Aerial Surveys for Ship Strike Mitigation and Other Field Observations of North Atlantic Right Whales (*Eubalaena glacialis*) off the East Coast of Florida
December 2011-March 2012

Southern Early Warning System

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INTRODUCTION

The North Atlantic right whale (*Eubalaena glacialis*) is considered one of the most endangered populations of large whales in the world (Kraus *et al.*, 2005). The species has shown little or no signs of recovery since receiving international protection from commercial whaling in 1935 and federal protection under the Endangered Species Conservation Act in 1970 and, subsequently, the Marine Mammal Protection Act in 1972 and Endangered Species Act in 1973 (Kraus *et al.*, 2005; NMFS, 2005). This lack of recovery is principally attributed to deaths from human related activities, mainly vessel collisions and fishing gear entanglements (Waring *et al*., 2012). Efforts to protect right whales in the western North Atlantic have increased substantially since the completion of the first recovery plan in 1991; however, the stock is still considered to be extremely low (Waring *et al*., 2012).

The Southeast U.S. (SEUS) is one of six major habitats identified for North Atlantic right whales (Waring *et al.*, 2012). Based on sighting records, the SEUS wintering population consists mainly of cow-calf pairs and juveniles and, to a lesser extent, adult males and non-calving adult females. The majority of calving is believed to occur off Florida and Georgia between December and March. However, right whales have been sighted in the calving area as early as September and as late as July (Taylor *et al*., 2010) and there are records of calving occurring in the northeastern U.S. (Patrician *et. al*., 2009). In 1994 (59 FR 28805), the National Oceanic and Atmospheric Administration's National Marine Fisheries Service (NOAA NMFS) designated the coastal waters of Florida and Georgia as critical habitat for right whales. In addition, NMFS published the Right Whale Minimum Approach Regulation in 1997 (50 CFR 224.103), prohibiting all approaches (vessel, aircraft, or other means) within 500 yards of any right whale (NMFS, 2005).

A Mandatory Ship Reporting System (MSRS) was federally implemented in the SEUS in 1999. The MSRS is endorsed by the International Maritime Organization (IMO) and requires all commercial vessels 300 gross tons or greater to report into a shore-based station when entering the designated right whale reporting area. In return, the vessels are provided with the latest right whale sighting locations (provided by aerial survey teams) and information on how to avoid collisions with right whales (NMFS, 2005). In order to reduce the likelihood of vessel collisions with right whales, NMFS, in cooperation with the U.S. Coast Guard (USCG), instituted recommended vessel routes in November 2006 for three major ports in the SEUS: Brunswick, GA; Fernandina, FL; and Jacksonville, FL. Additionally, on 10 October 2008 the Right Whale Ship Strike Reduction Rule (50 CFR Part 224), originally proposed by NMFS in 2006, was finalized and it became effective in December 2008. The rule established a seasonal speed restriction of 10 knots (18.5 km/hr) for vessels 65 ft (19.8 km) in length or greater traveling in designated seasonal management areas (SMA) along the U.S. East Coast. Military, law enforcement, and U.S. government vessels are exempt from speed restrictions in the SMA (50 CFR Part 224). The SEUS-SMA and MSRS are in effect from November 15 – April 15: the timeframe when right whales are typically found in the SEUS.

During the 1993-1994 right whale calving season several agencies and organizations began an extensive aerial survey network known as the Early Warning System (EWS) to reduce ship strikes in the SEUS (NMFS, 2005). The EWS provided valuable right whale sighting information (whale alerts) to the U.S. Army Corps of Engineers (USACE), USCG, U.S. Navy (USN), harbor pilots, port authorities, and other maritime organizations. The current three-plane EWS survey format was implemented during the 2002-2003 calving season and provides daily monitoring from Sapelo Island, GA (31°32N) to Crescent Beach, FL (29°47N). Under this framework, teams are divided into three

survey areas: the northern EWS (NEWS), central EWS (CEWS), and southern EWS (SEWS) (Figure 1). A fourth team surveys South Carolina and northern Georgia (SCGA). With the incorporation of the Navy's Fleet Area Control and Surveillance Facility Jacksonville (FACSFACJAX) as the sighting collection and dissemination center for all aerial survey aircraft, whale alerts were processed and transmitted to mariners in near real-time. The EWS was improved with the dissemination of information to the general public through USCG Broadcast Notices to Mariners (BNTM) and broadcasts over NOAA Weather Radio. Further refinements to the EWS network allowed the aerial survey teams to send whale alerts directly to recipients in select geographic regions or "bins"; thus, providing vessel operators with whale sighting information specific to their area of operation in near real-time (Figure 2).

This report summarizes FWRI's SEWS aerial survey data and other field observations for the 2011-2012 calving season (subsequently referred to as the 2012 season). During the 2012 calving season, the FWRI provided aerial survey coverage of the SEWS and CEWS survey areas (CEWS aerial survey results are detailed in a separate report). Whale identifications and life history information provided in this report are based on preliminary matches. Funding for the SEWS aerial surveys was provided by NMFS, subsequently referred to as NOAA Fisheries in this report.

METHODS

Aerial Surveys

Right whale aerial surveys were conducted daily, weather permitting, from 01 December 2011 to 31 March 2012. The SEWS area consisted of the ten southernmost east-west tracklines (lines 25-34) within the EWS framework (Figure 1). Tracklines were spaced 3 NM (5.5 km) apart and extended from Ponte Vedra, FL (30°14.0N) to Crescent Beach, FL (29°47.0N) from 0.5 NM (0.9 km) east of the shoreline to approximately 30 NM (55.6 km) offshore (080°47.0W). A full survey was defined as 100% coverage of the SEWS survey area. The SEWS and contingency survey configurations were consistent with previous EWS surveys carried out since the winter of 2003. Contingency plan surveys included east-west tracklines 1-30 within the EWS framework and were implemented to ensure aerial coverage of port entrances and inlets when one or more of the EWS teams were unable to survey due to aircraft availability (Table 1). Contingency surveys of varying coverage were flown from Cumberland Island, GA (30°47.0N) to Ponte Vedra, FL (29°59.0N) as needed. The SEWS team was also prepared to conduct coastal surveys south of the SEWS area targeting waters with favorable sea-surface temperature (SST) (14.3°C ± 2.1°C) for right whales in the SEUS (Keller et al., 2006). Aerial support for disentanglement events and biopsy were provided by the SEWS team as needed.

The survey aircraft was a twin engine Cessna 337 operated and maintained by Orion Aviation under provisions of FAA 14 CFR Part 135, FWC, NOAA requirements. Prior to the start of the calving season, pilots and aerial observers were required to successfully complete an aircraft ditching course. Observers were also required to take several online NOAA aircraft safety courses. Surveys were flown under visual flight rules (VFR) conditions and a flight plan was filed with the FAA for each day of survey. Aircraft typically departed the airport at 0900(L) and returned before sunset. In addition, flights were required not to extend beyond 45 minutes of reserve fuel. Survey personnel included a pilot-in-command (PIC), pilot-second-in-command (SIC), and two observers. Observers sat in the rear of the aircraft and visually scanned the survey area out to approximately 2.0 NM (3.7 km). Typically, the observer seated on the left recorded survey data and the observer seated on the right conducted photo-documentation through a hinged window during sightings.

Environmental conditions necessary to conduct a survey included visibility greater than 2.0 NM (3.7 km), winds less than approximately 17 knots (31.8 km/hr), and a minimum cloud ceiling of 1200 ft (365.8 m) over the survey area and airport. A sea state value of three or less on the Beaufort scale was targeted and preferred because the detectability of whales has been shown to decrease in sea states greater than three on the Beaufort scale (Hain et al., 1999). Survey team leaders participated in a sea state calibration flight aboard a NOAA operated DeHavilland Twin Otter aircraft to ensure standardized sea state determinations among EWS survey teams.

Whale Sighting Dissemination and Ground Duties

The EWS network facilitated the near real-time transmission of right whale sighting information (whale alerts) via email and cell phone text message to aerial survey teams, commercial shipping interests, dredge observers, harbor pilots, local and state agencies, NOAA Fisheries, USACE, USCG, USN, and volunteer networks. The whale alert message was designed to be brief in order to accommodate various types of hardware and the email format was standardized between EWS survey teams. EWS network participants were divided into email distribution lists based on geographic “bins”

that represent their area of operation or sighting interests (Figure 2). The SEWS team used satellite phone or marine band VHF radio to relay sighting information to the FWRI ground contact who was then responsible for sending the whale alert via email to the EWS network participants and following up with any reporting errors. Whale sighting location details were kept to a minimum when using marine band VHF radio in order to avoid potential harassment of whales by vessel operators in the surrounding area. Duplicate sightings of the same whale(s) were not disseminated unless more than an hour had passed from the previous sighting or the whale(s) had traveled more than 1.0 NM (1.85 km) from the original sighting location. In an effort to minimize the number of alerts, multiple whale sightings were occasionally combined into one whale alert notification if the whales were observed in close proximity to each other.

The FWRI ground contact fielded whale sighting reports from public citizens, volunteer sighting networks, and non-aerial survey team participants in the EWS network (*e.g.* dredge observers, USCG, USN), referred to as "OTHER" reports. FWRI staff assessed the details of the sighting (*e.g.* location, time lapse, and source) and contacted the reporting source if needed. Staff cross-referenced OTHER sighting reports with known whale sightings and relayed information to the respective survey team for verification. Aerial survey teams attempted to locate and verify OTHER sighting reports whenever feasible. Previously unknown, reliable sighting information was emailed to EWS participants without delay if the report was near a port or inlet or if aerial survey verification was not possible. Sightings verified by aerial survey teams were disseminated by the confirming survey team. The FWRI ground contact was also responsible for entering SEWS survey sighting information (date, time, and location) into the SEUS MSRS. Duplicate whale sightings that were not distributed to EWS participants via email continued to be updated in the MSRS. Sightings remained in the MSRS for 24 hours and could be accessed by vessel captains at any time during that period. Lastly, the FWRI ground contact maintained a near real-time knowledge of the position and maneuvers of the aircraft during survey and acted as a liaison between ground crews and the aircraft during entanglement, stranding, or other events.

Data Collection and Submission

Aerial Survey Data

The survey crew used a Fujitsu Lifebook T730 tablet PC to collect data electronically while in the aircraft. The tablet PC was small enough to comfortably sit in an observer's lap without obscuring his/her field of vision or presenting a safety hazard. Survey data were recorded at 10 second time intervals in a computer-based data logging program designed by NOAA Fisheries SEFSC. The new data logging program was specifically designed for touch-screen PCs (*e.g.* tablet PC); several drop-down and one-touch options improved data entry overall and further minimized the time spent looking away from the water. The program automatically retrieved times, locations, headings, and altitudes from the aircraft GPS and stored them in a Microsoft Access database. If the GPS or computer malfunctioned, GPS locations, headings, and altitudes were hand-recorded at intervals of five minutes on hard copy datasheets and later entered into a Microsoft Excel spreadsheet.

Environmental data collected by the observers and recorded in the survey database included: weather (*e.g.* clear), visibility, percent cloud cover, sea state (Beaufort scale), and the severity of the glare from the sun on the water. These data were updated throughout the survey when conditions changed. The survey program was configured to prompt observers to check and verify environmental conditions every seven minutes to ensure data were accurate throughout the survey.

Vessel information was recorded using an onboard AMEC CYPHO 101 AIS receiver and Siitech Web VTS Mate software. Observers used the Siitech software AIS viewer installed on the tablet PC to verify transmission of AIS data from vessels in the SEWS area. Vessels clearly identified through their AIS transmissions (*e.g.* merchant vessels) were not recorded in the survey database. Vessels 65 ft (19.8 m) or larger that were not detected on the AIS viewer were recorded in the survey database. These vessels were recorded when sighted within 2.0 NM (3.7 km) of the trackline. All small vessels (less than 65 ft (19.8 km) in length) within 1.5 NM (1.8 km) of the trackline were also recorded. Number and type of vessel, side of aircraft (*i.e.* left, right, both), and sighting time and location were entered in the survey database when the vessel was perpendicular to the trackline. Vessel heading, estimated length, and estimated speed were recorded for large vessels only. Exact GPS locations of vessels were not obtained unless the vessel was involved in a whale-vessel interaction (WVI). The presence of commercial fishing vessels (excluding shrimping vessels) and/or commercial fishing gear (*e.g.* crab pot buoys) were documented and reported to NOAA Fisheries.

Species recorded in the survey database included large whales (*e.g.* right whale and humpback whale), leatherback turtles, and large sharks (*e.g.* white shark). Leatherback turtles were identifiable out to approximately 1.0 NM (1.85 km) from the trackline depending on sea state and were recorded at the time of sighting (usually perpendicular to the trackline). When whale sightings occurred the survey plane would immediately break from the trackline and fly directly over the whale(s) to obtain an accurate GPS position. Large whale sighting data included: the initial and final sighting times and locations, number of whales per sighting, number of calves per sighting, heading of whale(s), observed behaviors, observer reliability (measure of certainty of whale species identification) and confidence (measure of certainty of number of whales observed).

In an effort to maintain consistent survey effort, the pilots were asked to not alert the observers to the presence of approaching whales. However, for vessel-strike mitigation purposes, the pilots did inform the observers of whales if they were passed by the survey plane without being sighted. Sighting verifications, such as these, were not included in the sightings per unit effort analyses because the detectability of the whale(s) was not consistent with standard survey protocols. A sighting was defined as any observed whale or group of whales at a given time and location; therefore, an individual whale may be part of more than one sighting per day and/or more than one sighting throughout the calving season.

Photographs were taken with a Canon EOS 40D Digital SLR camera equipped with a Canon EF 100-400mm lens. Digital format allowed for expeditious image review in the aircraft and also allowed FWRI to easily share image files with collaborators. The camera was set on shutter priority mode with a shutter speed of 1/1000 s and minimum ISO of 400 (shutter speed was decreased and ISO increased in low light conditions). Time spent photographing a sighting was directly related to the observers' ability to accurately identify the species of whale and obtain appropriate photo-documentation. Identification of individual whales in the field minimized time spent on scene with a sighting and prevented dissemination of duplicate sighting information. The largest constraints on photo-documentation were available daylight hours for survey and environmental conditions (*e.g.* sea state and visibility). Priority was to obtain a top-view head shot of the whale(s) in order to document the full callosity pattern. Photographs of the body, peduncle, fluke, and pectoral flippers were also obtained when possible in order to document scars and the overall body condition of the whale. When feasible, additional time was allotted to document and assist with WVI and critical right whale events (*e.g.* entanglements).

A set of Microsoft Access queries and macros developed by FWRI staff were used to scan the survey data for errors and compliance with the guidelines set by the North Atlantic Right Whale Consortium Database (NARWD) Manager and NOAA Fisheries. The aircraft flew at a target speed of 100 mph (160 km/h) and 1000 ft (305 m) altitude. In order to take into account aircraft fluctuations an allowable altitude range of 800 ft-1200 ft (244-366 m) was set. Survey effort was defined as the total nautical miles (NM) or time flown on trackline (east-west or north-south) while the plane was operating within survey parameters, with the wings-leveled, and in sea state three or less on the Beaufort scale. Short transits between tracklines and periods of circling or transiting outside survey parameters were not considered to be on-effort. The daily survey tables were combined into one database file for final submission to the NARWD Manager. In addition to the electronic survey data collected, hard copy datasheets for each survey day were compiled. Cover datasheets included: the survey crew, flight hours, nautical miles flown, environmental data, and summary of the day's sightings and events. Whale sighting datasheets included: a drawing of the callosity patterns of whale(s) seen, initial and final sighting times and locations, field letters and preliminary whale identifications, observed behaviors, EWS whale alert number, and ancillary photography information (*e.g.* image frames).

FWRI staff prepared and submitted weekly reports to NOAA Fisheries. These reports included a summary of survey activities conducted and details about right whale sightings documented during the reporting period.

Photo-identification

Individual right whales were mainly identified by the location, shape, and topography of the callosities that occur along their rostrum (Crone and Kraus 1990). Scars as well as callosities on the upper margins of the lower jaw (referred to as lip callosities), behind the blowholes, on the chin, along the mandible, and above the eye were also used to help identify individual whales (Hamilton and Martin 1999). Although the callosity patterns of calves are not fully developed until 7-12 months of age, distinctive crenations along the lower lip (referred to as lip ridges) can be used in the identification of calves (Hamilton and Martin 1999).

FWRI staff reviewed photographs after each survey and made preliminary matches to individuals in the online North Atlantic Right Whale Catalog (http://rwcatalog.neaq.org/Default.aspx), as well as whales with intermatch and season codes (temporary identification codes assigned to uncataloged whales). Photographs were also examined to look for new injuries, scars, and entanglements. Representative images and preliminary identifications were uploaded to an FTP site where research partners could reference them. New England Aquarium (NEA) personnel preliminarily verified FWRI's matches and assisted with the identification of unmatched whales (mainly juveniles). This allowed for up-to-date tracking of the number of cow-calf pairs and individual whales sighted in the SEUS as well as spatial and temporal movements of aggregations of whales during the calving season. FWRI staff maintained a website that combines in-season SEUS images and preliminary whale identifications. Information and photographs contributed to the website by aerial survey teams, NEA, and volunteer sighting networks have enhanced communication and improved the ability of survey teams to make more preliminary whale identifications (especially of juvenile whales not yet cataloged).

The online North Atlantic Right Whale Catalog was also used to obtain demographic information of individuals sighted during the 2012 calving season. The sex of most cataloged whales has been determined through photo-documentation or genetic analysis. Right whales of known age

were classified as adults at greater than or equal to nine years, juveniles from one to eight years, and calves at less than one year (born during the 2012 season). One year old whales were also referred to as "yearlings". Known reproductive females were classified as adults regardless of age and whales of unknown age were classified as adults in their ninth year from initial sighting. NEA personnel provided additional, unpublished information including, but not limited to; age and sex class of intermatch and season code whales when possible, calving intervals for the 2012 calving females, and sighting histories for injured and entangled whales.

At the end of the season all photographs and sighting data were submitted to NEA in accordance with the Data and Photographic Submission to the North Atlantic Right Whale Identification Database Version 6, October 2011 protocol (www.narwc.org/pdf/photosubmissionguide.pdf). As the curator of the North Atlantic Right Whale Identification Database, the central repository for archiving and maintaining images and sighting data on right whales, NEA will confirm the final identification of each whale.

Sighting Distance

Sighting or 'radial' distance (Buckland et al. 2001) was estimated by recording the aircraft location when the observer first detected a whale sighting (break-track position) and the initial observed location of the whale or group of whales. Geodetic distance between both locations was then calculated. Aircraft heading at the time of detection was used to estimate the sighting angle and perpendicular sighting distance (*i.e.* the distance from the whale sighting location to the closest point on the survey trackline). Sighting distance was calculated only for on-effort sightings for which less than five minutes elapsed between detection and initial pass over the whale. For the sightings recorded during surveys flown close to shore in a north-south direction (*i.e.* during transits), sighting distance was only calculated if the sightings occurred east of the trackline.

Whale-Vessel Interaction Documentation (WVI)

A WVI form was filled out whenever the survey team: a) observed a vessel within 500 yards (457 m) of a whale or group of whales, b) determined that the heading of a vessel could result in the vessel and whale(s) being approximately 1.0 NM (1.9 km) or less apart, or c) established communication with a vessel to transmit whale sighting location information in an attempt to prevent a collision or mitigate an interaction. Data reported on the WVI form incorporated information from before, during, and after the incident. Information collected included: whale(s) sighting times and locations, headings, and behaviors; vessel type and description, interaction times and locations, headings, and speed; notes on radio communication between observers and the vessel operator; vessel actions (*e.g.* changes in heading and/or speed); and the closest distance between whale(s) and the vessel. Photographs and/or video were obtained of the vessel and interaction if possible. WVI forms were completed at the end of survey and forwarded to NOAA Fisheries within 24 hours. At the end of the season, the SEWS survey WVI incidents were submitted to FWRI for inclusion in the WVI database.

RESULTS

Aerial Survey

SEWS Surveys

The SEWS survey team flew 58 out of an available 122 days between 01 December 2011 and 31 March 2012 (Figure 3, Table 2). Twenty-two full SEWS surveys (271.8 NM/503.4 km each), sixteen partial SEWS surveys, and twenty contingency surveys (average 354 NM/655 km each) were completed for a total of 17,331 NM (32,069 km) of trackline flown (Figure 4). The SEWS team conducted more contingency surveys during the 2012 season than in previous seasons. Contingency surveys were mainly flown during the first half of December and later half of March (Figure 5); all contingency surveys were also partial SEWS surveys. Effort varied both spatially and temporally, but the SEWS team flew at least a portion of the SEWS survey area 48% of the available days and 97% percent of survey effort was completed during favorable sea state conditions of sea state three or less on the Beaufort scale (Figure 6). Unlike previous seasons, no north-south coastal surveys south of the SEWS area were conducted. Fourteen surveys were conducted in December, January, and February and sixteen surveys were flown in March. Trackline effort was higher in December and March (4159 NM and 5318 NM/7703 km and 9848 km, respectively) than January and February (3964 NM and 3890 NM/ 7341 km and 7203 km, respectively) largely due to increased contingency survey effort during December and March. The majority of partial SEWS surveys resulted from poor weather conditions and associated daylight constraints; however, partial surveys also resulted from one or more of the following: disentanglement support, gunnery exercise schedule conflicts, and air traffic conflicts. The SEWS aircraft was unavailable for survey on one day due to mechanical repairs. Overall, the SEWS survey effort was near the average over the last four seasons (60 days and 15,193 NM). The SEWS team flew 277.2 hours during the 2012 season. The number of hours flown was below average (303.2 hours) compared to the last four seasons due to the small number of whales observed in 2012.

The first right whale sighting by the SEWS team occurred on 10 January 2012 and the last was on 17 March 2012. The SEWS team had 18 sightings consisting of 43 whales (not unique individuals) and sighted four of the six calving females observed in the SEUS (Table 3). Of the 18 sightings, six were cow-calf pairs, six[1] were single adults or juveniles, three were pairs, and four were groups of three or more whales (Figure 7). The SEWS team had zero sightings in December, 15 sightings of 37 whales in January, one sighting of two whales in February, and two sightings of four whales in March. Sightings were plotted by month to illustrate the temporal distribution of whales throughout the season (Figure 8). Adult and juvenile whale sightings peaked at the end of January and only cow-calf pairs were sighted in February and March (Figure 9). The number of right whale sightings per day ranged from zero to seven (January 28th) with an average of 0.3 sightings per survey day. As many as 15 right whales (not unique individuals) were sighted on a single day (January 28th) and an average 0.7 whales were sighted per survey day. The most sightings and whales per unit nautical mile of effort (0.00823 and 0.02385, respectively) occurred between 26 January and 01 February 2012 (Figure 10). The majority (72%) of sightings described above were documented during contingency survey; only five sightings of nine whales (not unique individuals) were documented in the SEWS area (Figure 11). These sightings occurred from 17 January 2012 through 16 March 2012 and consisted of a single juvenile whale and three unique cow-calf pairs.

[1] One sighting of two whales that were not associated have been categorized as two singles instead of a pair

A total of 2710 sightings of vessels were recorded by the SEWS team (Figure 12). This total does not represent the total number of vessels observed by the SEWS team, because vessels identified in AIS (*e.g.* large merchant) were not recorded in the survey database. The 2710 vessel sightings recorded were comprised of: 1255 recreational, 1007 commercial fishing, 89 sport-fishing, 48 motor yacht, 178 sailing, 28 personal watercraft, 95 government, one cruise ship, five large merchant, one pilot boat, one dredge, and two unknown vessels (vessel type definitions can be found in Appendix 4). The two unknown vessels were an overturned boat (sighted on two different days) that could not be classified. The cruise ship sighting was a casino boat (home-ported in Jacksonville, FL) that occasionally could not be detected using AIS. Merchant vessels, cruise ships, pilot boats, and dredge vessels have been removed from analyses in this report, because these vessels were not consistently recorded during survey and were only marked when not visible in AIS or opportunistically as needed for WVI. Vessels were distributed throughout the survey area, but there was an apparent increase in sightings around port entrances and inlets (Figure 13). Commercial fishing vessels were clustered near the shore while recreational vessels were sighted throughout the survey area. The vast majority (75%; n=755) of commercial fishing vessel sightings recorded were shrimpers and another 23% (n=233) were crabbers. Shrimping vessel sightings decreased in February and March and crabbing vessel sightings increased in February and March. The total number of vessels sightings recorded increased from December to January, decreased in February, and increased again in March (Figure 14). The least number of vessels were sighted in February and the most vessels were sighted in March. Most notable were the observed decrease in the proportion of commercial fishing vessel sightings to total vessel sightings in March (Figure 15); the observed increase in both number of sightings and proportion of recreational vessel sightings in March; and the apparent decrease in number of total vessel sightings in February. Survey effort in February was consistent with other months and environmental conditions did not impact the sightability of vessels within 1.5 NM (2.8km), so it is not likely these data were affected by effort or survey conditions.

Whale Alert Dissemination

The FWRI ground contact sent out 14 SEWS whale alerts to EWS network participants. Four sightings were not distributed because they were either duplicates of previous sightings or were combined with other sightings due to proximity. Duplicate sighting times and GPS locations were updated in the SEUS MSRS.

Sighting Distance

Of the 18 SEWS sightings, eight (44%) met the standards implemented for sighting distance calculations. The average sighting distance from the survey plane break-track position was 1.4 NM (1.6 km) (range 0.4-2.7 NM/0.7-5.0 km) (Figure 16). Most sightings (*n*=5) occurred between 0.4 NM (0.7 km) and 1.2 NM (2.2 km) from the plane. Three additional sightings occurred between 1.2 NM (2.2 km) and 3.0 NM (5.6 km) from the plane. The average perpendicular distance was 1.2 NM (2.2 km) (range 0.3-2.1 NM/0.6-3.9 km) (Figure 17).

Photo Analysis

Preliminary photo analysis indicates the SEWS team documented 22 individual right whales (excluding calves). Twenty-one whales have been preliminarily matched to catalog or known intermatch whales; the remaining one whale was matched to a 2011 SEUS season code whale (S067). The age and sex class of unique individual whales documented was: 17% (*n*=4) calving females, 4% (*n*=1) adult females (non-calving in 2012), 70% (*n*=16) juveniles and 9% (*n*=2) individuals of unknown age not known to be at least nine years-old (Figure 18). Neither adult males nor adults of

unknown age were documented by the SEWS team. The majority (*n*=18) of individuals were sighted in the CEWS area during contingency survey. The four unique whales sighted in the SEWS area included one juvenile and three females with calves. None of the 2012 calving females were sighted by the SEWS team prior to giving birth; however, Catalog #3390 was first sighted with a calf in the SEWS area. Behaviors documented during whale sightings are detailed in Table 3 and Appendix 1.

Whale-Vessel Interaction Documentation

During the 2012 season, the SEWS team documented two whale-vessel interactions with a cow-calf pair (Table 4). The interactions occurred off Amelia Island, FL in the CEWS area during contingency survey (Figure 19) and involved two vessels: a recreational vessel and a law enforcement vessel. Both vessels were observed within 500 yards (457 m) of the whales and the closest observed distance was 50 yards (46 m). A behavioral reaction to the presence of the vessel was observed during one interaction and involved diving when approached; the whales were initially observed resting at the surface.

Other Marine Species

During the 2012 season, the SEWS team documented two humpback whale (*Megaptera novaeangliae*) sightings (Figure 20). These sightings occurred off Ponte Vedra, FL between 4.5 NM and 2.6 NM (8.3 km and 4.8 km) offshore on 19 January 2012 and 26 January 2012, respectively. Photographs of the dorsal fin and body scars were used to link sightings of like individuals. One humpback whale was not photographed, but the other was matched to a whale sighted on four additional occasions by the CEWS survey team. Photographs and sighting data were distributed to aerial survey teams, GDNR, NOAA Fisheries, and Provincetown Center for Coastal Studies (PCCS) for comparison to the Gulf of Maine Humpback Whale Catalog and North Atlantic Humpback Whale Catalogue.

From approximately 12 March 2012 through 20 March 2012, a large offshore aggregation of leatherback turtles (*Dermochelys coriacea*) was observed by the CEWS and SEWS survey teams between Amelia Island and Jacksonville, FL (approximately 30°38N-30°23N and 81°08W-80°58W) (Figure 21). The total number of leatherback turtles per day counted by the CEWS and SEWS teams combined ranged from 108-178 during this time period and from 0-57 prior to 12 March 2012. Leatherback turtles are relatively slow swimmers and are only positively identifiable up to approximately 1.0 NM (1.9 km) from the plane, so it is unlikely there were many duplicate sightings of individual turtles in one day. However, it is likely that some of the same individual turtles were sighted more than once during different days of survey. Information about the increased number and general location of turtles observed was passed to dredge vessels operating between the St Mary's River entrance and the St Johns River entrance. In total, the SEWS team recorded 1185 leatherback turtle sightings during the 2012 season. The vast majority (*n*=1051) of these sightings occurred in the latter half of March during contingency survey; only 202 of the 1185 sightings occurred in the SEWS area. The number of leatherback turtles recorded by the SEWS team from 2007-2011 ranged from 40-554. Given the majority of sightings during the 2012 season occurred outside the SEWS area, the number of SEWS area sightings was most similar to the 2007 season (*n*=147). The majority of leatherback turtle sightings (92%) occurred in a sea state two or less on the Beaufort scale. Leatherback sighting data were distributed to NOAA Fisheries and sea turtle biologists/researchers with FWRI and GDNR.

The SEWS team documented twenty-four large shark sightings and a school of black-tip sharks (*Carcharhinus limbatus*) during the 2012 season (Figure 22). Species identification for large sharks

included: Sixteen white sharks (*Carcharodon carcharias*), four great hammerheads (*Sphyrna mokarran),* two short-fin makos *(Isurus oxyrinchus),* one scalloped hammerhead (*Sphyrna lewini*); and one probable white shark that could not be relocated for species confirmation. All sharks were observed free-swimming (*i.e.* not associated with an animal carcass). Sightings occurred from Butler Beach, FL to Amelia Island, FL approximately 5.5 NM to 30 NM (10 km to 56 km) offshore. There were three sightings during December, two during February, and eighteen during March. The majority (87%) of large sharks were sighted in a sea state two or less on the Beaufort scale. Sighting data were distributed to NOAA Fisheries and shark biologists/researchers with FWRI, GDNR, and the Massachusetts Division of Marine Fisheries.

On 22 January 2012, the SEWS team sighted a Florida manatee (*Trichechus manatus latirostris*) close to shore off Ponte Vedra Beach, FL. Manatee sightings are rare in northeast Florida during the winter months and have never been documented in the SEWS area. Manatees prefer water temperatures above 68°F (20°C) and cannot tolerate prolonged exposure to temperatures below about 16°C (Haubold *et. al.*, 2006). Cooler temperatures (preferred by right whales) cause manatees to lose body heat which can lead to cold-related stress and death.

EVENTS

Disentanglement and Injured Whale Observations

2011 Calf of Catalog #2746 - Injured

On 17 January 2012, the SEWS team sighted the 2011CalfOf2746, a one-year-old female right whale, with two large linear wounds on the left dorso-lateral body (Figure 23). The caudal of the two wounds appeared to be deeper and wider than the other. Both wounds were orange in color (likely due to the presence of cyamids) and showed signs of minor healing. The skin immediately surrounding the wounds was gray and sloughing, but the rest of the whale's skin was shiny black and its body condition appeared good. FWRI staff responded by vessel to obtain additional photo-documentation and a biopsy sample. The whale was sighted two additional times in the SEUS on 20 January 2012 and 25 January 2012 by the CEWS and NEWS survey teams, respectively. Photographs, sighting data, and detailed observations were distributed to NOAA Fisheries, NEA, and research partners. A formal wound analysis was not conducted; however, the wounds appear consistent with vessel injuries observed on Florida manatees (*Trichechus manatus latirostris*) (Wright et al., 1995, Rommel et. al., 2007). The whale had previously been seen without wounds on 17 August 2011 in the Bay of Fundy by NEA[2] and was subsequently sighted by PCCS in Massachusetts Bay on 23 March 2012 (Ganley, pers.comm., April 2012). The wounds appeared completely white and showed significant signs of healing by the March 2012 sighting by PCCS.

Catalog #1719 - Entanglement

On 19 January 2012, the NEWS survey team sighted Catalog #1719, an adult female right whale, approximately 15 NM (28 km) east of Sapelo Island, GA. The entanglement consisted of light colored rope exiting either side of the mouth and terminating near the peduncle on the left and approximately 5.0 ft (1.5 m) aft of the flukes on the right; the rope exiting the right side of the mouth had a short gangion just posterior to the right flipper (Figure 24). The SEWS team relieved the NEWS team and remained on scene to further document the entanglement and provide aerial support for disentanglement operations. The whale had sloughing skin on its head and body and many wounds and scars likely associated with the entanglement on its peduncle, but its overall body condition appeared good. GDNR staff responded by vessel for further assessment and attempted several grapple attachments to the short trailing rope, but the whale was very evasive. After additional documentation was obtained it was determined that the relatively minor entanglement could likely be shed by the whale without further intervention. All photographs and sighting data were submitted to NOAA Fisheries, NEA, and the ALWDN. The SCGA aerial survey team sighted Catalog #1719 the following day approximately 70 NM (130 km) to the north with no apparent change in the entanglement configuration or condition of the whale.

Stranding Responses

No right whale carcasses were detected in the SEUS during the 2012 season.

Dolphin Strandings

Two bottlenose dolphin (*Tursiops truncatus*) carcasses were sighted by the SEWS team: the first on 09 January 2012 approximately 5.0 NM (9.3 km) off Crescent Beach, FL and the second on 16 February 2012 approximately 0.4 NM (0.7 km) offshore inside the St Mary's River Entrance.

[2] Recent sighting information is preliminary and subject to change: Hamilton, pers. comm., January 2012

Photographs and sighting information were passed to the local Marine Mammal Stranding Network representatives and subsequently to NOAA Fisheries.

Catalog #1301 – Lost Calf

Catalog #1301 "Half Note", a 29 year-old female, was first sighted with a calf on 20 December 2011 by the CEWS aerial survey team. Based on subsequent sightings in the SEUS, #1301 is known to have lost her calf between 10 January 2012 and 24 January 2012; the calf is presumed dead though no carcass was recovered. The SEWS team responded to the location of a reported right whale sighting from the USN on the morning of 10 January 2012 and located #1301 and calf. The photo-documentation obtained during this sighting show the calf to be in poor body condition as described by Pettis *et al.* (2004). The calf appeared thin overall and had a prominent concavity just posterior to the blowholes deep enough for cyamids to accumulate (Figure 25). Based on sighting history, the calf was known to have been between 21 and 25 days old at the time of this sighting. Catalog #1301 has been calving since 1989, but only one calf is known to have survived beyond one-year of age; #1301's last two calves (2006 and 2008 season) were both documented to have died while #1301 was presumably in the SEUS.

Other Events

Biopsy Effort and Acoustic Study Support

The SEWS team assisted biopsy and acoustic study efforts by providing real-time location information and preliminary identifications of cow-calf pairs and un-sampled adults and juveniles to on-water teams. When time allowed, the SEWS team also provided on-water crews with updated whale locations or assisted with relocations if needed. Biopsy cruises were a collaborative effort between FWRI, GDNR, NEA, NOAA Fisheries, and Sea to Shore Alliance. During the 2012 season, biopsy teams collected samples from five calves and several juvenile and adult whales.

DISCUSSION and RECOMMENDATIONS

The SEWS team has conducted an average of 59 surveys per season (range 46-70) from 2008-2012 under the guideline of flying in a sea state three or less on the Beaufort scale; this average is approximately 50% of the available days in the calving season. The number of right whale sightings recorded and the number of whales photo-documented in the SEWS area are not directly proportional to the amount of surveys flown per season. From 2008-2012 the average number of sighting events per season was 125 (range 18-237); the average number of whales sighted per season was 306 (range 43-601); and the average number of unique whales identified per season was 99 (range 22-162). The lowest number of whales documented was during the 2012 season when 58 surveys were conducted; 18 sighting events of 43 whales were recorded; and 22 individual whales were identified. The highest number of whales were documented during the 2010 season when 60 surveys were conducted; 237 sighting events of 601 whales were recorded; and 162 individual whales were identified by the SEWS team. The number of whales observed by the SEWS team has varied widely between calving seasons and this was likely caused, in part, by changes in environmental conditions (*e.g.* sea surface temperature).

During the 2012 season, whale sightings in Florida dropped off dramatically in February and March; only cow-calf pairs and a single yearling were sighted off Florida during these months. Right whale distribution appears to have shifted north due to the warmer water conditions. Air temperatures were well above average from December through March in the vicinity of Jacksonville, FL and a few strong cold fronts in the beginning of January and mid-February did little to affect the overall warm trend (Florida Climate Center, 2012). According to Keller *et al.* (2006) the average sea surface temperature (SST) at right whale sighting locations in the SEUS is 14.3°C ± 2.1°C. A review of water temperature measurements from NOAA's National Data Buoy Center (www.ndbc.noaa.gov) shows warmer than average temperatures from January through March 2012 (Figure 26). It would be useful to have more flexibility built into the SEUS survey design so that all parties involved are better prepared and able to respond to shifts in whale distribution, as well as mitigate for extended periods of inclement weather in certain areas.

In addition to the apparent shift north in distribution this season, fewer individual whales were sighted in the SEUS during 2012 than from 2007-2011 and only six[3] cow-calf pairs were observed. Calf production has not been lower since 2000 when just one calf was documented. The low number of calves observed this season was likely caused by the effects of oceanographic conditions on the availability of food resources for the preceding two years and the number of reproductive females available to calve in the population during this timeframe (Greene *et. al.* 2003 and Kenney, 2010). Many whales sighted in the Bay of Fundy during the summer of 2011 were observed with graying skin and appeared thin similar to the late 1990's when a low number of calves were documented and whales appeared in poor health (Knowlton, 2011).

A difference was observed this year in the areas used by different sex and age classes: cow-calf pairs were sighted throughout the SEUS and other demographic groups occurred north of the SEWS area. Three of the six known cow-calf pairs in the SEUS (50%) were sighted in the SEWS area and a fourth was sighted just a few miles north of the SEWS northern trackline. Besides these cow-calf pairs, one other individual whale (a yearling) was sighted in the SEWS area. In contrast to the SEWS,

[3] A 7th cow-calf pair was sighted by NOAA NEFSC in the Gulf of Maine on 19 May 2012 (Henry *et. al.*, 2012)

91% of the individually identified whales in the SEUS during 2012 were not cow-calf pairs (Figure 27). Further analysis into the effects of survey effort on individual whales documented may provide valuable insights on survey design and improve the application of aerial survey resources.

The observed shift in whale sightings to the north is evident by the distribution of whale alerts. In 2011 the bins with the second and third largest number of sightings were the St. Augustine and Daytona bins to the south of the Jax/Fernandina bin and during 2012 the next largest number of sightings was in the Brunswick and Sapelo bins to the north of the Jax/Fernandina bin. One hundred and forty whale alerts were disseminated to EWS participants during the 2012 season (Figure 28). The majority (86%) of these sightings came from aerial survey teams. Of the remaining sightings, 1% originated from volunteer sighting networks and 13% were generated by OTHER sources (*e.g.* USN, USCG, dredge observers, commercial vessels, research vessels, citizens, etc.). The majority of sightings (37%, n=52) occurred in the Jax/Fernandina geographic bin, followed by the Brunswick, Sapelo, Savannah, and Charleston bins (Figure 29). Based on sighting distribution throughout the whale alerts geographic bins, it appears the bin method worked well to direct sightings to only those end-users for whom the information is relevant. The Jax/Fernandina bin is the largest bin by area and is situated in the middle of the calving area where sightings are typically most consistent. This bin has had the largest number of sightings each season since the bin method for sighting dissemination was created in 2008. The number of whale alerts generated by the EWS network was lower in 2012 than recent seasons. This reduction in sightings was likely due to a combination of less individual whales and total sightings throughout the SEUS, as well as whale distribution. With whales shifted north, volunteer sighting networks in Florida and OTHER sources generated far fewer sightings than during 2008-2011. This season the FWRI team also fielded several sighting reports off Virginia that were passed to NOAA NEFSC and NERO.

A relatively small number of endangered humpback whale (*Megaptera novaeangliae*) sightings (average 17 sightings per year) have been recorded off Florida and Georgia by the EWS survey teams during the last four winters. Individual photo-identification data has shown these whales may be resident in the SEUS during the winter similar to right whales. FWRI has been relaying humpback whale sightings near inlets and port entrance channels to dredge vessels, USN, USCG, and Jacksonville and Fernandina Harbor pilots via phone in order to mitigate vessel strikes. Since these agencies and organizations are already part of the EWS whale alert network, a simple modification to the current whale alert format would be the most efficient delivery method of sighting information. The number of humpback whale sightings observed each winter is typically far less than right whale sightings, so the addition of these sightings should not cause undue burden on the EWS whale alert recipients and will enhance ship strike mitigation for humpback whales in the SEUS.

FWRI staff has been coordinating with NOAA Fisheries, USCG, and USN to resolve airspace scheduling conflicts between right whale aerial surveys and the USCG in operation area W27C offshore St. Augustine, FL. Area W27C is within the SEWS area and scheduling conflicts occur because the airspace is typically reserved for the USCG 24 hours/day Monday-Friday throughout the calving season and other aircraft are prohibited from entering airspace reserved for gunnery exercises. Fortunately, the USCG does not utilized W27C as scheduled and the airspace can often be de-conflicted to allow for aerial surveys. There were approximately 44 days of schedule conflicts that needed to be resolved in order to conduct SEWS survey during the 2012 season; however, the USCG was conducting exercises in area W27C less than five of these 44 days. Often the SEWS team was able to adjust the order of lines flown to work around the active area until the schedule conflict could be resolved, but many of these days resulted in delayed takeoffs. The SEWS team also experienced

airspace conflicts with the USN in area W27C during February and March. All together, airspace conflicts in area W27C directly resulted in nine partial surveys. The affects of the airspace conflicts could have been more difficult for the SEWS team to manage this season if whale sightings had been more numerous in the SEWS area as in previous seasons. The process of de-conflicting airspace in W27C is time-consuming for FWRI staff, the USCG, and the USN. Airspace conflicts also result in un-surveyed waters and reduced mitigation during the calving season. It would be helpful to streamline scheduling prior to future calving season aerial surveys in order to significantly reduce time spent de-conflicting airspace.

During the 2012 season, the SEWS and CEWS teams combined observed a 157% increase in the number of commercial fishing vessels recorded, including a dramatic increase in the number of crabbing vessels sightings from 2011 (n=9) to 2012 (n=252) (Figure 30). The majority of crabbing vessels were recorded between Jacksonville Beach, FL and Crescent Beach, FL which was similar to the geographic distribution of vessels during the 2011 season. Sightings of crab pot buoys overlapped with the majority of crabbing vessel observations (Figure 31). The greatest concentration of crabbing gear and vessels during 2012 was between the St. Augustine Inlet and the GTM NERR near Ponte Vedra Beach, FL. Both gear and vessel sightings increased from December to January, then rapidly increased further in February and remained high into March. Sighting information from the aerial surveys was distributed to NOAA Fisheries and FWC fishery managers and biologists. The observed increase in crabbing gear and vessel sightings was unanticipated and overlapped with nearshore Florida waters where right whales are typically sighted. The vast majority of crabbing vessels were easily distinguishable from other vessel types; however, the crab pot buoys were difficult to detect from 1000 feet while on survey. Sightings of buoys were dependant on good weather conditions (*e.g.* low glare on the surface of the water) and 89% occurred in sea state two or less on the Beaufort scale. Prior to the 2013 season, it would be helpful to develop a strategy for documenting large amounts of fishing gear and/or vessels in a specified area, so that data collection can be as efficient as possible and not negatively impact other survey objectives.

Aerial surveys are an efficient tool to monitor the right whale population and support management actions. Although limited by weather and available daylight, the EWS surveys, throughout many seasons, have raised awareness of right whales among vessel operators, harbor pilots, and military personnel in the SEUS. Moreover, the consistent and comprehensive data gathered during these surveys can be used to evaluate protective measures, make informed management decisions, and identify emerging issues and future cumulative impacts to right whales in the calving area.

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FWRI – Leslie Ward, Tim Gowan, Christine Mathis, and Andrea Mosier

Cover photograph: Catalog #1208 and calf taken by Amy Willoughby, FWRI, on 17 March 2012 under NOAA Fisheries Permit #15488

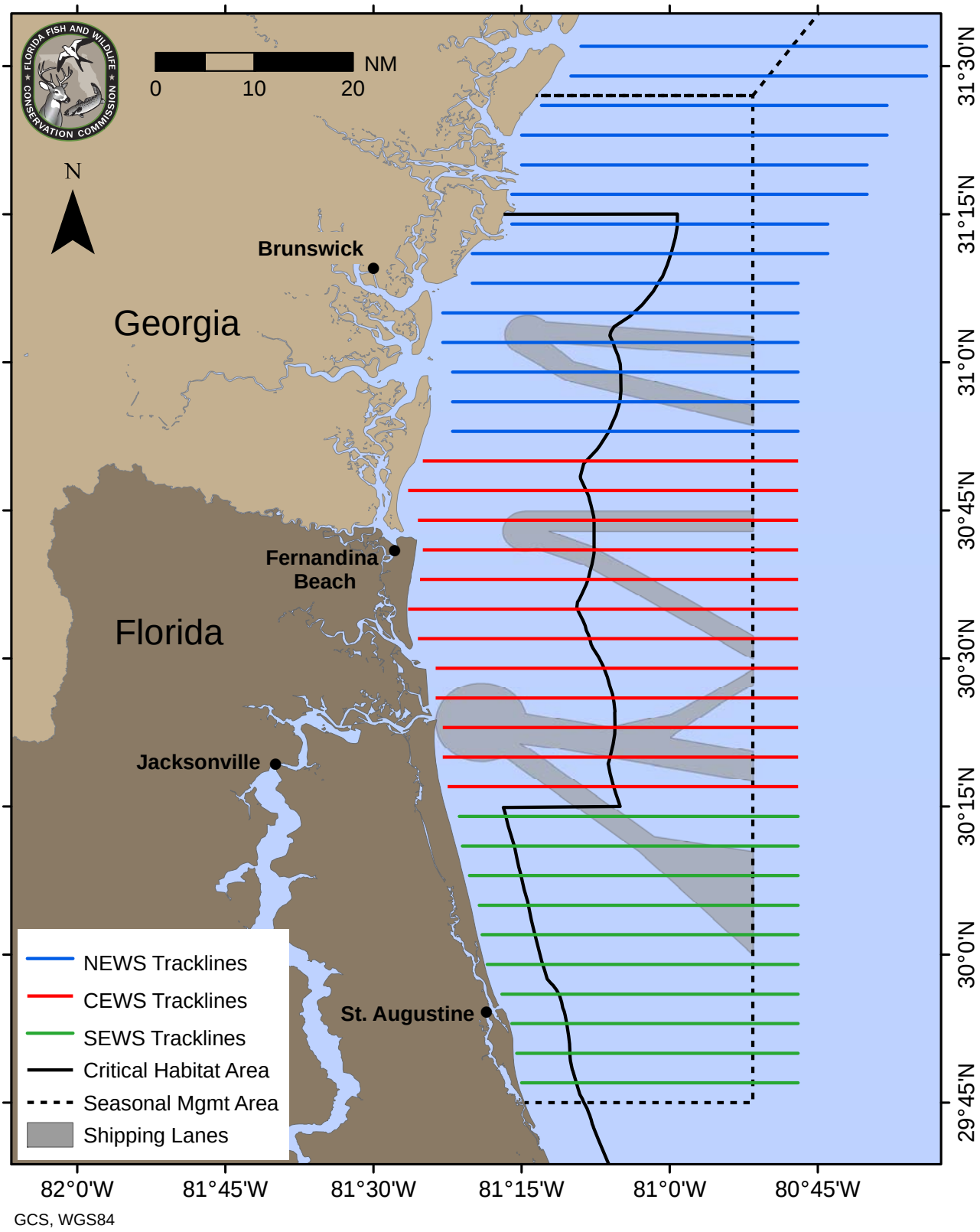

Figure 1. Early warning system (EWS) survey tracklines

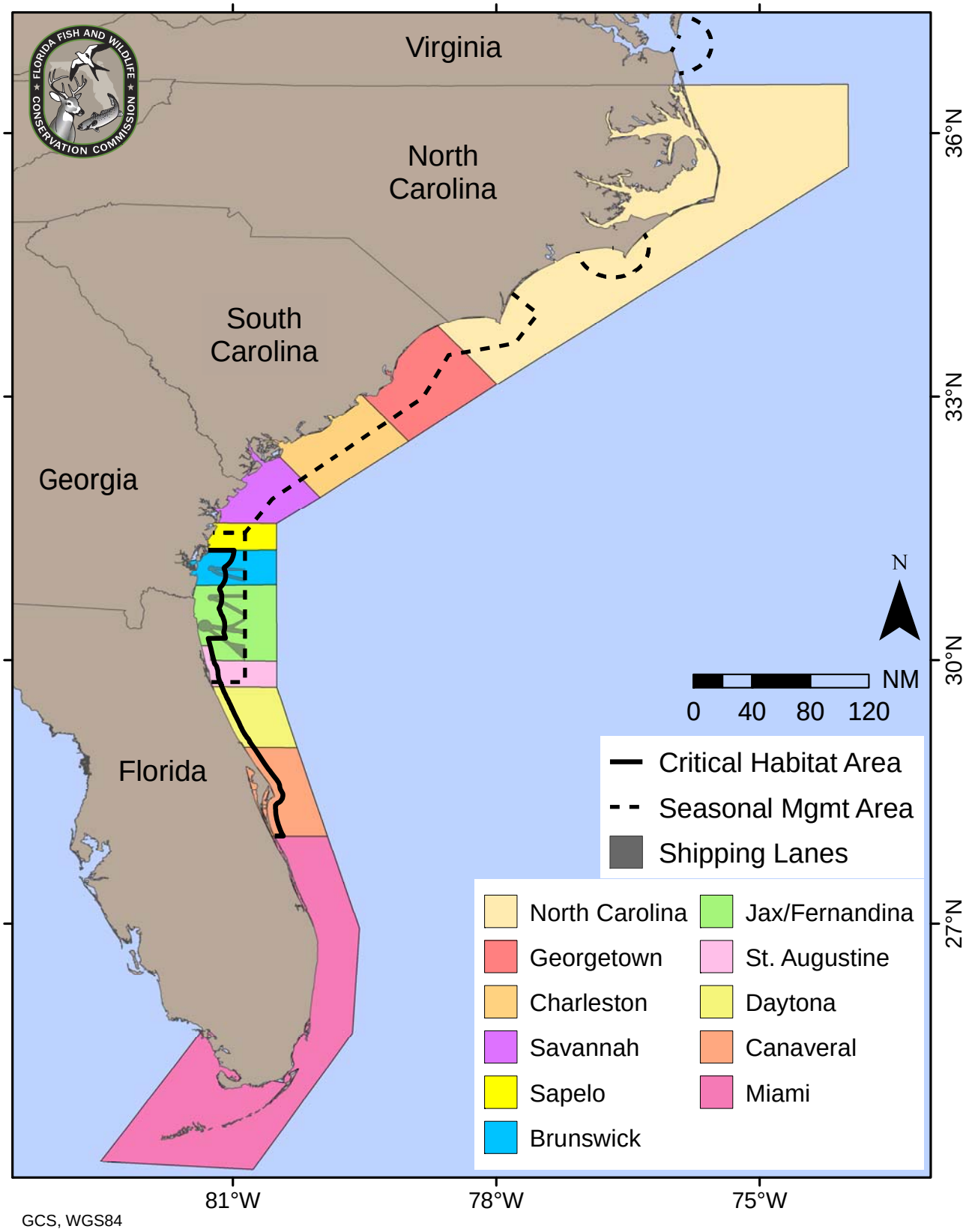

Figure 2. Early warning system (EWS) whale alert geographic "bins"

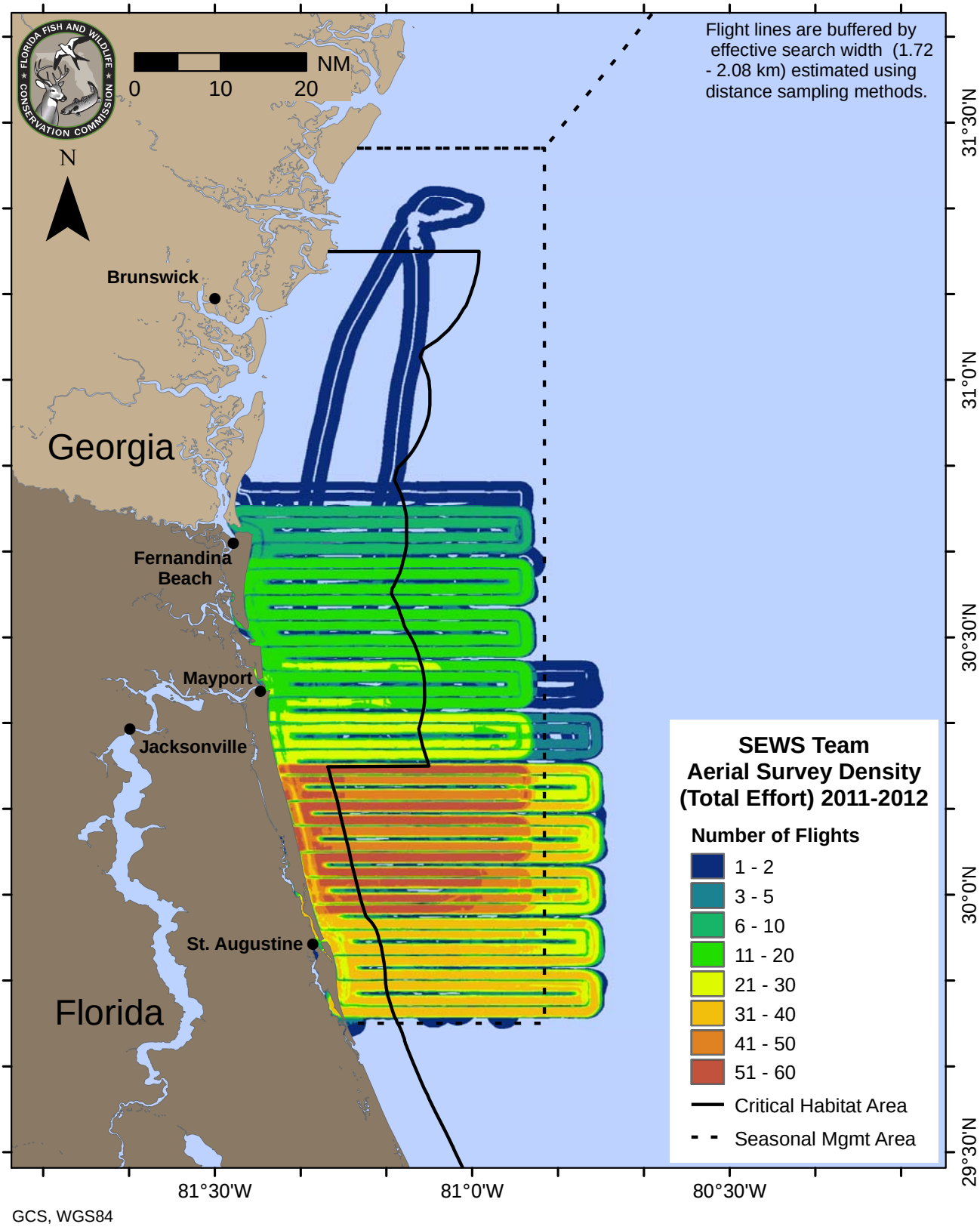

Figure 3. Total on- and off-effort survey conducted by the SEWS team, December 2011-March 2012

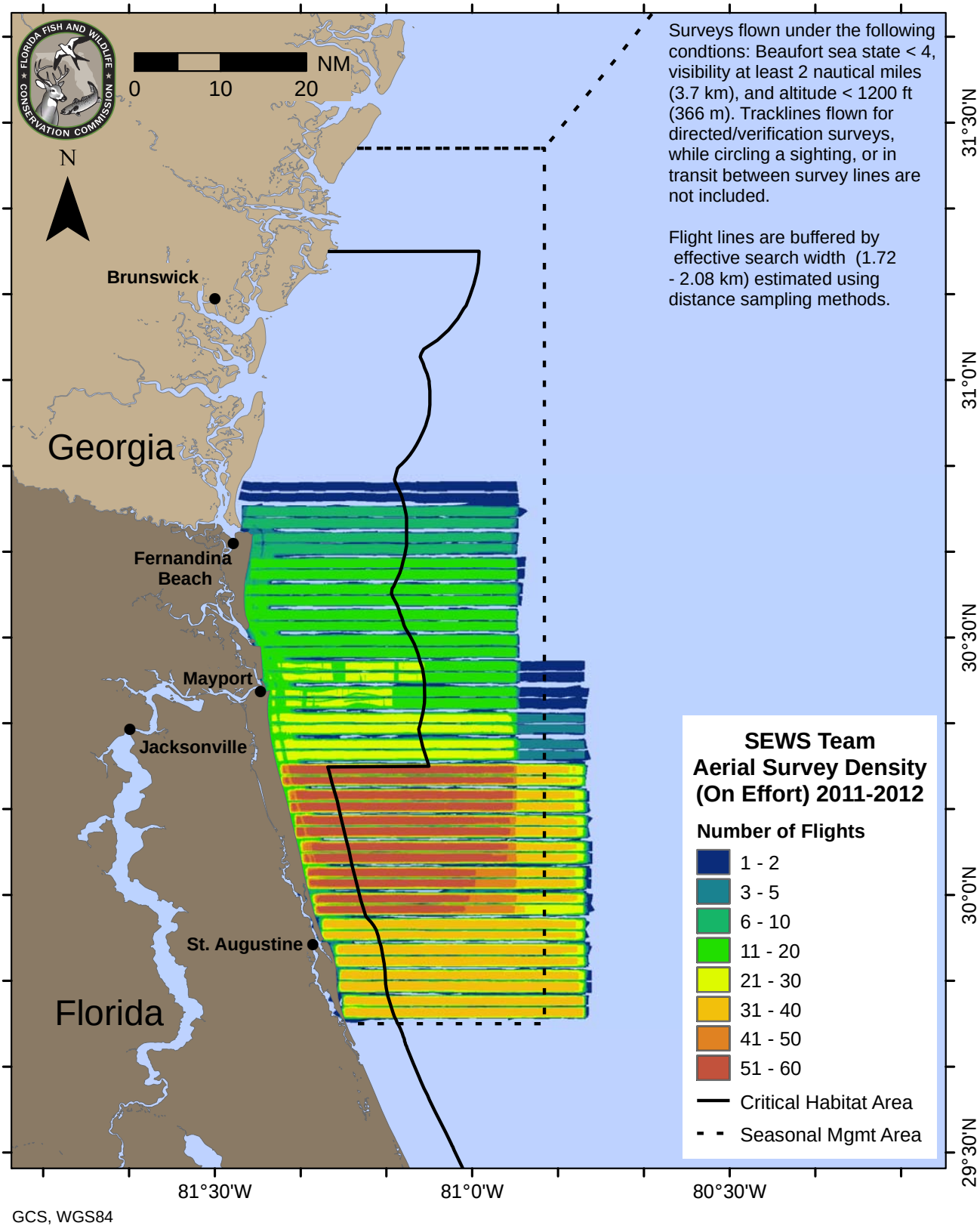

Figure 4. On-effort survey conducted by the SEWS team, December 2011-March 2012

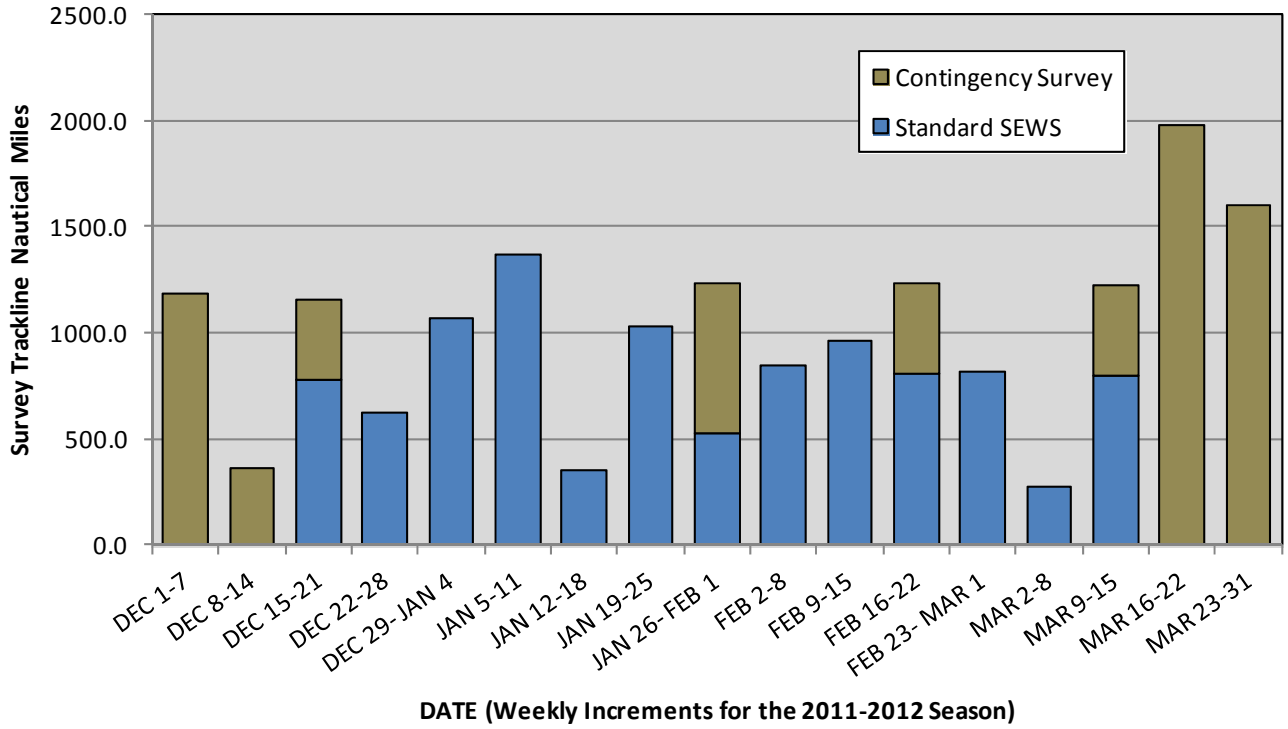

Figure 5. Total NM of survey flown per week by the SEWS survey team during the 2012 season displayed as NM for standard SEWS area surveys only and NM for contingency surveys

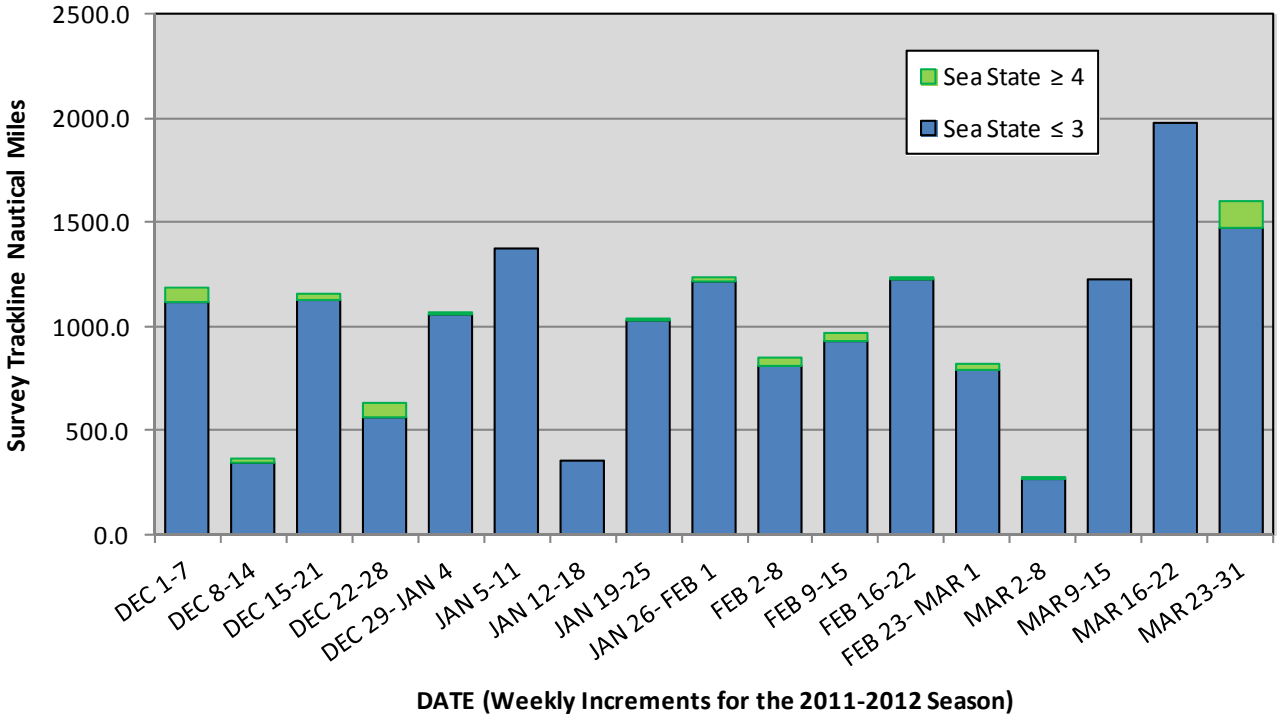

Figure 6. Total NM of survey flown per week by the SEWS survey team during the 2012 season displayed as sea state less than and greater than or equal to four on the Beaufort scale

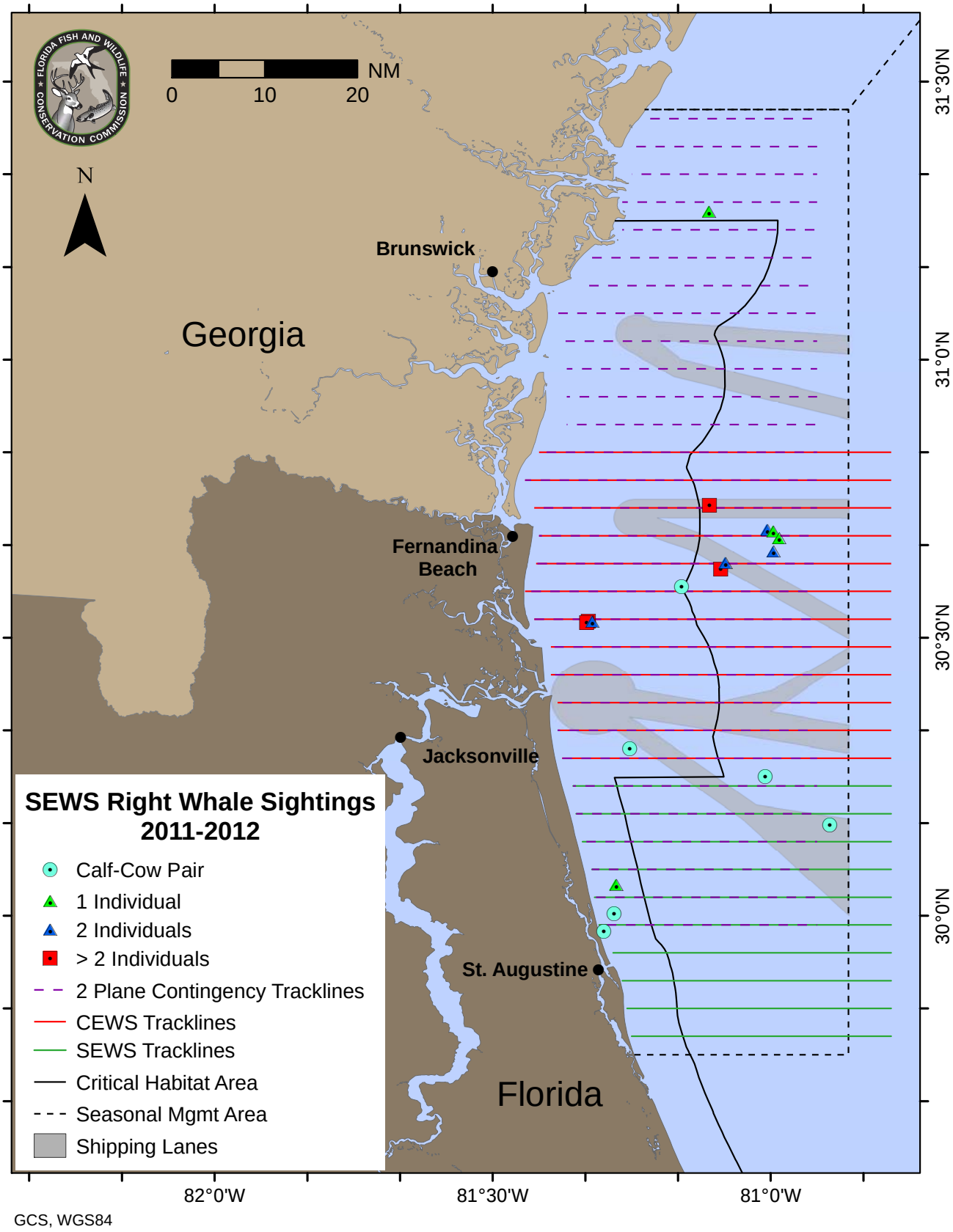

Figure 7. Right whale sightings by the SEWS survey team, December 2011-March 2012

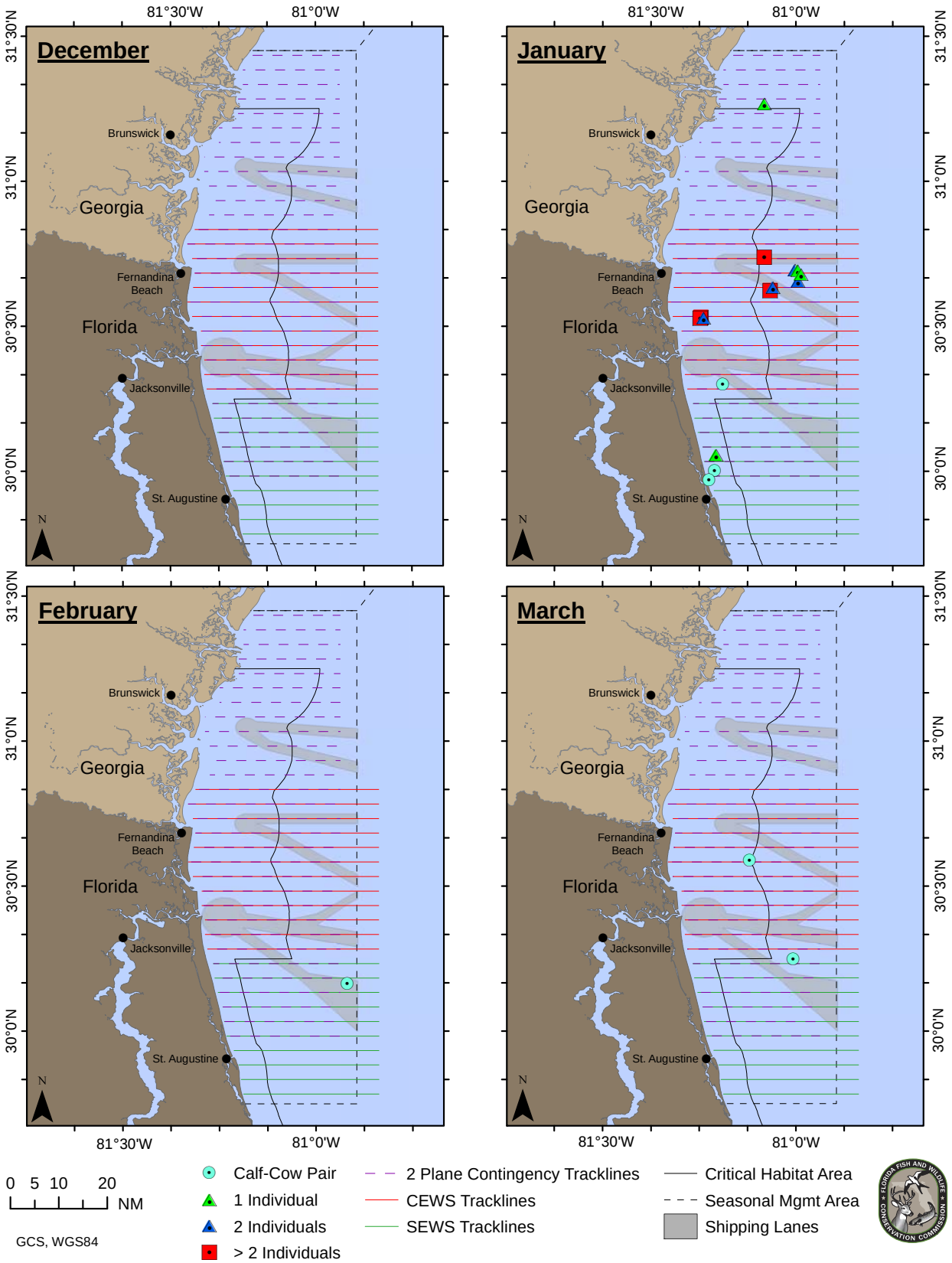

Figure 8. Right whale sightings by the SEWS survey team during the 2012 season displayed by month

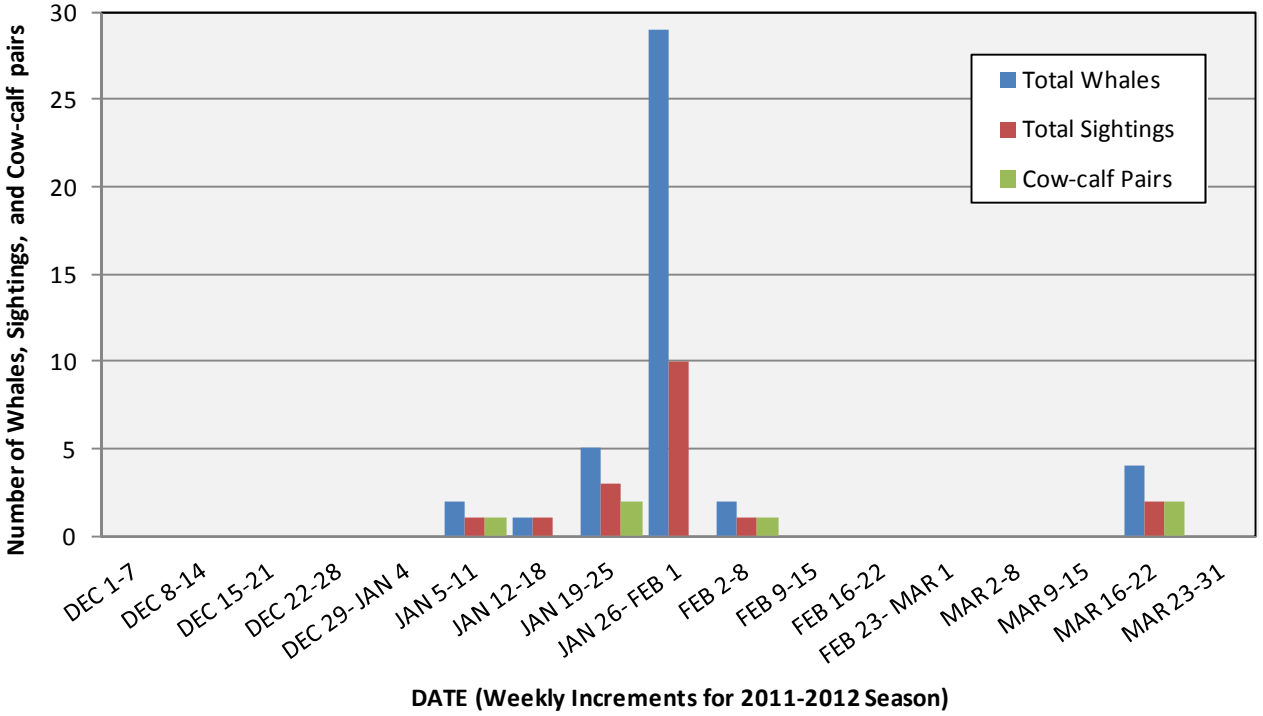

Figure 9. Total number of right whale sightings, right whales recorded, and cow-calf pairs recorded per week by the SEWS survey team during the 2012 season

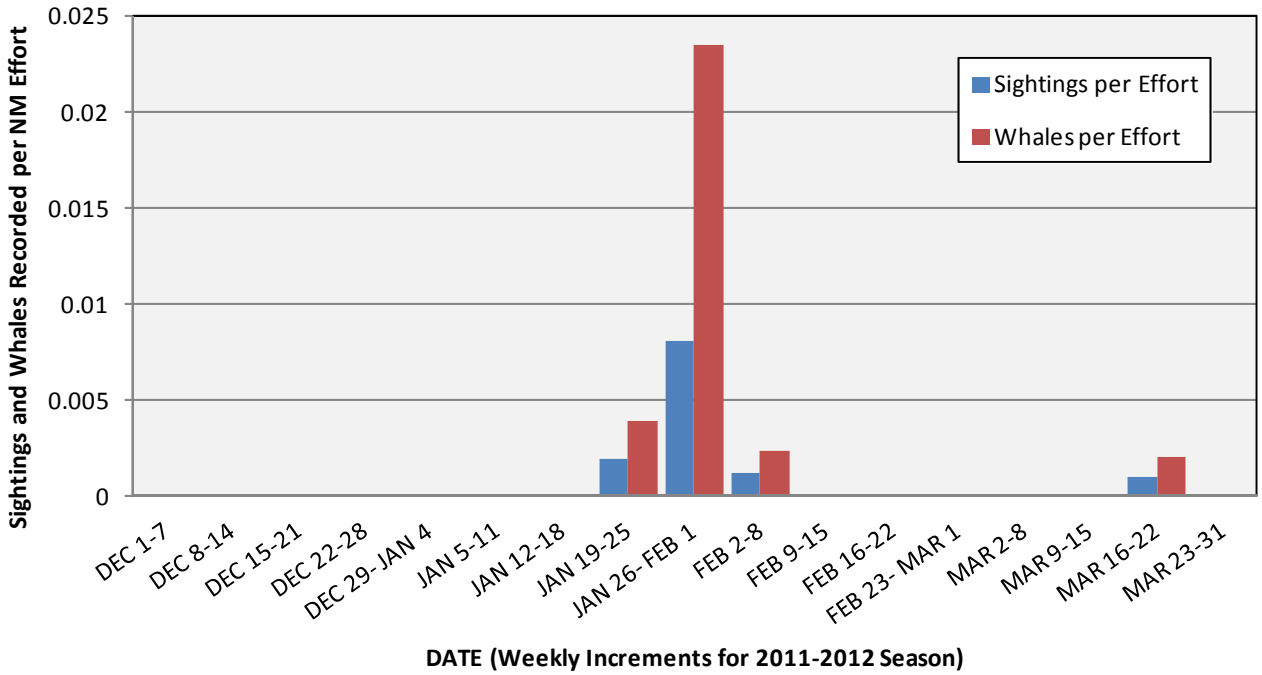

Figure 10. Right whale sightings and whales recorded per on-effort NM of trackline flown by the SEWS survey team during the 2012 season

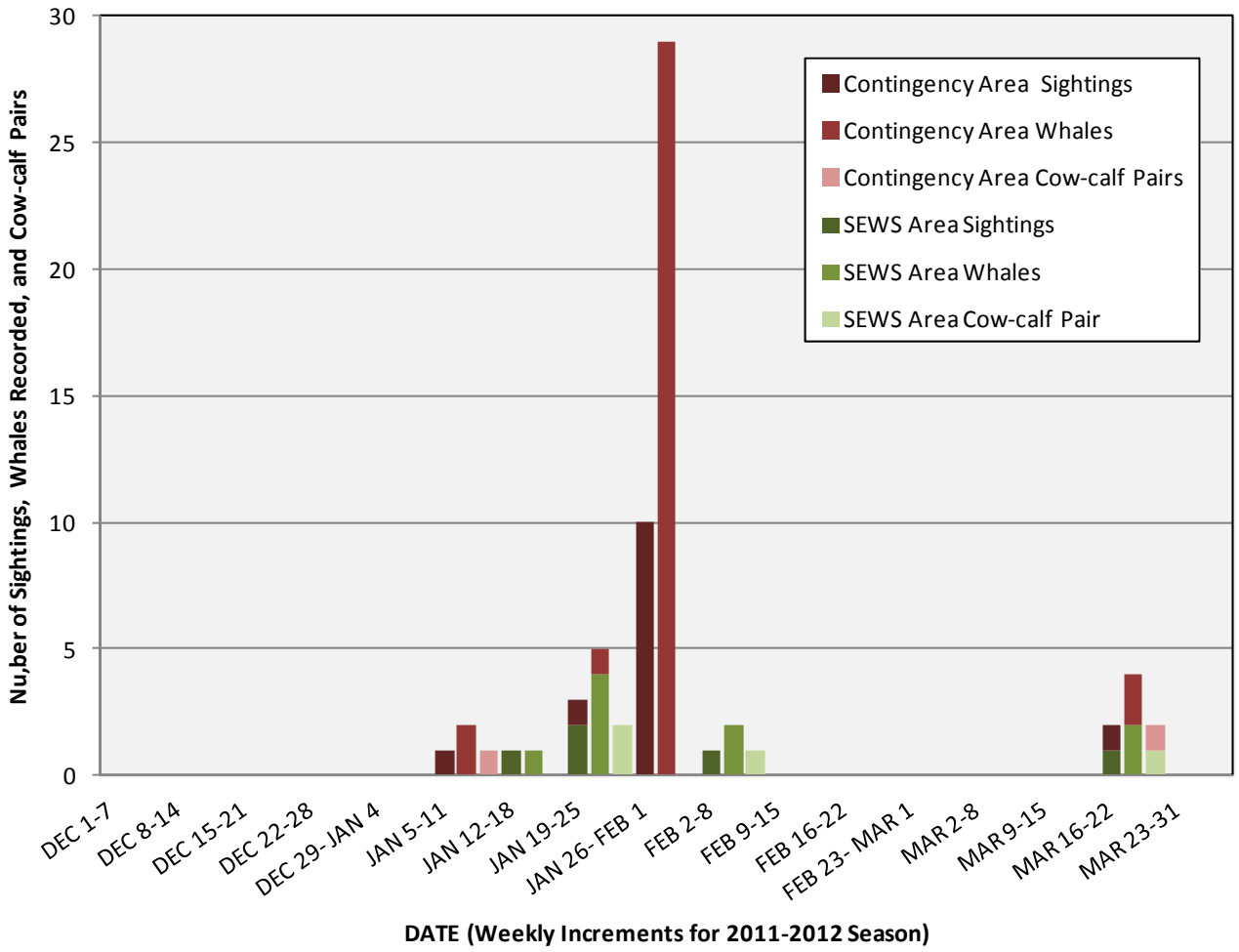

Figure 11**:** Right whale sightings, right whales recorded, and cow-calf pairs recorded by the SEWS team displayed as SEWS team contingency survey sightings and SEWS area sightings

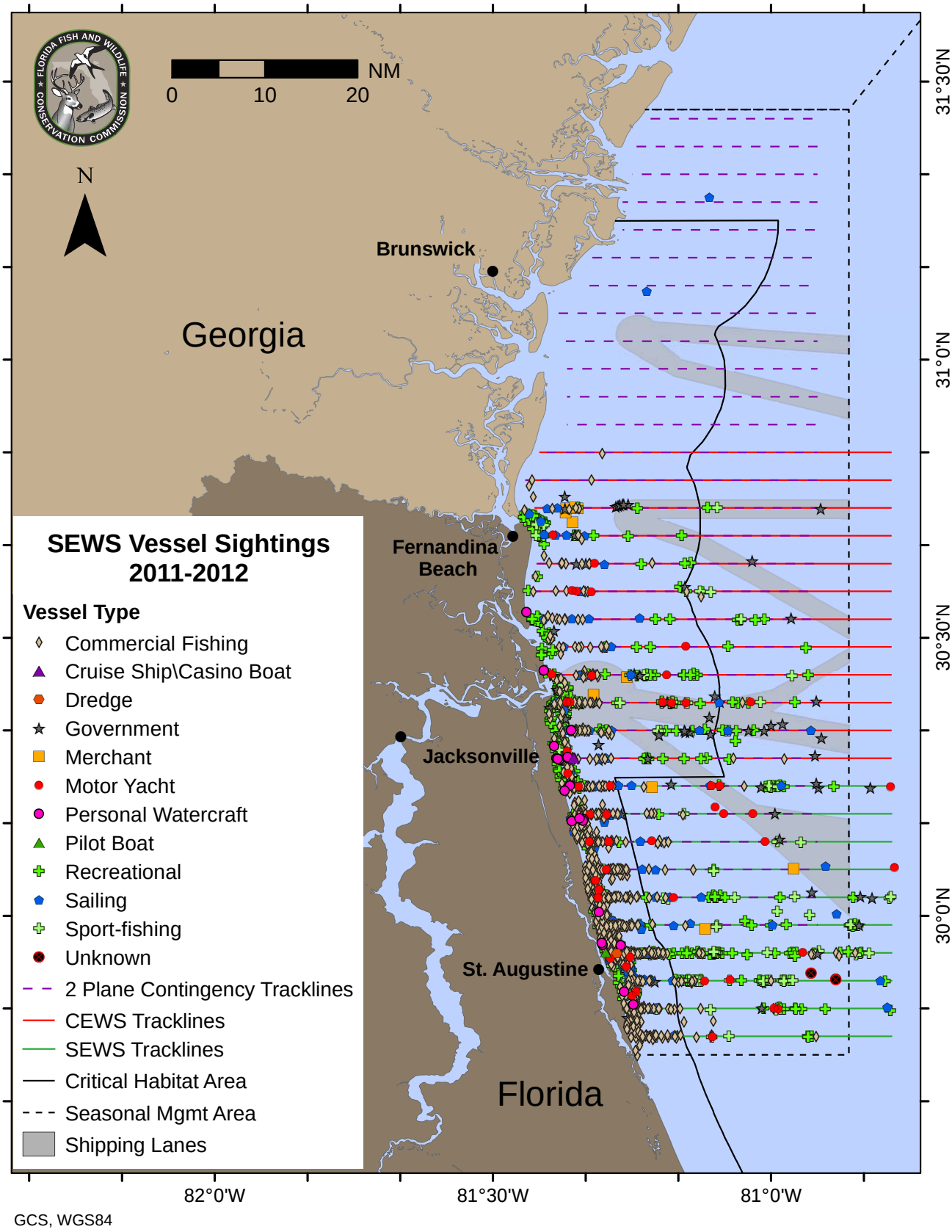

Figure 12. Vessel sightings by the SEWS survey team, December 2011-March 2012

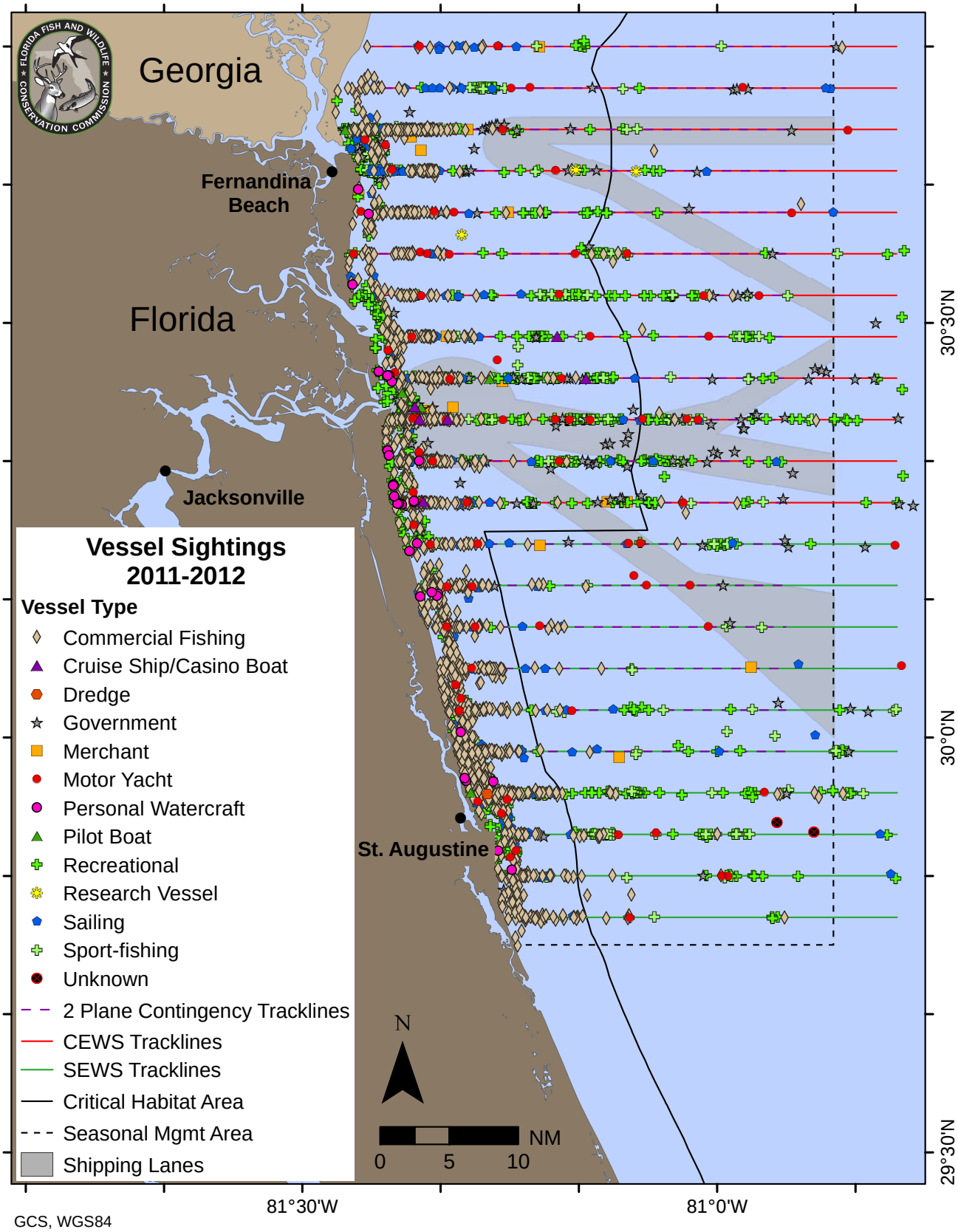

Figure 13. Vessel sightings within the CEWS and SEWS survey areas by the CEWS and SEWS survey teams, December 2011-March 2012

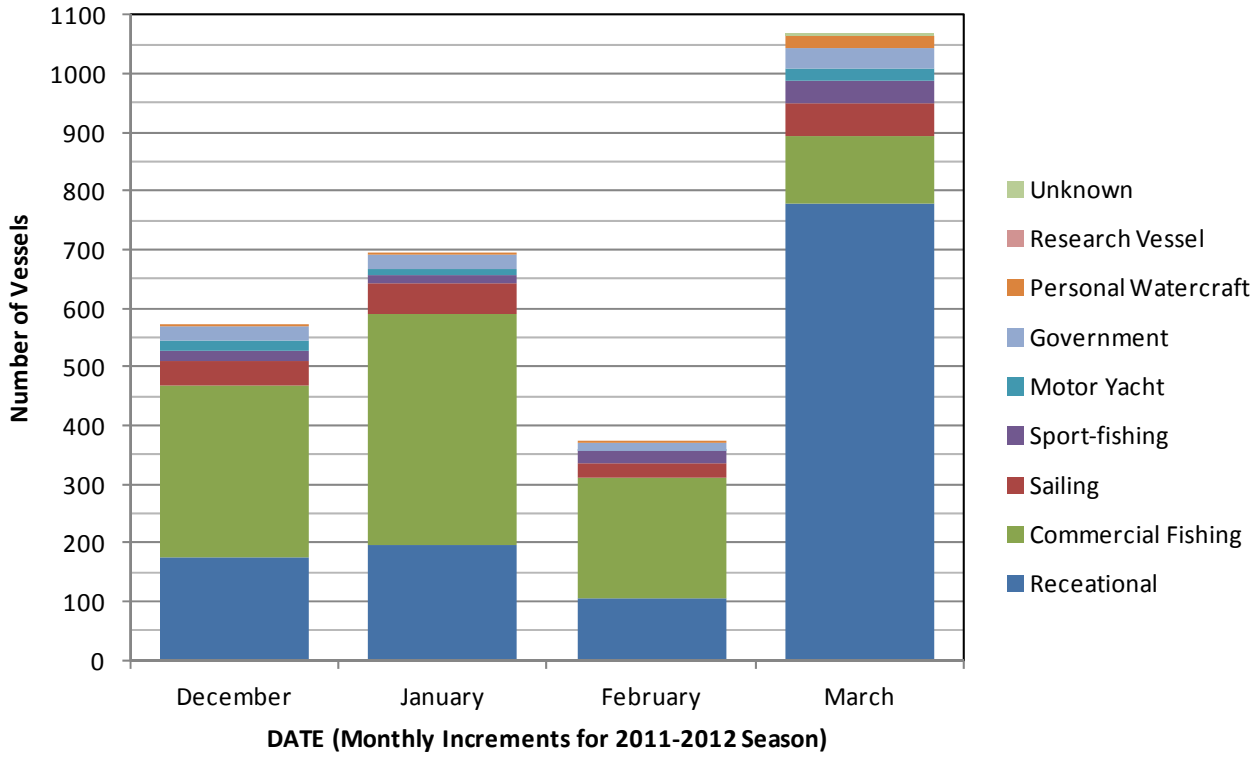

Figure 14. Total number of government and small vessel sightings by the SEWS survey team during the 2012 season displayed by month

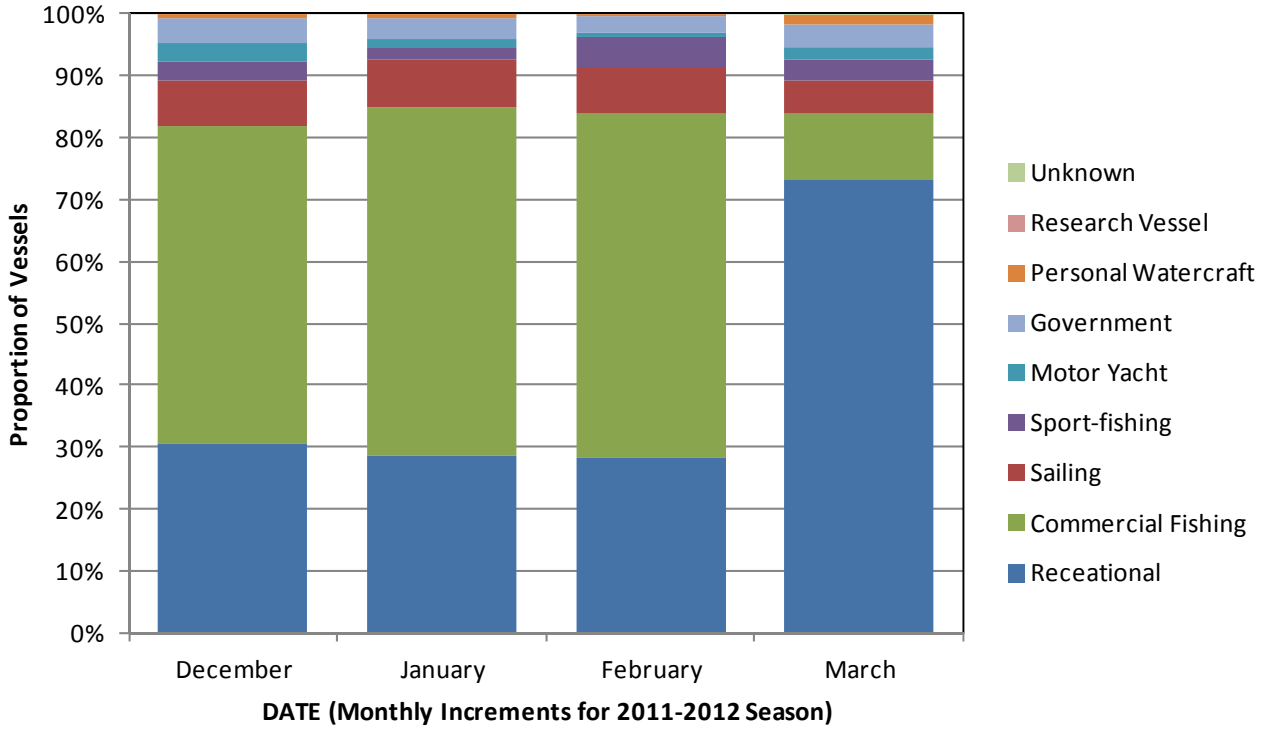

Figure 15. Proportion of government and small vessel sightings to total sightings by the SEWS survey team during the 2012 season displayed by month

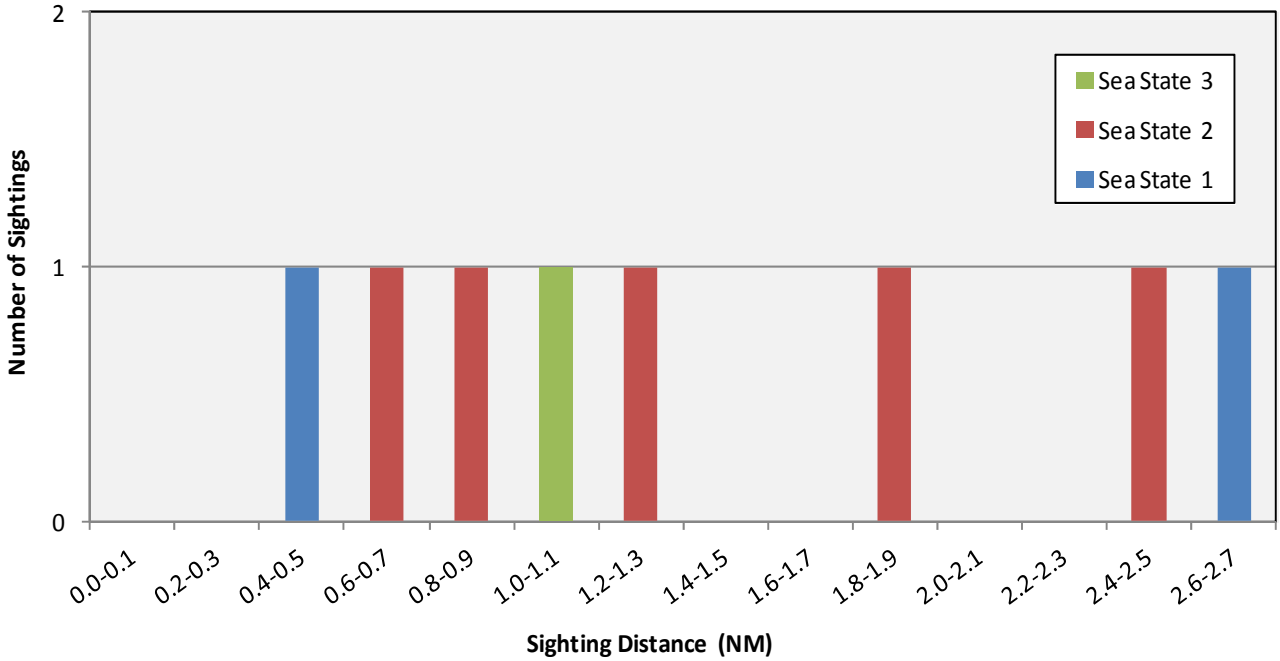

Figure 16. Sighting distance for on-effort sightings by the SEWS survey team during the 2012 season displayed by sea state (Beaufort scale)

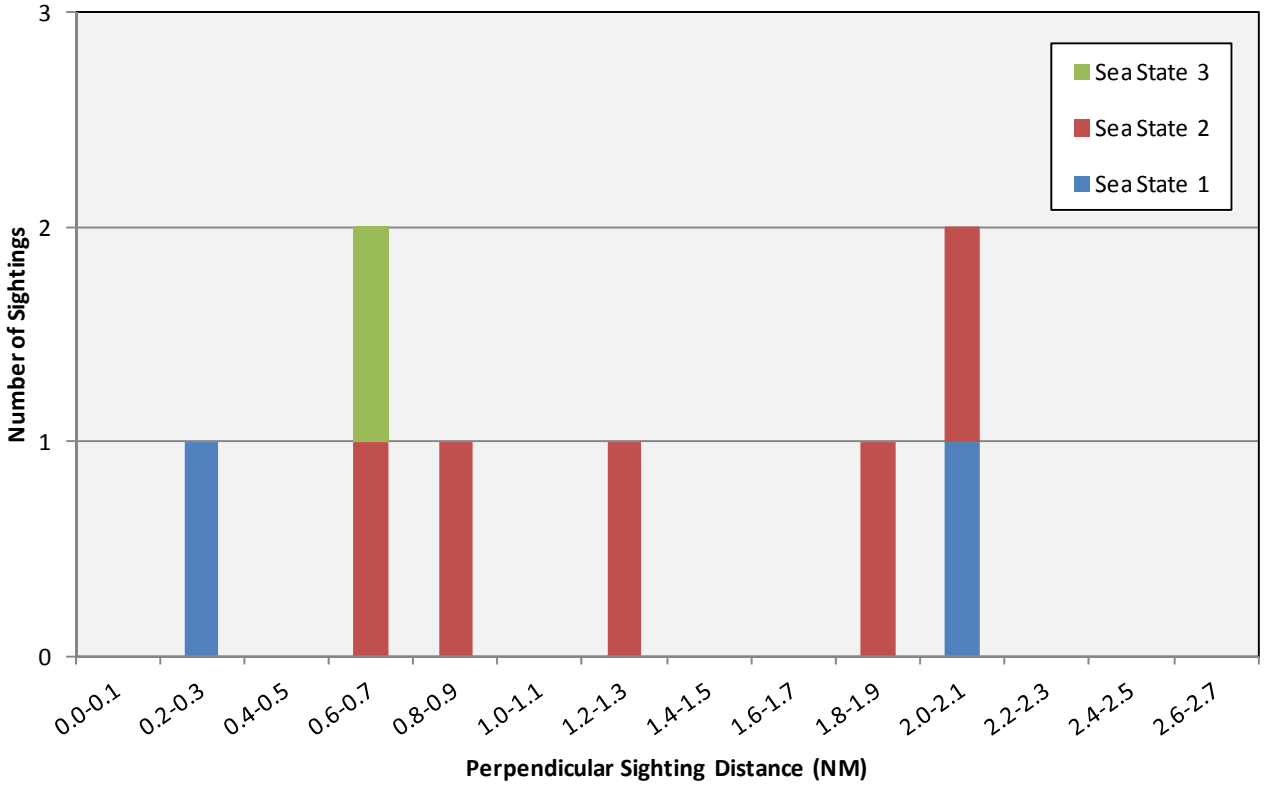

Figure 17. Perpendicular sighting distance for on-effort sightings by the SEWS survey team during the 2012 season displayed by sea state (Beaufort scale)

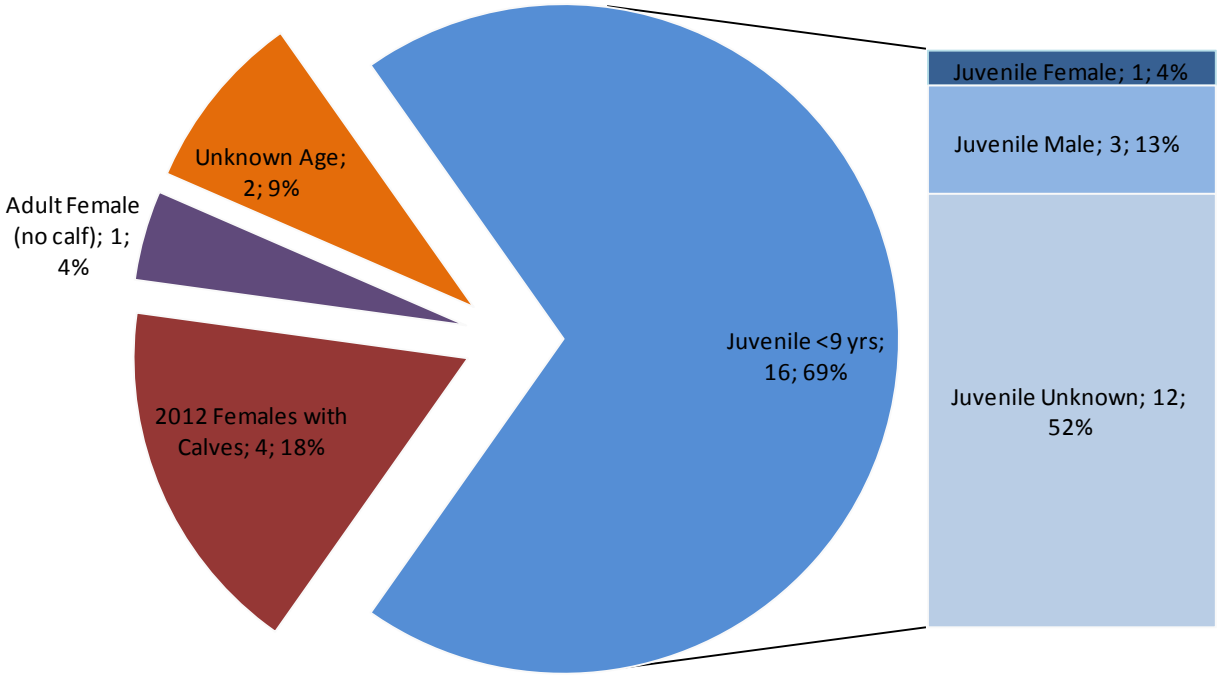

Figure 18. Age and sex class of individual whales sighted by the SEWS survey team during the 2012 season (*n*=22)

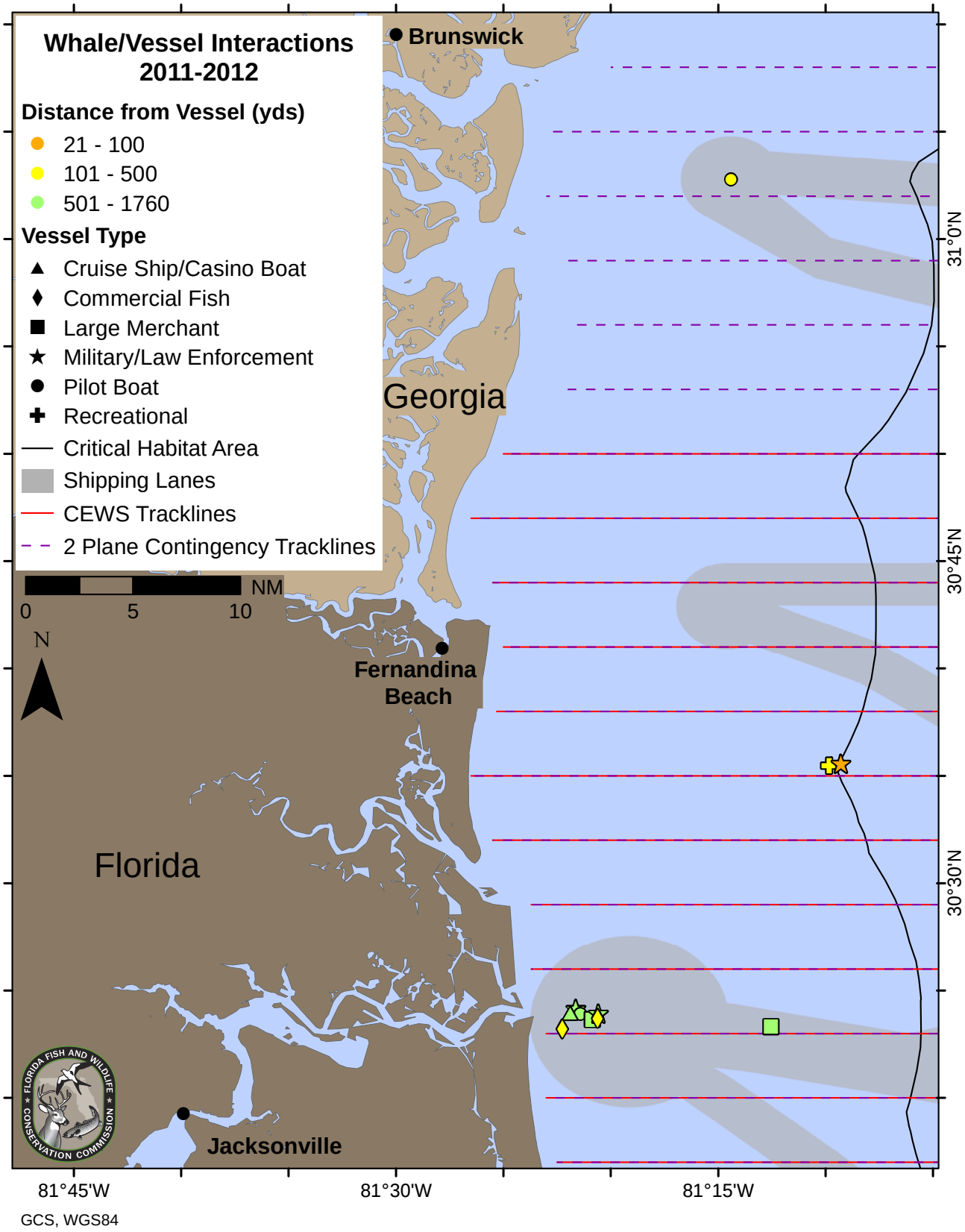

Figure 19. Whale-vessel interactions (WVI) documented by the CEWS and SEWS survey teams, December 2011-March 2012

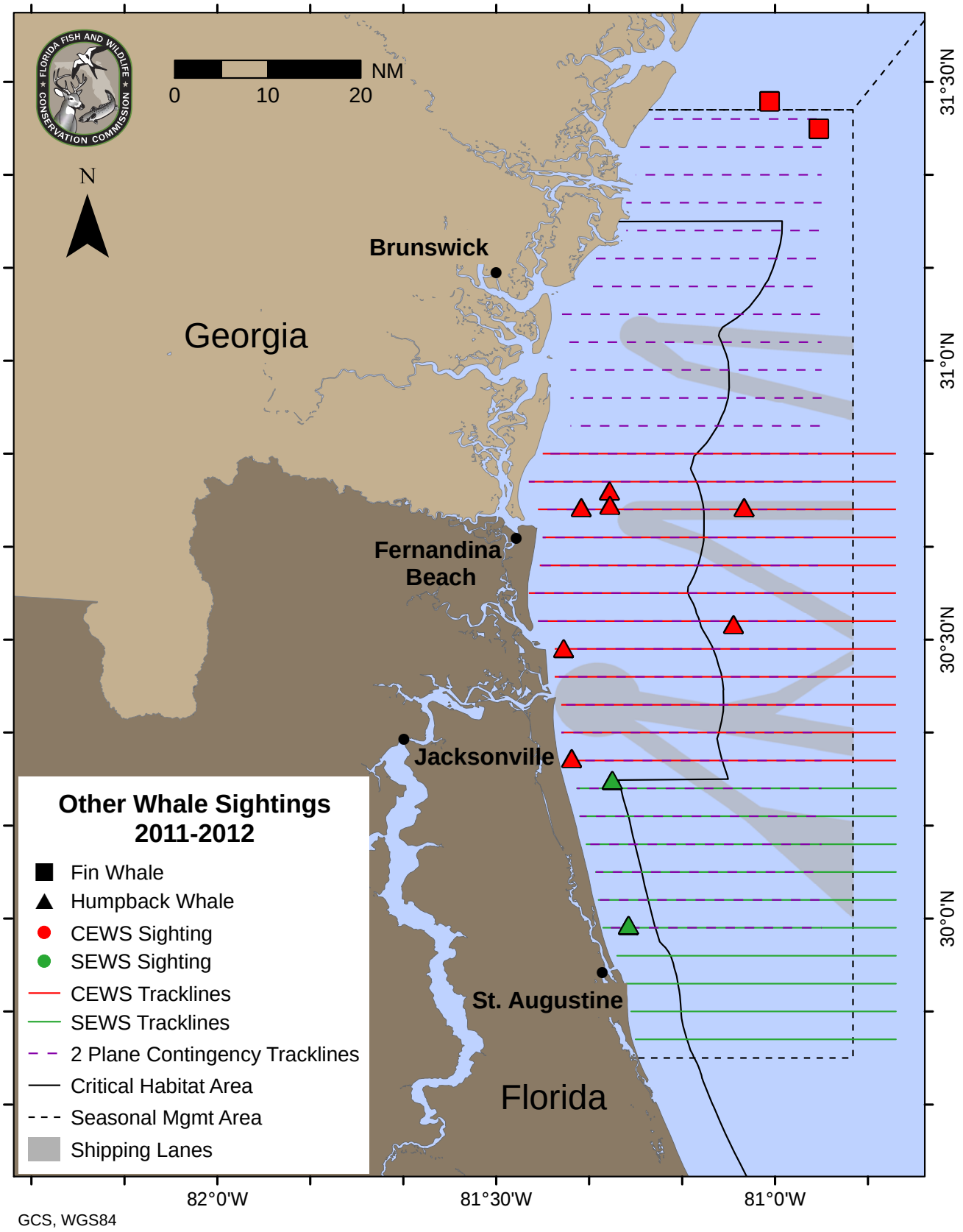

Figure 20. Humpback and fin whale sightings by the CEWS and SEWS survey teams, December 2011-March 2012

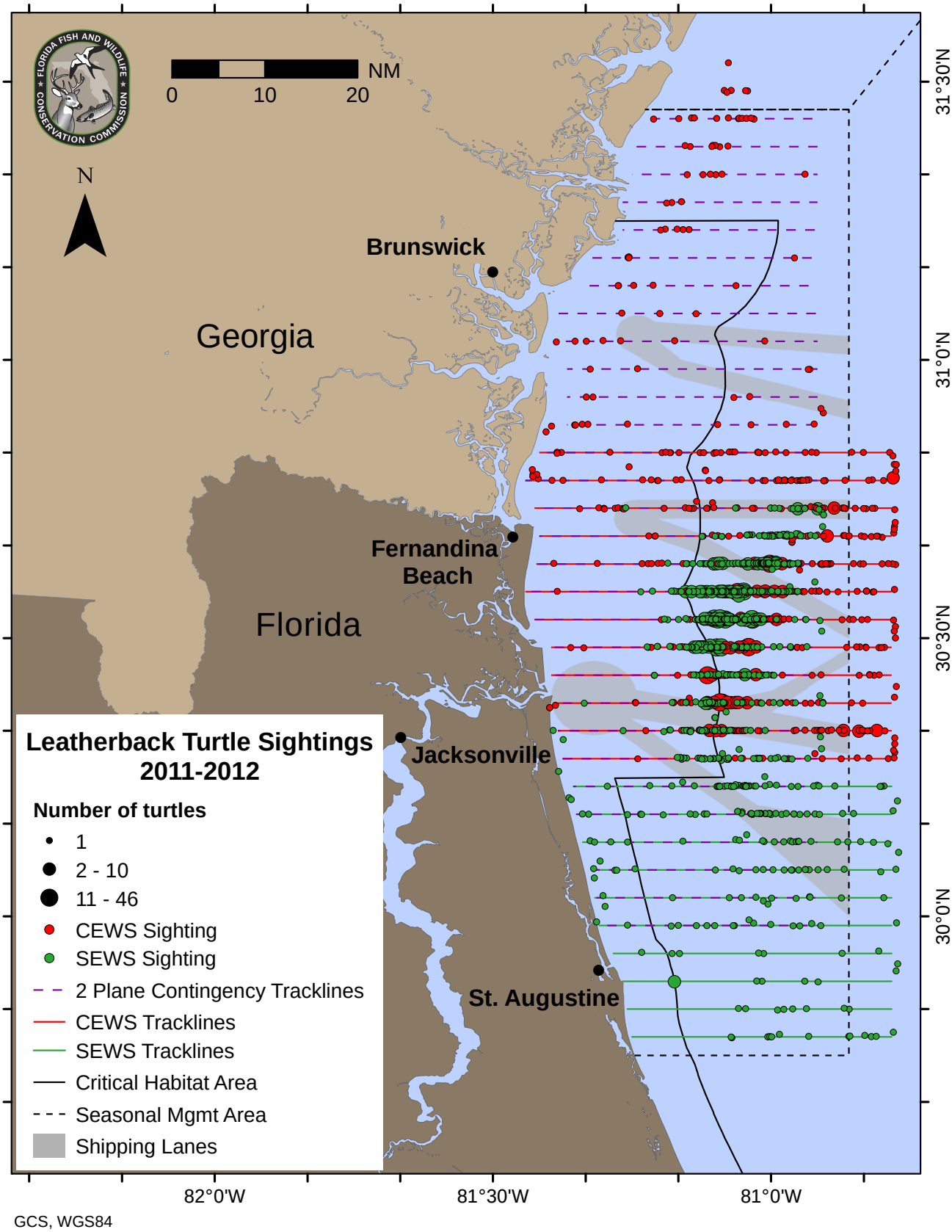

Figure 21. Leatherback turtle sightings by the CEWS and SEWS survey teams, December 2011-March 2012

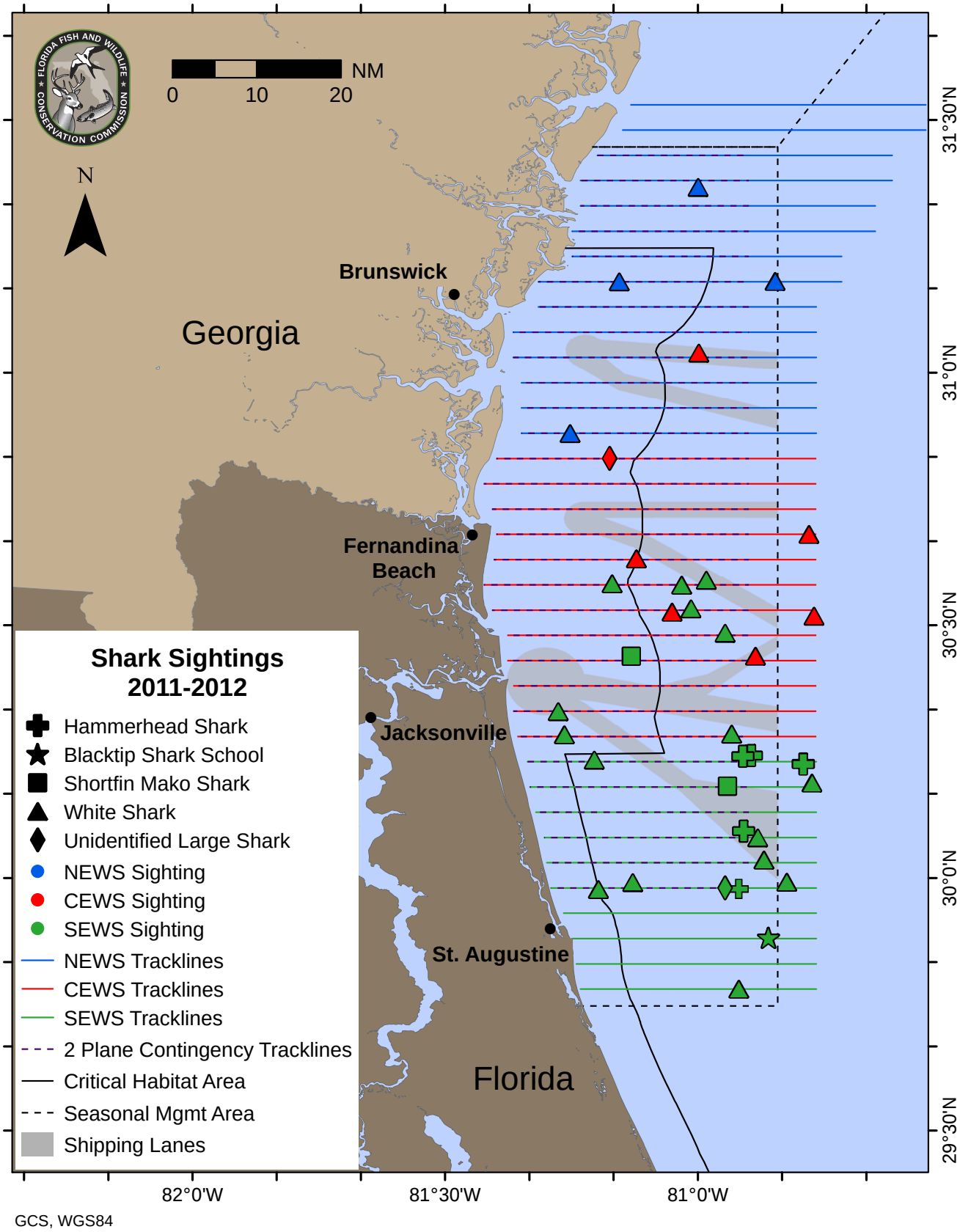

Figure 22. Large shark sightings by the CEWS, NEWS, and SEWS survey teams, December 2011-March 2012

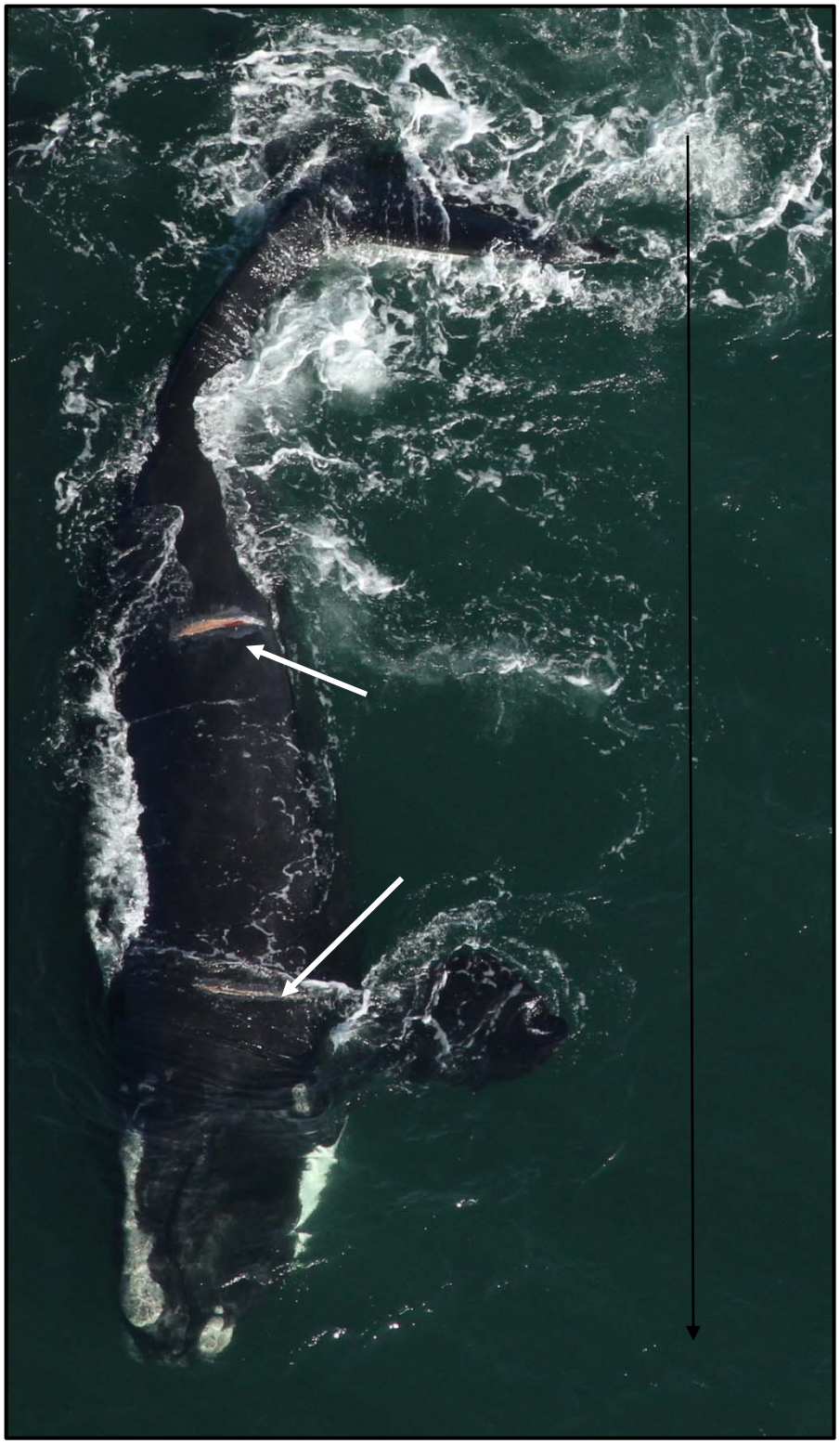

Figure 23. Intermatch code 2011 Calf of Catalog #2746; note the white arrows point to wounds/scars on the left side of the body and the black arrow indicates the whale's direction of movement; whale is rolling left side up. Whale was first sighted injured on 17 January 2012.

Photograph taken 20 January 2012 by Leah Crowe, FWRI, NOAA Fisheries Permit #15488

Figure 24. Catalog #1719; note entanglement originating from both sides of the mouth (white arrows), peduncle wounds/scars, and sloughing skin; black arrow indicates the whale's direction of movement

Photograph taken 19 January 2012 by Jen Jakush, FWRI, NOAA Fisheries Permit #15488

Figure 25. Calf of Catalog #1301; note thin body condition, increased cyamid coverage on peduncle, and divot with cyamids behind blowholes (white arrow); black arrow indicates the whale's direction of movement

Photograph taken 10 January 2012 by Amy Willoughby, FWRI, NOAA Fisheries Permit #15488

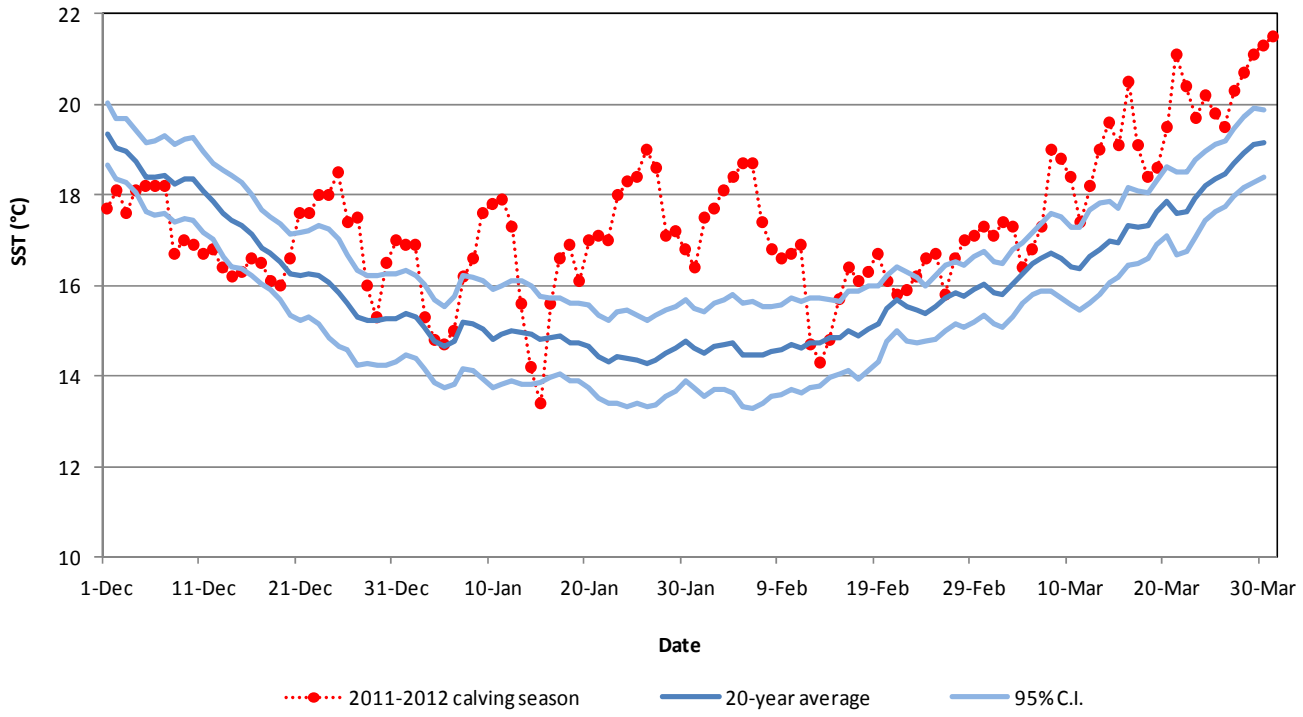

Figure 26. Average daily sea surface temperature (SST) at NOAA's National Data Buoy Center C-MAN Station SAUF1 located nearshore off St. Augustine, FL

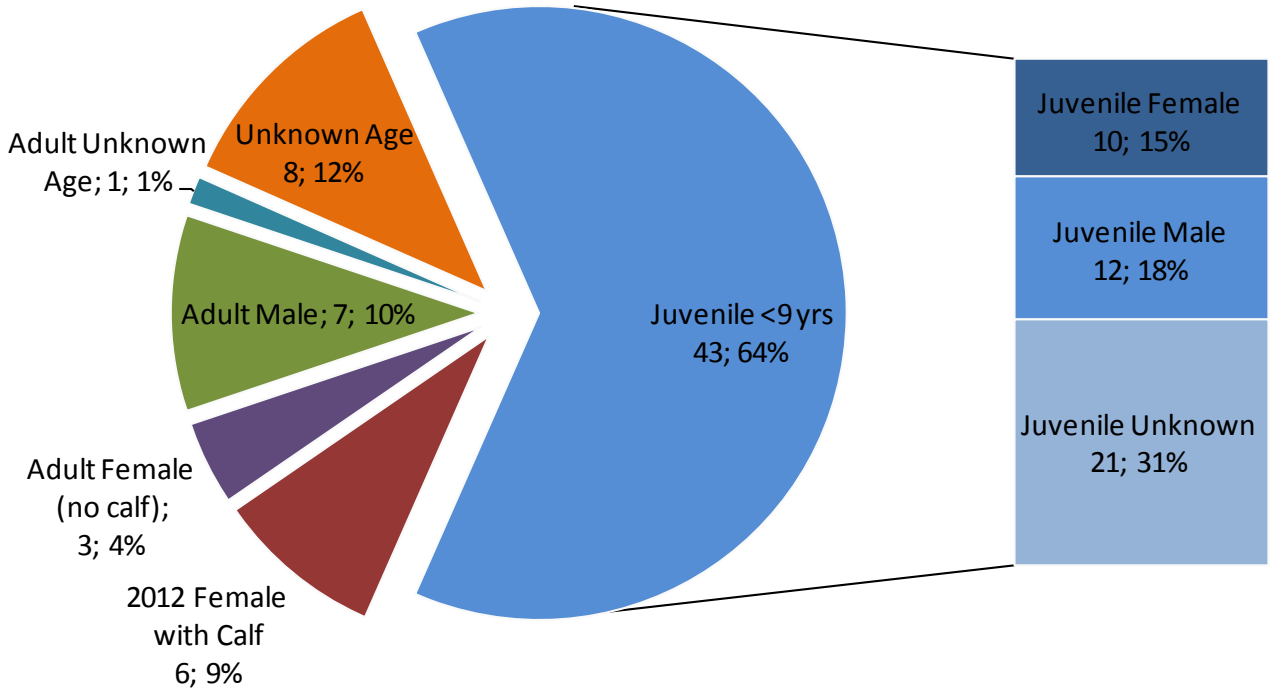

Figure 27. Age and sex class of individual whales sighted in the SEUS during the 2012 season (*n*=68)

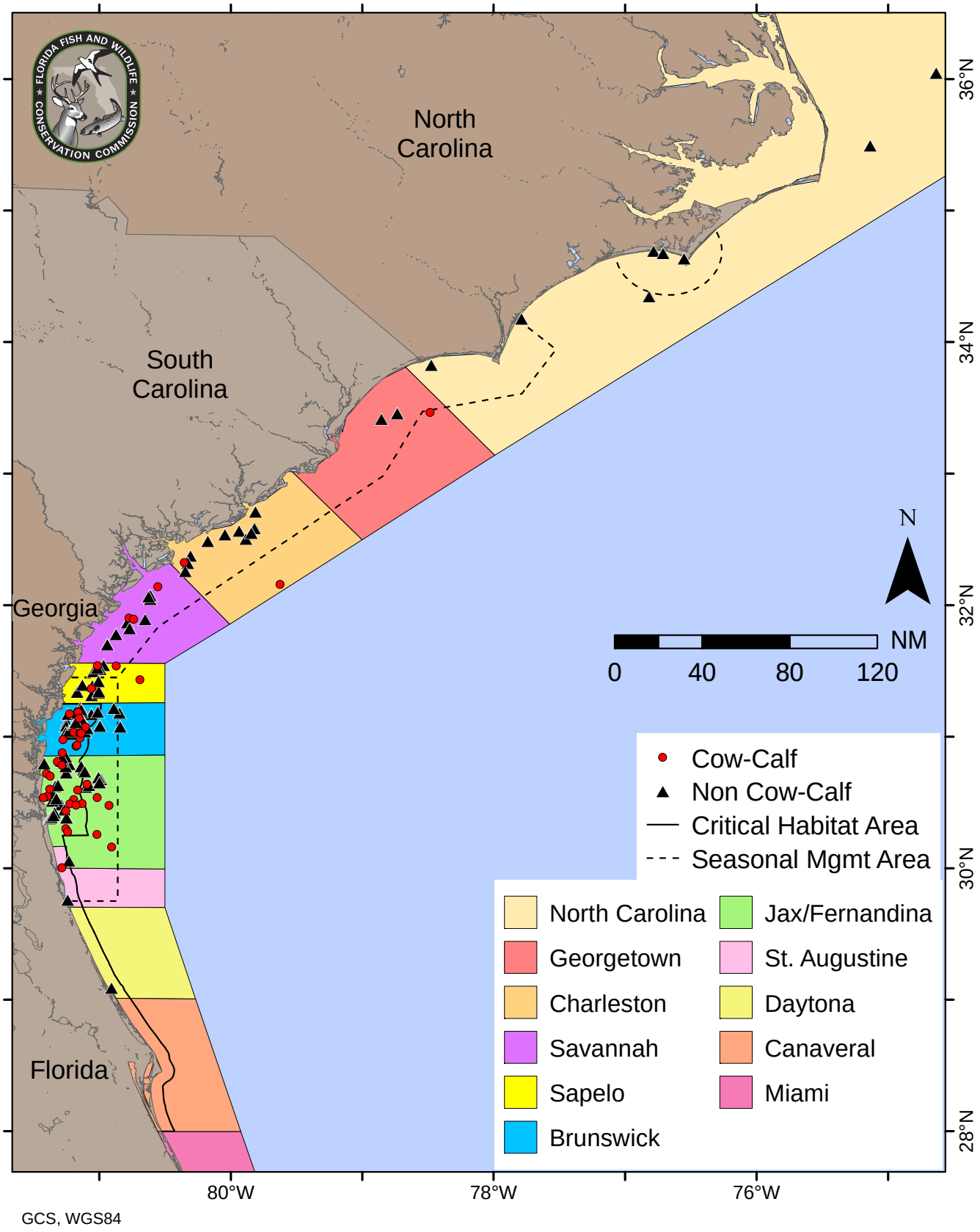

Figure 28. EWS whale alerts in the SEUS during the 2012 season

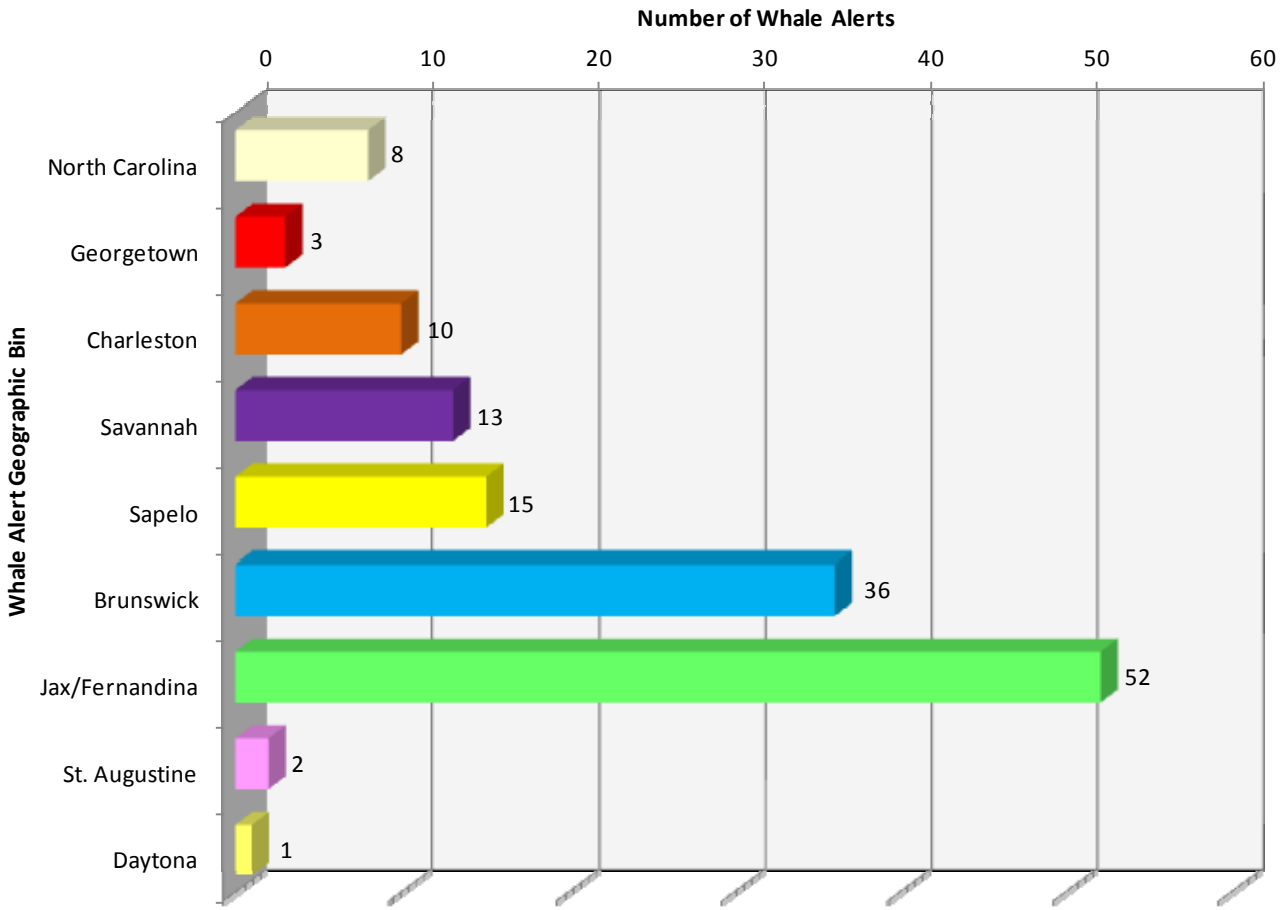

Figure 29. Distribution of EWS whale alerts displayed as number of alerts per geographic bin

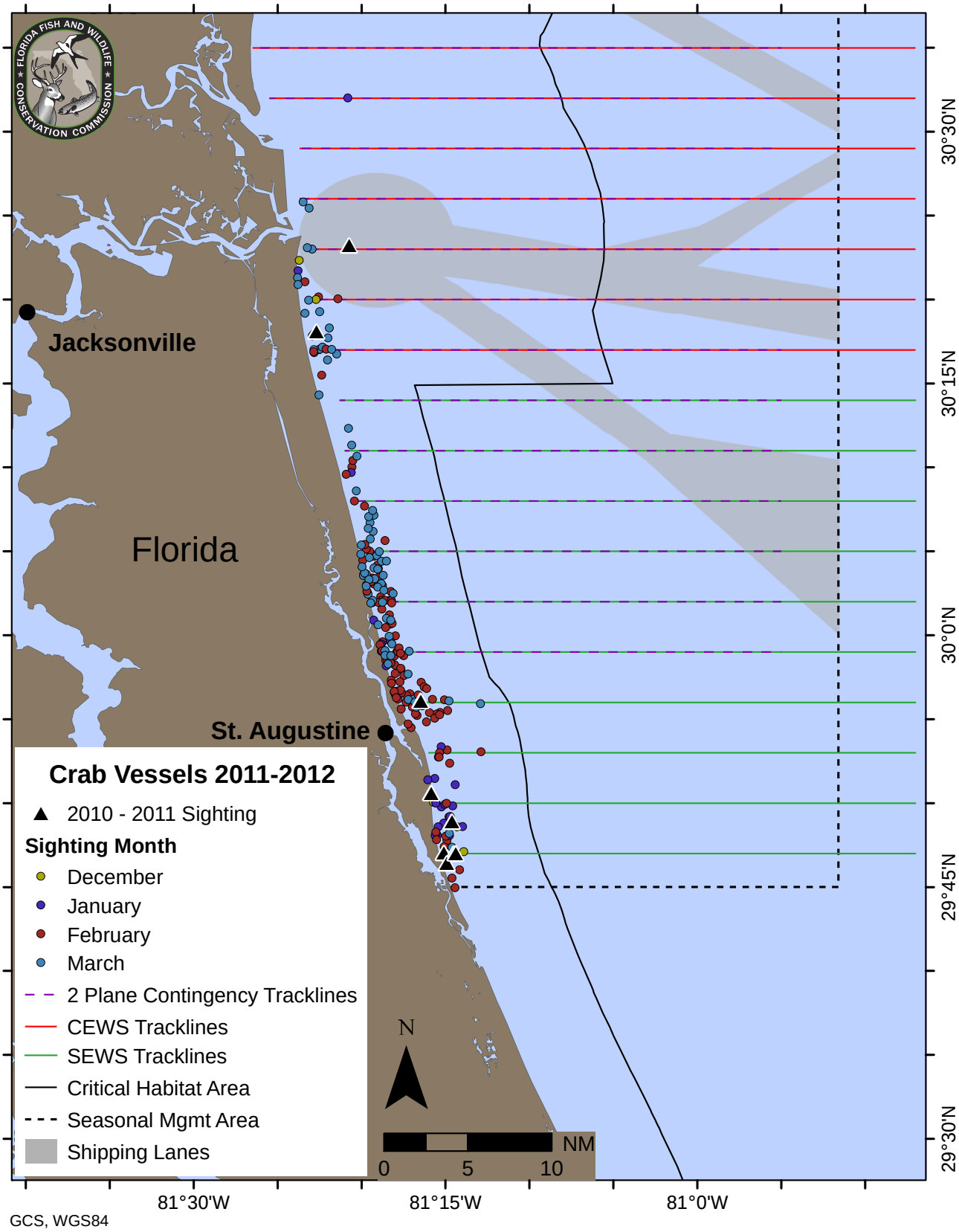

Figure 30. Crabbing vessel sightings by the CEWS and SEWS teams during the 2012 season displayed by month with crabbing vessel sightings by the CEWS and SEWS teams during the 2011 season

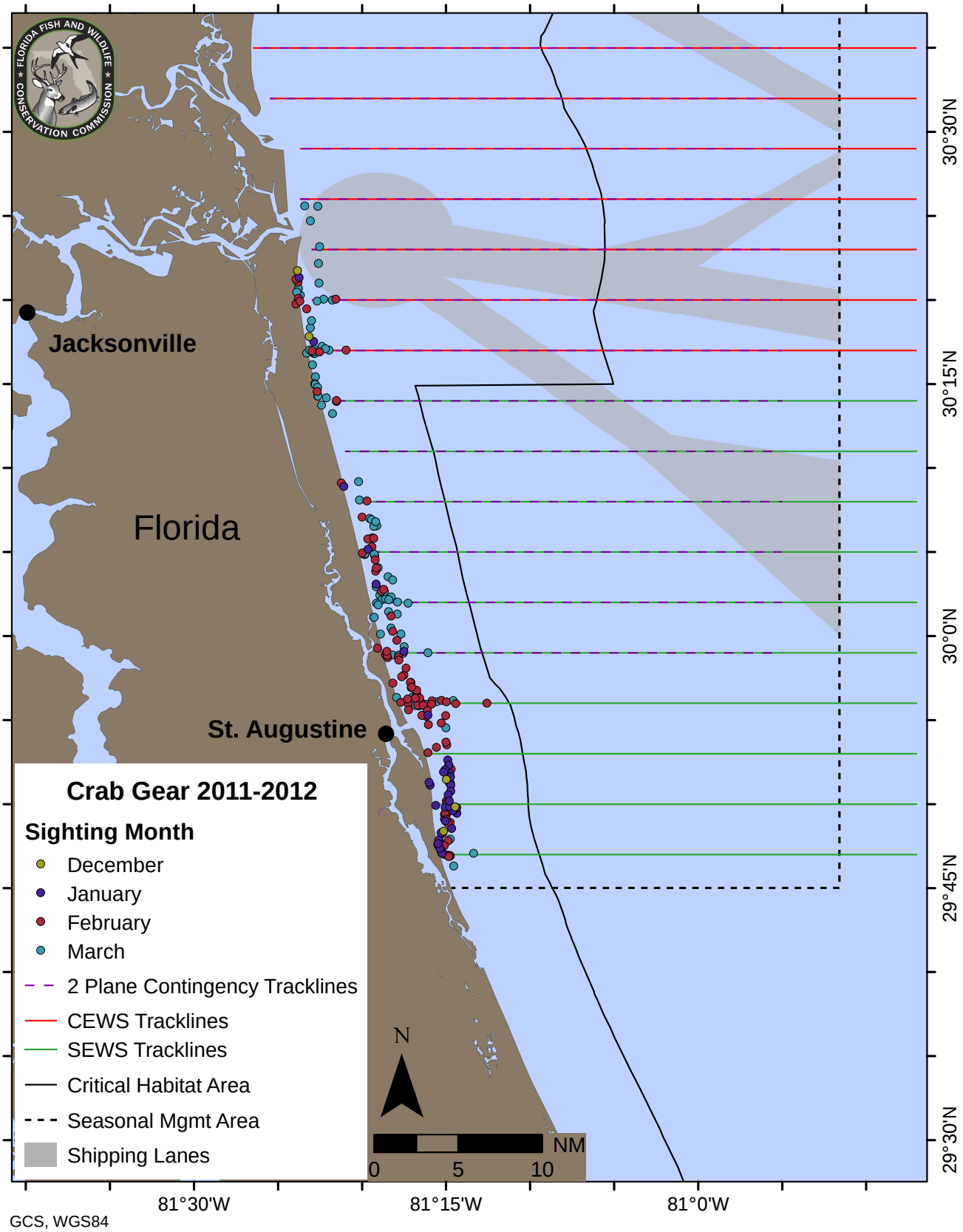

Figure 31. Crabbing gear (buoy) sightings by the CEWS and SEWS teams during the 2012 season displayed by month; sighting locations represent areas of observed gear, not individual buoys sighted

Table 1. Early warning system (EWS) survey tracklines

Survey Area	EWS Trackline Number	Trackline Latitude	Eastern End Point Longitude	Standard Nautical Mileage	2-Plane Tracklines	Trackline Latitude	2-Plane Eastern Longitude	2-Plane Nautical Mileage	1-Plane Tracklines	Trackline Latitude	1-Plane Eastern Longitude	1-Plane Nautical Mileage
NEWS	a	31° 32.0	80° 34.0	29.9								
NEWS	b	31° 29.0	80° 34.0	30.8								
NEWS	1	31° 26.0	80° 38.0	30.0	1	31° 26.0	80° 55.0	15.4				
NEWS	2	31° 23.0	80° 38.0	31.7	2	31° 23.0	80° 55.0	17.1				
NEWS	3	31° 20.0	80° 40.0	30.0	3	31° 20.0	80° 55.0	17.1				
NEWS	4	31° 17.0	80° 40.0	30.8	4	31° 17.0	80° 55.0	18.0				
NEWS	5	31° 14.0	80° 44.0	27.5	5	31° 14.0	80° 55.0	18.0	5	31° 14.0	81° 00.0	13.7
NEWS	6	31° 11.0	80° 44.0	30.9	6	31° 11.0	80° 55.0	21.4	6	31° 11.0	81° 00.0	17.1
NEWS	7	31° 08.0	80° 47.0	28.3	7	31° 08.0	80° 55.0	21.4	7	31° 08.0	81° 00.0	17.1
NEWS	8	31° 05.0	80° 47.0	30.9	8	31° 05.0	80° 55.0	24.0	8	31° 05.0	81° 00.0	19.7
NEWS	9	31° 02.0	80° 47.0	30.9	9	31° 02.0	80° 55.0	24.0	9	31° 02.0	81° 00.0	19.7
NEWS	10	30° 59.0	80° 47.0	30.1	10	30° 59.0	80° 55.0	23.2	10	30° 59.0	81° 00.0	18.9
NEWS	11	30° 56.0	80° 47.0	30.1	11	30° 56.0	80° 55.0	23.2	11	30° 56.0	81° 00.0	18.9
NEWS	12	30° 53.0	80° 47.0	30.2	12	30° 53.0	80° 55.0	23.2	12	30° 53.0	81° 00.0	18.9
CEWS	13	30° 50.0	80° 47.0	32.8	13	30° 50.0	80° 55.0	25.8	13	30° 50.0	81° 00.0	21.5
CEWS	14	30° 47.0	80° 47.0	34.1	14	30° 47.0	80° 55.0	27.1	14	30° 47.0	81° 00.0	22.8
CEWS	15	30° 44.0	80° 47.0	33.2	15	30° 44.0	80° 55.0	26.3	15	30° 44.0	81° 00.0	22.0
CEWS	16	30° 41.0	80° 47.0	32.8	16	30° 41.0	80° 55.0	25.9	16	30° 41.0	81° 00.0	21.6
CEWS	17	30° 38.0	80° 47.0	33.1	17	30° 38.0	80° 55.0	26.1	17	30° 38.0	81° 00.0	21.8
CEWS	18	30° 35.0	80° 47.0	34.1	18	30° 35.0	80° 55.0	27.2	18	30° 35.0	81° 00.0	22.9
CEWS	19	30° 32.0	80° 47.0	33.3	19	30° 32.0	80° 55.0	26.3	19	30° 32.0	81° 00.0	22.0
CEWS	20	30° 29.0	80° 47.0	31.7	20	30° 29.0	80° 55.0	24.8	20	30° 29.0	81° 00.0	20.5
CEWS	21	30° 26.0	80° 47.0	31.7	21	30° 26.0	80° 55.0	24.8	21	30° 26.0	81° 00.0	20.5
CEWS	22	30° 23.0	80° 47.0	31.1	22	30° 23.0	80° 55.0	24.2	22	30° 23.0	81° 00.0	19.9
CEWS	23	30° 20.0	80° 47.0	31.2	23	30° 20.0	80° 55.0	24.2	23	30° 20.0	81° 00.0	19.9
CEWS	24	30° 17.0	80° 47.0	30.8	24	30° 17.0	80° 55.0	23.8	24	30° 17.0	81° 00.0	19.5
SEWS	25	30° 14.0	80° 47.0	29.7	25	30° 14.0	80° 55.0	22.8	25	30° 14.0	81° 00.0	18.5
SEWS	26	30° 11.0	80° 47.0	29.5	26	30° 11.0	80° 55.0	22.5	26	30° 11.0	81° 00.0	18.2
SEWS	27	30° 08.0	80° 47.0	28.9	27	30° 08.0	80° 55.0	21.9				
SEWS	28	30° 05.0	80° 47.0	28.1	28	30° 05.0	80° 55.0	21.1				
SEWS	29	30° 02.0	80° 47.0	27.8	29	30° 02.0	80° 55.0	20.8				
SEWS	30	29° 59.0	80° 47.0	27.4	30	29° 59.0	80° 55.0	20.4				
SEWS	31	29° 56.0	80° 47.0	26.1								
SEWS	32	29° 53.0	80° 47.0	25.2								
SEWS	33	29° 50.0	80° 47.0	24.8								
SEWS	34	29° 47.0	80° 47.0	24.4								

Nautical mileage calculated using Geodetic Datums

Table 2. SEWS survey team activities, December 2011-March 2012

Date	Full	None	Partial	One/ Two Plane	EWS Lines	Number of RIWH Sightings	Number of RIWH Whales	RIWH M/C Pair	Number of HUWH Sightings	Flight Hours	Nautical Miles Flown	Nautical miles flown sea state ≤ 3	Transit Nautical Miles	WVI	Comments (LAT/LONG format degrees, minutes)
1-Dec-11		X													No fly - high winds/sea state
2-Dec-11		X													No fly - high winds/sea state
3-Dec-11		X													No fly - high winds/sea state
4-Dec-11				X	23-34	0	0	0	0	4.3	250.0	214.7			Southern portion of 2-plane contingency. Lines 3020N-2959N flown S to N then 2947N-2956N S to N. Fog and high winds in GA, so both planes shifted south. Standby due to high winds/sea state.
5-Dec-11				X	17-30	0	0	0	0	5.1	320.1	320.1			Southern portion of 2-plane contingency. Lines 3038N-2959N flown S to N. Cut lines 2959N and 3002N due to restricted airspace in Area 27C. Standby due to fog.
6-Dec-11				X	17-30	0	0	0	0	4.8	359.9	359.9	37.70		Southern portion of 2-plane contingency. Lines 3038N-2959N flown S to N. Cut lines 2959N and 3002N due to restricted airspace in Area 27C. Transit S on track. Standby due to fog.
7-Dec-11				X	14-17, 21-28	0	0	0	0	3.6	256.7	221.4	55.20		One-plane contingency. Lines 3047N-3038N and 3026N-3005N flown N to S. Lines 3047N and 3044N east to 8055W; cut lines 3041N-3038N and 3026N-3005N at approx 8105W due to high sea state. Transits N and S on track. Restricted airspace in Area 27C and between 3033N and 3017N east of 8100W.
8-Dec-11		X													No fly - high winds/sea state
9-Dec-11				X	17-30	0	0	0	0	4.7	364.0	338.9	33.10		Southern portion of 2-plane contingency. Lines 3038N-2959N flown N to S. Transit N on track.
10-Dec-11		X													No fly - high winds/sea state
11-Dec-11		X													No fly - high winds/sea state
12-Dec-11		X													No fly - high winds/sea state
13-Dec-11		X													No fly - high winds/sea state
14-Dec-11		X													No fly - high winds/sea state
15-Dec-11	X				25-34	0	0	0	0	4.6	271.8	271.8			Lines 3014N-2947N flown N to S. Standby due to fog.

Date	Full	None	Partial	One/ Two Plane	EWS Lines	Number of RIWH Sightings	Number of RIWH Whales	RIWH M/C Pair	Number of HUWH Sightings	Flight Hours	Nautical Miles Flown	Nautical miles flown sea state ≤ 3	Transit Nautical Miles	WVI	Comments (LAT/LONG format degrees, minutes)
16-Dec-11	X				25-34	0	0	0	0	4.5	271.8	271.8			Lines 3014N-2947N flown S to N
17-Dec-11			X		25-34	0	0	0	0	3.8	229.9	201.3			Lines 3014N-2947N flown S to N. Lines 3014N, 3011N and 3002N- 2953N cut at 8055W due to high sea state.
18-Dec-11		X													No fly - high winds/sea state
19-Dec-11		X													No fly - high winds/sea state
20-Dec-11				X	17-32	0	0	0	0	5.7	382.2	382.2			Southern portion of 2-plane contingency. Lines 3038N-2953N flown N to S; 3038N-2959N east to 8055W and 2956N-2953N east to 8047W. Transit to northern line was above survey speed (off effort) due to forecasted wind speed increase in the afternoon.
21-Dec-11		X													No fly - high winds/sea state
22-Dec-11	X				21-34	0	0	0	0	5.9	382.7	348.2			Flew lines 3026N-2947N. Lines 3014N-2947N flown S to N and 3026N-3017N flown N to S. Cut lines 3020N and 3017N at 8055W due to high sea state. Transit N to 3026N above survey speed (off effort) due to available survey time. Otter grounded due to mechanical issue; CEWS and SEWS teams completed the remaining NEWS and CEWS survey lines covering the Brunswick and Jacksonville channels.
23-Dec-11			X		25-34	0	0	0	0	3.6	243.9	208.9			Lines 3014N-2947N flown N to S. Cut lines 3008N-2959N at 8055W due to high sea state.
24-Dec-11		X													No fly - high winds/sea state
25-Dec-11		X													No fly - high winds/sea state
26-Dec-11		X													No fly - high winds/sea state
27-Dec-11		X													No fly - high winds/sea state
28-Dec-11		X													No fly - high winds/sea state
29-Dec-11	X				25-34	0	0	0	0	4.2	271.8	271.8			Lines 3014N-2947N flown N to S
30-Dec-11	X				25-34	0	0	0	0	4.1	282.8	282.8	11.00		Lines 3014N-2947N flown S to N. Transit S on track.
31-Dec-11	X				25-34	0	0	0	0	3.9	271.8	264.3			Lines 3014N-2947N flown S to N. Standby due to high winds.

Date	Full	None	Partial	One/ Two Plane	EWS Lines	Number of RIWH Sightings	Number of RIWH Whales	RIWH M/C Pair	Number of HUWH Sightings	Flight Hours	Nautical Miles Flown	Nautical miles flown sea state ≤ 3	Transit Nautical Miles	WVI	Comments (LAT/LONG format degrees, minutes)
1-Jan-12			X		25-34	0	0	0	0	3.9	240.0	240.0	13.40		Flew lines 3014N-2947N. Lines 3014N-3005N flown N to S and 3002N-2947N flown S to N. Transit S on track. Off effort for portions of lines 3005N-3014N due to patchy fog. Standby due to fog.
2-Jan-12		X													No fly - high winds/sea state
3-Jan-12		X													No fly - high winds/sea state
4-Jan-12		X													No fly - standby due to high winds/sea state. Survey canceled at 1245(L) due to mechanical issues with aircraft GPS and daylight constraints.
5-Jan-12		X													No fly - high winds/sea state
6-Jan-12	X				25-34	0	0	0	0	4.2	294.3	294.3	22.50		Lines 3014N-2947N flown N to S. Transit N and S on track.
7-Jan-12	X				25-34	0	0	0	0	3.7	287.0	287.0	15.20		Lines 3014N-2947N flown S to N. Transit S on track. Standby due to fog.
8-Jan-12	X				25-34	0	0	0	0	4.8	271.8	271.8			Lines 3014N-2947N flown S to N. Standby due to fog.
9-Jan-12			X		25-34	0	0	0	0	4.8	248.1	248.1			Lines 3014N-2947N flown S to N. Cut lines 2953N and 2956N and shifted lines 2959N and 2950N due to restricted airspace in Area 27C. Boxed area of reported sighting near 3009N 8050W. Standby due to fog.
10-Jan-12	X				25-34	1	2	1	0	4.9	271.8	271.8			Flew lines 3014N-2947N. Lines 2956N-2947N flown S to N and 3014N-2959N flown N to S. Transited N above survey speed (off effort) to verify a sighting report near 3017N. Standby due to fog.
11-Jan-12		X													No fly - high winds/sea state
12-Jan-12		X													No fly - high winds/sea state
13-Jan-12		X													No fly - high winds/sea state
14-Jan-12		X													No fly - high winds/sea state
15-Jan-12		X													No fly - high winds/sea state
16-Jan-12		X													No fly - high winds/sea state
17-Jan-12	X				23-34	1	1	0	0	7.0	354.2	354.2	20.50		Lines 3020N-2947N flown S to N. Transit S on track. Standby due to 27C airspace conflicts. After survey complete verified sighting report near 3001N.

Date	Full	None	Partial	One/ Two Plane	EWS Lines	Number of RIWH Sightings	Number of RIWH Whales	RIWH M/C Pair	Number of HUWH Sightings	Flight Hours	Nautical Miles Flown	Nautical miles flown sea state ≤ 3	Transit Nautical Miles	WVI	Comments (LAT/LONG format degrees, minutes)
18-Jan-12		X													No fly - high winds/sea state
19-Jan-12			X		29-34	1	1	0	1	7.7	155.7	153.9			Lines 3002N-2947N flown S to N. After re-fueling, transited north to relieve NEWS team and assist with disentanglement effort for #1719; all operations after re-fueling were off effort. Standby due to high winds.
20-Jan-12		X													No fly - aircraft repair
21-Jan-12		X													No fly - high winds/sea state
22-Jan-12	X				23-34	0	0	0	0	5.0	333.7	333.7			Lines 3020N-2947N flown N to S. Lines 2956N-2947N flown before lines 3020N-2959N due to fog to the north.
23-Jan-12		X													No fly - fog and high winds/sea state
24-Jan-12	X				25-34	0	0	0	0	4.7	271.8	271.8			Lines 3014N-2947N flown S to N. Standby due to fog.
25-Jan-12	X				25-34	2	4	2	0	4.8	271.8	271.8			Lines 3014N-2947N flown S to N. Standby due to fog.
26-Jan-12			X		25-34	0	0	0	1	4.4	257.9	238.2			Lines 3014N-2947N flown S to N. Cut lines 3011N and 3014N at 8055W due to high sea state. Standby due to fog.
27-Jan-12		X													No fly - high winds/sea state
28-Jan-12				X	15-30	7	15	0	0	8.6	374.9	374.9			Southern portion of 2-plane contingency. Lines 3044N-2959N flown S to N. Cut lines 3041N and 3044N at approx 8100W due to daylight constraints. Transit S above survey speed/over shoreline (off effort, no data collected).
29-Jan-12		X													No fly - high winds/sea state
30-Jan-12		X													No fly - high winds/sea state
31-Jan-12				X	17-30	3	14	0	0	6.0	330.9	330.9			Southern portion of 2-plane contingency. Lines 3038N-2959N flown N to S. Standby due to aircraft mechanical issue. Transit N off effort, above survey speed.
1-Feb-12	X				25-34	0	0	0	0	4.4	271.8	271.8			Lines 3014N-2947N flown S to N
2-Feb-12			X		25-34	0	0	0	0	4.2	257.9	249.0			Lines 3014N-2947N flown S to N. Cut lines 3011N-3014N at 8055W due to high sea state and patchy fog.
3-Feb-12		X													No fly - high winds/sea state

Date	Full	None	Partial	One/ Two Plane	EWS Lines	Number of RIWH Sightings	Number of RIWH Whales	RIWH M/C Pair	Number of HUWH Sightings	Flight Hours	Nautical Miles Flown	Nautical miles flown sea state ≤ 3	Transit Nautical Miles	WVI	Comments (LAT/LONG format degrees, minutes)
4-Feb-12			X		23-34	0	0	0	0	4.6	317.0	291.9			Lines 3020N-2947N flown S to N. Cut lines 2953N-3002N offshore due to high sea state. Standby due to high winds.
5-Feb-12	X				25-34	1	2	1	0	4.7	271.8	271.8			Lines 3014N-2947N flown S to N. Standby due to fog.
6-Feb-12		X													No fly - high winds/sea state, fog
7-Feb-12		X													No fly - high winds/sea state, fog
8-Feb-12		X													No fly - high winds/sea state, fog
9-Feb-12		X													No fly - high winds/sea state
10-Feb-12			X		25-34	0	0	0	0	4.0	268.4	268.4			Lines 3014N-2947N flown N to S. Cut western end of line 2956N due to air traffic.
11-Feb-12		X													No fly - high winds/sea state
12-Feb-12		X													No fly - high winds/sea state
13-Feb-12			X		25-34	0	0	0	0	3.6	248.2	248.2			Lines 3014N-2947N flown N to S. Cut lines 2953N and 2956N and shifted lines 2959N and 2950N due to restricted airspace in Area 27C. Standby due to high winds.
14-Feb-12			X		25-34	0	0	0	0	2.8	177.4	139.5			Lines 3014N-2947N flown N to S. Cut lines 3014N-3011N a few miles short and 3008N-2947N at 8100W due to high sea state. Standby due to high winds/sea state.
15-Feb-12	X				25-34	0	0	0	0	4.6	271.8	271.8			Lines 3014N-2947N flown N to S. Prior to start of survey, searched for sighting report near St. Augustine Inlet (no whale located).
16-Feb-12				X	15-30	0	0	0	0	5.6	428.3	428.3	45.30		Southern portion of 2-plane contingency. Lines 3044N-2959N flown N to S. Transit N on track. Shifted line 2959N north due to restricted airspace in Area 27C.
17-Feb-12		X													No fly - low ceiling, fog, and rain
18-Feb-12			X		25-34	0	0	0	0	4.0	259.0	259.0			Lines 3014N-2947N flown from N to S. Prior to start of survey, flew along coast between St. Augustine Inlet and Ponte Vedra to document and assess crab boats and gear. Cut offshore portion of lines 3002N and 2959N due to fog bank. Standby due to visibility restrictions.
19-Feb-12		X													No fly - high winds/sea state
20-Feb-12		X													No fly - high winds/sea state

Date	Full	None	Partial	One/ Two Plane	EWS Lines	Number of RIWH Sightings	Number of RIWH Whales	RIWH M/C Pair	Number of HUWH Sightings	Flight Hours	Nautical Miles Flown	Nautical miles flown sea state ≤ 3	Transit Nautical Miles	WVI	Comments (LAT/LONG format degrees, minutes)
21-Feb-12	X				25-34	0	0	0	0	4.1	271.8	264.9			Lines 3014N-2947N flown N to S
22-Feb-12	X				25-34	0	0	0	0	4.4	271.8	271.8			Lines 3014N-2947N flown N to S
23-Feb-12			X		21-30	0	0	0	0	3.6	302.5	275.1	22.90		Lines 3026N-2959N flown N to S. Cut lines 3020N-3005N offshore due to high sea state. Shifted line 2959N north due to restricted airspace in Area 27C. Ended survey due to increased sea state inshore and Area 27C constraints.
24-Feb-12		X													No fly- high winds/sea state
25-Feb-12		X													No fly - high winds/sea state
26-Feb-12		X													No fly - high winds/sea state
27-Feb-12		X													No fly - high winds/sea state
28-Feb-12		X													No fly - fog, high winds/sea state
29-Feb-12			X		25-34	0	0	0	0	4.5	271.8	271.8			Lines 3014N-2947N flown N to S. Cut western end of line 3059N due to air traffic. Standby due to fog offshore.
1-Mar-12			X		25-34	0	0	0	0	3.7	245.9	238.0			Lines 3014N-2947N flown N to S. Cut lines 3014N-3005N offshore due to fog. Cut lines 2953N and 2956N and shifted lines 2959N and 2950N due to restricted airspace in Area 27C. Standby due to low ceiling.
2-Mar-12		X													No fly - offshore fog and high winds/sea state
3-Mar-12		X													No fly - high winds/sea state
4-Mar-12		X													No fly - high winds/sea state
5-Mar-12		X													No fly - high winds/sea state
6-Mar-12		X													No fly - high winds/sea state
7-Mar-12		X													No fly - high winds/sea state
8-Mar-12	X				25-34	0	0	0	0	4.5	271.8	261.7			Lines 3014N-2947N flown S to N. Standby due to high sea state
9-Mar-12	X				25-34	0	0	0	0	4.4	271.8	271.8			Lines 3014N-2947N flown N to S. Prior to start of survey, flew along coast from S to N to document and assess crab boats and gear. Standby due to fog.
10-Mar-12		X													No fly - high winds/sea state
11-Mar-12		X													No fly - high winds/sea state
12-Mar-12		X													No fly - high winds/sea state

Date	Full	None	Partial	One/ Two Plane	EWS Lines	Number of RIWH Sightings	Number of RIWH Whales	RIWH M/C Pair	Number of HUWH Sightings	Flight Hours	Nautical Miles Flown	Nautical miles flown sea state ≤ 3	Transit Nautical Miles	WVI	Comments (LAT/LONG format degrees, minutes)
13-Mar-12			X		25-34	0	0	0	0	5.2	254.4	254.4			Lines 3014N-2947N flown S to N. Prior to start of survey, flew along coast from N to S to document and assess crab boats and gear. Off watch for inshore portions of lines 2950N and 2953N due to GPS outage.
14-Mar-12	X				25-34	0	0	0	0	4.4	271.8	271.8			Lines 3014N- 2947N flown N to S. Delayed takeoff due to fog.
15-Mar-12				X	15-30	0	0	0	0	6.3	422.6	422.6	39.60		Southern portion of 2-plane contingency. Lines 3044N-2959N flown N to S. Transit N on track. Standby due to fog.
16-Mar-12				X	19-30	1	2	1	0	4.9	296.0	296.0	29.50		Southern portion of 2-plane contingency. Lines 3032N-2959N flown S to N. Cut lines 3002N and 2959N due to restricted airspace in Area 27C. Transit S on track. Delayed takeoff due to plane maintenance.
17-Mar-12				X	15-30	1	2	1	0	6.8	423.6	423.6	40.60	Yes	Southern portion of 2-plane contingency. Lines 3044N-2959N flown N to S. Transit N on track. Two WVIs (recreational and LE vessel). Delayed takeoff due to fog.
18-Mar-12				X	15-30	0	0	0	0	6.0	423.5	423.5	40.50		Southern portion of 2-plane contingency. Lines 3044N- 2959N flown N to S. Transit N on track. Delayed takeoff due to fog.
19-Mar-12				X	15-30	0	0	0	0	5.7	411.7	411.7	38.80		Southern portion of 2-plane contingency. Lines 3044N to 2959N flown N to S. Cut lines 3002N and 2959N due to restricted airspace in Area 27C. Transit N on track. Delayed takeoff due to fog.
20-Mar-12				X	15-30	0	0	0	0	6.0	422.5	422.5	40.60		Southern portion of 2-plane contingency. Lines 3044N- 2959N flown N to S. Transit N on track. Cut western end of line 2959N due to air traffic. Delayed takeoff due to fog.
21-Mar-12		X													No fly - pilot rest and high winds/sea state
22-Mar-12		X													No fly - high winds/sea state
23-Mar-12				X	17-30	0	0	0	0	5.0	365.2	365.2	34.30		Southern portion of 2-plane contingency. Lines 3038N to 2959N flown N to S. Transit N on track. Delayed takeoff for improved visibility.

Date	Full	None	Partial	One/ Two Plane	EWS Lines	Number of RIWH Sightings	Number of RIWH Whales	RIWH M/C Pair	Number of HUWH Sightings	Flight Hours	Nautical Miles Flown	Nautical miles flown sea state ≤ 3	Transit Nautical Miles	WVI	Comments (LAT/LONG format degrees, minutes)
24-Mar-12				X	19-30	0	0	0	0	3.9	311.8	280.4	34.30		Southern portion of 2-plane contingency. Lines 3032N to 2959N flown N to S. Transit N on track. Survey shortened due to approaching frontal system. Delayed takeoff for improved visibility.
25-Mar-12		X													No fly - high winds/sea state
26-Mar-12				X	17-28	0	0	0	0	2.8	191.6	94.6	33.00		Southern portion of 2-plane contingency. Lines 3038N-3005N flown N to S. Cut lines west of 8100W due to high sea state. Ended survey due to increasing high sea state. Delayed takeoff for improved visibility.
27-Mar-12		X													No fly - high winds/sea state
28-Mar-12				X	17-30	0	0	0	0	5.6	365.4	365.4	34.50		Southern portion of 2-plane contingency. Lines 3038N-2959N flown N to S. Transit N on track. Delayed takeoff for improved visibility.
29-Mar-12		X													No fly - high winds/sea state
30-Mar-12				X	17-30	0	0	0	0	5.6	368.1	368.1	37.20		Southern portion of 2-plane contingency. Lines 3038N-2959N flown N to S. Transit N on track. Delayed takeoff for improved visibility.
31-Mar-12		X													No fly - high winds/seas state

Table 3. Right whale sightings by the SEWS survey team, December 2011-March 2012

Date	Time (L)	Latitude (Decimal Degrees)	Longitude (Decimal Degrees)	RIWH Letter	RIWH Catalog ID # Intermatch Code Season Code	Sex	Age	Behaviors	Whale Alert Number	Comments
1/10/2012	1125	30.30096	-81.25374	A	1301	F	29	W/CALF, NURS, BOD CNT, HDLFT	SEWS001	
1/10/2012	1125	30.30096	-81.25374	B	2012CalfOf1301	U	C	CALF W/MOM, NURS, BOD CNT, SICK	SEWS001	
1/17/2012	1540	30.05646	-81.27907	A	2011CalfOf2746	F	1	BRCH, WH CHN	SEWS002	
1/19/2012	1430	31.26646	-81.11224	A	1719	F	>24	ENTGL, LIN TR, FL	SEWS003	
1/25/2012	1152	30.00413	-81.28140	A	3390	F	>9	W/CALF, BOD CNT, HDLFT, BODO	SEWS004	
1/25/2012	1152	30.00413	-81.28140	B	2012CalfOf3390	U	C	CALF W/MOM, BOD CNT, BODO	SEWS004	
1/25/2012	1349	29.97146	-81.30057	C	UNPH	U	U		-	Updated Position SEWS004
1/25/2012	1349	29.97146	-81.30057	D	UNPH	U	U		-	
1/28/2012	1411	30.62279	-81.08990	A	3950	M	3		SEWS005	
1/28/2012	1411	30.62279	-81.08990	B	3917	U	3		SEWS005	
1/28/2012	1411	30.62279	-81.08990	C	2011CalfOf3293	U	1		SEWS005	
1/28/2012	1411	30.62279	-81.08990	D	3920	U	3		SEWS005	
1/28/2012	1508	30.63479	-81.08257	E	3623	M	6	BOD CNT, BEL/BEL, PENIS, MALE, INTRO, WH CHN, WH BEL	SEWS006	
1/28/2012	1508	30.63479	-81.08257	F	3790	U	>5	BOD CNT, BEL/BEL, INTRO	SEWS006	

Date	Time (L)	Latitude (Decimal Degrees)	Longitude (Decimal Degrees)	RIWH Letter	RIWH Catalog ID # Intermatch Code Season Code	Sex	Age	Behaviors	Whale Alert Number	Comments
1/28/2012	1607	30.69163	-80.99674	G	UNPH	U	U		-	Updated Position SEWS008
1/28/2012	1616	30.67896	-80.98657	H	3701	U	5	LBTL, TL SLSH	SEWS007	
1/28/2012	1633	30.69396	-81.00724	I	2011CalfOf2790	U	1		SEWS008	
1/28/2012	1633	30.69396	-81.00724	#1	3791	U	5		SEWS008	
1/28/2012	1651	30.65546	-80.99607	J	3460	U	8	BOD CNT	SEWS009	
1/28/2012	1651	30.65546	-80.99607	K	3720	U	5	BOD CNT	SEWS009	
1/28/2012	1717	30.73779	-81.11074	L	4001	M	2	HDLFT	SEWS010	
1/28/2012	1717	30.73779	-81.11074	M	S067	U	U		SEWS010	
1/28/2012	1717	30.73779	-81.11074	N	3810	U	4		SEWS010	
1/31/2012	1105	30.52713	-81.33074	A	3720	U	5	SAG, BEL/BEL, HDLFT	-	Updated Position SEWS011
1/31/2012	1105	30.52713	-81.33074	B	3950	M	3	SAG, HDLFT	-	
1/31/2012	1105	30.52713	-81.33074	C	2011CalfOf2420	U	1	SAG, HDLFT, FLIP, BEL UP, BLK BEL, BLK CHN, FEM	-	
1/31/2012	1105	30.52713	-81.33074	D	S067	U	U	SAG	-	
1/31/2012	1105	30.52713	-81.33074	E	3570	U	7	SAG, HDLFT	-	
1/31/2012	1116	30.52946	-81.32207	F	3790	U	>5		-	Updated Position SEWS011
1/31/2012	1116	30.52946	-81.32207	G	3623	M	6	WH CHN	-	
1/31/2012	1143	30.52979	-81.32807	H	3623	M	6	WH CHN, HDLFT, SAG	SEWS011	
1/31/2012	1143	30.52979	-81.32807	I	3570	U	7	HDLFT, SAG	SEWS011	
1/31/2012	1143	30.52979	-81.32807	J	S067	U	U	SAG	SEWS011	

Date	Time (L)	Latitude (Decimal Degrees)	Longitude (Decimal Degrees)	RIWH Letter	RIWH Catalog ID # Intermatch Code Season Code	Sex	Age	Behaviors	Whale Alert Number	Comments
1/31/2012	1143	30.52979	-81.32807	K	3950	M	3	HDLFT, SAG	SEWS011	
1/31/2012	1143	30.52979	-81.32807	L	3720	U	5	FLIP, HDLFT, SAG	SEWS011	
1/31/2012	1143	30.52979	-81.32807	M	2011CalfOf2420	U	1	FLIP, HDLFT, SAG, BLK CHN, BLK BEL, FEM, BODO	SEWS011	
1/31/2012	1143	30.52979	-81.32807	N	3790	U	>5	FLIP, BEL/BEL, SAG	SEWS011	
2/5/2012	1426	30.16379	-80.89374	A	1812	F	>24	W/CALF, NURS	SEWS012	
2/5/2012	1426	30.16379	-80.89374	B	2012CalfOf1812	U	C	CALF W/MOM, NURS	SEWS012	
3/16/2012	1434	30.25063	-81.01024	A	1208	F	>31	W/CALF, NURS, BOD CNT	SEWS013	
3/16/2012	1434	30.25063	-81.01024	B	2012CalfOf1208	U	C	CALF W/MOM, NURS, BOD CNT, BRCH, CHN BRCH, ROLL, FLIP	SEWS013	
3/17/2012	1123	30.59163	-81.16040	A	1208	F	>31	W/CALF, BEL UP, BOD CNT, WH CHN, WH BEL, AVD, HDLFT, ROLL	SEWS014	
3/17/2012	1123	30.59163	-81.16040	B	2012CalfOf1208	U	C	CALF W/MOM, ROLL, BOD CNT, FLIP, LBTL, BLK CHN, BLK BEL, AVD, BEL UP	SEWS014	

Table 4. Whale-vessel interaction events documented by the SEWS survey team, December 2011-March 2012

Date	WVI ID	Survey Area	Whale ID	Initial Whale LAT	Initial Whale LONG	Vessel #	Vessel Type	Est. Initial Vessel Speed (kts)	Closest Distance (yds)	Initial Whale Behavior	Reaction to Vessel	Comms Achieved	Additional Event Details and Communication Notes
3/17/2012	677	CEWS	Catalog #1208 and calf	30.59163	-81.16040	1	Recreational/ 28ft center console	0	400	Surface Resting/ Rolling at surface	No	No	Vessel was stationary within 500 yards of whales upon arrival (it is unknown if the vessel affected the whales' behavior upon initial approach). Vessel departed quickly to the SW (increased speed rapidly) after the aircraft arrived on scene and observers attempted to establish communication on VHF Ch. 16.
3/17/2012	677	CEWS	Catalog #1208 and calf	30.59163	-81.16040	2	Law Enforcement / 30ft center console	20	50	Surface Resting/ Rolling at surface	Yes	Yes	Vessel passed whales from the SE at a high rate of speed then made a U-turn, approached whales, and stopped approx 400 yards W of the whales. Observers determined the vessel was LE and attempted communication on VHF CH. 16 after the vessel made the U-turn. Vessel remained stationary for 3-5 minutes then began to motor closer to the whales. The whales dove (rolling away from the vessel), surfaced a short distance away, and resumed surface resting behavior. The observers hailed the vessel a second time on Ch. 16 and established communication. Observers advised LE on the direction the whales headed when they dove and the vessel departed the area slowly to the NE. Shortly after LE reported the sighting to FWC.

Appendix 1. Behavior codes

Behavior Code	Behavior Name
AGG VSL	Aggressive Approach
APPR	Approacher to SAG
BEL UP	Belly Up
BEL/BEL	Belly to Belly
BLK BEL	Black Belly
BLK CHN	Black Chin
BOD CNT	Body Contact
BODO	Bottlenose Dolphins
BRCH	Breaching
CALF	Calf Alone
CALF W/ UNPH	Calf With Unphotographed Whale(s)
CALF W/MOM	Calf of a Mom/Calf Pair
CHN BRCH	Chin Breach
CUR	Curious Approach
DEAD ON BEACH	Dead on Beach
DFCN	Defecation
DSENTGL	Disentangled
DSENTGL ATT	Disentanglement Attempt
ENTGL	Entangled
FCL	Focal Animal
FEM	Female
FL	Fluking
FLIP	Flippering/ Flipper Slapping
FLTG DEAD	Floating Dead
FRST DEAD	First Sighting of a Dead Whale
FRST ENTGL	First Entangled
FRST SATTG	First Satellite Tagged
HDLFT	Head Lift
HDPSH	Head Push
INTRO	Intromission
LBTL	Lobtailing
LIN TR	Linear Travel
LIVE STRAND	Live stranded

Behavior Code	Behavior Name
LN GONE	Line Gone
LOG	Logging
MALE	Male
MOPN	Mouth Open
MUD	Mud
NOT FL	Not Fluking
NURS	Probable Nursing
PENIS	Penis observed
POST	Posturing
PRT DSENTGL	Disentangled Partially
RACE	Racing Dive
RAND SUB TRV	Random Subsurface Movement
RETRVD	Carcass Retrieved
ROLL	Rolling
SAG	Surface Active Group
SATTG GONE	Satellite tag Gone
SICK	Sick Whale
SPY	Spyhopping
TL BRCH	Tail Breach
TL SLSH	Tail Slash
UW EXH	Underwater Exhalation
W/CALF	Mom of a Mom/Calf Pair
W/CALF UNPH	Mom with Unphotographed Calf
W/SATTG	Satellite Tagged
W/TELBUOY	Telemetry Buoy
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

Appendix 2. Acronyms and Abbreviations

AFF	Automatic Flight Following
AIS	Automatic Identification System
ALWDN	Atlantic Large Whale Disentanglement Network
BNTM	Broadcast Notices to Mariners (USCG)
C	Calf age class
CEWS	Central Early Warning System (aerial survey)
CFR	Code of Federal Regulations
DMA	Dynamic Management Area
EF, IS, USM	Electro-Focus, Image stabilizer, Ultrasonic motor
ELT	Emergency Locator Transmitter
EPIRB	Emergency Position Indicator Radio Beacon
EWS	Early Warning System
F	Female (sex)
FAA	Federal Aviation Administration
FACSFACJAX	Fleet Area Control and Surveillance Facility Jacksonville (U.S. Navy)
FL	Florida
FTP	File transfer protocol
FWC	Florida Fish and Wildlife Conservation Commission
FWC-LE	Florida Fish and Wildlife Conservation Commission Law Enforcement
FWRI	Fish and Wildlife Research Institute (part of FWC)
GA	Georgia
GDNR	Georgia Department of Natural Resources
GIS	Geographic Information Systems
GPS	Global Positioning System
GTM NERR	Guana Tolomato Matanzas National Estuarine Research Reserve
ID	Identification
IFR	Instrument Flight Rules
IMO	International Maritime Organization
JAXPORT	Port of Jacksonville, FL
LAT	Latitude
LONG	Longitude
M	Male (sex)

MRC	Marine Resources Council
MSRS	Mandatory Ship Reporting System
NARWD	North Atlantic Right Whale Consortium Database
NC	North Carolina
NEA	New England Aquarium
NEFSC	NOAA NMFS, Northeast Fisheries Science Center
NEWS	Northern Early Warning System (aerial survey)
NGA	National Geospatial-Intelligence Agency
NMFS	National Marine Fisheries Service (aka NOAA Fisheries)
NOAA	National Oceanic and Atmospheric Administration
ODMDS	Ocean dredges material disposal site
PC	Personal computer
PCCS	Provincetown Center for Coastal Studies
PIC	Pilot in Command
RIWH	Right Whale
SAG	Surface Active Group
SC	South Carolina
SCGA	South Carolina Northern Georgia (aerial survey)
SEFSC	NOAA NMFS, Southeast Fisheries Science Center
SEUS	Southeast United States
SEWS	Southern Early Warning System (aerial survey)
SIC	Second In Command (pilot)
SLR	Single Lens Reflex
SMA	Seasonal Management Area
SST	Sea surface temperature
U	Unknown (sex or age class)
UNCW	University of North Carolina Wilmington
UNID	Unidentified (whale)
USACE	United States Army Corps of Engineers
USCG	United States Coast Guard
USN	United States Navy
USWTR	Undersea Warfare Training Range
VFR	Visual Flight Rules
VHF	Very High Frequency
WVI	Whale-Vessel Interaction(s)

Appendix 3. Units of measure

ft	feet
hr	hour
km	kilometers
km/hr	Kilometer per hour
knots, kn, kts	knots
m	meter
Mhz	mega hertz
min	minute
mph	miles per hour
NM	nautical miles
s	second
yd	yard

Appendix 4. Definition of terms

Term	Definition
Adult	Any calving female, or whale 9 years of age or older
Aggregation	When animals purposely come together in a defined area during a discrete time period
Associated	When whales coordinate their movement within a body length or two. Association categories applicable to whale sightings in SEUS include: mother-calf pair, surface active group (SAG), pairs or groups not engaged in SAG behavior, and singleton (not associated).
Calf	Whale less than one year of age
Callosity	Raised patches of roughened tissue. Occurs on the top of the head, chin, jaw, lips, above the eyes and behind the blowholes. The callosity pattern is black in color, but appears white due to the presence of cyamids.
Confidence	Measure of certainty of number of whales observed
Cow	Calving female, refers to a calving female from 2012 season for the purposes of this report
Critical Habitat	Specific areas within the geographical area occupied by the species that contain physical or biological features essential to conservation and those features may require special management considerations or protection. Also, specific areas outside the geographical area occupied by the species, if the agency determines that the area itself is essential for conservation.
Cyamids	Small white crustaceans of the order Amphipoda that live exclusively on cetaceans. Cyamids, also known as "whale lice" colonize the callosities of right.
Effort	The total nautical miles (NM) or time flown on trackline (east-west or north-south) while the plane was operating within survey parameters, wings-level, and is sea state three or less on the Beaufort scale. Short transits between tracklines and periods of circling or transiting outside survey parameters were not considered to be “on-effort”.
FAA 14 CFR Part 135 and NOAA Fisheries survey requirements and preferences	In accordance with FAA 14 CFR Part 135 and additional NOAA requirements, the aircraft were equipped with: IFR certification, GPS unit with direct linkage to the tablet PC, Emergency Locator Transmitter (ELT), Automatic Flight Following (AFF) transponder, 2-B:C rating fire extinguishers, primary and secondary VHF radios, marine band radio with linkage to intercom system, DC power for observer tablet PC, back-up GPS with direct linkage to the tablet PC, Automatic Identification System (AIS) receiver, VHF telemetry, satellite phone, and extended over water operations emergency equipment as listed in FAA 14 CFR Part 135.167 including a registered 406 MHz emergency position indicator radio beacon (EPIRB) and an inflatable life raft. Aerial observers were required to wear a Nomex flight suit and an aviation style personal flotation device (PFD) equipped with a safety knife, signaling mirror, high-pitch safety whistle, strobe light, streamer, and a 406 MHz personal EPIRB with built in GPS receiver
Geodetic Distance	The shortest path along the ellipsoid of the earth at sea level between one point and another
Intermatch Code	A code assigned by NEA to a whale that has been matched for more than one sighting but the Catalog number is unknown
Juvenile	Whale 1-8 years of age (except calving females within this range)
Mitigation	A reduction in the extent of exposure to a risk and/or the likelihood or its occurrence

Term	Definition
OTHER Sighting	Sighting report from non-aerial survey team participant in the EWS network (*e.g.* USN, USCG, dredge observers)
Peduncle	Where the fluke (tail) meets the body of the whale
Reliability	Measure of certainty of whale species identification
Rostrum	Curved upper jaw or “snout” of a right whale
Season Code	A temporary code given to a whale within a season when the Catalog number or Intermatch code is unknown to assist in the recognition of individuals in the field .
Sighting	A sighting is defined as any observed whale or group of whales at a given time and location. A sighting may consist of one or many whales. An individual whale may not be counted more than once during a sighting; however, an individual whale may be part of more than one sighting per day and/or more than one sighting throughout the calving season.
Verification	A response or deviation from survey by the survey team to the location of a sighting reported from another source (e.g. USCG, USN, public boater) in order to record, document, and disseminate sighting information. Verification sightings are excluded from effort analyses.
Vessel- Commercial Fishing	Vessel involved in fishing for commercial purposes, can be various sizes. Category includes shrimp vessels and crab vessels. Typically does not transmit AIS data.
Vessel- Cruise Ship	Passenger ship used for pleasure voyages, includes casino boats. Typically transmits AIS data.
Vessel- Government	Vessel involved in government operations. Category includes USACE, USCG, USN, Homeland Security and law enforcement. Typically does not transmit AIS data.
Vessel- Large Merchant	Ship that transports cargo. Category includes car carrier, container ship, tanker, freighter, tug and barge. Typically transmits AIS data.
Vessel - "Large"	Government/military vessels of all sizes, vessels 65 ft (19.8 m) or larger, and any vessel expected to be transmitting AIS data. Information recorded for "large" vessels included: type of vessel, time, location, heading, estimated length, estimated speed, estimated distance from aircraft, and name or hull number if discernible. Recorded within 2 NM (3.7 km) of survey trackline. Information on vessels required to carry an AIS transponder available at: (www.navcen.uscg.gov/?pageName=AISmain.html)
Vessel- Motor Yacht	Vessel with enclosed living area for passengers, often used for socializing or transiting. Many have dinghies or other small vessels onboard. Can be classified as large (>100ft) or small (<100ft). Typically does not transmit AIS data.
Vessel- Personal Watercraft	Any vessel designed to typically carry one or two people. Includes: jet ski, wave runner, kayak, canoe. Typically does not transmit AIS data.
Vessel- Recreational	Vessel without substantial closed spaces, typically center console, often with outboard engines. Includes parasail operators. Typically does not transmit AIS data.
Vessel- Research	Vessel designed and equipped to carry out research at sea, can be various sizes. Typically transmits AIS data.
Vessel- Sailing	Vessel powered by the wind. Can be classified as large (>50ft) or small(<50ft). Includes windsurfers. Typically does not transmit AIS data.

Term	Definition
Vessel - "Small"	Vessel less than 65 ft (19.8 km) in length. Information recorded for "small" vessels included: vessel type, time, location, number of vessels, and side of aircraft (i.e. left, right, both). Exact GPS locations of vessels and heading, length, speed, and name or registration number of small vessels were not obtained unless the vessel was involved in a whale-vessel interaction (WVI). Recorded within 1.5 NM (1.8 km) of survey trackline.
Vessel- Sport-fishing	Larger recreational vessel with multiple towers, outriggers and inboard engines. Includes charter fishing vessels. Typically does not transmit AIS data.
Whale alert	Whale sighting information transmitted from (mainly) aerial survey teams to EWS network participants in near real-time via email and text message. Whale alert includes: distance and bearing to nearest sea buoy, whale alert number (consecutive for each reporting source), date, final sighting time and position, number of whales, number of calves, and heading of whales. Example of whale alert format: Subject: WHALE ALERT 18NM ESE "STJ" (SEWS041) Body: 24JAN2011, 11:57(L), 3015.3N 08059.6W, 1 ADULT, 1 CALF, HDG N
WVI	A situation when the survey team a) observed a vessel within 500 yards (457 m) of a whale or group of whales, b) determined that the heading of a vessel could result in the vessel and whale(s) being approximately 1.0 NM (1.9 km) or less apart, or c) established communication with a vessel to transmit whale sighting location information in an attempt to prevent a collision or mitigate an interaction.
Yearling	One year old whale