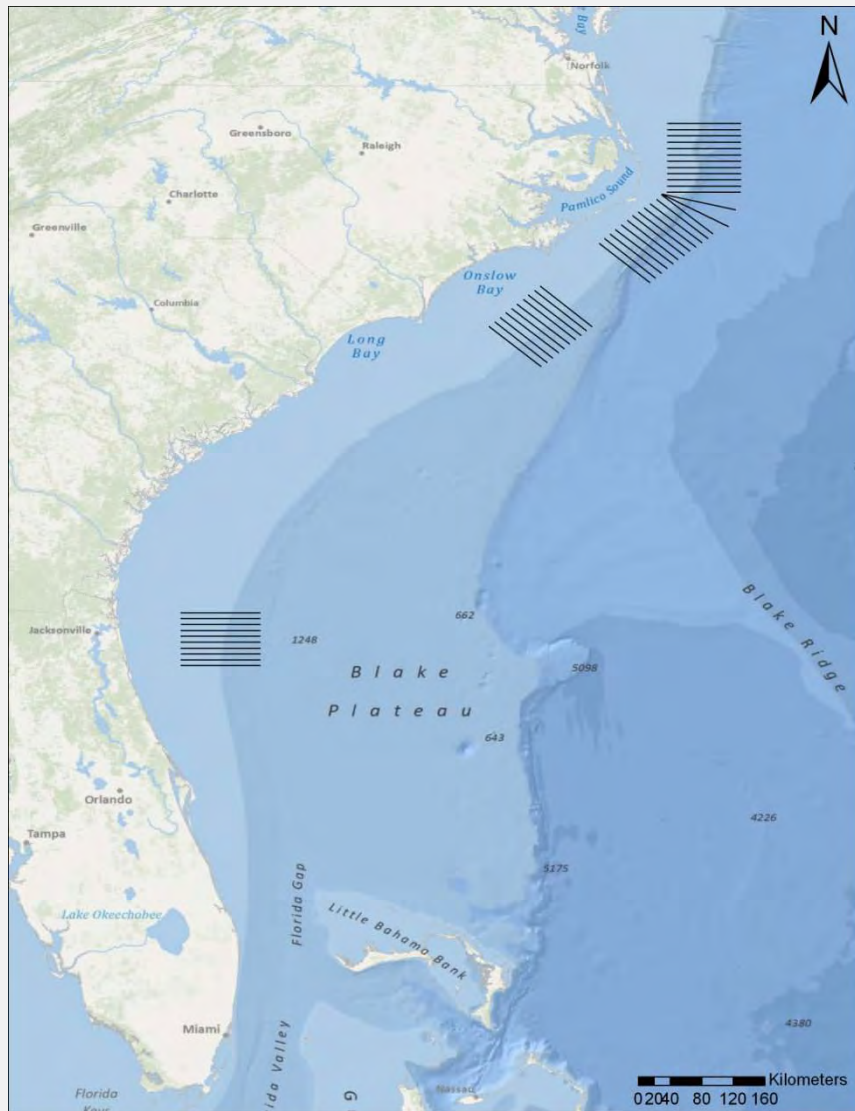


***Appendix D***

***Hatteras/Onslow Bay/JAX Baseline Monitoring Annual Review  
Presentations***

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# AFAST Protected Species Monitoring Program

Jacksonville, FL  
Onslow Bay, NC  
Cape Hatteras, NC

July 2010 – December 2011



AFAST Monitoring of Protected Species  
Jacksonville, FL, Onslow Bay and Cape Hatteras, NC  
July 2010 to December 2011

# Performers

Duke

Project Co-ordination  
Vessel-Based Line Transect Surveys  
Photo-ID and Biopsy Sampling  
Passive Acoustic Monitoring

UNC Wilmington

Aerial Line Transect Surveys

Scripps

Passive Acoustic Monitoring

St. Andrews

Density Estimation & Modeling



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# Timeline of Monitoring Program

## Onslow Bay

June 2007

Monitoring Program Begins

Fourth Year of Reporting

## Jacksonville

January 2009

July 2009

Aerial Surveys Initiated

Full Monitoring Program Begins

Second Year of Reporting

## Hatteras

May 2011

TO-9 & Monitoring Program Begins

First Year of Reporting



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# Significant Changes in this Reporting Period

1. Addition of Hatteras Survey Area (Vessel, Aerial & Passive Acoustics)
2. Elimination of Onslow & JAX Vessel Line Transect Surveys (May 2011)
3. Vessel Survey Effort Redirected to Photo-ID & Biopsy Sampling
4. Single HARP Deployment at Each Site



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# Presentation Outline

Task Order 9 & Hatteras Vessel Surveys	Andy
Onslow Vessel Surveys	Zach
Onslow Photo-ID	Kim
JAX Vessel Surveys and Photo-ID	Heather
Passive Acoustics	Lynne
Aerial Survey Effort Across Sites	Bill
Onslow and Hatteras Aerial Surveys	Ryan
JAX Aerial Surveys	Erin
Density Estimation	Charles



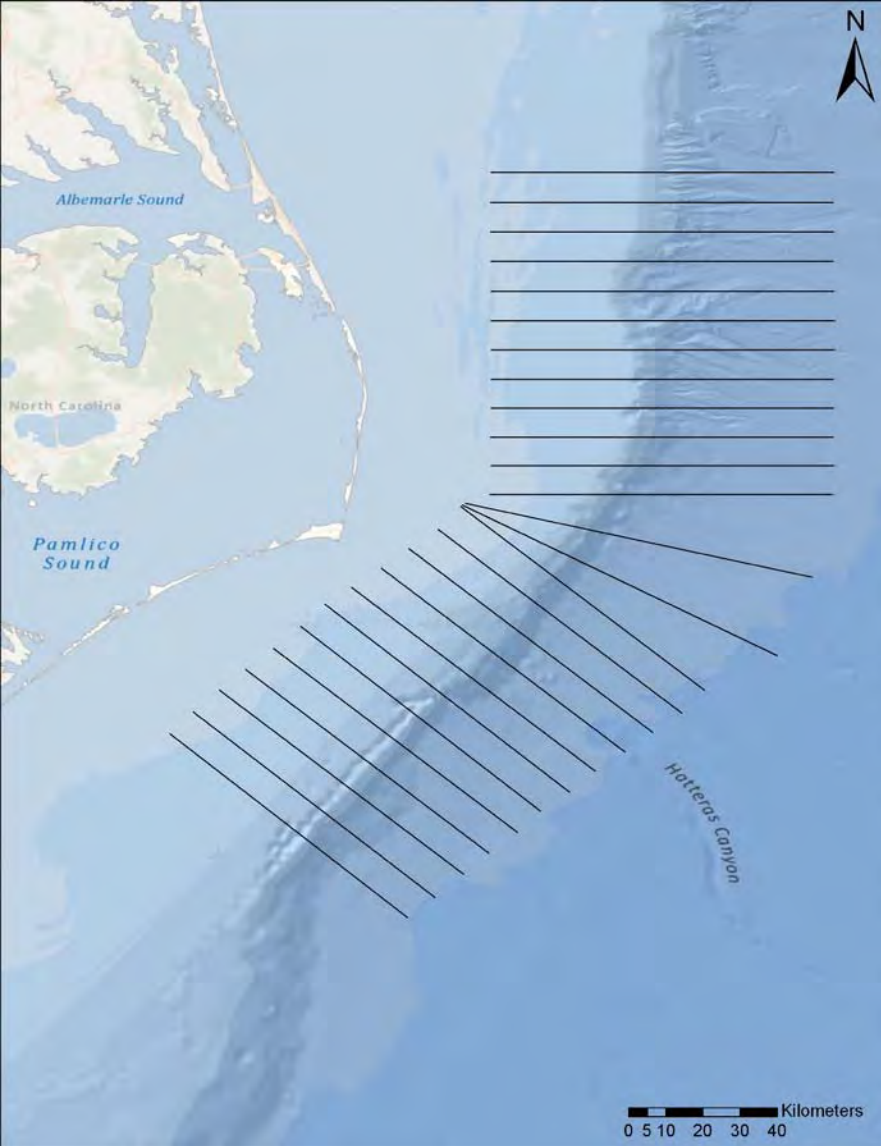
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## Task Order 9 – Cape Hatteras

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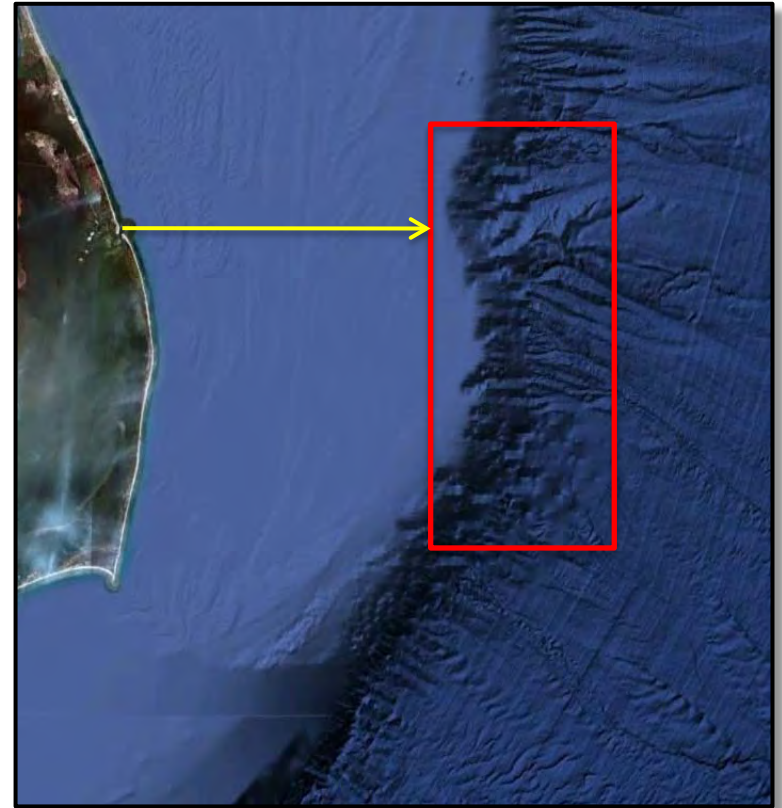
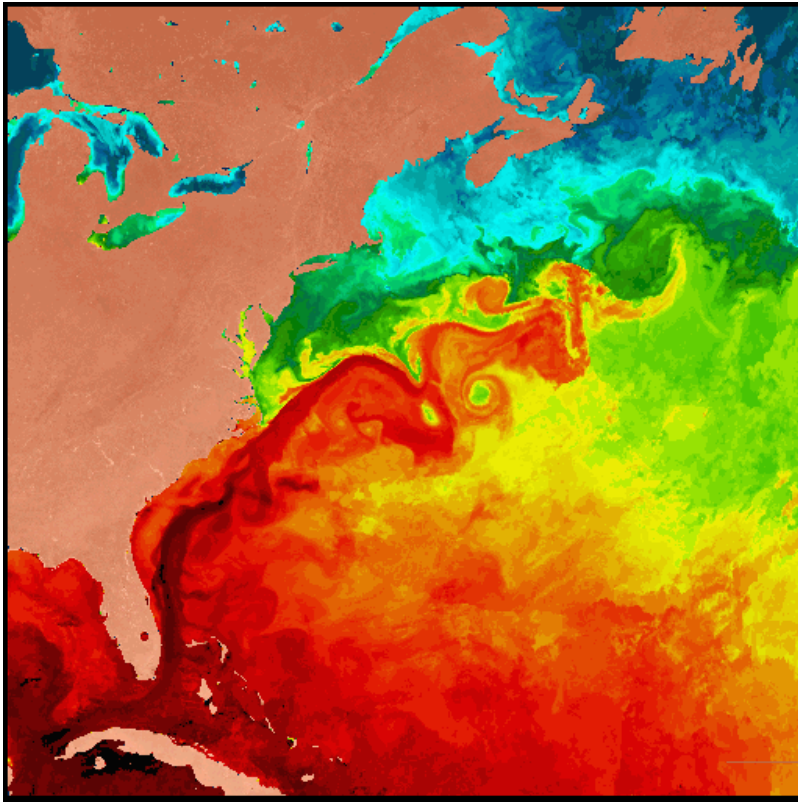




## Objectives – Cape Hatteras

1. Document the distribution of marine mammals off Cape Hatteras;
2. Collect biopsy samples from representative small cetaceans in this area;
3. Determine whether short-finned pilot whales respond to the sounds of a Simrad EK-60 38 kHz echosounder; and
4. Collect baseline data on the diving behavior of short-finned pilot whales.

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## Task Order 9 – Cape Hatteras

Day Trips with:

*RV Volute*

*RHIB Exocetus*

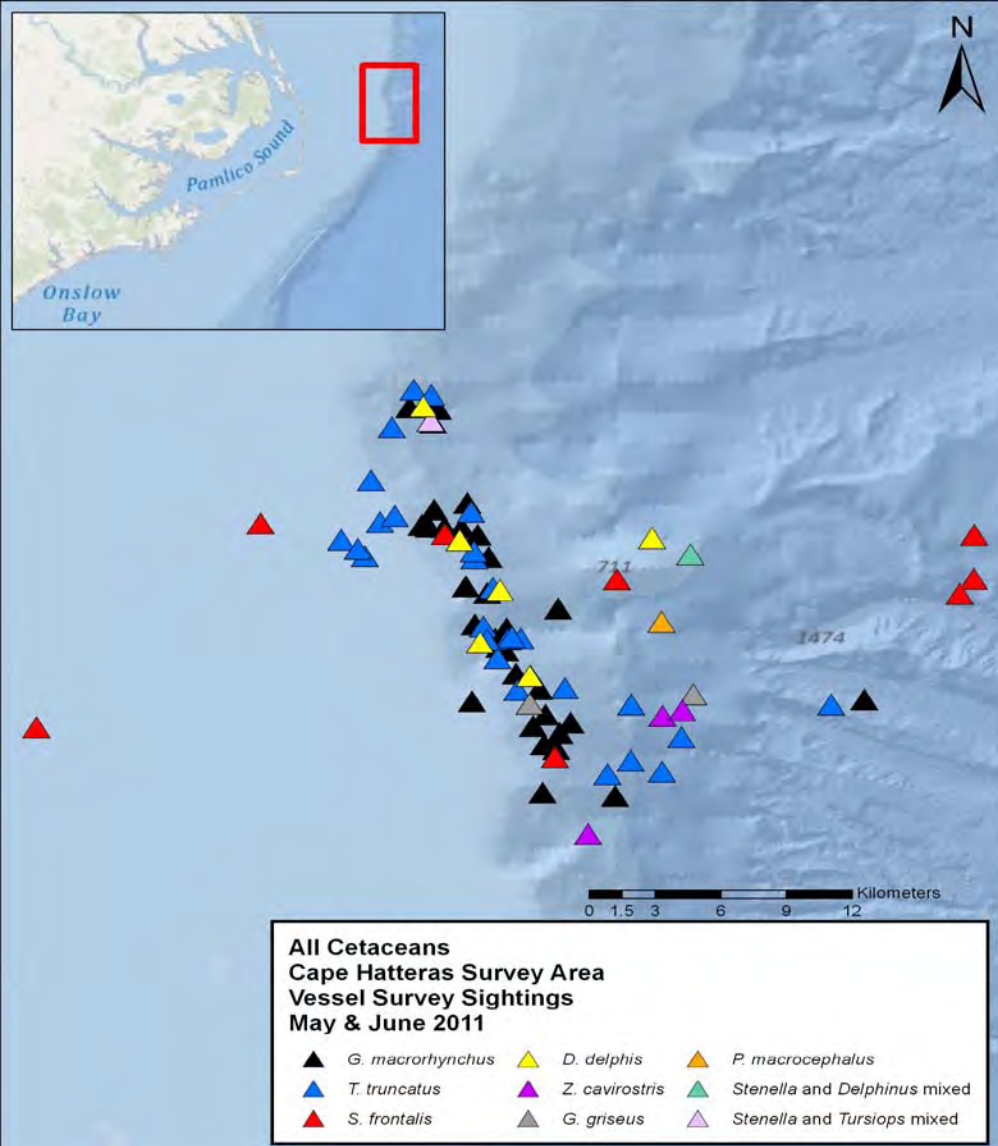
*RHIB Balaena*

13 Field Days

23 Small Boat Days



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## Sightings – Cape Hatteras

13 field days

82 sightings of seven species

24 biopsy samples

14 *Tursiops truncatus*

6 *Stenella frontalis*

4 *Globicephala macrorhynchus*

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# Pilot Whale EK-60 Experiment – Cape Hatteras



DTags – Fine-Scale Diving Behavior



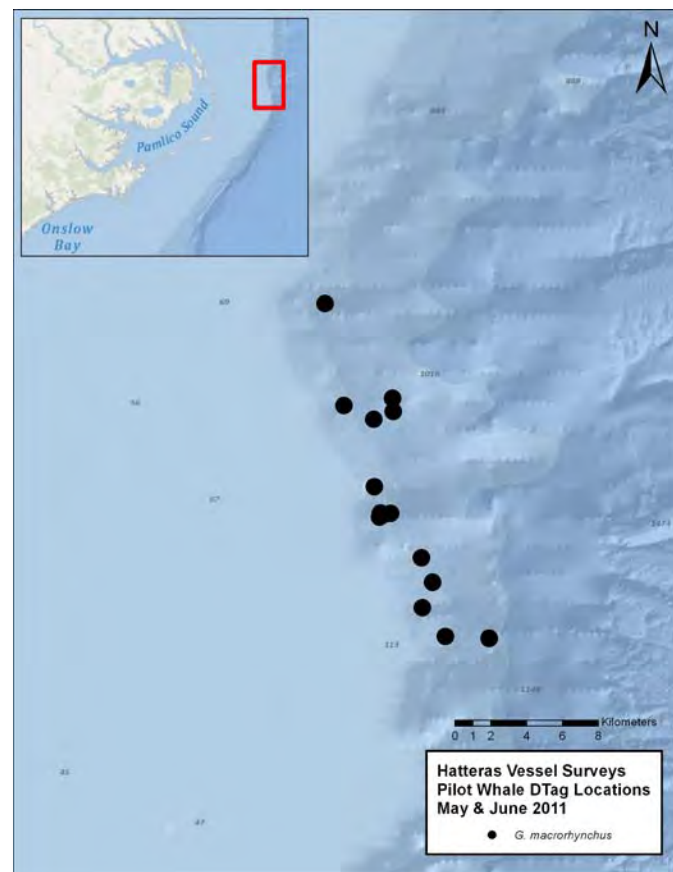
Photo-ID & Focal Animal Behavior



Biopsy Sampling



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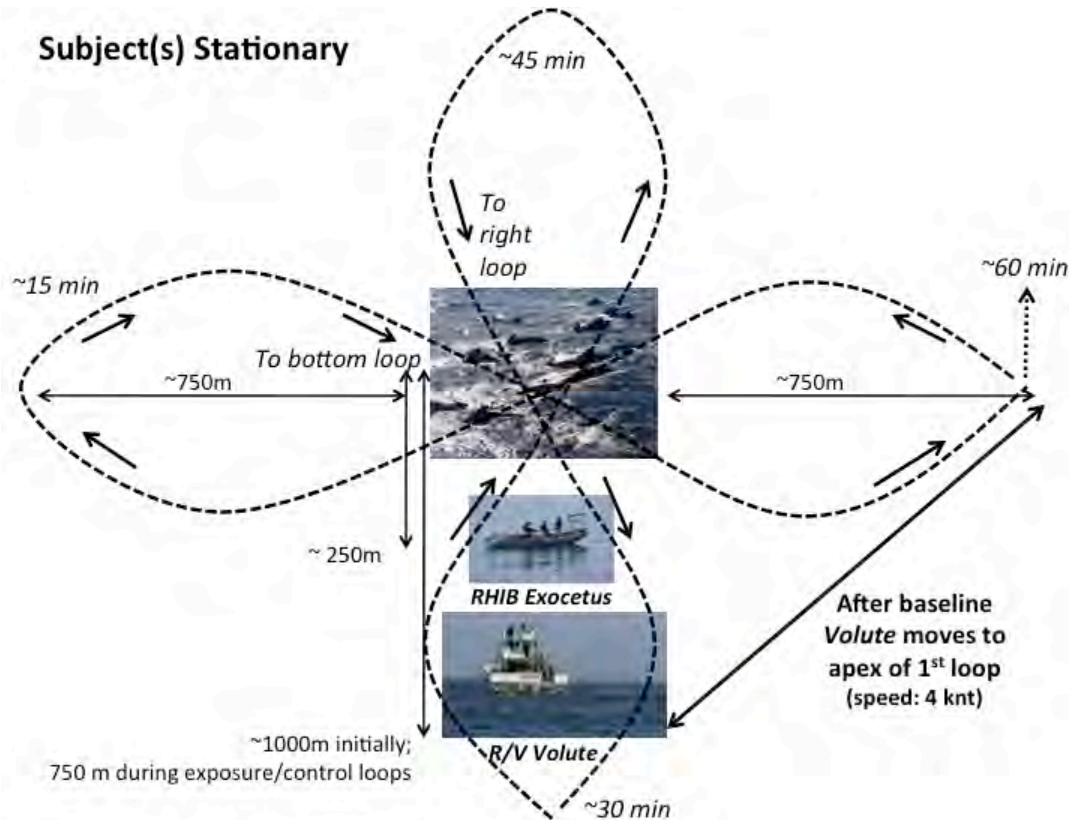


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# Pilot Whale EK-60 Experiment – Cape Hatteras



## Experimental Protocol:

1 Hour Pre-exposure

1 Hour First Treatment

1 Hour Second Treatment

1 Hour Post-exposure

Order of treatments (EK-60 & control) was randomized and observers were blind

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Jacksonville, FL, Onslow Bay and Cape Hatteras, NC  
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Animal ID	DTag Version	Duration	Treatment
Gm-11-147a	2	4:29	Playback
Gm-11-148a	2	4:21	Playback
Gm-11-149b	2	4:17	Control
Gm-11-149c	2	3:26	Playback
Gm-11-150a	2	4:16	Playback
Gm-11-150b	2	3:21	Control
Gm-11-155a	2	3:52	Playback
Gm-11-156a	2	2:56	Control
Gm-11-158a	3	4:20	Control
Gm-11-158b	2	4:25	Playback
Gm-11-165a	2	4:19	Control

## DTag Deployments on Pilot Whales

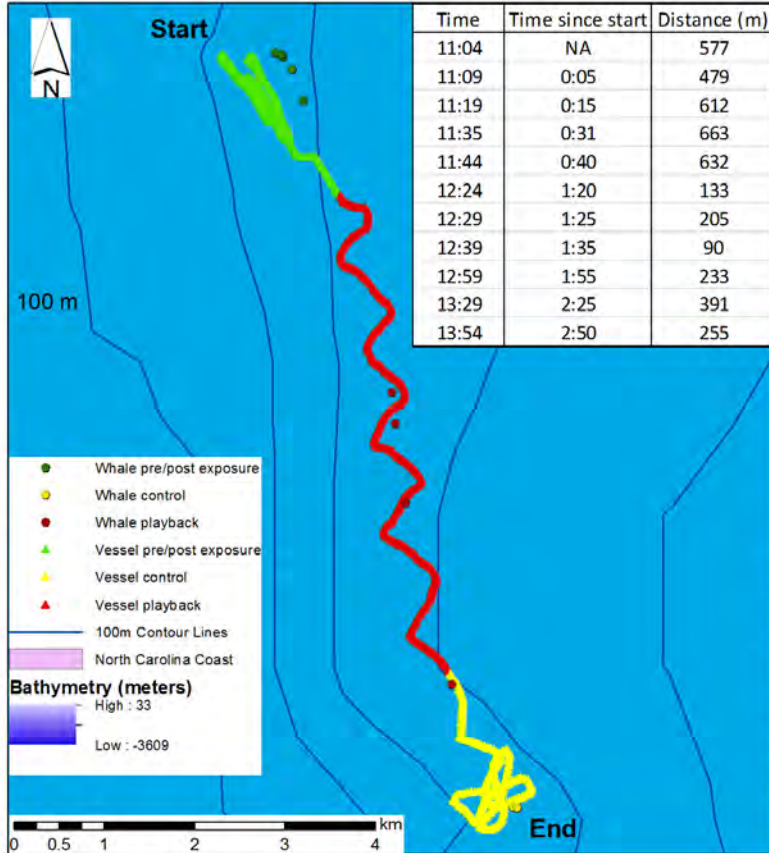
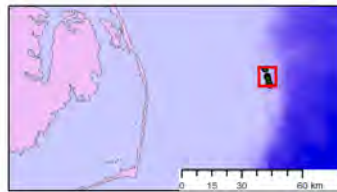
(excludes four short  
deployments)

Median = 4:17 hrs

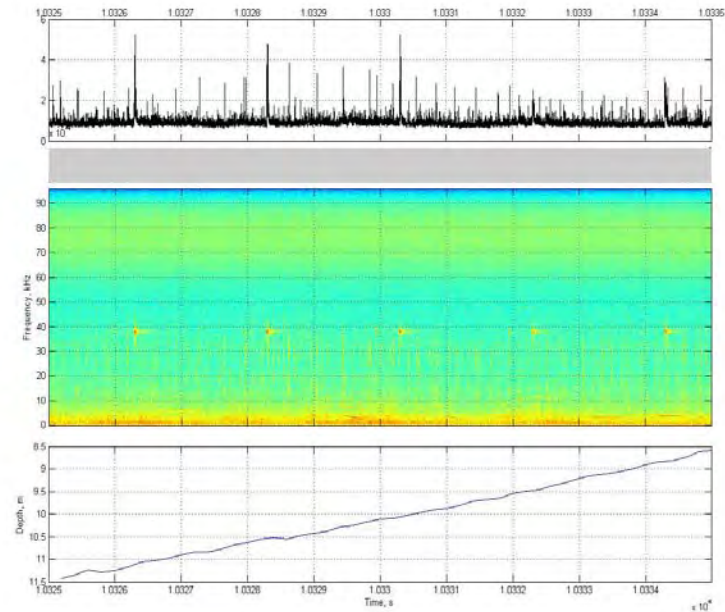


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# Pilot whale 149c in relation to the sound producing vessel



Pre-Exposure  
Exposure  
Post-Exposure



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## First Look at Surface Behavior:

Group Spread:	Whale $p = 0.0004$	Treatment $p = 0.1392$
Synchrony of Surfacing	Whale $p = 0.6161$	Treatment $p = 0.9568$
Synchrony of Heading	Whale $p = 0.0184$	Treatment $p = 0.5419$
Behavioral State	Whale $p = 0.0045$	Treatment $p = 0.3669$

Behavior of individual groups of whales varies considerably, but no apparent effect of the EK-60 system



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<b>Animal ID</b>	<b>Buzzes Pre</b>	<b>Buzzes Control</b>	<b>Buzzes EK-60</b>	<b>Buzzes Post</b>	<b>Total Buzzes</b>
Gm-11-147a	14 (7)	0 (3)	0 (3)	51 (4)	65
Gm-11-149c	17 (1)	94 (3)	0 (6)	NA	111
Gm-11-150a	0 (3)	0 (0)	3 (3)	0 (0)	3
Gm-11-155a	0 (0)	0 (1)	10 (1)	15 (2)	25
Gm-11-158b	NA (3)	NA (2)	NA (1)	NA (3)	NA

Numbers in brackets represent dives (submergences > 20 m)



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Jacksonville, FL, Onslow Bay and Cape Hatteras, NC  
July 2010 to December 2011

## Thanks to:

### Collaborators:

Alex Bocconcelli, Tom Hurst, Laela Sayigh, Colin Ware, Peter Tyack

### Field Crew:

Matt Bowers, Dani Crain, Erin Cummings, Meagan Dunphy-Daly, Ari Friedlaender, Dave Johnston, Alex Loer, Ryan McAlarney, Jim Moir, Doug Nowacek, Brandon Southall, Reny Tyson, Andrew Westgate & Matt Winegartner

### Additional Funding:

NOAA Office of Science & Technology, Ocean Acoustics Program  
Office of Naval Research  
Strategic Environmental Research & Development Program

### Permits:

NMFS 14241-01 & 808-1798-01



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# Vessel-based Monitoring in the CHPT and JAX OPAREAs Onslow Bay, NC and Jacksonville, FL



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# Platforms



- Offshore sport fishing vessels
- High (4 - 5m) flying bridge observation platform
- Fast cruising speeds to reach study area



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# Observation Methods

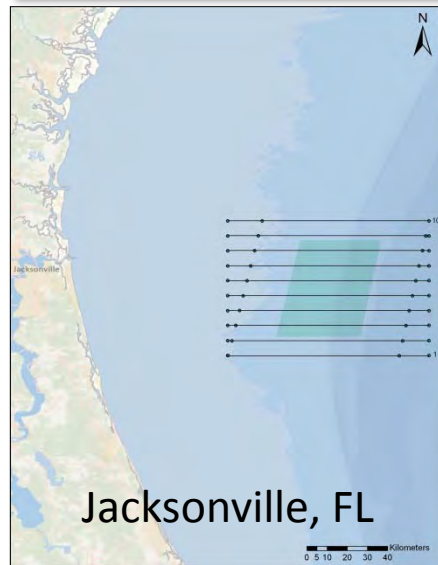
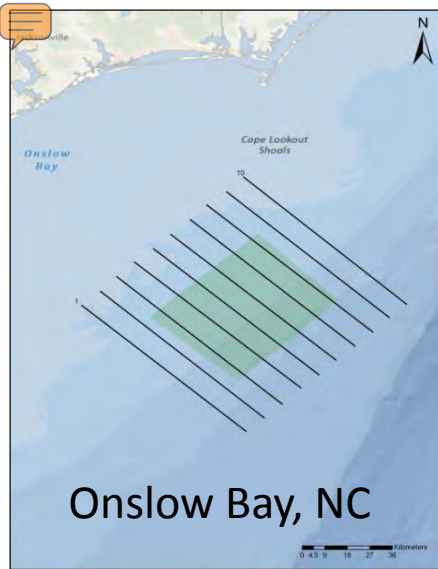


## Line Transect

- 10 tracklines at 10 kts
- Port & starboard observer
- Central observer/data recorder
- Naked eye & 7 x 50 binos
- Nikon & Canon digital SLR cameras (100-400 mm)

## Photo-ID & Biopsy

- 200 m contour line, tidal & oceanic fronts
- Port & starboard observer
- Central observer/data recorder
- Naked eye & 7 x 50 binos
- Nikon & Canon digital SLR cameras (100-400 mm)



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# Photo-ID & Biopsy

- Spp. catalogs
  - *T. truncatus*, *S. frontalis*, *G. griseus*, *G. macrorhynchus*, *S. bredanensis*
- Residency and population structure



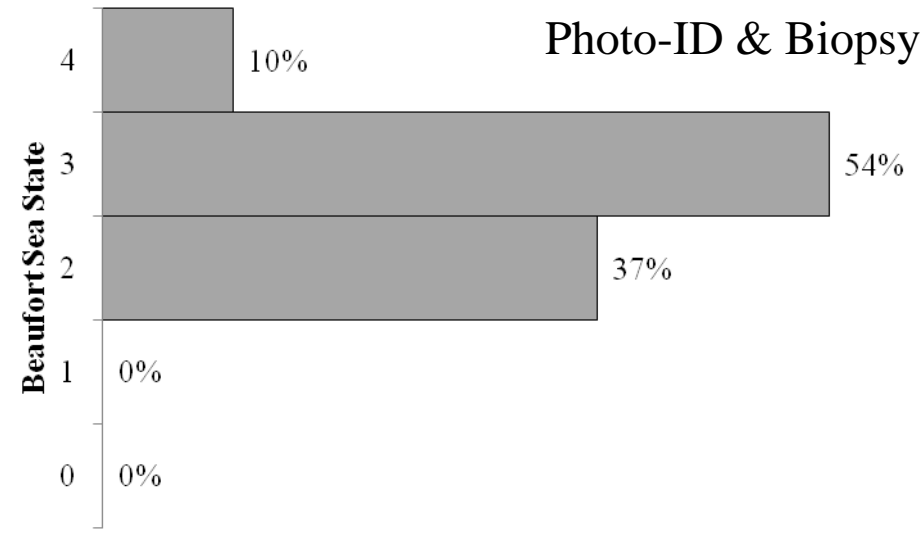
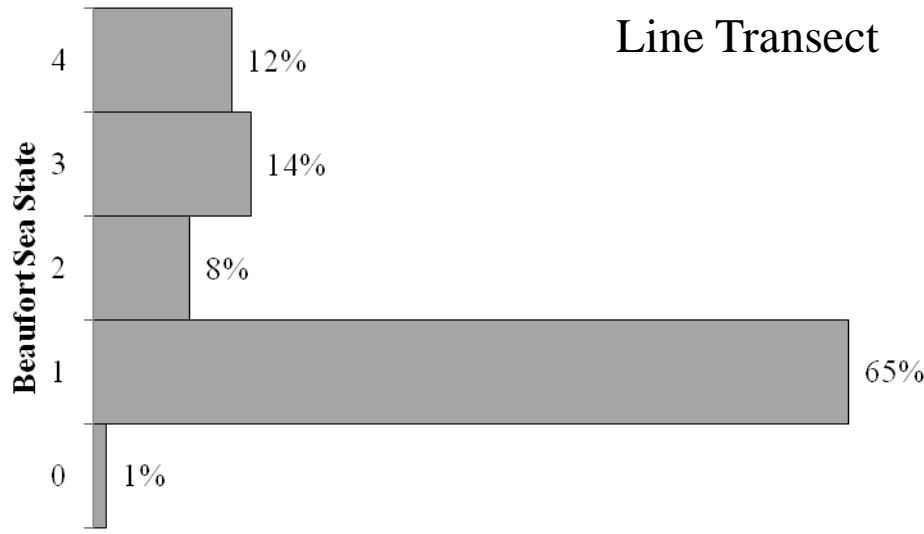
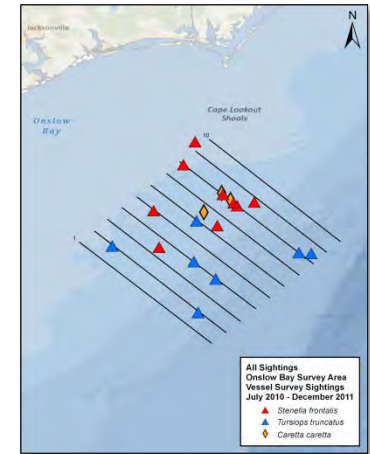
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# Onslow Survey Effort

Trackline	Number of tracklines surveyed			
	Year 1	Year 2	Year 3	Year 4
1	1	1	2	0
2	2	2	1	1
3	3	3	2	0
4	4	2	2	1
5	4	4	1	1
6	3	2	1	1
7	4	1	4	0
8	2	2	3	1
9	3	4	2	0
10	4	2	3	0
<b>Total</b>	<b>30</b>	<b>23</b>	<b>21</b>	<b>5</b>

- 397 hours visual effort
  - Year 1: 128 hrs
  - Year 2: 102 hrs
  - Year 3: 115 hrs
  - Year 4: 52 hrs
- Most effort in BSS 1-3



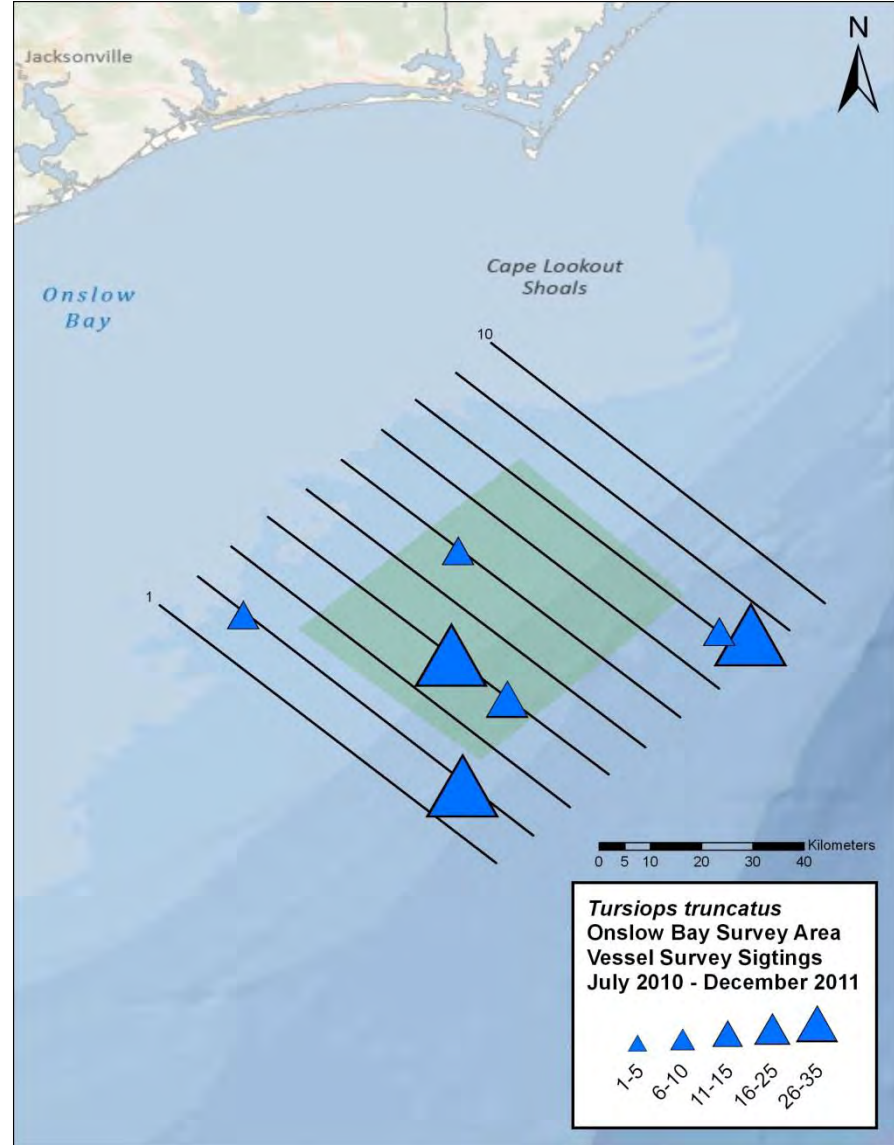
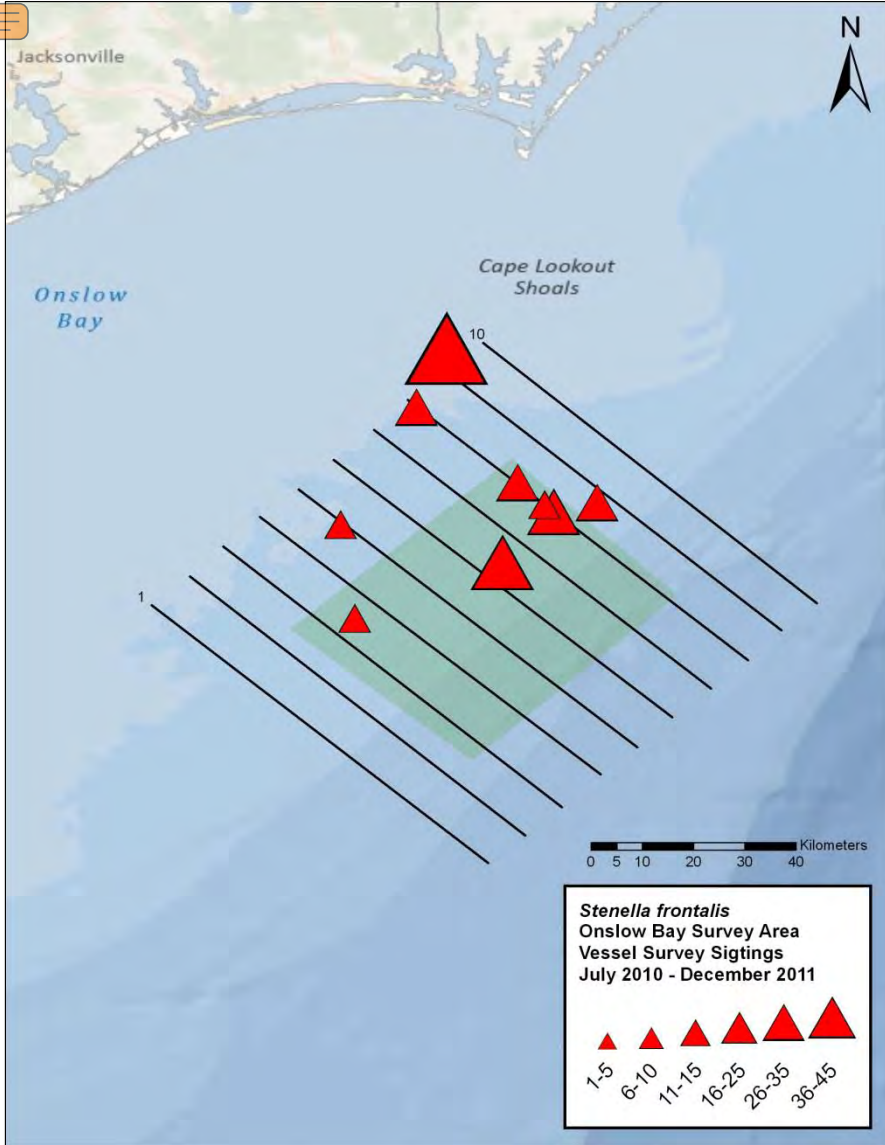
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# Onslow Cetacean Sightings

Species	Sightings					Mean Group Size
	Year 1	Year 2	Year 3	Year 4 Line Transect	Year 4 Photo- ID & Biopsy	
<i>Globicephala</i> spp.	1	0	2	0	0	31.0
<i>Grampus griseus</i>	3	0	3	0	0	30.5
<i>Stenella frontalis</i>	6	17	17	5	4	16.5
<i>Tursiops truncatus</i>	23	14	29	6	1	11.2
<i>Steno bredanensis</i>	0	0	1	0	0	27.0
Unid. delphinid	3	2	3	0	0	1.7
<b>Total:</b>	<b>36</b>	<b>33</b>	<b>55</b>	<b>11</b>	<b>5</b>	



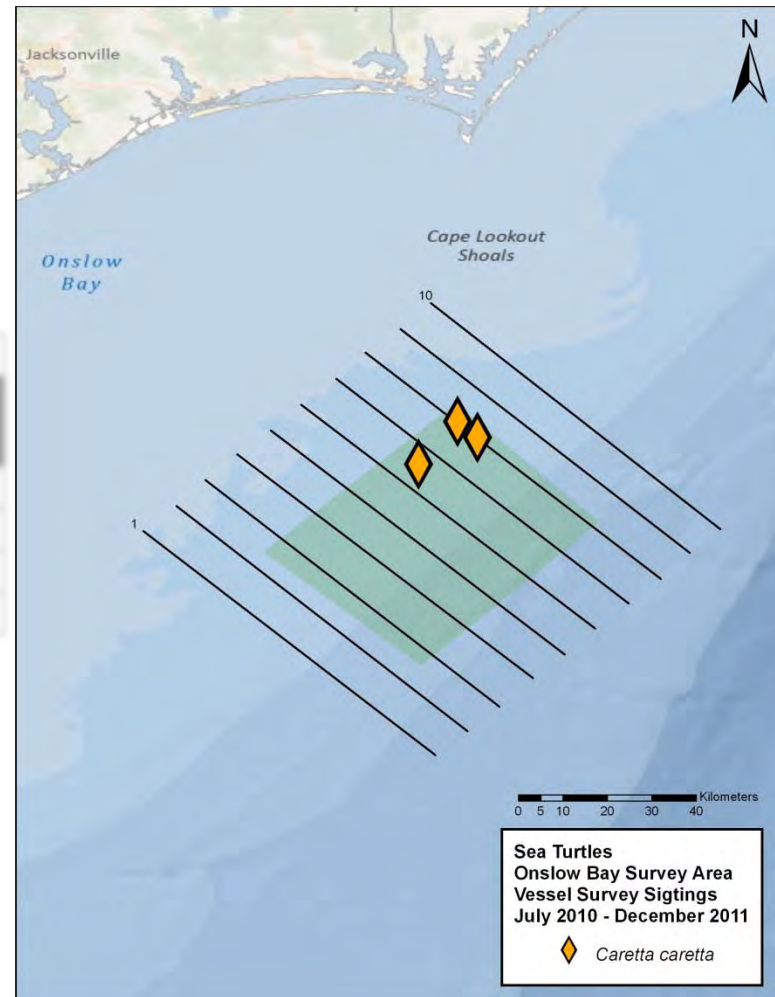
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# Onslow Sea Turtle Sightings

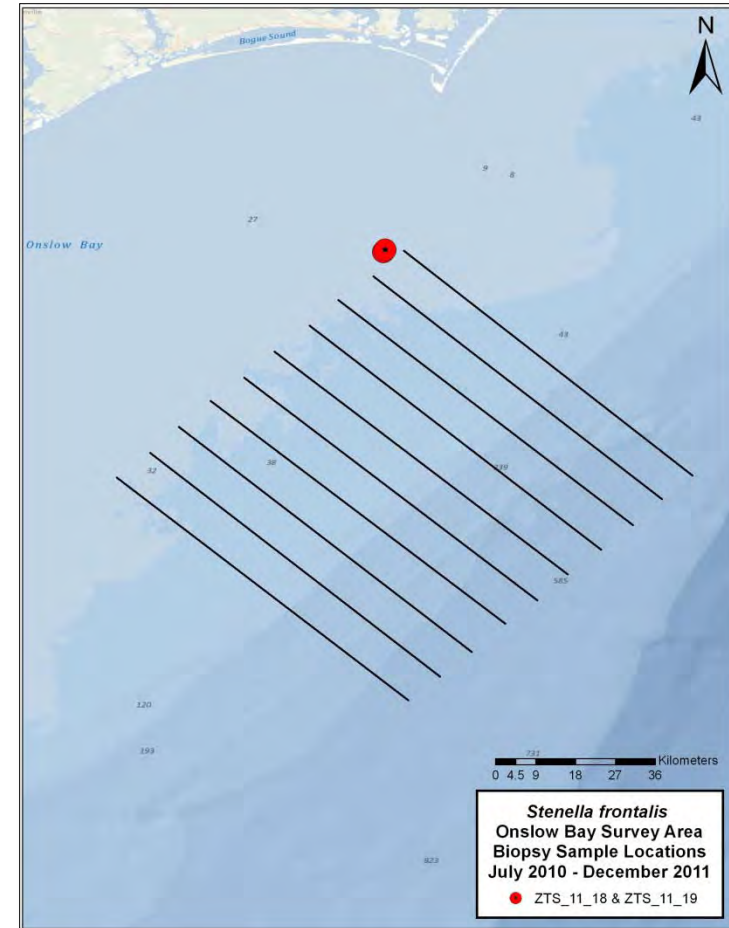
Species	Sightings				Year 4 Photo-ID & Biopsy
	Year 1	Year 2	Year 3	Year 4 Line Transect	
<i>Caretta caretta</i>	19	49	47	2	1
<i>Dermochelys coriacea</i>	0	0	2	0	0
Unid. Sea Turtle	1	0	1	0	0
<b>Total:</b>	<b>20</b>	<b>49</b>	<b>50</b>	<b>2</b>	<b>1</b>



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# Biopsy

Date	Time	Sample #	Species	Latitude	Longitude
12-Sep-11	7:51	ZTS_11_18	<i>Stenella frontalis</i>	34.26987	-76.65175
12-Sep-11	8:00	ZTS_11_19	<i>Stenella frontalis</i>	34.27420	-76.64799



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# Photo-identification - Onslow Bay



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July 2010 to December 2011

# Photo-identification - Onslow Bay

Species	Year 1		Year 2		Year 3		Year 4		Year 5-to date	
	Catalog size	Matches	Catalog size	Matches	Catalog size	Matches	Catalog size	Matches	Catalog size	Matches
<i>Tursiops truncatus</i>	52	0	78	0	106	5	112	5	122	7
<i>Stenella frontalis</i>	3	0	29	0	49	1	68	2	68	2
<i>Globicephala sp.</i>	8	0	8	0	16	0	16	0	16	0
<i>Grampus griseus</i>	5	0	5	0	7	0	7	0	7	0
<i>Steno bredanensis</i>	0	0	0	0	12	0	12	0	12	0



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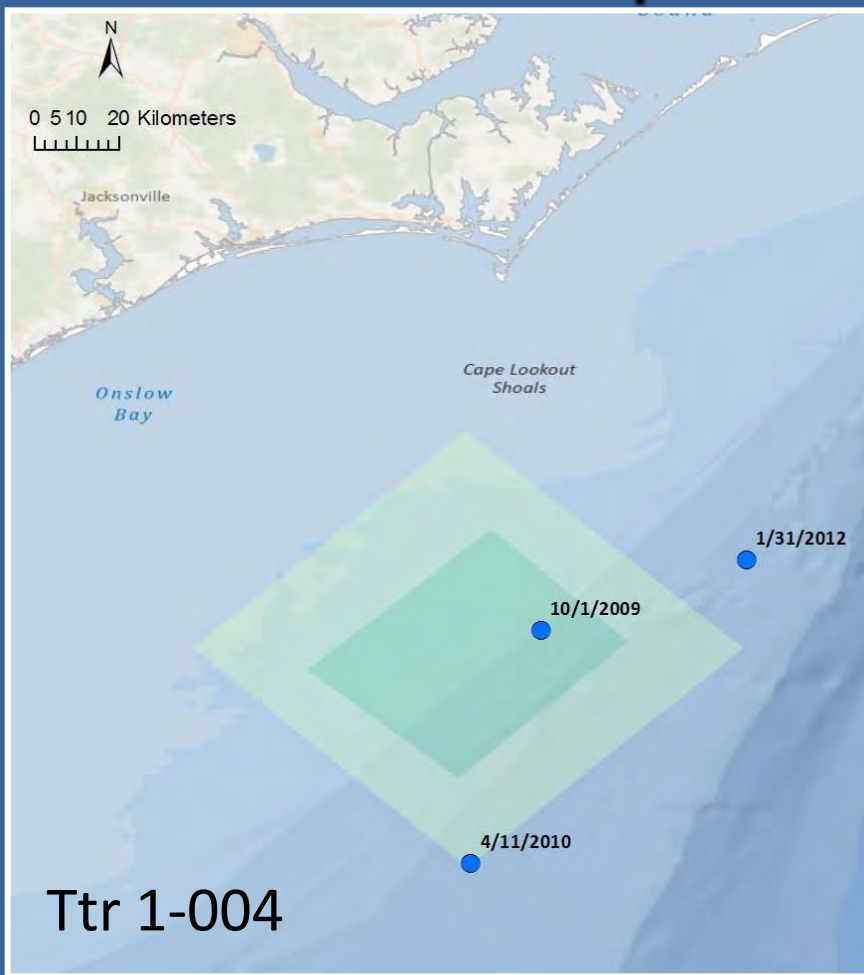
# Photo-identification - Onslow Bay



<i>Tursiops truncatus</i>			
ID	First sighting	Second sighting	Third sighting
1-004	1-Oct-09	11-Apr-10	31-Jan-12
6-010	23-Sep-07	31-Jan-12	
4-002	15-Sep-09	1-Oct-09	
6-018	29-Apr-09	10-Oct-10	
7-015*	28-Apr-09	20-Apr-10	
8-009*	28-Apr-09	20-Apr-10	
9-016	25-Jul-08	17-Aug-09	

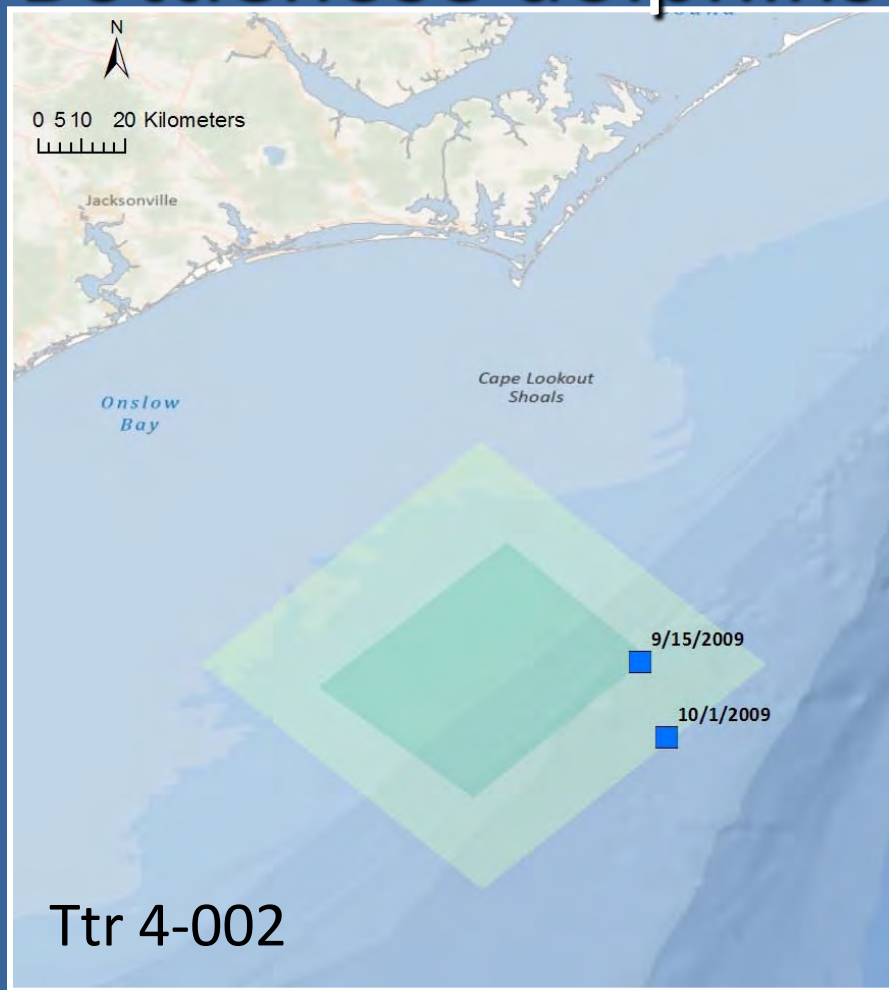
AFAST Monitoring of Protected Species  
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# Bottlenose dolphins



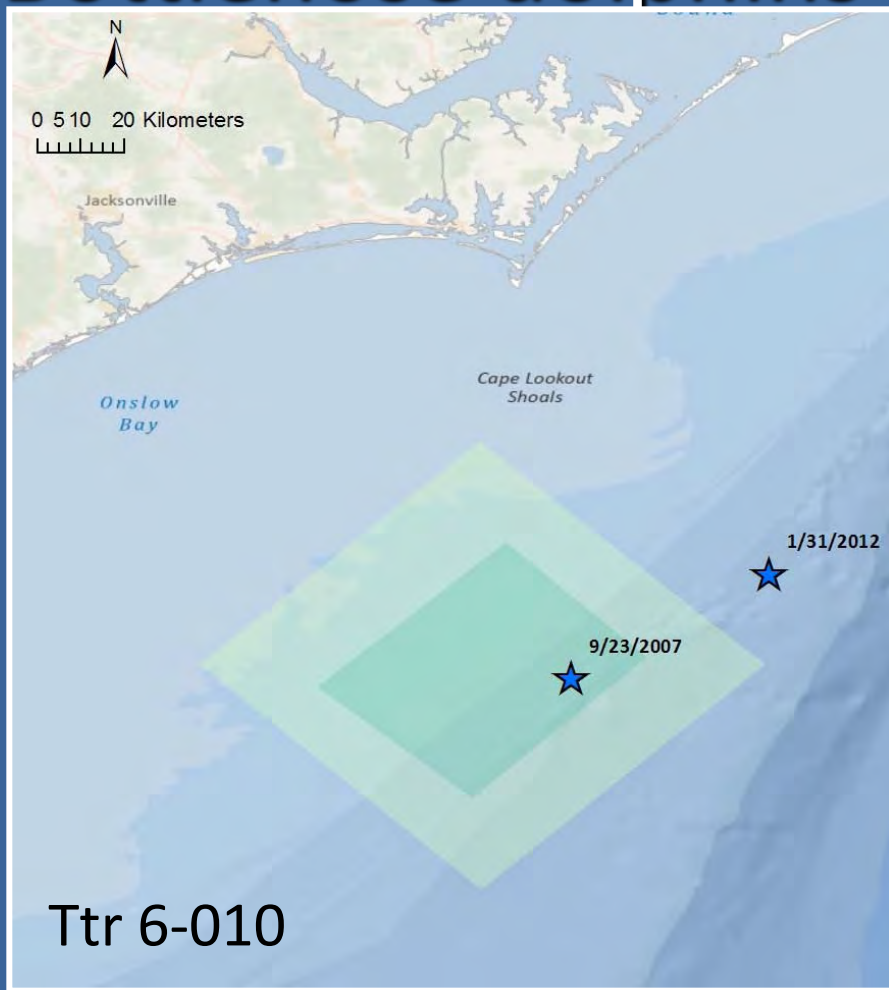
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# Bottlenose dolphins



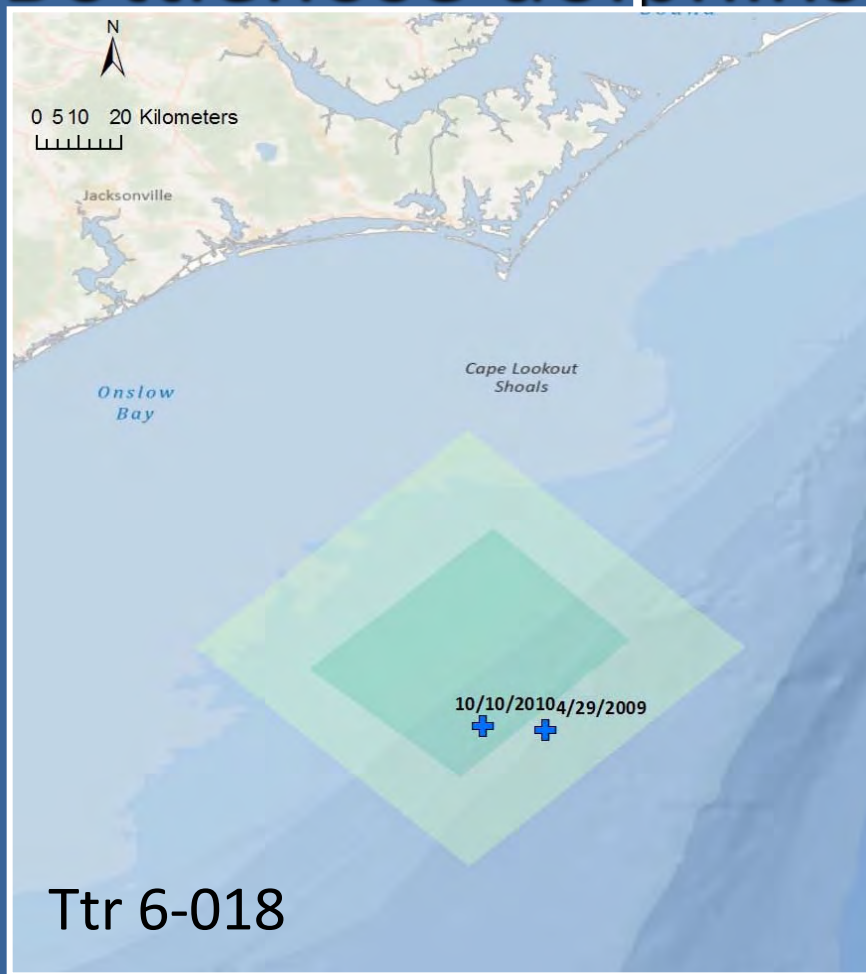
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# Bottlenose dolphins



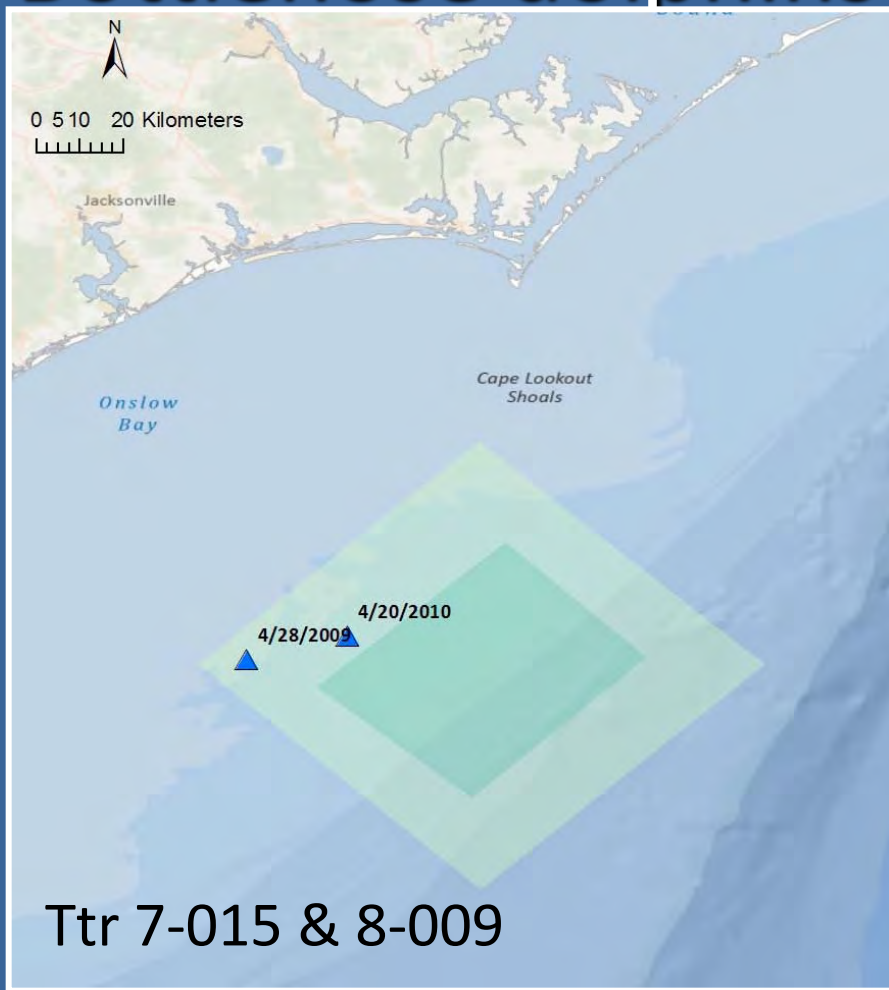
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# Bottlenose dolphins



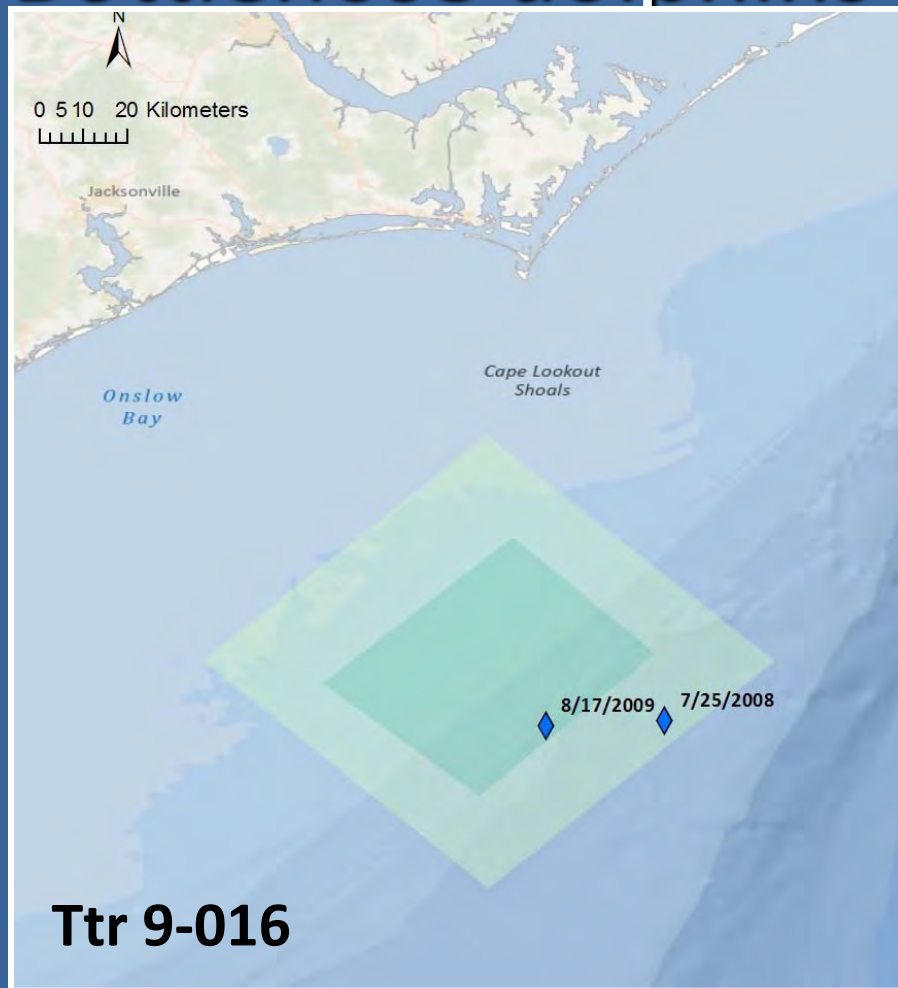
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# Bottlenose dolphins



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# Bottlenose dolphins



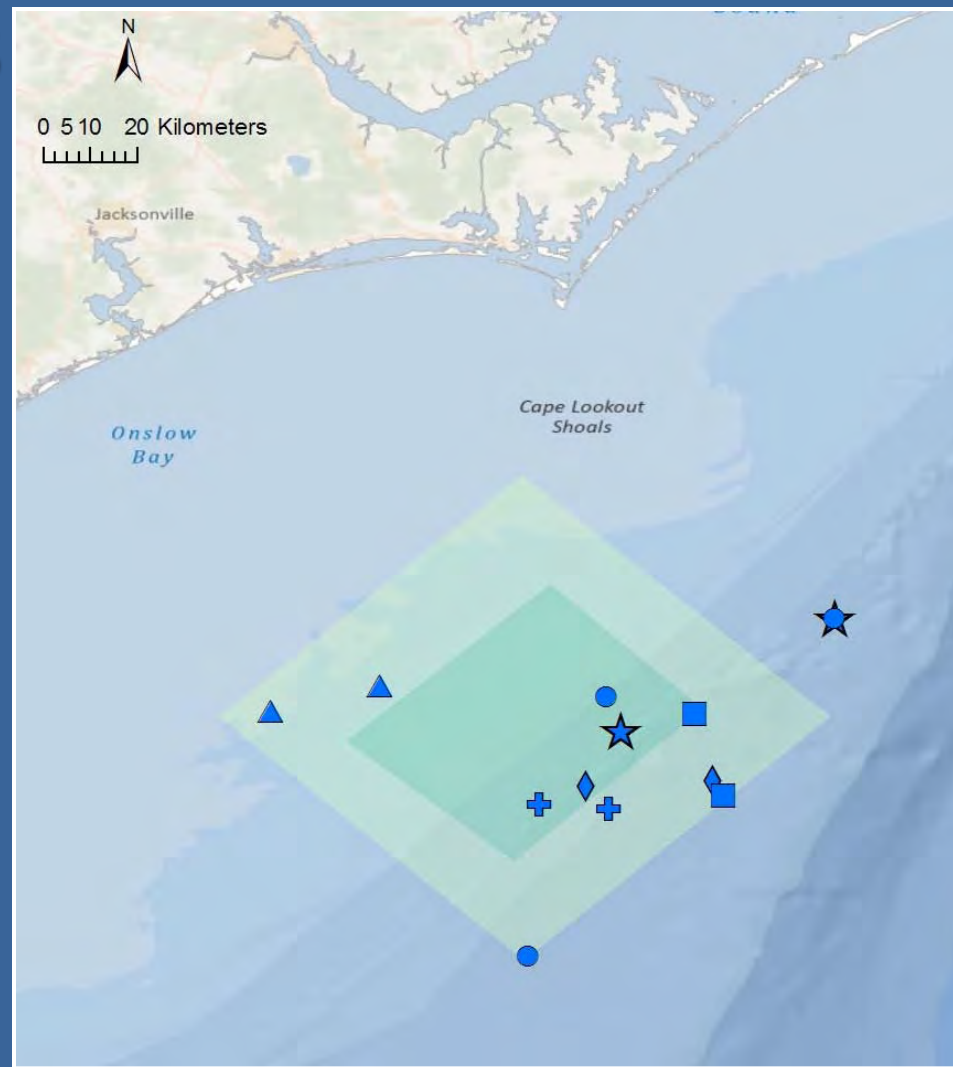
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# Bottlenose dolphins

Catalog = 122 individuals

Matches = 7

Ranging from 1 month – ~4.5 years



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# Photo-identification - Onslow Bay



<i>Stenella frontalis</i>			
ID	First sighting	Second sighting	Third sighting
9-013	9-Aug-09	1-Oct-09	
Sf-8004 (ZTS_11_09)	28-Jun-01	24-Jun-02	12-Sep-11



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# SERDP Monitoring of dolphins in Onslow Bay, NC



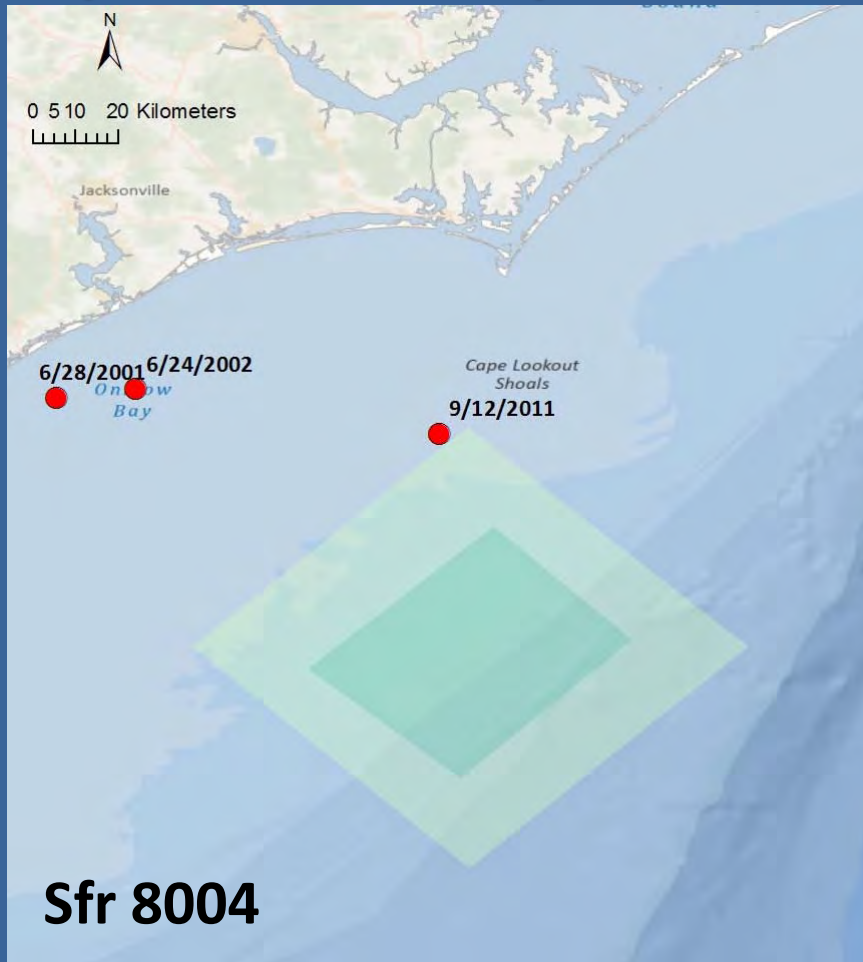
- April 2001-October 2003
- Monthly surveys
- 4 legs, 15-nm each
- Depth: 10-25m

Spotted dolphins:

7 of 22 dolphins identified in multiple years

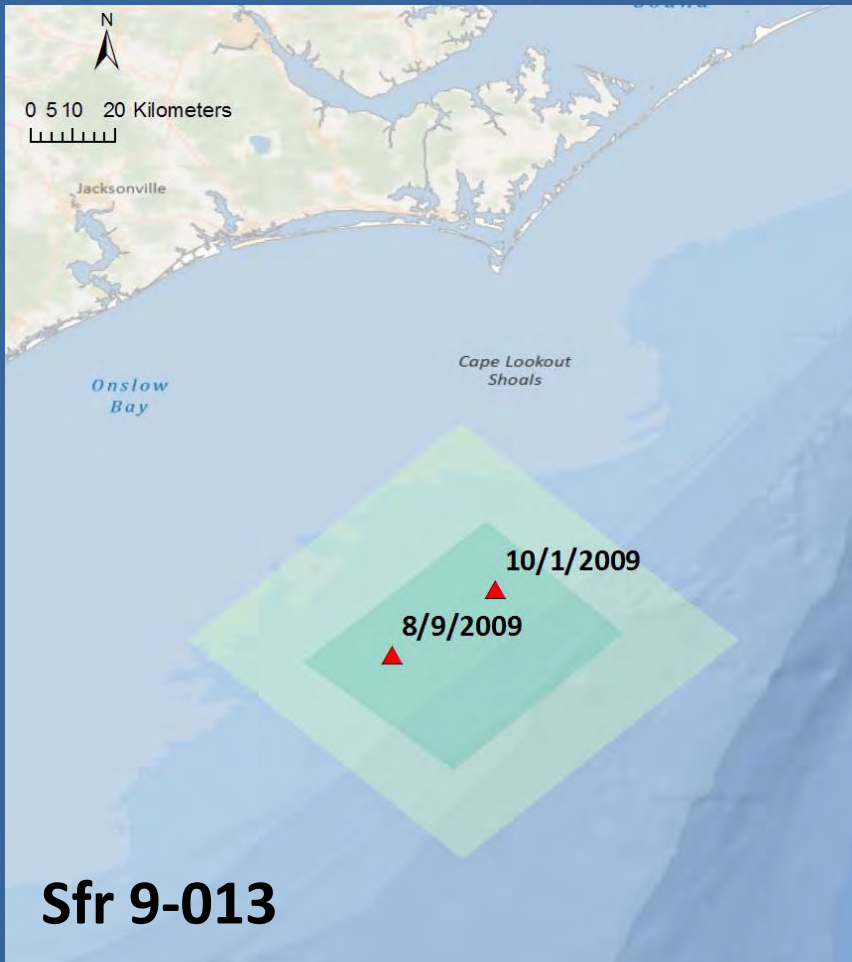
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# Spotted dolphins



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# Spotted dolphins



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# Photo-identification - Onslow Bay

Compare images of stranded cetaceans vs. Onslow Bay Photo-ID catalogs for all species



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# Photo-identification - Onslow Bay

We have now re-sighted approximately 6% of bottlenose dolphins and 3% of spotted dolphins identified in Onslow Bay.

Several of these re-sightings span periods of up to 10 years, suggesting some degree of residency.

Importance of matched samples

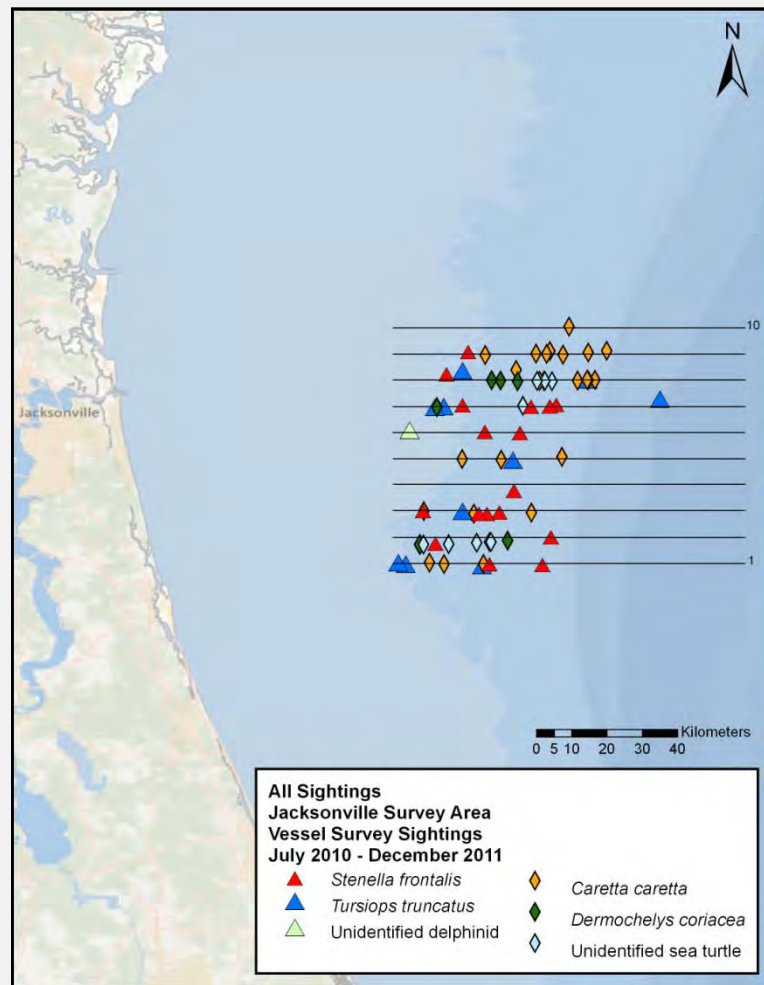
We have not re-sighted any other species, although the catalog sizes for these species are very small.

We will continue to compare to regional catalogs



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# Jacksonville Survey Effort

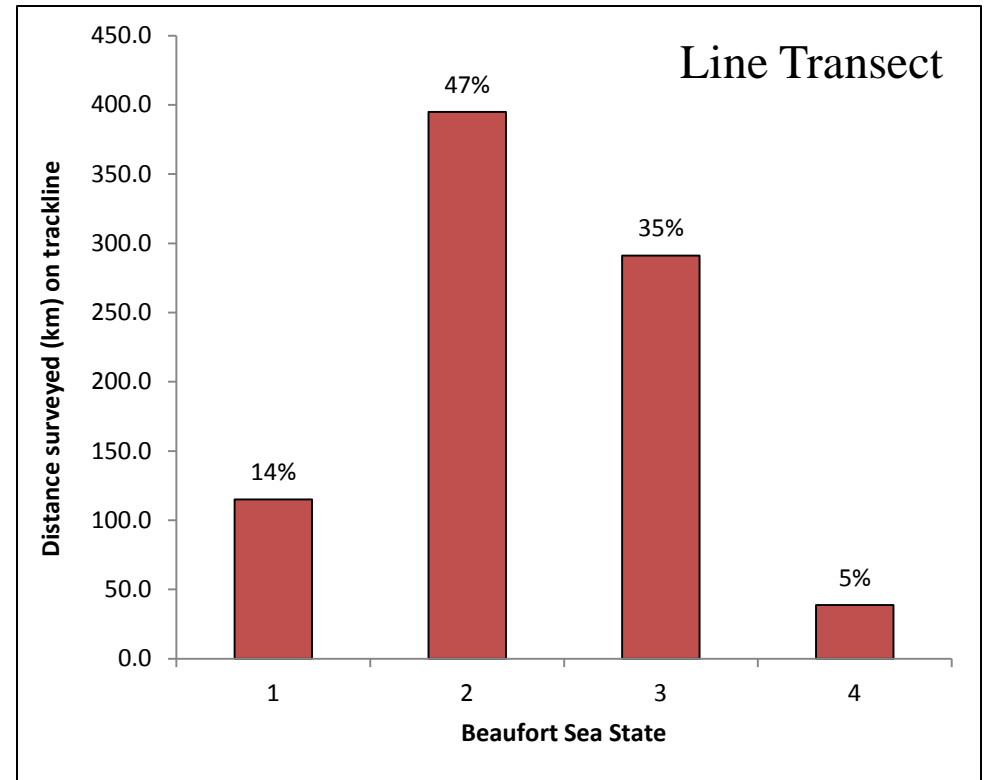


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Jacksonville, FL, Onslow Bay and Cape Hatteras, NC  
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# Jacksonville Survey Effort

Date	Trackline	Total (km)	Survey Time
6-Jul-10	8	60.8	3:40
8-Jul-10	6	84.9	5:04
12-Jul-10	4	79.3	4:22
14-Aug-10	7	37.0	2:39
10-Oct-10	2	64.0	4:14
12-Oct-10	9	52.6	3:13
13-Oct-10	7	57.4	4:01
18-Dec-10	10	68.9	3:37
20-Jan-11	8	67.9	3:47
30-Jan-11	5	71.5	3:45
14-Mar-11	9	70.6	3:42
18-Mar-11	1	72.4	4:53
19-Mar-11	3	70.5	4:46

- 148 hours of visual effort
  - Year 1: 96 hrs
  - Year 2: 52 hrs
- Most effort in BSS 2-3



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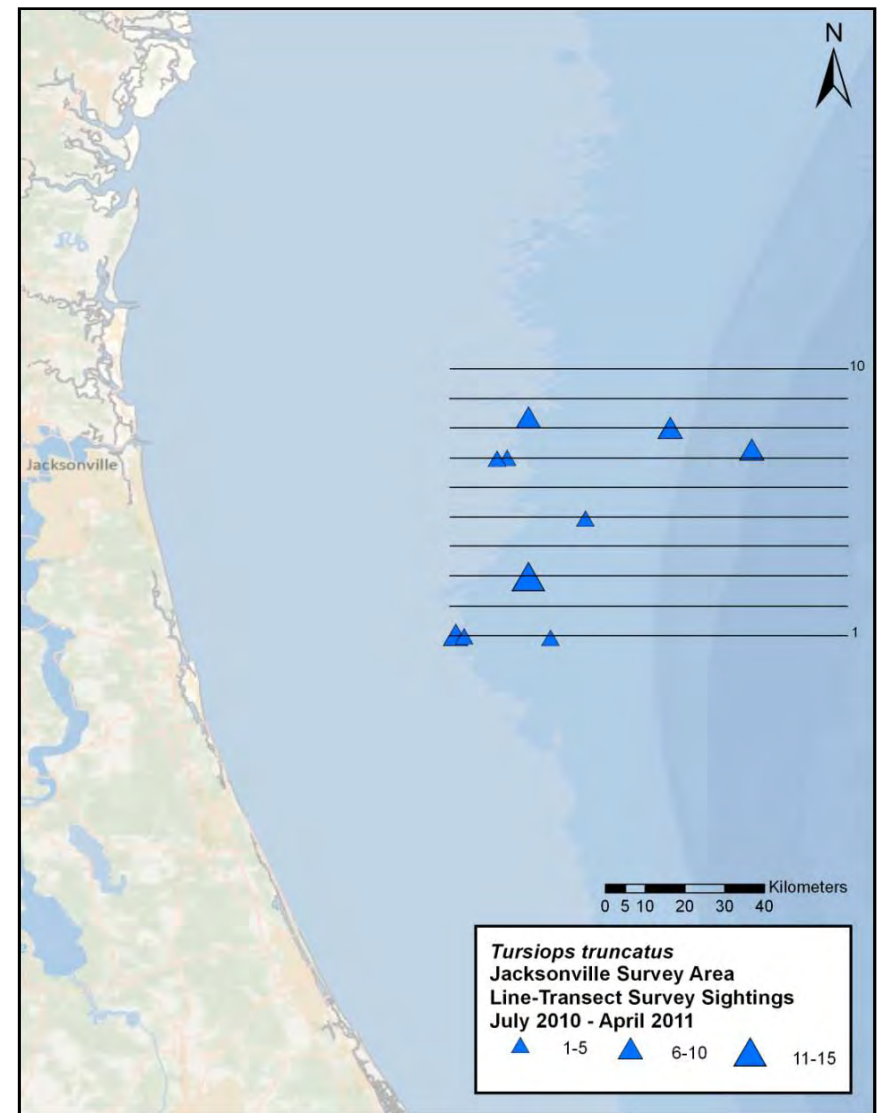
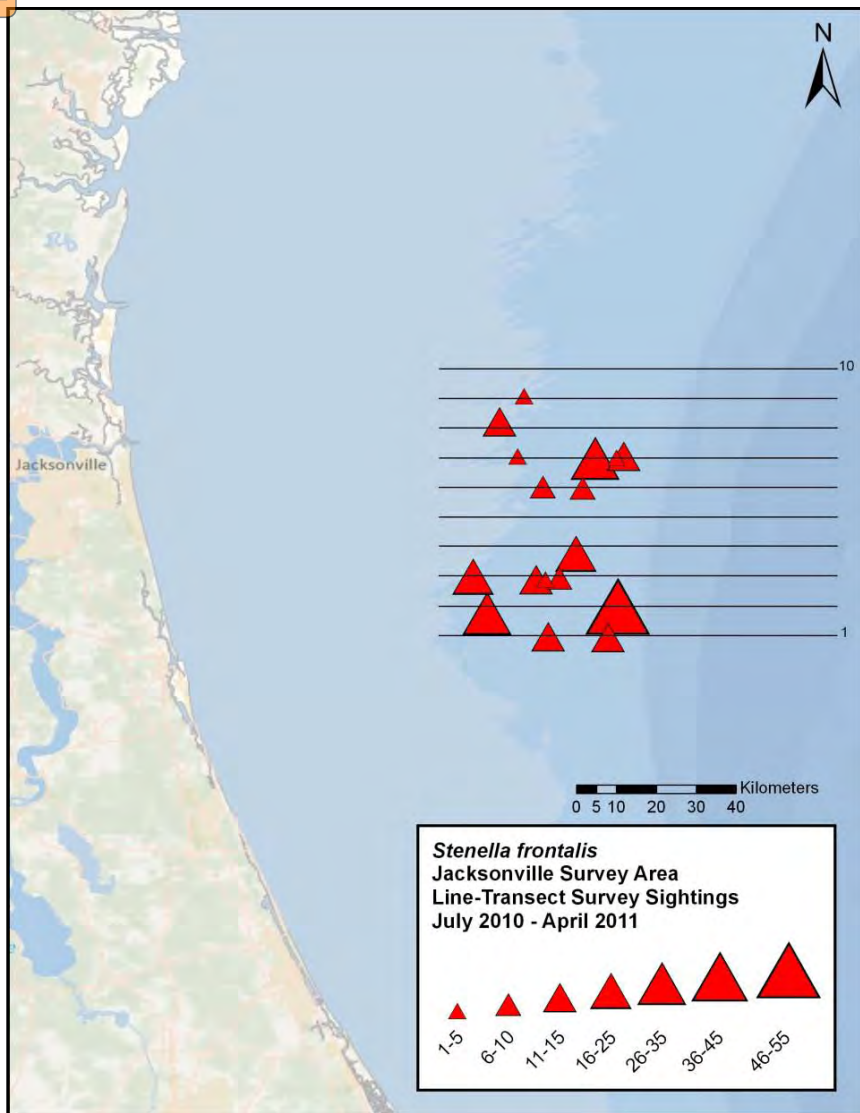


# Jacksonville Cetacean Sightings

Species	Sightings		Mean Group Size
	Year 1	Year 2	
<i>Stenella frontalis</i>	24	17	9.4
<i>Tursiops truncatus</i>	15	10	6.3
<i>Globicephala macrorhynchus</i>	3	0	33.3
<i>Grampus griseus</i>	2	0	21.5
Unidentified delphinid	12	1	1.8
<b>Total:</b>	<b>56</b>	<b>28</b>	

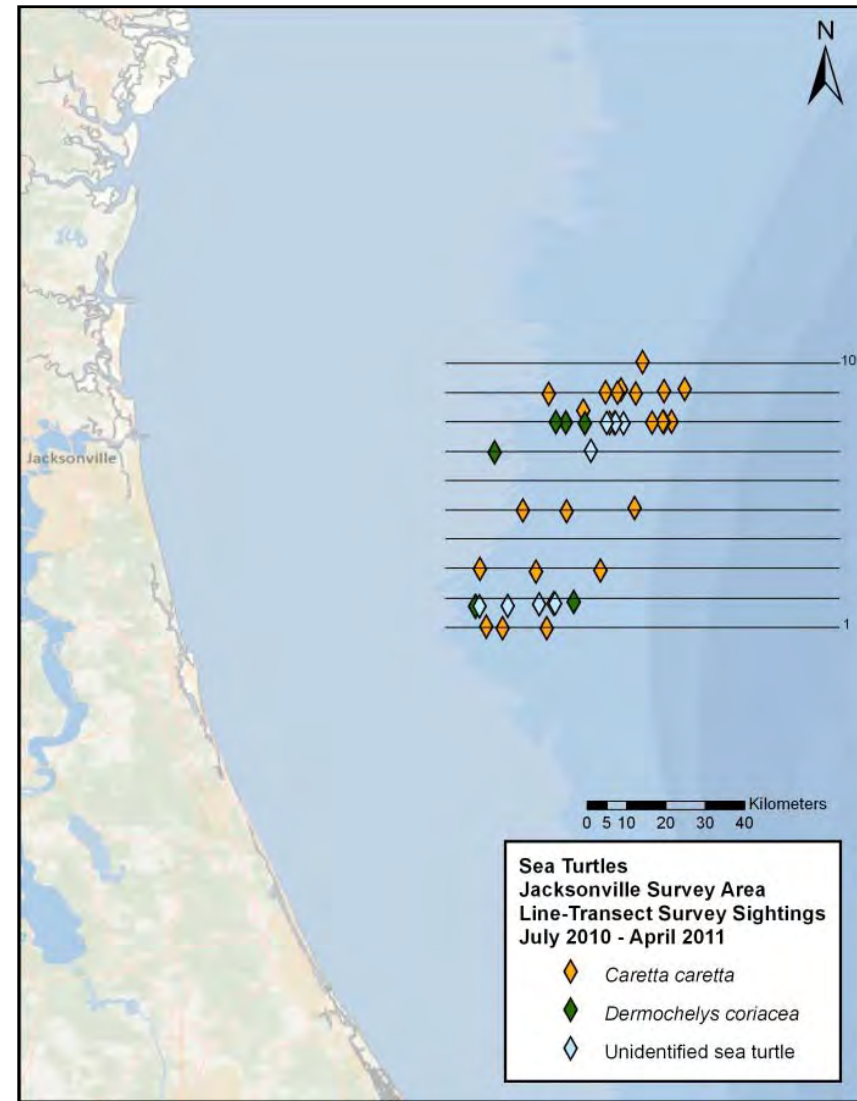


AFAST Monitoring of Protected Species  
 Jacksonville, FL, Onslow Bay and Cape Hatteras, NC  
 July 2010 to December 2011



AFAST Monitoring of Protected Species  
 Jacksonville, FL, Onslow Bay and Cape Hatteras, NC  
 July 2010 to December 2011

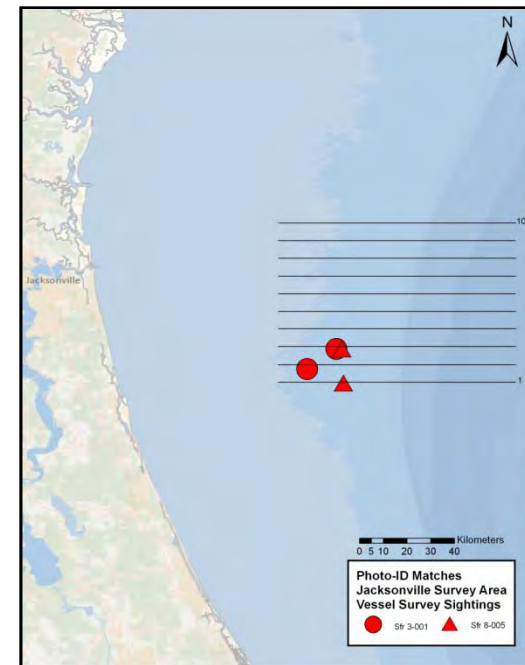
# Jacksonville Sea Turtle Sightings



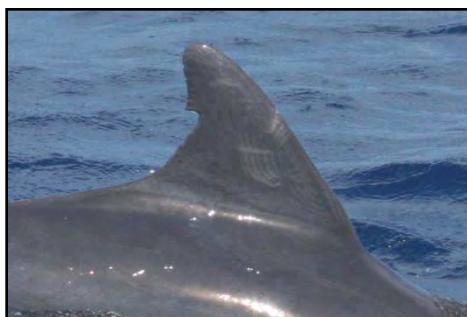
Species	Common Name	Sightings	
		Year 1	Year 2
<i>Caretta caretta</i>	Loggerhead sea turtle	48	25
<i>Dermochelys coriacea</i>	Leatherback sea turtle	5	7
<i>Lepidochelys kempii</i>	Kemp's Ridley sea turtle	1	0
Unidentified sea turtle	Unidentified sea turtle	3	8
	<b>Total:</b>	<b>57</b>	<b>40</b>

AFast Monitoring of Protected Species  
Jacksonville, FL, Onslow Bay and Cape Hatteras, NC  
July 2010 to December 2011

# Photo Identification



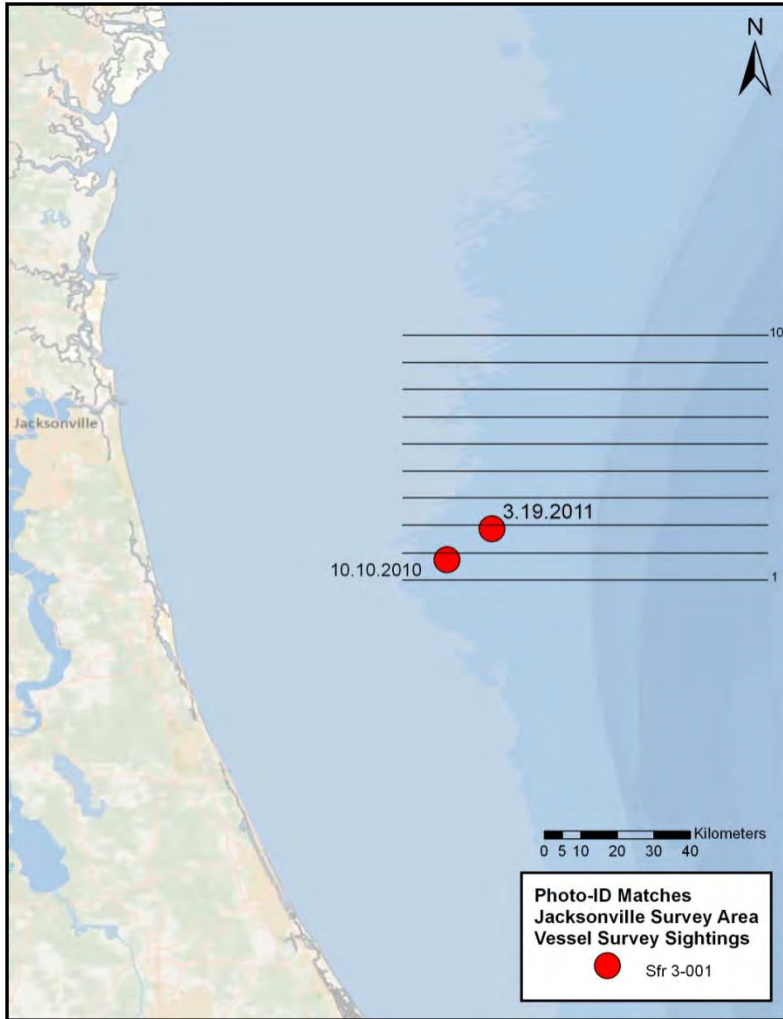
Species	Year 1			Year 2		
	Images	Catalog Size	Matches	Images	Catalog Size	Matches
<i>Tursiops truncatus</i>	779	0	0	332	21	0
<i>Stenella frontalis</i>	781	0	0	1267	41	2
<i>Globicephala macrorhynchus</i>	1368	0	0	0	0	0
<i>Grampus griseus</i>	405	0	0	0	0	0



AFAST Monitoring of Protected Species  
 Jacksonville, FL, Onslow Bay and Cape Hatteras, NC  
 July 2010 to December 2011

# Photo Identification Matches

## Sfr 3-001



Sfr 3-001 10 October 2010



Sfr 3-001 19 March 2011

AFAST Monitoring of Protected Species  
Jacksonville, FL, Onslow Bay and Cape Hatteras, NC  
July 2010 to December 2011

# Photo Identification Matches

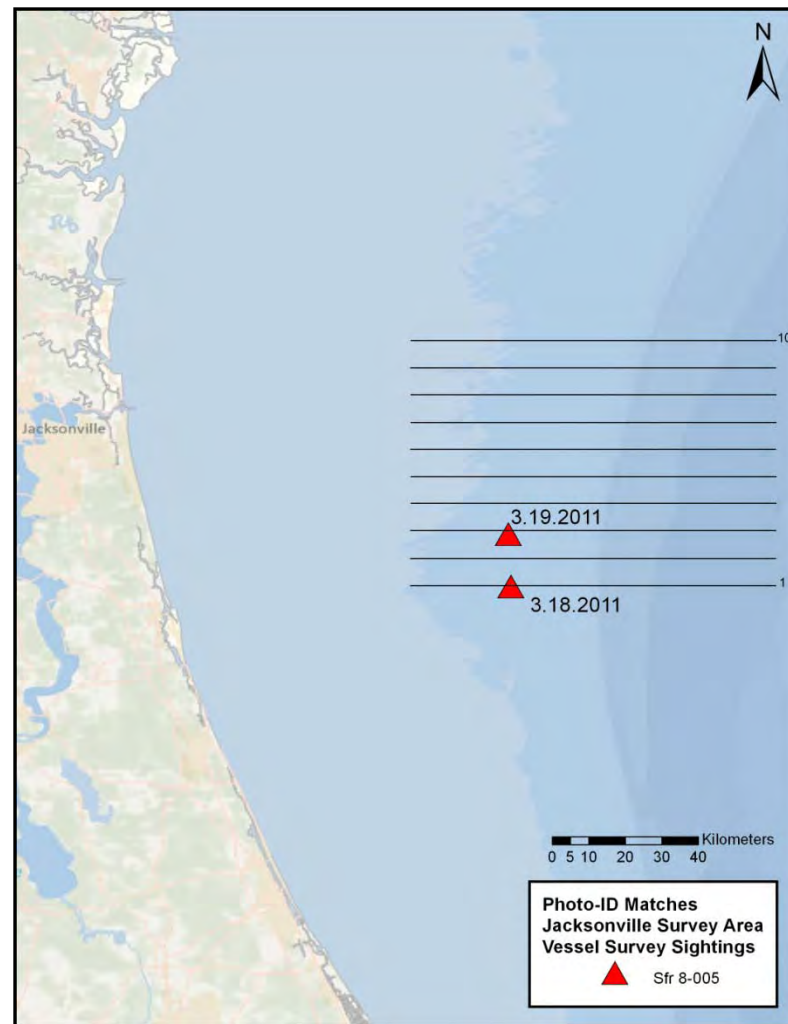
## Sfr 8-005



Sfr 8-005  
18 March 2011

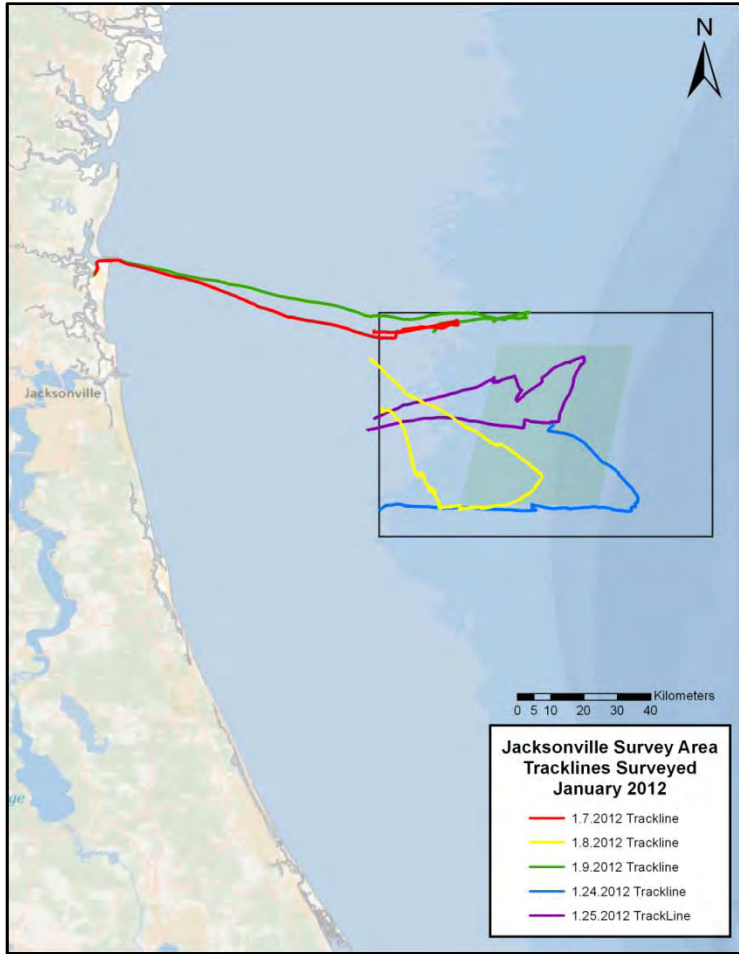


Sfr 8-005  
19 March 2011



AFAST Monitoring of Protected Species  
Jacksonville, FL, Onslow Bay and Cape Hatteras, NC  
July 2010 to December 2011

# Photo-ID and Biopsy Surveys – January 2012



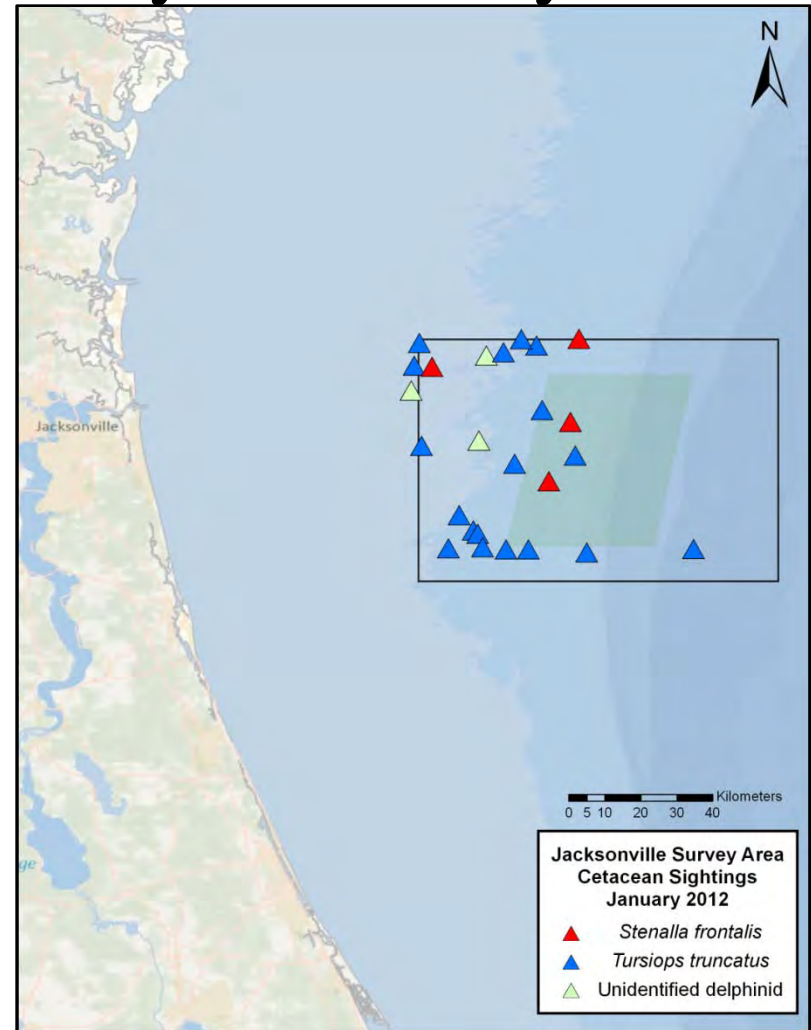
- Deploy Rhib from R/V *Stellwagen*



- Eliminate transit time to/from area
- Survey new portion of area each day

AFAST Monitoring of Protected Species  
Jacksonville, FL, Onslow Bay and Cape Hatteras, NC  
July 2010 to December 2011

# Photo-ID and Biopsy Surveys – January 2012



AFAST Monitoring of Protected Species  
Jacksonville, FL, Onslow Bay and Cape Hatteras, NC  
July 2010 to December 2011



# Biopsy – January 2012



Date	Common Name	Group Size	Biopsy samples	Photo-id Images
7-Jan-12	Bottlenose dolphin	2	0	0
7-Jan-12	Atlantic spotted dolphin	15	1	98
7-Jan-12	Unidentified delphinid	3	0	0
7-Jan-12	Bottlenose dolphin	3	0	21
8-Jan-12	Bottlenose dolphin	2	0	0
8-Jan-12	Bottlenose dolphin	2	0	2
8-Jan-12	Bottlenose dolphin	1	1	40
8-Jan-12	Bottlenose dolphin	2	1	36
8-Jan-12	Bottlenose dolphin	5	0	2
8-Jan-12	Bottlenose dolphin	2	2	22
8-Jan-12	Bottlenose dolphin	2	0	0
8-Jan-12	Atlantic spotted dolphin	6	3	99
8-Jan-12	Bottlenose dolphin	7	0	3
8-Jan-12	Unidentified delphinid	2	0	0
8-Jan-12	Unidentified delphinid	2	0	0
9-Jan-12	Bottlenose dolphin	2	0	1
9-Jan-12	Atlantic spotted dolphin	35	4	80
9-Jan-12	Bottlenose dolphin	2	1	34
9-Jan-12	Bottlenose dolphin	20	0	0
24-Jan-12	Bottlenose dolphin	1	0	0
24-Jan-12	Bottlenose dolphin	9	2	28
24-Jan-12	Bottlenose dolphin	9	1	24
25-Jan-12	Bottlenose dolphin	4	1	27
25-Jan-12	Atlantic spotted dolphin	25	2	113
25-Jan-12	Bottlenose dolphin	8	2	40

AFAST Monitoring of Protected Species  
 Jacksonville, FL, Onslow Bay and Cape Hatteras, NC  
 July 2010 to December 2011

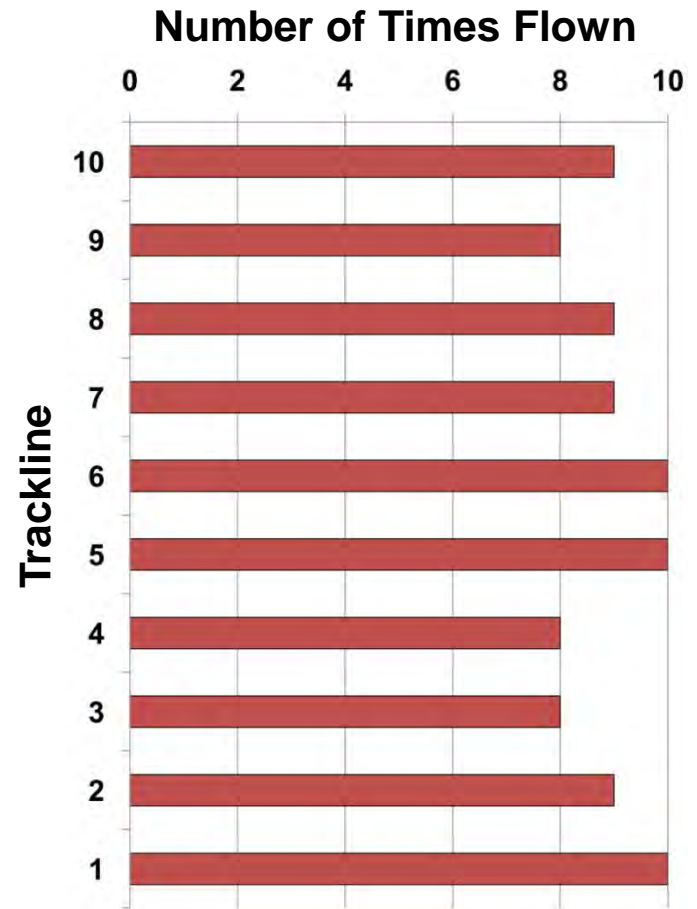
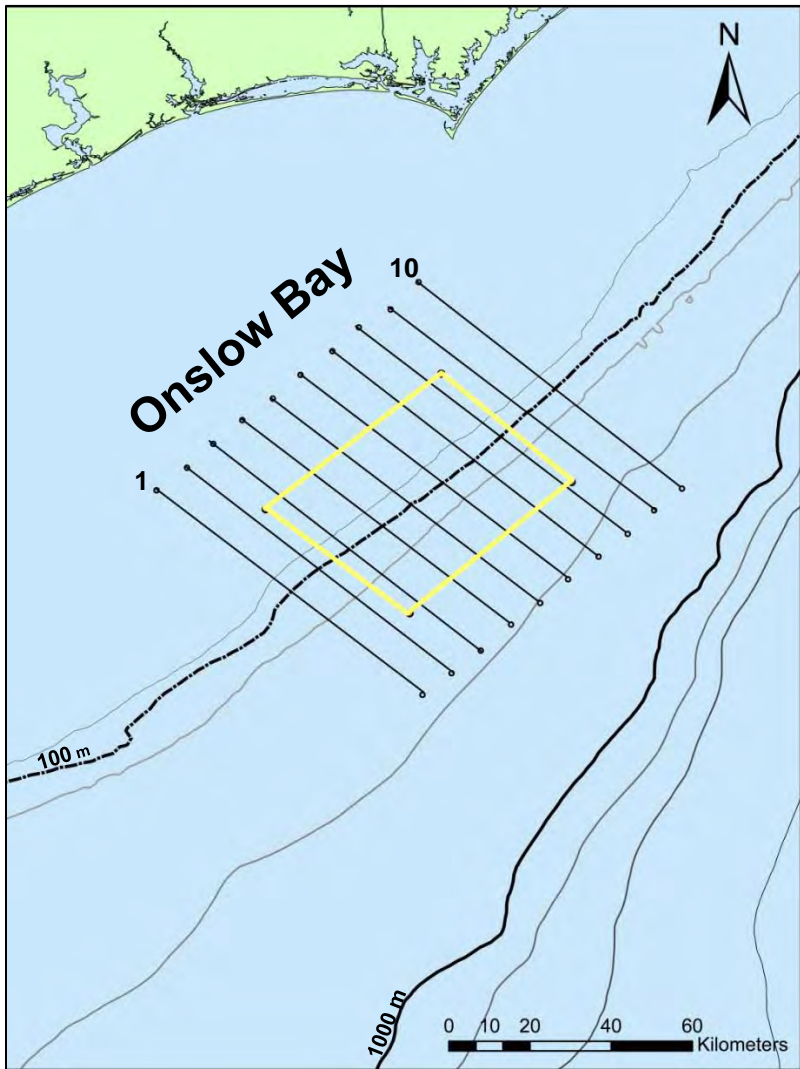
# **AERIAL SURVEYS**

## **Onslow Bay and Cape Hatteras, NC Jacksonville, FL**

**William McLellan  
Ryan McAlarney  
Erin Cummings  
Ann Pabst**

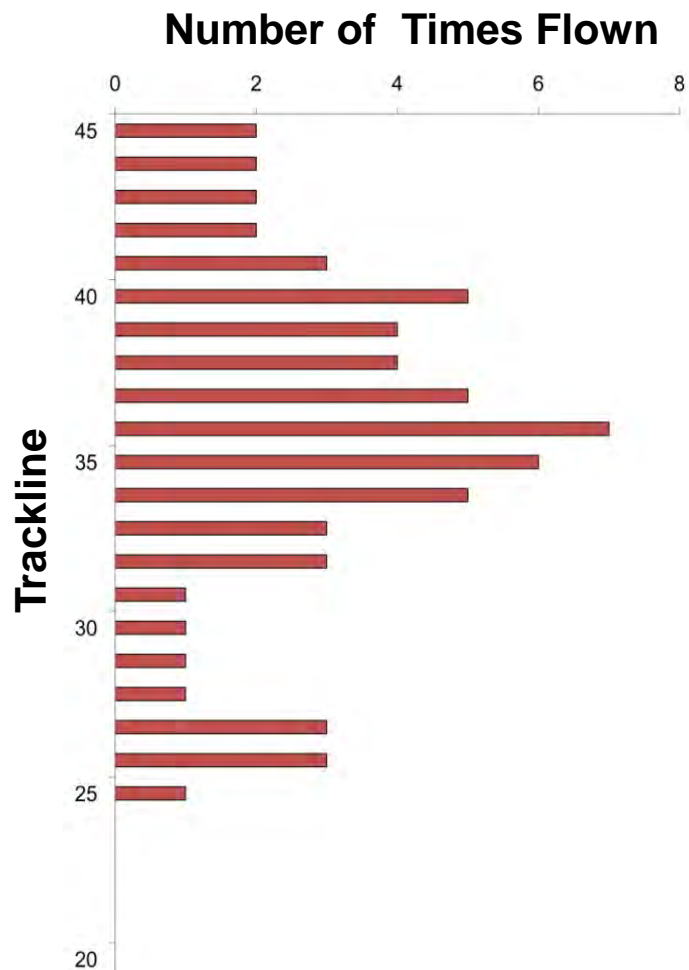
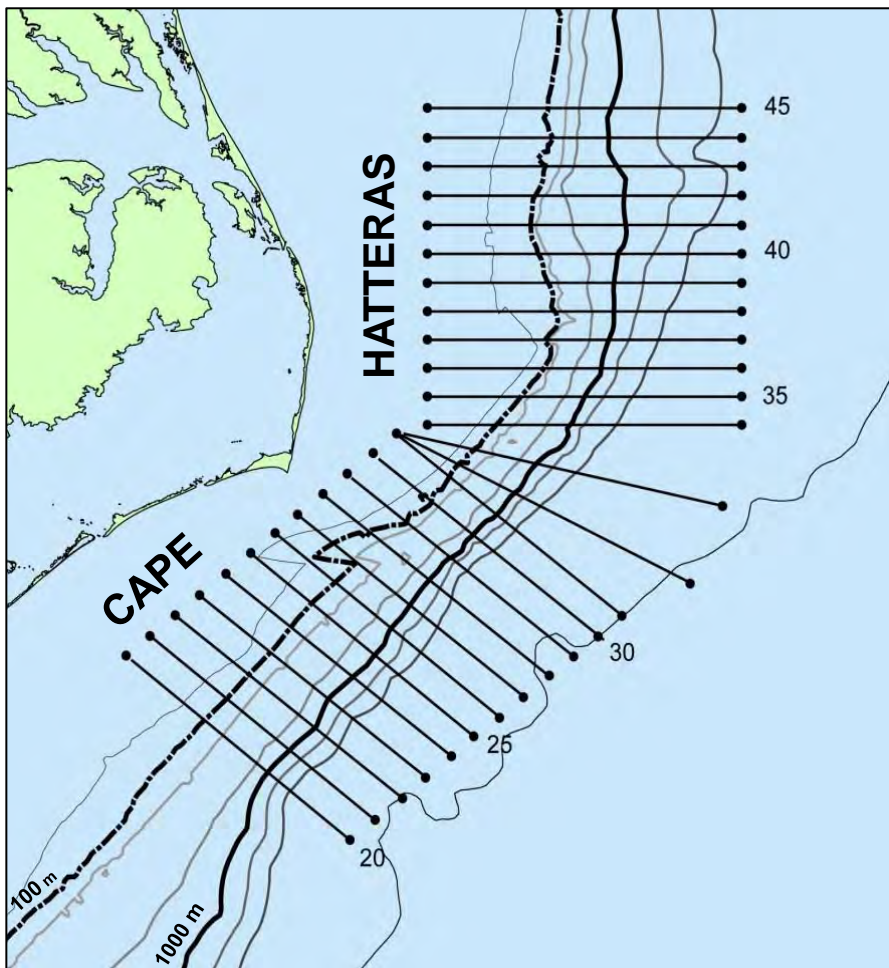


**AFAST Monitoring of Protected Species  
Jacksonville, FL, Onslow Bay and Cape Hatteras, NC  
July 2010 to December 2011**



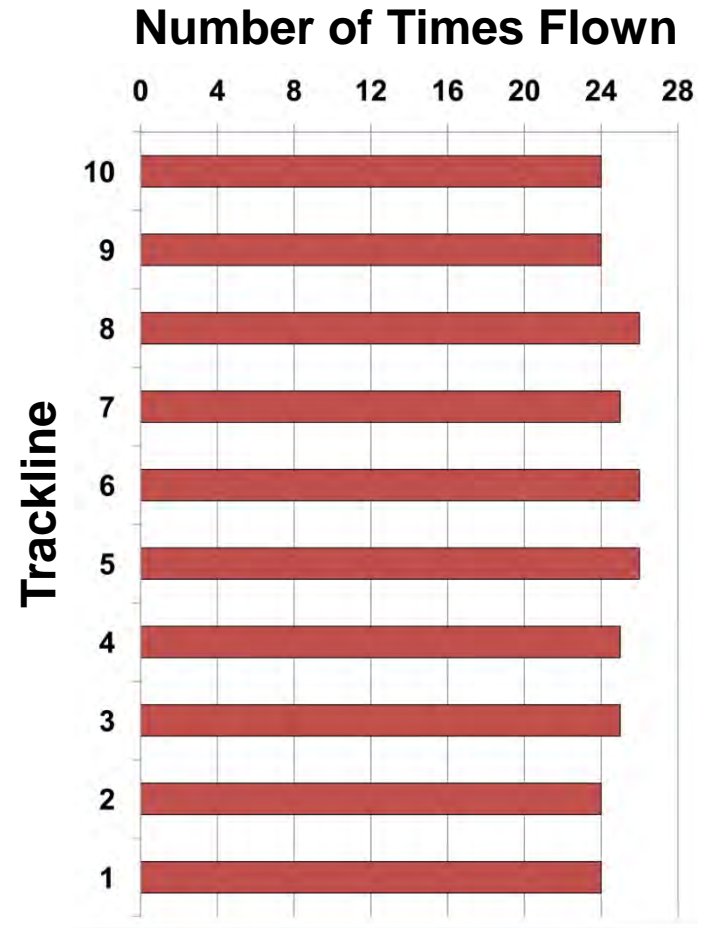
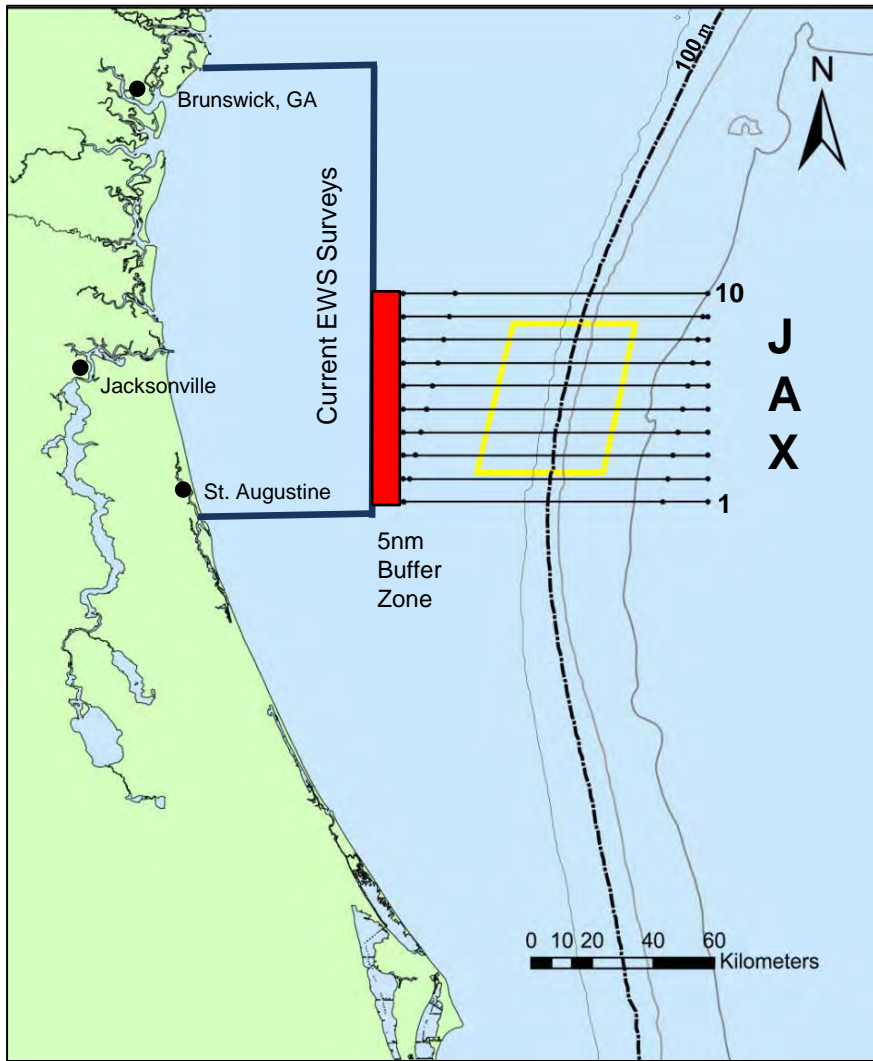
**July 2010 - April 2011**

AFAST Monitoring of Protected Species  
 Jacksonville, FL, Onslow Bay and Cape Hatteras, NC  
 July 2010 to December 2011



**May 2011 - Dec 2011**

AFAST Monitoring of Protected Species  
 Jacksonville, FL, Onslow Bay and Cape Hatteras, NC  
 July 2010 to December 2011



**July 2010 - Dec 2011**

**AFAST Monitoring of Protected Species  
Jacksonville, FL, Onslow Bay and Cape Hatteras, NC  
July 2010 to December 2011**

# Aerial Surveys

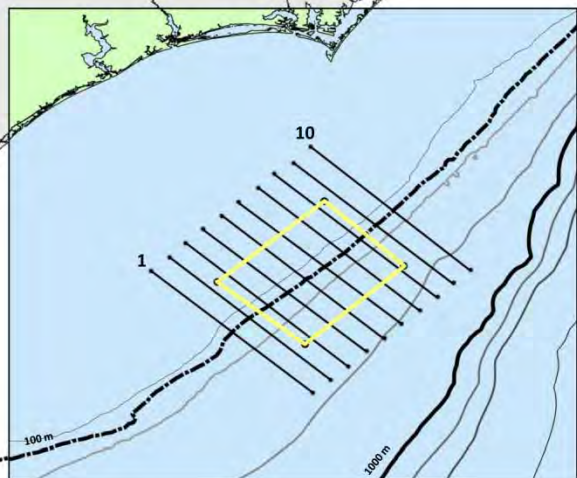
## Methods

- CFR Part 135 certified aircraft
- 2 dedicated pilots
- Surveys conducted at 305 m and ~185 km/hr
- 2 observers conducting separate strip surveys



AFAST Monitoring of Protected Species  
Jacksonville, FL, Onslow Bay and Cape Hatteras, NC  
July 2010 to December 2011

**Onslow Bay Aerial Surveys  
Annual Report to the US NAVY**

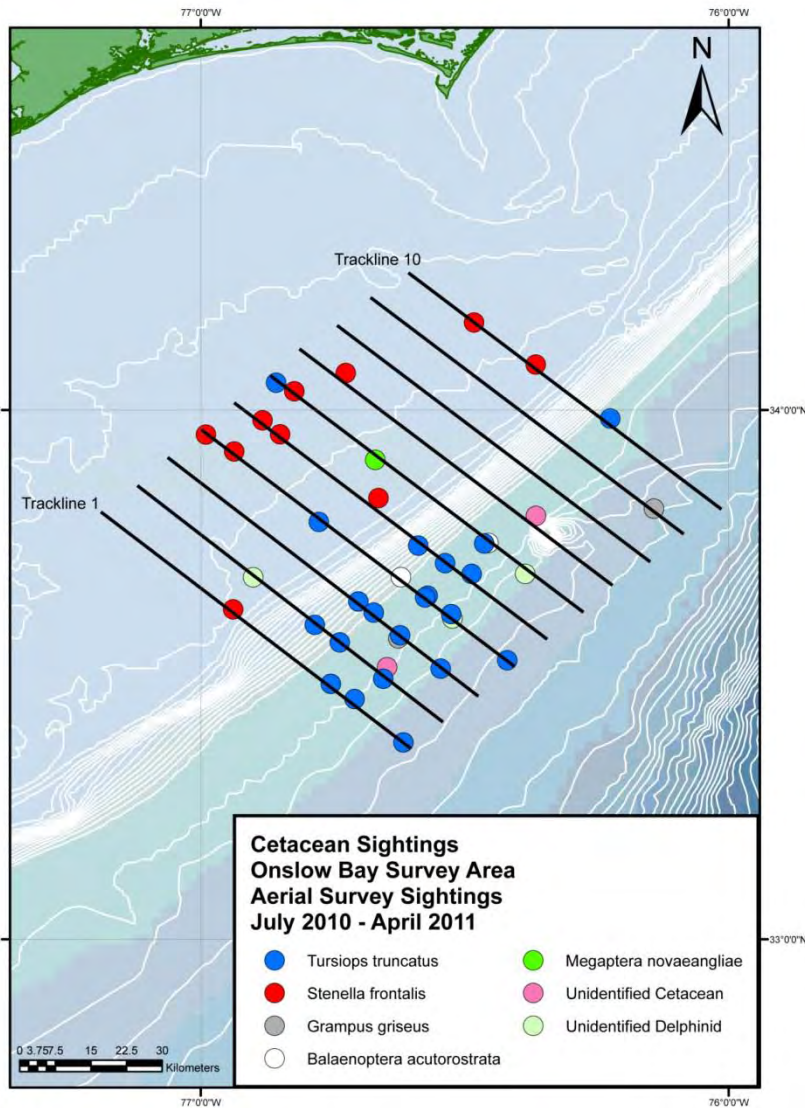


Ryan McAlarney  
Erin Cummings  
Ann Pabst  
Bill McLellan

**Onslow Bay, NC  
Aerial Surveys  
July 2010 – April 2011**

**14 days of survey effort  
90 tracklines flown**

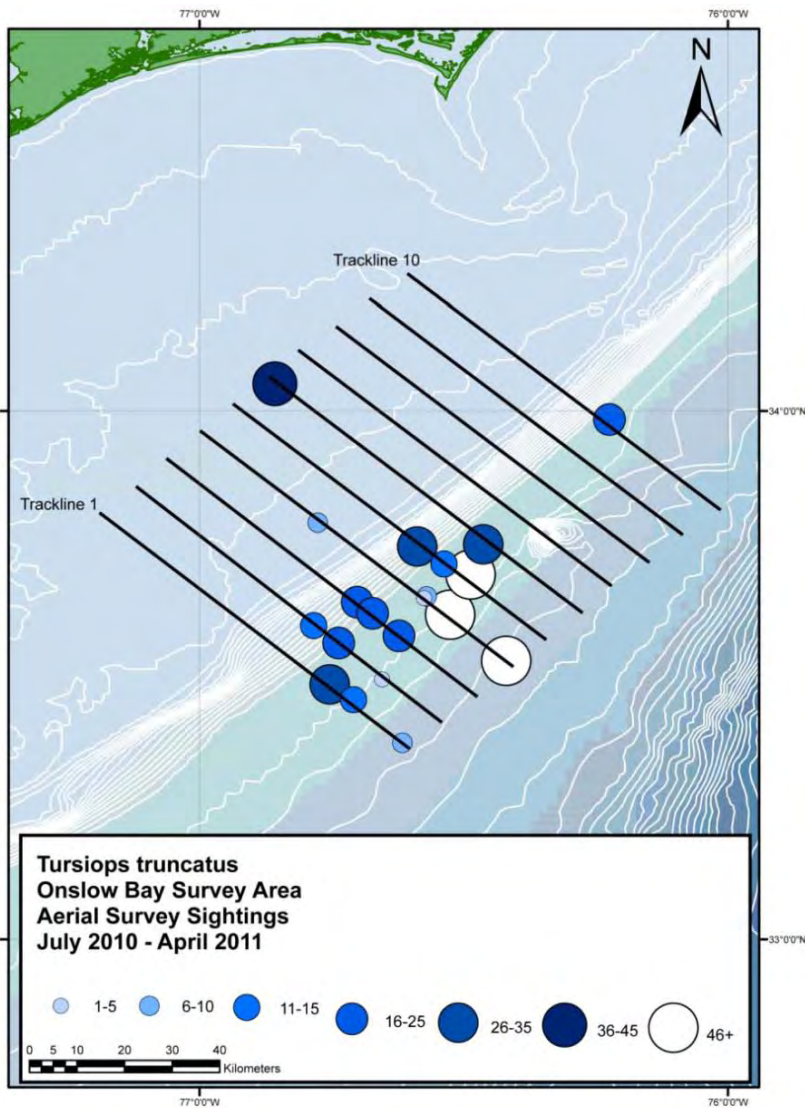
**AFAST Monitoring of Protected Species  
Jacksonville, FL, Onslow Bay and Cape Hatteras, NC  
July 2010 to December 2011**



**41 Sightings**  
**1127 Individuals**  
**5 Species**

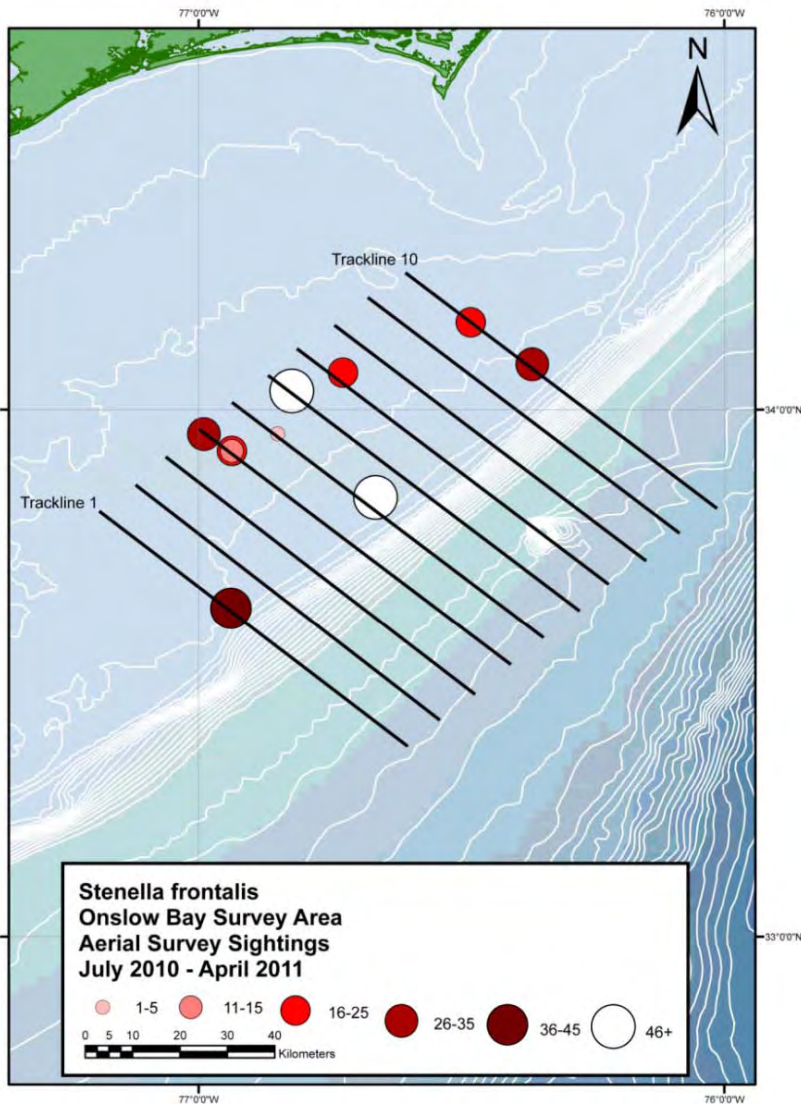
**AFAST Monitoring of Protected Species**  
**Jacksonville, FL, Onslow Bay and Cape Hatteras, NC**  
**July 2010 to December 2011**



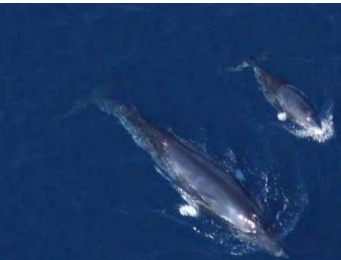


**21 Sightings**  
**679 Individuals**

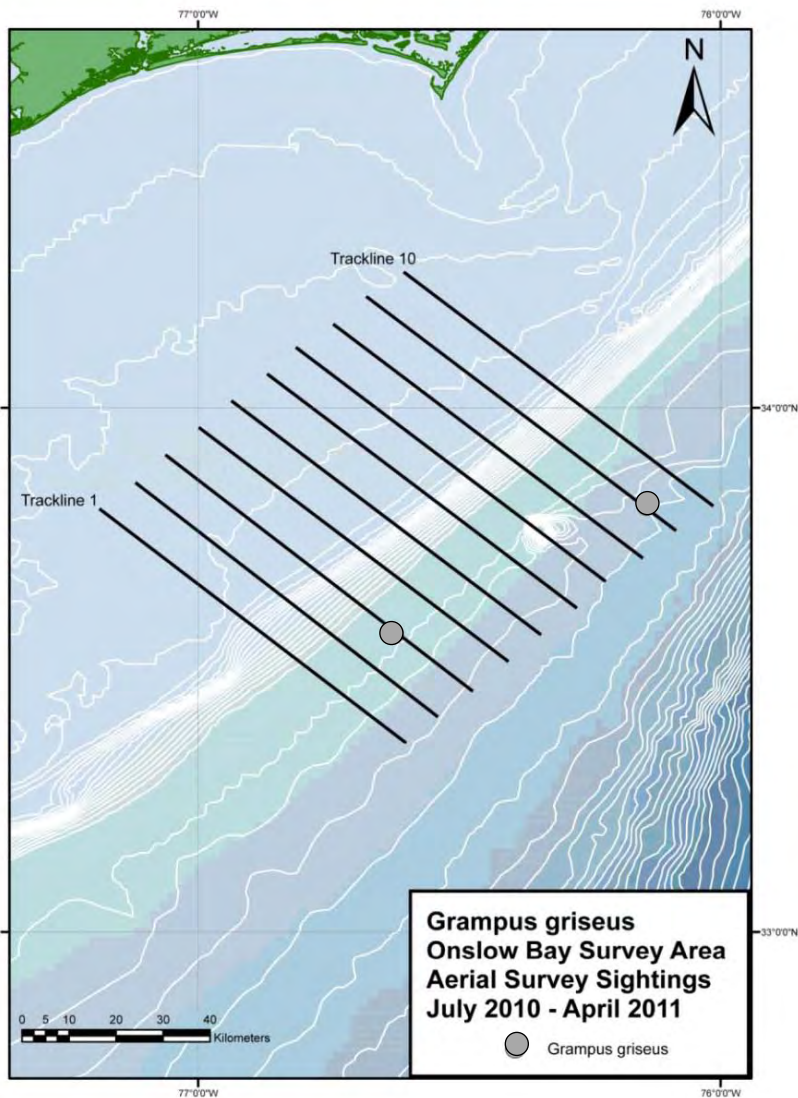
**AFAST Monitoring of Protected Species**  
**Jacksonville, FL, Onslow Bay and Cape Hatteras, NC**  
**July 2010 to December 2011**



**10 Sightings**  
**411 Individuals**



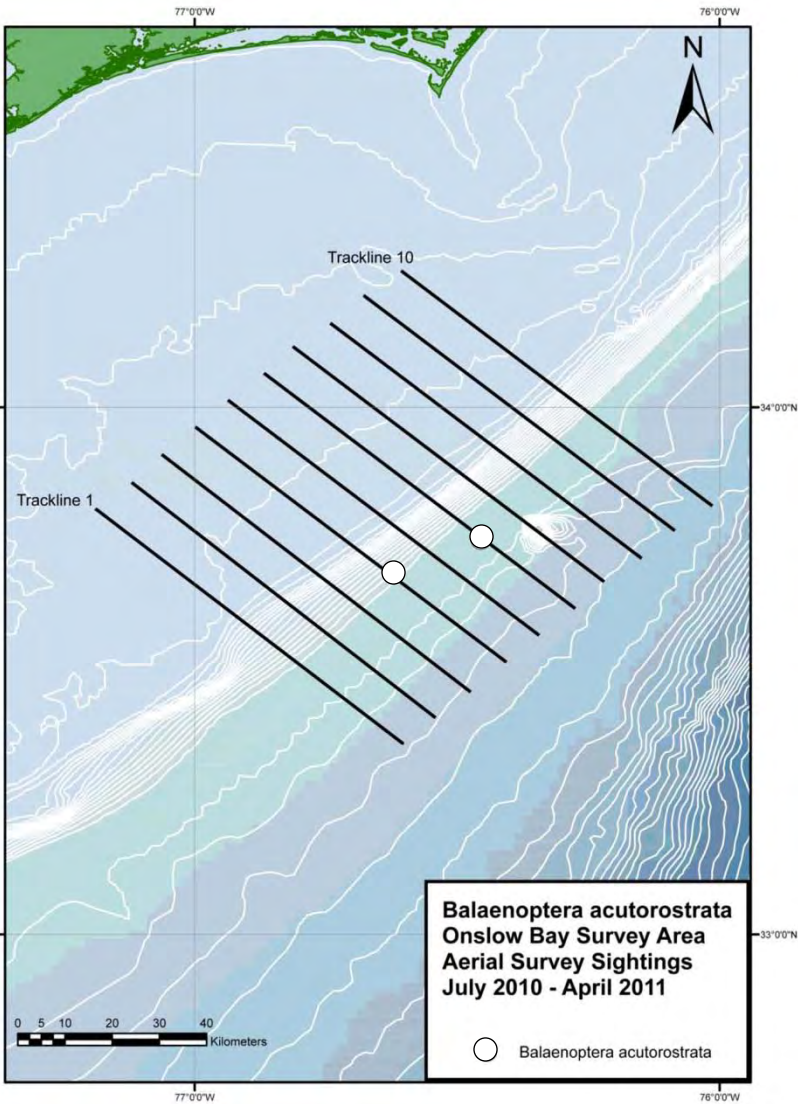
**AFAST Monitoring of Protected Species**  
**Jacksonville, FL, Onslow Bay and Cape Hatteras, NC**  
**July 2010 to December 2011**



2 Sightings  
 12 Individuals



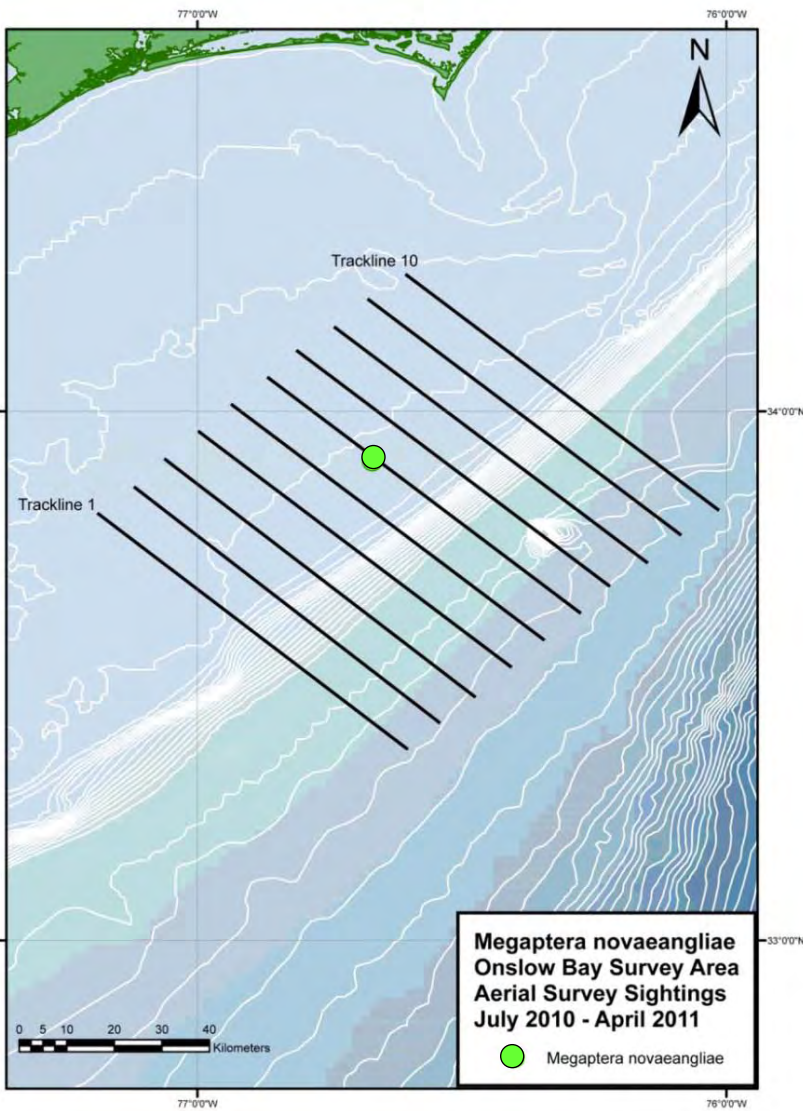
AFAST Monitoring of Protected Species  
 Jacksonville, FL, Onslow Bay and Cape Hatteras, NC  
 July 2010 to December 2011



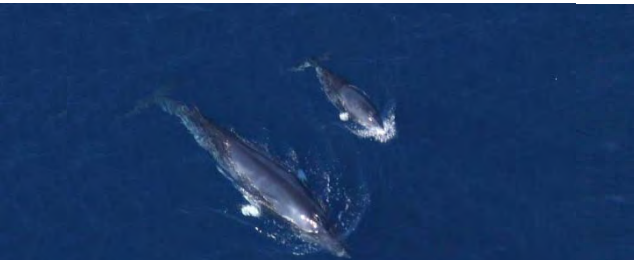
2 Sightings  
3 Individuals



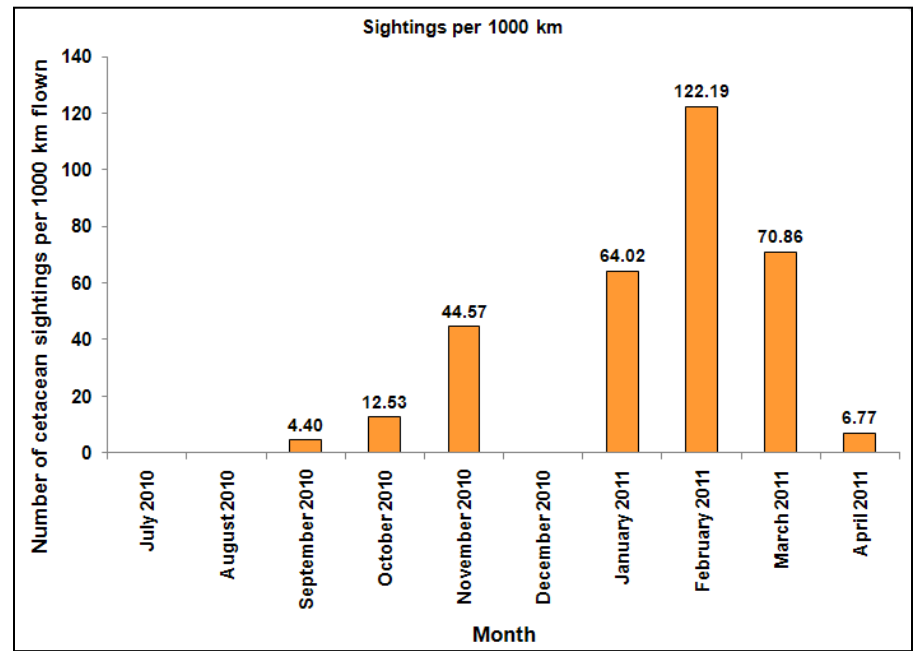
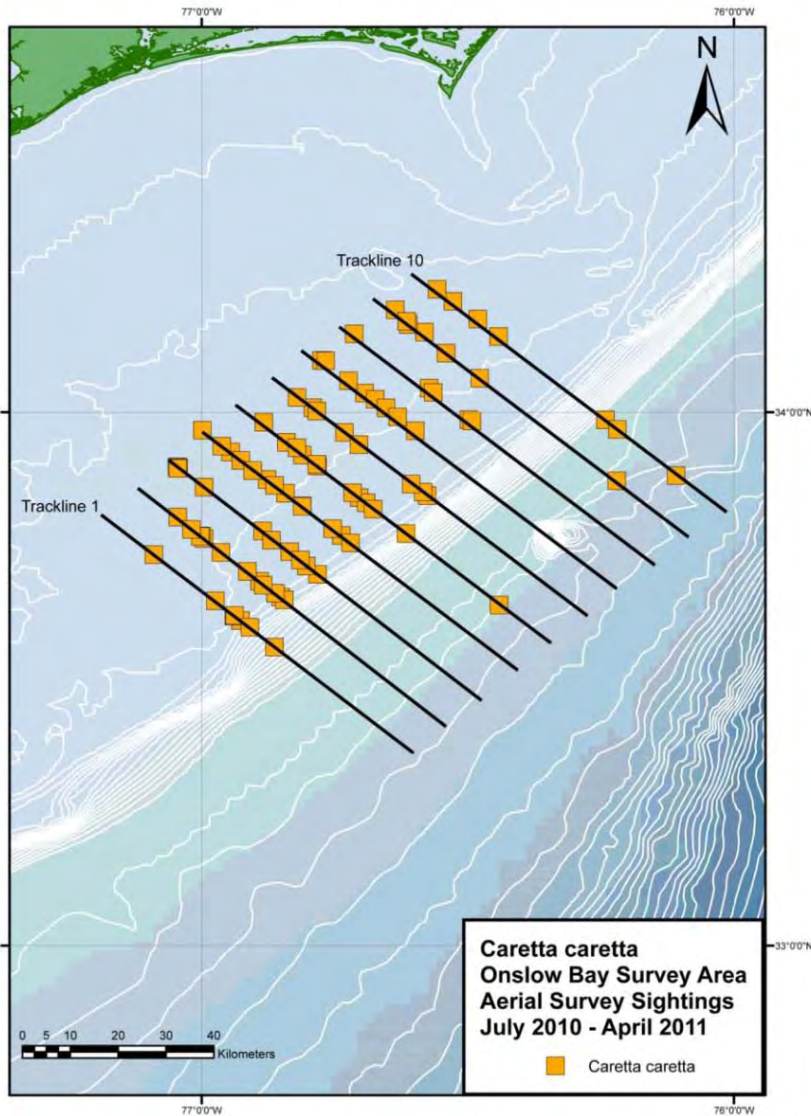
AFAST Monitoring of Protected Species  
Jacksonville, FL, Onslow Bay and Cape Hatteras, NC  
July 2010 to December 2011



1 Sighting  
 2 Individuals



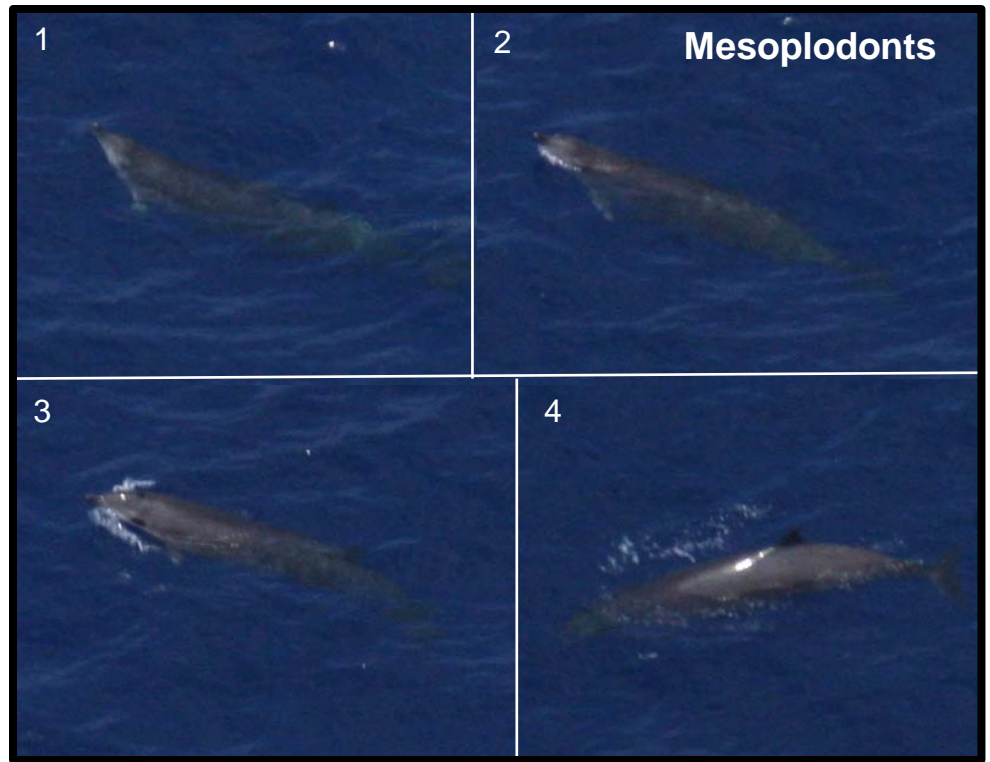
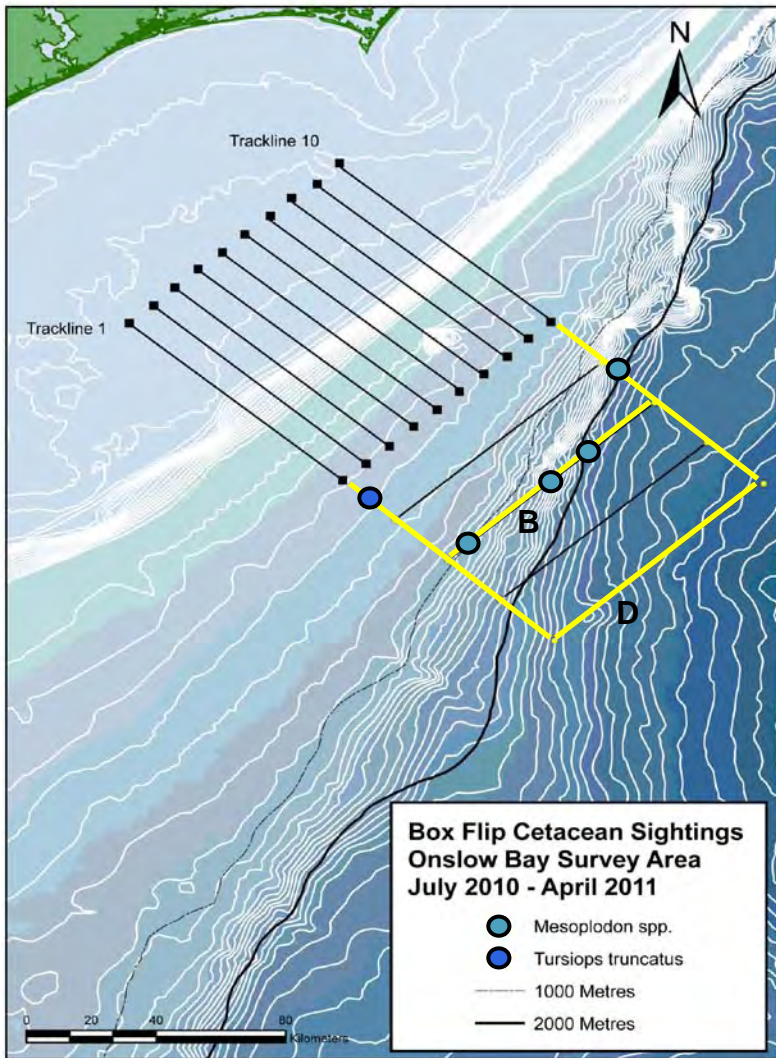
**AFAST Monitoring of Protected Species**  
**Jacksonville, FL, Onslow Bay and Cape Hatteras, NC**  
**July 2010 to December 2011**



181 Loggerheads  
 53 Unidentified



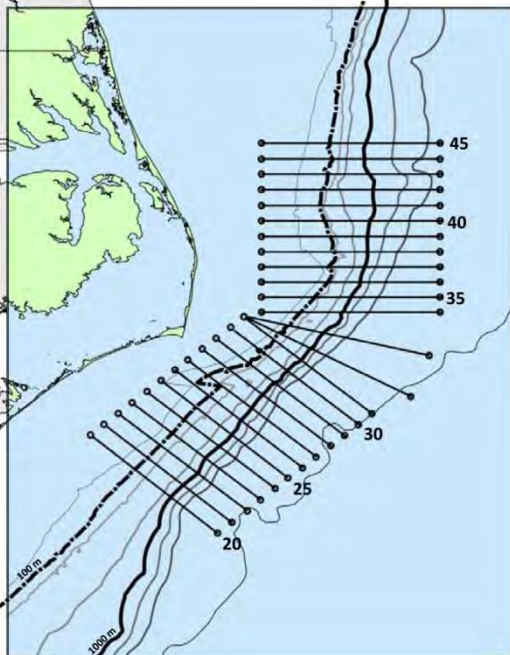
AFAST Monitoring of Protected Species  
 Jacksonville, FL, Onslow Bay and Cape Hatteras, NC  
 July 2010 to December 2011



August 2010 - Line D - No sightings	
November 2010 - Line B - Meoplodonts	3/10
Tursiops	1/7
March 2011 - Line B - Meoplodonts	1/1

AFAST Monitoring of Protected Species  
Jacksonville, FL, Onslow Bay and Cape Hatteras, NC  
July 2010 to December 2011

**Cape Hatteras Aerial Surveys  
Annual Report to the US NAVY**



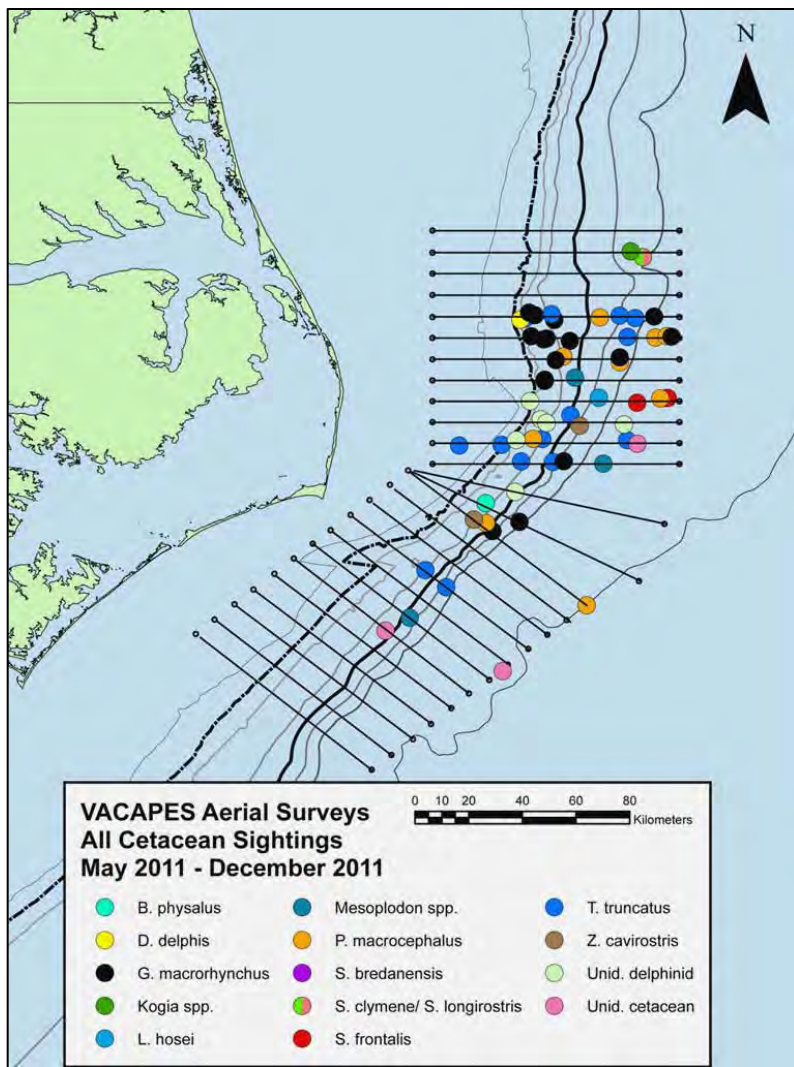
Ryan McAlarney  
Erin Cummings  
Ann Pabst  
Bill McLellan

**Cape Hatteras, NC  
Aerial Surveys  
May 2011 - December 2011**

**10 days of survey effort  
64 tracklines flown**

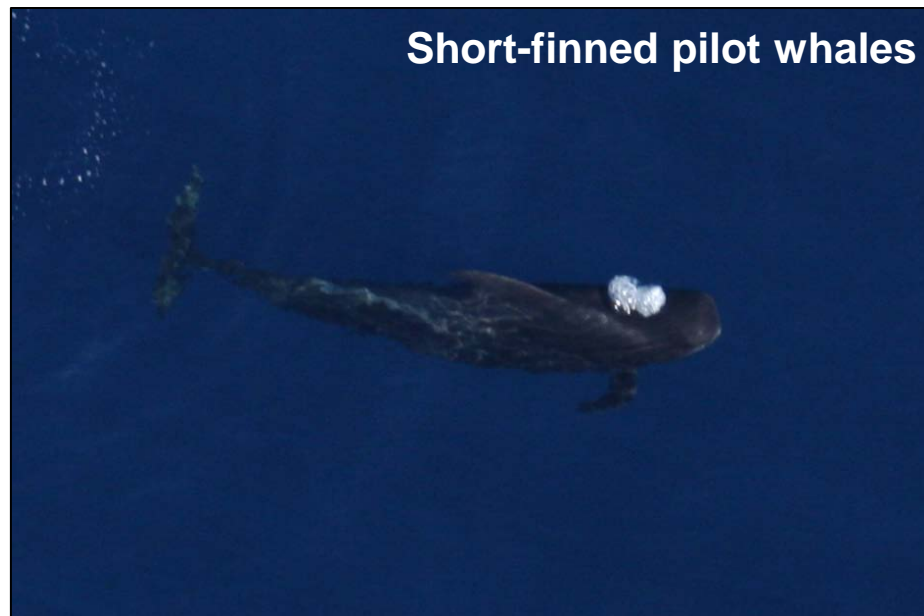
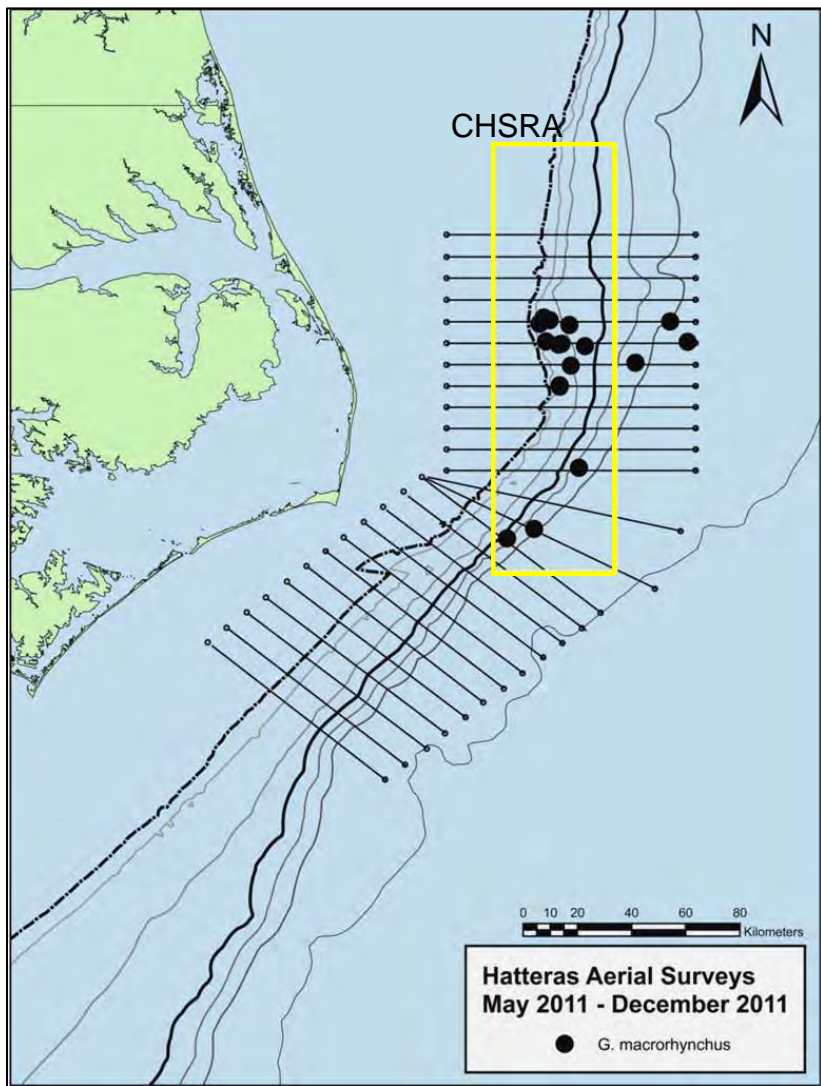
**AFAST Monitoring of Protected Species  
Jacksonville, FL, Onslow Bay and Cape Hatteras, NC  
July 2010 to December 2011**



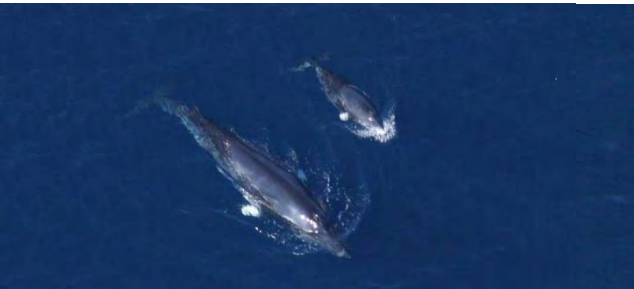


**66 Sightings**  
**1270 Individuals**  
**13 Species**

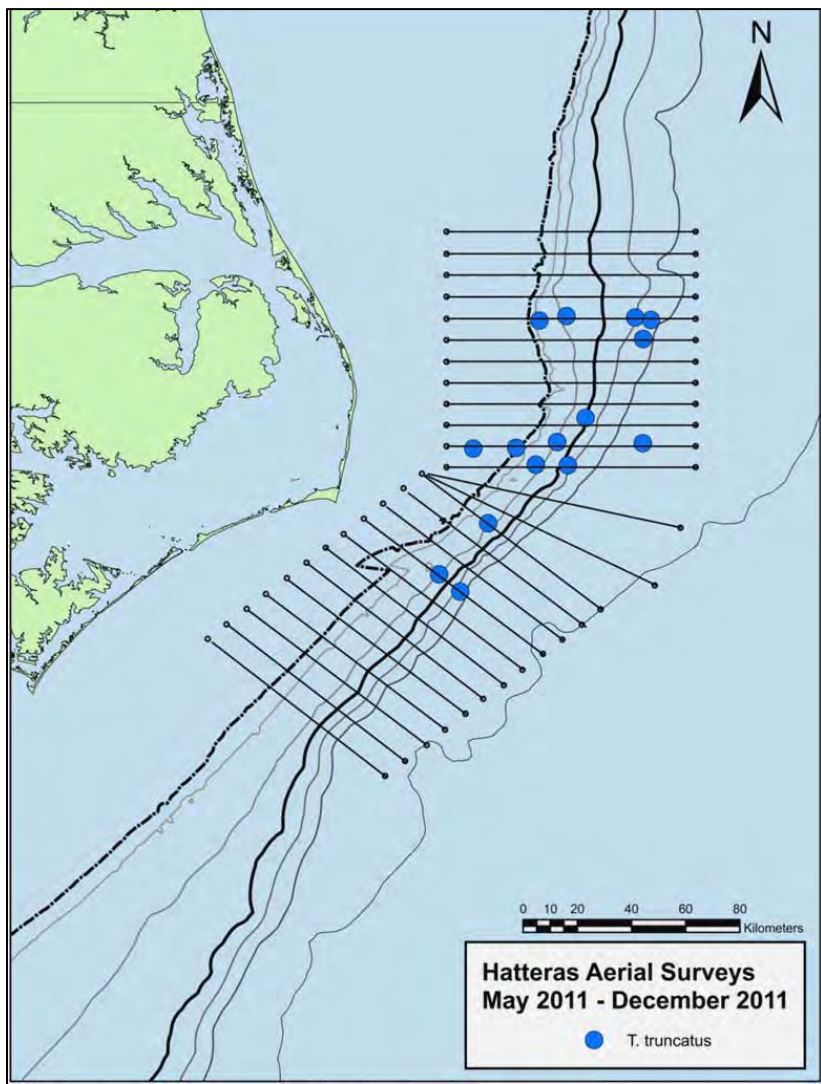
**AFAST Monitoring of Protected Species**  
**Jacksonville, FL, Onslow Bay and Cape Hatteras, NC**  
**July 2010 to December 2011**



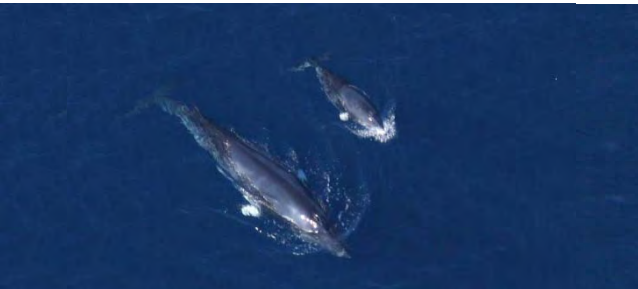
17 Sightings  
 327 Individuals



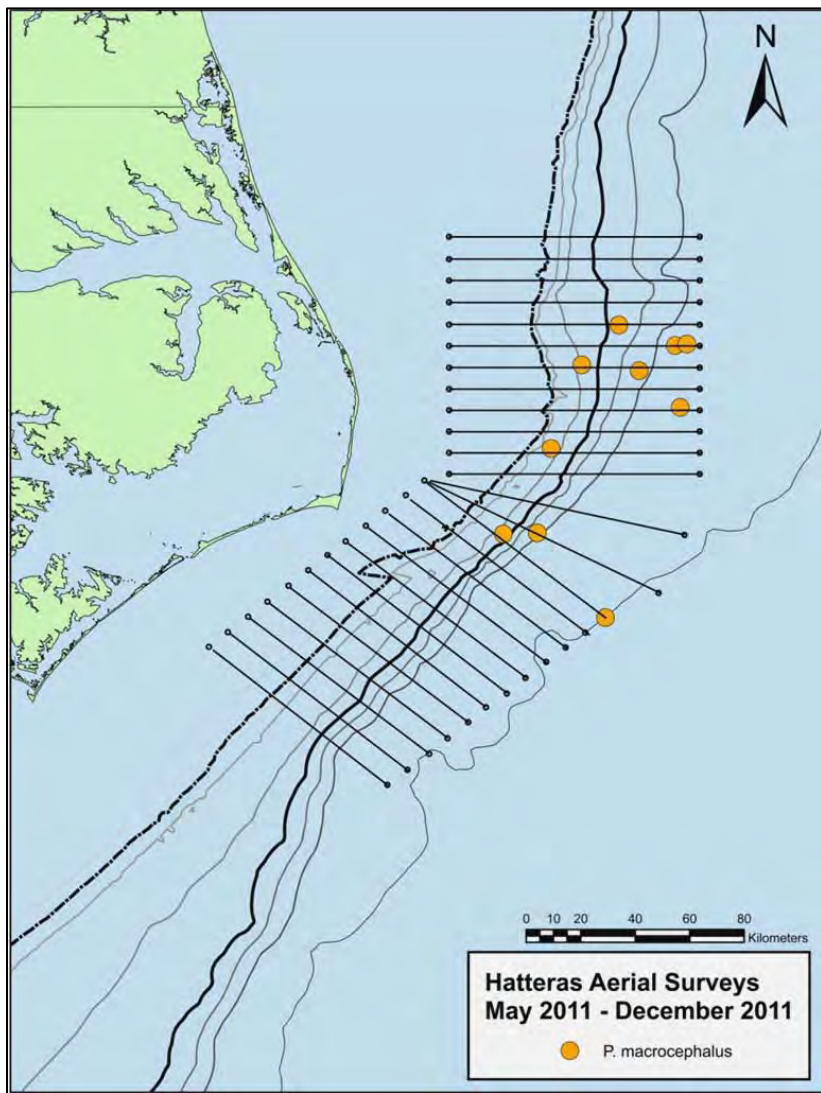
AFAST Monitoring of Protected Species  
 Jacksonville, FL, Onslow Bay and Cape Hatteras, NC  
 July 2010 to December 2011



15 Sightings  
272 Individuals



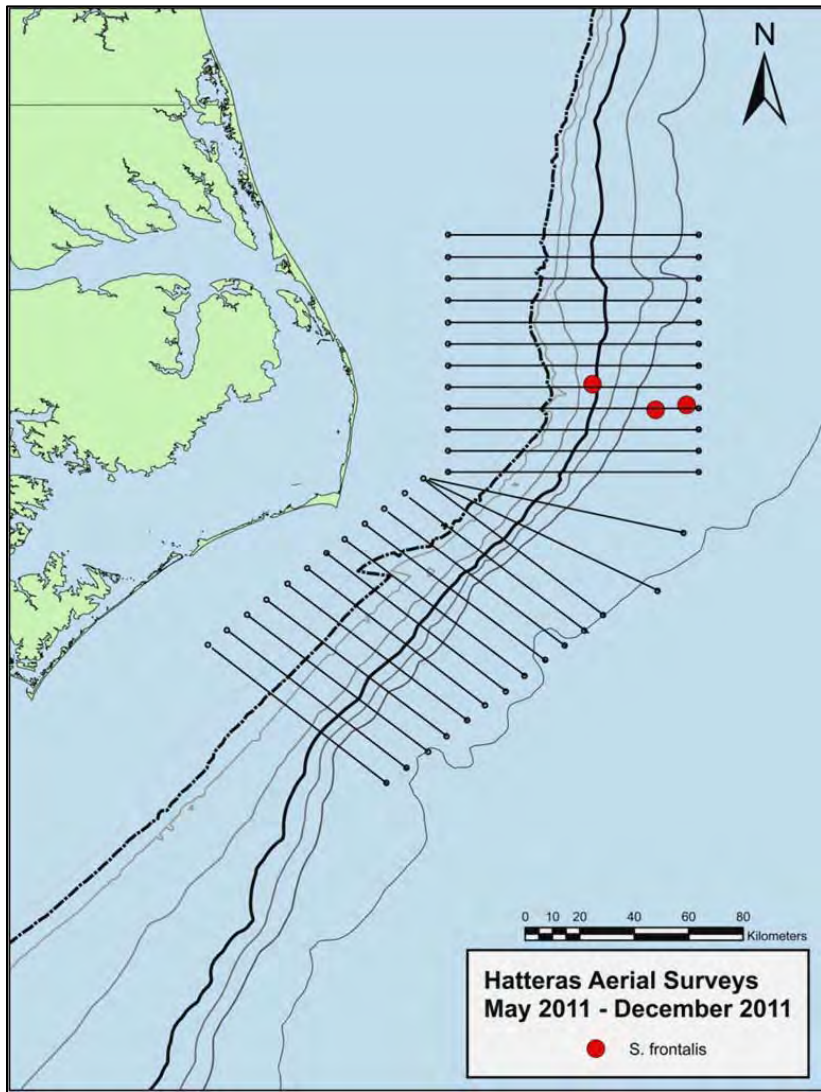
AFAST Monitoring of Protected Species  
Jacksonville, FL, Onslow Bay and Cape Hatteras, NC  
July 2010 to December 2011



10 Sightings  
 18 Individuals



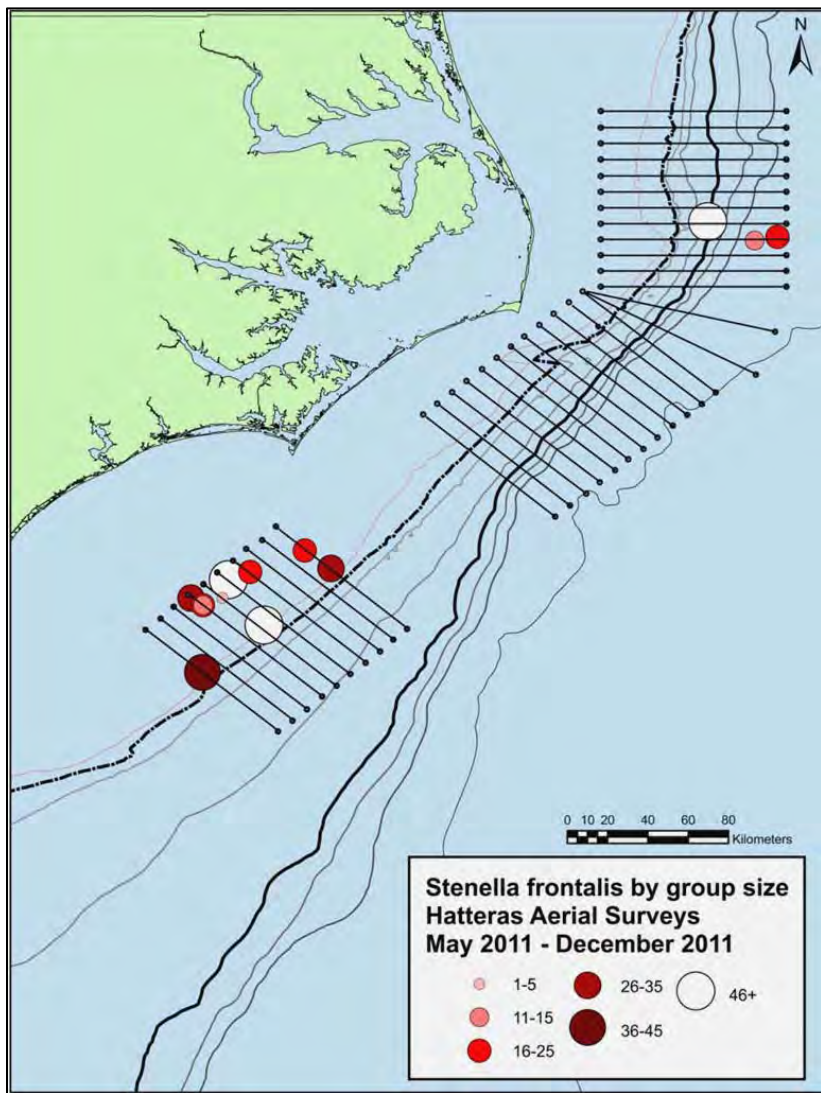
AFAST Monitoring of Protected Species  
 Jacksonville, FL, Onslow Bay and Cape Hatteras, NC  
 July 2010 to December 2011



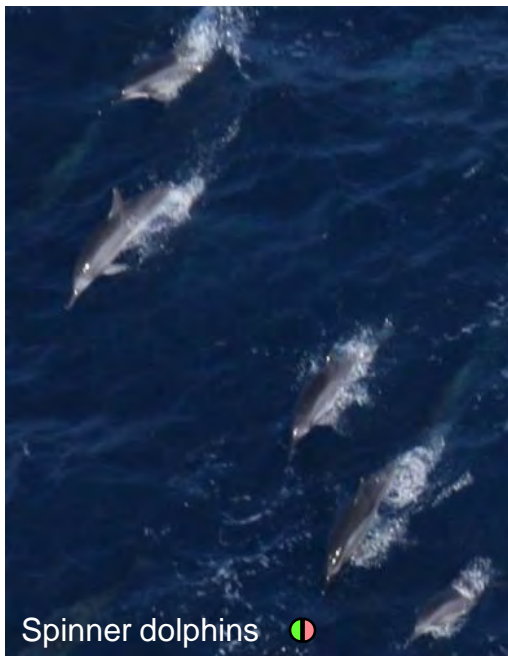
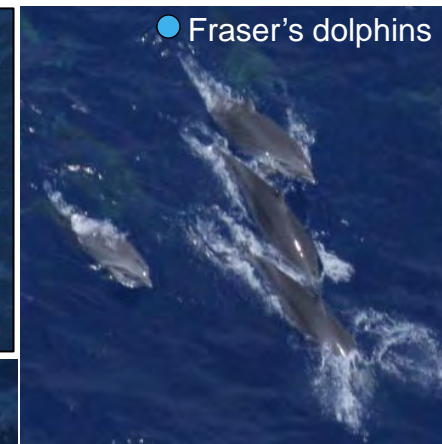
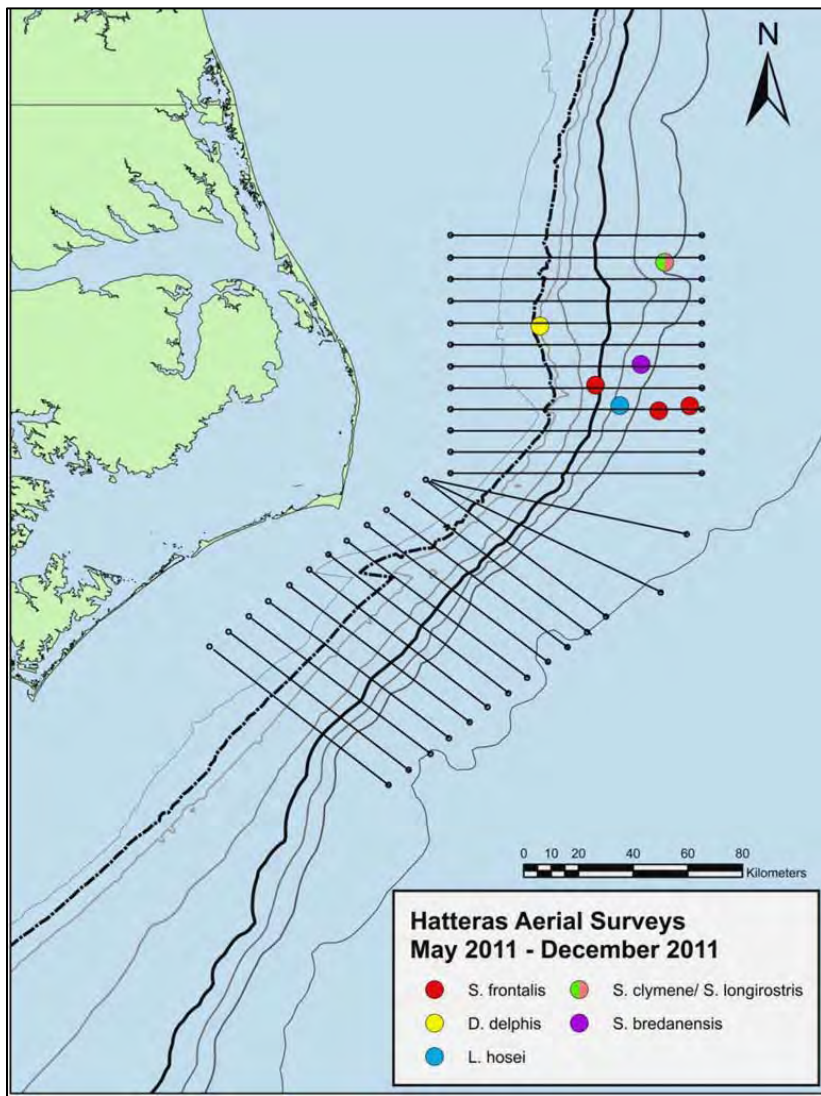
**3 Sightings**  
**84 Individuals**



**AFAST Monitoring of Protected Species**  
 Jacksonville, FL, Onslow Bay and Cape Hatteras, NC  
 July 2010 to December 2011

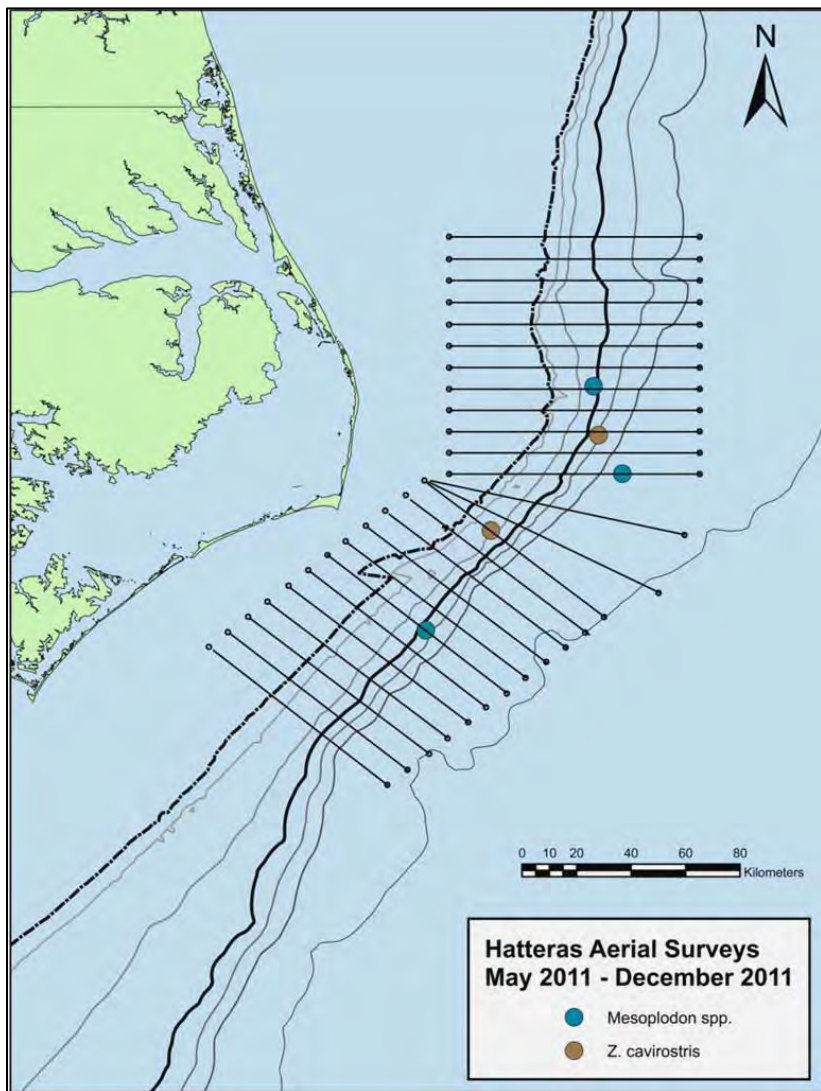


AFAST Monitoring of Protected Species  
Jacksonville, FL, Onslow Bay and Cape Hatteras, NC  
July 2010 to December 2011



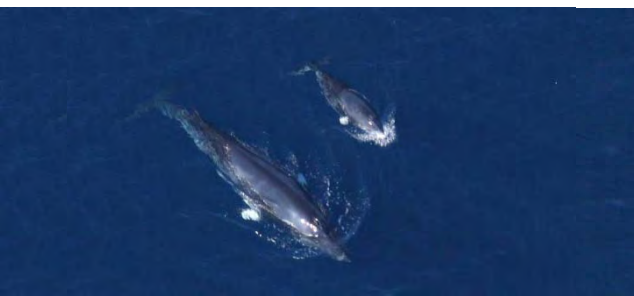
Single sighting of each species

AFAST Monitoring of Protected Species  
Jacksonville, FL, Onslow Bay and Cape Hatteras, NC  
July 2010 to December 2011



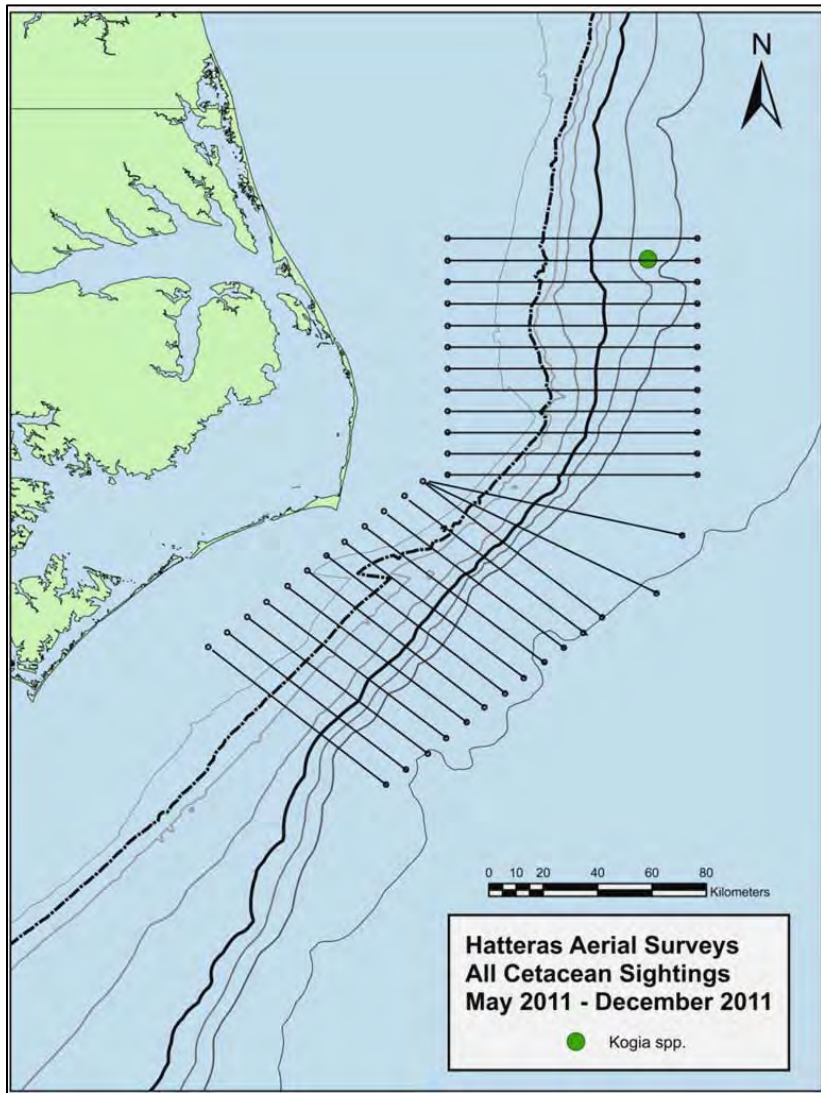
Cuvier's beaked whale

Mesoplodont	3 Sightings	6 Individuals
Cuvier's	2 Sightings	5 Individuals

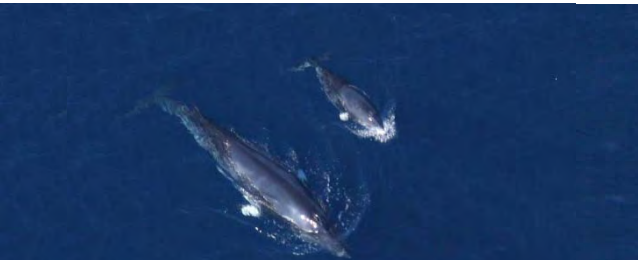


**AFAST Monitoring of Protected Species**  
**Jacksonville, FL, Onslow Bay and Cape Hatteras, NC**  
**July 2010 to December 2011**

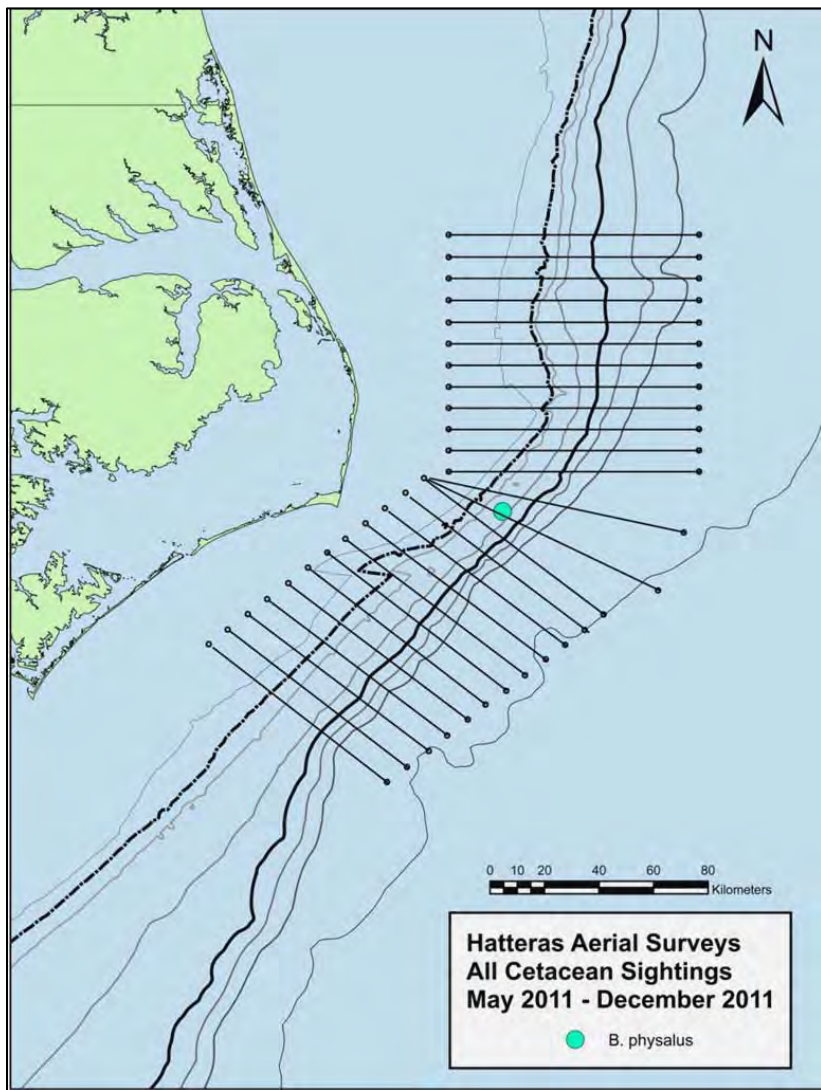




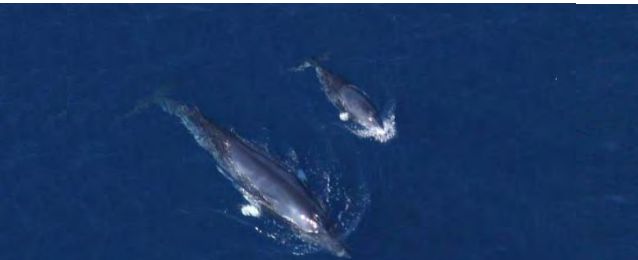
1 Sighting  
 1 Individual



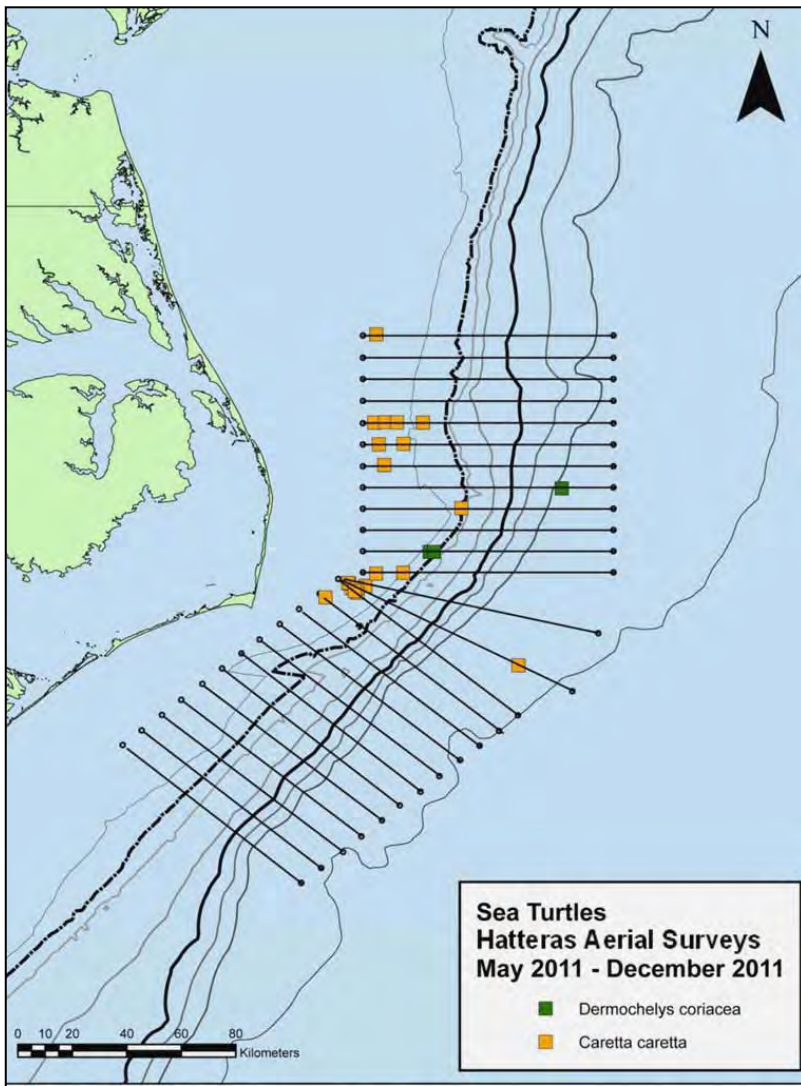
**AFAST Monitoring of Protected Species**  
**Jacksonville, FL, Onslow Bay and Cape Hatteras, NC**  
**July 2010 to December 2011**



**1 Sighting**  
**1 Individual**



**AFAST Monitoring of Protected Species**  
**Jacksonville, FL, Onslow Bay and Cape Hatteras, NC**  
**July 2010 to December 2011**



29 Sightings



3 Sightings



AFAST Monitoring of Protected Species  
Jacksonville, FL, Onslow Bay and Cape Hatteras, NC  
July 2010 to December 2011

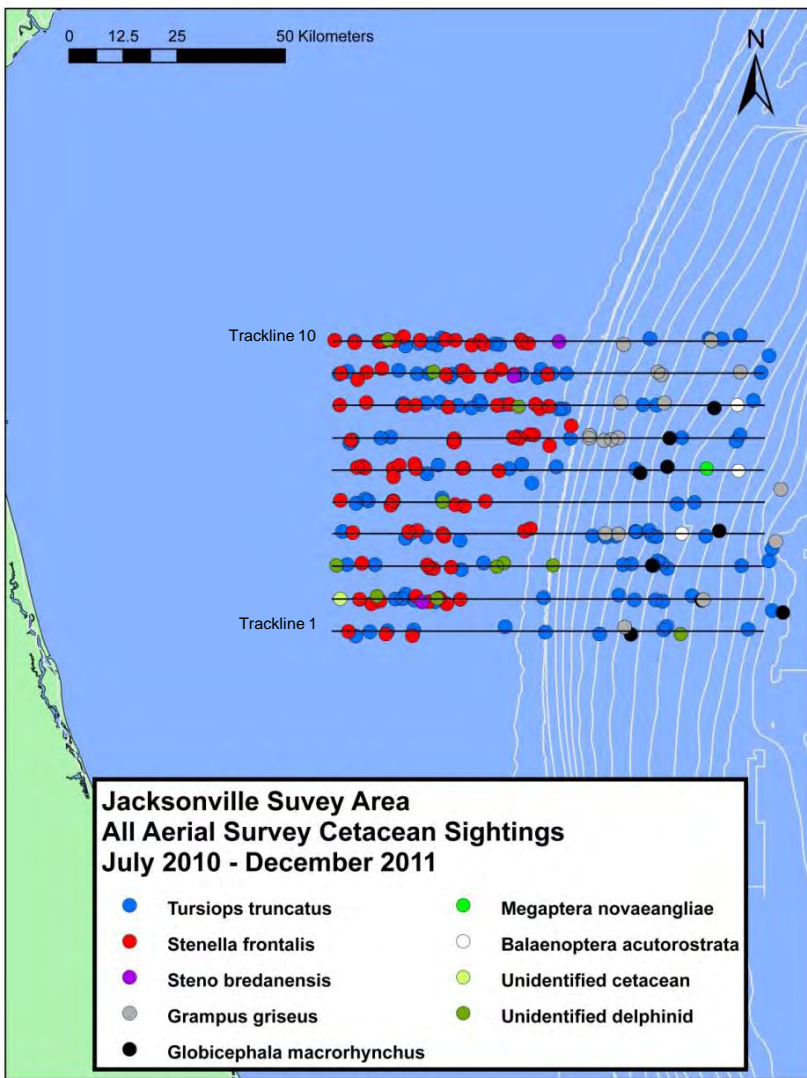
# Jacksonville Aerial Surveys Annual Report to the US NAVY



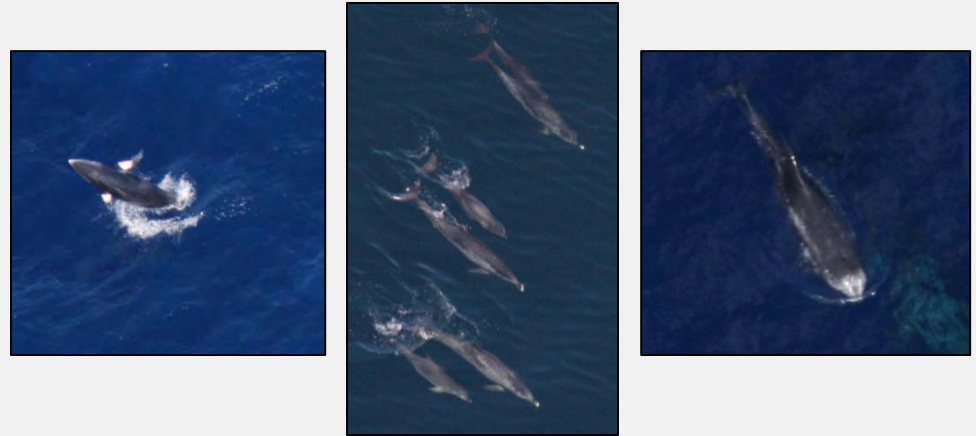
Erin Cummings, Ryan McAlarney,  
Peter Nilsson, Heather Foley,  
Rachel Hardee, Richard Holt,  
Ann Pabst, Bill McLellan

## Jacksonville, FL Aerial Surveys July 2010 - December 2011

AFAST Monitoring of Protected Species  
Jacksonville, FL, Onslow Bay and Cape Hatteras, NC  
July 2010 to December 2011

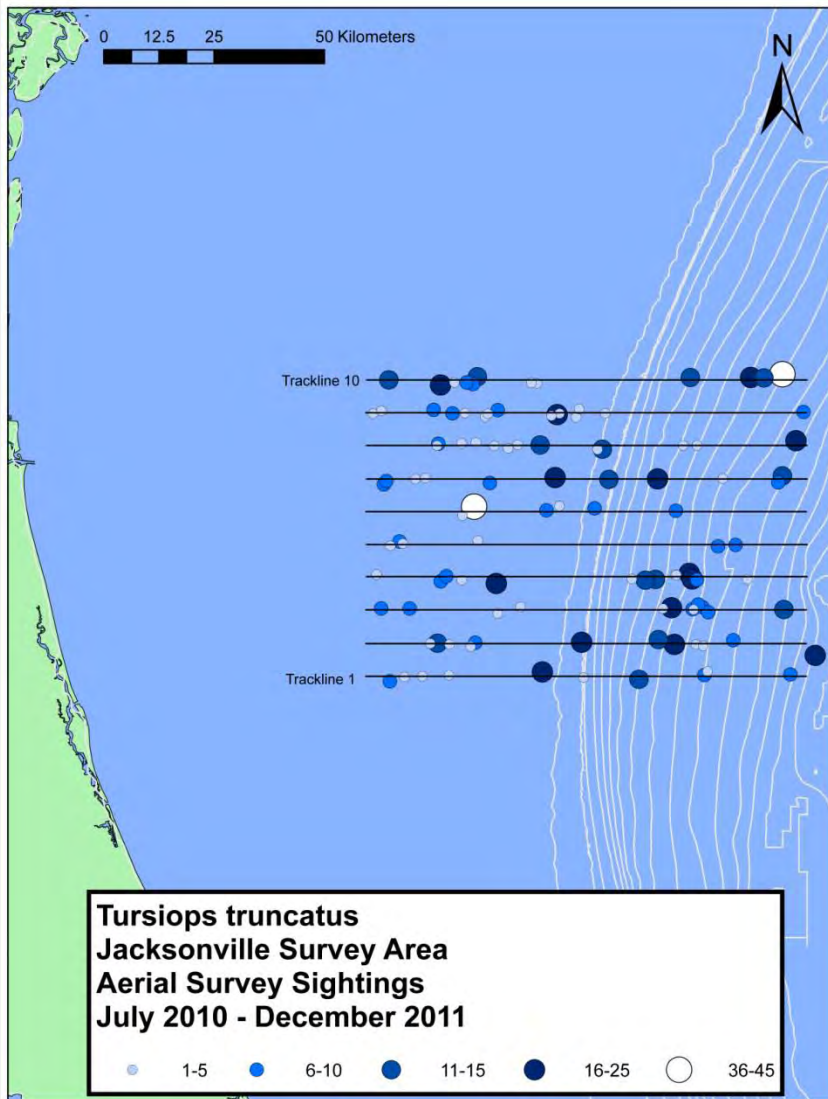


## All Cetaceans



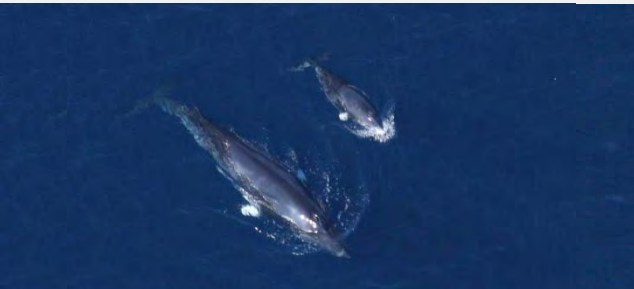
**241 Sightings**  
**3198 Individuals**  
**7 Species**

AFAST Monitoring of Protected Species  
 Jacksonville, FL, Onslow Bay and Cape Hatteras, NC  
 July 2010 to December 2011

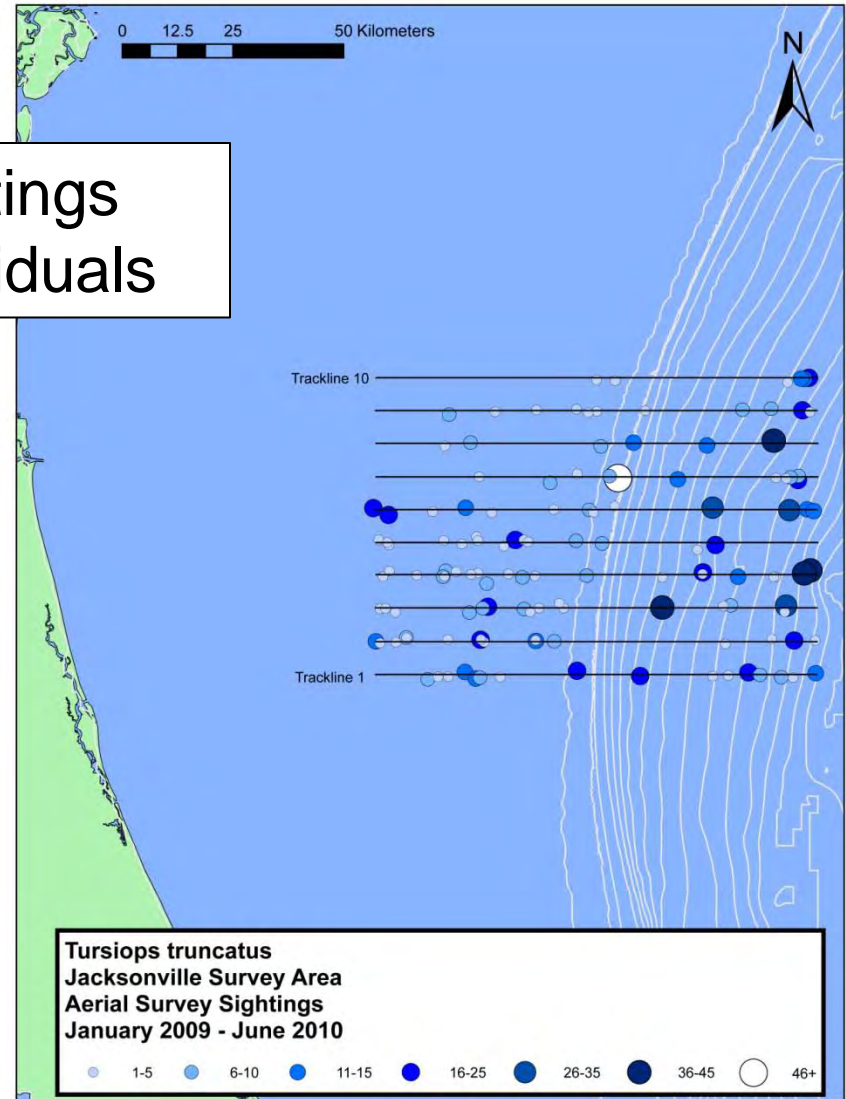
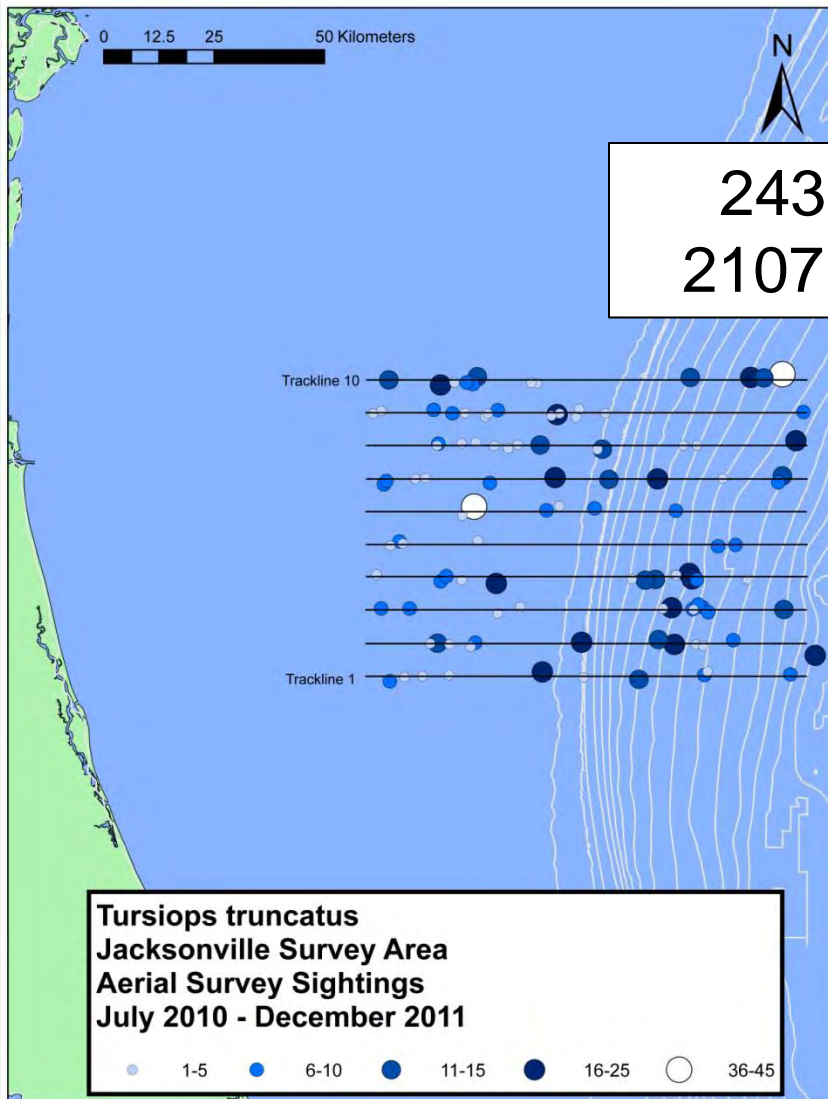


**Bottlenose dolphins**

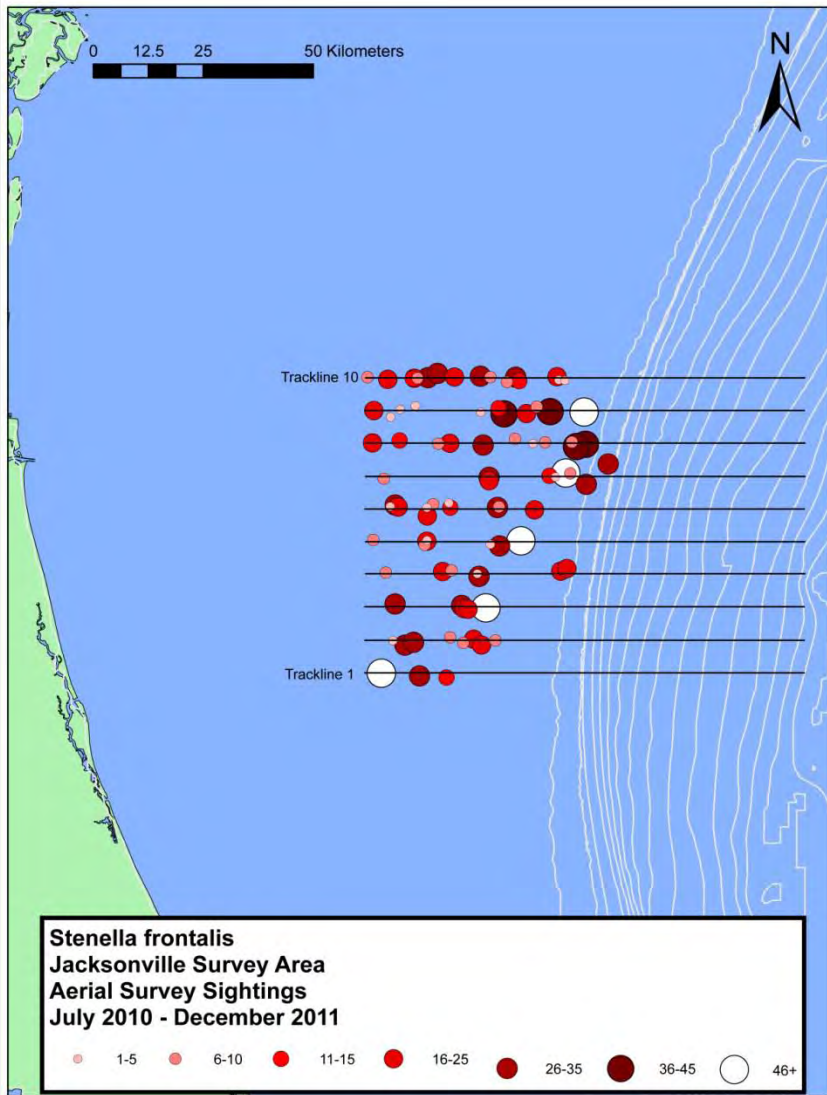
**111 Sightings**  
**928 Individuals**



**AFAST Monitoring of Protected Species**  
**Jacksonville, FL, Onslow Bay and Cape Hatteras, NC**  
**July 2010 to December 2011**

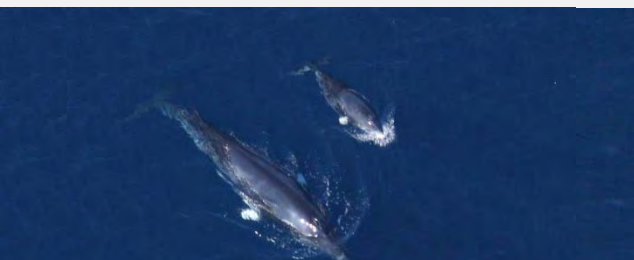


**AFAST Monitoring of Protected Species**  
**Jacksonville, FL, Onslow Bay and Cape Hatteras, NC**  
**July 2010 to December 2011**



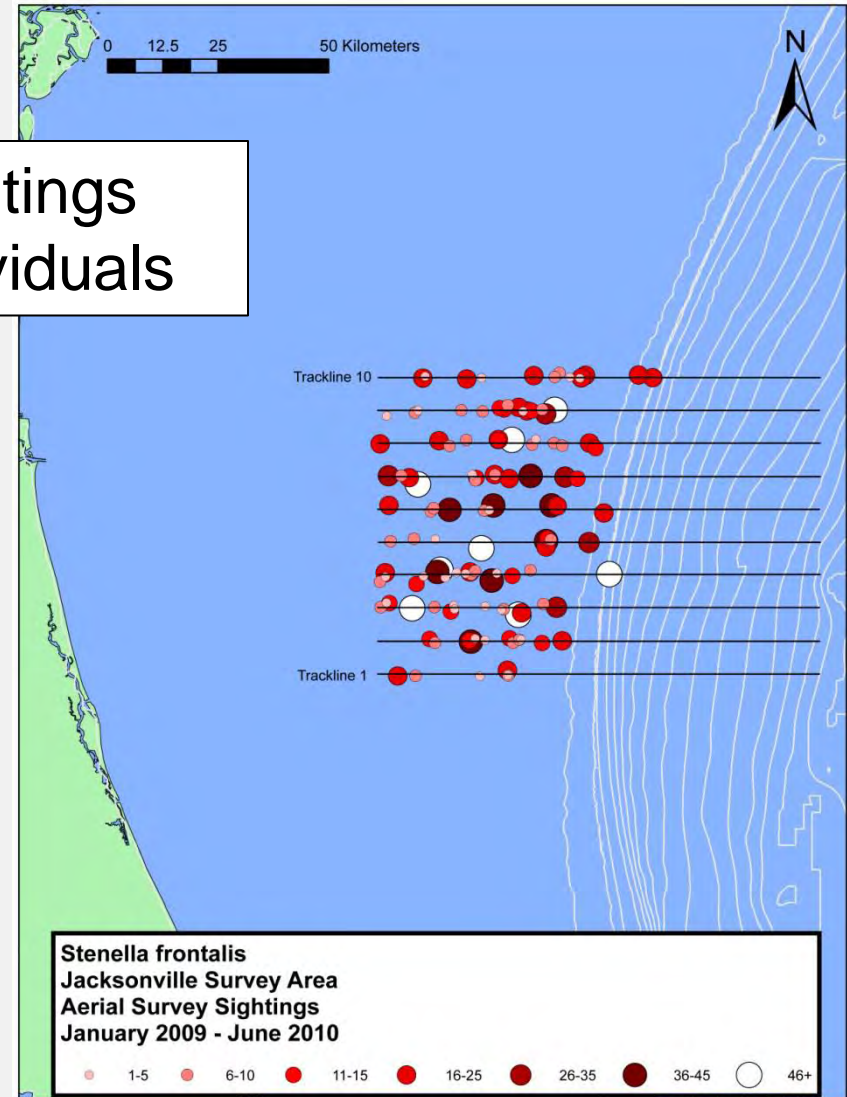
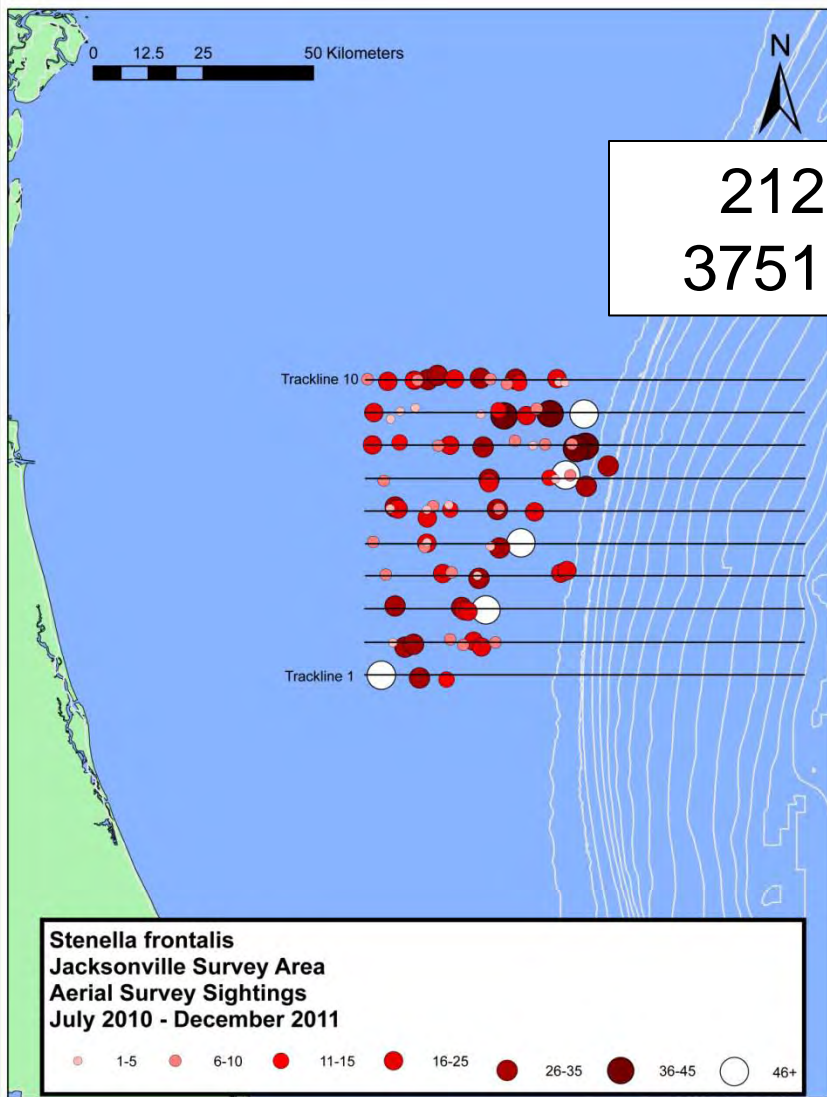
**Atlantic spotted dolphins**

**88 Sightings**  
**1671 Individuals**

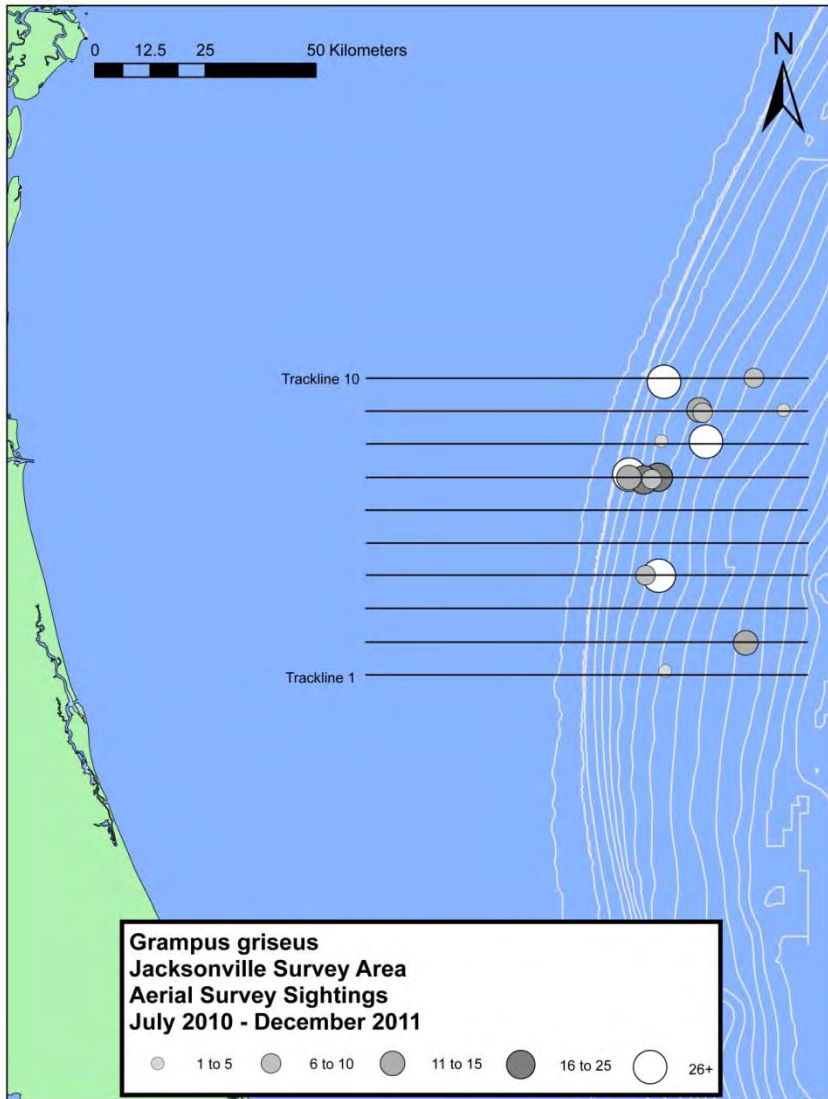


**AFAST Monitoring of Protected Species**  
**Jacksonville, FL, Onslow Bay and Cape Hatteras, NC**  
**July 2010 to December 2011**



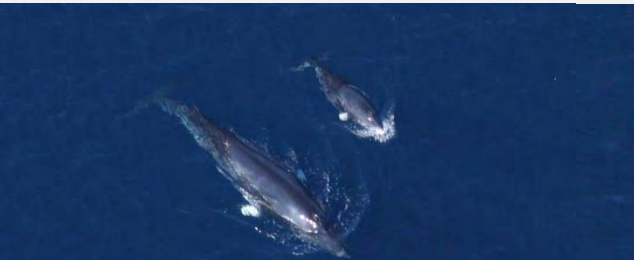


AFAST Monitoring of Protected Species  
Jacksonville, FL, Onslow Bay and Cape Hatteras, NC  
July 2010 to December 2011

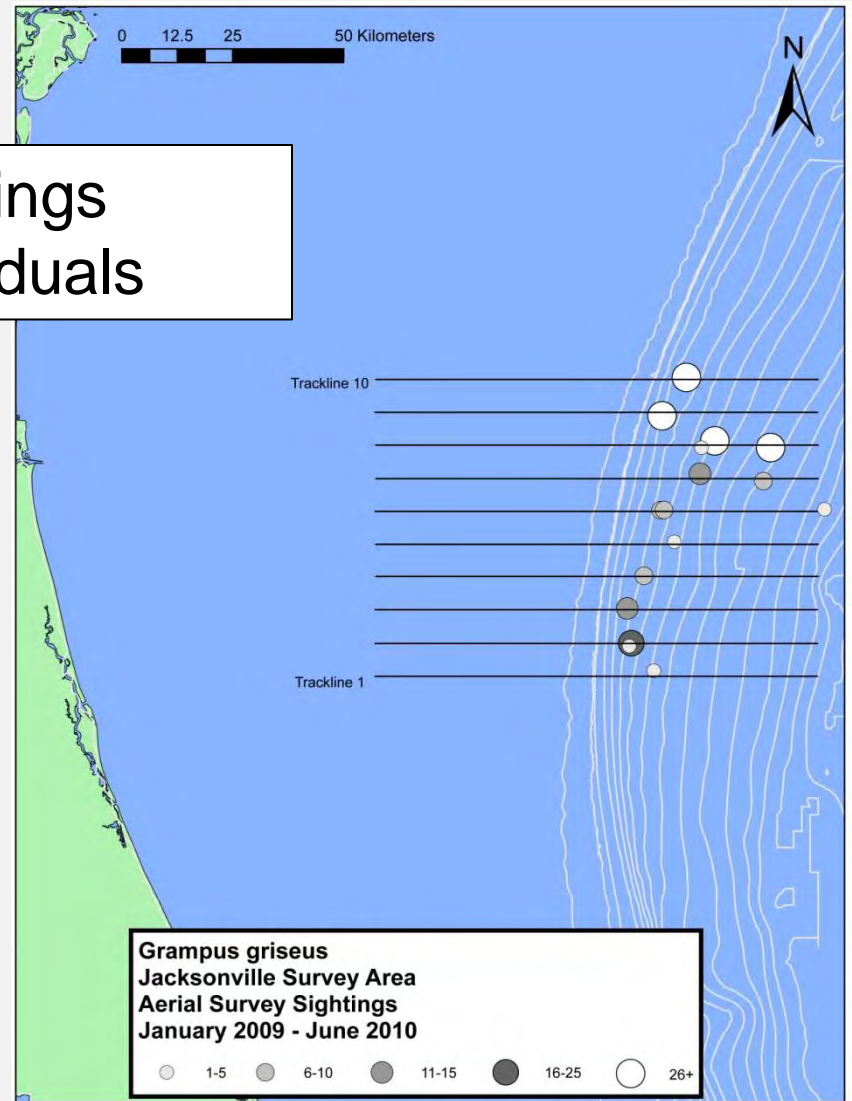
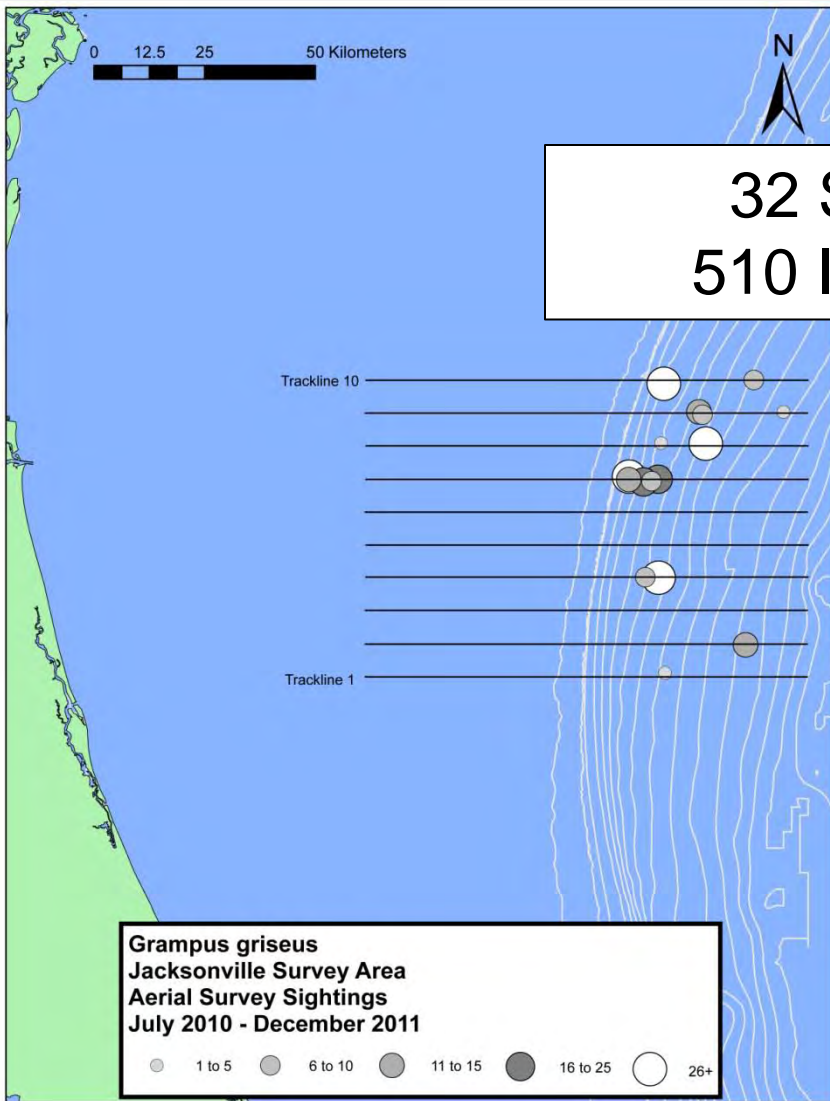


**Risso's dolphins**

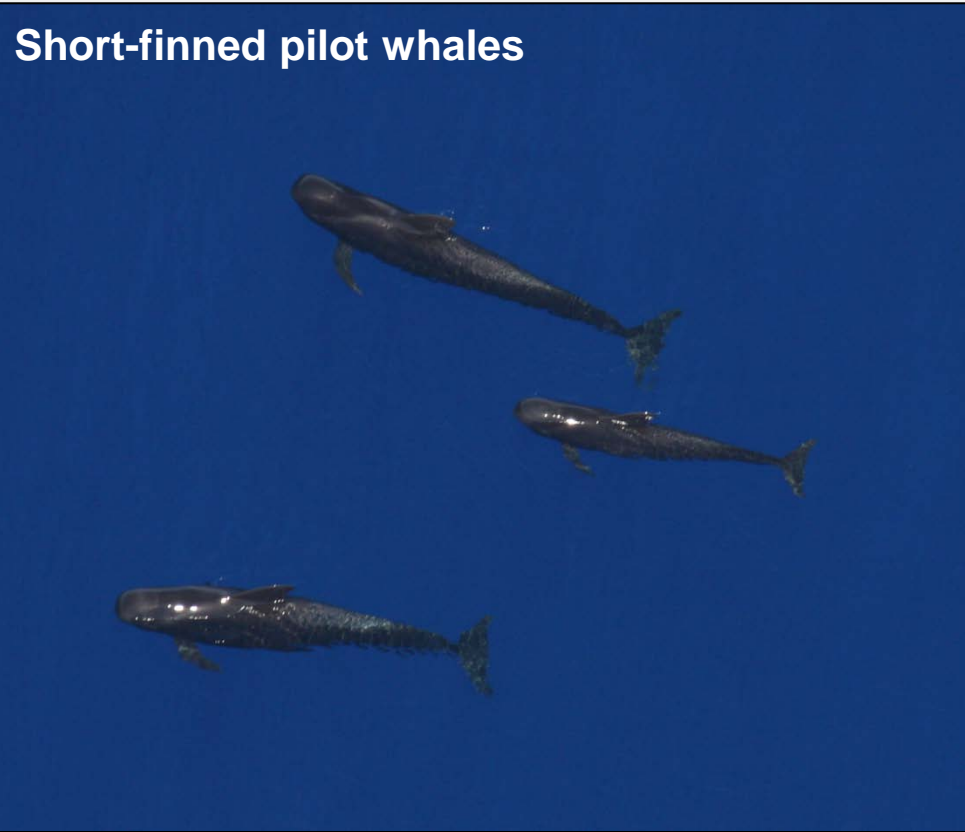
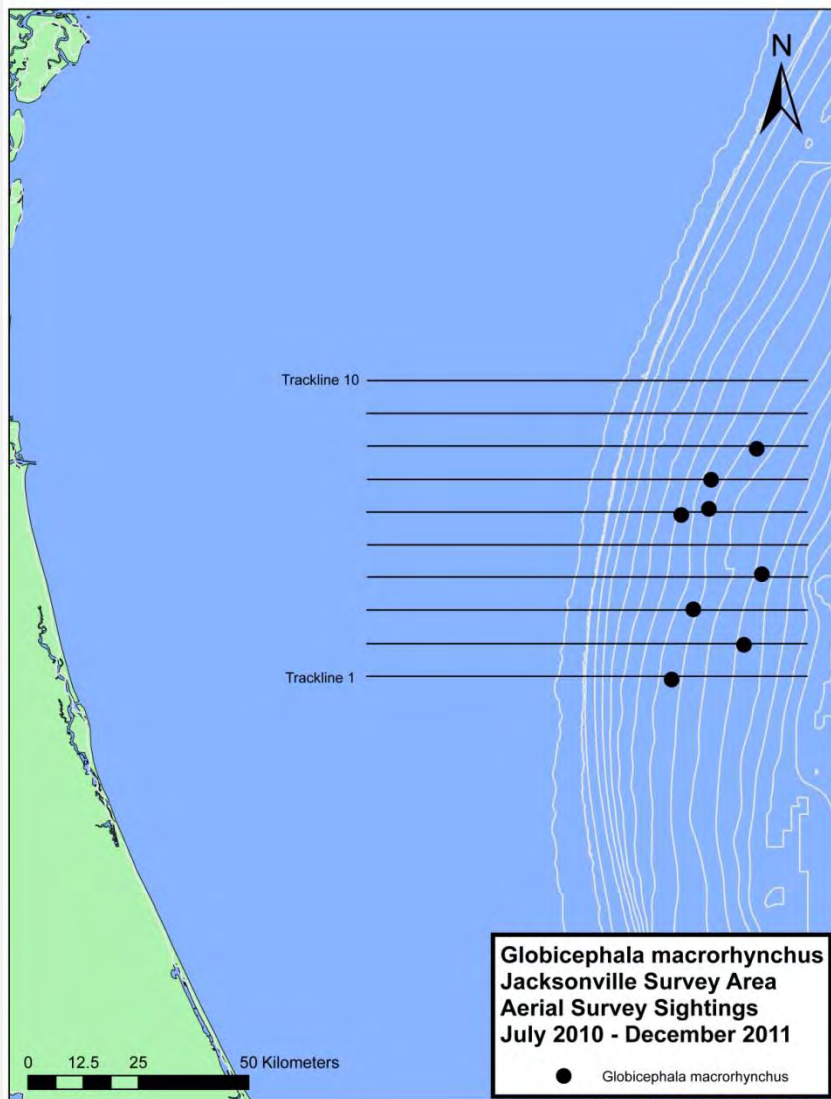
**16 Sightings**  
**282 Individuals**



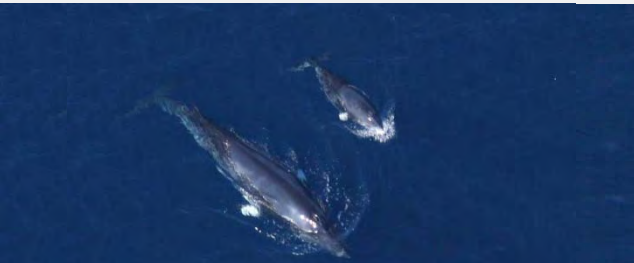
**AFAST Monitoring of Protected Species**  
**Jacksonville, FL, Onslow Bay and Cape Hatteras, NC**  
**July 2010 to December 2011**



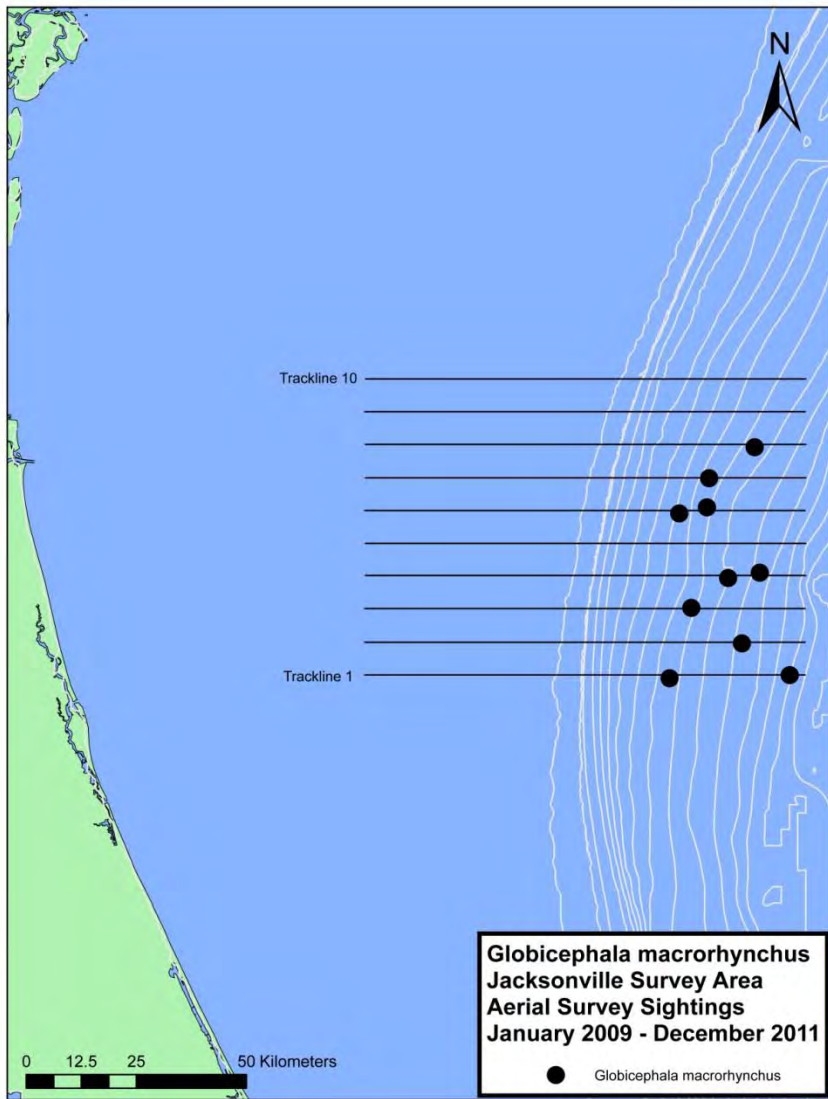
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**July 2010 to December 2011**



**8 Sightings**  
**173 Individuals**



**AFAST Monitoring of Protected Species**  
**Jacksonville, FL, Onslow Bay and Cape Hatteras, NC**  
**July 2010 to December 2011**

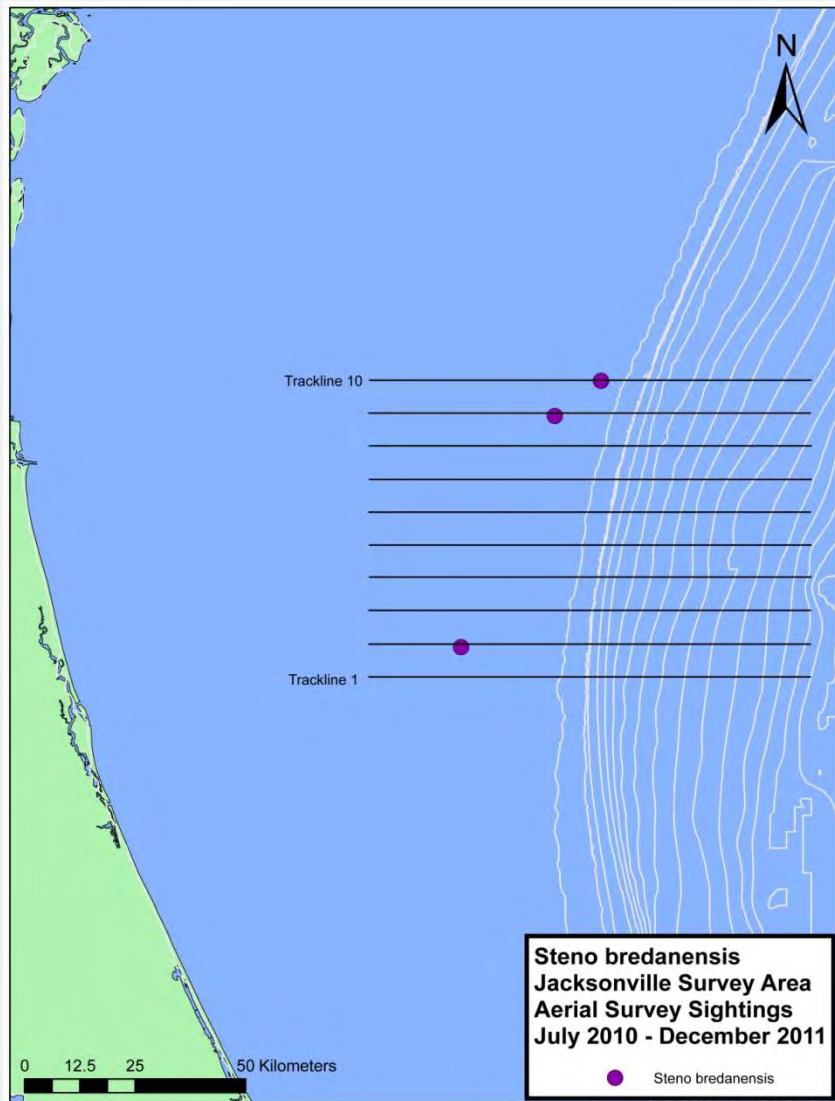


## Short-finned pilot whales



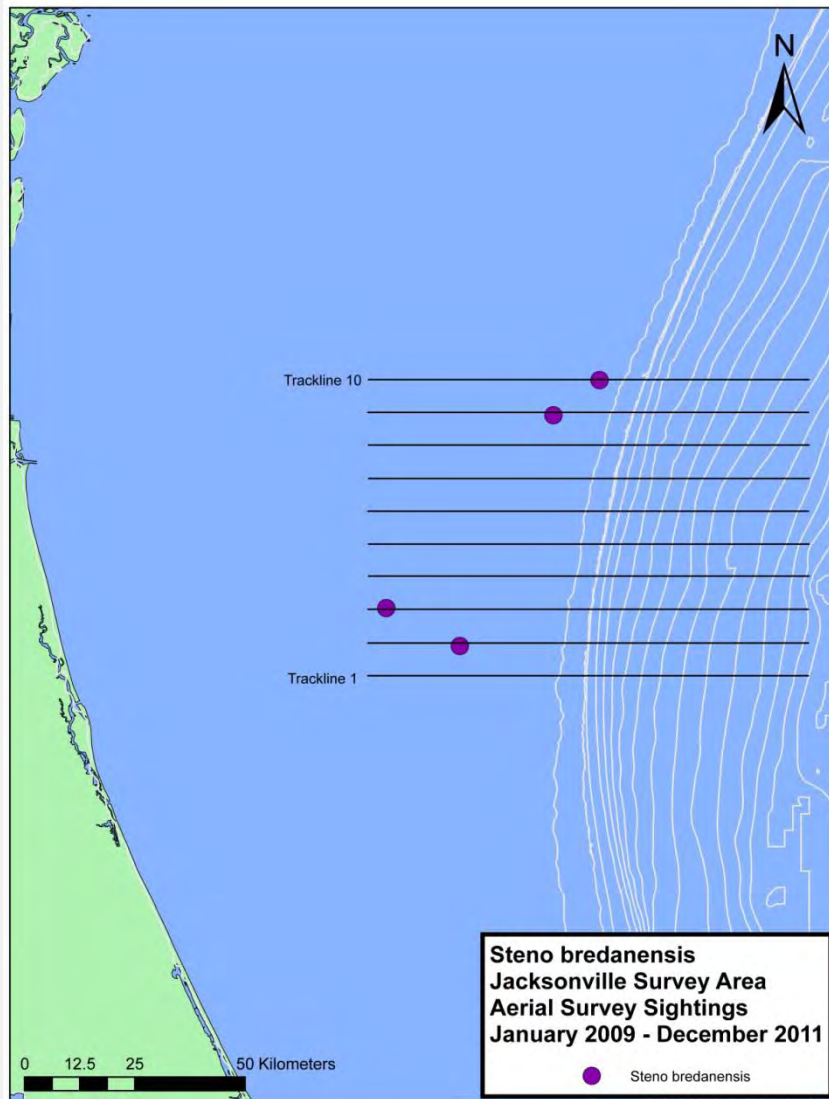
10 Sightings  
 192 Individuals

AFAST Monitoring of Protected Species  
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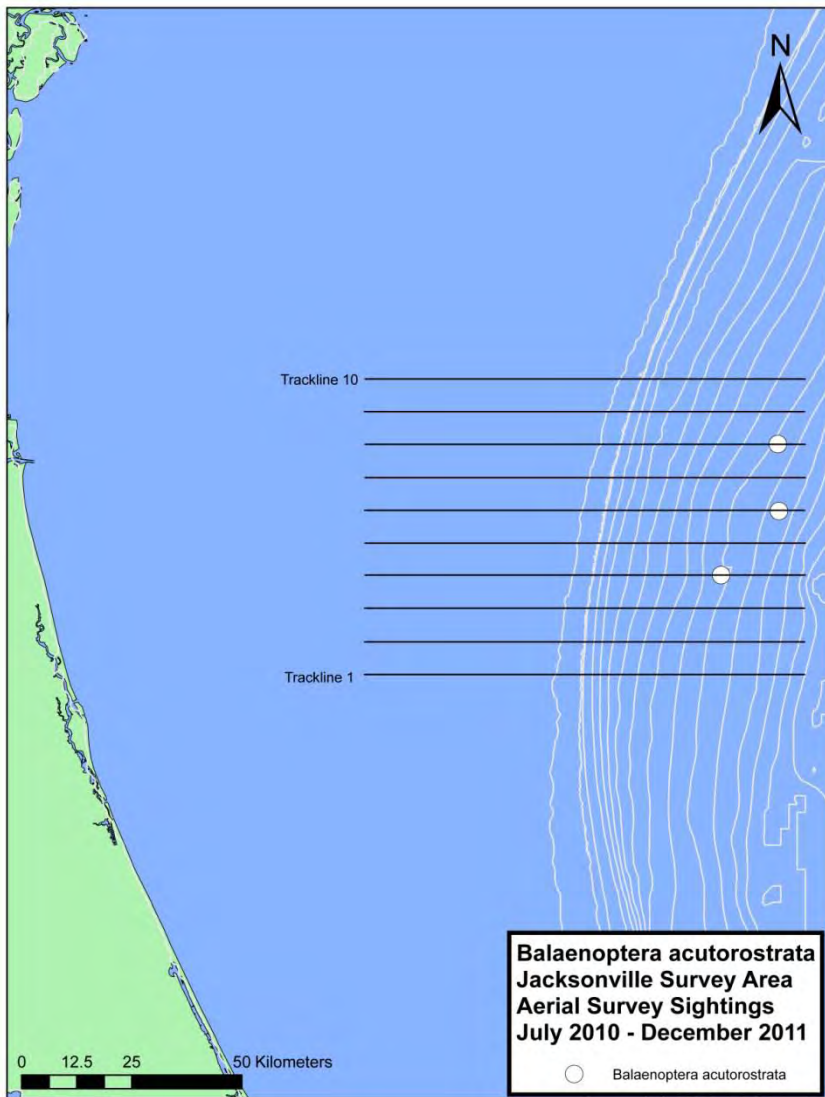
**3 Sightings**  
**114 Individuals**

**AFAST Monitoring of Protected Species**  
**Jacksonville, FL, Onslow Bay and Cape Hatteras, NC**  
**July 2010 to December 2011**



**4 Sightings**  
**164 Individuals**

**AFAST Monitoring of Protected Species**  
**Jacksonville, FL, Onslow Bay and Cape Hatteras, NC**  
**July 2010 to December 2011**



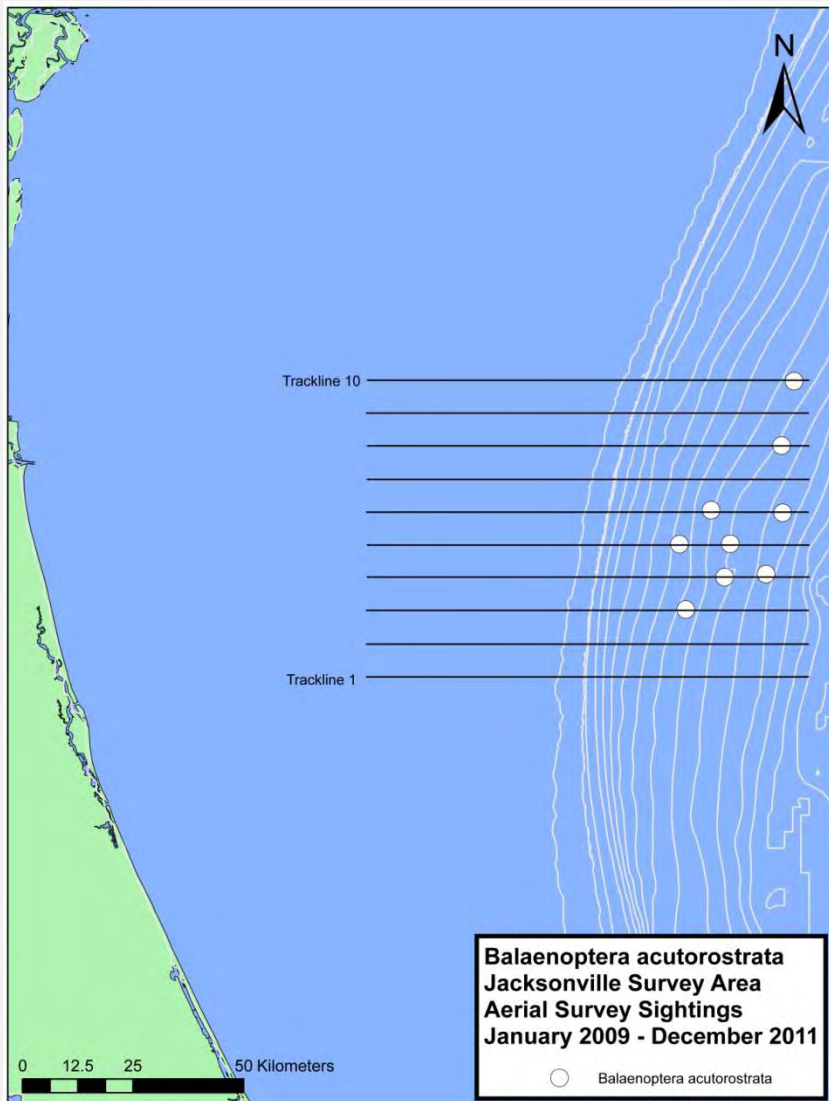
## Minke whales



3 Sightings  
 5 Individuals

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 Jacksonville, FL, Onslow Bay and Cape Hatteras, NC  
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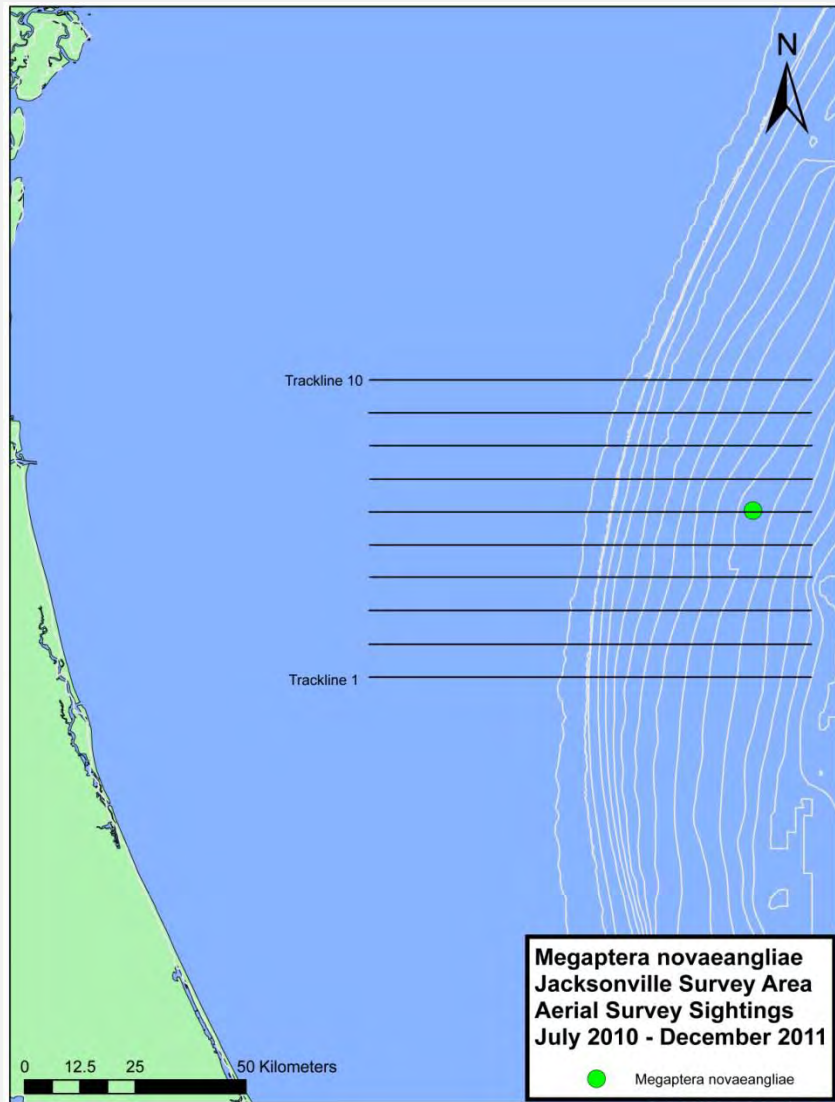


## Minke whales

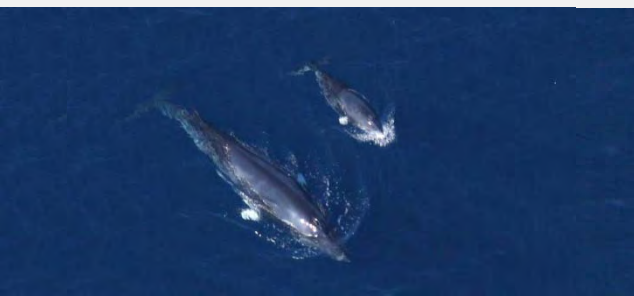


9 Sightings  
 13 Individuals  
 1 Mom/calf pair

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**1 Sighting  
1 Individual**



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July 2010 to December 2011**



Kogiid



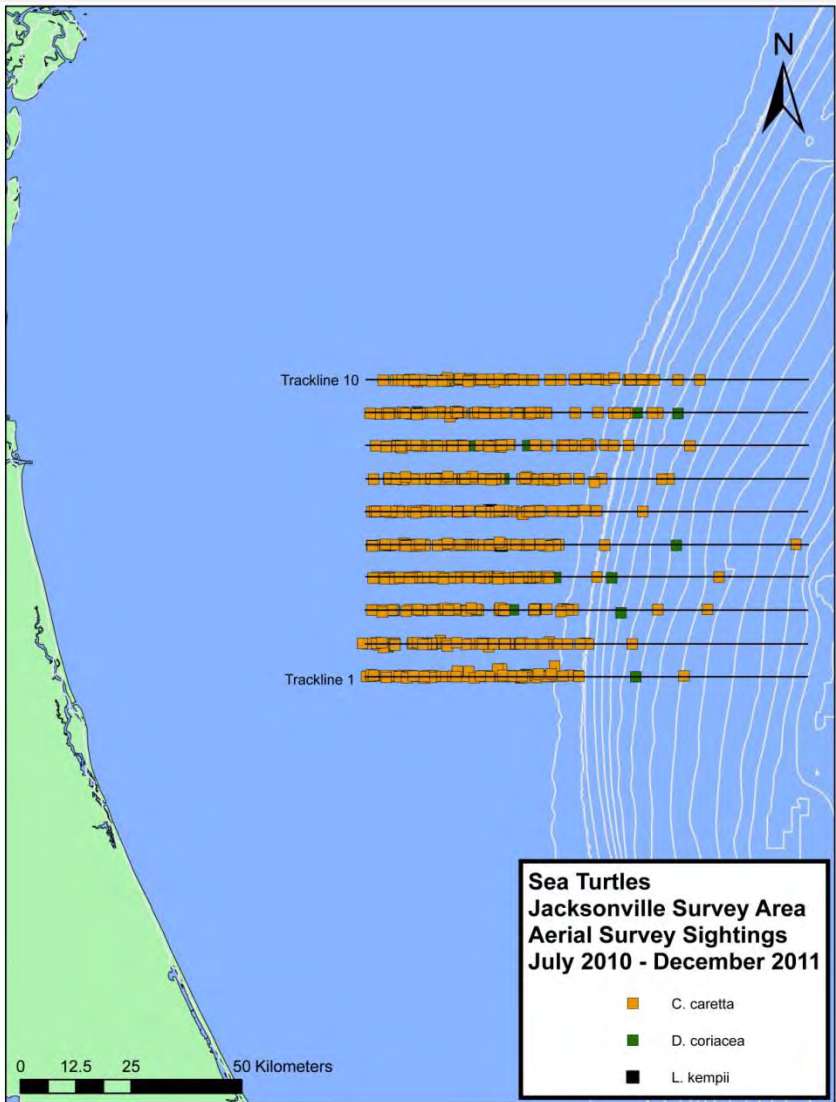
Sperm whale



North Atlantic right whale

Foley *et al.*, 2011

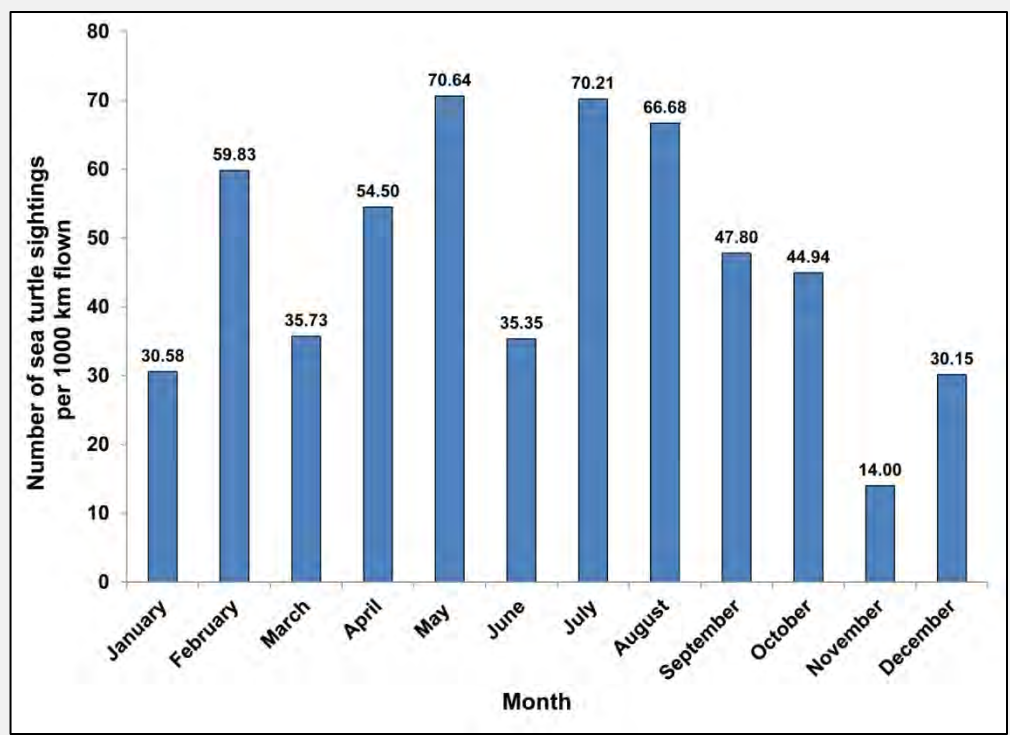
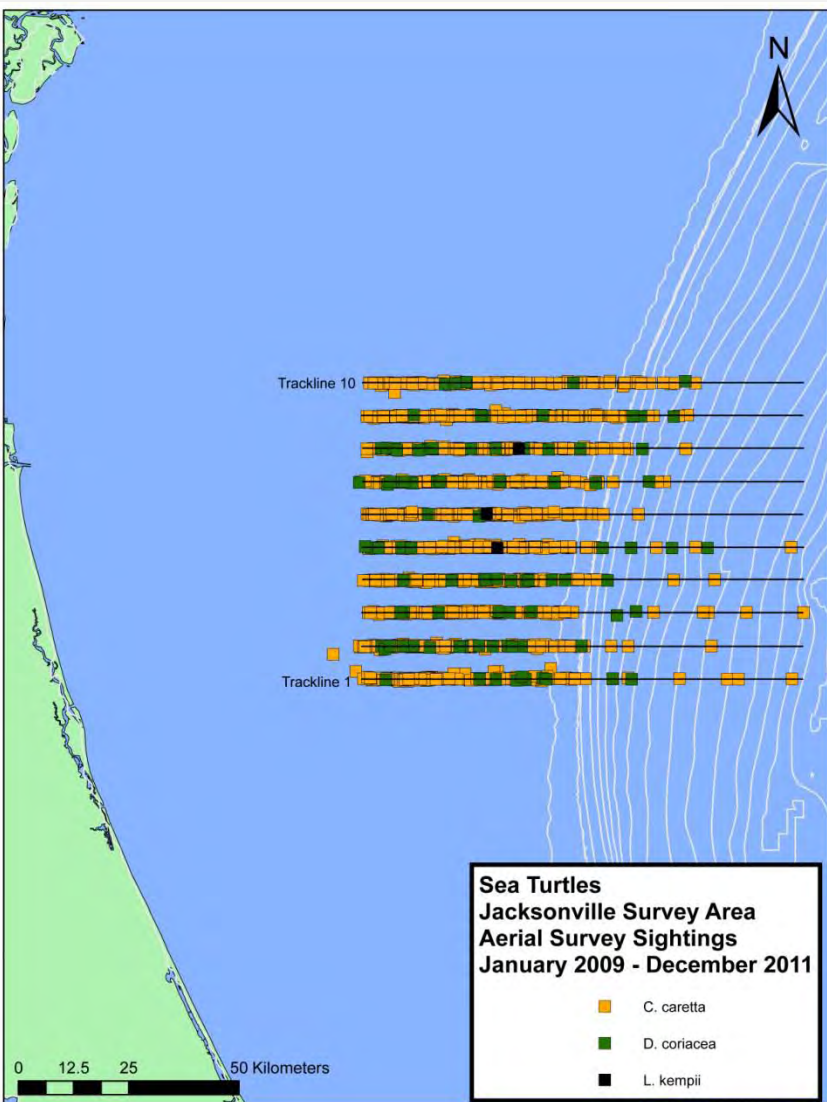
AFAST Monitoring of Protected Species  
Jacksonville, FL, Onslow Bay and Cape Hatteras, NC  
July 2010 to December 2011



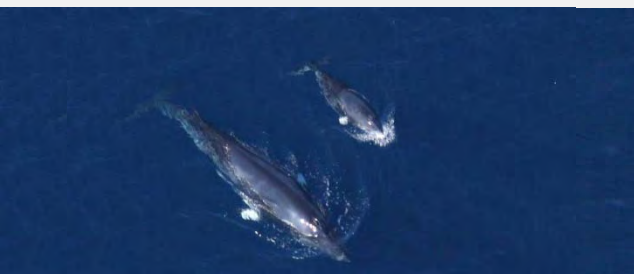
**3 Species**  
**845 Individuals**



**AFAST Monitoring of Protected Species**  
**Jacksonville, FL, Onslow Bay and Cape Hatteras, NC**  
**July 2010 to December 2011**



**3 Species  
2688 Individuals**



**AFAST Monitoring of Protected Species  
Jacksonville, FL, Onslow Bay and Cape Hatteras, NC  
July 2010 to December 2011**



AFAST Monitoring of Protected Species  
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July 2010 to December 2011



# Passive Acoustic Monitoring in Onslow Bay and Jacksonville



AFAST Monitoring of Protected Species  
Jacksonville, FL, Onslow Bay and Cape Hatteras, NC  
July 2010 to December 2011

# Passive Acoustic Monitoring

Two collection methods:

- 1) Four-element towed hydrophone array during boat-based surveys
- 2) Bottom-mounted recorders: High-frequency Acoustic Recording Packages (HARPs)



AFAST Monitoring of Protected Species  
Jacksonville, FL, Onslow Bay and Cape Hatteras, NC  
July 2010 to December 2011



# Onslow Bay Year 4

Analyzed whistles and clicks of all towed array data to date (September 2007 – August 2010)

Analyzed HARP data from deployments 04A & 04C for odontocete vocalizations

Analyzed all HARP data for mysticete calls (October 2007 – June 2010)

Examined temporal patterns for all HARP data analyzed (October 2007 – June 2010)



AFAST Monitoring of Protected Species  
Jacksonville, FL, Onslow Bay and Cape Hatteras, NC  
July 2010 to December 2011

# Jacksonville Year 2

Began saving whistles from towed array data using Raven 1.3

Analyzed HARP data from deployments 01A, 03A, & 04B for odontocete vocalizations

Examined general temporal patterns for all HARP data analyzed to date

Examined ambient noise variability



AFAST Monitoring of Protected Species  
Jacksonville, FL, Onslow Bay and Cape Hatteras, NC  
July 2010 to December 2011

# Onslow Bay Towed Array Results

**Year 4** – Two towed array surveys in conjunction with visual surveys

➤ Two confirmed detections – Tt and Sf



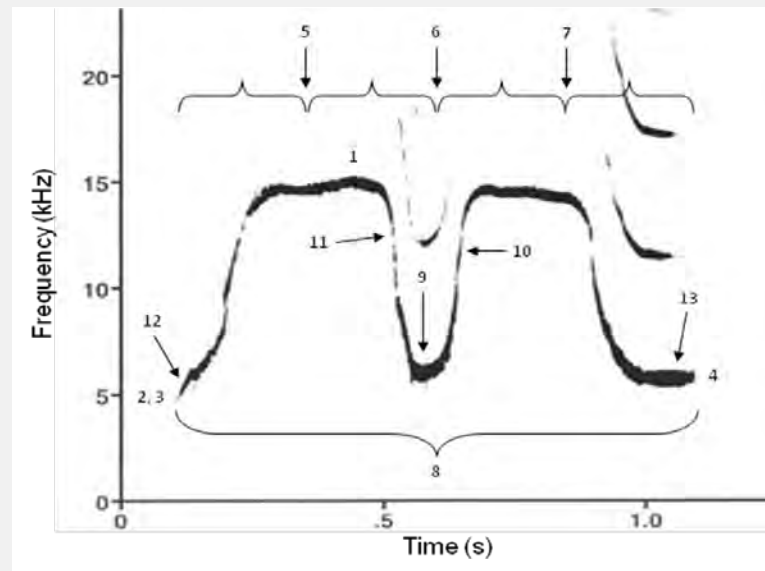
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Jacksonville, FL, Onslow Bay and Cape Hatteras, NC  
July 2010 to December 2011

# Onslow Bay Towed Array - Whistles

Used Raven 1.3 to locate whistles:

Species	# Recording Sessions	# Whistles Analyzed
<i>Globicephala macrorhynchus</i>	6	89
<i>Stenella frontalis</i>	14	162
<i>Steno bredanensis</i>	1	35
<i>Tursiops truncatus</i>	27	338

Extracted whistle contours and measured 22 variables



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# Onslow Bay Towed Array - Whistles

Compared each whistle variable using Kruskal-Wallis tests:

	Kruskal-Wallis Results	Multiple Comparison Test Results with Bonferroni Corrections					
		Gm/Sf	Gm/Sb	Gm/Tt	Sf/Sb	Sf/Tt	Sb/Tt
Max Freq	p<0.001*						
Min Freq	p<0.001*						
Freq Range	p<0.001*						
Start Freq	p<0.001*						
End Freq	p<0.001*						
1st Q Freq	p<0.001*						
2nd Q Freq	p<0.001*						
3rd Q Freq	p<0.001*						
Mean Freq	p<0.001*						
Duration	p<0.001*						
# Inflection Points	p<0.001*						
Max Slope	p<0.001*						
Min Slope	p<0.001*						
Slope Range	p<0.001*						
Start Slope	p<0.001*						
End Slope	p<0.001*						
1st Q Slope	p=0.300	N/A	N/A	N/A	N/A	N/A	N/A
2nd Q Slope	p<0.001*						
3rd Q Slope	p<0.001*						
Mean Slope	p<0.001*						
Start Slope Sign	p<0.001*						
End Slope Sign	p<0.001*						

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 Jacksonville, FL, Onslow Bay and Cape Hatteras, NC  
 July 2010 to December 2011

# Onslow Bay Towed Array - Whistles

Constructed CARTs using all variables

Actual Species	% Classified as			
	<i>G. macrorhynchus</i>	<i>S. frontalis</i>	<i>S. bredanensis</i>	<i>T. truncatus</i>
<i>G. macrorhynchus</i>	<b>84.3</b>	6.7	3.4	5.6
<i>S. frontalis</i>	10.5	<b>63.0</b>	0.6	25.9
<i>S. bredanensis</i>	51.4	8.6	<b>40.0</b>	0
<i>T. truncatus</i>	2.7	4.7	0.3	<b>92.3</b>

Overall Correct Classification: 74.2%

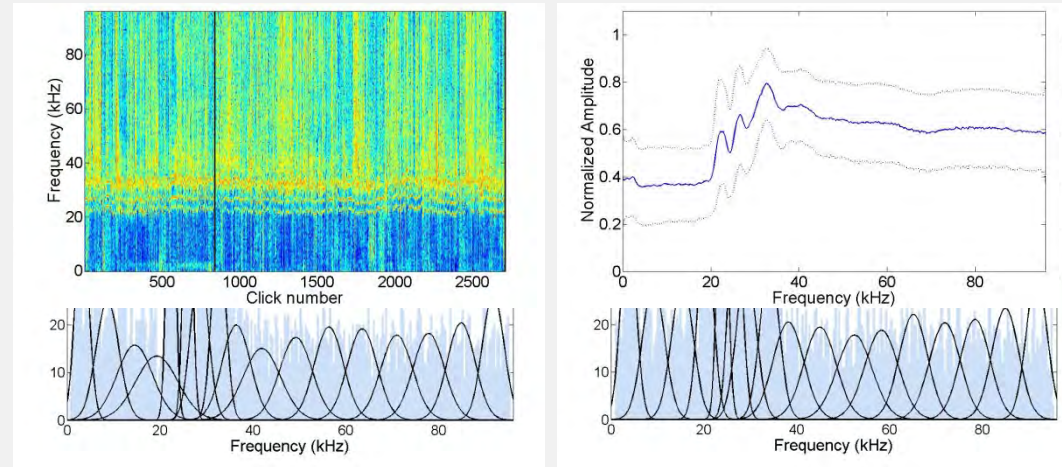


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July 2010 to December 2011

# Onslow Bay Towed Array - Clicks

- 1) Used customized routines in Matlab to select up to five clicks per click train
- 2) Determined frequency values of consistent spectral peaks and notches in frequency domain
- 3) Obtained means for consistent peaks and notches by fitting Gaussian curves

Risso's dolphins:



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# Jacksonville Towed Array Results

**Year 2** – Three towed array surveys in conjunction with visual surveys

➤ Two confirmed detections – Tt and Sf



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# Future Plans for Towed Array Recordings

Will be examining odontocete whistles collected along the Atlantic coast for species-specificity

- Recordings supplied by NEFSC (Sofie Van Parijs), SEFSC (Melissa Soldevilla & Lance Garrison), and Duke
- Julie Oswald = lead analyst

Also planning to use recordings to look for species-specific patterns in clicks with similar methods previously described

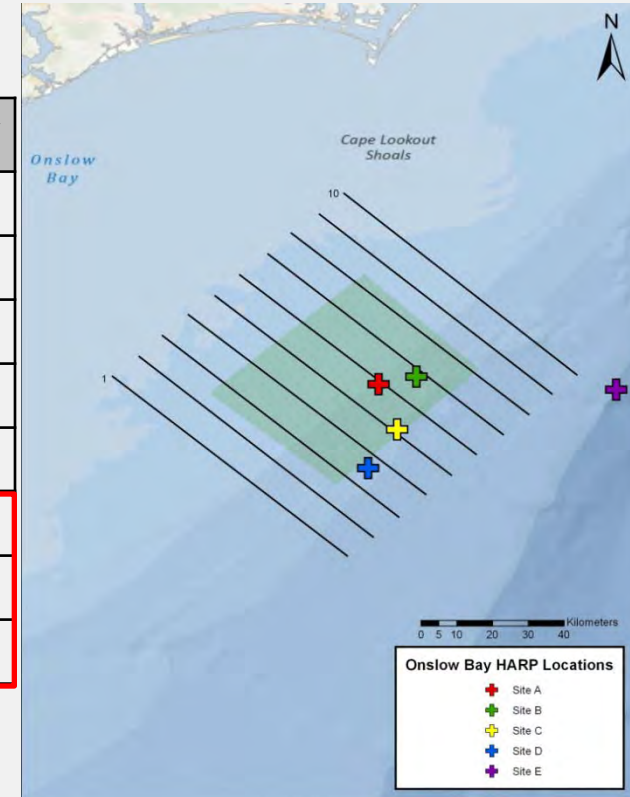


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July 2010 to December 2011

# Onslow Bay HARPs

Site	Deployment Date	Retrieval Date	Latitude	Longitude	Depth (m)	Sampling Rate	Duty Cycle	Amount of data
1A	9-Oct-07	27-May-08	33.79138	-76.52382	162m	200 kHz	5 min on/5 min off	2TB
2B	30-May-08	24-Nov-08	33.81107	-76.42829	232m	200 kHz	5 min on/5 min off	2TB
3A	24-Apr-09	16-Sep-09	33.7895	-76.5192	174m	200 kHz	5 min on/5 min off	2TB
4A	8-Nov-09	19-Jun-10	33.7873	-76.5241	171m	200 kHz	5 min on/10 min off	1.2TB
4C	8-Nov-09	19-Jun-10	33.6778	-76.4769	335m	200 kHz	5 min on/10 min off	2TB
5A	29-Jul-10	10-Jun-11	33.7932	-76.5162	171m	200 kHz	5 min on/5 min off	~2TB
5D	29-Jul-10	10-Jun-11	33.5807	-76.5502	338m	200 kHz	5 min on/5 min off	~2TB
6E	18-Aug-11		33.7779	-75.9264	952m	200 kHz	5 min on/5 min off	

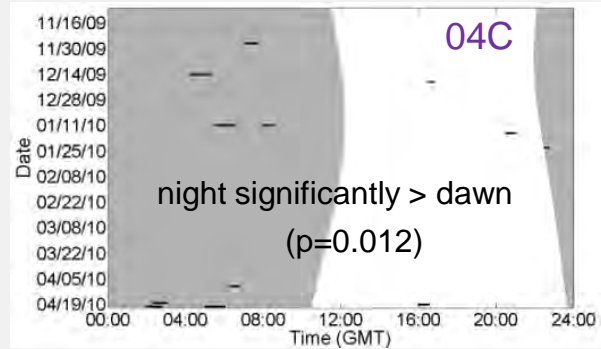
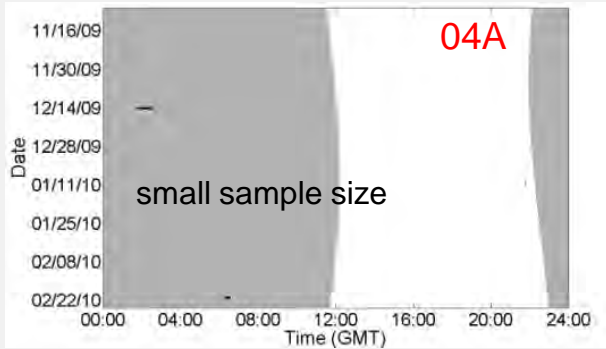
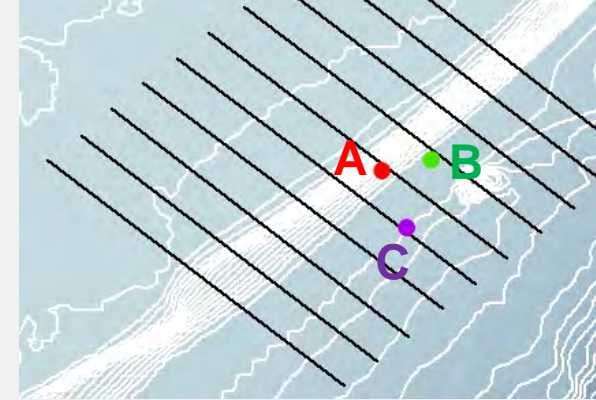
Deployments and Retrievals during Year 4 – not analyzed yet



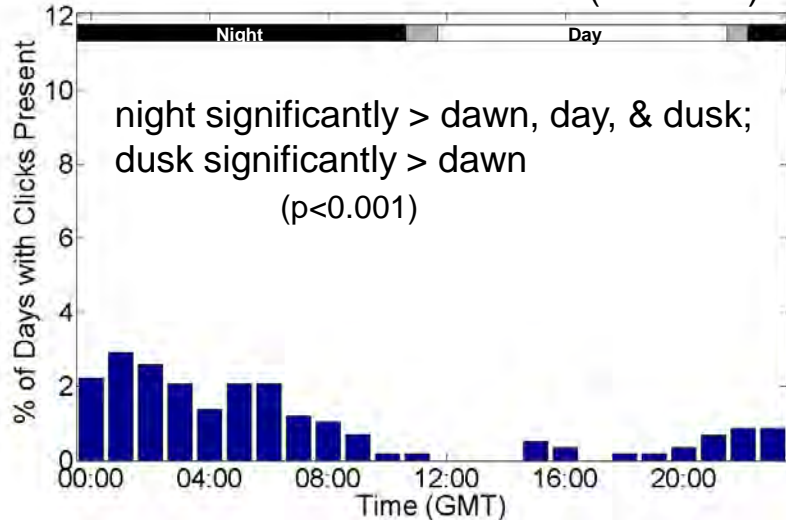
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# OB HARP Analysis – Risso’s Dolphins



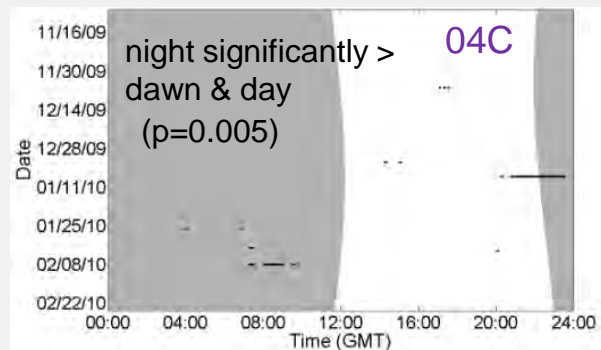
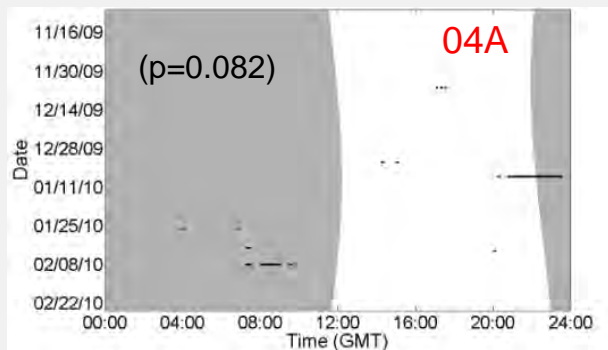
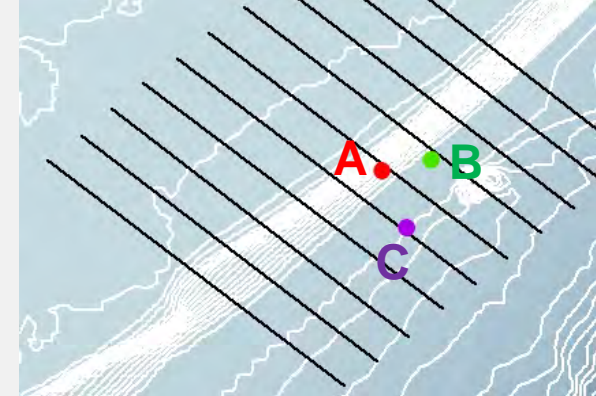
Combined (01A-04C)



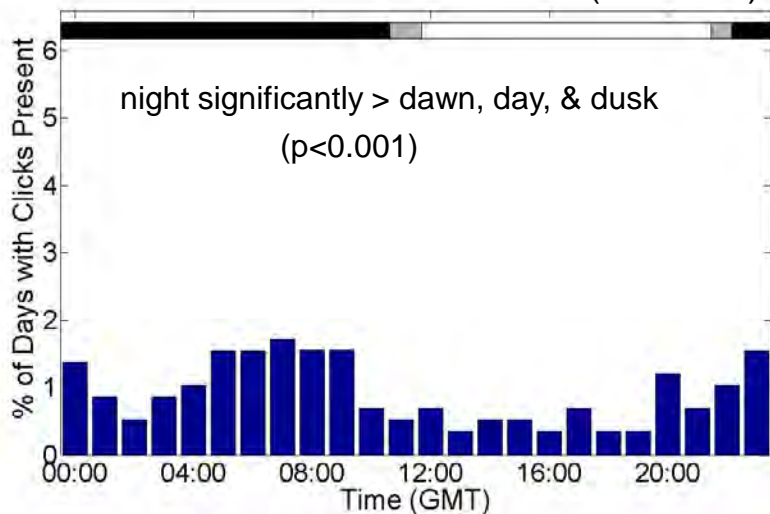
Nocturnal increase in click occurrence lends support to the idea that Risso’s dolphins forage at night

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# OB HARP Analysis – Sperm Whales



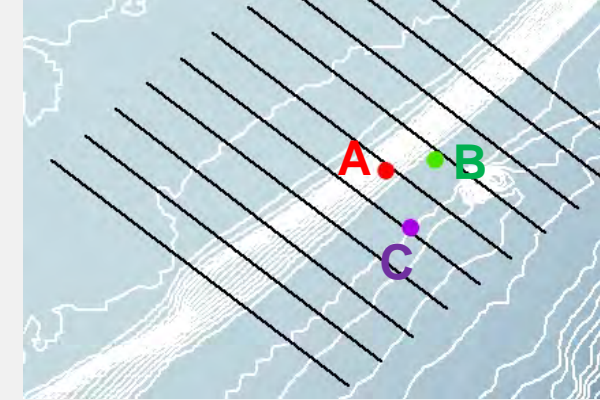
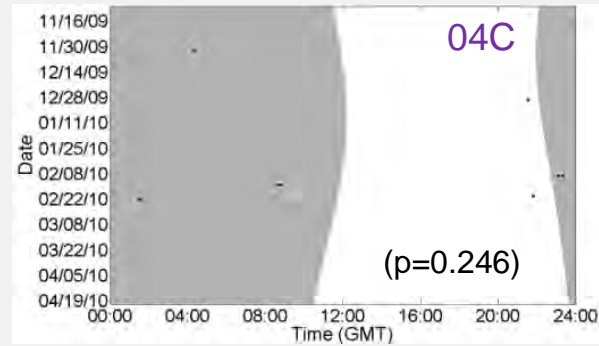
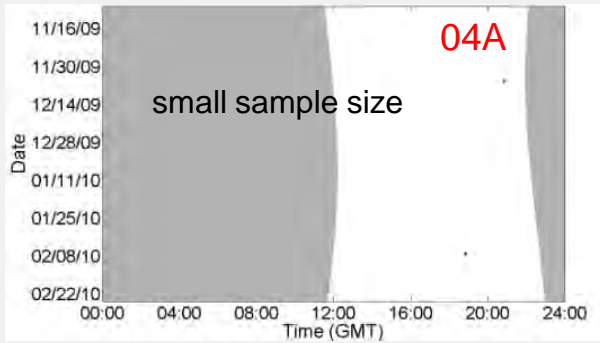
Combined (01A-04C)



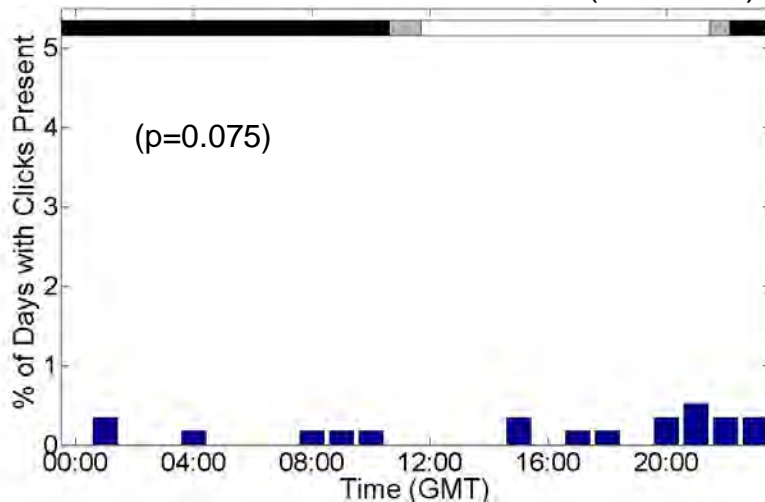
Nocturnal increase in click occurrence overall

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# OB HARP Analysis – *Kogia* spp.



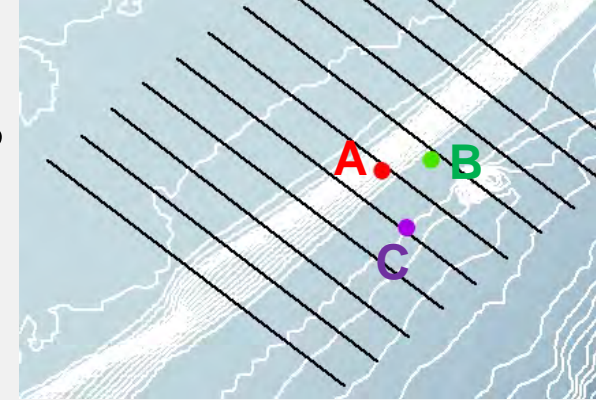
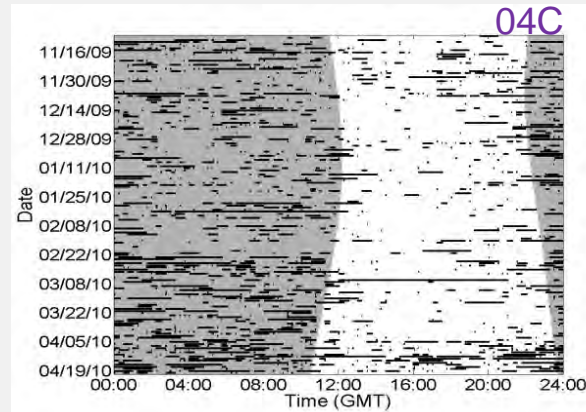
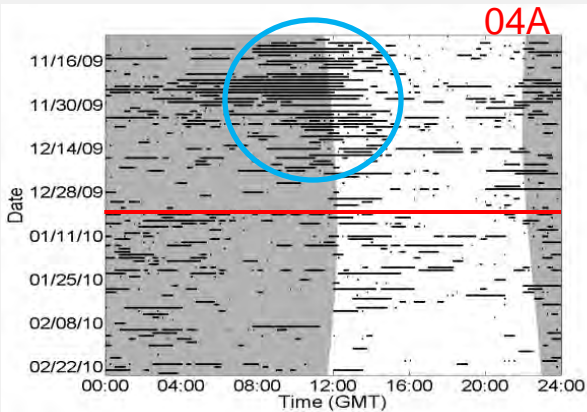
Combined (01A-04C)



No significant diel variation in *Kogia* clicks but small sample sizes

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# OB HARP Analysis – UnIDed Delphinids



Overall, two patterns in click occurrence seen:

- 1) Increase at night (year-round except for winter Site A)
- 2) Increase at dawn (winter, Site A only)

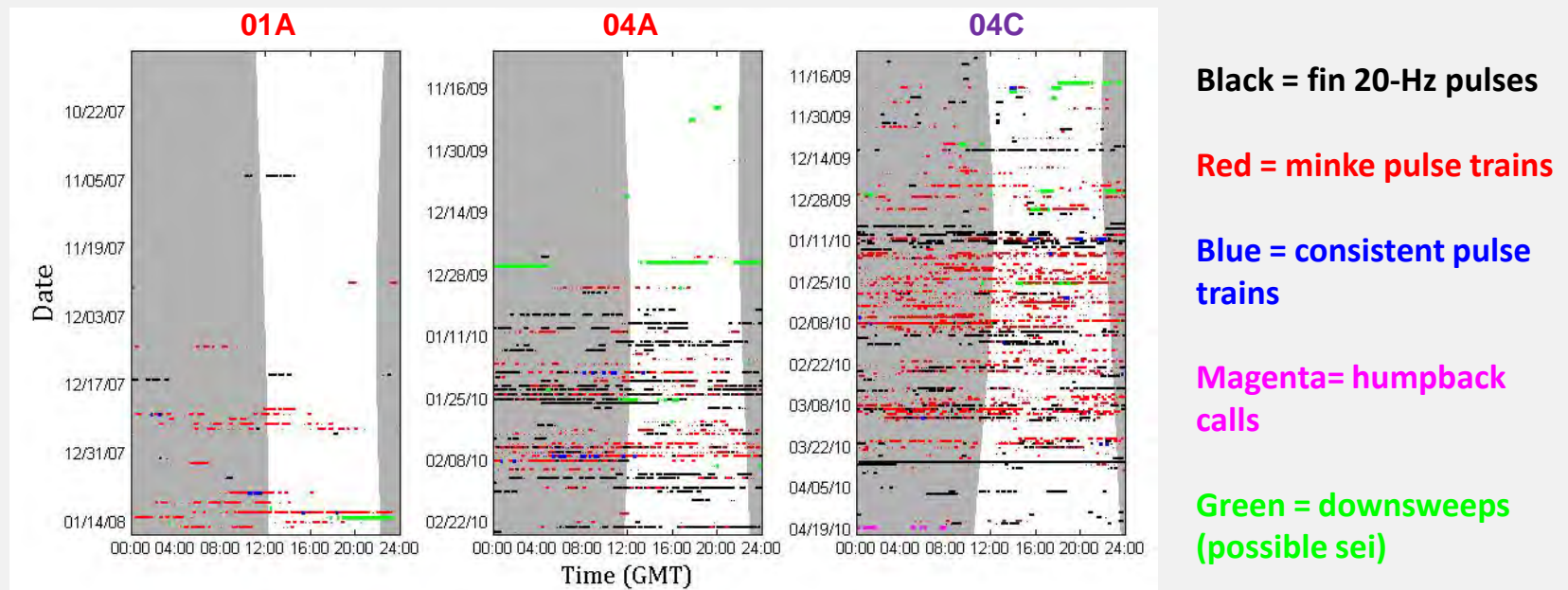


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# Year 4 OB HARP Analysis – Mysticetes

Sounds from fin, minke, humpback, and possibly sei whales were recorded on the three winter HARPs only

- Sounds were produced throughout the winter when these animals are expected to be on breeding grounds



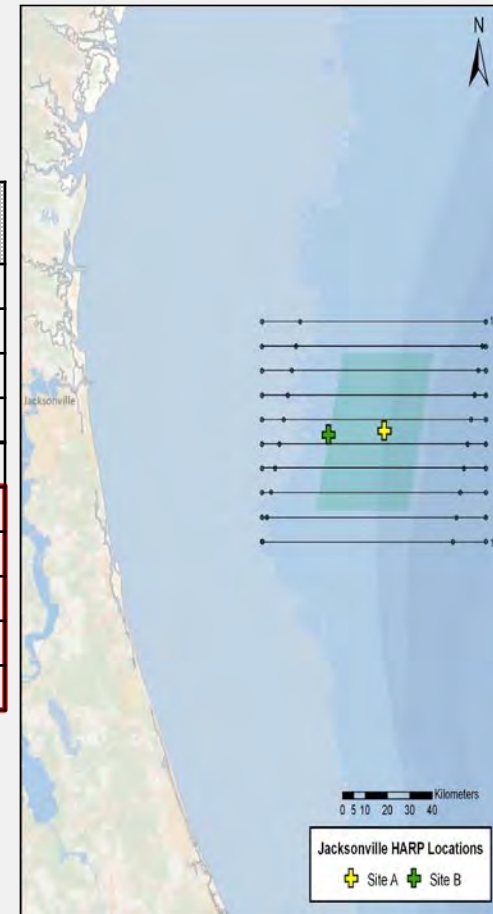
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July 2010 to December 2011



# Jacksonville HARPs

Site	Deployment Date	Retrieval Date	Latitude	Longitude	Depth (m)	Sampling Rate	Duty Cycle	Amount of Data
1A	30-Mar-09	16-Sep-09	30.2771	-80.2158	80	200 kHz	5 min on/10 min off	0.8 TB
1B	30-Mar-09	16-Sep-09	30.2582	-80.4282	40	200 kHz	5 min on/10 min off	2 TB
2A	16-Sep-09	21-Feb-10	30.2805	-80.2160	85	200 kHz	5 min on/10 min off	1.3 TB
2B	23-Sep-09	21-Feb-10	30.2580	-80.4280	40	200 kHz	5 min on/10 min off	0 TB
3A	21-Feb-10	26-Aug-10	30.2811	-80.2153	90	200 kHz	5 min on/10 min off	2 TB
4B	9-Mar-10	26-Aug-10	30.2592	-80.4257	40	200 kHz	5 min on/10 min off	2 TB
5A	26-Aug-10	1-Feb-11	30.2682	-80.2089	91	200 kHz	5 min on/10 min off	~2 TB
5B	26-Aug-10	1-Feb-11	30.2571	-80.4327	37	200 kHz	5 min on/10 min off	~2 TB
6A	1-Feb-11	14-Jul-11	30.2782	-80.2209	91	200 kHz	5 min on/10 min off	~2 TB
6B	1-Feb-11	14-Jul-11	30.2577	-80.4278	37	200 kHz	5 min on/10 min off	~2 TB

↑ Deployments and Retrievals during Year 2



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# Jacksonville HARP Detections Summary

Offshore Site

Inshore Site

	JAX01A	JAX02A	JAX03A	All A	JAX01B	JAX04B	All B
# Days Recorded	54	91	159	304	161	164	325
# Days with Click Detections	49 (90.7%)	91 (100%)	157 (98.7%)	297 (97.7%)	154 (95.7%)	153 (93.3%)	307 (94.5%)
# Days with Whistle Detections	31 (57.4%)	79 (86.8%)	139 (87.4%)	250 (82.2%)	146 (90.7%)	125 (76.2%)	271 (83.4%)
Recording Effort (hrs)	1273	2152	3808	7233	3837	3907	7743
Click bout recordings (hrs)	250 (19.6%)	631 (29.3%)	1175 (30.9%)	2056 (28.4%)	475 (12.4%)	203 (5.2%)	678 (8.8%)
Whistle bout recordings (hrs)	26 (9.5%)	83 (3.9%)	185 (4.9%)	295 (4.1%)	163 (4.2%)	55 (1.4%)	218 (2.8%)
Total # of Click Bouts	388	827	1669	2884	1401	886	2287
Total # of Whistle Bouts	105	437	809	1351	687	397	1084

Spring &  
Summer

Fall &  
Winter

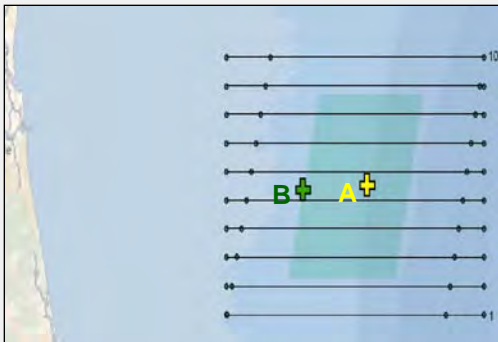
Spring &  
Summer

Spring &  
Summer

Spring &  
Summer

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July 2010 to December 2011

# JAX HARP Analysis – UnIDed Delphinid Click Events



Overall greater click activity and click events of longer duration at offshore site

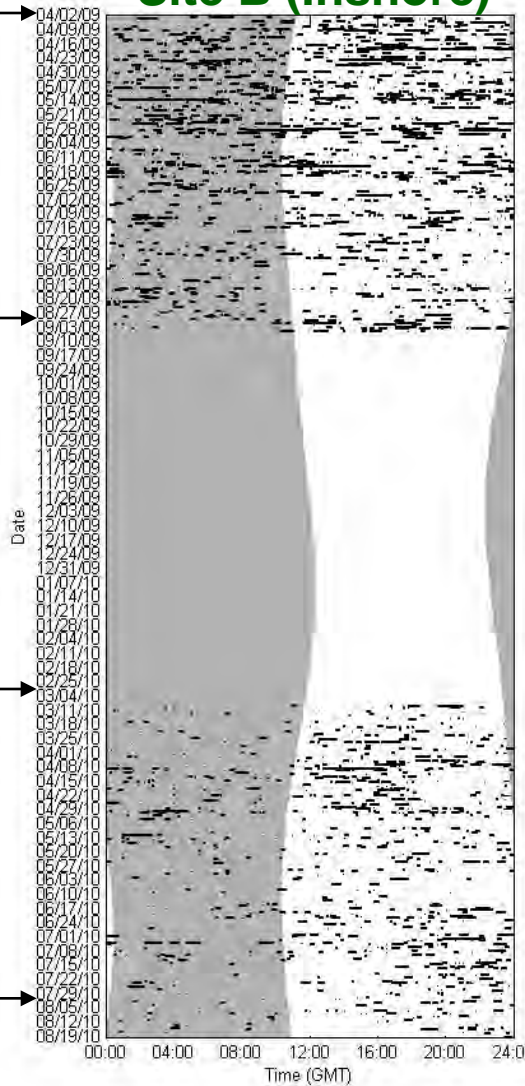
Apr 2009 →

Sep 2009 →

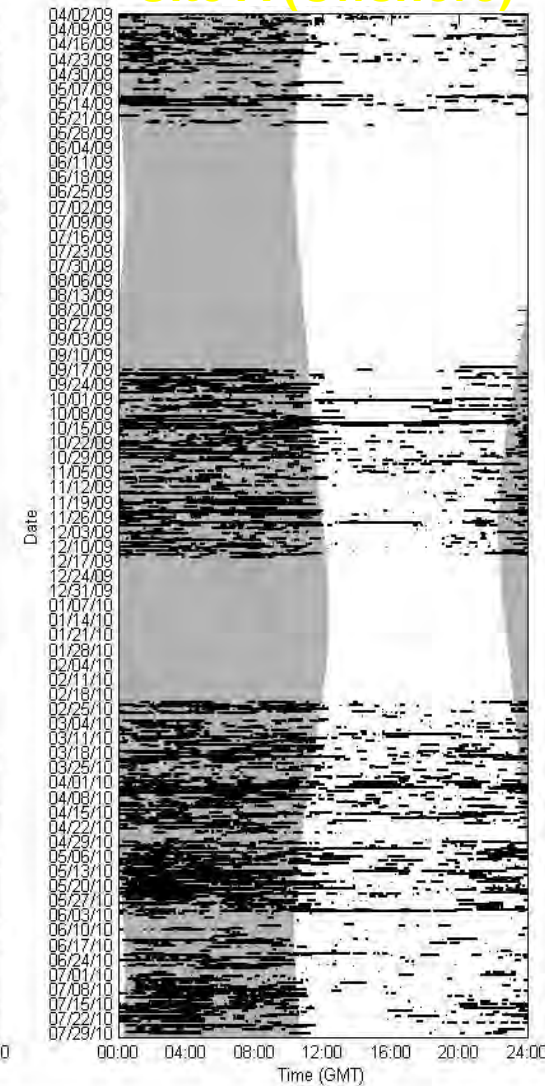
Mar 2010 →

Aug 2010 →

**Site B (Inshore)**

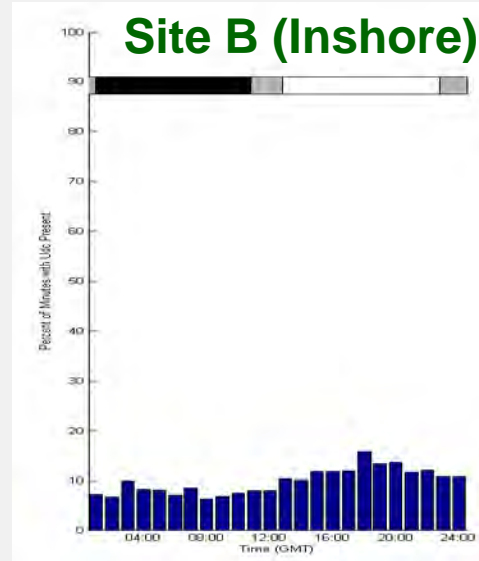
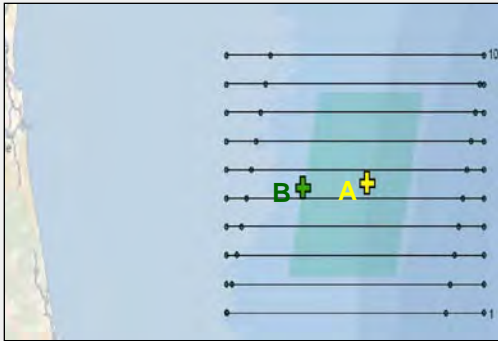


**Site A (Offshore)**

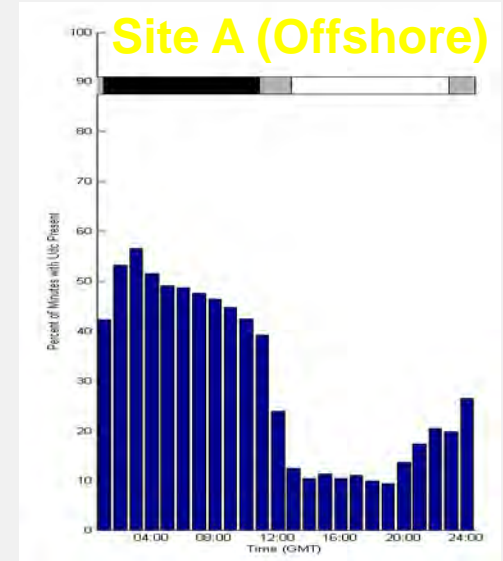


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July 2010 to December 2011

# JAX HARP Analysis – UnIDed Delphinid Click Events



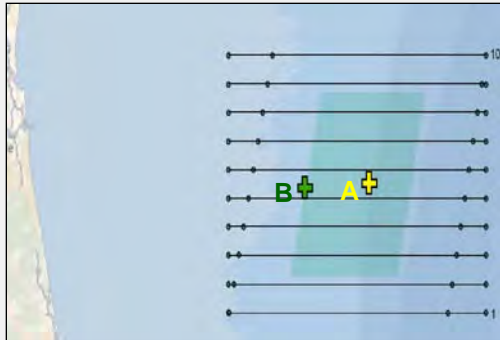
Clicks occurred more frequently during day



Clicks exhibited strong nocturnal increase

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July 2010 to December 2011

# JAX HARP Analysis – UnIDed Delphinid Whistle Events



Apr 2009 →

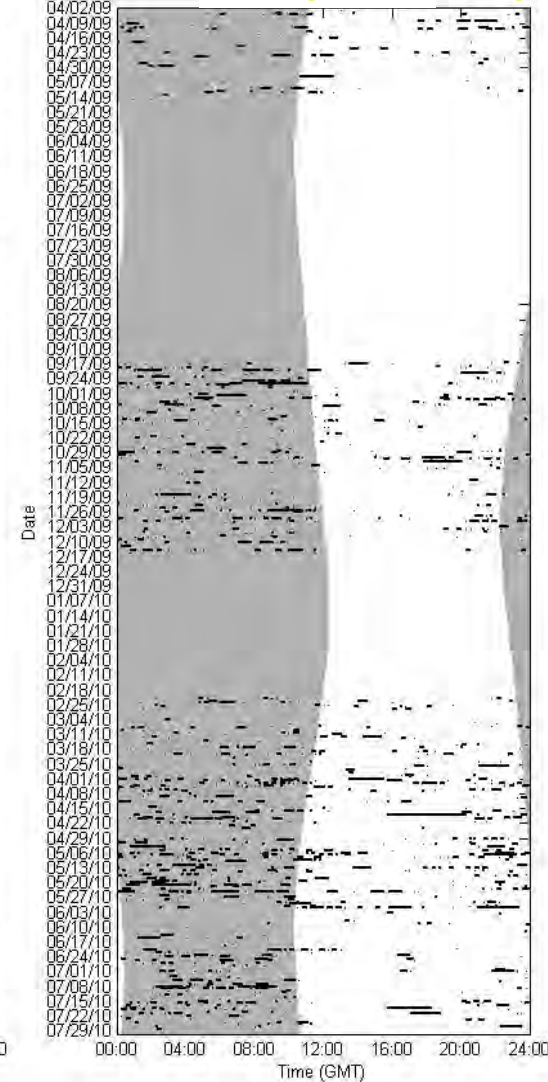
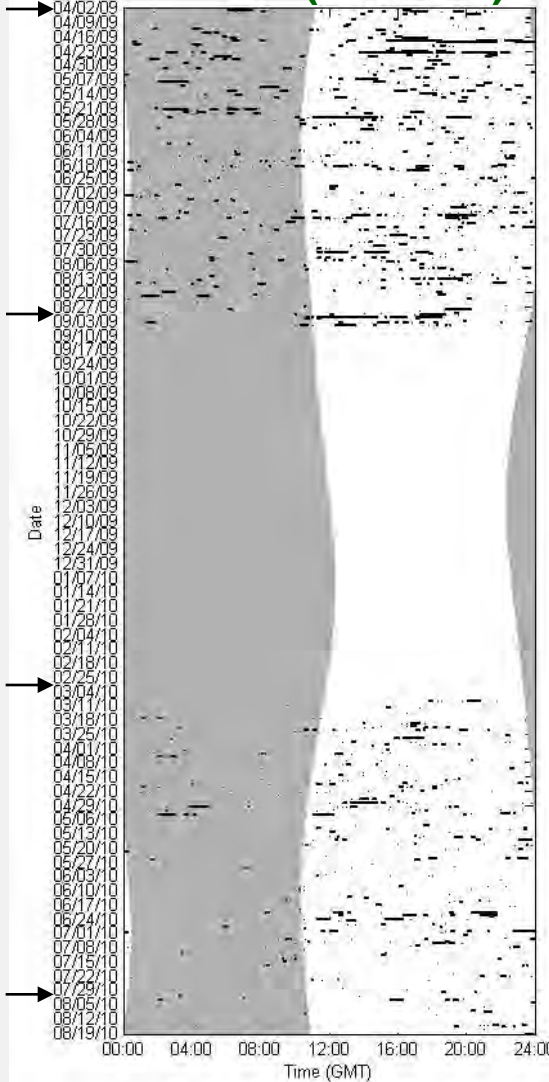
Site B (Inshore)

Site A (Offshore)

Sep 2009 →

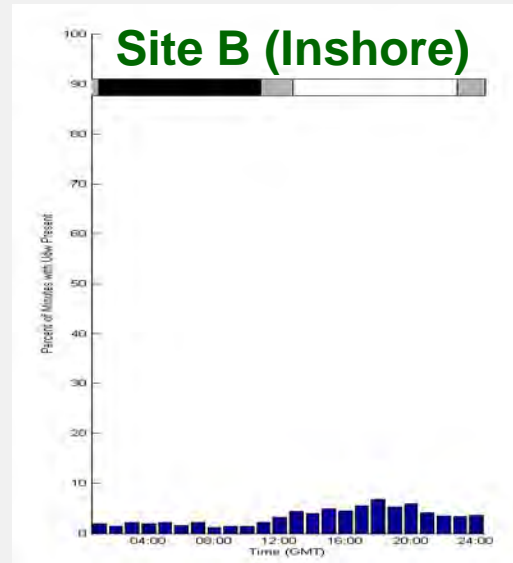
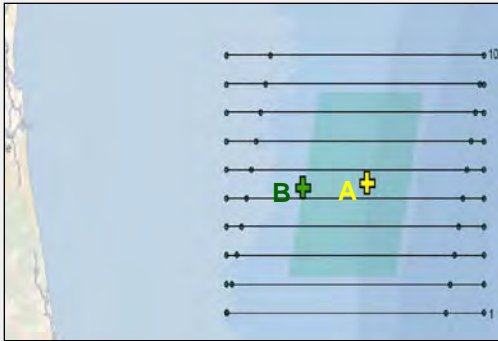
Mar 2010 →

Aug 2010 →

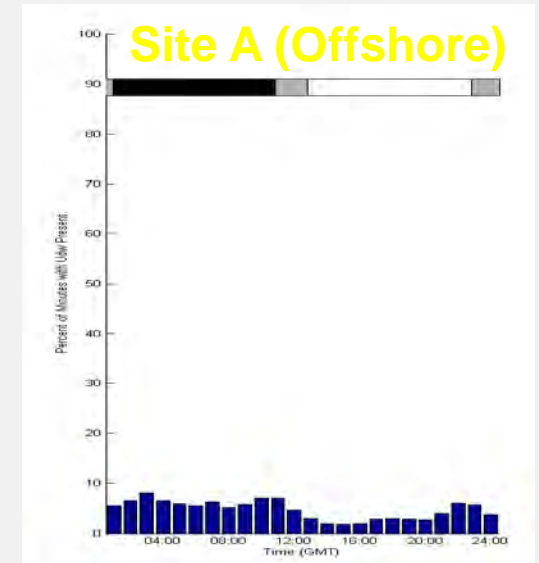


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# JAX HARP Analysis – UnIDed Delphinid Whistle Events



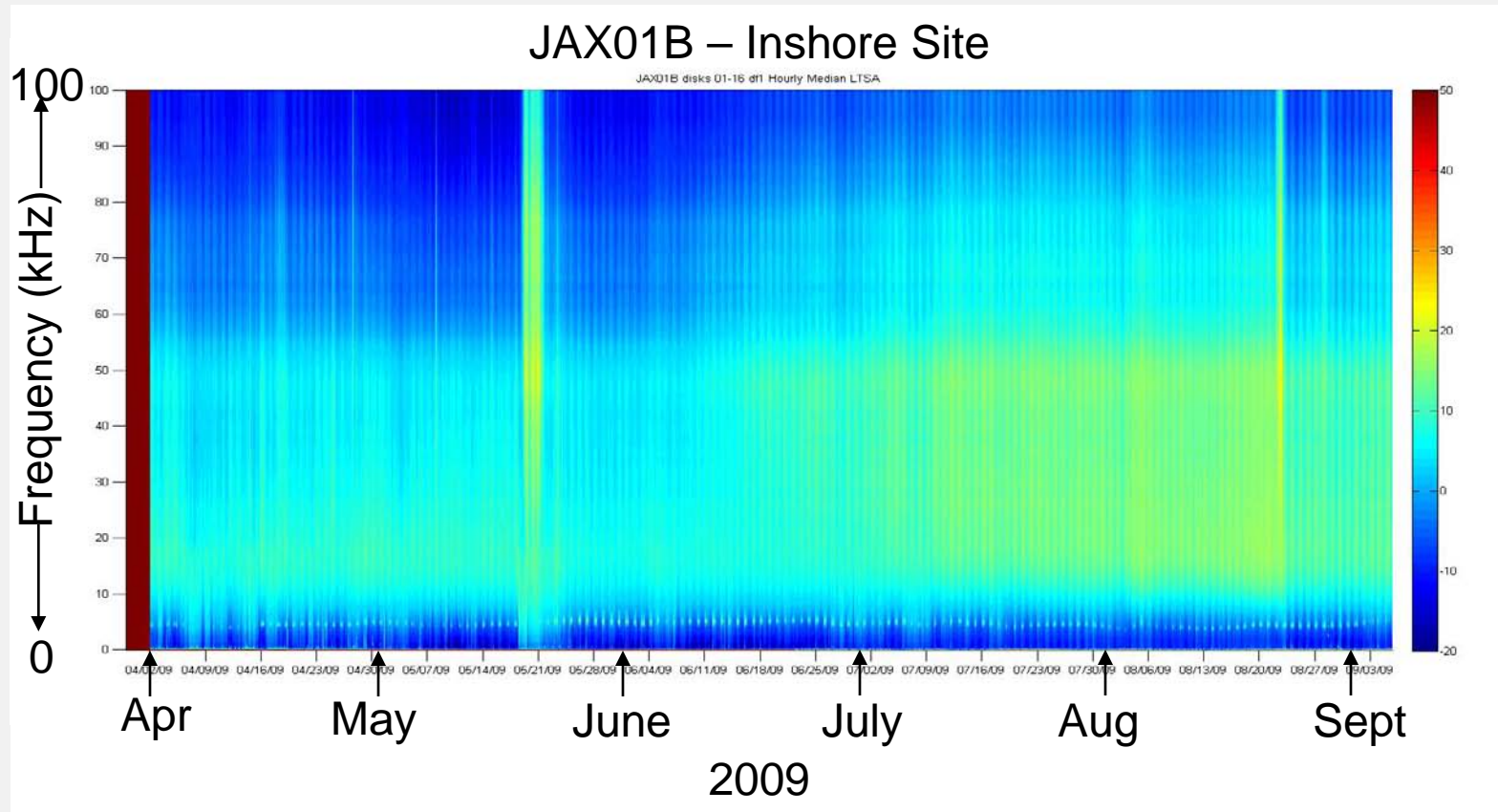
Whistles occurred  
more frequently  
during day



Whistles occurred  
slightly more during  
night

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# JAX HARP Ambient Noise



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# Current HARP Locations & Retrieval Dates



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# Analysis of the aerial and shipboard surveys undertaken in the UWSTR regions

C Paxton and L Burt

RUWPA, CREEM, University of St Andrews

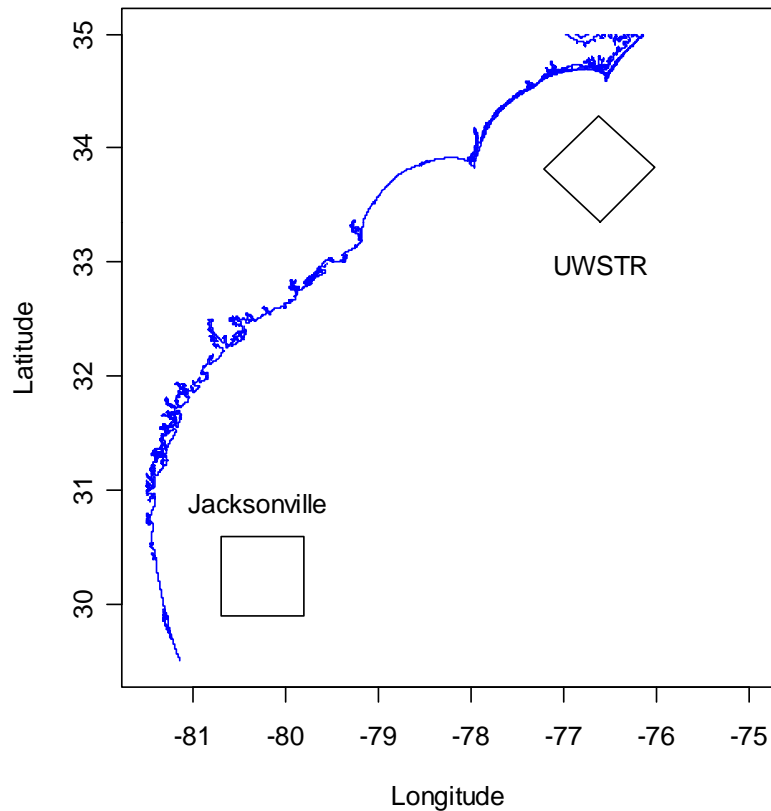


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July 2010 to December 2011

# Outline of talk

- Introduce the task
- Analysis methods
- Results: USWTR
- Results: Jacksonville

# Outline of task



- Two survey regions: USWTR, Jacksonville
- Data: both aerial and ship surveys from several years
- Aim: to estimate density and abundance of marine animals
- Methods: use detection function models and density surface models

# Concept of DSM

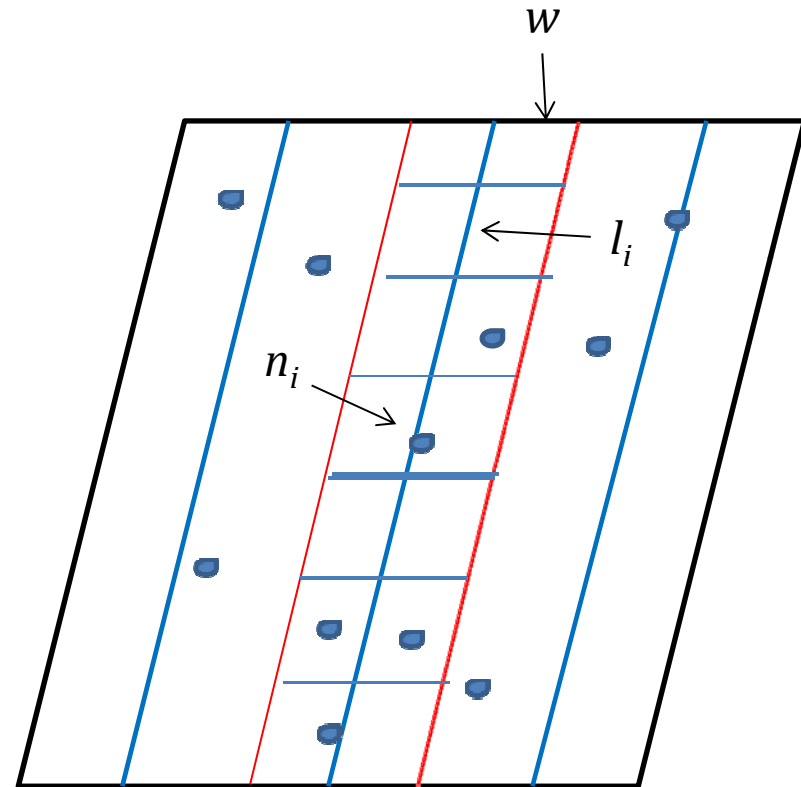
The transect line is divided into small segments of length  $l_i$

The area of each segment is given by  
$$a_i = 2wl_i$$
where  $w$  is the truncation distance

The number of groups detected in a segment is given by  $n_i$

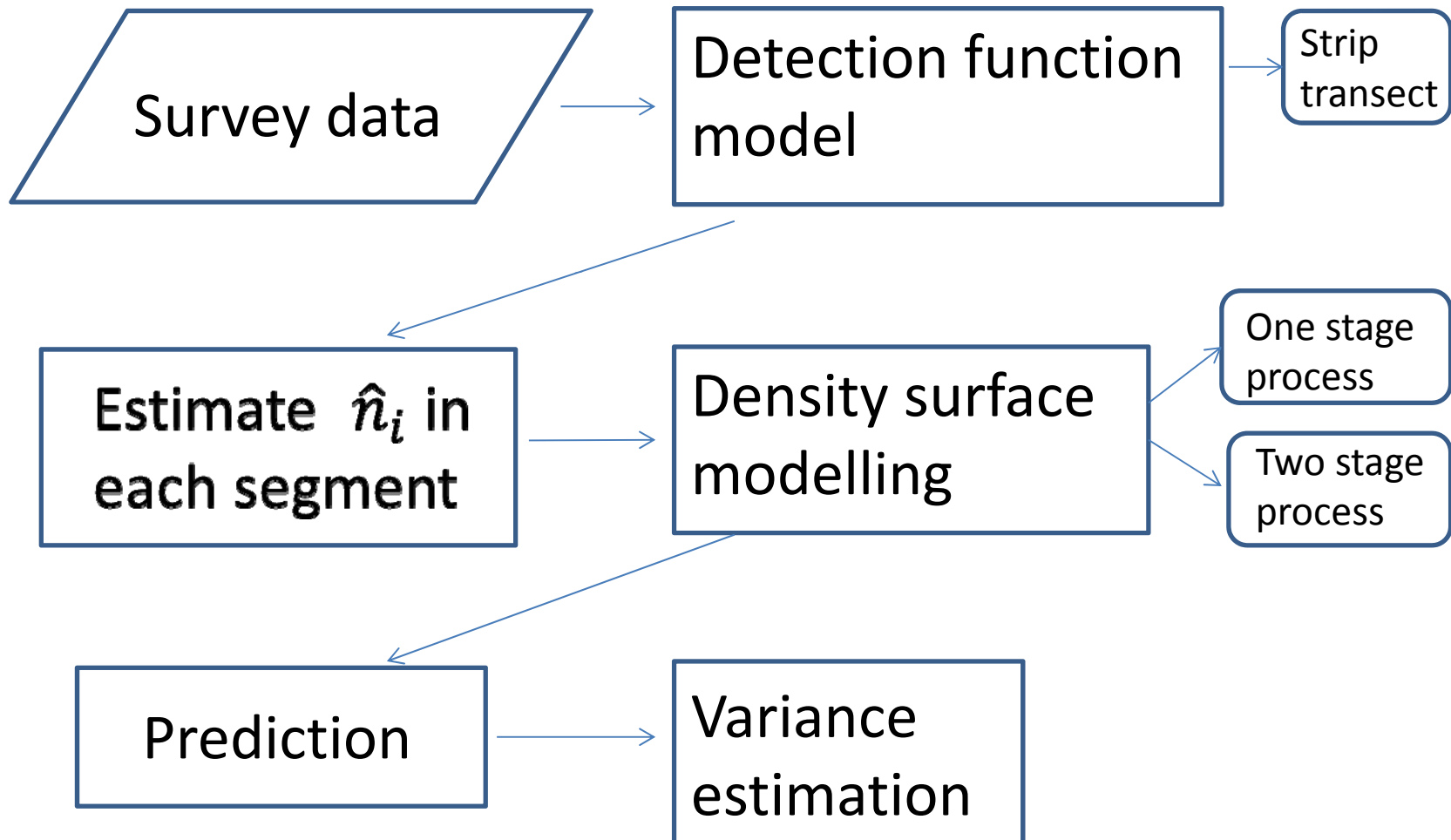
Density in each segment is given by

$$D_i = \frac{n_i}{a_i}$$



However, we need to account for the probability of detection,  $p$   
- use the detection function models to obtain  $p$

# Analysis methods



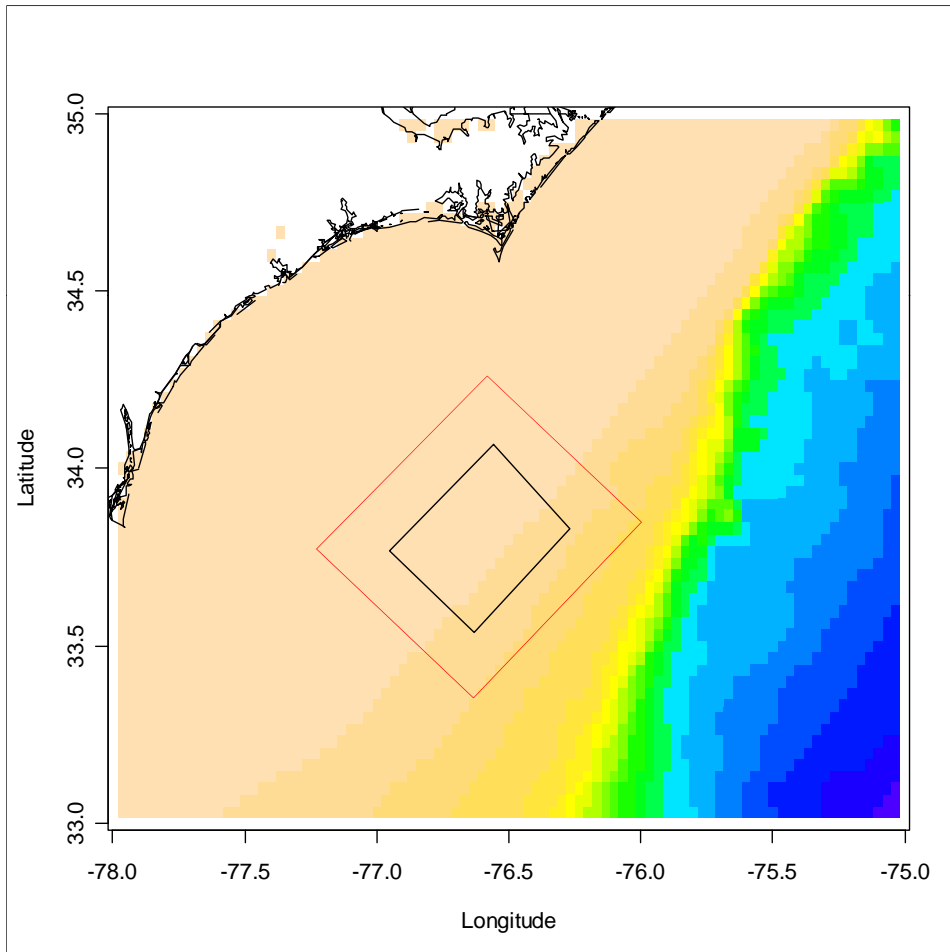
# DSM: One or two stage process

- Jacksonville density surface was analysed as a one stage process
  - Model density
- USWTR density surface was analysed in two stages:
  - Model presence/absence as a logistic function
  - Model non-zero density

# Two types of DS model: explanatory variables

- Models to predict abundance
  - Temporal variables (year, season, month, day of year), location, depth, survey platform (aerial/shipboard)
  - Prediction assumed 'ship'
- Model to explain distribution
  - Year, SST, depth, survey platform

# USWTR region



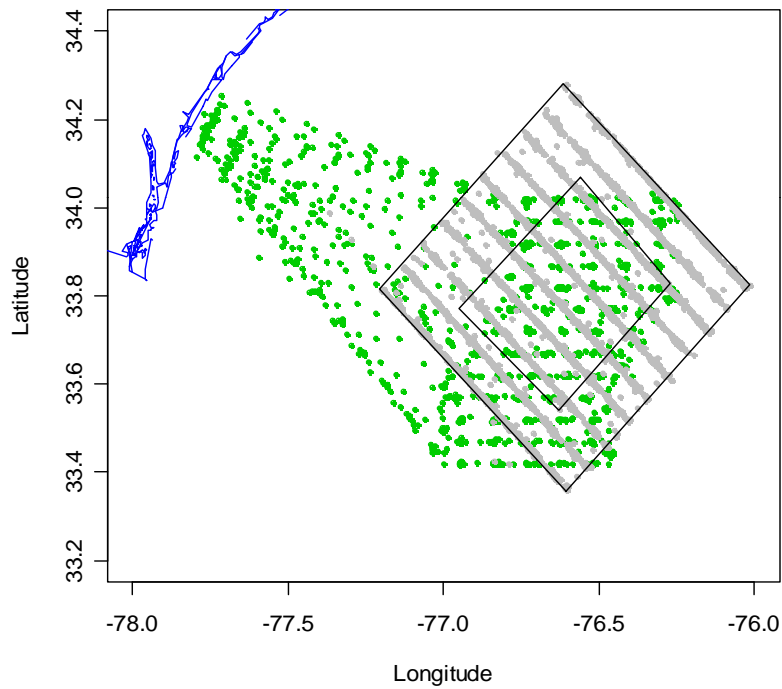
Core region = 1,800km<sup>2</sup>  
Total region = 5,700km<sup>2</sup>

Bathymetry:  
colours represent 200m intervals  
upto 4,200m dark blue

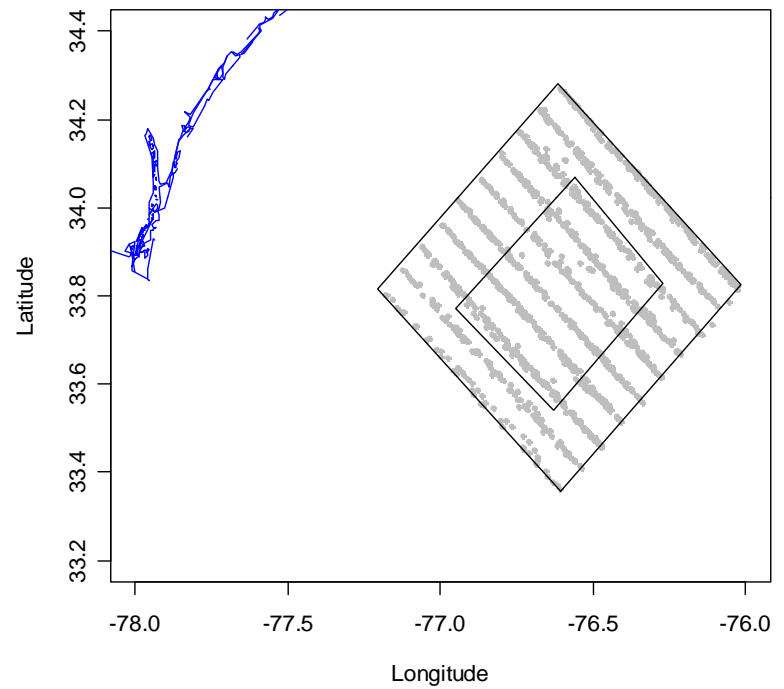


# Spatial coverage of USWTR surveys

a) Aerial surveys



b) Ship surveys



Green = Onslow surveys

# Temporal coverage of surveys

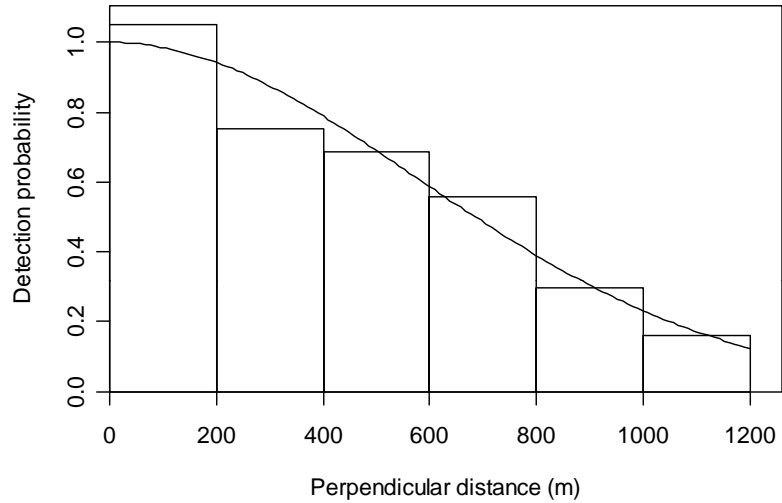
Month	1998	1999	2007	2008	2009	2010	2011
January		A			A, S	A, S	A
February				A	A, S	A	A
March		A		A, S	A, S	A, S	A
April		A		A	A, S	A, S	A
May		A		A, S	A	S	
June		A	A, S	A, S	A, S	A, S	
July		A	A, S	A, S	A, S		
August			A, S	A, S	A, S	A, S	
September	A		A, S	S	A, S	A, S	
October	A		A, S	A	A, S	A, S	
November	A		A, S	A, S	A	A	
December	A		A	A	A		

A = aerial survey , S = ship survey

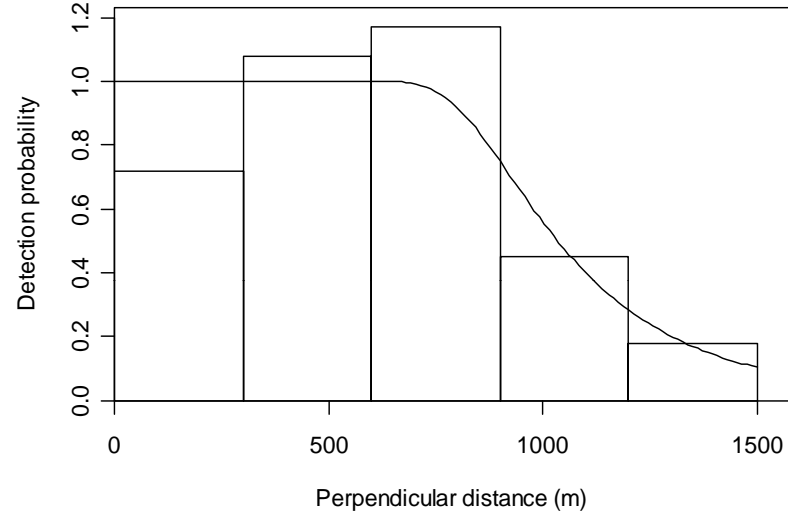
Green = Onslow aerial surveys

# Fitted detection functions

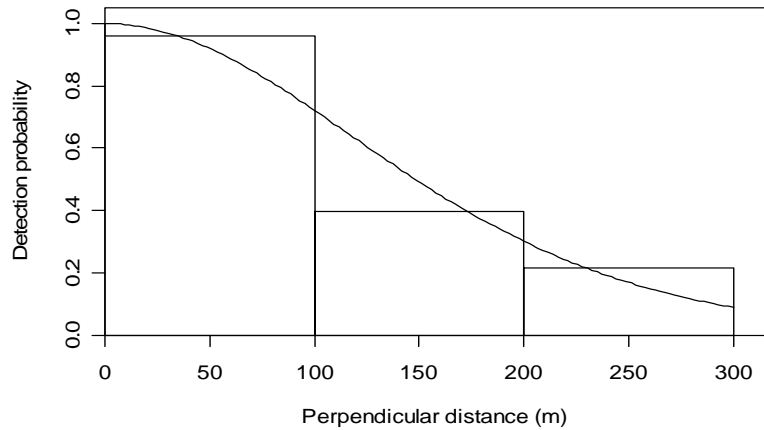
**Aerial - dolphins**



**Aerial - whales**

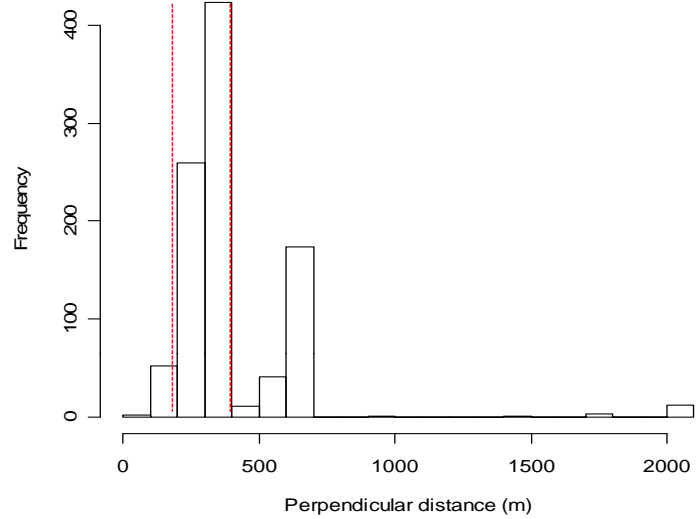


**Ship - dolphins**

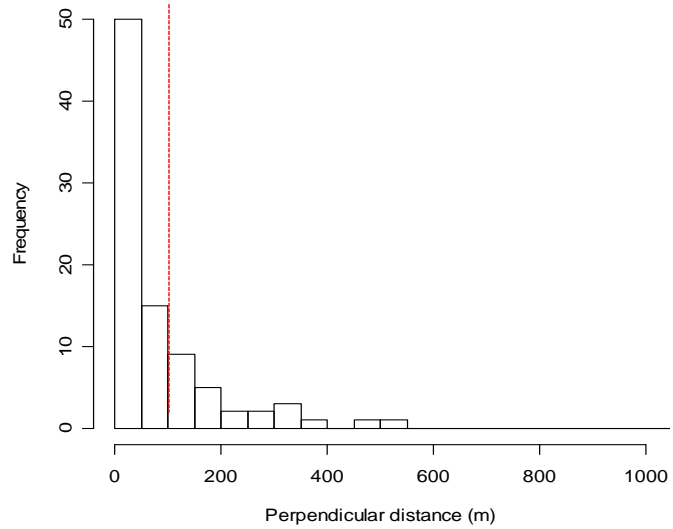


# Strip transects

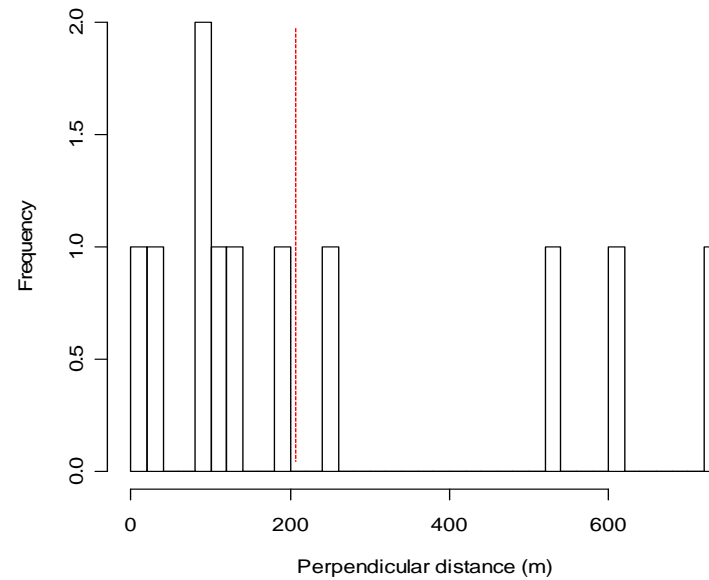
**Aerial - turtles**



**Ship - turtles\***



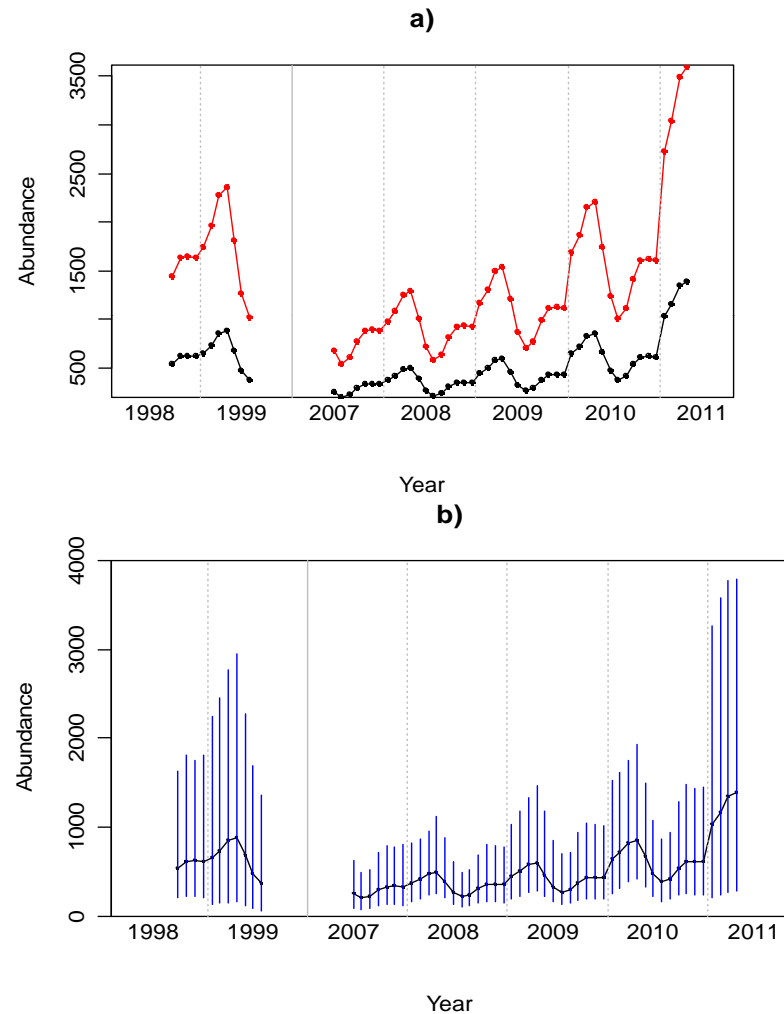
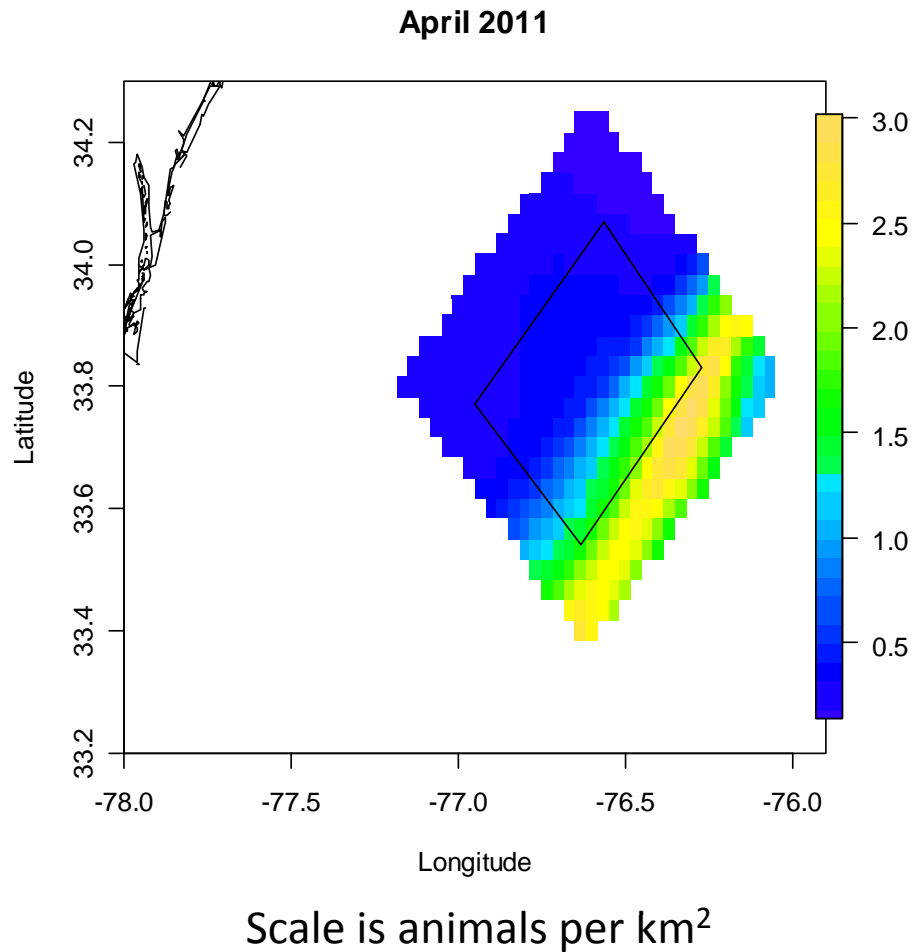
**Ship - whales**



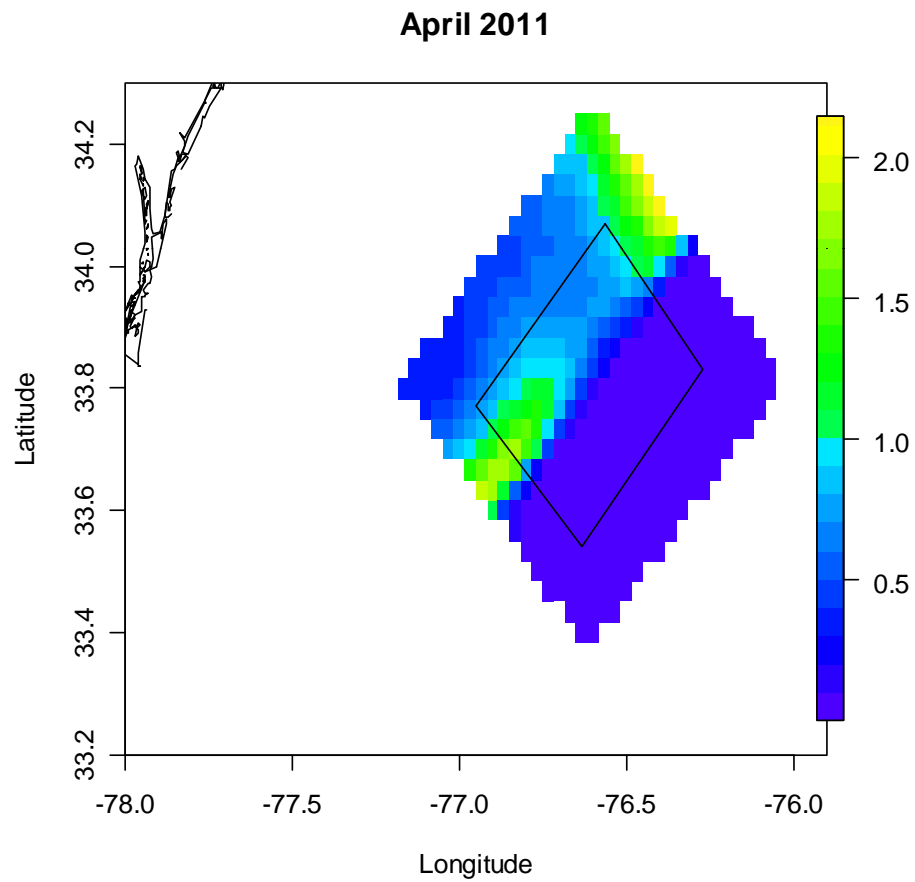
# Fitted models for abundance

Species	% non-zero segments	Model	Terms in model	% Deviance
Bottlenose dolphins	2.4	Predictive logistic	$s(\text{Year})+s(\text{Dayofyear})+s(\text{Depth})+s(\text{tLon,tLat})+\text{Platform}$	6.34
		Non-zero density	$S(\text{Year})+s(\text{Depth})+\text{Platform}$	24.9
Spotted dolphins	1.1	Predictive logistic	$s(\text{Year})+s(\text{Dayofyear})+s(\text{Depth})+s(\text{tLon,tLat})+\text{Platform}$	19.3
		Non-zero density	$\text{Year}+\text{Depth}+s(\text{tLon,tLat})+\text{Platform}$	42.9
Loggerhead turtles	5.4	Predictive logistic	$s(\text{Year})+s(\text{Dayofyear})+s(\text{Depth})+s(\text{tLon,tLat})$	20.6
		Non-zero density	$s(\text{Year})+s(\text{Lon})+\text{Platform}$	23.1

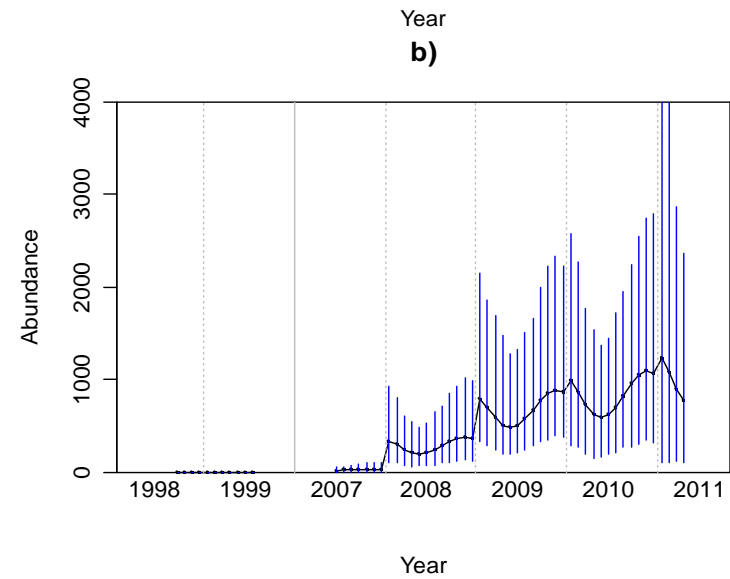
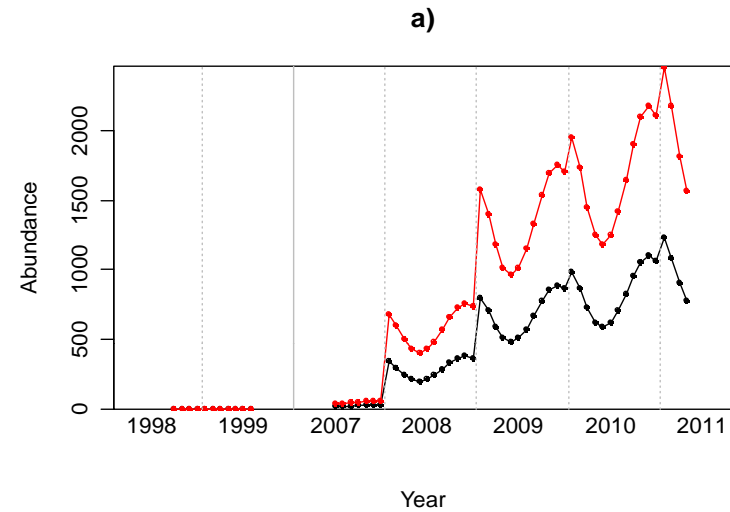
# Results: Bottlenose dolphins



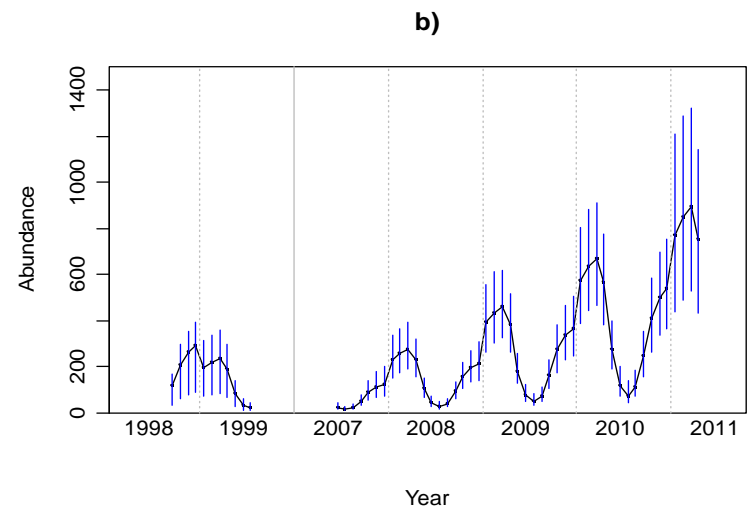
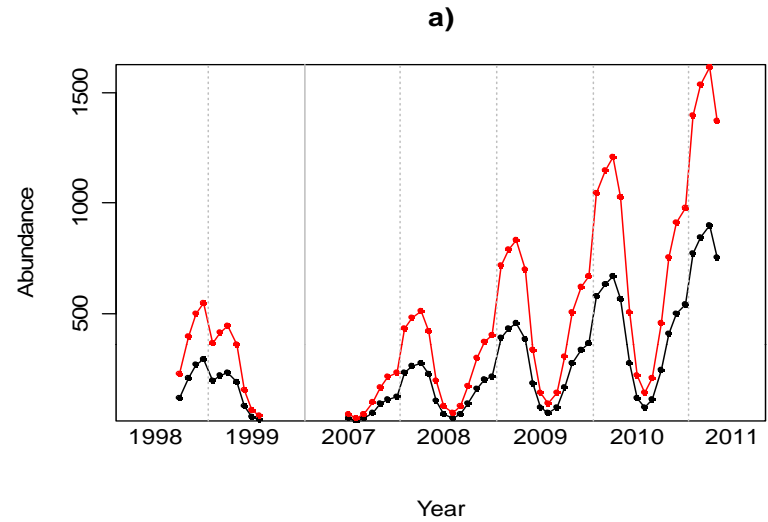
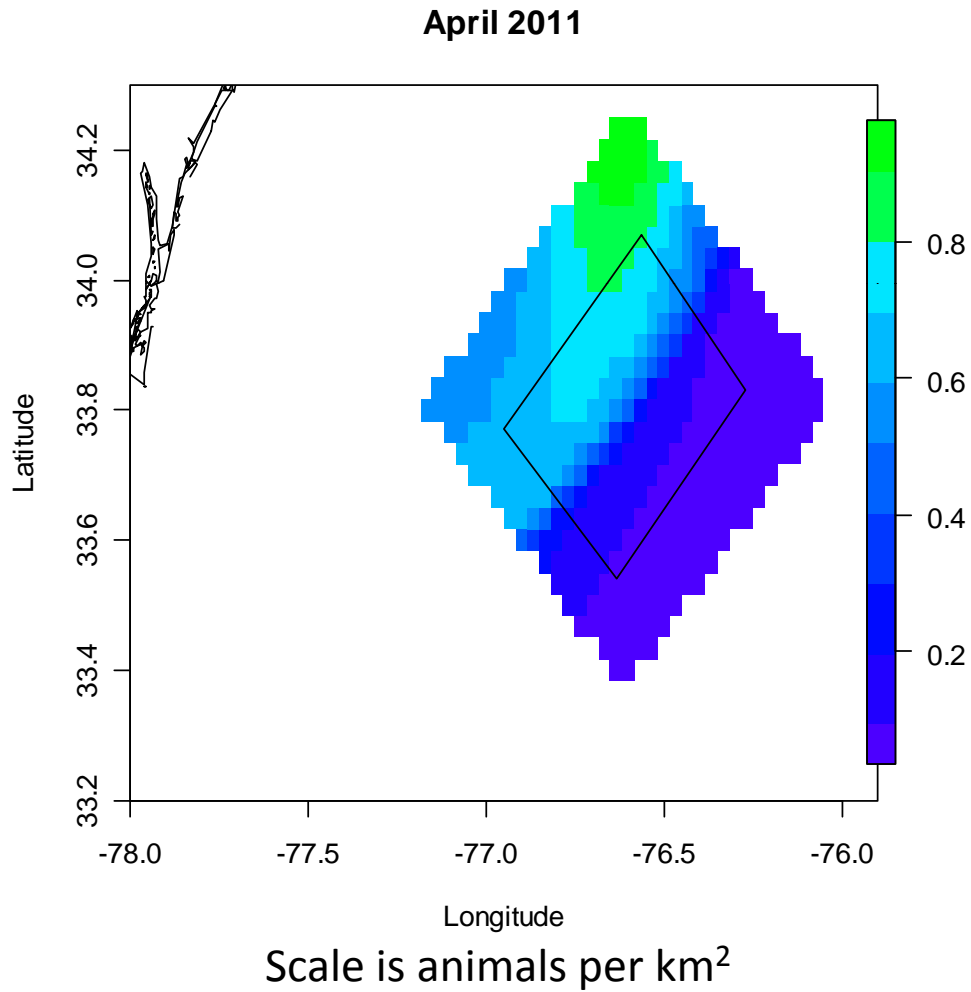
# Results: Spotted dolphins



Scale is animals per km<sup>2</sup>



# Results: Loggerhead turtles





# Results: Ziphids and pilot whales

- Only 12 segments had non-zero density
- No models fitted
- Average estimate
  - 4 (95% CI 1 – 7) in core region
  - 8 (95% CI 3 -13) in outside core region

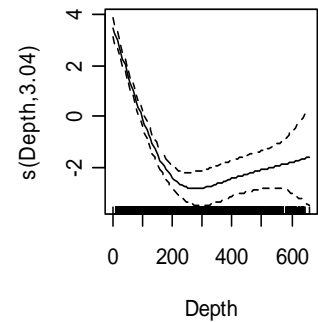
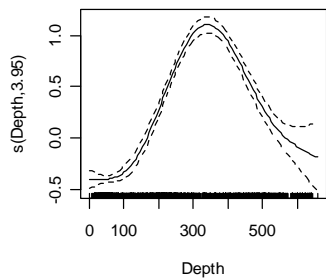
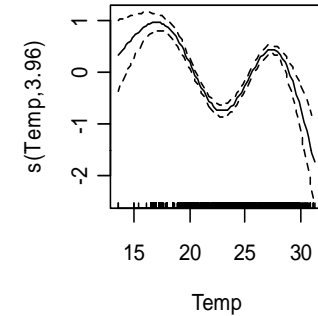
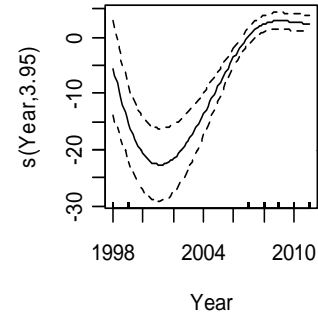
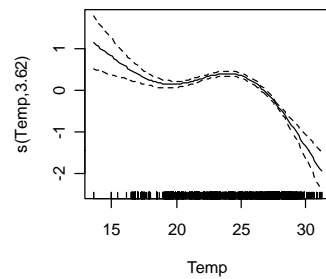
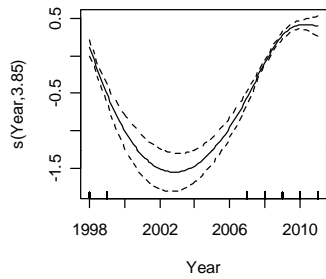
# Fitted explanatory models

<b>Species</b>	<b>Terms in model</b>	<b>% Deviance</b>
<b>Bottlenose dolphins</b>	<i>s(Year) + s(Temp) + s(Depth) + Platform</i>	<b>5.38</b>
<b>Spotted dolphins</b>	<i>s(Year) + s(Temp) + s(Depth) + Platform</i>	<b>19.8</b>
<b>Loggerhead turtles</b>	<i>s(Year) + s(Temp) + s(Depth)</i>	<b>19.1</b>

# Response to explanatory variables

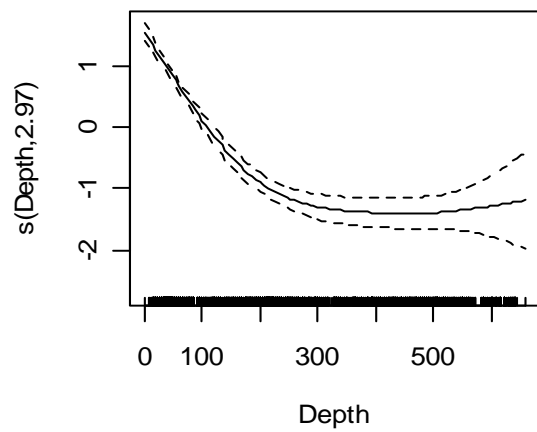
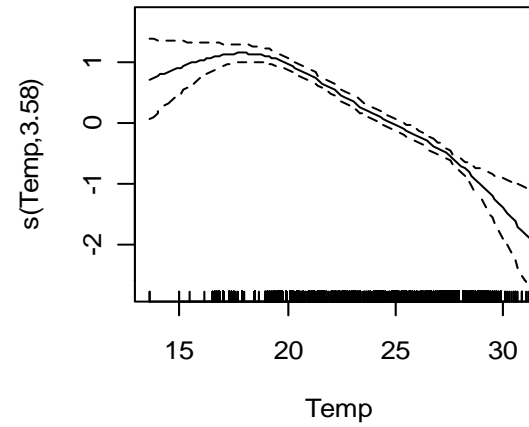
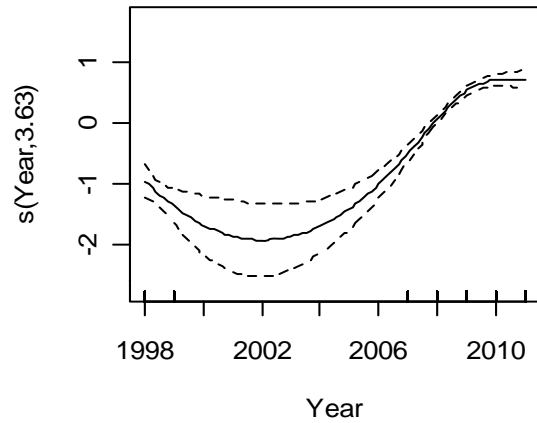
Bottlenose dolphins

Spotted dolphins

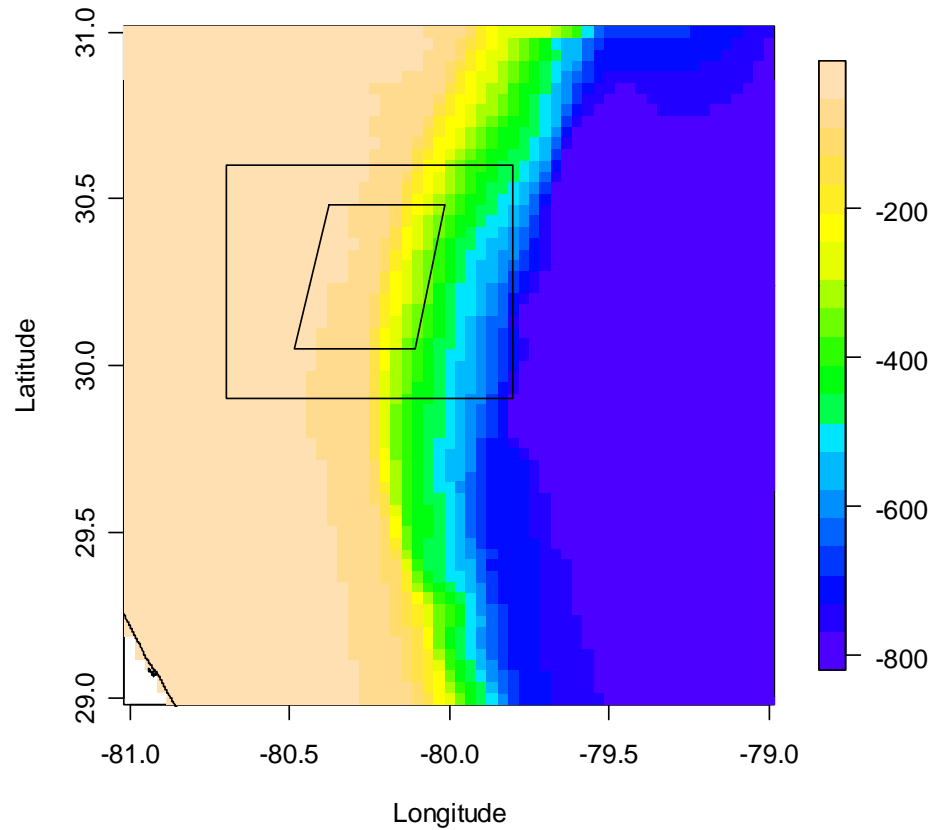


# Response to explanatory variables

## Loggerhead turtles



# Jacksonville region

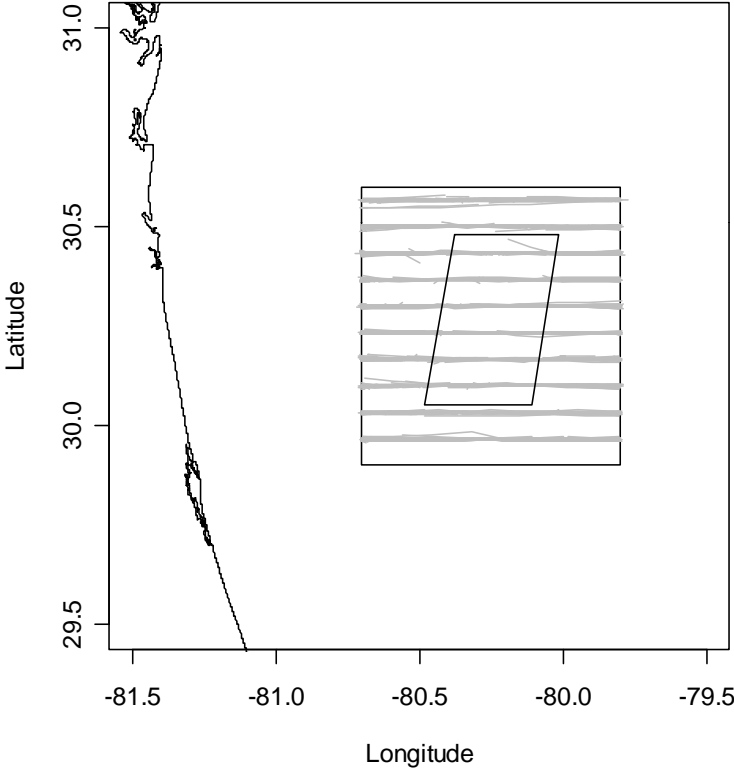


Core region = 1,680km<sup>2</sup>  
Total region = 6,710km<sup>2</sup>

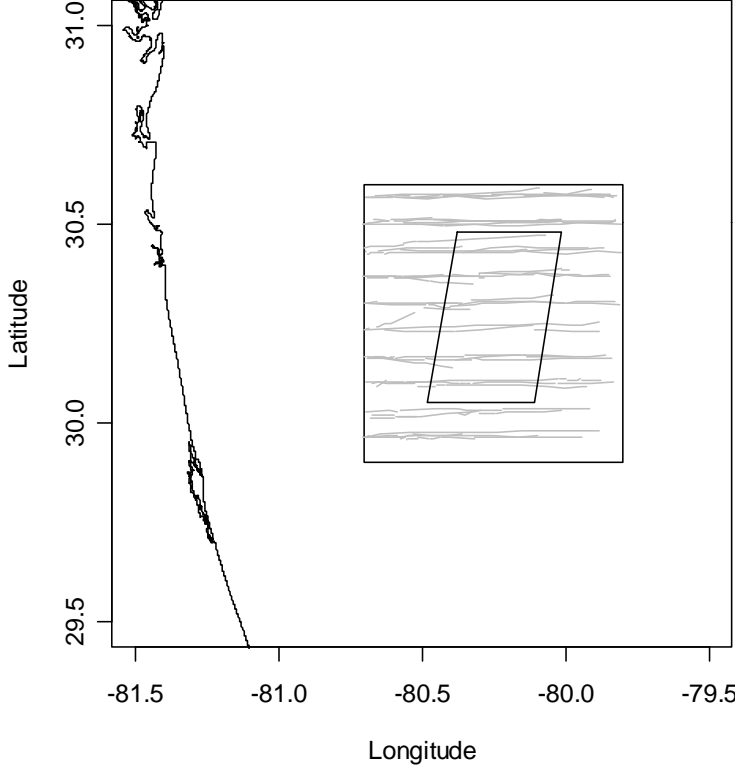
Bathymetry in metres

# Spatial coverage of Jacksonville surveys

a) Aerial surveys

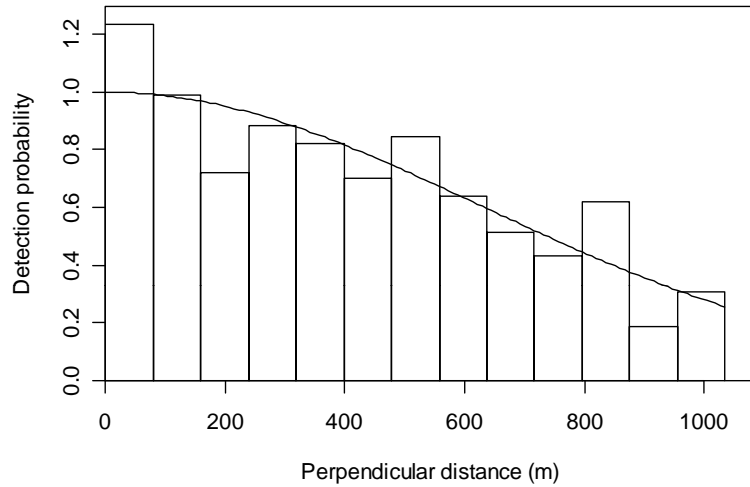


b) Ship surveys

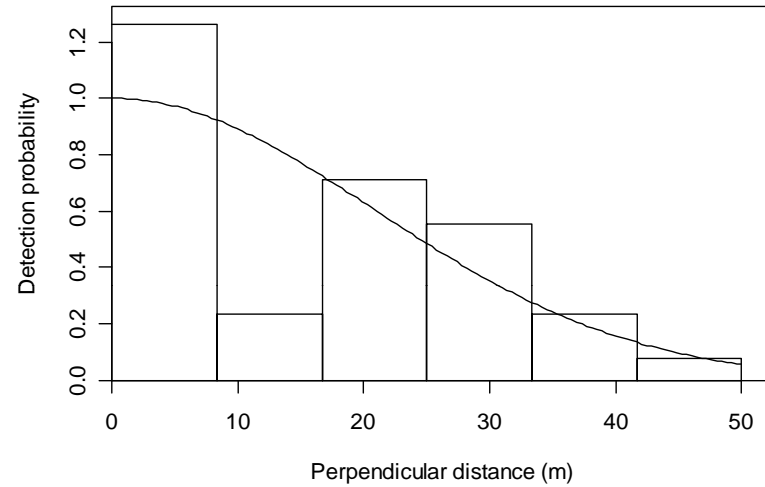


# Fitted detection functions

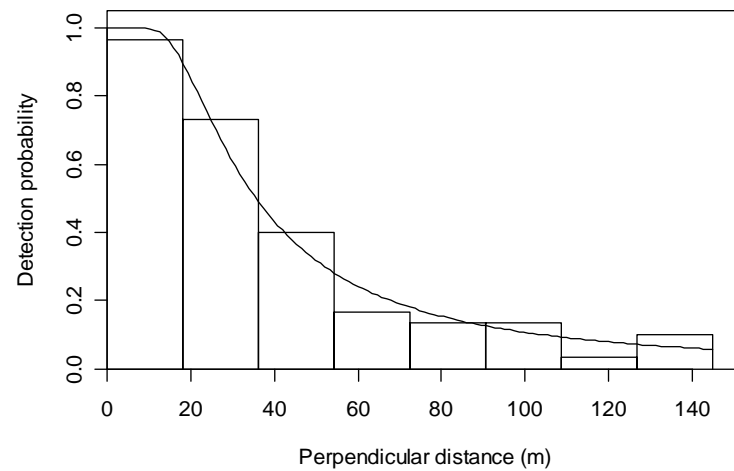
**Aerial - dolphins**



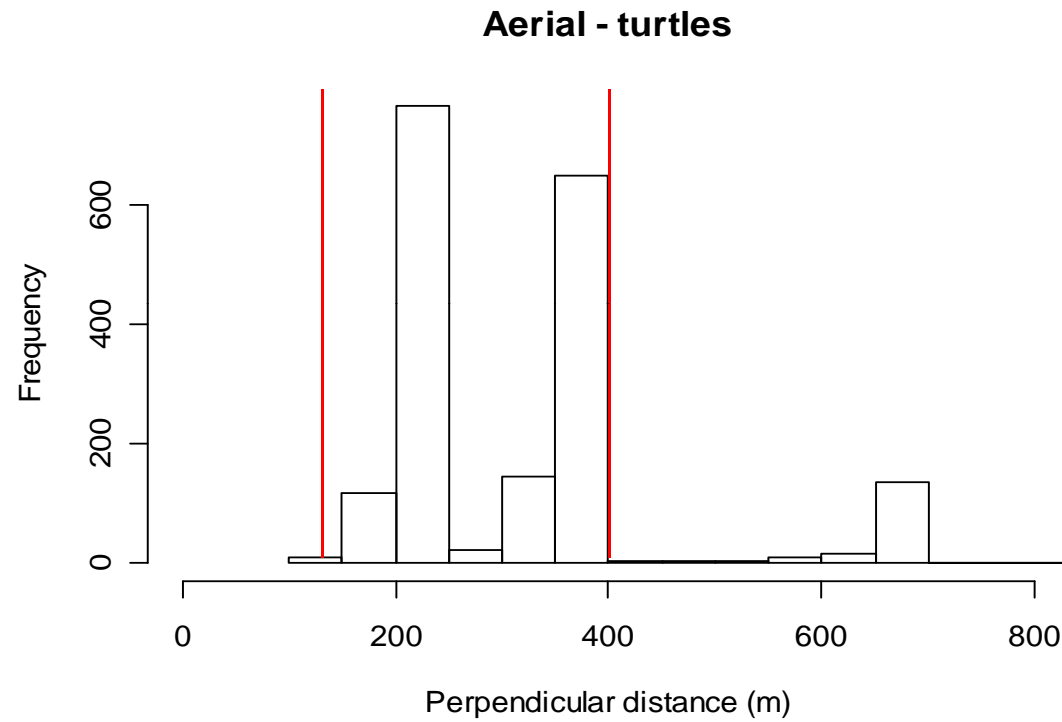
**Ship - dolphins**



**Ship - turtles**



# Strip transects

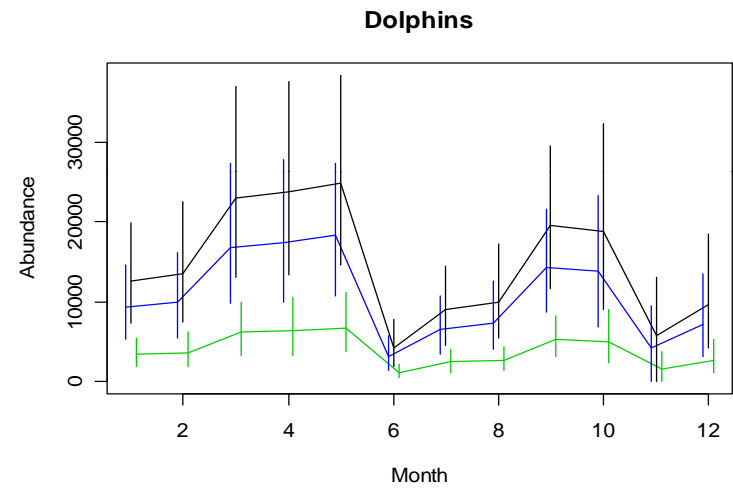
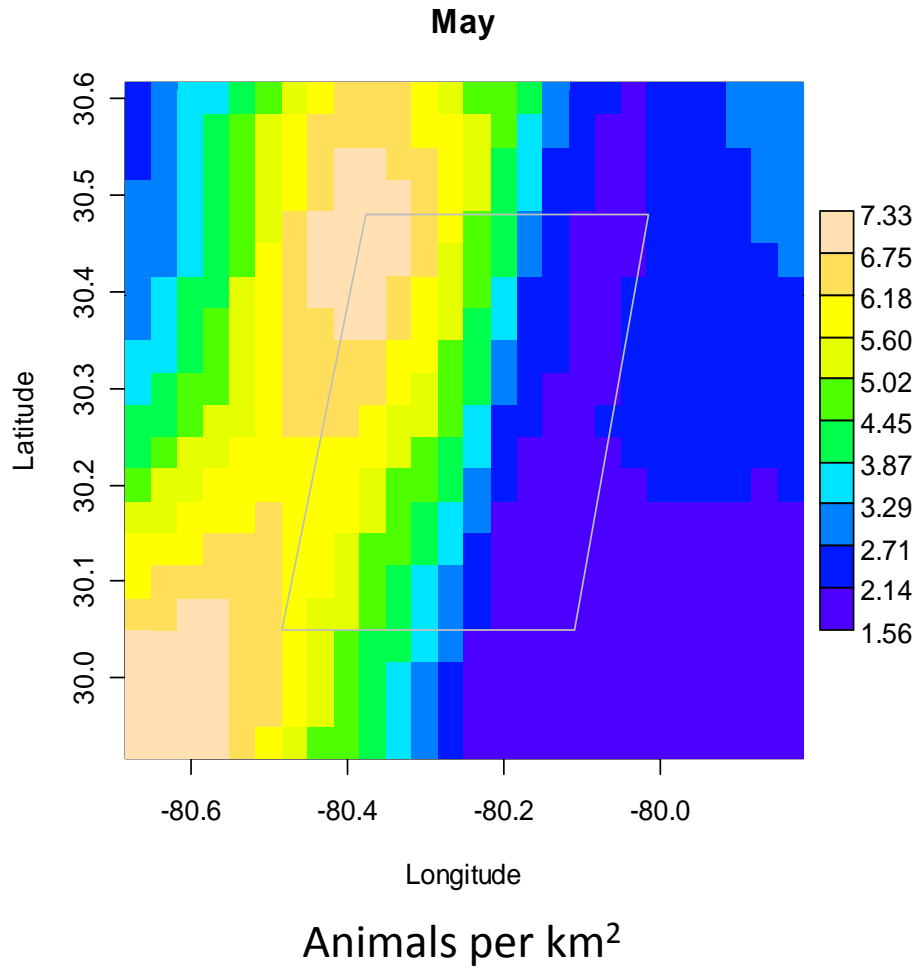




# Fitted models of abundance

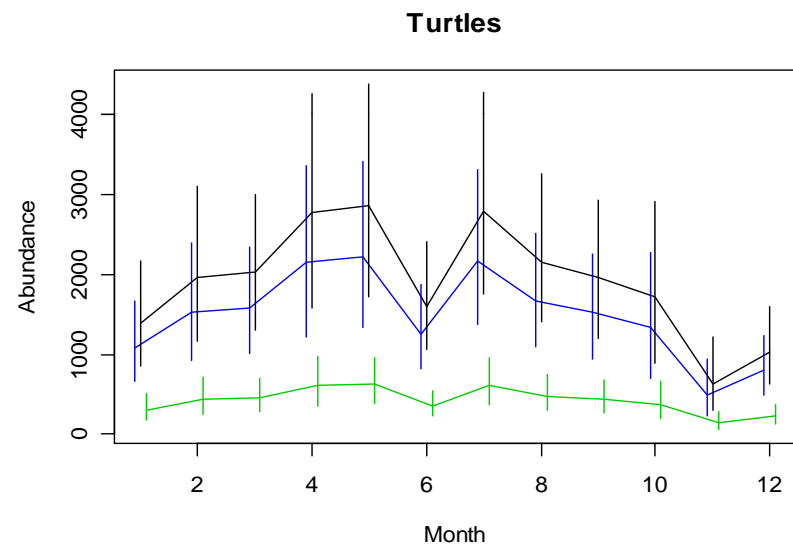
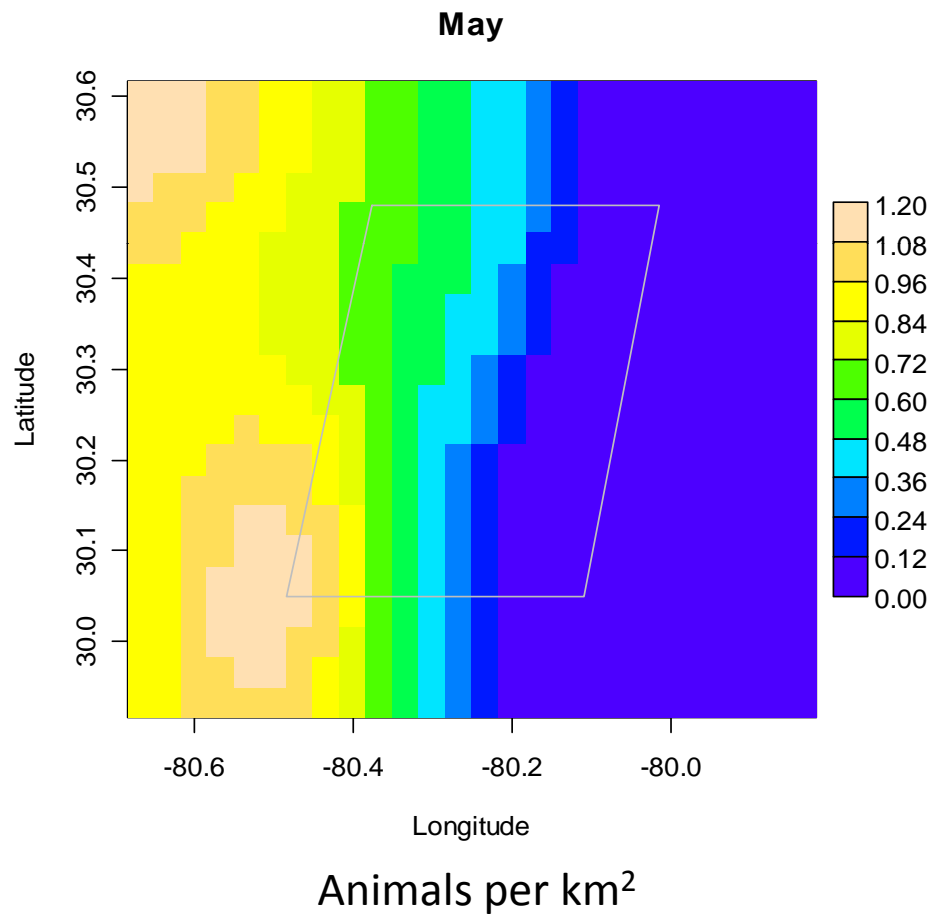
Species	% of non-zero segments	Terms in the model	% Deviance
Dolphins	7.9	<i>Platform + Month + s(Lon,Lat) + s(Depth)</i>	11.7
Turtles	18.9	<i>Platform + Month + s(Lon,Lat) + Depth</i>	32.4
Loggerhead turtles	15.7	<i>Platform + Month + s(Lon,Lat) + Depth</i>	31.1

# Results: Dolphins



Inner region  
Outer region  
Total

# Results: turtles

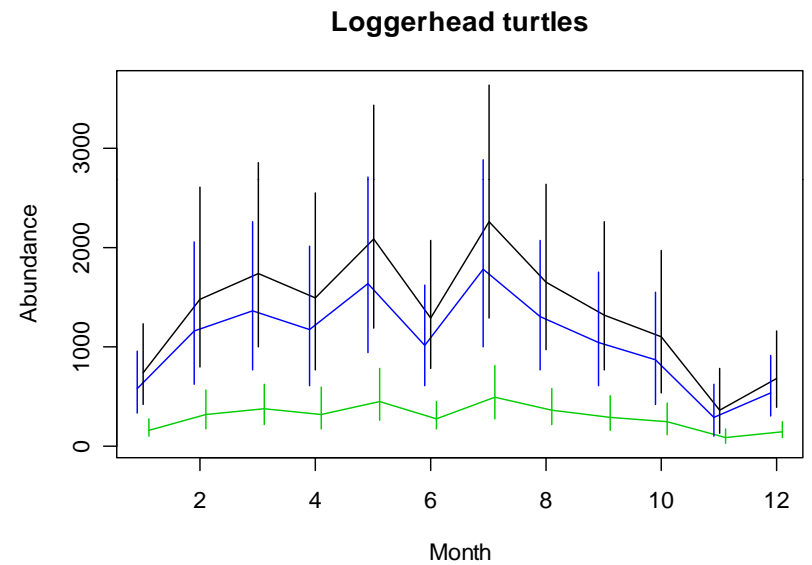
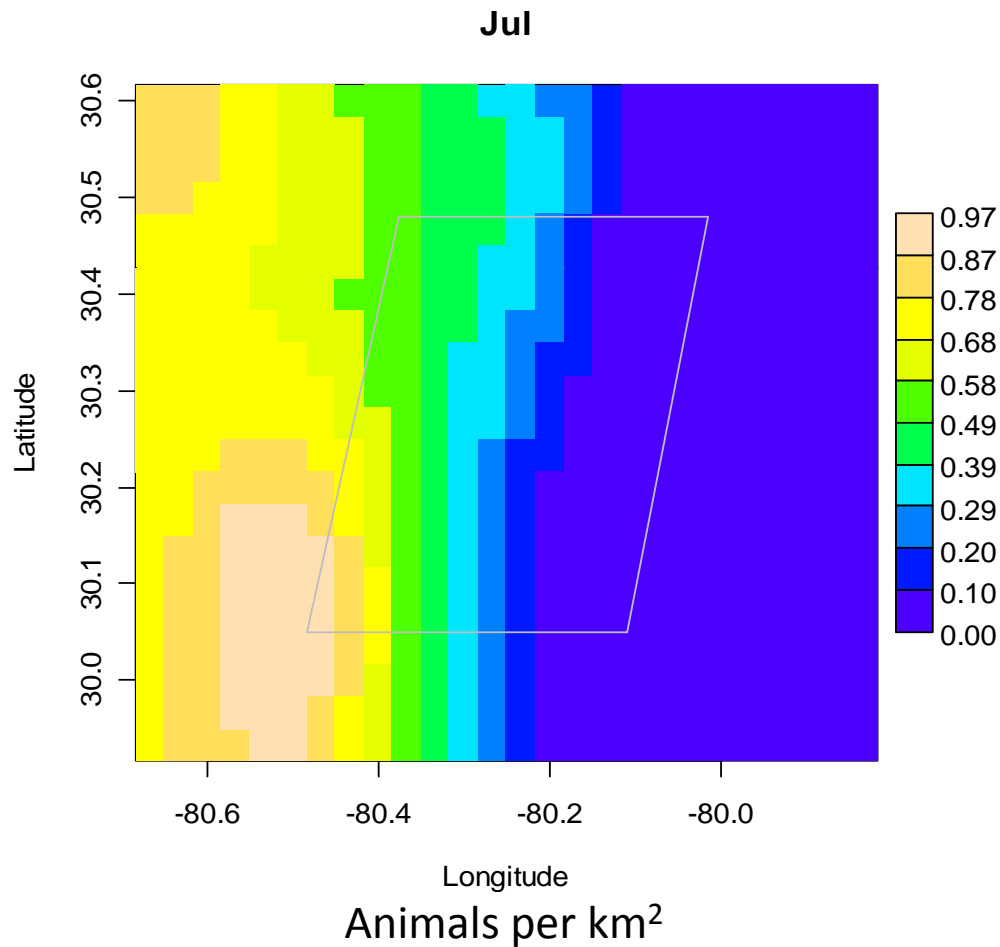


Inner region

Outer region

Total

# Results: Loggerhead turtles



Inner region  
Outer region  
Total

# Fitted explanatory models

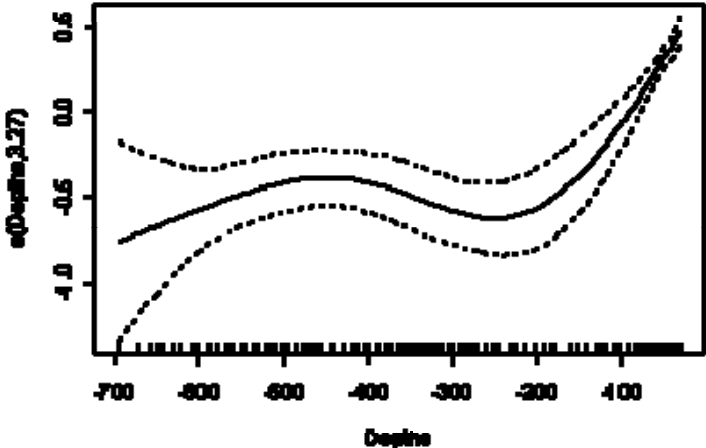
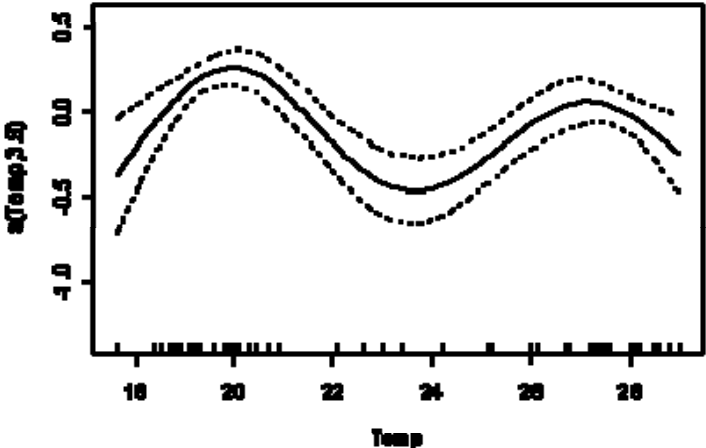
Species	Terms in model	% Deviance
Dolphins	<i>Platform + Year + s(Temp) + s(Depth)</i>	8.6
Turtles	<i>Platform + Year + s(Temp) + s(Depth)</i>	29.1
Loggerhead turtles	<i>Platform + Year + s(Temp) + s(Depth)</i>	26.9

# Response to explanatory variables

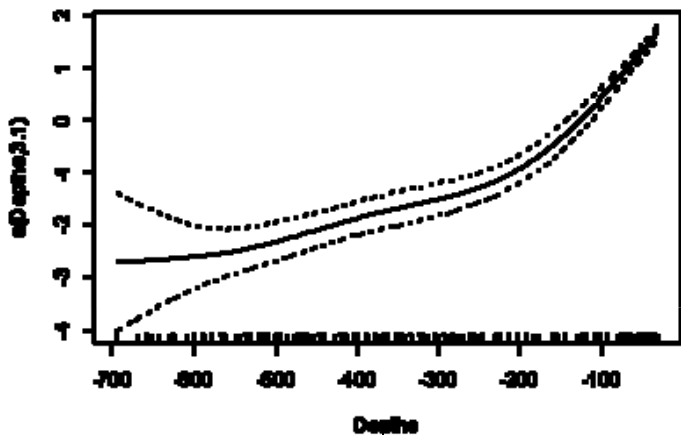
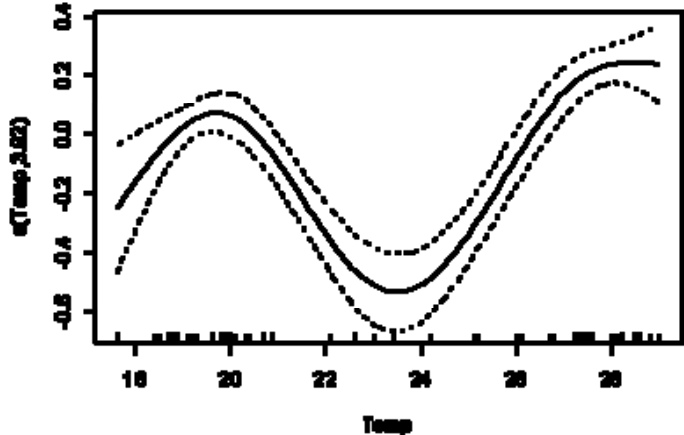
Temperature

Depth

Dolphins



Turtles



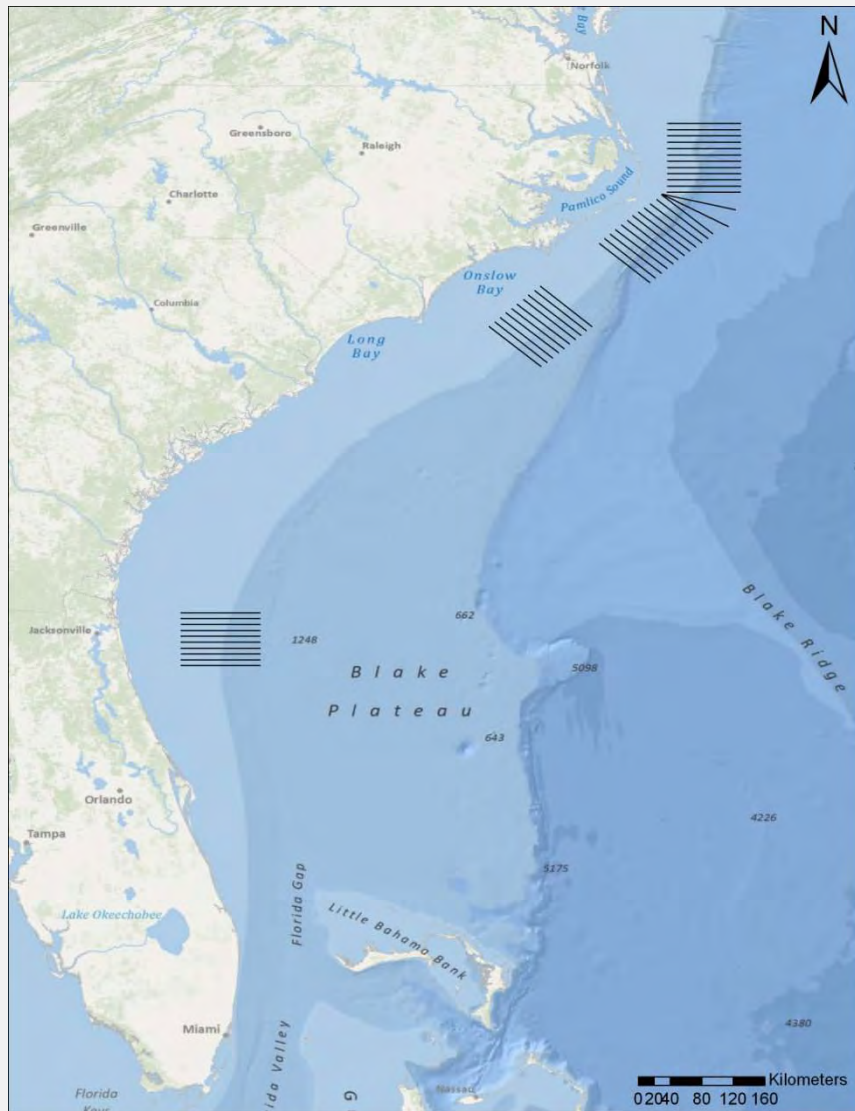
# Summary

- Combined aerial and ship survey data
- Estimated abundance of dolphins and turtles over time
- Cyclic nature to abundance estimates
  - Possibly in relation to sea surface temperature

# Potential issues

- Attraction of dolphins to ship
- Turtle perpendicular distribution
- Detection on the trackline,  $g(0)$
- Availability bias
- Prediction
  - less ship data in future
  - for turtles, use plane not ship?





## Discussion Topics

Data Access & Use

Publications

Aerial Survey Co-ordination

Analytical Questions

Consideration of Survey Approaches



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July 2010 to December 2011

# Data Access

## *Aerial Surveys*

OBIS SEAMAP - 6 data sets uploaded in this reporting period

UNCW has now provided 19 data sets to OBIS

With the upcoming uploads of 2011- 2012 data this summer, UNCW will be the largest non-NOAA data provider!

## *Vessel Surveys*

OBIS-SEAMAP – all data uploaded through October 2010

Upcoming data upload will include all surveys through December 2011



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## Data Use

Survey data from OBIS-SEAMAP provided to UNC-CH researcher investigating offshore NC site for renewable energy development

Survey data from OBIS-SEAMAP used by Large Whale TRT for investigation of whale distribution in mid-Atlantic



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## Publications - Completed

Foley, H.J., R.C. Holt, R.E. Hardee, P.B. Nilsson, K.A. Jackson, A.J. Read, D.A. Pabst & W.A. McLellan. 2011. Observations of the birth of a North Atlantic right whale (*Eubalaena glacialis*) outside critical habitat in the southeastern United States. *Marine Mammal Science* 27: E234–E240.

Schick R.S., P.N. Halpin, A.J. Read, D.L. Urban, B.D. Best, C.P. Good, J.J. Roberts, E.A. LaBrecque, C. Dunn, L.P. Garrison, K.D. Hyrenbach, W.A. McLellan, D.A. Pabst, D.L. Palka & P. Stevick. 2011. Community structure in pelagic marine mammals at large spatial scales as revealed by multivariate ordination. *Marine Ecology Progress Series* 434: 165–181.

Best, B.D., P.N. Halpin, A.J. Read, E. Fujioka, C.P. Good, E.A. LaBrecque, R.S. Schick, J.J. Roberts, L.J. Hazen, S.S. Qian, D.L. Palka, L.P. Garrison & W.A. McLellan. *In Press*. An online cetacean habitat modeling system for the U.S. east coast and Gulf of Mexico. *Endangered Species Research*.



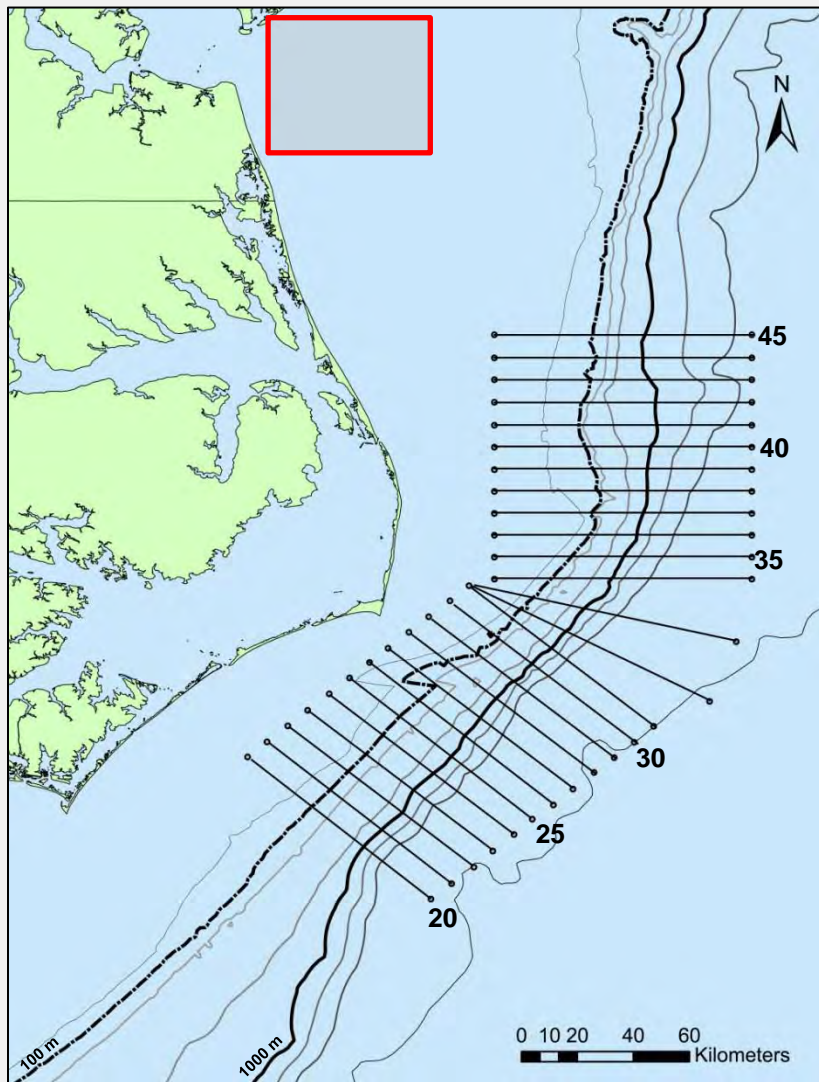
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## Publications – In Progress

Topic	Lead	Analysis	Manuscript
Marine Mammal Density – Onslow Bay	AJR	✓	✓
Sea Turtle Density – Onslow Bay	AJR	✓	
Seabird Habitat Models – Onslow Bay	LHT	✓	✓
Black-Capped Petrel Habitat Model – Onslow Bay	LHT	✓	
Marine Mammal Habitat Models – Onslow Bay	LHT		
Occurrence of Odontocetes – Onslow Bay HARPs	LWH	✓	
Occurrence of Mysticetes– Onslow Bay HARPs	LWH	✓	
Odontocete Vocalizations – Onslow Bay Pop-Ups	LWH	✓	✓
Minke whale distribution and possible calving site	RJM	✓	



AFAST Monitoring of Protected Species  
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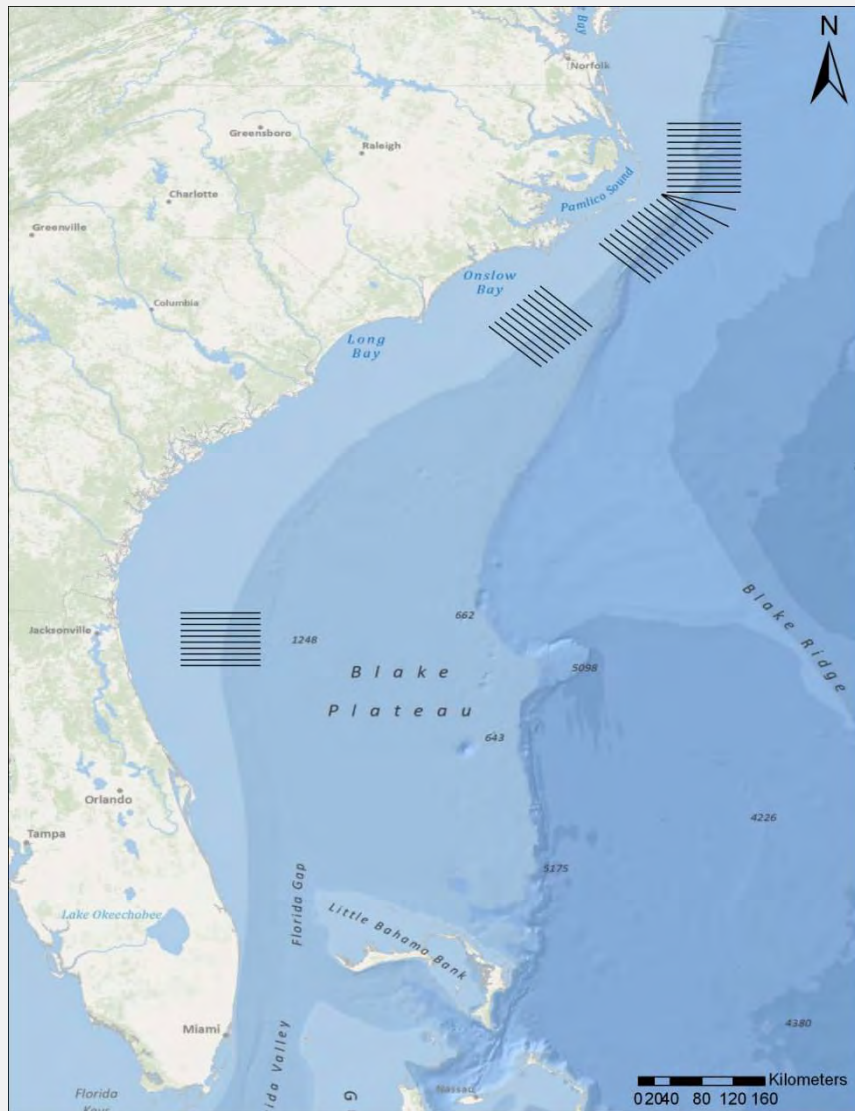
## Aerial Survey Co-Ordination

Virginia Aquarium has received funding to carry out wind-power surveys at the mouth of the Chesapeake Bay.

UNCW will advise on design, aerial survey training and database management to ensure complementary to current Navy data collection protocols.



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Jacksonville, FL, Onslow Bay and Cape Hatteras, NC  
July 2010 to December 2011

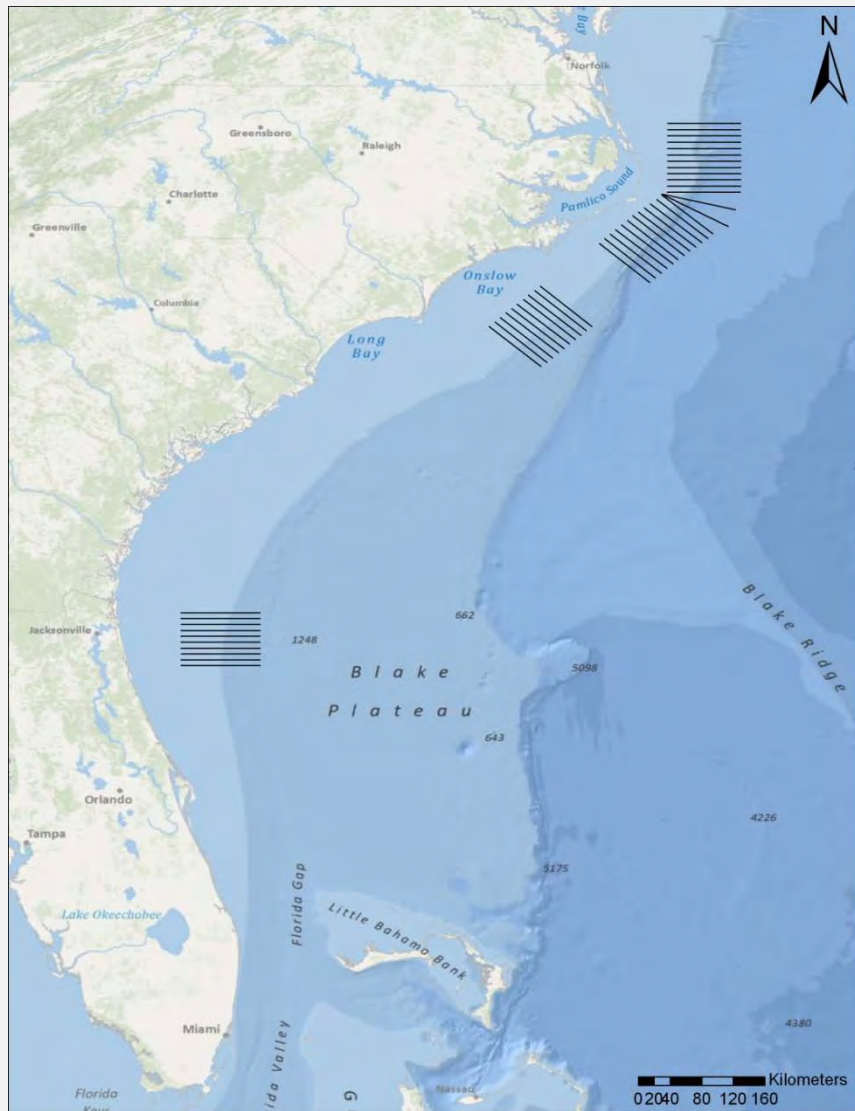


## Analytical Questions

Estimation of  $g(0)$ ?

Attraction of odontocetes in JAX

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## Survey Approach

Is the current allocation of survey effort sufficient and appropriate?

And, specifically, do we need occasional vessel line transect calibration surveys in Onslow?

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