



**EcoHealth Alliance**

*Formerly known as Wildlife Trust*

FINAL REPORT TO  
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION (NOAA)

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**Documenting Spatial and Temporal Distribution  
of North Atlantic Right Whales off South Carolina and Northern Georgia  
2010 – 2011**

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ECOHEALTH ALLIANCE  
AQUATIC CONSERVATION PROGRAM

233 Third St. N., Suite 300  
St. Petersburg, Florida 33701

Prepared by:

Dianna W. Schulte and Cynthia R. Taylor

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## Abstract

The North Atlantic right whale, *Eubalaena glacialis*, is listed as a federally-protected endangered species under the Endangered Species Act, in addition to being protected by the Marine Mammal Protection Act. The winter calving grounds off the coasts of Georgia and Florida have been designated as critical habitat. The region just north of the critical habitat, including northern Georgia and South Carolina (SCGA), has long been considered an important migratory route. However, survey effort and photo-identification data since 2004 has suggested that some individuals utilize this area not only as a migratory route, but as a residency area as well. The purpose of this aerial survey effort is to collect data on the distribution and use patterns of right whales off the coasts of northern Georgia and South Carolina to assist in determining appropriate management actions in the region. A total of 42 surveys were flown from 15 November 2010 to 15 April 2011 and extended from North Myrtle Beach, South Carolina (33.82°N) to St. Catherine's Island, Georgia (31.58°N). Preliminarily, 28 right whale sightings consisting of 47 right whales were documented (including re-sightings of six individuals, one individual that was sighted four times and two whales that were not photographed). Sightings consisted of seven cow/calf pairs, 12 single whales, and nine groups of two or more adult/juvenile right whales. Preliminary photo-identification has resulted in the confirmed identification of five individual cow/calf pairs and 22 of the 26 individual adult/juvenile whales. The individuals documented include 13 females, eight males and 15 individuals of unknown gender (including five calves), for a total of 36 individual photographed whales in the study area. Of the 13 females seen, seven gave birth to new calves this season, although only five were seen with their calves within the study area. The remaining two calving females were seen while pregnant prior to giving birth. Preliminary sightings of note include 19 individuals, including two cow/calf pairs, that were unique to the study area and not sighted by other survey teams to the south. Also of note were the observations of an entangled whale, a whale that was recently struck by a vessel and two surface active groups. The number of whales sighted was greatest in February, resulting in 40% of all whales documented during the 2010-2011 season.

## **Introduction**

The North Atlantic right whale, *Eubalaena glacialis*, is listed as a federally-protected endangered species under the Endangered Species Act, in addition to being protected by the Marine Mammal Protection Act. Recent increases in calving may have been accompanied by increases in mortality (Kraus et al. 2005); however, examination of the minimum number alive population index suggests a positive trend in numbers (Waring et al. 2009). A slow reproductive rate is further hindered by human-related mortality, the largest known threat to the species, including vessel collisions and entanglement in fishing gear (NMFS, 2005). It is essential that mitigation measures are enacted quickly and efficiently to minimize human-related mortality, particularly in the calving grounds of the Southeast United States (SEUS).

Right whales are slow moving, especially when accompanied by a calf, and are often not easily seen while at the water's surface due to the lack of a dorsal fin. These factors make them vulnerable to collisions with vessels, especially in areas of increased vessel traffic. The winter calving grounds off Georgia and northern Florida have been designated as critical habitat for right whales. An Early Warning System (EWS) was created to provide right whale location information to military and commercial vessels transiting the critical habitat area. The region just north of the critical habitat, including northern Georgia and South Carolina, has long been considered an important migratory route. However, survey effort and photo-identification data since 2004 suggests that some individuals utilize this area not only as a migratory route, but as a residency area as well. Resource managers are interested in learning more about right whale use of this southern mid-Atlantic region. In addition, continuing mortality from vessel collisions and gear entanglement in the mid-Atlantic region is of concern to researchers and managers.

Aerial survey coverage along the entire coasts of Georgia and South Carolina is enabling a better understanding of distribution and use of these habitats by calving females and other demographic segments of the population. Conservationists, researchers, and managers have speculated that the current boundaries of the SEUS critical habitat, established in 1994, and other existing management boundaries may not accurately delineate the areas in need of management measures to facilitate recovery of the species and reduce anthropogenic mortality. Through this continuing multi-year study we hope to provide managers with a more thorough understanding of right whale use of the study area to assist with management decisions and recovery challenges.

## **Methods**

### *Study Area*

The South Carolina/northern Georgia (SCGA) survey season began on 15 November 2010 and concluded on 15 April 2011. The SCGA survey area for the 2010-2011 season extended from North Myrtle Beach, South Carolina to the southern end of St. Catherine's Island, Georgia. The survey area was divided into three sections: northern, middle and southern. The northern area extended from North Myrtle Beach, SC (33.82°N) to Cape Romain, SC (33.01°N) and consisted of 16 southeast/northwest transect lines of varied lengths (35.1 - 35.3 nmi) which were flown at approximately 4 nmi intervals. The middle area extended from Cape Romain, SC to Fripp Island, SC (32.34°N) and consisted of 16 southeast/northwest transect lines of varied lengths (35.3 - 35.4 nmi) which were also flown at approximately 4 nmi intervals. The southern section extended from Hilton Head Island, SC (32.23°N) to

St. Catherine's Island, GA (31.58°N) and consisted of 14 east/west transect lines of varied lengths (11.7 – 29.0 nmi) which were flown at 3 nmi intervals (Figure 1). The northern and middle transect lines were flown in a southeast/northwest direction as opposed to the east/west orientation of the southern section in order to cover a larger bathymetric range. A complete northern survey consisted of 563.4 nmi of trackline, a complete middle survey consisted of 565.2 nmi of trackline, and a complete southern survey consisted of 323.5 nmi of trackline (Table 1). These totals do not include miles flown in transit to, from, and between transect lines. The survey aircraft departed from Mt. Pleasant Regional Airport in Mt. Pleasant, SC. After completing half of the survey lines for the day, the plane would land to refuel and to provide a rest period to avoid observer fatigue. When flying in the northern section, the plane would refuel at Georgetown Airport in Georgetown, SC. In the middle section the plane would refuel at Mt. Pleasant Regional Airport in Mt. Pleasant, SC or at Charleston Executive Airport in Johns Island, SC. In the southern section, the plane would refuel at Hilton Head Airport in Hilton Head, SC. The plane returned to Mt. Pleasant Regional Airport at the end of each normal survey day. Without whale sightings, a complete northern survey took approximately 8.1 Hobbs hours to finish, a complete middle section took approximately 7.7 Hobbs hours, and a complete southern section took approximately 6.3 Hobbs hours, including transit times to and from the airports.

### *Aerial Surveys*

Surveys were scheduled to be flown from 15 November 2010 through 15 April 2011, weather permitting, under VFR (visual flight rules) conditions. Conditions necessary for survey flight included a minimum ceiling of 455m, visibility greater than 2nmi, wind speed less than 12 knots, and Beaufort sea state of 3 or less. Surveys were conducted in a Cessna 337 Skymaster aircraft owned and operated by Orion Aviation. The aircraft was equipped with Global Positioning System (GPS), Automatic Identification System (AIS), navigation aids, radar, aviation VHF radio, marine VHF radio, life raft, GPIRB-equipped PFDs, flares, EPIRB, and satellite telephone. Flight protocols included mandatory usage of PFDs and Nomex flight suits. All observers were also required to complete emergency egress training prior to the start of the survey season.

Surveys were flown at an altitude of 1000 ft (303 m) and at a ground speed of 100 knots. The surveys were typically flown south to north with the western waypoint of the southernmost trackline as the start point. However, the section flown, the start point and direction of flight was determined daily, based on weather conditions throughout the survey area and other survey factors. Spreading survey effort equally amongst the survey areas was also a factor. The survey crew consisted of a pilot, co-pilot and two observers. The observers were positioned on either side of the aircraft behind the pilot and co-pilot seats. All events, sightings, and changes in environmental conditions were recorded on a laptop computer using Logger 2000, a software program designed for marine data entry. To minimize time spent looking away from the window, when an event occurred the left observer recorded the time and position of the event on the computer while the right observer recorded the time and event information into a handheld digital voice recorder. Time, location, number and species of all large whales were recorded. In addition, the AIS receiver that was installed in the plane recorded large vessel (over 33m in length) information including name, position, speed, length, and course.

**Table 1. South Carolina-Georgia survey trackline waypoints for the 2010-2011 season.**

Track Line	Latitude West	Longitude West	Latitude East	Longitude East
1	31.58	-81.13	31.58	-80.57
2	31.63	-81.12	31.63	-80.57
3	31.68	-81.12	31.68	-80.57
4	31.73	-81.10	31.73	-80.57
5	31.78	-81.05	31.78	-80.50
6	31.83	-81.00	31.83	-80.50
7	31.88	-80.95	31.88	-80.43
8	31.93	-80.90	31.93	-80.43
9	31.98	-80.85	31.98	-80.43
10	32.03	-80.80	32.03	-80.43
11	32.08	-80.75	32.08	-80.37
12	32.13	-80.70	32.13	-80.37
13	32.18	-80.65	32.18	-80.37
14	32.23	-80.60	32.23	-80.37
15	32.34	-80.45	31.89	-80.00
16	32.41	-80.42	31.96	-79.97
17	32.49	-80.39	32.04	-79.94
18	32.50	-80.30	32.05	-79.85
19	32.54	-80.23	32.09	-79.78
20	32.57	-80.16	32.12	-79.71
21	32.60	-80.08	32.15	-79.63
22	32.62	-79.99	32.17	-79.54
23	32.66	-79.93	32.21	-79.48
24	32.71	-79.88	32.26	-79.43
25	32.76	-79.82	32.31	-79.37
26	32.80	-79.75	32.35	-79.30
27	32.85	-79.70	32.40	-79.25
28	32.89	-79.63	32.44	-79.18
29	32.97	-79.61	32.52	-79.16
30	33.02	-79.56	32.57	-79.11
31	33.01	-79.44	32.56	-78.99
32	33.02	-79.35	32.57	-78.90
33	33.10	-79.32	32.65	-78.87
34	33.13	-79.25	32.68	-78.80
35	33.18	-79.19	32.73	-78.74
36	33.27	-79.18	32.82	-78.73
37	33.35	-79.15	32.90	-78.70
38	33.43	-79.12	32.98	-78.67
39	33.49	-79.08	33.04	-78.63
40	33.54	-79.02	33.09	-78.57
41	33.60	-78.98	33.15	-78.53
42	33.65	-78.92	33.20	-78.47
43	33.70	-78.87	33.25	-78.42
44	33.75	-78.81	33.30	-78.36
45	33.79	-78.74	33.34	-78.29
46	33.82	-78.67	33.37	-78.22

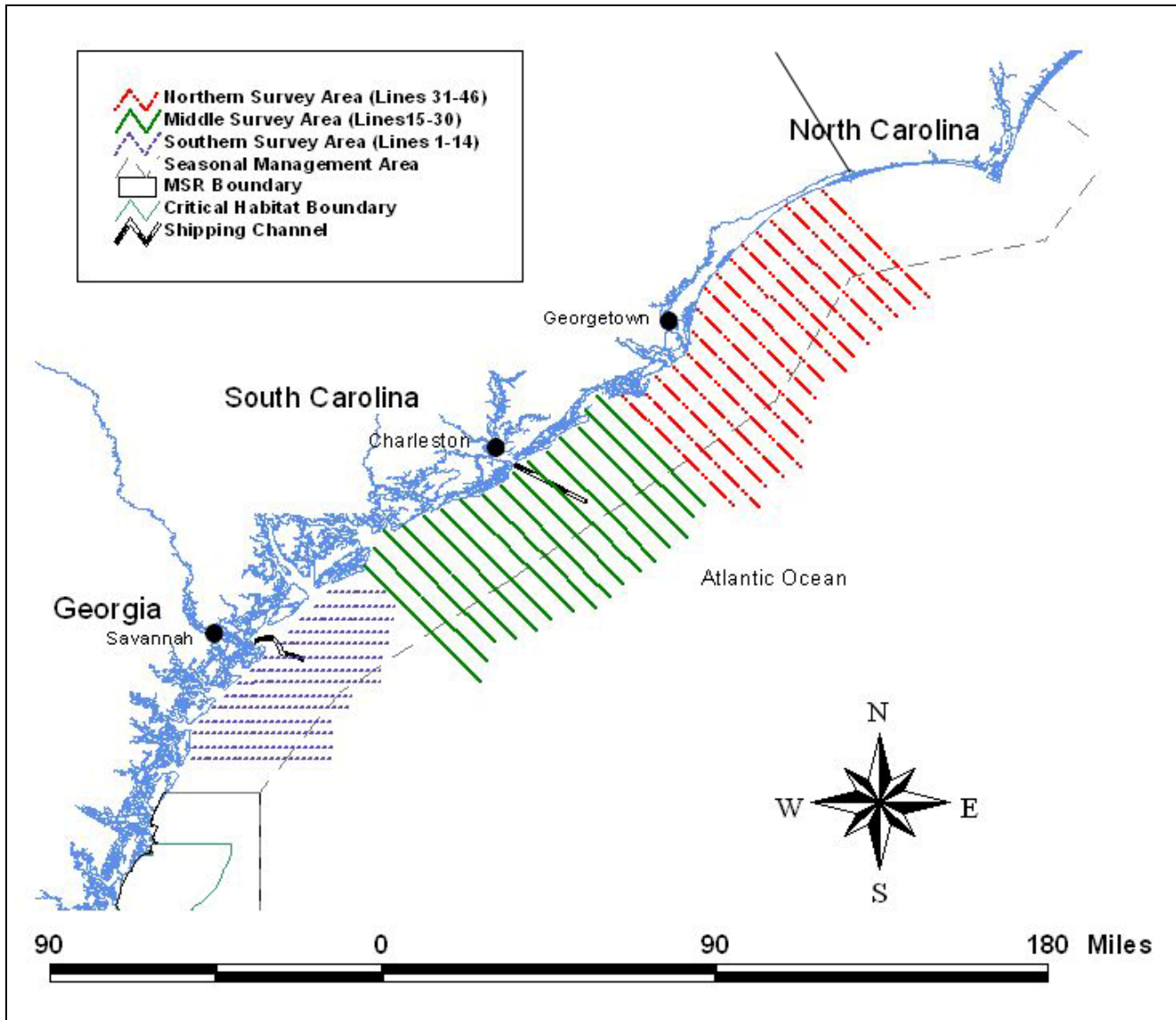


Figure 1. Map of survey tracklines flown during the 2010-2011 season.

Sighting distance for all large whales was calculated from overhead GPS positions. When a right whale was observed, a GPS position was recorded along the trackline at the point of observation. The survey aircraft then broke track and flew directly over the right whale to obtain a GPS position. The aircraft also circled at 1000 ft over each right whale encountered to obtain photographs. Circling for photographic documentation was generally limited to 15 minutes for each sighting, with a maximum of 30 minutes during special circumstances. After right whales were documented the aircraft returned to the trackline at the point of departure to continue the survey.

*Determination of Sighting Distance from the Trackline*

Sighting distance from the trackline for observed right whales was calculated whenever possible, using the latitude and longitude position (lat/long) on the trackline perpendicular to the position of the whale

sighting (lat1,long1), and the lat/long of the exact overhead position of the right whale (lat2,long2). The whale's distance in nautical miles from the trackline was determined by the equation<sup>1</sup>:

$$= \text{ACOS}(\text{COS}(\text{RAD}(90-a)) * \text{COS}(\text{RAD}(90-b)) + \text{SIN}(\text{RAD}(90-a)) * \text{SIN}(\text{RAD}(90-b)) * \text{COS}(\text{RAD}(c-d))) * 3440.065$$

$$a = \text{lat } 1, b = \text{lat } 2, c = \text{long } 1, d = \text{long } 2$$

The sighting distance from the trackline of large vessels was determined using angles obtained from a digital inclinometer at the time of the vessel's sighting and the equation:

$$= (a/3.281) * (\text{TAN}(\text{RADIANS}(b)))$$

$$a = \text{altitude}, b = \text{angle}$$

### *Notification of Right Whale Sighting Information*

Upon completing data collection for each right whale sighting, the aircraft would immediately use the aircraft satellite phone to call a designated ground contact. The ground contact would then relay the right whale sighting information via email to distribution lists which included harbor pilots, USCG, Navy, and other stakeholders and interested parties. The information sent included date, time, latitude, longitude, number of adults and calves, direction of movement, and distance in nautical miles from the closest sea buoy. The communication system supported real-time notification of right whale presence to ships in order to minimize the probability of right whale death or injury due to ship strike. It also facilitated verification of sighting reports by aerial survey teams from other sources such as military ships and aircraft.

### *Photographic Identification*

Right whales are identified by the patterns of cornified skin primarily located on the top of the head between the tip of the rostrum and the blowhole (Payne et al. 1983; Kraus et al. 1986). Photographs of right whale callosity patterns and other features, including scars, are used for identification and the cataloging of individual right whales. Right whales observed during the SCGA aerial surveys were photographed in order to identify individual animals. During a right whale sighting, the left observer recorded all sighting information into the voice recorder and entered the sighting positions into the computer. If possible, the observer also sketched the right whale(s) being photographed, including callosity patterns and body scarring, and recorded observed behaviors. The aircraft would circle at an altitude of 1000 ft (303m) over the whale(s) while the right observer photographed the animals through the co-pilot's sliding window or through the right observer's window which could be opened. Photographs were taken using a Canon 20D digital camera with a fixed 300 mm image stabilizing lens. All photographs obtained during the season were compared against each other and the New England Aquarium's (NEA) catalog of North Atlantic right whales in order to determine the probable identity of individual right whales encountered during the 2010-2011 SCGA survey season. Preliminary photo-identification by the SCGA EcoHealth Alliance team and initial verification by NEA has been completed and all photographs taken during the 2010-2011 season have been forwarded to NEA for

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<sup>1</sup> equation source: [http://bluemm.blogspot.com/2007\\_01\\_01\\_archive.html](http://bluemm.blogspot.com/2007_01_01_archive.html)



final confirmation. All right whale identification information included in this report is preliminary and should not be considered final until NEA completes the confirmation process.

## Results

### *Aerial Surveys*

A total of 42 SCGA surveys were flown from 15 November 2010 through 15 April 2011 (Tables 2 and 3). A total of 277.9 hours of Hobbs time was logged, averaging 7.1 hours per survey in the northern section, 6.9 hours in the middle section, and 6.0 hours in the southern section (including complete and partial surveys). A total of 3317.4 nautical miles (nmi) of trackline were flown in the northern section, 10047.2 nmi in the middle, and 4449.8 nmi in the southern, for a total of 17814.4 nmi of trackline flown. The northern survey area was completed on three survey days and partially completed on four survey days. The middle survey area was completed on nine survey days and partially completed on 11 survey days. The southern survey area was completed on 10 survey days and partially completed on five survey days. The 20 partially completed SCGA flights were largely due to factors such as weather and sea state conditions. See Figure 2 for a graphical representation of survey effort. Days with no survey effort in the SCGA survey area were primarily due to unacceptable weather conditions.

### *Sighting Distances for Right Whales*

Sighting distances were calculated whenever possible, and the average sighting distance for all right whale sightings was 0.70 (SD = 0.46) nautical miles from the trackline (Figure 3).

### *Sightings of Large Vessels*

AIS data for large vessels were collected continuously during the surveys and saved into a text file using the software Coastal Explorer to be analyzed at a later date.

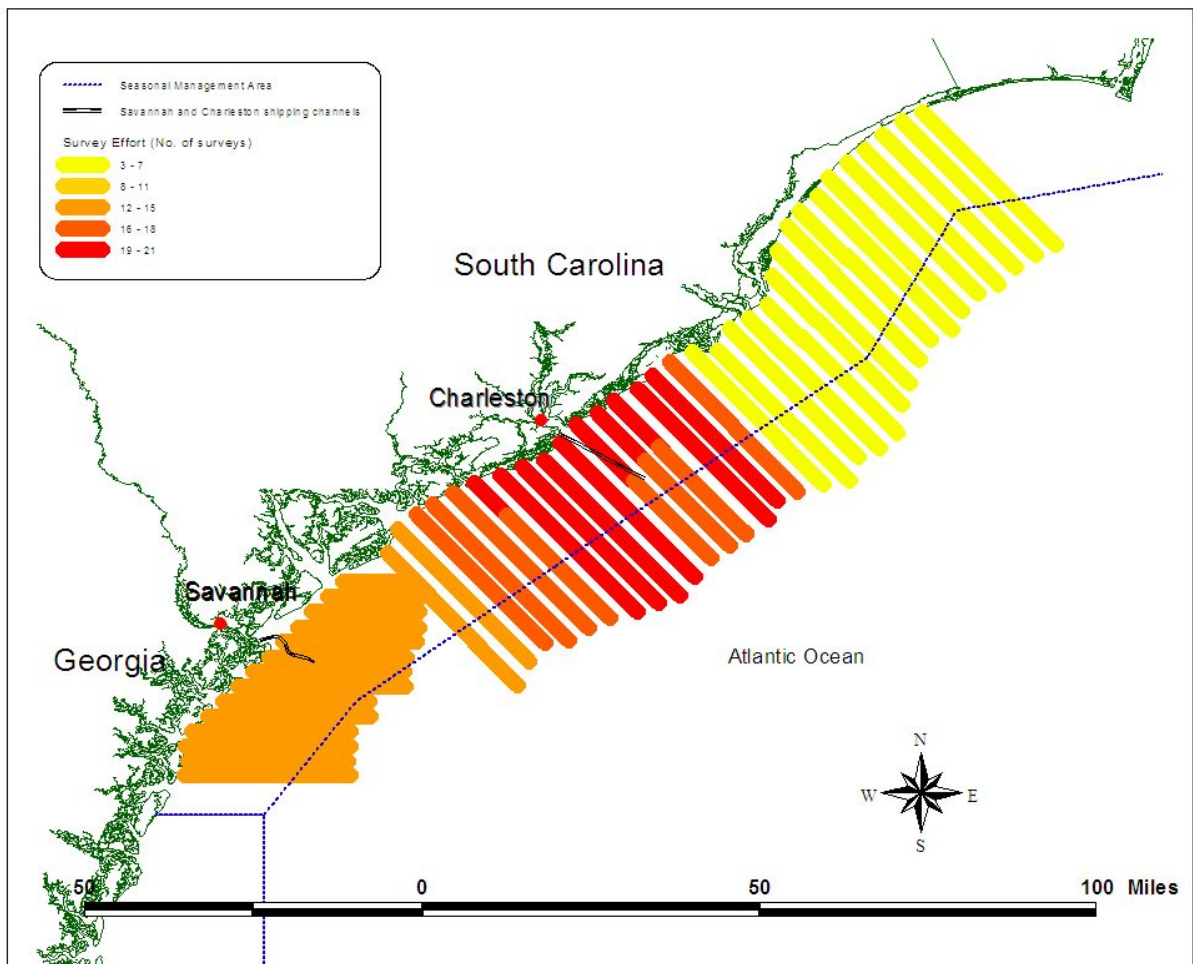
**Table 2. Survey effort for SCGA surveys conducted during the 2010-2011 season. "S" refers to the southern survey zone, "M" to the middle, and "N" to the north.**

Date	Complete Surveys	Partial Surveys	Hobbs	Total Trackline NM Flown	Trackline NM Flown in Beaufort 3 or Less	Number of Right Whales Seen	Comments
15-Nov-10		M	6.8	494.40	494.40	0	Incomplete-mechanical
18-Nov-10	S		6.6	323.50	323.50	2	Complete
20-Nov-10		N	8.4	528.30	528.30	0	Incomplete-sunset
22-Nov-10	M		7.4	565.20	565.20	0	Complete
27-Nov-10		S	4.7	296.40	296.40	0	Incomplete-sunset
3-Dec-10		M	4.7	353.40	353.40	0	Incomplete-wind
4-Dec-10	S		6.4	323.50	323.50	2	Complete
8-Dec-10		M	4.2	335.50	335.50	0	Incomplete-sunset
15-Dec-10	M		7.2	565.20	565.20	0	Complete

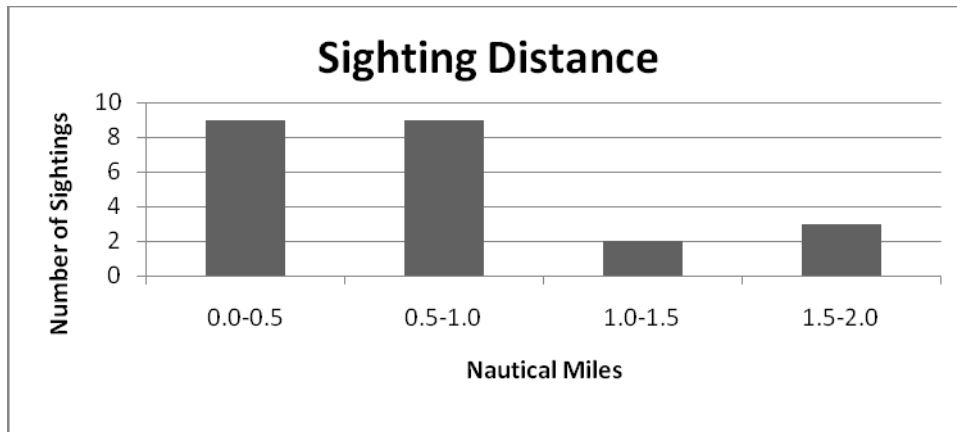
Date	Complete Surveys	Partial Surveys	Hobbs	Total Trackline NM Flown	Trackline NM Flown in Beaufort 3 or Less	Number of Right Whales Seen	Comments
20-Dec-10		S	4.5	208.30	208.30	1	Incomplete-wind
21-Dec-10	M		8	565.20	565.20	1	Complete
24-Dec-10		M	4.4	353.00	353.00	0	Incomplete-wind
25-Dec-10	N		7.9	563.40	563.40	0	Complete
28-Dec-10	S		6.5	323.50	323.50	1	Complete
29-Dec-10		M	6.2	445.05	445.05	0	Incomplete-wind
30-Dec-10	S		6.4	323.50	323.50	2	Complete
31-Dec-10		N	8.5	528.30	528.30	1	Incomplete-sunset
4-Jan-11		M	8.4	529.90	529.90	4	Incomplete-sunset
14-Jan-11	M		7.4	565.20	565.20	0	Complete
15-Jan-11	S		7.5	323.50	323.50	5	Complete
20-Jan-11		M	7.2	494.60	494.60	1	Incomplete-fog
24-Jan-11		N	3.8	188.76	188.76	0	Incomplete-wind
27-Jan-11		P	5.6	381.80	381.80	0	Incomplete-wind
6-Feb-11	M		7.3	565.20	565.20	0	Complete
13-Feb-11		S	5.7	93.61	93.61	11	Incomplete-wind
17-Feb-11		M	8.9	558.60	558.60	5	Incomplete-fog
24-Feb-11		S	6.4	297.60	297.60	3	Incomplete-fog
12-Mar-11	S		5.7	323.50	323.50	0	Complete
13-Mar-11	S		5.9	323.50	323.50	0	Complete
14-Mar-11		M	7.8	504.26	504.26	6	Incomplete-fog
17-Mar-11	M		7.1	565.20	565.20	0	Complete
18-Mar-11	S		6.2	323.50	323.50	2	Complete
21-Mar-11	S		5.9	323.50	323.50	0	Complete
22-Mar-11		M	5.2	333.76	333.76	0	Incomplete-wind
25-Mar-11	S		5.8	323.50	323.50	0	Complete
26-Mar-11	M		7.4	565.20	565.20	0	Complete
3-Apr-11	N		7.9	563.40	563.40	0	Complete
7-Apr-11	M		7.5	565.20	565.20	0	Complete
8-Apr-11		S	5.9	318.84	318.84	0	Incomplete-military ops
9-Apr-11		M	7.5	557.90	557.90	0	Incomplete-fog
13-Apr-11	M		7.5	565.20	565.20	0	Complete
14-Apr-11	N		7.6	563.40	563.40	0	Complete

**Table 3. Survey effort totals for SCGA surveys conducted during the 2010-2011 season.**

Survey Area	Complete Surveys	Partial Surveys	Hobbs Time	Total Trackline Miles Flown	Total Trackline Miles Beaufort ≤ 3	Number of Right Whales Seen
North	3	4	49.7	3317.4	3317.4	1
Middle	9	11	138.1	10047.2	10047.2	17
South	10	5	90.1	4449.8	4449.8	29
Totals	22	20	277.9	17814.4	17814.4	47



**Figure 2. Survey effort (in sea state 3 or less) for SCGA surveys conducted during the 2010-2011 season. Areas with higher (19-21 surveys) effort are depicted in red; areas with lower (3-7 surveys) effort are depicted in yellow.**



**Figure 3. Right whale sighting distances during the 2010-2011 season.**

### *Whale/Ship Interactions*

One co-occurrence of whales and vessels was documented in the SCGA survey area during the 2010-2011 survey season.

On 31 December 2010, a recreational vessel, *Phantom 309*, reported a whale close to shore by Murrell’s Inlet, SC in the northern survey area to U.S. Coast Guard via VHF Channel 16. The survey aircraft went directly to the location and found several small vessels (recreational and sport fishing) and a right whale (identified as S057) in the area. Two of these vessels, *Dirty Pirate Hooker* and an unidentified recreational vessel, were within 10-100 feet of the right whale. Communication was initiated with these vessels and both stopped approaching the whale; however the boats did not immediately and actively move away from the whale. The whale continued moving to the southwest. The survey aircraft continued on survey. During the transit back to the airport, the aircraft circled the location of the co-occurrence and no vessels or whales were observed at that location.

### *Dead/Injured/Entangled Right Whales*

One severely injured right whale was observed in the SCGA study area on 20 January 2011 at position 32°18.5N, 080° 12.0W (middle survey area). This whale, identified as EGNO 3853, had approximately 14 propeller cuts beginning at the right blowhole and continuing aft and across the body to the left flank. EGNO 3853 had been seen uninjured five days prior on 15 January 2011 at position 31° 45.5N, 080° 41.9W in the southern survey area.

One entangled right whale was observed within the SCGA study area during the 2010-2011 season. On 13 February 2011, an entangled whale identified as BK01SEUS10 (formerly S047) was observed in the southern section traveling with another whale, the 2009 calf of 1303. This pair was initially observed at 14:36(L) at position 31°41.3N, 080°46.0W. BK01SEUS10 appeared to have light green line trailing below the whale with two bitter ends approximately 6-10 feet aft of the flukes. The right flipper appeared to be involved as well and was much lighter in color than the rest of the body. No line was observed over the head or back of the whale. The SCGA ground contact was notified at 14:47(L) and reported the situation to NOAA officials. The nearest response vessel, from Georgia DNR, was approximately 40nm south and currently assisting a second entangled whale. The aircraft was capable of staying on scene less than one hour (due to fuel consumption). Based on these facts, no immediate

vessel response was initiated. The aircraft continued to document this whale until 15:12(L) when it was required to land for fuel. The pair of whales was re-sighted at 16:30(L) and additional images and documentation were obtained. The aircraft left the whales at 16:41(L) at position 31° 44.5N, 080° 40.8W. Throughout the duration of the two sightings, the pair moved steadily to the northeast at approximately 2.3 knots.

### *Humpback Whales*

One humpback whale was observed within the SCGA study area during the 2010-2011 season. On 31 December 2010, a single humpback whale was observed in the northern survey area at position 33° 19.1N, 078° 21.8W, approximately 35nm offshore. This whale was traveling slowly to the northeast.

### *Right Whale Sightings and Identifications*

Twenty-eight right whale sightings were documented during the SCGA surveys, consisting of 47 right whales. The total number of whales seen includes resights of six individuals and one individual sighted four times for a total of 36 different individual whales. Two whales were not photographed. Seven cow/calf pairs, 12 single whales, and nine groups of two or more adult/juvenile right whales were documented (Figure 4). Preliminary photo-identification by the SCGA EcoHealth Alliance team and verification by New England Aquarium (NEA) has resulted in the identification of five cow/calf pairs (two of the pairs were observed twice) and 22 of the 26 individual adult/juvenile whales which accounts for the 36 animals photographed during the season (Tables 4 and 5). The two individual whales that were not photographed will not be identified. All right whale identification information included in this report is preliminary and should not be considered final until NEA completes the confirmation process.

The 36 individual right whales documented include 13 females, eight males and 15 individuals of unknown gender, which includes the 5 calves (Table 5). Of the animals with a known age and gender, adult males (nine or more years old) accounted for 14% of the individuals observed. Females that had calved (either before or after being observed in the SCGA study area) accounted for 20% of all observed individuals (Figure 5). Of the 13 females seen, seven gave birth to new calves during the 2010-2011 season, although only five were seen with their calves within the SCGA study area. The remaining two calving females were seen in the SCGA survey area while pregnant prior to giving birth. Of the seven 2010-2011 mothers seen in the SCGA survey area, four last gave birth in 2008 and three were first-time mothers.

**Table 4. Right whale sightings from SCGA surveys conducted during the 2010-2011 season. "Poss" indicates photo-identification that has not yet been verified by NEA. The numbers and codes listed in the "EGNO" column include EGNO numbers for known whales and intermatch codes (i.e. BK01SEUS09), which were created to assist in the preliminary matching of juvenile whales until they are assigned EGNOs.**

Sighting #	Whale #	Month	Day	Year	Time (L)	Survey Name	Latitude	Longitude	RIWHLetter	NEAq EGNO	NRWNnumber
1	1	11	18	2010	9:12	SCRW20101118	31.55663	-81.02851	A	2912	SCGA001
1	2	11	18	2010	9:12	SCRW20101118	31.55663	-81.02851	B	3194	SCGA001
2	3	12	04	2010	14:07	SCRW20101204	32.08008	-80.56777	A	3430	SCGA002
2	4	12	04	2010	14:07	SCRW20101204	32.08008	-80.56777	B	3314	SCGA002
3	5	12	20	2010	15:21	SCRW20101220	31.93648	-80.58041	A	2040	SCGA003
4	6	12	21	2010	13:04	SCRW20101221	32.47870	-79.94413	A	2040	SCGA004
5	7	12	28	2010	11:44	SCRW20101228	31.61931	-81.01163	A	1245	SCGA005
6	8	12	30	2010	13:47	SCRW20101230	32.35188	-80.32230	A	S056 poss	SCGA006
6	9	12	30	2010	13:47	SCRW20101230	32.35188	-80.32230	B	3940	SCGA006
7	10	12	31	2010	15:12	SCRW20101231	33.51371	-79.03014	A	2009CalfOf2520 poss	SCGA007
8	11	01	04	2011	9:03	SCRW20110104	32.84679	-79.46224	A	2040	SCGA008
8	12	01	04	2011	9:03	SCRW20110104	32.84679	-79.46224	B	2011Calfof2040	SCGA008
9	13	01	04	2011	14:53	SCRW20110104	32.26952	-80.15165	C	3530	SCGA009
9	14	01	04	2011	14:53	SCRW20110104	32.26952	-80.15165	D	no images	SCGA009
10	15	01	15	2011	9:15	SCRW20110115	31.58606	-80.95747	A	2040	SCGA010
10	16	01	15	2011	9:15	SCRW20110115	31.58606	-80.95747	B	2011Calfof2040	SCGA010
11	17	01	15	2011	11:02	SCRW20110115	31.75383	-80.70071	C	3853	SCGA011
12	18	01	15	2011	13:47	SCRW20110115	32.03472	-80.63319	D	3670	SCGA012
13	19	01	15	2011	15:02	SCRW20110115	32.21841	-80.43340	E	3692	SCGA013
14	20	01	20	2011	15:54	SCRW20110120	32.30758	-80.19957	A	3853	SCGA014
15	21	02	13	2011	13:07	SCRW20110213	31.61942	-80.71005	A	1323	SCGA015
15	22	02	13	2011	13:07	SCRW20110213	31.61942	-80.71005	B	1036	SCGA015
15	23	02	13	2011	13:07	SCRW20110213	31.61942	-80.71005	C	2209	SCGA015
15	24	02	13	2011	13:07	SCRW20110213	31.61942	-80.71005	D	2215	SCGA015
15	25	02	13	2011	13:07	SCRW20110213	31.61942	-80.71005	E	S048 poss	SCGA015
16	26	02	13	2011	13:43	SCRW20110213	31.61667	-80.74265	F	3323	SCGA016
17	27	02	13	2011	14:36	SCRW20110213	31.68512	-80.75930	G	2009CalfOf1303	SCGA017
17	28	02	13	2011	14:36	SCRW20110213	31.68512	-80.75930	H	BK01SEUS10	SCGA017
18	29	02	13	2011	16:30	SCRW20110213	31.73383	-80.68600	I	2009CalfOf1303	SCGA018
18	30	02	13	2011	16:30	SCRW20110213	31.73383	-80.68600	J	BK01SEUS10	SCGA018
19	31	02	13	2011	16:52	SCRW20110213	31.82989	-80.69506	K	no images	SCGA019
20	32	02	17	2011	10:27	SCRW20110217	32.44902	-80.14603	A	1033	SCGA020

Sighting #	Whale #	Month	Day	Year	Time (L)	Survey Name	Latitude	Longitude	RIWHLetter	NEAq EGNO	NRWNumber
21	33	02	17	2011	14:17	SCRW20110217	32.63505	-79.70810	B	3110	SCGA021
21	34	02	17	2011	14:17	SCRW20110217	32.63505	-79.70810	C	S061 poss	SCGA021
22	35	02	17	2011	15:35	SCRW20110217	32.75043	-79.55871	D	3750	SCGA022
22	36	02	17	2011	15:35	SCRW20110217	32.75043	-79.55871	E	3520	SCGA022
23	37	02	24	2011	13:39	SCRW20110224	31.82601	-80.81042	A	2009CalfOf2791	SCGA023
24	38	02	24	2011	14:14	SCRW20110224	31.82838	-80.83141	B	3240	SCGA024
24	39	02	24	2011	14:14	SCRW20110224	31.82838	-80.83141	C	2011CalfOf3240	SCGA024
25	40	03	14	2011	8:30	SCRW20110314	32.47894	-80.19792	A	3270	SCGA025
25	41	03	14	2011	8:30	SCRW20110314	32.47894	-80.19792	B	2011CalfOf3270	SCGA025
26	42	03	14	2011	11:42	SCRW20110314	32.45029	-80.22505	C	3270	N/A
26	43	03	14	2011	11:42	SCRW20110314	32.45029	-80.22505	D	2011CalfOf3270	N/A
27	44	03	14	2011	12:24	SCRW20110314	32.38788	-79.75303	E	3020	SCGA026
27	45	03	14	2011	12:24	SCRW20110314	32.38788	-79.75303	F	2011CalfOf3020	SCGA026
28	46	03	18	2011	12:36	SCRW20110318	31.94239	-80.81437	A	3115	SCGA027
28	47	03	18	2011	12:36	SCRW20110318	31.94239	-80.81437	B	2011CalfOf3115	SCGA027

**Table 5. Demographics of individual right whales sighted during the 2010-2011 SCGA season. Asterisk (\*) indicates right whales that are unique to the SCGA survey area. "U" is an abbreviation for "unknown". Individuals in bold are 2010-2011 mothers.**

	Identification code (EGNO/Intermatch)	Date Sighted	Birth Year	Age	Calf of	Gender	First Seen	Last Seen	# calves produced (inc. 1011)	Last Known Calving
*	1033	2/17/2011	N/A	>33	N/A	M	1978	2009	N/A	N/A
*	1036	2/13/2011	N/A	>41	N/A	U	1970	2009	N/A	N/A
	<b>1245</b>	12/28/2010	1982	29	1140	F	1982	2009	5	2008
*	1323	2/13/2011	N/A	>28	N/A	M	1983	2009	N/A	N/A
	<b>2040</b>	12/20/2010	1990	21	1140	F	1990	2008	4	2008
*	2209	2/13/2011	1992	19	1509	M	1992	2008	N/A	N/A
*	2215	2/13/2011	1992	19	1315	M	1992	2008	N/A	N/A
*	2912	11/18/2010	1999	12	1612	F	1999	2008	1	2007
*	<b>3020</b>	3/14/2011	N/A	>11	N/A	F	2000	2008	2	2008
	3110	2/17/2011	2001	10	1710	M	2001	2008	N/A	N/A
*	<b>3115</b>	3/18/2011	2001	10	1815	F	2001	2008	2	2008
*	3194	11/18/2010	N/A	>10	N/A	F	2001	2008	0	N/A
	<b>3240</b>	2/24/2011	2002	9	1240	F	2002	2009	1	N/A
	<b>3270</b>	3/14/2011	N/A	>9	N/A	F	2002	2009	1	N/A
	3314	12/4/2010	2003	8	2114	F	2003	2009	0	N/A
	3323	2/13/2011	2003	8	2123	M	2003	2008	N/A	N/A
	<b>3430</b>	12/4/2010	2004	7	2330	F	2004	2008	1	N/A

	Identification code (EGNO/Intermatch)	Date Sighted	Birth Year	Age	Calf of	Gender	First Seen	Last Seen	# calves produced (inc. 1011)	Last Known Calving
*	3520	2/17/2011	2005	6	2040	F	2005	2009	0	N/A
	3530	1/4/2011	N/A	>6	N/A	M	2005	2010	N/A	N/A
	3670	1/15/2011	2006	5	2320	F	2006	2009	0	N/A
*	3692	1/15/2011	N/A	>5	N/A	U	2006	2009	0	N/A
	3750	2/17/2011	2007	4	1705	M	2007	2010	N/A	N/A
*	3853	1/15/2011	2008	3	2753	U	2008	2009	0	N/A
*	3940	12/30/2010	2009	2	3440	F	2009	2010	0	N/A
	2009CalfOf1303	2/13/2011	2009	2	1303	U	2009	2009	N/A	N/A
*	2009CalfOf2791	2/24/2011	2009	2	2791	U	2009	2010	N/A	N/A
	2011CalfOf2040	1/4/2011	2011	0	2040	U	2011	2011	N/A	N/A
*	2011CalfOf3020	3/14/2011	2011	0	3020	U	2011	2011	N/A	N/A
*	2011CalfOf3115	3/18/2011	2011	0	3115	U	2011	2011	N/A	N/A
	2011CalfOf3240	2/24/2011	2011	0	3240	U	2011	2011	N/A	N/A
	2011CalfOf3270	3/14/2011	2011	0	3270	U	2011	2011	N/A	N/A
*	BK01SEUS10	2/13/2011	N/A	U	N/A	U	2010	2010	N/A	N/A
	S048 poss	2/13/2011	N/A	U	N/A	U	2010	2010	N/A	N/A
*	S056 poss	12/30/2010	N/A	U	N/A	U	2011	2011	N/A	N/A
*	2009CalfOf2520 poss	12/31/2010	2009	2	2520	U	2009	2009	N/A	N/A
	S061 poss	2/17/2011	N/A	U	N/A	U	2011	2011	N/A	N/A



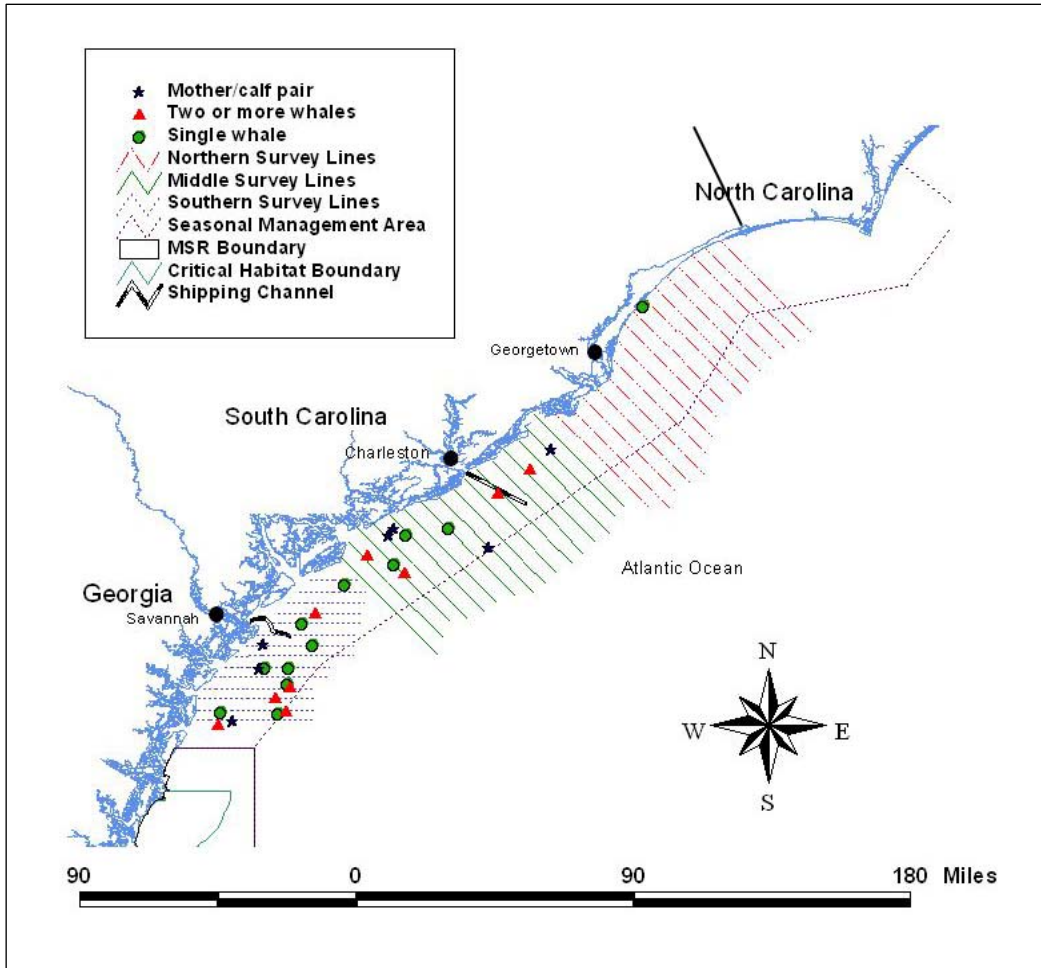


Figure 4. Right whale sightings by group type during the SCGA 2010-2011 season.

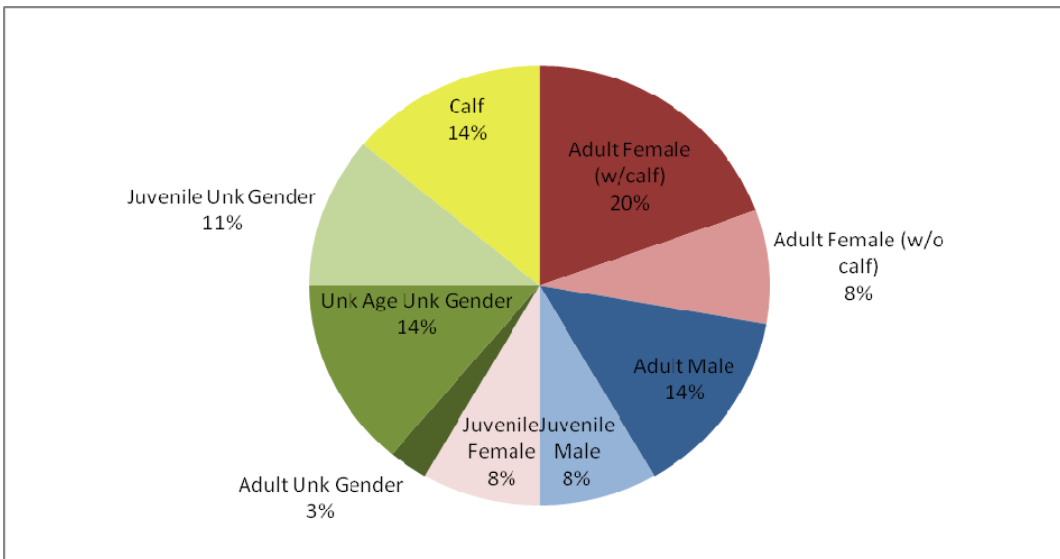


Figure 5. Preliminary demographic distribution of right whales observed during the SCGA 2010-2011 season.

Sightings of note include 19 individuals that were unique to the study area (based on preliminary analysis) and not sighted by EWS survey teams to the south: EGNOs 3020 and calf, 3115 and calf, 1033, 1036, 1323, 2209, 2215, 2912, 3194, 3520, 3692, 3853, 3940, 2009 calf of 2791, BK01SEUS10, S056 and S057. Additionally, three of these unique whales (EGNOs 1033, 1036 and 3194) had never been previously documented in the southeast U.S. Also of note was the sighting of a cow/calf pair, Pico and calf (EGNO 3270). Pico had also never been documented in the southeast U.S. but had been documented in January 2009 near the Azores. Two surface active groups (SAGs) were documented. These two groups involved a total of seven participants, four of which were adult males, one was an adult (>41 years old) of unknown gender, and two were of unknown age and gender. None of the SAG participants were known to be adult females. Other notable sightings included the observation of an entangled whale, BK01SEUS10, on 13 February 2011 and the observation of a recently injured whale, EGNO 3853, on 20 January 2011. EGNO 3853 was observed uninjured five days prior on 15 January 2011.

Geographic locations of the 28 SCGA right whale sightings are depicted by month in Figure 6. During the 2010-2011 season, 50% of the right whale sightings occurred in the months of November-January while 50% of the sightings occurred during February-April (Figures 7 and 8). This temporally even distribution of sightings is very similar to the results of the 2006-2007, 2007-2008 and 2008-2009 seasons where the sightings were relatively evenly distributed between both halves of the season, but is in contrast to the other seasons where the vast majority of sightings occurred in one half of the season. The number of right whale sightings per trackline miles flown was calculated for each week of the season (Figure 9). An increase in sightings relative to effort was noted during the second half of February.

The average number of whales per sighting during the 2010-2011 season was greatest in February and March with 1.9 and 2.0 whales per sighting respectively (average for entire season was 1.7 whales per sighting) yet 40% of all whales seen were documented during February (compared with 17% in March) (Figure 7).

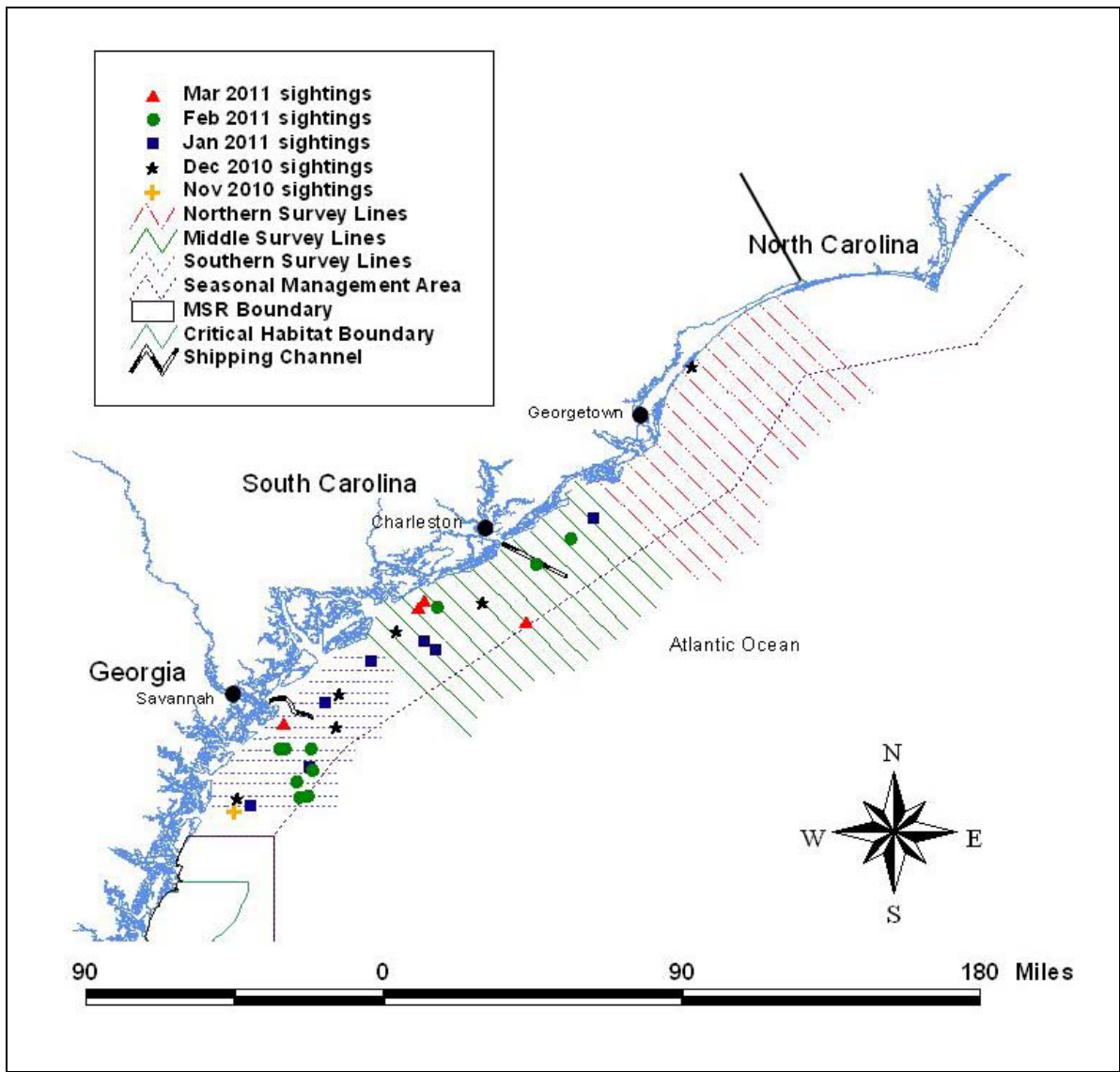


Figure 6. Right whale sightings by month during the SCGA 2010-2011 season.

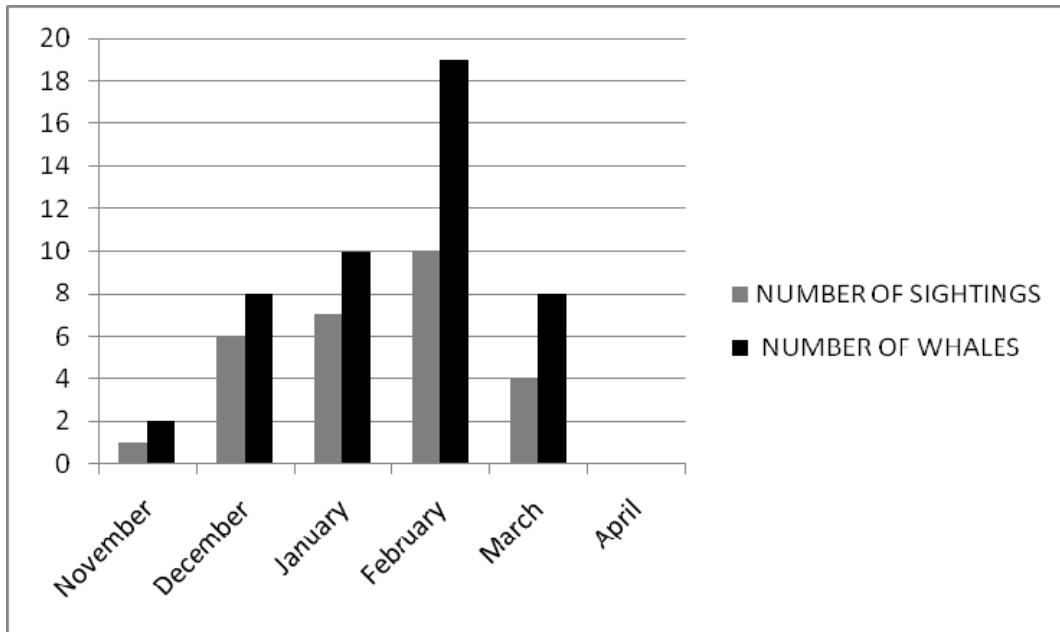


Figure 7. Number of sightings and right whales by month during the SCGA 2010-2011 season.

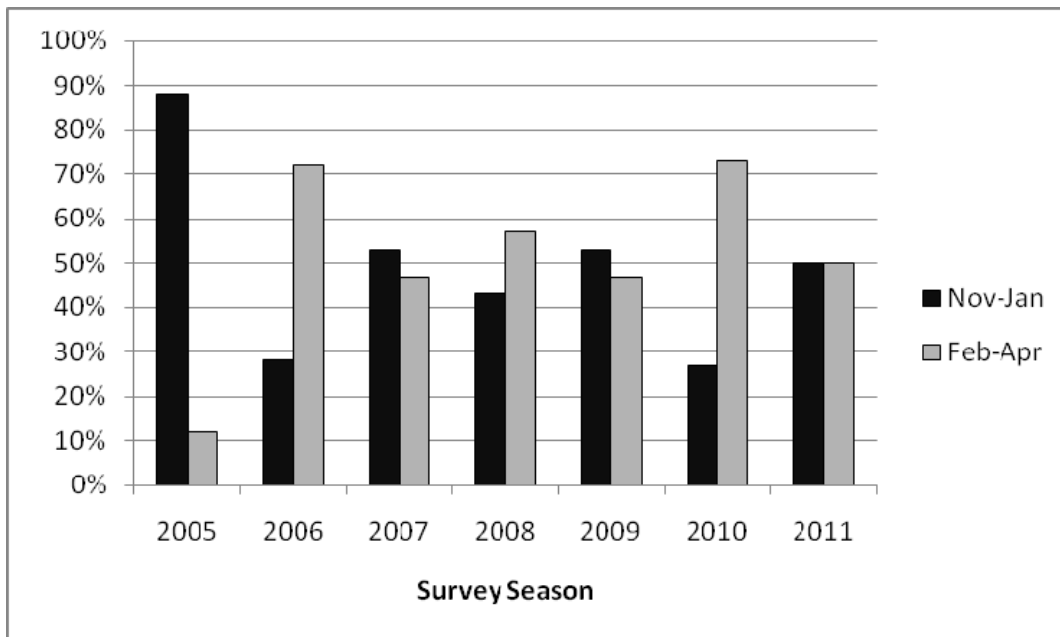


Figure 8. Temporal distribution of SCGA right whale sightings for all survey seasons.

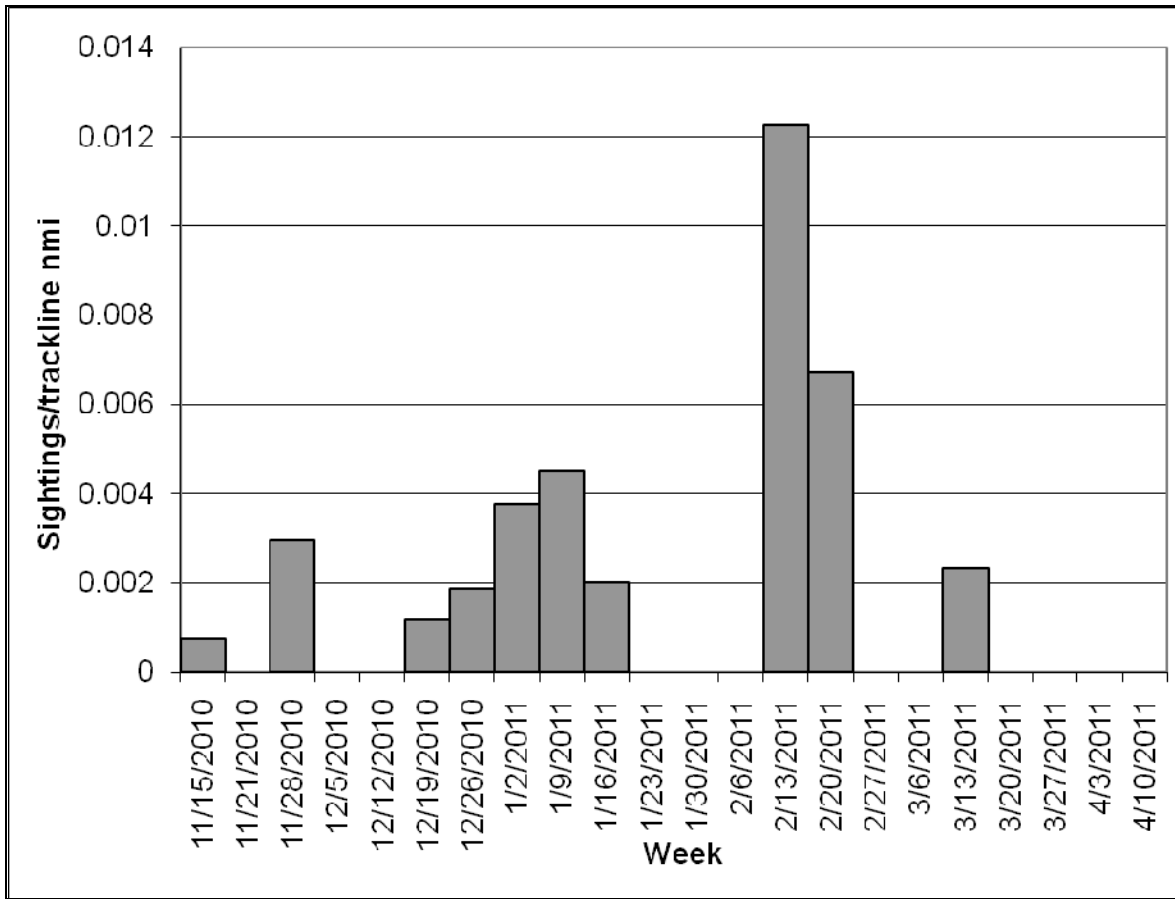


Figure 9. Weekly right whale sightings per trackline nmi flown during the 2010-2011 season.

## Discussion and Recommendations

A total of 36 individual right whales (including five calves) were documented in the SCGA survey zone during the 2010-2011 season, considerably lower than the average number of right whales documented seasonally since 2004 ( $n = 61$ ). Of the animals with a known age and/or gender, 14% were adult males and 27% were juveniles, indicating the importance of the region to demographic groups other than calving females. Two surface active groups (SAGs) were observed during the season involving a total of seven individuals. Four of the seven participants were adult males; one was an adult of unknown gender. The remaining two were of unknown age and gender. No known adult females were involved. SAGs are believed to play a role in mating however often do not lead directly to calving. Based on preliminary analysis, 19 whales (including two cow/calf pairs) sighted in the SCGA survey zone were not sighted further south by other aerial survey teams, indicating that a portion of the population may migrate to the mid-Atlantic region rather than the Florida/Georgia critical habitat.

The calving ground off the SEUS is an extremely important area for reproduction in the North Atlantic right whale. In addition, this area is vital to military and commercial interests. Three major shipping routes pass through the designated critical habitat, increasing the risk of an interaction between a ship and the slow-moving right whale. Three additional shipping routes are located in the vicinity, to the north and south of the critical habitat boundary. The Early Warning System and associated aerial surveys and communication systems, as well as the newly implemented ship speed zones, have likely decreased the risk of ship strikes to whales while in the critical habitat. Seven years of expanded aerial survey coverage has provided more reliable information on right whale distribution and habitat use and additional protection outside the traditional SEUS survey areas. The coast of South Carolina had been surveyed sporadically in the past, but for the past seven years consistent survey effort throughout the migration and calving season has provided valuable additional sightings and increased warnings to mariners. The number of right whales sighted in the SCGA survey area ( $n = 47$ ) is lower than the combined EWS survey areas to south; however survey effort expended in the region was also lower due to weather conditions, funding levels, and a large coverage area. A sightings-per-unit-effort analysis would be useful to compare effort-corrected data throughout the region to determine whale densities and important whale habitat in the SEUS and mid-Atlantic.

The boundary of the current critical habitat was designated in 1994 by NMFS based on the best available scientific data at the time. Seventeen additional years of spatial and temporal distribution data now exist, which provide a more accurate picture of right whale distribution in the southeast and mid-Atlantic. The data from these surveys provide valuable information regarding the most appropriate boundaries for critical management designations that will protect features essential to the conservation of the species. Additionally, distribution data in this region will assist with other management actions that may be implemented in the future, such as ship reporting systems, speed zones, or routing. Data collected during these surveys will assist in determining the effectiveness of the seasonal management area implemented in 2008 along the eastern seaboard (50 CFR Part 224).

Portions of the east coast of the United States are without consistent survey effort, limiting spatial and temporal distribution data and ultimately protection available for the right whale. However, limitations of these aerial survey efforts must also be addressed, including high costs, the inability to fly in inclement weather and darkness, safety issues, observer bias, observer fatigue, etc. If the goal is to provide maximum protection for right whales, we must investigate new technologies and management

techniques that may provide a more reliable means for detecting and protecting right whales throughout their range. Without moving forward on these fronts it is unlikely that we will ever reach a potential biological removal level of zero for North Atlantic right whales, as calculated in Marine Mammal Protection Act stock assessment reports (NMFS 2009).

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