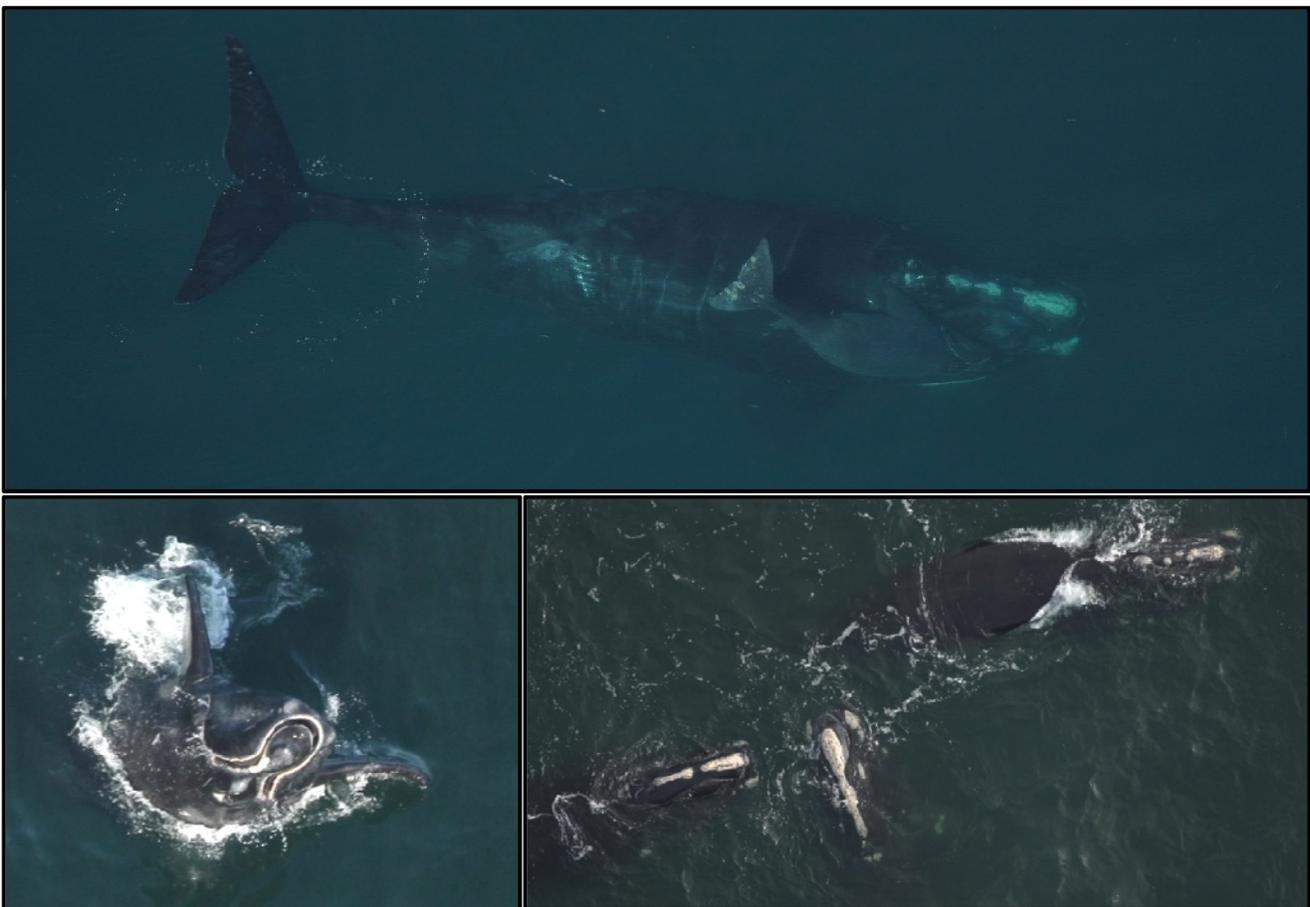


**Aerial Surveys for Ship Strike Mitigation and Other Field Observations of North Atlantic Right Whales (*Eubalaena glacialis*) off the East Coast of Florida
December 2012-March 2013**

Southern Early Warning System

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Submitted August 2013

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FWC/FWRI File Code: F4062-12-I5
P.O. Number: 6WCA90016
Requisition Number: NFFN53001200049

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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.*, 2013). 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 and no mortality or serious injury can be considered insignificant (Waring *et al.*, 2013).

The Southeast U.S. (SEUS) is one of six major habitats identified for North Atlantic right whales (Waring *et al.*, 2013). 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). Movements within and between habitats are extensive and right whales have been documented migrating back and forth between the SEUS and northern habitat within a calving season (Waring *et al.*, 2013). In 1994 (59 FR 28805), the National Oceanic and Atmospheric Administration's National Marine Fisheries Service (NOAA NMFS) designated the coastal waters of Georgia and Florida 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 sighting locations (reported by aerial survey teams) and information on how to avoid collisions with 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, in 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. With the incorporation of the Navy's Fleet Area Control and Surveillance Facility Jacksonville (FACSFACJAX) as the sighting collection and dissemination center for all survey aircraft, whale alerts were processed and transmitted to mariners in near real-time.

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). 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 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 2012-2013 calving season (subsequently referred to as the 2013 season). During the 2013 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 1 December 2012 to 31 March 2013. The SEWS area consisted of the ten southernmost east-west tracklines (lines 25-34) within the overall EWS survey framework (Figure 1). Tracklines were spaced 3.0 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 (56 km) offshore (080°47.0W). A full survey was defined as 100% coverage of the SEWS predefined tracklines. Contingency plan surveys of varying coverage were flown from Sapelo Island, GA (31°26.0N) to Ponte Vedra, FL (29°59.0N)) as needed. These surveys included east-west tracklines 1-30 within the overall EWS survey framework and were implemented to ensure aerial coverage of port entrances when one or more of the EWS teams were unable to survey due to aircraft availability (Table 1). The SEWS team was also prepared to conduct coastal surveys south of the SEWS area and provide aerial support for disentanglement and stranding events as well as biopsy as needed. The SEWS and contingency plan survey configurations were consistent with previous EWS surveys carried out since the winter of 2003.

The survey aircraft was a twin engine Cessna 337 operated and maintained by Orion Aviation under provisions of FAA 14 CFR Part 135, NOAA Fisheries SERO PRD requirements, and consistent with NOAA's Aviation Safety Policy. Aircraft typically departed the airport at 0900(L) and returned before sunset. 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 (Hain *et al.*, 1999). Survey team leaders participated in a 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 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.

FWRI staff fielded whale sighting reports from public citizens, volunteer 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, source, and time lapse) and contacted the reporting source for additional information 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 these sighting reports whenever feasible. OTHER sightings were emailed to EWS participants without delay if the report was near a port or inlet and aerial survey verification was not possible in near real-time. Sightings verified by aerial survey teams were disseminated by the confirming survey team. Duplicate sightings of the same whale(s) were not typically disseminated unless more than an hour had passed from the previous sighting or the whale(s) had traveled more than 1.0 NM (1.9 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.

SEWS survey sighting information (date, time, and location) was entered into the WHALESSOUTH MSRS and NOAA Fisheries’ online EWS sighting database¹. Duplicate whale sightings that were not distributed to EWS participants via email continued to be updated in the MSRS and EWS sighting database. Near real-time sightings remained in the MSRS for 24 hours and could be accessed by vessel captains at any time during that period. Sightings entered into the EWS sighting database were available to the public 24 hours after the initial sighting.

Throughout survey, the FWRI ground contact maintained a near real-time knowledge of the position and maneuvers of the aircraft during survey, disseminated whale sighting information and monitored weather conditions. The ground contact also acted as a liaison between ground crews and the aircraft during special response events (*e.g.*, entanglements and WVI).

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. Times, locations, headings, and altitudes from the aircraft GPS were automatically retrieved and stored in a Microsoft Access database. Environmental data and sighting information was entered into the database by the observers. If the GPS or computer malfunctioned, GPS locations, headings, and altitudes were hand-recorded at intervals of five minutes on hard copy datasheets.

Environmental data recorded during survey included: weather (*e.g.*, clear, overcast, haze, fog, etc.), visibility, percent cloud cover, sea state (Beaufort scale), sun penetration, 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.

Large vessel information was recorded using an onboard AIS receiver (model AMEC CYPHO 101) and Siitech Web VTS Mate software. During survey, observers used the Siitech software AIS viewer installed on the tablet PC to verify transmission of AIS data from vessels. 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

¹ http://sero.nmfs.noaa.gov/protected_resources/right_whale/seus_sightings/index.html

the survey database. These large vessels were entered 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 (2.8 km) of the trackline were also recorded. Number and type of vessels, 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 was recorded for large vessels only. Exact GPS locations of vessels were not obtained unless the vessel was involved in a whale-vessel interaction (WVI). Commercial fishing gear (*e.g.*, crab buoys) was documented as well.

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 (1.9 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: 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 by the observers. Sighting verifications, such as these, were not included in the sightings per unit effort (SPUE) analyses because the detection 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 100-400 mm telephoto zoom 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 whale-vessel interactions (WVI) and other critical events.

A set of Microsoft Access queries and macros were used to scan the survey data for errors and compliance with the guidelines set by the North Atlantic Right Whale Consortium (NARWC) sightings database manager and NOAA Fisheries. The aircraft flew at a target speed of 100 knots (185 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 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 NARWC. 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), as well as scars. 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 the online North Atlantic Right Whale Catalog of identified right whales (<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 SEUS images and preliminary whale identifications. Information and photographs contributed to the website by aerial survey teams, NEA, and volunteer networks have enhanced communication and improved the ability of survey teams to make more preliminary whale identifications (especially of juvenile whales not yet cataloged).

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 curators of the NARWC 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. Sighting distance is recorded to estimate probability detection functions.

Sightings per unit Effort

Sightings per unit effort (SPUE) is a basic method of estimating whale density that takes into account differences in effort between survey areas or calving seasons; the observed number of whales is corrected by the amount of survey effort in order to make comparisons. Distance sampling methods were used to determine effective search widths as a function of sea state conditions. Effective search widths were then used to buffer each segment of the survey tracklines and the resulting area surveyed was calculated for each segment. Estimates of the area surveyed were adjusted by removing a blind spot below the plane, which was previously determined to be 186 meters on each side of the plane for surveys flown at 1000 feet. The area surveyed was added up using a grid of 3 x 3 NM cells oriented along the east-west tracklines. The same sampling grid was used to calculate SPUE as the number of whale sightings divided by the area surveyed per cell.

Whale-Vessel Interaction (WVI) Documentation

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 43 out of an available 121 days between 1 December 2012 and 31 March 2013 for a total of 196.3 hours (Table 2). Effort varied both spatially and temporally, but the SEWS team flew at least a portion of the SEWS survey area 35% of the available days (Figure 3). Twenty-four full SEWS surveys (272 NM/504 km each), thirteen partial SEWS surveys (average 211 NM/391 km), and six contingency surveys (299-436 NM/554-807 km) were completed for a total of 12,084 NM (22,380 km) of on-effort trackline flown (Figure 4). The SEWS team conducted nine surveys in December, 12 in January, 10 in February, and 12 in March (Figure 5). Contingency surveys were flown during December and mid-February (Figure 6); five contingency surveys were also partial SEWS surveys. One north-south coastal survey south of the SEWS area was conducted in order to document an injured calf. Ninety-six percent of survey effort was completed during favorable sea state conditions of three or less on the Beaufort scale (Figure 7). The majority of partial SEWS surveys resulted from poor weather conditions and associated daylight constraints; however, partial surveys also resulted from military operations and airspace conflicts. The SEWS aircraft was unavailable for survey for nine days in December due to mechanical repairs and pilot availability.

Right Whale Sightings

The SEWS survey team documented 25 sightings totaling 49 right whales (Table 3), but this total does not correspond to unique individuals as some whales were resighted throughout the season (see Photo Analysis section below). The first right whale sighting occurred on 4 December 2012 and the last was on 22 February 2013. Of the 25 sightings, 17 were cow-calf pairs, three were single adults or juveniles, three were pairs, and two were groups of three whales. All sightings were within approximately 15 NM (28 km) off the shore (Figure 8). Sightings were intermittent and occurred only during December, January and February (Figure 9). There were five sightings of 10 whales in December, 15 sightings of 30 whales in January, five sightings of nine whales in February, and zero sightings in March (Figure 10). The most sightings and whales per unit nautical mile of effort occurred during the week of 29 December 2012 and 4 January 2013 (Figure 11). Whale sightings per unit effort (SPUE) were calculated for the SEWS area (Figure 12).

Whale Alert Dissemination

The FWRI ground contact sent out 25 SEWS whale alerts to EWS network participants.

Photo Analysis

Preliminary photo analysis indicates the SEWS team documented 20 individual adult and juvenile right whales (*i.e.*, excluding calves) including 11 of the 19 females observed with calves in the SEUS. Five of these whales, including four females with calves, were sighted in the CEWS area during contingency surveys. Seven whales, including a female with a calf, were unique to the SEWS area (*i.e.*, were not seen in other survey areas this calving season). As many as seven individual adult and juvenile whales, including three females with calves, were sighted during a single survey. The age and sex class of individual whales identified was: 55% ($n=11$) females with calves, 5% ($n=1$) adult females (non-calving in 2013), 30% ($n=6$) juveniles and 10% ($n=2$) individuals of unknown age not known to be at least nine years-old (Figure 13). No adult males were documented by the SEWS team. Behaviors documented during whale sightings are detailed in Table 3 and Appendix 1.

Sighting Distance

Of the 25 SEWS sightings, 14 (56%) were used for sighting distance calculations. The average sighting distance from the survey plane break-track position was 1.2 NM (2.2 km) (range 0.1-3.2 NM/0.2-5.9 km) (Figure 14). Most sightings ($n=9$) occurred between 0.4 NM (0.7 km) and 1.2 NM (2.2 km) from the plane. The average perpendicular distance was 1.1 NM (2.2 km) (range 0.1-3.2 NM/0.2-5.9 km) (Figure 15).

Vessel Sightings

A total of 1071 sightings of vessels were recorded by the SEWS team. 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 1071 vessel sightings recorded include: 440 recreational, 331 commercial fishing, 132 sailing, 82 government, 43 motor yacht, 29 sport-fishing, nine personal watercraft, two research, two large merchant and one pilot boat (definitions are included in Appendix 4). The vast majority (91%; $n=301$) of commercial fishing vessel sightings recorded were shrimping vessels. Merchant vessels and pilot boats have been removed from analyses in this report, because these vessels were only marked when not visible in AIS or as needed for WVI. The number of vessel sightings recorded decreased from December through February and then increased in March (Figures 16). Most notable were: (1) an increase in recreational vessel sightings recorded in March; (2) a decrease in commercial fishing vessels from December through March; (3) a higher number of government vessel sightings in December and February; and (4) an increase in sailing vessel sightings in January and March (Figure 17). Vessels were distributed throughout the survey area with a high number of sightings concentrated within approximately 5.0 NM (9.3 km) of the shore and extending farther offshore near St. Augustine Inlet (Figure 18).

Whale-Vessel Interaction (WVI) Documentation

During the 2013 season, the SEWS team documented six WVI with four groups of whales (Figure 19, Table 4). Three interactions involved a cow-calf pair near the Jacksonville shipping lane and occurred in the CEWS area during contingency survey. One pilot boat, one military vessel, one USCG cutter, two commercial fishing and one small motor yacht were involved in WVIs. The groups of whales involved consisted of three cow-calf pairs (milling or traveling) and a SAG of three whales. A behavioral reaction to the presence of the vessel was observed during two interactions with cow-calf pairs and involved longer dive intervals and an obvious change in direction of travel. Three vessels were observed within 500 yd (457 m) of the whale(s) and the closest observed distance between whale(s) and vessel was 250 yd (229 m). VHF radio communication was established with all vessels, but was subsequently lost during one interaction before information about the whale could be passed directly to the captain. Vessel captains responded positively when communication was established, including changes in vessel course and/or speed to avoid the location of the whale(s).

Other Marine Species

During the 2013 season, the SEWS team documented nine humpback whale (*Megaptera novaeangliae*) sightings consisting of 11 whales. These sightings occurred between 4 February 2013 and 5 March 2013, from Little Talbot Island, FL to Butler Beach, FL between 0.3 NM and 2.8 NM (0.6 km and 5.2 km) offshore (Figure 20). Photographs of the dorsal fin and body scars were used to individualize sightings of whales. Five individual whales were identified by the SEWS team; two of these whales were seen three and five times, respectively. 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.

During the 2013 season, the SEWS team recorded 399 sightings of leatherback turtles (*Dermochelys coriacea*). Approximately 40% ($n=160$) of these sightings were during January. Leatherback turtles were recorded throughout the area surveyed, but the majority of sightings (97%, $n=389$) occurred greater than 5.0 NM (9.3 km) offshore (Figure 21). Sighting data were distributed to NOAA Fisheries and sea turtle biologists with FWRI and GDNR.

The SEWS team documented 19 large shark sightings during the 2013 season. These sightings consisted of 14 white sharks (*Carcharodon carcharias*), one shortfin makos (*Isurus oxyrinchus*), two great hammerheads (*Sphyrna mokarran*), and two unidentified large sharks. All sharks were observed free-swimming (*i.e.*, not associated with an animal carcass). Sightings occurred from Mayport, FL to St. Augustine Beach, FL approximately 0.3 NM (0.6 km) to 29 NM (54 km) offshore (Figure 22). There was one sighting in December, nine during January, four during February, and five during March. Photographs and sighting data were distributed to NOAA Fisheries and shark biologists with FWRI, GDNR, University of North Florida, and the Massachusetts Division of Marine Fisheries.

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 right whale 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 (S2S). During the 2013 season, biopsy teams collected samples from 17 calves and several juvenile and adult whales.

Injured Whale Observations

2013 Calf of Catalog #1612

The 2013 Calf of Catalog #1612 was sighted on 29 January 2013 by the SEWS team off Mayport, FL with a series (minimum twelve) of roughly equidistant wounds paired with a long linear wound (Figure 23). The wounds were located across a portion of the calf's dorsum and are consistent with vessel injuries observed on Florida manatees (*Trichechus manatus latirostris*) (Wright *et al.*, 1995, Rommel *et. al.*, 2007). The calf was last sighted without these wounds on 21 January 2013. On 6 February 2013 the SEWS team responded to a report from the volunteer sighting network of the pair off Ormond Beach, FL in order to further document the recently acquired injury and observe the pair. The calf was active and its behaviors, including nursing, appeared normal during the sighting. The pair was last sighted on 24 February 2013 by the SCGA team off Tybee Island, GA (M. White, *pers.comm.*, April 2013).

Stranding Responses

Right Whale Strandings

No right whale carcasses were detected by the SEWS team; however, the carcass of Catalog #4193 (EgNEFL1235) was discovered south of the EWS survey area on 18 December 2012.

Dolphin Strandings

A bottlenose dolphin (*Tursiops truncatus*) carcass was sighted by the SEWS team on 24 February 2013 approximately 12 NM (22 km) off Ponte Vedra, FL. Photographs and sighting information were passed to NOAA Fisheries and the local Marine Mammal Stranding Network representatives.

DISCUSSION and RECOMMENDATIONS

Since 2004, the SEWS team has conducted an average of 64 surveys per season (SD 13.8, range 43-79); this average is approximately 50% of the available survey days in the calving season. From 2009-2013 the average number of surveys per season has been significantly fewer than during 2004-2008 and the total number of surveys per season has been more variable during 2009-2013 than during 2004-2008 (2004-2008 average 76 surveys per season, SD 3.5, range 70-79; 2009-2013 average 52 surveys per season, SD 7.4, range 43-60). These differences can be principally attributed to variable weather conditions that affect sea state and our efforts since 2009 to conduct surveys in a sea state of three or less on the Beaufort scale.

During the 2013 season, the total number of adult and juvenile whales (*i.e.*, excluding calves) identified in the SEUS decreased to 41 individuals. This is the lowest number of individuals documented in the SEUS since at least the 2004 season. There were substantially fewer sightings of juvenile whales and also fewer sightings of non-calving adult females and adult males; almost half of the 41 whales identified in the SEUS were females with calves² ($n=19$) (Figure 13).

On 1 January 2013, the SEWS team sighted Catalog #3320, a reproductive female of unknown age, with two juvenile whales. She was not subsequently sighted with a calf in the SEUS. According to Browning *et al.* (2010), reproductive females usually migrate to the calving area only to give birth and reproductive females sighted in the SEUS without a calf can be presumed to have experienced perinatal loss. Catalog #3320 gave birth during the 2009 season and was therefore available to calve in 2013, so this sighting represents a potential case of perinatal mortality.

The SEWS team sighted Catalog #1334, an adult female of unknown age, with a calf on 21 February 2013. This was the only observation of the pair during the 2013 season. Catalog #1334 has given birth to at least nine calves which makes her the most productive female known in the population and she is almost exclusively sighted during her calving years in the SEUS, suggesting she uses northern habitats that are not well surveyed by researchers (Hamilton, 2013). Given her sighting history, this SEWS sighting is likely to be the only documentation of the 2013 calf of #1334.

Fewer crabbing vessel sightings ($n=14$) were observed in the SEWS area this season than during the 2012 season ($n=216$). In 2012 an unanticipated increase in crabbing, including fixed gear and vessel transits, occurred in the coastal waters off Florida where whales are typically sighted; however, this increase also coincided with a decrease in whale sightings (Jackson *et al.*, 2012). The increased crabbing observed in 2012 did not continue into the 2013 calving season, but it could conceivably occur again when right whales are more active in the SEWS area and should continue to be monitored.

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 in the SEUS. Moreover, the consistent and comprehensive data gathered during these surveys can be used to assess protective measures, make informed management decisions, and identify emerging issues and future cumulative impacts to right whales in the calving area. Continued evaluation of SEUS aerial survey design and methods is needed so that field teams are better prepared for contingencies and can systematically respond to seasonal changes in environmental conditions and whale distribution, as well as mitigate for extended periods of in-season inclement weather conditions that are not suitable for survey.

² A 20th cow-calf pair sighted in Cape Cod Bay on 12 January 2013 (Asmutis-Silva, 2013) was not sighted in the SEUS during the 2013 calving season.

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ACKNOWLEDGEMENTS

NOAA Fisheries Service and the Florida Fish and Wildlife Conservation Commission provided funding and support for this research. Surveys were conducted under Permit #15488 issued to the Georgia Department of Natural Resources by the National Oceanic and Atmospheric Administration - National Marine Fisheries Service.

Andrea Krzystan, FWRI, provided GIS support and created the maps included in this report. Data were collected by the FWRI survey team members: Amy Etherington, Marjorie Foster, Kelsey Howe, Orla O'Brien, Kate Pagan, Emily Walker and Amy Willoughby (team members Jen Jakush, Katie Jackson, and Tom Pitchford authored this report).

Thank you to Georgia Department of Natural Resources, Marineland Right Whale Project, Marine Resources Council, New England Aquarium, NOAA Fisheries Service, Sea to Shore Alliance, USACE Jacksonville district and dredge observers, USCG Sector Jacksonville, USN FACSFAC Jacksonville, and many more EWS Network participants for their collaboration.

Special thank you to the following for their support and partnership during the calving season:

NOAA Fisheries – Barb Zoodsma, Jamison Smith, David Morin, Blair Mase, Liz Stratton

NOAA Corps – LTJG Zachary Cress

Orion Aviation – Ed Coffman, Jason Clay (SIC), Graham Hill (PIC), David Huddle (PIC), Stan Huddle (PIC), Ryan MacGregor (PIC), Joe Molina (SIC), Bob Stickle (PIC); Orion Aircraft used during 2013 season: N1314S and N337CH

Sea to Shore Alliance survey team leaders, Tricia Naessig and Melanie White; project coordinator, Cyndi Taylor; and the rest of the Sea to Shore Alliance survey team members

GDNR – Clay George, Nicole Brandt, and Mark Dodd

GTM NERR

NEA – Philip Hamilton, Amy Knowlton and Monica Zani

MRC – Julie Albert

Marineland Right Whale Project – Jim Hain and Joy Hamp

FWC and NOAA Law Enforcement

FWC – Doug Adams

PCCS – Scott Landry, Jooke Robbins and Laura Ganley

Southeast U.S. Marine Mammal Stranding Network

St. Johns County Habitat Conservation and Beach Management Staff

UNCW – Bill McLellan, Ann Pabst, Alex Costidis and the USWTR aerial survey team members

WHOI – Michael Moore

FWRI – Leslie Ward, Tim Gowan, Nadia Gordon, Rachel Cimino, Christine Mathis and Andrea Mosier

Cover photographs: Catalog #2753 and calf taken by Amy Willoughby on 4 December 2012 (top), 2013 calf of Catalog #2413 taken by Kate Pagan on 15 January 2013 (bottom left), Catalog #3320, #3611, and the 2010CalfOf1145 taken by Jennifer Jakush 1 January 2013 (bottom right). All photographs taken by FWRI staff under NOAA Fisheries permit #15488.

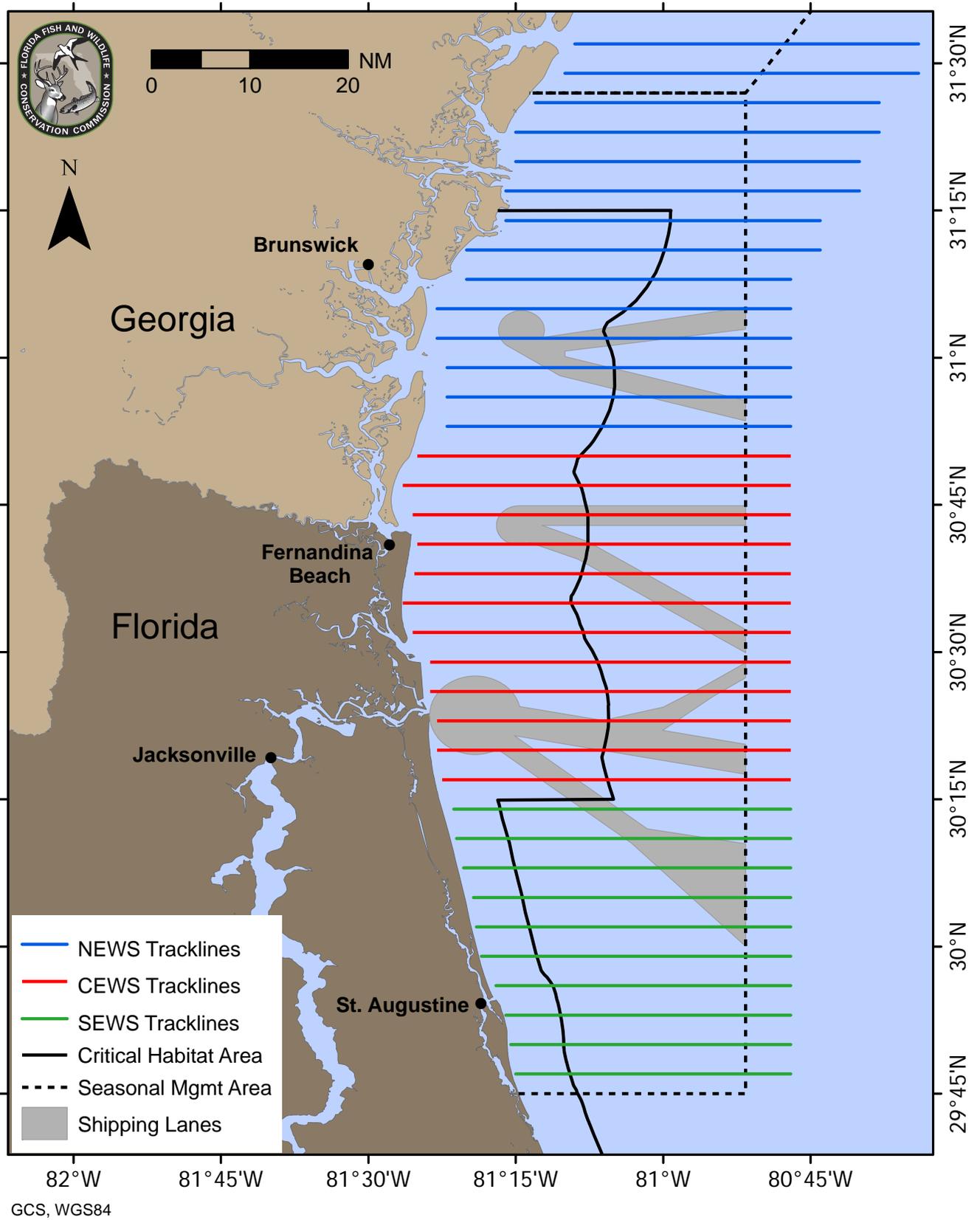


Figure 1. Early warning system (EWS) survey tracklines

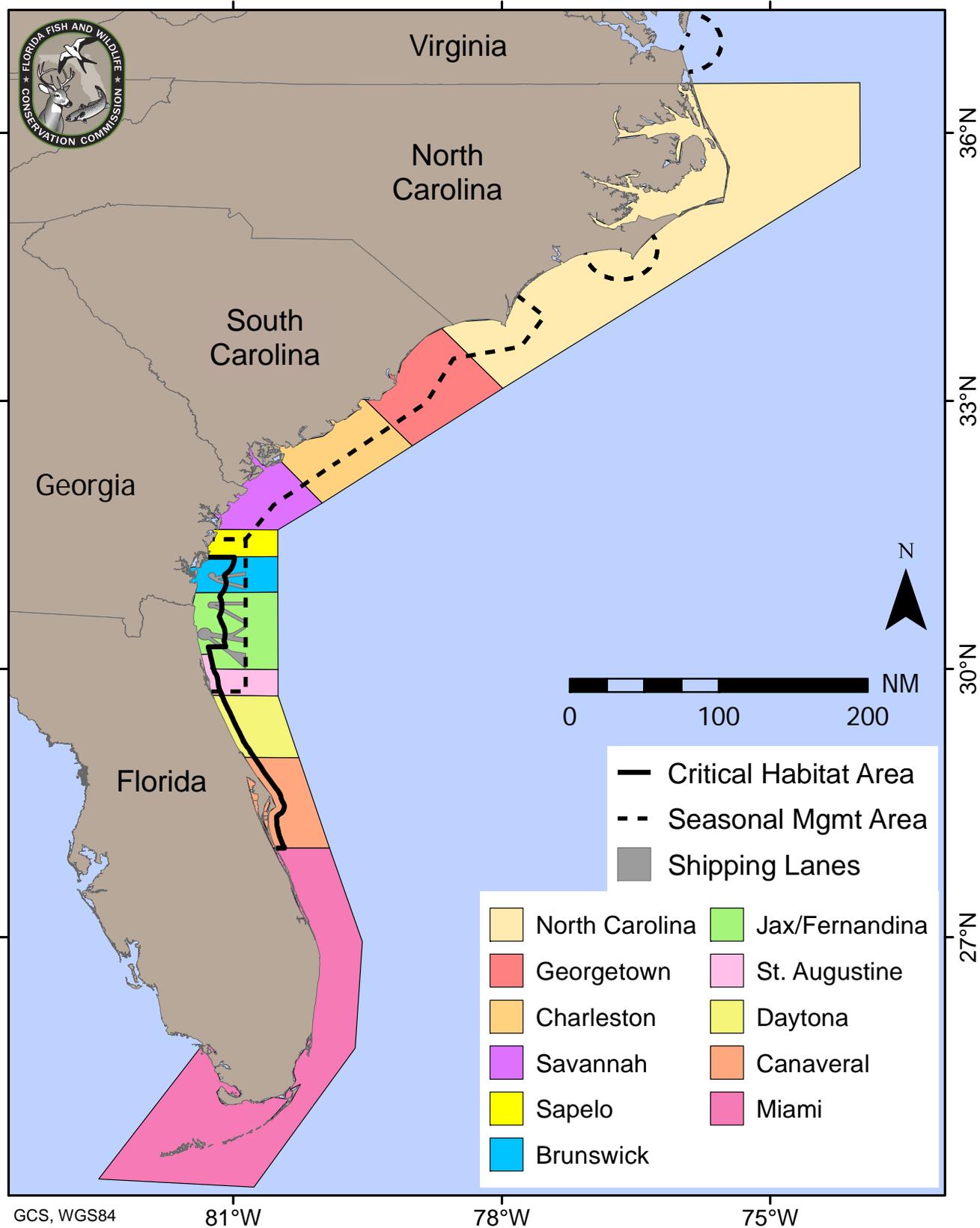


Figure 2. Early warning system (EWS) whale alert geographic “bins”

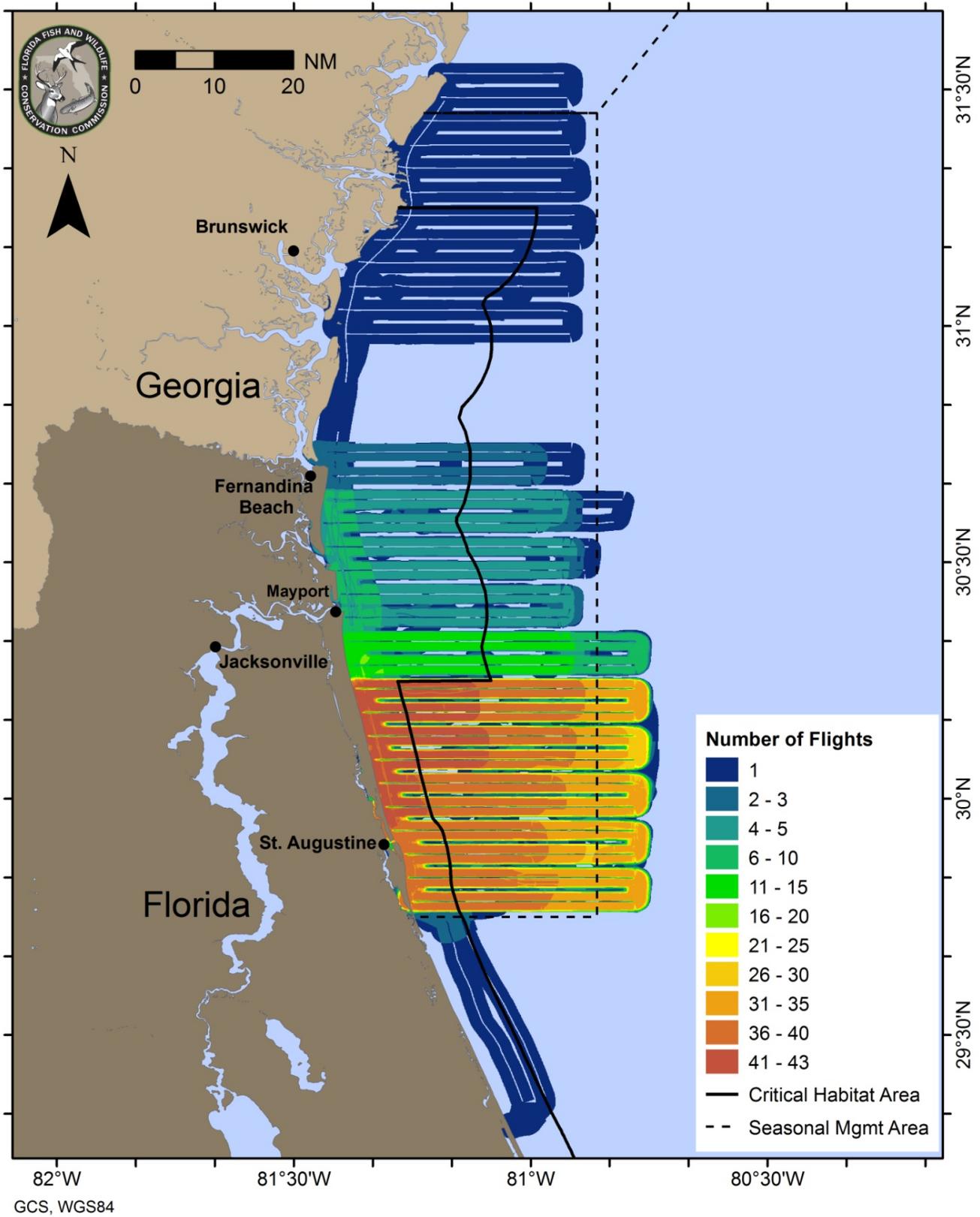


Figure 3. Total on- and off-effort survey conducted by the SEWS team December 2012 through March 2013

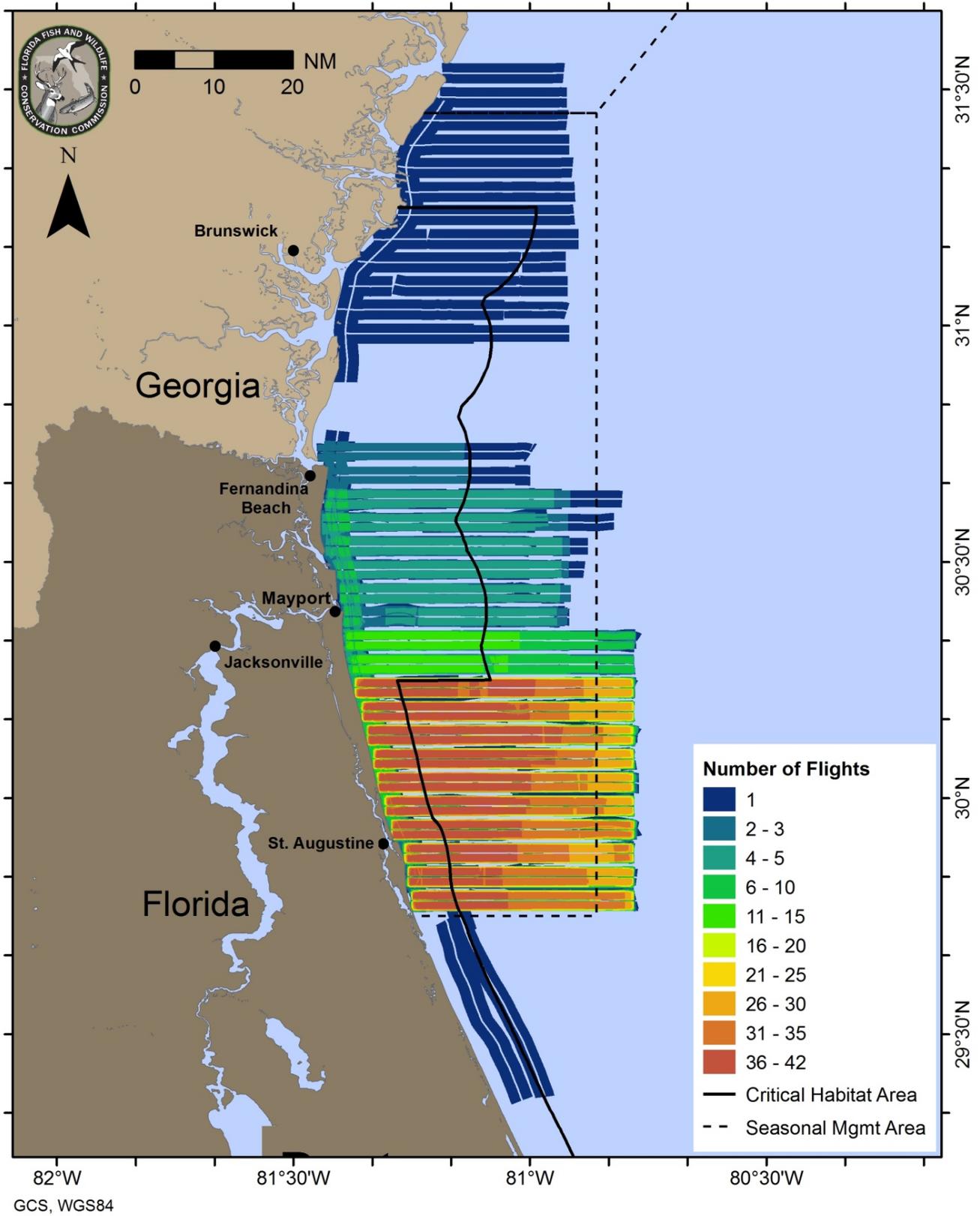


Figure 4. Total on-effort survey conducted by the SEWS team December 2012 through March 2013

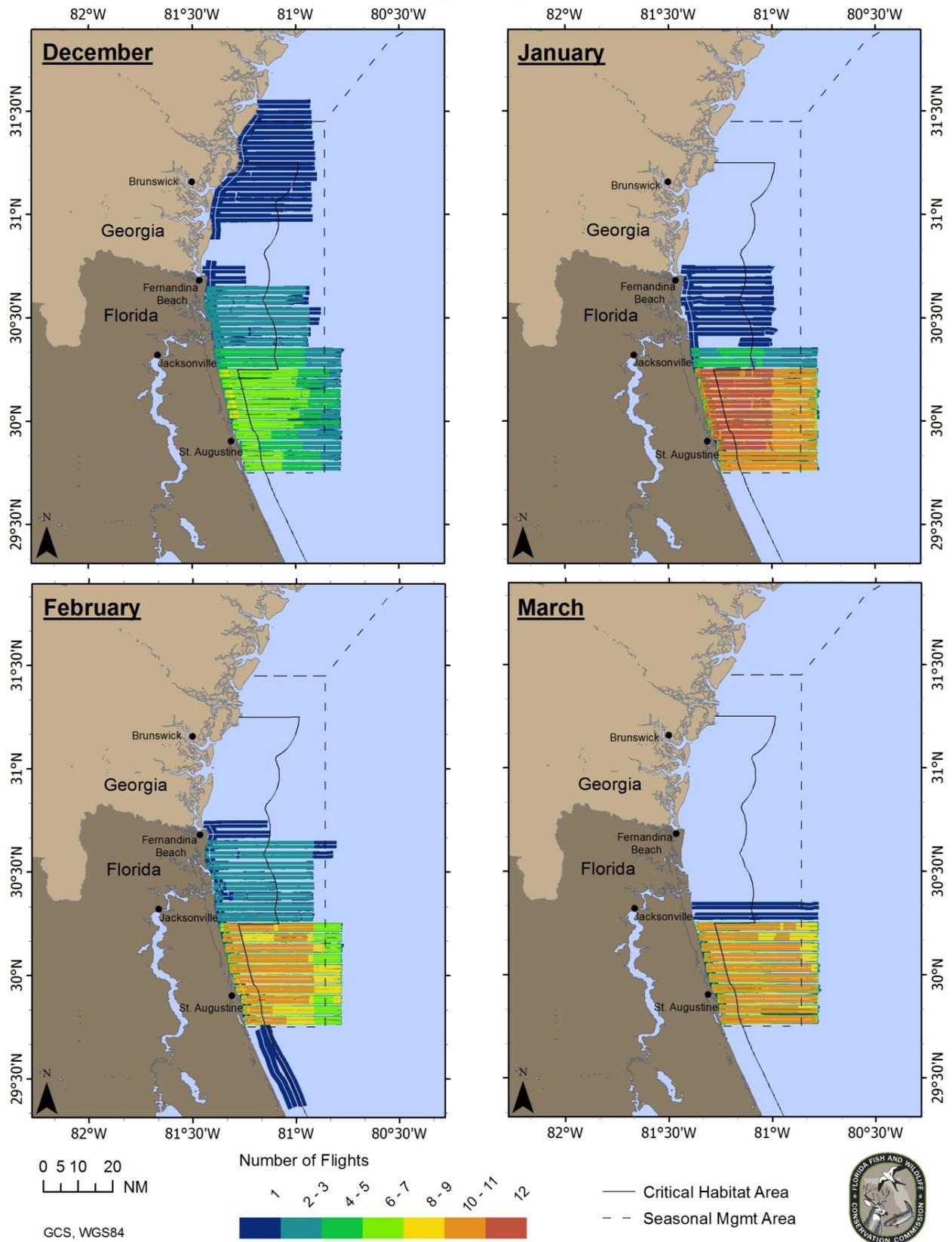


Figure 5. Monthly on-effort survey conducted by the SEWS team December 2012 through March 2013

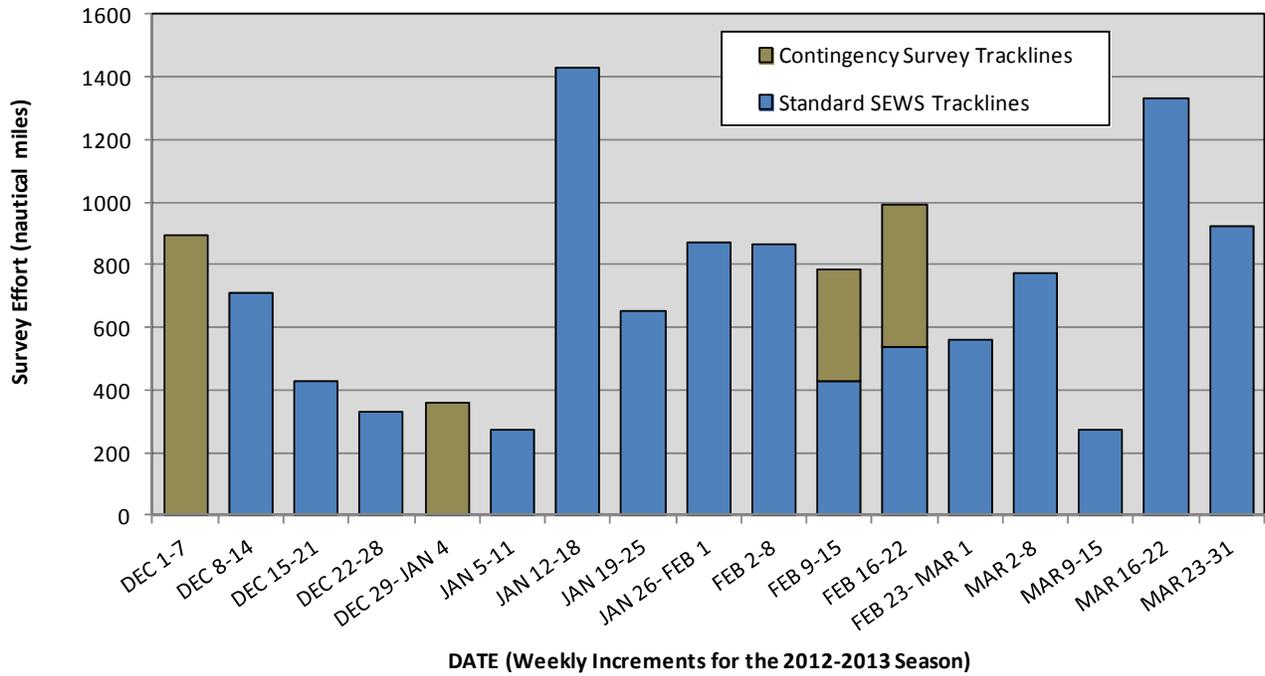


Figure 6. Weekly survey effort conducted by the SEWS team December 2012 through March 2013

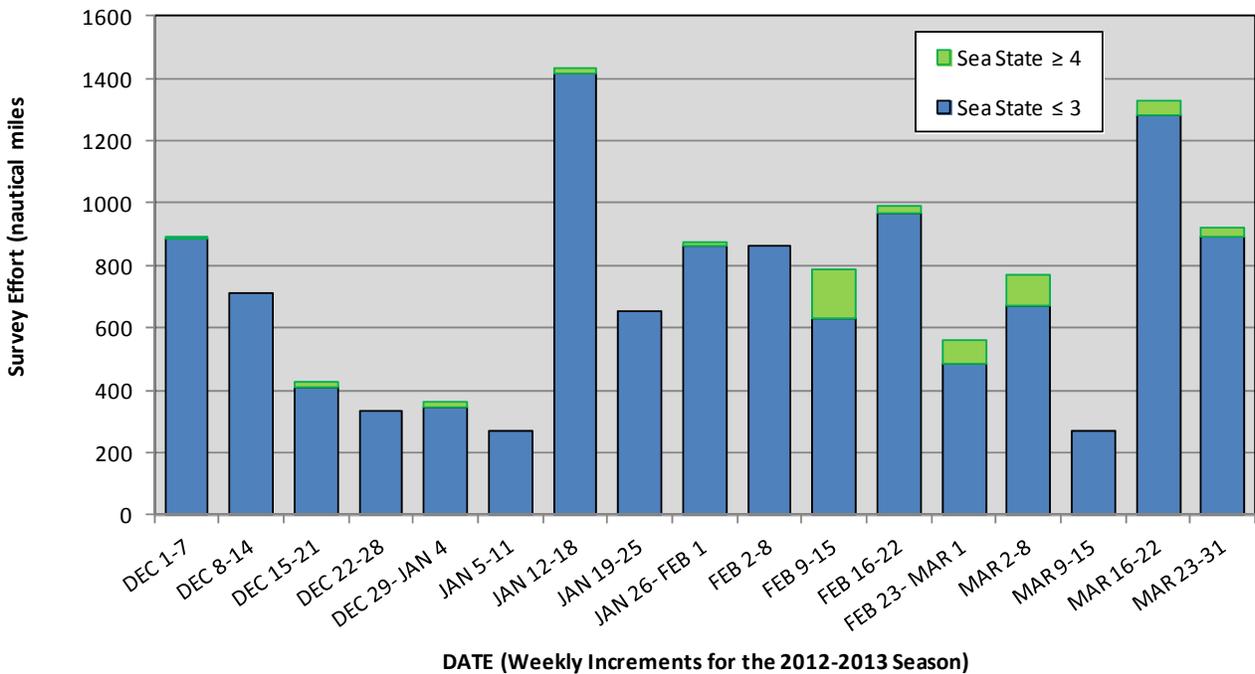


Figure 7. Weekly survey effort conducted by the SEWS team above and below sea state three December 2012 through March 2013

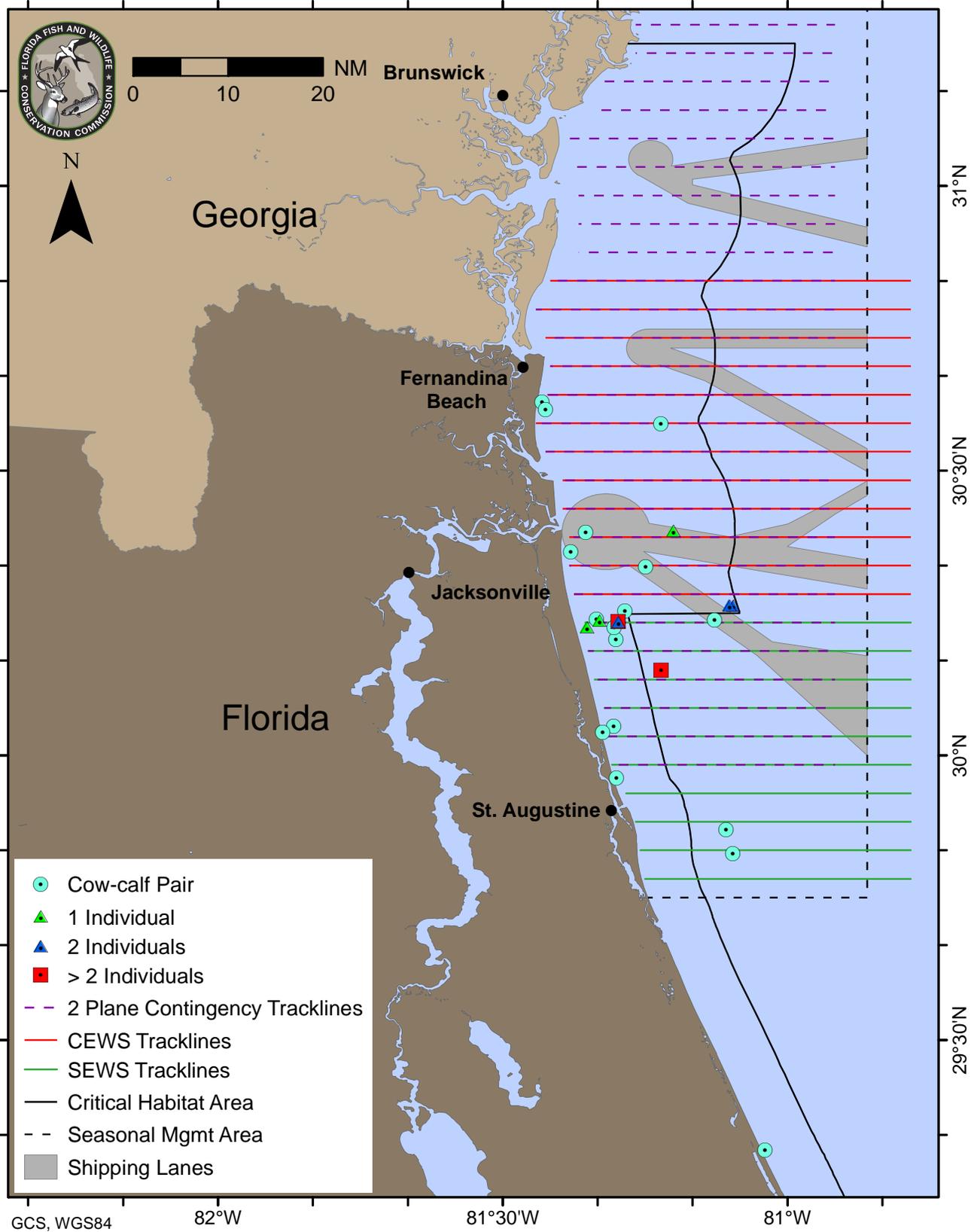


Figure 8. Right whale sightings by the SEWS team
December 2012 through March 2013

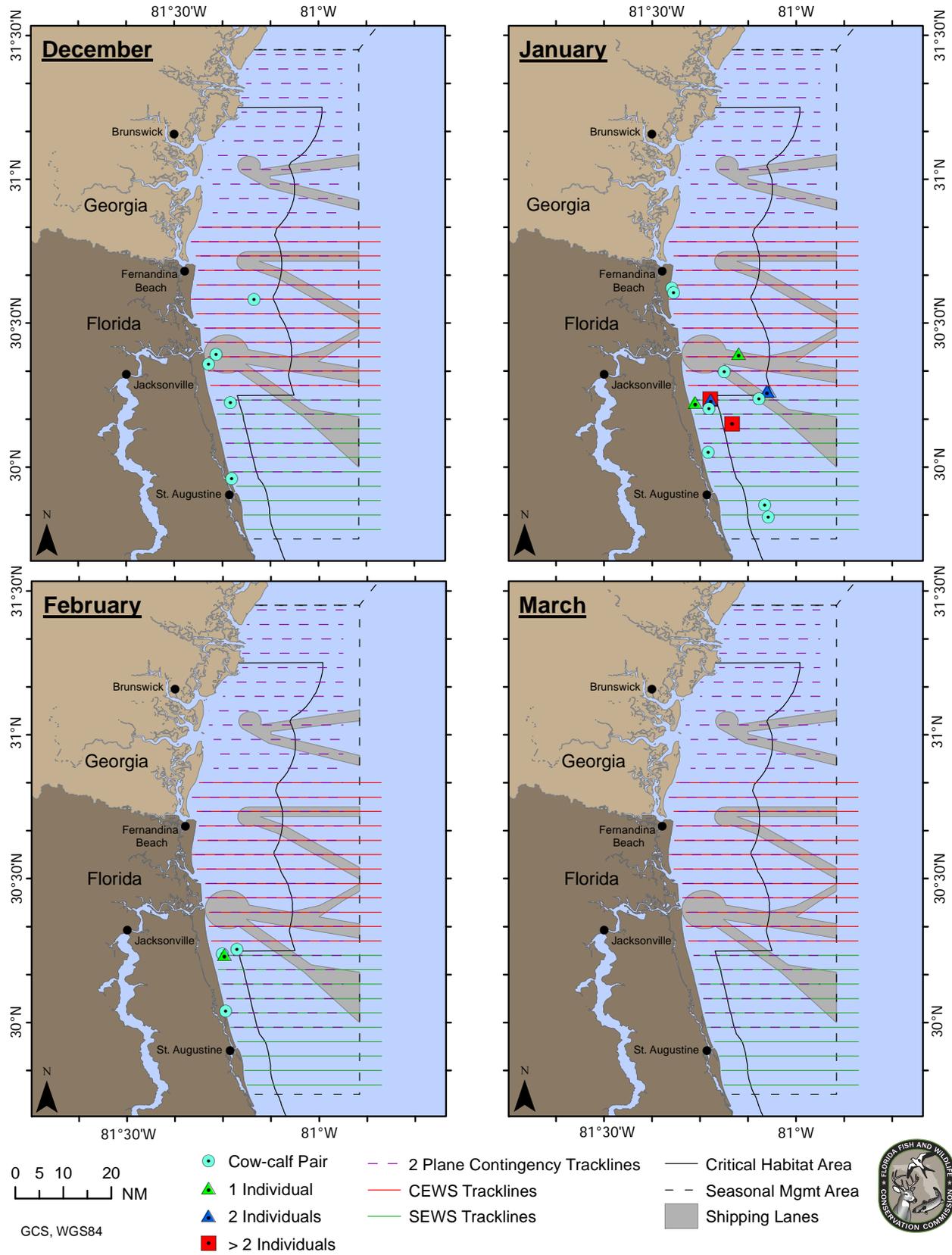


Figure 9. Monthly right whale sightings by the SEWS team December 2012 through March 2013

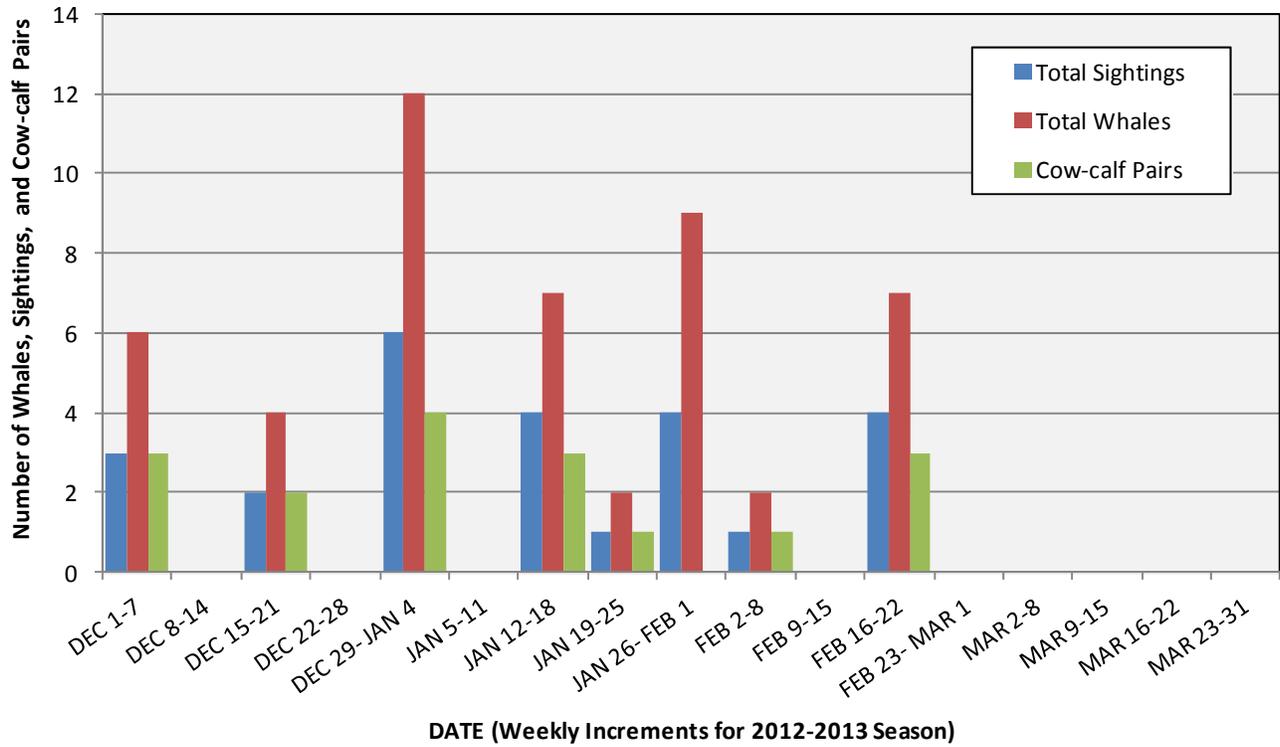


Figure 10. Weekly right whale sightings, right whales and cow-calf pairs by the SEWS team December 2012 through March 2013

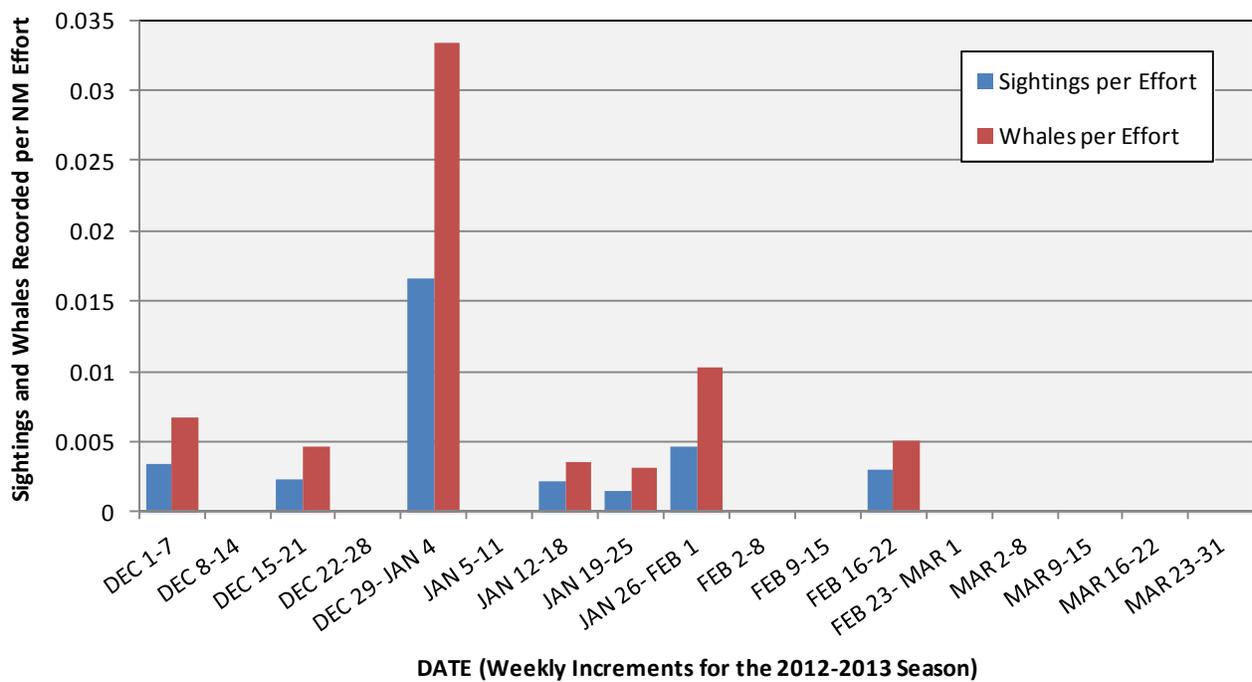


Figure 11. Weekly right whale sightings and whales per NM of on-effort trackline flow by the SEWS team December 2012 through March 2013

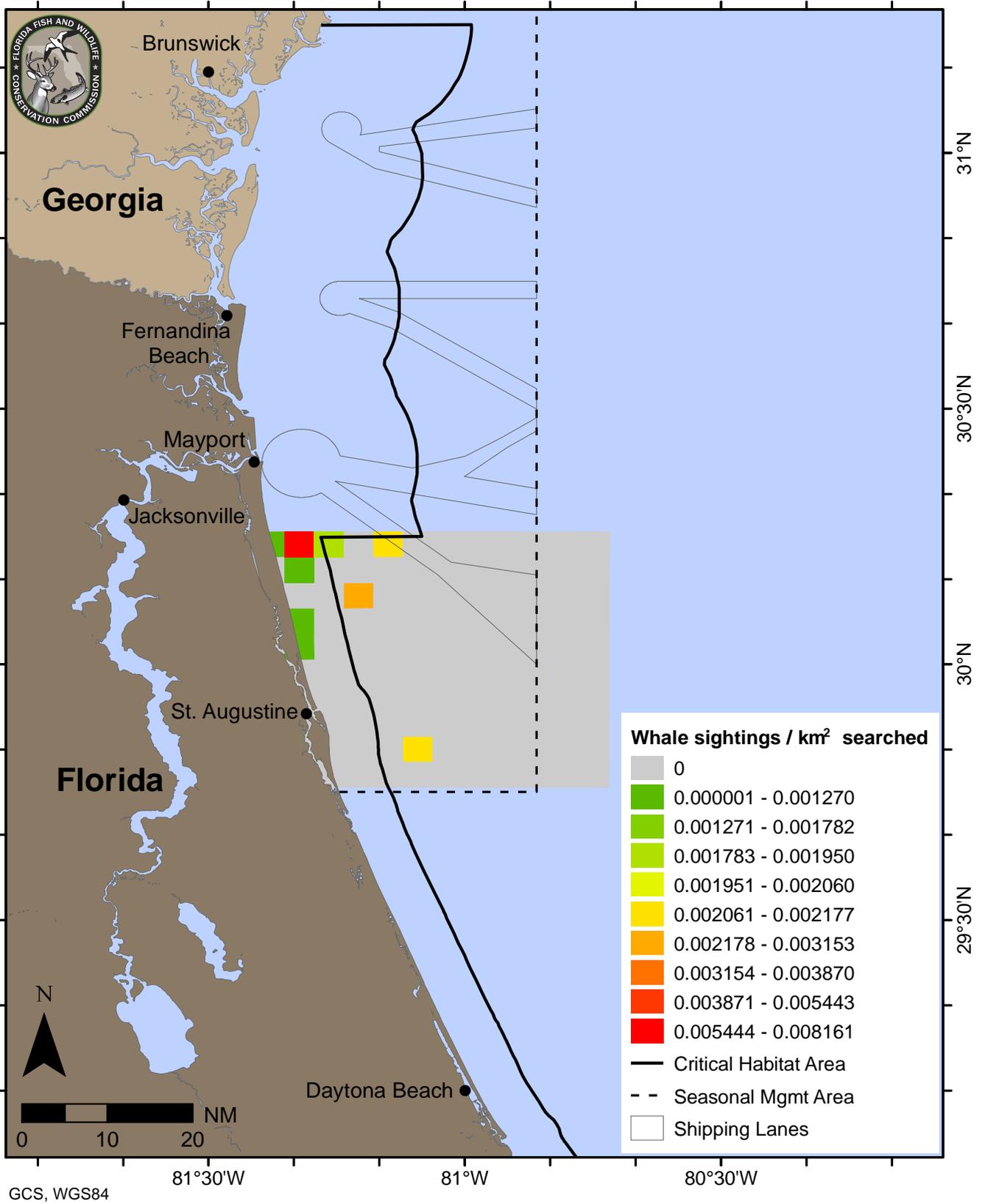


Figure 12. On-effort sightings per unit effort (SPUE) in the SEWS area December 2012-March 2013. SPUE is displayed as the number of whales sighted per km² of area surveyed in 3 x 3 NM grid cells.

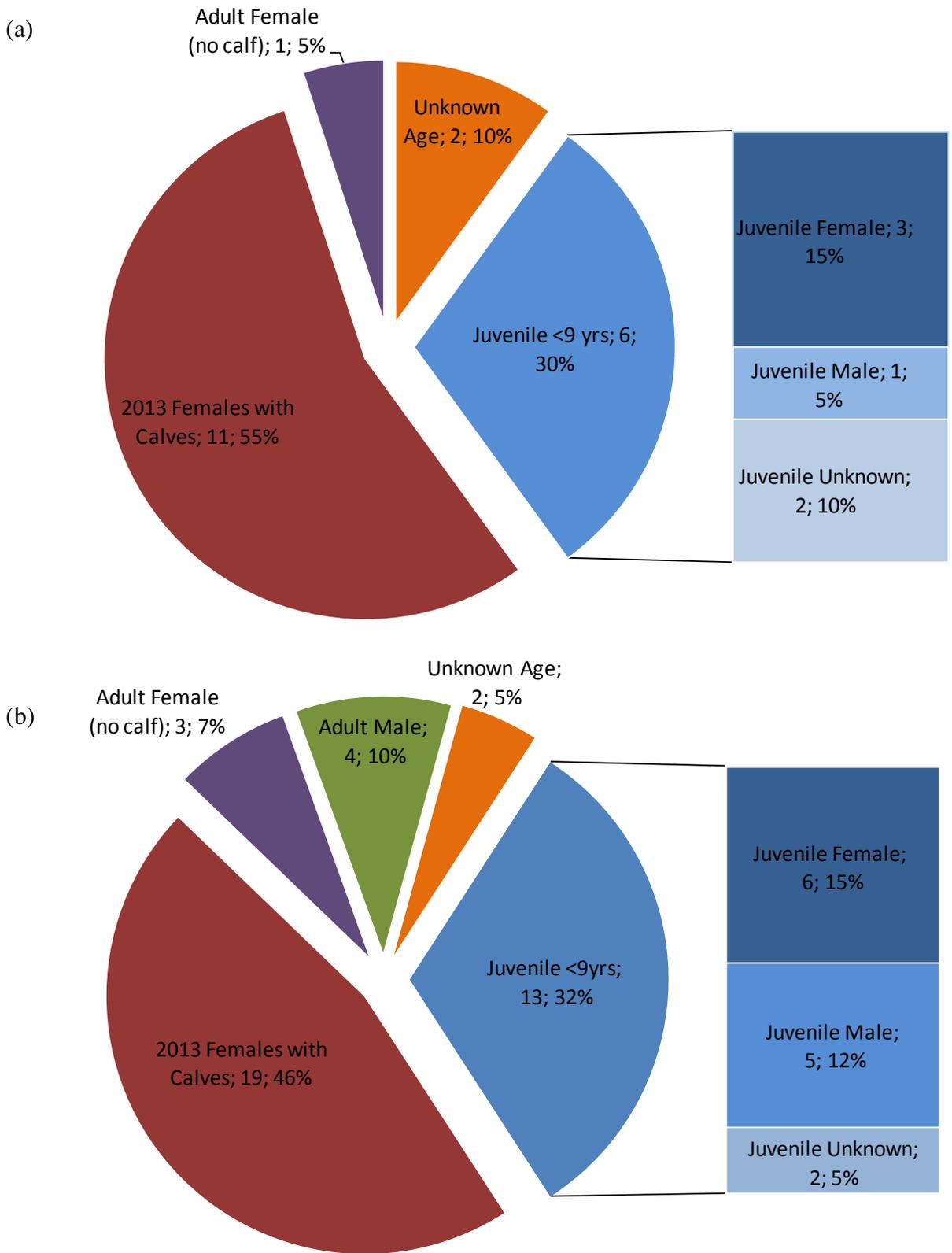


Figure 13. Age and sex class of individual whales

(a) Total individual whales ($n=20$) sighted by the SEWS team, December 2012-March 2013

(b) Total individual whales ($n=41$) sighted in the SEUS from December 2012 through March 2013 provided for reference

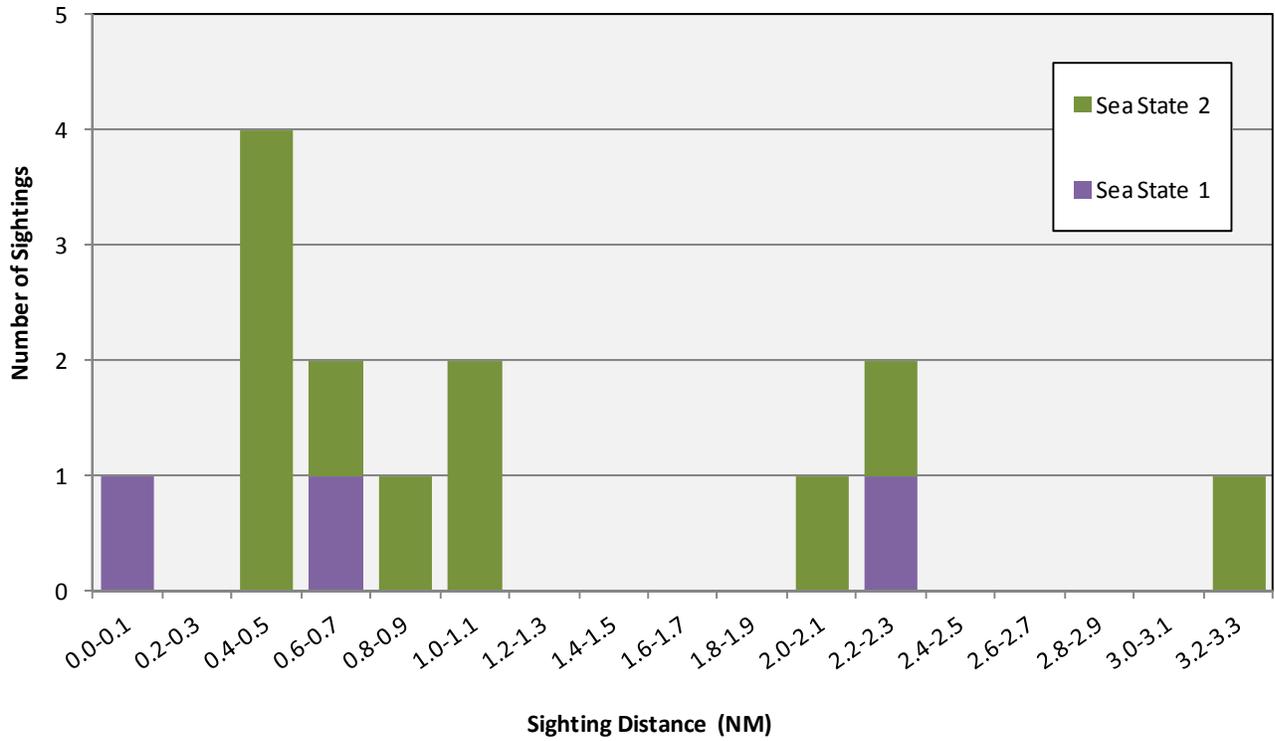


Figure 14. Sighting distance for on-effort right whale sightings by the SEWS team
Sightings from December 2012 through March 2013 displayed by sea state (Beaufort scale)

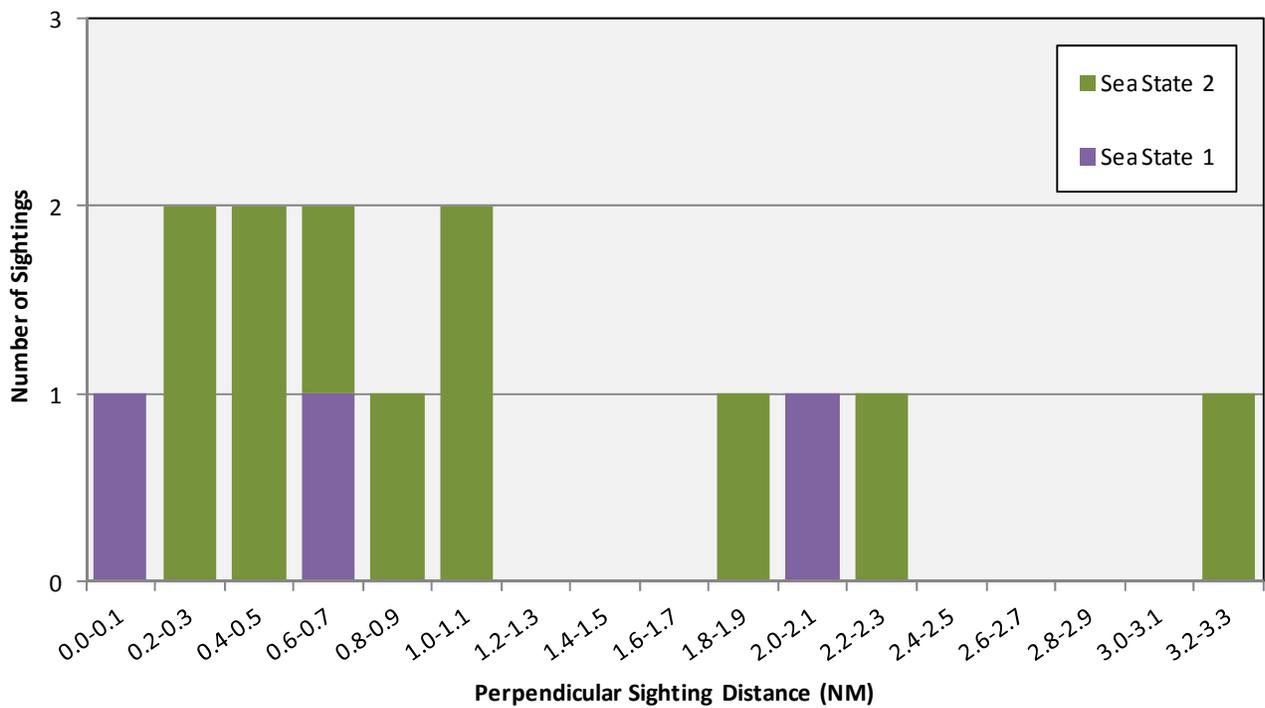


Figure 15. Perpendicular sighting distance for on-effort sightings by the SEWS team
Sightings from December 2012 through March 2013 displayed by sea state (Beaufort scale)

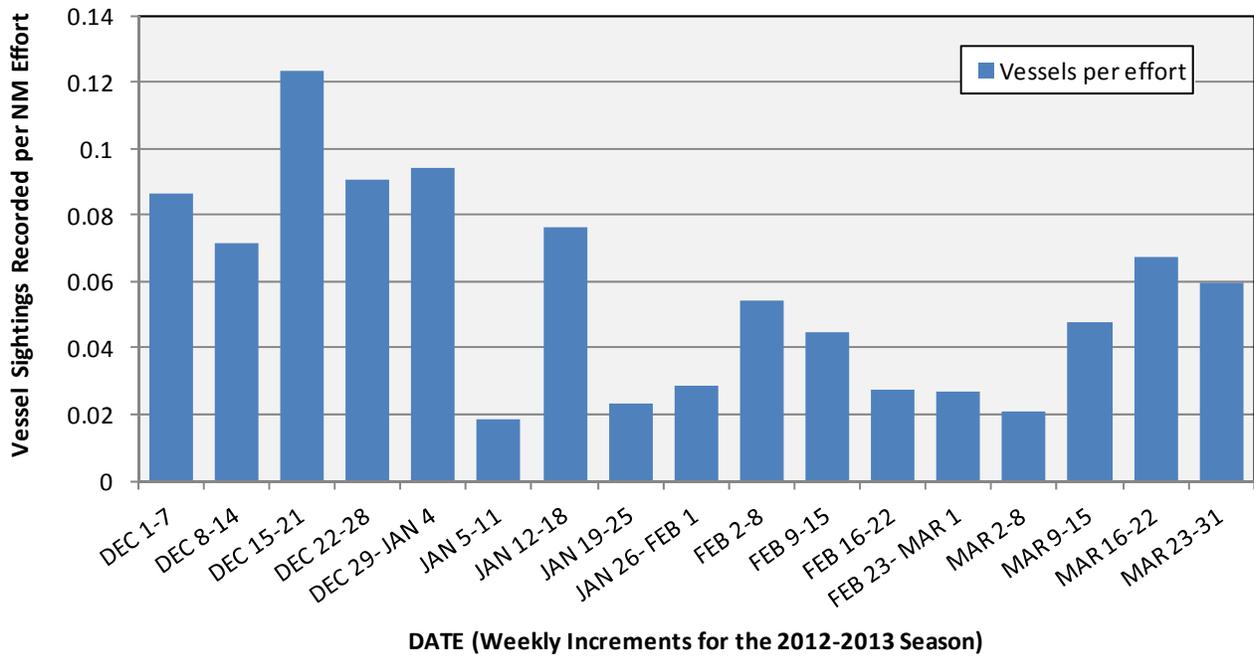


Figure 16. Weekly on-effort vessel sightings per NM of trackline flown by the SEWS team
Sightings include government and small vessels recorded from December 2012 through March 2013

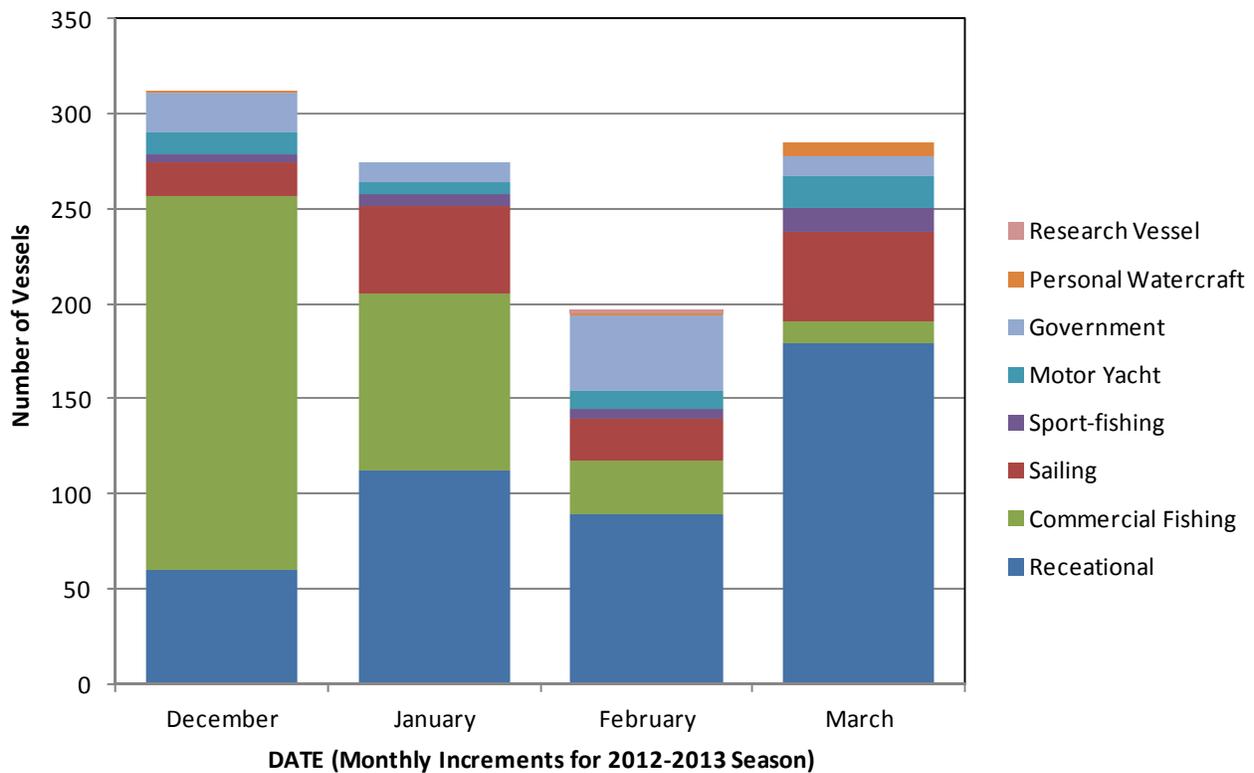


Figure 17. Monthly total of government and small vessel sightings by the SEWS team
Sightings displayed by defined vessel categories (Appendix 4), December 2012-March 2013

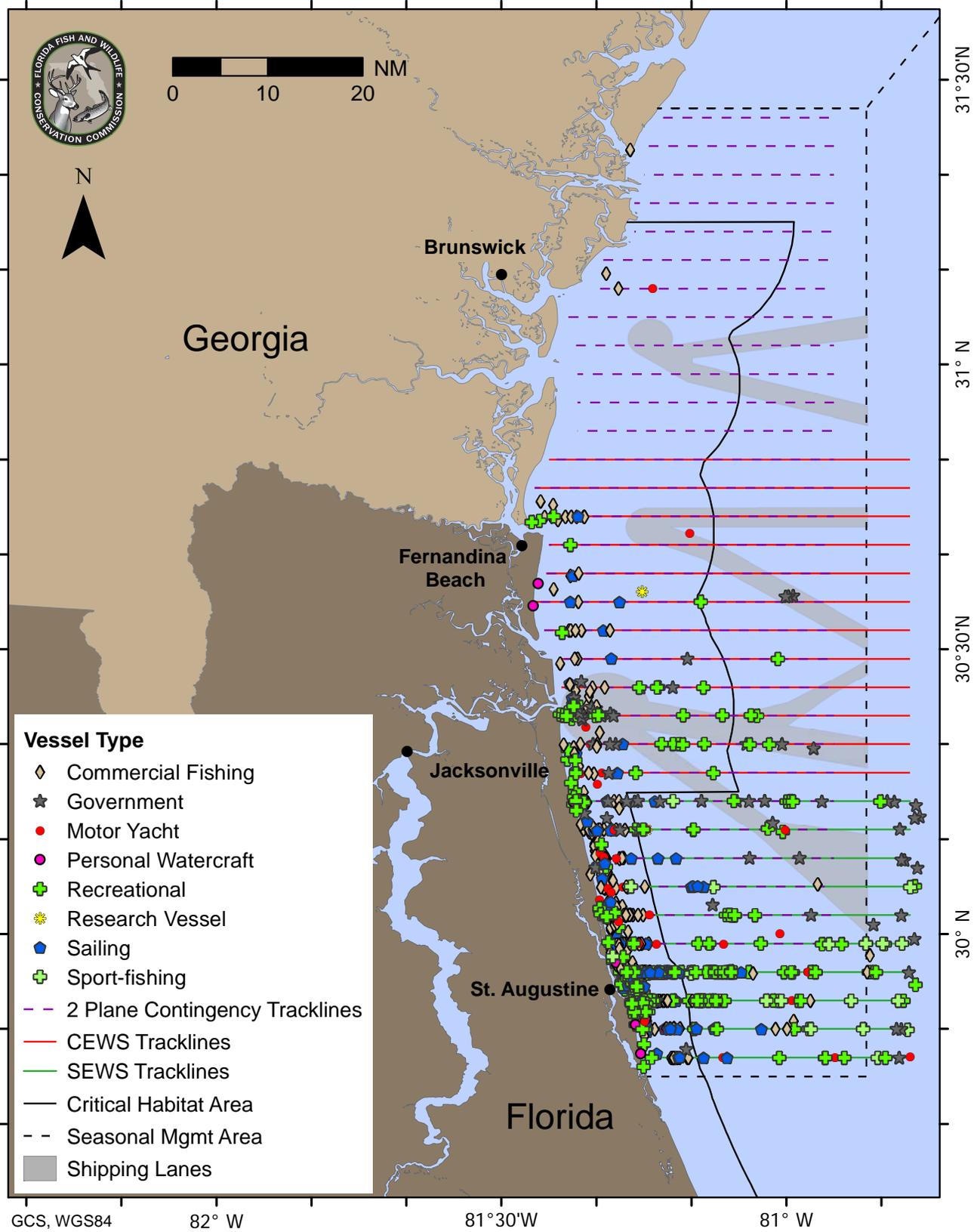


Figure 18. Vessel sightings by the SEWS team
December 2012 through March 2013

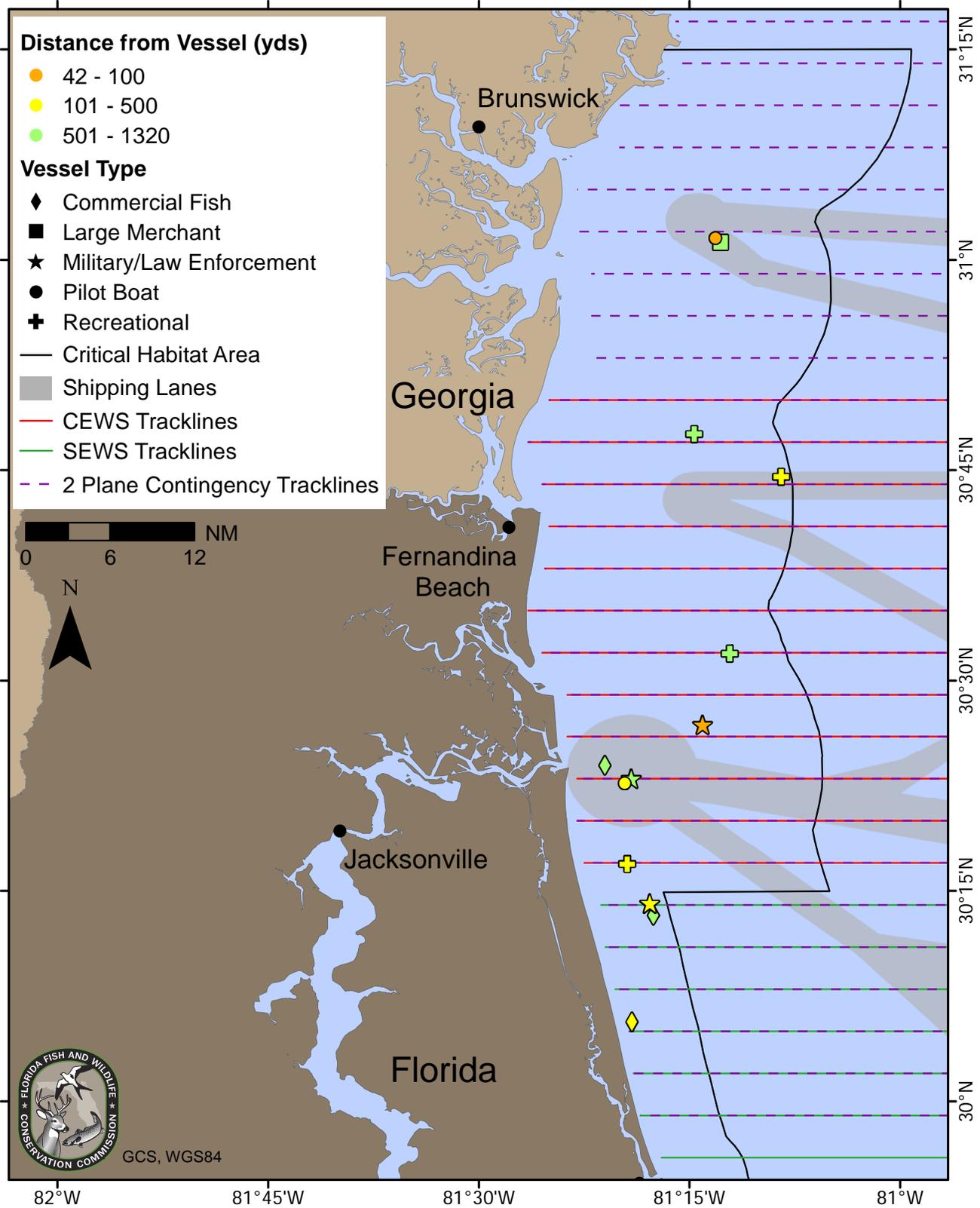


Figure 19. Whale-vessel interactions (WVI) documented by the CEWS and SEWS teams December 2012 through March 2013

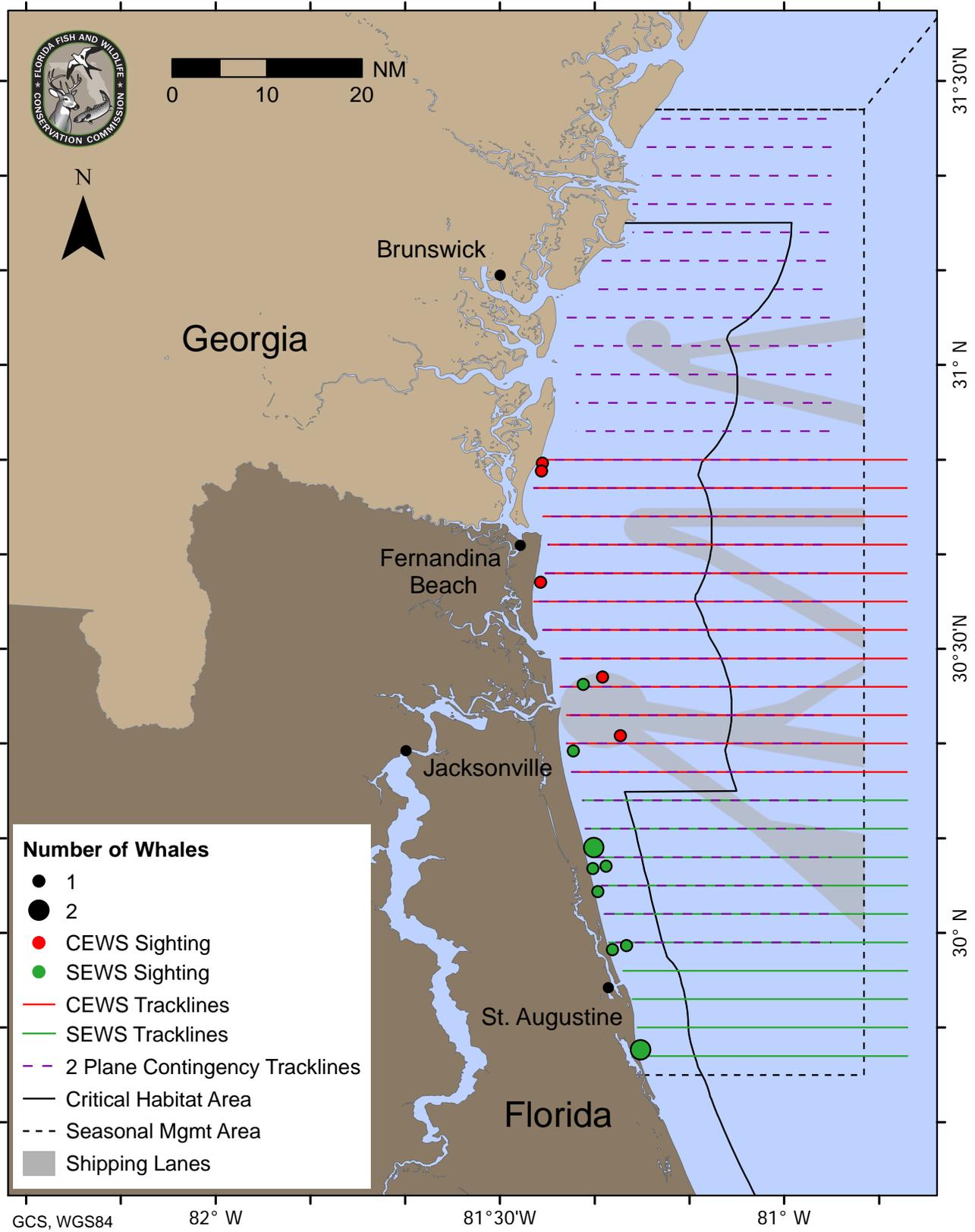


Figure 20. Humpback whale sightings by the CEWS and SEWS teams December 2012 through March 2013

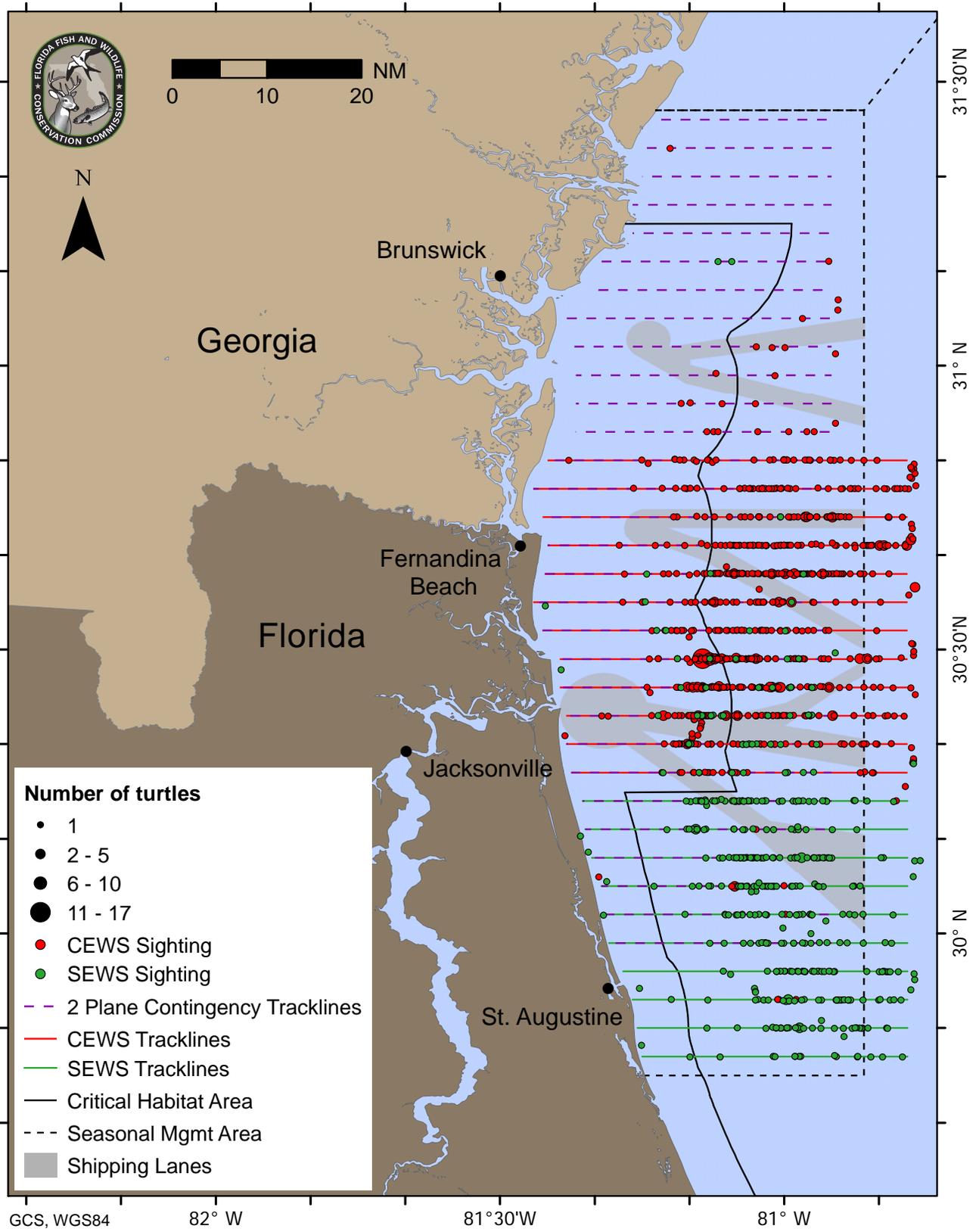


Figure 21. Leatherback turtle sightings by the CEWS and SEWS teams December 2012 through March 2013

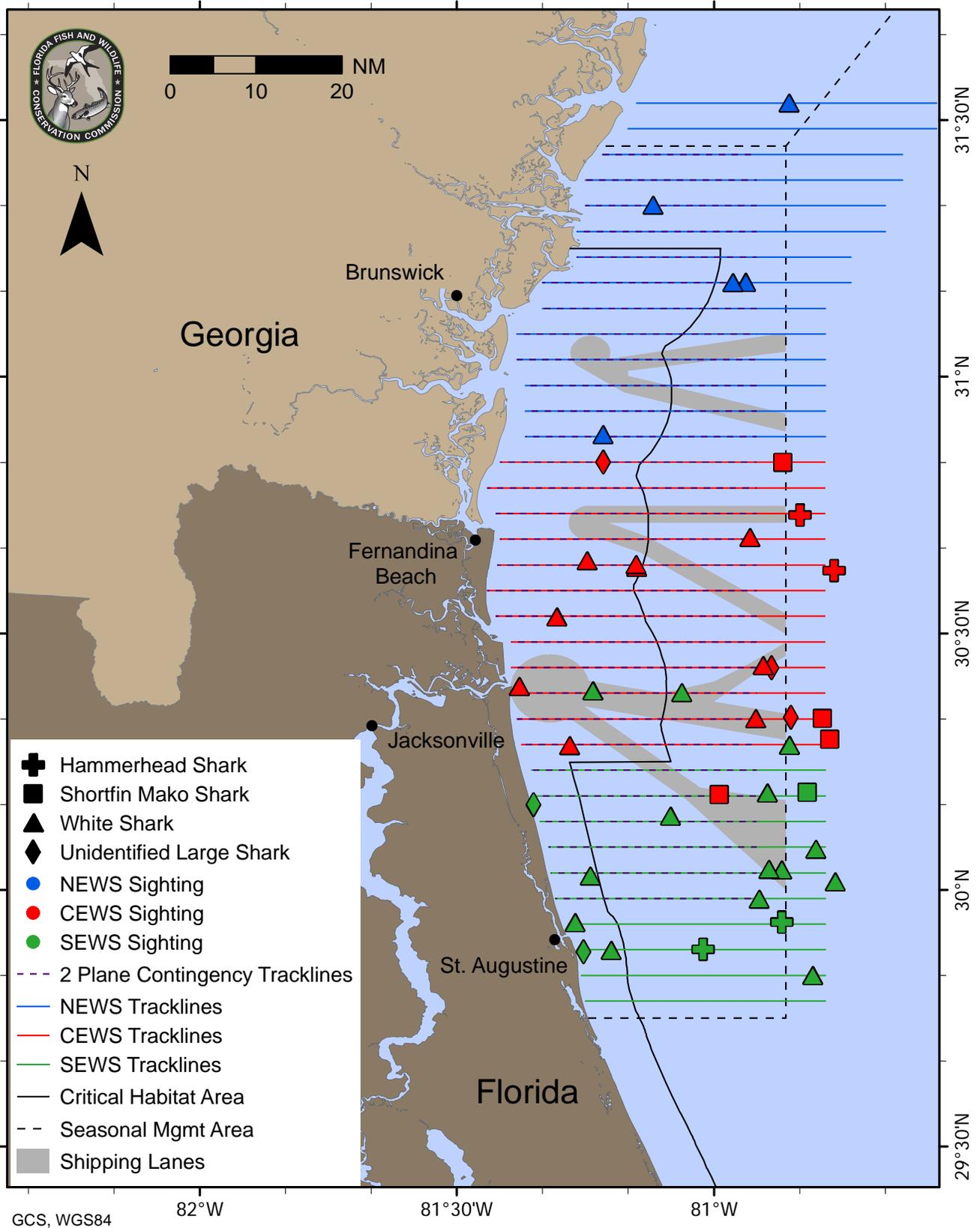


Figure 22. Large shark sightings by the CEWS, NEWS, and SEWS teams December 2012 through March 2013



Figure 23. Photograph of the 2013 Calf of Catalog #1612 with vessel wounds. A white circle marks the location of vessel wounds on the calf's left side/dorsum and the black arrow indicates the whales' direction of movement; the calf's mother is located in the bottom of the frame. The calf was first sighted with injury on 29 January 2013. Photograph taken 06 February 2013 by Jennifer Jakush, FWRI, NOAA Fisheries Permit #15488

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								

Table 2. SEWS survey team activities, December 2012-March 2013

Date	Full	None	Partial	One/ Two Plane	EWS Lines	Number of RIWH Sightings	Number of RIWH Whales	RIWH M/C Pair	Number of HUWH Whales	Flight Hours	Total Nautical Miles	Trackline Nautical Miles	On Effort Nautical Miles	WVI	Comments (LAT/LONG format degrees, minutes)
1-Dec-12		X													No fly - high winds and rain
2-Dec-12		X													No fly - high winds and rain
3-Dec-12				X	a-b, 1-10, 15-16	0	0	0	0	5.2	466.94	321.60	315.27		Modified 2-plane contingency due to fog/low ceiling. Lines 3044N-3041N flown N to S and lines 3132N-3059N flown S to N. Lines 3044N-3041N cut at 08110W due to high sea state. Periods of off effort due to fog and time constraints. Transited south on track. Standby due to low ceiling and rain.
4-Dec-12				X	17-24	3	6	3	0	6.3	527.94	229.38	229.38	Yes	Southern portion of 2-plane contingency. Lines 3038N-3017N flown N to S. Transit north on track. Transit south above survey speed (off effort) due to daylight constraints. Standby due to fog.
5-Dec-12				X	17-30	0	0	0	0	5.1	418.02	342.47	342.47		Southern portion of 2-plane contingency. Lines 3038N- 2959N flown N to S. Lines 3014N-3011N cut at approx. 08059W due to low clouds/rain. Transit north on track. Standby due to fog.
6-Dec-12		X													No fly - high winds
7-Dec-12		X													No fly - high winds and low ceiling
8-Dec-12		X													No fly - low ceiling and fog
9-Dec-12			X		25-34	0	0	0	0	3.7	344.98	265.90	265.90		Lines 3014N-2947N flown. Lines 3014N-2959N flown N to S and lines 2956N-2947N flown S to N. Line 3002N cut at approx. 08052W due to warship. Standby due to fog.
10-Dec-12			X		25-34	0	0	0	0	2.8	254.35	174.82	174.82		Lines 3014N-2947N flown. Lines 2950N-2947N flown S to N and lines 3014N-2953N flown N to S. Switched direction due to fog offshore. Cut all lines offshore due to fog bank between 08049W and 08107W. Few periods of off effort due to fog during offshore portions of lines. 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 Whales	Flight Hours	Total Nautical Miles	Trackline Nautical Miles	On Effort Nautical Miles	WVI	Comments (LAT/LONG format degrees, minutes)
11-Dec-12			X		23-34	0	0	0	0	3.9	370.46	270.84	270.84		Lines 3020N-2947N flown S to N. Lines 3008N-2947N cut at approx. 08100W due to offshore fog. After completion of 3011N line most of the fog had cleared, so offshore portions of lines 2959N-3008N (previously cut) were flown N to S. Then lines 3020N-3014N flown S to N. Did not fly offshore portions of 2956N-2947N due to restricted airspace in Area 27C. Standby due to fog and low ceiling.
12-Dec-12		X													No fly - high wind and rain
13-Dec-12		X													No fly - high wind and rain
14-Dec-12		X													No fly - high wind and sea state
15-Dec-12		X													No fly - high wind, rain, and low ceiling/fog
16-Dec-12			X		25-34	1	2	1	0	6.2	519.49	256.15	256.15	Yes	Lines 3014N-3005N flown N to S. Responded to sighting verification, then lines 3002N-2947N flown S to N. Lines 3014N-3011N cut due to low clouds at approx. 08055W. Standby due to fog.
17-Dec-12		X													No fly - PIC illness
18-Dec-12		X													No fly - high winds
19-Dec-12		X													No fly - PIC illness
20-Dec-12			X		25-34	1	2	1	0	3.4	255.39	172.47	151.69		After takeoff, responded directly to sighting report from land then lines 3014N-2947N flown N to S. Lines 3014N-2953N cut between 08058W and 08102W due to high sea state.
21-Dec-12		X													No fly - high winds
22-Dec-12		X													No fly - no PIC, high winds
23-Dec-12		X													No fly - no PIC
24-Dec-12		X													No fly - no PIC
25-Dec-12		X													No fly - no PIC
26-Dec-12		X													No fly - high winds and rain
27-Dec-12		X													No fly - high winds
28-Dec-12	X				23-34	0	0	0	0	5.5	487.88	331.47	331.47		Lines 3020N-2947N flown S to N
29-Dec-12		X													No fly - plane repair, high winds
30-Dec-12		X													No fly - plane repair, high winds
31-Dec-12		X													No fly - plane repair

Date	Full	None	Partial	One/ Two Plane	EWS Lines	Number of RIWH Sightings	Number of RIWH Whales	RIWH M/C Pair	Number of HUWH Whales	Flight Hours	Total Nautical Miles	Trackline Nautical Miles	On Effort Nautical Miles	WVI	Comments (LAT/LONG format degrees, minutes)
1-Jan-13				X	15-32	6	12	4	0	7.4	659.47	359.96	346.56	Yes	Southern portion of 2-plane contingency. Lines 3044N-2953N flown. Lines 3044N-3017N flown S to N, then lines 3014N-2953N flown N to S. Lines 3020N-3017N flown east to 08055W. All other lines flown east to 08100W.
2-Jan-13		X													No fly - high winds and rain
3-Jan-13		X													No fly - high winds and rain
4-Jan-13		X													No fly - high winds
5-Jan-13		X													No fly - high winds
6-Jan-13		X													No fly - high winds and rain
7-Jan-13		X													No fly - high winds
8-Jan-13		X													No fly - high winds and rain
9-Jan-13		X													No fly - low ceiling/fog
10-Jan-13		X													No fly - low ceiling/fog and high winds
11-Jan-13	X				25-34	0	0	0	0	4.4	360.19	271.24	271.24		Lines 3014N-2947N flown S to N. Delayed takeoff due to fog.
12-Jan-13	X				25-34	0	0	0	0	4.6	390.79	271.45	271.45		Lines 3014N-2947N flown S to N. Delayed takeoff/standby due to fog.
13-Jan-13	X				25-34	1	1	0	0	4.7	397.52	286.59	286.59		Lines 3014N-2947N flown N to S. Transit north on track. Delayed takeoff due to fog.
14-Jan-13	X				25-34	0	0	0	0	4.4	374.81	272.22	272.22		Lines 3014N- 2947N flown S to N. Delayed takeoff due to fog.
15-Jan-13	X				23-34	2	4	2	0	6.4	509.05	331.31	331.31		Lines 3020N- 2947N flown S to N. Delayed takeoff due to fog.
16-Jan-13	X				25-34	1	2	1	0	4.7	413.23	269.44	251.96		Lines 3014N-2947N flown S to N
17-Jan-13		X													No fly - high winds
18-Jan-13		X													No fly - high winds
19-Jan-13		X													No fly - high winds
20-Jan-13		X													No fly - high winds
21-Jan-13	X				23-34	1	2	1	0	5.3	472.70	356.21	356.21		Lines 3020N- 2947N flown S to N
22-Jan-13		X													No fly - high winds
23-Jan-13		X													No fly - high winds
24-Jan-13		X													No fly - 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 Whales	Flight Hours	Total Nautical Miles	Trackline Nautical Miles	On Effort Nautical Miles	WVI	Comments (LAT/LONG format degrees, minutes)
25-Jan-13	X				25-34	0	0	0	0	3.9	348.14	295.04	295.04		Lines 3014N-2947N flown. Lines 3014N-2953N flown S to N then lines 2950N-2947N flown S to N. Survey configuration altered due to restricted airspace in Area 27C. Transit south on track.
26-Jan-13	X				23-34	2	4	0	0	4.9	471.45	332.11	332.11		Lines 3020N-2947N flown S to N. Standby due to high winds.
27-Jan-13		X													No fly - high winds
28-Jan-13			X		25-34	1	3	0	0	4.0	374.76	261.50	250.31		Lines 3014N-2947N flown N to S. Lines 3008N-2959N cut at approx. 08050W due to high sea state. Standby due to high winds.
29-Jan-13	X				25-34	1	2	0	0	4.1	377.61	280.93	280.93		Lines 3014N to 2947N flown N to S. Delayed takeoff due to fog.
30-Jan-13		X													No fly - high winds
31-Jan-13		X													No fly - high winds
1-Feb-13		X													No fly - high winds
2-Feb-13		X													No fly - high winds
3-Feb-13		X													No fly - high winds
4-Feb-13	X				25-34	0	0	0	2	5.4	486.82	269.99	269.99		Lines 3014N-2947N flown. Lines 2950N-2947N flown S to N. Transit north above survey speed (off effort) to sighting verification. Lines 3002N-2953N flown N to S and lines 3014N-3005N flown S to N. Survey configuration altered due to airspace conflict in Area 27C. Delayed takeoff due to high winds.
5-Feb-13	X				25-34	0	0	0	1	4.4	391.42	272.67	272.67		Lines 3014N-2947N flown S to N
6-Feb-13	X				25-34	1	2	1	1	5.7	475.92	322.25	322.25		After takeoff, flew to 2949N to sighting verification (no whales found). Lines 3014N-2947N flown N to S. Coastal survey flown south 3NM offshore to 2918N to photograph 2013CalfOf1612 (injured). Flew 5NM offshore north to St. Augustine.
7-Feb-13		X													No fly - high winds and rain
8-Feb-13		X													No fly - high winds
9-Feb-13		X													No fly - high winds
10-Feb-13		X													No fly - 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 Whales	Flight Hours	Total Nautical Miles	Trackline Nautical Miles	On Effort Nautical Miles	WVI	Comments (LAT/LONG format degrees, minutes)
11-Feb-13		X													No fly - high winds
12-Feb-13	X				25-34	0	0	0	0	4.8	410.31	270.58	267.22		Lines 3014N-2947N flown S to N. Broke south from 2947N for sighting verification. Delayed takeoff due to low ceiling.
13-Feb-13		X													No fly- high winds and rain
14-Feb-13			X		23-30	0	0	0	1	3.0	284.66	156.26	97.59		Lines 3020N-2959N flown. Lines 3014N-2959N flown N to S then lines 3020N-3017N flown S to N. Cut lines 3008N-2959N between 08102W and 08107W and cut lines 3020N-3017N at approx 08056W, due to high sea state. Standby due to rain and low ceiling.
15-Feb-13				X	15-30	0	0	0	2	5.6	513.68	359.76	265.16		Southern portion of 2-plane contingency. Lines 3044N-2959N flown N to S. Lines 3014N-2959N cut offshore between 08059W-08116W due to high sea state. Transit north on track.
16-Feb-13		X													No fly - high winds
17-Feb-13		X													No fly - high winds
18-Feb-13				X	17-34	1	2	1	1	6.9	645.38	451.62	451.62		Southern portion of 2-plane contingency. Lines 3038N- 2947N flown N to S. Transit north on track.
19-Feb-13		X													No fly - high winds, aircraft maintenance
20-Feb-13		X													No fly - high winds
21-Feb-13	X				25-34	2	3	1	2	5.8	526.67	272.73	272.73	Yes	Lines 3014N-2947N flown S to N. Transited south after 2956N line for sighting verification (HUWH).
22-Feb-13	X				25-34	1	2	1		4.8	410.11	267.51	242.59		Lines 3014N-2947N flown S to N. Transited south after 3008N line for sighting verification.
23-Feb-13		X													No fly - high winds and rain
24-Feb-13			X		25-34	0	0	0		3.5	330.22	267.37	251.43		Lines 3014N-2947N flown N to S. Cut lines 3008N-3005N at approx. 08049W due to high sea state. Standby due to high winds and low ceiling.
25-Feb-13		X													No fly - high winds and rain
26-Feb-13		X													No fly - high winds and rain

Date	Full	None	Partial	One/ Two Plane	EWS Lines	Number of RIWH Sightings	Number of RIWH Whales	RIWH M/C Pair	Number of HUWH Whales	Flight Hours	Total Nautical Miles	Trackline Nautical Miles	On Effort Nautical Miles	WVI	Comments (LAT/LONG format degrees, minutes)
27-Feb-13			X		25-34	0	0	0		4.5	394.18	292.96	233.49		Lines 3014N-2947N flown. Lines 2950N-2947N flown S to N. Transit north on track. Lines 3014N-2953N flown N to S. Cut lines 3008N-3005N at 08048N due to high sea state. Cut portion of line 2953N due restricted airspace in Area 27C. Transit south on track. Delayed takeoff due to high winds.
28-Feb-13		X													No fly - high winds
1-Mar-13		X													No fly - high winds
2-Mar-13		X													No fly - high winds
3-Mar-13		X													No fly - high winds
4-Mar-13	X				25-34	0	0	0		3.5	329.60	271.78	265.88		Lines 3014N-2947N flown S to N. Standby due to high winds.
5-Mar-13			X		25-34	0	0	0	1	3.0	278.07	164.06	71.78		Lines 3014N-2947N flown. Lines 3014N-2959N flown N to S. Transit south for sighting verification after line 3005N. Lines 2956N-2947N flown S to N. Cut lines 3008N-2947N between 08112W and 08057W due to high sea state. Standby due to delayed co-pilot.
6-Mar-13		X													No fly - high winds
7-Mar-13		X													No fly - high winds. Winds highest in the SEWS area, so used SEWS aircraft to fly CEWS survey. CEWS aircraft repair in progress.
8-Mar-13	X				23-34	0	0	0		4.4	419.42	335.64	331.21		Lines 3020N-2947N flown S to N
9-Mar-13		X													No fly - high winds
10-Mar-13		X													No fly - high winds
11-Mar-13		X													No fly - high winds
12-Mar-13		X													No fly - high winds
13-Mar-13		X													No fly - high winds
14-Mar-13		X													No fly - high winds
15-Mar-13	X				25-34	0	0	0		4.2	361.95	271.55	271.55		Lines 3014N-2947N flown. Lines 3014N-2959N flown S to N and lines 2956N-2947N flown N to S. Delayed takeoff/standby due to DST and high 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 Whales	Flight Hours	Total Nautical Miles	Trackline Nautical Miles	On Effort Nautical Miles	WVI	Comments (LAT/LONG format degrees, minutes)
16-Mar-13			X		25-34	0	0	0		3.5	335.90	261.19	247.57		Lines 3014N-3047N flown N to S. Cut lines 3008N-3005N at 08052W due to high sea state. Line 2959N cut just east of the shoreline due to air traffic. Delayed takeoff due to DST.
17-Mar-13			X		25-34	0	0	0		3.8	318.98	252.82	219.65		Lines 3014N-2947N flown N to S. Cut lines 2956N-2953N at 08058W due to high sea state.
18-Mar-13	X				25-34	0	0	0		3.8	349.70	271.89	271.89		Lines 3014N-2947N flown S to N. Offshore portion of line 2950N modified approx. 1 mile south to avoid restricted airspace in Area 27C. Delayed takeoff due to DST.
19-Mar-13	X				25-34	0	0	0		3.6	360.72	273.33	271.37		Lines 3014N-2947N flown S to N. Delayed takeoff due to DST and additional standby due to rain, high wind, and low ceiling.
20-Mar-13		X													No fly - high winds and rain
21-Mar-13		X													No fly - high winds
22-Mar-13	X				25-34	0	0	0		3.6	337.67	271.24	271.24		Lines 3014N-2947N flown. Lines 3002N-2947N flown N to S then lines 3014N-3005N flown N to S. Survey configuration altered due to restricted airspace in Area 27C. Delayed takeoff due to DST and then additional standby due to high sea state.
23-Mar-13		X													No fly - rain, thunderstorms, and low ceiling associated with stalled front
24-Mar-13		X													No fly - high winds, rain, thunderstorms, and low ceiling associated with approaching cold front
25-Mar-13		X													No fly - high winds
26-Mar-13		X													No fly - high winds
27-Mar-13		X													No fly - high winds
28-Mar-13		X													No fly - high winds. Standby until 1530(L) due to high winds.
29-Mar-13	X				25-34	0	0	0		3.7	347.26	272.47	272.47		Lines 3014N-2947N flown N to S. Delayed takeoff due to DST.

Date	Full	None	Partial	One/ Two Plane	EWS Lines	Number of RIWH Sightings	Number of RIWH Whales	RIWH M/C Pair	Number of HUWH Whales	Flight Hours	Total Nautical Miles	Trackline Nautical Miles	On Effort Nautical Miles	WVI	Comments (LAT/LONG format degrees, minutes)
30-Mar-13			X		25-34	0	0	0		3.9	358.34	280.86	249.09		Lines 3014N-2947N flown. Lines 3014N-3011N flown N to S and lines 3008N-2947N flown S to N. Lines 3014N-3011N cut at approx. 08055W due to high sea state. Transit south on track. Delayed takeoff due to DST.
31-Mar-13		X													No fly - high winds

Table 3. SEWS survey team right whale sightings, December 2012-March 2013

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
12/4/2012	11:18:29	30.35796	-81.38024	A	1946	F	24	BOD CNT, W/CALF	SEWS001	
12/4/2012	11:18:29	30.35796	-81.38024	B	2013CalfOf1946	Unk	Calf	CALF W/MOM,BOD CNT, HD LFT	SEWS001	
12/4/2012	12:29:25	30.58229	-81.22207	C	2753	F	16	BOD CNT, HD TLT, WH CHN, W/CALF, NURS	SEWS002	
12/4/2012	12:29:25	30.58229	-81.22207	D	2013CalfOf2753	Unk	Calf	BOD CNT, NURS; CALF W/MOM	SEWS002	
12/4/2012	14:09:24	30.39229	-81.35407	E	1946	F	24	W/CALF, NURS, LOG, HD TLT, BODO	SEWS004	Whales in Jax channel, also paged as SEWS003
12/4/2012	14:09:24	30.39229	-81.35407	F	2013CalfOf1946	Unk	Calf	CALF W/MOM, NURS, BODO	SEWS004	Whales in Jax channel, also paged as SEWS003
12/16/2012	11:14:04	30.22463	-81.30440	A	2413	F	19	W/CALF	SEWS005	
12/16/2012	11:14:04	30.22463	-81.30440	B	2013CalfOf2413	Unk	Calf	CALF W/MOM	SEWS005	
12/20/2012	9:46:19	29.96063	-81.30007	A	3540	F	8	W/CALF, NURS, HD TLT	SEWS006	
12/20/2012	9:46:19	29.96063	-81.30007	B	2013CalfOf3540	Unk	Calf	CALF W/MOM, NURS	SEWS006	
1/1/2013	9:26:18	30.20363	-81.30124	A	UNPH	Unk	Unk	W/CALF	SEWS008	Unable to relocate after WVI with SEWS007; Paged first pass location
1/1/2013	9:26:18	30.20363	-81.30124	B	UNPH	Unk	Unk	CALF W/MOM	SEWS008	
1/1/2013	9:32:43	30.23513	-81.29724	C	3320	F	>10	SAG, HD LFT, BLK BEL	SEWS007	Paged as CEWS018
1/1/2013	9:32:43	30.23513	-81.29724	D	2010CalfOf1145	F	3	SAG, BEL/BEL, HD LFT, BEL UP, BLK BEL, FEM, BLK CHN, INTRO, FLIP	SEWS007	

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
1/1/2013	9:32:43	30.23513	-81.29724	E	3611	Unk	7	SAG, BEL/BEL, MALE, INTRO, PENIS, BLK BEL, HD LFT	SEWS007	
1/1/2013	11:04:15	30.33129	-81.24874	F	3513	F	8	HD TLT, NURS, W/CALF	SEWS009	
1/1/2013	11:04:15	30.33129	-81.24874	G	2013CalfOf3513	Unk	Calf	NURS, CALF W/MOM	SEWS009	
1/1/2013	12:00:08	30.39513	-81.20174	H	3503	F	8		SEWS010	
1/1/2013	13:08:00	30.60772	-81.42457	I	2912	F	14	W/CALF	SEWS011	
1/1/2013	13:08:00	30.60779	-81.42457	J	2013CalfOf2912	Unk	Calf	FEM, ROLL, BLK BEL, CALF W/MOM	SEWS011	
1/1/2013	15:12:42	30.62096	-81.43074	K	2912	F	14	BOD CNT, W/CALF	SEWS012	
1/1/2013	15:12:42	30.62096	-81.43074	L	2013CalfOf2912	Unk	Calf	BOD CNT, HD LFT, ROLL, BLK CHN, CALF W/MOM	SEWS012	
1/13/2013	11:10:03	30.22529	-81.35307	A	S074	Unk	Unk	LIN TR	SEWS013	
1/15/2013	10:26:51	29.82763	-81.09590	A	1612	F	>27	W/CALF, BOD CNT, TL SLSH?	SEWS014	
1/15/2013	10:26:51	29.82763	-81.09590	B	2013CalfOf1612	Unk	Calf	HD LFT, BOD CNT, ROLL, FLIP, CALF W/MOM	SEWS014	
1/15/2013	13:35:48	29.86963	-81.10790	C	1612	F	>27	BOD CNT, W/CALF	SEWS015	
1/15/2013	13:35:48	29.86963	-81.10790	D	2013CalfOf1612	Unk	Calf	BOD CNT, ROLL, BLK CHN, CALF W/MOM	SEWS015	
1/16/2013	13:23:11	30.23829	-81.12790	A	1612	F	>27	W/CALF, LOG	SEWS016	
1/16/2013	13:23:11	30.23829	-81.12790	B	2013CalfOf1612	Unk	Calf	CALF W/MOM, LOG	SEWS016	
1/21/2013	12:05:49	30.05129	-81.30490	A	2042	F	23	BOD CNT, ROLL, WH CHN, WH BEL, NURS, W/CALF	SEWS017	
1/21/2013	12:05:49	30.05129	-81.30490	B	2013CalfOf2042	Unk	Calf	BOD CNT, WH BEL, ROLL, CALF W/MOM, HD LFT, WH CHN, NURS	SEWS017	
1/26/2013	16:14:49	30.26263	-81.09640	A	4057	Unk	3	SAG, BLK CHN, HD LFT	SEWS018	

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
1/26/2013	16:14:49	30.26263	-81.09640	B	3860	F	5	SAG, HD LFT, BLK CHN	SEWS018	
1/26/2013	16:53:23	30.26363	-81.10290	C	4057	Unk	3	SAG	SEWS018	Re-sighting of SEWS018
1/26/2013	16:53:23	30.26363	-81.10290	D	3860	F	5	SAG, HD LFT	SEWS018	
1/28/2013	11:10:45	30.15013	-81.22157	A	4057	Unk	3	SAG, BEL UP, BLK BEL, MALE , BLK CHN	SEWS019	
1/28/2013	11:10:45	30.15013	-81.22157	B	CT03SEUS10	Unk	Unk	SAG	SEWS019	
1/28/2013	11:10:45	30.15013	-81.22157	C	3860	F	5	SAG, POST	SEWS019	
1/29/2013	10:28:04	30.23446	-81.29824	A	CT03SEUS10	Unk	Unk	BEL/BEL, BOD CNT	SEWS020	
1/29/2013	10:28:04	30.23446	-81.29824	B	3860	F	5	BEL/BEL; BOD CNT; HD LFT	SEWS020	
2/6/2013	14:25:14	29.30696	-81.03974	A	1612	F	>27	NURS, W/CALF, MOPN, POST	SEWS021	
2/6/2013	14:25:14	29.30696	-81.03974	B	2013CalfOf1612	Unk	Calf	NURS, CALF W/MOM, POST?	SEWS021	
2/18/2013	13:07:05	30.25379	-81.28540	A	3692	F	>7	W/CALF, BOD CNT	SEWS022	
2/18/2013	13:07:05	30.25379	-81.28540	B	2013CalfOf3692	Unk	Calf	CALF W/MOM, BOD CNT	SEWS022	
2/21/2013	13:52:57	30.23913	-81.33524	A	1334	F	>30	LIN TR, W/CALF, BOD CNT, HD TLT	SEWS024	
2/21/2013	13:52:57	30.23913	-81.33524	B	2013CalfOf1334	Unk	Calf	LIN TR, CALF W/MOM, BOD CNT	SEWS024	
2/21/2013	14:00:16	30.23679	-81.33107	C	3892	M	5	MOPN	SEWS023	Paged before SEWS024
2/22/2013	12:45:55	30.04046	-81.32424	A	3515	F	8	W/CALF, BOD CNT	SEWS025	
2/22/2013	12:45:55	30.04046	-81.32424	B	2013CalfOf3515	Unk	Calf	CALF W/MOM, BOD CNT, HD LFT, ROLL, WH CHN, WH BEL	SEWS025	

Table 4. Whale-vessel interaction events documented by the SEWS survey team, December 2012-March 2013

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
12/4/2012	1213	CEWS	Catalog #1946 and calf	30.39229	-81.35407	1	Pilot Boat 56ft	20	250	Milling	No	Yes	Vessel was initially sighted 2 miles SE of the whales heading NW. Observers hailed vessel on VHF Ch.16, established communication on a working channel, and informed the captain of the whales' location. Captain responded he had a visual on the whales and intended to position his vessel between the whales and an inbound cargo ship. Observers provided updated location information for the whales to the Pilot throughout the interaction.
12/4/2012	1213	CEWS	Catalog #1946 and calf	30.39229	-81.35407	2	Military 53ft	10	880	Milling	No	Yes	Vessel was initially sighted 3 miles E of the whales heading W. Observers hailed vessel on VHF Ch.16, established communication on a working channel, and informed the captain of the whales' location. Captain replied he would alter course S to avoid whales and would pass information to a second vessel following behind.
12/4/2012	1213	CEWS	Catalog #1946 and calf	30.39229	-81.35407	3	Commercial Fishing/ Shrimp 79ft	4	880	Milling	No	Yes	Vessel was initially sighted 1 mile WNW of the whales heading ENE. Observers hailed vessel on VHF Ch.16, but could not establish communication on a working channel and switched back to Ch.16. Observers informed the captain of the whales' location. Captain replied he would alter course E and then N. After approximately 15 minutes the vessel was still heading E towards the whales, so observers hailed again and provided updated information on the whales' location and 500 yard rule. The vessel then altered course N, heading away from whales.

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
12/16/2012	146	SEWS	Catalog #2413 and calf	30.22463	-81.30440	1	Commercial Fishing/ Shrimp 85ft	3-5	880	Milling	Yes	Yes	Vessel was initially sighted 2 miles SE of the whales heading NNW. Observers hailed vessel on VHF Ch.16, but could not establish communication on a working channel and switched back to Ch.16. After multiple attempts, observers could not reestablish communication with the vessel. As the vessel approached, the whales remained subsurface longer and after the vessel passed abeam the whales the whales turned parallel to the vessel's track (the whales had previously been heading towards the path of the vessel).
1/1/2013	111	SEWS	Catalog #3320, #3611, and the 2010 Calf of Catalog #1145	30.23513	-81.29724	1	USCG Cutter 87ft	15	300	SAG	No	Yes	Vessel was initially sighted 300 yards SE of the whales heading N. Observers hailed vessel on VHF Ch.16, established communication on a working channel, and informed the captain of the whales' location. Captain replied he had eyes on the whales and would alter course E. Observers also relayed sighting information for nearby cow-calf pair.
2/21/2013	1383	SEWS	Catalog #1334 and calf	30.23913	-81.33524	1	Motor Yacht 43ft	30	400	Swimming/ Traveling	Yes	Yes	Vessel was initially sighted 5-7 miles N of the whales heading S. Observers hailed vessel on VHF Ch.16, established communication on a working channel, and informed the captain of the whales' location and 500 yard rule. Captain altered course to the SSE, but did not slow down. This WVI progressed rapidly because the vessel was traveling quickly; whales remained subsurface as the vessel passed and during all communications with the vessel. Captain was advised of additional whale sightings in the area.

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
BUBLS	Bubbles
CALF	Calf Alone
CALF W/MOM	Calf of a Mom/Calf Pair
CALF W/OTHER(S)	Calf With Another Whale
CALF W/ UNPH	Calf With Unphotographed Whale(s)
CHN BRCH	Chin Breach
DEAD ON BEACH	Dead on Beach
DFCN	Defecation
DSENTGL	Disentangled
DSENTGL ATT	Disentanglement Attempt
ENTGL	Entangled
FEED	Unspecified Feeding
FEM	Female
FL	Fluking
FLIP	Flipping/ 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
HD TLT	Head Tilt
INTRO	Intromission
LBTL	Lobtailing
LIN TR	Linear Travel

Behavior Code	Behavior Name
LIVE STRAND	Live stranded
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
SICK	Sick Whale
SKM FD	Surface or Skim Feeding
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/TELBUEOY	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)
CEWS	Central Early Warning System (aerial survey)
CFR	Code of Federal Regulations
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
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
HUWH	Humpback Whale
ID	Identification
IFR	Instrument Flight Rules
IMO	International Maritime Organization
LAT	Latitude
LONG	Longitude
M	Male (sex)
MRC	Marine Resources Council
MSRS	Mandatory Ship Reporting System
NARWC	North Atlantic Right Whale Consortium
NC	North Carolina
NDBC	National Data Buoy Center
NEA	New England Aquarium

NEFSC	(NOAA NMFS) Northeast Fisheries Science Center
NEWS	Northern Early Warning System (aerial survey)
NMFS	National Marine Fisheries Service (aka NOAA Fisheries Service)
NOAA	National Oceanic and Atmospheric Administration
ODMDS	Ocean dredged material disposal site
PC	Personal computer
PCCS	Provincetown Center for Coastal Studies
PFD	Personal flotation device
PIC	Pilot in Command
RIWH	Right Whale
S2S	Sea To Shore Alliance
SAG	Surface Active Group
SC	South Carolina
SCGA	South Carolina Northern Georgia (aerial survey)
SD	Standard Deviation
SEFSC	NOAA NMFS, Southeast Fisheries Science Center
SERO PRD	(NOAA) Southeast Regional Office Protected Recourses Division
SEUS	Southeast United States
SEWS	Southern Early Warning System (aerial survey)
SIC	Second In Command (pilot)
SLR	Single Lens Reflex
SMA	Seasonal Management Area
SPUE	Sightings Per Unit Effort
SST	Sea surface temperature
Unk	Unknown (sex or age class)
UNCW	University of North Carolina Wilmington
UNPH	Unphotographed
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

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	Whale known to be 9 years of age or older and calving female of any age; a whale of unknown age is classified as adult in their ninth year from initial sighting.
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).
Beaufort Scale	An empirical measure that relates wind speed to observed conditions at sea or on land.
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

Term	Definition
Ground contact	FWRI staff member stationed in an office that maintains a near real-time knowledge of the position and maneuvers of the aircraft during survey, monitored weather conditions, and acts as the communication liaison for the survey team.
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
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.

Term	Definition
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.
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>i.e.</i> , 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.
Volunteer Networks	The Marineland Right Whale Project and Marine Resources Council (MRC) right whale monitoring program organize volunteers who search for right whales from land in Florida, record sighting information and alert other network members who can obtain photo-documentation of sightings. These efforts range from dedicated land surveys to opportunistic sighting reports through MRC's hotline number.
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