	30.166143	-80.513385	4	*C. caretta*	1
1-Oct-09	14:11	On effort	30.166431	-80.495764	4	*C. caretta*	1
1-Oct-09	14:13	On effort	30.166979	-80.446214	4	*D. coriacea*	1
1-Oct-09	14:16	On effort	30.162858	-80.399396	4	*C. caretta*	2
1-Oct-09	14:58	On effort	30.100513	-80.283820	3	*C. caretta*	1
1-Oct-09	15:04	On effort	30.101708	-80.482805	3	*C. caretta*	1
1-Oct-09	15:04	On effort	30.101724	-80.481887	3	*C. caretta*	1
1-Oct-09	15:05	On effort	30.101996	-80.502765	3	*C. caretta*	1
1-Oct-09	15:06	On effort	30.102238	-80.553790	3	*C. caretta*	1
1-Oct-09	15:08	On effort	30.101718	-80.615030	3	*D. coriacea*	1
1-Oct-09	15:09	On effort	30.101755	-80.635778	3	*C. caretta*	2
1-Oct-09	15:20	On effort	30.031617	-80.664644	2	*C. caretta*	4
1-Oct-09	15:20	On effort	30.031704	-80.650425	2	*D. coriacea*	1
1-Oct-09	15:21	On effort	30.031577	-80.617114	2	*D. coriacea*	1
1-Oct-09	15:22	On effort	30.029015	-80.561634	2	*D. coriacea*	1
1-Oct-09	15:23	On effort	30.028819	-80.539874	2	*C. caretta*	1
1-Oct-09	15:26	On effort	30.031049	-80.432883	2	*D. coriacea*	1
1-Oct-09	15:28	On effort	30.031237	-80.374363	2	*D. coriacea*	1
1-Oct-09	15:30	On effort	30.032029	-80.280653	2	*C. caretta*	1
1-Oct-09	15:33	On effort	30.031802	-80.192395	2	*C. caretta*	1
1-Oct-09	16:05	On effort	29.966803	-80.486004	1	*C. caretta*	1
1-Oct-09	16:06	On effort	29.967737	-80.528164	1	*C. caretta*	1

1-Oct-09	16:08	On effort	29.964699	-80.609571	1	*C. caretta*	1
1-Oct-09	16:09	On effort	29.963225	-80.651804	1	*D. coriacea*	1

Table 4. Effort table for vessel surveys in the JAX USWTR study region during Sept 24-Oct 23 2009.

Date	Line	Sea State	Kilometers Surveyed
26-Sep-09	4	1 to 2	81.27
4-Oct-09	3	1 to 2	81.23
6-Oct-09	1	2	59.09

Table 5. Cetacean and sea turtle sightings during vessel surveys in the JAX USWTR site during Sept 24-Oct 23 2009.

Date	Time	On/Off Effort	Latitude	Longitude	Track Number	Species	Group Size
26-Sep-09	10:39	On effort	30.1617	-80.6161	4	*S. frontalis*	6
26-Sep-09	12:31	On effort	30.1604	-80.3184	4	*T. truncatus*	20
26-Sep-09	15:24	Off effort	30.1821	-79.9550	N/A	*G. macrorhynchus*	35
26-Sep-09	16:06	Off effort	30.2083	-80.0240	N/A	*G. macrorhynchus*	50
04-Oct-09	14:43	On effort	30.0989	-80.0296	3	*T. truncatus*	9
04-Oct-09	16:23	On effort	30.0992	-80.3258	3	*S. frontalis*	3
04-Oct-09	16:40	On effort	30.1014	-80.3508	3	Unid. delphinid	2
04-Oct-09	16:50	On effort	30.1013	-80.3734	3	Unid. delphinid	1
04-Oct-09	17:18	On effort	30.1048	-80.4644	3	*C. caretta*	1
04-Oct-09	17:32	On effort	30.1040	-80.5146	3	*C. caretta*	1
04-Oct-09	17:46	On effort	30.1020	-80.5615	3	*C. caretta*	1
04-Oct-09	17:55	On effort	30.1011	-80.5900	3	*C. caretta*	1
04-Oct-09	18:01	On effort	30.1007	-80.6107	3	*C. caretta*	1
04-Oct-09	18:04	On effort	30.1011	-80.6214	3	*C. caretta*	1
04-Oct-09	18:05	On effort	30.1012	-80.6240	3	*C. caretta*	2
04-Oct-09	18:13	On effort	30.1016	-80.6508	3	*C. caretta*	1
04-Oct-09	18:16	On effort	30.1005	-80.6633	3	*C. caretta*	1
04-Oct-09	18:20	On effort	30.0991	-80.6759	3	Unid. delphinid	2
06-Oct-09	11:08	On effort	29.9668	-80.5550	1	*T. truncatus*	2
06-Oct-09	11:35	On effort	29.9679	-80.4651	1	S. frontalis	1
06-Oct-09	12:02	On effort	29.9686	-80.4094	1	*T. truncatus*	1

Table 6. Aerial survey effort table for the Onslow Bay USWTR study region during Sept 24-Oct 23 2009.

Date	Line	Sea State	Kilometers Flown	Hobbs Hours
30-Sep-09	5	3 to 4	73.6	4.0
30-Sep-09	6	3 to 4	73.6	
30-Sep-09	7	3 to 4	74.2	
30-Sep-09	8	3 to 4	76.4	
30-Sep-09	9	3 to 4	73.5	
30-Sep-09	10	3 to 4	74.0	
1-Oct-09	5	2 to 3	75.1	8.4
1-Oct-09	6	2 to 3	74.3	
1-Oct-09	7	2 to 3	73.2	
1-Oct-09	8	2 to 3	71.7	
1-Oct-09	9	2 to 3	72.7	
1-Oct-09	10	2 to 3	72.1	
1-Oct-09	1	2 to 3	73.6	
1-Oct-09	2	2 to 3	74.2	
1-Oct-09	3	2 to 3	72.4	
1-Oct-09	4	2 to 3	76.9	
2-Oct-09	1	2 to 3	74.0	4.0
2-Oct-09	2	2 to 3	73.6	
2-Oct-09	3	2 to 3	74.7	
2-Oct-09	4	2 to 3	72.4	
2-Oct-09	5	2 to 3	74.4	
2-Oct-09	6	2 to 3	73.5	
21-Oct-09	10	2 to 3	73.4	5.0
21-Oct-09	9	2 to 3	73	
21-Oct-09	8	2 to 3	71.7	
21-Oct-09	7	2 to 3	73.1	

Table 7. Cetacean sightings during aerial surveys in the Onslow Bay USWTR study region during Sept 24-Oct 23 2009.

Date	Time	On/Off Effort	Latitute	Longitude	Track Number	Species	Group Size
30-Sep-09	14:15	On	33.881552	-76.244972	9	*T. truncatus*	43
1-Oct-09	8:42	On	33.739176	-76.572540	5	*T. truncatus*	4
1-Oct-09	8:56	On	33.724444	-76.555044	5	*T. truncatus*	8
1-Oct-09	9:45	On	34.076573	-76.766611	7	*S. frontalis*	20
1-Oct-09	10:14	On	33.827829	-76.418514	7	*T. truncatus*	15
1-Oct-09	10:24	On	33.740108	-76.312358	7	*T. truncatus*	6
1-Oct-09	11:01	On	33.972348	-76.473672	8	*T. truncatus*	2
1-Oct-09	11:11	On	34.042681	-76.555923	8	*S. frontalis*	6
1-Oct-09	11:29	On	34.150825	-76.699600	8	*S. frontalis*	9
1-Oct-09	12:29	On	34.209822	-76.525553	10	*S. frontalis*	27
1-Oct-09	14:29	On	33.765256	-77.127123	1	*S. frontalis*	4
1-Oct-09	15:42	On	33.596687	-76.664434	3	*T. truncatus*	19
2-Oct-09	9:50	Off	33.475239	-76.447250	offshore 3 & 4	*T. truncatus*	11
2-Oct-09	10:01	Off	33.504595	-76.392273	offshore 3 & 4	*T. truncatus*	8
2-Oct-09	10:07	On	33.535099	-76.421927	4	*T. truncatus*	15
21-Oct-09	11:08	Off	33.823938	-75.995138	offshore 10	*P. macrocephalus*	1
21-Oct-09	11:08	Off	33.823938	-75.995138	offshore 10	*G. macrorhynchus*	12
21-Oct-09	11:32	On	33.932099	-76.176954	10	*T. truncatus*	6
21-Oct-09	12:37	On	33.756576	-76.181401	8	*T. truncatus*	2
21-Oct-09	12:43	On	33.829105	-76.279533	8	*T. truncatus*	40
21-Oct-09	13:02	On	34.079645	-76.624388	8	*S. frontalis*	4
21-Oct-09	13:47	On	33.720393	-76.290826	7	*T. truncatus*	12

Table 8. Sea turtle sightings during aerial surveys in the Onslow Bay USWTR study region during Sept 24-Oct 23 2009.

Date	Time	On/Off Effort	Latitude	Longitude	Track Number	Species	Group Size
30-Sep-09	12:15	On	33.898165	-76.779545	5	*C. caretta*	1
30-Sep-09	12:40	On	33.727209	-76.421946	6	*C. caretta*	1
30-Sep-09	13:48	On	34.144996	-76.707060	8	*C. caretta*	1
1-Oct-09	8:33	On	33.884291	-76.761412	5	*C. caretta*	1
1-Oct-09	10:06	On	33.954023	-76.583867	7	Unid. Turtle	1
1-Oct-09	10:20	On	33.791158	-76.371512	7	Unid. Turtle	1
1-Oct-09	10:47	On	33.797331	-76.249619	8	*D. coriacea*	1
1-Oct-09	10:59	On	33.967964	-76.469564	8	*C. caretta*	1
1-Oct-09	11:58	On	33.889715	-76.246905	9	Unid. Turtle	1
1-Oct-09	12:25	On	34.158049	-76.456182	10	*C. caretta*	1
1-Oct-09	12:25	On	34.163205	-76.462239	10	*C. caretta*	1
1-Oct-09	14:44	On	33.674688	-77.017042	1	*C. caretta*	1
1-Oct-09	0.616	On	33.610435	-76.929048	1	*C. caretta*	1
1-Oct-09	0.633	On	33.616420	-76.806435	2	*D. coriacea*	1
1-Oct-09	0.639	On	33.790268	-77.028675	2	*C. caretta*	1
2-Oct-09	9:04	On	33.671246	-76.878142	2	*C. caretta*	1
2-Oct-09	9:19	On	33.852473	-76.983985	3	*C. caretta*	1
2-Oct-09	9:34	On	33.556246	-76.601330	3	*D. coriacea*	1
2-Oct-09	10:25	On	33.842027	-76.836401	4	*C. caretta*	1
21-Oct-09	11:54	On	34.196512	-76.512789	10	Unid. Turtle	1
21-Oct-09	11:56	On	34.229434	-76.555606	10	Unid. Turtle	2
21-Oct-09	12:03	On	34.173013	-76.617934	9	*C. caretta*	1
21-Oct-09	12:57	On	34.001956	-76.520666	8	Unid. Turtle	1
21-Oct-09	13:15	On	34.097636	-76.770540	7	*C. caretta*	1
21-Oct-09	13:16	On	34.066873	-76.730287	7	Unid. Turtle	1
21-Oct-09	13:23	On	33.936095	-76.558414	7	Unid. Turtle	1
21-Oct-09	11:58	On	34.271778	-76.611080	10	Unid. Turtle	1
21-Oct-09	12:02	On	34.187579	-76.638317	9	*C. caretta*	1
21-Oct-09	12:04	On	34.158849	-76.598833	9	*C. caretta*	1
21-Oct-09	12:04	On	34.145489	-76.581990	9	*C. caretta*	1
21-Oct-09	12:05	On	34.121615	-76.550240	9	Unid. Turtle	2
21-Oct-09	12:58	On	34.032365	-76.560665	8	*C. caretta*	1
21-Oct-09	13:09	On	34.125001	-76.682664	8	Unid. Turtle	1
21-Oct-09	13:10	On	34.153882	-76.720640	8	*C. caretta*	4
21-Oct-09	13:15	On	34.099198	-76.772674	7	*C. caretta*	1
21-Oct-09	13:17	On	34.058683	-76.719290	7	Unid. Turtle	1

Table 9. Effort table for vessel surveys in the Onslow Bay USWTR study region during Sept 24-Oct 23 2009.

Date	Line	Sea State	Kilometers Surveyed
24-Sep-09	10	1	74.08
01-Oct-09	7	1 to 3	74.08
22-Oct-09	9	2 to 3	74.08

Table 10. Cetacean and sea turtle sightings during vessel surveys in the Onslow Bay USWTR study region during Sept 24-Oct 23 2009.

Date	Line	On/Off Effort	Time	Latitude	Longitude	Species	Group Size
24-Sep-09	10	On Effort	11:08:38	33.982849	-76.235503	*T. truncatus*	10
24-Sep-09	10	On Effort	12:46:20	34.123636	-76.424480	*C. caretta*	1
01-Oct-09	7	On Effort	9:32:23	33.664432	-76.229127	*T. truncatus*	5
01-Oct-09	7	On Effort	9:32:23	33.664432	-76.229127	*T. truncatus*	5
01-Oct-09	7	On Effort	11:35:54	33.854490	-76.452732	*T. truncatus*	42
01-Oct-09	7	On Effort	12:41:32	33.923188	-76.540281	*S. frontalis*	103
01-Oct-09	7	On Effort	13:35:16	33.984940	-76.623289	*S. frontalis*	6
01-Oct-09	7	On Effort	14:34:44	34.057646	-76.743284	*S. frontalis*	15
22-Oct-09	9	Off Effort	9:54:20	33.797799	-76.129716	*T. truncatus*	2
22-Oct-09	9	On Effort	13:09:45	34.112597	-76.537091	*C. caretta*	1
22-Oct-09	9	On Effort	13:16:45	34.124536	-76.558528	*C. caretta*	1
22-Oct-09	9	On Effort	13:04:11	34.098492	-76.529773	*C. caretta*	1
22-Oct-09	9	On Effort	13:18:23	34.130950	-76.562160	*C. caretta*	1
22-Oct-09	9	On Effort	13:44:54	34.186433	-76.639441	*T. truncatus or S. frontalis*	1
22-Oct-09	9	On Effort	14:00:34	34.202096	-76.654138	*T. truncatus*	1

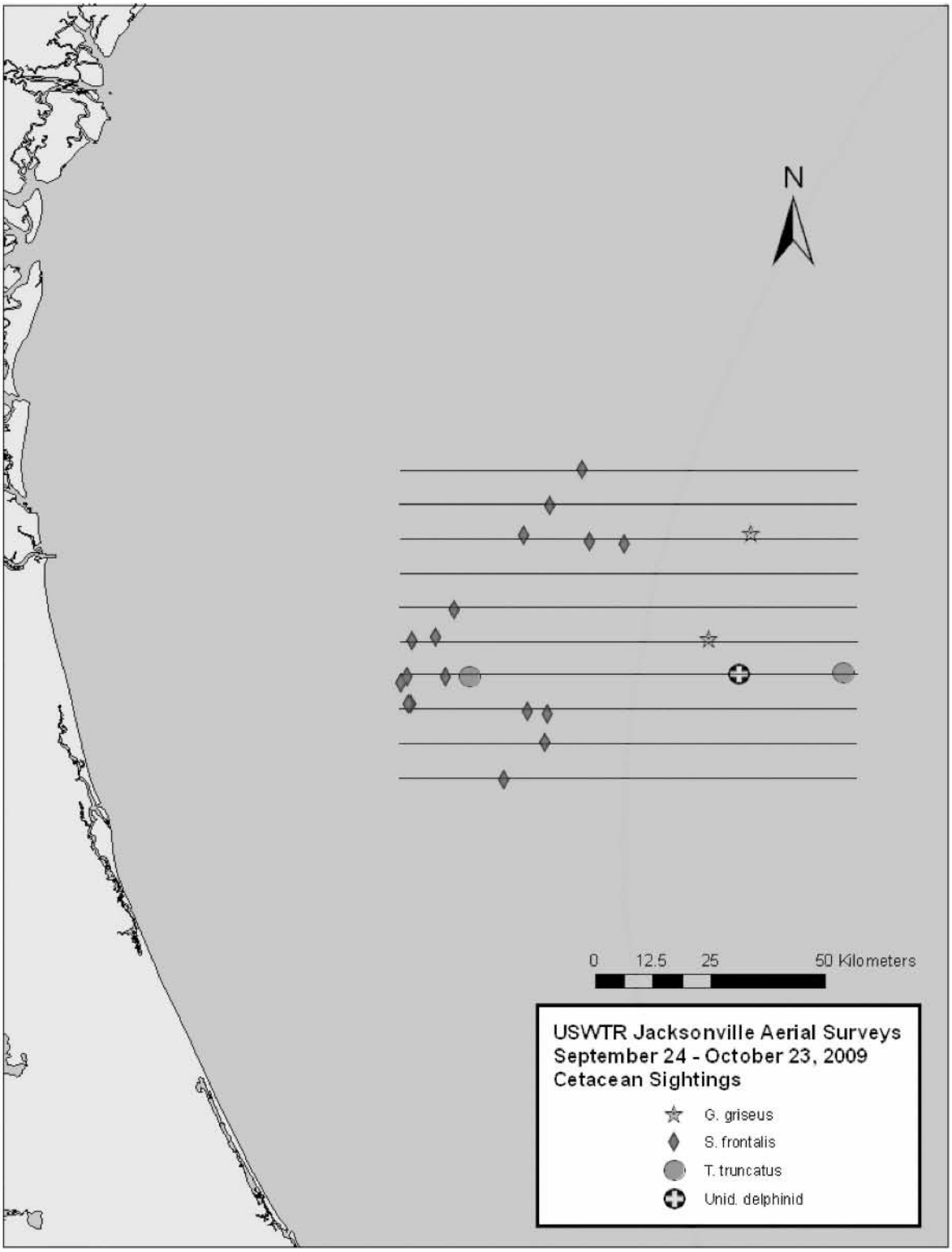


Figure 1. The locations of cetaceans sighted during aerial surveys of the JAX USWTR study region during Sept 24-Oct 23 2009.

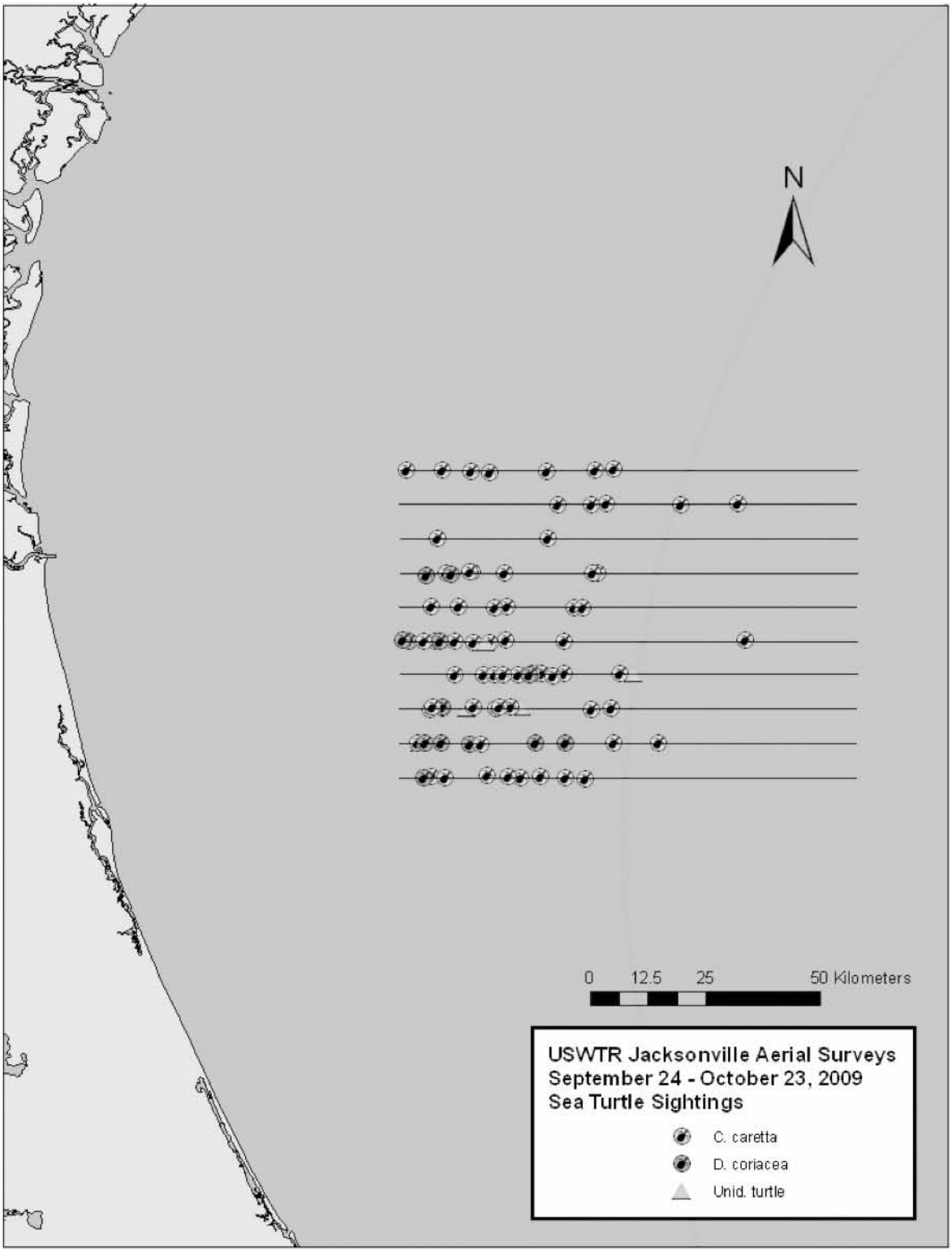


Figure 2. The locations of turtles sighted during aerial surveys of the JAX USWTR study region during Sept 24-Oct 23 2009.

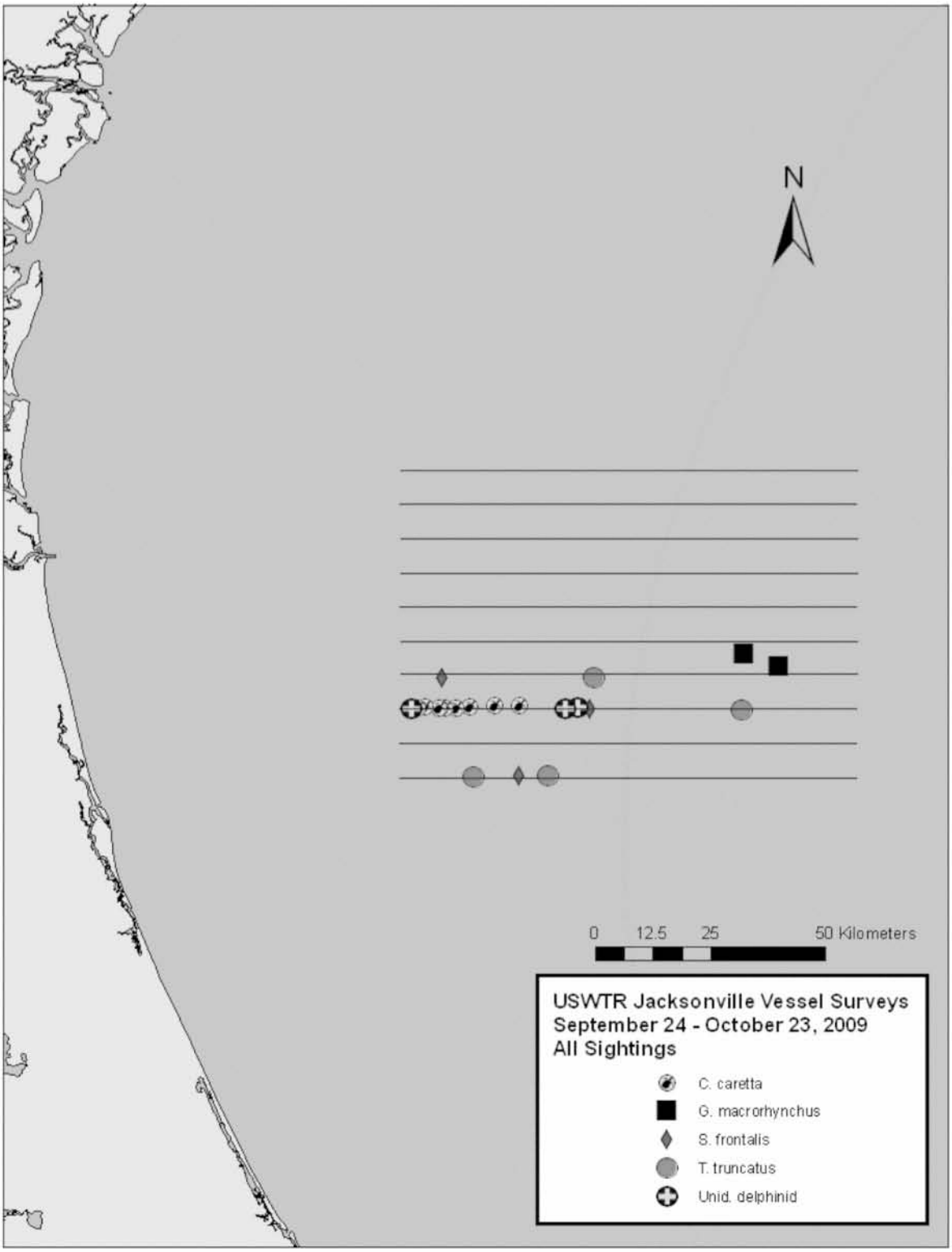


Figure 3. The locations of cetaceans and turtles sighted during vessel surveys of the JAX USWTR study region during Sept 24-Oct 23 2009.

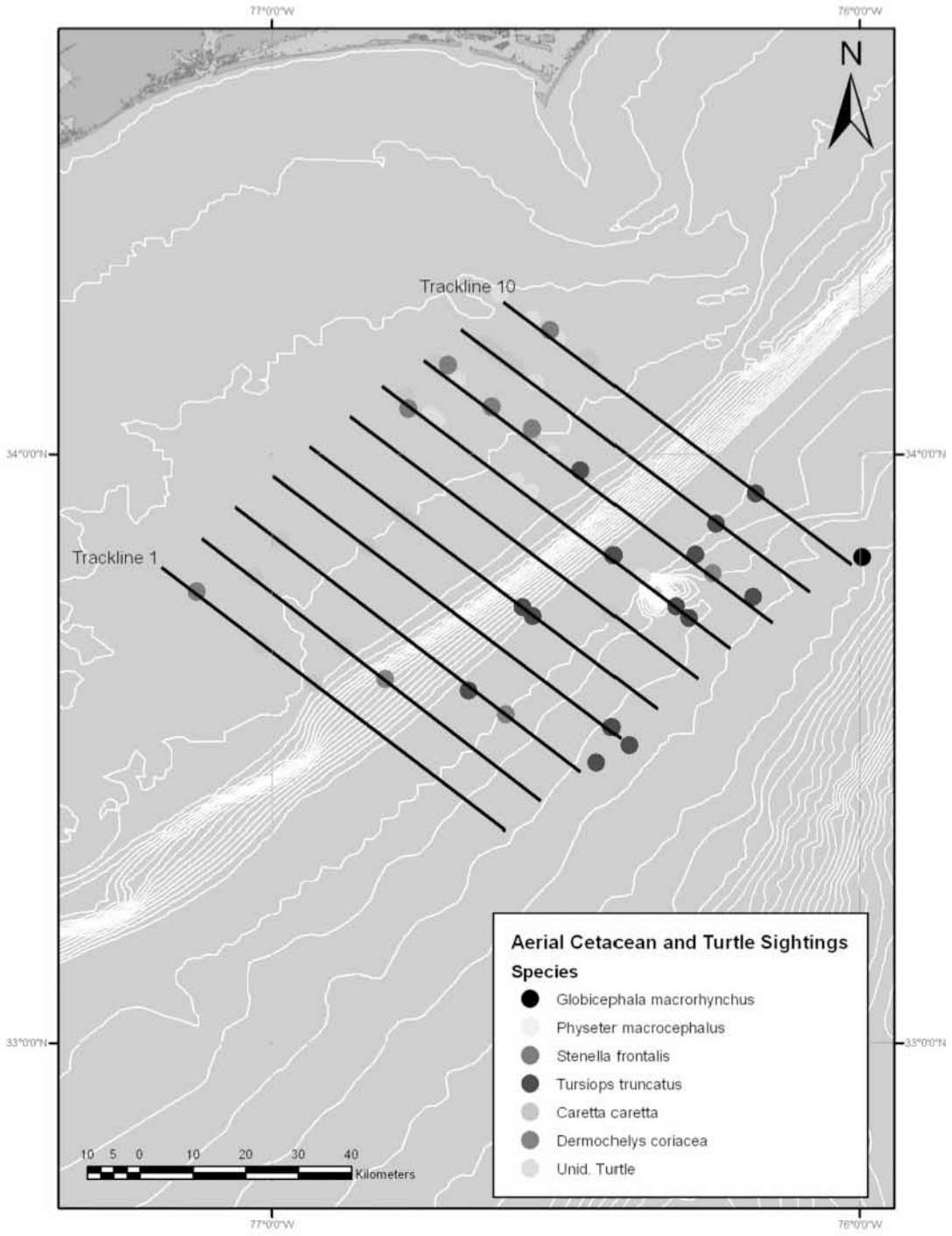


Figure 4. The locations of cetaceans and turtles sighted during aerial surveys of the Onslow Bay USWTR study region during Sept 24-Oct 23 2009.

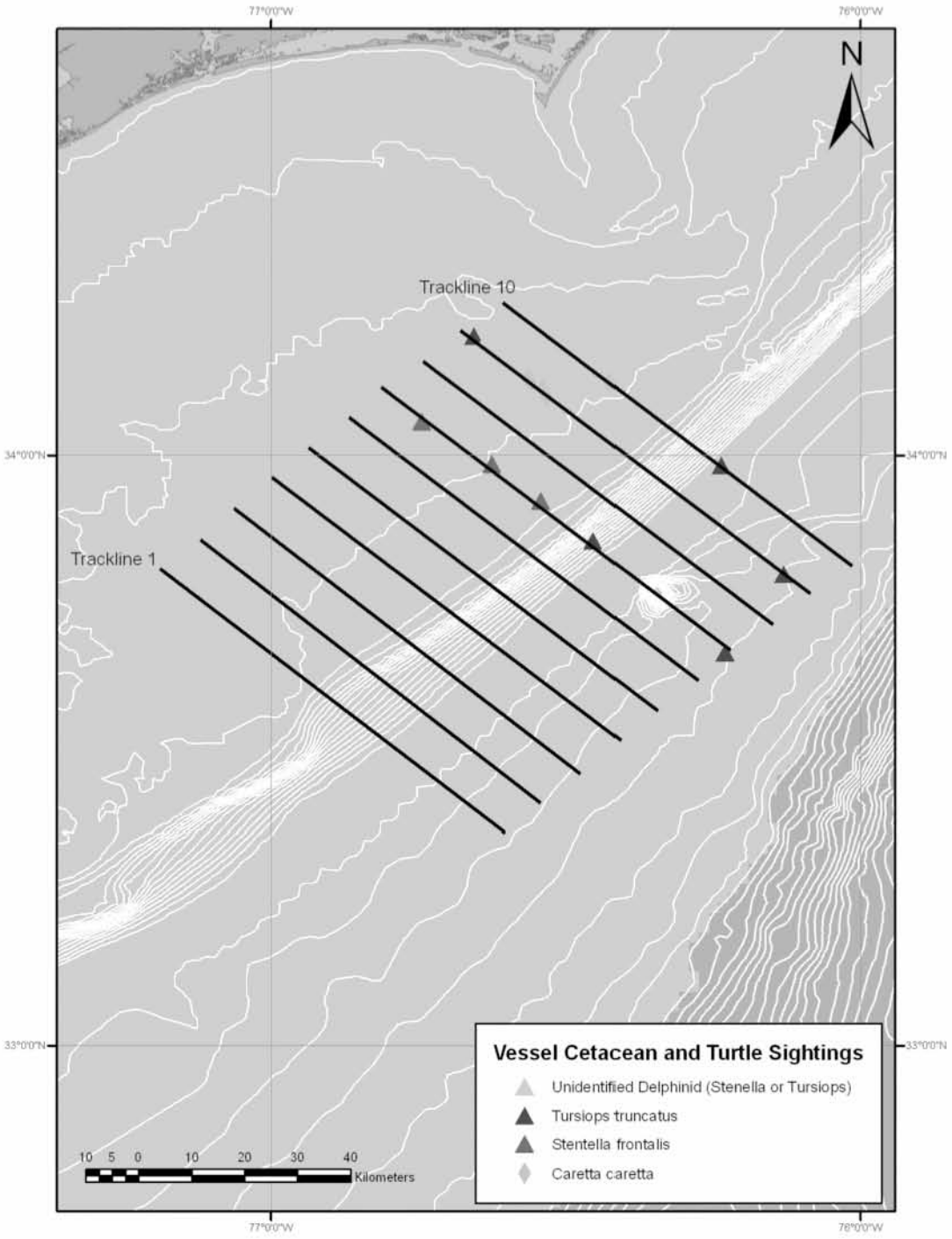


Figure 5. The locations of cetaceans and turtles sighted during vessel surveys of the Onslow Bay USWTR study region during Sept 24-Oct 23 2009.

Monitoring of Protected Species in the Proposed Onslow Bay and Jacksonville USWTRs
Progress Report: October 24 through November 23, 2009

Planning (Task 1, 2 & 3)
The final report meeting for Onslow Bay USWTR Year 2 was held at Duke University on November 4, 2009. This meeting was attended by Duke and UNCW staff, several Navy representatives and representatives from Parsons and GeoMarine. The meeting consisted of several presentations that summarized the work to date at both USWTR locations and plans for the future for both sites. During this reporting period PI Johnston and Postdoctoral fellow Soldevilla began planning the next round of HARP redeployments in the JAX USWTR. Planning for the deployment of Cornell pop-ups and protected species surveys during the next Navy training exercise in the JAX USWTR (December 7-11, 2009) was also initiated. A standard operating procedure (SOP) for transiting right whale calving habitat was established for the JAX USWTR survey team. A project web wiki was created to facilitate document and information sharing for the JAX USWTR project.

Purchasing (Task 1).
Purchases for the next round of HARP deployments in JAX were started during this reporting period.

Travel (Task 1 & 3)
William McLellan, CO-PI, attended and presented at the Southeast Implementation Team meeting in Jacksonville, Florida on 27 October. SOPs for interacting with right whale EWS flights were finalized. The focus of the meeting was the implementation of recovery plans for endangered large whales in the southeast. CO-PI McLellan also attended and presented at the Right Whale Consortium meeting held at the New Bedford Whaling Museum on Nov 17 – 18. Presentations were made on right whale sightings from USTWR surveys and right whale mortalities investigated along the US east coast.

JAX Survey activity (Task 2)

Aerial Surveys
Aerial surveys were conducted on the 17th, 18th and 20th of November covering all ten tracklines twice. Weather conditions during the survey period ranged from moderate to poor on the 17th and the 20th, to excellent on the 18th (Table 1). The survey was cancelled on the 19th due to persistent fog. Cetacean encounters consisted of two groups of *Grampus griseus*, one single *Kogia* species, and two encounters with unidentified delphinids. The two species in the genus *Kogia* (pygmy sperm whale, *Kogia breviceps*, and dwarf sperm whale, *Kogia sima*) are very rarely observed during aerial and vessel surveys due to their elusive nature, inconspicuous behavior, and deep offshore habitat. Due to their similarity in appearance, the two can often not be identified to species. This sighting

constitutes the sole observation so far of a Kogiid in the study area. Several unidentified sea turtles were observed during the November surveys (n=16), in addition to 13 *Caretta caretta* and four *Dermochelys coriacea.* In addition, a juvenile whale shark *(Rhincodon typus)* was observed, which is the first time this species have been encountered in the USWTR range (Table 2; Figure 1).

Vessel Surveys

Weather conditions were not conducive to surveying during the reporting period 24 October to 22 November with the exception of one weather window (November 17th through the 20th) during which time aerial surveys were conducted. Adverse weather conditions during the remainder of the reporting period precluded any vessel surveys.

JAX HARPs (Task 3)

Both HARPs in the JAX USWTR are in place and recording.

Onslow Bay Survey activity (Task 5)

Aerial Surveys

The Onslow Bay USWTR team conducted two days of aerial surveys completing ten tracklines during the reporting period of October 24 to November 23, 2009 (Table 3). On November 8th prior to conducting surveys in the range the USWTR team responded to a report of a right whale seen approximately one and a half miles off the coast from Masonboro jetty. A search pattern was flown from the shore out to 5 miles beginning at Masonboro Jetty continuing south to the Fort Fisher Aquarium on Carolina Beach. Approximately 3 miles offshore from the aquarium the team encountered three right whales that were traveling south (Table 4 and Figure 2). The USWTR team contacted the US Coast Guard who then issued a notice to mariners alerting them that right whales were seen in the area and to maintain a minimum safe distance of 500 yards from the whales. The Coast Guard also relayed sighting information to the UNCW ground contacts. Photo documentation was collected of all whales to check for entanglements and record callosity patterns that can later be used to identify individual whales using the New England Aquariums Right Whale Catalogue. These whales were later identified as Egl # 3142, 3513, and 3648 and represent the first sightings in the southeast region for the 2009-2010 season. Once all animals were documented and deemed clear of entanglements the team proceeded out to the USWTR range where six tracklines were flown. Survey conditions were good and resulted in two sightings of *Tursiops truncatus* as well as 26 sea turtles (Tables 4 and 5). The following day, November 9th survey conditions had deteriorated and only 4 tracklines were flown resulting in two sea turtle sightings. All sighting locations are presented in Figure 2.

Vessel Surveys

There was no vessel survey effort from Oct 24-Nov 23, 2009 due to a combination of poor weather conditions and prior charter commitments of the vessels used for surveys.

Onslow Bay HARPs (Task 6)

We received the new CPU board for the 1st HARP at the beginning of November. Shortly after this, on November 8th, we (Lynne Williams, Melissa Soldevilla, and Danielle Waples) were able to deploy the two HARPs in Onslow Bay from the *R/V Cape Fear*. We deployed one HARP in the same location as from our first and third deployments (at 171-m depth) and put the second HARP farther out at 335-m depth (Figure 3). Both locations are detailed in Figure 3. Although we are still sampling at 200 kHz, we have changed the duty cycle of the instruments so that they will record for 5 minutes out of every 15 minutes. This change will allow us to record for up to six months.

Exercise Monitoring (Task 7)

Planning for the next exercise in the JAX USWTR was initiated.

Table 1. Aerial survey effort table for the JAX USWTR study region during Oct 24-Nov 23 2009

Date	Line	Sea State	Kilometers Flown	Hobbs Hours
17-Nov-09	10	1 to 4	86.0	4.0
17-Nov-09	9	1 to 4	87.9	
17-Nov-09	8	1 to 3	86.8	
17-Nov-09	7	1 to 3	83.4	
17-Nov-09	6	1 to 3	86.9	
17-Nov-09	5	1 to 3	86.4	
18-Nov-09	1	1 to 2	86.6	7.5
18-Nov-09	2	1 to 2	84.3	
18-Nov-09	3	1 to 2	85.8	
18-Nov-09	4	2	86.7	
18-Nov-09	5	1 to 3	86.0	
18-Nov-09	6	1 to 3	86.3	
18-Nov-09	10	2 to 3	86.1	
18-Nov-09	9	1 to 2	85.8	
18-Nov-09	8	1 to 3	87.2	
18-Nov-09	7	1 to 3	85.9	
20-Nov-09	1	3 to 4	86.4	3.2
20-Nov-09	2	3 to 4	86.5	
20-Nov-09	3	3 to 4	86.4	
20-Nov-09	4	2 to 4	85.8	

Table 2. Cetacean, sea turtle and large shark sightings during aerial surveys in the JAX USWTR study region during Oct 24-Nov 23 2009.

Date	Time	On/Off Effort	Latitude	Longitude	Track Number	Observer	Species	Group Size
17-Nov-09	13:46	On Effort	30.498	-80.609	9	Right	*C. caretta*	1
17-Nov-09	15:25	On Effort	30.232	-80.152	5	Right	*D. coriacea*	1
18-Nov-09	9:03	On Effort	29.966	-79.895	1	Left	Unidentified turtle	1
18-Nov-09	9:13	On Effort	30.037	-79.944	2	Right	*Kogia* species	1
18-Nov-09	9:24	On Effort	30.032	-80.281	2	Left	*C. caretta*	1
18-Nov-09	9:25	On Effort	30.031	-80.321	2	Left	*C. caretta*	1
18-Nov-09	9:29	On Effort	30.031	-80.449	2	Right	Unidentified turtle	1
18-Nov-09	9:33	On Effort	30.031	-80.597	2	Right	Unidentified turtle	1
18-Nov-09	9:40	On Effort	30.100	-80.632	3	Left	*C. caretta*	1
18-Nov-09	9:41	On Effort	30.100	-80.622	3	Right	*D. coriacea*	1
18-Nov-09	9:41	On Effort	30.100	-80.600	3	Right	*C. caretta*	1
18-Nov-09	9:44	On Effort	30.113	-80.556	3	Left	Unidentified delphinid	3
18-Nov-09	9:57	On Effort	30.100	-80.481	3	Left	*C. caretta*	2
18-Nov-09	10:02	On Effort	30.101	-80.274	3	Right	Unidentified turtle	1
18-Nov-09	10:10	On Effort	30.101	-79.994	3	Left	*C. caretta*	4
18-Nov-09	10:11	On Effort	30.100	-79.928	3	Right	Unidentified turtle	1
18-Nov-09	10:12	On Effort	30.101	-79.916	3	Left	*C. caretta*	2
18-Nov-09	10:41	On Effort	30.166	-80.535	4	Right	Unidentified turtle	1
18-Nov-09	10:49	On Effort	30.234	-80.689	5	Right	*R. typus*	1
18-Nov-09	10:57	On Effort	30.233	-80.497	5	Left	*C. caretta*	2
18-Nov-09	11:40	On Effort	30.309	-80.475	6	Right	Unidentified delphinid	1
18-Nov-09	13:46	On Effort	30.568	-80.606	10	Left	*C. caretta*	2
18-Nov-09	13:48	On Effort	30.568	-80.553	10	Right	Unidentified turtle	1
18-Nov-09	13:49	On Effort	30.568	-80.494	10	Right	Unidentified turtle	1
18-Nov-09	13:51	On Effort	30.568	-80.448	10	Right	Unidentified turtle	1
18-Nov-09	13:51	On Effort	30.568	-80.426	10	Right	Unidentified turtle	1
18-Nov-09	14:28	On Effort	30.499	-80.395	9	Right	Unidentified turtle	1
18-Nov-09	14:29	On Effort	30.499	-80.437	9	Right	Unidentified turtle	1
18-Nov-09	14:31	On Effort	30.499	-80.502	9	Right	Unidentified turtle	1
18-Nov-09	14:32	On Effort	30.499	-80.549	9	Left	*C. caretta*	1
18-Nov-09	14:33	On Effort	30.499	-80.584	9	Left	*C. caretta*	2
18-Nov-09	14:33	On Effort	30.499	-80.589	9	Right	Unidentified turtle	1
18-Nov-09	14:34	On Effort	30.499	-80.623	9	Right	Unidentified turtle	1
18-Nov-09	14:40	On Effort	30.434	-80.649	8	Left	*D. coriacea*	1
18-Nov-09	14:42	On Effort	30.434	-80.579	8	Left	*C. caretta*	3
18-Nov-09	15:02	On Effort	30.429	-79.897	8	Right	*G. griseus*	40
18-Nov-09	15:31	On Effort	30.365	-80.517	7	Right	Unidentified turtle	1
18-Nov-09	15:36	On Effort	30.365	-80.706	7	Right	*D. coriacea*	1
20-Nov-09	9:11	On Effort	29.967	-80.601	1	Right	*C. caretta*	1
20-Nov-09	9:48	On Effort	30.032	-80.180	2	Right	*G. griseus*	20

Table 3. Aerial survey effort table for the Onslow Bay USWTR study region during Oct 24-Nov 23 2009

Date	Line	Sea State	Kilometers Flown	Hobbs Hours
8-Nov-09	1	1 to 2	75.0	4.5
8-Nov-09	2	1 to 3	74.6	
8-Nov-09	3	1 to 2	74.2	
8-Nov-09	4	1 to 3	74.0	
8-Nov-09	5	1 to 2	74.4	
8-Nov-09	6	1 to 3	74.3	
9-Nov-09	7	3	74.2	3.4
9-Nov-09	8	3	74.9	
9-Nov-09	9	3	73.0	
9-Nov-09	10	3	74.1	

Table 4. Cetacean sightings during aerial surveys in the Onslow Bay USWTR study region during Oct 24-Nov 23 2009.

Date	Time	On/Off Effort	Latitute	Longitude	Track Number	Species	Group Size
8-Nov-09	12:39	Off Effort	33.966810	-77.875979		*E. glacialis*	3
8-Nov-09	13:51	On Effort	33.407155	-76.643227	1	*T.truncatus*	38
8-Nov-09	14:55	On Effort	33.623729	-76.540808	4	*T.truncatus*	4

Table 5. Sea turtle and shark sightings during aerial surveys in the Onslow Bay USWTR study region during Oct 24-Nov 23 2009.

Date	Time	On/Off Effort	Latitude	Longitude	Track Number	Species	Group Size
8-Nov-09	13:28	On Effort	33.647821	-76.972049	1	*C. caretta*	2
8-Nov-09	14:08	On Effort	33.665816	-76.871465	2	*C. caretta*	1
8-Nov-09	14:08	On Effort	33.645901	-76.845813	2	Unid. turtle	1
8-Nov-09	14:09	On Effort	33.679399	-76.888699	2	*C. caretta*	1
8-Nov-09	14:13	On Effort	33.756276	-76.988613	2	*C. caretta*	2
8-Nov-09	14:15	On Effort	33.804874	-77.051340	2	*C. caretta*	1
8-Nov-09	14:21	On Effort	33.899431	-77.049546	3	*C. caretta*	1
8-Nov-09	14:21	On Effort	33.894745	-77.041877	3	*C. caretta*	2
8-Nov-09	14:22	On Effort	33.887182	-77.030274	3	Unid. turtle	1
8-Nov-09	14:24	On Effort	33.840048	-76.967916	3	*C. caretta*	2
8-Nov-09	14:27	On Effort	33.770925	-76.877474	3	Unid. turtle	1
8-Nov-09	14:30	On Effort	33.708602	-76.796400	3	*C. caretta*	3
8-Nov-09	15:26	On Effort	34.007062	-76.924330	5	*C. caretta*	3
8-Nov-09	15:36	On Effort	33.799470	-76.648673	5	*C. caretta*	1
8-Nov-09	16:00	On Effort	33.846249	-76.582095	6	*C. caretta*	1
8-Nov-09	16:09	On Effort	34.034573	-76.830253	6	*C. caretta*	3
9-Nov-09	9:48	On Effort	34.020247	-76.544867	8	*C. caretta*	1
9-Nov-09	10:01	On Effort	34.135681	-76.570197	9	Unid. turtle	1

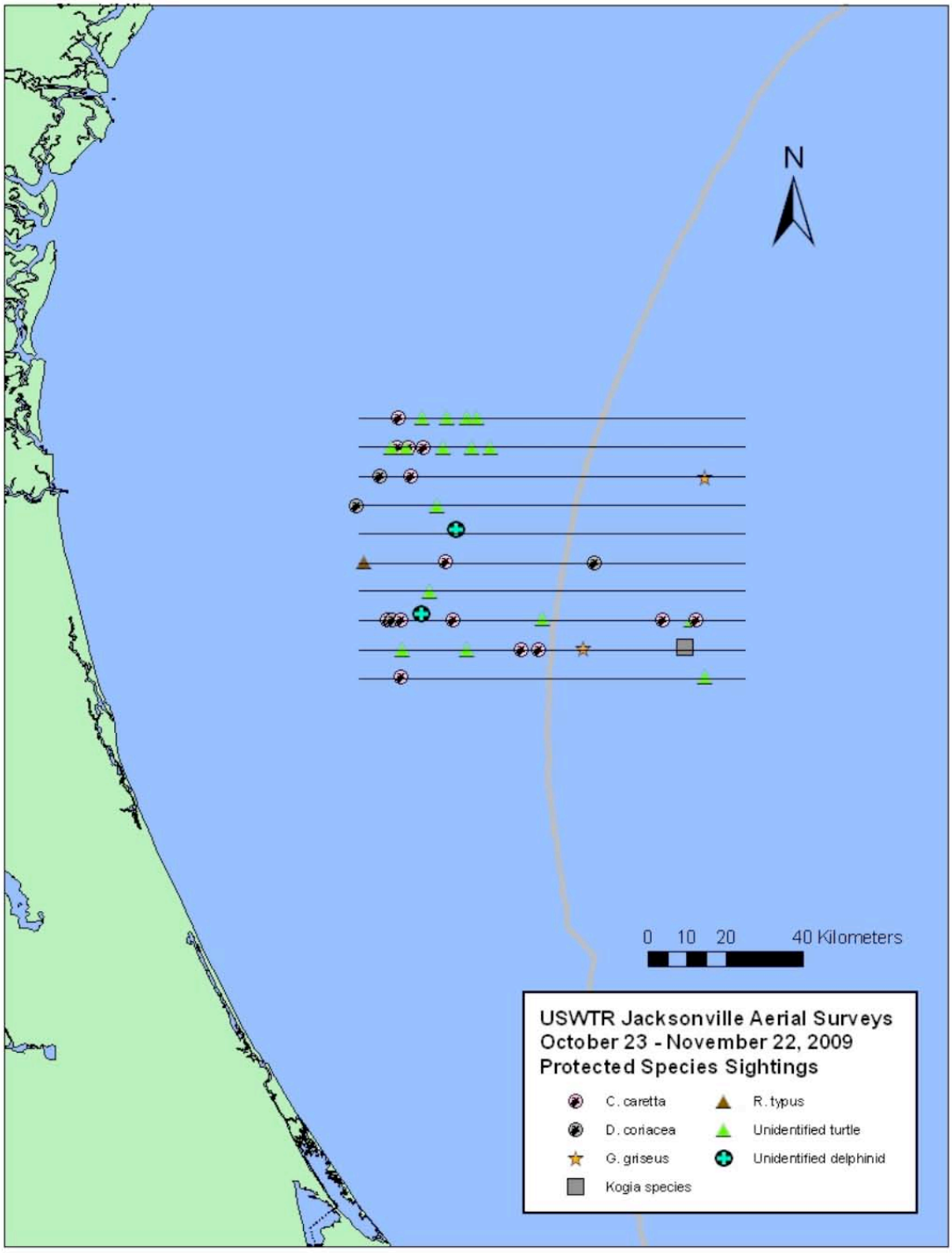


Figure 1. The locations of cetaceans, turtles and sharks sighted during aerial and vessel surveys of the JAX USWTR study region during Oct 24-Nov 23 2009.

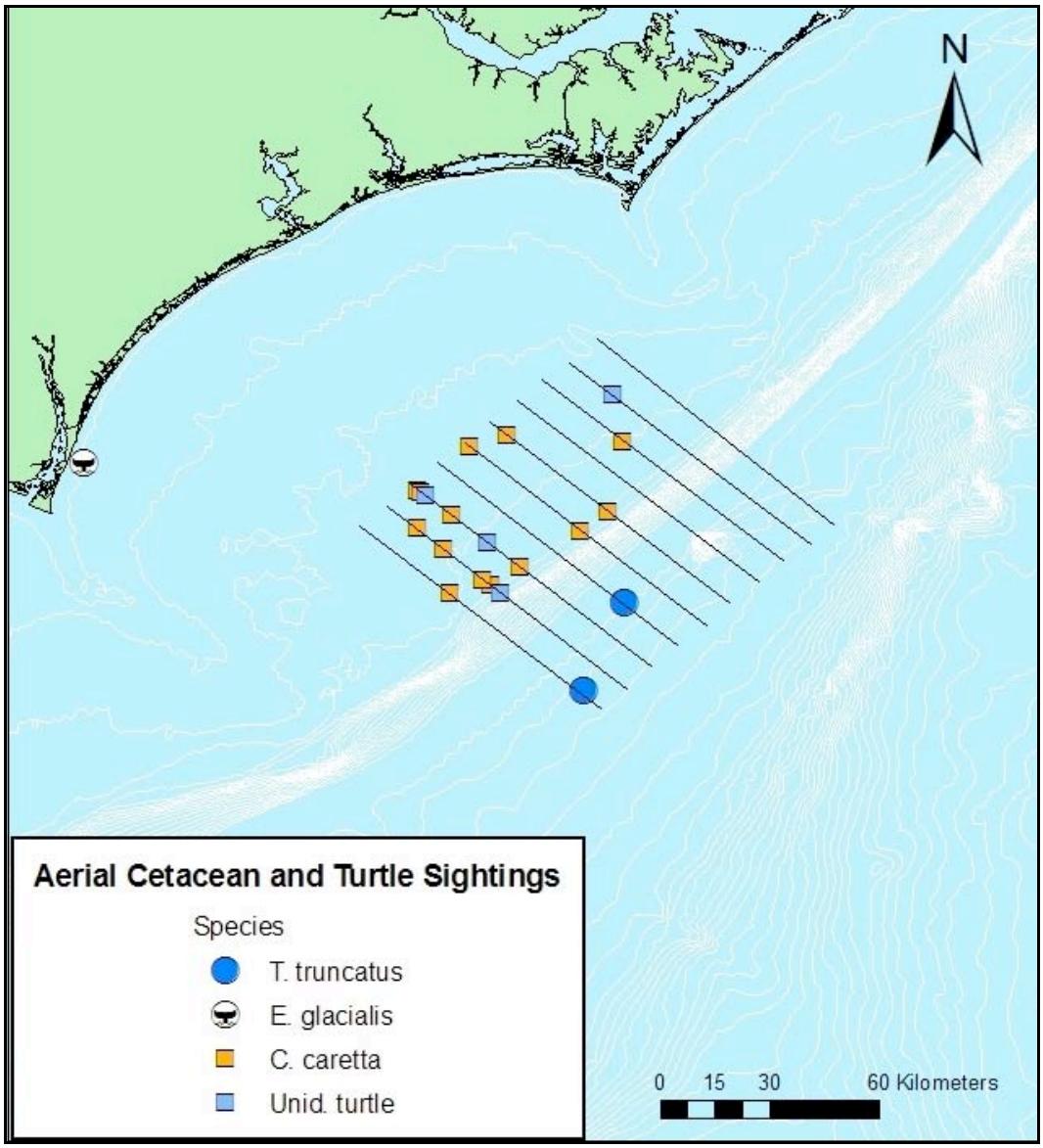


Figure 2. The locations of cetaceans and turtles sighted during aerial and vessel surveys of the Onslow Bay USWTR study region during Oct 24-Nov 23 2009.

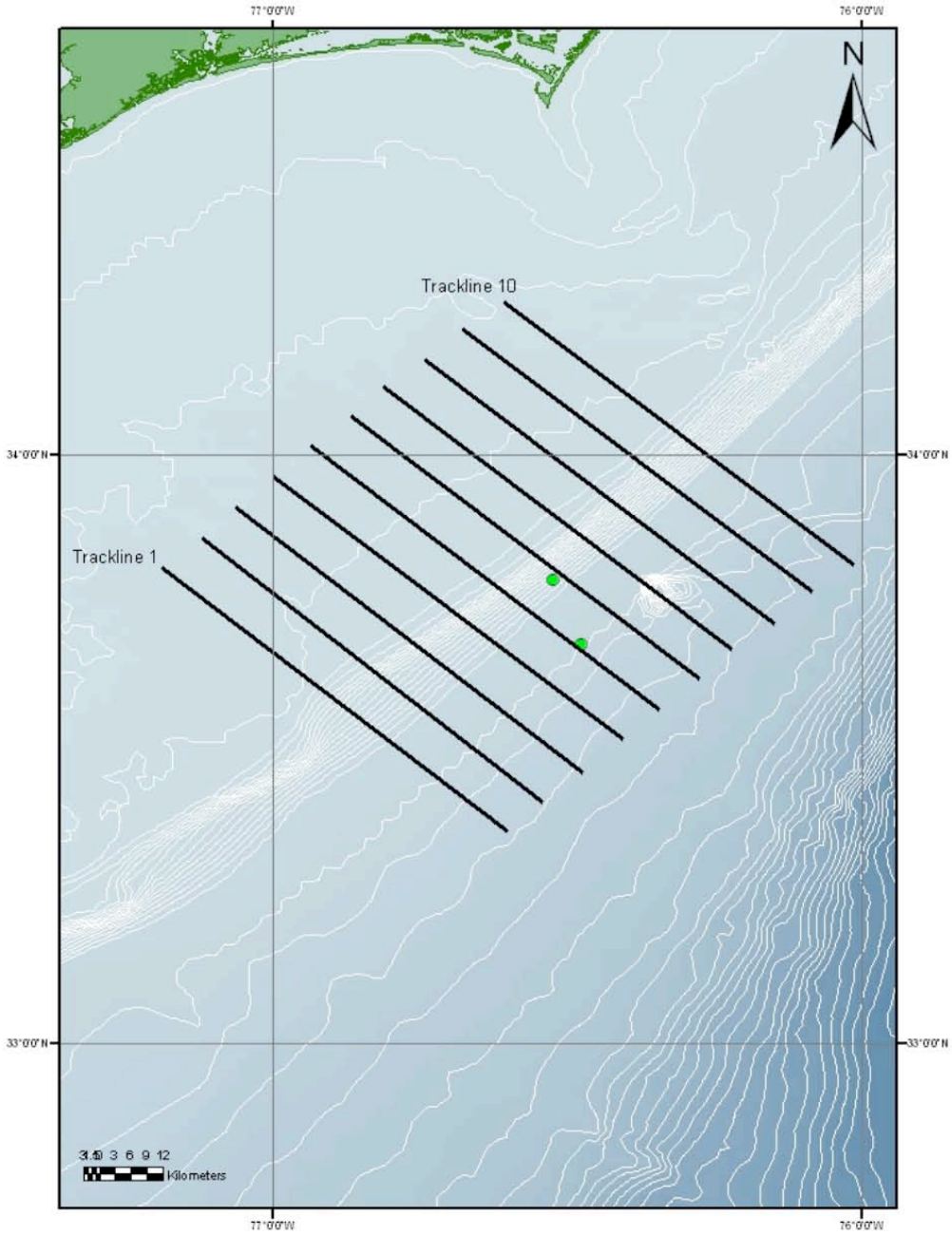


Figure 3. Locations of HARPs deployed in the Onslow Bay USWTR study area.

Monitoring of Protected Species in the Proposed Onslow Bay and Jacksonville USWTRs
Progress Report: November 24 through December 23, 2009

Planning (Task 1, 2 & 3)
During this period UNCW and Duke scientists finalized plans for 1.) the deployment of pop-ups and 2.) aerial surveys during a Navy training exercise in the JAX USWTR (December 7-11, 2009). PI Johnston and Postdoctoral fellow Soldevilla continued planning the next round of HARP redeployments in the JAX USWTR, likely to occur in February 2010.

Purchasing (Task 1).
Purchases for the next round of HARP deployments in JAX were completed during this reporting period. This month two CellSet communication systems were purchased. These allow aerial observers to communicate through their headsets via the satellite phone with land-based teams. One of these units has been delivered to both survey teams as of the end of this month.

Travel (Task 1 & 3)
No project travel was undertaken during this reporting period.

JAX Survey activity (Task 2)

Aerial Surveys
Several storm systems passing through the area during the reporting period resulted in sub-optimal survey conditions (Table 1). Aerial surveys were conducted on December 8th and 10th. Ten survey lines were flown on December 8th in sub-optimal weather conditions and two lines were completed on December 10th before the survey was aborted due to very poor sea state and visibility (Table 1). A survey attempt on the 14th was cancelled just prior to mobilization due to dense, persistent fog in the survey area. Three loggerhead sea turtles (*Caretta caretta*) were observed; however, no cetaceans were encountered during the surveys (Table 2; Figure 1).

Vessel Surveys
A vessel survey onboard the *R/V Volute* was attempted on 15th December in a lull in the persistently high winds which plagued the area during the reporting period. The survey was cancelled, however, during transit to the USWTR range due to fouling of the propeller. The weather throughout the remainder of the reporting period was not conducive to vessel surveys.

On 4 December two members of the Jacksonville USWTR team conducted off effort visual surveys from the *R/V Stellwagen* during the deployment of the nine pop-up buoys in the JAX USWTR site. Visual surveys commenced at 8:58 with the first buoy deployment and ended at 17:07 with the final buoy deployment. When possible, observation occurred from the top of the wheelhouse; however,

due to deteriorating sea state and persistent rain after 12:25 the observers moved to the wheelhouse for the remainder of the day. One sea turtle, *C. caretta,* and one pod of dolphins, *Stenella frontalis*, were observed during the survey.

Towed Passive Acoustics
There was no towed passive acoustic survey effort from Nov 24-Dec 23, 2009

Onslow Bay Survey activity (Task 5)

Aerial Surveys
On December 17, 2009 we conducted our only survey day for this reporting period. Seasonally high seas and rapidly changing forecasts made it difficult to identify suitable survey conditions. A total of 10 tracklines were flown in a Beaufort Sea State 3 to 4 (Table 3) during which two groups of dolphins were encountered. High seas prevented photo documentation of either group and both groups are listed as unidentified delphinids (Table 4, Figure 2). There were also five sea turtle sightings in the range, two identified as loggerheads and three unidentified sea turtles (Table 5, Figure 2).

Vessel Surveys
There was no vessel survey effort from Nov 24-Dec 23, 2009 due to persistent inclement weather conditions.

Towed Passive Acoustics
There was no towed passive acoustic survey effort from Nov 24-Dec 23, 2009 due to persistent inclement weather conditions.

Exercise Monitoring (Task 7)
Nine pop-up acoustic recorders were deployed from the R/V Stellwagen in the JAX USWTR study location on December 4th, 2009. They are slated for recovery in early January 2010. Aerial surveys were conducted on December 8th and 10th coincident with the SEASWITI exercise held off the coast of northern Florida (including the USWTR range) between December 7th and 11th.

Table 1. Aerial survey effort table for the JAX USWTR study region during Nov 24-Dec 23, 2009

Date	Line	Sea State	Kilometers Flown	Hobbs Hours
8-Dec-09	10	3 to 4	88.4	5.3
8-Dec-09	9	3 to 4	86.0	
8-Dec-09	8	3 to 4	86.6	
8-Dec-09	7	3 to 4	86.3	
8-Dec-09	6	3	86.3	
8-Dec-09	5	3	86.1	
8-Dec-09	4	3 to 4	87.1	
8-Dec-09	3	3 to 4	86.0	
8-Dec-09	2	3 to 4	86.7	
8-Dec-09	1	2 to 4	86.4	
10-Dec-09	1	5	86.3	2.0
10-Dec-09	2	5	86.6	

Table 2. Sea turtle sightings during aerial surveys in the JAX USWTR study region during Nov 24-Dec 23, 2009.

Date	Time	On/Off Effort	Latitude	Longitude	Track Number	Observer	Species	Group Size
8-Dec-09	12:35	On effort	30.166432	-80.261243	4	Left	*C. caretta*	1
8-Dec-09	13:10	On effort	30.100306	-80.534221	3	Left	*C. caretta*	1
8-Dec-09	13:47	On effort	29.965570	-79.823295	2	Right	C. caretta	1

Table 3. Aerial survey effort table for the Onslow Bay USWTR study region during Nov 24-Dec 23, 2009

Date	Line	Sea State	Kilometers Flown	Hobbs Hours
17-Dec-09	5	3 to 4	74.3	6.4
17-Dec-09	6	3 to 4	74.8	
17-Dec-09	7	3 to 4	74.4	
17-Dec-09	8	3 to 4	75.3	
17-Dec-09	9	3 to 4	73.0	
17-Dec-09	10	3 to 4	71.6	
17-Dec-09	4	3 to 4	74.8	
17-Dec-09	3	3 to 4	74.9	
17-Dec-09	2	3	74.4	
17-Dec-09	1	3	73.6	

Table 4. Cetacean sightings during aerial surveys in the Onslow Bay USWTR study region during Nov 24-Dec 23, 2009.

Date	Time	On/Off Effort	Latitute	Longitude	Track Number	Species	Group Size
17-Dec-09	10:56	On Effort	33.862939	-76.343101	8	Unidentified delphinid	2
17-Dec-09	11:56	On Effort	34.135101	-76.433447	10	Unidentified delphinid	15

Table 5. Sea turtle sightings during aerial surveys in the Onslow Bay USWTR study region during Nov 24-Dec 23, 2009.

Date	Time	On/Off Effort	Latitude	Longitude	Track Number	Species	Group Size
17-Dec-09	11:19	On Effort	34.124850	-76.557451	9	Unidentified turtle	1
17-Dec-09	12:13	On Effort	34.189596	-76.502615	10	*C.caretta*	1
17-Dec-09	14:59	On Effort	33.773244	-77.010398	2	Unidentified turtle	1
17-Dec-09	15:06	On Effort	33.606821	-76.793782	2	Unidentified turtle	1
17-Dec-09	15:37	On Effort	33.780631	-77.151036	1	*C.caretta*	1

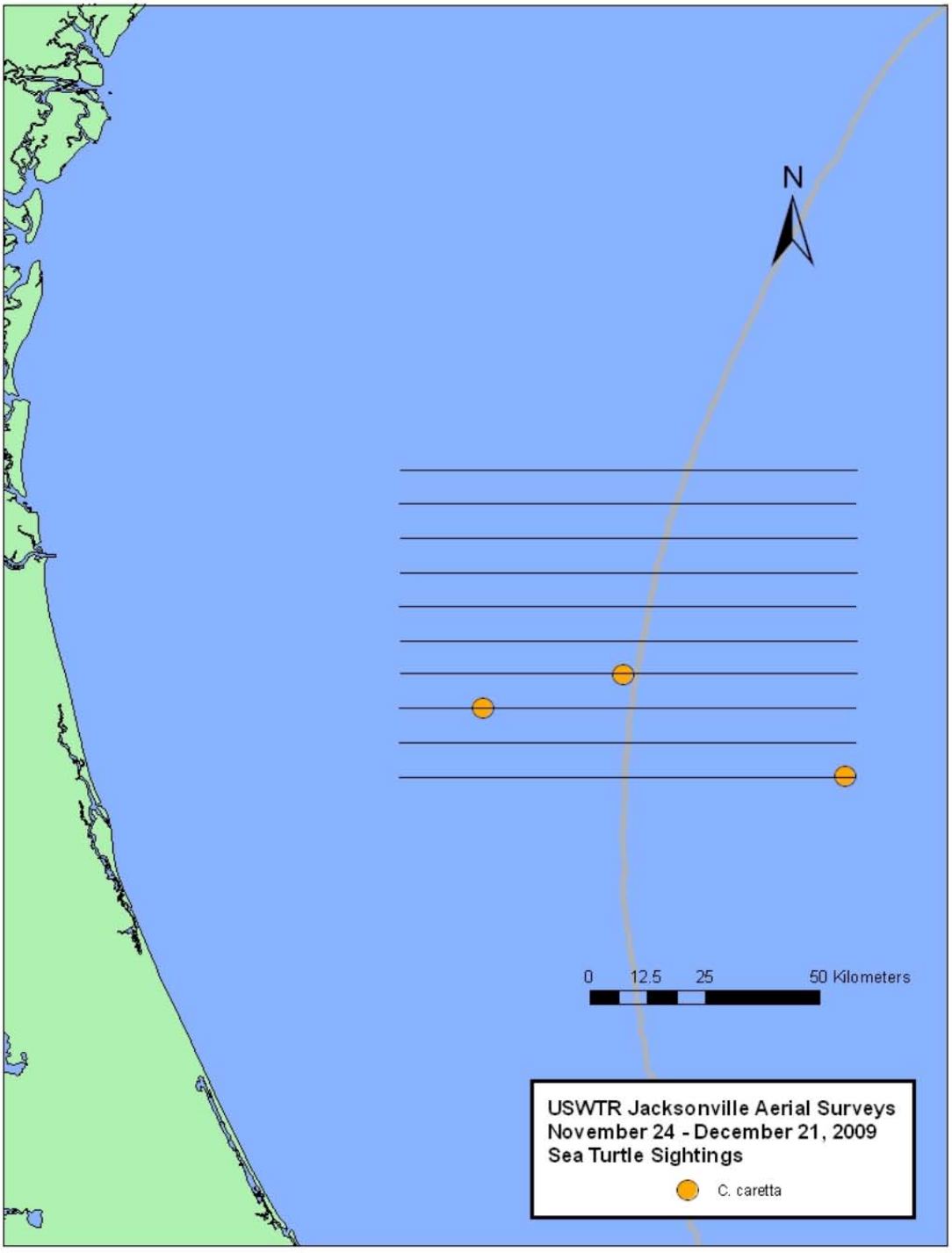


Figure 1. The locations of cetaceans, turtles and sharks sighted during aerial surveys of the JAX USWTR study region during Nov 24-Dec 23 2009.

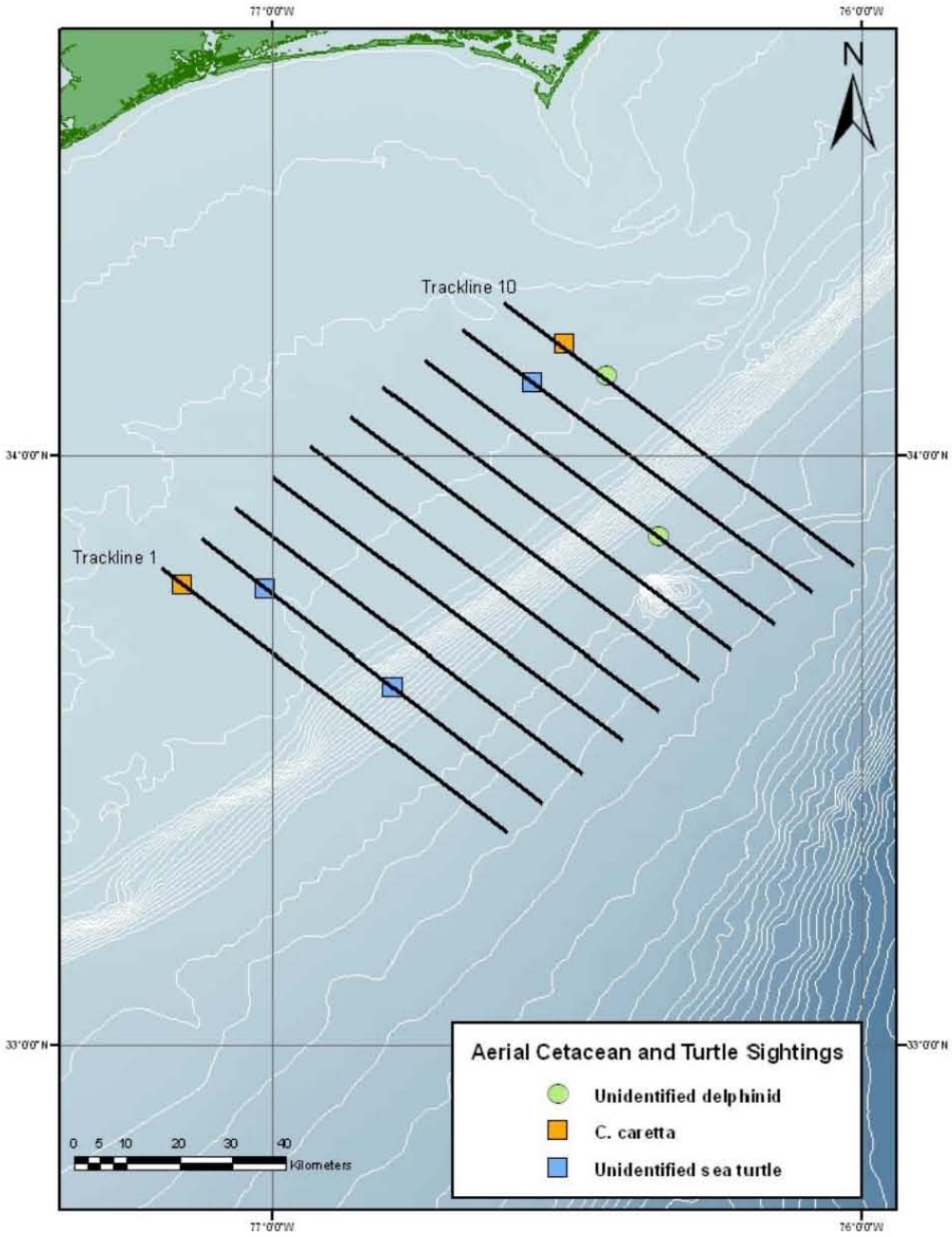


Figure 2. The locations of cetaceans and turtles sighted during aerial surveys of the Onslow Bay USWTR study region during Nov 24-Dec 23, 2009.

Monitoring of Protected Species in the Proposed Onslow Bay and Jacksonville USWTRs
Progress Report: December 24, 2009 through January 18, 2010

Planning (Task 1, 2 & 3)
During this period UNCW and Duke finalized budgets for continuation of both the Onslow & JAX USWTR ranges through June 2010. The housing contract for the JAX observers was extended through June 2010.

Purchasing (Task 1).
One Dell desktop CPU was purchased at UNCW to replace a failing older machine. The twin monitors were kept from past purchases. Environmental float coats were purchased for the JAX team to conduct winter vessel surveys. Two Garmin GPS were purchased to replace aging (non-functional) units for Onslow Bay aerial surveys.

Travel (Task 1 & 3)
No project travel was undertaken during this reporting period.

JAX Survey Activity (Task 2)
Aerial Surveys
Two full sets of aerial surveys have been flown since the last reporting period. All ten survey lines were flown both on 22 December and 7 January. Weather conditions for the surveys were moderate on 22 December and moderate to good on 7 January (**Table 1**). There were eleven cetacean sightings over the two survey days; *Tursiops truncatus* were encountered six times, *Stenella frontalis* were spotted once while off effort investigating a large splash, and four unidentified delphinids were recorded (**Table 2; Figure 1**). Marine turtle sightings consisted of 39 *Caretta caretta* and four unidentified turtles (**Table 3; Figure 2**).

Vessel Surveys
Two complete tracklines were surveyed from the *R/V Volute* during the reporting period. On 13 and 14 January tracklines 10 and 8 were surveyed respectively. Weather conditions ranged from moderate to good (**Table 4**). There were eight cetacean sightings during the two days, comprised of three *T. truncatus*, two *S. frontalis*, and three brief unidentified delphinid encounters. There were also four marine turtles spotted while surveying, including one *Dermochelys coriacea* and three *C. caretta* (**Table 5; Figure 3**).

On 7 January one member of the Jacksonville USWTR team conducted off effort visual surveys from the *R/V Volute* during the retrieval of the nine pop-up buoys in the JAX USWTR site. Visual surveys commenced at 7:00 for the transit through *Eubalaena glacialis* habitat and ended at 18:35 with sunset. Two marine turtles, *Chelonia mydas,* and one pod of dolphins, *T. truncatus*, were observed during the survey (**Table 6**).

Towed Passive Acoustics

On 14 January the towed acoustic array was deployed from the *R/V Volute* during visual survey effort. The towed array was deployed at 11:29 local time. Due to technical problems with the generator powering the system the array was recovered at 12:52 local time. During this time three acoustic files were recorded totaling 15 minutes 50 seconds. These recordings encompass one visual sighting of an unidentified dolphin species.

Onslow Bay Survey Activity (Task 5)

Aerial Surveys

Prior to this month's aerial surveys there had been no sightings of marine mammals for the month of January which had only seen ten tracklines flown in a Beaufort Sea State 3 to 4 in 2009. Survey conditions this month were much better and as a result the probability of detecting marine mammals was greatly increased. A total of 20 tracklines were flown over two days with a total of 14.5 Hobbs hours with a Beaufort Sea State 2 dominating both days (**Table 7**). On January 14th ten tracklines were flown during which five *T. truncatus* sightings were made as well as a single *S. frontalis* sighting (**Table 8 and Figure 4**). On January 15th ten tracklines were again flown with eight *T. truncatus* sightings (one was off effort), three *S. frontalis* sightings and a single *Grampus griseus* sighting which was seen while off effort between tracklines 7 and 8. This last sighting represents the first visual detection of this species outside of the summer months. Both days also produced a number of sea turtle sightings that were dominated by loggerheads (**Table 9 and Figure 4**). The data collected during this month gives us the first clear look at the presence of cetaceans in the Onslow Bay USWTR range and will be beneficial in estimating species abundance.

Vessel Surveys

Two track lines were surveyed on January 15th and January 16th 2010 aboard the *R/V Sensation*, a 53' sport fishing vessel (**Table 10**). Six groups of cetacean were encountered; one group of bottlenose dolphins (*T. truncatus*), four groups of spotted dolphins (*S. frontalis*), and one group which was either bottlenose or spotted dolphins (could not be identified to species; **Table 11**). Ten loggerhead sea turtles (*C. caretta*) also were sighted (**Table 11**). The locations of cetaceans and sea turtles sighted during vessel surveys are presented in **Figure 5**.

Towed Passive Acoustics

The towed acoustic array was deployed from the *F/V Sensation* on the 15th of January, 2010, for 4.97 hours of simultaneous visual and acoustic survey. During that time, a total of 1.48 hours of acoustic recordings were taken. Three visual sightings occurred during the acquisition of acoustic data; one group was identified as *T. truncatus* and two were identified as *S. frontalis*. Numerous vocalizations including clicks, whistles, and burst-pulses were recorded. One other acoustic detection was made that day without visual observation to confirm the species. The towed array also was deployed from the *F/V Sensation* on the

16th of January, 2010, for 5.42 hours of simultaneous visual and acoustic survey. During that time, a total of 2.38 hours of acoustic recordings were taken. Three visual sightings occurred during the acquisition of acoustic data; two groups were identified as *S. frontalis* and one group was either *T. truncatus* or *S. frontalis*. Numerous vocalizations including clicks, burst-pulses, and whistles were recorded. Two other acoustic detections were made that day without visual observation to confirm the species.

Exercise Monitoring (Task 7)

On 7 January one member of the Jacksonville USWTR went out the R/V Volute team to retrieve the nine pop-up buoys in the JAX USWTR site.

No injuries to staff were recorded during this reporting period.

No problems currently exist that hamper progress of the projects.

Table 1. Aerial survey effort table for the JAX USWTR study region during Dec 24, 2009- Jan 18, 2010.

Date	Line	Sea State	Kilometers Flown	HOBBS Hours
22-Dec-09	1	2-3	86.59	7.8
22-Dec-09	2	2-3	86.78	
22-Dec-09	3	2-3	85.31	
22-Dec-09	4	2-3	85.63	
22-Dec-09	5	2-3	86.44	
22-Dec-09	6	2-3	86.67	
22-Dec-09	7	2-3	85.36	
22-Dec-09	8	2-3	85.68	
22-Dec-09	9	2-3	86.23	
22-Dec-09	10	2-3	85.25	
7-Jan-10	1	3	86.04	7.7
7-Jan-10	2	3	86.36	
7-Jan-10	3	2-3	87.81	
7-Jan-10	4	2-3	84.81	
7-Jan-10	5	2-3	86.82	
7-Jan-10	6	2-3	86.40	
7-Jan-10	7	2	85.37	
7-Jan-10	8	2	87.31	
7-Jan-10	9	2	85.48	
7-Jan-10	10	2	86.04	

Table 2. Cetacean sightings during aerial surveys in the JAX USWTR study region during Dec 24, 2009- Jan 18, 2010.

Date	Time	On/Off Effort	Latitude	Longitude	Track Number	Species	Group Size
22-Dec-09	10:27	On	30.097936	-80.611650	3	Unid. Delphinid	1
22-Dec-09	11:17	On	30.166376	-80.683375	4	Unid. Delphinid	3
22-Dec-09	12:12	On	30.297574	-80.405397	6	Unid. Delphinid	3
22-Dec-09	14:16	On	30.363803	-80.206578	7	*T. truncatus*	50
22-Dec-09	15:23	On	30.499372	-80.249891	9	*T. truncatus*	4
22-Dec-09	15:45	On	30.497783	-79.816314	9	*T. truncatus*	3
22-Dec-09	16:13	On	30.564581	-80.305144	10	Unid. Delphinid	1
7-Jan-10	10:50	On	30.028720	-80.690989	2	*T. truncatus*	1
7-Jan-10	12:02	On	30.164537	-80.559666	4	*T. truncatus*	2
7-Jan-10	15:17	Off	30.349972	-80.619776	7	*S. frontalis*	65
7-Jan-10	15:54	On	30.439802	-79.890082	8	*T. truncatus*	45

Table 3 (2x pages). Sea turtle sightings during aerial surveys in the JAX USWTR study region during Dec 24, 2009- Jan 18, 2010.

Date	Time	On/Off Effort	Latitude	Longitude	Track Number	Species	Group Size
22-Dec-09	8:54	On	29.965498	-80.401568	1	*C. caretta*	1
22-Dec-09	8:58	On	29.965947	-80.244734	1	*C. caretta*	1
22-Dec-09	9:18	On	30.031820	-79.988273	2	*C. caretta*	1
22-Dec-09	9:32	On	30.031990	-80.516822	2	*C. caretta*	1
22-Dec-09	9:35	On	30.031993	-80.622506	2	*C. caretta*	1
22-Dec-09	10:35	On	30.100800	-80.324777	3	*C. caretta*	1
22-Dec-09	10:36	On	30.100410	-80.283564	3	*C. caretta*	1
22-Dec-09	11:31	On	30.232466	-80.545990	5	*C. caretta*	1
22-Dec-09	11:33	On	30.232962	-80.468077	5	*C. caretta*	1
22-Dec-09	11:36	On	30.233110	-80.332826	5	*C. caretta*	1
22-Dec-09	12:06	On	30.300739	-80.258858	6	*C. caretta*	1
22-Dec-09	12:06	On	30.300584	-80.275585	6	*C. caretta*	1
22-Dec-09	12:07	On	30.300488	-80.291179	6	*C. caretta*	1
22-Dec-09	14:05	On	30.365169	-80.549155	7	*C. caretta*	1
22-Dec-09	14:07	On	30.365643	-80.485548	7	*C. caretta*	1
22-Dec-09	14:49	On	30.433780	-80.375603	8	*C. caretta*	2
22-Dec-09	15:09	On	30.499047	-80.505264	9	*C. caretta*	1
22-Dec-09	15:11	On	30.499153	-80.430882	9	Unid. sea turtle	1
22-Dec-09	15:14	On	30.499460	-80.302333	9	*C. caretta*	1

Date	Time	On/Off Effort	Latitude	Longitude	Track Number	Species	Group Size
22-Dec-09	15:15	On	30.499046	-80.270865	9	*C. caretta*	1
22-Dec-09	16:11	On	30.567508	-80.285777	10	*C. caretta*	1
22-Dec-09	16:23	On	30.567339	-80.424851	10	*C. caretta*	1
22-Dec-09	16:28	On	30.566978	-80.598099	10	Unid. sea turtle	1
7-Jan-10	10:32	On	30.030968	-80.257298	2	*C. caretta*	1
7-Jan-10	10:39	On	30.030648	-80.491165	2	*C. caretta*	1
7-Jan-10	11:57	On	30.165740	-80.441015	4	*C. caretta*	1
7-Jan-10	13:14	On	30.299153	-80.557557	6	*C. caretta*	1
7-Jan-10	14:59	On	30.366124	-80.667015	7	*C. caretta*	1
7-Jan-10	15:25	On	30.368561	-80.481447	7	*C. caretta*	1
7-Jan-10	15:30	On	30.367835	-80.287313	7	*C. caretta*	1
7-Jan-10	16:09	On	30.431476	-80.159948	8	Unid. sea turtle	1
7-Jan-10	16:12	On	30.432876	-80.266783	8	Unid. sea turtle	1
7-Jan-10	16:16	On	30.432587	-80.392421	8	*C. caretta*	1
7-Jan-10	16:25	On	30.432106	-80.493542	8	*C. caretta*	2
7-Jan-10	16:27	On	30.432251	-80.551611	8	*C. caretta*	1
7-Jan-10	16:35	On	30.496968	-80.652018	9	*C. caretta*	1
7-Jan-10	16:37	On	30.499251	-80.585836	9	*C. caretta*	1
7-Jan-10	16:37	On	30.499347	-80.583876	9	*C. caretta*	1
7-Jan-10	16:38	On	30.500025	-80.538136	9	*C. caretta*	1
7-Jan-10	16:40	On	30.500468	-80.474392	9	*C. caretta*	1
7-Jan-10	17:26	On	30.565993	-80.585532	10	*C. caretta*	1

Table 4. Vessel survey effort table for the JAX USWTR study region during Dec 24, 2009- Jan 18, 2010.

Date	Line	Sea State	Kilometers Surveyed
13-Jan-09	10	2 to 3	86.03
14-Jan-09	8	2 to3	86.08

Table 5. Cetacean and sea turtle sightings for vessel surveys in JAX study region during Dec 23, 2009- Jan 18, 2010.

Date	Time	On/Off Effort	Latitude	Longitude	Line	Species	Group Size
13-Jan-10	10:29	On	30.567982	-80.628400	10	*T. truncatus*	5
13-Jan-10	11:06	Off	30.564430	-80.512458	10	*C. caretta*	1
13-Jan-10	11:35	On	30.564930	-80.432060	10	*T. truncatus*	2
13-Jan-10	11:53	On	30.569257	-80.395757	10	*T. truncatus*	2
13-Jan-10	12:45	On	30.572975	-80.254310	10	Unid. delphinid	1
13-Jan-10	13:05	On	30.573375	-80.194413	10	*D. coriacea*	1
13-Jan-10	14:51	On	30.569478	-79.858819	10	*Stenella sp.*	1
14-Jan-10	12:47	On	30.441682	-80.398922	8	Unid. delphinid	3
14-Jan-10	12:52	On	30.441505	-80.379987	8	*C. caretta*	1
14-Jan-10	13:13	Off	30.430632	-80.362470	8	*S. frontalis*	8
14-Jan-10	13:25	On	30.427455	-80.338912	8	*S. frontalis*	7
14-Jan-10	14:04	On	30.441954	-80.205903	8	*C. caretta*	1

Table 6. Cetacean and sea turtle sightings during pop-up buoy recovery on January 7, 2010 in the JAX USWTR study region.

Date	Time	On/Off Effort	Latitude	Longitude	Line	Species	Group Size
10-Jan-10	11:21	Off Effort	30.324103	-80.639342	N/A	*T. truncatus*	4
10-Jan-10	11:59	Off Effort	30.250613	-80.492775	N/A	*C. mydas*	1
10-Jan-10	12:59	Off Effort	30.137303	-80.275460	N/A	*C. mydas*	1

Table 7. Aerial survey effort table for the Onslow Bay USWTR study region during Dec 23, 2009- Jan 18, 2010.

Date	Line	Sea State	Kilometers Flown	Hobbs Hours
14-Jan-10	5	1 to 2	74.3	6.7
14-Jan-10	6	1 to 3	72.0	
14-Jan-10	7	1 to 2	72.6	
14-Jan-10	8	1 to 3	74.3	
14-Jan-10	9	1 to 2	71.0	
14-Jan-10	10	1 to 2	73.4	
14-Jan-10	4	2 to 3	74.9	
14-Jan-10	3	2 to 3	74.7	
14-Jan-10	2	2	76.4	
14-Jan-10	1	2	73.8	
15-Jan-10	1	2 to 3	77.6	7.8
15-Jan-10	2	2 to 3	73.4	
15-Jan-10	3	2 to 3	75.0	
15-Jan-10	4	2 to 3	72.6	
15-Jan-10	5	2 to 3	72.6	
15-Jan-10	6	2 to 3	73.6	
15-Jan-10	7	2	65.9	
15-Jan-10	8	2	74.9	
15-Jan-10	9	2	73.8	
15-Jan-10	10	2	73.1	

Table 8. Cetacean sightings during aerial surveys in the Onslow Bay USWTR study region during Dec 24, 2009- Jan 18, 2010.

Date	Time	On/Off Effort	Latitute	Longitude	Track Number	Species	Group Size
14-Jan-10	10:34	On Effort	33.668686	-76.355825	6	*T. truncatus*	5
14-Jan-10	10:44	On Effort	33.740090	-76.452193	6	*T. truncatus*	5
14-Jan-10	11:33	On Effort	33.805552	-76.393617	7	*T. truncatus*	3
14-Jan-10	11:51	On Effort	33.746017	-76.176662	8	*T. truncatus*	15
14-Jan-10	13:01	On Effort	33.829063	-76.035037	10	*T. truncatus*	1
14-Jan-10	13:25	On Effort	34.276465	-76.603520	10	*S. frontalis*	37
15-Jan-10	9:45	On Effort	33.558281	-76.738722	2	*T. truncatus*	8
15-Jan-10	10:39	On Effort	33.602597	-76.529002	4	*T. truncatus*	20
15-Jan-10	11:25	On Effort	33.698764	-76.511070	5	*T. truncatus*	22
15-Jan-10	11:44	Off Effort	33.601521	-76.270769	5	*T. truncatus*	8
15-Jan-10	12:02	On Effort	33.725468	-76.420365	6	*T. truncatus*	14
15-Jan-10	12:23	On Effort	34.041882	-76.828397	6	*T. truncatus*	3
15-Jan-10	12:35	On Effort	34.061379	-76.860277	6	*T. truncatus*	46
15-Jan-10	14:27	On Effort	34.074558	-76.731663	7	*S. frontalis*	30
15-Jan-10	14:43	On Effort	33.917354	-76.538055	7	*S. frontalis*	28
15-Jan-10	15:02	On Effort	33.709471	-76.265296	7	*T. truncatus*	27
15-Jan-10	15:09	Off Effort	33.663290	-76.193747	7 & 8	*G. griseus*	5
15-Jan-10	16:29	On Effort	34.156027	-76.457154	10	*S. frontalis*	47

Table 9 (2x pages). Sea turtle sightings during aerial surveys in the Onslow Bay USWTR study region during Dec 23, 2009-Jan 18, 2010.

Date	Time	On/Off Effort	Latitude	Longitude	Track Number	Species	Group Size
14-Jan-10	10:07	On Effort	33.965648	-76.867731	5	Unidentified turtle	2
14-Jan-10	10:09	On Effort	33.923697	-76.811427	5	C. caretta	1
14-Jan-10	10:12	On Effort	33.840001	-76.702502	5	Unidentified turtle	1
14-Jan-10	10:14	On Effort	33.814917	-76.669130	5	C. caretta	1
14-Jan-10	10:17	On Effort	33.746442	-76.579315	5	Unidentified turtle	3
14-Jan-10	10:30	On Effort	33.646098	-76.317713	6	C. caretta	2
14-Jan-10	10:30	On Effort	33.638825	-76.306292	6	C. caretta	1
14-Jan-10	10:31	On Effort	33.670578	-76.352304	6	C. caretta	1
14-Jan-10	11:04	On Effort	33.874559	-76.619818	6	C. caretta	1
14-Jan-10	11:04	On Effort	33.872254	-76.616934	6	C. caretta	1
14-Jan-10	11:06	On Effort	33.909722	-76.665854	6	C. caretta	2
14-Jan-10	11:06	On Effort	33.914810	-76.672279	6	C. caretta	1
14-Jan-10	11:07	On Effort	33.944545	-76.712111	6	Unidentified turtle	1
14-Jan-10	11:08	On Effort	33.966343	-76.740460	6	Unidentified turtle	6
14-Jan-10	11:09	On Effort	33.985336	-76.765886	6	C. caretta	1
14-Jan-10	11:10	On Effort	33.995354	-76.779329	6	Unidentified turtle	1
14-Jan-10	11:11	On Effort	34.024434	-76.817598	6	C. caretta	4
14-Jan-10	11:18	On Effort	34.092177	-76.764066	7	C. caretta	1
14-Jan-10	11:19	On Effort	34.059438	-76.720813	7	Unidentified turtle	3
14-Jan-10	11:20	On Effort	34.045413	-76.702587	7	Unidentified turtle	1
14-Jan-10	11:21	On Effort	34.012311	-76.659354	7	C. caretta	4
14-Jan-10	11:21	On Effort	34.005927	-76.650882	7	Unidentified turtle	1
14-Jan-10	11:23	On Effort	33.977871	-76.613812	7	C. caretta	4
14-Jan-10	11:23	On Effort	33.967905	-76.601169	7	C. caretta	1
14-Jan-10	11:24	On Effort	33.946586	-76.573009	7	Unidentified turtle	3
14-Jan-10	12:08	On Effort	33.916353	-76.408430	8	Unidentified turtle	1
14-Jan-10	12:09	On Effort	33.928146	-76.423492	8	C. caretta	2
14-Jan-10	12:12	On Effort	33.993659	-76.508969	8	Unidentified turtle	3
14-Jan-10	12:12	On Effort	33.993358	-76.508537	8	Unidentified turtle	1
14-Jan-10	12:13	On Effort	34.023472	-76.548059	8	Unidentified turtle	2
14-Jan-10	12:14	On Effort	34.036416	-76.565283	8	Unidentified turtle	2
14-Jan-10	12:15	On Effort	34.051552	-76.585052	8	Unidentified turtle	3
14-Jan-10	12:17	On Effort	34.100200	-76.649405	8	C. caretta	2
14-Jan-10	12:27	On Effort	34.139535	-76.575368	9	Unidentified turtle	1
14-Jan-10	12:28	On Effort	34.117338	-76.545862	9	C. caretta	6
14-Jan-10	12:28	On Effort	34.106038	-76.531052	9	C. caretta	3
14-Jan-10	12:30	On Effort	34.071325	-76.485160	9	C. caretta	2
14-Jan-10	13:15	On Effort	34.082984	-76.367326	10	Unidentified turtle	1
14-Jan-10	13:18	On Effort	34.144279	-76.446622	10	C. caretta	1

Date	Time	On/Off Effort	Latitude	Longitude	Track Number	Species	Group Size
14-Jan-10	13:20	On Effort	34.189273	-76.504534	10	C. caretta	1
14-Jan-10	15:02	On Effort	33.665026	-76.598966	4	Unidentified turtle	1
14-Jan-10	15:25	On Effort	33.715429	-76.805102	3	Unidentified turtle	1
14-Jan-10	15:30	On Effort	33.821663	-76.946388	3	Unidentified turtle	1
14-Jan-10	15:40	On Effort	33.789380	-77.028498	2	Unidentified turtle	1
14-Jan-10	16:12	On Effort	33.607468	-76.925138	1	C. caretta	1
14-Jan-10	16:16	On Effort	33.691822	-77.036045	1	C. caretta	1
15-Jan-10	9:14	On Effort	33.641101	-76.967232	1	Unidentified turtle	1
15-Jan-10	9:15	On Effort	33.604474	-76.919300	1	C. caretta	1
15-Jan-10	9:17	On Effort	33.576127	-76.881928	1	C. caretta	1
15-Jan-10	9:17	On Effort	33.579637	-76.886918	1	C. caretta	1
15-Jan-10	9:55	On Effort	33.630946	-76.825886	2	C. caretta	1
15-Jan-10	9:55	On Effort	33.639060	-76.836189	2	Unidentified turtle	1
15-Jan-10	9:57	On Effort	33.666273	-76.872060	2	C. caretta	1
15-Jan-10	9:59	On Effort	33.712078	-76.931008	2	Unidentified turtle	1
15-Jan-10	10:02	On Effort	33.771174	-77.007343	2	Unidentified turtle	1
15-Jan-10	10:13	On Effort	33.830949	-76.955997	3	C. caretta	2
15-Jan-10	10:18	On Effort	33.711685	-76.801000	3	C. caretta	1
15-Jan-10	10:18	On Effort	33.710213	-76.799080	3	C. caretta	5
15-Jan-10	10:55	On Effort	33.741221	-76.702998	4	C. caretta	2
15-Jan-10	10:56	On Effort	33.773269	-76.745160	4	C. caretta	1
15-Jan-10	11:00	On Effort	33.847695	-76.843923	4	C. caretta	3
15-Jan-10	11:05	On Effort	33.952166	-76.982796	4	C. caretta	1
15-Jan-10	11:05	On Effort	33.948782	-76.978225	4	C. caretta	1
15-Jan-10	11:10	On Effort	33.990576	-76.898168	5	Unidentified turtle	1
15-Jan-10	11:12	On Effort	33.948889	-76.846308	5	C. caretta	1
15-Jan-10	11:20	On Effort	33.761875	-76.599828	5	C. caretta	1
15-Jan-10	12:10	On Effort	33.863797	-76.604394	6	C. caretta	5
15-Jan-10	12:11	On Effort	33.874170	-76.618101	6	C. caretta	2
15-Jan-10	12:12	On Effort	33.907346	-76.661745	6	C. caretta	2
15-Jan-10	12:15	On Effort	33.959703	-76.731066	6	C. caretta	3
15-Jan-10	12:15	On Effort	33.978821	-76.756144	6	C. caretta	2
15-Jan-10	12:16	On Effort	33.990441	-76.771721	6	C. caretta	2
15-Jan-10	12:17	On Effort	34.012474	-76.800743	6	C. caretta	1
15-Jan-10	14:25	On Effort	34.087031	-76.757116	7	C. caretta	2
15-Jan-10	14:37	On Effort	34.042827	-76.702060	7	C. caretta	1
15-Jan-10	14:39	On Effort	33.985401	-76.623156	7	C. caretta	2
15-Jan-10	14:40	On Effort	33.973712	-76.608101	7	C. caretta	1
15-Jan-10	15:31	On Effort	33.943784	-76.445273	8	C. caretta	1
15-Jan-10	15:32	On Effort	33.970031	-76.479706	8	Unidentified turtle	3
15-Jan-10	15:34	On Effort	34.022094	-76.547805	8	C. caretta	4
15-Jan-10	15:37	On Effort	34.087611	-76.633540	8	C. caretta	3
15-Jan-10	15:48	On Effort	34.116694	-76.541219	9	C. caretta	1
15-Jan-10	15:51	On Effort	34.041217	-76.444075	9	C. caretta	1
15-Jan-10	15:55	On Effort	34.014760	-76.408320	9	Unidentified turtle	1
15-Jan-10	16:18	On Effort	34.040514	-76.314311	10	C. caretta	1

Table 10. Effort table for vessel surveys in the Onslow Bay USWTR study region Dec. 24, 2009-Jan. 20, 2010.

Date	Line	Sea State	Kilometers Surveyed
15-Jan-10	8	1 to 3	74.08
16-Jan-10	10	1 to 2	74.08

Table 11. Cetacean and sea turtle sightings during vessel surveys in the Onslow Bay USWTR study region Dec. 24, 2009-Jan. 20, 2010.

Date	Line	On/Off Effort	Time	Latitude	Longitude	Species	Group Size
15-Jan-10	8	On Effort	10:49:25	33.87121232	-76.35241463	*Tursiops truncatus*	3
15-Jan-10	8	On Effort	11:51:52	33.97257913	-76.48418642	*Caretta caretta*	1
15-Jan-10	8	On Effort	12:16:06	34.02118207	-76.54131083	*Caretta caretta*	1
15-Jan-10	8	On Effort	12:18:54	34.02904596	-76.54650791	*Caretta caretta*	1
15-Jan-10	8	On Effort	12:21:52	34.03573287	-76.56105396	*Caretta caretta*	1
15-Jan-10	8	On Effort	12:23:24	34.03721781	76.55807427	*Caretta caretta*	1
15-Jan-10	8	Off Effort	12:25:32	34.04200124	-76.55425806	*Caretta caretta*	1
15-Jan-10	8	On Effort	13:07:06	34.11310593	-76.65615506	*Caretta caretta*	1
15-Jan-10	8	On Effort	13:08:02	34.10988122	-76.65978769	*Caretta caretta*	1
15-Jan-10	8	On Effort	13:14:16	34.11967611	-76.69020911	*Stenella frontalis*	143
15-Jan-10	8	On Effort	14:01:58	34.16424703	-76.73084802	*Stenella frontalis*	24
15-Jan-10	8	Off Effort	14:12:48	34.16560371	-76.734773	*Caretta caretta*	1
16-Jan-10	10	On Effort	11:21:06	34.05210751	-76.33090789	*Stenella frontalis*	8
16-Jan-10	10	Off Effort	11:46:14	34.05775883	-76.33603748	*Caretta caretta*	1
16-Jan-10	10	On Effort	12:25:58	34.13519674	-76.43269955	*Stenella frontalis*	127
16-Jan-10	10	On Effort	14:06:16	34.2643833	-76.59539949	*Tusiops truncatus* or *Stenella frontalis*	10

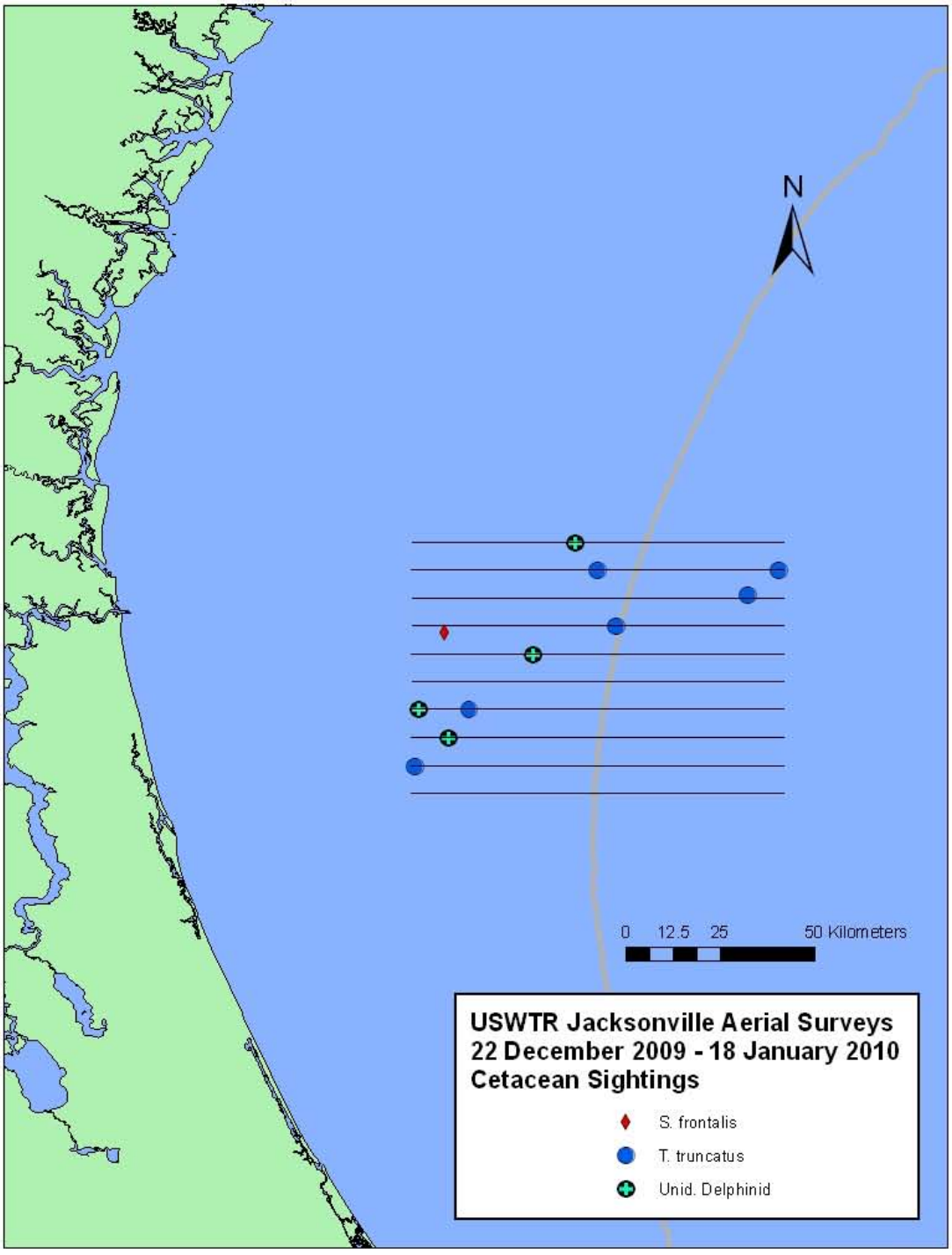


Figure 1. The locations of cetaceans sighted during aerial surveys on 22 Dec, 2009 and 11 Jan, 2010 of the JAX USWTR study region.

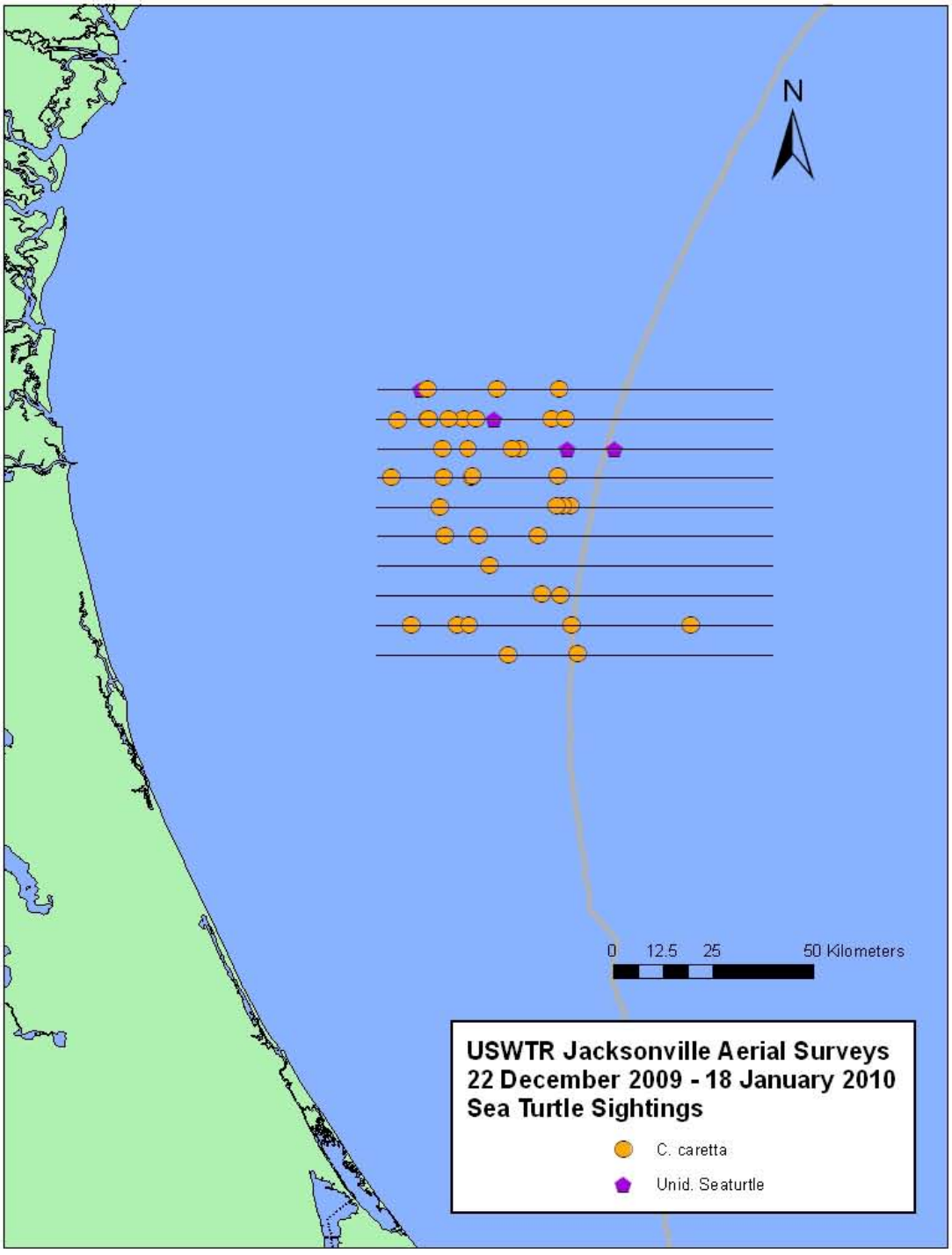


Figure 2. The locations of sea turtles sighted during aerial surveys on 22 Dec, 2009 and 11 Jan, 2010 of the JAX USWTR study region.

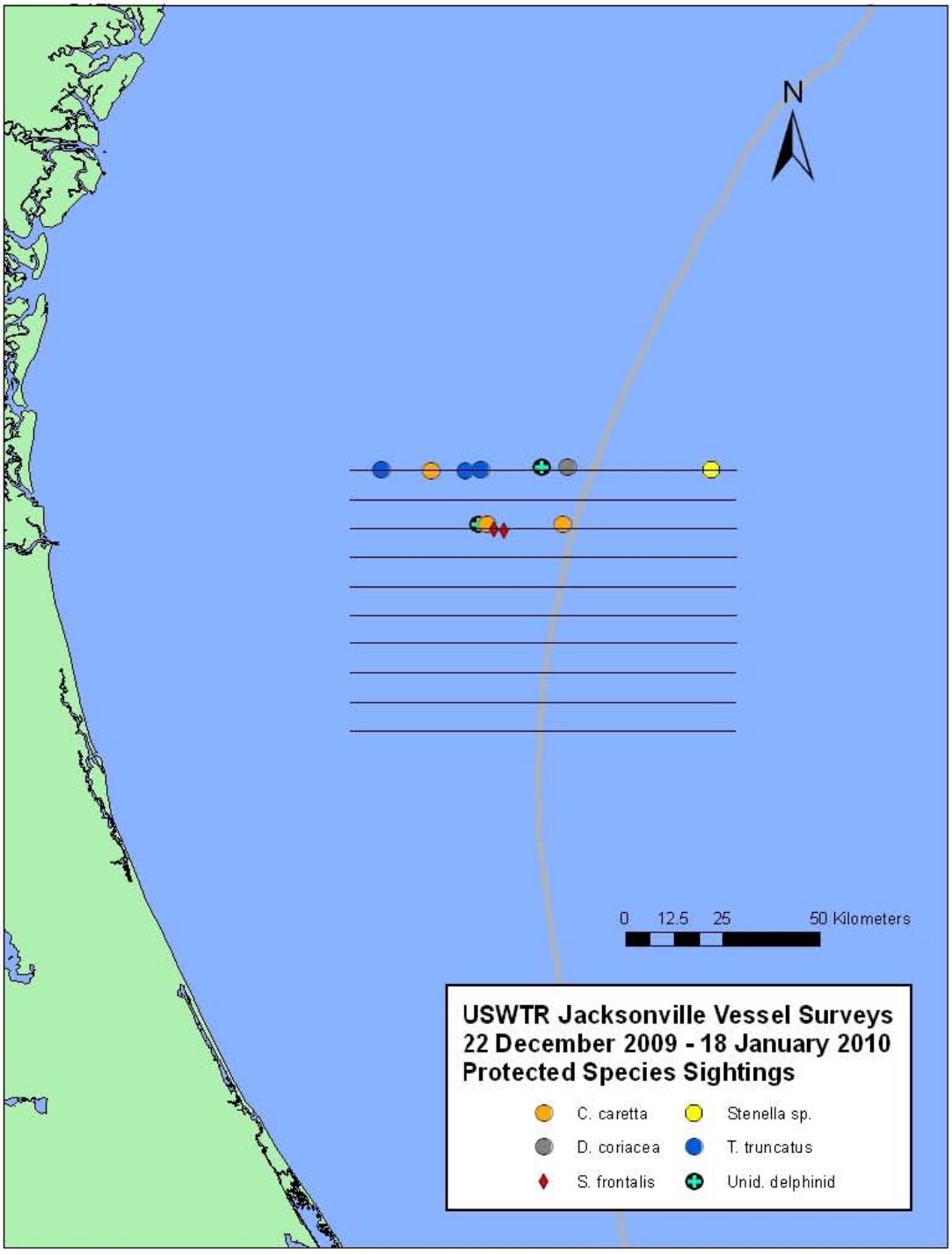


Figure 3. The locations of cetaceans and sea turtles sighted during vessel surveys on 13 and 14 Jan, 2010 of the JAX USWTR study region.

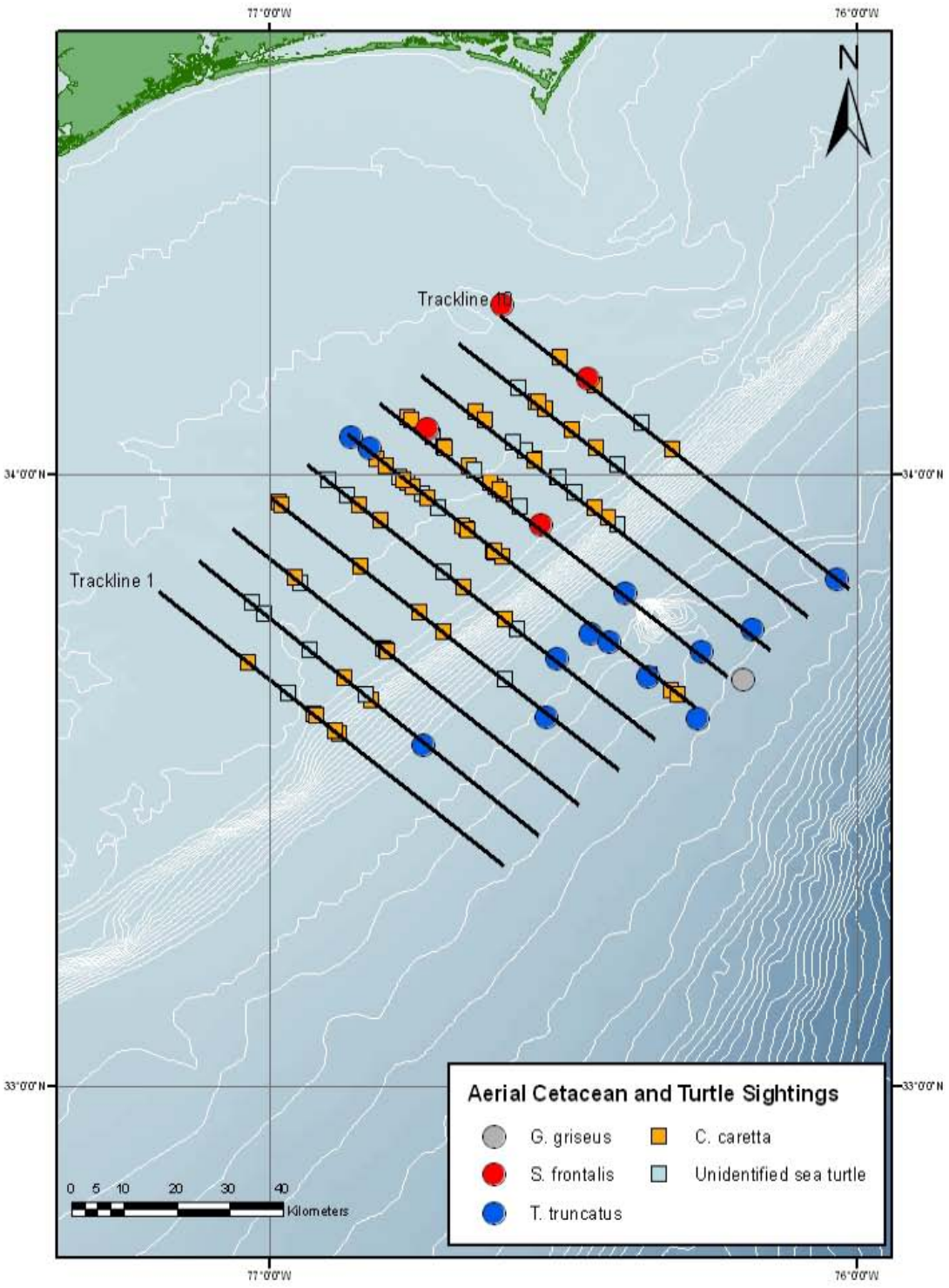


Figure 4. The locations of cetaceans and turtles sighted during aerial surveys on 14 and 15 Jan, 2010 of the Onslow Bay USWTR study region.

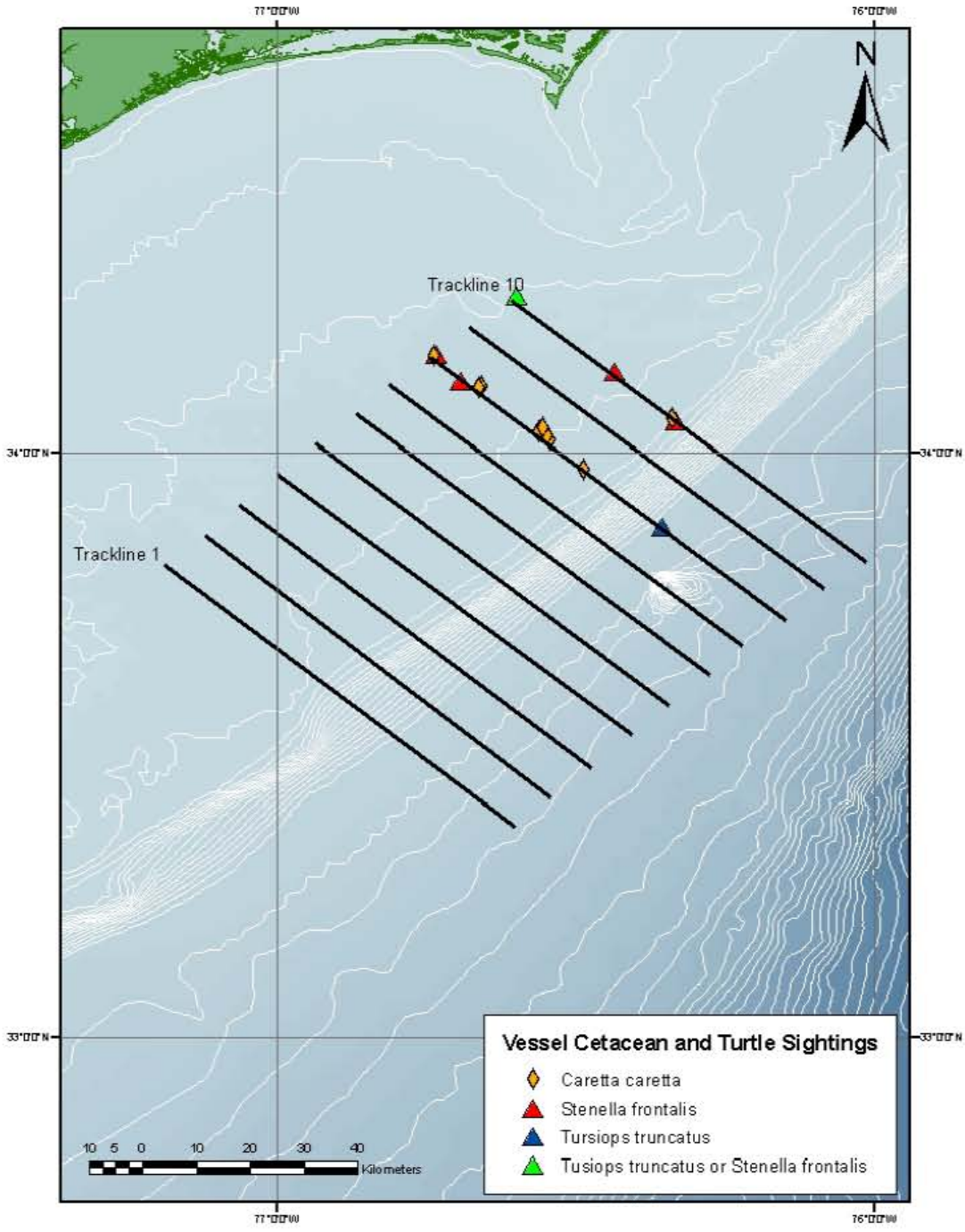


Figure 5. The locations of cetaceans and turtles sighted during vessel surveys on 15 and 16 Jan, 2010 of the Onslow Bay USWTR study region.

Monitoring of Protected Species in the Proposed Onslow Bay and Jacksonville USWTRs
Progress Report: January 19, 2010 through February 23, 2010

Planning (Task 1, 2 & 3)
During this reporting period Duke and UNCW project PIs and team members developed a proposal for a second modification to the Parsons contract in response to further Navy monitoring needs in both Onslow Bay and Jacksonville USWTR study regions. This included the development of a revised cost estimate and technical proposal, and a detailed review and submission of cost backup documentation to accompany the proposal. Jen Dunn coordinated the rapid development of this proposal and collated detailed cost backup information for the proposal.

Purchasing (Task 1).
One pair of headsets originally purchased at the beginning of this project was sent back to David Clark for refurbishment to replace ear cups and wiring which cost ¼ of the original purchase price. Office staples were purchased to re-supply the Fernandina office. Consumable supplies for HARP redeployments (tape, batteries, cable ties) were also purchased.

Travel (Task 1 & 3)
D. Ann Pabst and William McLellan (Co-PIs) traveled to Fernandina Beach on a re-supply trip and to conduct performance evaluations with UNCW staff members. Co-PI Johnston traveled to Fernandina Beach with Scripps engineer Chris Garsha to help refurbish HARP units in the JAX USWTR study region. Ryan McAlarney and Erin Cummings, UNCW Onslow Bay observers, traveled to Fernandina Beach where they joined the JAX team in conducting dual platform aerial and vessel surveys in the Jacksonville USWTR site. This represents the first effort where both aerial and vessel surveys were conducted simultaneously at the Jacksonville site.

JAX Survey Activity (Task 2)
Aerial Surveys
A total of 66 track lines were flown during the current reporting period.
Ten lines were flown on January 19th, 20th, 27th, February 19th, 20th, 21st and 6 lines on January 28th. Weather conditions for the surveys (Table 1) ranged from fair to excellent. There were a total of 76 cetacean encounters during aerial surveys for this period. Species observed were *Tursiops truncatus* (37 sightings), *Stenella frontalis* (26 sightings), *Grampus griseus* (2 sightings), *Balaenoptera acutorostrata* (2 sightings), *Stenella* sp. (1 sighting) and 8 sightings of unidentified delphinids (Table 2). Numerous sea turtles were noted during this reporting period. *Caretta caretta* and *Dermochelys coriacea* were seen regularly along with many unidentified sea turtles (Table 3). Please see Figure 1 for the locations of cetacean sightings and Figure 2 for the locations of sea turtle sightings during aerial surveys.

Vessel Surveys

Two vessel surveys were attempted from the *R/V Volute* during this reporting period; however, the survey for 27 January was aborted at the nearshore end of the survey area due to seas higher than forecasted. A survey of trackline 6 was completed the next day, and was truncated by 21kilometers due to an aircraft carrier at the offshore end of the line that closed vessel traffic on the site (Table 4). There were three cetacean sightings (one *S. frontalis*, one *T. truncatus* and one unidentified delphinid) and three sea turtle encounters (two *C. caretta* and one *D. coriacea)* during the survey (Table 5; Figure 3).

Towed Passive Acoustics

On 28 January the towed acoustic array was deployed from the *R/V Volute* for a total of 283 minutes. Forty-six minutes of recordings were acquired encompassing three visual sighting events, one *S. frontalis*, one *T. truncatus* and one unidentified delphinid.

JAX HARPs (Task 3)

The JAX HARPs were refurbished during this reporting period. We recovered both instruments without any issues, and have developed a smooth system for launch and recovery with Alex Loer and the R/V Stellwagen. After retrieval, it was discovered that the inshore HARP did not initialize after deployment. It remains unclear why. The batteries were found drained and one connection within the Ethernet communications system was found disconnected. The instrument was thoroughly tested, refurbished and deployed in the offshore site. The second HARP was also recovered without issues and appears to have functioned normally for over half the deployment period. An initial inspection of the hydrophone revealed that it had been flooded with seawater at some point during the deployment. A quick review of the disks revealed that sometime at the end of the year (during December 2009) the data stream was compromised by this saltwater invasion. A further inspection of the hydrophone casing revealed several small scratches beside a clean sigmoidal gash about an inch long that penetrated the hydrophone casing. All indications suggest that a marine mammal or shark had chewed on the hydrophone. This second instrument had a CPU and memory board upgrade and it is ready to be redeployed when a new hydrophone is ready. The redeployment of the second unit is tentatively scheduled to occur between March 2 and 14. Scripps personnel will return to install and verify the new hydrophone and finish the redeployment.

Onslow Bay Survey Activity (Task 5)

Aerial Surveys

Aerial survey effort was conducted during this reporting period in which all ten lines were covered once. Survey conditions were good with most of the effort being conducted in a BSS 2-3 (Table 6). There were four cetacean sightings: two *S. frontalis,* one *T. truncatus* and one *Globicephala macrorhynchus* (Table 7, Figure 4). For this last species this month marks the first on effort sighting within the range in winter months. This species was also seen in October during an on

effort survey leg transiting out to the USWTR range. There were also a number of sea turtle sightings recorded within the range this month with *C. caretta* being the dominant species (Table 8, Figure 4).

Vessel Surveys

There was no vessel survey effort from Jan 24-Feb 23, 2010 due to persistent inclement weather conditions.

Towed Passive Acoustics

There was no towed passive acoustics effort from Jan 24-Feb 23, 2010 due to persistent inclement weather conditions.

Onslow HARPs (Task 6)

Onslow HARPs are slated for refurbishment in April 2010.

Exercise Monitoring (Task 7)

No exercise monitoring was conducted during this reporting period.

Additional Project Information

No injuries were sustained during the reporting period.

No problems were encountered that precluded data collection.

Table 1. (2x pages) Aerial survey effort table for the JAX USWTR study region during Jan 19, 2010 - Feb 23, 2010.

Date	Line	Sea State	Kilometers Flown	HOBBS Hours
19-Jan-10	10	1-2	85.5	
19-Jan-10	9	1-2	86.5	
19-Jan-10	8	1-2	86.3	
19-Jan-10	7	1-2	86.9	
19-Jan-10	6	2-3	85.6	7.3
19-Jan-10	5	2	86.5	
19-Jan-10	4	1-2	87.2	
19-Jan-10	3	1-2	86.0	
19-Jan-10	2	1-3	78.2	
19-Jan-10	1	1-3	87.3	
20-Jan-10	1	2-3	85.4	
20-Jan-10	2	2	83.0	
20-Jan-10	3	2	83.9	
20-Jan-10	4	1-2	86.6	
20-Jan-10	5	1-2	86.3	7.3
20-Jan-10	6	1-2	83.0	
20-Jan-10	7	1-2	77.1	
20-Jan-10	8	1-2	83.6	
20-Jan-10	9	1-2	82.8	
20-Jan-10	10	1-2	81.3	
27-Jan-10	10	3-4	85.2	
27-Jan-10	9	3-4	87.0	
27-Jan-10	8	3-4	86.3	
27-Jan-10	7	2-4	86.5	
27-Jan-10	6	3-4	86.5	7.1
27-Jan-10	5	2-4	86.4	
27-Jan-10	4	2-4	86.4	
27-Jan-10	3	2-4	86.2	
27-Jan-10	2	2-4	86.5	
27-Jan-10	1	2-4	85.3	
28-Jan-10	1	2-3	82.0	
28-Jan-10	2	1-3	86.2	
28-Jan-10	3	1-3	84.4	5.8
28-Jan-10	4	1-3	87.0	
28-Jan-10	5	2-3	83.2	
28-Jan-10	6	2-3	84.8	
19-Feb-10	1	3-4	86.6	
19-Feb-10	2	3	86.6	
19-Feb-10	3	3	86.3	
19-Feb-10	4	2-3	86.5	
19-Feb-10	5	3	86.1	6.5
19-Feb-10	6	2-3	86.3	
19-Feb-10	7	1-3	86.1	
19-Feb-10	8	1-3	87.4	
19-Feb-10	9	1-3	86.0	
19-Feb-10	10	1-3	85.9	

Date	Line	Sea State	Kilometers Flown	HOBBS Hours
20-Feb-10	10	1-2	85.5	
20-Feb-10	9	1-2	86.3	
20-Feb-10	8	1-2	85.0	
20-Feb-10	7	1-2	86.3	
20-Feb-10	6	1-3	81.5	8.0
20-Feb-10	5	1-3	83.9	
20-Feb-10	4	1-3	85.7	
20-Feb-10	3	1-3	83.9	
20-Feb-10	2	1-3	84.4	
20-Feb-10	1	1-3	84.0	
21-Feb-10	1	1-2	86.5	
21-Feb-10	2	1-2	85.2	
21-Feb-10	3	1-2	83.5	
21-Feb-10	4	1-2	84.8	
21-Feb-10	5	1-2	81.7	8.3
21-Feb-10	6	1	80.8	
21-Feb-10	7	1	77.4	
21-Feb-10	8	1	85.3	
21-Feb-10	9	1-2	85.4	
21-Feb-10	10	1-2	85.0	

Table 2 (2x pages). Cetacean sightings during aerial surveys in the JAX USWTR study region during Jan 19, 2010 - Feb 23, 2010.

Date	Time	On/Off Effort	Latitute	Longitude	Track Number	Species	Group Size
19-Jan-10	10:18	On Effort	30.368094	-79.839967	7	*T. truncatus*	10
19-Jan-10	10:23	On Effort	30.362928	-79.864591	7	*T. truncatus*	5
19-Jan-10	11:20	On Effort	30.300247	-79.821877	6	*T. truncatus*	11
19-Jan-10	14:27	On Effort	30.091970	-80.385131	3	*T. truncatus*	4
19-Jan-10	14:54	On Effort	30.035396	-80.486387	2	*T. truncatus*	24
19-Jan-10	15:02	On Effort	30.034382	-80.374406	2	*T. truncatus*	2
19-Jan-10	15:23	On Effort	30.026904	-79.988553	2	*T. truncatus*	5
20-Jan-10	9:55	On Effort	30.035027	-80.409063	2	*S. frontalis*	3
20-Jan-10	10:03	On Effort	30.030747	-80.479153	2	*T. truncatus*	3
20-Jan-10	10:26	On Effort	30.098657	-80.691225	3	*T. truncatus*	3
20-Jan-10	10:48	On Effort	30.101009	-80.116509	3	*T. truncatus*	40
20-Jan-10	10:57	On Effort	30.104286	-79.992491	3	*T. truncatus*	5
20-Jan-10	12:07	On Effort	30.298620	-79.858260	6	*T. truncatus*	30
20-Jan-10	12:26	On Effort	30.301264	-80.488315	6	Unid. delphinid	1
20-Jan-10	14:07	On Effort	30.368279	-80.678521	7	*S. frontalis*	30
20-Jan-10	14:15	On Effort	30.363624	-80.499746	7	*S. frontalis*	15
20-Jan-10	14:23	On Effort	30.372688	-80.289967	7	*T. truncatus*	3
20-Jan-10	14:34	On Effort	30.361459	-80.084967	7	*T. truncatus*	14
20-Jan-10	15:06	On Effort	30.436033	-80.506570	8	*T. truncatus*	7
20-Jan-10	15:22	On Effort	30.501224	-80.530414	9	*S. frontalis*	7
20-Jan-10	15:48	On Effort	30.567242	-79.818377	10	*T. truncatus*	16
20-Jan-10	16:08	On Effort	30.562322	-80.363101	10	Unid. delphinid	14
27-Jan-10	15:26	On Effort	30.099334	-79.828985	3	Unid. delphinid	1
27-Jan-10	17:02	On Effort	29.965491	-80.641395	1	*Stenella sp.*	9
28-Jan-10	9:32	On Effort	29.959962	-80.573048	1	*T. truncatus*	5
28-Jan-10	9:52	On Effort	29.970192	-80.259753	1	Unid. delphinid	18
28-Jan-10	10:17	On Effort	29.968545	-80.057141	1	Unid. delphinid	1
28-Jan-10	11:04	On Effort	30.028005	-80.366154	2	*S. frontalis*	11
28-Jan-10	11:18	On Effort	30.030443	-80.658599	2	*T. truncatus*	2
28-Jan-10	11:41	On Effort	30.101081	-80.585021	3	*S. frontalis*	10
28-Jan-10	12:02	On Effort	30.096646	-80.444014	3	*S. frontalis*	8
28-Jan-10	12:59	On Effort	30.163580	-80.684992	4	*T. truncatus*	2
28-Jan-10	15:08	On Effort	30.230264	-80.524258	5	*T. truncatus*	3
28-Jan-10	15:23	On Effort	30.238250	-80.398262	5	*T. truncatus*	3
28-Jan-10	16:02	On Effort	30.302032	-80.120480	6	*G. griseus*	7
28-Jan-10	16:14	On Effort	30.300036	-80.337468	6	*T. truncatus*	3
20-Feb-10	10:33	On Effort	30.499955	-80.396613	9	*S. frontalis*	17
20-Feb-10	10:48	On Effort	30.500891	-80.618709	9	*S. frontalis*	2
20-Feb-10	10:56	On Effort	30.432762	-80.620269	8	Unid. delphinid	3
20-Feb-10	12:05	On Effort	30.368241	-80.652563	7	*S. frontalis*	10
20-Feb-10	12:18	Off Effort	30.295976	-80.599638	6	*S. frontalis*	2
20-Feb-10	12:27	On Effort	30.303476	-80.516636	6	*T. truncatus*	12
20-Feb-10	12:36	On Effort	30.298273	-80.473435	6	*S. frontalis*	3
20-Feb-10	12:42	On Effort	30.307844	-80.346851	6	*S. frontalis*	45
20-Feb-10	13:15	On Effort	30.234682	-80.064016	5	*B. acutorostrata*	1
20-Feb-10	13:35	On Effort	30.220544	-80.489406	5	*S. frontalis*	60
20-Feb-10	13:45	On Effort	30.238398	-80.693274	5	*T. truncatus*	1
20-Feb-10	15:26	On Effort	30.169151	-80.521569	4	*S. frontalis*	2
20-Feb-10	15:46	On Effort	30.163147	-79.885885	4	*T. truncatus*	3
20-Feb-10	16:17	On Effort	30.103998	-80.545810	3	*S. frontalis*	4

Date	Time	On/Off Effort	Latitute	Longitude	Track Number	Species	Group Size
20-Feb-10	16:35	On Effort	30.037500	-80.374863	2	Unid. delphinid	5
20-Feb-10	16:59	On Effort	29.973820	-79.925572	1	Unid. delphinid	5
21-Feb-10	9:00	On Effort	30.034156	-79.805427	2	*T. truncatus*	4
21-Feb-10	9:10	On Effort	30.033649	-79.848469	2	*T. truncatus*	20
21-Feb-10	9:55	On Effort	30.090595	-80.509092	3	*T. truncatus*	8
21-Feb-10	10:02	On Effort	30.085494	-80.414333	3	*S. frontalis*	50
21-Feb-10	10:23	On Effort	30.104639	-79.864820	3	*T. truncatus*	26
21-Feb-10	10:43	On Effort	30.168803	-80.153954	4	*G. griseus*	7
21-Feb-10	11:01	On Effort	30.175268	-80.557259	4	*T. truncatus*	6
21-Feb-10	11:18	On Effort	30.228045	-80.672911	5	*T. truncatus*	1
21-Feb-10	11:27	On Effort	30.237415	-80.561136	5	*T. truncatus*	3
21-Feb-10	11:35	On Effort	30.236873	-80.491644	5	*T. truncatus*	3
21-Feb-10	11:47	On Effort	30.238243	-80.348145	5	*S. frontalis*	7
21-Feb-10	11:52	On Effort	30.236288	-80.292178	5	*T. truncatus*	8
21-Feb-10	12:16	On Effort	30.303635	-79.999596	6	*B. acutorostrata*	1
21-Feb-10	12:37	On Effort	30.307680	-80.465500	6	*S. frontalis*	40
21-Feb-10	14:26	On Effort	30.350682	-80.618624	7	*S. frontalis*	70
21-Feb-10	14:36	On Effort	30.370790	-80.462578	7	*S. frontalis*	18
21-Feb-10	14:42	On Effort	30.368036	-80.389323	7	*S. frontalis*	40
21-Feb-10	14:50	On Effort	30.354268	-80.344896	7	*T. truncatus*	6
21-Feb-10	15:10	On Effort	30.364399	-79.885563	7	*T. truncatus*	3
21-Feb-10	15:23	On Effort	30.430170	-80.025826	8	*T. truncatus*	13
21-Feb-10	15:43	On Effort	30.440175	-80.456014	8	*S. frontalis*	12
21-Feb-10	16:04	On Effort	30.493992	-80.358464	9	*S. frontalis*	30
21-Feb-10	16:36	On Effort	30.572472	-80.277572	10	*S. frontalis*	18
21-Feb-10	16:48	On Effort	30.566559	-80.608603	10	*S. frontalis*	18

Table 3 (4x pages). Sea turtle sightings during aerial surveys in the JAX USWTR study region during Jan 19, 2010 - Feb 23, 2010.

Date	Time	On/Off Effort	Latitude	Longitude	Track Number	Species	Group Size
19-Jan-10	9:56	On	30.434127	-80.352844	8	*C. caretta*	1
19-Jan-10	10:00	On	30.434214	-80.209340	8	*C. caretta*	1
19-Jan-10	11:39	On	30.232290	-80.274277	5	*C. caretta*	1
19-Jan-10	13:35	On	30.166912	-80.625587	4	*C. caretta*	1
19-Jan-10	13:38	On	30.167246	-80.536419	4	*C. caretta*	1
19-Jan-10	13:39	On	30.167200	-80.494497	4	*C. caretta*	2
19-Jan-10	13:45	On	30.168020	-80.272495	4	*C. caretta*	1
19-Jan-10	13:46	On	30.167973	-80.262807	4	*C. caretta*	1
19-Jan-10	14:41	On	30.099499	-80.658473	3	*C. caretta*	1
19-Jan-10	14:46	On	30.032010	-80.643162	2	*D. coriacea*	1
19-Jan-10	15:57	On	29.964911	-80.644896	1	*C. caretta*	1
20-Jan-10	9:06	On	29.966060	-80.596401	1	*C. caretta*	1
20-Jan-10	9:11	On	29.966406	-80.371544	1	Unid. Seaturtle	1
20-Jan-10	9:13	On	29.966369	-80.295468	1	*C. caretta*	2
20-Jan-10	9:50	On	30.030892	-80.271656	2	Unid. Seaturtle	1
20-Jan-10	9:53	On	30.031389	-80.358517	2	*C. caretta*	1
20-Jan-10	9:53	On	30.031303	-80.368874	2	Unid. Seaturtle	1
20-Jan-10	9:53	On	30.031389	-80.385767	2	Unid. Seaturtle	1
20-Jan-10	10:19	On	30.030901	-80.637721	2	*C. caretta*	1
20-Jan-10	10:20	On	30.030491	-80.694715	2	*C. caretta*	1
20-Jan-10	10:20	On	30.030468	-80.697535	2	*C. caretta*	1
20-Jan-10	10:35	On	30.100388	-80.625006	3	Unid. Seaturtle	1
20-Jan-10	10:37	On	30.100492	-80.548021	3	Unid. Seaturtle	2
20-Jan-10	10:40	On	30.100783	-80.408151	3	*C. caretta*	1
20-Jan-10	10:43	On	30.100923	-80.321203	3	*C. caretta*	1
20-Jan-10	10:44	On	30.100972	-80.272217	3	*C. caretta*	1
20-Jan-10	10:44	On	30.100979	-80.270201	3	*C. caretta*	1
20-Jan-10	11:24	On	30.166170	-80.355583	4	Unid. Seaturtle	1
20-Jan-10	11:25	On	30.166121	-80.409776	4	Unid. Seaturtle	1
20-Jan-10	11:26	On	30.168326	-80.424652	4	*D. coriacea*	2
20-Jan-10	11:32	On	30.165784	-80.588996	4	*C. caretta*	1
20-Jan-10	11:33	On	30.165797	-80.615828	4	*C. caretta*	1
20-Jan-10	11:45	On	30.233285	-80.401017	5	Unid. Seaturtle	1
20-Jan-10	11:50	On	30.233216	-80.289355	5	*C. caretta*	1
20-Jan-10	12:23	On	30.299760	-80.405974	6	Unid. Seaturtle	1
20-Jan-10	14:12	On	30.364375	-80.602241	7	*C. caretta*	1
20-Jan-10	14:13	On	30.367083	-80.571071	7	*C. caretta*	1
20-Jan-10	14:13	On	30.366684	-80.540792	7	*D. coriacea*	1
20-Jan-10	14:14	On	30.366801	-80.512023	7	Unid. Seaturtle	1
20-Jan-10	14:18	On	30.366792	-80.434054	7	*C. caretta*	1
20-Jan-10	14:18	On	30.366906	-80.421697	7	*C. caretta*	1
20-Jan-10	14:19	On	30.366845	-80.383708	7	*C. caretta*	1
20-Jan-10	14:58	On	30.432392	-80.231867	8	*C. caretta*	1
20-Jan-10	15:00	On	30.432475	-80.324133	8	*C. caretta*	1
20-Jan-10	15:03	On	30.432418	-80.412123	8	*C. caretta*	2
20-Jan-10	15:04	On	30.431974	-80.464450	8	*C. caretta*	1
20-Jan-10	15:10	On	30.431516	-80.586286	8	*C. caretta*	2
20-Jan-10	15:17	On	30.499211	-80.645100	9	*C. caretta*	1
20-Jan-10	15:18	On	30.500477	-80.614815	9	Unid. Seaturtle	2
20-Jan-10	15:18	On	30.500534	-80.595852	9	Unid. Seaturtle	4
27-Jan-10	10:50	On	30.497974	-80.588156	9	*C. caretta*	1
27-Jan-10	11:41	On	30.365127	-80.337588	7	*C. caretta*	1
27-Jan-10	14:58	On	30.167814	-80.655985	4	*C. caretta*	1
27-Jan-10	15:03	On	30.167399	-80.480802	4	*C. caretta*	1
27-Jan-10	15:04	On	30.167142	-80.434641	4	Unid. Seaturtle	1
27-Jan-10	16:12	On	30.033084	-80.504018	2	Unid. Seaturtle	1
27-Jan-10	16:56	On	29.964212	-80.519861	1	*C. caretta*	1
27-Jan-10	16:58	On	29.963735	-80.612545	1	*C. caretta*	1
28-Jan-10	9:28	On	29.965874	80.645810	1	Unid. Seaturtle	1
28-Jan-10	9:31	Off	29.962802	-80.599122	1	*D. coriacea*	1
28-Jan-10	9:44	On	29.966246	80.443662	1	*C. caretta*	1
28-Jan-10	9:44	On	29.966243	-80.444693	1	*C. caretta*	1

Date	Time	On/Off Effort	Latitude	Longitude	Track Number	Species	Group Size
28-Jan-10	9:46	On	29.966443	-80.375928	1	*C. caretta*	1
28-Jan-10	9:46	On	29.966357	80.387729	1	Unid. Seaturtle	1
28-Jan-10	11:09	On	30.031518	80.408018	2	Unid. Seaturtle	1
28-Jan-10	11:11	On	30.031393	-80.473511	2	*C. caretta*	1
28-Jan-10	11:11	On	30.031356	80.483605	2	Unid. Seaturtle	1
28-Jan-10	11:12	On	30.031482	-80.498770	2	*C. caretta*	1
28-Jan-10	11:12	On	30.031421	-80.510538	2	*C. caretta*	1
28-Jan-10	11:12	On	30.031395	80.514661	2	Unid. Seaturtle	1
28-Jan-10	11:14	2.7	30.031067	-80.570732	2	Unid. Seaturtle	1
28-Jan-10	11:15	On	30.030842	-80.627892	2	*C. caretta*	1
28-Jan-10	11:39	On	30.100337	80.608193	3	Unid. Seaturtle	3
28-Jan-10	11:58	On	30.098813	80.523909	3	Unid. Seaturtle	1
28-Jan-10	12:00	On	30.100546	80.472517	3	*C. caretta*	1
28-Jan-10	12:00	On	30.100648	-80.451952	3	*C. caretta*	1
28-Jan-10	12:38	On	30.166299	80.236667	4	*C. caretta*	1
28-Jan-10	12:43	On	30.166211	-80.416667	4	*C. caretta*	1
28-Jan-10	12:48	On	30.166066	-80.545775	4	*C. caretta*	1
28-Jan-10	12:50	Off	30.165367	-80.603724	4	*D. coriacea*	1
28-Jan-10	12:51	On	30.166625	80.597649	4	*D. coriacea*	1
28-Jan-10	15:12	On	30.233323	-80.463677	5	*C. caretta*	1
28-Jan-10	15:13	On	30.233811	80.436111	5	*C. caretta*	2
28-Jan-10	15:13	On	30.233805	-80.436569	5	*C. caretta*	1
28-Jan-10	15:14	On	30.233810	-80.407492	5	*C. caretta*	1
28-Jan-10	15:29	On	30.233469	80.350920	5	*C. caretta*	2
28-Jan-10	15:31	On	30.234176	80.287473	5	*C. caretta*	1
28-Jan-10	15:31	On	30.233991	-80.276257	5	*C. caretta*	1
28-Jan-10	16:11	On	30.299000	80.283856	6	Unid. Seaturtle	1
28-Jan-10	16:22	On	30.299338	-80.402664	6	*C. caretta*	1
28-Jan-10	16:25	On	30.299149	80.527143	6	Unid. Seaturtle	1
28-Jan-10	16:29	On	30.299004	-80.637224	6	*C. caretta*	1
19-Feb-10	10:18	On	30.099968	-80.614461	3	*C. caretta*	1
19-Feb-10	11:58	On	30.300214	-80.500372	6	*C. caretta*	1
19-Feb-10	12:02	On	30.300069	-80.611535	6	*C. caretta*	1
19-Feb-10	13:44	On	30.365414	-80.562004	7	*C. caretta*	1
19-Feb-10	13:47	On	30.365483	-80.477107	7	*C. caretta*	1
19-Feb-10	13:54	On	30.366759	-80.328203	7	*C. caretta*	1
19-Feb-10	14:29	On	30.433916	-80.255053	8	*D. coriacea*	1
19-Feb-10	14:38	On	30.433555	-80.472532	8	*C. caretta*	2
19-Feb-10	14:49	On	30.498968	-80.626622	9	*C. caretta*	1
19-Feb-10	14:51	On	30.499062	-80.577891	9	*C. caretta*	1
19-Feb-10	14:52	On	30.499250	-80.514702	9	*C. caretta*	1
19-Feb-10	15:31	On	30.567223	-80.365963	10	*C. caretta*	2
19-Feb-10	15:37	On	30.566714	-80.603203	10	*C. caretta*	1
19-Feb-10	15:39	On	30.566545	-80.666463	10	*C. caretta*	2
20-Feb-10	9:44	On	30.565864	-80.625436	10	*C. caretta*	3
20-Feb-10	9:44	On	30.565775	-80.623834	10	*C. caretta*	1
20-Feb-10	9:45	On	30.566162	-80.585383	10	*C. caretta*	1
20-Feb-10	9:53	On	30.566702	-80.321080	10	*C. caretta*	1
20-Feb-10	9:54	On	30.566794	-80.266321	10	*C. caretta*	1
20-Feb-10	10:22	On	30.499951	-80.217201	9	*C. caretta*	1
20-Feb-10	10:22	On	30.499932	-80.225575	9	Unid. seaturtle	1
20-Feb-10	10:23	On	30.499918	-80.260149	9	*C. caretta*	2
20-Feb-10	10:24	On	30.499748	-80.303568	9	*C. caretta*	2
20-Feb-10	10:24	On	30.499839	-80.278145	9	*C. caretta*	1
20-Feb-10	10:30	On	30.499763	-80.377635	9	*C. caretta*	1
20-Feb-10	10:31	On	30.499840	-80.399430	9	*C. caretta*	1
20-Feb-10	10:39	On	30.499597	-80.485433	9	*C. caretta*	1
20-Feb-10	10:40	On	30.499557	-80.537593	9	*C. caretta*	1
20-Feb-10	10:41	On	30.499539	-80.580633	9	*C. caretta*	5
20-Feb-10	10:41	On	30.499540	-80.585648	9	*C. caretta*	2
20-Feb-10	10:42	On	30.499498	-80.595415	9	*C. caretta*	3
20-Feb-10	10:49	On	30.499951	-80.646232	9	*C. caretta*	2
20-Feb-10	10:50	On	30.499167	-80.684272	9	*C. caretta*	1

Date	Time	On/Off Effort	Latitude	Longitude	Track Number	Species	Group Size
20-Feb-10	11:17	On	30.433001	-80.498033	8	*C. caretta*	3
20-Feb-10	11:18	On	30.433297	-80.465422	8	*C. caretta*	3
20-Feb-10	11:18	On	30.433422	-80.455525	8	*C. caretta*	1
20-Feb-10	11:22	On	30.433410	-80.311014	8	Unid. seaturtle	1
20-Feb-10	11:25	On	30.433512	-80.212100	8	*C. caretta*	1
20-Feb-10	11:51	On	30.366200	-80.223566	7	*C. caretta*	1
20-Feb-10	11:53	On	30.366056	-80.302827	7	*C. caretta*	1
20-Feb-10	11:54	On	30.365928	-80.351623	7	*C. caretta*	1
20-Feb-10	11:58	On	30.365756	-80.482424	7	*C. caretta*	1
20-Feb-10	12:00	On	30.365752	-80.578061	7	*C. caretta*	1
20-Feb-10	12:13	On	30.298076	-80.662381	6	*C. caretta*	1
20-Feb-10	12:14	On	30.299376	-80.630461	6	*C. caretta*	1
20-Feb-10	12:14	On	30.299111	-80.644859	6	*C. caretta*	1
20-Feb-10	12:47	On	30.300131	-80.280769	6	*C. caretta*	1
20-Feb-10	13:32	On	30.232779	-80.464949	5	*C. caretta*	1
20-Feb-10	13:37	On	30.233441	-80.513720	5	*C. caretta*	1
20-Feb-10	15:29	On	30.166229	-80.399973	4	*C. caretta*	1
20-Feb-10	15:32	On	30.166474	-80.279310	4	*C. caretta*	1
20-Feb-10	15:32	On	30.166356	-80.272266	4	*C. caretta*	1
20-Feb-10	16:12	On	30.100528	-80.482959	3	*C. caretta*	1
20-Feb-10	16:28	On	30.031373	-80.592192	2	*C. caretta*	1
20-Feb-10	16:30	On	30.031640	-80.515057	2	*C. caretta*	1
20-Feb-10	16:38	On	30.031639	-80.286655	2	*C. caretta*	1
20-Feb-10	16:42	On	30.031465	-80.158169	2	Unid. seaturtle	1
21-Feb-10	8:38	On	29.965243	-80.505803	1	*C. caretta*	1
21-Feb-10	8:38	On	29.965257	-80.507573	1	Unid. seaturtle	1
21-Feb-10	8:42	On	29.965443	-80.350439	1	Unid. seaturtle	1
21-Feb-10	8:46	On	29.965437	-80.188799	1	*C. caretta*	1
21-Feb-10	8:52	On	29.965144	-79.955871	1	*C. caretta*	1
21-Feb-10	8:52	On	29.965056	-79.932900	1	*C. caretta*	1
21-Feb-10	9:29	On	30.032120	-80.389601	2	Unid. seaturtle	1
21-Feb-10	9:31	On	30.032338	-80.463837	2	*C. caretta*	1
21-Feb-10	9:31	On	30.032181	-80.492934	2	Unid. seaturtle	1
21-Feb-10	9:40	On	30.099365	-80.658357	3	Unid. seaturtle	2
21-Feb-10	10:10	On	30.100339	-80.301111	3	*C. caretta*	1
21-Feb-10	10:38	On	30.166338	-80.064786	4	*C. caretta*	1
21-Feb-10	10:52	On	30.166730	-80.268801	4	*C. caretta*	1
21-Feb-10	10:55	On	30.166745	-80.391231	4	*C. caretta*	1
21-Feb-10	10:56	On	30.166688	-80.437198	4	*C. caretta*	3
21-Feb-10	10:58	On	30.166491	-80.509623	4	*C. caretta*	2
21-Feb-10	11:11	On	30.166056	-80.683378	4	*C. caretta*	1
21-Feb-10	11:24	On	30.232575	-80.617937	5	*C. caretta*	1
21-Feb-10	11:33	On	30.232177	-80.513457	5	*C. caretta*	3
21-Feb-10	11:44	On	30.232581	-80.437825	5	*C. caretta*	1
21-Feb-10	11:46	On	30.232836	-80.372772	5	*C. caretta*	1
21-Feb-10	12:31	On	30.301000	-80.257254	6	*C. caretta*	4
21-Feb-10	12:34	On	30.300402	-80.372948	6	Unid. seaturtle	3
21-Feb-10	12:36	On	30.300284	-80.448465	6	*C. caretta*	2
21-Feb-10	14:33	On	30.365226	-80.547975	7	Unid. seaturtle	1
21-Feb-10	14:34	On	30.365615	-80.505194	7	*C. caretta*	1
21-Feb-10	14:35	On	30.365147	-80.466082	7	Unid. seaturtle	1
21-Feb-10	14:55	On	30.365954	-80.313542	7	*C. caretta*	1
21-Feb-10	14:55	On	30.365630	-80.296967	7	*C. caretta*	1
21-Feb-10	14:57	On	30.365819	-80.227714	7	Unid. seaturtle	3
21-Feb-10	15:37	On	30.433569	-80.207054	8	*C. caretta*	3
21-Feb-10	15:38	On	30.433789	-80.278162	8	*C. caretta*	1
21-Feb-10	15:41	On	30.433950	-80.390762	8	Unid. seaturtle	1
21-Feb-10	15:41	On	30.433978	-80.396392	8	Unid. seaturtle	2
21-Feb-10	15:47	On	30.433407	-80.490761	8	*C. caretta*	1
21-Feb-10	15:47	On	30.433246	-80.484685	8	*C. caretta*	1
21-Feb-10	15:50	On	30.433055	-80.626976	8	Unid. seaturtle	1
21-Feb-10	15:51	On	30.433280	-80.660645	8	Unid. seaturtle	3
21-Feb-10	15:55	On	30.497951	-80.666477	9	*C. caretta*	1

Date	Time	On/Off Effort	Latitude	Longitude	Track Number	Species	Group Size
21-Feb-10	15:57	On	30.498829	-80.609646	9	*C. caretta*	1
21-Feb-10	15:58	On	30.499157	-80.574456	9	*C. caretta*	3
21-Feb-10	15:59	On	30.498906	-80.508135	9	*C. caretta*	2
21-Feb-10	16:01	On	30.499395	-80.435228	9	Unid. seaturtle	1
21-Feb-10	16:08	On	30.499461	-80.268270	9	*C. caretta*	1
21-Feb-10	16:10	On	30.499649	-80.219302	9	*C. caretta*	1
21-Feb-10	16:11	On	30.499532	-80.188571	9	*C. caretta*	1
21-Feb-10	16:32	On	30.567109	-80.165184	10	*C. caretta*	1
21-Feb-10	16:32	On	30.567108	-80.143254	10	Unid. seaturtle	1
21-Feb-10	16:34	On	30.567080	-80.230362	10	*C. caretta*	1
21-Feb-10	16:34	On	30.567175	-80.218925	10	Unid. seaturtle	1
21-Feb-10	16:35	On	30.567262	-80.254747	10	*C. caretta*	2
21-Feb-10	16:40	On	30.567120	-80.341537	10	*C. caretta*	1
21-Feb-10	16:47	On	30.566800	-80.579505	10	Cca	1

Table 4. Vessel survey effort table for the JAX USWTR study region during Jan 19, 2010 - Feb 23, 2010.

Date	Line	Sea State	Kilometers Surveyed	Survey Time (Hrs)	Total Time at Sea (Hrs)
28-Jan-10	6	1-3	63.05	3:43	13:40

Table 5. Cetacean and sea turtle sightings for vessel surveys in JAX study region during Jan 19, 2010 - Feb 23, 2010.

Date	Time	On/Off Effort	Latitude	Longitude	Line	Species	Group Size
28-Jan-10	14:16	On effort	30.302944	-80.353822	6	*S. frontalis*	5
28-Jan-10	14:39	On effort	30.300664	-80.406183	6	*T. truncatus*	3
28-Jan-10	15:11	On effort	30.300260	-80.486600	6	Unid. delphinid	3
28-Jan-10	14:24	On effort	30.302467	-80.377815	6	*C. caretta*	1
28-Jan-10	14:27	On effort	30.302740	-80.389045	6	*D. coriacea*	1
28-Jan-10	15:44	On effort	30.297800	-80.587080	6	*C. caretta*	1

Table 6. Aerial survey effort table for the Onslow Bay USWTR study region during Jan 19, 2010 - Feb 23, 2010.

Date	Line	Sea State	Kilometers Flown	Hobbs Hours
21-Feb-10	1	2 to 3	74.5	8.0
21-Feb-10	2	3	73.5	
21-Feb-10	3	3	75.4	
21-Feb-10	4	2 to 3	75.2	
21-Feb-10	5	2 to 3	73.6	
21-Feb-10	6	2	72.0	
21-Feb-10	10	1 to 3	73.8	
21-Feb-10	9	1 to 3	72.2	
21-Feb-10	8	1 to 3	71.3	
21-Feb-10	7	1 to 2	73.3	

Table 7. Cetacean sightings during aerial surveys in the Onslow Bay USWTR study region during Jan 19, 2010 - Feb 23, 2010.

Date	Time	On/Off Effort	Latitute	Longitude	Track Number	Species	Group Size
21-Feb-10	11:26	On Effort	33.924674	-76.66271	6	Sfr	18
21-Feb-10	14:41	On Effort	33.897988	-76.253719	9	Ttr	11
21-Feb-10	15:17	On Effort	33.98478	-76.500092	8	Sfr	8
21-Feb-10	15:39	On Effort	33.757085	-76.19298	8	Gma	23

Table 8. Sea turtle sightings during aerial surveys in the Onslow Bay USWTR study region during Jan 19, 2010 - Feb 23, 2010.

Date	Time	On/Off Effort	Latitude	Longitude	Track Number	Species	Group Size
21-Feb-10	9:33	On Effort	33.667997	-76.872876	2	Cca	1
21-Feb-10	9:35	On Effort	33.709395	-76.926478	2	Cca	1
21-Feb-10	11:22	On Effort	33.876367	-76.620640	6	Cca	1
21-Feb-10	11:23	On Effort	33.890604	-76.638503	6	Cca	1
21-Feb-10	12:00	On Effort	34.037150	-76.831854	6	Cca	2
21-Feb-10	12:00	On Effort	34.034801	-76.828779	6	Cca	1
21-Feb-10	12:01	On Effort	34.048215	-76.850544	6	Cca	2
21-Feb-10	14:01	On Effort	34.255498	-76.589260	10	Cca	1
21-Feb-10	14:01	On Effort	34.253342	-76.586512	10	Cca	1
21-Feb-10	14:03	On Effort	34.221560	-76.545455	10	Cca	1
21-Feb-10	14:03	On Effort	34.20881	-76.529055	10	Cca	2
21-Feb-10	14:05	On Effort	34.171494	-76.480713	10	Cca	3
21-Feb-10	14:52	On Effort	34.063529	-76.468725	9	Cca	3
21-Feb-10	14:55	On Effort	34.117065	-76.537982	9	Cca	2
21-Feb-10	14:55	On Effort	34.123505	-76.546724	9	Cca	2
21-Feb-10	14:56	On Effort	34.140015	-76.568197	9	Cca	5
21-Feb-10	14:58	On Effort	34.176295	-76.615111	9	Cca	4
21-Feb-10	15:04	On Effort	34.160274	-76.726437	8	Cca	3
21-Feb-10	15:04	On Effort	34.157408	-76.722546	8	Cca	1
21-Feb-10	15:07	On Effort	34.106766	-76.658314	8	Cca	1
21-Feb-10	15:08	On Effort	34.080735	-76.621368	8	Turt	2
21-Feb-10	15:12	On Effort	34.016392	-76.539278	8	Cca	4
21-Feb-10	15:34	On Effort	33.793947	-76.24495	8	Turt	1
21-Feb-10	16:13	On Effort	33.973686	-76.608215	7	Cca	1
21-Feb-10	16:18	On Effort	34.058254	-76.720467	7	Cca	2
21-Feb-10	16:19	On Effort	34.087095	-76.757460	7	Cca	2
21-Feb-10	16:19	On Effort	34.081816	-76.749535	7	Cca	2

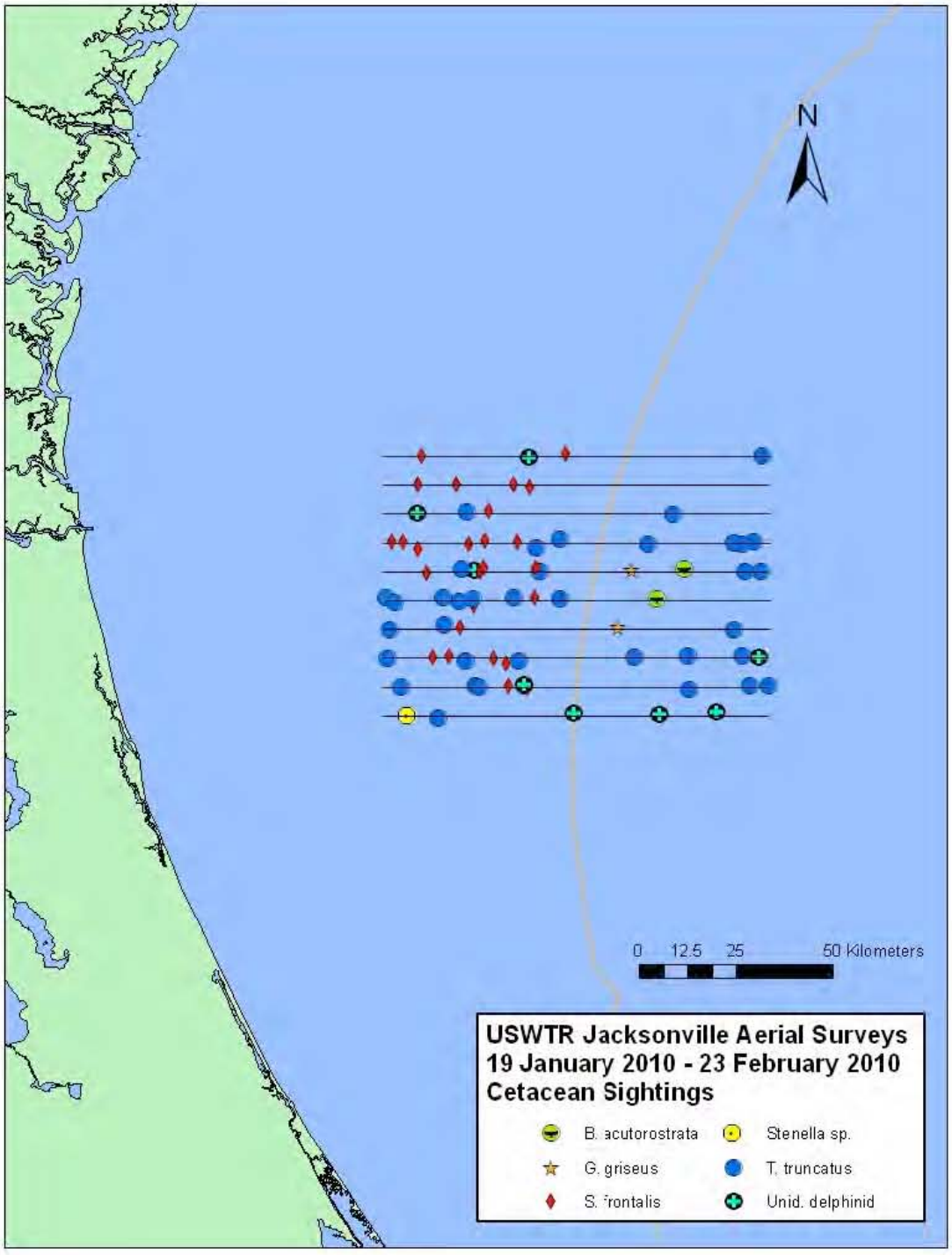


Figure 1. The locations of cetaceans sighted while conducting aerial surveys during the January 19th to February 23 2010 reporting period of the JAX USWTR study region.

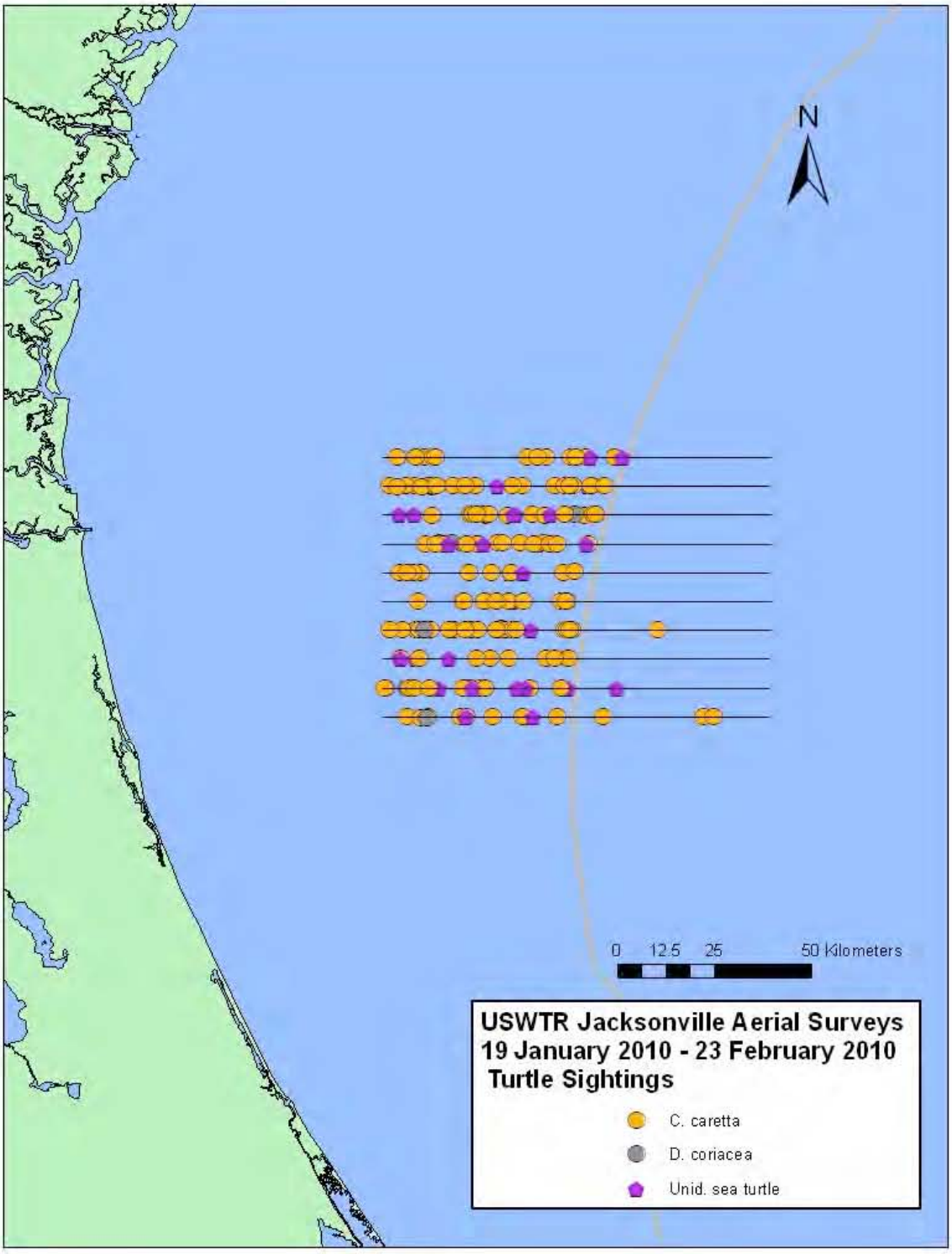


Figure 2. The locations of sea turtles sighted during aerial surveys between January 19th and February 23, 2010 in the JAX USWTR study region.

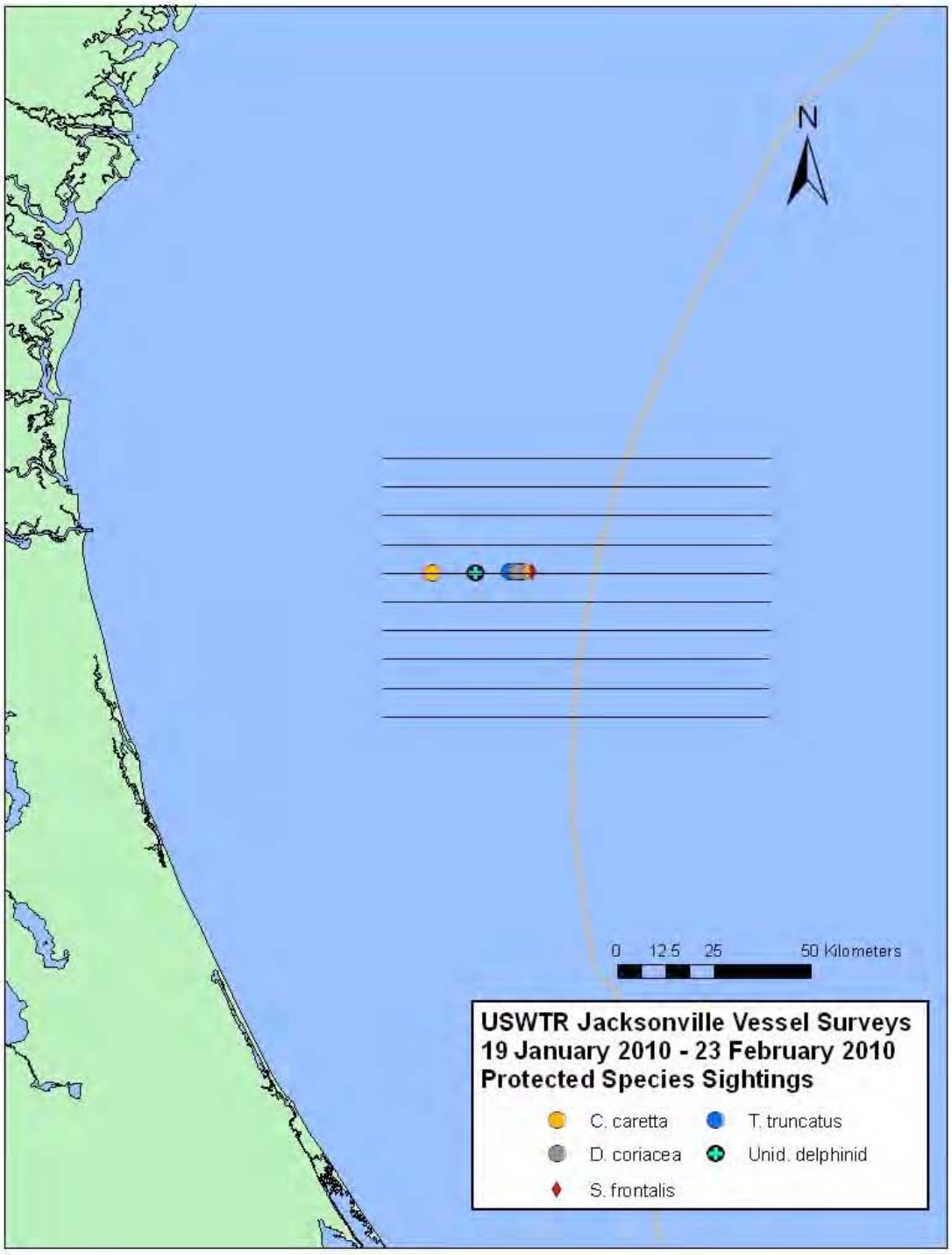


Figure 3. Cetaceans and sea turtles observed during truncated vessel surveys of the JAX USWTR study region, January 19 through February 23, 2010.

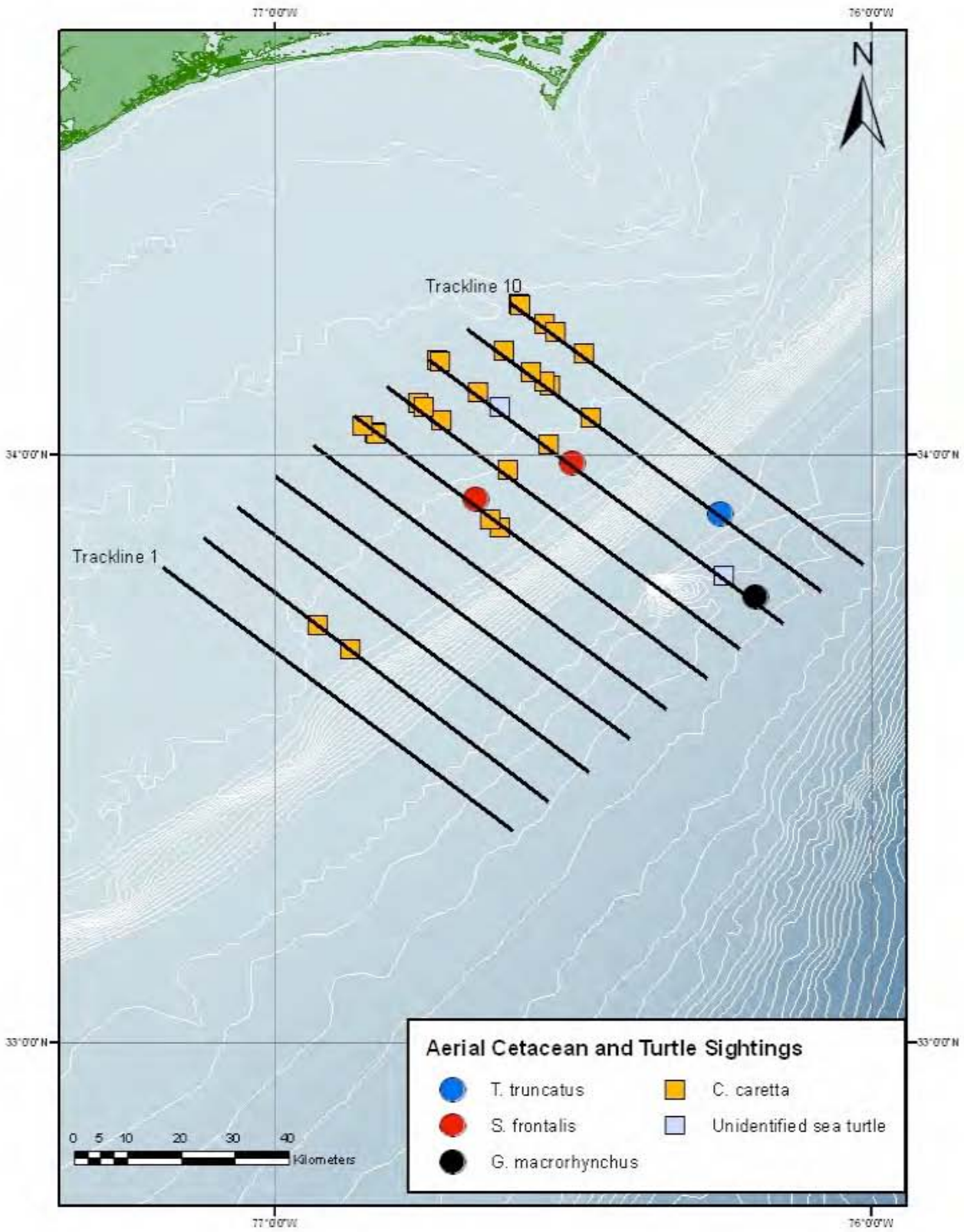


Figure 4. The locations of cetaceans and turtles sighted during aerial surveys on 21 Jan, 2010 of the Onslow Bay USWTR study region.

Monitoring of Protected Species in the Proposed Onslow Bay and Jacksonville USWTRs
Progress Report: February 24, 2010 through March 23, 2010

Planning (Task 1, 2 & 3)
During this reporting period the second contract modification with Parsons was finalized. Parsons submitted the final proposal for contract modification 2 to the Navy on Thursday February 25 2010 and it was awarded Friday the 26th.

Purchasing (Task 1).
UNCW purchased an image recovery software package to grab images from un-cooperative digital compact flash cards. UNCW sent a pair of David Clark headsets out to be refurbished as a savings instead of buying a new pair.

Travel (Task 1 & 3)
Scripps HARP engineer Ethan Roth traveled to the JAX study area to install a new hydrophone and deploy the inshore HARP.

JAX Survey Activity (Task 2)
Aerial Surveys
The region was plagued by less than ideal survey conditions for the majority of the reporting period. However, eight tracklines were flown in good conditions on 20 March 2010 (Table 1). Cetaceans were encountered 15 times during the survey (Table 2, Figure 1). Spotted dolphins (*Stenella frontalis*) were the most frequently encountered species (8 sightings), followed by North Atlantic right whales (*Eubalena glacialis; 2* sightings), one sighting each of bottlenose dolphins (*Tursiops truncatus)* and Risso's dolphins (*Grampus griseus).* In addition, delphinids which could not be identified to species were encountered three times. This was the first time during the JAX USWTR surveys that right whales have been seen in the survey area. In addition, the aerial survey team witnessed the birth of a right whale calf during the first right whale encounter of the day. Numerous sea turtles were seen during the aerial survey: loggerhead sea turtles (*Caretta caretta*; n = 48), Kemp's Ridley sea turtle (*Lepidochelys kempii*; n = 1), and 12 unidentified sea turtles (Table 3, Figure 2).

Vessel Surveys
Two complete tracklines were surveyed during this reporting period. Trackline 4 was surveyed on 1 March and trackline 2 completed on 10 March. For both surveys, the *R/V Volute* launched out of St. Augustine, FL. Weather conditions ranged from moderate to good for both surveys (Table 4). There were nine cetacean sightings, all of which were spotted dolphins (*S. frontalis).* There were no marine turtles seen while on effort during either survey (Table 5, Figure 3).

Towed Passive Acoustics
The towed acoustic array was deployed from the *R/V Volute* during two vessel surveys. On 1 March the array was deployed for a total of 256 minutes. Because

there were only three observers, recordings were only obtained during visual observation events. Ten files were recorded encompassing six sightings of *S. frontalis,* with a total recording time of 42 minutes. On 10 March the array was deployed for a total of 280 minutes. Thirty seven files, totaling 184 minutes, were recorded, which included three visual sighting events of *S. frontalis*.

JAX HARPs (Task 3)

The second HARP was successfully redeployed at the inshore site on March 9, 2010. Both HARPs are now deployed in the study area.

Onslow Bay Survey Activity (Task 5)

Aerial Surveys

Aerial surveys for the month of March were spread over three days and resulted in all ten lines being flown twice (Table 6). On March 8, 2010 all ten lines were flown under a Beaufort Sea state 3-4 covering most of the range for the morning surveys and a BSS 2-3 in the afternoon. There were two sightings of cetaceans inside the range both of which were bottlenose dolphins (Table 7, Figure 4). In addition to the surveys inside the range the team flew a coastal survey specifically from Wrightsville beach to Cape Lookout before beginning their survey lines. On March 9, 2010 survey conditions had greatly improved with BSS 1 and 2 dominating the range. Sea conditions were uniform throughout the range and no current boarder of the Gulf Stream was observed. A single sighting of a fin whale (*Balaenoptera physalis*) was seen on the offshore portion of line ten. This sighting is the first baleen whale seen within the Onslow Bay USWTR site and the first time this species has been seen by any UNCW aerial surveys south of Cape Hatteras. In addition there was a single sighting of common dolphins (*Delphinus delphis*) on the offshore half of line 7. This sighting represents the first time this species has been seen in the Onslow Bay USWTR range since the preliminary surveys in 1998 and 1999. Nine bottlenose dolphin sightings were also recorded giving a total of 11 sightings on 6 lines flown. Additional USWTR lines were not flown in the afternoon as the team responded to reports of a large whale seen off of Wrightsville beach. On March 10, 2010 the final 4 track lines were completed under fair conditions with a single cetacean sighting being recorded. The UNCW stranding network received a report from an observer on a coastal dredge of a right whale sighting approximately 2km outside of the mouth of the Cape Fear River in Long Bay. Over the three day period there were numerous sea turtles sighting the majority of which were loggerhead sea turtles followed by unidentified sea turtles and leatherback sea turtles (Figure 8, Table 5).

Vessel Surveys

One track line was surveyed on March 9th, 2010 aboard the *R/V Cetus*, a modified 40' offshore fishing vessel (Table 9). Two groups of bottlenose dolphins (*Tursiops Truncatus*) were the only cetacean groups encountered (Table 10). Two loggerhead sea turtles (*Caretta caretta*) were also sighted during the survey.

The locations of dolphins and sea turtles sighted along line 9 during vessel surveys are shown in Figure 6

Towed Passive Acoustics

The towed acoustic array was deployed from the *R/V Cetus* on the 9th of March, 2010, for 4.4 hours of simultaneous visual and acoustic survey. During that time, a total of 46 minutes of acoustic recordings were taken. Two visual sightings occurred during the acquisition of acoustic data; both groups were identified as *Tursiops truncatus*. Numerous vocalizations including clicks, whistles, and burst-pulses were recorded.

Exercise Monitoring (Task 7)

Nothing to report.

Table 1. Aerial survey effort table for the JAX USWTR study region during Feb 24, 2010 - Mar 23, 2010.

Date	Line	Sea State	Kilometers Flown	HOBBS Hours
20-Mar-10	1	2 to 3	86.5	7.5
20-Mar-10	2	2 to 3	85.6	
20-Mar-10	3	1 to 3	85.3	
20-Mar-10	4	2 to 3	85.5	
20-Mar-10	5	2 to 3	85.3	
20-Mar-10	6	2 to 3	85.0	
20-Mar-10	7	2 to 3	83.2	
20-Mar-10	8	2 to 3	85.3	

Table 2. Cetacean sightings during aerial surveys in the JAX USWTR study region during Feb 24, 2010 - Mar 23, 2010.

Date	Time	On/Off Effort	Latitude	Longitude	Track Number	Species	Common Name	Group Size
20-Mar-10	10:02	On Effort	30.028323	-80.425266	2	*S. frontalis*	Spotted Dolphin	7
20-Mar-10	10:08	On Effort	30.036836	-80.502131	2	*S. frontalis*	Spotted Dolphin	4
20-Mar-10	10:20	On Effort	30.047163	-80.697271	2	*E. glacialis*	No. Atl. Right Whale	2
20-Mar-10	13:01	On Effort	30.099889	-80.367558	3	*T. truncatus*	Bottlenose Dolphin	2
20-Mar-10	13:12	On Effort	30.100872	-80.336616	3	*S. frontalis*	Spotted Dolphin	29
20-Mar-10	13:49	On Effort	30.174741	-80.512669	4	Unid. delphinid	Unid. delphinid	2
20-Mar-10	14:14	On Effort	30.232452	-80.270676	5	*S. frontalis*	Spotted Dolphin	34
20-Mar-10	14:41	On Effort	30.292360	-80.240354	6	*S. frontalis*	Spotted Dolphin	19
20-Mar-10	14:48	On Effort	30.308002	-80.395258	6	Unid. delphinid	Unid. delphinid	3
20-Mar-10	15:10	On Effort	30.362502	-80.432803	7	*S. frontalis*	Spotted Dolphin	20
20-Mar-10	15:16	On Effort	30.367844	-80.264885	7	Unid. delphinid	Unid. delphinid	4
20-Mar-10	15:33	On Effort	30.361425	-79.911819	7	*G. griseus*	Risso's Dolphin	6
20-Mar-10	15:55	On Effort	30.434805	-80.269575	8	*S. frontalis*	Spotted Dolphin	21
20-Mar-10	15:58	On Effort	30.442233	-80.378832	8	*S. frontalis*	Spotted Dolphin	2
20-Mar-10	16:11	On Effort	30.428521	-80.677282	8	*E. glacialis*	No. Atl. Right Whale	1

Table 3 Sea turtle sightings during aerial surveys in the JAX USWTR study region during Feb 24, 2010 - Mar 23, 2010.

Date	Time	On/Off Effort	Latitude	Longitude	Track Number	Species	Common Name	Group Size
20-Mar-10	9:26	On Effort	29.965475	-80.386834	1	*C. caretta*	Loggerhead Sea Turtle	1
20-Mar-10	9:26	On Effort	29.965543	-80.373441	1	*C. caretta*	Loggerhead Sea Turtle	1
20-Mar-10	9:57	On Effort	30.032581	-80.274625	2	*C. caretta*	Loggerhead Sea Turtle	1
20-Mar-10	10:05	On Effort	30.032270	-80.466821	2	*C. caretta*	Loggerhead Sea Turtle	1
20-Mar-10	10:18	On Effort	30.031629	-80.649836	2	*C. caretta*	Loggerhead Sea Turtle	1
20-Mar-10	12:52	On Effort	30.099767	-80.626413	3	*C. caretta*	Loggerhead Sea Turtle	1
20-Mar-10	13:37	On Effort	30.166559	-80.206622	4	*C. caretta*	Loggerhead Sea Turtle	1
20-Mar-10	13:38	On Effort	30.166644	-80.221309	4	*C. caretta*	Loggerhead Sea Turtle	1
20-Mar-10	13:45	On Effort	30.166394	-80.353119	4	*C. caretta*	Loggerhead Sea Turtle	1
20-Mar-10	13:47	On Effort	30.166730	-80.430771	4	*C. caretta*	Loggerhead Sea Turtle	1
20-Mar-10	13:48	On Effort	30.166579	-80.471078	4	*C. caretta*	Loggerhead Sea Turtle	1
20-Mar-10	13:57	On Effort	30.166433	-80.565088	4	*C. caretta*	Loggerhead Sea Turtle	1
20-Mar-10	14:00	On Effort	30.166079	-80.663821	4	*C. caretta*	Loggerhead Sea Turtle	1
20-Mar-10	14:00	On Effort	30.166232	-80.679204	4	*C. caretta*	Loggerhead Sea Turtle	1
20-Mar-10	14:05	On Effort	30.232255	-80.621980	5	*C. caretta*	Loggerhead Sea Turtle	1
20-Mar-10	14:07	On Effort	30.232486	-80.522047	5	*C. caretta*	Loggerhead Sea Turtle	3
20-Mar-10	14:09	On Effort	30.232586	-80.460650	5	*C. caretta*	Loggerhead Sea Turtle	3
20-Mar-10	14:11	On Effort	30.232840	-80.347943	5	*C. caretta*	Loggerhead Sea Turtle	1
20-Mar-10	14:39	On Effort	30.300439	-80.216354	6	*C. caretta*	Loggerhead Sea Turtle	1
20-Mar-10	14:45	On Effort	30.300431	-80.340154	6	Unid. seaturtle	Unid. Sea Turtle	1
20-Mar-10	14:55	On Effort	30.301162	-80.439892	6	*C. caretta*	Loggerhead Sea Turtle	1
20-Mar-10	14:56	On Effort	30.300364	-80.474801	6	*C. caretta*	Loggerhead Sea Turtle	1
20-Mar-10	14:58	On Effort	30.300091	-80.536718	6	Unid. seaturtle	Unid. Sea Turtle	1
20-Mar-10	14:59	On Effort	30.300022	-80.601604	6	*C. caretta*	Loggerhead Sea Turtle	2
20-Mar-10	15:04	On Effort	30.364085	-80.672022	7	*C. caretta*	Loggerhead Sea Turtle	1
20-Mar-10	15:04	On Effort	30.364509	-80.679275	7	*C. caretta*	Loggerhead Sea Turtle	3
20-Mar-10	15:05	On Effort	30.365132	-80.622735	7	*C. caretta*	Loggerhead Sea Turtle	1
20-Mar-10	15:06	On Effort	30.365252	-80.594722	7	*C. caretta*	Loggerhead Sea Turtle	1
20-Mar-10	15:08	On Effort	30.365387	-80.522324	7	Unid. seaturtle	Unid. Sea Turtle	1
20-Mar-10	15:09	On Effort	30.365471	-80.468543	7	*C. caretta*	Loggerhead Sea Turtle	2
20-Mar-10	15:12	On Effort	30.365617	-80.392292	7	Unid. seaturtle	Unid. Sea Turtle	1
20-Mar-10	15:14	On Effort	30.365686	-80.293390	7	*C. caretta*	Loggerhead Sea Turtle	1
20-Mar-10	15:25	On Effort	30.364523	-80.218230	7	*C. caretta*	Loggerhead Sea Turtle	1
20-Mar-10	15:26	On Effort	30.365535	-80.188521	7	*C. caretta*	Loggerhead Sea Turtle	1
20-Mar-10	15:46	On Effort	30.433636	-79.940230	8	Unid. seaturtle	Unid. Sea Turtle	1
20-Mar-10	15:51	On Effort	30.433802	-80.178189	8	*C. caretta*	Loggerhead Sea Turtle	1
20-Mar-10	15:56	On Effort	30.433446	-80.305929	8	*C. caretta*	Loggerhead Sea Turtle	1
20-Mar-10	16:03	On Effort	30.433872	-80.380367	8	*L. kempii*	Kemp's ridley Sea Turtle	1
20-Mar-10	16:05	On Effort	30.433679	-80.464695	8	*C. caretta*	Loggerhead Sea Turtle	2
20-Mar-10	16:05	On Effort	30.433720	-80.427749	8	*C. caretta*	Loggerhead Sea Turtle	1
20-Mar-10	16:06	On Effort	30.433523	-80.508589	8	*C. caretta*	Loggerhead Sea Turtle	2
20-Mar-10	16:08	On Effort	30.433309	-80.584302	8	*C. caretta*	Loggerhead Sea Turtle	2
20-Mar-10	16:08	On Effort	30.433315	-80.594983	8	Unid. seaturtle	Unid. Sea Turtle	3
20-Mar-10	16:09	On Effort	30.433194	-80.637071	8	Unid. seaturtle	Unid. Sea Turtle	4
20-Mar-10	16:10	On Effort	30.433423	-80.669506	8	*C. caretta*	Loggerhead Sea Turtle	1

Table 4. Vessel survey effort table for the JAX USWTR study region during Feb 24, 2010 - Mar 23, 2010.

Date	Line	Sea State	Kilometers Surveyed	Survey Time (Hrs:min)	Total Time at Sea (Hrs:min)
1-Mar-10	4	1-3	69.65	4:16	13:27
10-Mar-10	2	2-3	75.41	4:40	12:36

Table 5. Cetacean and sea turtle sightings for vessel surveys in JAX study region during Feb 24, 2010 - Mar 23, 2010.

Date	Time	On/Off Effort	Latitude	Longitude	Line	Species	Species	Group Size
01-Mar-10	15:05	On effort	30.169377	-80.349359	4	*S. frontalis*	Spotted Dolphin	1
01-Mar-10	16:33	On effort	30.166634	-80.589490	4	*S. frontalis*	Spotted Dolphin	2
01-Mar-10	16:45	On effort	30.166619	-80.608868	4	*S. frontalis*	Spotted Dolphin	3
01-Mar-10	17:03	On effort	30.165464	-80.648855	4	*S. frontalis*	Spotted Dolphin	9
01-Mar-10	17:09	On effort	30.167196	-80.669589	4	*S. frontalis*	Spotted Dolphin	17
01-Mar-10	17:17	On effort	30.165281	-80.679358	4	*S. frontalis*	Spotted Dolphin	5
10-Mar-10	14:21	On effort	30.034332	-80.220109	2	*S. frontalis*	Spotted Dolphin	4
10-Mar-10	15:38	On effort	30.036555	-80.441874	2	*S. frontalis*	Spotted Dolphin	4
10-Mar-10	16:42	On effort	30.032250	-80.577244	2	*S. frontalis*	Spotted Dolphin	13

Table 6. Aerial survey effort table for the Onslow Bay USWTR study region during Feb 24, 2010 - March 23, 2010.

Date	Line	Sea State	Kilometers Flown	Hobbs Hours
8-Mar-10	10	3 to 4	74.1	6.7
8-Mar-10	9	3 to 4	72.9	
8-Mar-10	8	3 to 4	75.0	
8-Mar-10	7	3 to 4	74.5	
8-Mar-10	6	2 to 3	74.3	
8-Mar-10	5	2 to 3	74.1	
8-Mar-10	4	2 to 3	74.5	
8-Mar-10	3	2 to 3	74.5	
8-Mar-10	2	2 to 3	70.1	
8-Mar-10	1	2 to 3	74.2	
9-Mar-10	5	1	68.7	6.5
9-Mar-10	6	1	67.9	
9-Mar-10	7	1	68.8	
9-Mar-10	8	1 to 2	70.6	
9-Mar-10	9	1	71.7	
9-Mar-10	10	1 to 2	63.8	
10-Mar-10	4	1 to 3	74.6	2.7
10-Mar-10	3	1 to 4	74.7	
10-Mar-10	2	1 to 4	72.9	
10-Mar-10	1	1 to 4	74	

Table 7. Cetacean sightings during aerial surveys in the Onslow Bay USWTR study region during Feb 24, 2010 - Mar 23, 2010.

Date	Time	On/Off Effort	Latitute	Longitude	Track Number	Species	Common Name	Group Size
8-Mar-10	15:30	On	33.487350	-76.636780	2	*T. truncatus*	Bottlenose dolphin	4
8-Mar-10	15:43	On	33.410814	-76.538489	2	*T. truncatus*	Bottlenose dolphin	5
9-Mar-10	9:02	On	33.960739	-76.832647	5	*T. truncatus*	Bottlenose dolphin	15
9-Mar-10	9:17	On	33.830343	-76.706071	5	*T. truncatus*	Bottlenose dolphin	6
9-Mar-10	9:32	On	33.720726	-76.534367	5	*T. truncatus*	Bottlenose dolphin	20
9-Mar-10	9:52	On	33.743504	-76.443130	6	*T. truncatus*	Bottlenose dolphin	65
9-Mar-10	10:11	On	34.017554	-76.803091	6	*T. truncatus*	Bottlenose dolphin	5
9-Mar-10	10:42	On	33.770576	-76.346663	7	D. delphis	Common dolphin	20
9-Mar-10	10:57	On	33.719563	-76.280838	7	*T. truncatus*	Bottlenose dolphin	9
9-Mar-10	11:14	On	33.796304	-76.241464	8	*T. truncatus*	Bottlenose dolphin	13
9-Mar-10	12:03	On	33.871443	-76.213856	9	*T. truncatus*	Bottlenose dolphin	30
9-Mar-10	12:19	On	33.858932	-76.064517	10	*T. truncatus*	Bottlenose dolphin	4
9-Mar-10	12:30	On	33.963446	-76.221540	10	B. physalis	Fin whale	1
10-Mar-10	9:57	On	33.844501	-77.105389	2	Unid delphinid	Unid delphinid	3

Table 8 (2x pages). Sea turtle sightings during aerial surveys in the Onslow Bay USWTR study region during Feb 24, 2010 - Mar 23, 2010.

Date	Time	On/Off Effort	Latitude	Longitude	Track Number	Species	Common Name	Group Size
8-Mar-10	9:28	On	34.172064	-76.481553	10	C. caretta	Loggerhead sea turtle	1
8-Mar-10	9:28	On	34.159272	-76.465052	10	C. caretta	Loggerhead sea turtle	1
8-Mar-10	10:46	On	33.900383	-76.514606	7	C. caretta	Loggerhead sea turtle	1
8-Mar-10	13:21	On	34.034656	-76.829645	6	C. caretta	Loggerhead sea turtle	1
8-Mar-10	13:24	On	33.974706	-76.750432	6	C. caretta	Loggerhead sea turtle	2
8-Mar-10	13:25	On	33.961879	-76.733515	6	C. caretta	Loggerhead sea turtle	1
8-Mar-10	13:28	On	33.891283	-76.640286	6	C. caretta	Loggerhead sea turtle	2
8-Mar-10	13:58	On	33.84073	-76.704016	5	C. caretta	Loggerhead sea turtle	1
8-Mar-10	14:13	On	33.886270	-76.894710	4	C. caretta	Loggerhead sea turtle	2
8-Mar-10	14:15	On	33.861046	-76.861237	4	C. caretta	Loggerhead sea turtle	3
8-Mar-10	14:47	On	33.709701	-76.798452	3	C. caretta	Loggerhead sea turtle	1
8-Mar-10	14:54	On	33.859603	-76.994319	3	C. caretta	Loggerhead sea turtle	2
8-Mar-10	15:08	On	33.683007	-76.892560	2	C. caretta	Loggerhead sea turtle	1
8-Mar-10	16:00	On	33.605138	-76.921055	1	C. caretta	Loggerhead sea turtle	1
8-Mar-10	16:06	On	33.738402	-77.095697	1	C. caretta	Loggerhead sea turtle	1
8-Mar-10	14:04	On	33.976917	-76.883754	5	Unid sea turtle	Unid sea turtle	1
8-Mar-10	14:48	On	33.729017	-76.823853	3	Unid sea turtle	Unid sea turtle	1
9-Mar-10	8:57	On	33.994510	-76.907648	5	C. caretta	Loggerhead sea turtle	1
9-Mar-10	9:11	On	33.918617	-76.807588	5	C. caretta	Loggerhead sea turtle	1
9-Mar-10	9:12	On	33.898118	-76.780137	5	C. caretta	Loggerhead sea turtle	1
9-Mar-10	9:14	On	33.861196	-76.731401	5	C. caretta	Loggerhead sea turtle	1
9-Mar-10	9:25	On	33.804625	-76.656746	5	C. caretta	Loggerhead sea turtle	1
9-Mar-10	9:25	On	33.815028	-76.670268	5	C. caretta	Loggerhead sea turtle	3
9-Mar-10	9:26	On	33.777730	-76.621617	5	C. caretta	Loggerhead sea turtle	4
9-Mar-10	9:27	On	33.767922	-76.608612	5	C. caretta	Loggerhead sea turtle	1
9-Mar-10	10:01	On	33.827833	-76.556565	6	C. caretta	Loggerhead sea turtle	2
9-Mar-10	10:02	On	33.840224	-76.572808	6	C. caretta	Loggerhead sea turtle	2
9-Mar-10	10:02	On	33.829569	-76.558756	6	C. caretta	Loggerhead sea turtle	2
9-Mar-10	10:03	On	33.853433	-76.589936	6	C. caretta	Loggerhead sea turtle	6
9-Mar-10	10:03	On	33.868095	-76.609311	6	C. caretta	Loggerhead sea turtle	6
9-Mar-10	10:04	On	33.878250	-76.622588	6	C. caretta	Loggerhead sea turtle	3
9-Mar-10	10:05	On	33.910465	-76.665191	6	C. caretta	Loggerhead sea turtle	7
9-Mar-10	10:06	On	33.925011	-76.684041	6	C. caretta	Loggerhead sea turtle	1
9-Mar-10	10:06	On	33.932773	-76.694397	6	C. caretta	Loggerhead sea turtle	8
9-Mar-10	10:07	On	33.953511	-76.722034	6	C. caretta	Loggerhead sea turtle	6
9-Mar-10	10:08	On	33.967823	-76.740828	6	C. caretta	Loggerhead sea turtle	1
9-Mar-10	10:08	On	33.978584	-76.754946	6	C. caretta	Loggerhead sea turtle	9
9-Mar-10	10:09	On	33.988278	-76.767975	6	C. caretta	Loggerhead sea turtle	3
9-Mar-10	10:09	On	33.995584	-76.777413	6	C. caretta	Loggerhead sea turtle	11
9-Mar-10	10:26	On	34.062607	-76.726383	7	C. caretta	Loggerhead sea turtle	4
9-Mar-10	10:28	On	34.022386	-76.674311	7	C. caretta	Loggerhead sea turtle	4
9-Mar-10	10:28	On	34.007107	-76.654329	7	C. caretta	Loggerhead sea turtle	3
9-Mar-10	10:29	On	34.002681	-76.648498	7	C. caretta	Loggerhead sea turtle	2
9-Mar-10	10:29	On	33.988287	-76.62972	7	C. caretta	Loggerhead sea turtle	3
9-Mar-10	10:31	On	33.960023	-76.592718	7	C. caretta	Loggerhead sea turtle	5
9-Mar-10	10:31	On	33.946583	-76.575289	7	C. caretta	Loggerhead sea turtle	6
9-Mar-10	10:32	On	33.920036	-76.540688	7	C. caretta	Loggerhead sea turtle	9
9-Mar-10	11:34	On	33.988721	-76.501293	8	C. caretta	Loggerhead sea turtle	1
9-Mar-10	11:37	On	34.052926	-76.585845	8	C. caretta	Loggerhead sea turtle	1
9-Mar-10	11:37	On	34.053929	-76.587145	8	C. caretta	Loggerhead sea turtle	9
9-Mar-10	11:39	On	34.090787	-76.635594	8	C. caretta	Loggerhead sea turtle	1
9-Mar-10	11:40	On	34.111894	-76.663395	8	C. caretta	Loggerhead sea turtle	1
9-Mar-10	11:40	On	34.117421	-76.670594	8	C. caretta	Loggerhead sea turtle	4
9-Mar-10	11:41	On	34.139577	-76.699706	8	C. caretta	Loggerhead sea turtle	3
9-Mar-10	11:49	On	34.137698	-76.574108	9	C. caretta	Loggerhead sea turtle	7
9-Mar-10	11:53	On	34.037500	-76.441284	9	C. caretta	Loggerhead sea turtle	3
9-Mar-10	12:50	On	34.095748	-76.382541	10	C. caretta	Loggerhead sea turtle	4
9-Mar-10	12:56	On	34.243997	-76.573399	10	C. caretta	Loggerhead sea turtle	8
9-Mar-10	11:47	On	34.176778	-76.625806	9	D. coriacea	Leatherback sea turtle	1
9-Mar-10	8:58	On	33.965190	-76.868758	5	Unid sea turtle	Unid sea turtle	1
9-Mar-10	9:15	On	33.848781	-76.715022	5	Unid sea turtle	Unid sea turtle	4
9-Mar-10	9:28	On	33.747555	-76.582032	5	Unid sea turtle	Unid sea turtle	3
9-Mar-10	10:25	On	34.075464	-76.746079	7	Unid sea turtle	Unid sea turtle	1
9-Mar-10	11:49	On	34.135153	-76.570658	9	Unid sea turtle	Unid sea turtle	2

Date	Time	On/Off Effort	Latitude	Longitude	Track Number	Species	Common Name	Group Size
10-Mar-10	9:06	On	33.948010	-76.977026	4	C. caretta	Loggerhead sea turtle	3
10-Mar-10	9:11	On	33.834044	-76.825617	4	C. caretta	Loggerhead sea turtle	1
10-Mar-10	9:16	On	33.730928	-76.689260	4	C. caretta	Loggerhead sea turtle	1
10-Mar-10	9:44	On	33.749665	-76.850862	3	C. caretta	Loggerhead sea turtle	1
10-Mar-10	9:49	On	33.861604	-76.996910	3	C. caretta	Loggerhead sea turtle	1
10-Mar-10	9:51	On	33.903755	-77.052064	3	C. caretta	Loggerhead sea turtle	3
10-Mar-10	10:10	On	33.748703	-76.977710	2	C. caretta	Loggerhead sea turtle	1
10-Mar-10	10:14	On	33.658099	-76.860420	2	C. caretta	Loggerhead sea turtle	1
10-Mar-10	10:15	On	33.656404	-76.858287	2	C. caretta	Loggerhead sea turtle	1
10-Mar-10	10:41	On	33.606329	-76.921889	1	C. caretta	Loggerhead sea turtle	2
10-Mar-10	10:48	On	33.763636	-77.128773	1	C. caretta	Loggerhead sea turtle	3
10-Mar-10	9:08	On	33.912517	-76.929805	4	Unid sea turtle	Unid sea turtle	1
10-Mar-10	9:45	On	33.768800	-76.875785	3	Unid sea turtle	Unid sea turtle	1
10-Mar-10	9:48	On	33.837673	-76.965543	3	Unid sea turtle	Unid sea turtle	1
10-Mar-10	9:49	On	33.853603	-76.986306	3	Unid sea turtle	Unid sea turtle	2
10-Mar-10	9:51	On	33.902847	-77.050866	3	Unid sea turtle	Unid sea turtle	3
10-Mar-10	10:10	On	33.761414	-76.994305	2	Unid sea turtle	Unid sea turtle	2
10-Mar-10	10:50	On	33.791794	-77.165896	1	Unid sea turtle	Unid sea turtle	3

Table 9. Effort table for vessel surveys in the Onslow Bay USWTR study region Feb 24, 2010 - Mar 23, 2010.

Date	Line	Sea State	Kilometers Surveyed
9-Mar-10	9	1 to 3	74.08

Table 10. Cetacean and sea turtle sightings during vessel surveys in the Onslow Bay USWTR study region Feb 24, 2010 - Mar 23, 2010.

Date	Line	On/Off Effort	Time	Latitude	Longitude	Species	Group Size
9-Mar-10	9	Off	11:22:52	33.8542666	-76.19377	Bottlenose dolphins	10
9-Mar-10	9	Off	11:42:06	33.8600213	-76.2037111	Bottlenose dolphins	23
9-Mar-10	9	Off	14:36:14	34.1516478	-76.5824346	Loggerhead sea turtle	1
9-Mar-10	9	Off	14:38:34	34.1541451	-76.5851299	Loggerhead sea turtle	1

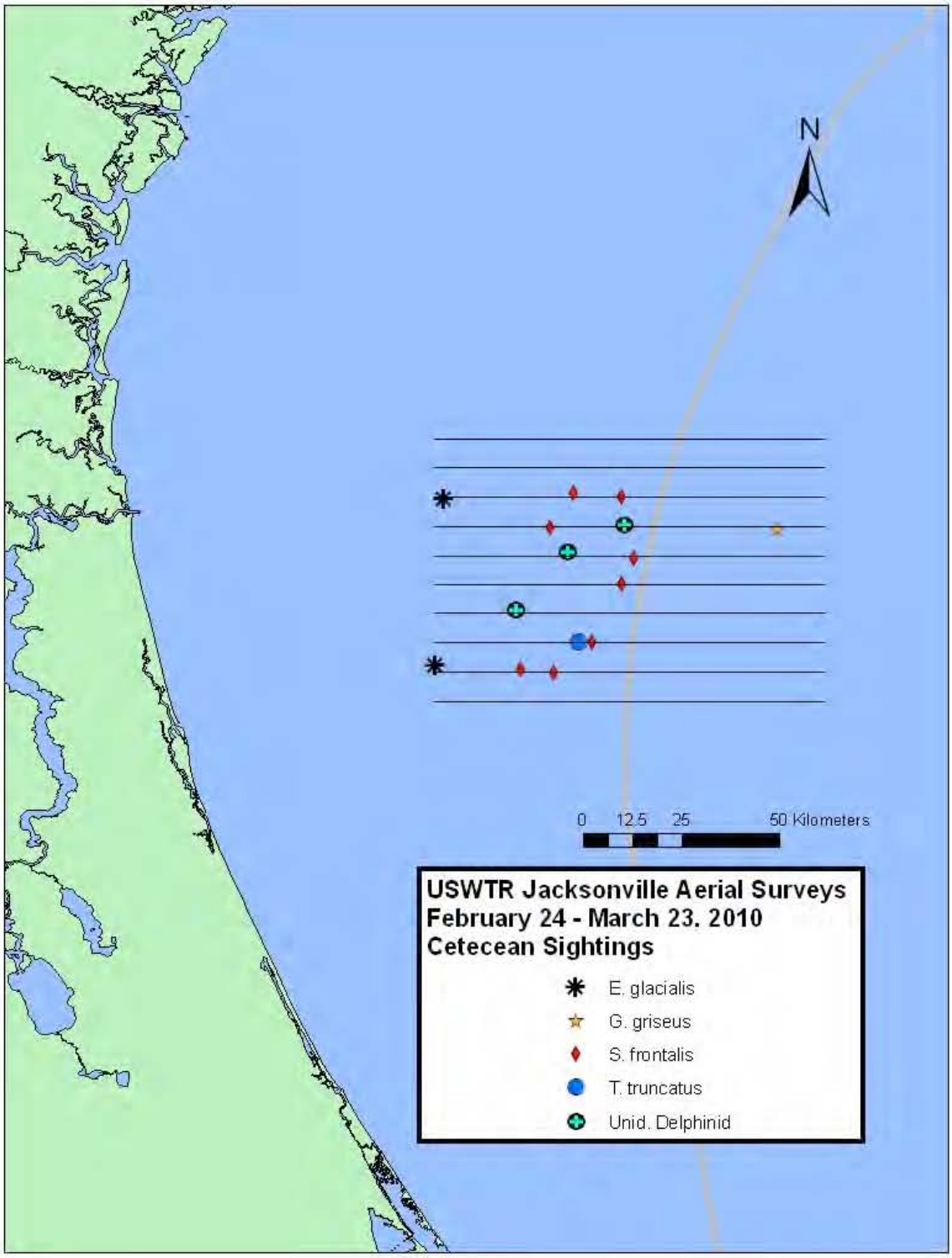


Figure 1. The locations of cetaceans sighted while conducting aerial surveys during the February 24, 2010 - March 23, 2010 reporting period of the JAX USWTR study region.

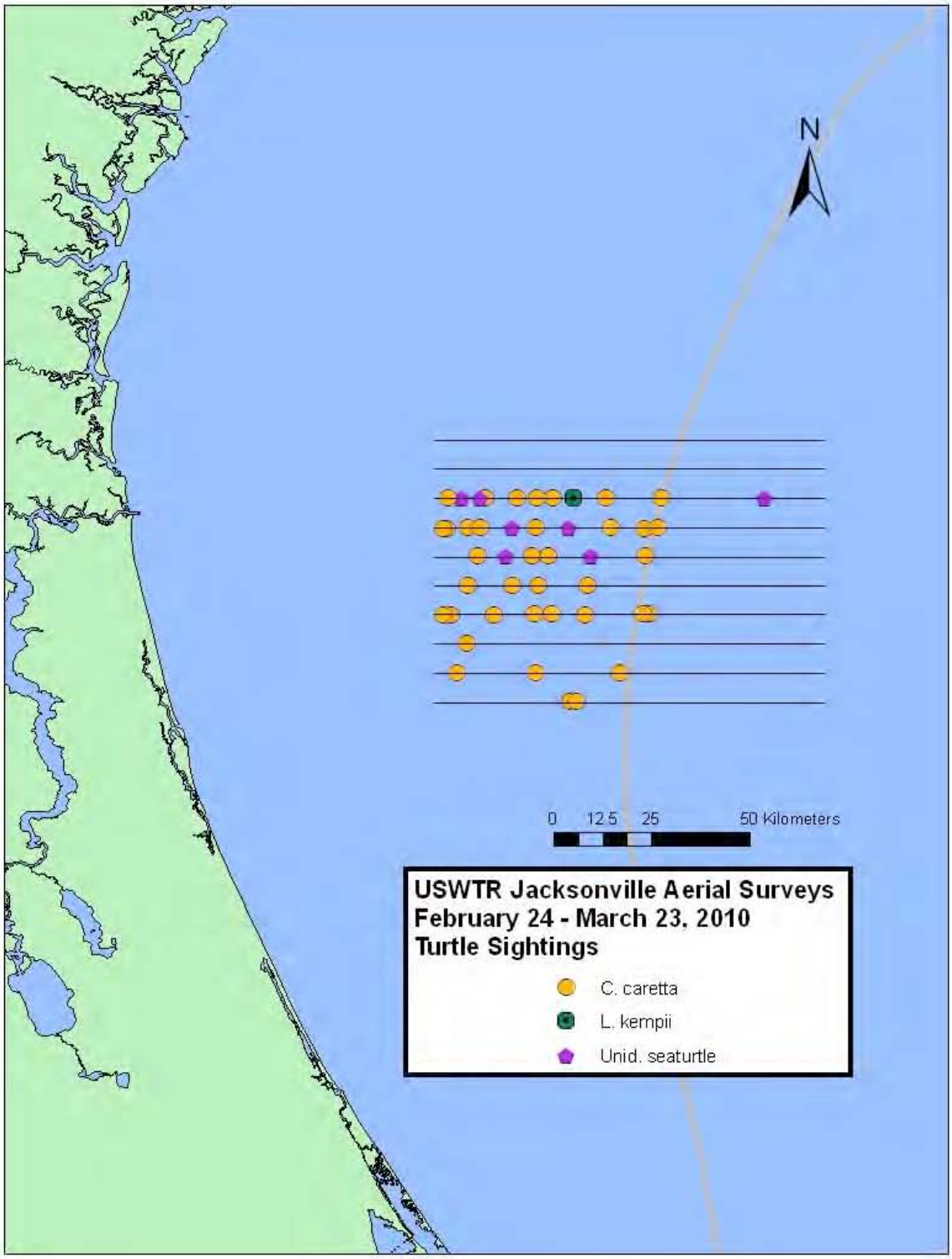


Figure 2. The locations of sea turtles sighted during aerial surveys between February 24, 2010 - March 23, 2010 in the JAX USWTR study region.

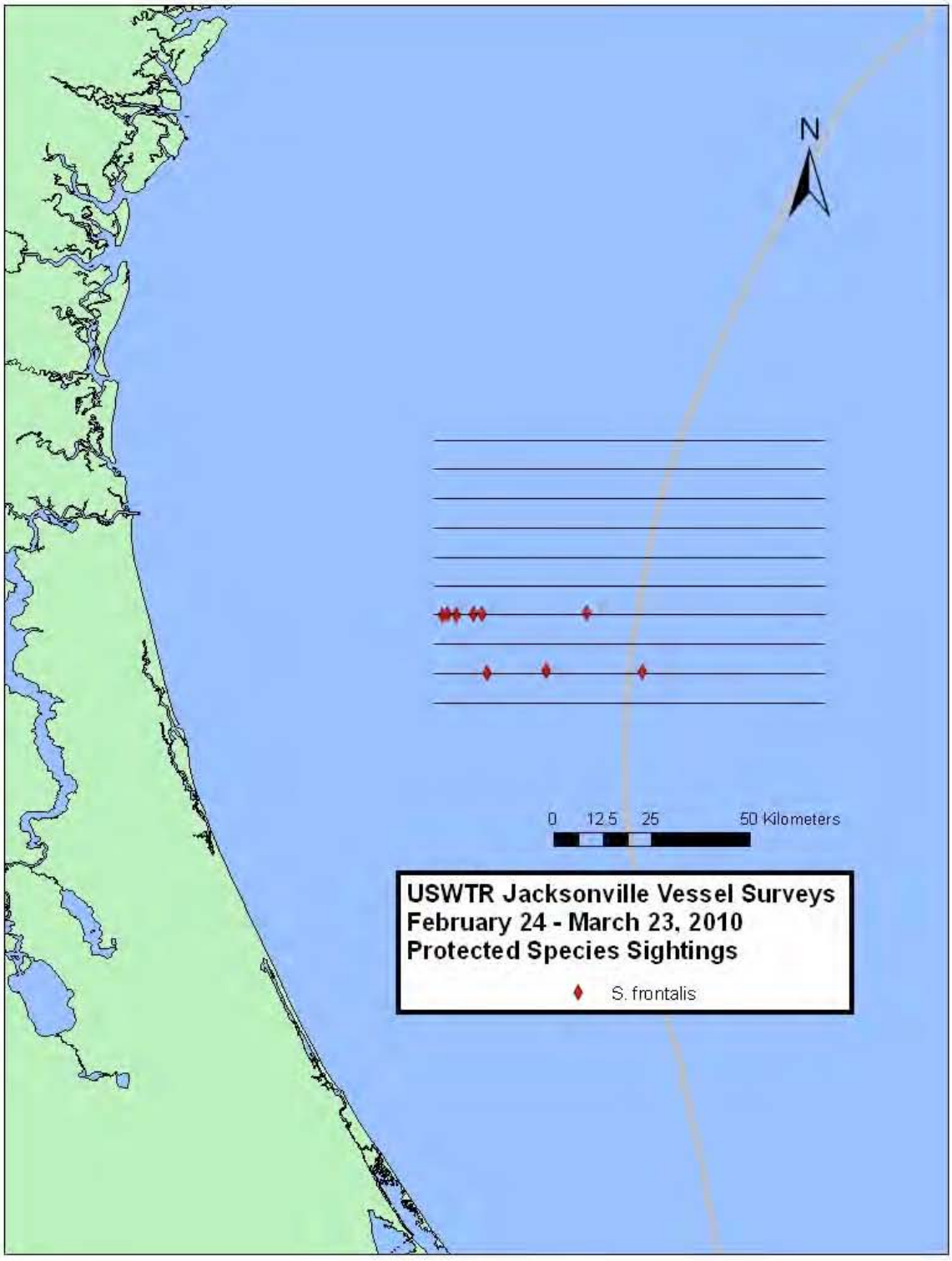


Figure 3. Cetaceans and sea turtles observed during vessel surveys of the JAX USWTR study region, February 24, 2010 - March 23, 2010.

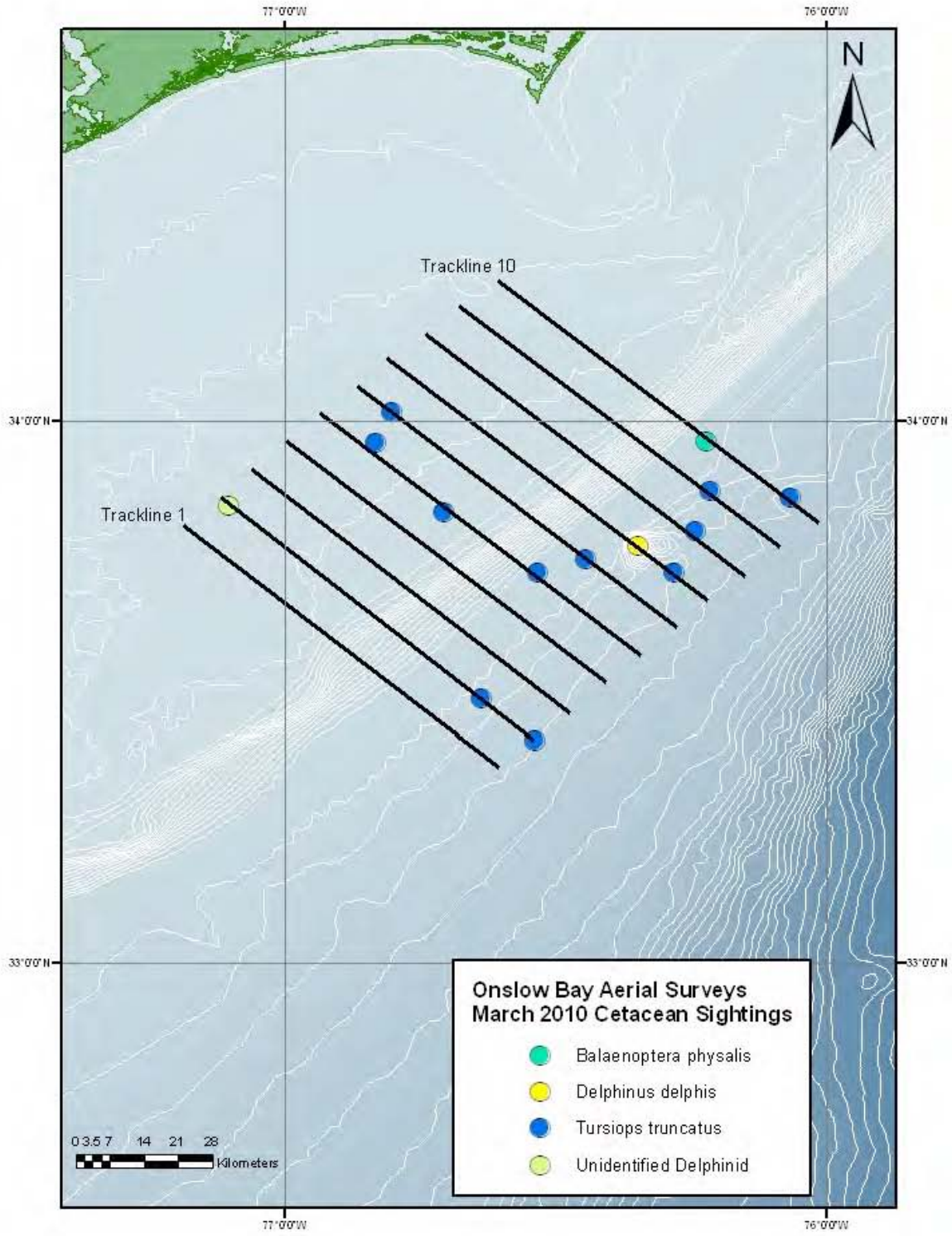


Figure 4. The locations of cetaceans sighted during aerial surveys from February 24, 2010 - March 23, 2010 of the Onslow Bay USWTR study region.

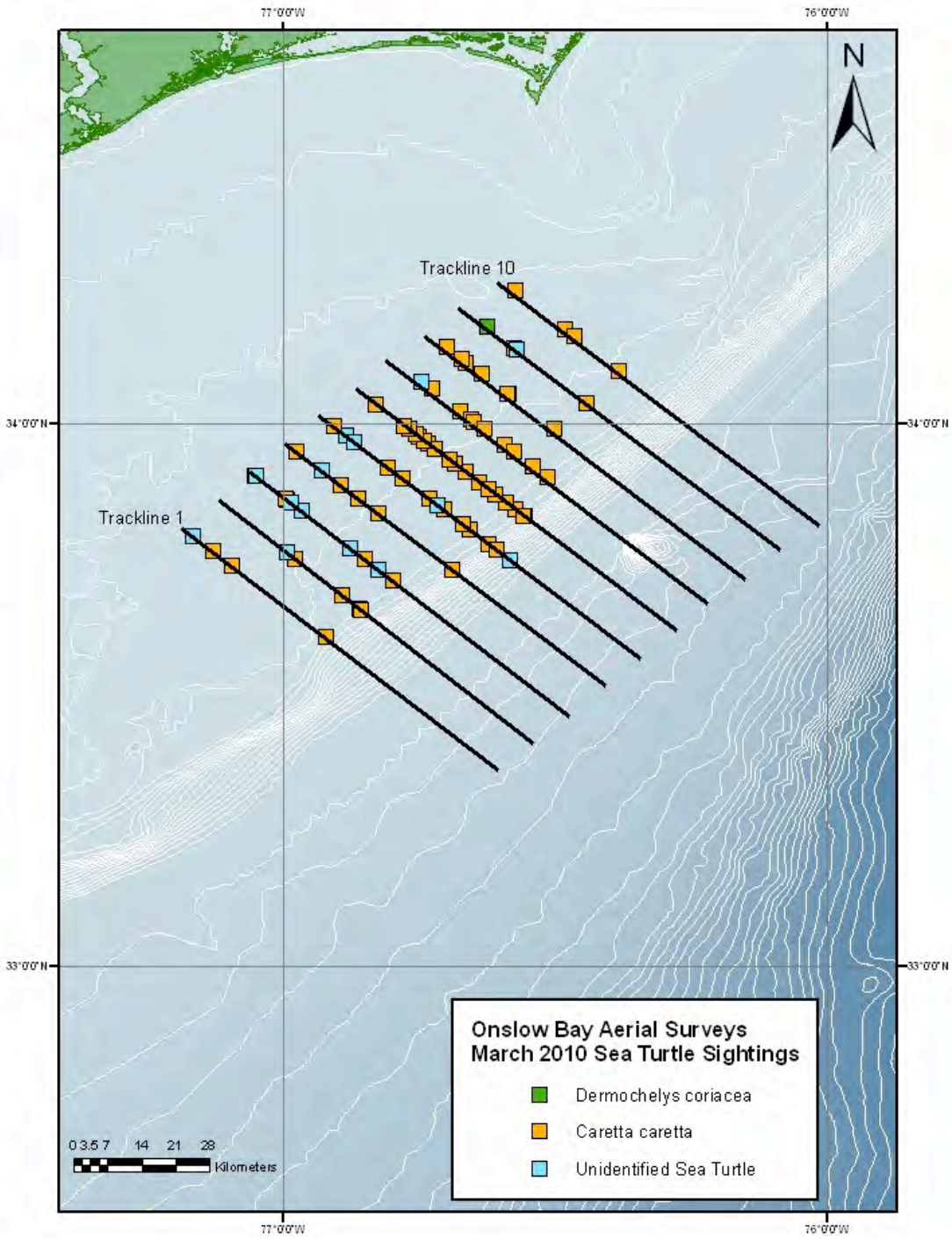


Figure 5. The locations of turtles sighted during aerial surveys from February 24, 2010 - March 23, 2010 of the Onslow Bay USWTR study region.

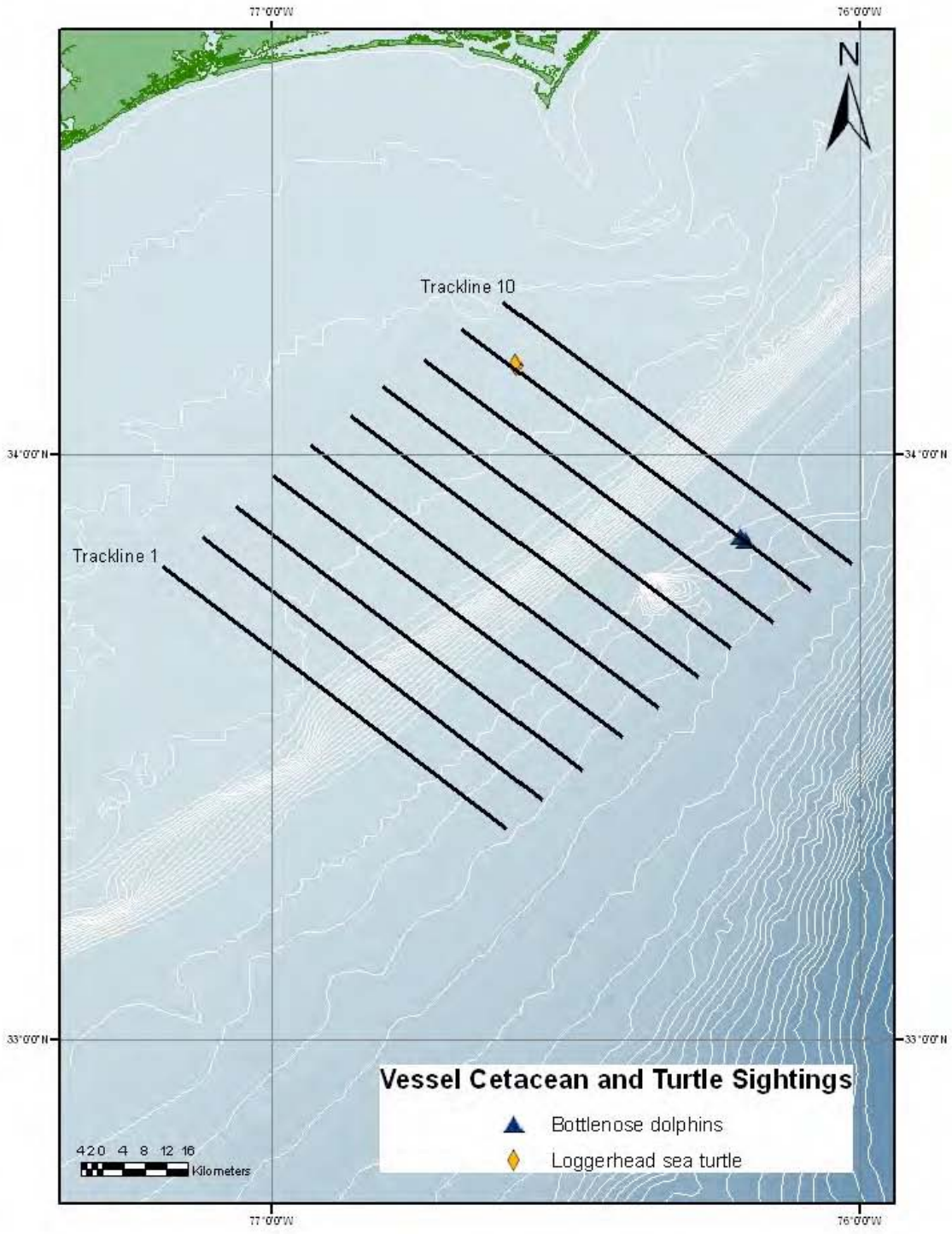


Figure 6. Locations of cetaceans and sea turtles sighted during vessel surveys on March 9, 2010 in the Onslow Bay USWTR study region. Note both bottlenose dolphin and loggerhead sea turtle sightings were very close to one another making it difficult to see two different sightings of each on the map.

Monitoring of Protected Species in the Proposed Onslow Bay and Jacksonville USWTRs
Progress Report: March 24, 2010 through April 23, 2010

Planning (Task 1, 2 & 3)
On 20 April 2010, all data from USTWR JAX surveys and data from USTWR Onslow Bay surveys for 2008-2010 were published on the website OBIS-SEAMAP. These survey data provide much needed sightings coverage of ocean sites that were, until recently, relatively unknown.

Purchasing (Task 1).
No purchasing was undertaken during the reporting period.

Travel (Task 1 & 3)
Rachel Hardee and Richard Holt from the JAX USWTR as well as Erin Cummings and Ryan McAlarney from the Onslow Bay survey team traveled to the SEAMAMMS conference in Virginia Beach, VA, to present posters on survey activity and results from their respective study areas. Lynn Williams presented a talk on results from the HARP data collected from Onslow Bay since it was deployed. Also attending SEAMAMMS was Julia Burrows, Daniel Waples, Kim Urian, Dr. Pabst, Dr. Read and William McLellan. Attached to this report are the abstracts and posters presented at SEAMAMMS, as well as a report by postdoc Melissa Soldevilla on the initial results of HARP monitoring in the JAX USWTR study site.

JAX Survey Activity (Task 2)
Aerial Surveys
There were 37 tracklines surveyed since the last reporting period. Twenty-two lines were flown in good to excellent conditions and 15 lines were surveyed in moderate to good conditions (Table 1). There were 77 cetacean sightings during survey effort this month (Table 2, Figure 1). Bottlenose dolphins (*Tursiops truncatus*) were encountered most often with 40 sightings. Atlantic spotted dolphins (*Stenella frontalis*) were seen on 29 instances and Risso's dolphins (*Grampus griseus*) were spotted three times. A single group of short-finned pilot whales (*Globicephala macrorhynchus*) were observed on 2 April 2010. This constitutes the first time this species have been recorded during the JAX USWTR aerial surveys. Additionally, there were four cetacean sightings in which the animals could only be identified as delphinids. A right whale (*Eubalena glacialis*) cow/calf pair was photographed on 2 April 2010 during transit to the range, approximately 3 km from the western edge of the survey area. The right whale was identified as right whale ID# 3360. There were nearly 300 sea turtles seen during this reporting period (Table 3, Figure 2). Sighted most often were loggerhead sea turtles (*Caretta caretta*). There was an increase this month in the number of sightings of unidentified turtles. This is likely due to the marked increased of smaller sea turtles seen from the plane, which are typically not identifiable to species from the survey altitude (305 m) unless photographs are obtained. A Kemp's Ridley sea turtle (*Lepidochelys kempii*) was photographed incidentally during a cetacean encounter on 3 April 2010 and it is suspected that many of the smaller sea turtles observed may be Kemp's Ridley sea turtles as well.

Vessel Surveys
No vessel surveys were conducted during this period. A new engine is currently being installed in the R/V Volute.

Towed Passive Acoustics
There were no passive acoustic data collected during this reporting period.

Onslow Bay Survey Activity (Task 5)

Aerial Surveys
Two days of aerial survey effort were conducted during the March 24 – April 23 2010 survey period. On April 11th all ten tracklines were surveyed during which two groups of cetacean (one bottlenose dolphin and one spotted dolphin sighting) were sighted (Table 5 and 6, Figure 3) along with a number of sea turtle sightings. The following day, April 12, 2010 all ten tracklines were again flown resulting in a single cetacean sighting of a group of bottlenose dolphin as well as a number of sea turtle sightings. In addition to the USWTR surveys the team flew coastal surveys within Onslow Bay while transiting to and from the USWTR survey area patrolling for migrating right whales. No notable sightings were recorded during coastal transits. Both survey days forecasted low winds and sea states during the days prior to our flights. Actual conditions within the range were much higher than forecasted resulting in surveys being conducted in sea states above the preferred target range (Table 4). One possible source of discrepancy between the actual and forecasted conditions is the loss of data from NOAA Buoy # 41036 which has been out of service since December 19, 2009 as it drifted north on the Gulf Stream. This buoy is normally placed 10 miles inshore of the Onslow Bay survey area and has been the main resource used at predicting weather conditions. As of yet there is no scheduled date for when this buoy will be restored. Once this buoys data is again incorporated into the forecasting models it will greatly enhance our ability to predict the rapidly changing conditions in this offshore survey area.

Vessel Surveys
A total of three track lines were surveyed during the study period. Line 10 was surveyed on April 2nd 2010 aboard the R/V *Cetus*, a modified 10m offshore fishing vessel, and lines 1 and 7 were surveyed on April 11th and 12th 2010, respectively, aboard the M/V *Sensation*, a 53' sport fishing vessel (Table 7). Three groups of bottlenose dolphins (*T.truncatus*) and 12 Loggerhead sea turtles (*C.caretta*) were encountered (Table 8). Locations of cetaceans and sea turtles sighted in Onslow Bay during vessel surveys are presented in Figure 4.

Towed Passive Acoustics
The towed acoustic array was deployed from the *R/V Cetus* on the 2nd of April, 2010, for 5.33 hours of simultaneous visual and acoustic survey. During that time, a total of 1.98 hours of acoustic recordings were taken. Two visual sightings occurred during the acquisition of acoustic data; both groups were identified as *T. truncatus*. Numerous vocalizations including clicks, whistles, and burst-pulses were recorded. One other acoustic detection was made that day without visual observation to confirm the species. The towed array was also deployed from the *F/V Sensation* on the 11th and 12th of April, 2010. On April 11th, 4.5 hours of simultaneous visual and acoustic survey were performed. During that time, a total of 1.67 hours of acoustic recordings were taken. One visual sighting occurred during the acquisition of acoustic data; the group was identified as bottlenose dolphins (*T.truncatus)*. Numerous vocalizations including clicks, whistles, and burst-pulses were recorded. Two other acoustic detections were made that day without visual observation to confirm species. On April 12th, 4.3 hours of simultaneous visual and acoustic survey were performed. During that time, a total of 28 minutes of acoustic recordings were taken. No visual sightings occurred during the

acquisition of data; however, two acoustic detections were made that day without visual observation to confirm species.

Exercise Monitoring (Task 7)
No exercise monitoring occurred during this reporting period.

Table 1. Aerial survey effort table for the JAX USWTR study region during March 24, 2010 - April 23, 2010.

Date	Line	Sea State	Kilometers Flown	HOBBS Hours
24-Mar-10	10	2 to 3	86.1	5.0
24-Mar-10	9	2 to 3	86.2	
24-Mar-10	8	2 to 3	84.2	
24-Mar-10	7	2 to 3	83.6	
24-Mar-10	6	1 to 2	80.7	
24-Mar-10	5	1 to 2	85.2	
31-Mar-10	1	2 to 4	85.0	4.7
31-Mar-10	2	2 to 4	84.8	
31-Mar-10	3	2 to 3	81.6	
31-Mar-10	4	2 to 3	86.0	
31-Mar-10	9	2 to 3	78.0	
31-Mar-10	10	2	82.3	
1-Apr-10	10	2 to 3	86.1	8.1
1-Apr-10	9	2 to 3	86.0	
1-Apr-10	8	2 to 3	86.4	
1-Apr-10	7	2 to 4	86.3	
1-Apr-10	6	2 to 4	85.2	
1-Apr-10	5	2 to 4	83.4	
1-Apr-10	4	1 to 3	75.0	
1-Apr-10	3	1 to 3	79.4	
1-Apr-10	2	1 to 3	83.5	
1-Apr-10	1	1 to 3	82.8	
2-Apr-10	1	1 to 2	82.1	8.8
2-Apr-10	2	1 to 2	80.8	
2-Apr-10	3	1 to 2	83.6	
2-Apr-10	4	1 to 2	77.2	
2-Apr-10	5	1 to 2	86.5	
2-Apr-10	6	1 to 2	80.0	
2-Apr-10	7	1 to 2	82.8	
2-Apr-10	8	1 to 2	84.9	
2-Apr-10	9	1 to 2	84.8	
2-Apr-10	10	1 to 3	79.5	
3-Apr-10	10	1 to 2	83.2	4.2
3-Apr-10	9	1 to 2	76.6	
3-Apr-10	8	1 to 2	84.6	
3-Apr-10	7	1 to 2	82.6	
3-Apr-10	6	1 to 2	84.1	

Table 2 (2x pages). Cetacean sightings during aerial surveys in the JAX USWTR study region during March 24, 2010 - April 23, 2010.

Date	Time	On/Off Effort	Latitute	Longitude	Track Number	Species	Common Name	Group Size
24-Mar-10	10:16	On effort	30.431388	-80.386431	8	*S. frontalis*	Atlantic Spotted Dolphin	10
24-Mar-10	10:36	On effort	30.429088	-80.037463	8	*G. griseus*	Risso's Dolphin	2
24-Mar-10	11:14	On effort	30.362014	-80.294141	7	*S. frontalis*	Atlantic Spotted Dolphin	12
24-Mar-10	11:25	On effort	30.370039	-80.461945	7	*S. frontalis*	Atlantic Spotted Dolphin	6
24-Mar-10	11:49	On effort	30.302538	-80.655800	6	Unid. Delphind	Unid. delphinid	3
24-Mar-10	12:11	On effort	30.302457	-80.113317	6	*G. griseus*	Risso's Dolphin	9
24-Mar-10	12:18	On effort	30.304547	-80.030007	6	Unid. Delphind	Unid. delphinid	2
31-Mar-10	14:08	On effort	30.032377	-80.325045	2	*S. frontalis*	Atlantic Spotted Dolphin	18
31-Mar-10	14:30	On effort	30.099076	-80.680099	3	*T. truncatus*	Bottlenose Dolphin	5
31-Mar-10	15:26	On effort	30.169487	-80.458317	4	*S. frontalis*	Atlantic Spotted Dolphin	2
31-Mar-10	15:36	On effort	30.171467	-80.540148	4	*S. frontalis*	Atlantic Spotted Dolphin	2
31-Mar-10	16:02	On effort	30.502046	-80.372564	9	*T. truncatus*	Bottlenose Dolphin	1
31-Mar-10	16:06	On effort	30.502116	-80.340091	9	*S. frontalis*	Atlantic Spotted Dolphin	80
31-Mar-10	16:09	On effort	30.503607	-80.291330	9	*T. truncatus*	Bottlenose Dolphin	1
31-Mar-10	16:21	On effort	30.500793	-80.151141	9	*T. truncatus*	Bottlenose Dolphin	2
31-Mar-10	16:29	On effort	30.504652	-79.895241	9	*T. truncatus*	Bottlenose Dolphin	10
31-Mar-10	16:35	On effort	30.501375	-79.831675	9	*T. truncatus*	Bottlenose Dolphin	18
31-Mar-10	16:48	On effort	30.572718	-80.122620	10	Unid. Delphind	Unid. delphinid	3
31-Mar-10	16:54	On effort	30.572921	-80.169614	10	*S. frontalis*	Atlantic Spotted Dolphin	25
31-Mar-10	17:01	On effort	30.562104	-80.212544	10	*T. truncatus*	Bottlenose Dolphin	3
31-Mar-10	17:05	On effort	30.568151	-80.309380	10	*S. frontalis*	Atlantic Spotted Dolphin	2
1-Apr-10	11:32	On effort	30.306852	-80.213772	6	*T. truncatus*	Bottlenose Dolphin	3
1-Apr-10	12:21	On effort	30.240809	-80.355085	5	*S. frontalis*	Atlantic Spotted Dolphin	11
1-Apr-10	12:36	On effort	30.239016	-80.583593	5	*S. frontalis*	Atlantic Spotted Dolphin	3
1-Apr-10	14:25	On effort	30.173926	-80.535763	4	*T. truncatus*	Bottlenose Dolphin	2
1-Apr-10	14:30	On effort	30.170693	-80.491403	4	*T. truncatus*	Bottlenose Dolphin	1
1-Apr-10	14:36	On effort	30.175791	-80.389746	4	*S. frontalis*	Atlantic Spotted Dolphin	6
1-Apr-10	14:44	On effort	30.165493	-80.270584	4	*T. truncatus*	Bottlenose Dolphin	7
1-Apr-10	15:00	On effort	30.163185	-79.962582	4	*T. truncatus*	Bottlenose Dolphin	11
1-Apr-10	15:24	On effort	30.102853	-80.187906	3	*G. griseus*	Risso's Dolphin	11
1-Apr-10	15:31	On effort	30.099932	-80.317157	3	*T. truncatus*	Bottlenose Dolphin	1
1-Apr-10	15:37	On effort	30.107272	-80.363344	3	*S. frontalis*	Atlantic Spotted Dolphin	6
1-Apr-10	16:03	On effort	30.035986	-80.485707	2	*T. truncatus*	Bottlenose Dolphin	3
1-Apr-10	16:47	On effort	29.962665	-80.435568	1	*S. frontalis*	Atlantic Spotted Dolphin	4
2-Apr-10	9:09	On effort	29.961342	-80.623578	1	*S. frontalis*	Atlantic Spotted Dolphin	8
2-Apr-10	9:15	On effort	29.959600	-80.446274	1	*T. truncatus*	Bottlenose Dolphin	3
2-Apr-10	9:40	On effort	29.961503	-80.013987	1	*T. truncatus*	Bottlenose Dolphin	2
2-Apr-10	9:48	On effort	29.963709	-79.918157	1	*T. truncatus*	Bottlenose Dolphin	8
2-Apr-10	9:53	On effort	29.958657	-79.850725	1	*T. truncatus*	Bottlenose Dolphin	5
2-Apr-10	9:56	On effort	29.964526	-79.832764	1	*G. macrorhynchus*	Short-finned pilot whale	5
2-Apr-10	10:09	On effort	30.037085	-79.894317	2	*T. truncatus*	Bottlenose Dolphin	4
2-Apr-10	10:26	On effort	30.032868	-80.373894	2	*T. truncatus*	Bottlenose Dolphin	15

2-Apr-10	10:36	On effort	30.033836	-80.482236	2	*S. frontalis*	Atlantic Spotted Dolphin	3
2-Apr-10	10:42	On effort	30.032604	-80.513773	2	*S. frontalis*	Atlantic Spotted Dolphin	12
2-Apr-10	10:58	On effort	30.092114	-80.551591	3	*S. frontalis*	Atlantic Spotted Dolphin	11
2-Apr-10	11:03	On effort	30.099114	-80.481895	3	*T. truncatus*	Bottlenose Dolphin	10
2-Apr-10	11:21	On effort	30.104917	-79.977374	3	*T. truncatus*	Bottlenose Dolphin	6
2-Apr-10	11:26	On effort	30.092008	-79.867933	3	*T. truncatus*	Bottlenose Dolphin	1
2-Apr-10	11:35	On effort	30.176137	-79.815244	4	*T. truncatus*	Bottlenose Dolphin	
2-Apr-10	11:39	On effort	30.163063	-79.889926	4	*T. truncatus*	Bottlenose Dolphin	4
2-Apr-10	12:03	On effort	30.172578	-80.512579	4	*S. frontalis*	Atlantic Spotted Dolphin	25
2-Apr-10	12:08	On effort	30.166215	-80.616192	4	*T. truncatus*	Bottlenose Dolphin	2
2-Apr-10	12:15	On effort	30.175159	-80.67196	4	*T. truncatus*	Bottlenose Dolphin	2
2-Apr-10	12:30	On effort	30.244618	-80.494633	5	*T. truncatus*	Bottlenose Dolphin	1
2-Apr-10	12:39	On effort	30.225323	-80.43902	5	*T. truncatus*	Bottlenose Dolphin	1
2-Apr-10	12:53	On effort	30.218106	-80.045485	5	*T. truncatus*	Bottlenose Dolphin	5
2-Apr-10	13:20	On effort	30.299055	-80.265751	6	*T. truncatus*	Bottlenose Dolphin	6
2-Apr-10	13:26	On effort	30.306456	-80.335262	6	*S. frontalis*	Atlantic Spotted Dolphin	18
2-Apr-10	15:30	On effort	30.365679	-80.3191	7	*S. frontalis*	Atlantic Spotted Dolphin	28
2-Apr-10	15:34	On effort	30.361301	-80.274064	7	Unid. Delphind	Unid. delphinid	1
2-Apr-10	15:54	On effort	30.365067	-79.85561	7	*T. truncatus*	Bottlenose Dolphin	10
2-Apr-10	16:11	On effort	30.435725	-80.175345	8	*T. truncatus*	Bottlenose Dolphin	12
2-Apr-10	16:44	On effort	30.498584	-80.45633	9	*T. truncatus*	Bottlenose Dolphin	4
2-Apr-10	17:21	On effort	30.567434	-80.140728	10	*S. frontalis*	Atlantic Spotted Dolphin	18
2-Apr-10	17:26	On effort	30.567027	-80.285993	10	*S. frontalis*	Atlantic Spotted Dolphin	22
2-Apr-10	17:36	On effort	30.567220	-80.489157	10	*S. frontalis*	Atlantic Spotted Dolphin	4
3-Apr-10	8:37	On effort	30.563400	-80.250618	10	*T. truncatus*	Bottlenose Dolphin	1
3-Apr-10	8:55	On effort	30.558371	-79.861974	10	*T. truncatus*	Bottlenose Dolphin	1
3-Apr-10	9:27	On effort	30.502812	-80.443168	9	*S. frontalis*	Atlantic Spotted Dolphin	12
3-Apr-10	9:32	On effort	30.498981	-80.486959	9	*S. frontalis*	Atlantic Spotted Dolphin	9
3-Apr-10	9:38	On effort	30.496229	-80.624682	9	*S. frontalis*	Atlantic Spotted Dolphin	10
3-Apr-10	9:57	On effort	30.428283	-80.241561	8	*T. truncatus*	Bottlenose Dolphin	10
3-Apr-10	10:37	On effort	30.370552	-80.507992	7	*S. frontalis*	Atlantic Spotted Dolphin	3
3-Apr-10	10:47	On effort	30.364375	-80.636263	7	*S. frontalis*	Atlantic Spotted Dolphin	24
3-Apr-10	11:01	On effort	30.293566	-80.463537	6	*T. truncatus*	Bottlenose Dolphin	1
3-Apr-10	11:10	On effort	30.294518	-80.257094	6	*T. truncatus*	Bottlenose Dolphin	3
3-Apr-10	11:30	On effort	30.296693	-79.808363	6	*T. truncatus*	Bottlenose Dolphin	12

Table 3 (4x pages). Sea turtle sightings during aerial surveys in the JAX USWTR study region during March 24, 2010 - April 23, 2010.

Date	Time	On/Off Effort	Latitude	Longitude	Track Number	Species	Common Name	Group Size
24-Mar-10	9:06	On Effort	30.567294	-80.486973	10	*C. caretta*	Loggerhead Sea Turtle	1
24-Mar-10	9:09	On Effort	30.567326	-80.379917	10	*C. caretta*	Loggerhead Sea Turtle	1
24-Mar-10	9:44	On Effort	30.498713	-80.150725	9	*C. caretta*	Loggerhead Sea Turtle	2
24-Mar-10	9:48	On Effort	30.498978	-80.314899	9	*C. caretta*	Loggerhead Sea Turtle	1
24-Mar-10	9:54	On Effort	30.498803	-80.522280	9	*C. caretta*	Loggerhead Sea Turtle	1
24-Mar-10	9:56	On Effort	30.498500	-80.589576	9	*C. caretta*	Loggerhead Sea Turtle	1
24-Mar-10	9:56	On Effort	30.498499	-80.598616	9	*C. caretta*	Loggerhead Sea Turtle	1
24-Mar-10	9:57	On Effort	30.498289	-80.649904	9	*C. caretta*	Loggerhead Sea Turtle	1
24-Mar-10	10:02	On Effort	30.426862	-80.689727	8	*C. caretta*	Loggerhead Sea Turtle	1
24-Mar-10	10:03	On Effort	30.433451	-80.632588	8	*C. caretta*	Loggerhead Sea Turtle	2
24-Mar-10	10:04	On Effort	30.433766	-80.601294	8	Unid. sea turtle	Unid. sea turtle	1
24-Mar-10	10:08	On Effort	30.434016	-80.474235	8	*C. caretta*	Loggerhead Sea Turtle	2
24-Mar-10	10:26	On Effort	30.433955	-80.313701	8	*C. caretta*	Loggerhead Sea Turtle	1
24-Mar-10	10:26	On Effort	30.434115	-80.288908	8	*C. caretta*	Loggerhead Sea Turtle	1
24-Mar-10	10:29	On Effort	30.434117	-80.202388	8	Unid. sea turtle	Unid. sea turtle	2
24-Mar-10	11:33	On Effort	30.365562	-80.522841	7	*C. caretta*	Loggerhead Sea Turtle	1
24-Mar-10	11:34	On Effort	30.364885	-80.549990	7	*C. caretta*	Loggerhead Sea Turtle	1
24-Mar-10	11:36	On Effort	30.364837	-80.626302	7	Unid. sea turtle	Unid. sea turtle	2
24-Mar-10	11:38	On Effort	30.364613	-80.688866	7	*C. caretta*	Loggerhead Sea Turtle	1
24-Mar-10	11:57	On Effort	30.300623	-80.530066	6	*C. caretta*	Loggerhead Sea Turtle	1
24-Mar-10	12:01	On Effort	30.300728	-80.401245	6	Unid. sea turtle	Unid. sea turtle	1
24-Mar-10	12:57	On Effort	30.231972	-80.378059	5	*C. caretta*	Loggerhead Sea Turtle	1
24-Mar-10	12:58	On Effort	30.232259	-80.439790	5	*C. caretta*	Loggerhead Sea Turtle	1
24-Mar-10	12:58	On Effort	30.232154	-80.443375	5	Unid. sea turtle	Unid. sea turtle	3
24-Mar-10	12:59	On Effort	30.232141	-80.461687	5	*C. caretta*	Loggerhead Sea Turtle	2
24-Mar-10	13:02	On Effort	30.231948	-80.581830	5	*C. caretta*	Loggerhead Sea Turtle	1
24-Mar-10	13:04	On Effort	30.231922	-80.642595	5	*C. caretta*	Loggerhead Sea Turtle	1
31-Mar-10	14:19	On Effort	30.032073	-80.471281	2	*C. caretta*	Loggerhead Sea Turtle	1
31-Mar-10	14:21	On Effort	30.031944	-80.530676	2	*C. caretta*	Loggerhead Sea Turtle	1
31-Mar-10	15:31	On Effort	30.166325	-80.491997	4	*C. caretta*	Loggerhead Sea Turtle	1
31-Mar-10	15:31	On Effort	30.166404	-80.511724	4	*C. caretta*	Loggerhead Sea Turtle	1
31-Mar-10	15:40	On Effort	30.166106	-80.655086	4	*C. caretta*	Loggerhead Sea Turtle	1
31-Mar-10	15:40	On Effort	30.166241	-80.673845	4	*C. caretta*	Loggerhead Sea Turtle	1
31-Mar-10	15:52	On Effort	30.498571	-80.656912	9	*C. caretta*	Loggerhead Sea Turtle	2
31-Mar-10	15:52	On Effort	30.498559	-80.656648	9	*C. caretta*	Loggerhead Sea Turtle	1
31-Mar-10	15:53	On Effort	30.498905	-80.631751	9	*C. caretta*	Loggerhead Sea Turtle	3
31-Mar-10	15:54	On Effort	30.499012	-80.597075	9	*C. caretta*	Loggerhead Sea Turtle	3
31-Mar-10	15:54	On Effort	30.499101	-80.573123	9	*C. caretta*	Loggerhead Sea Turtle	3
31-Mar-10	15:54	On Effort	30.499011	-80.592174	9	*C. caretta*	Loggerhead Sea Turtle	2
31-Mar-10	15:55	On Effort	30.499190	-80.531806	9	*C. caretta*	Loggerhead Sea Turtle	3
31-Mar-10	15:55	On Effort	30.499158	-80.537305	9	Unid. sea turtle	Unid. sea turtle	1
31-Mar-10	15:57	On Effort	30.499302	-80.456003	9	Unid. sea turtle	Unid. sea turtle	1

31-Mar-10	16:17	On Effort	30.499380	-80.221563	9	*C. caretta*	Loggerhead Sea Turtle	1
31-Mar-10	17:09	On Effort	30.567284	-80.355627	10	Unid. sea turtle	Unid. sea turtle	1
31-Mar-10	17:13	On Effort	30.566988	-80.502750	10	*C. caretta*	Loggerhead Sea Turtle	1
31-Mar-10	17:13	On Effort	30.567004	-80.499043	10	*C. caretta*	Loggerhead Sea Turtle	1
31-Mar-10	17:14	On Effort	30.566836	-80.570466	10	Unid. sea turtle	Unid. sea turtle	1
31-Mar-10	17:15	On Effort	30.566757	-80.597297	10	*C. caretta*	Loggerhead Sea Turtle	1
31-Mar-10	17:16	On Effort	30.566684	-80.619658	10	*C. caretta*	Loggerhead Sea Turtle	5
31-Mar-10	17:16	On Effort	30.566666	-80.648355	10	*C. caretta*	Loggerhead Sea Turtle	2
31-Mar-10	17:17	On Effort	30.566536	-80.685169	10	*C. caretta*	Loggerhead Sea Turtle	5
31-Mar-10	17:17	On Effort	30.566599	-80.675692	10	*C. caretta*	Loggerhead Sea Turtle	1
1-Apr-10	10:42	On Effort	30.3661360	-80.3661030	7	*C. caretta*	Loggerhead Sea Turtle	1
1-Apr-10	10:43	On Effort	30.3661550	-80.4041050	7	Unid. sea turtle	Unid. sea turtle	1
1-Apr-10	10:46	On Effort	30.3659530	-80.5163080	7	*C. caretta*	Loggerhead Sea Turtle	1
1-Apr-10	10:55	On Effort	30.297457	-80.674508	6	Unid. sea turtle	Unid. sea turtle	1
1-Apr-10	11:21	On Effort	30.299970	-80.383497	6	Unid. sea turtle	Unid. sea turtle	1
1-Apr-10	12:29	On Effort	30.2330810	-80.4445760	5	*C. caretta*	Loggerhead Sea Turtle	1
1-Apr-10	14:17	On Effort	30.165302	-80.697645	4	*C. caretta*	Loggerhead Sea Turtle	1
1-Apr-10	14:18	On Effort	30.1657320	-80.6689100	4	Unid. sea turtle	Unid. sea turtle	1
1-Apr-10	14:19	On Effort	30.165708	-80.644909	4	*C. caretta*	Loggerhead Sea Turtle	1
1-Apr-10	14:20	On Effort	30.165861	-80.583087	4	Unid. sea turtle	Unid. sea turtle	1
1-Apr-10	14:33	On Effort	30.166213	-80.433398	4	*C. caretta*	Loggerhead Sea Turtle	1
1-Apr-10	14:41	On Effort	30.1664210	-80.3116890	4	Unid. sea turtle	Unid. sea turtle	1
1-Apr-10	15:47	On Effort	30.100436	-80.498892	3	*C. caretta*	Loggerhead Sea Turtle	1
1-Apr-10	15:47	On Effort	30.1004800	-80.4744760	3	Unid. sea turtle	Unid. sea turtle	1
1-Apr-10	15:48	On Effort	30.100358	-80.529854	3	*C. caretta*	Loggerhead Sea Turtle	1
1-Apr-10	15:49	On Effort	30.100327	-80.550423	3	*C. caretta*	Loggerhead Sea Turtle	1
1-Apr-10	15:52	On Effort	30.100071	-80.682629	3	*C. caretta*	Loggerhead Sea Turtle	1
1-Apr-10	15:52	On Effort	30.099968	-80.671037	3	Unid. sea turtle	Unid. sea turtle	1
1-Apr-10	15:57	On Effort	30.031726	-80.668162	2	*C. caretta*	Loggerhead Sea Turtle	1
1-Apr-10	15:58	On Effort	30.031326	-80.635289	2	*C. caretta*	Loggerhead Sea Turtle	1
1-Apr-10	15:58	On Effort	30.031349	-80.610825	2	*C. caretta*	Loggerhead Sea Turtle	1
1-Apr-10	15:58	On Effort	30.0313400	-80.6046190	2	Unid. sea turtle	Unid. sea turtle	3
1-Apr-10	15:59	On Effort	30.031457	-80.595225	2	*C. caretta*	Loggerhead Sea Turtle	1
1-Apr-10	15:59	On Effort	30.031493	-80.569883	2	*C. caretta*	Loggerhead Sea Turtle	1
1-Apr-10	16:00	On Effort	30.0314450	-80.5540160	2	*C. caretta*	Loggerhead Sea Turtle	1
1-Apr-10	16:01	On Effort	30.0316080	-80.5057760	2	*C. caretta*	Loggerhead Sea Turtle	1
1-Apr-10	16:12	On Effort	30.031868	-80.275036	2	*C. caretta*	Loggerhead Sea Turtle	1
1-Apr-10	16:43	On Effort	29.9659210	-80.3708830	1	*C. caretta*	Loggerhead Sea Turtle	1
1-Apr-10	16:55	On Effort	29.9653460	-80.6491670	1	*C. caretta*	Loggerhead Sea Turtle	1
2-Apr-10	9:12	On Effort	29.965215	-80.545697	1	*C. caretta*	Loggerhead Sea Turtle	1
2-Apr-10	9:21	On Effort	29.965105	-80.419148	1	*C. caretta*	Loggerhead Sea Turtle	1
2-Apr-10	10:47	On Effort	30.031775	-80.581927	2	*C. caretta*	Loggerhead Sea Turtle	1
2-Apr-10	10:48	On Effort	30.031734	-80.610540	2	*C. caretta*	Loggerhead Sea Turtle	2

2-Apr-10	11:01	On Effort	30.100746	-80.532937	3	*C. caretta*	Loggerhead Sea Turtle	1
2-Apr-10	11:01	On Effort	30.100106	-80.507810	3	*C. caretta*	Loggerhead Sea Turtle	2
2-Apr-10	11:08	On Effort	30.100360	-80.433341	3	Unid. sea turtle	Unid. sea turtle	1
2-Apr-10	11:12	On Effort	30.100262	-80.274858	3	Unid. sea turtle	Unid. sea turtle	3
2-Apr-10	11:53	On Effort	30.167511	-80.259354	4	*C. caretta*	Loggerhead Sea Turtle	1
2-Apr-10	11:59	On Effort	30.166671	-80.399993	4	*C. caretta*	Loggerhead Sea Turtle	1
2-Apr-10	12:00	On Effort	30.166586	-80.454301	4	*C. caretta*	Loggerhead Sea Turtle	1
2-Apr-10	12:01	On Effort	30.166542	-80.482073	4	*C. caretta*	Loggerhead Sea Turtle	1
2-Apr-10	12:23	On Effort	30.232389	-80.671304	5	*C. caretta*	Loggerhead Sea Turtle	2
2-Apr-10	12:24	On Effort	30.232254	-80.650172	5	*C. caretta*	Loggerhead Sea Turtle	2
2-Apr-10	12:24	On Effort	30.232279	-80.627037	5	*C. caretta*	Loggerhead Sea Turtle	2
2-Apr-10	12:26	On Effort	30.232537	-80.561596	5	*C. caretta*	Loggerhead Sea Turtle	2
2-Apr-10	12:27	On Effort	30.232617	-80.510335	5	Unid. sea turtle	Unid. sea turtle	1
2-Apr-10	13:18	On Effort	30.300425	-80.218023	6	*C. caretta*	Loggerhead Sea Turtle	1
2-Apr-10	13:26	On Effort	30.304767	-80.309144	6	*C. caretta*	Loggerhead Sea Turtle	1
2-Apr-10	13:37	On Effort	30.299726	-80.674536	6	*C. caretta*	Loggerhead Sea Turtle	1
2-Apr-10	13:37	On Effort	30.299710	-80.678288	6	*C. caretta*	Loggerhead Sea Turtle	1
2-Apr-10	15:21	On Effort	30.365127	-80.652659	7	*C. caretta*	Loggerhead Sea Turtle	2
2-Apr-10	15:21	On Effort	30.365109	-80.650647	7	*C. caretta*	Loggerhead Sea Turtle	3
2-Apr-10	15:22	On Effort	30.365242	-80.611985	7	*C. caretta*	Loggerhead Sea Turtle	1
2-Apr-10	15:23	On Effort	30.365276	-80.590156	7	*C. caretta*	Loggerhead Sea Turtle	3
2-Apr-10	15:24	On Effort	30.365401	-80.545544	7	*C. caretta*	Loggerhead Sea Turtle	1
2-Apr-10	15:24	On Effort	30.365395	-80.528076	7	*C. caretta*	Loggerhead Sea Turtle	3
2-Apr-10	15:25	On Effort	30.365447	-80.515283	7	*C. caretta*	Loggerhead Sea Turtle	1
2-Apr-10	15:26	On Effort	30.365470	-80.474578	7	*C. caretta*	Loggerhead Sea Turtle	1
2-Apr-10	15:28	On Effort	30.365683	-80.384327	7	*C. caretta*	Loggerhead Sea Turtle	2
2-Apr-10	15:29	On Effort	30.365692	-80.365171	7	*C. caretta*	Loggerhead Sea Turtle	1
2-Apr-10	16:22	On Effort	30.433736	-80.248053	8	*C. caretta*	Loggerhead Sea Turtle	1
2-Apr-10	16:23	On Effort	30.433720	-80.269359	8	*C. caretta*	Loggerhead Sea Turtle	1
2-Apr-10	16:23	On Effort	30.433681	-80.289136	8	Unid. sea turtle	Unid. sea turtle	3
2-Apr-10	16:25	On Effort	30.433697	-80.339620	8	*C. caretta*	Loggerhead Sea Turtle	3
2-Apr-10	16:26	On Effort	30.433605	-80.395444	8	*C. caretta*	Loggerhead Sea Turtle	2
2-Apr-10	16:26	On Effort	30.433623	-80.388464	8	*C. caretta*	Loggerhead Sea Turtle	2
2-Apr-10	16:27	On Effort	30.433650	-80.420986	8	*C. caretta*	Loggerhead Sea Turtle	2
2-Apr-10	16:30	On Effort	30.433431	-80.536213	8	*C. caretta*	Loggerhead Sea Turtle	2
2-Apr-10	16:30	On Effort	30.433361	-80.560756	8	*C. caretta*	Loggerhead Sea Turtle	3
2-Apr-10	16:32	On Effort	30.433118	-80.640198	8	*C. caretta*	Loggerhead Sea Turtle	1
2-Apr-10	16:32	On Effort	30.433261	-80.609786	8	*C. caretta*	Loggerhead Sea Turtle	2
2-Apr-10	16:32	On Effort	30.433150	-80.638273	8	*C. caretta*	Loggerhead Sea Turtle	2
2-Apr-10	16:34	On Effort	30.433202	-80.690055	8	*C. caretta*	Loggerhead Sea Turtle	1
2-Apr-10	16:38	On Effort	30.498598	-80.660643	9	Unid. sea turtle	Unid. sea turtle	1
2-Apr-10	16:40	On Effort	30.499023	-80.604308	9	Unid. sea turtle	Unid. sea turtle	4
2-Apr-10	16:40	On Effort	30.499147	-80.571885	9	Unid. sea turtle	Unid. sea turtle	5

2-Apr-10	16:41	On Effort	30.499229	-80.547945	9	*C. caretta*	Loggerhead Sea Turtle	4
2-Apr-10	16:41	On Effort	30.499196	-80.551560	9	*C. caretta*	Loggerhead Sea Turtle	6
2-Apr-10	16:42	On Effort	30.499257	-80.509296	9	*C. caretta*	Loggerhead Sea Turtle	3
2-Apr-10	16:52	On Effort	30.499454	-80.318959	9	*C. caretta*	Loggerhead Sea Turtle	1
2-Apr-10	17:00	On Effort	30.499030	-80.133132	9	*C. caretta*	Loggerhead Sea Turtle	1
2-Apr-10	17:18	On Effort	30.567302	-80.085730	10	*C. caretta*	Loggerhead Sea Turtle	1
2-Apr-10	17:23	On Effort	30.567321	-80.195202	10	*C. caretta*	Loggerhead Sea Turtle	1
2-Apr-10	17:25	On Effort	30.567201	-80.262607	10	*C. caretta*	Loggerhead Sea Turtle	2
2-Apr-10	17:30	On Effort	30.567440	-80.336212	10	*C. caretta*	Loggerhead Sea Turtle	1
2-Apr-10	17:43	On Effort	30.566593	-80.645813	10	*C. caretta*	Loggerhead Sea Turtle	1
2-Apr-10	17:43	On Effort	30.566664	-80.642479	10	*C. caretta*	Loggerhead Sea Turtle	1
2-Apr-10	17:43	On Effort	30.566515	-80.655792	10	*C. caretta*	Loggerhead Sea Turtle	3
3-Apr-10	8:25	On Effort	30.565911	-80.681409	10	Unid. sea turtle	Unid. sea turtle	3
3-Apr-10	8:25	On Effort	30.566042	-80.670227	10	Unid. sea turtle	Unid. sea turtle	2
3-Apr-10	8:26	On Effort	30.566182	-80.643714	10	Unid. sea turtle	Unid. sea turtle	1
3-Apr-10	8:27	On Effort	30.566382	-80.608878	10	Unid. sea turtle	Unid. sea turtle	2
3-Apr-10	8:27	On Effort	30.566249	-80.619345	10	Unid. sea turtle	Unid. sea turtle	3
3-Apr-10	8:30	On Effort	30.566609	-80.497587	10	Unid. sea turtle	Unid. sea turtle	2
3-Apr-10	9:35	On Effort	30.499595	-80.545578	9	Unid. sea turtle	Unid. sea turtle	4
3-Apr-10	9:36	On Effort	30.499414	-80.583656	9	Unid. sea turtle	Unid. sea turtle	4
3-Apr-10	9:36	On Effort	30.499438	-80.590211	9	Unid. sea turtle	Unid. sea turtle	6
3-Apr-10	9:37	On Effort	30.499323	-80.623452	9	Unid. sea turtle	Unid. sea turtle	4
3-Apr-10	9:38	Off effort	30.496229	-80.624682	9	*L. kempii*	Kemp's Ridley Sea Turtle	1
3-Apr-10	9:40	On Effort	30.499813	-80.661395	9	Unid. sea turtle	Unid. sea turtle	2
3-Apr-10	9:45	On Effort	30.433353	-80.670301	8	Unid. sea turtle	Unid. sea turtle	2
3-Apr-10	9:46	On Effort	30.432876	-80.628565	8	Unid. sea turtle	Unid. sea turtle	2
3-Apr-10	9:46	On Effort	30.432850	-80.642903	8	Unid. sea turtle	Unid. sea turtle	2
3-Apr-10	9:47	On Effort	30.432965	-80.581628	8	Unid. sea turtle	Unid. sea turtle	2
3-Apr-10	9:50	On Effort	30.433172	-80.496739	8	Unid. sea turtle	Unid. sea turtle	2
3-Apr-10	9:50	On Effort	30.433160	-80.482546	8	Unid. sea turtle	Unid. sea turtle	4
3-Apr-10	9:55	On Effort	30.433354	-80.312309	8	Unid. sea turtle	Unid. sea turtle	3
3-Apr-10	10:35	On Effort	30.365981	-80.425846	7	Unid. sea turtle	Unid. sea turtle	2
3-Apr-10	10:44	On Effort	30.365786	-80.559614	7	*C. caretta*	Loggerhead Sea Turtle	1
3-Apr-10	10:46	On Effort	30.365598	-80.619618	7	Unid. sea turtle	Unid. sea turtle	1
3-Apr-10	10:51	On Effort	30.367550	-80.693420	7	*C. caretta*	Loggerhead Sea Turtle	1
3-Apr-10	10:55	On Effort	30.299524	-80.644651	6	*C. caretta*	Loggerhead Sea Turtle	1
3-Apr-10	10:56	On Effort	30.299539	-80.615208	6	Unid. sea turtle	Unid. sea turtle	4
3-Apr-10	10:58	On Effort	30.299737	-80.535776	6	*C. caretta*	Loggerhead Sea Turtle	1
3-Apr-10	10:58	On Effort	30.299651	-80.563760	6	Unid. sea turtle	Unid. sea turtle	1
3-Apr-10	10:58	On Effort	30.299645	-80.557459	6	Unid. sea turtle	Unid. sea turtle	1
3-Apr-10	10:59	On Effort	30.299811	-80.492393	6	Unid. sea turtle	Unid. sea turtle	1
3-Apr-10	11:00	On Effort	30.299817	-80.480669	6	Unid. sea turtle	Unid. sea turtle	3
3-Apr-10	11:08	On Effort	30.300065	-80.315070	6	Unid. sea turtle	Unid. sea turtle	3

Table 4. Aerial survey effort table for the Onslow Bay USWTR study region during March 24, 2010 - April 23, 2010.

Date	Line	Sea State	Kilometers Flown	Hobbs Hours
11-Apr-10	6	2 to 4	74.5	7.0
11-Apr-10	5	2 to 3	75.5	
11-Apr-10	4	2 to 4	75.3	
11-Apr-10	3	2 to 3	75.1	
11-Apr-10	2	2 to 4	71.9	
11-Apr-10	1	2 to 4	74.5	
11-Apr-10	7	2 to 3	74.3	
11-Apr-10	8	2 to 3	75.3	
11-Apr-10	9	2 to 3	73.0	
11-Apr-10	10	2 to 3	74.1	
12-Apr-10	10	1 to 3	72.8	6.8
12-Apr-10	9	2 to 3	73.1	
12-Apr-10	8	2 to 3	74.9	
12-Apr-10	7	2 to 3	74.8	
12-Apr-10	6	2 to 3	74.7	
12-Apr-10	5	2 to 3	72.8	
12-Apr-10	1	2 to 3	74.3	
12-Apr-10	2	2 to 3	74.5	
12-Apr-10	3	2 to 3	75.3	
12-Apr-10	4	2 to 3	74.3	

Table 5. Cetacean sightings during aerial surveys in the Onslow Bay USWTR study region during March 24, 2010 - April 23, 2010.

Date	Time	On/Off Effort	Latitute	Longitude	Track Number	Species	Common Name	Group Size
11-Apr-10	9:53	On	34.010019	-76.930714	5	S. frontalis	Atlantic Spotted dolphin	18
11-Apr-10	11:15	On	33.484779	-76.651031	2	T. truncatus	Bottlenose dolphin	40
12-Apr-10	11:17	On	33.685951	-76.498036	5	T. truncatus	Bottlenose dolphin	9

Table 6. Sea turtle sightings during aerial surveys in the Onslow Bay USWTR study region during March 24, 2010 - April 23, 2010.

Date	Time	On/Off Effort	Latitude	Longitude	Track Number	Species	Common Name	Group Size
11-Apr-10	9:05	On	34.05457	-76.854696	6	C. caretta	Loggerhead sea turtle	2
11-Apr-10	9:19	On	33.753297	-76.45773	6	Unid sea turtle	Unid sea turtle	1
11-Apr-10	9:48	On	33.960538	-76.863675	5	C. caretta	Loggerhead sea turtle	1
11-Apr-10	9:50	On	34.003161	-76.920216	5	C. caretta	Loggerhead sea turtle	1
11-Apr-10	10:46	On	33.773411	-76.883261	3	C. caretta	Loggerhead sea turtle	1
11-Apr-10	10:52	On	33.900722	-77.049539	3	C. caretta	Loggerhead sea turtle	1
11-Apr-10	11:01	On	33.739419	-76.96437	2	C. caretta	Loggerhead sea turtle	1
11-Apr-10	11:05	On	33.667044	-76.870733	2	C. caretta	Loggerhead sea turtle	1
11-Apr-10	11:57	On	33.795604	-77.172689	1	C. caretta	Loggerhead sea turtle	1
11-Apr-10	14:08	On	34.022195	-76.672521	7	C. caretta	Loggerhead sea turtle	1
11-Apr-10	14:08	On	34.012545	-76.659842	7	C. caretta	Loggerhead sea turtle	1
11-Apr-10	14:40	On	34.00999	-76.530938	8	C. caretta	Loggerhead sea turtle	1
11-Apr-10	14:53	On	34.17084	-76.616313	9	C. caretta	Loggerhead sea turtle	1
11-Apr-10	14:56	On	34.114997	-76.542141	9	C. caretta	Loggerhead sea turtle	1
11-Apr-10	15:01	On	33.998321	-76.387938	9	C. caretta	Loggerhead sea turtle	1
11-Apr-10	15:31	On	34.171487	-76.481811	10	C. caretta	Loggerhead sea turtle	1
11-Apr-10	15:34	On	34.226395	-76.552354	10	C. caretta	Loggerhead sea turtle	1
12-Apr-10	9:06	On	34.260347	-76.593000	10	C. caretta	Loggerhead sea turtle	3
12-Apr-10	9:07	On	34.245283	-76.574369	10	C. caretta	Loggerhead sea turtle	2
12-Apr-10	9:08	On	34.215017	-76.535104	10	C. caretta	Loggerhead sea turtle	1
12-Apr-10	9:09	On	34.205325	-76.522603	10	C. caretta	Loggerhead sea turtle	4
12-Apr-10	9:10	On	34.169130	-76.476012	10	C. caretta	Loggerhead sea turtle	1
12-Apr-10	9:20	On	34.016787	-76.279442	10	C. caretta	Loggerhead sea turtle	1
12-Apr-10	9:44	On	34.002838	-76.396980	9	Unid sea turtle	Unid sea turtle	1
12-Apr-10	9:48	On	34.105410	-76.532150	9	C. caretta	Loggerhead sea turtle	1
12-Apr-10	9:49	On	34.111477	-76.540201	9	Unid sea turtle	Unid sea turtle	2
12-Apr-10	9:53	On	34.201625	-76.659705	9	Unid sea turtle	Unid sea turtle	2
12-Apr-10	9:58	On	34.141664	-76.701370	8	C. caretta	Loggerhead sea turtle	1
12-Apr-10	9:58	On	34.131522	-76.688228	8	C. caretta	Loggerhead sea turtle	2
12-Apr-10	10:00	On	34.101123	-76.648155	8	C. caretta	Loggerhead sea turtle	1
12-Apr-10	10:00	On	34.088152	-76.631007	8	Unid sea turtle	Unid sea turtle	3
12-Apr-10	10:01	On	34.059282	-76.593320	8	C. caretta	Loggerhead sea turtle	1
12-Apr-10	10:40	On	34.073505	-76.742117	7	Unid sea turtle	Unid sea turtle	4
12-Apr-10	10:41	On	34.110676	-76.790741	7	C. caretta	Loggerhead sea turtle	2
12-Apr-10	10:46	On	34.055040	-76.859105	6	C. caretta	Loggerhead sea turtle	4
12-Apr-10	10:46	On	34.049133	-76.849504	6	Unid sea turtle	Unid sea turtle	1
12-Apr-10	10:47	On	34.023453	-76.813501	6	C. caretta	Loggerhead sea turtle	1
12-Apr-10	10:48	On	34.003460	-76.787213	6	C. caretta	Loggerhead sea turtle	1
12-Apr-10	11:45	On	34.002549	-76.919181	5	Unid sea turtle	Unid sea turtle	1
12-Apr-10	14:35	On	33.773823	-77.011464	2	C. caretta	Loggerhead sea turtle	1
12-Apr-10	14:52	On	33.721309	-76.812493	3	Unid sea turtle	Unid sea turtle	1

Table 7. Effort table for vessel surveys in the Onslow Bay USWTR study region March 24, 2010 – April 23, 2010.

Date	Line	Sea State	Km Surveyed	Survey	At Sea	Platform
2-Apr-10	10	3-Feb	74.08	5:11	10:10	*R/V Cetus*
11-Apr-10	1	4-Feb	74.08	4:30	11:10	*M/V Sensation*
12-Apr-10	7	3-Feb	74.08	4:13	9:00	*M/V Sensation*

Table 8. Cetacean and sea turtle sightings during vessel surveys in the Onslow Bay USWTR study region March 24, 2010 – April 23, 2010. * indicates approximate values-exact values were not obtained that day due to software problems.

Date	Time	On/Off Effort	Latitude	Longitude	Species	Common Name	Group Size
2-Apr-10	12:20	On	34.059380	-76.333961	*T. truncatus*	Bottlenose dolphins	9
2-Apr-10	14:00	On	34.184760	-76.499986	*C. caretta*	Loggerhead sea turtle	1
2-Apr-10	14:32	On	34.245226	-76.577878	*T. truncatus*	Bottlenose dolphins	36
2-Apr-10	14:53	Off	34.247264	-76.587190	*C. caretta*	Loggerhead sea turtle	1
2-Apr-10	14:56	Off	34.249868	-76.586747	*C. caretta*	Loggerhead sea turtle	1
2-Apr-10	14:57	Off	34.247900	-76.587490	*C. caretta*	Loggerhead sea turtle	1
2-Apr-10	15:02	Off	34.247740	-76.587591	*C. caretta*	Loggerhead sea turtle	1
2-Apr-10	15:28	On	34.271450	-76.609531	*C. caretta*	Loggerhead sea turtle	1
11-Apr-10	9:00*	Off	33.35960*	-76.60170*	*T. truncatus*	Bottlenose dolphins	12
12-Apr-10	12:35	On	34.046848	-76.706958	*C. caretta*	Loggerhead sea turtle	1
12-Apr-10	12:39	On	34.053326	-76.712476	*C. caretta*	Loggerhead sea turtle	1
12-Apr-10	12:52	On	34.079756	-76.745518	*C. caretta*	Loggerhead sea turtle	1
12-Apr-10	13:00	Off	34.094514	-76.755889	*C. caretta*	Loggerhead sea turtle	1
12-Apr-10	13:19	Off	34.115588	-76.798813	*C. caretta*	Loggerhead sea turtle	1
12-Apr-10	13:21	On	34.121355	-76.803717	*C. caretta*	Loggerhead sea turtle	1

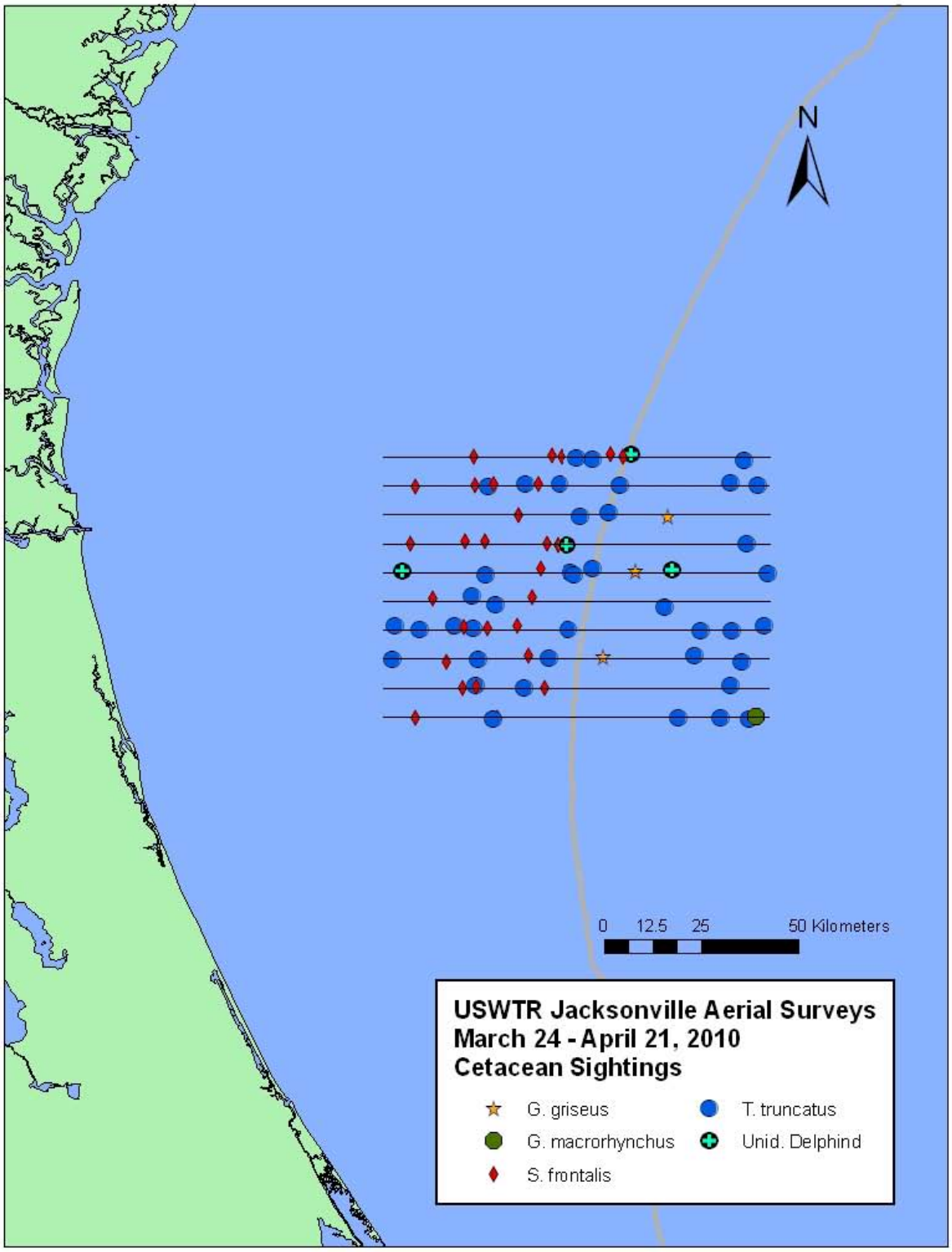


Figure 1. The locations of cetaceans sighted while conducting aerial surveys during the March 24, 2010 - April 23, 2010 reporting period of the JAX USWTR study region.

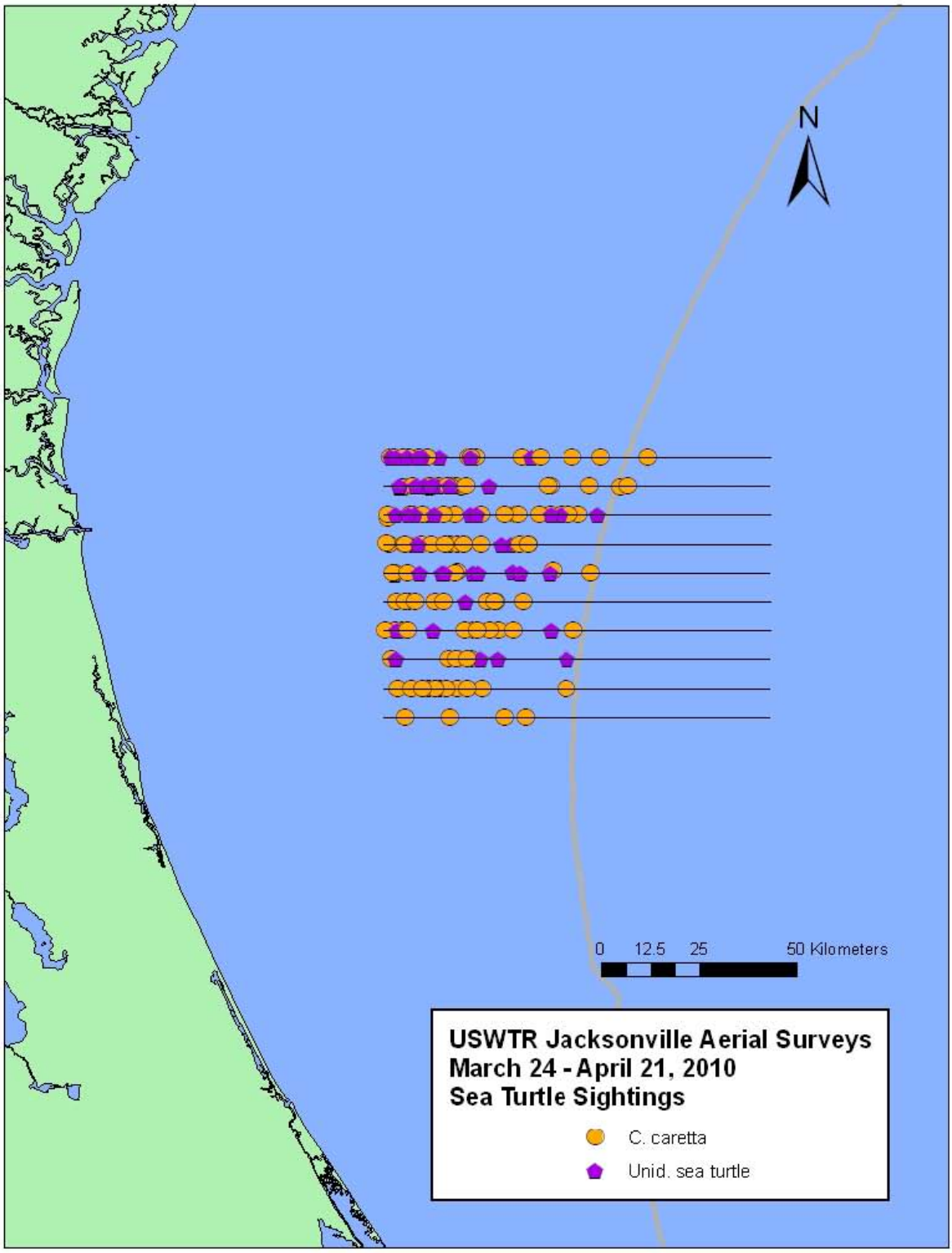


Figure 2. The locations of sea turtles sighted during aerial surveys between March 24, 2010 - April 23, 2010 in the JAX USWTR study region.

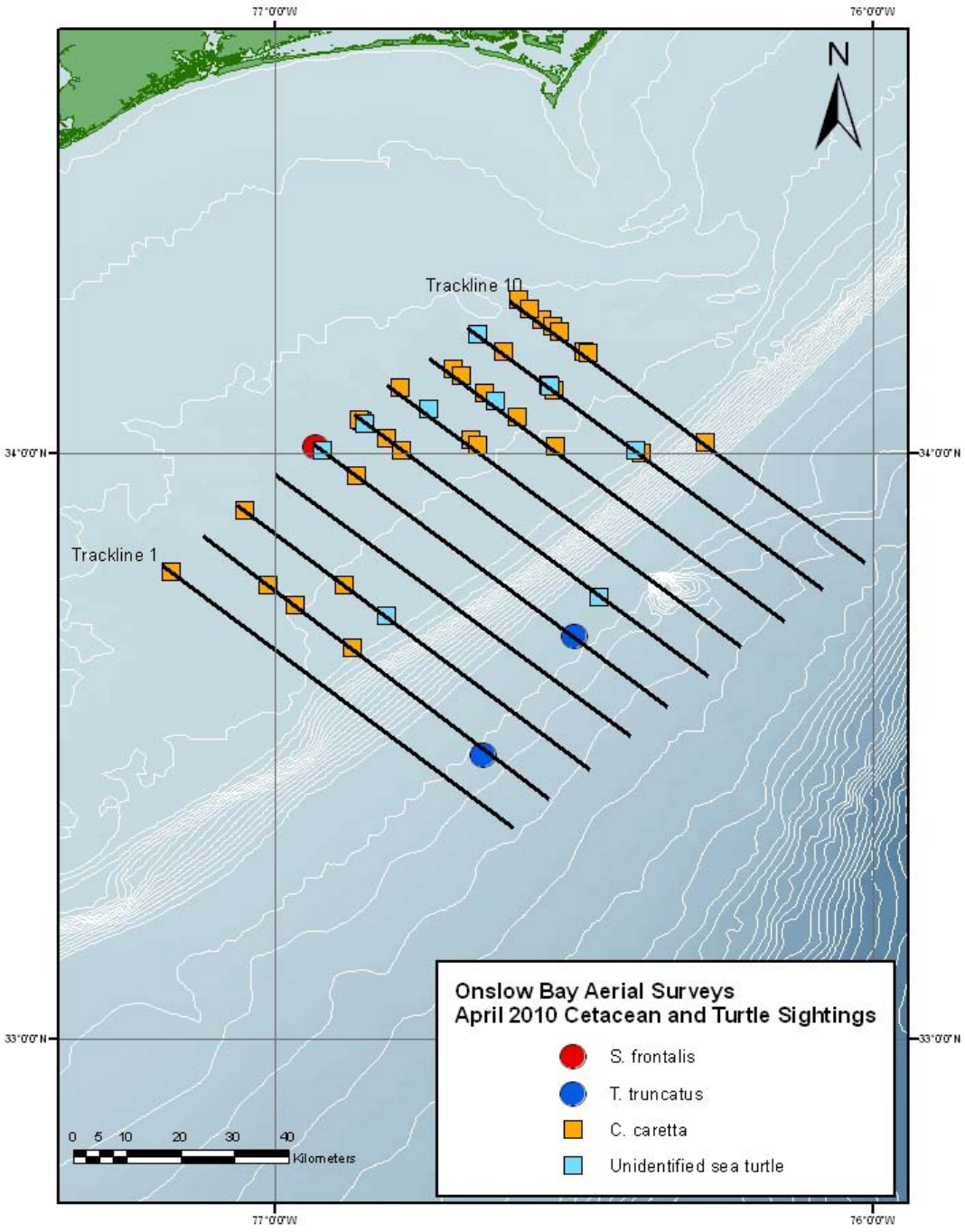


Figure 3. The locations of cetaceans and sea turtles sighted during aerial surveys from March 24, 2010 - April 23, 2010 of the Onslow Bay USWTR study region.

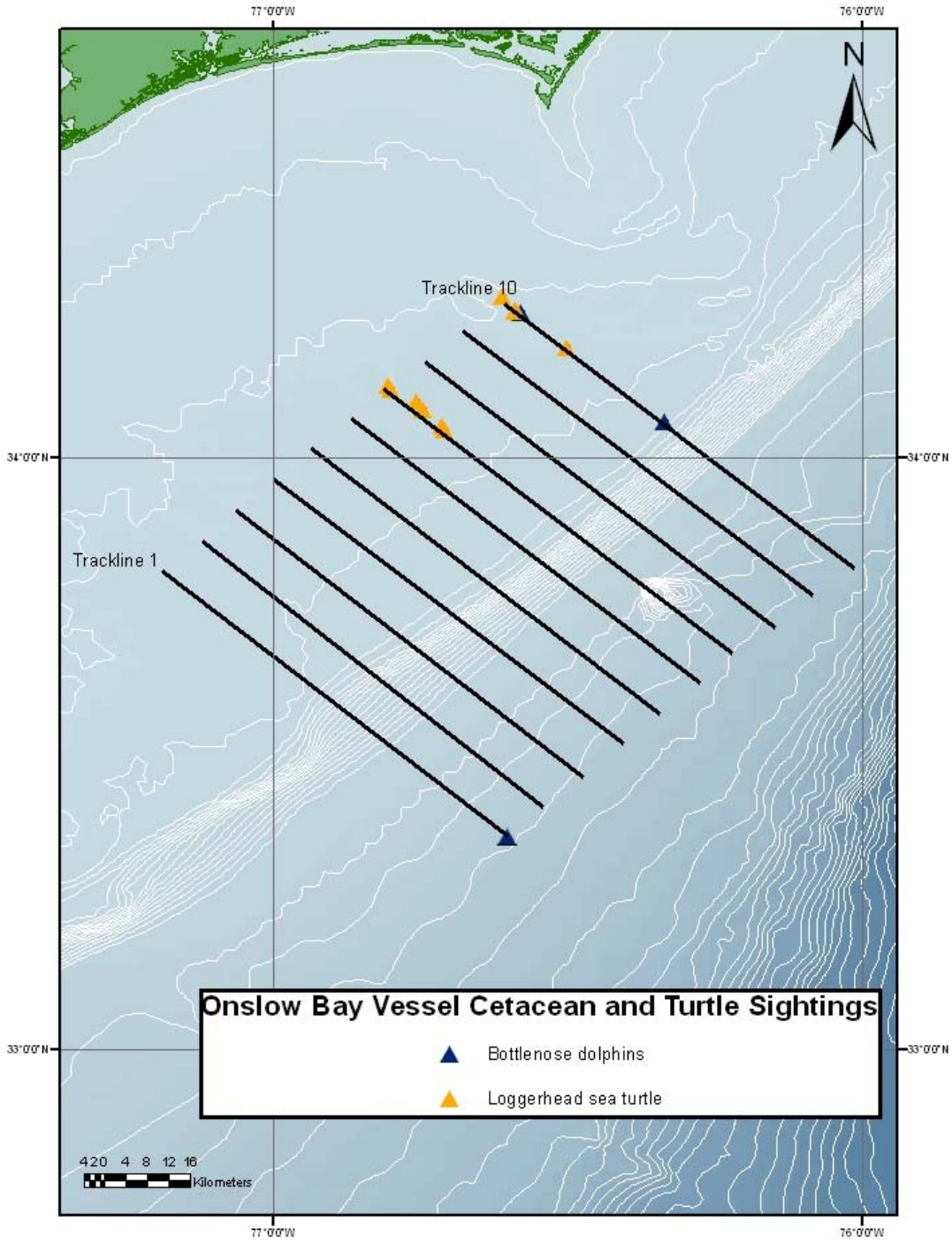


Figure 4. Locations of cetaceans and sea turtles sighted during vessel surveys in the Onslow Bay USWTR study region March 24, 2010 – April 20, 2010. Note the bottlenose dolphin sighting partially hidden by the loggerhead sea turtle sighting near the inshore region of line 10.

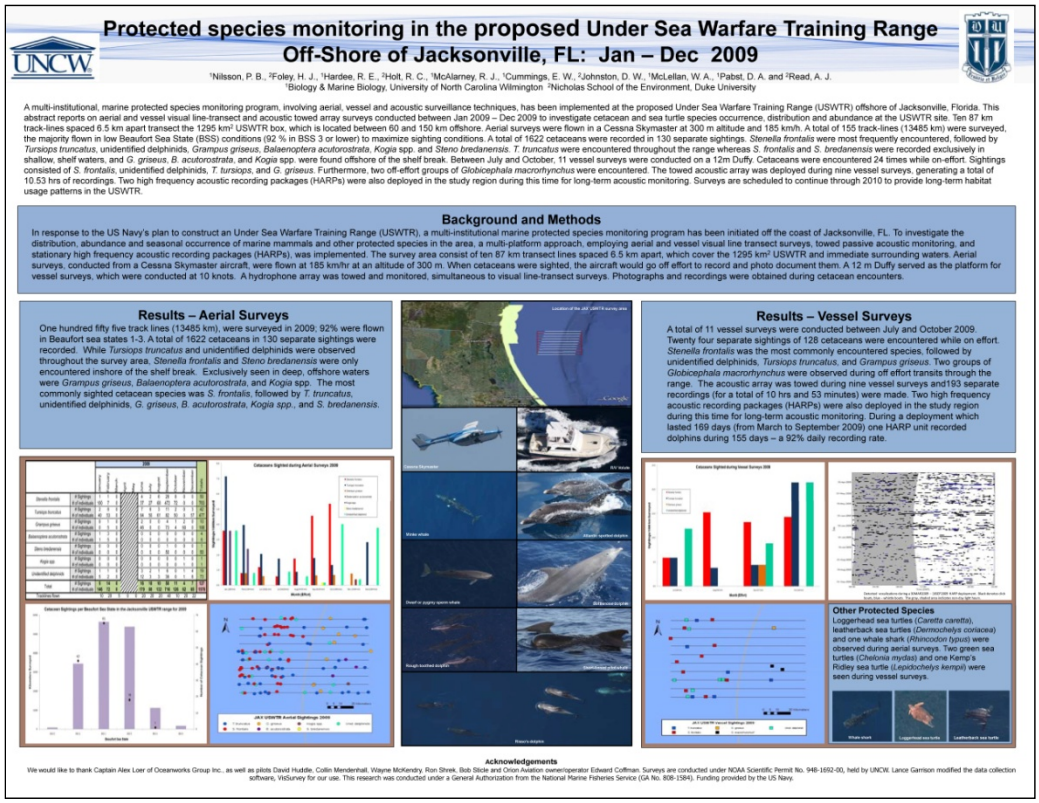
Appendix 1: Presented material at Seamamms

Protected species monitoring in the proposed Under Sea Warfare Training Range Off-Shore of Jacksonville, FL: Jan – Dec 2009

[1]Nilsson, P.B., [2]Foley, H. J., [1]Hardee, R.E., [2]Holt, R. C., [1]McAlarney, R.J., [1]Cummings, E. W., [2]Johnston, D.W., [1]McLellan, W. A., [1]Pabst, D. A. and [2]Read, A.J.

[1]Biology & Marine Biology, University of North Carolina Wilmington
[2]Nicholas School of the Environment, Duke University

A multi-institutional, marine protected species monitoring program, involving aerial, vessel and acoustic surveillance techniques, has been implemented at the proposed Under Sea Warfare Training Range (USWTR) offshore of Jacksonville, Florida. This abstract reports on aerial and vessel visual line-transect and acoustic towed array surveys conducted between Jan 2009 – Dec 2009 to investigate cetacean and sea turtle species occurrence, distribution and abundance at the USTWR site. Ten 87 km track-lines spaced 6.5 km apart transect the 1295 km^2 USWTR box, which is located between 60 and 150 km offshore. Aerial surveys were flown in a Cessna Skymaster at 300 m altitude and 185 km/h. A total of 155 track-lines (13485 km) were surveyed, the majority flown in low Beaufort Sea State (BSS) conditions (92 % in BSS 3 or lower) to maximize sighting conditions. A total of 1622 cetaceans were recorded in 130 separate sightings. *Stenella frontalis* were most frequently encountered, followed by *Tursiops truncatus*, unidentified delphinids*, Grampus griseus*, *Balaenoptera acutorostrata*, *Kogia* spp. and *Steno bredanensis*. *T. truncatus* were encountered throughout the range whereas *S. frontalis* and *S. bredanensis* were recorded exclusively in shallow, shelf waters, and *G. griseus*, *B. acutorostrata*, and *Kogia* spp. were found offshore of the shelf break. Between July and October, 11 vessel surveys were conducted on a 12m Duffy. Cetaceans were encountered 24 times while on-effort. Sightings consisted of *S. frontalis*, unidentified delphinids*, T. tursiops*, and *G. griseus*. Furthermore, two off-effort groups of *Globicephala macrorhynchus* were encountered. The towed acoustic array was deployed during nine vessel surveys, generating a total of 10.53 hrs of recordings. Two high frequency acoustic recording packages (HARPs) were also deployed in the study region during this time for long-term acoustic monitoring. Surveys are scheduled to continue through 2010 to provide long-term habitat usage patterns in the USWTR.

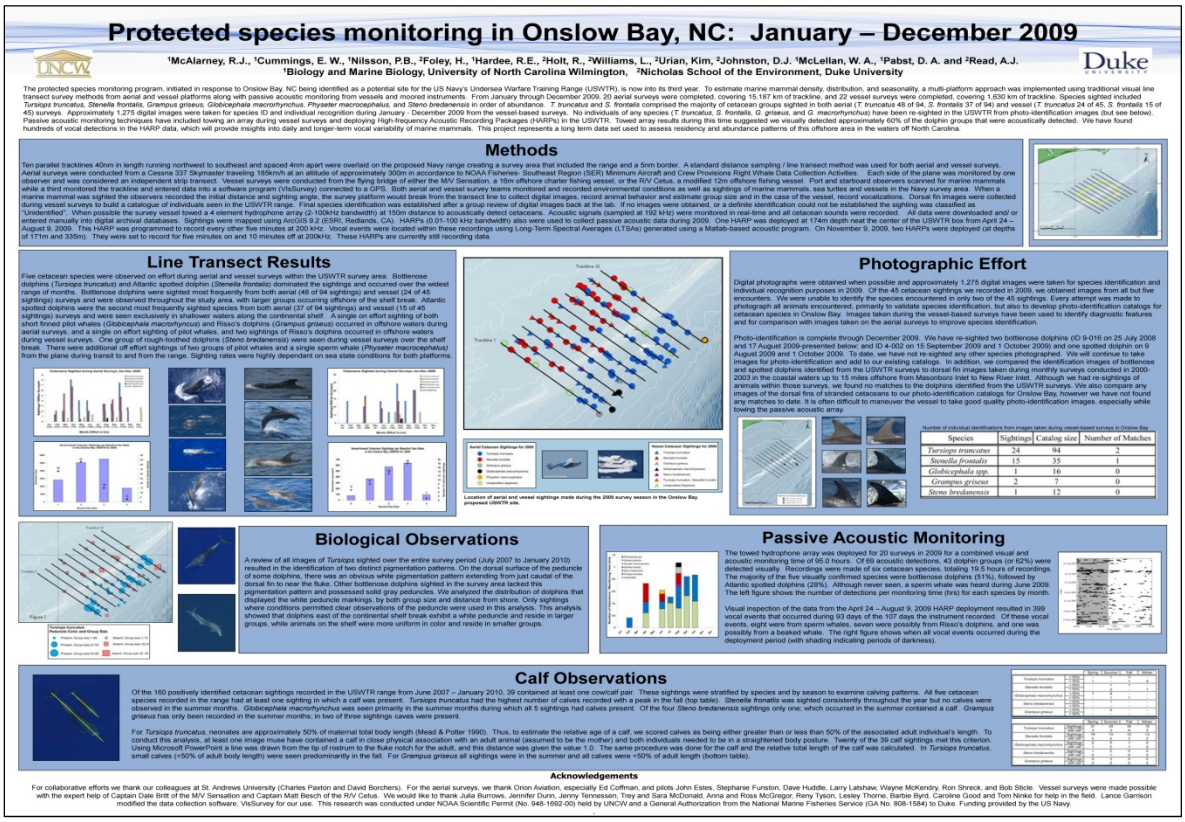


Protected species monitoring in Onslow Bay, NC: January – December 2009

[1]McAlarney, R.J., [1]Cummings, E. W., [1]Nilsson, P.B., [2]Foley, H., [1]Hardee, R.E., [2]Holt, R., [2]Williams, L., [2]Urian, K., [2]Johnston, D.J. [1]McLellan, W. A., [1]Pabst, D. A. and [2]Read, A.J.

[1]Biology and Marine Biology, University of North Carolina Wilmington
[2]Nicholas School of the Environment, Duke University

The protected species monitoring program, initiated in response to Onslow Bay, NC being identified as a potential site for the US Navy's Undersea Warfare Training Range (USWTR), is now into its third year. To estimate marine mammal density, distribution, and seasonality, a multi-platform approach was implemented using traditional visual line transect survey methods from aerial and vessel platforms along with passive acoustic monitoring from vessels and moored instruments. From January through December 2009, 20 aerial surveys were completed, covering 15,187 km of trackline, and 22 vessel surveys were completed, covering 1,630 km of trackline. Species sighted included *Tursiops truncatus, Stenella frontalis, Grampus griseus, Globicephala macrorhynchus*, *Physeter macrocephalus,* and *Steno bredanensis* in order of abundance*. T. truncatus* and *S. frontalis* comprised the majority of cetacean groups sighted in both aerial (*T. truncatus* 48 of 94, *S. frontalis* 37 of 94) and vessel (*T. truncatus* 24 of 45, *S. frontalis* 15 of 45) surveys. Approximately 1,275 digital images were taken for species ID and individual recognition during January - December 2009 from the vessel-based surveys. No individuals of any species (*T. truncatus, S. frontalis*, *G. griseus,* and *G. macrorhynchus*) have been re-sighted in the USWTR from photo-identification images. Passive acoustic monitoring techniques have included towing an array during vessel surveys and deploying High-frequency Acoustic Recording Packages (HARPs) in the USWTR. Towed array results during this time suggested we visually detected approximately 60% of the dolphin groups that were acoustically detected. We have found hundreds of vocal detections in the HARP data, which will provide insights into daily and longer-term vocal variability of marine mammals. This project represents a long term data set used to assess residency and abundance patterns of this offshore area in the waters off North Carolina.



Temporal patterns of odontocete vocalizations in Onslow Bay, North Carolina

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1 Duke University Marine Lab, 2 Scripps Institution of Oceanography, UCSD

Stationary passive acoustic monitoring allows researchers to examine diel, seasonal, and inter-annual trends in vocalization patterns of odontocete cetaceans. We used bottom-mounted High-frequency Acoustic Recording Packages (HARPs; 0.01-100 kHz bandwidth) to examine temporal patterns of odontocete vocalizations in Onslow Bay, NC, over three deployment periods: (1) October 10, 2007 – January 16, 2008 (Site A); (2) May 30 – September 10, 2008 (Site B); and (3) April 24 – August 9, 2009 (Site A). We used Long-Term Spectral Averages (LTSAs) to locate vocal bouts within the HARP datasets and found hundreds of odontocete vocal bouts from several species, including sperm whales (*Physeter macrocephalus*), pilot whales (*Globicephala macrorhynchus*), Risso's dolphins (*Grampus griseus*), and unidentified odontocetes. The daily duration of these vocal bouts increased from mid-October 2007 to mid-January 2008, but we found no discernable pattern from June to September 2008 or from April to August 2009. When all vocal bouts were considered, there was a significant increase at dawn from October to January at Site A (Kruskal-Wallis, $p<0.001$), an increase at night from June to September at Site B (Kruskal-Wallis, $p<0.001$), and an increase at night from April to August at Site A (Kruskal-Wallis, $p<0.001$). These diel differences may represent behavioral differences among species or a seasonal change in vocal behavior within species. In addition, we found a significant nocturnal increase in the occurrence of Risso's dolphin click bouts (Kruskal-Wallis, $p<0.001$) and sperm whale click bouts (Kruskal-Wallis, $p<0.001$), perhaps because these species forage on squid that exhibit diel vertical migrations. These time series of acoustic recordings allow us to examine temporal patterns of odontocete vocalizations on monthly and daily time scales. Future deployments will occur year-round in the same locations, providing a more complete picture of the occurrence of vocalizing odontocetes in Onslow Bay.

Monitoring of Protected Species in the Proposed Onslow Bay and Jacksonville USWTRs
Progress Report: 20 April 2010 through 19 May 2010

Planning (Task 1, 2 & 3)

A conference call was conducted and included all members of Onslow and JAX teams. Discussions covered wrap up of three years of Onslow surveys and future survey directions for Onslow as well as one year wrap up of JAX. Potential for extending survey lines off-shore of existing range was discussed for both survey sites. Survey personnel are training to assist in oil spill cleanup operations.

Purchasing (Task 1)

No purchases were made during this reporting period.

Travel (Task 1 & 3)

Ryan McAlarney traveled up to the Duke Marine Lab for potential vessel survey work on May 6 and 7, 2010. Vessel surveys were only conducted on 7 May 2010 due to unfavorable survey conditions.

William McLellan planned to travel and present JAX survey data to the Southeast Implementation Team meeting on 4 May. The presentation was to include all winter sightings of large whales including right whales sighted on effort during surveys. The meeting was cancelled on 2 May due to the extensive NOAA and Southeast Region Marine Mammal Stranding Network involvement with the Louisiana oil spill response.

JAX Survey Activity (Task 2)

Aerial Surveys

A total of 10 tracklines were surveyed in good to fair conditions during this reporting period. On 6 May 2010, tracklines 1 and 2 were surveyed. However, due to persistent low clouds, the survey had to be aborted after 30 km on line 3. On May 7th, track lines 3 to 10 were flown (Table 1). There were 16 sightings of cetaceans during the aerial surveys: bottlenose dolphins (*Tursiops truncatus*: 7 sightings), Atlantic spotted dolphins (*Stenella frontalis*: 7 sightings), sperm whales (*Physeter macrocephalus*: 1 sighting), and unidentified delphinids (1 sighting, Table 2, Figure 1). This is the first time sperm whales have been observed in the study area since the inception of aerial surveys in January 2009. A total of 77 sea turtles were recorded during aerial survey effort this reporting period: loggerhead sea turtles (n = 45), unidentified sea turtles (n = 31), and one leatherback sea turtle (Table 3, Figure 2).

Vessel Surveys

A new engine was installed in the *R/V Volute*, and the vessel is now ready to resume surveys.

Onslow Bay Survey Activity (Task 5)

Aerial Surveys

There were no aerial surveys conducted during this reporting period due to high winds off- shore causing increased Beaufort Sea States. The survey team did assist with vessel surveys during this reporting period.

Vessel Surveys

Vessel surveys were conducted on 20 April 2010 which was actually during the previous reporting period, however to allow for data analysis the effort will be included in this survey period.

Two track lines were surveyed during the study period aboard the M/V *Sensation*, a 53' sport fishing vessel. Line 4 was surveyed on 20 April 2010 and line 3 was surveyed on 7 May 2010 (Table 4). Two groups of bottlenose dolphins (*Tursiops trucatus*), two groups of Atlantic spotted dolphins (*Stenella frontalis*), one group of unidentified dolphins, and ten Loggerhead sea turtles were sighted (Table 5). Locations of cetaceans and sea turtles sighted in Onslow Bay during vessel surveys are presented in Figure 3.

Towed Passive Acoustics

The towed acoustic array was deployed from the *F/V Sensation* on the 7th of May, 2010, for 4.48 hours of simultaneous visual and acoustic survey. During that time, a total of 47 minutes of acoustic recordings were taken. Three acoustic detections were made that day without visual confirmation of the species despite circling back for one of the groups off-effort.

Exercise Monitoring (Task 7)

Table 1. Aerial survey effort table for the JAX USWTR study region during April 24, 2010 – May 19, 2010.

Date	Line	Sea State	Kilometers Flown	HOBBS Hours
6-May-10	1	2-3	81.6	3.9
6-May-10	2	1-3	72.0	
6-May-10	3	2-3	30.7	
7-May-10	3	2-3	48.0	6.1
7-May-10	4	2-3	83.0	
7-May-10	5	2	84.9	
7-May-10	6	2	77.8	
7-May-10	7	2	82.7	
7-May-10	8	2	84.0	
7-May-10	9	1-2	84.9	
7-May-10	10	1-2	85.7	

Table 2. Cetacean sightings during aerial surveys in the JAX USWTR study region during April 24, 2010 – May 19, 2010.

Date	Time	On/Off Effort	Latitute	Longitude	Track Number	Species	Common Name	Group Size
6-May-10	9:53	On	29.958342	-80.487387	1	*T. truncatus*	Bottlenose Dolphin	10
6-May-10	10:05	On	29.972346	-80.290129	1	*T. truncatus*	Bottlenose Dolphin	24
6-May-10	10:41	On	30.031996	-80.336320	2	*T. truncatus*	Bottlenose Dolphin	6
6-May-10	10:49	On	30.030748	-80.510834	2	*S. frontalis*	Atlantic Spotted Dolphin	40
6-May-10	13:42	On	30.096822	-80.544239	3	*S. frontalis*	Atlantic Spotted Dolphin	4
6-May-10	13:52	On	30.102411	-80.481820	3	*S. frontalis*	Atlantic Spotted Dolphin	4
7-May-10	10:00	On	30.148260	-80.148623	4	*P. macrocephalus*	Sperm Whale	2
7-May-10	10:10	On	30.167974	-80.229344	4	*S. frontalis*	Atlantic Spotted Dolphin	75
7-May-10	10:19	On	30.164865	-80.375852	4	*T. truncatus*	Bottlenose Dolphin	4
7-May-10	10:51	On	30.234612	-80.389831	5	*T. truncatus*	Bottlenose Dolphin	5
7-May-10	11:01	On	30.231191	-80.239313	5	*T. truncatus*	Bottlenose Dolphin	8
7-May-10	11:59	On	30.375496	-80.608868	7	Unid. Delphinid	Unid. Delphinid	3
7-May-10	12:48	On	30.439407	-80.575846	8	*S. frontalis*	Atlantic Spotted Dolphin	18
7-May-10	12:55	On	30.432984	-80.695540	8	*S. frontalis*	Atlantic Spotted Dolphin	17
7-May-10	14:39	On	30.496633	-80.267536	9	*T. truncatus*	Bottlenose Dolphin	5
7-May-10	15:23	On	30.566378	-80.289206	10	*S. frontalis*	Atlantic Spotted Dolphin	3

Table 3. Sea turtle sightings during aerial surveys in the JAX USWTR study region during April 24, 2010 – May 19, 2010.

Date	Time	On/Off Effort	Latitude	Longitude	Track Number	Species	Common Name	Group Size
6-May-10	9:46	On	29.965177	-80.668963	1	Unid. Sea Turtle	Unid. Sea Turtle	1
6-May-10	9:50	On	29.965885	-80.522465	1	*C. caretta*	Loggerhead Sea Turtle	1
6-May-10	10:04	On	29.966334	-80.299699	1	Unid. Sea Turtle	Unid. Sea Turtle	1
6-May-10	10:46	On	30.031116	-80.454175	2	*C. caretta*	Loggerhead Sea Turtle	1
6-May-10	13:39	On	30.099887	-80.572043	3	*C. caretta*	Loggerhead Sea Turtle	1
6-May-10	13:40	On	30.099512	-80.565715	3	*C. caretta*	Loggerhead Sea Turtle	1
6-May-10	13:54	On	30.101082	-80.418631	3	*C. caretta*	Loggerhead Sea Turtle	1
6-May-10	13:56	On	30.100996	-80.343180	3	*C. caretta*	Loggerhead Sea Turtle	1
7-May-10	9:25	On	30.101754	-80.286554	3	*C. caretta*	Loggerhead Sea Turtle	1
7-May-10	10:15	On	30.165886	-80.286109	4	*D. coriacea*	Leatherback Sea Turtle	1
7-May-10	10:32	On	30.165829	-80.465372	4	*C. caretta*	Loggerhead Sea Turtle	1
7-May-10	10:32	On	30.166542	-80.443867	4	*C. caretta*	Loggerhead Sea Turtle	2
7-May-10	10:34	On	30.165508	-80.532059	4	Unid. Sea Turtle	Unid. Sea Turtle	1
7-May-10	10:35	On	30.165405	-80.563304	4	*C. caretta*	Loggerhead Sea Turtle	1
7-May-10	10:38	On	30.165221	-80.666783	4	*C. caretta*	Loggerhead Sea Turtle	1
7-May-10	10:44	On	30.233067	-80.615095	5	*C. caretta*	Loggerhead Sea Turtle	1
7-May-10	10:45	On	30.233375	-80.591664	5	Unid. Sea Turtle	Unid. Sea Turtle	1
7-May-10	10:46	On	30.233455	-80.537231	5	*C. caretta*	Loggerhead Sea Turtle	1
7-May-10	10:48	On	30.233389	-80.485648	5	*C. caretta*	Loggerhead Sea Turtle	1
7-May-10	10:48	On	30.233457	-80.461223	5	*C. caretta*	Loggerhead Sea Turtle	1
7-May-10	10:49	On	30.233446	-80.441127	5	*C. caretta*	Loggerhead Sea Turtle	2
7-May-10	10:50	On	30.233445	-80.417063	5	*C. caretta*	Loggerhead Sea Turtle	1
7-May-10	10:50	On	30.233379	-80.420766	5	*C. caretta*	Loggerhead Sea Turtle	1
7-May-10	10:59	On	30.233808	-80.292253	5	*C. caretta*	Loggerhead Sea Turtle	1
7-May-10	11:00	On	30.233489	-80.242494	5	*C. caretta*	Loggerhead Sea Turtle	1
7-May-10	11:33	On	30.299813	-80.208193	6	*C. caretta*	Loggerhead Sea Turtle	1
7-May-10	11:43	On	30.299471	-80.527219	6	*C. caretta*	Loggerhead Sea Turtle	1
7-May-10	11:44	On	30.299361	-80.563232	6	*C. caretta*	Loggerhead Sea Turtle	1
7-May-10	11:45	On	30.298997	-80.626740	6	*C. caretta*	Loggerhead Sea Turtle	2
7-May-10	12:03	On	30.366215	-80.554721	7	*C. caretta*	Loggerhead Sea Turtle	1
7-May-10	12:07	On	30.366723	-80.386513	7	*C. caretta*	Loggerhead Sea Turtle	1
7-May-10	12:08	On	30.366889	-80.357586	7	*C. caretta*	Loggerhead Sea Turtle	1
7-May-10	12:09	On	30.366819	-80.333428	7	*C. caretta*	Loggerhead Sea Turtle	1
7-May-10	12:40	On	30.433003	-80.336979	8	*C. caretta*	Loggerhead Sea Turtle	1
7-May-10	12:45	On	30.432697	-80.500829	8	*C. caretta*	Loggerhead Sea Turtle	1
7-May-10	14:28	On	30.500233	-80.618054	9	*C. caretta*	Loggerhead Sea Turtle	2
7-May-10	14:30	On	30.500817	-80.539733	9	*C. caretta*	Loggerhead Sea Turtle	1
7-May-10	14:33	On	30.500596	-80.449497	9	*C. caretta*	Loggerhead Sea Turtle	1
7-May-10	14:54	On	30.500558	-80.174878	9	Unid. Sea Turtle	Unid. Sea Turtle	2
7-May-10	14:57	On	30.500220	-80.055240	9	*C. caretta*	Loggerhead Sea Turtle	1
7-May-10	15:16	On	30.566161	-80.131508	10	*C. caretta*	Loggerhead Sea Turtle	1
7-May-10	15:16	On	30.566103	-80.128995	10	Unid. Sea Turtle	Unid. Sea Turtle	2
7-May-10	15:31	On	30.565963	-80.421856	10	Unid. Sea Turtle	Unid. Sea Turtle	1
7-May-10	15:33	On	30.565925	-80.500304	10	*C. caretta*	Loggerhead Sea Turtle	1
7-May-10	15:33	On	30.565990	-80.485165	10	Unid. Sea Turtle	Unid. Sea Turtle	2
7-May-10	15:33	On	30.566031	-80.482399	10	Unid. Sea Turtle	Unid. Sea Turtle	2
7-May-10	15:34	On	30.565911	-80.506358	10	*C. caretta*	Loggerhead Sea Turtle	2
7-May-10	15:34	On	30.565842	-80.528303	10	Unid. Sea Turtle	Unid. Sea Turtle	3
7-May-10	15:35	On	30.565793	-80.573770	10	Unid. Sea Turtle	Unid. Sea Turtle	3
7-May-10	15:35	On	30.565837	-80.539089	10	Unid. Sea Turtle	Unid. Sea Turtle	4
7-May-10	15:36	On	30.565856	-80.597138	10	*C. caretta*	Loggerhead Sea Turtle	1
7-May-10	15:37	On	30.565699	-80.632902	10	*C. caretta*	Loggerhead Sea Turtle	2
7-May-10	15:38	On	30.565552	-80.661221	10	Unid. Sea Turtle	Unid. Sea Turtle	4
7-May-10	15:38	On	30.565496	-80.685179	10	Unid. Sea Turtle	Unid. Sea Turtle	1
7-May-10	15:39	On	30.565429	-80.698184	10	Unid. Sea Turtle	Unid. Sea Turtle	3

Table 4. Effort table for vessel surveys in the Onslow Bay USWTR study region April 20 2010 - May 19, 2010. Survey effort on May 7, 2010 began approximately 8 nautical miles (14.816 km) short of the offshore end of the line 3 due to poor weather conditions.

Date	Line	Sea State	Km Surveyed	Survey Time (hrs:min)	At Sea Time (hrs:min)	Platform
20-Apr-10	4	1 to 3	74.08	5:17	10:30	M/V *Sensation*
7-May-10	3	2 to 4	59.264	4:14	10:00	M/V *Sensation*

Table 5. Cetacean and sea turtle sightings during vessel surveys in the Onslow Bay USWTR study region April 20, 2010 – May 19, 2010.

Date	Time	On/Off Effort	Latitude	Longitude	Track Number	Species	Common Name	Group Size
20-Apr-10	11:37	On	33.731211	-76.692660	4	*C. caretta*	Loggerhead sea turtle	1
20-Apr-10	11:50	On	33.758524	-76.724754	4	*S. frontalis*	Atlantic Spotted dolphin	6
20-Apr-10	13:08	On	33.883569	-76.883295	4	*T. truncatus*	Bottlenose dolphin	3
20-Apr-10	13:25	Off	33.876146	-76.891088	4	*C. caretta*	Loggerhead sea turtle	1
20-Apr-10	13:24	On	33.874849	-76.885402	4	*T. truncatus*	Bottlenose dolphin	6
20-Apr-10	13:58	On	33.918110	-76.928715	4	*C. caretta*	Loggerhead sea turtle	1
20-Apr-10	14:04	On	33.919320	-76.947476	4	*C. caretta*	Loggerhead sea turtle	1
20-Apr-10	14:08	On	33.931435	-76.954542	4	*C. caretta*	Loggerhead sea turtle	1
20-Apr-10	14:09	On	33.941647	-76.965374	4	*S. frontalis*	Atlantic Spotted dolphin	12
20-Apr-10	14:35	On	33.964580	-76.999233	4	*C. caretta*	Loggerhead sea turtle	2
20-Apr-10	14:38	On	33.969259	-77.008858	4	*C. caretta*	Loggerhead sea turtle	1
20-Apr-10	14:38	On	33.967444	-77.001737	4	*C. caretta*	Loggerhead sea turtle	1
20-Apr-10	14:40	On	33.967773	-77.009449	4	*C. caretta*	Loggerhead sea turtle	1
7-May-10	12:23	On	33.837161	-76.956916	3	*C. caretta*	Loggerhead sea turtle	1
7-May-10	13:17	Off	33.892583	-77.030339	3	Unidentified	Unidentified dolphin	2

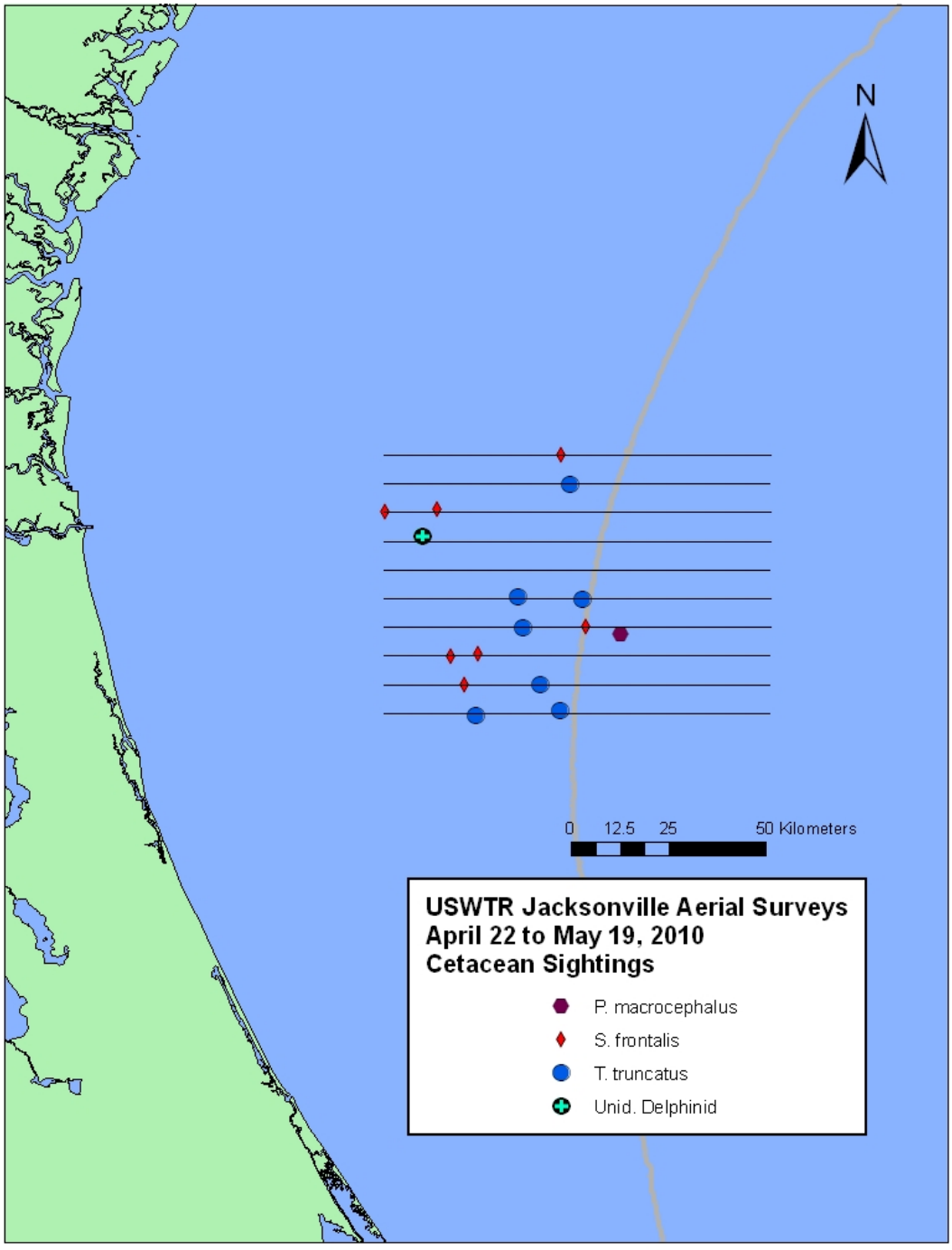

Figure 1. The locations of cetaceans sighted during aerial surveys between April 24, 2010 – May 19, 2010 in the JAX USWTR study region.

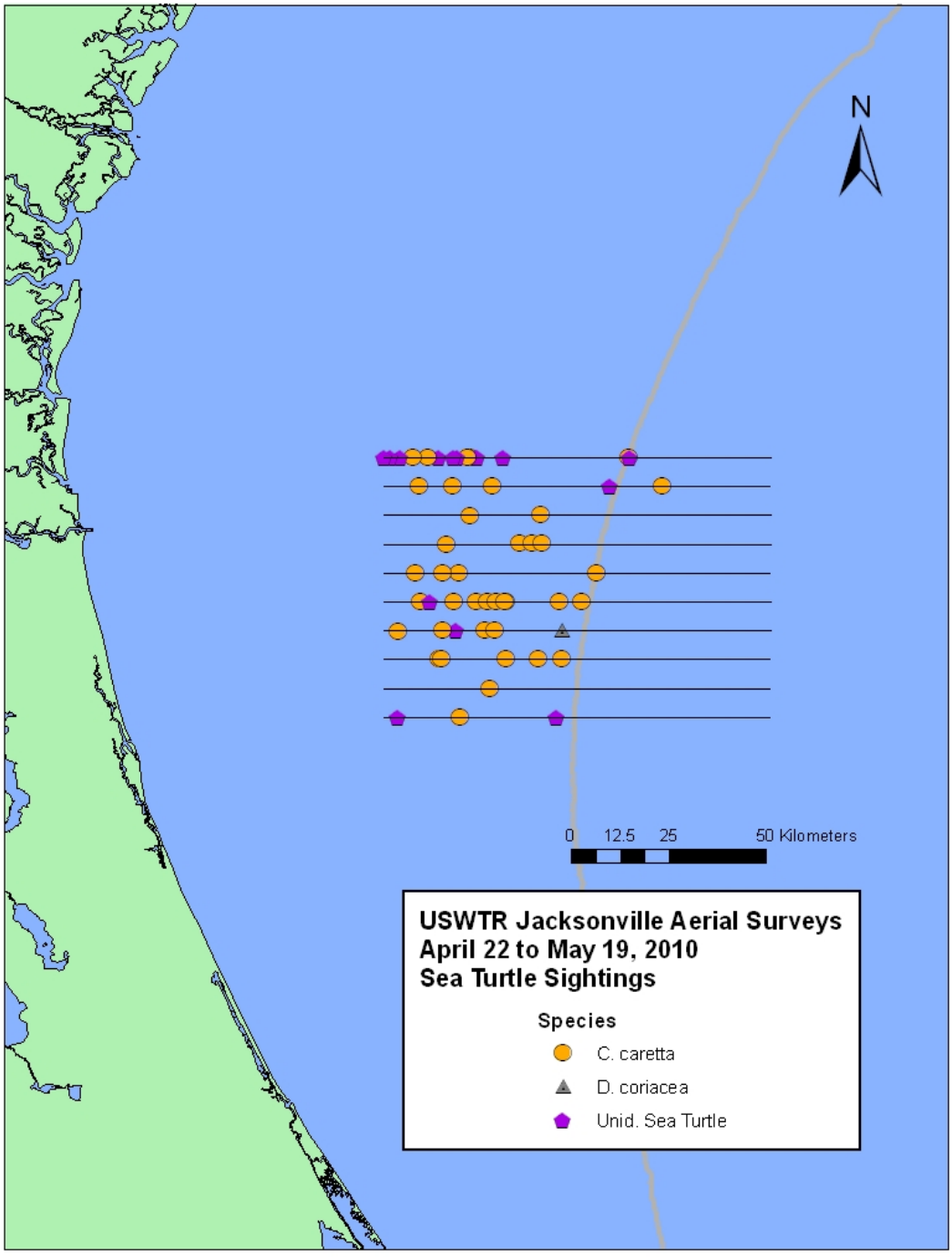

Figure 2. The locations of sea turtles sighted during aerial surveys between April 24, 2010 – May 19, 2010 in the JAX USWTR study region.

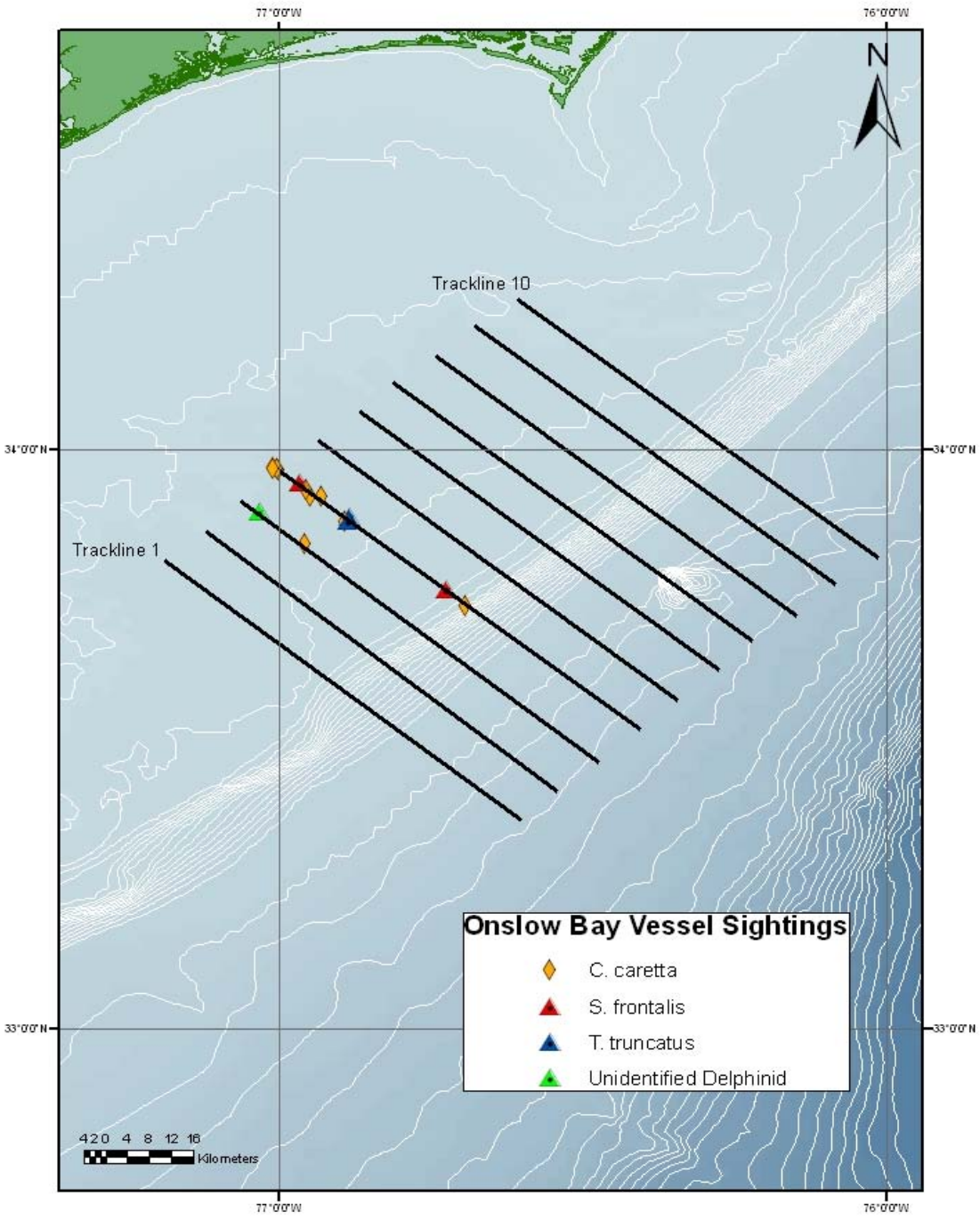

Figure 3. Locations of cetaceans and sea turtles sighted during vessel surveys in Onslow Bay USWTR study region April 20, 2010 - May 19, 2010. Survey effort for line 3 began approximately 8 nautical miles (14.816 km) short of the offshore end of the line due to poor weather conditions.

Monitoring of Protected Species in the Proposed Onslow Bay and Jacksonville USWTRs
Progress Report: May 24, 2010 through June 23, 2010

Planning (Task 1, 2 & 3)
Jennifer Dunn (Duke Marine Lab), D. Ann Pabst and William McLellan (UNC Wilmington) participated in the planning meeting for future Navy Monitoring operation in San Diego, CA on June 17-18.

Purchasing (Task 1).
No purchasing was conducted during the reporting period.

Travel (Task 1 & 3)
On June 18th Ryan McAlarney traveled to Beaufort to assist the Duke team aboard the R/V Stellwagen in retrieving the two HARP's deployed in the Onslow Bay USWTR site.

JAX Survey activity (Task 2)
Aerial Surveys
Thirty-six tracklines were flown in good to fair conditions during this reporting period (Table 1). The surveys were flown from June 4th through the 7th to cover exercises being conducted in the area as requested by the Navy. Cetacean sightings consisted of one encounter with short-finned pilot whales (*Globicephala macrorhynchus*) and three encounters with Atlantic-spotted dolphins (*Stenella frontalis*; Figure 1, Table 2). A total of 31 sea turtles were observed while on-effort during this month's aerial surveys: 25 loggerhead sea turtles (*Caretta caretta*), one leatherback sea turtle (*Dermochelys coriacea*), and five unidentified sea turtles (Figure 2, Table 3).

Vessel Surveys
A total of 6 vessel surveys were performed on the 20th and 23rd of May, and on the 10th, 12th, 14th, and 16th of June. Survey conditions ranged from excellent to fair (Table 4).
There were eight on-effort cetacean sightings: Risso's dolphins (*Grampus griseus*: one encounter), bottlenose dolphins (*Tursiops truncatus*: five encounters) and Atlantic spotted dolphins (*S. frontalis*: two encounters). In addition, a group of 15 short-finned pilot whales (*G. macrorhynchus*) were observed prior to commencing survey on June 12th, and a single, unidentified dolphin spotted first by the boat captain on June 16th (Figure 3, Table 5). Eighteen loggerhead sea turtles (*C. caretta*) and three unidentified sea turtles were seen during vessel surveys this reporting period (Figure 3, Table 5).

Towed Passive Acoustics
The towed acoustic array was deployed during all vessel surveys. On May 20th the entire survey was recorded for later analysis while on May 23rd and June 16th recordings were only taken during visual sightings. The remaining surveys in June all had a dedicated observer and recordings were made during all suspected vocalizations. Additionally, the off-effort short-finned pilot whales (*G. macrorhynchus*) were recorded opportunistically. A total of 82 files encompassing 8 hours and 10 minutes were recorded.

Onslow Bay Survey Activity (Task 5)

Aerial Surveys

Two full sets of tracklines were flown this month with surveys being conducted over three consecutive days from the 16th to the 18th of June. Good survey conditions were present for each day with the majority of effort occurring in a Beaufort Sea State 1 or 2 (Table 6). On the first survey day six tracklines were flown resulting in a single sighting of a group of Atlantic spotted dolphins (*S. frontalis*) on line nine (Table 7 and Figure 4). The following day ten tracklines were covered with two groups of bottlenose dolphins (*T. truncatus*) encountered inside the range on line three and nine. The team documented one animal within the group on line nine that had a bright white coloration extending from behind the dorsal fin down the peduncle and laterally forward of the dorsal fin on both sides. Examination of the photos collected as well as comparison with images published in Rotstein *et al.* 2009 in the journal *Emerging Infectious Diseases* suggests that the discoloration could be evidence of the fungus *Lacazia loboi*. Symptoms of this fungal infection appear as raised gray to white nodules on the epidermis. As the paper states, there have been recorded cases of this disease occurring in offshore population of bottlenose dolphins off North Carolina. One the final day, June 18th three sightings of bottlenose dolphins were recorded, all offshore of the shelf break. Sea state conditions were the lowest of the three days with the majority occurring in a Beaufort sea state one. On all days a low number of sea turtles were observed with loggerheads (*C. caretta*) being the dominant species (Table 8 and Figure 4).

Vessel Surveys

One track line was surveyed during the study period. Line 7 was surveyed on 16 June 2010 aboard the M/V *Cetus* (Table 9). One group of bottlenose dolphins (*T. truncatus*) and two groups of Atlantic spotted dolphins (*S. frontalis*) were sighted (Table 10). Locations of cetaceans sighted in Onslow Bay during vessel surveys are presented in Figure 5.

Towed Passive Acoustics

The towed acoustic array was deployed from the *R/V Cetus* on the 16th of June, 2010, for 5.77 hours of simultaneous visual and acoustic survey. During that time, a total of 2.5 hours of acoustic recordings were taken. Three visual sightings occurred during the acquisition of acoustic data; one group was identified as bottlenose dolphins (*T. truncatus*) and the other two as Atlantic spotted dolphins (*S. frontalis)*. Vocalizations including clicks and whistles were recorded. Three other acoustic detections were made that day without visual observation to confirm the species, although one acoustic detection most likely consisted of clicks from Risso's dolphins (*G. griseus*)and sperm whales (*Physeter macrocephalus*).

Onslow Bay HARPs

The HARPs deployed in the Onslow Bay USWTR study area were retrieved on June 19th from the *R/V Stellwagen*. One of the recovered HARPs (the one at 335m depth) had data on all 16 disk drives and appeared to have finished recording sometime on April 20th. The other recovered HARP (the one at 171m) had data on only 10 ½ disks. It appears the battery voltage became too low around February 24th which resulted in the end of recording. All of the data logger boards and both hydrophones are being shipped to Scripps in order to update

them with a new compression code that should allow about twice the recording capacity with the same size disk drives. Due to the problem with the one HARP, they will also assess its boards to ensure they were not the cause of the battery drainage. Once Scripps ships these items back to us, we will redeploy the HARPs at the same locations as our last deployment.

Exercise Monitoring (Task 7)
Thirty-six tracklines were flown in good to fair conditions during this reporting period (Table 1). The surveys were flown from June 4th through the 7th to cover exercises being conducted in the area as requested by the Navy.

No injuries were sustained during the reporting period.

No problems were encountered that hampered the progress of monitoring efforts during the4 reporting period.

Table 1. Aerial survey effort table for the JAX USWTR study region during May 24, 2010 through June 23, 2010.

Date	Line	Sea State	Kilometers Flown	HOBBS Hours
4-Jun-10	1	2 to 4	86.3	6.3
4-Jun-10	2	2 to 4	87.0	
4-Jun-10	3	2 to 4	86.1	
4-Jun-10	4	2 to 3	85.7	
4-Jun-10	5	2 to 3	86.3	
4-Jun-10	6	2 to 3	84.3	
4-Jun-10	7	2 to 4	85.6	
4-Jun-10	8	1 to 4	86.5	
4-Jun-10	9	1 to 3	85.1	
4-Jun-10	10	2 to 3	86.0	
5-Jun-10	10	3 to 4	86.5	5.3
5-Jun-10	9	3 to 4	75.0	
5-Jun-10	8	3 to 4	76.9	
5-Jun-10	7	2 to 4	73.8	
5 Jun 10	6	2 to 3	76.1	
5-Jun-10	5	2 to 3	85.6	
5-Jun-10	4	2	85.1	
5-Jun-10	3	2 to 3	86.1	
5-Jun-10	2	2 to 3	87.3	
5-Jun-10	1	2 to 3	84.2	
6-Jun-10	1	2 to 3	84.8	6.6
6-Jun-10	2	2 to 3	86.5	
6-Jun-10	3	2 to 3	86.4	
6-Jun-10	4	2 to 3	84.3	
6-Jun-10	5	2 to 3	69.4	
6-Jun-10	6	2 to 3	86.1	
6-Jun-10	7	2 to 3	76	
6-Jun-10	8	2 to 3	86.2	
6-Jun-10	9	2 to 3	86.1	
6-Jun-10	10	2 to 3	86.6	
7-Jun-10	10	3 - 4	80.84	3.4
7-Jun-10	9	3 - 4	85.34	
7-Jun-10	8	3 - 4	86.02	
7-Jun-10	7	3 - 4	86.16	
7-Jun-10	6	3 - 4	86.44	
7-Jun-10	5	3 - 4	86.75	

Table 2. Cetacean sightings during aerial surveys in the JAX USWTR study region during May 24, 2010 through June 23, 2010.

Date	Time	On/Off Effort	Latitute	Longitude	Track Number	Species	Common Name	Group Size
4-Jun-10	10:14	On effort	30.162127	-79.958743	4	*G. macrorhynchus*	Short-finned Pilot Whale	14
5-Jun-10	11:30	On effort	30.172613	-80.579141	4	*S. frontalis*	Atlantic Spotted Dolphin	40
6-Jun-10	8:59	On effort	29.961922	-80.435265	1	*S. frontalis*	Atlantic Spotted Dolphin	10
6-Jun-10	10:40	On effort	30.147797	-80.621601	4	*S. frontalis*	Atlantic Spotted Dolphin	12

Table 3 Sea turtle sightings during aerial surveys in the JAX USWTR study region during May 24, 2010 - June 23, 2010.

Date	Time	On/Off Effort	Latitude	Longitude	Track Number	Species	Common Name	Group Size
4-Jun-10	9:46	On effort	30.102523	-80.514510	3	Unid. Sea Turtle	Unid. Sea Turtle	1
4-Jun-10	10:32	On effort	30.168068	-80.422343	4	*C. caretta*	Loggerhead Sea Turtle	1
4-Jun-10	10:37	On effort	30.166255	-80.589124	4	*C. caretta*	Loggerhead Sea Turtle	1
4-Jun-10	13:38	On effort	30.366644	-80.565255	7	*C. caretta*	Loggerhead Sea Turtle	1
4-Jun-10	14:34	On effort	30.500298	-80.500771	9	*C. caretta*	Loggerhead Sea Turtle	1
4-Jun-10	15:11	On effort	30.566360	-80.359100	10	Unid. Sea Turtle	Unid. Sea Turtle	1
4-Jun-10	15:12	On effort	30.566295	-80.423006	10	*C. caretta*	Loggerhead Sea Turtle	1
4-Jun-10	15:15	On effort	30.566087	-80.509882	10	*D. coriacea*	Leatherback Sea Turtle	1
5-Jun-10	11:20	On effort	30.231795	-80.617223	5	*C. caretta*	Loggerhead Sea Turtle	1
5-Jun-10	13:12	On effort	29.964643	-80.549199	1	*C. caretta*	Loggerhead Sea Turtle	1
5-Jun-10	13:14	On effort	29.964585	-80.605190	1	*C. caretta*	Loggerhead Sea Turtle	1
5-Jun-10	13:14	On effort	29.964566	-80.605058	1	*C. caretta*	Loggerhead Sea Turtle	1
6-Jun-10	9:46	On effort	30.030629	-80.634998	2	Unid. Sea Turtle	Unid. Sea Turtle	1
6-Jun-10	9:52	On effort	30.100435	-80.642929	3	*C. caretta*	Loggerhead Sea Turtle	1
6-Jun-10	9:53	On effort	30.100593	-80.601563	3	*C. caretta*	Loggerhead Sea Turtle	1
6-Jun-10	9:55	On effort	30.100951	-80.514581	3	*C. caretta*	Loggerhead Sea Turtle	2
6-Jun-10	9:58	On effort	30.101044	-80.387801	3	Unid. Sea Turtle	Unid. Sea Turtle	1
6-Jun-10	10:33	On effort	30.165782	-80.421135	4	*C. caretta*	Loggerhead Sea Turtle	2
6-Jun-10	10:34	On effort	30.165717	-80.445309	4	*C. caretta*	Loggerhead Sea Turtle	1
6-Jun-10	10:36	On effort	30.165588	-80.531980	4	*C. caretta*	Loggerhead Sea Turtle	1
6-Jun-10	10:37	On effort	30.165447	-80.562730	4	Unid. Sea Turtle	Unid. Sea Turtle	1
6-Jun-10	10:49	On effort	30.165678	-80.672380	4	*C. caretta*	Loggerhead Sea Turtle	1
6-Jun-10	11:37	On effort	30.299496	-80.484935	6	*C. caretta*	Loggerhead Sea Turtle	1
6-Jun-10	11:37	On effort	30.299996	-80.492729	6	*C. caretta*	Loggerhead Sea Turtle	1
6-Jun-10	11:40	On effort	30.304315	-80.598426	6	*C. caretta*	Loggerhead Sea Turtle	1
6-Jun-10	11:41	On effort	30.300370	-80.639157	6	*C. caretta*	Loggerhead Sea Turtle	1
6-Jun-10	13:38	On effort	30.366622	-80.290970	7	*C. caretta*	Loggerhead Sea Turtle	1
7-Jun-10	11:17	On effort	30.233158	-80.307193	5	*C. caretta*	Loggerhead Sea Turtle	1
7-Jun-10	11:19	On effort	30.233131	-80.391554	5	*C. caretta*	Loggerhead Sea Turtle	1

Table 4. Vessel survey effort table for the JAX USWTR study region during May 24, 2010 through June 23, 2010.

Date	Time	On/Off Effort	Latitude	Longitude	Track Number	Species	Common Name	Group Size
4-Jun-10	9:46	On effort	30.102523	-80.514510	3	Unid. Sea Turtle	Unid. Sea Turtle	1
4-Jun-10	10:32	On effort	30.168068	-80.422343	4	*C. caretta*	Loggerhead Sea Turtle	1
4-Jun-10	10:37	On effort	30.166255	-80.589124	4	*C. caretta*	Loggerhead Sea Turtle	1
4-Jun-10	13:38	On effort	30.366644	-80.565255	7	*C. caretta*	Loggerhead Sea Turtle	1
4-Jun-10	14:34	On effort	30.500298	-80.500771	9	*C. caretta*	Loggerhead Sea Turtle	1
4-Jun-10	15:11	On effort	30.566360	-80.359100	10	Unid. Sea Turtle	Unid. Sea Turtle	1
4-Jun-10	15:12	On effort	30.566295	-80.423006	10	*C. caretta*	Loggerhead Sea Turtle	1
4-Jun-10	15:15	On effort	30.566087	-80.509882	10	*D. coriacea*	Leatherback Sea Turtle	1
5-Jun-10	11:20	On effort	30.231795	-80.617223	5	*C. caretta*	Loggerhead Sea Turtle	1
5-Jun-10	13:12	On effort	29.964643	-80.549199	1	*C. caretta*	Loggerhead Sea Turtle	1
5-Jun-10	13:14	On effort	29.964585	-80.605190	1	*C. caretta*	Loggerhead Sea Turtle	1
5-Jun-10	13:14	On effort	29.964566	-80.605058	1	*C. caretta*	Loggerhead Sea Turtle	1
6-Jun-10	9:46	On effort	30.030629	-80.634998	2	Unid. Sea Turtle	Unid. Sea Turtle	1
6-Jun-10	9:52	On effort	30.100435	-80.642929	3	*C. caretta*	Loggerhead Sea Turtle	1
6-Jun-10	9:53	On effort	30.100593	-80.601563	3	*C. caretta*	Loggerhead Sea Turtle	1
6-Jun-10	9:55	On effort	30.100951	-80.514581	3	*C. caretta*	Loggerhead Sea Turtle	2
6-Jun-10	9:58	On effort	30.101044	-80.387801	3	Unid. Sea Turtle	Unid. Sea Turtle	1
6-Jun-10	10:33	On effort	30.165782	-80.421135	4	*C. caretta*	Loggerhead Sea Turtle	2
6-Jun-10	10:34	On effort	30.165717	-80.445309	4	*C. caretta*	Loggerhead Sea Turtle	1
6-Jun-10	10:36	On effort	30.165588	-80.531980	4	*C. caretta*	Loggerhead Sea Turtle	1
6-Jun-10	10:37	On effort	30.165447	-80.562730	4	Unid. Sea Turtle	Unid. Sea Turtle	1
6-Jun-10	10:49	On effort	30.165678	-80.672380	4	*C. caretta*	Loggerhead Sea Turtle	1
6-Jun-10	11:37	On effort	30.299496	-80.484935	6	*C. caretta*	Loggerhead Sea Turtle	1
6-Jun-10	11:37	On effort	30.299996	-80.492729	6	*C. caretta*	Loggerhead Sea Turtle	1
6-Jun-10	11:40	On effort	30.304315	-80.598426	6	*C. caretta*	Loggerhead Sea Turtle	1
6-Jun-10	11:41	On effort	30.300370	-80.639157	6	*C. caretta*	Loggerhead Sea Turtle	1
6-Jun-10	13:38	On effort	30.366622	-80.290970	7	*C. caretta*	Loggerhead Sea Turtle	1
7-Jun-10	11:17	On effort	30.233158	-80.307193	5	*C. caretta*	Loggerhead Sea Turtle	1
7-Jun-10	11:19	On effort	30.233131	-80.391554	5	*C. caretta*	Loggerhead Sea Turtle	1

Table 5. Cetacean and sea turtle sightings for vessel surveys in JAX study region during May 24, 2010 through June 23, 2010.

Date	Time	On/Off Effort	Latitude	Longitude	Line	Species	Common Name	Group Size
20-May-10	14:12	On effort	30.506195	-80.295272	9	*S. frontalis*	Atlantic Spotted Dolphin	1
20-May-10	14:23	On effort	30.505725	-80.330123	9	*C. caretta*	Loggerhead Sea Turtle	1
20-May-10	15:01	On effort	30.509397	-80.450341	9	*C. caretta*	Loggerhead Sea Turtle	1
20-May-10	15:26	On effort	30.513175	-80.484023	9	*S. frontalis*	Atlantic Spotted Dolphin	16
20-May-10	15:45	On effort	30.510552	-80.542606	9	*C. caretta*	Loggerhead Sea Turtle	1
20-May-10	15:52	On effort	30.511185	-80.563626	9	*C. caretta*	Loggerhead Sea Turtle	1
20-May-10	15:56	On effort	30.511745	-80.579101	9	*C. caretta*	Loggerhead Sea Turtle	1
20-May-10	16:19	On effort	30.507112	-80.620221	9	*T. truncatus*	Bottlenose Dolphin	2
23-May-10	15:34	On effort	30.367712	-80.319432	7	*T. truncatus*	Bottlenose Dolphin	8
23-May-10	16:58	On effort	30.368032	-80.587025	7	*C. caretta*	Loggerhead Sea Turtle	13
23-May-10	17:03	On effort	30.368362	-80.603263	7	*C. caretta*	Loggerhead Sea Turtle	1
23-May-10	17:04	On effort	30.368954	-80.609633	7	*C. caretta*	Loggerhead Sea Turtle	1
10-Jun-10	12:22	Off effort	30.245583	-79.901683	N/A	*G. macrorhynchus*	Short-finned Pilot Whale	15
10-Jun-10	15:18	On effort	30.243697	-80.367558	5	*C. caretta*	Loggerhead Sea Turtle	1
10-Jun-10	15:41	On effort	30.243932	-80.450660	5	*C. caretta*	Loggerhead Sea Turtle	1
10-Jun-10	15:45	On effort	30.243774	-80.465003	5	*C. caretta*	Loggerhead Sea Turtle	1
10-Jun-10	16:01	On effort	30.239685	-80.522905	5	*C. caretta*	Loggerhead Sea Turtle	1
10-Jun-10	16:05	On effort	30.238952	-80.535578	5	*C. caretta*	Loggerhead Sea Turtle	1
12-Jun-10	12:37	On effort	30.111181	-79.944292	3	*T. truncatus*	Bottlenose Dolphin	16
12-Jun-10	13:01	On effort	30.110376	-80.002467	3	*T. truncatus*	Bottlenose Dolphin	15
12-Jun-10	16:21	On effort	30.103611	-80.563661	3	*T. truncatus*	Bottlenose Dolphin	4
12-Jun-10	16:40	On effort	30.104279	-80.630623	3	Unid. Sea Turtle	Unid. Sea Turtle	1
12-Jun-10	16:40	On effort	30.104277	-80.634041	3	Unid. Sea Turtle	Unid. Sea Turtle	1
14-Jun-10	14:52	Off effort	29.974706	-80.405760	1	*C. caretta*	Loggerhead Sea Turtle	1
14-Jun-10	14:54	On effort	29.974656	-80.410498	1	*C. caretta*	Loggerhead Sea Turtle	1
14-Jun-10	16:01	On effort	29.971806	-80.643988	1	*C. caretta*	Loggerhead Sea Turtle	1
16-Jun-10	12:39	On effort	30.575563	-79.912951	10	*G. griseus*	Risso's Dolphin	8
16-Jun-10	16:23	On effort	30.575663	-80.533142	10	*C. caretta*	Loggerhead Sea Turtle	1
16-Jun-10	16:34	On effort	30.573075	-80.570085	10	*C. caretta*	Loggerhead Sea Turtle	1
16-Jun-10	16:59	Off effort	30.569375	-80.660116	10	Unid. Delphinid	Unid. Delphinid	1
16-Jun-10	17:13	On effort	30.568348	-80.683091	10	Unid. Sea Turtle	Unid. Sea Turtle	1

Table 6. Aerial survey effort table for the Onslow Bay USWTR study region during May 24, 2010 through June 23, 2010.

Date	Line	Sea State	Kilometers Flown	Hobbs Hours
16-Jun-10	5	1 to 2	74.2	3.7
16-Jun-10	6	1 to 2	74.1	
16-Jun-10	7	1 to 2	74.2	
16-Jun-10	8	2 to 3	74.8	
16-Jun-10	9	2 to 3	74.7	
16-Jun-10	10	2 to 3	72.9	
17-Jun-10	1	2 to 3	74.3	6.4
17-Jun-10	2	2 to 3	74.0	
17-Jun-10	3	2 to 3	71.8	
17-Jun-10	4	2	74.4	
17-Jun-10	5	2	74.1	
17-Jun-10	6	2	73.7	
17-Jun-10	7	2	74.3	
17-Jun-10	8	2	75.2	
17-Jun-10	9	2	74.5	
17-Jun-10	10	2	73.7	
18-Jun-10	4	1 to 3	73.5	2.9
18-Jun-10	3	1 to 2	73.5	
18-Jun-10	2	1 to 2	74.6	
18-Jun-10	1	1 to 2	72.9	

Table 7. Cetacean sightings during aerial surveys in the Onslow Bay USWTR study region during May 24, 2010 through June 23, 2010.

Date	Time	On / Off Effort	Latitude	Longitude	Track Number	Species	Common Name	Group Size
16-Jun-10	11:04	On	34.013141	-76.406738	9	*S. frontalis*	Atlantic Spotted Dolphin	55
17-Jun-10	10:07	On	33.574286	-76.630432	3	*T. truncatus*	Bottlenose Dolphin	21
17-Jun-10	14:37	On	33.871597	-76.208675	9	*T. truncatus*	Bottlenose Dolphin	13
18-Jun-10	9:20	On	33.637239	-76.561817	4	*T. truncatus*	Bottlenose Dolphin	8
18-Jun-10	9:38	On	33.556626	-76.603283	3	*T. truncatus*	Bottlenose Dolphin	32
18-Jun-10	10:36	On	33.430727	-76.703646	1	*T. truncatus*	Bottlenose Dolphin	25

Table 8. Sea turtle sightings during aerial surveys in the Onslow Bay USWTR study region during May 24, 2010 through June 23, 2010.

Date	Time	On / Off Effort	Latitude	Longitude	Line	Species	Common Name	Group Size
16-Jun-10	10:45	On Effort	34.061262	-76.601679	8	*C. caretta*	Loggerhead Sea Turtle	1
16-Jun-10	10:48	On Effort	34.13628	-76.700404	8	Unid. Sea Turtle	Unid. Sea Turtle	1
16-Jun-10	10:57	On Effort	34.161591	-76.591787	9	*C. caretta*	Loggerhead Sea Turtle	1
16-Jun-10	11:01	On Effort	34.06234	-76.462631	9	*C. caretta*	Loggerhead Sea Turtle	2
16-Jun-10	11:38	On Effort	34.142977	-76.447917	10	*C. caretta*	Loggerhead Sea Turtle	1
16-Jun-10	11:39	On Effort	34.158292	-76.467704	10	*C. caretta*	Loggerhead Sea Turtle	1
17-Jun-10	14:24	On Effort	34.088759	-76.497305	9	*C. caretta*	Loggerhead Sea Turtle	1
18-Jun-10	9:12	On Effort	33.722898	-76.674437	4	*C. caretta*	Loggerhead Sea Turtle	1
18-Jun-10	10:15	On Effort	33.699048	-76.909166	2	*C. caretta*	Loggerhead Sea Turtle	1
18-Jun-10	10:52	On Effort	33.617614	-76.941325	1	*C. caretta*	Loggerhead Sea Turtle	1
18-Jun-10	10:55	On Effort	33.684558	-77.029150	1	*C. caretta*	Loggerhead Sea Turtle	1

Table 9. Effort table for vessel surveys in the Onslow Bay USWTR study region May 24, 2010 through June 23, 2010.

Date	Line	Sea State	Km Surveyed	Survey Time (hrs:min)	At Sea Time (hrs:min)	Platform
16-Jun-10	7	2-4	74.08	5:46	12:30	M/V *Cetus*

Table 10. Cetacean and sea turtle sightings during vessel surveys in the Onslow Bay USWTR study region May 24, 2010 through June 23, 2010.

Date	Time	On / Off Effort	Latitude	Longitude	Track Number	Species	Common Name	Group Size
16-Jun-10	14:30	On	33.98965499	-76.6541519	7	*T. truncatus*	Bottlenose dolphin	2
16-Jun-10	15:21	On	34.06926266	-76.7442492	7	*S. frontalis*	Atlantic Spotted dolphin	8
16-Jun-10	15:56	On	34.07421701	-76.7452991	7	*S. frontalis*	Atlantic Spotted dolphin	14

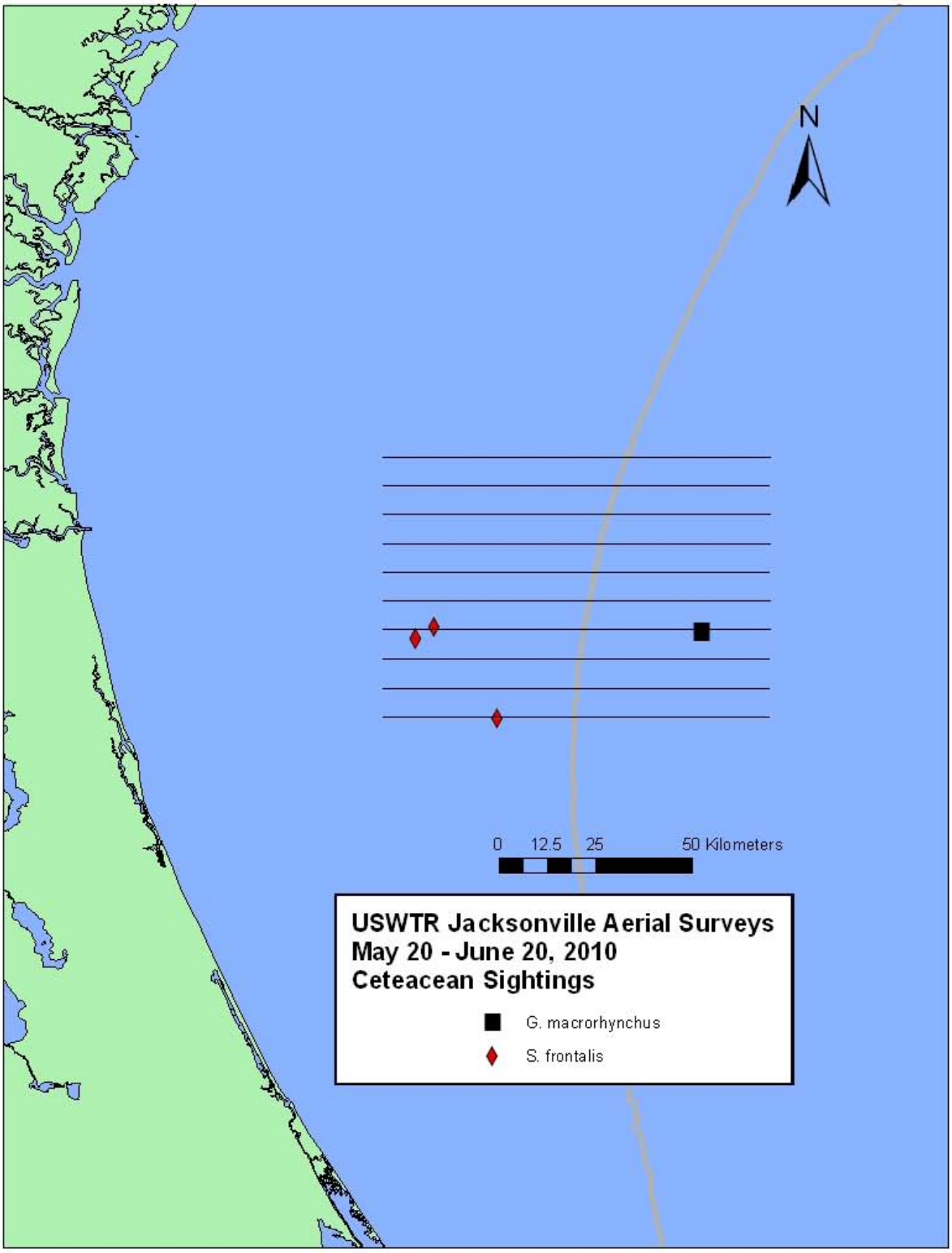

Figure 1. The locations of cetaceans sighted while conducting aerial surveys during the May 24, 2010 through June 23, 2010reporting period of the JAX USWTR study region.

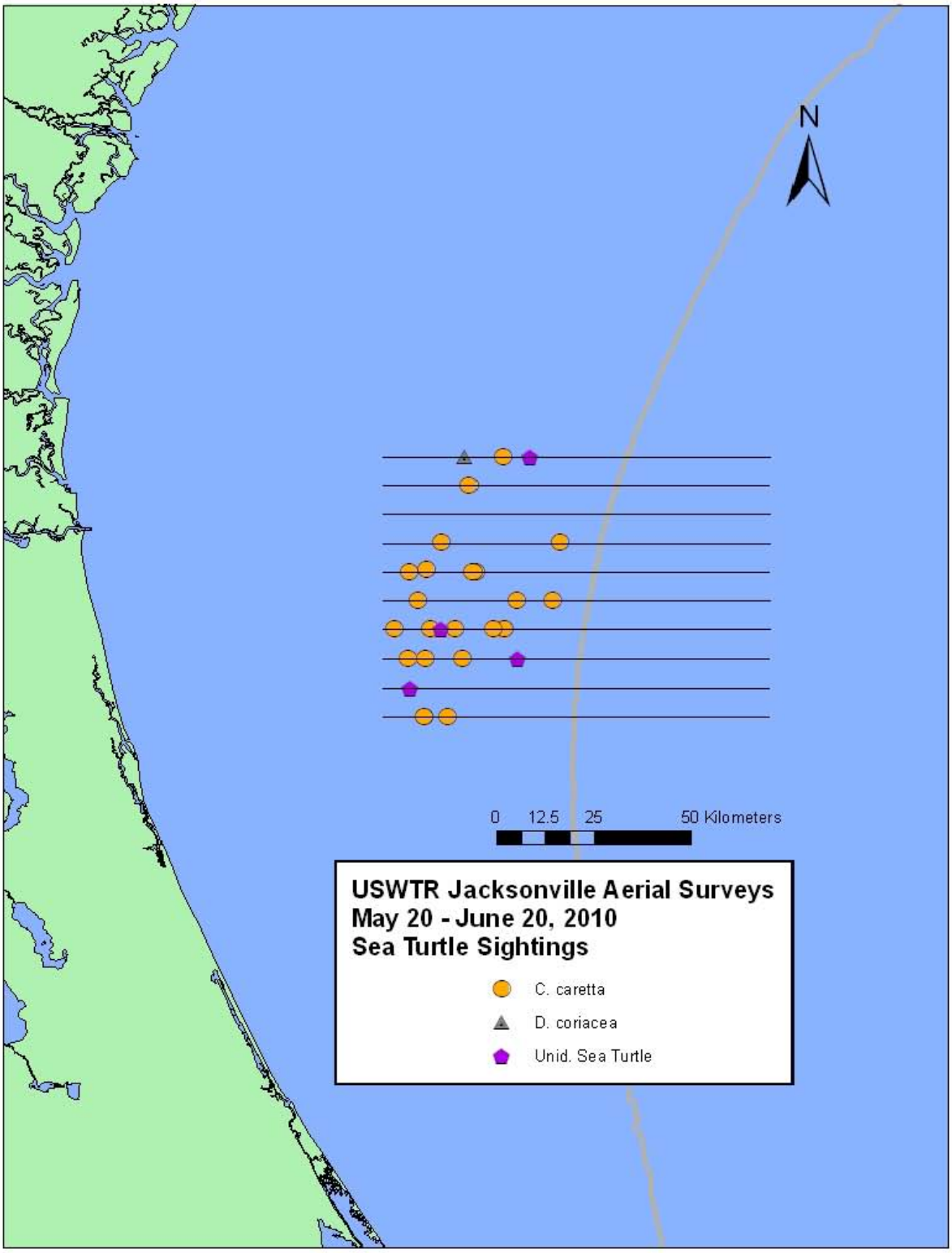

Figure 2. The locations of sea turtles sighted during aerial surveys between May 24, 2010 through June 23, 2010 in the JAX USWTR study region.

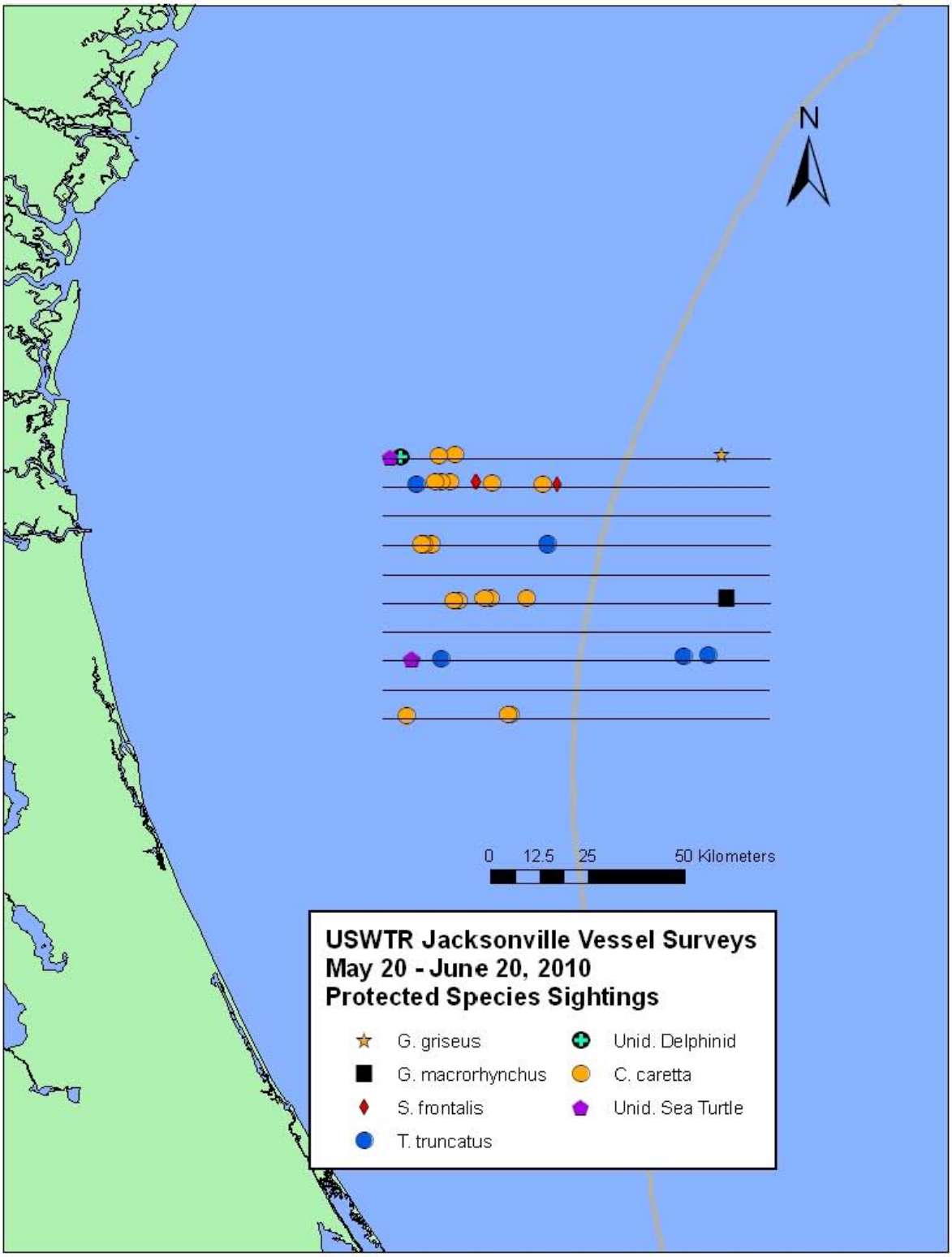

Figure 3. Cetaceans and sea turtles observed during vessel surveys of the JAX USWTR study region, May 24, 2010 through June 23, 2010

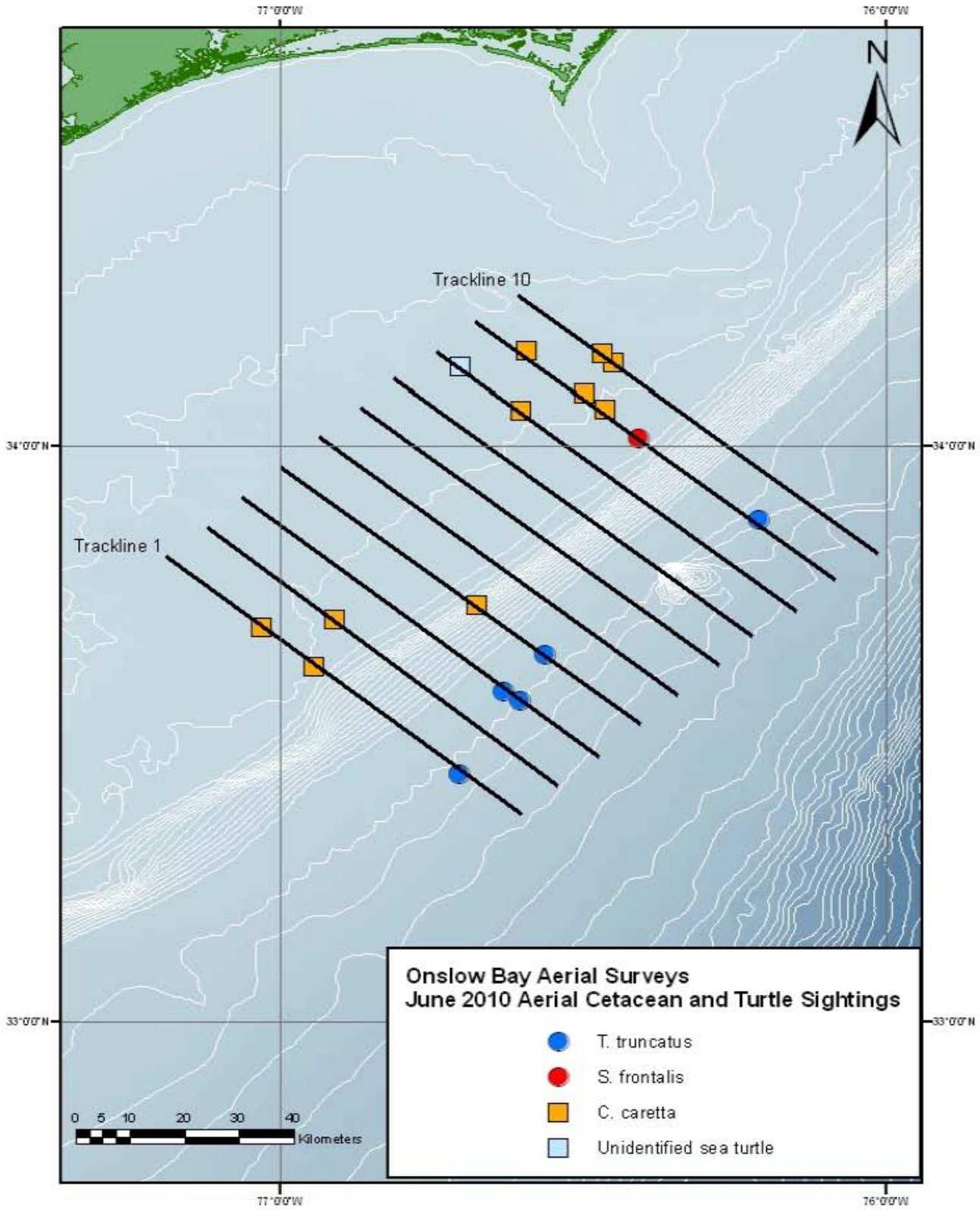

Figure 4. The locations of cetaceans and sea turtles sighted during aerial surveys from May 24, 2010 through June 23, 2010 of the Onslow Bay USWTR study region.

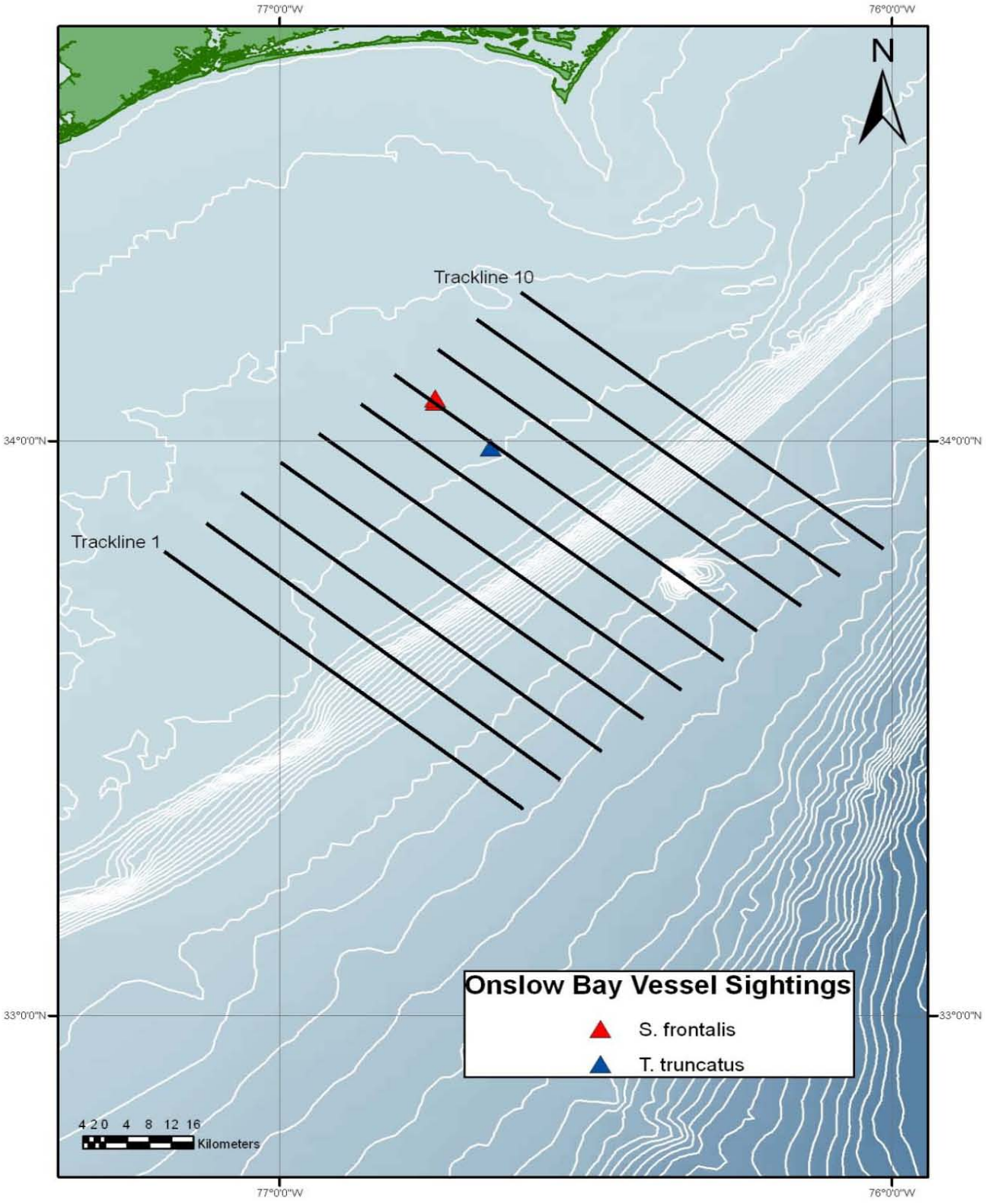

Figure 5. Locations of cetaceans and sea turtles sighted during vessel surveys on June 16, 2010 in the Onslow Bay USWTR study region.

Monitoring of Protected Species in the Proposed Onslow Bay and Jacksonville USWTRs
Progress Report: June 24, 2010 through July 23, 2010

Planning (Task 1, 2 & 3)
Discussions are ongoing in planning exercise monitoring operations for multiple Navy sites around the country.

Purchasing (Task 1)
Research equipment was purchased for the survey vessel R/V Volute. In addition, office supplies were purchased for the Fernandina Beach office.

Travel (Task 1 & 3)
Ann Pabst and William McLellan (UNCW) traveled to the Duke Marine Lab in Beaufort, NC to discuss winter survey effort in Onslow and JAX sites with Andy Read and Dave Johnston (Duke) and e2M administration.

JAX Survey activity (Task 2)
Aerial Surveys
No aerial surveys were performed during the reporting period as all favorable weather days were used for vessel survey effort.

Vessel Surveys
A total of 3 vessel surveys were performed on the 6th, 8th and 12th of July. Survey conditions ranged from fair to good (Table 1). There were four on-effort cetacean sightings: Atlantic spotted dolphins (*Stenella frontalis*, two encounters), bottlenose dolphins (*Tursiops truncatus*, one encounter) and unidentified delphinids (one encounter). In addition, there were two off-effort sightings of *S. frontalis* (Figure 1, Table 2). A single loggerhead sea turtle (*Caretta caretta*) was also seen during the vessel surveys (Figure 1, Table 2).

Towed Passive Acoustics
The towed acoustic array was deployed during two vessel surveys. On July 6th the entire survey was performed with a dedicated acoustic monitor. On July 8th the array was deployed with a dedicated acoustic monitor, but after two hours and 30 minutes of surveying, the PAM computer began to experience technical difficulties. After some in situ troubleshooting it was determined that the issue could not be resolved in the field, and acoustic monitoring was discontinued. The PAM computer was removed from the R/V Volute at the end of the survey and taken to the lab for additional attempts to resolve the problem. On July 12th the acoustic array was deployed, and monitoring attempted, but technical issues with the computer persisted, and the survey was completed without the use of acoustic monitoring. Troubleshooting of the PAM computer continues and should be complete prior to the next vessel survey. A total of 20 files encompassing 1 hour and 5 minutes were recorded on July 6th and 8th.

Onslow Bay Survey Activity (Task 5)

Aerial Surveys

On July 8th a single day of survey effort was conducted that covered 10 tracklines (Table 3). Higher than forecasted winds and sea state resulted in poor survey conditions leading to no cetacean or sea turtle sightings during these flights. Observers did note a higher number of military vessels present in the range than had been observed the entire previous year. These activities correspond with an AFAST event being instituted for the Southeastern United States.

Vessel Surveys

The inshore half of track line 5 was surveyed on 7 July 2010 aboard the M/V Sensation (Table 4). One group of Atlantic spotted dolphins (*S. frontalis*) was sighted (Table 5). Locations of cetaceans sighted in Onslow Bay during vessel surveys are presented in Figure 2.

Towed Passive Acoustics

The towed acoustic array was deployed from the *F/V Sensation* on the 7th of July, 2010, for 3.15 hours of simultaneous visual and acoustic survey. During that time, a total of 19 minutes of acoustic recordings were taken. One visual sighting occurred during the acquisition of acoustic data; the group was identified as *S. frontalis*. Vocalizations including clicks and whistles were recorded.

Onslow Bay HARPs

The data logger boards and hydrophones of the two Onslow Bay USWTR HARPs were updated with the new compression code at Scripps and sent back to Beaufort. We are now waiting on a weather window to redeploy the instruments. They will be redeployed in the same locations as our last deployment.

Exercise Monitoring (Task 7)

No exercise monitoring was conducted during the reporting period.

No injuries were sustained during this reporting period.

Table 1. Vessel survey effort table for the JAX USWTR study region during June 24, 2010 through July 23, 2010.

Date	Line	Sea State	Kilometers Surveyed	Survey Time (Hrs:min)	Total Time at Sea (Hrs:min)
6-Jul-10	8	2-4	60.61	4:21	13:39
8-Jul-10	6	2-3	83.22	5:00	14:45
12-Jul-10	4	2-3	79.71	4:22	12:21

Table 2. Cetacean and sea turtle sightings for vessel surveys in JAX study region during June 24, 2010 through July 23, 2010.

Date	Time	On/off effort	Latitude	Longitude	Line	Species	Common Name	Group Size
06-Jul-10	15:06	On effort	30.459210	-80.384780	8	*C. caretta*	Loggerhead Sea Turtle	1
06-Jul-10	15:59	On effort	30.457817	-80.521895	8	*T. truncatus*	Bottlenose Dolphin	7
06-Jul-10	16:21	Off effort	30.448217	-80.562863	8	*S. frontalis*	Atlantic Spotted Dolphin	15
08-Jul-10	15:24	On effort	30.298120	-80.374713	6	*S. frontalis*	Atlantic Spotted Dolphin	10
08-Jul-10	16:18	On effort	30.300952	-80.464900	6	*S. frontalis*	Atlantic Spotted Dolphin	8
08-Jul-10	17:23	On effort	30.305677	-80.656960	6	Unid. delphinid	Unid. Delphind	2
12-Jul-10	15:26	Off effort	30.150446	-80.390450	4	*S. frontalis*	Atlantic Spotted Dolphin	17

Table 3. Aerial survey effort table for the Onslow Bay USWTR study region during June 24, 2010 through July 23, 2010.

Date	Line	Sea State	Kilometers Flown	Hobbs Hours
8-Jul-10	1	3	74.5	6.1
8-Jul-10	2	3	74.2	
8-Jul-10	3	3	74.7	
8-Jul-10	4	2 to 3	74.6	
8-Jul-10	5	2 to 3	74.5	
8-Jul-10	6	2 to 3	73.9	
8-Jul-10	7	2 to 4	74.5	
8-Jul-10	8	2 to 4	74.8	
8-Jul-10	9	2 to 4	73.1	
8-Jul-10	10	2 to 4	74.0	

Table 4. Effort table for vessel surveys in the Onslow Bay USWTR study region June 24 through July 23, 2010.

Date	Line	Sea State	Km Surveyed	Survey Time (hrs:min)	At Sea Time (hrs:min)	Platform
7-Jul-10	5 (inshore)	3-4	37.04	5:20	10:15	M/V Sensation

Table 5. Cetacean and sea turtle sightings during vessel surveys in the Onslow Bay USWTR study region June 24, 2010 through July 23, 2010.

Date	Time	On / Off Effort	Latitude	Longitude	Track Number	Species	Common Name	Group Size
7-Jul-10	11:11	On	33.953800	-76.860470	5	*S. frontalis*	Atlantic spotted dolphin	2

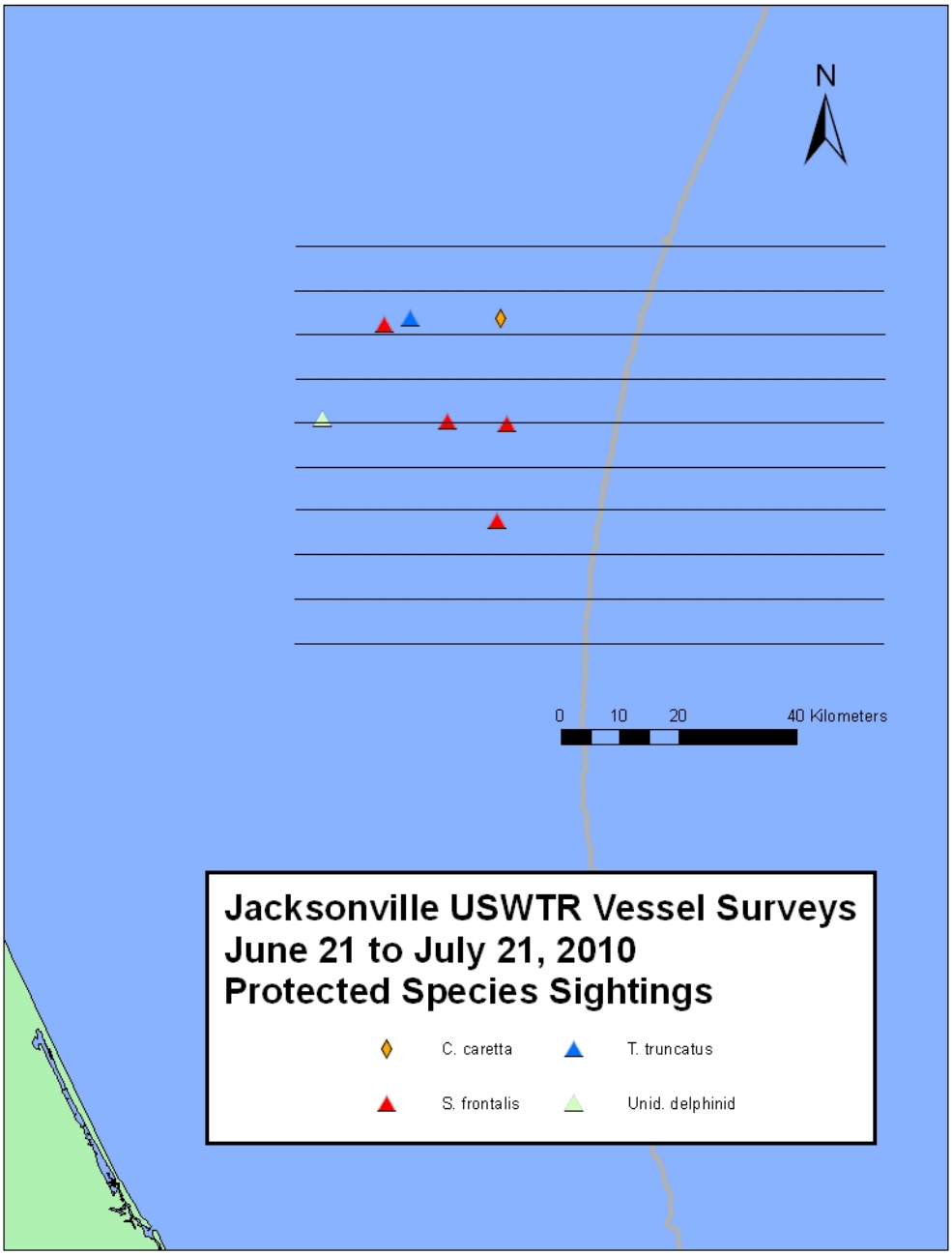

Figure 1. Cetaceans and sea turtles observed during vessel surveys of the JAX USWTR study region, June 24, 2010 through July 23, 2010

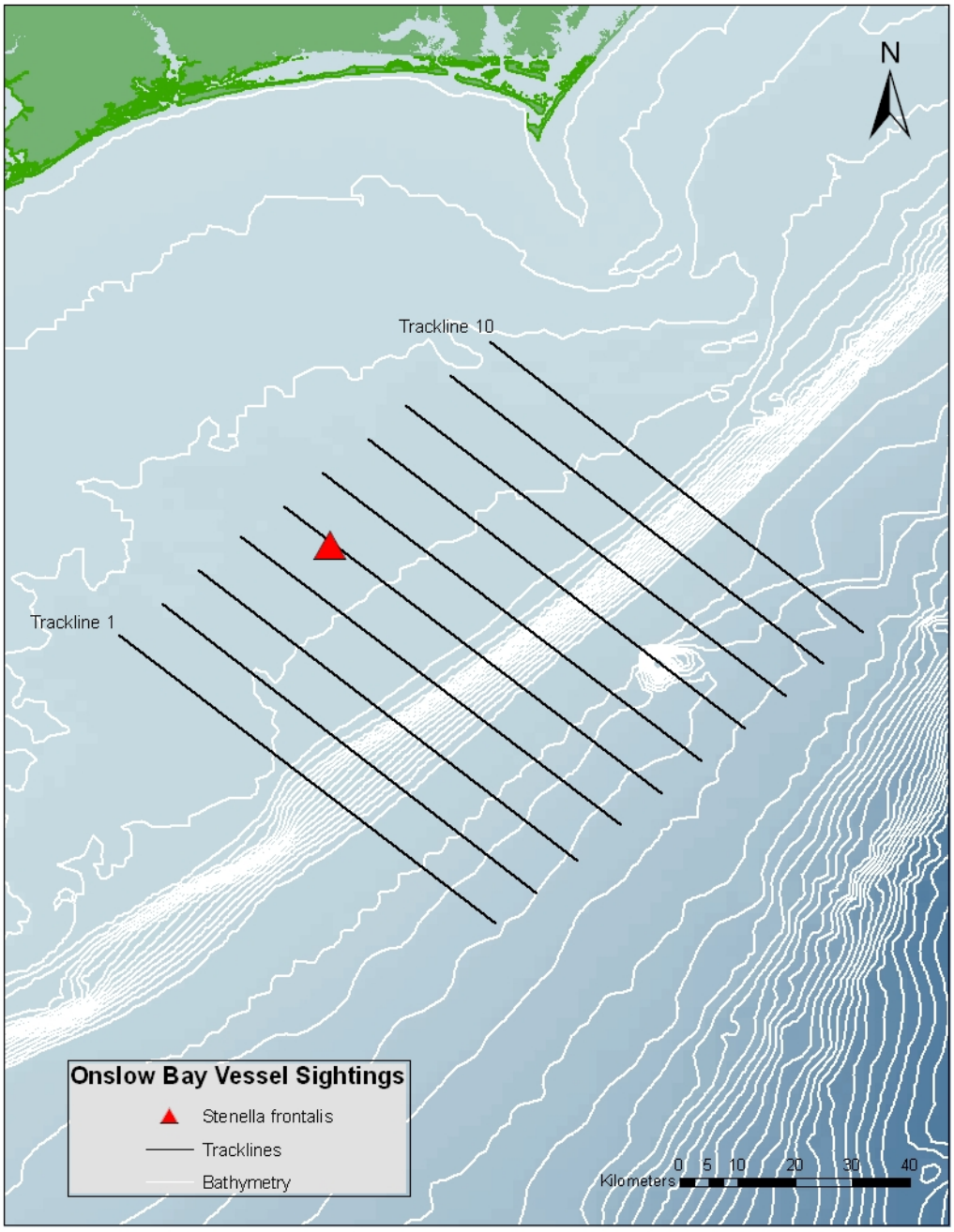

Figure 2. Locations of cetaceans and sea turtles sighted during vessel surveys from June 24, 2010 through July 23, 2010 of the Onslow Bay USWTR study region.

Appendix F - March 2010 SEASWITI Monitoring Cruise Report

August 2010

Cruise Report, Marine Species Monitoring & Lookout Effectiveness Study

Southeastern Antisubmarine Warfare Integrated Training Initiative (SEASWITI), March 2010

Jacksonville Range Complex

Prepared for:
United States Fleet Forces

Prepared by:

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List of Acronyms and Abbreviations

ASW	antisubmarine warfare
DMMO	data marine mammal observer
ft	foot (feet)
GPS	global positioning system
HRC	Hawaii Range Complex
km	kilometer(s)
LMMO	liaison marine mammal observer
m	meter(s)
MFAS	mid-frequency active sonar
MMO	marine mammal observer
nm	nautical mile(s)
NMFS	National Marine Fisheries Service
PMAP	Protective Measures Assessment Protocol
PMRF	Pacific Missile Range Facility
SEASWITI	Southeastern Antisubmarine Warfare Integrated Training Initiative
SMMO	survey marine mammal observer
VHF	very high frequency
yd(s)	yard(s)

SECTION 1 INTRODUCTION

In order to train with mid-frequency active sonar (MFAS), the United States (U.S.) Navy has obtained a permit from the National Marine Fisheries Service (NMFS) under the Marine Mammal Protection Act and Endangered Species Act. The Atlantic Fleet Active Sonar Training (AFAST) Monitoring Plan, implemented in January 2009, was developed with NMFS to comply with the requirements under the permit. The monitoring plan and reporting will provide science-based answers to questions regarding whether or not marine mammals are exposed and reacting to Navy MFAS. The objectives of the monitoring plan are to address the following questions:

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

2. If marine mammals and sea turtles are exposed to MFAS in the Northwestern Atlantic of Gulf of Mexico (or "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. Are the Navy's suite of mitigation measures for MFAS (e.g., Protective Measures Assessment Protocol [PMAP], major exercise measures agreed to by the Navy through permitting) effective at avoiding TTS, injury, and mortality of marine mammals and sea turtles?

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

In a concerted effort to address the fourth question above, a study was initiated to determine the effectiveness of the Navy lookout team, including lookouts in the pilot house, on the bridge wings, and/or the forward lookout on the flying bridge. Trained biologists were utilized for the study to collect data that would characterize the likelihood of detecting marine species in the field from a U.S. Navy destroyer (DDG). The University of St. Andrews, Scotland, under contract to the U.S. Navy, developed an initial protocol for use during this study. Changes to the protocol were required during the initial implementation of this protocol. As such, the MMOs modified the protocol as necessary. The results gathered were the first attempt to implement this new protocol on a DDG; therefore, recommendations for ways to improve the protocol are an important part in the outcome of this study. Data collected will be combined with future monitoring efforts in order to determine the effectiveness of Navy lookout teams as a whole, rather than specific to each vessel.

As part of this data collection effort, four U.S. Navy civilian MMOs (Ms. Amy Farak, Dr. Sean F. Hanser, Mr. Anurag Kumar, and Ms. Toni Mizerek) participated in a Southeastern Antisubmarine Warfare Integrated Training Initiative (SEASWITI) on 15-19 March 2010. These

MMOs were stationed aboard a DDG, hereafter referred to as DDG A. The goals of the SEASWITI monitoring and this study were:

1. Collect data to assess the effectiveness of the Navy lookout team.

2. Obtain data to characterize the possible exposure of marine species to MFAS.

SECTION 2 SEASWITI DESCRIPTION

SEASWITI is an event with up to two submarines and either two DDGs and one FFG or one CG, one DDG, and one FFG. SEASWITI events are a requirement to provide the necessary training to prospective submarine commanders in rigorous and realistic scenarios involving undersea warfare. The ships and their embarked helicopters would be conducting antisubmarine warfare (ASW) localization training using the AN/SQS-53, AN/SQS-56, and AN/AQS-13 or AN/AQS-22 dipping sonar. The submarine also periodically operates the AN/BQQ-10 sonar. Participants in this SEASWITI included DDG A, a CG, a FFG, maritime patrol aircraft (fixed-wing patrol squadron), helicopter antisubmarine squadron, submarines, torpedo recovery helicopter and boats, and range control for subsurface, surface, and air.

SECTION 3 METHODS

3.1. SHIPBOARD MONITORING

MMO surveys were conducted on a not-to-interfere basis, which means that the MMOs would not replace required Navy lookouts, would not dictate operational requirements/maneuvers, and would remove themselves from the bridge wing if necessary for DDG A to accomplish its mission objectives. The exceptions would be if a marine mammal was sighted by the MMO within the shut-down zone during MFAS (200 yards [yds], 183 meters [m]) and was not sighted by the Navy lookout team, or if the vessel was in danger of striking the marine species. In these cases, the MMO would report the sighting to the Navy lookout team for appropriate reporting and action.

The initial protocol for data collection was provided by the University of St. Andrews and is included as Appendix A. This protocol was modified by the MMOs during an initial implementation during February 2010 in the Hawaii Range Complex. Additional changes were made as necessary during the event. The MMO survey on DDG A was conducted on the bridge wings (elevated 60 feet [ft; 20 m] above the waterline), with one MMO on each wing (called survey MMOs, or SMMOs). One MMO was stationed on the starboard bridge wing and acted as a liaison to the starboard lookout (called liaison MMO or LMMO). The fourth MMO was responsible for acting as a liaison with the port lookout, but also was responsible for recording data (data MMO or DMMO) reported by the two SMMOs and the LMMO. A rotation schedule was used, such that an MMO would be on effort for one hour on port, one hour as the LMMO on the flying bridge, one hour as an SMMO on starboard, and one hour as DMMO on port. While on effort, MMOs used naked eye and 7 X 50 magnification binoculars to scan the area from dead ahead to just aft of the beam.

If an animal was visually detected by the SMMOs, information would be collected on twenty-three sighting, environmental, and operational parameters. Sightings obtained first by the

SMMOs before the Navy lookout were considered to be "trials" unless the sighting was aft of the beam. If applicable, photographs would be taken using a Canon EOS 20D digital camera with a 100 – 400 mm zoom lens. No photographs would be taken until the Navy lookout had the sighting so as not to inappropriately call attention to the sighting. No opportunities arose during this effort for photographs.

The LMMO stationed on the starboard bridge wing reported sightings made by the Navy starboard lookout. Once the starboard lookout sighted an animal or was informed of a sighting by the bridge, the lookout would relay the approximate bearing, distance (estimated by eye), and animal group (whale or dolphin) to the LMMO. The LMMO would relay this information to the DMMOs for recording and to determine if the sighting was considered a duplicate.

The DMMO stationed on the port bridge wing recorded sightings made by the Navy port lookout, as well as record data collected by the SMMOs and the LMMO. For each event (e.g., begin effort, end effort, observer rotation, weather change) the DMMO recorded time, location, and weather information as per the protocol (Appendix A). At the time of an event, a waypoint was immediately taken so that the accurate time and location would be recorded. Associated information could then be added.

Usage of the software program WinCruz was attempted on 17 – 18 March to compare an alternate way to record data. In WinCruz, once a sighting is identified, the user inputs a single command and the program records the exact time and location. The program then prompts the data recorder to enter additional environmental, effort, and sighting data. Most of the required information is similar to the protocol (Appendix A), although some differences needed to be accounted for.

3.2. EQUIPMENT LIST & COMMUNICATIONS

Communication between DDG A officers and MMOs was accomplished during meals in the wardroom, a morning operational brief, and on the ship's bridge as required. The equipment used by the MMOs is included in Table 1. A complete list of all recommended equipment for future MMO opportunities is provided in Appendix B.

Table 1. Equipment Used during SEASWITI

Equipment	Quantity	Location
Hand-held marine VHF radio, with headsets	4	• SMMO on port wing • SMMO on starboard wing • LMMO on starboard bridge wing • DMMO on port bridge wing
Hand-held GPS	1	• GARMIN GPSmap 276C on starboard bridge wing
Audio data recorders with timestamp	3	• SMMO on port wing • SMMO on starboard wing • LMMO on starboard bridge wing
Binoculars (with reticle)	4	• SMMO on port wing (Fujinon 7 X 50) • SMMO on starboard wing (Fujinon 7 X 50) • LMMO on starboard bridge wing (Fujinon 7 X 50) • DMMO on port wing (Steiner 7 X 50)
Clipboards	3	• SMMO on port wing • SMMO on starboard wing • LMMO on flying bridge

SECTION 4 RESULTS

Effort and environmental information was collected when the MMOs began effort, at each rotation, as weather changes occurred, and when the MMOs went off effort. The MMOs spent approximately 27.5 hours searching for marine species during the event (Table 2). Three people were vigilant during virtually all of the on effort hours; therefore this study comprised a total of just over 82 hours of marine mammal shipboard monitoring. The DMMO was often observing when there were no data to record but this effort was not recorded and therefore not included. During the times that the vessel was entering or exiting Mayport, Florida, limited time was spent on effort because of the set-up and break-down procedures as well as allowing sailors to complete their tasks without interference. For whole days out at sea, approximately 7 hours per day were spent on effort. Sea conditions were less conducive for obtaining sightings on the afternoon of 17 March and most of 18 March because of winds (Table 2). MMOs were off effort for less than 3 hours during the course of the event because of rain on the afternoon of 17 March and the morning of 18 March.

Table 2. Effort Hours and Environmental Conditions during the Study

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

The MMOs recorded 4 independent sightings of marine mammals, that is, sightings not seen by the Navy lookout team (Table 3). Additionally, the Navy lookout team recorded 3 independent sightings, and 6 sightings were seen by both the MMOs and the Navy lookout team (Table 3). One species could be positively identified (*Stenella frontalis* or Atlantic spotted dolphin); no sea turtles were observed. One additional dolphin was seen as the vessel was leaving Mayport, Florida. The MMOs were not on effort at the time and were not able to record data on the sighting. Therefore, this sighting was not included in the total sightings count.

Table 3. Number of Sightings, by Species

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

Reviewing the data qualitatively, poor sighting conditions were correlated with low sightings. On the days when number of sightings was the lowest (16 and 18 March), the wind speed and sea states were relatively greater than the remaining days with a greater number of sightings (Table 2, Table 4). All MMO sightings were available as trials. The most trials (5 of 6 sightings, or 83.3% of the sightings) as well as the highest rate of setting up trials (1.15 trials/hour) were recorded on 15 March (Table 4). The results of this study suggest that the rate of setting up trials is less than one trial every two hours during March off the east coast of Florida.

Table 4. Effort Hours, Sighting Rates, and Trial Rates

Date	Hours of Effort	# of Unique Sightings*	Sightings/ Hour	# of Trials	Trials/ Hour
15 Mar	4 h 21 min	6	1.38	5	1.15
16 Mar	6 h 37 min	2	0.30	1	0.15
17 Mar	7 h 51 min	5	0.64	4	0.51
18 Mar	7 h 57 min	0	0	0	0
19 Mar	1 h 8 min	0	0	0	0
Total	**27 h 54 min**	**13**	**0.46 (mean)**	**10**	**0.36 (mean)**

** Number of sightings includes both MMO and Navy lookout team sightings combined*

Locations and specific information related to each sighting are provided in Figure 1 and Table 5.

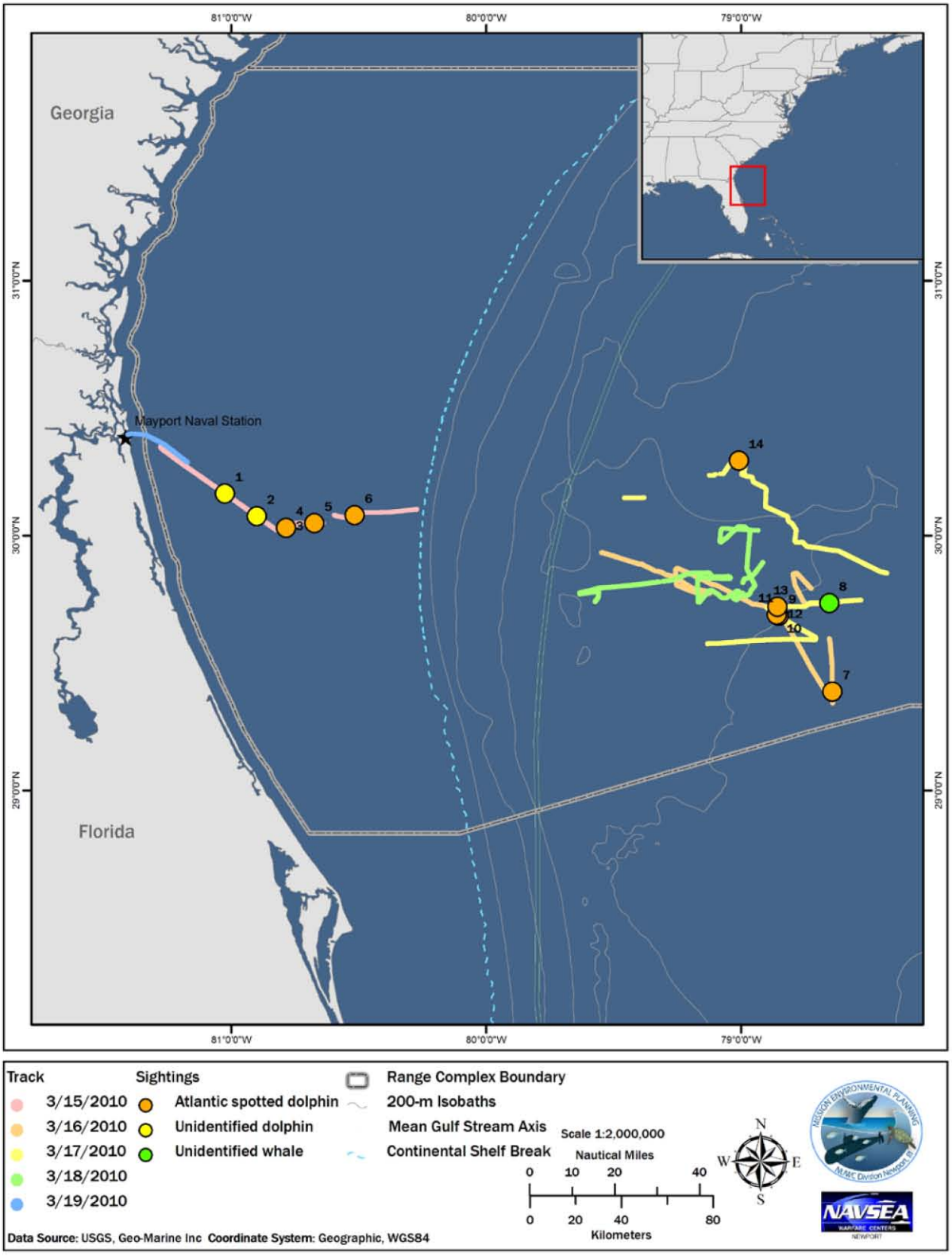

Figure 1. Vessel Locations at Marine Mammal Sightings

Table 5. Marine Species Sightings Data

Data Category	Sighting 1	Sighting 2	Sighting 3	Sighting 4	Sighting 5	Sighting 6	Sighting 7
Sightings Information							
Effort (on/off)	On	On	On	On	On	On	
Date	03/15/10	03/15/10	03/15/10	03/15/10	03/15/10	03/15/10	03/16/10
Time	1453	1529	1557	1558	1650	1828	1509
Location	JAX OPAREA	JAX OPAREA	JAX OPAREA	JAX OPAREA	JAX OPAREA	JAX OPAREA	JAX OPAREA
Detection Sensor	MMO & Bridge	Lookout	MMO	MMO & Lookout	MMO	MMO & Lookout	MMO
Species/Group	Unidentified dolphin	Unidentified dolphin	Unidentified dolphin	Atlantic spotted dolphin	Atlantic spotted dolphin	Atlantic spotted dolphin	Atlantic spotted dolphin
Group Size	2	2	2	1	3	3	15
# Calves							
Bearing (true)	110	10°	105°	80°	105°	96°	5° relative
Distance (yds)	100	1,013	244	20	67	20	20
Length of contact			10 sec				10-15 sec
Environmental Information							
Wave height (ft)	< 3 ft	< 3 ft	< 3 ft	< 3 ft	< 3 ft	< 3 ft	< 3 ft
Visibility	Excellent	Excellent	Excellent	Excellent	Excellent	Good	Good
BSS	2	1	1	1	1	3	3
% cloud cover	50%	90%	90%	90%	90%	90%	40%
Operational Information							
Sonar on/off	Off	Off					
Ship bearing (true)	130°	225°	75°	75°	95°	66°	
Animal motion	Closing	Parallel	Closing	Closing	Closing	Closing	Closing
Behavior	Bowriding						
Mitigation implemented	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Comments	animals approaching bow, assumed bowriding (could not see bow)	Animals closed from behind ship	animals approaching bow, assumed bowriding	assumed bowriding, MMO saw down through water	animals heading toward bow, assumed bowriding	animals heading toward bow, assumed bowriding	animals heading toward bow, came up from under ship

Data Category	Sighting 8	Sighting 9	Sighting 10	Sighting 11	Sighting 12	Sighting 13
Sightings Information						
Effort (on/off)	Off	On	On	On	On	On
Date	03/16/10	03/17/10	03/17/10	03/7/10	03/17/10	03/17/10
Time	1928	1017	1019	1019	1042	1623
Location	JAX OPAREA	JAX OPAREA	JAX OPAREA	JAX OPAREA	JAX OPAREA	JAX OPAREA
Detection Sensor	Lookout	MMO	MMO	Lookout	MMO & Lookout	Lookout
Species/Group	Unidentified whale	Atlantic spotted dolphin	Atlantic spotted dolphin	Atlantic spotted dolphin	Atlantic spotted dolphin	Atlantic spotted dolphin
Group Size	1	2	6	3	20	2
# Calves						
Bearing (true)	350°relative	5° relative	340° relative		30° relative	256°
Distance (yds)	12,000	10	200	10	10	3.33
Length of contact					15 sec	
Environmental Information						
Wave height (ft)		< 3 ft	< 3 ft	< 3 ft	< 3 ft	4 – 6 ft
Visibility		Good	Good	Good	Good	Moderate
BSS		2	2	2	2	4
% cloud cover		100%	100%	100%	100%	100%
Operational Information						
Sonar on/off	On					
Ship bearing (true)						256°
Animal motion	None	Closing	Closing		Closing	Parallel
Behavior	Dove	Bowriding	Jumping		Bowriding	Bowriding
Mitigation implemented	None					
Comments	Lookout saw fluke	Saw animal jump, then assumed bowriding		Could be a duplicate of sighting # 10. Lookout saw dolphins as they passed beam		

SECTION 5 CONCLUSION

5.1. MARINE SPECIES MONITORING AND LOOKOUT EFFECTIVENESS

The goals of the SEASWITI monitoring effort are provided below, with a conclusion regarding each of the goals:

1. Collect data to determine the effectiveness of the Navy lookout team.

   The survey protocol developed by the University of St. Andrews required changes once implementation was attempted. Data was able to be collected that will feed into a spreadsheet in order to begin determining the effectiveness of the Navy lookouts. The survey was successfully implemented.

   This event is the first aboard a DDG in which data was collected to determine effectiveness; data will be combined with future monitoring efforts in order to determine the effectiveness of Navy lookouts as a whole, rather than specific to each vessel.

2. Obtain data to characterize the possible exposure of marine species to MFAS.

   Sightings information included the bearing and distance of the animal to DDG A. This information can be used to determine, if MFAS was in use, to what level the animal may have been exposed to MFAS. Reconstruction of the event and the determination of the possible exposures of marine species to MFAS will be completed under separate task. Obtaining the data needed to make these determinations was successful.

5.2. LESSONS LEARNED

Many lessons learned were noted for the SEASWITI, and are separated into those for shipboard monitoring and operational information below.

5.2.1. Shipboard Monitoring

- Many dolphin sightings appeared to have come from the stern of the ship, as they suddenly appeared within close proximity of the ship. Recommendation is to consider having an MMO at the stern of the ship to potentially identify where the dolphins are coming from.

- From DDG A, we could not clearly see the bow, as it was obscured by the super structure of the ship. Any dolphins that approached the bow or were bowriding were difficult to follow thus it was difficult to accurately identify whether dolphins at the bow were new sightings or resightings.

- DMMOs attempted to use WinCruz to record effort and sightings information. This program has the potential to record sightings in a faster, more accurate, and more

efficient manner than recording data by hand. We had approximately 1.5 days to test and evaluate the program to determine if it might meet our needs in the future. During this time, we had multiple sightings and resightings and discovered which parts of WinCruz work well for us and which need reevaluation or changes.

- WinCruz is not able to record all necessary data fields, especially related to the trials. Need to set up strict rules to incorporate these data if we are going to use WinCruz for future effort.

- In situations where a MMO and a LO have a sighting at the same time, there is no easy way to indicate this in WinCruz. Currently, these are indicated as 2 separate sightings, and notes need to be entered into the comments field.

- The output from WinCrus needs to be smoothed in order to use the data. This extra effort needs to be reviewed to determine the cost-benefit of using the program.

- Although the radios indicated a full battery, they would run out of charge during on-effort periods. Recommend to recharged the radios nightly so that they are operable for the entirety of each day.

- DDG A was the first usage of the headsets attached to the radios. They were extremely useful, as it allowed for clear communication (wind reduction) and helped to prevent cueing the Navy lookout team.

- Attending daily ship operations brief is highly recommended. It facilitates communication between the ship's officers and the MMOs and keeps the MMOs current on the daily operations of the ship.

- Designating a DMMO was effective in recording Navy LO data in addition to MMO data. This maintained consistency in recording applicable information.

- Given this first attempt to conduct the lookout effectiveness study on a DDG, it was determined that conducting the study on a DDG is possible. The upper gantry on the bridge wings (near the bigeyes) was most suitable for the SMMOs, as it allowed for the best view and separate from the Navy lookout team.

5.2.2. Operational Information

- An extension cord and power strip would be helpful to bring so that electronics can be charged at once and in one location. Additionally, it would provide additional locations where the computer can be set up (if using WinCruz) in case of inclement weather.

SECTION 6 ACKNOWLEDGEMENTS

We thank the officers and crew for their outstanding support and hospitality during this cruise. We also thank Mr. Jene Nissen (USFF), Ron Filipowicz (USFF contractor), and LT Matt Maples

(DESRON 24) for pre-cruise planning. We sincerely appreciate the support from Commodore John Kersch (DESRON 24), as he made us feel welcome and appreciated what we were doing for the Navy.

APPENDIX A LOOKOUT EFFECTIVENESS SURVEY PROTOCOL

Calibrating US Navy lookout observer effectiveness

Information for Marine Mammal Observers

Version 1.0

ML BURT, L THOMAS and OTHERS

CONTENTS

1 INTRODUCTION

1.1 Aim of the project

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

Data will be collected to help quantify the effectiveness of the OT during Navy s in February 2010 using the protocol detailed in this manual. The protocol will then be revised, for use in a second exercise to take place later in 2010. Further iterations are expected thereafter.

1.2 Overview of analysis methods

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

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

1.3 Overview of survey methods

In order to obtain a realistic probability of detection of every surfacing for the OT, it is important that the OT search as usual. However, some additional information from the OT will be required:

namely, information on every surfacing. Since this is not typically recorded, and we do not wish to interfere with the normal operation of the OT, we designate one of the MMOs to ensuring that this information is obtained (as detailed below). This MMO will be called the liaison MMO (LMMO) since they need to liaise with the OT. The other MMOs also search and record every surfacing, in such a way that the OT do not know what they are doing. To distinguish them from the LMMO, we refer to them as surveying MMOs (SMMOs).

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

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

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

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

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

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

1.4 Overview of the manual

This manual describes the survey protocol and sighting procedures of the various observers and details the data to be collected. It should be borne in mind that the protocol may need to be adapted if procedures are found to be infeasible. Contact details for the St Andrews team are given in section 1.5.

1.5 Contact details

If anything is unclear, or the protocol can not be implemented, then do not hesitate to contact the support team at St Andrews University, Scotland. Note that the UK is 10 hours ahead of Hawaii.

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2 SURVEY PROCEDURE

2.1 Search platforms

2.1.1 Frigate

The platforms available for observation on a frigate are the bridge, bridge wings (with Big Eyes installed), the upper bridge and the fantail (stern of the ship).

2.2 Observer configuration

2.2.1 OT

Dedicated LOs are positioned on the upper bridge and fantail with additional observers operating opportunistically on the bridge. An acoustic observer may also be available. We assume that the upper bridge LO will be the one primarily making confirmed sightings, and that all sightings by other members of the OT will be reported to them. Officers on the bridge or in combat are

responsible for entering marine mammal records into a log (Appendix B); this log will not be used in the current survey as it is not detailed enough for our purposes – instead the LMMO will keep detailed records (see below). All OT personnel should search independently of the SMMOs.

2.2.2 MMO

Three MMO are required; two on the bridge wings who are actively searching (SMMOs) and one with the navy LO on the upper bridge (the LMMO). The primary purpose of the MMO on the upper bridge is to record all detections and surfacings detected by the OT. The MMO should all be in contact with each other and also be aware of any sightings made by the OT.

It is anticipated that the MMOs will rotate positions, for example, port SMMO, starboard SMMO, LMMO, resting. If it is feasible, the fourth MMO could be stationed in the bridge in order to ensure that all bridge sightings are recorded.

It is also conceivable that the LMMO may sometimes be able to operate as an additional search platform, aiding the SMMOs, if they are able to stand behind the LO and hence not cue them with their sightings. This is something that will need to be determined on board the vessel.

Lastly, it may be useful to have a fourth MMO on duty, aiding the SMMOs as a data recorder. It is our hope that the SMMOs will be able to use audio recording devices to record data, rather than having to look down and record data on paper. Looking down greatly increases the chance of losing a tracked animal, missing sightings, etc. However, should it not be possible to obtain an audio recording device, or should its use not be feasible, then having a fourth MMO to transcribe SMMO data would be very valuable.

2.3 OT procedure

It is important that the OT search as usual and independently of the MMO. Having detected a marine mammal, the LO should report each surfacing of the group they detect to the LMMO. The LMMO will be positioned on the upper bridge will record this information. However, the LO should not alter their usual search behaviour in order to better detect repeat surfacings – they should carry on with whatever search behaviour they would use if the MMOs were not present.

If the bridge, or other member of the OT, detect an animal, they should inform the LO. This will both inform the LMMO who can record the information and allow the LO to track each surfacing. It is not necessary for the bridge or other observers to inform the LO of each surfacing they detect after the first one, if it is obvious it is of the same group, unless this is their normal procedure. As stated earlier, we are not focussed on repeat surfacings.

It is our understanding that LOs have access to a compass and this should be used to determine the angle from the trackline to the sighting if this is their usual method. Distances are estimated by eye.

2.4 SMMO procedure

The main functions of the SMMO are to detect and track marine mammals and determine whether sightings made by the OT and reported to them by the LMMO are duplicates with sightings they have made. The SMMOs should search from the vessel to the horizon using binoculars concentrating forward of the vessel to abeam. The search pattern is:

- Port observer: searches on the port side of the vessel from about 5^{o} starboard to abeam.
- Starboard observer: searches on the starboard side from about 5^{o} port to abeam.

On detecting an animal, they should attempt to record each surfacing until the animal goes abeam. Tracking an animal has three uses: it helps to identify any animals subsequently seen by the OT; species and group size can be more accurate (because animals and groups are seen more than once) and information on surfacing behaviour is required for the analyses. The MMOs will need to be in contact with each other and thus be aware of any sightings made by the OT which will help with duplicate identification; duplicate sightings are animals seen first by the SMMO and then by the OT (as reported by the LO via the LMMO).

If the OT detect an animal prior to the SMMO, then the SMMO should attempt to locate it to determine species and group size and then continue to track and record each surfacing (but see section 3.4, below). If the OT sighting occurs during SMMO tracking, the SMMO should continue to track the animal until it is lost, or goes abeam, and then attempt to locate the sighting made by the OT.

SMMO should primarily concentrate their search effort forward of abeam but if substantial numbers of animals approach the vessel from behind abeam (i.e. dolphins that can swim faster than the vessel) then it may be necessary to search behind abeam.

Angleboards should ideally be used to measure bearings to sightings relative to the ship and the binoculars should have reticles for use in calculating distances.

Each SMMO should record information into an audio recording device for later transcription on to a SMMO sighting form; alternatively a fourth MMO may be available to do real-time data transcription. Effort information should be recorded on an MMO effort form.

The SMMOs assess the duplicate status of each surfacing.

If there are too many animals in view for an SMMO to keep track of, the SMMO should choose a small number of trials (one or two) that they can track accurately and follow them until it is clear the OT has duplicated that target or the track ends.

2.5 LMMO

The primary function of the LMMO is to record information (section 4) on the first sightings of all the OT. Information on all subsequent sightings should also be recorded if possible. The LMMO will pass the information of sightings to the SMMOs as soon as possible to determine if the OT has duplicated as sighting made by the SMMOs. In some cases this will inform the SMMOs of animals not yet detected. The LMMO can also actively search for animals and

inform the SMMOs of any sightings they make (so the SMMOs can use them to set up trials), as long as this does not cue the LO or compromise data recording.

3 SIGHTING PROTOCOL

This section relates to the procedure to be followed on detecting a marine mammal.

3.1 LO

On sighting a marine mammal, the LO should inform the LMMO giving all required information (see section 4) but in particular time of sighting, species, sighting angle, sighting distance and group size. The LO should also give the information for any subsequent sightings of the same group to the LMMO.

3.2 Bridge (or other OT member)

On sighting, or detecting, a marine mammal, the bridge should inform the LMMO – this may be via the LO if LMMO is not in direct contact with the bridge. Subsequent sightings of the same should also be passed to the LO, although it seems likely in practice that the primary responsibility for tracking already sighted groups within the OT will fall upon the LO.

3.3 SMMO

On sighting a marine mammal, the SMMO should

1. Collect and record the following information: time of sighting, species, sighting angle, sighting distance and group size. Other information (such as cue or behaviour) should be collected if there is time.

2. Attempt to track the animal, recording information on all subsequent sightings.

3. Assess duplicate status, maybe in consultation with the LMMO.

4. Inform the bridge of any animal within the operational standoff range of the vessel if active sonar operations are taking place.

3.4 Tracking priority

The first priority for SMMOs is to find and track animals before the OT see them, to set up trials for the OT. When the OT report a sighting (via the LMMO) of a new group they should determine whether it is a duplicate or not (i.e. something they were tracking already). A secondary priority is to track groups already seen by the OT, to determine resighting rates. With this in mind, the procedure for SMMOs on detecting an animal is as follows:

- On locating an animal, or group, attempt to track until the animal is lost or is a long way behind and unlikely to approach the vessel.

- If the OT detect an animal while both SMMOs are searching (i.e. not tracking anything), one SMMO should attempt to locate the OT sighting (to confirm species and group size) and continue to track it and record each surfacing. This will be necessary to determine how many surfacings the OT detect. The other SMMO should continue to search as setting up new trials is more important.

- If the OT detect an animal while one SMMO is engaged in tracking, that SMMO should determine whether the OT sighting is a duplicate or not. If it is, the SMMO should continue tracking the group while the other SMMO searches for new groups. If it is not, the SMMO should continue tracking their group, while the other SMMO attempts to track the group seen by the OT, if possible. If this is not possible, the other SMMO should revert to searching for new groups to track.

- If the OT detect an animal while both SMMOs are engaged in tracking, the SMMOs should continue determine if the OT sighting is a duplicate or not. In either case, they should continue tracking their groups until the track is finished or the group is sighted by the OT.

3.5 Group size definition

In the case of aggregated groups, the angle and distance measurement should be estimated to the geometric centre of the aggregation. A group can be thought of as the smallest unit that can be tracked as a unit. A convenient rule is, for example, to define a group as containing animals not more than 3 animal lengths from each other (this may depend on species). The group may exhibit the same swimming pattern and general behaviour although not necessarily with a synchronised surfacing pattern.

Difficulties may arise when animals are not in tight, easily defined clusters, but in loose aggregations whose boundaries and group size must be determined subjectively. In this case, it is better to identify smaller, homogenous groups within the aggregation, and associate each with an angle, distance and group size.

Problems can also arise when a group is formed of animals swimming in a long line at relatively equal distances from each other (e.g. pilot whales). In this case, group boundaries can be taken at convenient discontinuities in the distribution.

Large groups of dolphins may comprise of several hundreds of animals. Often these groups are compact and form a single unit. Sometimes subgroups may form but may only last for a short time with frequent interchange of animals between groups. In this case, it is better to treat the whole group as a single unit. As these groups will have a continuous cue, it is not necessary to make continuous resightings, but only at appropriate intervals, say 5 minutes or perhaps more frequently close to the vessel.

If relatively stable subgroups can be identified, then the details for the first subgroup sighted should be recorded and then this subgroup should be followed. Include a comment that it is part of a larger aggregation, and if possible, how many other subgroups there are in the aggregation and group sizes. A duplicate sighting would occur if the OT detects the subgroup being tracked.

If a groups splits while being tracked, then one subgroup should be tracked. The groups sizes recorded should reflect that the group has split and is now smaller than the original sighting. The fact that the group has split should be recorded in the data. When tracking of the subgroup has finished, the SMMO should then try to relocate one of the other subgroups and track it.

3.6 Surfacing and availability

A surfacing is defined as any opportunity that an animal is available to be detected visually. This could be when the animals are at the surface or even below the surface if the water is clear enough.

Some animals may be intermittently available, for example if they are at the surface for a short time and then dive and then return to the surface. Others might be continuously available, for example large groups of dolphin schools which surface asynchronously. As ever, it is important to record the first sighting of these and as discussed in section 3.5, record the final sighting and, if feasible, at appropriate intervals such as every 5 minutes.

Some animals may provide both intermittent and continuous cues (i.e. a blow but then stays close to the surface and if the water is clear enough can still be seen). In this case, treat each discrete surfacing (ie. fluke, blow, body) as a resurfacing but include a comment that the animal is continuously available.

4 DATA COLLECTION

It is anticipated that data will be recorded onto audio recorders or paper forms and transcribed at the end of each day. The information collected by the OT is recorded by the LMMO onto a sightings form. Sightings by the SMMOs are recorded or transcribed onto a MMO sighting form. Forms for search effort and weather and other basic information are also provided. Note the form number and total number of forms (at the top of the paper form) is used to prevent forms being lost.

4.1 Sightings form

This form should be used to record all sighting information. All information is required upon initial sighting. Information needed for each resurfacing is indicated in bold.

FIELD	DESCRIPTION
SIGHTING #	**This is the number of each sighting and should be sequential.**
RESIGHTING #	**The number of times the object has been resighted. The initial sighting will have a resighting number of zero and subsequent resightings will be 1, 2, etc. Each resighting starts a new column on the sighting report form.**
RESIGHTING. STATUS	**D definite resightings (at least 90% likely to be the same animal or group)** **P possible resighting (more than 50% likely)** **R remote resighting (less than 50% likely)**
TIME	**Time of sighting.**

FIELD	DESCRIPTION
SPECIES CODE	**The five letter code used to identify the species. Refer to section 4.4. If a species is not listed, then include this information in the 'Comment' for the record.**
DURATION (if cue continuous)	**If the cue is continuous, then indicate the length of time, you were observing this sighting.**
ANIMAL (A) bearing	**Estimated angle of the bow of the ship to the sighting. A sighting dead ahead is 0^o and angles go from 0-360^o.**
SIGHTING DISTANCE	**Estimate of sighting distance in metres?**
GROUP SIZE	**Give the best estimate of group size, including calves. In mixed schools enter the number of each species.**
DUPLICATE SIGHT #	**Duplicate sighting number. This allows duplicate sightings to be cross-referenced.**
DUPLICATE TRIAL	**Indicate if this is a valid duplicate:** **Yes – sighting seen first by MMO** **No – sighting seen first by OT**
DUPLICATE STATUS	**Duplicate status of a sighting:** **D – definite duplicate (at least 90% likely to be the same animal)** **P – possible duplicate (more than 50% likely)** **R – remote change of being a duplicate (less than 50% likely)**
SHIP LATITUDE	
SHIP LONGITUDE	
SHIP (S) BEARING	
RELATIVE MOTION A/S & A'S BEARING	Indicates of the animal is opening away from the ship, closing towards the ship, or moving parallel to the ship's track. The heading of the animal relative to the ship should be recorded relative to the line of sight where 0° indicates the animal is heading directly away, 90° indicates the animal is heading from left to right, 180° - directly towards the ship, 270° - heading right to left.
DETECTION SENSOR	Observer who made the sighting: MMO + observer code LO Bridge Acoustic
NUMBER OF CALVES	Enter the number of calves in a group.

FIELD	DESCRIPTION
SIGHTING CUE	Indicator of cue which led to the sighting: BL - blow BW – bowride BY - body DV - dive FL – fluke up GL – glint of sunlight off body HS – head slap JU - jump /breach/spin PA – peduncle arch PP – porpoise PS – pectoral fin slap SL- slick, footprint or ring SN – spin SP - splash TS – tail slap WL – seabirds or other associated wildlife OT – other
BEHAVIOUR	BR – Breaching BW – Bow riding FD – Feeding FL - Fluking FS – Flipper slapping ML – Milling LO – Logging RE – Resting TR – Travelling TS – Tail slap VO - Vocalizing
END OF TRACK	Reason for stopping a track. BE - sighting behind the beam LO - sighting lost OB - sighting obscured NC - no change of the sighting with respect to the boat (this may happen if the sighting is far away) MA - sighting passed to other LO to follow OT – other
OPERATIONS INFORMATION	Were any mitigation measures implemented?
COMMENT	Any additional information.

4.1.1 Sighting number/Duplicate sighting number

The duplicate sighting number on the sightings form is the number given to the surfacing by the LMMO, and called down to the SMMOs. If the SMMOs think this is the same as a surfacing they sighted, they give write down the LMMOs sighting number under "DUPLICATE SIGHT #" on the form. Two types of duplicate sighting can be distinguished: those that represent valid trials for estimating the OT detection function and those that do not. Valid trials are where the SMMO saw the surfacing independently (for example because they were tracking the group) and then the LMMO radios down to inform the SMMO that a surfacing has been seen by the OT, and the SMMO determines it's the same as the one they just saw. In this scenario, "Yes" should be entered under "DUPLICATE TRIAL". By contrast, trials do not occur when the LMMO alerts the SMMOs to a surfacing that the OT have seen but the SMMOs had not previously seen, and then the SMMOs see the surfacing and record information on it. In this case, although it's a duplicate (because both OT and SMMO saw the surfacing), it is not a valid trial as the OT saw it first directed the SMMO to see it. Hence "No" should be entered under "DUPLICATE TRIAL".

This duplicate information should be recorded by the SMMO since they are making any duplicate assessment. It is not necessary for the LMMO to fill in this information. The LMMO just need to pass sighting numbers of OT sightings to the SMMO so that the SMMO can fill in the duplicate information on their forms.

4.1.2 Multi species sighting

When recording groups of mixed species, record the information on separate lines but assign the same sighting number.

4.1.3 High density regions

It is anticipated that in the region chosen for the survey, animal density will be low. However, if the density of animals is high, so that the assessment of duplicate status becomes difficult, then indicate this on the effort form (see section 4.2). Cross-referencing of duplicates may need to be reconsidered. If density of animals is high (i.e. detections occur more than once every few minutes), then the timing of sightings becomes critical.

4.2 MMO Effort/weather form

This form should be completed by the LMMO everytime an 'event' occurs, for example at the start/end of search effort, observer rotation, changes in the weather. If the density of animals is too high to make it difficult to assess duplicate status, then indicate this in the 'Event' field. Sometimes the weather will be too bad for searching, in which there will be no search effort.

FIELD	DESCRIPTION
EFFORT	Whether search effort is ON or OFF.
EVENT	Record the event: 1 – begin search effort 2 – stop search effort 3 – observer rotation 4 – weather change 5 – transect waypoint 6 – high animal density 7 – back to normal animal density 8 – end of day
TIME	Time of event
LATITUDE	
LONGITUDE	
Port MMO	MMO who is searching on port side of vessel.
Starboard MMO	MMO who is searching on starboard of vessel.
LMMO	MMO who is acting as liaison MMO.
SEA STATE	Beaufort Sea state on a scale of 0-7.
SONAR	Is sonar On or Off?
EXPLOSIVES	Are explosives in use: Yes or No.
VISIBILITY	General impression for spotting marine animals: B – Bad (<0.5km) P – Poor (0.5 – 1.5km) M – Moderate (1.5 – 10km) G – Good (10 - 15km) E – Excellent (<15km)
WAVE HEIGHT	Light (0 – 3ft) Moderate (4 – 6ft) Heavy (>6ft)
SWELL DIRECTION	
WIND DIRECTION	
WIND SPEED	
% GLARE	
% CLOUD COVER	

4.3 MMO Observer code form

This should be completed at the start of the survey and the observer codes decided. The heights are needed if reticle readings have to be converted to distances.

FIELD	DESCRIPTION
CODE	Two letter code for each observer.
NAME OF OBSERVER	Name of the observer
EYE HEIGHT	Eye height (in feet) of the observer (to be used for converting reticle estimates to distances).
PLATFORM HEIGHT	Height of SMMO platform (in feet) above sea level.

4.4 Table of species codes

CODE	COMMON NAME	SCIENTIFIC NAME
BALMU	Blue whale	*Balaenoptera musculus*
BALPH	Fin whale	*Balaenoptera physalus*
MEGNO	Humpback whale	*Megaptera novaeangliae*
BALAC	Minke whale	*Balaenoptera acutorostrata*
BALED	Bryde's whale	*Balaenoptera edeni*
BALBO	Sei whale	*Balaenoptera borealis*
BALMU	Blue whale	*Balaenoptera musculus*
BAL--	Unidentified rorqual	Balaenopteridae
WHALE	Unidentified whale	
ZIP--	Unidentified beaked whales	Ziphiid
MES--	Unidentified *Mesoplodon*	*Mesoplodon* spp.
MESDE	Blainville's beaked whale	*Mesoplodon densirostris*
ZIPCA	Cuvier's beaked whale	*Ziphius cavirostris*
INDPA	Longman's beaked whale	*Indopacetus pacificus*
PHYMA	Sperm whale	*Physeter macrocephalus*
KOGBR	Pygmy sperm whale	*Kogia breviceps*
KOGSI	Dwarf sperm whale	*Kogia simus*
KOG--	Unidentified pygmy/dwarf sperm whale	*Kogia* spp.
ORCOR	Killer whale	*Orcinus orca*
PSECR	False killer whale	*Pseudorca crassidens*
FERAT	Pygmy killer whale	*Feresa attenuata*
PEPEL	Melon-headed whale	*Peponocephala electra*
GLOMA	Short-finned pilot whale	*Globicephala macrorhynchus*
TURTR	Bottlenose dolphin	*Tursiops truncatus*
STEAT	Pantropical spotted dolphin	*Stenella attenuata*
GRAGR	Risso's dolphin	*Grampus griseus*
STELO	Spinner dolphin	*Stenella longirostris*

CODE	COMMON NAME	SCIENTIFIC NAME
STECO	Striped dolphin	*Stenella coeruleoalba*
STEBR	Rough-toothed dolphin	*Steno bredanensis*
LAGHO	Fraser's dolphin	*Lagenodelphis hosei*
DOLPH	Unidentified dolphin	
CET--	Unidentified cetacean	
CHEMY	Green turtle	*Chelonia mydas*
EREIM	Hawksbill turtle	*Eretmochelys imbricata*
DERCO	Leatherback turtle	*Dermochelys coriacea*
CARCA	Loggerhead turtle	*Caretta caretta*
LEPOL	Olive ridley turtle	*Lepidochelys olivacea*
TURTL	Unidentified turtle	
MONSC	Hawaiian monk seal	*Monachus schauinslandi*

5 OTHER ACTIVITIES

5.1 Final cruise report

At the end of the cruise a brief report which contains a general evaluation of the survey (i.e. suitability of vessel, platform locations, search procedure, sighting protocol, equipment, general operation etc.) would be helpful. Perhaps include a summary of the survey data collected (number of miles/km searched, number of sightings of each species) and any problems that have occurred, any adaptations to the protocol that may have been implemented or if any new species codes have been added. This information will be useful to refine survey methods for the next survey and in the analysis of the data.

5.2 And finally!

Have a good time and enjoy the survey! Don't forget you can contact the St Andrews team at any time (time difference allowing).

APPENDIX A
EQUIPMENT LIST

LO Equipment

Each LO should have the following equipment, which are all provided:

- Compass for measuring sighting angle
- 7x50 binoculars for searching
- Big Eyes for group size
- Headsets or other means of communicating with bridge

MMO Equipment

Each MMO should have the following equipment:

- 7x50 Binoculars with reticles
- Compass (provided on platform)
- GPS or synchronized digital watch
- Radios (handheld or headsets to communicate with other MMO)
- Clipboard
- Pencils
- MMO sighting forms
- MMO effort/weather forms (LMMO only)
- Equipment to communicate with bridge
- Crib sheet for converting reticles to distances?
- Crib sheet of species codes
- Audio recording device, if possible, for recording sightings without needing to look down to paper survey form. Automatic time stamp, if possible.

APPENDIX B LO DATA – DAILY MARINE MAMMAL LOG

The following table describes the data recorded in the LO 'Daily marine mammal log'.

FIELD	DESCRIPTION
A. DTG	Date and time of sighting DDHHMM Z MMM YY
B. Species/Type of mammal	Types are Whale/Dolphin/Porpoise/Seal/Sea lion/Turtle/Generic (i.e. unknown)
C. Number of mammals	Number
D. Calves	Yes/No
E. Initial detection source	Visual/Aural
F. Initial bearing/range	Bearing in degrees (true)/ Range in yards
G. Unit position	Latitude DDMMSS N/S and Longitude DDDMMSS E/W
H. Unit course/speed	Course in degrees (true)/ Speed in knots
I. Last known bearing/range	Bearing in degrees (true)/ Range in yards
J. Total time visually observed	Time in minutes
K. Wave height	Wave height in feet
L. Visibility	Visibility in nautical miles
M. MFAS status	No/Yes or On/Off
N. MFAS action taken	Power down -6dB/Power down -10dB/Shutdown/None
The following fields are completed if MFAS was transmitting when a mammal was sighted and subsequently powered down/shut down, or course changed.	
O. Duration of action	Minutes
P. Maneuver conducted	Turn STBD/Turn PORT
Q. Degrees of course change	Degrees
R. Range action taken	Range in yards
S. Action impact	Tactical degradation assessment – examples: None Slight - degraded ASW screen integrity when ship manoeuvred to open whales Moderate – lost contract when power reduced Significant – engagement interrupted when MFAS as shutdown
T. Narrative of observation	Examples: Dolphins sighted at 12ooyds off port bow, closing on ship. Maneuvered to confirm bow riding and continued MFAS events.

APPENDIX B RECOMMENDED EQUIPMENT LIST FOR MMO SHIPBOARD SURVEYS

Equipment	Quantity	Location
Hand-held marine VHF radio	3	• SMMO on port wing • SMMO on starboard wing • LMMO
Hand-held GPS	3	• SMMO on port wing • SMMO on starboard wing • DMMO • Recommend GPS unit used be consistent; still determining best-suited GPS available
Audio data recorders with timestamp	3	• SMMO on port wing • SMMO on starboard wing • LMMO
Binoculars (with reticle)	4	• SMMO on port wing • SMMO on starboard wing • LMMO • DMMO Recommend all binoculars be Fujinon 7 X 50 for consistency.
Digital watch with seconds showing	4	• SMMO on port wing • SMMO on starboard wing • LMMO • DMMO
Angle board	3	• SMMO on port wing • SMMO on starboard wing • LMMO
Camera	2	• SMMO on port wing • SMMO on starboard wing
Clipboards	4	• SMMO on port wing • SMMO on starboard wing • LMMO • DMMO
Pelican case/dry bag	Ship dependent	One container at each MMO location is necessary. Depending on the type of vessel, the number of containers/bags needed may vary. • FFG: 3, one each for starboard bridge wing, port bridge wing, and flying bridge • DDG: 3 • CG: 3
Misc. Supplies: zip ties, duct tape, electrical tape, rubber bands		

Appendix G - June 2010 SEASWITI Monitoring Cruise Report

August 2010

Cruise Report, Marine Species Monitoring & Lookout Effectiveness Study

Southeastern Antisubmarine Warfare Integrated Training Initiative (SEASWITI), June 2010

Jacksonville Range Complex

Prepared for:
United States Fleet Forces

Prepared by:

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List of Acronyms and Abbreviations

ASW	antisubmarine warfare
DMMO	data marine mammal observer
ft	foot (feet)
GPS	global positioning system
HRC	Hawaii Range Complex
km	kilometer(s)
LMMO	liaison marine mammal observer
m	meter(s)
MFAS	mid-frequency active sonar
MMO	marine mammal observer
nm	nautical mile(s)
NMFS	National Marine Fisheries Service
PMAP	Protective Measures Assessment Protocol
PMRF	Pacific Missile Range Facility
SEASWITI	Southeastern Antisubmarine Warfare Integrated Training Initiative
SMMO	survey marine mammal observer
VHF	very high frequency
yd(s)	yard(s)

SECTION 1 INTRODUCTION

In order to train with mid-frequency active sonar (MFAS), the United States (U.S.) Navy has obtained a permit from the National Marine Fisheries Service (NMFS) under the Marine Mammal Protection Act and Endangered Species Act. The Atlantic Fleet Active Sonar Training (AFAST) Monitoring Plan, implemented in January 2009, was developed with NMFS to comply with the requirements under the permit. The monitoring plan and reporting will provide science-based answers to questions regarding whether or not marine mammals are exposed and reacting to Navy MFAS. The objectives of the monitoring plan are to address the following questions:

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

2. If marine mammals and sea turtles are exposed to MFAS in the Northwestern Atlantic of Gulf of Mexico (or "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. Are the Navy's suite of mitigation measures for MFAS (e.g., Protective Measures Assessment Protocol [PMAP], major exercise measures agreed to by the Navy through permitting) effective at avoiding TTS, injury, and mortality of marine mammals and sea turtles?

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

In a concerted effort to address the fourth question above, a study was initiated to determine the effectiveness of the Navy lookout team, including lookouts in the pilot house, on the bridge wings, and/or the forward lookout on the flying bridge. Trained biologists were utilized for the study to collect data that would characterize the likelihood of detecting marine species in the field from a U.S. Navy destroyer (DDG). The University of St. Andrews, Scotland, under contract to the U.S. Navy, developed an initial protocol for use during this study. Changes to the protocol were required during the initial implementation of this protocol. As such, the MMOs modified the protocol as necessary. Data collected will be combined with future monitoring efforts in order to determine the effectiveness of Navy lookout teams as a whole, rather than specific to each vessel.

As part of this data collection effort, four U.S. Navy civilian MMOs (Ms. Amy Farak, Mr. Anurag Kumar, Ms. Toni Mizerek, and Ms. Deanna Rees) participated in a Southeastern Antisubmarine Warfare Integrated Training Initiative (SEASWITI) on 04-09 June 2010. These MMOs were stationed aboard a DDG, hereafter referred to as DDG B. The goals of the SEASWITI monitoring and this study were:

1. Collect data to assess the effectiveness of the Navy lookout team.

2. Obtain data to characterize the possible exposure of marine species to MFAS.

SECTION 2 SEASWITI DESCRIPTION

SEASWITI events are a requirement to provide the necessary training to prospective submarine commanders in rigorous and realistic scenarios involving undersea warfare. The ships and their embarked helicopters would be conducting antisubmarine warfare (ASW) localization training using the AN/SQS-53, AN/SQS-56, and AN/AQS-13 or AN/AQS-22 dipping sonar. The submarine also periodically operates the AN/BQQ-10 sonar. Ten vessels participated in this SEASWITI, including vessels from the British and Peruvian navies.

SECTION 3 METHODS

3.1. SHIPBOARD MONITORING

MMO surveys were conducted on a not-to-interfere basis, which means that the MMOs would not replace required Navy lookouts, would not dictate operational requirements/maneuvers, and would remove themselves from the bridge wing if necessary for DDG B to accomplish its mission objectives. The exceptions would be if a marine mammal was sighted by the MMO within the shut-down zone during MFAS (200 yards [yds], 183 meters [m]) and was not sighted by the Navy lookout team, or if the vessel was in danger of striking the marine species. In these cases, the MMO would report the sighting to the Navy lookout team for appropriate reporting and action.

The initial protocol for data collection was provided by the University of St. Andrews and is included as Appendix A; this protocol was modified by the MMOs on two prior surveys. Additional changes were made as necessary during this event. The MMO survey on DDG B was conducted on the bridge wings (elevated 60 feet [ft; 20 m] above the waterline), with one MMO on each wing (called survey MMOs, or SMMOs). One MMO was stationed on the starboard bridge wing and acted as a liaison to the starboard lookout (called liaison MMO or LMMO). The fourth MMO was responsible for acting as a liaison with the port lookout, but also was responsible for recording data (data MMO or DMMO) reported by the two SMMOs and the LMMO. A rotation schedule was used, such that an MMO would be on effort for one hour on port, one hour as the LMMO on starboard, one hour as an SMMO on starboard, and one hour as DMMO on port. While on effort, MMOs used naked eye and 7 X 50 magnification binoculars to scan the area from dead ahead to just aft of the beam.

If an animal was visually detected by the SMMOs, information would be collected on twenty-three sighting, environmental, and operational parameters. Sightings obtained first by the SMMOs before the Navy lookout were considered to be “trials” unless the sighting was aft of the beam. If applicable, photographs would be taken using a Canon EOS 20D digital camera with a 100 – 400 mm zoom lens. No photographs would be taken until the Navy lookout had the sighting so as not to inappropriately call attention to the sighting. No opportunities arose during this effort for photographs.

The LMMO stationed on the starboard bridge wing reported sightings made by the Navy starboard lookout. Once the starboard lookout sighted an animal or was informed of a sighting by the bridge, the lookout would relay the approximate bearing, distance (estimated by eye), and animal group (whale or dolphin) to the LMMO. The LMMO would relay this information to the DMMOs for recording and to determine if the sighting was considered a duplicate.

The DMMO stationed on the port bridge wing recorded sightings made by the Navy port lookout, as well as record data collected by the SMMOs and the LMMO. For each event (e.g., begin effort, end effort, observer rotation, weather change) the DMMO recorded time, location, and weather information as per the protocol (Appendix A). At the time of an event, a waypoint was immediately taken so that the accurate time and location would be recorded. Associated information could then be added.

3.2. EQUIPMENT LIST & COMMUNICATIONS

Communication between DDG B officers and MMOs was accomplished during meals in the wardroom, a morning operational brief, and on the ship's bridge as required. The equipment used by the MMOs is included in Table 1. A complete list of all recommended equipment for future MMO opportunities is provided in Appendix B.

Table 1. Equipment Used during SEASWITI

Equipment	Quantity	Location
Hand-held marine VHF radio, with headsets	4	• SMMO on port wing • SMMO on starboard wing • LMMO on starboard bridge wing • DMMO on port bridge wing
Hand-held GPS	1	• GARMIN GPSmap 276C on starboard bridge wing
Binoculars (with reticle)	4	• SMMO on port wing (Fujinon 7 X 50) • SMMO on starboard wing (Fujinon 7 X 50) • LMMO on starboard bridge wing (Fujinon 7 X 50) • DMMO on port wing (Steiner 7 X 50)
Clipboards	2	• One for effort form • one for sightings form

SECTION 4 RESULTS

Effort and environmental information was collected when the MMOs began effort, at each rotation, as weather changes occurred, and when the MMOs went off effort. The MMOs spent approximately 42 hours searching for marine species during the event (Table 2). Three people were vigilant during virtually all of the on effort hours; therefore this study comprised a total of just over 126 hours of marine mammal shipboard monitoring. The DMMO was often observing when there were no data to record but this effort was not recorded and therefore not included. During the times that the vessel was entering or exiting Mayport, Florida, limited time was spent on effort because of the set-up and break-down procedures as well as allowing sailors to complete their tasks without interference. For whole days out at sea, approximately 8.5 – 9.5 hours per day were spent on effort. Rain was encountered on the afternoon of 06 June, and sea states increased on 07 – 08 June (Table 2).

Table 2. Effort Hours and Environmental Conditions

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

The MMOs recorded 12 independent sightings of marine mammals, that is, sightings not seen by the Navy lookout team (Table 3). Additionally, the Navy lookout team recorded 3 independent sightings (one of which was determined to be much larger than a bottlenose dolphin, therefore included as an "unidentified cetacean"), and 4 sightings were seen by both the MMOs and the Navy lookout team (Table 3). One species could be positively identified (*Stenella frontalis* or Atlantic spotted dolphin); one sea turtle was observed.

Table 3. Number of Sightings, by Species

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

Trials were only successfully conducted on the first day of the event, with 10 of 12 sightings (83%) available for trials, or a rate of 1.79 trials per hour of effort (Table 4). Sightings on 06 and 07 June were not available for trials given their location (aft of the beam), or were seen first by the Navy lookout team.

Table 4. Effort Hours, Sighting Rates, and Trial Rates

Date	Hours of Effort	# of Unique Sightings*	Sightings/ Hour	# of Trials	Trials/ Hour
04 Jun	5 hr 35 min	12	2.15	10	1.79
05 Jun	8 hr 23 min	0	0	0	0
06 Jun	8 hr 27 min	3	0.36	0	0
07 Jun	9 hr 25 min	5	0.53	0	0
08 Jun	9 hr 7 min	0	0	0	0
09 Jun	1 hr 8 min	1	0.88	0	0
Total	**42 hr 5 min**	**21**	**0.65 (mean)**	**10**	**0.30 (mean)**

** Number of sightings includes both MMO and Navy lookout team sightings combined*

Locations and specific information related to each sighting are provided in Figure 1 and Table 5.

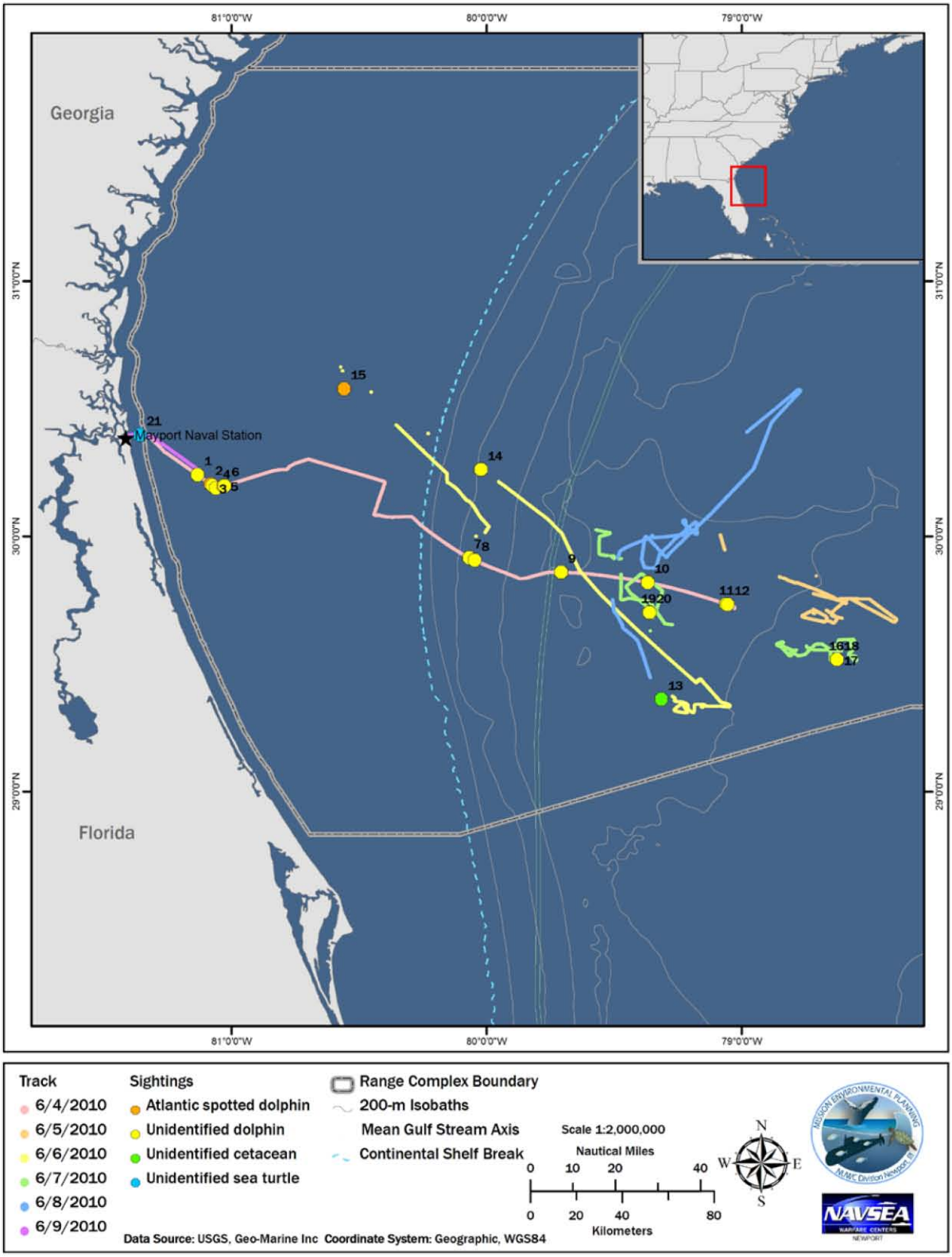

Figure 1. Vessel Locations at Marine Mammal Sightings

Table 5. Marine Species Sightings Data

Data Category	Sighting 1	Sighting 2	Sighting 3	Sighting 4	Sighting 5	Sighting 6	Sighting 7
Sightings Information							
Effort (on/off)	On	On	On	On	On	On	Off
Date	06/04/10	06/04/10	06/04/10	06/04/10	06/04/10	06/04/10	06/04/10
Time	1039	1048	1049	1049	1057	1057	1456
Location	JAX OPAREA	JAX OPAREA	JAX OPAREA	JAX OPAREA	JAX OPAREA	JAX OPAREA	JAX OPAREA
Detection Sensor	MMO	MMO	MMO	MMO	MMO	MMO and Bridge	MMO
Species/Group	Unidentified dolphin	Atlantic spotted dolphin	Unidentified dolphin	Unidentified dolphin	Unidentified dolphin	Unidentified dolphin	Unidentified dolphin
Group Size	1	4	2	1	2	4	2
# Calves							
Bearing (true)	45°	105°	205°	165°	340° relative	75° relative	40° relative
Distance (yds)	730	365	730	10	100	50	200
Length of contact							< 6 min
Environmental Information							
Wave height (ft)	< 3 ft	< 3 ft	< 3 ft	< 3 ft	< 3 ft	< 3 ft	< 3 ft
Visibility	Good	Good	Good	Good	Good	Good	Good
BSS	1	1	1	1	1	1	1
% cloud cover	100	100	100	100	100	100	90
Operational Information							
Sonar on/off	Off	Off	Off	Off	Off	Off	Off
Ship bearing (true)	135	135	135	75			
Animal motion	Opening	Closing	Parallel	Closing	Closing	Closing	Closing
Behavior	Porpoising	Porpoising	Porpoising	Traveling	Jumping	Jumping	Jumping
Mitigation implemented	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Comments		Bowriding/ playing in wake	Animals were jumping/playing in one place	Animals were underwater when observed; probable Atlantic spotted. Could be duplicate of Sighting #3.	Probable spotted dolphin.		Port lookout saw dolphins bowride after they came from starboard

Data Category	Sighting 8	Sighting 9	Sighting 10	Sighting 11	Sighting 12	Sighting 13	Sighting 14
Sightings Information							
Effort (on/off)	Off	On	On	On	On	Off	On
Date	06/04/10	06/04/10	06/04/10	06/04/10	06/04/10	06/06/10	06/06/10
Time	1502	1634	1815	1954	1957	0735	1327
Location	JAX OPAREA	JAX OPAREA	JAX OPAREA	JAX OPAREA	JAX OPAREA	JAX OPAREA	JAX OPAREA
Detection Sensor	MMO	MMO	MMO	MMO & Lookout	MMO & Lookout	Lookout	Lookout
Species/Group	Unidentified dolphin	Unidentified splash	Unidentified dolphin	Unidentified dolphin	Unidentified dolphin	Unidentified cetacean	Unidentified dolphin
Group Size	2			4	5	4-6	1
# Calves							
Bearing (true)	200° relative	85° relative	70r	320° relative	320° relative		
Distance (yds)	547	1,750	1,458	150	150		
Length of contact				5 min	5 min		5 sec
Environmental Information							
Wave height (ft)	< 3 ft	< 3 ft	< 3 ft	< 3 ft	< 3 ft	< 3 ft	< 3 ft
Visibility	Good	Good	Good	Good	Good	Excellent	Excellent
BSS	1	1	1	1	1	3	2
% cloud cover	90	90	90	90	90	0	
Operational Information							
Sonar on/off	Off	Off	Off	Off	Off	Off	Off
Ship bearing (true)			110				304
Animal motion	Closing	None	Parallel	Closing	Closing		Parallel
Behavior	Jumping	Splash	Jumping	Bowriding	Jumping		Traveling
Mitigation implemented	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Comments	Motion was closing to the wake, not the ship	Saw splash, did not resight, not sure if it was an actual sighting		Possible common, bottlenose, or pantropical spotted dolphin	Aft lookout reported initial sighting to bridge/	See note*	

*MMOs not on station, information provided by lookouts: no flukes out of water except once but barely out (1 indiv. 1 time). Dark grey/black with no distinctive markings. Larger than dolphins, definitely larger than bottlenose. Head did not come out of water when porpoising. More body observed aft pectoral fin than in front of it.

Data Category	Sighting 15	Sighting 16	Sighting 17	Sighting 18	Sighting 19	Sighting 20	Sighting 21
Sightings Information							
Effort (on/off)	On	On	On	On	On	On	Off
Date	06/06/10	06/07/10	06/07/10	06/07/10	06/07/10	06/07/10	06/09/10
Time	1514	0724	0724	0725	1539	1540	0715
Location	JAX OPAREA	JAX OPAREA	JAX OPAREA	JAX OPAREA	JAX OPAREA	JAX OPAREA	JAX OPAREA
Detection Sensor	MMO	MMO	MMO & Lookout	MMO	MMO	Bridge	MMO
Species/Group	Atlantic spotted dolphin	Unidentified dolphin	Unidentified dolphin	Unidentified dolphin	Unidentified dolphin	Unidentified dolphin	Unidentified hardshell turtle
Group Size	7	1	2	15	2	1	1
# Calves							
Bearing (true)	45° relative	90° relative	30° relative	260° relative	275°	195°	330° relative
Distance (yds)	100	50	30	75	547	500	
Length of contact					3.5 minutes		
Environmental Information							
Wave height (ft)	< 3 ft	4 – 6 ft	4 – 6 ft	4 – 6 ft	4 – 6 ft	4 – 6 ft	< 3 ft
Visibility		Good	Good	Good	Good	Good	Good
BSS		4	4	4	3	3	2
% cloud cover	100	40	40	40	80	80	20
Operational Information							
Sonar on/off		On	On	On	On	On	Off
Ship bearing (true)					165	165	
Animal motion	Parallel	Parallel	Parallel	Closing	Parallel	Closing	
Behavior		Traveling	Traveling	Traveling	Traveling	Porpoising	Dove
Mitigation implemented	N/A	N/A			N/A	Yes*	N/A
Comments		Heading toward fantail; saw body underwater					MMO saw shell and then the turtle dove

*Bridge relayed sighting to CIC, who relayed to soanr to power down by 10 dB. Sonar returned to normal approximately 1 minute after last sighting.

SECTION 5 CONCLUSION

5.1. MARINE SPECIES MONITORING AND LOOKOUT EFFECTIVENESS

The goals of the SEASWITI monitoring effort are provided below, with a conclusion regarding each of the goals:

1. Collect data to determine the effectiveness of the Navy lookout team.

   The survey protocol developed by the University of St. Andrews required changes once implementation was attempted. Data was able to be collected that will feed into a spreadsheet in order to begin determining the effectiveness of the Navy lookouts. The survey was successfully implemented.

   This event is the second aboard a DDG in which data was collected to determine effectiveness; data will be combined with future monitoring efforts in order to determine the effectiveness of Navy lookouts as a whole, rather than specific to each vessel.

2. Obtain data to characterize the possible exposure of marine species to MFAS.

   Sightings information included the bearing and distance of the animal to DDG B. This information can be used to determine, if MFAS was in use, to what level the animal may have been exposed to MFAS. Reconstruction of the event and the determination of the possible exposures of marine species to MFAS will be completed under separate task. Obtaining the data needed to make these determinations was successful.

5.2. LESSONS LEARNED

Many lessons learned were noted for the SEASWITI, and are separated into those for shipboard monitoring and operational information below.

5.2.1. Shipboard Monitoring

- This event was the first for one of the MMOs regarding the lookout effectiveness study. As such, the following changes to the data forms were recommended:

  - Environmental information needs to be standardized or more clearly identified. For example, the sea state descriptions currently provided on the effort datasheet are inaccurate, and resulted in different sea state determinations by different MMOs. Recommend updating the descriptions on the effort form and/or provide a more detailed reference sheet for environmental data.

  - Environmental and sighting data was entered into a spreadsheet each night. When entering sightings information, it was determined that knowing who reported the

sighting would be beneficial. Recommend adding who saw the animal to the datasheet.

- The relative motion of an animal is provided as opening, closing, or parallel, as requested by NMFS. However, an addition option of "none" is recommended, as an animal may be stationary, which would not otherwise be captured. Recommend adding "none" to the relative motion data sheet.

- Sightings data was entered nightly. However, upon entering concurrent sightings by an MMO and the LO, the numbering scheme was discussed. Prior surveys were reviewed, and it was determined that inconsistencies are present in the data. Recommend standardizing the information and fully defining it in the protocol.

- Navy lookouts on the bridge wings, after an initial sighting, enter the pilot house to report the sighting. Therefore, they are unable to resight the animal when the MMO is able. Once the Navy lookout team reports a sighting, should resightings then be recorded by the MMO, or is the trial then considered a success? Should bow riding dolphins be considered separately from an animal sighted at a distance from the ship? Recommend further discussions of the protocol to determine the best way ahead.

5.2.2. Operational Information

- Rechargeable batteries and equipment was used during this study (radios, GPS). Electronic equipment needing to be plugged in needs to be safety checked by shipboard electrician or chief engineer. The ship's electricity is different than on land, and therefore unapproved electronics have the potential to short and harm shipboard systems. Recommend electronics be approved prior to embark, if possible.

- Radios (with headsets) were used by the MMOs to communicate sightings information. However, interference with the ship's systems (e.g., spy radar) resulted in the radios being inoperable. Recommend future lookout effectiveness studies be conducted on FFGs where interference with spy radar systems would be eliminated.

SECTION 6 ACKNOWLEDGEMENTS

We thank the officers and crew for their outstanding support and hospitality during this cruise. We also thank Mr. Jene Nissen (USFF), Ron Filipowicz (USFF contractor), and LT Matt Maples (CDS 24) for pre-cruise planning. We sincerely appreciate the support from Commodore Aaron Jacobs (CDS 24) and his staff for their cooperation.

APPENDIX A LOOKOUT EFFECTIVENESS SURVEY PROTOCOL

Calibrating US Navy lookout observer effectiveness

Information for Marine Mammal Observers

Version 1.0

ML BURT, L THOMAS and OTHERS

CONTENTS

1 INTRODUCTION

1.1 Aim of the project

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

Data will be collected to help quantify the effectiveness of the OT during Navy s in February 2010 using the protocol detailed in this manual. The protocol will then be revised, for use in a second exercise to take place later in 2010. Further iterations are expected thereafter.

1.2 Overview of analysis methods

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

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

1.3 Overview of survey methods

In order to obtain a realistic probability of detection of every surfacing for the OT, it is important that the OT search as usual. However, some additional information from the OT will be required:

namely, information on every surfacing. Since this is not typically recorded, and we do not wish to interfere with the normal operation of the OT, we designate one of the MMOs to ensuring that this information is obtained (as detailed below). This MMO will be called the liaison MMO (LMMO) since they need to liaise with the OT. The other MMOs also search and record every surfacing, in such a way that the OT do not know what they are doing. To distinguish them from the LMMO, we refer to them as surveying MMOs (SMMOs).

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

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

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

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

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

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

1.4 Overview of the manual

This manual describes the survey protocol and sighting procedures of the various observers and details the data to be collected. It should be borne in mind that the protocol may need to be adapted if procedures are found to be infeasible. Contact details for the St Andrews team are given in section 1.5.

1.5 Contact details

If anything is unclear, or the protocol can not be implemented, then do not hesitate to contact the support team at St Andrews University, Scotland. Note that the UK is 10 hours ahead of Hawaii.

NAME	TELEPHONE	EMAIL	FAX
Len Thomas	+44 1334 461801	len@mcs.st-and.ac.uk	+44 1334 461800
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2 SURVEY PROCEDURE

2.1 Search platforms

2.1.1 Frigate

The platforms available for observation on a frigate are the bridge, bridge wings (with Big Eyes installed), the upper bridge and the fantail (stern of the ship).

2.2 Observer configuration

2.2.1 OT

Dedicated LOs are positioned on the upper bridge and fantail with additional observers operating opportunistically on the bridge. An acoustic observer may also be available. We assume that the upper bridge LO will be the one primarily making confirmed sightings, and that all sightings by other members of the OT will be reported to them. Officers on the bridge or in combat are

responsible for entering marine mammal records into a log (Appendix B); this log will not be used in the current survey as it is not detailed enough for our purposes – instead the LMMO will keep detailed records (see below). All OT personnel should search independently of the SMMOs.

2.2.2 MMO

Three MMO are required; two on the bridge wings who are actively searching (SMMOs) and one with the navy LO on the upper bridge (the LMMO). The primary purpose of the MMO on the upper bridge is to record all detections and surfacings detected by the OT. The MMO should all be in contact with each other and also be aware of any sightings made by the OT.

It is anticipated that the MMOs will rotate positions, for example, port SMMO, starboard SMMO, LMMO, resting. If it is feasible, the fourth MMO could be stationed in the bridge in order to ensure that all bridge sightings are recorded.

It is also conceivable that the LMMO may sometimes be able to operate as an additional search platform, aiding the SMMOs, if they are able to stand behind the LO and hence not cue them with their sightings. This is something that will need to be determined on board the vessel.

Lastly, it may be useful to have a fourth MMO on duty, aiding the SMMOs as a data recorder. It is our hope that the SMMOs will be able to use audio recording devices to record data, rather than having to look down and record data on paper. Looking down greatly increases the chance of losing a tracked animal, missing sightings, etc. However, should it not be possible to obtain an audio recording device, or should its use not be feasible, then having a fourth MMO to transcribe SMMO data would be very valuable.

2.3 OT procedure

It is important that the OT search as usual and independently of the MMO. Having detected a marine mammal, the LO should report each surfacing of the group they detect to the LMMO. The LMMO will be positioned on the upper bridge will record this information. However, the LO should not alter their usual search behaviour in order to better detect repeat surfacings – they should carry on with whatever search behaviour they would use if the MMOs were not present.

If the bridge, or other member of the OT, detect an animal, they should inform the LO. This will both inform the LMMO who can record the information and allow the LO to track each surfacing. It is not necessary for the bridge or other observers to inform the LO of each surfacing they detect after the first one, if it is obvious it is of the same group, unless this is their normal procedure. As stated earlier, we are not focussed on repeat surfacings.

It is our understanding that LOs have access to a compass and this should be used to determine the angle from the trackline to the sighting if this is their usual method. Distances are estimated by eye.

2.4 SMMO procedure

The main functions of the SMMO are to detect and track marine mammals and determine whether sightings made by the OT and reported to them by the LMMO are duplicates with sightings they have made. The SMMOs should search from the vessel to the horizon using binoculars concentrating forward of the vessel to abeam. The search pattern is:

- Port observer: searches on the port side of the vessel from about 5^{o} starboard to abeam.
- Starboard observer: searches on the starboard side from about 5^{o} port to abeam.

On detecting an animal, they should attempt to record each surfacing until the animal goes abeam. Tracking an animal has three uses: it helps to identify any animals subsequently seen by the OT; species and group size can be more accurate (because animals and groups are seen more than once) and information on surfacing behaviour is required for the analyses. The MMOs will need to be in contact with each other and thus be aware of any sightings made by the OT which will help with duplicate identification; duplicate sightings are animals seen first by the SMMO and then by the OT (as reported by the LO via the LMMO).

If the OT detect an animal prior to the SMMO, then the SMMO should attempt to locate it to determine species and group size and then continue to track and record each surfacing (but see section 3.4, below). If the OT sighting occurs during SMMO tracking, the SMMO should continue to track the animal until it is lost, or goes abeam, and then attempt to locate the sighting made by the OT.

SMMO should primarily concentrate their search effort forward of abeam but if substantial numbers of animals approach the vessel from behind abeam (i.e. dolphins that can swim faster than the vessel) then it may be necessary to search behind abeam.

Angleboards should ideally be used to measure bearings to sightings relative to the ship and the binoculars should have reticles for use in calculating distances.

Each SMMO should record information into an audio recording device for later transcription on to a SMMO sighting form; alternatively a fourth MMO may be available to do real-time data transcription. Effort information should be recorded on an MMO effort form.

The SMMOs assess the duplicate status of each surfacing.

If there are too many animals in view for an SMMO to keep track of, the SMMO should choose a small number of trials (one or two) that they can track accurately and follow them until it is clear the OT has duplicated that target or the track ends.

2.5 LMMO

The primary function of the LMMO is to record information (section 4) on the first sightings of all the OT. Information on all subsequent sightings should also be recorded if possible. The LMMO will pass the information of sightings to the SMMOs as soon as possible to determine if the OT has duplicated as sighting made by the SMMOs. In some cases this will inform the SMMOs of animals not yet detected. The LMMO can also actively search for animals and

inform the SMMOs of any sightings they make (so the SMMOs can use them to set up trials), as long as this does not cue the LO or compromise data recording.

3 SIGHTING PROTOCOL

This section relates to the procedure to be followed on detecting a marine mammal.

3.1 LO

On sighting a marine mammal, the LO should inform the LMMO giving all required information (see section 4) but in particular time of sighting, species, sighting angle, sighting distance and group size. The LO should also give the information for any subsequent sightings of the same group to the LMMO.

3.2 Bridge (or other OT member)

On sighting, or detecting, a marine mammal, the bridge should inform the LMMO – this may be via the LO if LMMO is not in direct contact with the bridge. Subsequent sightings of the same should also be passed to the LO, although it seems likely in practice that the primary responsibility for tracking already sighted groups within the OT will fall upon the LO.

3.3 SMMO

On sighting a marine mammal, the SMMO should

1. Collect and record the following information: time of sighting, species, sighting angle, sighting distance and group size. Other information (such as cue or behaviour) should be collected if there is time.

2. Attempt to track the animal, recording information on all subsequent sightings.

3. Assess duplicate status, maybe in consultation with the LMMO.

4. Inform the bridge of any animal within the operational standoff range of the vessel if active sonar operations are taking place.

3.4 Tracking priority

The first priority for SMMOs is to find and track animals before the OT see them, to set up trials for the OT. When the OT report a sighting (via the LMMO) of a new group they should determine whether it is a duplicate or not (i.e. something they were tracking already). A secondary priority is to track groups already seen by the OT, to determine resighting rates. With this in mind, the procedure for SMMOs on detecting an animal is as follows:

- On locating an animal, or group, attempt to track until the animal is lost or is a long way behind and unlikely to approach the vessel.

- If the OT detect an animal while both SMMOs are searching (i.e. not tracking anything), one SMMO should attempt to locate the OT sighting (to confirm species and group size) and continue to track it and record each surfacing. This will be necessary to determine how many surfacings the OT detect. The other SMMO should continue to search as setting up new trials is more important.

- If the OT detect an animal while one SMMO is engaged in tracking, that SMMO should determine whether the OT sighting is a duplicate or not. If it is, the SMMO should continue tracking the group while the other SMMO searches for new groups. If it is not, the SMMO should continue tracking their group, while the other SMMO attempts to track the group seen by the OT, if possible. If this is not possible, the other SMMO should revert to searching for new groups to track.

- If the OT detect an animal while both SMMOs are engaged in tracking, the SMMOs should continue determine if the OT sighting is a duplicate or not. In either case, they should continue tracking their groups until the track is finished or the group is sighted by the OT.

3.5 Group size definition

In the case of aggregated groups, the angle and distance measurement should be estimated to the geometric centre of the aggregation. A group can be thought of as the smallest unit that can be tracked as a unit. A convenient rule is, for example, to define a group as containing animals not more than 3 animal lengths from each other (this may depend on species). The group may exhibit the same swimming pattern and general behaviour although not necessarily with a synchronised surfacing pattern.

Difficulties may arise when animals are not in tight, easily defined clusters, but in loose aggregations whose boundaries and group size must be determined subjectively. In this case, it is better to identify smaller, homogenous groups within the aggregation, and associate each with an angle, distance and group size.

Problems can also arise when a group is formed of animals swimming in a long line at relatively equal distances from each other (e.g. pilot whales). In this case, group boundaries can be taken at convenient discontinuities in the distribution.

Large groups of dolphins may comprise of several hundreds of animals. Often these groups are compact and form a single unit. Sometimes subgroups may form but may only last for a short time with frequent interchange of animals between groups. In this case, it is better to treat the whole group as a single unit. As these groups will have a continuous cue, it is not necessary to make continuous resightings, but only at appropriate intervals, say 5 minutes or perhaps more frequently close to the vessel.

If relatively stable subgroups can be identified, then the details for the first subgroup sighted should be recorded and then this subgroup should be followed. Include a comment that it is part of a larger aggregation, and if possible, how many other subgroups there are in the aggregation and group sizes. A duplicate sighting would occur if the OT detects the subgroup being tracked.

If a groups splits while being tracked, then one subgroup should be tracked. The groups sizes recorded should reflect that the group has split and is now smaller than the original sighting. The fact that the group has split should be recorded in the data. When tracking of the subgroup has finished, the SMMO should then try to relocate one of the other subgroups and track it.

3.6 Surfacing and availability

A surfacing is defined as any opportunity that an animal is available to be detected visually. This could be when the animals are at the surface or even below the surface if the water is clear enough.

Some animals may be intermittently available, for example if they are at the surface for a short time and then dive and then return to the surface. Others might be continuously available, for example large groups of dolphin schools which surface asynchronously. As ever, it is important to record the first sighting of these and as discussed in section 3.5, record the final sighting and, if feasible, at appropriate intervals such as every 5 minutes.

Some animals may provide both intermittent and continuous cues (i.e. a blow but then stays close to the surface and if the water is clear enough can still be seen). In this case, treat each discrete surfacing (ie. fluke, blow, body) as a resurfacing but include a comment that the animal is continuously available.

4 DATA COLLECTION

It is anticipated that data will be recorded onto audio recorders or paper forms and transcribed at the end of each day. The information collected by the OT is recorded by the LMMO onto a sightings form. Sightings by the SMMOs are recorded or transcribed onto a MMO sighting form. Forms for search effort and weather and other basic information are also provided. Note the form number and total number of forms (at the top of the paper form) is used to prevent forms being lost.

4.1 Sightings form

This form should be used to record all sighting information. All information is required upon initial sighting. Information needed for each resurfacing is indicated in bold.

FIELD	DESCRIPTION
SIGHTING #	**This is the number of each sighting and should be sequential.**
RESIGHTING #	**The number of times the object has been resighted. The initial sighting will have a resighting number of zero and subsequent resightings will be 1, 2, etc. Each resighting starts a new column on the sighting report form.**
RESIGHTING. STATUS	**D definite resightings (at least 90% likely to be the same animal or group)** **P possible resighting (more than 50% likely)** **R remote resighting (less than 50% likely)**
TIME	**Time of sighting.**

FIELD	DESCRIPTION
SPECIES CODE	**The five letter code used to identify the species. Refer to section 4.4. If a species is not listed, then include this information in the 'Comment' for the record.**
DURATION (if cue continuous)	**If the cue is continuous, then indicate the length of time, you were observing this sighting.**
ANIMAL (A) bearing	**Estimated angle of the bow of the ship to the sighting. A sighting dead ahead is 0^o and angles go from 0-360^o.**
SIGHTING DISTANCE	**Estimate of sighting distance in metres?**
GROUP SIZE	**Give the best estimate of group size, including calves. In mixed schools enter the number of each species.**
DUPLICATE SIGHT #	**Duplicate sighting number. This allows duplicate sightings to be cross-referenced.**
DUPLICATE TRIAL	**Indicate if this is a valid duplicate:** **Yes – sighting seen first by MMO** **No – sighting seen first by OT**
DUPLICATE STATUS	**Duplicate status of a sighting:** **D – definite duplicate (at least 90% likely to be the same animal)** **P – possible duplicate (more than 50% likely)** **R – remote change of being a duplicate (less than 50% likely)**
SHIP LATITUDE	
SHIP LONGITUDE	
SHIP (S) BEARING	
RELATIVE MOTION A/S & A'S BEARING	Indicates of the animal is opening away from the ship, closing towards the ship, or moving parallel to the ship's track. The heading of the animal relative to the ship should be recorded relative to the line of sight where 0° indicates the animal is heading directly away, 90° indicates the animal is heading from left to right, 180° - directly towards the ship, 270° - heading right to left.
DETECTION SENSOR	Observer who made the sighting: MMO + observer code LO Bridge Acoustic
NUMBER OF CALVES	Enter the number of calves in a group.

FIELD	DESCRIPTION
SIGHTING CUE	Indicator of cue which led to the sighting: BL - blow BW – bowride BY - body DV - dive FL – fluke up GL – glint of sunlight off body HS – head slap JU - jump /breach/spin PA – peduncle arch PP – porpoise PS – pectoral fin slap SL- slick, footprint or ring SN – spin SP - splash TS – tail slap WL – seabirds or other associated wildlife OT – other
BEHAVIOUR	BR – Breaching BW – Bow riding FD – Feeding FL - Fluking FS – Flipper slapping ML – Milling LO – Logging RE – Resting TR – Travelling TS – Tail slap VO - Vocalizing
END OF TRACK	Reason for stopping a track. BE - sighting behind the beam LO - sighting lost OB - sighting obscured NC - no change of the sighting with respect to the boat (this may happen if the sighting is far away) MA - sighting passed to other LO to follow OT – other
OPERATIONS INFORMATION	Were any mitigation measures implemented?
COMMENT	Any additional information.

4.1.1 Sighting number/Duplicate sighting number

The duplicate sighting number on the sightings form is the number given to the surfacing by the LMMO, and called down to the SMMOs. If the SMMOs think this is the same as a surfacing they sighted, they give write down the LMMOs sighting number under "DUPLICATE SIGHT #" on the form. Two types of duplicate sighting can be distinguished: those that represent valid trials for estimating the OT detection function and those that do not. Valid trials are where the SMMO saw the surfacing independently (for example because they were tracking the group) and then the LMMO radios down to inform the SMMO that a surfacing has been seen by the OT, and the SMMO determines it's the same as the one they just saw. In this scenario, "Yes" should be entered under "DUPLICATE TRIAL". By contrast, trials do not occur when the LMMO alerts the SMMOs to a surfacing that the OT have seen but the SMMOs had not previously seen, and then the SMMOs see the surfacing and record information on it. In this case, although it's a duplicate (because both OT and SMMO saw the surfacing), it is not a valid trial as the OT saw it first directed the SMMO to see it. Hence "No" should be entered under "DUPLICATE TRIAL".

This duplicate information should be recorded by the SMMO since they are making any duplicate assessment. It is not necessary for the LMMO to fill in this information. The LMMO just need to pass sighting numbers of OT sightings to the SMMO so that the SMMO can fill in the duplicate information on their forms.

4.1.2 Multi species sighting

When recording groups of mixed species, record the information on separate lines but assign the same sighting number.

4.1.3 High density regions

It is anticipated that in the region chosen for the survey, animal density will be low. However, if the density of animals is high, so that the assessment of duplicate status becomes difficult, then indicate this on the effort form (see section 4.2). Cross-referencing of duplicates may need to be reconsidered. If density of animals is high (i.e. detections occur more than once every few minutes), then the timing of sightings becomes critical.

4.2 MMO Effort/weather form

This form should be completed by the LMMO everytime an 'event' occurs, for example at the start/end of search effort, observer rotation, changes in the weather. If the density of animals is too high to make it difficult to assess duplicate status, then indicate this in the 'Event' field. Sometimes the weather will be too bad for searching, in which there will be no search effort.

FIELD	DESCRIPTION
EFFORT	Whether search effort is ON or OFF.
EVENT	Record the event: 1 – begin search effort 2 – stop search effort 3 – observer rotation 4 – weather change 5 – transect waypoint 6 – high animal density 7 – back to normal animal density 8 – end of day
TIME	Time of event
LATITUDE	
LONGITUDE	
Port MMO	MMO who is searching on port side of vessel.
Starboard MMO	MMO who is searching on starboard of vessel.
LMMO	MMO who is acting as liaison MMO.
SEA STATE	Beaufort Sea state on a scale of 0-7.
SONAR	Is sonar On or Off?
EXPLOSIVES	Are explosives in use: Yes or No.
VISIBILITY	General impression for spotting marine animals: B – Bad (<0.5km) P – Poor (0.5 – 1.5km) M – Moderate (1.5 – 10km) G – Good (10 - 15km) E – Excellent (<15km)
WAVE HEIGHT	Light (0 – 3ft) Moderate (4 – 6ft) Heavy (>6ft)
SWELL DIRECTION	
WIND DIRECTION	
WIND SPEED	
% GLARE	
% CLOUD COVER	

4.3 MMO Observer code form

This should be completed at the start of the survey and the observer codes decided. The heights are needed if reticle readings have to be converted to distances.

FIELD	DESCRIPTION
CODE	Two letter code for each observer.
NAME OF OBSERVER	Name of the observer
EYE HEIGHT	Eye height (in feet) of the observer (to be used for converting reticle estimates to distances).
PLATFORM HEIGHT	Height of SMMO platform (in feet) above sea level.

4.4 Table of species codes

CODE	COMMON NAME	SCIENTIFIC NAME
BALMU	Blue whale	*Balaenoptera musculus*
BALPH	Fin whale	*Balaenoptera physalus*
MEGNO	Humpback whale	*Megaptera novaeangliae*
BALAC	Minke whale	*Balaenoptera acutorostrata*
BALED	Bryde's whale	*Balaenoptera edeni*
BALBO	Sei whale	*Balaenoptera borealis*
BALMU	Blue whale	*Balaenoptera musculus*
BAL--	Unidentified rorqual	Balaenopteridae
WHALE	Unidentified whale	
ZIP--	Unidentified beaked whales	Ziphiid
MES--	Unidentified *Mesoplodon*	*Mesoplodon* spp.
MESDE	Blainville's beaked whale	*Mesoplodon densirostris*
ZIPCA	Cuvier's beaked whale	*Ziphius cavirostris*
INDPA	Longman's beaked whale	*Indopacetus pacificus*
PHYMA	Sperm whale	*Physeter macrocephalus*
KOGBR	Pygmy sperm whale	*Kogia breviceps*
KOGSI	Dwarf sperm whale	*Kogia simus*
KOG--	Unidentified pygmy/dwarf sperm whale	*Kogia* spp.
ORCOR	Killer whale	*Orcinus orca*
PSECR	False killer whale	*Pseudorca crassidens*
FERAT	Pygmy killer whale	*Feresa attenuata*
PEPEL	Melon-headed whale	*Peponocephala electra*
GLOMA	Short-finned pilot whale	*Globicephala macrorhynchus*
TURTR	Bottlenose dolphin	*Tursiops truncatus*
STEAT	Pantropical spotted dolphin	*Stenella attenuata*
GRAGR	Risso's dolphin	*Grampus griseus*
STELO	Spinner dolphin	*Stenella longirostris*

CODE	COMMON NAME	SCIENTIFIC NAME
STECO	Striped dolphin	*Stenella coeruleoalba*
STEBR	Rough-toothed dolphin	*Steno bredanensis*
LAGHO	Fraser's dolphin	*Lagenodelphis hosei*
DOLPH	Unidentified dolphin	
CET--	Unidentified cetacean	
CHEMY	Green turtle	*Chelonia mydas*
EREIM	Hawksbill turtle	*Eretmochelys imbricata*
DERCO	Leatherback turtle	*Dermochelys coriacea*
CARCA	Loggerhead turtle	*Caretta caretta*
LEPOL	Olive ridley turtle	*Lepidochelys olivacea*
TURTL	Unidentified turtle	
MONSC	Hawaiian monk seal	*Monachus schauinslandi*

5 OTHER ACTIVITIES

5.1 Final cruise report

At the end of the cruise a brief report which contains a general evaluation of the survey (i.e. suitability of vessel, platform locations, search procedure, sighting protocol, equipment, general operation etc.) would be helpful. Perhaps include a summary of the survey data collected (number of miles/km searched, number of sightings of each species) and any problems that have occurred, any adaptations to the protocol that may have been implemented or if any new species codes have been added. This information will be useful to refine survey methods for the next survey and in the analysis of the data.

5.2 And finally!

Have a good time and enjoy the survey! Don't forget you can contact the St Andrews team at any time (time difference allowing).

APPENDIX A
EQUIPMENT LIST

LO Equipment

Each LO should have the following equipment, which are all provided:

- Compass for measuring sighting angle
- 7x50? binoculars for searching
- Big Eyes for group size
- Headsets or other means of communicating with bridge

MMO Equipment

Each MMO should have the following equipment:

- 7x50? Binoculars with reticles
- Compass (provided on platform)
- GPS or synchronised digital watch
- Radios (handheld or headsets to communicate with other MMO)
- Clipboard
- Pencils
- MMO sighting forms
- MMO effort/weather forms (LMMO only)
- Equipment to communicate with bridge
- Crib sheet for converting reticles to distances?
- Crib sheet of species codes
- Audio recording device, if possible, for recording sightings without needing to look down to paper survey form. Automatic time stamp, if possible.

APPENDIX B LO DATA – DAILY MARINE MAMMAL LOG

The following table describes the data recorded in the LO 'Daily marine mammal log'.

FIELD	DESCRIPTION
A. DTG	Date and time of sighting DDHHMM Z MMM YY
B. Species/Type of mammal	Types are Whale/Dolphin/Porpoise/Seal/Sea lion/Turtle/Generic (i.e. unknown)
C. Number of mammals	Number
D. Calves	Yes/No
E. Initial detection source	Visual/Aural
F. Initial bearing/range	Bearing in degrees (true)/ Range in yards
G. Unit position	Latitude DDMMSS N/S and Longitude DDDMMSS E/W
H. Unit course/speed	Course in degrees (true)/ Speed in knots
I. Last known bearing/range	Bearing in degrees (true)/ Range in yards
J. Total time visually observed	Time in minutes
K. Wave height	Wave height in feet
L. Visibility	Visibility in nautical miles
M. MFAS status	No/Yes or On/Off
N. MFAS action taken	Powerdown -6dB/Powerdown -10dB/Shutdown/None
The following fields are completed if MFAS was transmitting when a mammal was sighted and subsequently powered down/shut down, or course changed.	
O. Duration of action	Minutes
P. Maneuver conducted	Turn STBD/Turn PORT
Q. Degrees of course change	Degrees
R. Range action taken	Range in yards
S. Action impact	Tactical degradation assessment – examples: None Slight - degraded ASW screen integrity when ship manoeuvred to open whales Moderate – lost contract when power reduced Significant – engagement interrupted when MFAS as shutdown
T. Narrative of observation	Examples: Dolphins sighted at 12ooyds off port bow, closing on ship. Maneuvered to confirm bow riding and continued MFAS events.

APPENDIX B RECOMMENDED EQUIPMENT LIST FOR MMO SHIPBOARD SURVEYS

Equipment	Quantity	Location
Hand-held marine VHF radio	3	• SMMO on port wing • SMMO on starboard wing • LMMO
Hand-held GPS	3	• SMMO on port wing • SMMO on starboard wing • DMMO • Recommend GPS unit used be consistent; still determining best-suited GPS available
Audio data recorders with timestamp	3	• SMMO on port wing • SMMO on starboard wing • LMMO
Binoculars (with reticle)	4	• SMMO on port wing • SMMO on starboard wing • LMMO • DMMO Recommend all binoculars be Fujinon 7 X 50 for consistency.
Digital watch with seconds showing	4	• SMMO on port wing • SMMO on starboard wing • LMMO • DMMO
Angle board	3	• SMMO on port wing • SMMO on starboard wing • LMMO
Camera	2	• SMMO on port wing • SMMO on starboard wing
Clipboards	4	• SMMO on port wing • SMMO on starboard wing • LMMO • DMMO
Pelican case/dry bag	Ship dependent	One container at each MMO location is necessary. Depending on the type of vessel, the number of containers/bags needed may vary. • FFG: 3, one each for starboard bridge wing, port bridge wing, and flying bridge • DDG: 3 • CG: 3
Misc. Supplies: zip ties, duct tape, electrical tape, rubber bands		