EARLY WARNING SYSTEM

Central EWS 2007
FINAL REPORT

Aerial Surveys to Reduce Ship/Whale Collisions
in the Calving Ground of the North Atlantic Right Whale *(Eubalaena glacialis)*

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INTRODUCTION

There are fewer than 400 North Atlantic right whales *(Eubalaena glacialis*) [1] in the world, despite international protection since 1935 and federal protection since 1970. Failure of the North Atlantic stock to show signs of recovery can be attributed to several factors, including the effects of human activity on mortality rates. Vessel strikes account for the largest number of confirmed deaths. Of the 77 right whale mortalities documented from 1970 through April 2007, at least 28 (36%) were due to collisions with vessels and 9 (12%) were due to entanglements (Knowlton and Kraus, 2001; unpublished data, New England Aquarium). In addition, serious injuries caused by human activity in some cases can lead to the animal's demise (Knowlton and Kraus, 2001). Fujiwara and Caswell suggest that the right whale population would no longer be in decline if mortality from anthropogenic sources were eliminated.

The coastal waters of the Southeast U.S. (SEUS) support the only known calving ground for this small population. Some calving may also occur as far north as the Carolina's based on a small number of M/C pairs seen in those waters early in the calving season. Right whales typically arrive in the area in December to give birth and depart the habitat by late February to mid March to head for the feeding grounds off the Northeast U.S. However, right whales have been documented as early as October and as late as April in this area. Vessel traffic within the SEUS critical habitat is high as three major shipping channels transect the high right whale density area between Brunswick, GA and St. Augustine, FL.

The three major entrance channels serve three commercial shipping ports and two military bases. The Brunswick channel, at the northern end of the critical habitat extends 8 nautical miles (nm) (14.6 km) offshore and serves the port of Brunswick, Georgia. The channel centered in the area at the GA/FL border is the St. Marys entrance channel, which runs 14 nm (25.9 km) offshore and serves the Kings Bay Naval Submarine Base, as well as the port of Fernandina Beach, Florida. The southern-most channel is the St. Johns River entrance channel, which runs 4 nm (7.28 km) offshore and serves the port of Jacksonville, Florida and the Mayport Naval Base. This is by far the busiest channel in the area with all forms of large vessel traffic, including container ships, car carriers, tankers, bulk freighters, tug and tows and cruise ships as well as U.S. Coast Guard (USCG) and U.S. Naval vessels. Commercial vessel traffic in this federally designated critical habitat has increased substantially over the past 40 years (Knowlton et al., 1997). Port expansions and diversions of military traffic to local bases closed elsewhere augment this trend. Based out of many small inlets and harbors along the coast, commercial fishing, charter and recreational vessels increase the traffic utilizing and transiting the area dramatically.

The Brunswick and St. Marys River Entrance channels are dredged almost annually while dredging the St. Johns River Entrance channel is less frequent to maintain

[1] North Atlantic Right Whale Report Card. North Atlantic Right Whale Consortium. November 2006. http://www.rightwhaleweb.org/papers/pdf/NARWC_Report_Card2006.pdf

required depths. This occurs during the winter to avoid impacts to sea turtles that frequent the area in summer. Dredged material is usually removed from channels and carried to offshore disposal sites using ocean-going hopper dredges. These vessels work continuously, often making many transits between channels and disposal sites within a 24-hour period. Consequently, dredging activities increase the vessel traffic in the vicinity of channels and within critical habitat substantially.

During the 1994 calving season (December 1993 through March 1994), the first comprehensive aerial surveys, referred to as the Early Warning System (EWS) surveys, were conducted to locate right whales and provide whale detection and reporting services to mariners in the calving ground, including the U.S. Navy, Army Corps of Engineers (ACOE) and Coast Guard (USCG); and port authorities and harbor pilots. These groups have used the sighting information in their efforts to avoid collisions with right whales.

From 1994 to 2002, the New England Aquarium's (NEAq) EWS surveys covered the majority of the high-density area and provided daily coverage of the three shipping channels within it. Prior to the start of the 2003 calving season, surveys in the southeastern U.S. were redesigned to allow for more daily coverage of a larger area. Beginning in 2003, the NEAq's EWS surveys were extended eastward to 30-35 nm (54.8-63.9 km) from the coast and reduced in latitudinal range. The area includes the St. Marys River Entrance and the St. Johns River Entrance. This redesigned survey area is referred to as the Central EWS survey area. To the north, Georgia Department of Natural Resources (GDNR) conducts similar surveys that represent the Northern EWS surveys. In addition, Florida Conservation Commission/Florida Wildlife Research Institute (FWC) conducts surveys in the southern section of the critical habitat (southern EWS).

Prior to the 2004 calving season survey aircraft and crew used during the EWS surveys were held to newly imposed federal standards. Survey aircraft were all certified under 14 CFR, Part 135 (airline, aircraft less than 10 seats). In addition, pilots and observers underwent intense pre-season training that included emergency-egress. Pilots also attended FAA Part 135 ground school and passed all associated check rides. A second pilot in command (SIC) was also added to each survey flight to ensure a higher safety margin during survey operations. The addition of a second pilot limited data recording during the surveys that were conducted in a Cessna 337 as the number of science crew was reduced from three to two persons due to weight and balance constraints. For this reason all surveys flown since 2004 have been conducted without a dedicated data recorder.

This report describes the results of the Central EWS right whale aerial survey effort, during the 2006-2007 season (December 1, 2006 – March 31, 2007). The report also shares right whale identification data collected throughout the region by other aerial survey teams. The following terms will be used throughout the report:
Central EWS- represents the survey flown primarily by NEAq.
SEUS-refers to the Southeast U.S extending from South Carolina to Florida
EWS -refers the area flown by the northern, central and southern EWS survey teams and incorporates the entire designated critical habitat.

ACOE, USCG and Navy provide the funding for Central EWS surveys with support from National Oceanic and Atmospheric's National Marine Fisheries Service (NOAA Fisheries).

METHODS

Aerial Surveys

Central EWS surveys were flown daily from December 1, 2006 through March 31, 2007. The surveys were conducted in the area from the southern end of Cumberland Island, GA, approximately 6.5 nm (12 km) north of the St. Marys River entrance (30° 50.0N), to Jacksonville, FL, approximately 6.5 nm (12 km) south of the St. Johns River entrance (30° 17.0N), from the shoreline to 30-35 nm (54.8-63.9 km) offshore. Twelve east/west transects were flown perpendicular to the coast at 3 nm (5.5 km) intervals with a western limit of 0.5 nm (0.9 km) off the shoreline. A total of 406 nm (761 km) of on-transect tracklines were flown during each completed survey. In addition, a number of contingency surveys were flown. When an aircraft of an adjacent survey (northern EWS or southern EWS) was unable to fly for a period of time (due to maintenance or extended disentanglement efforts) a pre-approved contingency plan would be flown. Contingency plans were developed to ensure aerial survey coverage of port entrances in the absence of one (2-plane contingency) or two (1-plane contingency) of the EWS survey aircrafts. The redirected survey for the central EWS team covered an area extending approximately 26 nm (47.6 km) north of the Brunswick-Bar channel sea-buoy (31° 26.0N) south to the St. Marys River Entrance channel sea-buoy (30° 41.0N). Fourteen east/west transects were flown perpendicular to the coast 3 nm (5.5 km) intervals from 0.5 nm (0.9 km) off the shoreline out to 15- 24 nm (27.5-43.9 km) from the shore.

Necessary conditions for all flights included a minimum ceiling of 1000 feet (305 meters), visibility greater than 3 nm (5.5 km) and winds less than 17 knots. Surveys were conducted in a 14 CFR Part 135 certified twin engine Cessna 337 Skymaster. The aircraft was equipped with GPS, Automated Identification System (AIS) receiver, Automatic Flight Following (AFF) transponder, full IFR (instrument flight rules) instrumentation, aircraft mounted marine radio, life raft, medical kit, a waterproof handheld VHF marine radio, a registered removable 406mHz EPIRB, aircraft mounted ELT and satellite phone.

The surveys were flown at an altitude of 1000 feet (305m) above sea level and an average air speed of approximately 100 Mph (160 km/hr). The survey team consisted of a pilot in command (PIC), pilot second in command (SIC), and two observers positioned on each side of the aircraft in the rear seats. Each observer was individually equipped with, but not limited to, a Nomex flight suit, FAA approved survival vest, strobe light, rescue streamer, combo-edge knife and Personal Locator Beacon (PLB) with GPS. The observers scanned the water surface out to at least 2 nm (3.7 km). In order to maintain standardized sighting effort, the PIC and SIC were instructed not to alert the observers to any sightings, but were allowed to report a sighting after it had been passed by the aircraft if missed by the observers. The distance of each right whale sighting from the flight track was measured using GPS positions of the sighting and the transect line.

All right whale sightings were recorded into a digital voice recorder and entered into a computerized logging program. Logger 2000 was created by International Fund for Animal Welfare (IFAW) and designed for compatibility with the Right Whale Consortium database, curated by the University of Rhode Island (URI). During surveys, Logger 2000 downloaded, at 10-second intervals, time, position (latitude and longitude), altitude, heading and aircraft speed directly from the aircraft's GPS. All downloaded data is stored in a Microsoft Access database. In addition to the automatically downloaded data, the observers could manually enter information on Beaufort, visibility, cloud cover, and weather. Due to the change in configuration of aircraft personnel with the addition of a second pilot and loss of the data recorder position no other marine species sightings were logged during flights except basking sharks and leatherback turtles. These two species were logged because of requests by researchers.

All commercial and military vessels were recorded. Vessels that were visually estimated to be 100 ft (30.5 m) or larger were recorded as they were visually sighted on the transect lines. In addition, detailed location and vessel information data of all commercial vessels required to carry an AIS (Automatic Identification System) transponder (appendix 4) were recorded into a separate computerized database.

When sightings of right whales occurred, the aircraft left the transect line at a right angle to the sighting and flew directly over the whale(s) to obtain an exact GPS location of the whale(s). The aircraft then circled the whale(s), allowing observers to obtain photographic identifications of the individuals sighted. High-resolution digital images were obtained at an altitude of 1000 ft (305 m) using a digital D70 camera with a fixed Nikkor 300mm lens. At the conclusion of photographic work on each sighting, the aircraft returned to the transect line at the point of departure. These methods conformed to research protocols followed by the North Atlantic Right Whale Consortium (NARWC) as approved by NOAA Fisheries.

All photographic and effort data were submitted to NARWC at the conclusion of the survey season.

Notification of Agencies

During the EWS season, all right whale sightings were reported to the Fleet Area Control and Surveillance at Naval Air Station Jacksonville Facility (FACSFACJAX). Right whale sightings were reported directly, via satellite phone, from the survey aircraft to a ground contact that relayed the information to FACSFACJAX. This near real time data is broadcast over the NAVTEX system via the USCG, and is received automatically by military and commercial vessels. The USCG also transmits a Broadcast Notice to Mariners over VHF marine-band radio channel 16. A marine user group, which includes local, state, federal, non-profit and commercial interests is provided with pagers and receives sighting information from FACSFACJAX almost immediately via the pager system. At the same time the ground contacts for the EWS observer teams (FWRI,

NEAq and WT) entered right whale sighting information into the Mandatory Ship Reporting System (MSR) via an Internet data entry portal.

Photographic Identification

Observers obtained high quality images right whale callosity patterns, and any scars and other markings that were obvious. The image numbers were recorded by date, time, right whale letter for the day and photographer. Digital metadata time was synchronized to the GPS and the computer-logging program (Logger 2000) times at the start of each survey for accuracy.

Photographs of right whale callosity patterns were used as a basis for identification and cataloging of individuals, following methods developed by Payne *et al*. (1983) and Kraus *et al*. (1986b). Photographs taken during the survey effort were used to classify individuals on the basis of callosity patterns, topography, pigmentation and scars. Final matches will be confirmed using photographs from the North Atlantic Right Whale Consortium database, archived at NEAq.

One or two good quality digital images of each right whale considered to be a new individual for the season were emailed to the NEAq office in Boston for preliminary identification. The identifications were shared with the NEAq team as well as other researchers from Associated Scientists at Woods Hole, FWC, Marineland, Marine Resources Council and Wildlife Trust (all of which also sent images to NEAq for preliminary identifications) and the NMFS SEUS right whale coordinator. This allowed for an up-to-date tally of the number of mother/calf pairs during the season. Intermatching of non-mother/calf pairs was also initiated during the season. Photographs of all individuals were downloaded at the end of the day to look for entanglement or other injuries.

Distribution

Sightings of all right whales were recorded by time and location within the study area. Integration of the right whale sightings data collected during these surveys with previously collected data will help to further identify high-use areas within the southeast region. All right whale sightings for the season were plotted and displayed by group size and association type. Sightings were plotted for the four-month long season and also plotted by month to illustrate temporal distribution. In addition, ship traffic was plotted to visually compare right whale sightings versus ship traffic recorded by the aerial survey effort.

Sighting Distance

The sighting distance for each right whale sighting event was determined. The distance was calculated by using the GPS-derived overhead position of the whale(s) and

the exact position of where the aircraft broke from the transect line. The sighting distance calculated by using the following calculation:

Aircraft's latitude when whale is sighted =LAT A
Whale's latitude =LAT B
Aircraft's longitude when whale is sighted =LONG A
Whale's longitude =LONG B

LAT A-LAT B =LAT C
LONG A-LONG B= LONG C

Square root of ((LAT C x LAT C) + (LONG C x LONG C)) x 60= sighting distance (nm)

Sighting events that occurred while the survey aircraft was not on transect were not included in the summary.

Demographics

An analysis of the sex and age composition of the 2007 wintering population of right whales in the survey area was conducted using data from all aerial surveys in the SEUS and the existing catalog of identified right whales from the western North Atlantic. Right whales with known ages (because they were previously identified in their calving year) were classified as juveniles (1-8 yrs) or adults ($\geq$9 yrs). Whales of unknown age were classified as unknown age until their ninth year in which they become classified as an adult. All calving females were classified as adults regardless of age. Sexes were determined by one or all of the following methods: 1) direct observation of the genital area, 2) association with a calf, 3) by the testing of biopsy samples for a genetic marker unique to the Y chromosome (Brown *et al*., 1994).

Calving Intervals and Rates

Right whale cows in this population have been monitored since 1980, and records of calf production are documented in the North Atlantic Right Whale Catalog (Kraus *et al*., 2001). Data collected on reproductive females (cows) that gave birth in the monitoring area during the survey period were used to update information on calving intervals, rates of reproduction, time frame and location of calving.

Associations and Behaviors

The survey team remained on site until positive species identification was made. During this time photographs were obtained and visible associations and behaviors were recorded with as much detail as possible.

The time spent at each sighting is directly correlated to the survey team's ability to make an accurate species identification and obtain photographic documentation of the event. The exception was made in the event of a ship/whale interaction or "close calls",

entanglement, dead whales and events that caused concern for the welfare of the whale(s) (whales in a shipping channel or river).

Whales are considered associated if within several body lengths of each other and coordinating their movements at the surface (Hamilton, 2002). Associations were described as one of the following types.

1. Surface Active Group (SAG)
2. (Mother/Calf pair) M/C
3. Echelon feed
4. Other
5. Not associated

Behaviors were also recorded when observed. Photographers attempted to capture photographic evidence of the behaviors for later confirmation.

A whale or group of whales were also given a direction of travel if it was determined that the whale(s) had traveled a significant distance while the survey team was on site.

Vessel Sightings

All large vessels, greater than 100 ft (30.5 m), sighted during a survey were entered into Logger 2000. Vessels that are no longer recorded due to the loss a dedicated recorder include commercial fishing vessels and all recreational vessels. The aircraft did not break track during large vessel sightings in order to maximize time available for survey effort. The position (latitude and longitude) of the aircraft was recorded when perpendicular to the vessel. The vessel was recorded with a bearing, estimated distance from the aircraft and the vessel's heading.

Vessels recorded included commercial and military vessels. Small commercial vessels (less than 100 ft) were also recorded, these include tugs, pilot boats and dredge crew and survey vessels. All entries include type of vessel, time, and heading. During a sighting event, if a vessel was determined to have the potential for a "close call" with a whale or group of whales the vessel was contacted directly by the survey aircraft in an attempt to prevent the threat of an interaction. When "close call" events occurred the survey team would record detailed information about the situation. Data collected included type of vessel, vessel's position, whale's position, whale's reaction (if any), closest distance between whale and vessel, radio communication (if any) between aircraft and vessel, and vessel's actions (course change or speed change). All "close call" events, regardless of vessel type (commercial, military, recreational or commercial fishing) and vessel size, were reported at the conclusion of the survey to NOAA Fisheries. In addition, all "close call" reports were compiled and forwarded to FWC at the end of the season for inclusion in the close call database.

Automatic Identification System (AIS)

The AIS is a shipboard broadcast system that acts like a transponder, operating in the VHF maritime band, that is capable of handling well over 4,500 reports per minute

and updates as often as every two seconds. AIS is currently being used for identifying and monitoring maritime traffic throughout U.S. waters by various commercial shipping interests. The AIS system sends and receives vessel identification information that is designed for display on a laptop computer or chart plotter. The standards and regulation of AIS are established by the International Maritime Organization (IMO) and as established at the 73rd Session of their Maritime Safety Committee. The majority of large, commercial maritime traffic involved in international travel are currently required to carry AIS and the remaining commercial vessel traffic (coastal and international) is required as of July of 2007.

All commercial vessel traffic that are currently required to carry AIS transponders (Appendix 1) were recorded into a separate database during all Central EWS and two-plane contingency surveys. Data was collected using a Sealinks, Shine Micro RadarPlus SL161R dual channel AIS receiver. Data from the AIS receiver was downloaded directly to the onboard laptop into Shipplotter, software by Centro de Observação Astronómica no Algarve (COAA). The data collected included Mobile Maritime Service Identities (MMSI), navigational status, rate of turn, speed over ground, position, course over ground, heading (true), and time every 2 to 10 seconds. In addition, every 6 minutes the IMO number, radio call sign, name, ship dimensions, draft, destination and estimated time of arrival were also recorded. AIS data were collected during the entire survey flight and covered an area extending from Charleston, SC to Jacksonville, FL.

EWS RESULTS

Survey Effort

The central EWS survey team was on-site for 121 days (01 December 2006- 31 March 2007) during the right whale calving season and a total of 82 surveys were conducted. The first survey was conducted on December 5, 2006 and the last survey occurred on March 31, 2007.

Some surveys were conducted with favorable environmental conditions throughout the duration of the survey, where as others were flown with favorable environmental conditions during part of the survey. Favorable conditions were considered to consist of a Beaufort force 3 or less and visibility of at least 2 nautical miles.

During the 2007 season, 452.8 hours of survey effort resulted in 52 complete surveys ($\geq$90% of survey area flown) and 30 partial surveys (< 90% of survey area flown). Thus, some measure of aerial coverage was provided 68% of the season. When a partial central EWS survey was conducted effort priority was given to the shipping channels (St. Marys River Entrance Channel and St. Johns River Entrance Channel) and the immediate surrounding areas. During a partial two-plane contingency survey the effort priority was given to the Brunswick and the St Marys River Entrance channel). A summary of all survey effort (including the contingency surveys) is shown in Table 1.

During the 2007 EWS season, the Central EWS team was redirected during three different time periods in order to fly the two-plane contingency plan. The first two-plane contingency survey period took place on 16 December 2006. One contingency survey was flown in order to relieve the Northern EWS so they could offer support to disentanglement efforts. The second two- plane contingency period was due to maintenance down time on the Northern EWS survey aircraft. Two surveys were flown on 31 January and 1 February. The third two-plane contingency period was on 29 March and 31 March 2007 and was due to the Northern EWS team's budget constraints. A summary of the effort during the two-plane contingency surveys is described in Table 2. Figure 1 represents the survey area of the Central EWS and the two-plane contingency area flown by the Central EWS team when needed. Figure 2 represents the survey effort flown by the Central EWS during the 2007 season. A total of 383 nm of on-transect (701 km) were flown by the Central EWS team during each completed two-plane contingency survey.

In order to evaluate how much effort was given to the EWS surveys during the 2007 season the number of days on site was multiplied by the on-transect miles per survey in order to evaluate how much of the available effort for the season was conducted in favorable sighting conditions (Beaufort $\leq$3 and visibility > 2 nm). There are 406 on-transect miles (nm) to be flown per Central EWS survey and 383 on-transect miles (nm) per two-plane contingency survey. Therefore, 49,011 nm were available to be flown during the 2007 season (116 days x 406 nm + 5 days x 383 nm). During the 2007 season 29,290 nm of the available 49,011 nm were flown (60%). Of the 29,290 nm of trackline flown, 23,324 nm were flown in favorable conditions (80%). Thus, 47% of the total miles available to be flown during the season were flown in favorable conditions.

Table 1. Total Central EWS Survey Effort (including contingency surveys).

Number of Available Survey Days	Number of Surveys Flown/ Percent	Number of Full Surveys	Number of Partial Surveys	Number of Available Transect Miles (nm)	Number of Transect Miles Flown (nm)/Percent of Total Available	Percent of Transect Miles Flown in Beaufort ≤3	Number of Transect Miles Flown in Beaufort ≤3/ Percent of Total Available
121	82	52	30	49,126	29,290		23,324
	68%				60%	80%	47%

Table 2. Two-Plane Contingency Surveys

Number of Surveys Flown	Number of Full Surveys	Number of Partial Surveys	Number of Transect Miles Flown	Number of Transect Miles Flown in Beaufort < 3/ Percent of Total Available
5	4	1	1,549	1,155
				75%

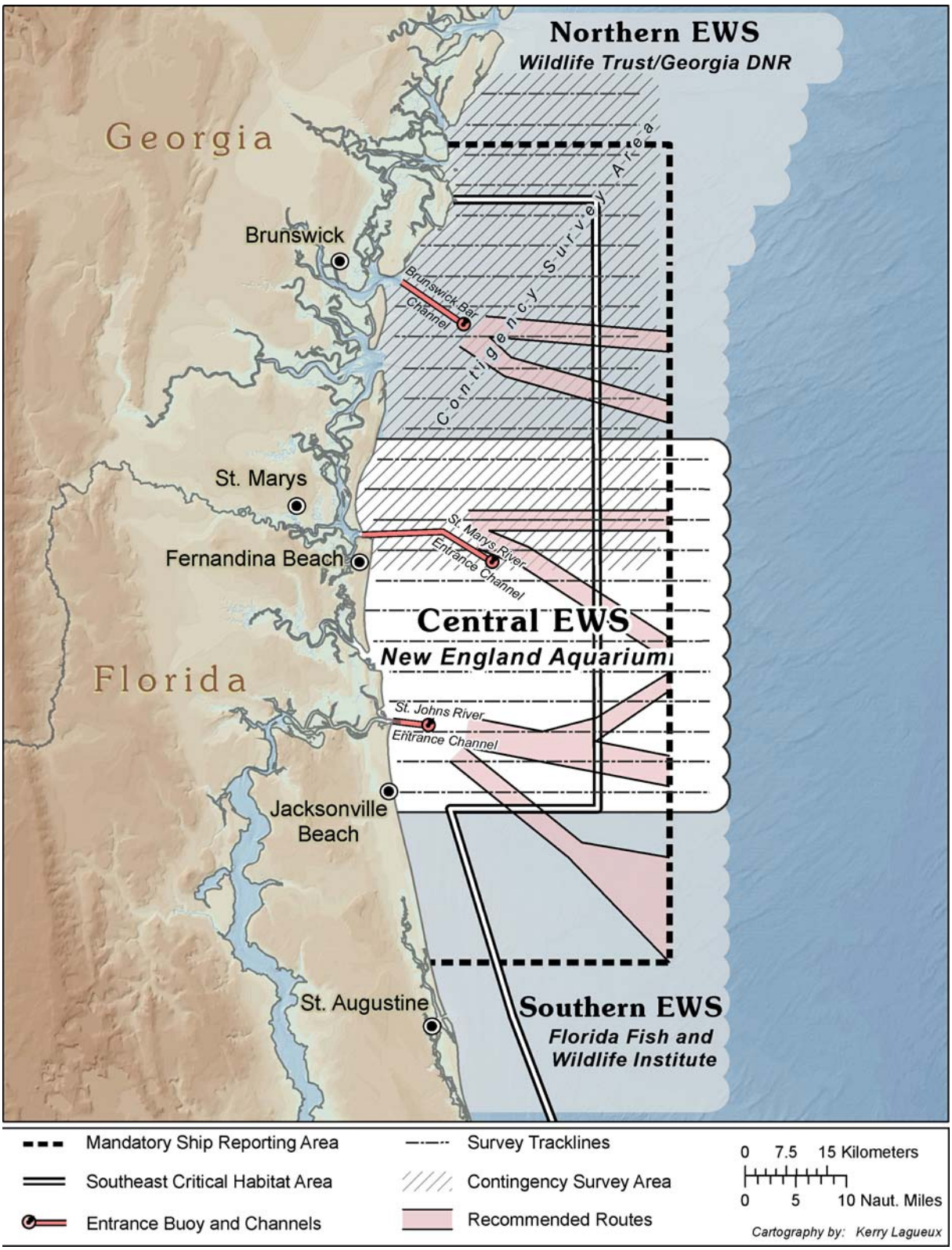

Figure 1. Central EWS Survey Area (including contingency plan flown by NEAq). Projected in Universe Transverse Mercator, Zone 17, using a North American Datum 1983.

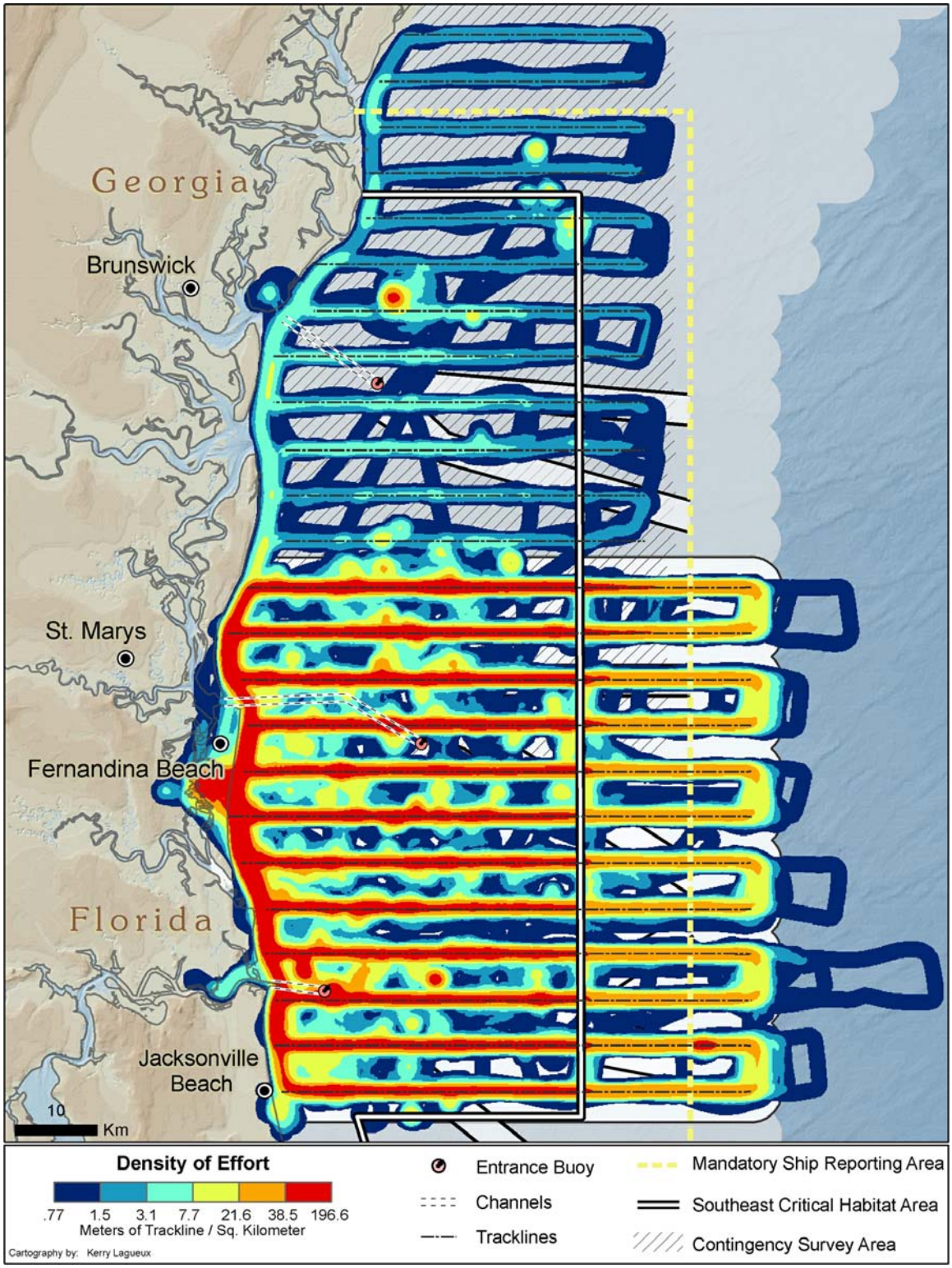

Figure 2. 2007 Central EWS survey effort. Kernel density of all months survey effort using a 1000 kilometer search radius and a cell size of 100 meters. Projected in Universe Transverse Mercator, Zone 17, using a North American Datum 1983.

Sightings and Photo-identifications

A sighting event is defined as an event by which the aircraft breaks from the trackline and a whale or group of whales are circled until they are positively identified as right whales. A single sighting event can be of a single whale or a group of whales. There were 197 sighting events of 398 right whales, including calves (not all unique individuals) in the central EWS survey area (including 5 days of survey effort as the two-plane contingency) during the 2007 season. Of the 22 females known to have given birth in the 2007, 18 of them were documented in the SEUS. Four right whale females were not documented in the SEUS but were documented with calves elsewhere in 2007 (#3280 documented in North Carolina in April, #1814 documented in Massachusetts in May and #2360 documented in the Great South Channel off Massachusetts in June and #2912 documented in Massachusetts Bay in July). Of the 18 documented in the SEUS, 17 were documented in the EWS. The Central EWS documented all 17 of the moms known to be in the EWS area but only 15 of them were documented with calves. Therefore, 2 of the females were documented in the Central EWS only prior to calving. All 197 sighting events were reported to the EWS pager system via FACSFACJAX and 196 of the sightings events were photo documented.

Of the 196 right whale sighting events that were photo-documented, 52 of the sightings were of single whales (includes pregnant females), 26 pairs (not mom/calf), 78 mom/calf pairs, 18 sightings were groups of whales associated in SAG and 22 sightings were groups of whales (3-5) not associated in a SAG.

The first right whale sighting documented by the Central EWS survey occurred on 11 December 2007. As the coastal, southern progression of right whales continued the number of right whale sightings increased from 1 to a maximum of 9 sightings per day with as many as 17 individual whales (Figure 2). Sightings continued throughout the season with the last right whale sighting reported by the Central EWS on 29 March 2007. The temporal occurrence of non-mom/calf right whales in the survey area peaked in mid February and lasted through mid March while the temporal occurrence of mom/calf pairs was consistently high during February (Figure 3) and steadily declined during March.

All Central EWS right whale sightings from the 2007 season are plotted on a chart of the study area in Figure 4 (including the 5 days of two-plane contingency survey) and plotted monthly in Figure 5. All sightings of right whales are detailed in a table in Appendix 2 with the date, time, location, association and behavior type where applicable of each whale. Also included are the catalog identification numbers when known.

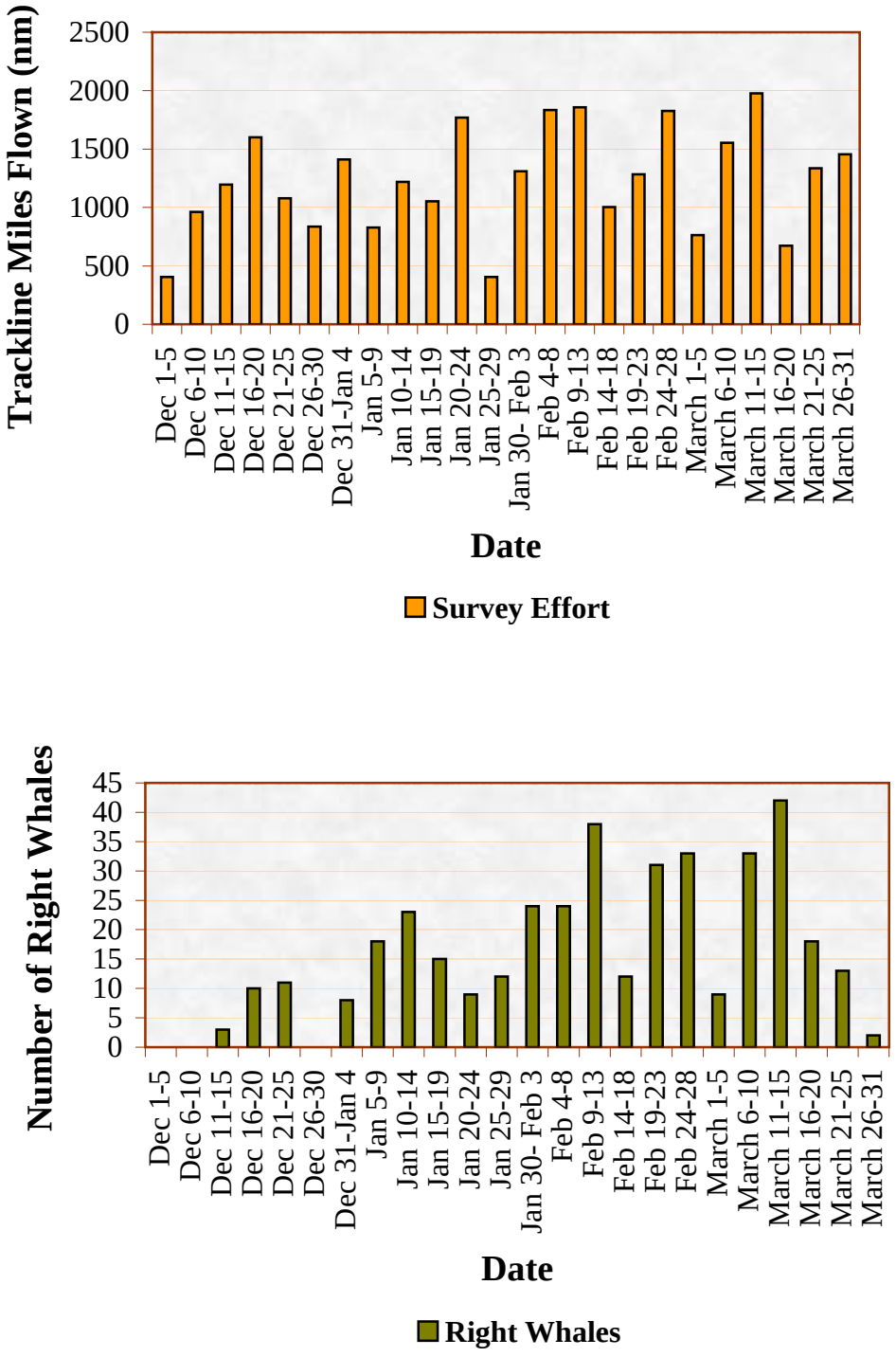

Figure 3. Effort vs. Number of Right Whales Sightings.

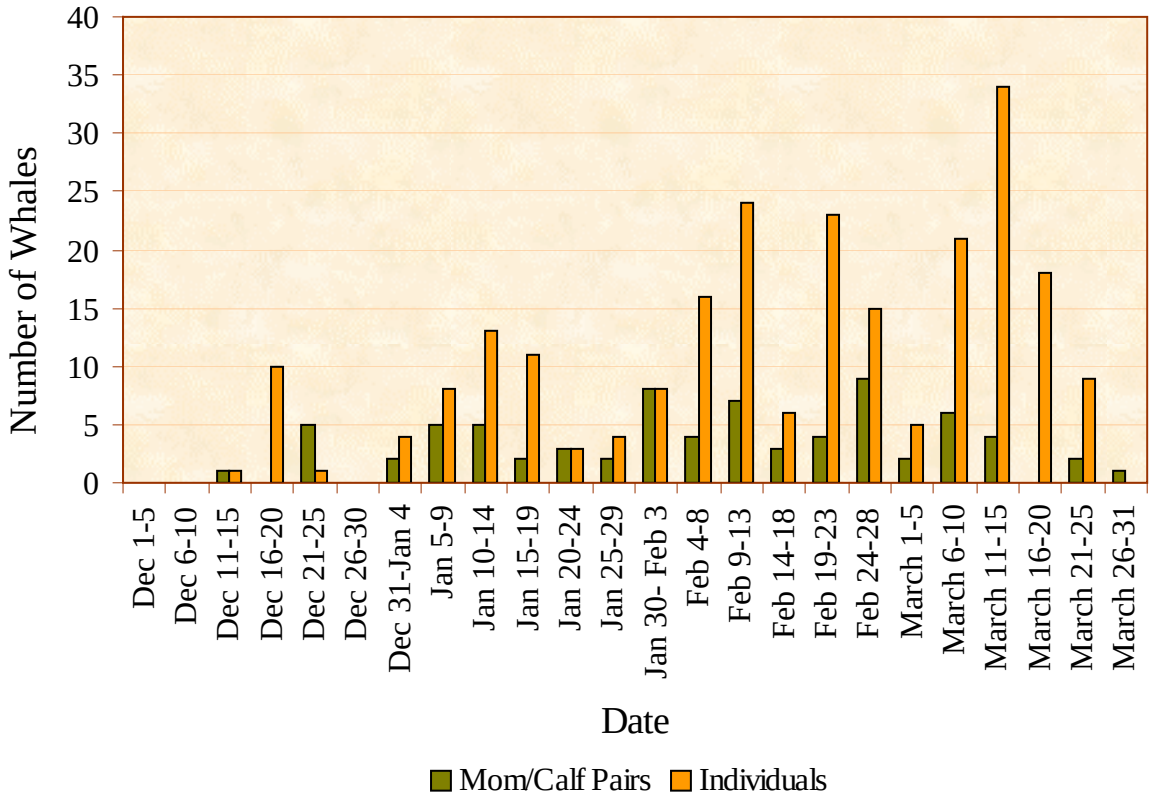

Figure 4. Temporal Occurrence of Right Whales. Mom/Calf Pairs vs. Individuals in the Central EWS during the 2007 Season.

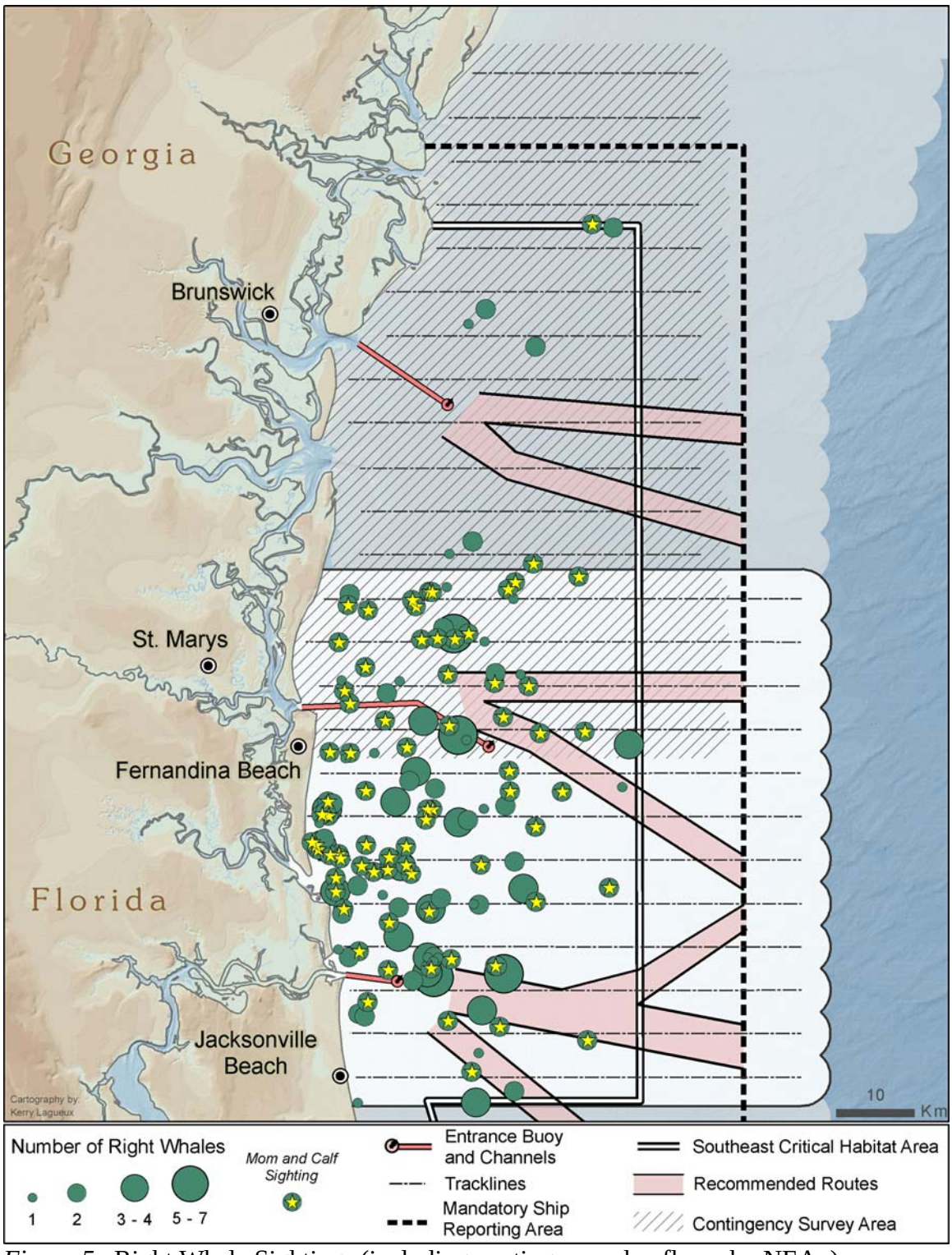

Figure 5. Right Whale Sightings (including contingency plan flown by NEAq). Projected in Universal Transverse Mercator, Zone 17, using a North American Datum 1983.

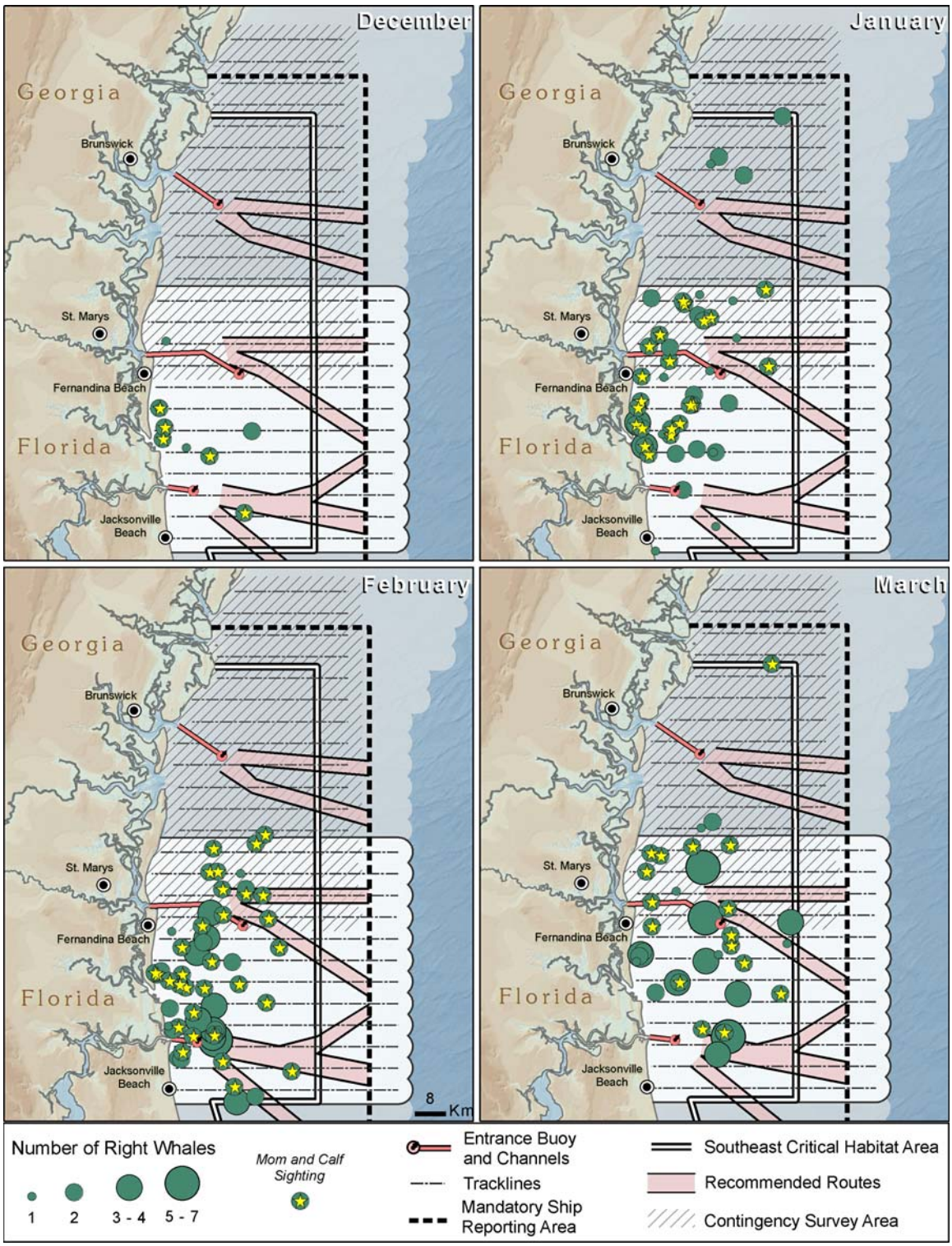

Figure 6. Right Whales Sightings by Month (including contingency plan flown by NEAq). Projected in Universal Transverse Mercator, Zone 17, using a North American Datum 1983.

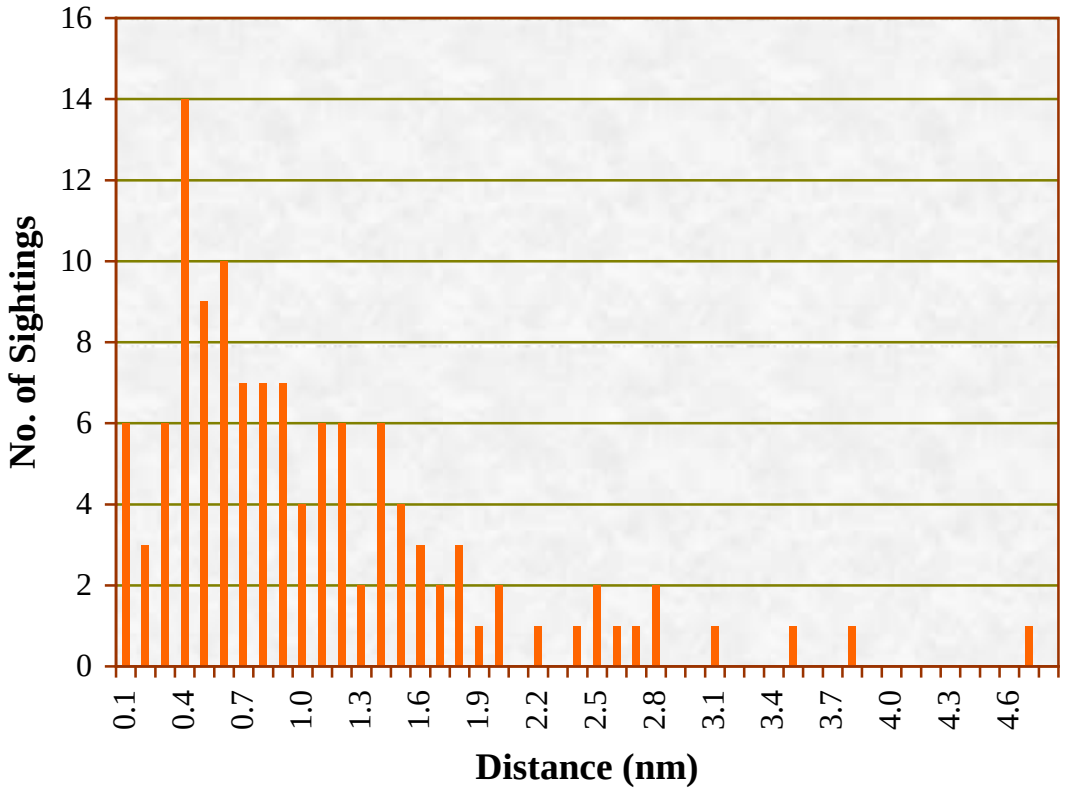

Figure 7. Central EWS Sighting Distance in all Sea States.

Sighting Distances

Sighting distances for right whale sighting events are summarized by 1/10 nm increments in Figure 6. Sighting events that occurred while the survey aircraft was not on transect were not included in this analysis. The mean sighting distance, without considering Beaufort sea state conditions as a factor is 1.0 nm. A summary of sighting distances where Beaufort sea state was considered is shown in Figure 7. Analysis of Beaufort sea state and sighting distances shows a mean of 1.0 nm during times of Beaufort 3 or less. The mean sighting distance during times of Beaufort 4 or greater is 1.8 nm but the frequency is reduced considerably (n =107 and 13, respectively), but 20% of the survey trackline miles were flown in a Beaufort 4 or greater but only 11% of the sightings were detected in the higher sea state suggesting a reduced total sighting ability in the higher sea states.

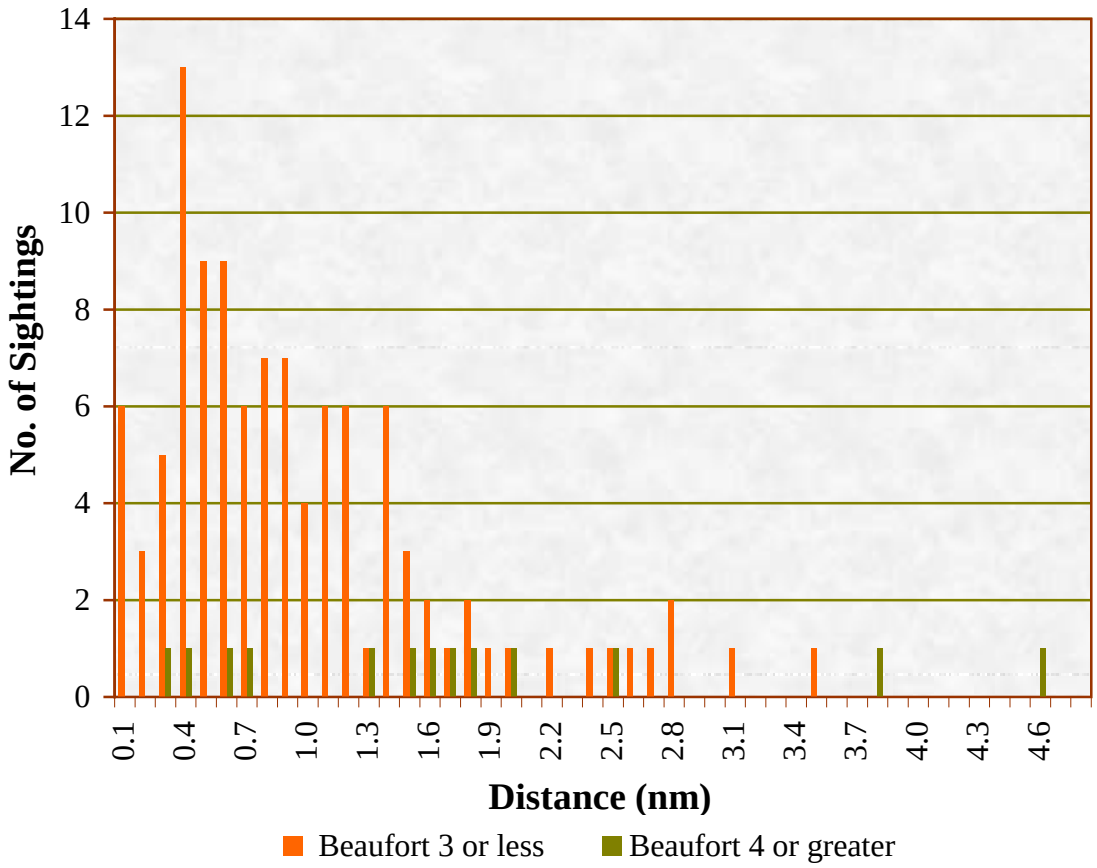

Figure 8. Sighting Distance (Beaufort Sea State Considered).

Demographics

The matching and confirming process for right whale identifications is still currently being conducted for the 2007 season. For this reason we are unable to illustrate an accurate demographic structure for the area. We do know that the area was highly utilized by a number of unidentified whales thought to be juveniles. Many of these whales have been matched to calves from previous seasons and have been given temporary intermatch codes. The preliminary count of whales documented during the 2007 season by all survey teams in the SEUS is 18 M/C pairs (36 whales), 28-catalogued individuals (non M/C pairs) and 44 intermatched whales (probable juveniles) for a minimum total of 108 right whales. We anticipate that once the data from all teams has been intermatched and compared to the catalog, this number of right whales seen during the season may change slightly.

Table 3 represents all the whales from the season that have been identified by a cataloge number or given an intermatch code. Table 3 also includes their age, age group and sex when known. Figure 8 is a graphical depiction of the demographic structure of the SEUS during the 2007 season.

Table 3. Preliminary Demographics of Right Whales During the 2007 Season.

Right Whale No.	Age	Right Whale No.	Age	Right Whale No.	Age	Unknown Age & Unknown Sex	Unknown Age & Unknown Sex	Right Whale No.
Adult Females w/Calves		**Adult Males**		**Juveniles of Unknown Sex**		**Intermatch Code**	**Intermatch Code**	**Females of Unknown Age**
1425	A	1327	A	3301	4	BK27	SE07CT07	3260
1620	A	1971	18	2912	8	BK33	SE07CT09	
1701	20	2057	17	3301	4	BK53	SE07CT10	
1705	20	2740	10	3314	4	CT15	SE07CT11	
1710	A	**Adult Females**		3317	4	SE06BK18	SE07CT12	
1810	A	1608	21	3405	3		SE07CT14	
1814*	A	1611	21	3420	3	SE07BK07	SE07CT15	
1911	18	1817	A	3430	3	SE07BK08	SE07CT18	
2145	16	**Adults of Unknown Sex**		3466	3	SE07BK11	SE07CT19	
2360*	A	2910	A	3540	2	SEUSBK12	SE07CT20	
2430	13	3190	A	3541	2	SEUSBK13	SE07CT22	
2460	13	2910	A	3545	1	SEUSBK15	SE07CT24	
2601	11	**Juvenile Males**		2006 Calf of 1817	1	SE07BK17	SE07CT25	
2605	11	3421	3	2006 Calf of 1611	1	SE07BK18	SE07CT26	
2611	11	3414	3	2006 Calf of 2660	1	SE07BK19	BK01SEUS06	
2614	11	3508	2	2006 Calf of 1946	3	SE07BK20	CT01SEUS06	
2642	11	3150	6	2004 Calf of 1911		SE07BK22	CT01SEUS06	
2645	11	3323	4			CT01RB06		
2746	10	3346	4			CT01BOF05		
2912*	8	**Juvenile Females**				SE07CT01		
3280*	A	3101	6			SE07CT04		
3360	U					SE07CT06		

*M/C pairs not seen in the SEUS

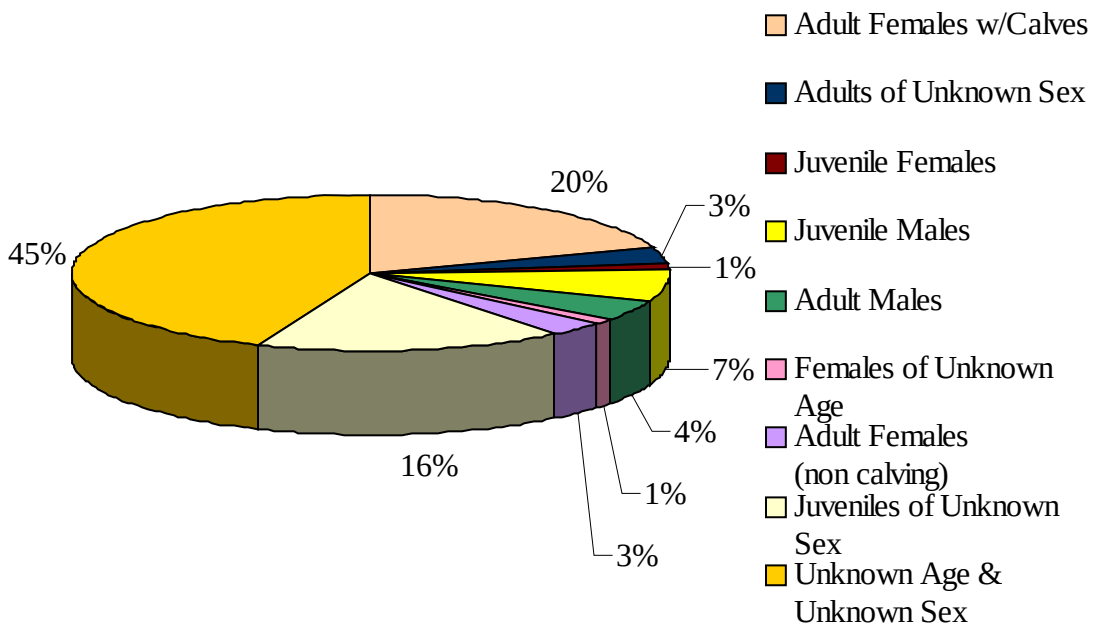

Figure 9. Preliminary Demographic Structure of the SEUS-2007.

Calving Intervals and Rates

Preliminary data from the 2007 calving season shows the calving interval ranged from 2-6 years with a mean of 3.6. Table 4 includes calving interval, number of calves and age class/age (when known) of each cow from the 2007 season. Nine right whales calved for the first time in 2007. All whales were documented in the Central EWS survey area except #1814, #2360, #2460 and #3280. Right whale # 1814, #2360 and #3280 were not documented in the SEUS.

Table 4. Calving Interval

2007 Cow/Calf Pairs	Age/Age Class	No. of Calves (including 2007 calf)	Calving Interval
1425	Adult	3	6
1620	Adult	4	3
1701	20	4	3
1705	20	3	3
1710	Adult	5	6
1810	Adult	4	5
1814*	Adult	1	N/A
1911	18	3	3
2145	16	3	3
2360*	Adult	2	3
2430	13	1	N/A
2460	13	2	3
2601	11	1	N/A
2605	11	1	N/A
2611	11	1	N/A
2614	11	2	3
2642	11	1	N/A
2645	11	2	2
2746	10	1	N/A
2912*	8	1	N/A
3280*	Adult	1	N/A
3360	U	1	N/A

* M/C paris not seen in the SEUS

Associations

During the 2007 season all right whale association types were documented except for echelon feeding. Appendix 2 summarizes all association types observed during each right whale sighting event.

Vessel Sightings

The tracks of all commercial shipping traffic during the 2007 season (carry an AIS transponder) are plotted in Figure 8. This plot contains the track of the vessel as it moved through the habitat and represents the density of traffic within a given area. Figure 9 displays the same data on density but according to ship type, tanker or cargo. Figure 10 displays the same shipping traffic but the plot represents average vessel speed. Figure 11 displays the same data on average speed but according to ship type, tanker or cargo. Figure 12 contains a plot of all other vessel traffic that was visually located during the survey effort (military and small commercial not required to carry AIS). Figure 12 is a plot of vessel locations observed during surveys and recorded abeam of the survey aircraft (plot does not include the track or speed of the vessel). Figure 12 also includes recreational vessels that were involved in "Close Call" or Ship/Whale interactions

"Close Call" or Ship/Whale Interactions

During the 2007 season the survey aircraft documented nine "close call" or ship/whale interactions events. A "close call" is defined as a situation when the survey team visually determines that a vessel is on a course that will result in the vessel and whale(s) being less than one nm apart. At this time, the survey team attempts to make contact, via Marine VHF Ch. 16, with the vessel in question. During the 2007 season the central EWS survey team was able to make positive contact in three of the nine "close call" situations documented. Table 5 summarizes the "close call" events documented.

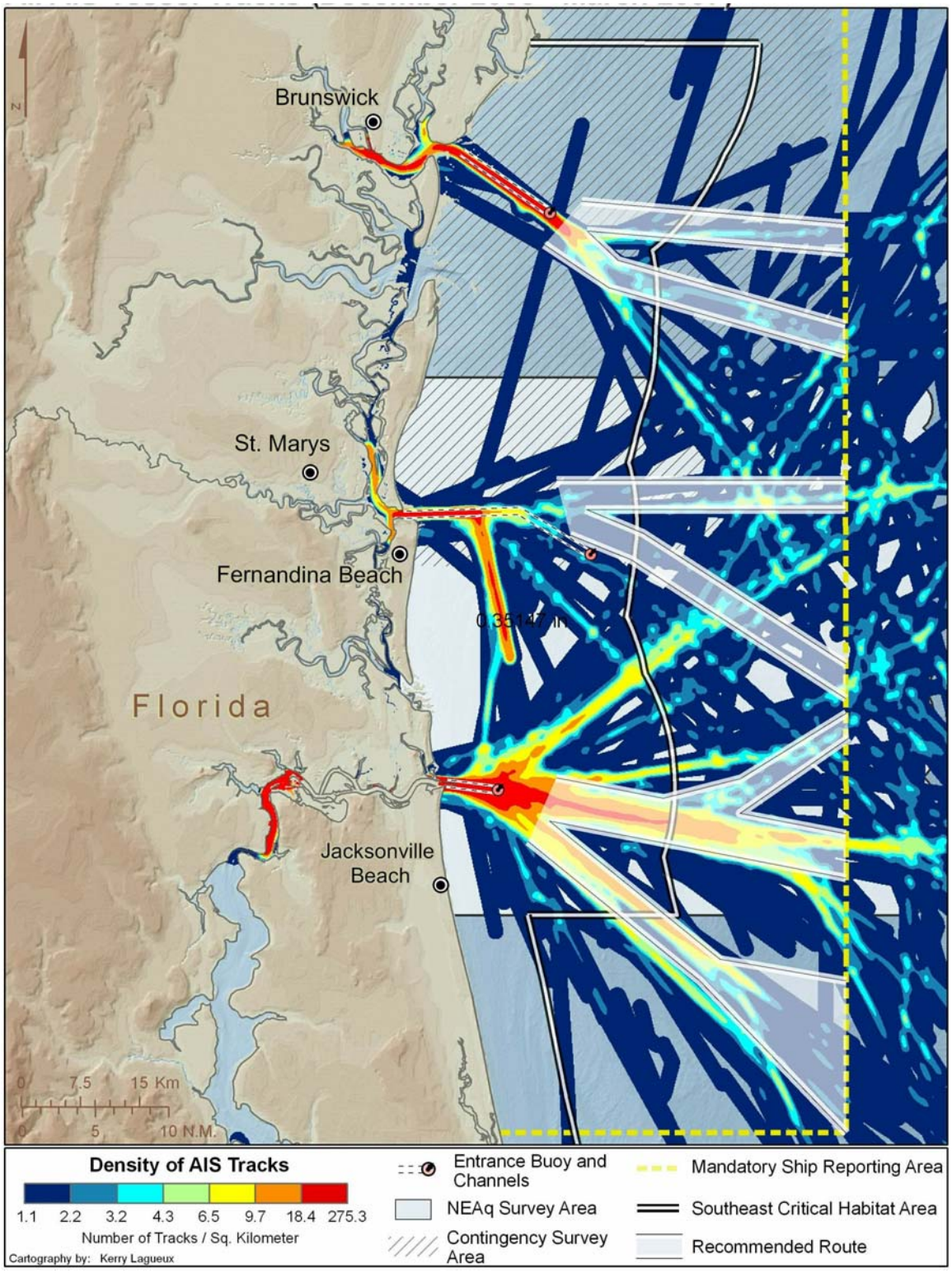

Figure 10. Commercial Shipping Traffic Density (Including Dredges). Projected in Universal Transverse Mercator, Zone 17, using a North American Datum 1983.

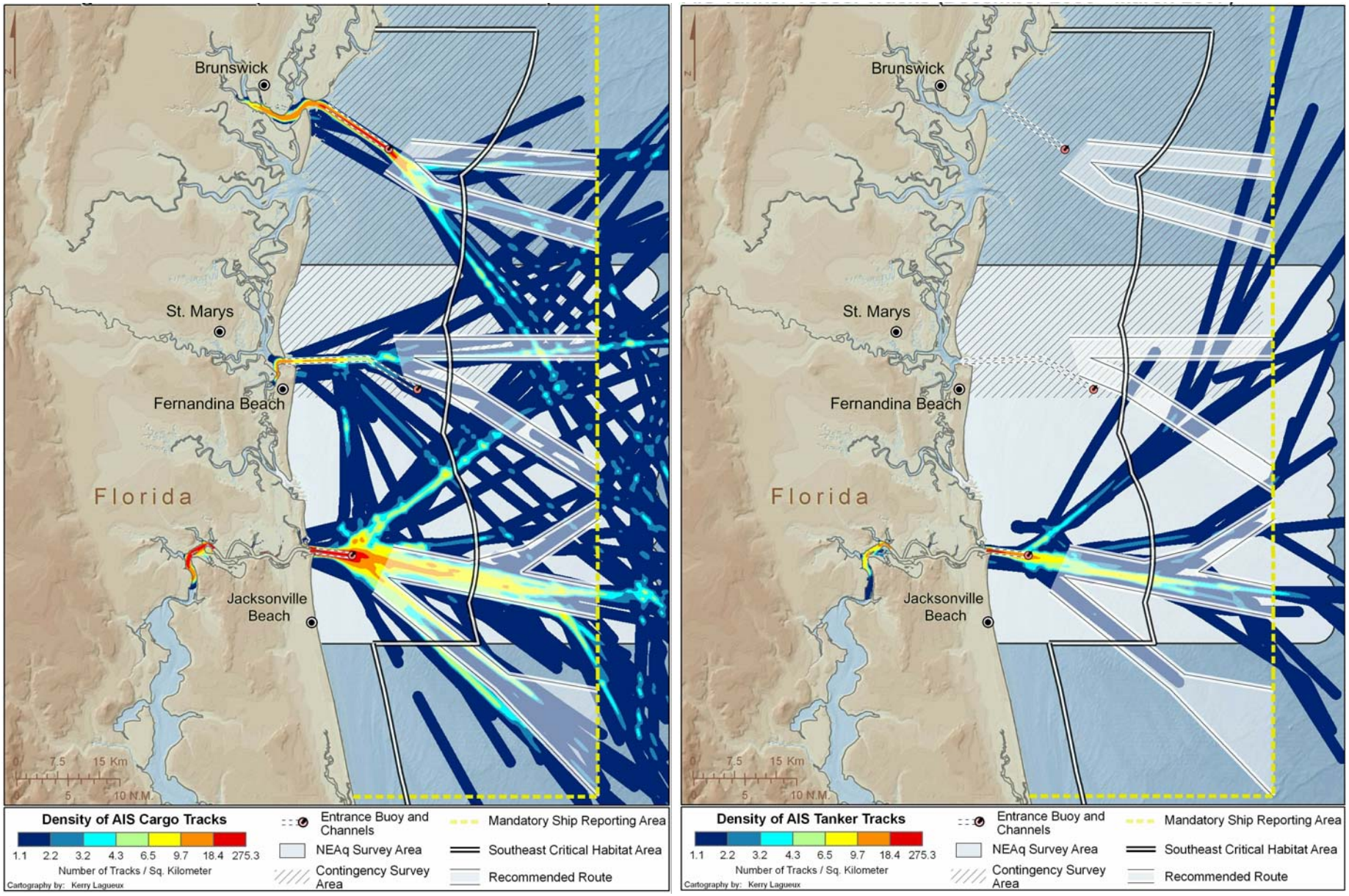

Figure 11. Commercial Shipping Traffic Density (Including Dredges) Tanker vs. Cargo. Projected in Universal Transverse Mercator, Zone 17, using a North American Datum 1983.

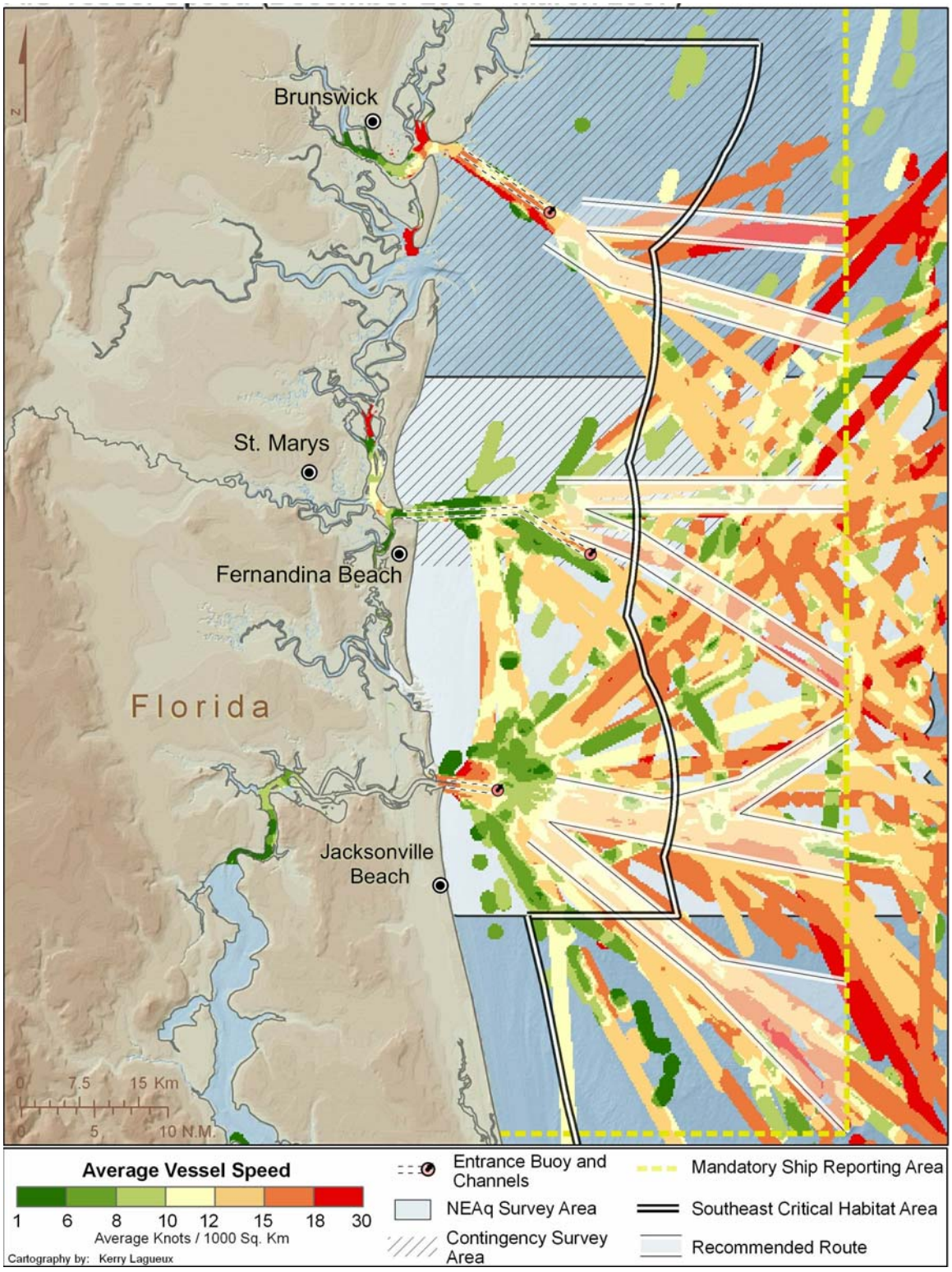

Figure 12. Average Commercial Shipping Traffic Speed (Including Dredges) Central EWS 2007. Projected in Universal Transverse Mercator, Zone 17, using a North American Datum 1983.

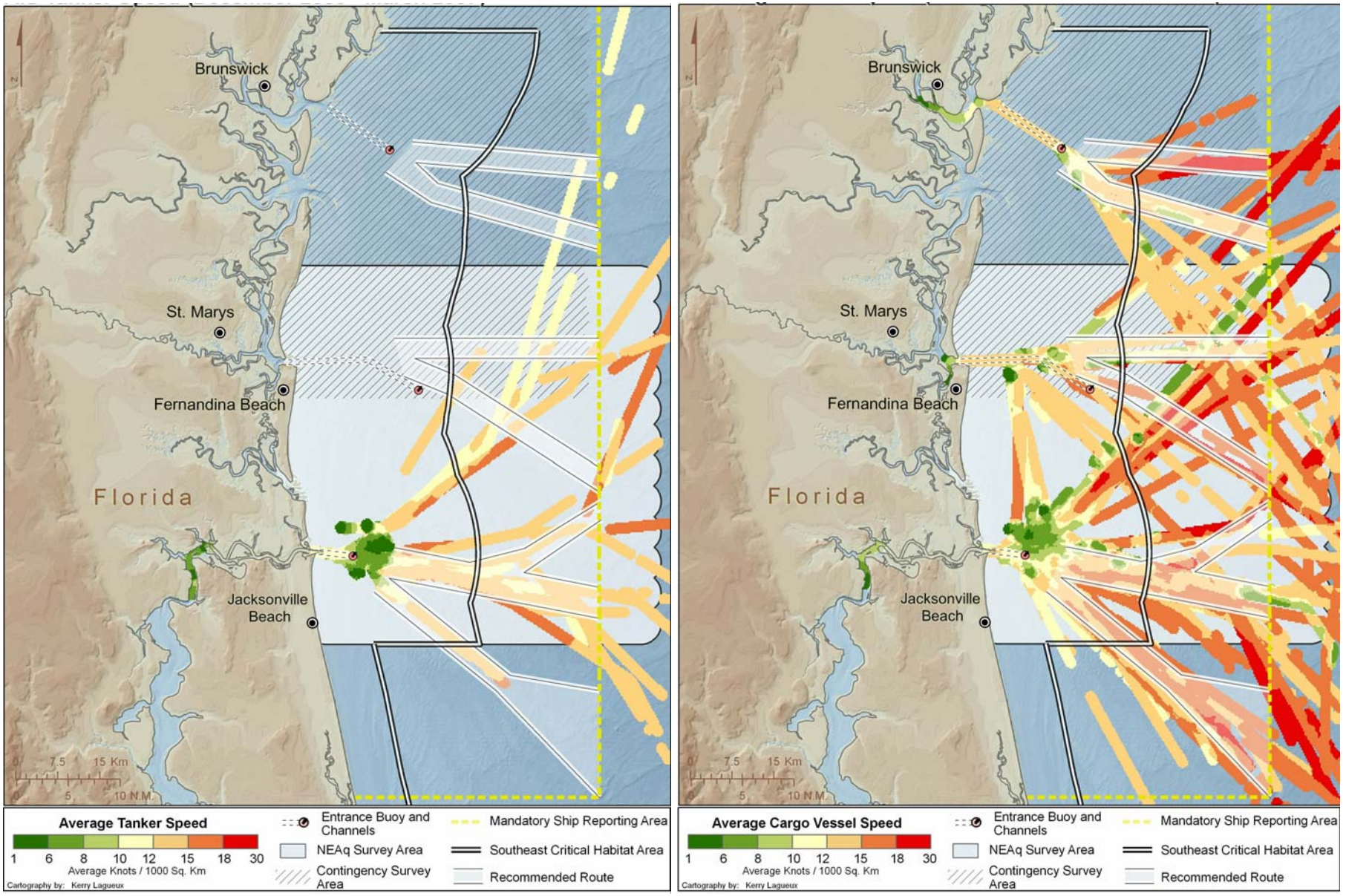

Figure 13. Average Commercial Shipping Traffic Speed in the Central EWS. Tanker vs. Cargo. Projected in Universe Transverse Mercator, Zone 17, using a Noerican Datum 1983.

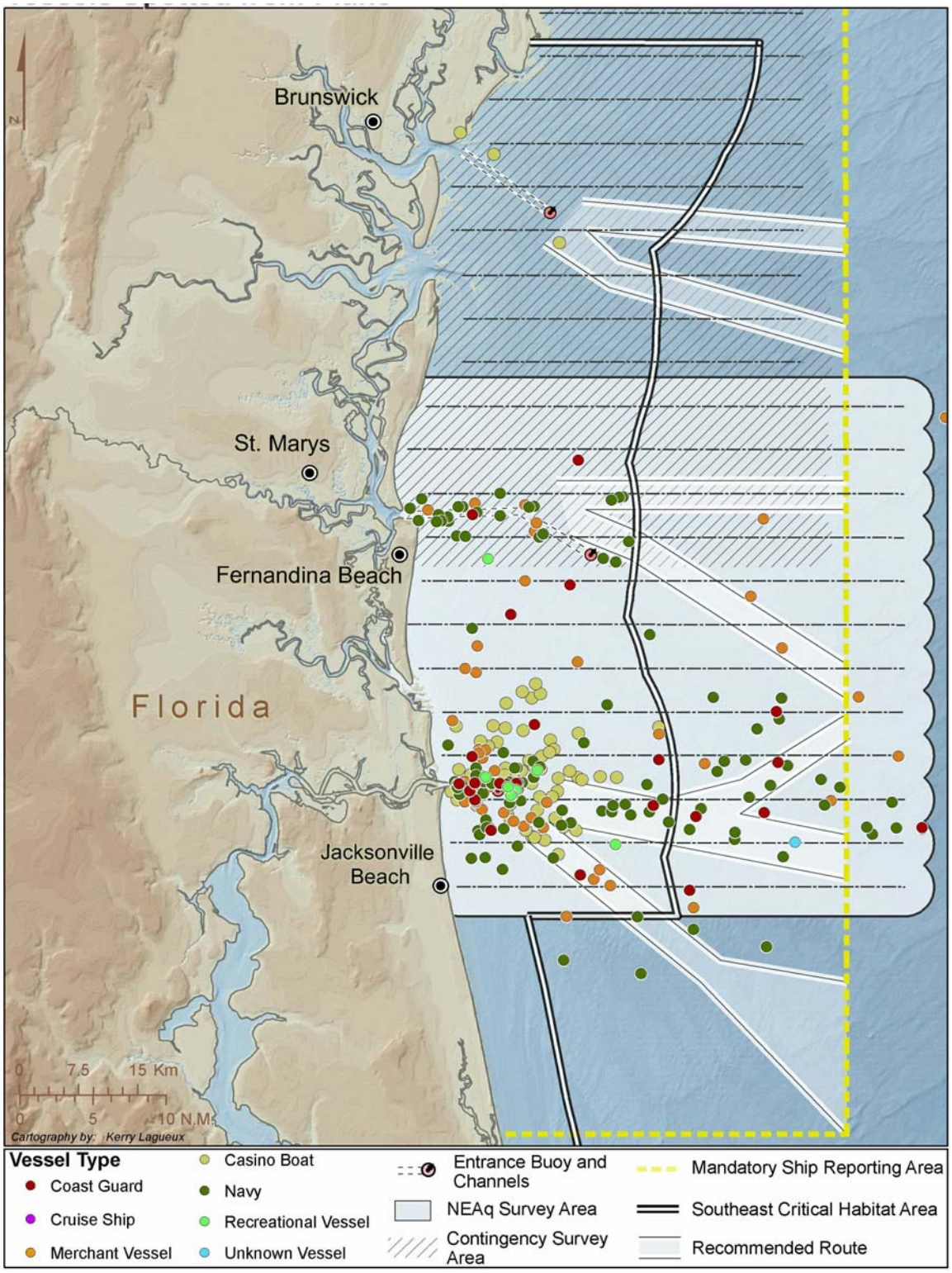

Figure 14. Military and Small Commercial Vessel Traffic. Map includes recreational vessels that were documented in "close call" whale/ship interactions.
Projected in Universal Transverse Mercator, Zone 17, using a North American Datum 1983.

Table 5. "Close Call" Vessel/Whale Events in the Central EWS.

Date	Latitude/ Longitude (of the whale)	Origin or Destination of Vessel	Number of Whales	Vessel Type and size (ft)	Communication	Closest Distance (estimated)	Vessels Action/ Whales Reaction
19-Dec-06	30.34008 -81.15221	St Johns River	1	19-22 ft. Recreational Vessel	No communication attempted	100 meters	No visible whale reaction observed.
16-Jan-07	30.47848 -81.3181	Fernandina Beach, FL	2	Large Merchant /Cargo	Positive communication	0.5 nm	Vessel slowed speed/No visible whale reaction observed.
22-Jan-07	30.47848 -81.3181	Mayport, FL	1	USCG Cutter	Positive communication	1.0 nm	No reaction from vessel/No visible whale reaction observed.
27-Jan-07	30.39465 -81.2992	Mayport, FL	2 (M/C)	Casino Boat	Positive communication	300 meters	Vessel was traveling extremely slow and had a visual on whales/No visible whale reaction.
27-Jan-07	30.39465 -81.2992	St. Johns River	2 (M/C)	21-26 ft. Recreational Vessel	Communication attempted/Negative contact	20-25 meters	Vessel was traveling slow and was thought to have seen the whales because it appeared the vessel approached whales/No visible whale reaction.
27-Jan-07	30.39465 -81.2992	St. Johns River	2 (M/C)	22-26 ft. Recreational Vessel	Communication attempted/Negative contact	5-10 meters	Vessel appeared to see whales because it stopped and waited for the whales to surface from a dive. When whales surfaced the vessel approached quickly and whales dove again.
27-Jan-07	30.39465 -81.2992	St. Johns River	2 (M/C)	Recreational	Communication negative/Negative contact	100 meters	Vessel was traveling fast, sighted whales and stopped 100 meters from the whales and reported the sighting to USCG.
02-Feb-07	30.42078 -81.27912	N/A	6	30-40 ft. Recreational Vessel	Communication negative/Negative contact	100 Meters	No reaction from vessel/no visible whale reaction.
08-Mar-07	30.41893 -81.24878	Anchorage outside the St. Johns	2 (M/C)	Large Merchant /Car Carrier	Positive Communication	0.4 nm*	Vessel slowed speed and altered course/No visible whale reaction.

*** Data from AIS**

Mortalities and Injuries

Mortalities and injuries that either occurred during the 2007 season or were first documented during the 2007 are summarized below. Moralities and injuries are broken down into three sections; entanglements, vessel strikes and other mortality. Table 6 summarizes mortality and injury events and denotes which of these events were documented within the Central EWS survey area.

Entanglement:

During the 2007 season two right whales were documented by EWS survey teams as being entangled. Both whales had been previously documented as entangled (although one was originally thought to be new).

On January 5, 2007 right whale #3346 was sighted by the Southern EWS survey team. Right whale #3346 was first documented entangled off the coast of St. Augustine, FL in 2004 and has been documented each winter in the SEUS since that time. The whale was sighted on numerous occasions by each of the three EWS survey teams and each team provided photographic documentation of the whale and its entanglement.

On January 15, 2007 a right whale was documented by the Northern EWS survey team entangled. The entangled whale became the subject of an extensive but unsuccessful disentanglement effort. The whale was later sighted off the coast of Massachusetts in late April free of gear.

Vessel Strikes:

On December 30, 2006 the northern EWS survey team documented and reported a dead right whale floating of the Georgia coast. The whale was towed to Fort Clinch State Park on Amelia Island, FL and a necropsy was preformed the following day. The whale, a two-year old male, had 20 (exact number?) propeller wounds running from its head to midway down the back/side of the whale (Figure 11). The whale was later identified as #3508 and had last been seen alive on December 18, 2006 off the coast of Georgia.

Other Mortalities:

On January 25, 2007 a dead right whale calf was reported floating off the coast of Florida. The Central EWS survey team responded to the report to confirm species identification and report an updated location to the USCG (for towing purposes). The right whale was towed a shore and a necropsy preformed. It was determined that the whale, a male calf had died during or soon after birth due to natural complications.

On March 30, 2007 a dead right whale was reported off the Outer Banks of North Carolina. The whale, a male calf was towed ashore and a necropsy preformed during which some evidence of entanglement interaction (although no gear was found on the whale) was found.

Figure 15. Right Whale #3508, December 31, 2006. Michael Moore (Woods Hole Oceanographic Institute) and Tom Pitchford (FWRI) prepare right whale #3508 for necropsy on a beach on Amelia Island, FL.

Photo: Monica Zani/New England Aquarium

Table 6. Entanglement, Injury and Other Mortality.

Entanglements

Date	Event	Fatal	Right Whale No.	Sex	Age	Notes
5-Jan-2007	Entanglement (previously known to be entangled)	No	#3346	M	4	Documented numerous times by the EWS survey teams throughout the 2007 season.
15-Jan-2007	Entanglement (previously known to be entangled)	No	U	U	U	Documented by the EWS survey teams. Disentanglement effort launched but unsuccessful in removing gear.

Vessel Strikes

Date	Event	Fatal	Right Whale No.	Sex	Age	Notes
30-Dec-2006	Vessel Strike	Yes	#3508	M	2	Found floating dead off Jekyll Island, GA

Other Mortality

Date	Event	Fatal	Right Whale No.	Sex	Age	Notes
25-Jan-2007*	Death occurred at or close to the time of birth and believed to be natural causes.	Yes	Calf	M	Neonate	Found floating dead off Ponte Vedra, FL
30-Mar-2007	Evidence of entanglement interaction (although no gear was found on the whale).	Yes	Calf	M	Calf	Found floating off the Outer Banks, NC

Dates represent the first documentation or report of entanglement or mortality event.
*Documented by the Central EWS survey team.

Discussion

The coastal waters of the Florida and Georgia are currently the only known calving ground for the North Atlantic Right Whale, although some whales have been documented first with calves outside this area. For over 10 years there has been extensive survey effort in the calving ground in the form of Early Warning System (EWS) surveys. Originally, the EWS surveys were designed to reduce the potential for ship strikes in the calving ground. However, over the past 10 plus years, in addition to the main objective of the EWS, these surveys have contributed hundreds of photo-documented right whale sightings. These data play an integral role in the understanding of right whale habitat, distribution, associations and reproduction.

Using contributed data from all survey groups, identification of all right whales photographed in the southeast in 2007 is currently being conducted. This data provides a better understanding of how the critical habitat and adjacent areas in the SEUS are being utilized by the population throughout the winter. At least 17 of the known 22 M/C pairs are known to have been in the EWS survey area. Of the 17 M/C pairs observed, one (6%) had previously calved in 2005 (although the 2005 calf was presumed dead by February of 2005, six (35%) previously calved in 2004, one (6%) of them had previously calved in 2002, two (12%) had previously calved in 2001 and seven (41%) had never calved before. Of the 10 females with multiple calvings, only three (30%) had a calving interval higher than 3 years, two at 5and one at 6 years. The Central EWS teams documented 17 (81%) of the 21 known M/C pairs. The mean calving interval using preliminary, contributed data for all known M/C pairs, in all regions in 2007, is 3.6 years, which indicates an improvement when compared to the average documented in the late 1990's. The mean calving interval for this population between 1993-1998 was over 5 years and had increased from 3.67 between 1980-1998 (Kraus et al., 2001).

The mean age of calving females in 2007 (including all 21 known moms) was 13.5 years. Of the 17 documented in the EWS survey area, 12 are of known age ranging from 10 to 20 years of age with a mean is 13.5 years. Of the seven females in the EWS survey area that calved for the first time one (14%) was age 10, four (57%) were age 11, one (14%) was age 13 and 1 (14%) was of unknown age. Of the four calving females never documented within the EWS survey area only one is of known age at 13 years.

Though all the individuals observed in the SEUS have not been identified, preliminary analysis indicate that a large number of non-M/C pairs (a minimum of 37 unique individuals have been documented thus far) were juveniles, many of which were involved in surface active groups. Since the Southeast U.S. is not a feeding ground, the presence and the behavior of these non-M/C pairs suggests the habitat may serve another function, at least in some years. The high number of calves born in the past six years and the documented increase in juvenile presence in the southeast U.S. warrants further exploration to define this additional function of the calving ground.

The teamwork and active participation of many agencies and interests is essential to the effectiveness of these surveys in mitigating collisions with right whales. The ability of the survey teams to alert FACSFACJAX, Naval Air Station, Jacksonville from

as far as 30-35 nm from shore is the crucial catalyst to this network. FACSFACJAX is able to acknowledge the right whale sightings data from the survey teams and initiate many notifications via pagers. U.S. Coast Guard (USCG) Office of Aids to Navigation in Miami transmits right whale sighting information via NAVTEX and the MSR system. These are the primary methods for contacting commercial shipping interests with right whale locations. The USCG also transmits Notice to Mariners over VHF marine-band radio while the survey teams' ground contact updates the Mandatory Ship Reporting MSR) system. Simultaneously, the Harbor Pilot Associations at the ports of Jacksonville, Fernandina, Brunswick and Savannah monitor pagers for information transmitted by FACSFACJAX and relay this information to ships being piloted to/from their respective ports. This transmission of near-real time data, which propels a chain reaction of alerts and notifications along the coastline of the southeastern U.S., is what distinguishes these aerial surveys as a meaningful conservation tool. Yet, this tool for collision mitigation has limitations on many fronts. First, survey effort is not consistent throughout the calving season as reduced visibility and weather too severe for survey aircraft to be launched result in numerous days with no survey effort. In turn, near real-time sightings are not provided to vessels every day. Second, in order for this effort to be effective, vessel operators must take measures to reduce the risk of a strike from occurring whenever transiting through the calving ground whether sightings are available or not. Third, the information provided to vessels that are outbound from a port in the critical habitat is limited to NAVTEX messages (which provide information every 4 hours). Fourth, the EWS system has not been proven as an effective measure in preventing vessel strikes from smaller, recreational vessels. Measures recommended in the Coast Pilot include minimize travel distance in the critical habitat during the calving season, post lookouts, consult MSR, NAVTEX, NOAA weather radio and Notice to Mariners for whale locations before entering the critical habitat, and during times of reduced visibility a reduced speed will minimize the risk of ship strike. However, both the incidence of interactions of vessels and right whales documented during the 2007 season and the preliminary analysis of the AIS data suggest that mitigation measures are not being taken by all vessel operators.

The collection of data using an AIS receiver allows for a more in-depth assessment of how vessels transit through the habitat. AIS data collected during the 2007 season shows that the majority of commercial vessels recorded are traveling at speeds in excess of 15-18 knots throughout the critical habitat and that ships begin to slow only as they approach entrance buoys. Further analysis is required in order to better understand if ships are making any speed or routing changes as they cross the MSR or critical habitat boundaries or when they receive a sighting in their vicinity. These analyses are presently underway and will be provided in a peer-reviewed paper. The first assessment of these data suggest that commercial shipping may not be making any changes to their operations and thus the effectiveness of the EWS surveys in mitigating commercial vessel strikes may be limited to direct contact via the survey aircraft.

A review of the mortality and injury data maintained by the New England Aquarium show a total of 77 mortalities and 90 serious injuries documented between

1970 and the present (Knowlton and Kraus 2001; NEAq unpublished data). 28 of the 77 (36%) mortalities were the result of ship strikes and 9 (12%) were caused by entanglement. The remainder were either of unknown cause or neonates. Twenty-seven of the 77 (35%) mortalities have occurred in the southeast region from South Carolina to Texas including 6 ship strikes, 1 entanglement, 4 unknown cause, and 16 calves.

Tracking the geographic area of where an injury interaction from vessel strike or entanglement occurred is harder to discern as the animals are still alive and can swim long distances with their injury. Of the 90 injuries (53 entanglement, 36 vessel strike and 1 unknown), 4 entanglement and 8 vessel strikes were initially documented in the Southeast U.S. At least one of the entanglements and 7 of the vessel strikes were known to have occurred in the Southeast region.

These cumulative data and the occurrence of one mortality from a vessel strike this season indicate that despite the educational and near real-time sighting information provided to mariners, vessel strikes remain a serious threat in the region. In addition, the advent of a new gillnet fishery in the calving ground clearly posed an unacceptable risk to this population. The risk to right whales created by moderate to large, fast moving, recreational vessels is also a threat. The potential for recreational vessels to cause harm to right whales is high and has been documented more frequently over the past several years. In addition, the increase in the number of documented recreational vessels in violation of the 500-yard approach rule in the past years is also a growing concern and should be aggressively approached by law enforcement.

In conclusion the implementation of a system that is not based on the ability of a survey team to visually locate, on a daily basis, the location of all right whales is needed in the calving ground to protect right whales from vessel collisions. Aerial surveys should be recognized as a tool for collecting data on the distribution and occurrence of right whales but not as a system that can consistently prevent commercial ship strikes over an extended period of time. The communication of right whale sightings from the EWS surveys to the shipping community has likely reduced the potential for ship strikes through continuing education and increased awareness of mariners as well as proactive measures taken by some organizations and federal agencies to reduce their risk of striking a whale. Yet, it is not an infallible plan to eliminate the potential of ship strikes to right whales in the southeast U.S. The publication of a proposed rule by the National Marine Fisheries Service on June 26, 2006 for speed restrictions of 10 knots or less for vessels 65 feet and greater at specified times and locations along the eastern seaboard (and including the calving ground) is a critical and welcome step towards reducing the level of vessel strikes with right whales. Finalizing this rule expeditiously is paramount. Also, the implementation of the temporary rule closing the SEUS Restricted Area to gillnet after the death of a calf from entanglement in 2006 further added to the protection of right whales in this critical area. The actions taken by NMFS to permanently close the calving ground to gillnet gear are to be commended. The joint efforts by the survey teams, NMFS, Navy, USCG and ACOE to monitor and implement protective measures in this only known calving ground must continue in order to bring this beleaguered population back from the edge of extinction.

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FACSFAC JAX, Naval Air Station Jacksonville went to great lengths to keep the system running efficiently. The U.S. Coast Guard group Mayport and station Brunswick displayed a great willingness to help with the effort as did the U.S. Army Corps of Engineers, South Atlantic Division and the U.S. Navy. On more than one occasion during the 2007 season the cooperation of the St. Johns Bar pilots and the Cumberland Sound pilots and the Brunswick Bar pilots was invaluable. The assistance of Barb Zoodsma of NOAA Fisheries was greatly appreciated through out the course of the season as well Clay George of Georgia Department of Natural Resources and Tom Pitchford of Florida Conservation Commission (FWRI).

The dedicated support from the New England Aquarium's Right Whale Research Team in Boston was a constant help throughout the field season Laura Lane-Cooke Lindsay Hall and Yan Guilbault.

With extreme gratitude we thank the EWS pilots Nate Jorgenson, Ken Pearson, Ron Salmon and Mike Vigus for their dedication and many long hours in the air. Also, Roy Hanan of Eagle Cap Aviation for the use of his aircraft and willingness to accommodate our ongoing effort.

Appendix 1:

IMO Carriage Requirement

The 73rd Session of the International Maritime Organization's (IMO) Maritime Safety Committee decided the following ships will be required to carry AIS equipment:

All ships of 300 gross tonnage and upwards-engaged on international voyages and cargo ships of 500 gross tonnage and upwards not engaged on international voyages and passenger ships irrespective of size shall be fitted with AIS, as follows:

- ships constructed on or after 1 July 2002;
- ships engaged on international voyages constructed before 1 July 2002;
- in the case of passenger ships, not later than 1 July 2003;
- in the case of tankers, not later than the first "safety equipment survey" after 1 July 2003;
- in the case of ships, other than passenger ships and tankers, of 50,000 gross tonnage and upwards, not later than 1 July 2004;
- in the case of ships, other than passenger ships and tankers, of 10,000 gross tonnage and upwards but less than 50,000 gross tonnage, not later than 1 July 2005;
- in the case of ships, other than passenger ships and tankers, of 3,000 gross tonnage and upwards but less than 10,000 gross tonnage, not later than 1 July 2006;
- in the case of ships, other than passenger ships and tankers, of 300 gross tonnage and upwards but less than 3,000 gross tonnage, not later than 1 July 2007; and
- in the case of ships not engaged on international voyages constructed before July 2002.

Source: http://www.navcen.uscg.gov/marcomms/ais.htm

The United States Coast Guard will also require AIS on certain vessels not subject to SOLAS under a forthcoming rulemaking. The pending rulemaking would require all commercial self-propelled vessel 65 feet of greater (including fishing and passenger vessels), towing vessels 26 feet or greater and 600 horsepower, vessel carrying 50 or more passengers or certain dangerous cargoes; dredges and certain high speed passenger craft; operating on U.S. navigable waters (46 CFR 10).

Appendix 2:
Right Whale Sightings
Central EWS 2007

Right Whale No.	EG LETTER	YEAR	MONTH	DAY	TIME	LAT	LONG	AREA	BEHAVIORS
1425	A	2006	12	11	1258	30.47397	81.27815	FL	W/CALF
2007 Calf Of 1425	B								CALF W/MOM
3360	A	2006	12	12	1207	30.49295	81.33935	FL	BODO
	A	2006	12	16	1028	31.31248	81.054	GA	
	A	2006	12	17	0931	30.84942	81.2478	GA	
	B								
	C								
	D								
3541	A	2006	12	18	1016	30.73947	81.39397	GA	ROLL
	A	2006	12	19	1207	30.53158	81.16427	FL	W/YRLG
2006 Calf Of 1611	B								YRLG W/MOM
1705	C	2006	12	19	1432	30.358	81.17993	FL	
1705	D	2006	12	19	1521	30.34008	81.15221	FL	
2430	A	2006	12	23	1133	30.51273	81.40235	FL	W/CALF
2007 Calf Of 2430	B								CALF W/MOM
	C	2006	12	23	1227	30.51333	81.39946	FL	W/CALF UNPH
1710	A	2006	12	24	0913	30.58423	81.41169	FL	NURS, W/CALF
2007 Calf Of 1710	B								CALF W/MOM
1710	C	2006	12	24	1328	30.53982	81.39803	FL	BODO, W/CALF
2007 Calf Of 1710	D								BODO, CALF W/MOM
	E	2006	12	24	1344	30.5476	81.39426	FL	
2430	F	2006	12	24	1440	30.34127	81.18445	FL	W/CALF
2007 Calf Of 2430	G								CALF W/MOM
1705	A	2007	1	2	1107	30.53497	81.07785	FL	
	B								
	C	2007	1	2	1141	30.49815	81.24917	FL	
1710	D	2007	1	2	1338	30.47665	81.39187	FL	BOD CNT, BODO, W/CALF
2007 Calf Of 1710	E								CALF W/ MOM
	F	2007	1	2	1347	30.43674	81.28214	FL	
2601	A	2007	1	3	1128	30.60052	81.4127	FL	W/CALF
2007 Calf Of 2601	B								CALF W/MOM
1710	A	2007	1	5	1259	30.58555	81.42043	FL	W/CALF
2007 Calf Of 1710	B								CALF W/MOM
2601	C	2007	1	5	1617	30.54572	81.42571	FL	W/CALF
2007 Calf Of 2601	D								CALF W/MOM
	E	2007	1	5	1619	30.54998	81.42045	FL	FLIP, LBTL, ROLL, W/CALF UNPH
SE06BK15	F	2007	1	5	1638	30.722	81.28564	GA	
	G								
1710	A								BODO, W/CALF

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Right Whale No.	EG LETTER	YEAR	MONTH	DAY	TIME	LAT	LONG	AREA	BEHAVIORS
2007 Calf Of 1710	B	2007	1	6	1104	30.49667	81.40235	FL	BODO, CALF W/MOM, ROLL, WH BEL, WH CHN
2601	C	2007	1	6	1209	30.7274	81.39063	GA	W/CALF
2007 Calf Of 2601	D								CALF W/MOM
	E	2007	1	6	1300	30.65602	81.3502	FL	BODO
	F	2007	1	6	1623	30.59558	81.17619	FL	NURS, W/YRLG
2006 Calf Of 1817	G								NURS, YRLG W/MOM
1710	A	2007	1	7	1359	30.681	81.07121	FL	W/CALF
2007 Calf Of 1710	B								CALF W/MOM
	C	2007	1	7	1432	30.79995	81.25865	GA	BOD CNT, BODO, W/YRLG
2006 Calf Of 1817	D								BOD CNT, BODO, YRLG
1705	A	2007	1	12	1120	30.51101	81.13332	FL	
	B								
3360	C	2007	1	12	1202	30.48217	81.21838	FL	WH CHN
	D	2007	1	12	1205	30.48207	81.21137	FL	BOD CNT, ENTGL
	E								BLK BEL, BLK CHN, BOD CNT
	F	2007	1	12	1456	30.38263	81.04329	FL	
2642	A	2007	1	13	0926	30.8585	81.07932	GA	W/CALF
2007 Calf Of 2642	B								CALF W/MOM
2645	C	2007	1	13	1027	30.75457	81.36283	GA	BODO, W/CALF
2007 Calf Of 2645	D								CALF W/MOM
	E	2007	1	13	1115	30.67072	81.22781	FL	ENTGL
	F								
	A	2007	1	14	0911	30.84657	81.25408	GA	ENTGL
	B								
2430	C	2007	1	14	1043	30.65722	81.4101	FL	W/CALF
2007 Calf Of 2430	D								CALF W/MOM
	E	2007	1	14	1057	30.61558	81.26997	FL	W/YRLG
2006 Calf Of 1611	F								YRLG W/MOM
2614	G	2007	1	14	1321	30.54853	81.30895	FL	W/CALF
2007 Calf Of 2614	H								CALF W/MOM
2645	I	2007	1	14	1349	30.82453	81.29572	GA	BODO, W/CALF
2007 Calf Of 2645	J								BODO, CALF W/MOM
1705	K	2007	1	14	1532	30.39675	81.2778	FL	
	A	2007	1	15	0921	30.83875	81.38315	GA	BOD CNT
2006 Calf Of 1611	B								BOD CNT
	C	2007	1	15	1101	30.68712	81.23685	FL	
	D								

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Right Whale No.	EG LETTER	YEAR	MONTH	DAY	TIME	LAT	LONG	AREA	BEHAVIORS
1705	E	2007	1	15	1339	30.4827	81.22273	FL	
2145	F	2007	1	15	1408	31.16475	81.20277	GA	BOD CNT
2007 Calf Of 2145	G								
BK01SEUS06	H	2007	1	15	1433	31.14772	81.22529	GA	BODO, ENTGL, TL SLSH
	I	2007	1	15	1645	31.12177	81.13625	GA	BOD CNT
	J								BOD CNT, WH BEL, WH CHN
	A	2007	1	16	1046	30.47848	81.3181	FL	BOD CNT, BODO
	B								
BK01SEUS06	C	2007	1	16	1601	31.25782	81.03288	GA	DSENTGL ATT, ENTGL, W/TELBUOY
	D	2007	1	16	1601	31.26066	81.04238	GA	W/UNPH EG
	A	2007	1	21	1008	30.74627	81.156	GA	RACE
1705	B	2007	1	21	1307	30.52438	81.35409	FL	BODO
1705	A	2007	1	22	0935	30.75879	81.23679	GA	
1810	B	2007	1	22	1201	30.69337	81.33637	FL	BODO, W/CALF
2007 Calf Of 1810	C								BODO, CALF W/MOM
2642	A	2007	1	24	0941	30.79328	81.22595	GA	BOD CNT, BODO, W/CALF, WH CHN
2007 Calf Of 2642	B								BOD CNT, BODO, CALF W/MOM, WH BEL
2642	C	2007	1	24	1118	30.78688	81.24419	GA	BODO, W/CALF
2007 Calf Of 2642	D								BODO, CALF W/MOM
	A	2007	1	25	1056	30.25328	81.3722	FL	CALF, FLTG DEAD, FRST DEAD
	B	2007	1	25	1414	30.74605	81.2428	GA	
2145	A	2007	1	26	1350	30.59202	81.27341	FL	W/CALF
2007 Calf Of 2145	B								CALF W/MOM
	C	2007	1	26	1359	30.59159	81.28052	FL	W/CALF
	D								CALF W/MOM
2006 CALF Of 1611	A	2007	1	27	0908	30.7903	81.44212	GA	
	B								
2614	C	2007	1	27	0918	30.8383	81.3134	GA	W/CALF
2007 Calf Of 2614	D								CALF W/MOM
	E	2007	1	27	0927	30.83288	81.16541	GA	FLIP
3540	F	2007	1	27	1152	30.52047	81.33573	FL	BLK BEL, ROLL
	G	2007	1	27	1238	30.48905	81.26195	FL	BODO
BOF2006CT02	H								BODO, WH CHN
	I	2007	1	27	1444	30.31055	81.21143	FL	ROLL

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Right Whale No.	EG LETTER	YEAR	MONTH	DAY	TIME	LAT	LONG	AREA	BEHAVIORS
2145	J	2007	1	27	1530	30.39465	81.2992	FL	AGG VSL, W/CALF
2007 Calf Of 2145	K								AGG VSL, CALF W/MOM
3540	L	2007	1	27	1719	30.38298	81.30679	FL	
2614	A	2007	1	30	0926	30.83192	81.30008	GA	BODO, W/CALF
2007 Calf Of 2614	B								BODO, CALF W/MOM
2145	C	2007	1	30	1259	30.53855	81.40968	FL	W/CALF
2007 Calf Of 2145	D								CALF W/MOM, LBTL, ROLL
1810	E	2007	1	30	1308	30.52195	81.33343	FL	BOD CNT, W/CALF
2007 Calf Of 1810	F								BOD CNT, CALF W/MOM
1701	G	2007	1	30	1310	30.53647	81.3314	FL	W/CALF
2007 Calf Of 1701	H								CALF W/MOM
1701	A	2007	1	31	1300	30.7247	81.33408	GA	BODO, NURS, W/MOM
2007 Calf Of 1701	B								BODO, CALF W/MOM, NURS
2145	A	2007	2	2	1158	30.68775	81.25162	FL	BODO, W/CALF
2007 Calf Of 2145	B								BODO, CALF W/MOM
3540	C	2007	2	2	1426	30.47707	81.27555	FL	SAG
3420	D								MOPN, SAG, WH CHN
3401	E								SAG
CT15	F								
1701	G	2007	2	2	1516	30.4616	81.33123	FL	BODO, W/CALF
2007 Calf Of 1701	H								BODO, CALF W/MOM
3420	#1	2007	2	2	1601	30.42078	81.27912	FL	BEL/BEL, BOD CNT
3401	I								
	J								
3540	K								
2642	L	2007	2	2	1609	30.40865	81.27559	FL	NURS, W/CALF
2007 Calf Of 2642	M								CALF W/MOM, NURS
	N	2007	2	2	1658	30.28131	81.31247	FL	
1701	A	2007	2	4	1106	30.66262	81.30752	FL	BODO, W/CALF
2007 Calf Of 1701	B								BODO, CALF W/MOM
2614	C	2007	2	4	1344	30.42805	81.371	FL	BOD CNT, W/CALF
2007 Calf Of 2614	D								BOD CNT, CALF W/MOM
	E	2007	2	4	1408	30.41458	81.05905	FL	
3333	A	2007	2	5	1631	30.35635	81.37192	FL	BODO, W/UNPH EG
	B								
	D	2007	2	5	1638	30.35318	81.36324	FL	BODO
	E								

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Right Whale No.	EG LETTER	YEAR	MONTH	DAY	TIME	LAT	LONG	AREA	BEHAVIORS
2746	A	2007	2	6	1407	30.73657	81.19122	GA	NURS, W/CALF
2007 Calf Of 2746	B								CALF W/MOM, NURS
	#1	2007	2	7	1229	30.59995	81.32217	FL	BODO, ROLL
	A								BODO
	B								
3423	C								
	D								
3423	E	2007	2	7	1402	30.62402	81.30404	FL	BODO, W/UNPH EG
3333	F								
1425	A	2007	2	8	0928	30.84115	81.27795	GA	BODO, ROLL, W/CALF
2007 Calf Of 1425	B								BODO, CALF W/MOM, ROLL
3150	C	2007	2	8	1350	30.26677	81.1647	FL	SAG
	D								
SE06BK15	E								
2642	F	2007	2	8	1433	30.32567	81.06782	FL	W/CALF
2007 Calf Of 2642	G								CALF W/MOM
2642	A	2007	2	9	1131	30.52767	81.20957	FL	W/CALF
2007 Calf Of 2642	B								CALF W/MOM, WH BEL, WH CHN
1425	C	2007	2	9	1438	30.55038	81.36173	FL	BODO, W/CALF
2007 Calf Of 1425	D								BLK CHN, BODO, CALF W/MOM
	E	2007	2	9	1450	30.64978	81.38876	FL	BODO
1705	F	2007	2	9	1616	30.85215	81.16367	GA	W/CALF
2007 Calf Of 1705	G								CALF W/MOM
2611	H	2007	2	9	1623	30.87357	81.1395	GA	BOD CNT, W/CALF
2007 Calf Of 2611	I								BOD CNT, CALF W/MOM
1701	A	2007	2	10	1210	30.51975	81.3516	FL	W/CALF
2007 Calf Of 1701	B								CALF W/MOM
2912	C	2007	2	10	1232	30.57913	81.22633	FL	SAG
	D								
2642	E	2007	2	10	1329	30.6129	81.3625	FL	W/CALF, WH CHN
2007 Calf Of 2642	F								CALF W/MOM
3423	A	2007	2	11	1046	30.63697	81.29773	FL	
	B	2007	2	11	1052	30.63449	81.29494	FL	BODO
	C								
3333	D								
	E								
2145	F								W/CALF

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Right Whale No.	EG LETTER	YEAR	MONTH	DAY	TIME	LAT	LONG	AREA	BEHAVIORS
2007 Calf Of 2145	G	2007	2	11	1317	30.55029	81.42832	FL	CALF W/MOM, LBTL, ROLL
2145	H	2007	2	11	1539	30.55383	81.43354	FL	W/CALF
2007 Calf Of 2145	I								CALF W/MOM
	A	2007	2	12	0947	30.33643	80.83653	FL	
	B	2007	2	12	1033	30.40353	81.27975	FL	SAG
3423	C								
	D								
	E								
	#1	2007	2	12	1134	30.39772	81.27164	FL	SAG
	F								
3340	G								
	H								
	I								
3423	J								
SE06BK15	K	2007	2	12	1153	30.42053	81.26575	FL	APPR
3333	L	2007	2	12	1155	30.42162	81.2714	FL	SAG
3401	M								SAG, WH BEL, WH CHN
	N	2007	2	12	1201	30.41633	81.27203	FL	APPR
2430	A	2007	2	14	1058	30.6791	81.13071	FL	BOD CNT, BRCH, CHN BRCH, LBTL, W/CALF, WH BEL
2007 Calf Of 2430	B								CALF W/MOM
	C	2007	2	14	1114	30.74792	81.18958	GA	BRCH, LBTL
	D								
2642	E	2007	2	14	1137	30.7866	81.28826	GA	LBTL, W/CALF
2007 Calf Of 2642	F								CALF W/MOM
	#1	2007	2	15	1230	30.25377	81.21543	FL	SAG
	A								
	B								
CT15	C								
2614	A	2007	2	17	1002	30.78772	81.26704	GA	BOD CNT, W/CALF
2007 Calf Of 2614	B								BOD CNT, CALF W/MOM
1701	A	2007	2	19	1247	30.7911	81.02859	GA	W/CALF
2007 Calf Of 1701	B								CALF W/MOM
	C	2007	2	19	1320	30.74664	81.25315	GA	
	D								W/CALF
2746	E								
2007 Calf Of 2746	F								CALF W/MOM
	#1								

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Right Whale No.	EG LETTER	YEAR	MONTH	DAY	TIME	LAT	LONG	AREA	BEHAVIORS
	A	2007	2	20	0950	30.78382	81.20383	GA	POST
	B								
	C								
	D								
2005 Calf Of 2040	E	2007	2	20	1019	30.77368	81.2114	GA	
	F	2007	2	20	1028	30.7891	81.2097	GA	
	G	2007	2	20	1129	30.71872	81.20351	GA	
	H	2007	2	20	1145	30.68368	81.2059	FL	
	I	2007	2	20	1152	30.69242	81.28529	FL	SAG
CT15	J								
	K								
	L								
1701	M	2007	2	20	1453	30.58918	81.11514	FL	W/CALF
2007 Calf Of 1701	N								CALF W/MOM
1701	A	2007	2	21	1402	30.5263	81.36812	FL	W/CALF
2007 Calf Of 1701	B								CALF W/MOM
	A	2007	2	22	1358	30.43014	81.39788	FL	BODO, FLIP
	B	2007	2	22	1419	30.28935	81.22147	FL	BOD CNT, BODO, W/CALF, WH CHN
	C								BOD CNT, BODO, CALF W/MOM, ROLL
	D	2007	2	22	1525	30.56692	81.17277	FL	
2005 Calf Of 2040	E								
	F	2007	2	22	1537	30.58362	81.13229	FL	
3420	G								
	H	2007	2	22	1734	30.51738	81.30175	FL	BOD CNT, W/CALF
	I								BOD CNT, CALF W/MOM
	A	2007	2	24	0925	30.8327	81.15372	GA	
2005 Calf Of 2040	B								
1701	C	2007	2	24	1217	30.57947	81.28235	FL	W/CALF
2007 Calf Of 1701	D								CALF W/MOM, NURS
1705	E	2007	2	24	1229	30.5577	81.41692	FL	W/CALF
2007 Calf Of 1705	F								CALF W/MOM
	G	2007	2	24	1438	30.47137	81.39332	FL	BODO, ROLL
3421	H								BODO
	I	2007	2	24	1627	30.42145	81.3843	FL	BODO
3460	J								
	#1	2007	2	24	1648	30.40432	81.24935	FL	
	K								
	L								
	M								

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Right Whale No.	EG LETTER	YEAR	MONTH	DAY	TIME	LAT	LONG	AREA	BEHAVIORS
3460	#1	2007	2	25	1029	30.44457	81.31827	FL	BODO
	A								BEL/BEL, BODO
3420	B								BODO
1705	C	2007	2	25	1200	30.73292	81.14615	GA	LBTL, W/CALF
2007 Calf Of 1705	D								CALF W/MOM
1701	A	2007	2	26	1211	30.48485	81.13577	FL	W/CALF
2007 Calf Of 1701	B								CALF W/MOM
	C	2007	2	26	1530	30.5448	81.43105	FL	BODO
2642	A	2007	2	27	0949	30.34815	81.25325	FL	W/CALF, WH CHN
2007 Calf Of 2642	B								CALF W/MOM
2430	C	2007	2	27	1046	30.37012	81.35992	FL	BOD CNT, BODO, W/CALF
2007 Calf Of 2430	D								BLK BEL, BOD CNT, BODO, CALF W/MOM
1701	E	2007	2	27	1135	30.53507	81.39598	FL	W/CALF
2007 Calf Of 1701	F								CALF W/MOM
	G	2007	2	27	1135	30.52035	81.40632	FL	BODO
2430	H	2007	2	27	1434	30.40665	81.3321	FL	BOD CNT, W/CALF
2007 Calf Of 2430	I								BOD CNT, CALF W/MOM
	A	2007	2	28	1030	30.43443	81.13642	FL	
	B	2007	2	28	1138	30.5149	81.18664	FL	
2642	C	2007	2	28	1204	30.61175	81.10117	FL	BEL/BEL, W/CALF, WH BEL, WH CHN
2007 Calf Of 2642	D								BEL/BEL, CALF W/MOM, WH BEL, WH CHN
	A	2007	3	3	1037	30.82585	81.3858	GA	W/CALF
	B								CALF W/MOM
	C	2007	3	3	1213	30.66595	81.0118	FL	APPR
	D	2007	3	3	1223	30.65345	81.01392	FL	SAG
CT15	E								
3421	F								
	G								
	A	2007	3	5	1443	30.50118	81.03896	FL	BOD CNT, W/CALF
	B								BOD CNT, CALF W/MOM
	A	2007	3	7	0924	30.82028	81.35915	GA	BODO, NURS, W/CALF
	B								BODO, CALF W/MOM, NURS
	C	2007	3	7	1018	30.80273	81.2985	GA	
	D								

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Right Whale No.	EG LETTER	YEAR	MONTH	DAY	TIME	LAT	LONG	AREA	BEHAVIORS
CT15	E	2007	3	7	1454	30.3599	81.20714	FL	BEL/BEL, BOD CNT, SAG
3421	F								BOD CNT, SAG
	G								BEL/BEL, SAG, WH BEL
2746	A	2007	3	8	1010	30.78318	81.39787	GA	W/CALF, WH CHN
2007 Calf Of 2746	B								CALF W/MOM, WH BEL, WH CHN
	C	2007	3	8	1024	30.7518	81.13661	GA	
1701	D	2007	3	8	1206	30.52742	81.30867	FL	BOD CNT, NURS, W/CALF
2007 Calf Of 1701	E								BOD CNT, CALF W/MOM, NURS
1701	F	2007	3	8	1400	30.41893	81.24878	FL	AGG VSL, BOD CNT, ROLL, W/CALF
2007 Calf Of 1701	G								AGG VSL, BOD CNT, CALF W/MOM
	H	2007	3	8	1452	30.61683	81.02112	FL	W/UNPH EG
	A	2007	3	10	1104	30.80149	81.39567	GA	
3360	B	2007	3	10	1120	30.69784	81.17931	FL	BOD CNT, W/CALF
2007 Calf Of 3360	C								BLK BEL, BLK CHN, BOD CNT, CALF W/MOM, ROLL
	D	2007	3	10	1207	30.59159	81.41299	FL	SAG
3540	E								
SE06BK15	F								
3460	G	2007	3	10	1214	30.59822	81.40609	FL	SAG
	H								
2746	I	2007	3	10	1234	30.61233	81.17045	FL	NURS, W/CALF
2007 Calf Of 2746	J								CALF W/MOM, NURS
	K	2007	3	10	1321	30.5765	81.23862	FL	SAG
SE07BK21	L								
SE07BK22	M								
	N	2007	3	10	1346	30.5887	81.4176	FL	
SE06BK15	O	2007	3	10	1347	30.58885	81.41538	FL	BODO
	P								
3540	Q	2007	3	10	1352	30.57532	81.42345	FL	BODO
3466	A	2007	3	11	1314	30.6645	81.07857	FL	
	B								
	C								
	D	2007	3	11	1335	30.65155	81.36321	FL	
	E	2007	3	11	1341	30.66796	81.35661	FL	

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Right Whale No.	EG LETTER	YEAR	MONTH	DAY	TIME	LAT	LONG	AREA	BEHAVIORS
	F	2007	3	11	1449	30.50002	81.15229	FL	BEL/BEL, SAG
	G								
	H								SAG
CT45	I	2007	3	11	1531	30.50363	81.37268	FL	BODO
	J								
3460	K	2007	3	11	1554	30.5049	81.3747	FL	
	L	2007	3	11	1714	30.43873	81.15848	FL	BODO, SAG, W/UNPH EG
	N								
1705	O	2007	3	11	1740	30.41129	81.18987	FL	NURS, W/CALF
	P								CALF W/MOM, NURS
2145	A	2007	3	12	1124	30.84083	81.27427	GA	W/CALF
2007 Calf Of 2145	B								CALF W/MOM
	C	2007	3	12	1204	30.73867	81.31676	GA	BODO, BRCH, FLIP, LBTL
1705	D	2007	3	12	1334	30.57158	81.13653	FL	BOD CNT, W/CALF
2007 Calf Of 1705	E								BOD CNT, CALF W/MOM
3460	F	2007	3	12	1446	30.52607	81.31528	FL	BODO
3540	G								
	H								
	I								
2614	A	2007	3	13	1034	30.84417	81.17347	GA	W/CALF
2007 Calf Of 2614	B								CALF W/MOM
	#1	2007	3	13	1152	30.67617	81.23938	FL	
	C								BOD CNT
BK33	D								
BK27	E								BEL/BEL
	F								BOD CNT
	G								WH CHN
	H								BOD CNT
SE07BK22	I	2007	3	13	1211	30.69053	81.24675	FL	
1705	J	2007	3	13	1226	30.63605	81.17149	FL	NURS, W/CALF
2007 Calf Of 1705	K								CALF W/MOM, NURS
	A	2007	3	14	0937	30.88417	81.2504	GA	LBTL
	B	2007	3	14	0951	30.89872	81.2198	GA	BLK BEL, BOD CNT, BODO, MALE
	C								BOD CNT, BODO
	D	2007	3	14	1410	30.4304	81.1098	FL	
SE07BK21	E								
	F								
	A	2007	3	19	1132	30.41112	81.18772	FL	SAG
	B								

Appendix 2:
Right Whale Sightings
Central EWS 2007

Right Whale No.	EG LETTER	YEAR	MONTH	DAY	TIME	LAT	LONG	AREA	BEHAVIORS
SE07BK21	C	2007	3	19	1142	30.40195	81.17832	FL	SAG
	D								
	E								
	F								
	G								
	H								
	I								
BK33	A	2007	3	20	1128	30.59171	81.20464	FL	
SE07BK21	B								
	C								
	D								
BK27	E								POST
	F	2007	3	20	1136	30.59805	81.20798	FL	
	G								
	H								
	I								
1701	A	2007	3	21	1041	30.71295	81.38323	GA	W/CALF
2007 Calf Of 1701	B								CALF W/MOM
	#1	2007	3	21	1332	30.79275	81.24499	GA	SAG
	C								
	D								
BK27	E								
	F								
	G								
	H								
	I	2007	3	21	1346	30.80112	81.23618	GA	
	J								
	K								
1701	L	2007	3	21	1427	30.65637	81.38298	FL	W/CALF
2007 Calf Of 1701	M								CALF W/MOM
3360	A	2007	3	29	1044	31.26163	81.06155	GA	W/CALF
2007 Calf Of 3360	B								CALF W/MOM

mother with calf (W/CALF), calf with mother (CALF W/MOM), last years mother with their calf that is now a yearling (W/YRLG), calf from last year still with its mother (YRLG W/MOM) with apparent nursing (NURS), belly to belly contact (BEL/BEL), body contact not belly to belly (BOD CNT), breach (BRCH), lobtail (LBTL), rolling (ROLL), associated with Bottlenose Dolphins (BODO), entangled (ENTGL), SAG (surface active, group), head lift (HDLFT), underwater exhalation (UWEXH), floating dead (FLTG DEAD), with unphotographed right whale (W/UNPH EG), with unphotographed calf (W/UNPH CALF), bubbles observed (BUBLS), approacher to a SAG (APPR), Flipper Slapping (FLIP), racing dive (RACE), entangled (ENTGL), posturing (POST), white belly (WH BEL), white chin (WH CHN), black belly (BLK BELL), white belly (WH BEL), aggressive vessel approach (AGG VSL)