CENTRAL EARLY WARNING SYSTEM

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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September 15, 2010 to:

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NOAA Fisheries
2382 Sadler Road
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Contract Number: WC133F-06-CN-0022

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INTRODUCTION

Approximately 400-450 North Atlantic right whales *(Eubalaena glacialis*) remain in the world, despite international protection since 1935 and federal protection since 1970 (Pettis, 2009). Failure of North Atlantic right whales 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 88 known right whale mortalities documented from 1970 through August 2010, at least 29 (33%) were due to collisions with vessels (confirmed and probable strikes) and 11 (13%) were due to entanglements (Knowlton and Kraus, 2001; Waring *et al.*, 2009; New England Aquarium unpublished data). Furthermore, an assessment of the subset of 67 right whales between 1970 and May 2005 that were able to be necropsied to determine cause of death indicated that 49% died from blunt and sharp trauma from vessel collisions (n=19) (Moore *et al.*, 2007). In addition, serious injuries caused by human activity in some cases can lead to the animal's demise (Knowlton and Kraus, 2001). A recent analysis of the 25 year right whale database (1980-2004) indicates a median population growth rate of about 1% (Pace *et al.*, 2007) which is likely due to an increase in calf numbers since 2001. Yet, the authors also note that the population has "almost no capacity to absorb additional mortality, and growth would benefit greatly if mortalities from ship strikes and entanglements were reduced."

Waters adjacent to the southeastern United States, concentrated along coastal Georgia (GA) and the east coast of Florida (FL) support the only known calving area for this small population, and were designated a critical habitat in 1994 under the Endangered Species Act (59 FR 28793). The majority of calving events are believed to occur off of the coastal waters of northern FL, and southern GA, supported by initial sightings of newborn calves in these regions. However, calving may occasionally occur outside of this critical habitat, based on a small number of mothers seen with very young calves at their first sighting of the season beyond these boundaries (Patrician *et al.*, 2009). Pregnant female right whales typically arrive in the southeastern U.S (SEUS) area beginning in December to give birth and depart the habitat by late February to mid March to head for the feeding grounds off the Northeastern U.S. (NEUS). On rare occasions sightings of right whales have been documented in the calving area outside of this timeframe, as early as September and as late as July.

Vessel traffic within the SEUS calving ground is considerable. Three major shipping channels transect the right whale high density area between Brunswick, GA and St. Augustine, FL. These channels serve three commercial shipping ports and two military bases. The Brunswick channel, at the northern end of the critical habitat extends eight nautical miles (nmi) (14.6 kilometers (km)) offshore and serves the port of Brunswick, GA. The channel centered in the area at the GA/FL border is the St. Marys River Entrance channel, which runs 14 nmi (25.9 km) offshore and serves the Kings Bay Naval Submarine Base, as well as the port of Fernandina Beach, FL. The southern-most channel is the St. Johns River Entrance channel, which runs four nmi (7.28 km) offshore

and serves the port of Jacksonville, FL (Jaxport) and Mayport Naval Base. This is by far the busiest channel in the area with various forms of large vessel traffic, including container ships, automobile carriers, tankers, break bulk freighters, tug and tows and cruise ships as well as U.S. Coast Guard (USCG) and U.S. Navy (USN) vessels. Jaxport is the twelfth busiest container port and second busiest vehicle handling port in the U.S. (Jaxport 2009 Annual Report). Commercial vessel traffic in this federally designated critical habitat has increased substantially since the 1950's (Knowlton, 1997). Port expansions and diversions of military traffic to local bases closed elsewhere augment this trend. In addition, local commercial fishing, charter and recreational vessels increase traffic in the area dramatically.

Shipping channels in the calving area are dredged to maintain required depth. The St. Marys River Entrance channel is dredged annually and the St. Johns River Entrance channel nearly annually. Hopper dredging in the Atlantic SEUS 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 throughout a 24-hour period. Consequently, dredging activities substantially increase the vessel traffic in the vicinity of channels and within the calving area.

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 USN, U.S. Army Corps of Engineers (USACE) and USCG; port authorities and harbor pilots. These groups use the sighting information in their efforts to avoid collisions between ships and right whales.

From 1994 to 2002, EWS surveys provided near-daily aerial monitoring of the core right whale calving area from 10 nmi (18.5 km) north of Brunswick, GA to 10 nmi (18.5 km) south of Jacksonville, FL and from shore east to approximately 20nmi (37 km) offshore. Importantly, this area included the three shipping channels within it. These surveys were flown by New England Aquarium (NEA).

Since December 2002, the EWS surveys have been configured to include three survey areas flown by different aerial survey teams: the northern EWS (NEWS) survey area flown by Wildlife Trust, GA (WTGA), the central EWS (CEWS) survey area flown by NEA, and the southern EWS (SEWS) survey area flown by Florida Fish and Wildlife Conservation Commission's Fish and Wildlife Research Institute (FWC). The NEWS surveys include the area from Sapelo Sound at the northern boundary to northern Cumberland Island, GA at the southern boundary [from 31° 32.0'N to 30° 53.0'N, and approximately 30 nmi offshore]. The SEWS surveys include the area from Ponte Vedra Beach in the north to 7 nmi (13 km) south of St Augustine Beach, FL at the southern boundary [from 30° 14.0'N to 29° 47.0'N, and 25 to 30 nmi offshore]. The CEWS surveys include the area from Cumberland Island, GA at the northern boundary, to Jacksonville Beach, FL in the south [from 30° 50.0'N to 30° 17.0'N, and approximately

30 to 35 nmi offshore]. The CEWS area includes entrances to the Port of Fernandina Beach (St. Marys River Entrance) and the Port of Jacksonville (St. Johns River Entrance), flown by the NEA under contract number WC133F-06-CN-0022 (Figure 1).

This report describes the results of effort data gathered by the NEA aerial survey team during the 2009-2010 season (01 December 2009 – 31 March 2010), subsequently referred to as the 2010 season. Furthermore, reproductive life histories of 2010 season cows are provided using cow calf sighting data from various entities, in order to provide the most accurate conclusions. For the purpose of this report, when referring to the "SEUS region", this is inclusive of the NEWS, CEWS and SEWS areas (see *Abbreviations* and *Definitions of Terms* at end of report).

The USACE, USCG and USN provided funding for CEWS surveys. Other support is provided by the National Oceanic and Atmospheric Administration's National Marine Fisheries Service (NOAA Fisheries Service).

METHODS

Aerial Surveys

The CEWS 2010 calving season occurred from December 01, 2009 through March 31, 2010. Over this timeframe, CEWS surveys could be flown daily, weather permitting. The CEWS survey area extended from the southern end of Cumberland Island, GA, approximately 6.5 nmi (12 km) north of the St. Marys River entrance (30° 50.0'N), to Jacksonville, FL, approximately 6.5 nmi (12 km) south of the St. Johns River entrance (30° 17.0'N), from the shoreline to 30 to 35 nmi (54.8-63.9 km) offshore. Twelve east/west transect lines were flown perpendicular to the coast at 3 nmi (5.5 km) intervals with a western limit of 0.5 nmi (0.9 km) from the shoreline (Figure 1). A total of 406 trackline nmi (761 km) were flown during each complete survey. Survey effort is defined as nmi flown on trackline, and does not include distances flown when aircraft is flying cross legs, transiting or circling.

In addition to the CEWS survey area, when an aircraft of an adjacent EWS survey (NEWS or SEWS) was unable to fly for a period of time due to maintenance, 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 (two-plane contingency) or two (one-plane contingency) of the EWS survey aircrafts (Figure 2). The two-plane contingency survey covers 30 transect lines shared between two aircrafts, covering an area extending from 31°26.0'N, approximately 23 nmi (42.6 km) north of the Brunswick-Bar channel sea-buoy, south to 29°59.0'N, approximately 25 nmi (46.3 km) south of St Johns sea-buoy. Redirected surveys for the NEA team during the two-plane contingency survey covered either the northern or southern section of this area, flying up to sixteen east/west transect lines perpendicular to the coast at three nmi (5.5 km) intervals from 0.5 nmi (0.9 km) off the shoreline out to 18 - 29 nmi (33.3-53.7 km) from the shore. The northern section covers 377 trackline nmi (698 km) and the southern section covers 399 trackline nmi (739 km). On two days, the southern section of the two-plane contingency survey was extended six nmi (11 km) to the south covering an additional two transect lines due to an increase in right whale sightings further south than in previous years. This modified survey covered an area from 30°38.0N to 29°53N, a total of 449 trackline nmi (831.5 km). In 2010, the NEA survey team was never required to perform a one-plane contingency survey.

Necessary conditions for all survey flights included a minimum cloud cover ceiling of 1000 feet (305 meters (m)), visibility greater than three nmi (5.5 km) and winds 17 knots or less. Surveys were conducted in a 14 CFR Part 135 certified twin engine Cessna 337 Skymaster. The aircraft was equipped with Global Positioning System (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 Emergency Position Indicating Radio Beacon (EPIRB), aircraft mounted 406MHz Emergency Locator Transmitter (ELT) and satellite phone.

Since the advent of the 2004 calving season, survey aircraft and crew for EWS surveys have all been certified under 14 CFR, Part 135 (aircraft less than 10 seats). In addition, pilots and observers undergo intense pre-season training that includes emergency-egress. Pilots also attend Federal Aviation Administration (FAA) Part 135 ground school and must pass all associated check rides. Since 2004, 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.

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), SIC, and two observers positioned on each side of the aircraft in the rear seats. Each observer was individually equipped with a Nomex ® flight suit, FAA approved survival vest, signal mirror, whistle, strobe light, emergency thermal blanket, rescue streamer, combo-edge knife and Personal Locator Beacon (PLB) with GPS. Observers scanned the water surface out to at least two nmi (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.

A sighting event is defined in this report as an event at which the aircraft deviated from the trackline and a whale or group of whales was circled until they were positively identified to species level. A single sighting event can be of a single whale or a group of associated whales. All right whale sightings were recorded into a digital voice recorder and entered into a computerized logging program, Logger 2000. Logger 2000 was created by International Fund for Animal Welfare (IFAW) and designed for compatibility with the Right Whale Consortium database, which is curated by the University of Rhode Island (URI). During surveys, Logger 2000 downloaded, at 10-second intervals; time, position (latitude and longitude), 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, observers manually entered information on Beaufort sea state, visibility, cloud cover, weather, and altitude at periodic intervals. Other marine species sightings logged during flights were large whales (humpback, pilot whales etc.), *Stenella* dolphin species, leatherback turtles and sharks. These species were opportunistically logged due to requests by researchers, but the aircraft did not break from the trackline to confirm species identification unless a sighting was suspected to be a right whale.

Positions were recorded for all commercial (excluding commercial fishing vessels) and military vessels, and for any other vessels that were visually estimated to be 100 ft (30.5 m) or greater in length. In addition, AIS-derived data on dynamic locations

and static vessel information were collected for all vessels required to carry an AIS transponder.

When an observer sighted a right whale, she would cue the pilots in to the relative distance and bearing from the aircraft. The pilot would then break from the trackline at a right angle to the sighting and fly directly over the whale(s) to obtain an exact overhead GPS location. The aircraft then circled the whale(s), allowing observers to obtain photographic documentation of the individuals sighted. Data recorded for each sighting included; date, time, behavior, association composition, image numbers, initial and final positions of whale(s), right whale letter for the day and photographer. The camera's digital metadata time was synchronized to the GPS, computer-logging program (Logger 2000) and digital voice recorder at the start of each survey for accuracy. After completing photographic documentation of each sighting, the aircraft returned to the trackline 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 Service.

Results provided in this report for survey effort are for NEA aerial surveys exclusively, including contingency surveys. When reporting on reproductive life histories, mortality, entanglement and injury events, sighting data from other survey teams have been referenced in order to provide a more comprehensive background to the assessment of NEA sighting events. Photographic data from EWS aerial survey teams has been submitted to NARWC and continues to be processed by NEA as curators of the photo identification catalog. Results provided in this report for whales' demographics in the CEWS calving grounds are based on preliminary matches and figures are likely to change slightly as data processing is completed.

Notification of Sightings to Agencies

Prior to the 2010 season, the EWS survey area was subdivided into geographic sighting "bins" (Figure 3). Email distribution lists were developed for each geographic bin to notify local, state, federal, non-profit and commercial marine interests of right whale sightings via sighting alerts. Sighting bins enabled users to receive only sighting alerts that pertained to their area of interest. Sighting alerts were brief, standardized messages that included date, time, latitude and longitude, group composition (i.e., how many adults and calves), and direction of movement. In the subject line, the whale(s) position was indicated as a relative bearing and distance to the nearest sea-buoy, as requested by the harbor pilots in order to make corresponding navigational alterations more efficient and timely. Because alerts were brief, users were allowed the option of receiving messages via email, pager or cellular telephone texting service.

During the EWS season, sightings of right whales were reported directly, via satellite phone, from the survey aircraft to the NEA ground contact, who disseminated the sighting information within 10 minutes of receiving it. Transfer of sighting information

is described in this report as the EWS Network, and involves alert notifications by various means, such as email, text, or phone call, from various sources depending on sighting circumstances, and the subsequent broadcasts. Typically observers in the survey aircraft sighted a whale(s) and relayed the information to the ground contact to distribute, but other scenarios occurred, such as public sightings (OTHER) relayed to the NEA ground contact via FWC, and transferred to the aerial team for sighting verification. Once a sighting was verified, documented and reported to the ground contact, this near real-time data was immediately emailed to the appropriate EWS distribution list of end users. The initial sighting on any survey day within the EWS area triggers a general Broadcast Notice to Mariners, transmitted over VHF marine-band radio by the USCG, which occurs every hour. Additionally, if right whales were spotted from the shoreline east to the longitude of 080º 51.6'W with the southern and northern boundaries at latitudes 30º 00.0'N and 31º 27.0'N, respectively, the survey team ground contact was responsible for entering the right whale sighting information into the Mandatory Ship Reporting System (MSRS) via an internet data entry portal. Consequently, ships reporting into the MSRS were aware of the most recent right whale sighting locations. Sighting information consisted of date, time, latitude and longitude, and remained in the MSRS for a period of 24 hours.

Survey coordination to verify right whale sightings reported by the public was contingent on sighting information, reliability of the report, time lapse and current flight plan. Standard protocol was to relocate public sightings and confirm details when feasible.

When groups of associated whales were within one nmi (1.85 km) of another group of whales, sightings were combined into one whale alert notification. Resights of the same animals were not sent out as whale alerts when whale(s) had not travelled more than one nmi (1.85 km) from their original, reported position and there had not been a time lag greater than one hour. However, all resights were reported to the survey team's ground contact, and positions were updated in the MSRS.

Maps were developed using geographic information system (GIS) software (ArcGIS 9.3) to display comprehensive charts of right whales sighted within five nmi (9.3 km) of channel entrances during a three-day survey period. These were distributed via email to harbor pilots at the ports of Fernandina Beach (Cumberland Sound Pilots) and Jacksonville (St Johns Bar Pilots), USCG officers, Navy representatives and the NOAA Fisheries Service Southeast Right Whale Recovery Coordinator.

Photographic Identification

For each sighting during routine survey flights, observers attempted to photograph individual right whale callosity patterns, scars and other markings. The time spent on-site was directly correlated to the survey team's ability to make an accurate species identification and obtain photographic documentation of the event. More time was spent on-site during vessel/whale interaction events, or occasions that caused concern for the welfare of the whale(s), such as whales in a shipping channel. Management of survey time was contingent upon limitations set by inclement weather forecasts and daylight hours available. In instances when a whale was observed but could not be photographed, sightings were sent out as whale alerts and entered into MSRS, but individual identification is unknown.

High-resolution digital images were obtained at an altitude of 1000 ft (305 m) using a Nikon digital D300 camera with a fixed Nikkor 300mm lens, and 1.4x teleconverter to increase original focal length by 40%. 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*. (1986). The ability of scientists to identify individuals allowed for accurate reporting of numbers of whales within the survey habitat, and prevented over-representing whales that were re-sighted within a single survey. Throughout the 2010 season, representative digital images of each right whale considered to be a new individual for the season, were emailed to personnel at the NEA office in Boston, Massachusetts (MA) for preliminary identification. The NEA curates the North Atlantic Right Whale Catalog (the Catalog). Identifications were shared with the NEA survey team, other EWS survey teams, and the NOAA Fisheries Service Southeast Right Whale Recovery Coordinator. This allowed for a comprehensive, up-to-date tally of the number of mother/calf (M/C) pairs during the season. Matching of non-M/C pairs was also initiated during the season. Photographs of all individuals were downloaded at the end of the day to look for entanglements and other injuries.

Sighting Distance

The distance that whales were sighted from the plane for each right whale sighting event was determined post season. 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. Sighting distances were calculated by using the following calculation according to Pythagorean Theorem:

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 (nmi)

Distances were calculated for sighting events that occurred while the aircraft was on a designated survey point (trackline, cross leg or in transit). Due to data recording limitations, not all sightings from designated survey points were included due to the inability to consistently obtain an accurate position when the aircraft deviated from survey point, while maintaining a visual fix on the whale(s). Sighting distances from sighting events where the survey team was forewarned of whale(s)' presence were not recorded, as effort was disproportionately allocated to the area prior to sighting the whale(s).

Demographics

A preliminary analysis of the sex and age composition of the 2010 wintering population of right whales in the survey area was conducted using data from the existing catalog of identified right whales from the western North Atlantic. Right whales with known ages (because they were identified in their calving year) were classified as; calves (born in the 2010 season), yearlings (2009 season calves), juveniles (1-8 yrs) or adults ($\geq$9 yrs). Whales of unknown age were classified as unknown age until their ninth year from initial sighting, in which they become classified as an adult. All calving females were classified as adults regardless of age. The sex (if known) of cataloged right whales was previously 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 Reproductive Rates

Reproductive female right whales (cows) in this population have been monitored since 1980, and records of calf production are documented in the Catalog (Kraus *et al*., 2007). Data collected on cows observed with calves during the 2010 survey period were used to update information for the population on calving intervals, rates of reproduction, time frame and area of calving, and is summarized in this report.

Associations and Behaviors

During a sighting event, photographs were obtained of right whales, and visible associations and behaviors were recorded with as much detail as possible.

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

- Surface Active Group (SAG)
- M/C or Mother/Yearling pair
- Other – pairs, associated group not in a SAG
- Not associated - Singleton

All 105 standardized behaviors that right whales are often engaged in are defined in the Data Photographic Submission to the North Atlantic Right Whale Identification Database (http://www.rightwhaleweb.org/papers.php?mc=3). These behaviors were recorded when observed during aerial surveys. Photographers attempted to capture photographic evidence of behaviors for confirmation.

A whale or group of whales, were also given a direction of travel if whale(s) appeared to be traveling at a moderate speed, and / or if it was determined that the whale(s) had traveled a significant distance while the survey team was on site.

Vessel Sightings

Ship traffic densities were plotted from AIS data, and the aerial survey team recorded vessels not carrying AIS transponders manually in order to compare vessel density with right whale sightings.

Commercial and military vessels, cruise ships, and large recreational vessels visually estimated to be greater than 100 ft (30.5 m) in length were recorded into Logger 2000. Certain types of small commercial vessels (estimated to be less than 100 ft) were also recorded, including tugs, pilot boats and dredge crew and survey vessels. The aircraft's position (latitude and longitude) along the transect was recorded when perpendicular to vessels. Data collected for each vessel recorded included; type of vessel, time sighted, vessel's heading, relative bearing and distance from the aircraft.

A vessel/whale interaction was defined as an event when the survey team visually determined that a vessel was on a course that could result in the vessel and whale(s) being less than one nmi (1.9 km) apart. When a vessel/whale interaction was observed, radio communication between survey team and vessel was attempted in order to prevent collision or mitigate an interaction. A positive response was a response from the vessel operator after aerial team observers attempted to make contact by hailing on VHF radio, and a negative response is when no response was obtained. In cases where no contact was made with vessel operators, and when a potential collision was perceived, the observer would make a general situation broadcast on VHF Channel 16. General broadcasts would consist of some or all of the information as follows; "Attention to all incoming / outgoing traffic to the St Johns Channel. Several groups of endangered North Atlantic right whales have been sighted in the vicinity of the approach to the St Johns Channel. Please use caution when transiting through the area, and post a lookout when possible. It is recommended that vessels travel 10 kts or less when traveling through areas where right whales are active. Please be advised that it is a violation of state and federal law to approach a right whale closer than 500 yards"

Vessel/whale interaction scenarios varied widely and included vessels remaining clear of whale(s) at a distance greater than one nmi (1.9 km) or vessels approaching whale(s) within 500 yards (457.2 m). Interactions when the observed vessel comes within 500 yards (457.2 m) at the closest distance to the whale(s), are defined in this report as "close approaches". When interaction events occurred, the survey team recorded detailed information about the situation prior to, during, and following the point of closest distance between vessel and whale(s). Data collected prior, during and post interaction included: type of vessel, vessel's position and course, whale's position, behavior and heading, whale's reaction (if any), vessel's actions (course change or speed change), radio communication (if any) between aerial team and vessel operator. Relative initial, closest and final positions of vessel(s) and whale(s) were obtained whenever possible. Photo documentation and video footage were also obtained when appropriate. All vessel/whale interaction events, regardless of vessel type (commercial, military, recreational or fishing) and size, were recorded in a separate database (Access 2000) and reported at the conclusion of the survey to NOAA Fisheries Service within 24 hours of

occurrence. In addition, all reported interaction events were compiled and forwarded to FWC at the end of the season for inclusion in the vessel/whale interaction database.

Automatic Identification System (AIS)

To obtain AIS[1] information, the survey plane was equipped with an AIS receiver. Data from all commercial vessel traffic transmitting from AIS transponders were automatically recorded into a separate database during EWS surveys. Data were collected using a Sealinks, Shine Micro RadarPlus SL161R dual channel AIS receiver. Data from the AIS receiver were downloaded directly to the onboard laptop into Shipplotter, software by Centro de Observação Astronómica no Algarve (COAA). Data were then translated into a more manageable database using Siitech software, which interprets data received from Shipplotter.

AIS data were collected during survey flights only and covered an area extending from Charleston, SC to Jacksonville, FL. Information was used to calculate average traffic speeds and densities for all AIS-derived track data. Compliance analyses for speed and recommended route use, were performed for cargo / tanker vessels that were east of the eastern edge of the precautionary circle surrounding an entrance buoy. Vessels west of this point were excluded in order to discount vessels that traveled beyond boundaries after reaching the entrance buoy (i.e. heading to anchorage outside of port entrances).

[1] For information on AIS, visit http://www.navcen.uscg.gov/?pageName=AIS

EWS RESULTS

Survey Effort

The NEA aerial survey team was on-site for 121 days (01 December 2009 - 31 March 2010) during the 2010 right whale calving season; however, surveys were only able to be conducted on 69 days (57% of available days, Table 1) due to inclement weather. Of the 69 surveys conducted, 33 were complete and 36 were partial surveys[2] (Table 2). Included in the 69 survey days are 12 days when the NEA team was redirected to fly contingency surveys. Ten of these surveys covered the northern section of a two-plane contingency survey area and two were southern two-plane contingency surveys (Table 2).

A total of 380.8 hours were spent surveying 22,560 nmi (41,782 km) of tracklines during 69 survey days, and 46% of total transect nmi available were flown during the 2010 season (Table 1). Total nmi available was based on flying 100% trackline nmi of each planned survey for all 121 days on-site.

Effort varied spatially and temporally within the season (Figure 4). More trackline miles were covered in March and January (6,857 and 6,599 nmi, respectively) than in February and December (4,537 and 4,567 nmi, respectively) (Figure 7).

Surveys were conducted in varying environmental conditions (Tables 1 to 3). Of the total trackline mileage flown during the 2010 season, 86% was flown in favorable conditions of a Beaufort sea state (SS) three or less and visibility of at least three nmi (5.6 km). When a partial survey was conducted, effort priority was given to the shipping channels and tracklines immediately to the north and south of channel entrances (St. Johns, St. Mary's or Brunswick Channel depending on survey area).

Sightings and Photographic Identification

All right whale sightings from NEA aerial surveys during the 2010 season were plotted and displayed by group size and association type, including the 12 days of contingency surveys (Figure 5). Sightings were plotted by month to illustrate temporal distribution within the season (Figure 6). All sightings of right whales are detailed in Appendix 1 with the date, time, location, association and behavior type (where applicable) for each whale. Also included are unconfirmed catalog identification numbers and intermatch / season codes when known. The majority of this data is preliminary, pending complete photo-matching, processing and confirmation.

The NEA survey had 205 sighting events, comprised of 441 right whales, including calves (not all unique individuals) during the 2010 EWS season (Figure 5). Of the 19 females (as of September 2010) known to have given birth in the 2010 season, 14 of

[2] A survey is defined as complete when at least 90% of trackline mileage is surveyed, and partial when less than 90% is surveyed.

them were documented with their calves by the NEA aerial survey team, and five of those were additionally sighted prior to calving.

The first right whale sighting documented by NEA in the 2010 season occurred on 08 December 2009, during a northern two-plane contingency flight, the NEA aerial survey team's third survey of the season. The number of sightings per day ranged from zero (n=15) to 15 separate sighting events on 09 March, 2010 (34 individual whales). Sightings continued throughout the season with the last right whale sighted in the CEWS on 26 March 2010. The average number of sightings for the 2010 season was 3 per survey flight, and averaging 6 whales per survey (ranging from two to 34). Number of whales and sightings per unit nmi of effort were highest between 06 to 10 March, 2010 (42 sightings of 97 whales and 1,570 nmi flown) and lowest between 01 to 05 December, 2009 (zero sightings and 514 nmi flown). The most sightings were recorded in January (71 sightings of 134 whales) and the most whales were seen in March (69 sightings of 166 whales). The highest proportion of singletons occurred in January (39%), and the highest proportion of SAGs were sighted in March (37%). However, the most sightings per unit effort (SPUE, in nautical miles surveyed) occurred in February, 2010 (0.01168), over four times higher than in December, 2009 (0.00263). Another peak in SPUE (Figure 11) between 14 to 18 February, 2010 was due to a moderate number of sightings (n=14) despite low survey effort (554 nmi), although number of whales per unit effort (Figure 10) during this time does not show the same peak since sightings were predominantly singletons (50%) (Figure 8 and 9). For most of December's survey effort, sightings and total numbers of whales were relatively low.

Of the 205 NEA survey sighting events, 187 sightings of 385 right whales were reported to the EWS network directly from the NEA survey team, distributed in 153 CEWS whale alerts by the ground contact. One CEWS whale alert referred to an entangled humpback whale (*Megaptera novaeangliae*) that was disseminated in error, making 154 total CEWS whale alerts distributed for the 2010 season. Thirty-four reported sightings were combined with one or more other sighting(s) since groups were within one nmi (1.85 km) of each other. Eighteen sighting events were not disseminated since they were duplicate sightings of animals observed within the same day.

Six of the 205 sighting events, and 19 of the total 441 whales sighted were not photo-documented. This was due to time constraints, equipment malfunction, difficult whale behavior or inability to relocate whale(s) following initial sighting. Six of the 19 un-photographed whales were associated with other whales that were documented. However, all un-photographed whales were represented in whale alert notifications.

Sighting Distances

The aerial survey team was occasionally made aware of sightings from external OTHER sources. In these circumstances, when the survey aircraft arrived at the position provided, the team remained in the area for a pre-determined period in order to locate the whale(s). Examples include instances when the survey team was notified of a whale via a public report and transited to the site specifically, or if subsequent whale sightings were seen at a distance when circling on an original sighting. In these cases, sighting distance data have not been added to summary calculations as the sighting cue was biased by the extended period in the vicinity of the sighting.

Of the 205 total sightings from the NEA survey team during the 2010 season, there were 120 (59%) right whale sighting events for which sighting distances are calculable, and these are tallied by 1/10 nmi increments in Figure 12. The mean sighting distance for the 2010 season, without considering SS conditions as a factor, is 1.34 nmi (2.48 km). Most sightings were made at distances between 1 and 1.9 nmi (45%), and 39% were sighted at 0.1 to 0.9 nmi from the aircraft, with 16% sighted at distances between 2 and 4.9 nmi. A summary of sighting distances by SS is shown in Figure 13. The mean sighting distance during times of SS 3 or less, was 1.35 nmi (2.5 km), and 1.29 nmi (2.3 km) during times of SS 4 or greater, although the number of sightings was reduced considerably (n =107 for SS $\leq$ 3 and 13 for SS$\geq$ 4) (Table 3). There was six times the amount of effort (nmi) dedicated to flying in favorable conditions of SS 3 or less, and SPUE analysis showed that there were 5.5 sightings per 1,000 nmi of survey effort in SS$\leq$3, compared to 4.2 sightings per 1,000 nmi of survey effort flown in SS$\geq$4.

Demographics

The matching and confirming process for identification of right whales sighted by the NEA survey team in the 2010 season is currently being processed, and all data analysis provided in this report is preliminary until final confirmation is complete. Data represented in Figures 14 and 15 describe sightings obtained from NEA aerial surveys only.

In 2010, the survey area covered by the NEA team was utilized by a high number of whales without Catalog Numbers, thought to be juveniles. The preliminary count of whales documented during the 2010 season by the NEA aerial survey team in the EWS area of responsibility are; 14 M/C pairs, 84 cataloged individuals (non M/C pairs) and 28 intermatch / season code whales (probable juveniles) for a minimum total of 140 right whales (126 adults/juveniles plus 14 calves).

Figure 14 displays the demographic structure for all preliminary matched, non-calf right whales sighted by the NEA aerial survey team. Juveniles were the age class most highly represented in the SEUS, composing 52% (including yearlings) of total whales preliminarily matched, whereas adults formed 34% of the observed population.

The dominant sex of the adult population sighted, were males (44%), which represented almost five times the portion of females without calves (9%). Eighteen adult females were observed by the NEA aerial survey team, 14 of which were verified to be pregnant or 2010 season mothers. Males form the largest portion of juveniles (48%), over twice as abundant as juvenile females (22%) (Figure 14).

Calving Intervals and Reproductive Rates

Table 4 describes names, Catalog Numbers and reproductive life histories for all 19 of the 2010 season cows, and includes moms that were not sighted by the NEA survey team. Data includes calving intervals, number of calves born over reproductive lifespan, and age (when known) or minimum age. One whale, Catalog Number 2460 (Monarch) and her calf were not sighted in the EWS area (only by the WTSC aerial survey team off of South Carolina) but have been included in the total counts for M/C pairs in order to assess calving intervals for all reproductive cows during the 2010 calving season (n=19).

Four right whales calved for the first known time in 2010 – three of the four were nine years of age, and one was known to be over eight years old (exact age is unknown). It is assumed that one of these first-time mothers (Catalog Number 3260) lost her calf during the 2010 season due to subsequent sightings of the mother without her calf.

Calving intervals ranged from two to five years with a mean of 3.3 years for all cows with multiple calvings (n=15). One of the 15 cows with multiple calvings had a two-year calving interval (Catalog Number 3180, Dragon), whose 2008 calf disappeared shortly after birth and is assumed to have died. Ten of the 15 cows with multiple calvings, had calving intervals of 3 years.

The cow with the most calves born over her known reproductive lifespan for this group of calving females was Catalog Number 1145 (Grand Teton), who gave birth to her 7th known calf. Grand Teton is the oldest mother of the 2010 season, at least 30 years old. Three females bore their fifth known calf this year (Catalog Number 1241, 1620 and 1701). The average age of 2010 season moms, considering known and minimum ages, is 15.8 years old (n=19).

Associations

Of the 205 total right whale sighting events documented by the NEA aerial survey team throughout the 2010 season, 74 were of single whales (including 19 pregnant female sightings), 55 of M/C pairs, 45 sightings were groups of whales associated in a SAG and 31 were “others”, i.e. associated whales not in a SAG. No feeding associations were observed. Appendix 1 describes each association type observed during all right whale sighting events observed by the NEA team. Percentage analysis of association types for all sightings by the NEA team during the 2010 season is provided in Figure 15.

The first sighting in the CEWS during the 2010 season was a SAG of two two-year olds on 09 December 2009. The temporal occurrence of SAGs sighted by the NEA survey team peaked in early March, with the highest number sighted on 09 March 2010 (n=6) and a total of 17 SAGs during the month. Low numbers of SAGs were sighted in December (n=5) and February (n=9) and a moderate number in January (n=12). Sightings of singletons (including pregnant females) were also low in December (n=3), peaking in January (n=29) and dropping marginally for February (n=24) and March (n=18). Of the five known 2010 mothers that were sighted by the NEA survey team prior to calving, one sighting was in December (Catalog Number 1701, Aphrodite), 12 sightings of four individuals were in January (Catalog Numbers 2710, 3260, 2614 and 3360) and six sightings of two individuals were in February (Catalog Numbers 3260 and 2614). No known pregnant females were sighted by the NEA aerial survey team in March.

The first M/C pair sighted in the CEWS, Catalog Number 3142 and calf were sighted by the NEA aerial survey team on 22 December 2009. Prior to this the only singleton sighted in the CEWS was a pregnant female, Aphrodite sighted on 15 December 2009. Also on 22 December, 2009 two M/C pairs were sighted by WTGA (Catalog Number 1241, Bugs and 1701, Aphrodite). The latest dates for first 2010 sightings of M/C pairs, were Catalog Numbers 2360 (Derecha) and 3360, both sighted on 20 March 2010 by University of North Carolina Wilmington (UNCW)/Duke and FWC respectively. The number of M/C pairs sighted by NEA peaked in the latter half of March (16-31 March 2010 n=15).

Vessel Sightings

Analyses of AIS data provided information on ship densities and ship speeds throughout the Seasonal Management Area (SMA), including changes in speed upon entering MSRS. Density distribution and average speeds of all AIS-derived tracks of commercial shipping traffic are plotted in Figures 16-19. Figure 16 represents the density of ship traffic as the total number of kilometers of ship transits per square km over the course of the season. The density distribution of AIS-derived tracks of cargo and tanker ships is represented in Figure 17. Figure 18 represents average vessel speed of all commercial shipping traffic (including tugs, dredges and some pilot boats). Figures 16 and 18 represent 534 unique vessels throughout the season, and 2,570 transits separated by date. Figures 17 and 19 represent 314 unique tanker / cargo vessels recorded throughout the season, and 830 vessel transits separated by date. Figure 20 displays plots for vessel traffic that is not required to carry AIS and was observed during surveys, recorded abeam of the survey aircraft (plot does not include the track or speed of the vessel). Two hundred and thirty-five unique vessels are represented in Figure 20.

There were 215 tanker / cargo vessel transits within the SMA that were east of the parameters circling the channel entrance buoys. Of these, 164 vessels (76%) remained for the entire channel approach / departure within recommended route boundaries, 30 vessels

(14%) spent the entire length of time outside of the recommended routes, and 21 vessels (10%) were both inside and outside of the recommended routes at some point during the transit. The number of vessel tracks within the SMA that were traveling over 10.9 kts was 32 (15%). Six of these vessels were also outside of the recommended routes at some point during their transit through the SMA.

Vessel/Whale Interactions

During the 2010 season the NEA survey aircraft documented 14 vessel/whale interaction events involving 20 vessels and 36 whales (Table 5). The 20 vessels involved consisted of 13 recreational vessels, two US Navy frigates, two commercial shrimp trawlers, two C-tractor naval vessel escorts and one USCG cutter. The NEA survey team was able to make positive contact in six of the 20 attempts at communication with vessels involved in interaction events. On 14 occasions, radio hails were attempted with no response from target vessels. Negative contact incidents involved ten recreational motor vessels, one USCG cutter, one US Navy frigate and one commercial shrimp trawler. Fifteen of the 20 vessels involved were estimated to have approached within 500 yards of right whales.

Mortalities and Injuries

Mortalities and injuries that either occurred or were first documented during the 2010 season are summarized in Table 6. Cases are broken down into three sections; entanglements, injuries and additional mortality. Event descriptions represent compiled data contributed from various research entities when relevant, and reference is credited in the following text.

Entanglements:

During the 2010 season, the CEWS survey team documented one entangled right whale and one entangled humpback whale.

On 09 March 2010 the NEA aerial survey team sighted a SAG of three whales, one of which was entangled whale, Catalog Number 3346 (Kingfisher). Entangling gear remains wrapped around the right flipper since a disentanglement response in 2004 which was able to remove multiple body wraps. This ongoing entanglement case was documented and reported although an on-water response was not launched since this entanglement case is listed as “document and monitor” by the Atlantic Large Whale Disentanglement Network.

On 09 December 2009 the NEA aerial team sighted a severely entangled humpback whale (Figure 21). The gear wrapped around both flippers, with a small buoy on each side, forward of the flippers. The trailing line terminated just aft of the fluke tips, and there was a cluster of three buoys parallel to the peduncle. An on-water response was not possible due to sea conditions. Based on the nature of entanglement, this whale has been tentatively matched by PCCS to a humpback sighted off the coast of Spanish Wells, Bahamas on 26 December 2009. The whale was successfully disentangled by recreational boaters that discovered the humpback in poor condition with patchy skin, low energy levels, covered in cyamids (Genus Cyamus) and in close proximity to a beach. The subsequent fate of this animal following its disentanglement is unknown.

Injuries:

The NEA aerial survey team documented two right whales that had visible injuries first observed in the 2010 season; Catalog Number 3745 and the 2009 Calf of Catalog Number 3290.

Catalog Number 3745 was first sighted by WTGA aerial survey team on 15 December 2009 off the coast of Georgia in a SAG of six individuals, with two series of propeller wounds on its left flank. The NEA aerial survey team obtained further photo documentation of this animal during six different sighting events between 22 December 2009 and 09 March 2010 (Figures 22 and 23). The 2009 Calf of Catalog Number 3290 was initially sighted by WTSC on 28 January 2010 off of coastal Georgia, with an apparently fresh mid-dorsal linear wound with a pink center. The NEA aerial survey team subsequently sighted this whale (Figure 24) the next day during a northern two-plane contingency survey approximately 33.2 nmi (61.5 km) northeast of Brunswick, GA.

Additional Mortalities:

There was one assumed mortality during the 2010 season, although no carcasses were discovered. The NEA aerial survey team sighted Catalog Number 3260 (Skittle) twice on 23 February 2010, once alone and four hours later in a paired association. The following day, she was sighted with a calf. When the NEA aerial survey team observed Skittle for the first time with her calf on 24 February 2010, she was making continuous, tight circles, thrashing her fluke on the surface of the water and raising her calf to the surface, supported on her back. The next sighting of Skittle was on 01 March 2010 when she was observed in a SAG without her calf. She has been sighted several times since then confirming that she is no longer associated with her calf. Although no carcass was retrieved that could be attributed to this calf's mortality, the 2010 calf of Skittle is assumed to have died.

TABLES AND FIGURES

Table 1. NEA Aerial Survey Effort (including contingency surveys)

Number of Available Survey Days	Percent of Available Survey Days Flown	Percent of Surveys Flown to Full	Percent of Surveys Partially Flown	Total Available Transect Miles (nmi)	Transect Miles Flown (nmi)/	Percent of Available Transect Miles Flown	Transect Miles Flown in Beaufort <4	Percent of Total Flown in Beaufort < 4
121	**57%**	**47.8%**	**52.2%**	**48,920**	**22,560.23**	**46.1%**	**19,474.4**	**86.3%**

Table 2. NEA Aerial Contingency Survey Effort

Type of Contingency Survey	Number of Surveys Flown	Number of Full Surveys	Number of Partial Surveys	Total Transect Miles Flown	Transect Miles Flown in Beaufort < 4	Percent of Total Flown in Beaufort < 4
Central EWS	57	25	32	18,525.16	15,587.28	84 %
Northern 2-plane	10	7	3	3,188.27	3,040.32	95.4 %
Southern 2-plane	2	1	1	846.8	846.8	100 %

Table 3. NEA Aerial Survey Right Whale Sighting Frequency

	Beaufort < 4	Beaufort > 3
Total Transect Miles Flown (nmi)	19,474.4	3,085.83
Number of Right Whale Sighting Events with Calculable Sighting Distances	107	13
Sighting Events with Calculable Sighting Distances per nmi of Effort	0.00549	0.00421
Total Number of Right Whale Sighting Events	180	25

Table 4. Reproductive Life Histories for 2010 Season Cows

Moms		Age / Min Age	Last Calving	Number of Calves (including 2010 calf)	Calving Interval
Catalog Number	**Name**				
1145	**Grand Teton**	>29	2005	7	5
1241**	**Bugs**	28	2005	5	5
1620**	**Mantis**	>24	2007	5	3
1701	**Aphrodite**	23	2007	5	3
1950		>21	2006	4	4
2360**	**Derecha**	>17	2007	3	3
2430	**Minus One**	16	2007	2	3
2460*	**Monarch**	>16	2007	3	3
2605	**Smoke**	14	2007	2	3
2614		14	2007	3	3
2642		14	2007	2	3
2645	**Insignia**	14	2007	3	3
2710		13	2006	2	4
3123		9	N/A	1	N/A
3142		9	N/A	1	N/A
3157**		9	N/A	1	N/A
3180***	**Dragon**	9	2008	2	2
3260****	**Skittle**	>8	N/A	1	N/A
3360		>7	2007	2	3

***** Not sighted in EWS, only sighted by WTSC

****** Not sighted by NEA aerial survey team but seen within EWS area

******* 2 year interval – 2008 calf disappeared during calving season

**** Calf assumed dead during the 2010 season

Table 5. NEA Aerial Survey Vessel/Whale Interactions

Date	Latitude and Longitude of whale(s)		Origin or Destination of Vessel (Visual / AIS)	Number of Whales and Compo-sition	Vessel Type and Size (feet)	Communication	Closest Distance (estimate / AIS / flyover data point)	Vessel's Action / Whale(s) Reaction
12/22/2009	30.58846	-81.15112	Approx 14 nmi offshore of Fernandina beach heading NNW	2 Mother calf pair	1 of 1 Approx 22 - 26 ft. Recreational Sport Fishing Vessel, twin outboard engine.	Observer attempted to hail four times on VHF Ch 16 with negative response.	Approx 20 yards	0.5 nmi SSE of whales heading NNW, cleared to the east. The wake of the boat went over the whales. No change in whales' behavior
1/12/2010	30.2961	-81.22912	Mayport, FL Approx 5 nmi southeast of St John's Channel entrance, southbound, performing maneuvres	1 Pregnant female singleton	1 of 2 453 ft US Navy Guided Missile Frigate	Initially whale was not in immediate risk of collision, but hails were attempted due to close proximity to whale, and warships' typically observed continuous manoeuvers. Multiple hails attempted on VHF Ch 16 to both C-tractor and warship for approx 60 mins, negative response. Ground contact phoned FACSFACJAX who attempted to hail warship, also with negative response.	Approx 300 yards	1 nmi NE of whale, heading south, altered course to SSW. Whale changed heading from east to west, vessels cleared to the east. Vessels altered course to NNW and cleared whale to the east. Vessel observed over several periods within 80 mins, between resuming survey and returning back on site due to vessels' continuous altered course.
	30.2961	-81.22912	Mayport, FL Approx 5 nmi southeast of St John's Channel entrance, southbound, performing maneuvres		2 of 2 100 ft US Navy escort C-tractor		Approx 300 yards	

Date	Latitude and Longitude of whale(s)		Origin or Destination of Vessel (Visual / AIS)	Number of Whales and Compo-sition	Vessel Type and Size (feet)	Communication	Closest Distance (estimate / AIS / flyover data point)	Vessel's Action / Whale(s) Reaction
1/18/2010	30.714	-81.37596	Outbound Fernandina Beach, FL	1 Singleton	1 of 3 Approx 26 ft Recreational motor boat	One attempted hail on VHF Ch 16 with negative response. While awaiting a response, vessel cleared the whale.	Approx 50 yards	1.5 nmi WSW of whale, outbound of St Mary's Channel, cleared whale to the south.
			Fernandina Beach, FL		2 of 3 Approx 70 ft Commercial Shrimp Trawler - believed to be turtle trawler working in conjunction with dredge	Positive contact on initial hail on VHF Ch 16, switched to Ch 10. Capt was made aware of whale's relative position to channel marker and indicated on Ch 10 that he would continue to monitor whale's position. He later assisted in coordination with additional vessel.	Approx 60 yards	Approx 1 nmi west of whale, nets down in channel throughout interaction. Cleared whale to the south. Whale continued on general NE heading throughout interaction, no behavior change.
			Outbound Fernandina Beach, FL		3 of 3 Approx 70 ft Commercial Shrimp Trawler	Two attempted hails on VHF Ch 16, negative response.	Approx 100 yards	2 nmi WSW of whale, outbound of channel, cleared whale to the south
1/19/2010	30.29415	-81.22477	Approx 10 nmi east of Jax beach, northbound.	2 Pair	1 of 1 Approx 21 ft Recreational motor boat	Two attempted hails on VHF Ch 16, negative response.	Approx 50 yards	0.25 nmi south of whales heading north, cleared whales to the east, and continued north. No change in whales' behavior.

Date	Latitude and Longitude of whale(s)		Origin or Destination of Vessel (Visual / AIS)	Number of Whales and Compo-sition	Vessel Type and Size (feet)	Communication	Closest Distance (estimate / AIS / flyover data point)	Vessel's Action / Whale(s) Reaction
1/29/2010	31.07816	-81.29235	Inbound Brunswick, GA	2 Juvenile pair	1 of 1 Approx 60 ft Coast Guard Cutter	One attempted hail on VHF Ch 16 with negative response. While awaiting a response, vessel cleared the whale.	Approx 300 yards	1 nmi SW heading NNE, reduced speed on approach to channel, cleared whales to west. No change in whales' behavior.
2/20/2010	30.14509	-80.18488	Approx 10 nmi northeast of St Augustine, heading southwest	6 Surface Active Group	1 of 1 Approx 25 ft Recreational fishing vessel, single outboard engine.	Three attempts to hail were made on VHF Ch 16 with negative response, general broadcast made over Ch 16 advising vessel of whales' relative position and 500 yard rule. Final attempt to hail was made using vessel's name, negative attempt.	Approx 100 yards	2 nmi NE of whales, heading SW, reduced speed to a stop within 200 yards of whales for 15 minutes, manoeuvered between northern-most pair in SAG and middle pair. When vessel was 150 yards to the east of the whales, speed increased and continued SW heading. No change in whales' behavior.

Date	Latitude and Longitude of whale(s)		Origin or Destination of Vessel (Visual / AIS)	Number of Whales and Compo-sition	Vessel Type and Size (feet)	Communication	Closest Distance (estimate / AIS / flyover data point)	Vessel's Action / Whale(s) Reaction
2/20/2010	29.89355	-81.05078	Approx 17 nmi northeast of St Augustine, heading northwest	1 Singleton	1 of 2 Approx 42 ft Recreational motor boat, twin outboard engine	Two attempted hails on VHF Ch 16, negative response.	Approx 0.5 nmi	2 nmi NE of whale heading SW, cleared to the north. Whale stopped lobtailing during and after interaction.
			Approx 17 nmi northeast of St Augustine, heading northwest		2 of 2 Approx 20 - 25 ft sport fishing vessel, twin outboard engine.	Two attempted hails on VHF Ch 16, negative response.	Approx 0.5 nmi	2 nmi NE of whale heading SW, cleared to the north. Whale stopped lobtailing during and after interaction.
2/21/2010	30.46048	-81.30075	Inbound St John's Channel, FL	9 Loosely associated	1 of 1 Approx 21 ft Recreational motor boat, single outboard engine.	Two attempted hails on VHF Ch 16, negative response.	Approx 200 yards	Offshore, heading SW to St Johns River entrance, whales were north of the sea buoy but heading south towards channel, cleared whales to SE, vessel reduced speed within 200 y of whales. Group of 9 whales were loosely associated, splitting and re-forming associations throughout.

Date	Latitude and Longitude of whale(s)		Origin or Destination of Vessel (Visual / AIS)	Number of Whales and Compo-sition	Vessel Type and Size (feet)	Communication	Closest Distance (estimate / AIS / flyover data point)	Vessel's Action / Whale(s) Reaction
3/5/2010	30.39553	-81.3436	Inbound Mayport, FL	2 Mother calf pair	1 of 3 453 ft US Navy Guided Missile Frigate	Positive contact on initial hail on VHF Ch 16, switched to Ch 10, then Ch 68. C-tractor operator informed observers that warship operators were monitoring Ch 12 for updates on whales' positions.	Approx 0.5 nmi	1.5 nmi SE of whales, cleared to the west. Warship and C-tractor reduced speed when informed of whales' position, C-tractor coordinated with warship in order to avoid whales on approach to channel. No change in whales' behavior.
			Outbound Mayport, FL		2 of 3 100 ft US Navy escort C-tractor	Positive contact on initial hail on VHF Ch 16, switched to 12.	Approx 0.5 nmi	
			Outbound St John's Channel, FL		3 of 3 Approx 40 ft Recreational motor boat, inboard engine.	Five attempted hails on VHF Ch 16, negative contact. General broadcast made on Ch 16 advising vessel of whales' relative position and 500 yard rule.	Approx 100 yards	2 nmi west of whales, outbound of St John's Channel heading east, cleared to the north. No change in whales' behavior.
3/9/2010	30.48818	-81.15276	Inbound St John's Channel, FL	1 Singleton	1 of 1 Approx 25 ft Recreational motor boat, single outboard engine.	Two attempted hails on VHF Ch 16, negative response. General broadcast made on Ch 16 advising vessel of whales' relative position and 500 yard rule.	Approx 100 yards	1 nmi ENE of whale, heading WSW, final position 1 nmi WSW of whale. No change in whale's behavior.

Date	Latitude and Longitude of whale(s)		Origin or Destination of Vessel (Visual / AIS)	Number of Whales and Compo-sition	Vessel Type and Size (feet)	Communication	Closest Distance (estimate / AIS / flyover data point)	Vessel's Action / Whale(s) Reaction
3/9/2010	30.3836	-81.1861	Inbound St John's Channel, FL	4 Surface Active Group	1 of 1 Approx 20 ft Recreational motor boat, single outboard engine	Two attempted hails on VHF Ch 16, negative response. General broadcast made on Ch 16 advising vessel of whales' relative position and 500 yard rule.	Approx 100 yards	3 nmi east of whales, heading west, reduced speed , maneouvered around whales, final position 1 nmi west of whales. No change in whales' behavior.
3/9/2010	30.3901	-81.15012	Inbound St John's Channel, FL	1 Singleton	1 of 1 Approx 20 ft Recreational motor boat	Positive contact after second hail, vessel slowed, observer stated 500 y rule, vessel, manoeuvered around whales and continued heading west.	Approx 50 yards	3 nmi east of whales, heading west, reduced speed , maneouvered around whales, final position 1 nmi west of whales. No change in whales' behavior.
3/9/2010	30.37974	-81.12808	Inbound St John's Channel, FL	2 Pair	1 of 1 Approx 18 ft Recreational motor boat, single outboard engine.	Positive contact after second hail, vessel slowed, observer stated 500 y rule, vessel, manoeuvered around whales and continued heading west.	Approx 50 yards	3 nmi east of whales, heading west, reduced speed , maneouvered around whales, final position 1 nmi west of whales. No change in whales' behavior.

Date	Latitude and Longitude of whale(s)		Origin or Destination of Vessel (Visual / AIS)	Number of Whales and Compo-sition	Vessel Type and Size (feet)	Communication	Closest Distance (estimate / AIS / flyover data point)	Vessel's Action / Whale(s) Reaction
3/9/2010	30.39745	-81.09719	Inbound St John's Channel, FL	2 Pair	1 of 1 Approx 30 ft Recreational motor boat, double outboard engine.	Positive contact after initial hail, vessel did not change speed, manoeuvered around whales and continued heading west.	Approx 50 yards	2 nmi east of whales, heading west, reduced speed , maneouvered around whales, final position 1 nmi west of whales. No change in whales' behavior.

Table 6. Entanglement, Injury and Additional Mortality

Entanglement

Date	Event	Fatal	Right Whale ID	Sex	Age	Notes
11-Jan-10	SEUS 2010 season sighting of previously known entanglement case	Unk	#3346	M	7	Known previous entanglement case Sighted 09-Mar-10 by NEA aerial survey team

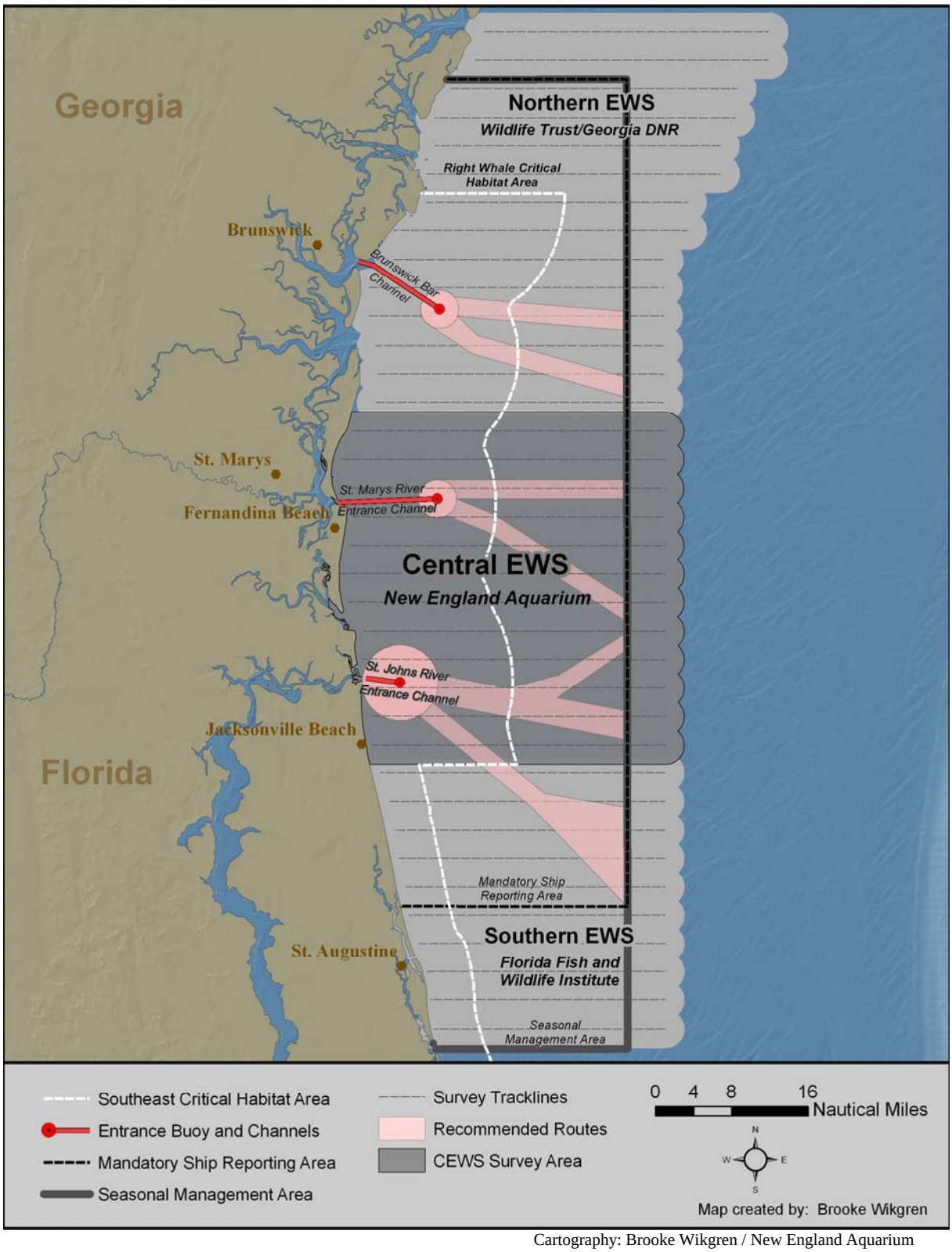
Injury

Date	Event	Fatal	Right Whale ID	Sex	Age	Notes
15-Dec-09	First documentation of two propeller wounds on left flank	No	#3745	M	3	First sighted injured by WTGA aerial survey team in a 6 whale SAG. Wounds appeared to be serious (>8cm deep), at least 2 wks old Subsequently documented six times by NEA aerial survey team.
28-Jan-10	First documentation of linear dorsal wound	No	2009 Calf of #3290	U	1	First sighted injured by WTSC aerial survey team. Wound looked fresh but not serious (<8cm deep). Subsequently documented by NEA aerial survey team on 29-Jan-10.

Additional Mortality

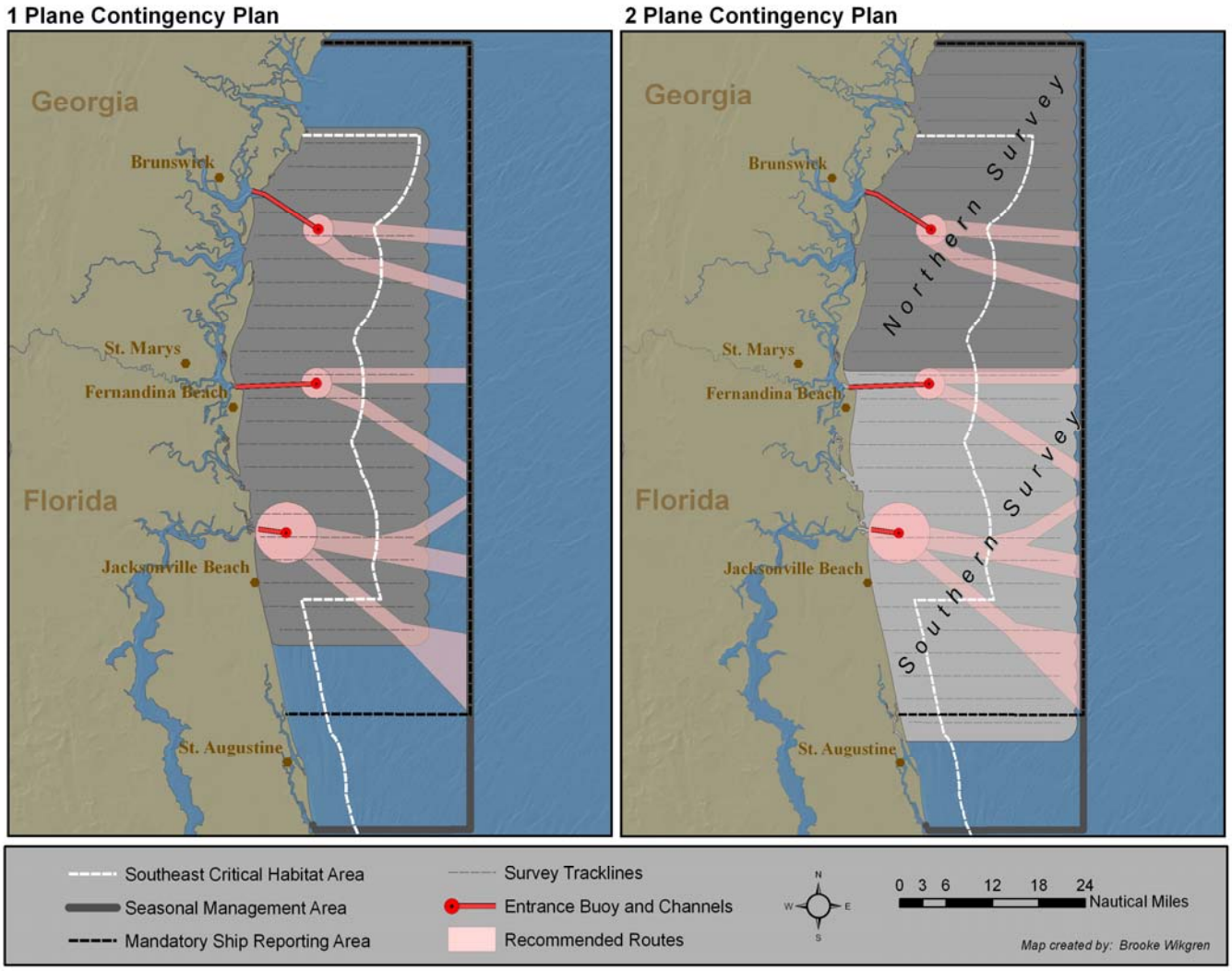
Date	Event	Fatal	Right Whale ID	Sex	Age	Notes
01-Mar-10	First documentation of #3260 without calf	Yes	2010 Calf of #3260	Unk	Calf	Lost calf between 24-Feb-10 and 01-Mar-10. Only one documented sighting of calf, by NEA aerial survey team. First time without calf, in a SAG, documented by NEA aerial survey team No carcass discovered

Figure 1. CEWS Survey Area



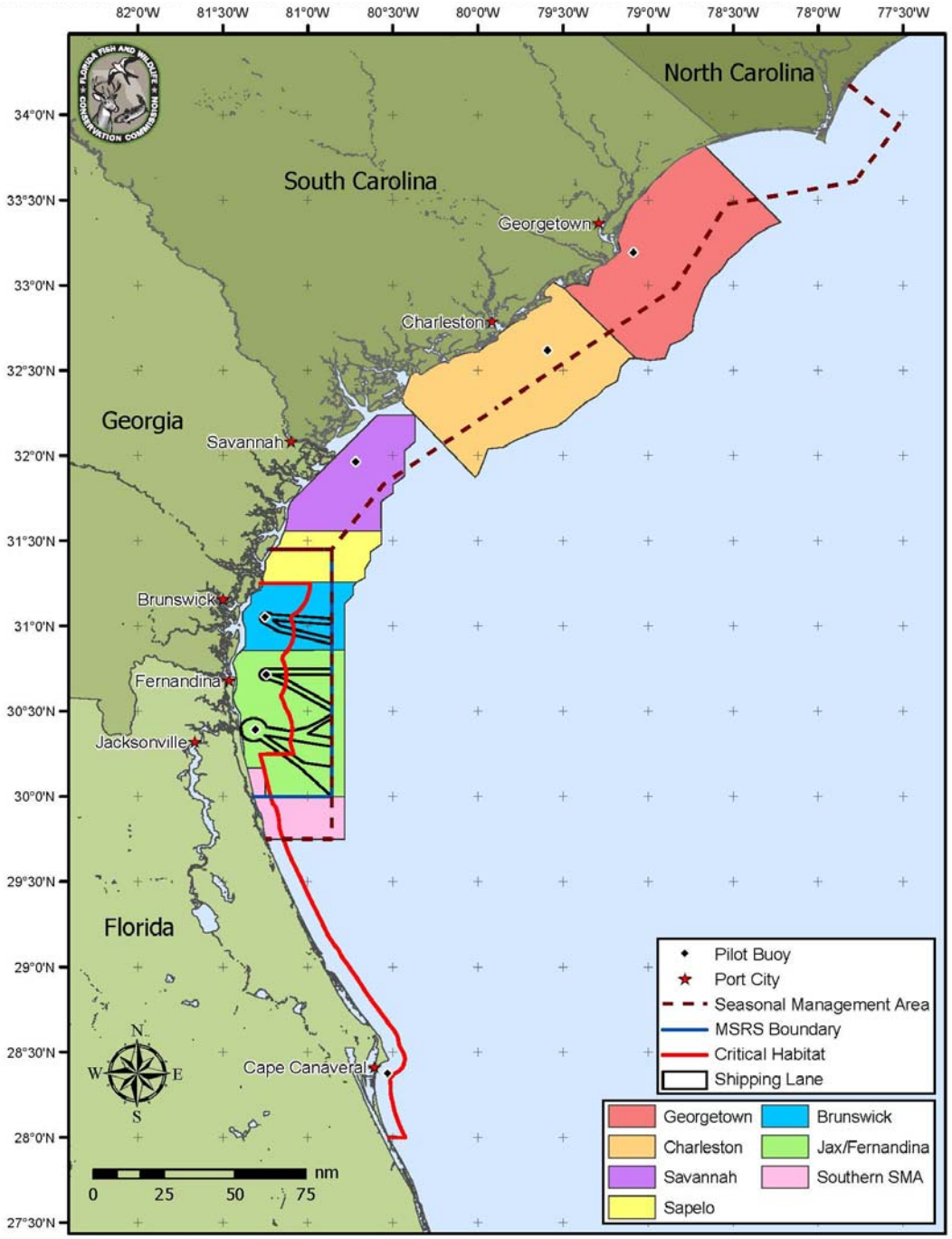
Cartography: Brooke Wikgren / New England Aquarium
Projected in Universe Transverse Mercator, Zone 17, using North American Datum 1983.

Figure 2. CEWS Contingency Survey Areas



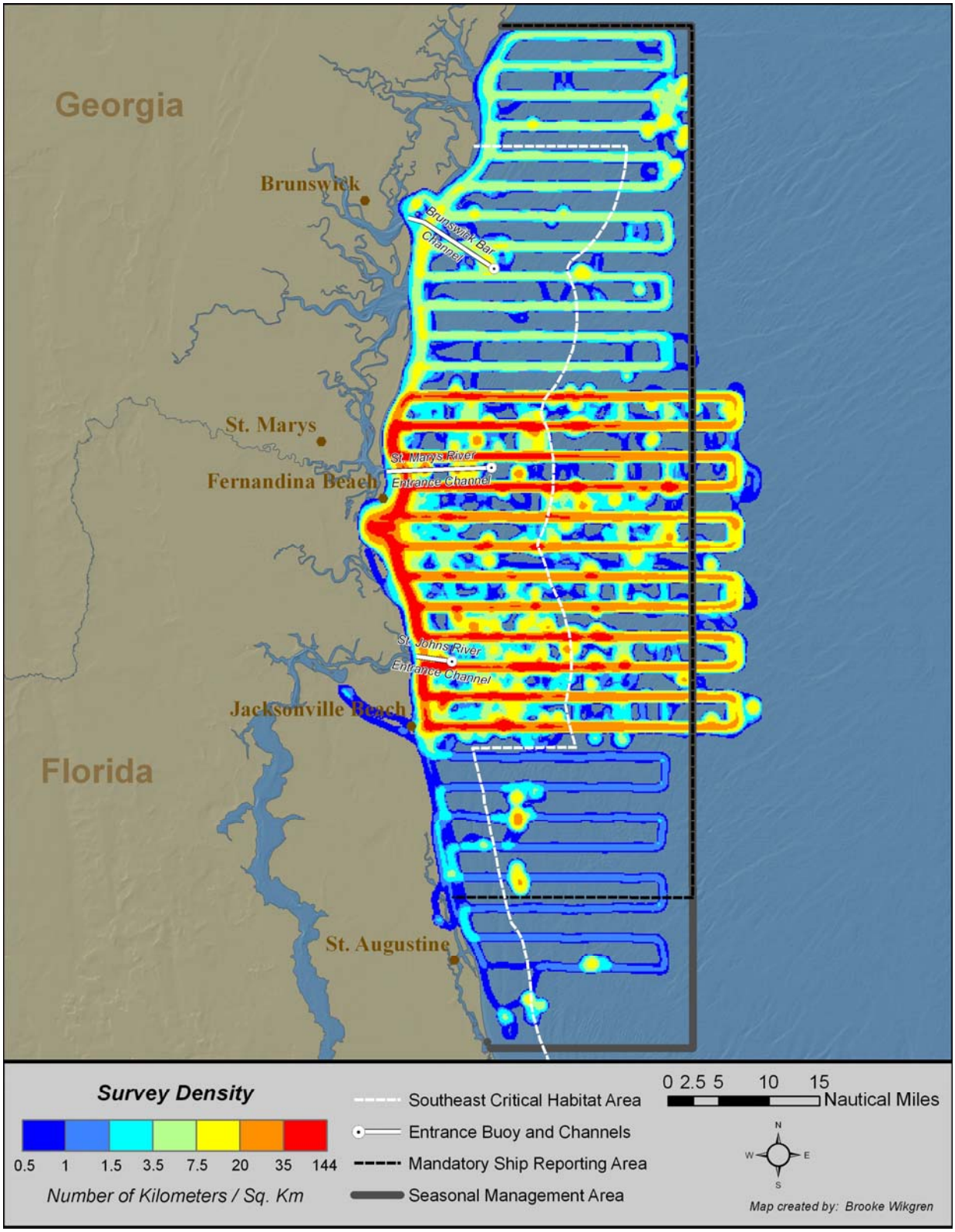
Cartography: Brooke Wikgren / New England Aquarium
Projected in Universe Transverse Mercator, Zone 17, using North American Datum 1983.

Figure 3. Whale Alert Geographic Bins Map



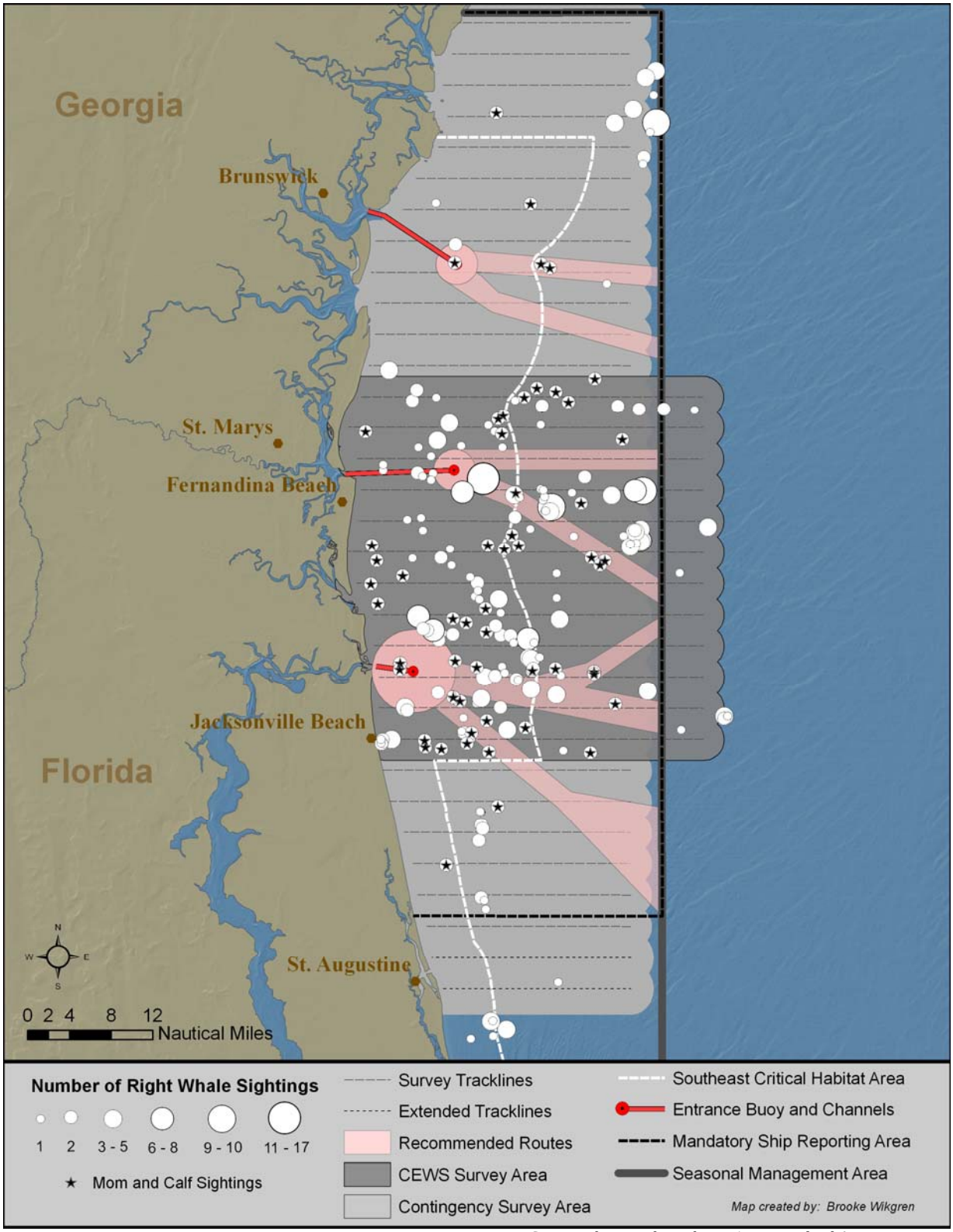
Map provided by Florida Fish and Wildlife Conservation Commission

Figure 4. NEA Aerial Survey Effort



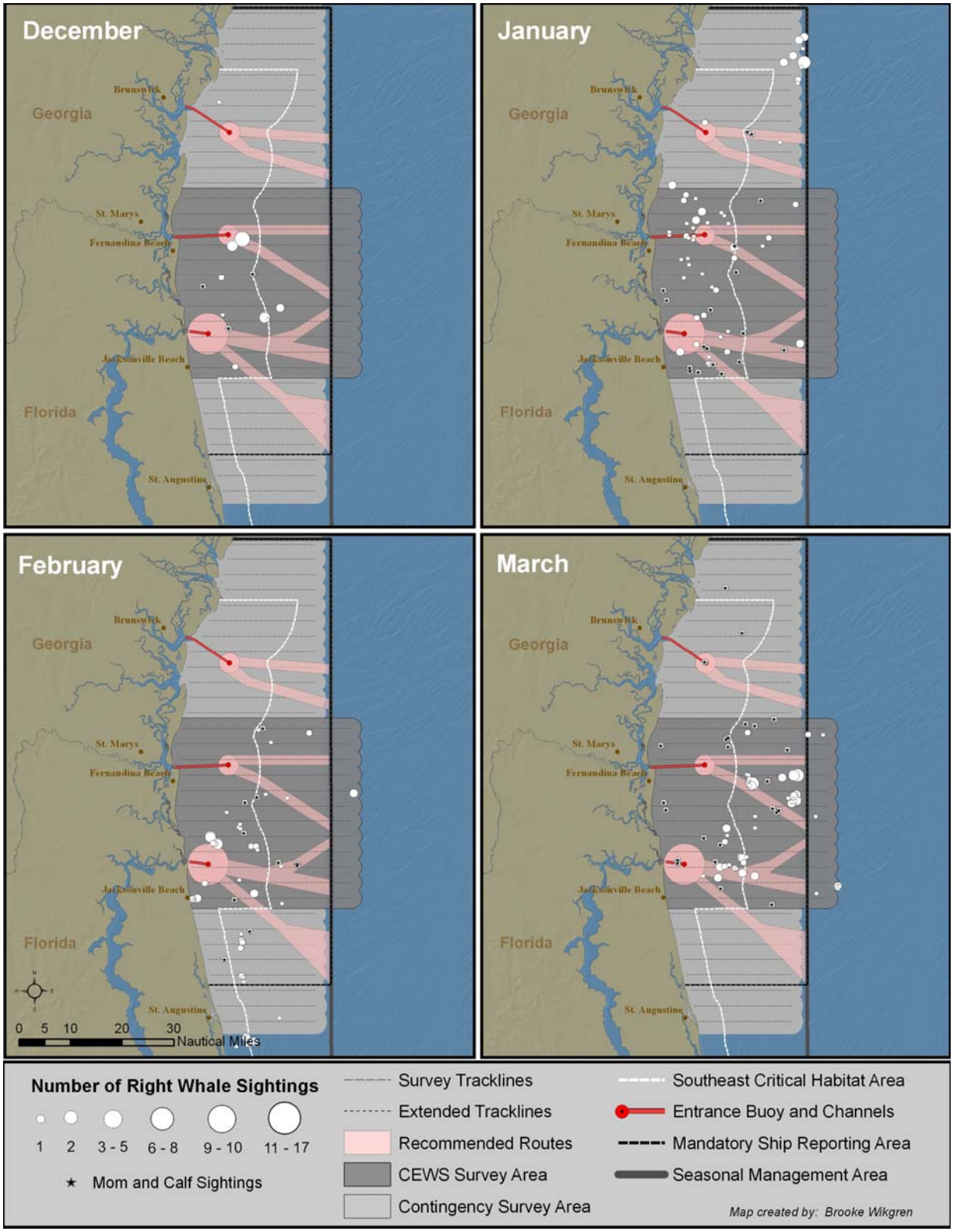
Cartography: Brooke Wikgren / New England Aquarium
Projected in Universe Transverse Mercator, Zone 17, using North American Datum 1983.

Figure 5. NEA Aerial Survey Right Whale Sighting Events



Cartography: Brooke Wikgren / New England Aquarium
Projected in Universe Transverse Mercator, Zone 17, using North American Datum 1983.

Figure 6. NEA Aerial Survey Right Whale Sighting Events by Month



Cartography: Brooke Wikgren / New England Aquarium
Projected in Universe Transverse Mercator, Zone 17, using North American Datum 1983.

Figure 7. NEA Aerial Survey Effort in trackline nmi displayed in 5 day blocks

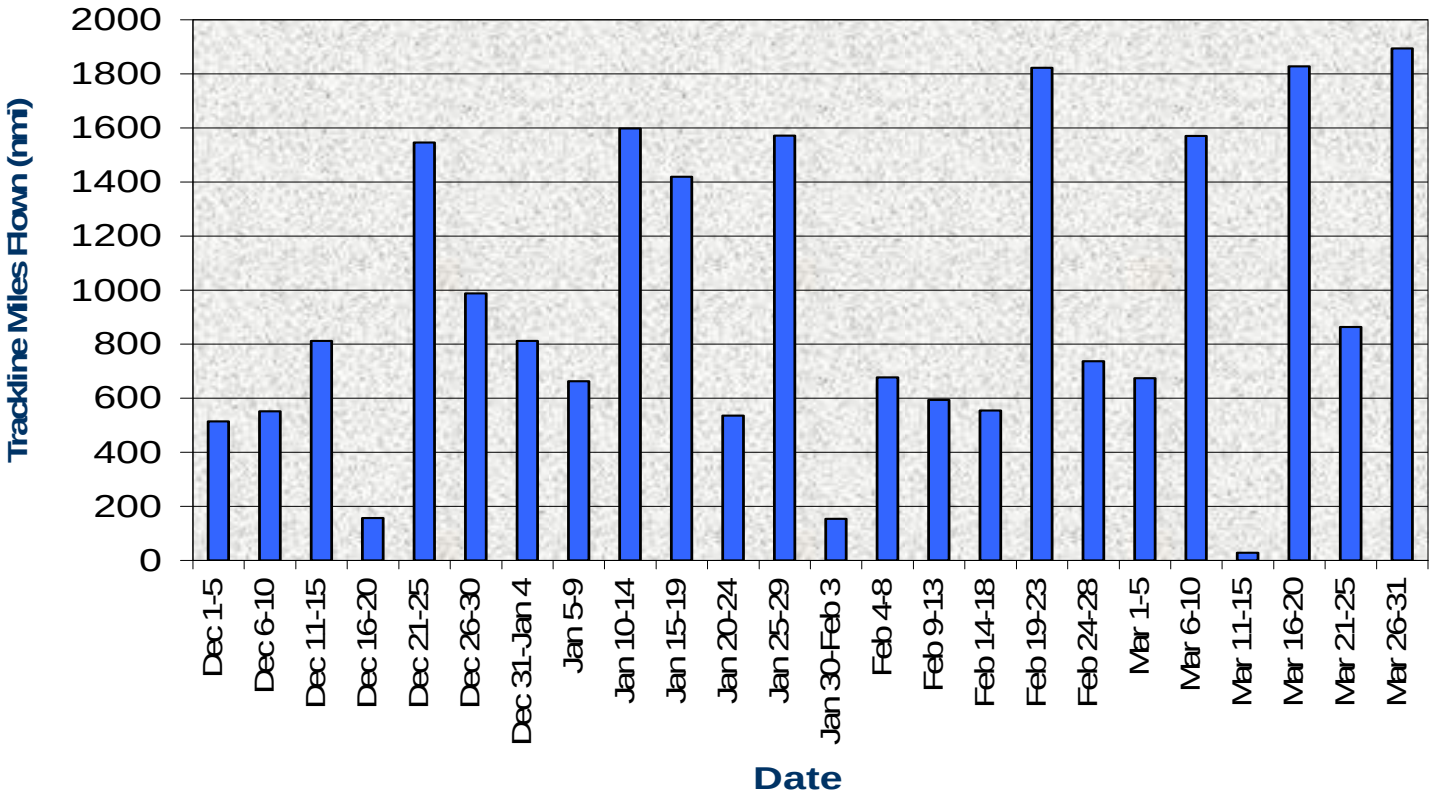


Figure 8. Temporal Occurrence of Right Whales for NEA Aerial Surveys displayed in 5 day blocks. Total numbers include individuals, mothers, and calves.

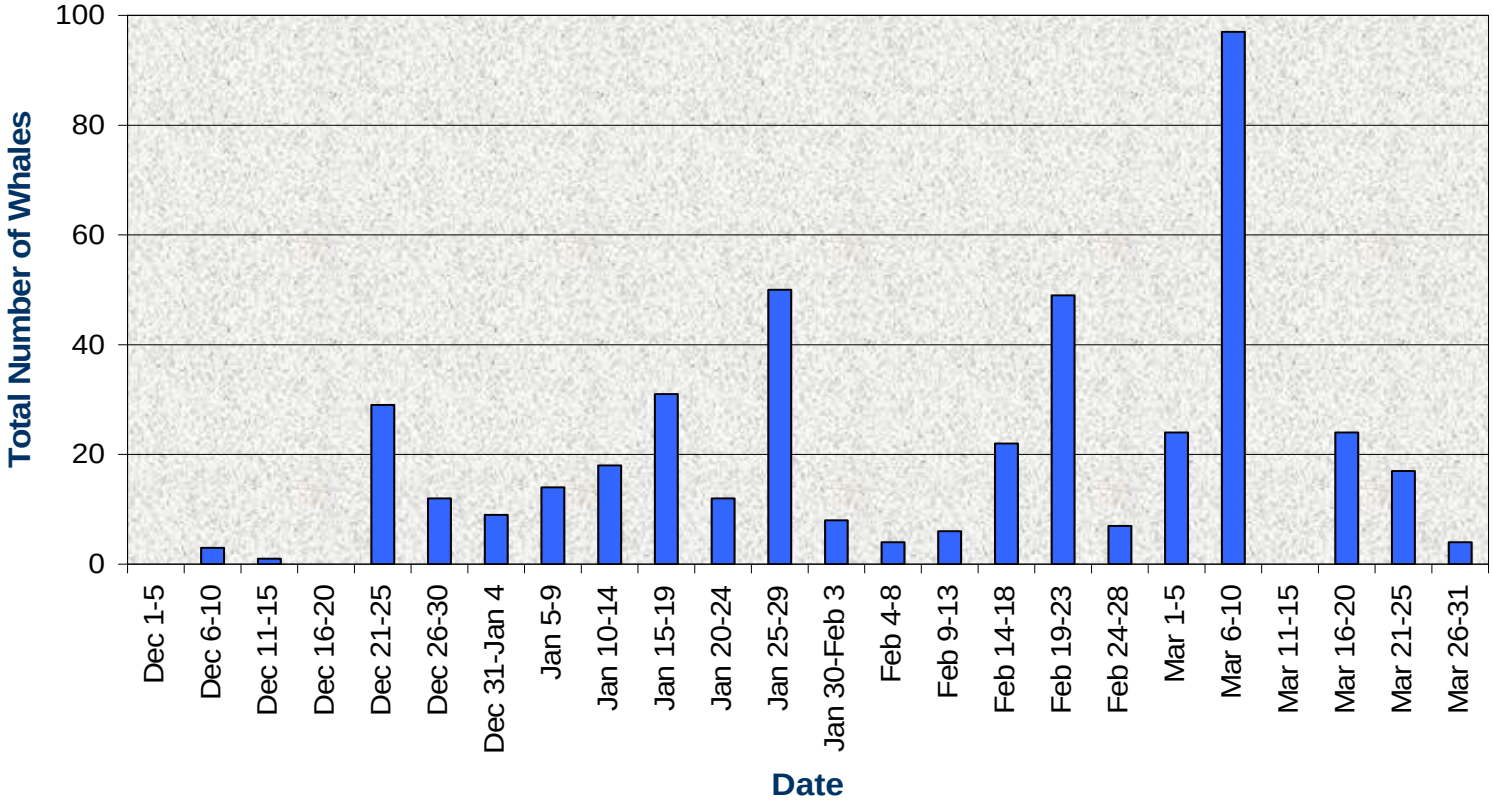


Figure 9. Temporal Occurrence of Sightings, Grouped by Associations.
SAGs, Mom/calf pairs, Singletons and groups of Others during NEA surveys displayed in 5 day blocks.

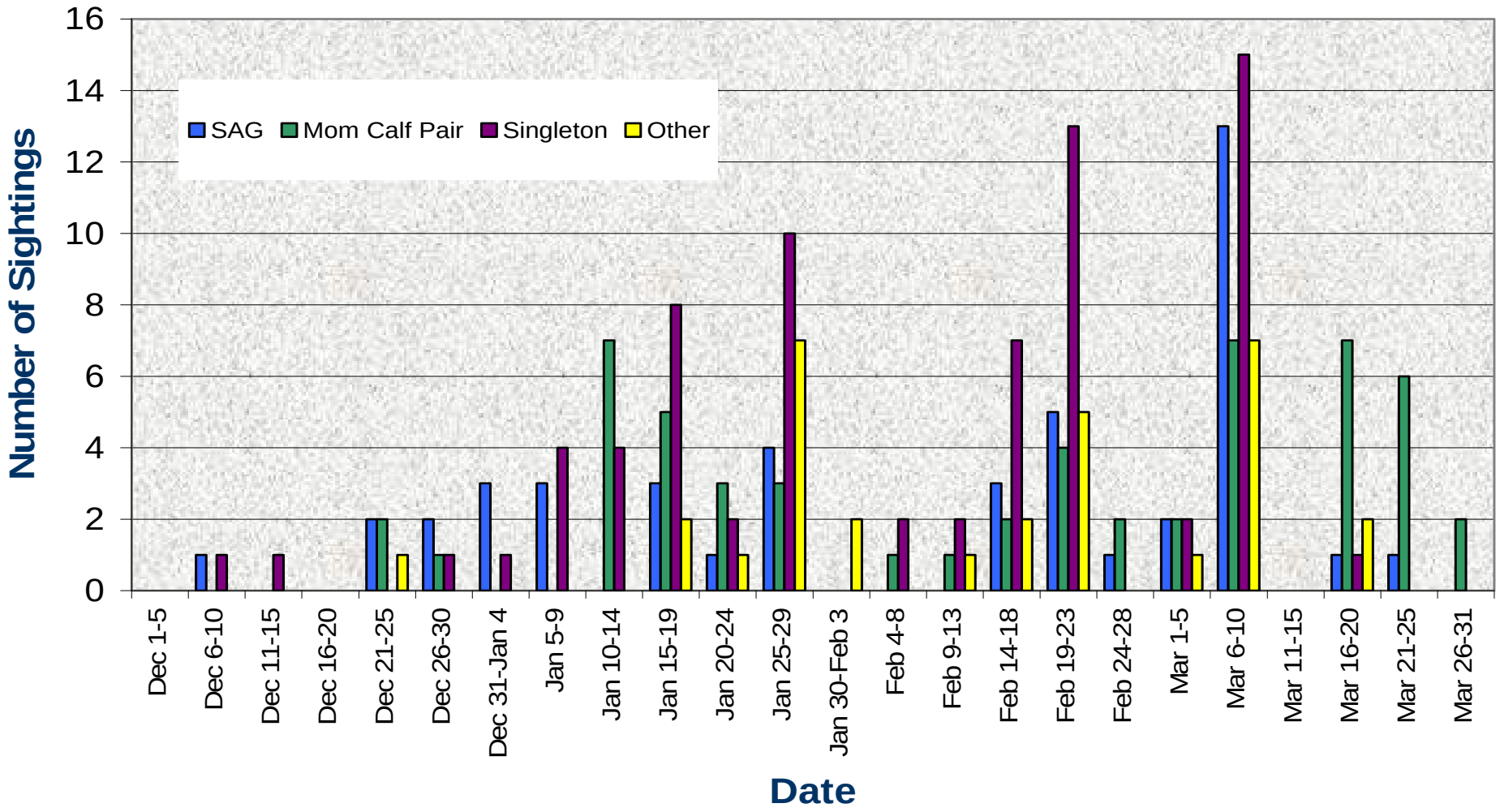


Figure 10. Whales per nmi trackline of NEA Aerial Survey Effort displayed in 5 day blocks

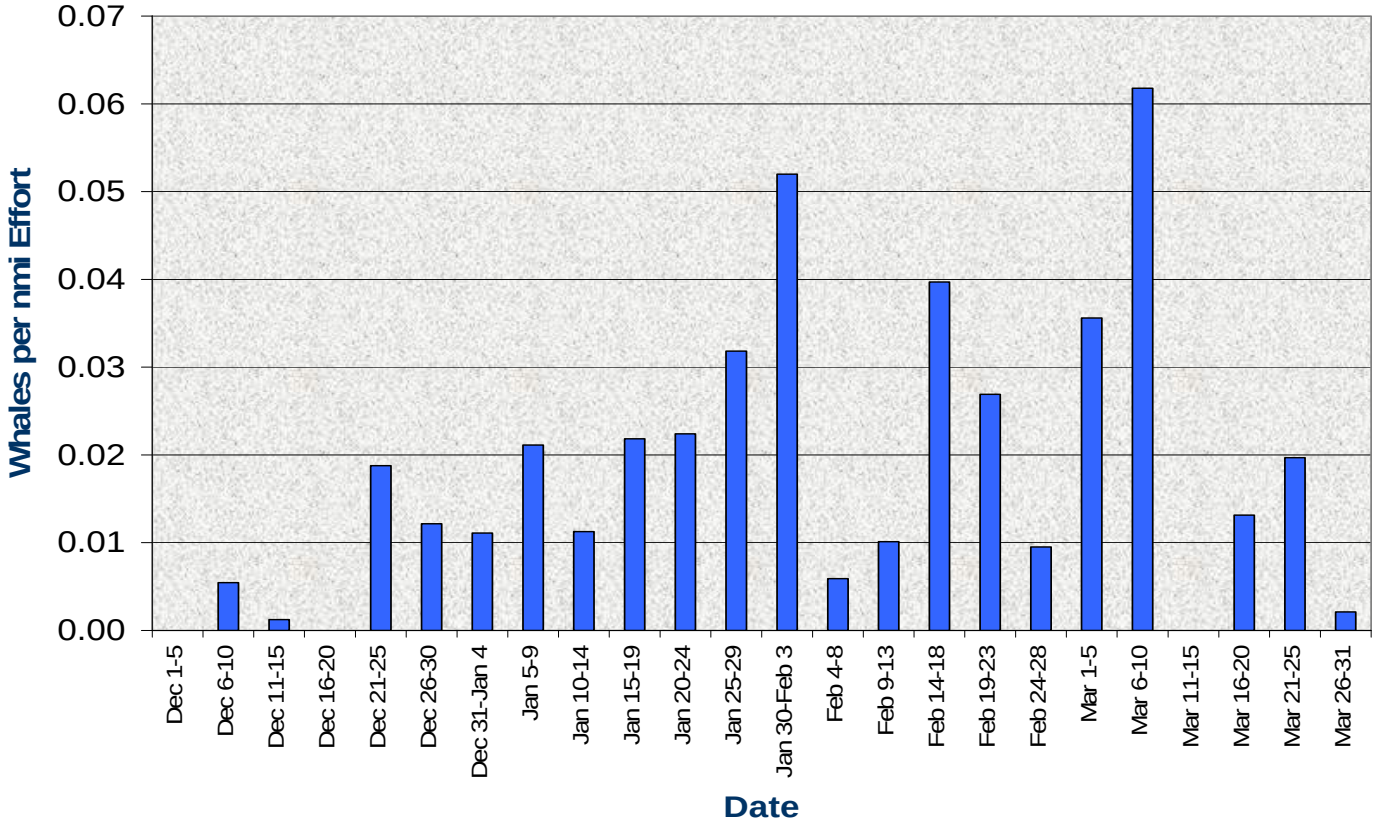


Figure 11. Sightings per nmi trackline of NEA Aerial Survey Effort displayed in 5 day blocks

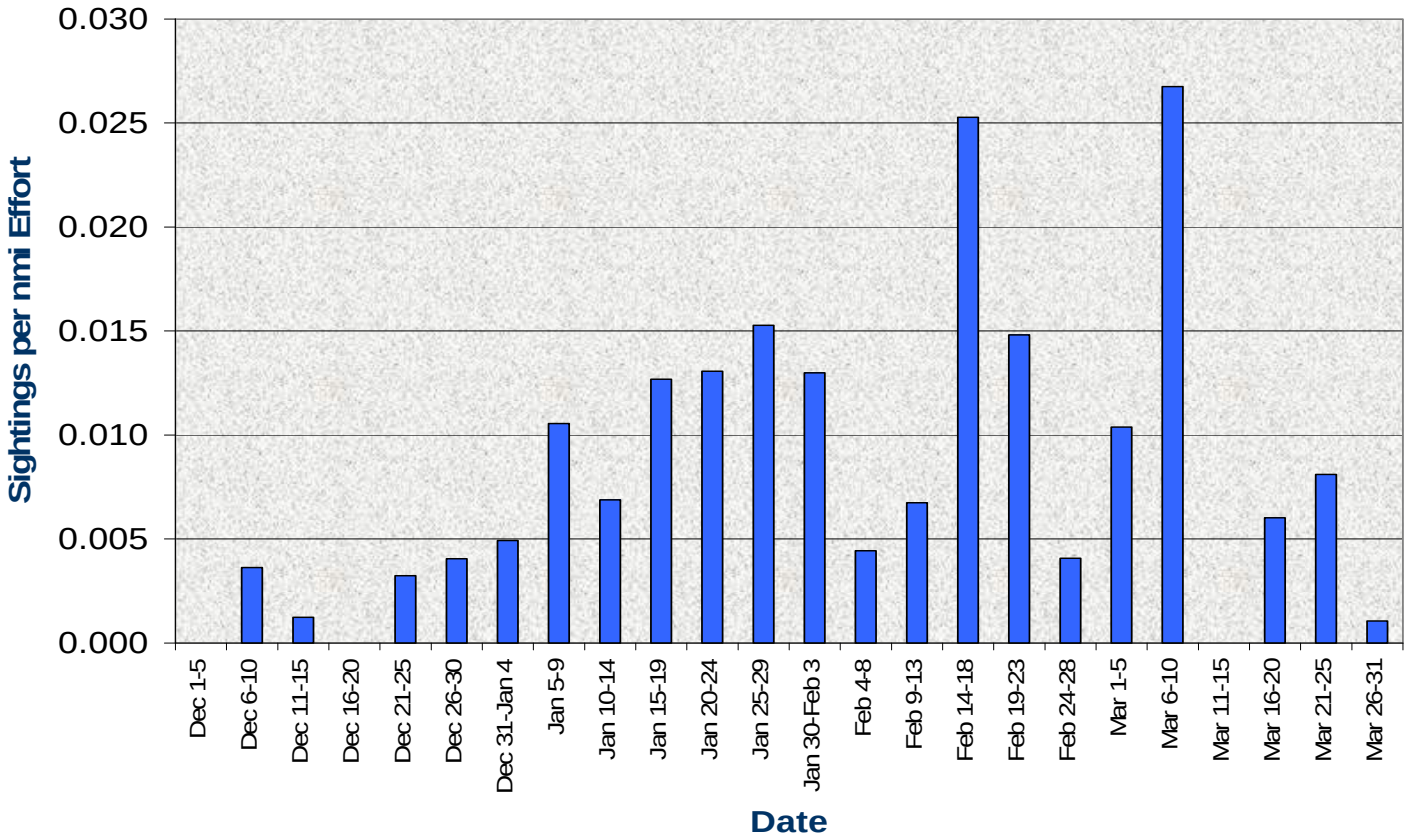


Figure 12. NEA Aerial Survey Sighting Distances (n=120)

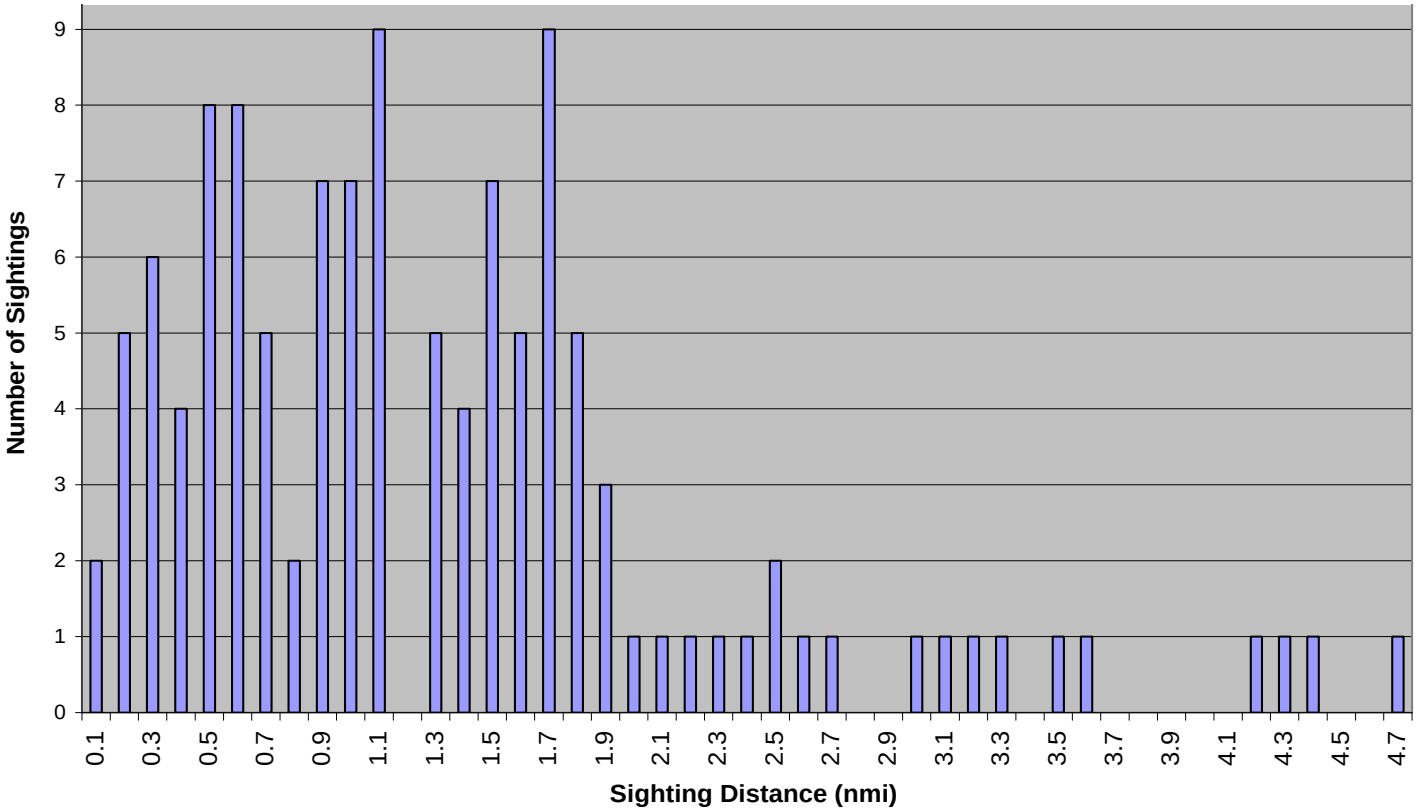


Figure 13. NEA Aerial Survey Sighting Distances with Beaufort Sea State (SS) Considered (n=120)

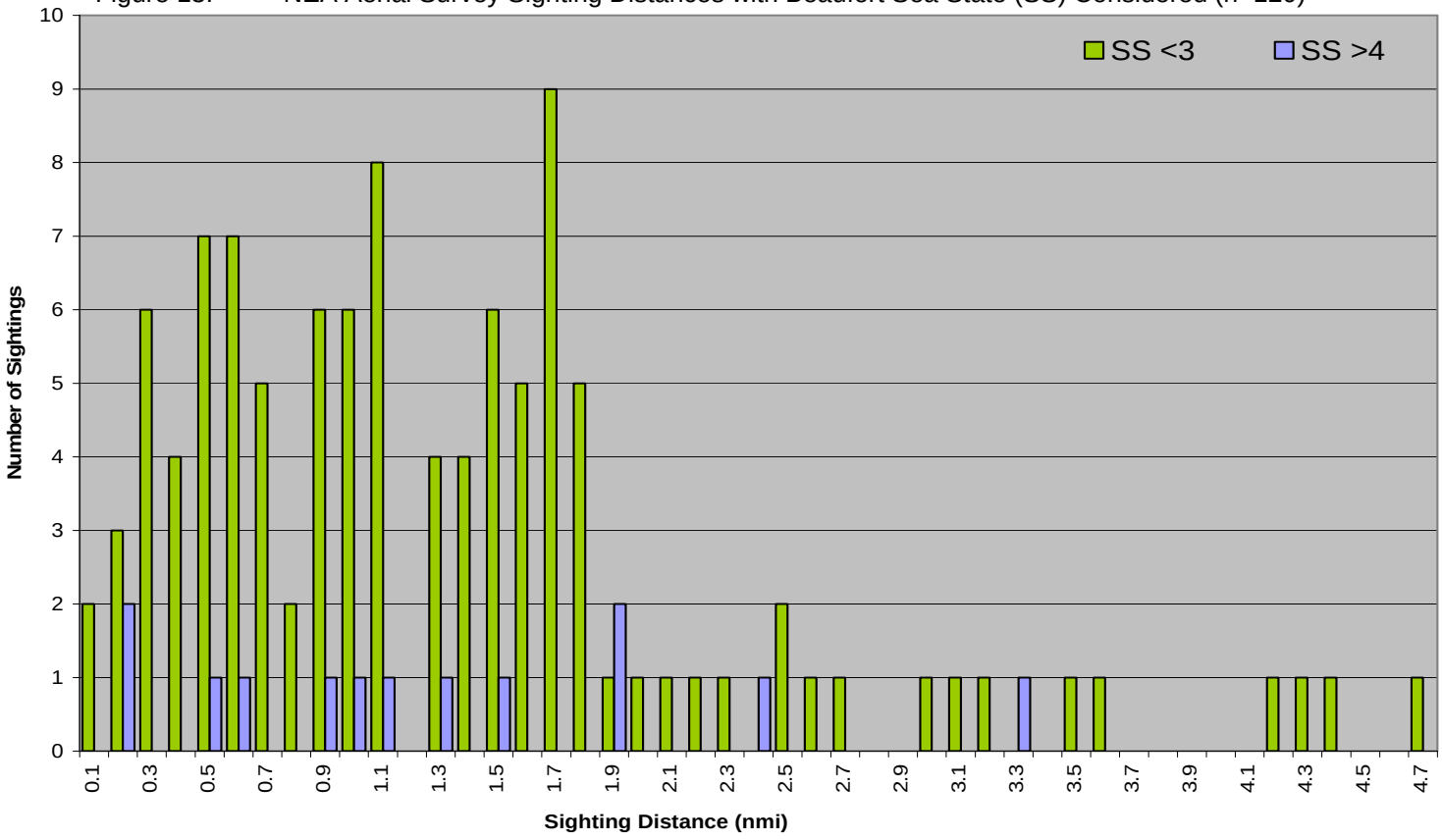
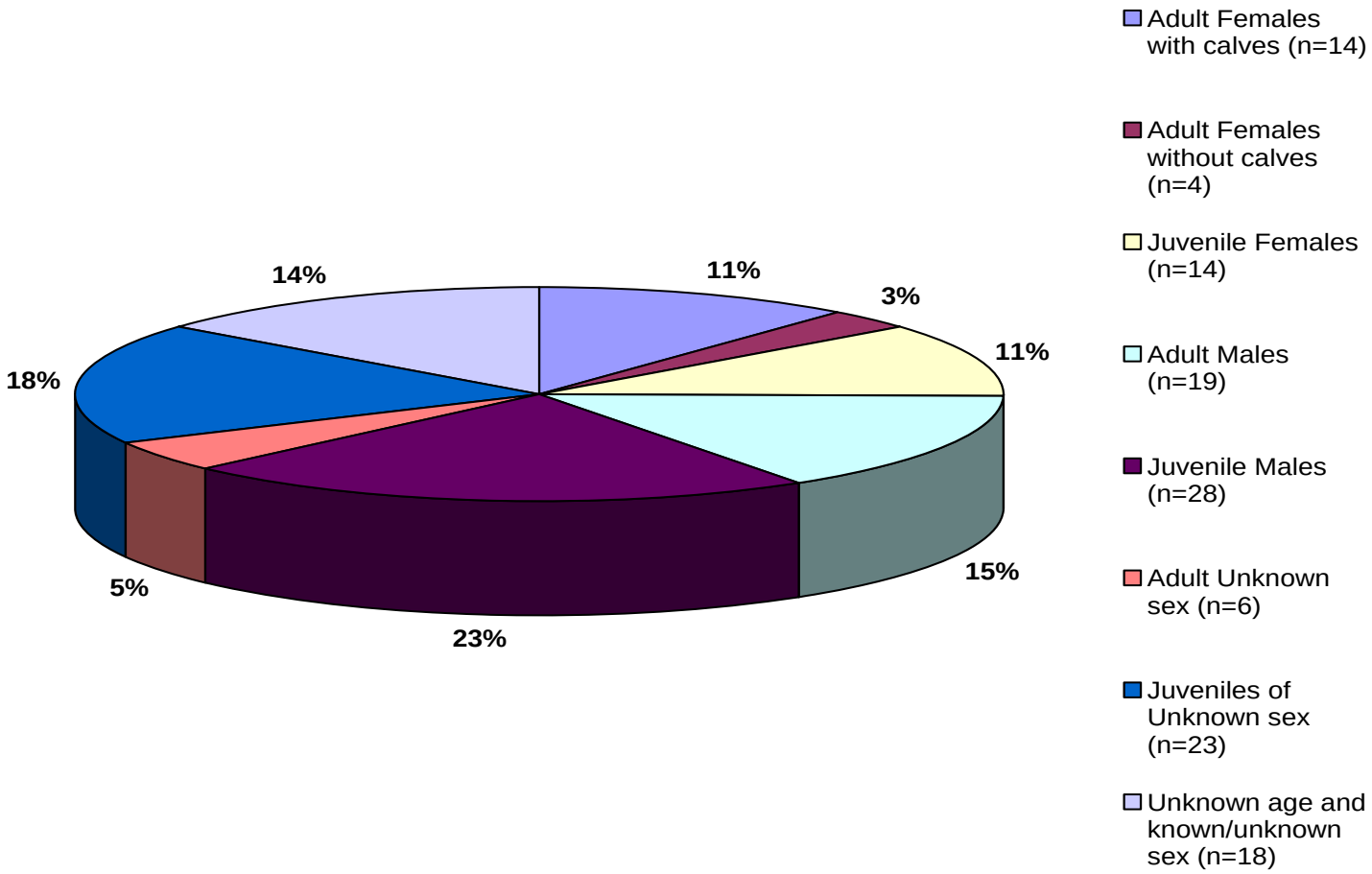
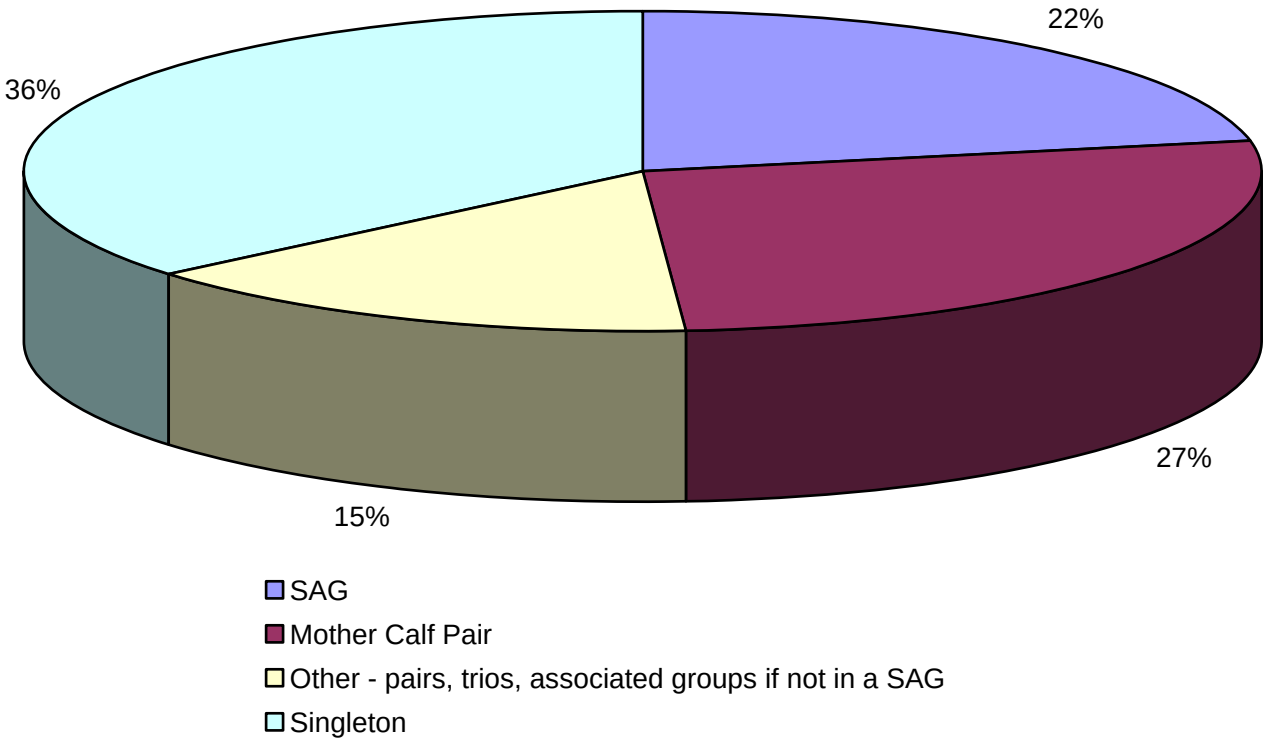


Figure 14. Demographic Structure of NEA Surveys for all preliminarily matched non-calf right whales



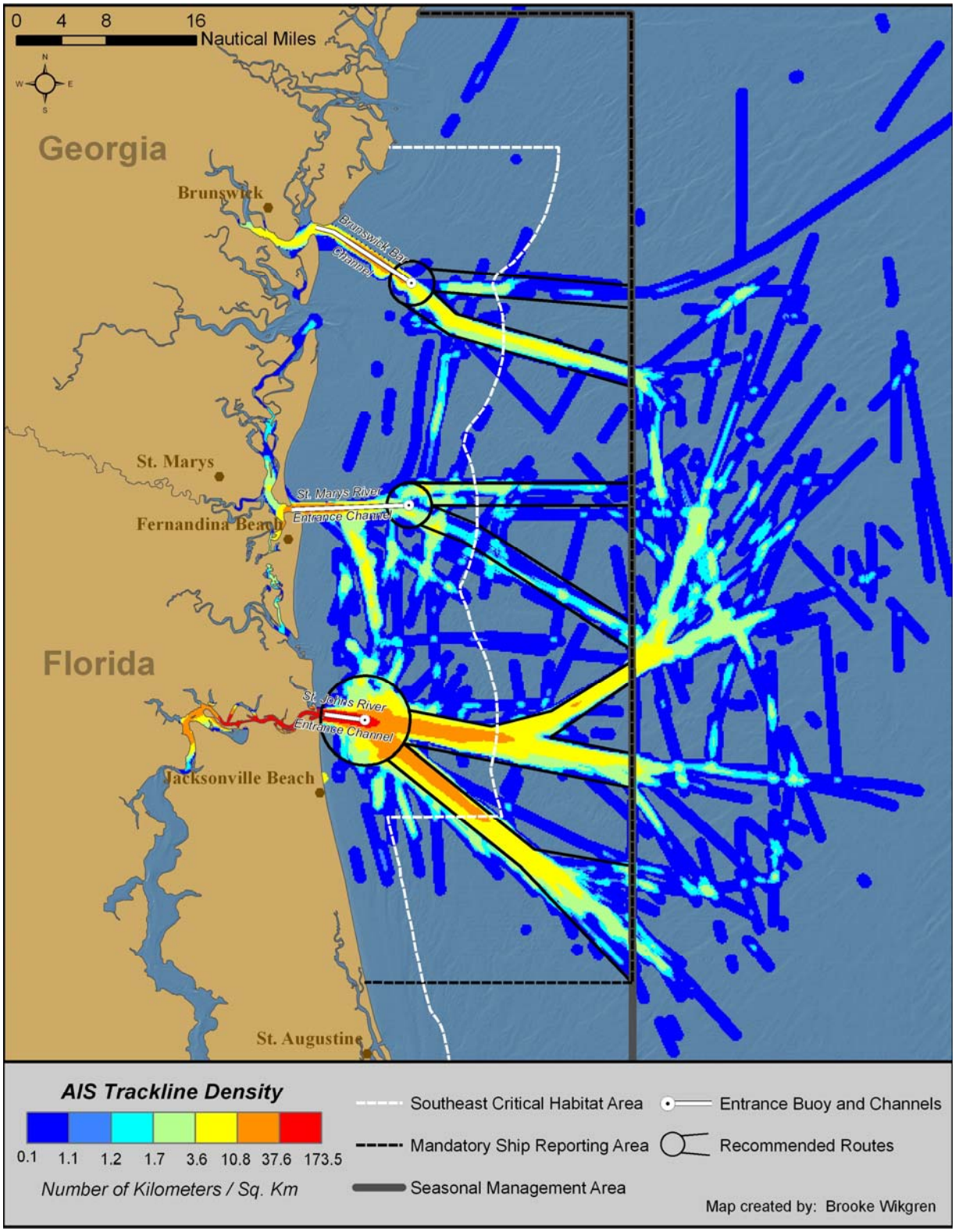
	Age Class					
Gender	**Adult**	**Juvenile**	**Yearling**	**Unknown Age**	**Grand Total**	**Percent**
Females without Calves	4	12	2	1	**19**	
Females with Calves	14	0	0	0	**14**	26%
Males	19	26	2	5	**52**	41%
Unknown Sex	6	16	7	12	**41**	33%
Grand Total	**43**	**54**	**11**	**18**	**126**	
Percent	34 %	43 %	9 %	14 %		

Figure 15. Association Types for all Right Whale Sightings from the NEA Aerial Survey Team



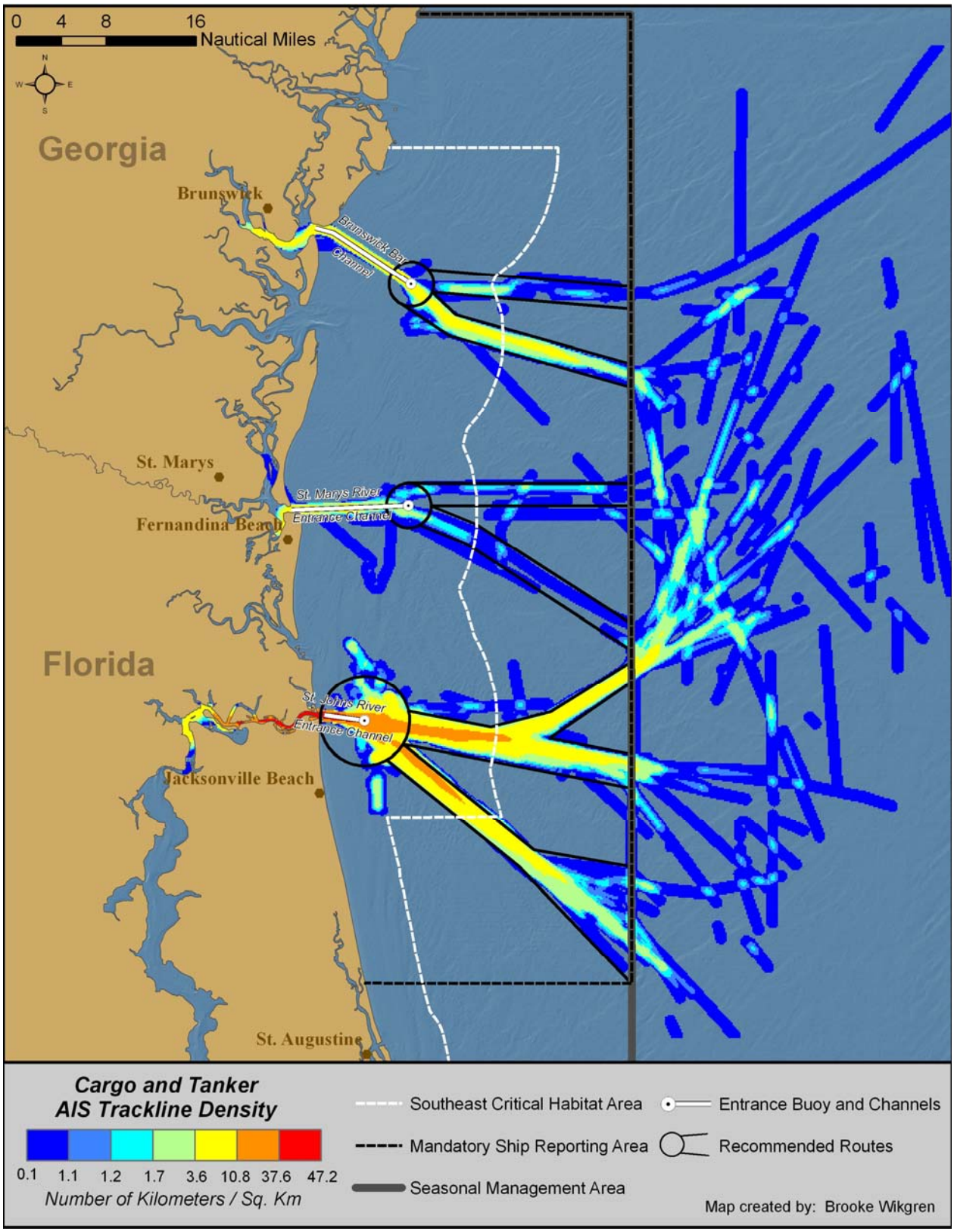
SAG	**45**
Mother Calf Pair	**55**
Other - pairs, trios, associated groups if not in a SAG	**31**
Singleton	**74**
Total Number of NEA Sightings	**205**

Figure 16. AIS Data for Commercial Shipping Traffic Density (including tugs, dredges and some pilot boats).



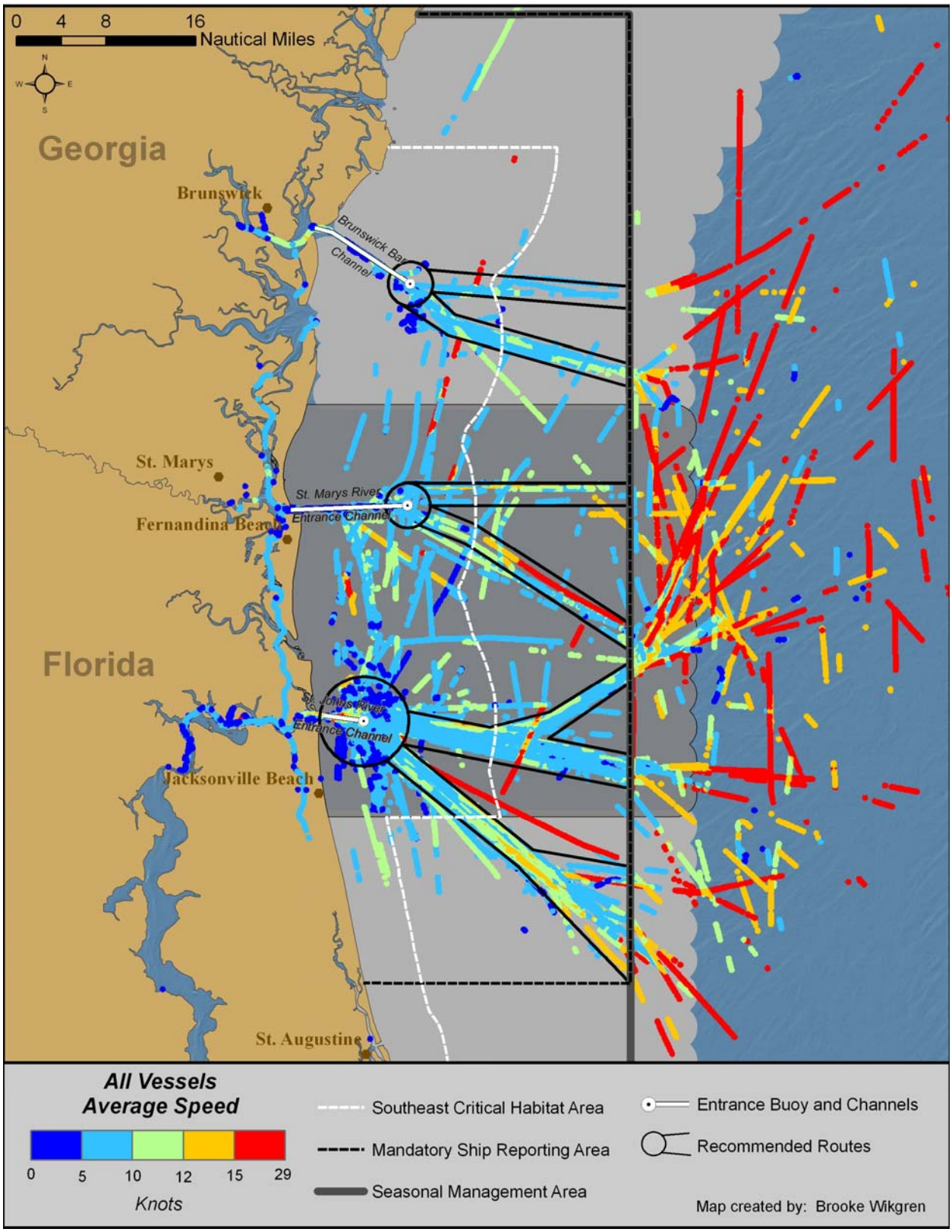
Cartography: Brooke Wikgren / New England Aquarium
Projected in Universe Transverse Mercator, Zone 17, using North American Datum 1983.

Figure 17. AIS Data for Commercial Tanker and Cargo Traffic Density



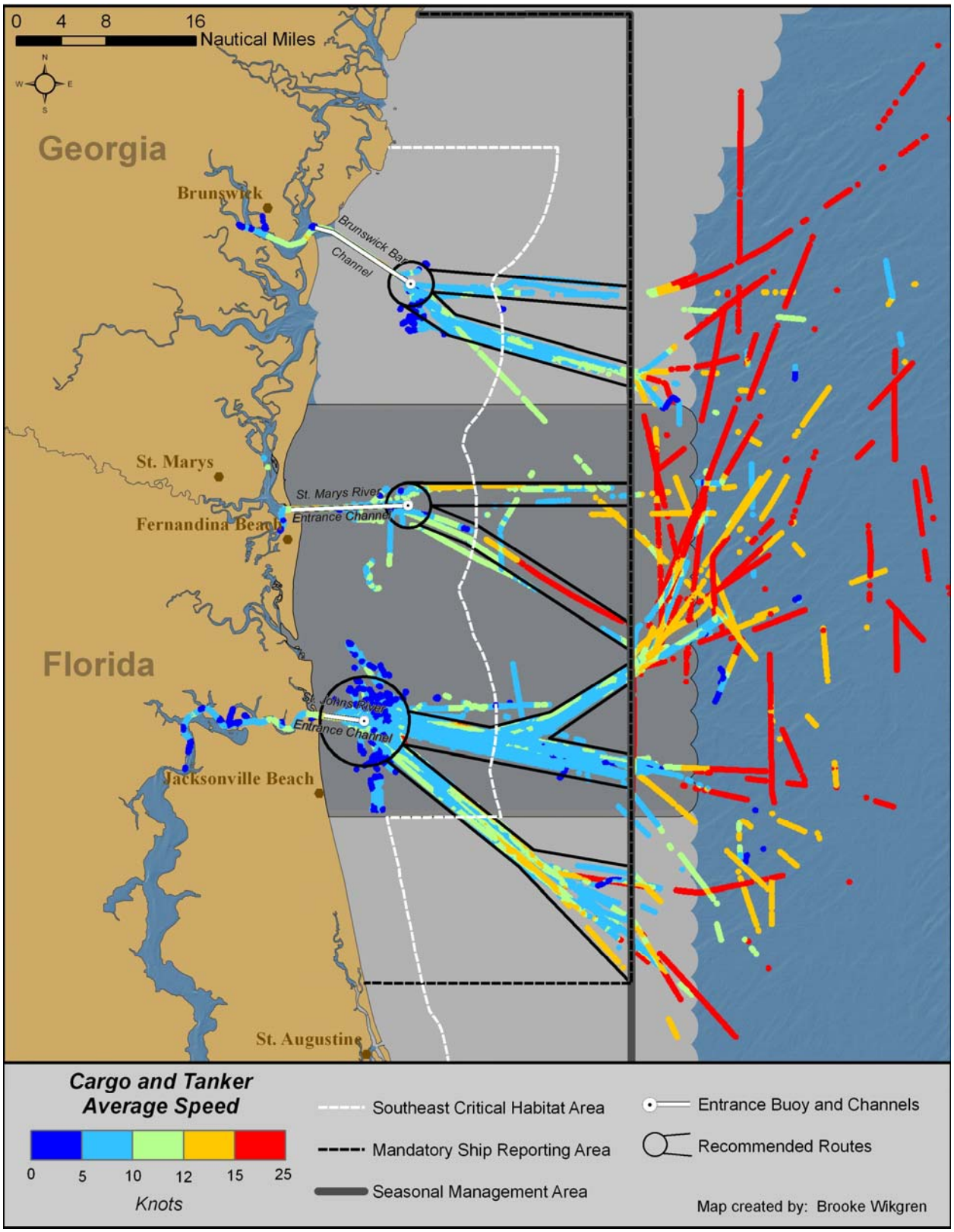
Cartography: Brooke Wikgren / New England Aquarium
Projected in Universe Transverse Mercator, Zone 17, using North American Datum 1983.

Figure 18. AIS Data for Average Traffic Speed (including tugs, dredges and some pilot boats)



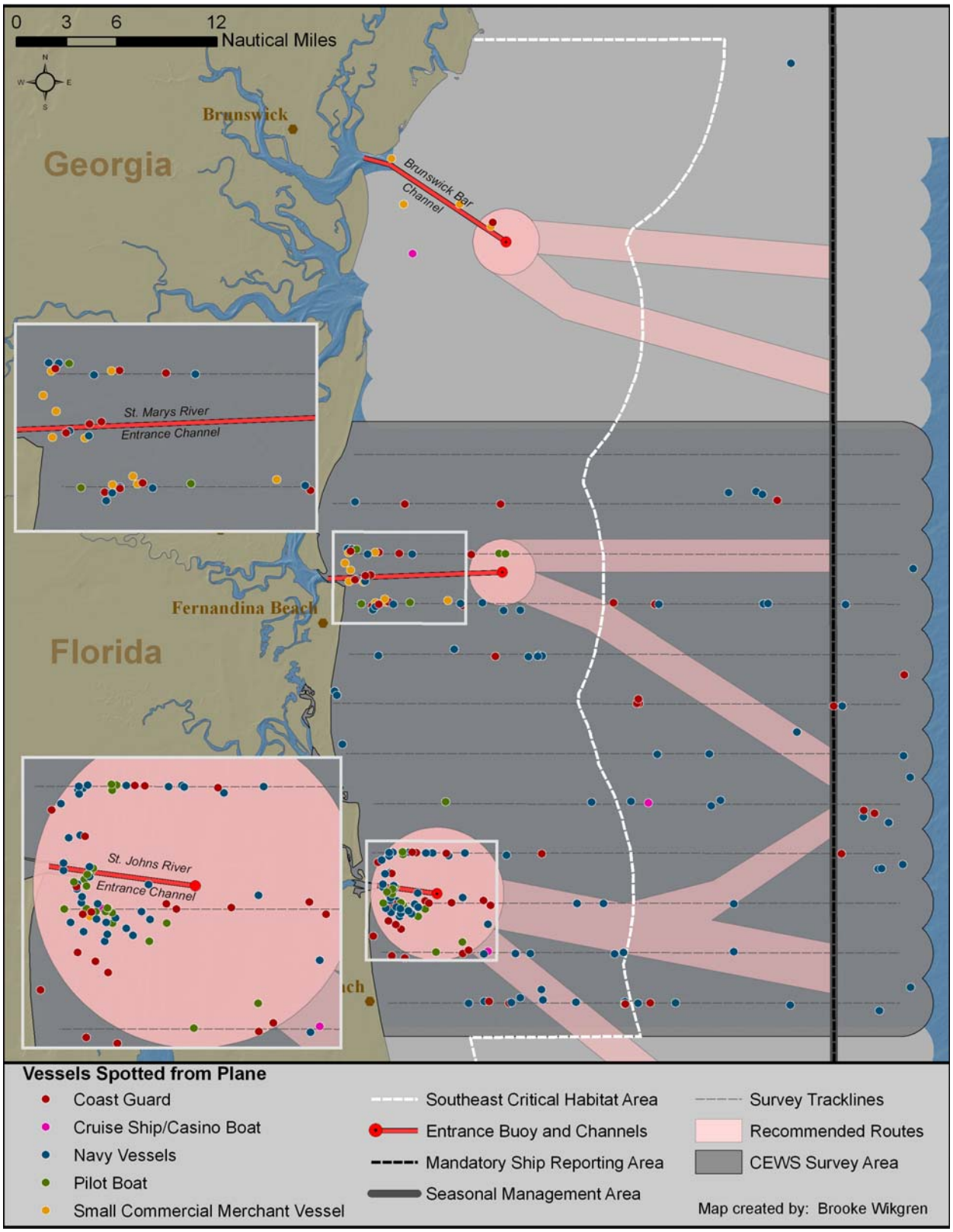
Cartography: Brooke Wikgren / New England Aquarium
Projected in Universe Transverse Mercator, Zone 17, using North American Datum 1983.

Figure 19. AIS Data for Average Traffic Speed of Commercial Tanker and Cargo Vessels



Cartography: Brooke Wikgren / New England Aquarium
Projected in Universe Transverse Mercator, Zone 17, using North American Datum 1983.

Figure 20. Ship Traffic (not required to carry AIS) Recorded Visually during NEA Aerial Surveys



Cartography: Brooke Wikgren / New England Aquarium
Projected in Universe Transverse Mercator, Zone 17, using North American Datum 1983.

Figure 21. Entangled humpback whale documented on 09 December 2009 by NEA aerial survey team

Photographer: Jessica Taylor / New England Aquarium

Figure 22. Catalog Number 3745 documented on 22 December 2009 by NEA aerial survey team showing position of propeller wounds on left flank of body.

Photographer: Suzie Hanlan / New England Aquarium

Figure 23. Catalog Number 3745 documented on 19 January 2010 by NEA aerial survey team showing series of two propeller cuts on left flank

Photographer: Jessica Taylor / New England Aquarium

Figure 24. 2009 Calf of Catalog Number 3290 documented on 29 January 2010 by NEA aerial survey team showing linear dorsal wound.

Photographer: Karen Vale / New England Aquarium

DISCUSSION

The coastal waters of the SEUS (primarily Florida and Georgia), are the only known calving ground for the North Atlantic right whale. For the past 16 years there has been extensive survey effort in the heart of the calving ground in the form of EWS surveys. The main objective of these surveys has been to provide mariners in the region with right whale sighting information so they could operate within the habitat without accidentally harming right whales.

The teamwork and active participation of many agencies and commercial shipping interests has been very effective in mitigating collisions with right whales. The ability of the survey teams to alert their ground contact immediately from anywhere in the critical habitat is crucial to the network's success. Each survey teams' ground contact receives right whale sighting information from the survey aircraft and initiates various notifications via email alerts: USCG Office of Aids to Navigation in Miami transmits, via NAVTEX, dynamic management measures to protect right whales; the USCG also transmits right whale-related seasonal messages via VHF Broadcast Notices to Mariners; and survey teams update the MSRS. Simultaneously, the Harbor Pilot Associations at the ports of Jacksonville, Fernandina, Brunswick and Savannah monitor pagers, cell phones, or email for information transmitted from the EWS Network 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 SEUS, is what distinguishes these aerial surveys as a meaningful conservation tool.

However, this tool for collision mitigation has limitations on many fronts. First and foremost, reduced visibility and inclement weather result in numerous days with limited or no survey effort, where near real-time sightings cannot be provided through the network. CEWS surveys (including contingency surveys) were flown on only 69 of the 121 (57%) available days during the 2010 season, with full surveys flown on only 33 (27%) of the available 121 days. This means that for 88 of the 121 days, there were portions of the CEWS or the entire area that were not monitored by CEWS aerial surveys. Second, for this effort to be effective, vessel operators must take measures to reduce the risk of a strike from occurring in the calving ground whether sightings are available or not. Third, the information provided to outbound vessels is limited to NAVTEX messages (which provide information every four hours) as opposed to the near real-time data provided by the MSRS for incoming vessels. Finally, the number and quality of sightings reported are dependent upon environmental conditions, light levels affecting glare, observer skill, whale behavior and respiration patterns. Therefore, recent regulatory measures (restricted speeds in particular) are a considerable improvement over depending exclusively on aerial survey data and outreach efforts for ship strike mitigation.

Despite the limitations described above, these aerial surveys are invaluable for monitoring of habitat use, vessel/whale interactions, calf production, the photographic assessment of injuries and entanglements, and the detection of mortalities of right whales in the SEUS. Continued collection of these data are important for evaluating the effectiveness of the recently implemented (December 2008) Ship Strike Reduction Rule

in the calving ground. In addition, measuring vessel compliance will be essential, as only high levels of compliance will provide the maximum benefit to right whales. AIS has proven to be a valuable tool for monitoring compliance, and should continue to be used. Enforcement of non-compliant vessels is also necessary to ensure a long-term change in the behavior of ship operators.

Over the past five seasons, the NEA survey team has been collecting AIS data to monitor vessel routes and speeds throughout the calving ground. AIS-derived ship speed data were collected only during periods when the NEA survey aircraft was airborne and therefore represents a small portion of total vessels that utilized the area. During the 2010 season, records were only collected for 69 days, during approximate 5.5 hour survey flights, out of a total of 152 days that the Seasonal Management Area was in affect (15 November, 2009 to 15 April, 2010). Based on this restricted sample size, the level of tanker and cargo vessel compliance is generally good for both use of recommended routes and speed. Seventy-six percent of traffic showed full compliance to remaining within recommended route boundaries, and 85% traveled under eleven knots whilst transiting through the SMA. Only three percent of the vessels were not compliant to both the recommended route parameters and speed restrictions.

During the 2010 season, various vessel types were involved in events where vessels appeared to approach right whales within 500 yards. Reducing risk of vessel/whale collisions from these interactions was limited by problems in establishing communication with vessel operators. It is consistently difficult and often impossible to communicate with small recreational vessel operators, particularly when they are travelling at high speeds. Of the thirteen interactions involving recreational vessels, ten attempts to establish contact were negative and three were positive. Other vessels that were not responsive to the survey teams' attempts to communicate via Marine VHF Ch. 16 included two military vessels, a USCG cutter, and a commercial shrimp trawler. However, in general, commercial vessel operators, harbor pilots and military vessel operators are responsive to communication from the survey team, and cooperative to coordination attempts, leading to successful interaction mitigation.

At least one and possibly two vessel struck animals was documented in the CEWS area. Catalog Number 3745 was sighted with a serious injury (Knowlton and Kraus, 2001) for the first time during the 2010 season. This two-year old male, had two series of propeller wounds on his left flank. The last time that he was documented without the wounds was in the SEUS on 26 February 2009. Orange cyamids were evident in the wound, and there was grey skin in the vicinity of the cuts, suggesting that the wound was obtained at least two weeks prior to initial sighting. The nature of the cuts; the distance apart, the length and the apparent depth indicate that this was not a large vessel. The cuts are not parallel to each other as would be expected from a twin propeller vessel strike, but the whale may have been flexed at the time of collision, or the propeller shaft may have bent on impact. The second animal, the 2009 calf of #3290, had a fairly shallow but fresh linear wound on its back but the cause of the wound is unknown.

Right whales have suffered varying degrees of injury from vessel strikes. A total of 43 free swimming right whales have been documented with propeller cuts (North Atlantic Right Whale Catalog unpublished data). Fourteen of these animals were first documented in the SEUS with propeller cut wounds and at least six of the strikes are known to have occurred in that region. The region where these interactions have occurred is not known for the majority of these animals. Vessel strikes from smaller, recreational vessels that typically operate at fast speeds (the mandatory ship strike reduction rule does not apply), remains a conservation concern. Monitoring recreational boating traffic and scaled-up efforts to mitigate these strikes should continue.

No new right whale entanglements were documented in the SEUS this season although a severely entangled humpback was sighted in the CEWS. An analysis of entanglement interactions of right whales based on scars, or animals carrying gear show that 78.1% of the population demonstrate evidence of an interaction (assessed through 2006; Knowlton *et al.* 2010). Of the 75 free swimming right whales that have been seen carrying gear (assessed through June 2010), at least nine were first documented in the SEUS however, little is known about where most of these animals acquired the gear as animals that survive can swim long distances with an entanglement.

The one assumed mortality during the 2010 season was the calf of Catalog Number 3260 (Skittle), in which the cause of death is unknown and a carcass was never discovered. When Skittle was initially observed with her 2010 season calf, she was displaying behavior similar to that which has been observed soon after birthing (Zani *et al*, 2008). The exact time of birth is known to have occurred sometime within an 18 hour period as the FWC aerial survey team had a sighting of her without a calf prior to initial sighting of M/C pair by the NEA team. Skittle was a first time mother, and was at least nine years in age when she gave birth (exact age unknown). She lost her calf within eight days, after which she was sighted in a SAG. The loss of newborn calves to first time mothers has been suggested in southern right whales (*Eubalaena australis*) which have higher proportions of two or four year calving intervals after the first recorded calf than after later calving events. Elwen and Best (2004) used this to infer mortality in first-borns calves for 'inexperienced' moms, and Browning et al. (2010) have suggested that the upper bound of perinatal and calf mortality in the calving ground averages 3 calves/year.

Of the 88 documented right whale carcasses from 1970 to present, 30 (34%) have been discovered in the SEUS from SC to Texas. Causes of death include six ship strikes, one entanglement, four of unknown causes, and 19 calves. It should be noted that these mortality numbers only represent documented carcasses and thus under represent the actual number of mortalities. Beyond the assumed mortality of the newborn calf, no additional mortalities were documented by any survey teams in the SEUS region during the 2010 season.

In addition to the main conservation objective of the EWS, these surveys have contributed thousands of photo-documented right whale sightings to the North Atlantic Right Whale Catalog. These data play an integral role in the understanding of habitat use, demographics, and reproductive success of this population. Monitoring these life history parameters is important for continued management of this essential calving habitat.

The mean calving interval for all known reproductive cows with multiple calving intervals in 2010 (3.3 years) was slightly lower than in 2009 (3.9 yrs), although numbers of calves born was twice as high in 2009. The mean calving interval for North Atlantic right whales between 1996-2002 was over 5 years (Kraus et al., 2007) and had increased from a 3.7 year average between 1980-1992 (Knowlton et al., 1994). The 2010 mean calving interval continues to be an improvement to the higher intervals documented during the late 1990's (Kraus et al., 2007). Of the 19 mothers documented in the 2010 season, 12 are of known age ranging from 9 to 28 years old. Of the four females in the 2010 season that calved for the first time, one was at least nine years old (whose birth year is unknown) and three were known to be nine years of age. Three of these four first-time moms are believed to have had successful calvings. A mean of nine years of age for first time mothers of a known age in 2010 is lower than the mean age for first calving of 11.4 years documented through 2005 (Kraus et al., 2007). Reduced calving intervals and younger age at first parturition may be a hopeful sign for the recovery of the North Atlantic right whale.

Five of the 2010 season M/C pairs were not sighted by the NEA aerial survey team. One of the five was first sighted beyond the eastern extent of the EWS survey area by the UNCW/Duke aerial survey team. Whether any M/C pairs were missed on the calving ground will not be determined until 2010 field seasons conducted in northern feeding grounds are completed. However, in recent years, very few new M/C pairs have been sighted that were not first seen in the SEUS, indicating the data collected during the season captures the vast majority of the births for the year.

Though all the individuals observed in the SEUS have not been identified, preliminary analysis indicates that a large proportion of juveniles frequented the critical calving grounds, many of which were involved in surface active groups. Since the SEUS is not known to be 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. Hamilton and Cooper (2010) noted an increase in mother/yearling pairs and yearlings present in the SEUS in 2001 to 2005 when analyzing life history data from 1993 to 2005. A documented increase in yearling, juvenile, non-calving female and adult male presence in the SEUS, despite substantial physiological investments in migration, and the lack of feeding, warrants further exploration to define this additional function of the calving ground. Greater protection from predators for younger individuals or a social benefit that improves overall fitness may be attracting non-M/C pairs to the calving grounds (Hamilton and Cooper, 2010).

In conclusion, the SEUS critical habitat has one of the highest densities of commercial shipping traffic along the eastern seaboard, but can now be considered one of the most well monitored and regulated habitats for North Atlantic right whales. The Ship Strike Reduction Rule in conjunction with the MSRS, Recommended Routes, and education and outreach efforts, provide the best chance for mitigating risks to the North Atlantic right whale population. The joint EWS survey efforts are a major tool in assessing the effectiveness of the recently implemented Right Whale Ship Strike Reduction Rule, and should continue into the near future in conjunction with other assessments of the habitat in order to evaluate the success of management implementations and ensure the long term protection of this most vulnerable segment of the population.

ABBREVIATIONS

AFF	Automatic Flight Following
AIS	Automated Identification System
CCB	Cape Cod Bay
CEWS	Central EWS survey area covered by the New England Aquarium.
CFR	Code of Federal Regulations
COAA	Centro de Observação Astronómica no Algarve
DIGITS	Data Image Gathering and Information Tracking System
DMA	Dynamic Management Area
Duke	Duke University, North Carolina
ELT	Emergency Locator Transmitter
EPIRB	Emergency Position Indicating Radio Beacon
EWS	Early Warning System
FAA	Federal Aviation Administration
FACSFAC JAX	Fleet Area Control and Surveillance Facility, Jacksonville
FL	Florida
FWC	Florida Fish and Wildlife Conservation Commission's Fish and Wildlife Research Institute
GA	Georgia
GDNR	Georgia Department of Natural Resources
GIS	Geographic Information System
GPS	Global Positioning System
ID	Identification
IFAW	International Fund for Animal Welfare
IFR	Instrument Flight Rules
Jaxport	Port of Jacksonville, Florida
IMO	International Maritime Organization
M/C	Mom (or Cow) calf pair association
MA	Massachusetts
Marineland	Marineland Right Whale Project
MMSI	Maritime Mobile Service Identity
MRC	Marine Resources Council
MSR / MSRS	Mandatory Ship Reporting System
NARWC	North Atlantic Right Whale Consortium
NAVTEX	Navigational Telex
NC	North Carolina
NEA	New England Aquarium
NEFSC	NOAA's National Marine Fisheries Service, Northeast Fisheries Science Center

NEUS	Northeastern United States
NEWS	Northern Early Warning System survey area covered by the Wildlife Trust, Georgia survey team.
NOAA Fisheries Service	National Oceanic and Atmospheric Administration's National Marine Fisheries Service
PCCS	Provincetown Center for Coastal Studies
PIC	Pilot in Command
PLB	Personal Locator Beacon
SAG	Surface Active Group
SC	South Carolina
SEUS	Southeastern United States
SEWS	Southern Early Warning System survey area covered by Florida Fish and Wildlife Conservation Commission's Fish and Wildlife Research Institute survey team
SIC	Second in Command
SMA	Seasonal Management Area
SPUE	Sightings per unit effort. Effort measured in nautical miles of survey.
SS	Beaufort sea-state
UNCW/Duke	University of North Carolina, Wilmington and Duke University joint survey team
URI	University of Rhode Island
USACE	United States Army Corps of Engineers
USCG	United States Coast Guard
USGS	US Geological Survey
USN	United States Navy
VHF	Very-high-frequency
WTGA	Wildlife Trust, Georgia
WTSC	Wildlife Trust, South Carolina aerial survey team.

UNITS OF MEASURE

d	Days
ft	Feet
hr	Hour
km	Kilometers
kts	Knots
m	Metres
MHz	Megahertz
Mph	Miles per hour
nmi	Nautical miles

DEFINITION OF TERMS

Adult	Any cow, or any individual 9 years of age or older
Associated	Whales that are within several body lengths of each other and coordinating their movements at the surface
Assumed Dead	For a calf in the SEUS: When mother has been seen in the SEUS post calving without her calf during good sighting conditions at least once.
CEWS	Central Early Warning System: Refers to the survey area covered by the New England Aquarium team. The regular survey area is from 30°50N to 30°17N, although summary data provided in this report for the CEWS area includes a selection of days when contingency surveys were flown.
Close Approach Event	A vessel/whale interaction when the observed vessel comes within 500 yards at the closest distance to the whale(s).
Cross legs	Flight path from one trackline to another at the eastern or western edge. Cross legs are north or south bound depending on direction of survey flight.
Cow	Reproductive female North Atlantic right whale
Effort	Any time that the aircraft is above water and observers have a visibility of one nmi or greater.
EWS area	The survey area covered by northern, central and southern Early Warning System aerial survey teams. This does not include the WTSC survey area.
EWS Network	Transfer of right whale sighting information from various sources where sighting originated, to the relevant distribution list of end users, and subsequent broadcasts.
Intermatch Code	A code given to a whale by NEA that has been matched for more than one sighting but the catalog # is unknown
Juvenile	1 – 8 years of age (except cows within this range)
Logger 2000	Computerized logging program created by IFAW and designed for compatibility with the Right Whale Consortium database
NAVTEX	An international, automated, direct-printing service for delivery of navigational warnings, meteorological forecasts, and urgent marine safety information to ships. USCG operated NAVTEX facility that disseminates SEUS right whale sighting information is Miami, FL.
Neonate	A calf less than four weeks old
One-plane Contingency Plan	The survey area flown by a single aircraft in the event that two of the three EWS survey planes is not able to fly, in order to cover most of the EWS area with allocated time.
OTHER	Alternative sources of sighting information reported through the EWS system. These were reliable sources such as Navy, US Coast Guard or the volunteer sighting network.

Season Code	A code given to a whale within season, to assist in the recognition of individuals in the field, based on matching within the season's sightings, when the catalog # is unknown
Serious Injury	Cuts deeper than 8 cm, as well as all whales carrying any type of gear, according to the criteria for cuts from entanglements or ship strikes (Knowlton and Kraus, 2001).
SEUS	Southeast United States. When referred to in the context of this report, the SEUS area includes survey areas of WTSC, NEWS, CEWS, and SEWS.
Sighting Event	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.
Survey Effort	Trackline nmi flown not including cross legs, transit miles or any deviation from tracklines.
Transects / Tracklines	Designated line of latitude that is followed for a survey flight. Tracklines are 3 nmi apart and extend 14 to 35 nmi to the east.
Two-plane Contingency Plan	The survey area flown by two EWS aircrafts in the event that one of the other survey planes is not able to fly, in order to cover most of the EWS area with allocated time.
Unit of Survey Effort	One unit is equivalent to one nmi flown when the survey team is on effort i.e. any time that the aircraft is above water and observers have a visibility of one nmi or greater.
Vessel/Whale Interaction Event	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 nautical mile apart and communication between survey team and vessel are attempted in order to prevent collision or mitigate an interaction.
Whale	Refers to north Atlantic right whale except for when indicated otherwise
Whales per nmi Effort	Individual whales per nautical mile of survey trackline

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ACKNOWLEDGEMENTS

First and foremost we must mention and thank the NEA right whale aerial survey observers of the 2010 season. These surveys would never be possible without the loyalty and extreme dedication of a team of highly qualified individuals. The New England Aquarium's EWS team consisted of Kelly Slivka, Karen Vale, and Suzanne Hanlan. Kerry Lagueux provided ongoing AIS interpretation and GIS support.

FACSFAC JAX, Naval Air Station Jacksonville went to great lengths to keep the system running efficiently with whale sightings from dredges and military vessels. The USCG group Mayport and station Brunswick displayed a great willingness to help with the effort, as did the USACE, South Atlantic Division and the U.S. Navy. Showing particular consideration were Lt. Callaghan of USCG and Nancy Allen of U.S. Navy. On more than one occasion during the 2010 season the cooperation of the St. Johns Bar pilots, the Cumberland Sound pilots and the Brunswick Bar pilots was invaluable. The assistance of Barb Zoodsma of NOAA Fisheries Service was greatly appreciated throughout the course of the season, as well as Clay George of GDNR and Tom Pitchford of FWC. The coordination among the various aerial survey teams is of extreme importance and we thank the dedication and support from Tricia Naessig of Wildlife Trust, and Katie Jackson of FWC, and their hardworking observers.

With extreme gratitude we thank the EWS pilots Holly Friedman, Ryan Hagins, Ken Pearson, and Mike Vigus for their dedication and many long hours in flight. Also thanking Brad Payne of Eagle Cap Aviation for use of the aircraft and willingness to accommodate our ongoing effort.

Great appreciation goes to the USACE, USCG, and U.S. Navy for providing funding to enable the CEWS 2010 aerial surveys. These aerial surveys were conducted under Scientific Research Permit No. 655-1652 issued to Scott D. Kraus by the Permit Division of the National Marine Fisheries Service.

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RIGHT WHALE CATALOG NUMBER	INTER-MATCH CODE/SEASON CODE	YEAR	MONTH	DAY	TIME (L)	LATITUDE	LONGITUDE	AREA	REGION	BEHAVIORS* (See below for description of behavior abbreviations)
3623		2009	12	8	1201	31.14375	-81.27926	GA	SEUS	BODO, ROLL, WH CHN
	2008CalfOf3130	2009	12	9	0938	30.28597	-81.21596	FL	SEUS	SAG
	2008CalfOf1243	2009	12	9	0938	30.28597	-81.21596	FL	SEUS	SAG
1701		2009	12	15	1238	30.45335	-81.26474	FL	SEUS	POST
	2008calfof2330	2009	12	21	1041	30.67996	-81.22890	FL	SEUS	BOD CNT, SAG
3670	3670	2009	12	21	1041	30.67996	-81.22890	FL	SEUS	SAG
	2009Calfof3101	2009	12	21	1041	30.67996	-81.22890	FL	SEUS	MOPN, SAG
	2007Calfof1710	2009	12	21	1041	30.67996	-81.22890	FL	SEUS	SAG
	2008CalfOf1812	2009	12	21	1041	30.67996	-81.22890	FL	SEUS	BOD CNT, SAG

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3714		2009	12	21	1041	30.67996	-81.22890	FL	SEUS	BOD CNT, SAG
3142		2009	12	22	1159	30.58846	-81.15112	FL	SEUS	W/CALF, WH BEL, WH CHN
	2010CalfOf3142	2009	12	22	1159	30.58846	-81.15112	FL	SEUS	CALF W/MOM
	2008CalfOf2753	2009	12	22	1411	30.70148	-81.19052	FL	SEUS	SAG
	2008CalfOf3130	2009	12	22	1411	30.70148	-81.19052	FL	SEUS	SAG
	2008CalfOf3130	2009	12	22	1411	30.70148	-81.19052	FL	SEUS	SAG
3670	3670	2009	12	22	1411	30.70148	-81.19052	FL	SEUS	SAG
	2008CalfOf1812	2009	12	22	1411	30.70148	-81.19052	FL	SEUS	SAG
		2009	12	22	1411	30.70148	-81.19052	FL	SEUS	SAG

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	2008CalfOf1408	2009	12	22	1411	30.70148	-81.19052	FL	SEUS	SAG
	CT05SEUS08	2009	12	22	1411	30.70148	-81.19052	FL	SEUS	SAG
	2008CalfOf1243	2009	12	22	1411	30.70148	-81.19052	FL	SEUS	SAG
3623		2009	12	22	1411	30.70148	-81.19052	FL	SEUS	SAG, WH CHN
3314		2009	12	22	1411	30.70148	-81.19052	FL	SEUS	
	2007Calfof1710	2009	12	22	1411	30.70148	-81.19052	FL	SEUS	SAG
3541		2009	12	22	1411	30.70148	-81.19052	FL	SEUS	SAG, WH CHN
3745		2009	12	22	1411	30.70148	-81.19052	FL	SEUS	SAG
		2009	12	22	1411	30.70148	-81.19052	FL	SEUS	SAG

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3617		2009	12	22	1411	30.70148	-81.19052	FL	SEUS	SAG
	2008calfof2330	2009	12	22	1411	30.70148	-81.19052	FL	SEUS	MOPN, SAG
1145		2009	12	24	1015	30.40944	-81.24130	FL	SEUS	W/CALF
	2010CalfOf1145	2009	12	24	1015	30.40944	-81.24130	FL	SEUS	CALF W/MOM
3742		2009	12	24	1148	30.57434	-81.26797	FL	SEUS	BEL/BEL, BOD CNT, HDLFT, WH BEL
3611		2009	12	24	1148	30.57434	-81.26797	FL	SEUS	BEL/BEL, BLK BEL, BOD CNT
	2008CalfOf2753	2009	12	26	1158	30.44517	-81.10725	FL	SEUS	SAG, WH CHN
3611		2009	12	26	1158	30.44517	-81.10725	FL	SEUS	BLK CHN, SAG
	2008CalfOf1812	2009	12	26	1158	30.44517	-81.10725	FL	SEUS	BOD CNT, SAG

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RIGHT WHALE CATALOG NUMBER	INTER-MATCH CODE/SEASON CODE	YEAR	MONTH	DAY	TIME (L)	LATITUDE	LONGITUDE	AREA	REGION	BEHAVIORS* (See below for description of behavior abbreviations)
	2008calfof2330	2009	12	26	1158	30.44517	-81.10725	FL	SEUS	BOD CNT, SAG
3742		2009	12	26	1158	30.44517	-81.10725	FL	SEUS	BOD CNT, ROLL, SAG, WH BEL
3670	3670	2009	12	26	1158	30.44517	-81.10725	FL	SEUS	BOD CNT, SAG
3139		2009	12	26	1217	30.43811	-81.09590	FL	SEUS	
	2010CalfOf1950	2009	12	26	1331	30.54501	-81.33877	FL	SEUS	BLK BEL, BLK CHN, BOD CNT, CALF W/MOM, HDLFT
1950		2009	12	26	1331	30.54501	-81.33877	FL	SEUS	BOD CNT, W/CALF
3670	3670	2009	12	27	1051	30.47607	-81.04817	FL	SEUS	BLK BEL, BLK CHN, BRCH, SAG
	2008CalfOf1408	2009	12	27	1051	30.47607	-81.04817	FL	SEUS	SAG
3611		2009	12	27	1051	30.47607	-81.04817	FL	SEUS	SAG

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RIGHT WHALE CATALOG NUMBER	INTER-MATCH CODE/SEASON CODE	YEAR	MONTH	DAY	TIME (L)	LATITUDE	LONGITUDE	AREA	REGION	BEHAVIORS* (See below for description of behavior abbreviations)
3714		2010	1	4	1004	30.76281	-81.27535	GA	SEUS	BODO, SAG
	2008CalfOf3130	2010	1	4	1004	30.76281	-81.27535	GA	SEUS	BODO, SAG
	CT05SEUS08	2010	1	4	1004	30.76281	-81.27535	GA	SEUS	BLK CHN, BODO, SAG
		2010	1	4	1004	30.76281	-81.27535	GA	SEUS	BEL UP, BODO, SAG, WH BEL, WH CHN
	2009CalfOf2145	2010	1	4	1054	30.75386	-81.23154	GA	SEUS	BODO, BRCH, WH BEL
3411		2010	1	4	1309	30.4521	-81.24529	FL	SEUS	BEL/BEL, SAG
3541		2010	1	4	1309	30.4521	-81.24529	FL	SEUS	BEL/BEL, SAG, WH BEL
	2009Calfof3317	2010	1	4	1337	30.44287	-81.27148	FL	SEUS	BOD CNT, MOPN, YRLG W/MOM
3317		2010	1	4	1337	30.44287	-81.27148	FL	SEUS	BOD CNT, MOPN, W/YRLG

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3541		2010	1	6	1310	30.79053	-81.25368	GA	SEUS	SAG, WH BEL, WH CHN
		2010	1	6	1310	30.79053	-81.25368	GA	SEUS	SAG
3648		2010	1	6	1310	30.79053	-81.25368	GA	SEUS	SAG, WH BEL
3623		2010	1	6	1539	30.33417	-81.33366	FL	SEUS	BODO, SAG
3623	2008CalfOf3130	2010	1	6	1539	30.33417	-81.33366	FL	SEUS	BODO, SAG
		2010	1	6	1539	30.33417	-81.33366	FL	SEUS	BODO, SAG
3714		2010	1	6	1539	30.33417	-81.33366	FL	SEUS	BODO, SAG
	2009CalfOf2145	2010	1	6	1539	30.33417	-81.33366	FL	SEUS	BODO, FLIP, SAG
	2008CalfOf3293	2010	1	7	1034	30.77704	-81.16894	GA	SEUS	

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	2009CalfOf1151	2010	1	7	1043	30.78721	-81.18107	GA	SEUS	YRLG
3123		2010	1	7	1122	30.75106	-81.31021	GA	SEUS	BODO
2614		2010	1	7	1536	30.40034	-81.15487	FL	SEUS	HDLFT
3714		2010	1	7	1605	30.35831	-81.27278	FL	SEUS	SAG
3646		2010	1	7	1605	30.35831	-81.27278	FL	SEUS	BLK BEL, BLK CHN, BUBLS, SAG
	2010CalfOf1701	2010	1	11	1035	30.302	-81.11113	FL	SEUS	CALF W/MOM
1701		2010	1	11	1035	30.302	-81.11131	FL	SEUS	W/CALF
2614		2010	1	11	1457	30.63486	-81.33111	FL	SEUS	
1145		2010	1	12	1025	30.27077	-81.29595	FL	SEUS	BOD CNT, HDLFT, W/CALF

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	2010CalfOf1145	2010	1	12	1025	30.27077	-81.29595	FL	SEUS	BLK CHN, BOD CNT, CALF W/MOM
3360		2010	1	12	1032	30.2961	-81.22912	FL	SEUS	AVD, HDLFT
3360		2010	1	12	1204	30.31716	-81.22608	FL	SEUS	BODO
1701		2010	1	12	1230	30.4704	-81.22079	FL	SEUS	BOD CNT, W/CALF
	2010CalfOf1701	2010	1	12	1230	30.4704	-81.22079	FL	SEUS	BOD CNT, CALF W/MOM
2614		2010	1	12	1446	30.67877	-81.02577	FL	SEUS	
1701		2010	1	13	1155	30.67915	-81.12991	FL	SEUS	BRCH, W/CALF
	2010CalfOf1701	2010	1	13	1155	30.67915	-81.12991	FL	SEUS	CALF W/MOM
1701		2010	1	14	1258	30.59375	-81.12442	FL	SEUS	BOD CNT, W/CALF

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	2010CalfOf1701	2010	1	14	1258	30.59375	-81.12442	FL	SEUS	BOD CNT, CALF W/MOM
1950		2010	1	14	1320	30.53205	-81.39765	FL	SEUS	BOD CNT, W/CALF
	2010CalfOf1950	2010	1	14	1320	30.53205	-81.39765	FL	SEUS	BOD CNT, CALF W/MOM
1950		2010	1	14	1520	30.50018	-81.38479	FL	SEUS	BODO, W/CALF
	2010CalfOf1950	2010	1	14	1520	30.50018	-81.38479	FL	SEUS	BODO, CALF W/MOM
1701		2010	1	15	1452	30.34469	-81.23251	FL	SEUS	BOD CNT, W/CALF
	2010CalfOf1701	2010	1	15	1452	30.34469	-81.23251	FL	SEUS	BLK CHN, BOD CNT, CALF W/MOM, HDLFT
3123		2010	1	16	1504	30.57304	-81.32126	FL	SEUS	
2614		2010	1	16	1541	30.61769	-81.30160	FL	SEUS	BODO, FLIP

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		2010	1	18	1050	30.67534	-81.13243	FL	SEUS	BODO, SAG
		2010	1	18	1050	30.67534	-81.13243	FL	SEUS	BODO, SAG
		2010	1	18	1050	30.67534	-81.13243	FL	SEUS	BODO, SAG
2710		2010	1	18	1050	30.67534	-81.13243	FL	SEUS	BODO, SAG
	2009CalfOf1266	2010	1	18	1051	30.67096	-81.12255	FL	SEUS	
	S038	2010	1	18	1158	30.714	-81.37596	GA	SEUS	HDLFT, POST
	S038	2010	1	18	1346	30.72336	-81.37606	GA	SEUS	
3430		2010	1	18	1512	30.36082	-80.88546	FL	SEUS	BOD CNT, SAG
3745		2010	1	18	1512	30.36082	-80.88546	FL	SEUS	BLK BEL, BOD CNT, SAG

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3503		2010	1	18	1512	30.36082	-80.88546	FL	SEUS	SAG
1145		2010	1	18	1546	30.39409	-81.09828	FL	SEUS	BOD CNT, W/CALF
	2010CalfOf1145	2010	1	18	1546	30.39409	-81.09828	FL	SEUS	
3317		2010	1	18	1614	30.34005	-80.94532	FL	SEUS	BOD CNT, W/YRLG
	2009Calfof3317	2010	1	18	1614	30.34005	-80.94532	FL	SEUS	BOD CNT, YRLG W/MOM
3180		2010	1	18	1639	30.26332	-81.17869	FL	SEUS	NURS, W/CALF
	2010CalfOf3180	2010	1	18	1639	30.26332	-81.17869	FL	SEUS	CALF W/MOM, NURS
3730		2010	1	19	0936	30.29415	-81.22477	FL	SEUS	
		2010	1	19	0936	30.29415	-81.22477	FL	SEUS	

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1145		2010	1	19	1033	30.35031	-81.24454	FL	SEUS	BOD CNT, W/CALF
	2010CalfOf1145	2010	1	19	1033	30.35031	-81.24454	FL	SEUS	BOD CNT, CALF W/MOM
	2008CalfOf1208	2010	1	19	1118	30.38178	-81.18335	FL	SEUS	WH BEL, WH CHN
		2010	1	19	1405	30.58821	-81.25171	FL	SEUS	
2614		2010	1	19	1511	30.63792	-81.30545	FL	SEUS	
3745		2010	1	19	1549	30.7047	-81.00188	FL	SEUS	BLK BEL, SAG
		2010	1	19	1549	30.7047	-81.00188	FL	SEUS	BLK BEL, SAG
3503		2010	1	19	1625	30.81329	-80.90111	GA	SEUS	BODO
3430		2010	1	19	1625	30.81329	-80.90111	GA	SEUS	

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3180		2010	1	20	0924	30.2816	-81.29757	FL	SEUS	BOD CNT, W/CALF
	2010CalfOf3180	2010	1	20	0924	30.2816	-81.29757	FL	SEUS	BOD CNT, CALF W/MOM
1950		2010	1	20	0929	30.29326	-81.21090	FL	SEUS	W/CALF
	2010CalfOf1950	2010	1	20	0929	30.29326	-81.21090	FL	SEUS	CALF W/MOM
3611		2010	1	20	1027	30.33443	-81.15760	FL	SEUS	BEL/BEL, BLK BEL, BLK CHN, SAG
3504		2010	1	20	1027	30.33443	-81.15760	FL	SEUS	BEL/BEL, SAG, WH BEL, WH CHN
3260		2010	1	20	1203	30.53424	-81.20016	FL	SEUS	
2614		2010	1	20	1203	30.53424	-81.20016	FL	SEUS	
	2009CalfOf1266	2010	1	20	1208	30.54307	-81.21435	FL	SEUS	

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3546		2010	1	20	1451	30.75183	-81.15457	GA	SEUS	BODO, FLIP, HDLFT
1701		2010	1	22	0952	30.26799	-81.26620	FL	SEUS	W/CALF
	2010CalfOf1701	2010	1	22	0952	30.26799	-81.26620	FL	SEUS	CALF W/MOM
		2010	1	25	1022	31.27293	-80.94578	GA	SEUS	SAG
		2010	1	25	1022	31.27293	-80.94578	GA	SEUS	SAG
	2008CalfOf2790	2010	1	25	1022	31.27293	-80.94578	GA	SEUS	BLK CHN, FLIP, SAG
2614		2010	1	27	1427	30.83203	-81.27756	GA	SEUS	
3692		2010	1	27	1524	30.70958	-81.28331	GA	SEUS	
3701		2010	1	27	1541	30.69895	-81.28659	FL	SEUS	

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	2009CalfOf3440	2010	1	27	1632	30.71076	-81.31175	GA	SEUS	BODO
		2010	1	27	1632	30.71076	-81.31175	GA	SEUS	BODO
3701		2010	1	27	1707	30.70478	-81.30273	FL	SEUS	
	3705	2010	1	28	0947	30.7372	-81.28700	GA	SEUS	WH CHN
	2009CalfOf1334	2010	1	28	1002	30.82667	-81.32180	GA	SEUS	WH CHN
	2009Calfof1503	2010	1	28	1002	30.82667	-81.32180	GA	SEUS	HDLFT
	2009CalfOf3440	2010	1	28	1006	30.84433	-81.31388	GA	SEUS	BEL UP, BLK BEL, BLK CHN, BOD CNT, ROLL
	2008calfof2330	2010	1	28	1006	30.84433	-81.31388	GA	SEUS	BEL UP, BLK BEL, BLK CHN, BOD CNT, ROLL
2642		2010	1	28	1043	30.82499	-81.03214	GA	SEUS	BOD CNT, W/CALF

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RIGHT WHALE CATALOG NUMBER	INTER-MATCH CODE/SEASON CODE	YEAR	MONTH	DAY	TIME (L)	LATITUDE	LONGITUDE	AREA	REGION	BEHAVIORS* (See below for description of behavior abbreviations)
	2010CalfOf2642	2010	1	28	1043	30.82499	-81.03214	GA	SEUS	BOD CNT, CALF W/MOM
2710		2010	1	28	1212	31.01406	-80.96062	GA	SEUS	HDLFT
3623		2010	1	28	1503	31.27325	-80.86829	GA	SEUS	SAG, WH CHN
		2010	1	28	1503	31.27325	-80.86829	GA	SEUS	BLK CHN, SAG
3245		2010	1	28	1503	31.27325	-80.86829	GA	SEUS	BLK CHN, HDLFT, SAG
3503		2010	1	28	1503	31.27325	-80.86829	GA	SEUS	BEL/BEL, HDLFT, SAG
3530		2010	1	28	1503	31.27325	-80.86829	GA	SEUS	SAG
3550		2010	1	28	1503	31.27325	-80.86829	GA	SEUS	MOPN, SAG
3302		2010	1	28	1503	31.27325	-80.86829	GA	SEUS	SAG

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3611		2010	1	28	1503	31.27325	-80.86829	GA	SEUS	SAG
3351		2010	1	28	1503	31.27325	-80.86829	GA	SEUS	BEL/BEL, SAG
	3680	2010	1	28	1521	31.25796	-80.88035	GA	SEUS	
	2008CalfOf1408	2010	1	28	1537	31.21751	-80.89147	GA	SEUS	BLK BEL, BLK CHN, BOD CNT
	2008CalfOf2790	2010	1	28	1537	31.21751	-80.89147	GA	SEUS	BLK BEL, BLK CHN, BOD CNT
	2009calfof1515	2010	1	28	1552	31.20588	-80.89315	GA	SEUS	LBTL, MOPN, WH BEL
	2009Calfof1503	2010	1	28	1717	30.87532	-81.36521	GA	SEUS	W/UNPH EG
	2009CalfOf1334	2010	1	28	1717	30.87532	-81.36521	GA	SEUS	W/UNPH EG
		2010	1	28	1717	30.87532	-81.36521	GA	SEUS	UNPH

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2642		2010	1	29	1124	31.04086	-81.06625	GA	SEUS	W/CALF
	2010CalfOf2642	2010	1	29	1124	31.04086	-81.06625	GA	SEUS	CALF W/MOM
	2008CalfOf1812	2010	1	29	1131	31.04465	-81.07460	GA	SEUS	BEL UP, BLK BEL, BLK CHN
2642		2010	1	29	1158	31.04769	-81.08294	GA	SEUS	W/CALF, WH CHN
	2010CalfOf2642	2010	1	29	1158	31.04769	-81.08294	GA	SEUS	CALF W/MOM
	2009CalfOf1334	2010	1	29	1215	31.07816	-81.29235	GA	SEUS	BOD CNT, BODO, HDLFT, WH CHN
	2009Calfof1503	2010	1	29	1215	31.07816	-81.29235	GA	SEUS	BOD CNT, BODO
3692		2010	1	29	1543	31.29474	-80.91132	GA	SEUS	SAG
3333		2010	1	29	1543	31.29474	-80.91132	GA	SEUS	SAG

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3530		2010	1	29	1543	31.29474	-80.91132	GA	SEUS	SAG, WH CHN
	2008CalfOf1408	2010	1	29	1605	31.35581	-80.86933	GA	SEUS	BEL UP, BLK BEL, BOD CNT, W/UNPH EG
3611		2010	1	29	1605	31.35581	-80.86933	GA	SEUS	BOD CNT, BRCH, LBTL, TL BRCH, W/UNPH EG
		2010	1	29	1617	31.34536	-80.88839	GA	SEUS	FLIP, SAG, TL BRCH, W/UNPH EG
	2009CalfOf3290	2010	1	29	1627	31.31746	-80.87314	GA	SEUS	BRCH, MOPN, WH BEL, WH CHN
		2010	1	29	1605	31.35581	-80.86933	GA	SEUS	BOD CNT, BRCH, LBTL, TL BRCH, UNPH
		2010	1	29	1617	31.34536	-80.88839	GA	SEUS	FLIP, SAG, TL BRCH, UNPH
		2010	1	29	1617	31.34536	-80.88839	GA	SEUS	FLIP, SAG, TL BRCH, UNPH
	2008CalfOf1408	2010	2	2	1510	30.45829	-81.28301	FL	SEUS	

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		2010	2	2	1510	30.45829	-81.28301	FL	SEUS	BLK BEL, HDLFT
	2008CalfOf2790	2010	2	2	1510	30.45829	-81.28301	FL	SEUS	BLK BEL, TL SLSH
		2010	2	2	1510	30.45829	-81.28301	FL	SEUS	BLK BEL, TL SLSH
	2008CalfOf3292	2010	2	2	1510	30.45829	-81.28301	FL	SEUS	BEL UP, BLK BEL, MOPN
	BK02SEUS09	2010	2	2	1510	30.45829	-81.28301	FL	SEUS	
3333		2010	2	2	1510	30.45829	-81.28301	FL	SEUS	
	2009Calfof3101	2010	2	2	1510	30.45829	-81.28301	FL	SEUS	UNPH
2614		2010	2	6	0947	30.78818	-81.08333	GA	SEUS	BLK BEL, LBTL
2642		2010	2	7	1255	30.83246	-81.11423	GA	SEUS	W/CALF

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	2010CalfOf2642	2010	2	7	1255	30.83246	-81.11423	GA	SEUS	CALF W/MOM
2614		2010	2	8	1102	30.62029	-81.10294	FL	SEUS	
3760		2010	2	9	1057	30.45058	-81.15720	FL	SEUS	BOD CNT
	2009CalfOf1266	2010	2	9	1057	30.45058	-81.15720	FL	SEUS	BOD CNT
2614		2010	2	9	1116	30.51197	-81.20512	FL	SEUS	
2614		2010	2	9	1153	30.50719	-81.19721	FL	SEUS	
1701		2010	2	11	1530	30.39738	-81.05604	FL	SEUS	BOD CNT, W/CALF
	2010CalfOf1701	2010	2	11	1530	30.39738	-81.05604	FL	SEUS	BOD CNT, CALF W/MOM
1950		2010	2	14	1145	30.594	-81.18095	FL	SEUS	W/CALF

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	2010CalfOf1950	2010	2	14	1145	30.594	-81.18095	FL	SEUS	
	S046	2010	2	14	1206	30.52128	-81.19966	FL	SEUS	ROLL, WH BEL, WH CHN
	2009Calfof2791	2010	2	14	1436	30.38566	-81.04650	FL	SEUS	
	S046	2010	2	14	1614	30.56223	-81.24877	FL	SEUS	WH BEL, WH CHN
2710		2010	2	15	0933	30.27682	-81.21886	FL	SEUS	BOD CNT, W/CALF
	2010CalfOf2710	2010	2	15	0933	30.27682	-81.21886	FL	SEUS	BOD CNT, CALF W/MOM
3296		2010	2	15	1041	30.45036	-81.13909	FL	SEUS	SAG
1409		2010	2	15	1041	30.45036	-81.13909	FL	SEUS	BRCH, SAG, WH BEL, WH CHN
		2010	2	15	1108	30.4385	-81.13367	FL	SEUS	UNPH

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3650		2010	2	17	0957	30.32961	-81.32976	FL	SEUS	SAG
3750	3750	2010	2	17	0957	30.32961	-81.32976	FL	SEUS	SAG
		2010	2	17	1040	30.27529	-81.37273	FL	SEUS	
3740		2010	2	17	1041	30.27666	-81.37826	FL	SEUS	
	3705	2010	2	17	1044	30.28208	-81.37480	FL	SEUS	BOD CNT, WH BEL, WH CHN
	2009Calfof1503	2010	2	17	1044	30.28208	-81.37480	FL	SEUS	BOD CNT
	2009CalfOf1334	2010	2	17	1049	30.2761	-81.37661	FL	SEUS	WH CHN
	2009CalfOf1281	2010	2	17	1049	30.2761	-81.37661	FL	SEUS	
		2010	2	17	1059	30.28247	-81.37825	FL	SEUS	

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3725		2010	2	17	1059	30.28247	-81.35826	FL	SEUS	SAG, W/UNPH EG
		2010	2	17	1059	30.28247	-81.35826	FL	SEUS	SAG, W/UNPH EG
		2010	2	17	1059	30.28247	-81.35826	FL	SEUS	SAG, UNPH
3750	3750	2010	2	19	0933	30.29816	-81.14526	FL	SEUS	SAG
3333		2010	2	19	0933	30.29816	-81.14526	FL	SEUS	BEL/BEL, SAG
3650		2010	2	19	0933	30.29816	-81.14526	FL	SEUS	SAG
		2010	2	19	1033	30.34069	-81.20195	FL	SEUS	
2710		2010	2	19	1409	30.6112	-81.13638	FL	SEUS	BOD CNT, W/CALF
	2010CalfOf2710	2010	2	19	1409	30.6112	-81.13638	FL	SEUS	BOD CNT, CALF W/MOM

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2440		2010	2	20	1200	30.16623	-81.19382	FL	SEUS	
3650		2010	2	20	1206	30.16624	-81.19443	FL	SEUS	
	3680	2010	2	20	1209	30.16694	-81.19467	FL	SEUS	
3660		2010	2	20	1345	30.14562	-81.19273	FL	SEUS	BEL/BEL, HDLFT, SAG, WH BEL, WH CHN
3650		2010	2	20	1345	30.14562	-81.19273	FL	SEUS	BEL/BEL, BLK CHN, HDLFT, SAG, TL SLSH
3333		2010	2	20	1352	30.12085	-81.19659	FL	SEUS	BEL UP, BEL/BEL, BLK BEL, BLK CHN, FLIP, ROLL, SAG
3750	3750	2010	2	20	1352	30.12085	-81.19659	FL	SEUS	BEL/BEL, BLK BEL, ROLL, SAG
2440		2010	2	20	1403	30.13968	-81.18973	FL	SEUS	POST
	3680	2010	2	20	1403	30.13968	-81.18973	FL	SEUS	

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1170		2010	2	20	1611	29.89355	-81.05078	FL	SEUS	LBTL
3725		2010	2	20	1635	29.8314	-81.17073	FL	SEUS	BLK BEL, BLK CHN, BODO, LBTL, TL BRCH
	3705	2010	2	20	1646	29.81764	-81.14590	FL	SEUS	SAG, WH BEL, WH CHN
		2010	2	20	1646	29.81764	-81.14590	FL	SEUS	SAG
	S037	2010	2	20	1646	29.81764	-81.14590	FL	SEUS	SAG
3725		2010	2	20	1654	29.83069	-81.17443	FL	SEUS	SAG
3745		2010	2	20	1654	29.83069	-81.17443	FL	SEUS	BLK BEL, BLK CHN, HDLFT, SAG
		2010	2	20	1654	29.83069	-81.17443	FL	SEUS	BEL UP, BLK BEL, BLK CHN, MALE, ROLL, SAG
	S041	2010	2	20	1704	29.80242	-81.21148	FL	SEUS	BODO

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		2010	2	20	1641	29.80694	--81.17002	FL	SEUS	UNPH
	3680	2010	2	21	1028	30.01046	-81.18415	FL	SEUS	
2904		2010	2	21	1033	30.02958	-81.19271	FL	SEUS	WH BEL, WH CHN
		2010	2	21	1033	30.02958	-81.19271	FL	SEUS	
3296		2010	2	21	1051	30.02472	-81.18697	FL	SEUS	BODO
3142		2010	2	21	1127	30.08152	-81.25680	FL	SEUS	BOD CNT, W/CALF, WH CHN
	2010CalfOf3142	2010	2	21	1127	30.08152	-81.25680	FL	SEUS	BOD CNT, CALF W/MOM
2710		2010	2	21	1208	30.17534	-81.16206	FL	SEUS	BOD CNT, W/CALF
	2010CalfOf2710	2010	2	21	1208	30.17534	-81.16206	FL	SEUS	BLK CHN, BOD CNT, CALF W/MOM

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1960		2010	2	21	1458	30.48012	-81.31010	FL	SEUS	
	2009calfof1515	2010	2	21	1458	30.48012	-81.31010	FL	SEUS	
3714		2010	2	21	1458	30.48012	-81.31010	FL	SEUS	
1320		2010	2	21	1458	30.48012	-81.31010	FL	SEUS	
		2010	2	21	1458	30.48012	-81.31010	FL	SEUS	
2209		2010	2	21	1458	30.48012	-81.31010	FL	SEUS	
1317		2010	2	21	1458	30.48012	-81.31010	FL	SEUS	
3190		2010	2	21	1531	30.46048	-81.30075	FL	SEUS	
2201		2010	2	21	1531	30.46048	-81.30075	FL	SEUS	POST

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2642		2010	2	21	1606	30.49294	-81.18504	FL	SEUS	W/CALF, WH CHN
	2010CalfOf2642	2010	2	21	1606	30.49294	-81.18504	FL	SEUS	CALF W/MOM
3260		2010	2	23	1147	30.26524	-81.04128	FL	SEUS	
	2008CalfOf3130	2010	2	23	1338	30.60861	-81.02251	FL	SEUS	MOPN
3411		2010	2	23	1633	30.81857	-80.94041	GA	SEUS	BEL/BEL, BLK CHN, BOD CNT, HDLFT
3260		2010	2	23	1633	30.81857	-80.94041	GA	SEUS	BEL/BEL, BOD CNT, WH BEL, WH CHN
	S046	2010	2	23	1657	30.82736	-81.13145	GA	SEUS	WH CHN
3260		2010	2	24	0945	30.39263	-80.98444	FL	SEUS	BOD CNT, HDLFT, W/CALF
	2010CalfOf3260	2010	2	24	0945	30.39263	-80.98444	FL	SEUS	BOD CNT, CALF W/MOM

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3260		2010	2	24	1020	30.38887	-80.98442	FL	SEUS	BOD CNT, W/CALF
	2010CalfOf3260	2010	2	24	1020	30.38887	-80.98442	FL	SEUS	BOD CNT, CALF W/MOM
3545		2010	2	27	1304	30.62366	-80.77332	FL	SEUS	SAG
1209		2010	2	27	1304	30.62366	-80.77332	FL	SEUS	BEL/BEL, SAG
3150		2010	2	27	1304	30.62366	-80.77332	FL	SEUS	SAG, WH BEL, WH CHN
		2010	3	1	0949	30.81146	-80.79822	GA	SEUS	MOPN
		2010	3	1	1050	30.68231	-80.90945	FL	SEUS	FEM, SAG
3260		2010	3	1	1050	30.68231	-80.90945	FL	SEUS	BLK BEL, FCL, SAG
3312		2010	3	1	1050	30.68231	-80.90945	FL	SEUS	SAG

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3190		2010	3	1	1050	30.68231	-80.90945	FL	SEUS	SAG
3630		2010	3	1	1050	30.68231	-80.90945	FL	SEUS	SAG
1960		2010	3	1	1050	30.68231	-80.90945	FL	SEUS	SAG
2770		2010	3	1	1050	30.68231	-80.90945	FL	SEUS	SAG
		2010	3	1	1140	30.68184	-80.89437	FL	SEUS	SAG
3312		2010	3	1	1140	30.68184	-80.89437	FL	SEUS	SAG
		2010	3	1	1140	30.68184	-80.89437	FL	SEUS	SAG
3630		2010	3	1	1140	30.68184	-80.89437	FL	SEUS	SAG
2770		2010	3	1	1140	30.68184	-80.89437	FL	SEUS	SAG

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3190		2010	3	1	1140	30.68184	-80.89437	FL	SEUS	SAG
3260		2010	3	1	1140	30.68184	-80.89437	FL	SEUS	FCL, SAG
1960		2010	3	1	1140	30.68184	-80.89437	FL	SEUS	SAG
2615		2010	3	1	1140	30.68184	-80.89437	FL	SEUS	SAG
2910		2010	3	1	1242	30.54976	-80.82631	FL	SEUS	
3295		2010	3	5	1131	30.81354	-80.85429	GA	SEUS	
3380		2010	3	5	1131	30.81354	-80.85429	GA	SEUS	
2645		2010	3	5	1443	30.40551	-81.34312	FL	SEUS	BOD CNT, W/CALF, WH CHN
	2010CalfOf2645	2010	3	5	1443	30.40551	-81.34312	FL	SEUS	BOD CNT, CALF W/MOM, WH BEL, WH CHN

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2645		2010	3	5	1556	30.39553	--81.34360	FL	SEUS	W/CALF, UNPH
	2010CalfOf2645	2010	3	5	1556	30.39553	--81.34360	FL	SEUS	W/MOM, UNPH
	BK56	2010	3	6	1024	30.41257	-81.10130	FL	SEUS	BEL/BEL, BODO, SAG
3229		2010	3	6	1024	30.41257	-81.10130	FL	SEUS	BEL/BEL, BODO, POST, SAG
3510		2010	3	6	1024	30.41257	-81.10130	FL	SEUS	BEL/BEL, BODO, CHN BRCH, HDLFT, SAG
3460		2010	3	6	1043	30.41538	-81.08557	FL	SEUS	APPR
	BK56	2010	3	6	1121	30.41479	-81.10445	FL	SEUS	SAG
3229		2010	3	6	1121	30.41479	-81.10445	FL	SEUS	SAG
3510		2010	3	6	1121	30.41479	-81.10445	FL	SEUS	SAG

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3460		2010	3	6	1121	30.41479	-81.10445	FL	SEUS	SAG
2645		2010	3	6	1139	30.45559	-81.18373	FL	SEUS	BOD CNT, W/CALF
	2010CalfOf2645	2010	3	6	1139	30.45559	-81.18373	FL	SEUS	CALF W/MOM
3466		2010	3	6	1411	30.54935	-81.05361	FL	SEUS	
3180		2010	3	6	1442	30.57467	-80.98884	FL	SEUS	NURS, W/CALF
	2010CalfOf3180	2010	3	6	1442	30.57467	-80.98884	FL	SEUS	CALF W/MOM, NURS
	S039	2010	3	6	1534	30.6497	-81.07465	FL	SEUS	
2605		2010	3	6	1637	30.76458	-80.93179	GA	SEUS	BOD CNT, W/CALF
	2010CalfOf2605	2010	3	6	1637	30.76458	-80.93179	GA	SEUS	BOD CNT, CALF W/MOM

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3229		2010	3	7	1130	30.60187	-80.89954	FL	SEUS	SAG
2740		2010	3	7	1130	30.60187	-80.89954	FL	SEUS	SAG
1628		2010	3	7	1130	30.60187	-80.89954	FL	SEUS	SAG
1121		2010	3	7	1130	30.60187	-80.89954	FL	SEUS	
3279		2010	3	7	1130	30.60187	-80.89954	FL	SEUS	
1613		2010	3	7	1130	30.60187	-80.89954	FL	SEUS	
2209		2010	3	7	1138	30.59733	-80.90651	FL	SEUS	
3466		2010	3	7	1139	30.59989	-80.89811	FL	SEUS	
	3680	2010	3	7	1139	30.59989	-80.89811	FL	SEUS	

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RIGHT WHALE CATALOG NUMBER	INTER-MATCH CODE/SEASON CODE	YEAR	MONTH	DAY	TIME (L)	LATITUDE	LONGITUDE	AREA	REGION	BEHAVIORS* (See below for description of behavior abbreviations)
3460		2010	3	7	1139	30.59989	-80.89811	FL	SEUS	
	2009CalfOf1281	2010	3	7	1157	30.59226	-80.91785	FL	SEUS	
3701		2010	3	7	1157	30.59226	-80.91785	FL	SEUS	
3629		2010	3	7	1157	30.59226	-80.91785	FL	SEUS	
1719		2010	3	7	1209	30.59644	-80.91783	FL	SEUS	
3060		2010	3	7	1211	30.60902	-80.92998	FL	SEUS	
3279		2010	3	7	1237	30.62027	-80.89858	FL	SEUS	
	BK56	2010	3	7	1237	30.62027	-80.89858	FL	SEUS	
3466		2010	3	7	1237	30.62027	-80.89858	FL	SEUS	

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3040		2010	3	7	1237	30.62027	-80.89858	FL	SEUS	
3460		2010	3	7	1237	30.62027	-80.89858	FL	SEUS	
2209		2010	3	7	1241	30.61579	-80.90883	FL	SEUS	
3701		2010	3	7	1241	30.61579	-80.90883	FL	SEUS	
		2010	3	7	1241	30.61579	-80.90883	FL	SEUS	
3629		2010	3	7	1243	30.61899	-80.90885	FL	SEUS	
2920		2010	3	7	1243	30.61899	-80.90885	FL	SEUS	
3725		2010	3	7	1500	30.50979	-81.05383	FL	SEUS	
2645		2010	3	7	1610	30.39959	-81.20155	FL	SEUS	

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	2010CalfOf2645	2010	3	7	1610	30.39959	-81.20155	FL	SEUS	
3180		2010	3	7	1719	30.31315	-81.18299	FL	SEUS	
	2010CalfOf3180	2010	3	7	1719	30.31315	-81.18299	FL	SEUS	
2209		2010	3	8	1042	30.65583	-81.06360	FL	SEUS	HDLFT, SAG
3208		2010	3	8	1042	30.65583	-81.06360	FL	SEUS	SAG
		2010	3	8	1042	30.65583	-81.06360	FL	SEUS	BLK BEL, BLK CHN, SAG
2920		2010	3	8	1042	30.65583	-81.06360	FL	SEUS	SAG
3279		2010	3	8	1042	30.65583	-81.06360	FL	SEUS	BEL/BEL, SAG, WH BEL, WH CHN
1628		2010	3	8	1042	30.65583	-80.06360	FL	SEUS	BEL/BEL, HDLFT, SAG

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		2010	3	8	1042	30.65583	-81.06360	FL	SEUS	SAG
3391		2010	3	8	1042	30.65583	-81.06360	FL	SEUS	BEL/BEL, HDLFT, SAG
	3680	2010	3	8	1042	30.65583	-81.06360	FL	SEUS	BEL/BEL, SAG
3745		2010	3	8	1108	30.64834	-81.06619	FL	SEUS	BEL/BEL, BLK BEL, BLK CHN, INTRO, MALE, SAG
3208		2010	3	8	1108	30.64834	-81.06619	FL	SEUS	BEL/BEL, BLK BEL, BLK CHN, INTRO, MALE, SAG
1628		2010	3	8	1108	30.64834	-81.06619	FL	SEUS	BEL/BEL, BLK BEL, BLK CHN, INTRO, SAG
2740		2010	3	8	1118	30.66683	-81.07944	FL	SEUS	
3060		2010	3	8	1134	30.67214	-81.07659	FL	SEUS	BRCH, BUBLS, FLIP
3460		2010	3	8	1139	30.68498	-81.08381	FL	SEUS	

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RIGHT WHALE CATALOG NUMBER	INTER-MATCH CODE/SEASON CODE	YEAR	MONTH	DAY	TIME (L)	LATITUDE	LONGITUDE	AREA	REGION	BEHAVIORS* (See below for description of behavior abbreviations)
3510		2010	3	8	1156	30.68303	-81.07873	FL	SEUS	
	S047	2010	3	8	1553	30.35408	-81.24837	FL	SEUS	LBTL, ROLL
3745		2010	3	9	0927	30.81884	-81.08115	GA	SEUS	SAG
	3392	2010	3	9	0927	30.81884	-81.08115	GA	SEUS	SAG
1701		2010	3	9	1149	30.56937	-81.38703	FL	SEUS	NURS, W/CALF
	2010CalfOf1701	2010	3	9	1149	30.56937	-81.38703	FL	SEUS	CALF W/MOM, NURS
3510		2010	3	9	1238	30.48607	-81.15743	FL	SEUS	
3346		2010	3	9	1252	30.5082	-81.16125	FL	SEUS	ENTGL, SAG
	S047	2010	3	9	1252	30.5082	-81.16125	FL	SEUS	SAG

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RIGHT WHALE CATALOG NUMBER	INTER-MATCH CODE/SEASON CODE	YEAR	MONTH	DAY	TIME (L)	LATITUDE	LONGITUDE	AREA	REGION	BEHAVIORS* (See below for description of behavior abbreviations)
	S037	2010	3	9	1252	30.5082	-81.16125	FL	SEUS	BLK BEL, BLK CHN, SAG
1701		2010	3	9	1314	30.59399	-81.39579	FL	SEUS	BOD CNT, BODO, W/CALF
	2010CalfOf1701	2010	3	9	1314	30.59399	-81.39579	FL	SEUS	BOD CNT, BODO, BRCH, CALF W/MOM, LBTL
		2010	3	9	1429	30.46568	-81.16682	FL	SEUS	BLK BEL, HDLFT, SAG
		2010	3	9	1429	30.46568	-81.16682	FL	SEUS	MALE, SAG
		2010	3	9	1456	30.38548	-81.16714	FL	SEUS	BOD CNT
		2010	3	9	1456	30.38548	-81.16714	FL	SEUS	BOD CNT, WH CHN
		2010	3	9	1511	30.38369	-81.18610	FL	SEUS	BLK BEL, BLK CHN, SAG, W/UNPH EG
3060		2010	3	9	1511	30.38369	-81.18610	FL	SEUS	SAG, W/UNPH EG

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		2010	3	9	1511	30.38369	-81.18610	FL	SEUS	POST, SAG, W/UNPH EG
		2010	3	9	1526	30.3901	-81.15012	FL	SEUS	UNPH
		2010	3	9	1557	30.37974	-81.12808	FL	SEUS	
		2010	3	9	1557	30.37974	-81.12808	FL	SEUS	
	S053	2010	3	9	1616	30.37893	-81.12505	FL	SEUS	
3515		2010	3	9	1702	30.35507	-81.05441	FL	SEUS	SAG, W/UNPH EG, WH BEL, WH CHN
3040		2010	3	9	1702	30.35507	-81.05441	FL	SEUS	SAG, W/UNPH EG
		2010	3	9	1702	30.35507	-81.05441	FL	SEUS	SAG, W/UNPH EG
		2010	3	9	1719	30.39745	-81.09719	FL	SEUS	

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		2010	3	9	1719	30.39745	-81.09719	FL	SEUS	
		2010	3	9	1729	30.36407	--81.10119	FL	SEUS	UNPH
		2010	3	9	1729	30.36407	--81.10119	FL	SEUS	UNPH
		2010	3	9	1729	30.36407	--81.10119	FL	SEUS	UNPH
		2010	3	9	1737	30.34867	--81.19287	FL	SEUS	SAG, UNPH
		2010	3	9	1737	30.34867	--81.19287	FL	SEUS	SAG, UNPH
		2010	3	9	1737	30.34867	--81.19287	FL	SEUS	SAG, UNPH
		2010	3	9	1737	30.34867	--81.19287	FL	SEUS	SAG, UNPH
		2010	3	9	1737	30.34867	--81.19287	FL	SEUS	SAG, UNPH

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2710		2010	3	16	1355	30.26203	-80.99151	FL	SEUS	W/CALF
	2010CalfOf2710	2010	3	16	1355	30.26203	-80.99151	FL	SEUS	CALF W/MOM
		2010	3	16	1405	30.29826	-80.82409	FL	SEUS	MOPN
2740		2010	3	16	1427	30.31679	-80.74444	FL	SEUS	W/UNPH EG
3208		2010	3	16	1427	30.31994	-30.26203	EAST	EAST	
		2010	3	16	1427	30.31994	-80.73774	FL	SEUS	
		2010	3	16	1439	30.32	-80.74386	FL	SEUS	SAG
1249		2010	3	16	1439	30.32	-80.74386	FL	SEUS	SAG
		2010	3	16	1439	30.32	-80.74386	FL	SEUS	SAG

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RIGHT WHALE CATALOG NUMBER	INTER-MATCH CODE/SEASON CODE	YEAR	MONTH	DAY	TIME (L)	LATITUDE	LONGITUDE	AREA	REGION	BEHAVIORS* (See below for description of behavior abbreviations)
1327		2010	3	16	1439	30.32	-80.74386	FL	SEUS	SAG
3208		2010	3	16	1439	30.32	-80.74386	FL	SEUS	SAG
		2010	3	16	1427	30.31679	-80.74444	FL	SEUS	UNPH
2430		2010	3	17	1057	30.47668	-81.24541	FL	SEUS	W/CALF
	2010CalfOf2430	2010	3	17	1057	30.47668	-81.24541	FL	SEUS	CALF W/MOM
1701		2010	3	18	1627	30.66247	-81.00827	FL	SEUS	W/CALF
	2010CalfOf1701	2010	3	18	1627	30.66247	-81.00827	FL	SEUS	BEL UP, BLK BEL, BLK CHN, CALF W/MOM, MALE, MOPN, TL SLSH
2605		2010	3	19	1522	30.84731	-81.09029	GA	SEUS	BOD CNT, W/CALF, WH CHN
	2010CalfOf2605	2010	3	19	1522	30.84731	-81.09029	GA	SEUS	BOD CNT, CALF W/MOM, WH BEL, WH CHN

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2605		2010	3	20	1527	30.80277	-81.15356	GA	SEUS	BOD CNT, W/CALF, WH CHN
	2010CalfOf2605	2010	3	20	1527	30.80277	-81.15356	GA	SEUS	BOD CNT, CALF W/MOM, WH BEL, WH CHN
2642		2010	3	20	1530	30.79796	-81.16213	GA	SEUS	BOD CNT, NURS, W/CALF, WH CHN
	2010CalfOf2642	2010	3	20	1530	30.79796	-81.16213	GA	SEUS	BOD CNT, CALF W/MOM, NURS
3123		2010	3	20	1541	30.77389	-81.15513	GA	SEUS	W/CALF
	2010CalfOf3123	2010	3	20	1541	30.77389	-81.15513	GA	SEUS	BRCH, CALF W/MOM, WH BEL, WH CHN
3123		2010	3	21	1010	30.77688	-81.40821	GA	SEUS	W/CALF
	2010CalfOf3123	2010	3	21	1010	30.77688	-81.40821	GA	SEUS	CALF W/MOM
1719		2010	3	24	1002	30.67494	-80.95193	FL	SEUS	BEL/BEL, BLK BEL, BLK CHN, FEM, MOPN, ROLL, SAG

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3191		2010	3	24	1002	30.67494	-80.95193	FL	SEUS	SAG
3208		2010	3	24	1002	30.67494	-80.95193	FL	SEUS	BEL/BEL, SAG
1429		2010	3	24	1002	30.67494	-80.95193	FL	SEUS	BEL/BEL, SAG
2920		2010	3	24	1002	30.67494	-80.95193	FL	SEUS	HDLFT, MOPN, SAG
3360		2010	3	24	1142	30.86231	-80.98316	GA	SEUS	BOD CNT, LOG, NURS, W/CALF, WH CHN
	2010CalfOf3360	2010	3	24	1142	30.86231	-80.98316	GA	SEUS	CALF W/MOM, NURS, WH CHN
2642		2010	3	24	1458	31.28927	-81.16628	GA	SEUS	BOD CNT, W/CALF
	2010CalfOf2642	2010	3	24	1458	31.28927	-81.16628	GA	SEUS	BOD CNT, CALF W/MOM, WH BEL
2614		2010	3	25	1027	30.84147	-81.05566	GA	SEUS	BOD CNT, W/CALF

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	2010CalfOf2614	2010	3	25	1027	30.84147	-81.05566	GA	SEUS	BOD CNT, CALF W/MOM
1145		2010	3	25	1146	31.04917	-81.24348	GA	SEUS	W/CALF
	2010CalfOf1145	2010	3	25	1146	31.04917	-81.24348	GA	SEUS	CALF W/MOM
1145		2010	3	25	1349	31.14283	-81.10280	GA	SEUS	BOD CNT, W/CALF
	2010CalfOf1145	2010	3	25	1349	31.14283	-81.10280	GA	SEUS	BOD CNT, CALF W/MOM
2642		2010	3	26	1502	30.56911	-80.96428	FL	SEUS	BOD CNT, W/CALF, WH BEL, WH CHN
	2010CalfOf2642	2010	3	26	1502	30.56911	-80.96428	FL	SEUS	BOD CNT, CALF W/MOM
2642		2010	3	26	1548	30.56272	-80.97335	FL	SEUS	BOD CNT, W/CALF, WH CHN
	2010CalfOf2642	2010	3	26	1548	30.56272	-80.97335	FL	SEUS	BOD CNT, CALF W/MOM

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BEHAVIORS	BEHAVIOR DESCRIPTION
APPR	Aggressive Approach
AVD	Avoidance to Platform
BEL UP	Belly Up
BEL/BEL	Belly to Belly
BLK BEL	Black Belly
BLK CHN	Black Chin
BOD CNT	Body Contact
BODO	Associated with Bottlenose Dolphins
BRCH	Breaching
BUBLS	Bubbles observed underwater
CALF W/MOM	Calf of a Mom/Calf Pair
CHN BRCH	Chin Breach
ENTGL	Entangled
FCL	Focal Animal
FEM	Female
FLIP	Flippering/ Flipper Slapping
HDLFT	Head Lift
INTRO	Intromission
LBTL	Lobtailing
LOG	Logging
MALE	Male
MOPN	Mouth Open
NURS	Nursing
POST	Posturing
ROLL	Rolling
SAG	Surface Active Group
TL BRCH	Tail Breach
TL SLSH	Tail Slash
UNPH	Unphotographed
W/CALF	Mom of a Mom Calf Pair
W/MOM	Calf of a Mom/Calf Pair
W/UNPH EG	With Unphotographed Whale
W/YRLG	Mom of Mom/Yearling Pair
WH BEL	White Belly
WH CHN	White Chin
YRLG	Yearling
YRLG W/MOM	Yearling of Mom/Calf Pair