



EcoHealth Alliance

Formerly known as Wildlife Trust

FINAL REPORT TO
GEORGIA DEPARTMENT OF NATURAL RESOURCES

NORTHERN EARLY WARNING SYSTEM
NORTH ATLANTIC RIGHT WHALE (*Eubalaena glacialis*)
AERIAL SURVEYS, 2010-2011 SEASON

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Abstract

The endangered North Atlantic right whale (*Eubalaena glacialis*) experiences a high level of anthropogenic mortality, including collisions with vessels and entanglement in fishing gear. In the Southeast United States, the only known calving ground for the species, an Early Warning System of aerial surveys was developed in 1993 to mitigate vessel collisions and document habitat use and reproductive status. The 2010-2011 Northern Early Warning System (NEWS) surveys were conducted from 1 December 2010 to 31 March 2011. The NEWS survey area extended from the northern end of Sapelo Island (31° 32.0N) to mid-Cumberland Island, Georgia (30° 53.0N), eastward approximately 32 nautical miles (nmi). A total of 35 NEWS surveys were conducted, logging 184.3 hours of flight time. The greatest amount of aerial survey effort occurred in January; however, the greatest number of right whales were sighted in December (n = 17) and February (n = 17).

A total of 26 right whale sighting events consisting of 50 right whales were documented during the 2010-2011 NEWS surveys (average = 1.9 whales per sighting, range: 1 - 5). Twelve of the 26 sightings were mother/calf pairs, nine were single animals, and five sightings were groups of two to five right whales. Preliminary photo analysis identified 37 individual whales, including seven mother/calf pairs and an additional 23 individual adult/juvenile whales. Five of the seven mothers documented during the NEWS surveys were first sighted with their 2011 calves in the NEWS survey area. Of the 37 individual right whales sighted during the NEWS season, the largest demographic group was mother/calf pairs (38%), followed by adult males (14%) and juveniles of unknown gender (14%). When classified solely by age, 47% of the individual whales were adults, 27% were juveniles, 19% were calves and 8% were of unknown age. Females with 2011 calves were the demographic group resighted the most within the NEWS survey area. Preliminary data indicate that five right whales were sighted solely within the NEWS survey area during the 2010-2011 calving season. Additionally, two entangled right whales, one right whale calf sighted alone and four humpback whales were observed by the NEWS survey team.

The 2010 – 2011 NEWS season represents the lowest number of sighting events, right whales sighted and number of individual whales sighted in the NEWS survey area since 2003. Thirty-seven individual right whales (based on preliminary analysis) were documented in the NEWS survey zone during the 2010-2011 season. This represents a 49% decrease in documented individuals compared to the 2009 – 2010 season (n = 73 whales), and a 65% decrease compared to the previous seven survey seasons (average = 105 whales/year). This reduction in NEWS survey sightings may be due to reduced survey effort, an overall reduction in the number of right whales sighted in the Southeast US in 2010 – 2011 and/or the effects of sea-surface temperature on right whale distribution.

Introduction

The North Atlantic right whale (*Eubalaena glacialis*) is protected in U.S and territorial waters pursuant to the Marine Mammal Protection Act of 1972, and is classified as an endangered species under the Endangered Species Act of 1973. The only known calving ground for the North Atlantic right whale consists of Atlantic coastal waters in the southeastern United States (SEUS). A portion of the region was designated as Critical Habitat for northern right whales by the National Oceanic and Atmospheric Administration's National Marine Fisheries Service (NMFS) in 1994 and encompasses the waters from Altamaha Sound, Georgia, to Sebastian Inlet, Florida, out to 5-15 nmi from the shoreline (50 CFR 226.203). Minimizing sources of anthropogenic mortality and serious injury is a primary objective of the North Atlantic Right Whale (*Eubalaena glacialis*) Recovery Plan (NMFS, 2005). Vessel collisions are a leading anthropogenic cause of right whale mortality. The SEUS critical habitat includes entrances to four commercial shipping ports (Brunswick, Georgia; Fernandina, Jacksonville and Port Canaveral, Florida), resulting in frequent usage of these waters by commercial and military vessels. The Early Warning System (EWS) was created in 1994 to alert military and commercial vessels to the presence of right whales, potentially reducing the probability of right whale/vessel collisions. The first EWS survey area encompassed waters from Brunswick, Georgia, to St. Augustine, Florida, out to approximately 20 nmi offshore. Data collected subsequently indicated that right whales regularly utilize waters outside of this area. In 2002, NMFS redesigned the EWS system to include three survey areas (northern, central and southern) encompassing waters from north Sapelo Island, Georgia (31° 32.0N), to Crescent Beach, Florida (29° 47.0N), out to approximately 30 nmi offshore. The survey effort described in this report covers the Northern Early Warning System (NEWS) survey zone, from the northern end of Sapelo Island (31° 32.0N) to mid-Cumberland Island, Georgia (30° 53.0N).

The objectives of the 2010-2011 NEWS surveys were to: 1) reduce vessel collisions with right whales, 2) document and provide support for right whale disentanglement, 3) document dead and stranded right whales, 4) monitor the status and trends of abundance and distribution of the western North Atlantic right whale, 5) characterize and monitor right whale habitat and 6) provide aerial support for ongoing right whale biopsy sampling efforts. This report presents the results of the NEWS aerial surveys from 1 December 2010 through 31 March 2011.

Methods

Study Area

NEWS surveys included waters from the northern end of Sapelo Island (31° 32.0N) to mid-Cumberland Island, Georgia (30° 53.0N), eastward approximately 32 nmi offshore. Fourteen east/west tracklines of various lengths (28.8-32.4 nmi) were flown at 3 nmi intervals (Fig. 1). A complete survey consisted of 442.8 nmi of trackline (Table 1), not including miles flown in transit to, from, and between transect lines. On days when the NEWS survey aircraft was unavailable due to maintenance, pilot absence or disentanglement aerial support, a two-plane or one-plane contingency plan was often implemented, during which Florida Fish and Wildlife Research Institute (FWRI) survey aircraft from the Central Early Warning System (CEWS) and/or the Southern Early Warning System (SEWS) shifted their survey coverage north to include much of the NEWS survey area. On days when the CEWS or SEWS survey aircraft were unavailable, the NEWS survey team flew a two-plane contingency plan, shifting coverage south into the northern section of the CEWS survey area.

Aerial Surveys

Surveys were flown daily, weather permitting, from 1 December 2010 through 31 March 2011. Survey aircraft departed from Malcolm McKinnon airport on St. Simons Island, Georgia, and returned to the same airfield after each flight. All NEWS surveys were conducted in a NOAA DeHaviland Twin Otter aircraft. The survey aircraft was equipped with Global Positioning System (GPS) navigation aids, radar, aviation VHF radio, marine VHF radio, a life raft, PFDs, survival suits, flares, an aircraft ELT, and a satellite telephone. Each observer was equipped with an individually registered GPIRB, FAA approved survival vest, NOMEX flight suit, knife, rescue streamer, and strobe light.

Surveys were flown at an altitude of 1000 ft (303 m) and an average air speed of 100 mph (160 km/hr). Surveys typically began at the western waypoint of the southernmost trackline, however the start point and direction of flight was determined daily based on weather conditions in the survey area and other survey factors. Attempts were made to fly the area surrounding the Brunswick shipping channel during each survey due to increased vessel traffic, including dredge activity. Environmental conditions required for a survey included: ceiling $\geq 455\text{m}$, visibility > 2 nmi, wind speed ≤ 10 knots, and Beaufort sea state ≤ 3 . On 30 November 2010, a flight was conducted to compare and standardize estimation of Beaufort sea state among SEUS aerial survey teams.

The survey crew consisted of a pilot (PIC) and co-pilot (SIC), two observers, and a data recorder. Observers were positioned on either side of the aircraft at forward bubble windows, and rotated positions every four tracklines to reduce observer fatigue.

Data Collection

The two forward observers reported all sightings to the data recorder. The data recorder logged these sightings into Logger 2000, a software program designed by the International Fund for Animal Welfare (IFAW) for marine survey data entry. The time, location, number, and species of all large whales, leatherback turtles, white sharks and manatees were recorded. Logger 2000 also recorded time, position (lat/long), altitude, heading, and aircraft speed at 10 s intervals. In addition, all vessels sighted within 1.5 nmi of the survey aircraft were recorded, except for any commercial or non-governmental vessel that would be transmitting Automatic Identification System (AIS) information. The type, heading and sighting angles (measured using a digital inclinometer) were noted for all recorded large vessels (≥ 100 ft).

When a right whale sighting event (consisting of a single whale or multiple whales) occurred, a GPS position was recorded along the trackline at the point of observation and another GPS location was obtained directly over the whale(s). The survey plane then circled the whale(s) to obtain digital photographs for photo-identification, a count of the number of whales present and behavioral observations. Once the whale(s) were photo-documented, a final overhead GPS position of the whale(s) was recorded and the survey plane returned to the trackline at the point of observation to continue the survey. Circling for photographic documentation was generally limited to 15 min per sighting.

Sighting distance from the trackline for observed right whales was calculated whenever possible, using the lat/long position on the trackline perpendicular to the position of the whale sighting (lat₁, long₁), and the lat/long exact overhead position of the right whale (lat₂, long₂). The whale's distance in nmi from the trackline was determined by subtracting the distance between the two latitude positions, as 1 min of latitude = 1 nmi in the study area (Fig. 2).

The NEWS survey team documented any observed co-occurrences of vessels and rights whales, including the location, number, heading, and behavior of the whales involved in the event. The location, name, type, length, speed, and heading of each of the vessels involved were also recorded throughout the event. Monitoring of the situation continued until the vessels were no longer in the same vicinity as the

right whales. Photographic and video documentation were obtained whenever possible. Attempts were also made to contact the vessels over VHF to alert them to the presence and location of the right whales. All the information collected for each co-occurrence was entered into an Access database and submitted to NMFS, the Georgia Department of Natural Resources (GDNR) and FWRI.

Suspected violations of the NMFS Final Rule to Implement Speed Restrictions to Reduce the Threat of Ship Collisions With North Atlantic Right Whales (Ship Speed Rule, 50 CFR Part 224) were also documented by the NEWS survey team. If vessels greater than 65 feet were observed traveling faster than 10 knots within the Southeast U.S. Seasonal Management Area (SEUS SMA), the survey team documented the location, name, type, length, estimated speed, and heading of the vessels. Photographic documentation was obtained whenever possible and attempts were made to contact the vessels over VHF to make them aware of the speed restrictions effective in SMAs along the east coast of the U.S. All the information collected during these events was submitted to NMFS and GDNR.

Right whales are individually identified by the patterns of cornified skin primarily located on the top of the head between the tip of the rostrum and the blowholes (Payne *et al.* 1983, Kraus *et al.* 1986). Photographs of right whale callosity patterns and other features, including scars, are used for identification and the cataloging of individual right whales. Right whales observed during the NEWS aerial surveys were photographed and sketched in order to identify individual animals. Photographs were taken with a Canon 50D digital camera with a Canon 100-400 mm image stabilized lens at an altitude of 1000 ft (303m). All photographs obtained during the 2010-2011 NEWS survey season were compared against each other, right whale images from other SEUS aerial survey teams and the New England Aquarium's (NEA) catalog of North Atlantic right whales to determine the probable identity and resights of each individual whale encountered. Whales matched to the NEA right whale catalog were assigned preliminary EGNO numbers (EGNO = North Atlantic Right Whale Catalog Number). Right whales that could not be matched to existing animals in the NEA catalog were assigned intermatch or season codes (e.g. BK01SEUS10 and S055) provided by NEA or FWRI to assist in the preliminary matching of unknown whales. Preliminary photo analysis by the NEWS team and initial verification by NEA has been completed. However, all right whale identifications listed within this report should be considered preliminary and unverified until NEA has analyzed all photographs from the 2010-2011 SEUS calving season.

Distribution of Right Whale Sighting Information

Near real-time right whale sighting data were disseminated to the maritime community as part of a system developed to minimize the probability of right whale death or injury due to collisions with vessels (Taylor and Brooks 2002). Following completion of data collection for each right whale sighting, sighting information was relayed from the survey aircraft to a designated ground contact via satellite phone. The ground contact then distributed the sighting information to various maritime, military, management, and scientific interests in the SEUS via an email distribution list. The email included distance and direction of the sighting from the closest channel sea buoy, source of the sighting, date, time, lat/long, direction of movement, age class, and number of right whales sighted. Email recipients included right whale aerial survey teams, harbor pilots, U.S. Coast Guard (USCG) NAVTEX, state agencies, the Fleet Area Control and Surveillance Facility (FACSFACJAX) at Naval Air Station Jacksonville and other maritime interests. FACSFACJAX disseminated right whale sighting information to military ships and aircraft operating throughout the SEUS, and the USCG used NAVTEX to notify large commercial vessels throughout the SEUS. Right whale reports also allowed aerial survey teams to investigate and verify sightings obtained from other sources such as the USCG, other military ships, recreational vessels, dredges, and aircraft. If a right whale sighting occurred within 5 nmi of the

Brunswick channel, the Brunswick harbor pilots were contacted directly by the ground contact with the sighting information. Sightings were also entered into the Mandatory Ship Reporting (MSR) system.

Results

Aerial Surveys

Thirty-five NEWS surveys, totaling 184.3 hours of survey effort, were conducted from 1 December 2010 to 31 March 2011 (Table 2). Overall, 13,342.4 nmi of trackline were flown, with 98% flown in a sea state ≤ 3 . The complete NEWS area was surveyed during 54% of flights ($n = 19$ days). Incomplete surveys occurred when required survey criteria for weather/sea conditions were not met ($n = 9$), two-plane contingency surveys were flown ($n = 4$), an entangled or distressed whale was sighted ($n = 2$) or limited flight hours were available before scheduled maintenance ($n = 1$). Excluding one-plane or two-plane contingency effort outside the NEWS survey area, a total of 12,998.3 nmi of trackline was flown solely within the NEWS area (Table 3). Non-survey days resulted from poor weather conditions ($n = 67$), aircraft maintenance or mechanical issues ($n = 11$), pilot unavailability ($n = 7$) and dedicated disentanglement aerial support flights ($n = 1$; Table 4). On six days that the EcoHealth Alliance (EHA) survey team could not fly the NEWS area (8 and 28 December 2010, 15 January, 16 March and 18 - 19 March 2011), FWRI flew one- or two-plane contingency flights in the NEWS zone. No right whales were sighted in the NEWS area during these contingency flights.

The spatial distribution of survey effort in the NEWS survey area (Fig. 3, 4) varied due to weather (e.g. sea state, rain, fog, low ceiling) and survey logistics (e.g. two-plane contingency flights, entangled or distressed whale response). Survey effort was greatest in the western portions of the NEWS survey area (i.e. west of $80^{\circ} 55.0W$) (range: 29 – 34 surveys; Fig. 3). The two northernmost tracklines (tracklines 13 and 14) and the eastern end of trackline 12 were flown the least (range: 22 – 25 surveys; Fig. 3), in part because these areas were not flown during two-plane contingency flights.

Survey effort varied among months (Fig. 4; Table 5), with the lowest effort occurring in December ($n = 3,084.5$ nmi flown) due to poor weather conditions, required pilot training, plane mechanical issues and two-plane contingency flights. The greatest survey effort occurred in January ($n = 3,513.2$ nmi flown) with seven of eight surveys complete (Fig. 4; Table 5). As with overall effort, monthly survey effort was biased spatially toward the western portions of the survey area (Fig. 4).

Sightings

A total of 26 right whale sighting events consisting of 50 right whales were documented during the NEWS surveys (average = 1.9 whales per sighting, range: 1 - 5) (Appendix 1). The first sighting was on 3 December 2010 and the last sighting was on 26 March 2011. Twelve of the 26 sightings were mother/calf pairs, nine were single animals, and five sightings were groups of two to five right whales (Fig. 5). The number of whales sighted each month did not correspond to survey effort. December and February both had the greatest number of right whales sighted ($n = 17$), followed by January ($n = 15$) and March ($n = 1$). The greatest number of sightings occurred in December ($n=11$), followed by January ($n=7$), February ($n=7$) and March ($n=1$) (Fig. 4, 6). Fourteen sightings occurred outside of the right whale critical habitat; seven of these were mother/calf pairs (Fig. 5). One of the 26 sightings ($n = 2$ whales) was documented in the CEWS survey area while the NEWS team was flying a two-plane contingency flight.

Average right whale sighting distance from the survey transect line was 0.36 nmi (SD = 0.36). Sighting distances ranged from 0.0 nmi to 1.43 nmi, with all sightings occurring in a Beaufort sea state ≤ 3 (Fig. 7).

Preliminary photo analysis of NEWS survey sightings by the EHA team and preliminary verification by NEA resulted in the identification of seven mother/calf pairs and an additional 23 individual adult/juvenile whales, for a total of 37 individual right whales (Appendix 1). Initial comparisons of whales sighted in the different SEUS survey areas (South Carolina/northern Georgia, NEWS, CEWS and SEWS) indicate that five whales (EGNOs 1801, 2950, 3760, 3780 and S055) may have only been sighted in the NEWS survey area during the 2010-2011 season. Results may change as further photo analysis is completed.

Basic demographic information for preliminarily identified right whales is provided in Figure 8. Of the 20 mother/calf pairs documented in the SEUS during the 2010-2011 calving season, seven were documented within the NEWS survey area (EGNO's 1604, 2660, 2746, 1308, 1911, 2040, 1245 and their 2011 calves). The first five of these seven mothers were first sighted with their 2011 calves in the NEWS survey area. Of the 37 individual right whales sighted during the season, the largest demographic group was mother/calf pairs (38%), followed by adult males (14%) and juveniles of unknown gender (14%). When classified solely by age, 47% of the individual whales were adults, 27% were juveniles, 19% were calves and 8% were of unknown age.

Females with 2011 calves were the demographic group resighted the most within the NEWS survey area (average = 1.7 sightings per whale, range: 1-3). EGNO 2746 and her 2011 calf were sighted most frequently (n = 3) and were also seen 62 days apart (21 December 2010 to 21 February 2011), the longest "residency period" documented by the NEWS team in the 2010-2011 season. Resight frequency for adult females without calves, presumed sexually mature males (10 years or older, Kraus *et al.* 2007) and juveniles in the NEWS survey area were 1.3, 1.0 and 1.0 sightings per whale, respectively.

Entangled Right Whales

Two entangled right whales (EGNO's 3911 and 3760) were observed by the NEWS survey team during 2010-2011 season. In total, 10.4 flight hours were spent documenting the entangled whales and providing aerial support for disentanglement efforts during the 2010-2011 calving season (Table 6).

EGNO 3911 was first sighted entangled on 25 December 2010 off of Jacksonville, Florida by the FWRI survey team. From 25 December 2010 to 14 January 2011, multiple agencies tracked, documented, assessed and attempted to disentangle the two year old female. On 15 January 2011, the NEWS survey team flew to the waters off Melbourne Beach, Florida to provide aerial support for the final disentanglement effort (Appendix 1). The disentanglement teams successfully employed sedation techniques to assist in the disentanglement efforts and it was believed that almost all of the entangling line was removed from the whale. EGNO 3911 was found floating dead off St. Augustine, Florida on 1 February 2011. During the necropsy, remaining line was found around the whale's right pectoral fin and extensively weaving in and out of the whale's baleen.

EGNO 3911 was not sighted by the NEWS survey team in the NEWS survey area during 2010-2011 season. However, on 4 January 2011, FWRI flew a dedicated flight to track and document EGNO 3911. FWRI located the entangled whale in the NEWS area and also documented three other right whales in the NEWS survey zone (Table 7).

EGNO 3760 was first sighted entangled in pink monofilament netting off Jekyll Island, Georgia by the NEWS survey team on 13 February 2011 (Fig. 5, Appendix 1). The four year old juvenile was in a surface active group with two other whales. The NEWS survey team provided aerial support to the GDNR disentanglement team for 3.5 hours. The disentanglement team was able to make multiple cuts to the netting coming out of the whale's mouth and looping over its head. It is hoped that the whale will eventually shed any remaining netting that may still be exiting the whale's mouth (S. Landry, pers. comm.). EGNO 3760 was not resighted during the 2010 – 2011 SEUS calving season.

Whale/Vessel Co-occurrences

The NEWS survey team did not observe any co-occurrences of whales and vessels during the 2010 – 2011 season. While tracking the entangled whale EGNO 3911 on 4 January 2011 in the NEWS area, the FWRI survey team observed a 62 ft recreational vessel traveling at 25 knots within 200 yards of the whale. A detailed report of the incident is attached in Appendix 2.

Ship Speed Rule Observations

The NEWS survey team did not observe any suspected violations of the NMFS Ship Speed Rule during the 2010 – 2011 SEUS calving season.

Dead, Injured or Distressed Right Whales

No dead right whales or other large whales were sighted during the 2010 – 2011 NEWS surveys. On 25 December 2010, the NEWS team sighted a right whale calf alone without a mother. The calf appeared young with multiple fetal folds, no cyamids visible and what appeared to be a white umbilicus on the calf's belly. In the 2.5 hours that the calf was observed by the NEWS survey team, no other right whales were sighted anywhere in the vicinity of the calf. The calf was generally milling in a half mile area. The calf's behaviors ranged from laying at the surface on its side with its mouth open to diving for multiple minutes. GDNR responded to the sighting by boat, documented the calf's behavior and obtained a skin sample for genetics. None of the 20 mothers documented in the SEUS during the 2010-2011 calving season are known to have lost their 2011 calves. No other sightings of a calf alone were reported during the 2010 – 2011 SEUS calving season.

Marine Animal Sightings

Four humpback whales (Table 8), five white sharks (Table 9), 211 leatherback turtles (Appendix 3) and zero manatees were sighted.

Fixed Fishing Gear Sightings

On 26 March 2011, the NEWS survey team sighted a row of four to five orange buoys located just offshore of Sapelo Island, Georgia at 31° 29.03 N, 81° 09.41W. The buoys were spaced about 100 ft apart and ran north to south parallel with the coastline.

Discussion and Recommendations

The 2010 – 2011 NEWS season represents the lowest number of sighting events, right whales sighted and number of individual whales sighted in the NEWS survey area since 2003. Thirty-seven individual right whales were documented in the NEWS survey zone during the 2010-2011 season. This represents a 49% decrease in documented individuals compared to the 2009 – 2010 season (n = 73 whales); an 80% decrease compared to the 2008 – 2009 season (n = 186 whales); and a 65% decrease compared to the previous seven survey seasons (average = 105 whales/year, Fig. 9; Table 3). Due primarily to unacceptable weather conditions, despite more liberal sea state estimates following the sea state calibration flight on 30NOV10, survey effort within the NEWS area (based on nmi of trackline flown) decreased by 2% compared to the 2009 – 2010 season (n = 13,329.2 nmi) and 29% compared to the previous seven survey seasons (average = 18,255.8 nmi/season; Fig. 9; Table 3). While survey effort during the 2010 – 2011 season was similar to the 2009 – 2010 season, a 49% reduction in the number of individual right whales during 2010 – 2011 indicates there is a lack of close correlation between effort and sightings. These reductions also suggest that other factors influence the number of right whales

present in the survey area. A sightings per unit effort analysis is needed to more clearly depict the link between effort and sightings in the NEWS survey zone.

An overall reduction in the number of right whales sighted was documented in all SEUS EWS survey areas during the 2010 – 2011 calving season. In total, approximately 163 individual right whales were sighted in the SEUS from November 2010 to April 2011, mostly within the CEWS and SEWS survey areas (Katie Jackson, FWRI, pers. comm.). This is a substantial decrease from the approximately 230 individual right whales sighted in the SEUS during the 2009-2010 season (Zani and Jackson 2010). The reduction in survey effort in the NEWS area combined with the overall reduction in the number of individual right whales sighted in the SEUS may partially explain the reduced number of right whales sighted in the NEWS area. However, since it is known that sea-surface temperature can affect right whale distribution (Keller *et al.* 2006), it is also possible that colder than average water temperatures off the coast of Georgia during the 2010-2011 season (Fig. 9) may have caused many right whales to migrate further south to the waters off the coast of Florida. Regardless of the cause of the reduction in right whale sightings, the change in right whale presence and distribution emphasizes the importance of continued management and research efforts in the SEUS to document habitat use and mitigate potential effects of human activities.

Along with the decrease in the overall number of whales sighted in the NEWS area, the average number of whales documented per sighting event in 2010 – 2011 (average = 1.9) decreased compared to the average for the past three seasons (average = 2.4 whales per sighting). The 2010-2011 surveys also reflected a change in the demographics of the sightings, with an increase in adult whales (n = 47% in 2010 – 2011; n = 37% in 2009 – 2010) and a decrease in juvenile whales sighted (n = 27% in 2010 – 2011; n = 48% in 2009 – 2010). However, since right whales move between the multiple EWS survey areas, a more complete picture of SEUS right whale demographics and behavior could be obtained if data from all SEUS survey teams were compiled and analyzed. This comprehensive analysis would give a better representation of right whale movements and residency patterns throughout the region and would be a practical tool for managers and researchers.

Acknowledgements

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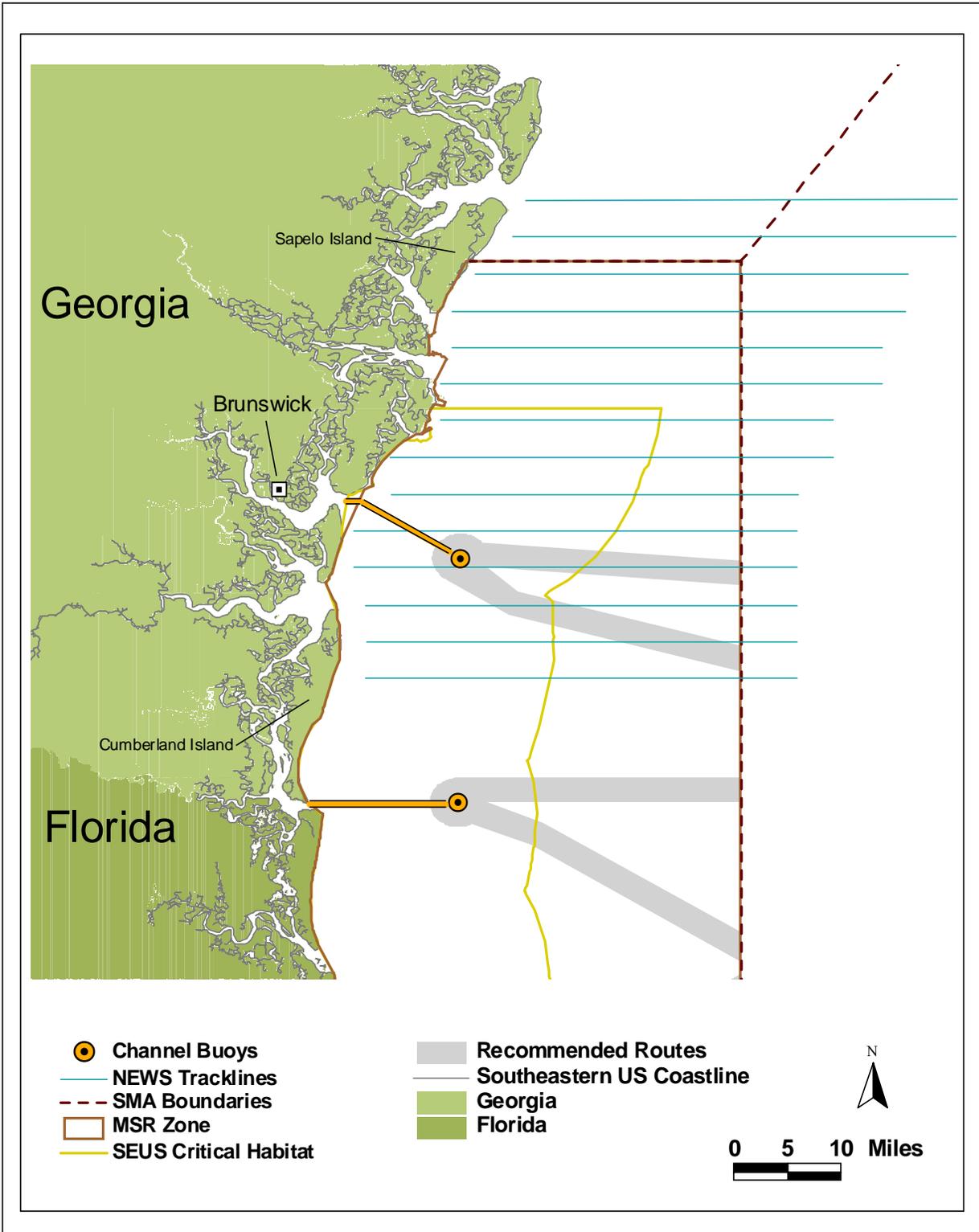


Figure 1. NEWS 2010-2011 survey tracklines.

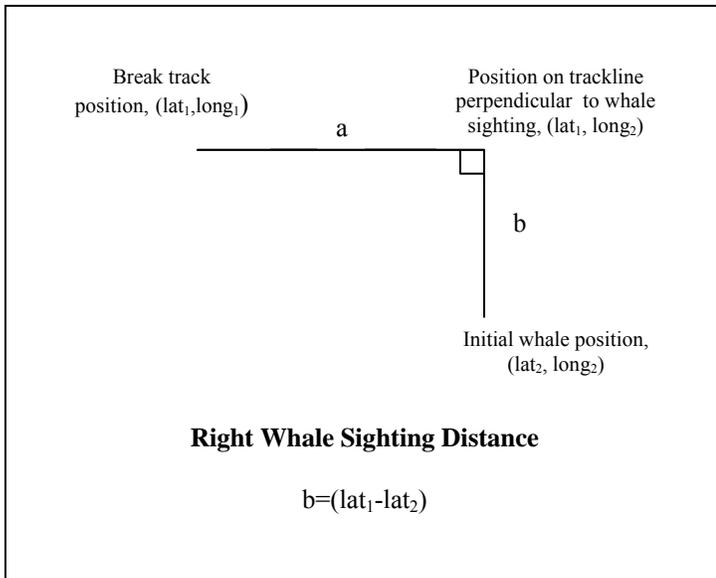


Figure 2. Diagram of method for determining sighting distances for right whales.

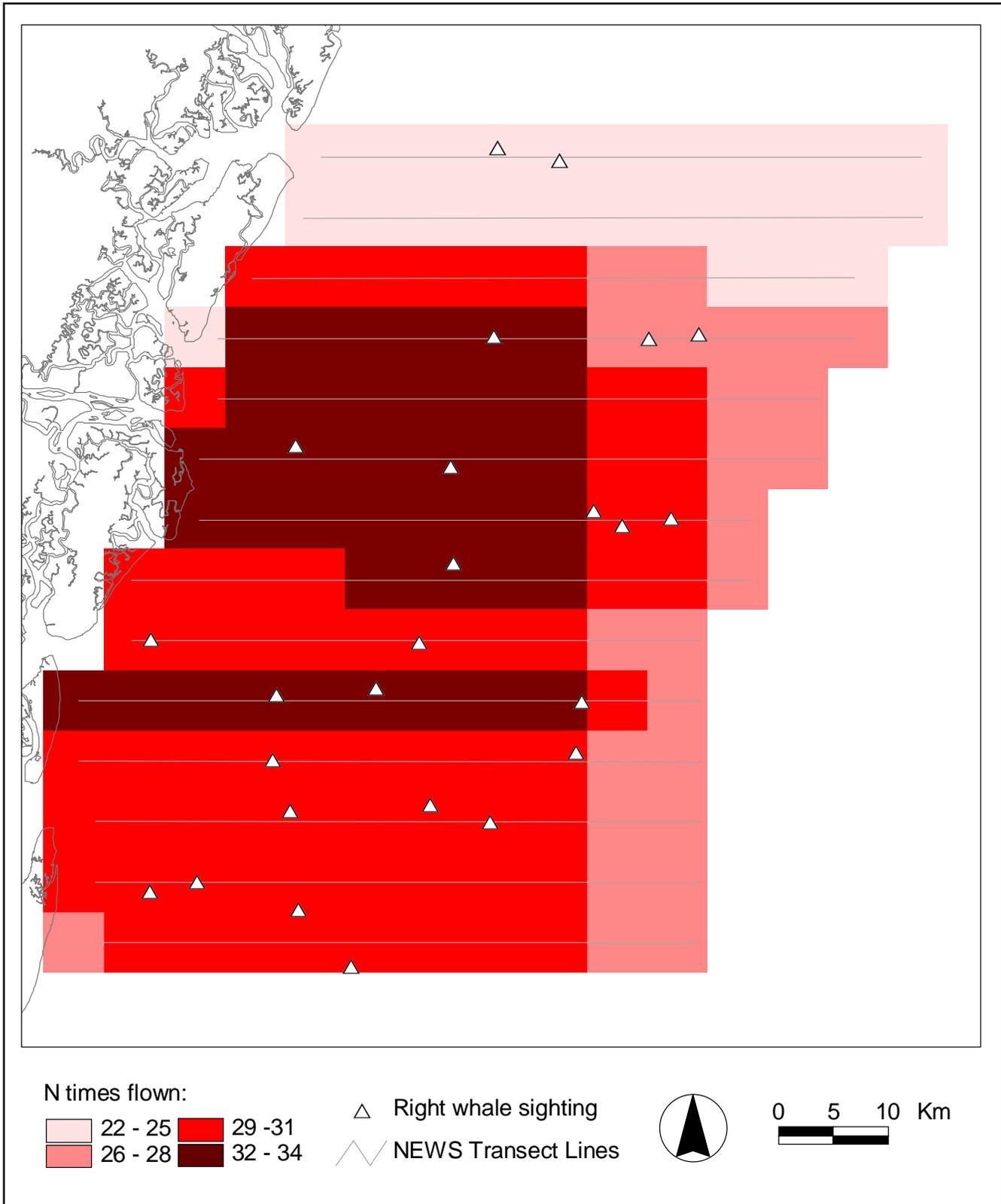


Figure 3. Spatial distribution of NEWS survey effort, 1 December 2010 to 31 March 2011.
 [Each 5.6 km² grid cell was surveyed 29 times on average (range = 22-34). Survey effort in ss ≤ 4.]



Figure 4. Spatial distribution of NEWS survey effort by month, December 2010 to March 2011.
 [Each 5.6 km² grid cell was surveyed an average of seven to eight times per month.]

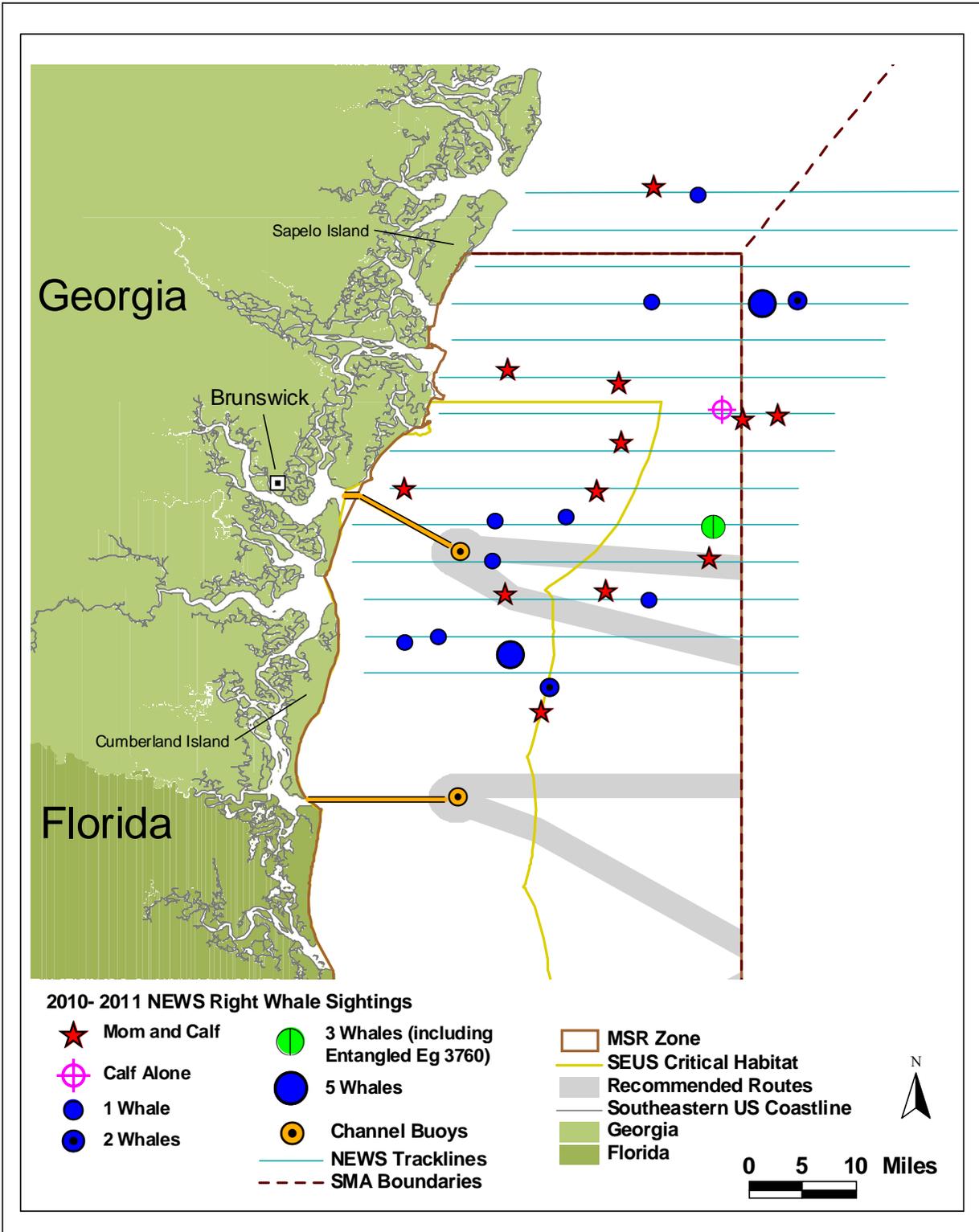


Figure 5. NEWS 2010-2011 right whale sightings.

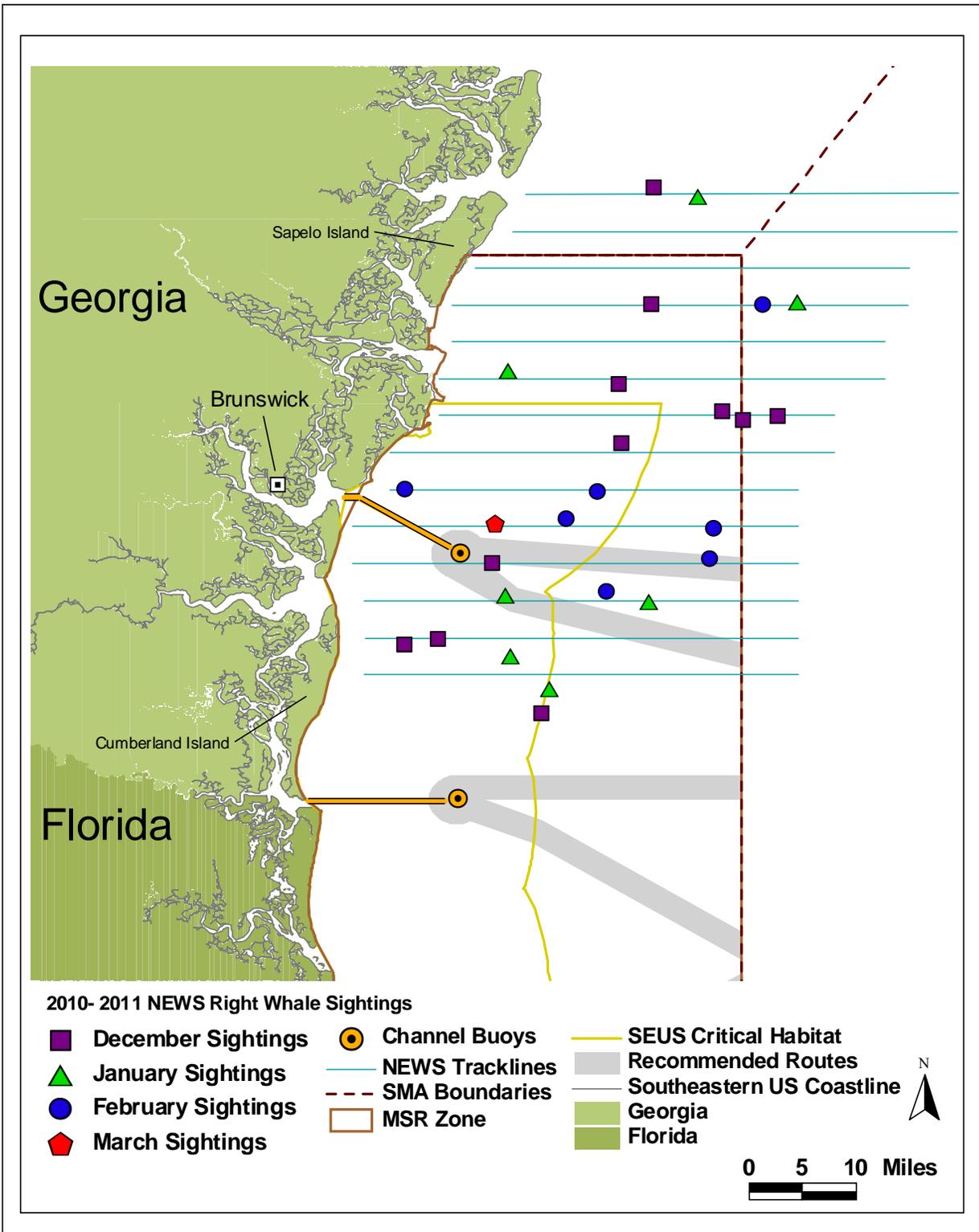


Figure 6. NEWS 2010-2011 right whale sightings classified by month.

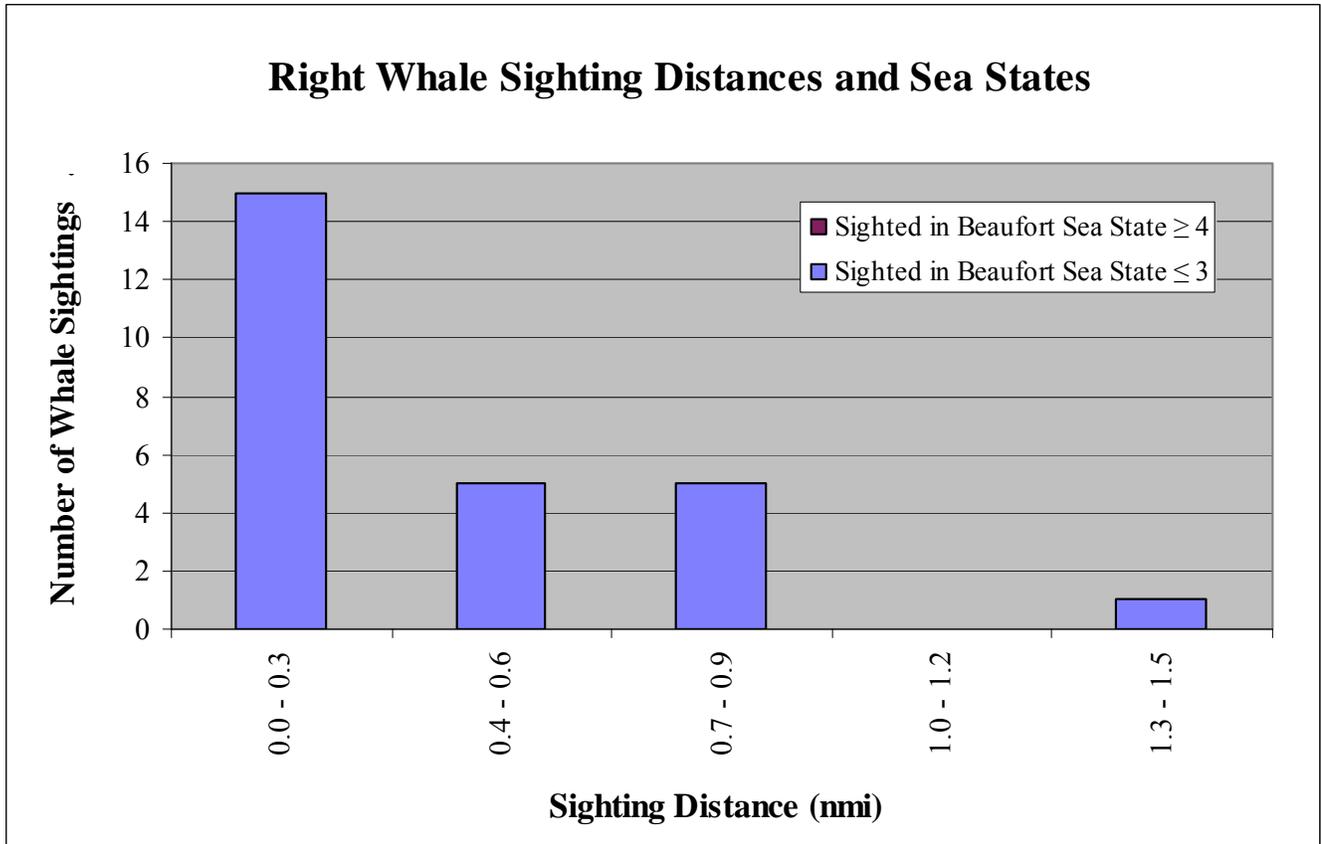


Figure 7. NEWS 2010-2011 right whale sighting distances and sea states.

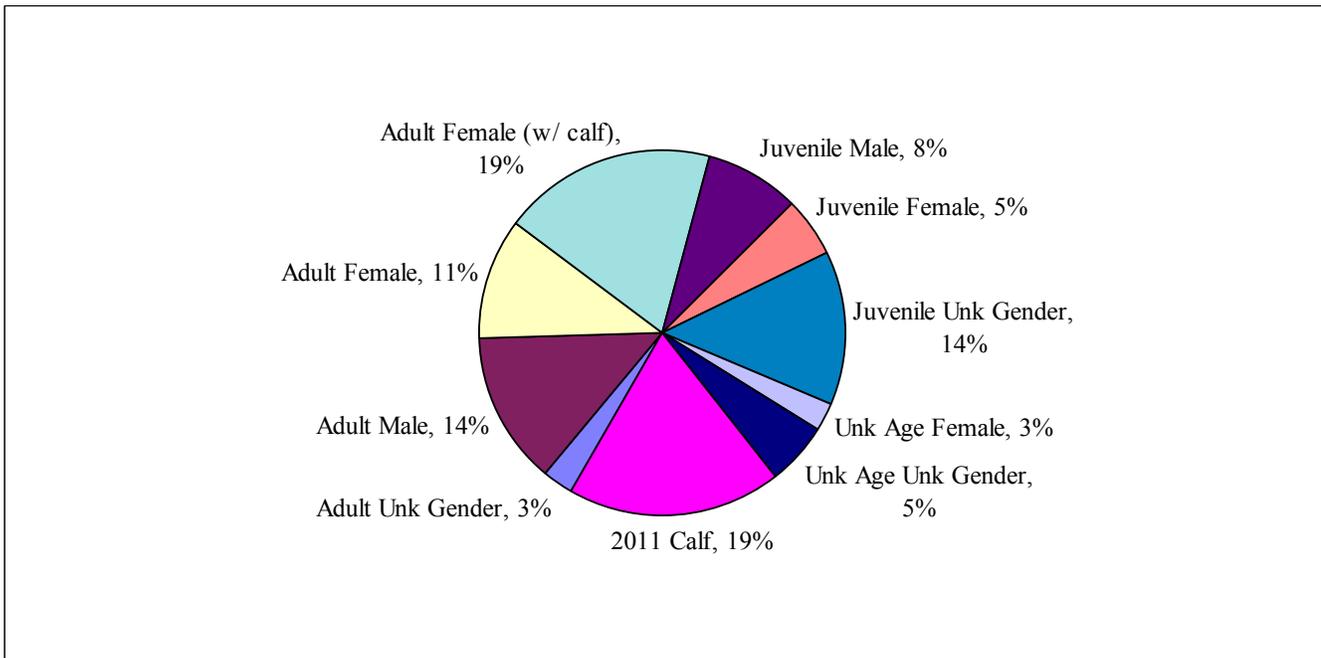


Figure 8. NEWS 2010-2011 right whale demographic summary.

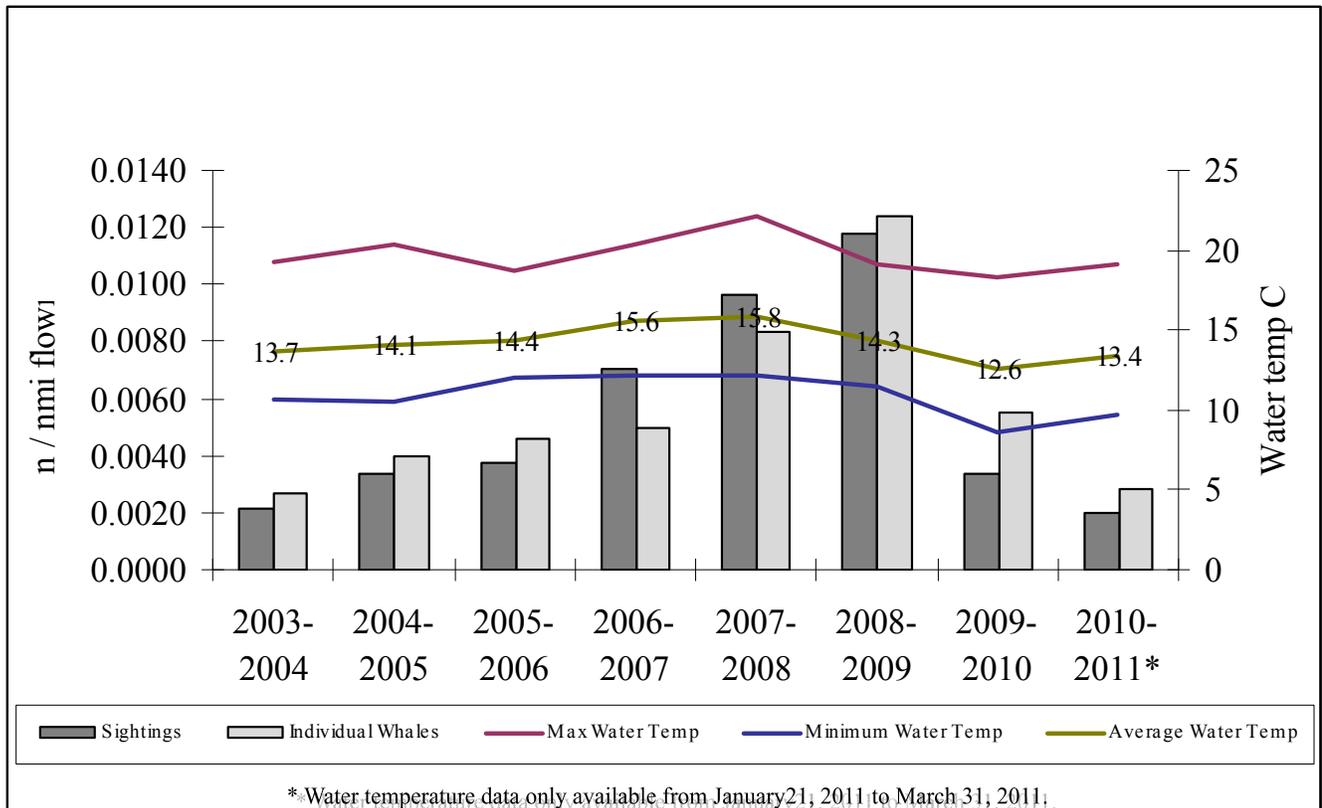


Figure 9. 2003-2011 right whale sightings/individuals vs. water temperatures at Gray’s Reef buoy. [Gray’s Reef buoy located between NEWS tracklines 11 & 12 at 31° 24.9N, 80° 52.9W (NDBC, 2011).]

Table 1. NEWS trackline waypoints.

Transect Number	Length (nmi)	Western Waypoint		Eastern Waypoint	
1	31.5	30° 53 N	81° 22 W	30° 53 N	80° 47 W
2	31.5	30° 56 N	81° 22 W	30° 56 N	80° 47 W
3	31.5	30° 59 N	81° 22 W	30° 59 N	80° 47 W
4	32.4	31° 02 N	81° 23 W	31° 02 N	80° 47 W
5	32.4	31° 05 N	81° 23 W	31° 05 N	80° 47 W
6	29.7	31° 08 N	81° 20 W	31° 08 N	80° 47 W
7	32.4	31° 11 N	81° 20 W	31° 11 N	80° 44 W
8	28.8	31° 14 N	81° 16 W	31° 14 N	80° 44 W
9	32.4	31° 17 N	81° 16 W	31° 17 N	80° 40 W
10	31.5	31° 20 N	81° 15 W	31° 20 N	80° 40 W
11	33.3	31° 23 N	81° 15 W	31° 23 N	80° 38 W
12	31.5	31° 26 N	81° 13 W	31° 26 N	80° 38 W
13	32.4	31° 29 N	81° 10 W	31° 29 N	80° 34 W
14	31.5	31° 32 N	81° 09 W	31° 32 N	80° 34 W

Total nmi 442.8

Table 2. NEWS right whale surveys, 1 December 2010 through 31 March 2011.

Date	Survey Name	Complete Surveys	Partial Surveys	Survey Hobbs Time	Total trackline nmi flown	Trackline nmi flown in Beaufort SS ≤ 3	Number of Whales Seen	Contingency Plan
03-Dec-10	NEWS20101203		1	4.8	233.8	224.1	2	
15-Dec-10	NEWS20101215	1		5.6	442.8	435.3	0	
17-Dec-10	NEWS20101217		1	4.1	283.8	283.8	1	
20-Dec-10	NEWS20101220		1	4.9	343.6	332.2	2	
21-Dec-10	NEWS20101221	1		6.6	442.8	442.8	4	
25-Dec-10	NEWS20101225		1	5.9	213.5	213.5	2	
29-Dec-10	NEWS20101229		1	4.4	313.5	313.5	0	2 Plane
30-Dec-10	NEWS20101230		1	5.4	367.9	367.9	3	2 Plane
31-Dec-10	NEWS20101231	1		6.0	442.8	442.8	3	
04-Jan-11	NEWS20110104		1	5.4	413.6	413.6	2	2 Plane
14-Jan-11	NEWS20110114	1		5.1	442.8	386.3	0	
16-Jan-11	NEWS20110116	1		5.6	442.8	442.8	3	
20-Jan-11	NEWS20110120	1		5.7	442.8	442.8	3	
23-Jan-11	NEWS20110123	1		5.5	442.8	423.8	2	
29-Jan-11	NEWS20110129	1		5.6	442.8	442.8	5	
30-Jan-11	NEWS20110130	1		6.0	442.8	442.8	0	
31-Jan-11	NEWS20110131	1		5.4	442.8	442.8	0	
06-Feb-11	NEWS20110206	1		5.6	442.8	442.8	1	
13-Feb-11	NEWS20110213		1	6.6	153.2	153.2	3	
14-Feb-11	NEWS20110214		1	4.9	376.6	305.8	0	
16-Feb-11	NEWS20110216	1		5.3	442.8	442.8	0	

Date	Survey Name	Complete Surveys	Partial Surveys	Survey Hobbs Time	Total trackline nmi flown	Trackline nmi flown in Beaufort SS < 3	Number of Whales Seen	Contingency Plan
17-Feb-11	NEWS20110217		1	3.5	290.7	290.7	0	
18-Feb-11	NEWS20110218		1	5.0	378.9	378.9	2	
19-Feb-11	NEWS20110219		1	5.5	347.4	332.1	2	
21-Feb-11	NEWS20110221		1	4.7	355.9	271.8	2	
24-Feb-11	NEWS20110224	1		5.7	442.8	442.8	2	
27-Feb-11	NEWS20110227		1	3.0	174.8	174.8	5	
05-Mar-11	NEWS20110305	1		5.4	442.8	442.8	0	
12-Mar-11	NEWS20110312	1		5.4	442.8	442.8	0	
13-Mar-11	NEWS20110313		1	5.1	367.9	364.8	0	2 Plane
14-Mar-11	NEWS20110314	1		6.0	442.8	442.8	0	
15-Mar-11	NEWS20110315		1	4.2	314.1	314.1	0	
21-Mar-11	NEWS20110321	1		5.3	442.8	442.8	0	
22-Mar-11	NEWS20110322	1		5.4	442.8	442.8	0	
26-Mar-11	NEWS20110326	1		5.7	442.8	437.1	1	
Total	35 Surveys	19	16	184.3	13342.4	13059.3	50	

Table 3. NEWS right whale survey data from December 2003 to March 2011.

NEWS Survey Season	Number of NEWS Surveys	Complete NEWS Surveys	Partial NEWS Surveys	Total Survey Hobbs Time	Total Trackline nmi Flown	Trackline nmi Flown in Beaufort SS < 3	Number of Right Whale Sighting Events	Number of Right Whales Sighted	Number of Individual Right Whales	Number of Individual Mother/Calf Pairs
2003-2004	61	31	30	279.4	21499.9	10369.8	46	83	58	13
2004-2005	67	28	39	323.0	23220.9	12089.1	79	185	93	16
2005-2006	59	26	33	273.5	19879.4	10144.8	75	178	92	14
2006-2007	55	22	33	258.1	17415.6	10243.8	123	271	87	14
2007-2008	46	28	18	261.0	17469.0	13653.5	168	414	146	17
2008-2009	44	22	20	248.1	14976.7	11871.6	176	434	186	28
2009-2010	37	15	22	181.5	13329.2	12122.8	45	104	73	6
2010-2011	35	19	16	180.1	12998.3	12715.2	26	50	37	7

Table 4. NEWS 2010-2011 non-weather related causes for no-fly days.

Date	Fly-able Day	Survey Attempted by EHA	Non-weather Related Reasons for Partial or No Survey by EcoHealth Alliance Survey Team	NEWS Area Covered by One or Two Plane Contingency
04-Dec-10	Y	N	Plane Mechanical Issue	N
05-Dec-10	N	N	NOAA Corp Pilot Safety Training	N
06-Dec-10	N	N	NOAA Corp Pilot Safety Training	N
07-Dec-10	N	N	NOAA Corp Pilot Safety Training	N
08-Dec-10	Y	N	NOAA Corp Pilot Safety Training	Y
09-Dec-10	N	N	NOAA Corp Pilot Safety Training	N
10-Dec-10	N	N	NOAA Corp Pilot Safety Training	N
11-Dec-10	N	N	NOAA Corp Pilot Safety Training	N
28-Dec-10	Y	N	Plane Mechanical Issue	Y
15-Jan-11	Y	N	EHA Survey Team Acting as Disentanglement Aerial Support	Y
24-Jan-11	Y	N	100 hr. Maintenance on NOAA46	N
25-Jan-11	N	N	100 hr. Maintenance on NOAA46	N
26-Jan-11	N	N	100 hr. Maintenance on NOAA46	N
27-Jan-11	N	N	100 hr. Maintenance on NOAA46	N
28-Jan-11	N	N	100 hr. Maintenance on NOAA46	N
16-Mar-11	Y	N	100 hr. Maintenance on NOAA46	Y
17-Mar-11	Y	N	100 hr. Maintenance on NOAA46	N
18-Mar-11	Y	N	100 hr. Maintenance on NOAA46	Y
19-Mar-11	Y	N	100 hr. Maintenance on NOAA46	Y

Table 5. NEWS 2010-2011 survey effort per month.

Survey Month	Number of NEWS Surveys	Number of complete NEWS Surveys	NEWS Survey Hobbs Time	Total trackline nmi flown	Trackline nmi flown in Beaufort SS < 3	Number of Whales Seen
December 2010	9	3	47.7	3084.5	3055.9	17
January 2011	8	7	44.3	3513.2	3437.7	15
February 2011	10	3	49.8	3405.9	3235.7	17
March 2011	8	6	42.5	3338.8	3330.0	1
Total	35	19	184.3	13342.4	13059.3	50

Table 6. NEWS survey team 2010-2011 entanglement related flights.

Date	Flight Name	Disentanglement Support Flight Hours	Description of Flights
15-Jan-11	NEWS20110115	6.9	Sedation and Disentanglement Aerial Support off Melbourne Beach, Florida for Entangled Whale EGNO 3911
13-Feb-11	NEWS20110213	3.5	Disentanglement Aerial Support off Jekyll Island, Georgia for Entangled Whale EGNO 3760
	Total	10.4 hrs	

Table 7. 2010-2011 FWRI right whale sightings in the NEWS survey area.

Sighting Event	Month	Day	Year	Time (Local)	Latitude	Longitude	Number of Whales Sighted	Time of Report	Sighting Identifier	EGNO	Sighting Source
1	01	04	2011	0946	31.01167	-81.18833	2 (Mom/Calf)	0956	SEWS016	1911 and Calf	FWRI
2	01	04	2011	1027	30.97167	-81.10667	1	1034	SEWS017	1968	FWRI
3	01	04	2011	1208	30.95000	-81.09500	1 (Entangled)	1251	SEWS018	3911	FWRI

Table 8. NEWS survey team 2010-2011 humpback whale sightings.

Sighting Event	Month	Day	Year	Time (Local)	Survey Name	Latitude	Longitude	Number of Whales	Heading	Season Code	Comments
1	02	13	2011	1130	NEWS20110213	31.02372	-81.12048	1	W	SEUS 1105	Ventral pleats partially inflated while swimming subsurface
2	03	13	2011	1014	NEWS20110313	30.67908	-81.37586	1	S	SEUS 1110	Sighted in CEWS survey area during two-plane contingency flight
3	03	14	2011	0948	NEWS20110314	30.94495	-81.31835	1	SW	SEUS 1110	Resight of humpback seen on 13 March, 2011
4	03	26	2011	0942	NEWS20110326	30.92650	-81.26972	1	N/A	SEUS 1104	Sighted earlier in NEWS area on 18 March 2011 by FWRI survey team

Table 9. NEWS 2010-2011 white shark sightings.

Sighting Event	Month	Day	Year	Time (Local)	Survey Name	Latitude	Longitude	Number of Sharks	Heading	Comments
1	02	21	2011	N/A	NEWS20110221	N/A	N/A	1	S	Time and location not recorded due to error. Shark about 10 ft long
2	03	13	2011	1129	NEWS20110313	30.82735	-81.24057	1	S	Shark about 10 ft long
3	03	15	2011	1010	NEWS20110315	30.98192	-81.06029	1	WSW	Shark about 5-6 ft long
4	03	15	2011	1032	NEWS20110315	31.04577	-81.05918	1	SSW	Shark about 7-8 ft long
5	03	26	2011	1231	NEWS20110326	31.34082	-80.78622	1	WSW	Shark about 5 ft long

Appendix 1. NEWS survey team 2010-2011 right whale sightings.

Whale Number	Month	Day	Year	Time (Local)	Survey Name	Latitude	Longitude	RIWH Letter	EGNO	Time of Report (Local)	NEWS Number	Comments	Sighting Distance (nmi)
1	12	03	2010	1214	NEWS20101203	31.54140	-80.97925	A	1604	1241	NEWS001	w/ Calf	0.45
2	12	03	2010	1214	NEWS20101203	31.54140	-80.97925	B	2011 Calf of 1604	1241	NEWS001	Calf	0.45
3	12	17	2010	1204	NEWS20101217	30.92510	-81.31437	A	S055	1238	NEWS002	Possible Yearling	0.50
4	12	20	2010	1427	NEWS20101220	31.19680	-81.02238	A	1604	1453	NEWS003	w/ Calf	0.76
5	12	20	2010	1427	NEWS20101220	31.19680	-81.02238	B	2011 Calf of 1604	1453	NEWS003	Calf	0.76
6	12	21	2010	1141	NEWS20101221	31.23393	-80.81148	A	2660	1217	NEWS004	w/ Calf	0.03
7	12	21	2010	1141	NEWS20101221	31.23393	-80.81148	B	2011 Calf of 2660	1217	NEWS004	Calf	0.03
8	12	21	2010	1228	NEWS20101221	31.27757	-81.02508	C	2746	1256	NEWS005	w/ Calf	0.38
9	12	21	2010	1228	NEWS20101221	31.27757	-81.02508	D	2011 Calf of 2746	1256	NEWS005	Calf	0.38
10	12	25	2010	1055	NEWS20101225	31.38442	-80.98306	A	3981	1121	NEWS006		0.07
11	12	25	2010	1206	NEWS20101225	31.24065	-80.88668	B	Unknown 2011 Calf	1517	NEWS007	Calf Sighted Alone	0.34
12	12	30	2010	1030	NEWS20101230	30.83202	-81.13012	A	2746	1136	NEWS008	w/ Calf, Sighted in CEWS Survey Area	0.09
13	12	30	2010	1030	NEWS20101230	30.83202	-81.13012	B	2011 Calf of 2746	1136	NEWS008	Calf, Sighted in CEWS Survey Area	0.09
14	12	30	2010	1135	NEWS20101230	30.93235	--81.26900	C	2009 Calf of 1151	1159	NEWS009		0.02
15	12	31	2010	1117	NEWS20101231	31.03410	-81.19627	A	3230	1159	NEWS010		0.10
16	12	31	2010	1256	NEWS20101231	31.22790	-80.85880	B	1308	1314	NEWS011	w/ Calf	0.25
17	12	31	2010	1256	NEWS20101231	31.22790	-80.85880	C	2011 Calf of 1308	1314	NEWS011	Calf	0.25
18	01	04	2011	1328	NEWS20110104	30.99213	-81.17970	A	1911	1354	NEWS012	w/ Calf	0.93
19	01	04	2011	1328	NEWS20110104	30.99213	-81.17970	B	2011 Calf of 1911	1354	NEWS012	Calf	0.93
20	01	15	2011	1047	NEWS20110115	28.00275	-80.50950	A	3911	1455	NEWS013	Entangled, Sighted off Melbourne Beach, FL	N/A
21	01	16	2011	0929	NEWS20110116	31.53013	--80.91900	A	3670	1016	NEWS014		0.23
22	01	16	2011	1136	NEWS20110116	31.29425	--81.17515	B	2040	1159	NEWS015	w/ Calf	0.68
23	01	16	2011	1136	NEWS20110116	31.29425	--81.17515	C	2011 Calf of 2040	1159	NEWS015	Calf	0.68
24	01	20	2011	1210	NEWS20110120	30.86337	-81.12032	A	3530	1240	NEWS016		0.59
25	01	20	2011	1210	NEWS20110120	30.86337	-81.12032	B	3540	1240	NEWS016		0.59
26	01	20	2011	1308	NEWS20110120	30.98308	-80.98660	C	3780	1344	NEWS017		0.00
27	01	23	2011	1406	NEWS20110123	31.38688	-80.78465	A	3230	1439	NEWS018		0.19
28	01	23	2011	1406	NEWS20110123	31.38688	-80.78465	B	3915	1439	NEWS018		0.19
29	01	29	2011	1110	NEWS20110129	30.90965	-81.17168	A	2608	1146	NEWS019		1.43
30	01	29	2011	1110	NEWS20110129	30.90965	-81.17168	B	2406	1146	NEWS019		1.43
31	01	29	2011	1110	NEWS20110129	30.90965	-81.17168	C	2770	1146	NEWS019		1.43
32	01	29	2011	1110	NEWS20110129	30.90965	-81.17168	D	1719	1146	NEWS019		1.43
33	01	29	2011	1110	NEWS20110129	30.90965	-81.17168	E	1803	1146	NEWS019		1.43
34	02	06	2011	1210	NEWS20110206	31.09347	-81.09660	A	1968	1237	NEWS020		0.59
35	02	13	2011	1205	NEWS20110213	31.08253	-80.89823	A	1934	1307	NEWS021		0.00
36	02	13	2011	1205	NEWS20110213	31.08253	-80.89823	B	3770	1307	NEWS021		0.00

Whale Number	Month	Day	Year	Time (Local)	Survey Name	Latitude	Longitude	RIWH Letter	EGNO	Time of Report (Local)	NEWS Number	Comments	Sighting Distance (nmi)
37	02	13	2011	1205	NEWS20110213	31.08253	-80.89823	C	3760	1307	NEWS021	Entangled	0.00
38	02	18	2011	1507	NEWS20110218	31.13138	-81.05487	A	1245	1530	NEWS022	w/ Calf	0.27
39	02	18	2011	1507	NEWS20110218	31.13138	-81.05487	B	2011 Calf of 1245	1530	NEWS022	Calf	0.27
40	02	19	2011	1339	NEWS20110219	31.04030	-80.90345	A	1245	1414	NEWS023	w/ Calf	0.67
41	02	19	2011	1339	NEWS20110219	31.04030	-80.90345	B	2011 Calf of 1245	1414	NEWS023	Calf	0.67
42	02	21	2011	1108	NEWS20110221	30.99667	-81.04398	A	2746	1140	NEWS024	w/ Calf	0.78
43	02	21	2011	1108	NEWS20110221	30.99667	-81.04398	B	2011 Calf of 2746	1140	NEWS024	Calf	0.78
44	02	24	2011	1337	NEWS20110224	31.13333	-81.31450	A	2040	1356	NEWS025	w/ Calf	0.00
45	02	24	2011	1337	NEWS20110224	31.13333	-81.31450	B	2011 Calf of 2040	1356	NEWS025	Calf	0.00
46	02	27	2011	1231	NEWS20110227	31.38310	-80.83245	A	S067	1307	NEWS026		0.00
47	02	27	2011	1231	NEWS20110227	31.38310	-80.83245	B	3843	1307	NEWS026		0.00
48	02	27	2011	1231	NEWS20110227	31.38310	-80.83245	C	2950	1307	NEWS026		0.00
49	02	27	2011	1231	NEWS20110227	31.38310	-80.83245	D	3560	1307	NEWS026		0.00
50	02	27	2011	1231	NEWS20110227	31.38310	-80.83245	E	1801	1307	NEWS026		0.00
51	03	26	2011	1047	NEWS20110326	31.08818	-81.19308	A	3780	1111	NEWS027		0.12

Appendix 2. FWRI 4 January, 2011 whale/vessel co-occurrence report forms.

Whale/Vessel Interaction Report Form

Date Unique Report #

Survey Agency or Organization: <input type="text" value="FWC"/>	Contact: <input type="text" value="Katie Jackson 904-237-4220"/>
Survey Area: <input type="text" value="Disentanglement Support (Relocation and Photo Documentation)"/>	
Observer's Last Name(s): <input type="text" value="Jackson, Jakush"/>	
Are there photos? <input type="checkbox"/> Yes <input type="checkbox"/> No	Location/name of photo files: <input type="text" value="2011-01-04-SEWS"/>
Is there video? <input type="checkbox"/> Yes <input type="checkbox"/> No	Location/name of video files: <input type="text"/>

Whale Information (Initial)

Time of initial whale sighting (local, 24 hour): <input type="text" value="1040"/>	Total number of whales: <input type="text" value="1"/>	Number of calves: <input type="text" value="0"/>
Whale IDs: <input type="text" value="2009 CalfOf 2611 (Entangled)"/>		
Whale's initial activity (select the one that best fits; use description for additional activities)		
Select: <input type="text" value="Swimming/Traveling"/>		
Description of whale activity	<input type="text" value="Entangled whale initially traveling North, mostly subsurface."/>	
Heading of Whale/Whale group: <input type="text" value="N"/>		
Whale's initial latitude: <input type="text" value="30.95217"/>	Whale's initial longitude: <input type="text" value="-81.11167"/>	(NAD 83 datum assumed)

Whale Information (Post Interaction)

Time whale was observed at the last location (local, 24 hour): <input type="text" value="1139"/>		
Whale's last latitude: <input type="text" value="30.953"/>	Whale's last longitude: <input type="text" value="-81.09033"/>	(NAD 83 datum assumed)
Did the whale change course? <input type="checkbox"/> Yes <input type="checkbox"/> No	Did the whale's activity change? <input type="checkbox"/> Yes <input type="checkbox"/> No	
New heading of Whale/Whale group: <input type="text" value="E"/>		
Description of activity/direction change:		
<input type="text" value="Behavior and heading did not appear altered by vessel"/>		

Additional Information

Upon initial sighting the whale was heading north but over the course of the observation the whale traveled east. The whale's speed varied and was often observed slowly turning slightly left before diving and resuming previous heading. Post interaction time and location is not the final/last pass on entangled whale. No photos of whale and vessel in the same frame.

Later the whale passed through the Brunswick, GA shipping channel in front of outbound car carrier "Bishu Highway". Car carrier was traveling just under 10 knots and appeared to not be a threat to the whale given its consistent heading. Aircraft stayed on scene with entangled whale.

Whale/Vessel Interaction Report Form

Date

Unique Report #

Vessel Information

Is this a close approach (500 yard rule?) No Homeport State Reg. #

Vessel of (one sheet for each vessel) Time vessel was spotted (24 hour)

Vessel Length (feet) Vessel Name

Vessel Code Vessel Type:

Vessel Description

Vessel Speed (knots) Vessel Speed (Qualitative): Vessel Heading

Method of determining speed

Inbound/Outbound: Destination Port

Origin Port

Description of vessel's initial location relative to whale(s)

Vessel's initial latitude Vessel's initial longitude (NAD 83 datum assumed)

Closest distance between whale and vessel Units:

Was communication attempted? (Did you try to hail them?):

Was communication achieved? (Did they respond?):

Did the vessel's heading change?: New Heading

Did the vessel's speed change?: New Speed (knots)

New Vessel Speed Qualitative:

Description of vessel's last location relative to whale(s)

Notes on the communication effort

Time of vessel's last recorded location (local, 24 hour)

Vessel's last latitude Vessel's last longitude (NAD 83 datum assumed)

Additional whale information specific to this vessel

FWRI_SEWS_04JAN2011

Vessel 1 IMG_5940



Appendix 3. NEWS 2010-2011 leatherback turtle sightings.

Survey Date	Time (GMT)	Latitude	Longitude	Number of Leatherback Turtles Sighted
3-Dec-10	201831	31.33388	-81.00450	1
3-Dec-10	201941	31.33382	-80.96520	1
3-Dec-10	202051	31.33373	-80.92575	1
3-Dec-10	205651	31.23442	-81.08630	1
3-Dec-10	212753	31.18297	-81.12566	1
3-Dec-10	212803	31.18303	-81.13088	1
3-Dec-10	212843	31.18255	-81.15144	1
15-Dec-10	170347	30.92060	-80.90600	1
15-Dec-10	173537	30.98392	-80.87743	1
15-Dec-10	173627	30.98375	-80.85033	1
15-Dec-10	193300	31.18887	-80.72202	1
15-Dec-10	201432	31.28414	-80.67478	1
15-Dec-10	201532	31.29880	-80.65456	1
15-Dec-10	201613	31.31663	-80.65065	1
15-Dec-10	201653	31.33188	-80.65508	1
15-Dec-10	202343	31.33344	-80.87556	1
15-Dec-10	204202	31.38395	-81.10332	1
15-Dec-10	205103	31.38402	-80.80863	1
15-Dec-10	205253	31.38382	-80.74910	1
15-Dec-10	205503	31.38362	-80.67751	2
15-Dec-10	205515	31.38357	-80.67098	1
15-Dec-10	205623	31.38355	-80.63467	1
15-Dec-10	205733	31.40727	-80.62051	1
15-Dec-10	210003	31.43310	-80.67166	1
15-Dec-10	210153	31.43355	-80.73130	1
15-Dec-10	210503	31.43352	-80.83369	1
15-Dec-10	213323	31.48387	-80.71042	1
15-Dec-10	213413	31.48376	-80.68266	1
15-Dec-10	213433	31.48376	-80.67177	2
17-Dec-10	164854	30.93365	-80.84756	1
17-Dec-10	182317	31.08337	-80.88865	1
17-Dec-10	182457	31.08332	-80.83212	1
17-Dec-10	190407	31.18297	-80.75318	1
20-Dec-10	212204	31.43333	-80.69528	1
20-Dec-10	212254	31.43350	-80.72225	1
21-Dec-10	143300	30.93463	-80.89165	1
21-Dec-10	151453	31.03278	-80.77958	1
21-Dec-10	163323	31.18370	-80.73777	1
21-Dec-10	175426	31.28432	-80.67645	1
21-Dec-10	175556	31.31307	-80.65404	1
21-Dec-10	175606	31.31790	-80.65352	1
21-Dec-10	192054	31.42155	-80.62117	1

Survey Date	Time (GMT)	Latitude	Longitude	Number of Leatherback Turtles Sighted
21-Dec-10	192224	31.43267	-80.65981	1
25-Dec-10	145355	31.53388	-80.60828	1
25-Dec-10	145715	31.48425	-80.55624	1
25-Dec-10	153407	31.43390	-80.71315	1
29-Dec-10	154514	30.83274	-80.89898	1
31-Dec-10	152108	30.89117	-80.77267	1
31-Dec-10	152128	30.90192	-80.77170	2
31-Dec-10	152408	30.93275	-80.83430	2
31-Dec-10	152410	30.93282	-80.83540	1
31-Dec-10	152518	30.93318	-80.87331	1
31-Dec-10	170530	31.09720	-80.77241	1
31-Dec-10	183854	31.28888	-80.65719	1
04-Jan-11	181034	31.03440	-80.86378	1
04-Jan-11	181524	30.98482	-80.78690	1
04-Jan-11	181632	30.98330	-80.82390	1
04-Jan-11	181652	30.98282	-80.83492	1
04-Jan-11	190525	30.93403	-80.89692	1
04-Jan-11	191556	30.88306	-80.93728	1
16-Jan-11	150418	31.48313	-80.69283	1
16-Jan-11	162259	31.28344	-80.76469	1
20-Jan-11	202901	31.33323	-80.67330	1
23-Jan-11	183028	31.29718	-80.65747	1
31-Jan-11	175138	31.38298	-80.76062	1
17-Feb-11	193126	31.51100	-80.55193	1
18-Feb-11	183755	30.88428	-80.78033	1
18-Feb-11	184356	30.93297	-80.89560	1
18-Feb-11	191615	30.98408	-80.80038	1
18-Feb-11	195548	31.08395	-80.81309	1
24-Feb-11	161600	31.43300	-80.75286	1
24-Feb-11	161650	31.43295	-80.72511	1
24-Feb-11	161700	31.43293	-80.71957	1
24-Feb-11	161720	31.43290	-80.70843	1
24-Feb-11	174343	31.18460	-80.77347	1
24-Feb-11	201647	30.93417	-80.89713	1
24-Feb-11	202658	30.88483	-80.93098	1
27-Feb-11	164654	31.48583	-80.68175	1
27-Feb-11	172216	31.43499	-80.64292	1
27-Feb-11	172544	31.38317	-80.65207	1
27-Feb-11	172555	31.38343	-80.65780	1
27-Feb-11	172605	31.38352	-80.66348	1
27-Feb-11	172606	31.38353	-80.66460	1
27-Feb-11	172625	31.38332	-80.67464	1
27-Feb-11	172635	31.38312	-80.68012	1

Survey Date	Time (GMT)	Latitude	Longitude	Number of Leatherback Turtles Sighted
05-Mar-11	143336	31.55300	-80.60833	1
05-Mar-11	143626	31.53469	-80.60941	1
05-Mar-11	151856	31.42238	-80.62098	1
05-Mar-11	152116	31.38418	-80.65386	1
05-Mar-11	152506	31.38410	-80.78742	1
05-Mar-11	175541	31.03140	-80.78682	1
12-Mar-11	145723	30.88333	-80.87411	1
12-Mar-11	150503	30.93375	-80.86431	1
12-Mar-11	153705	30.98358	-80.88918	1
12-Mar-11	153715	30.98358	-80.88350	1
12-Mar-11	153745	30.98353	-80.86633	2
12-Mar-11	154055	30.99580	-80.76753	1
12-Mar-11	154446	31.03337	-80.85142	1
12-Mar-11	154456	31.03368	-80.85679	1
12-Mar-11	154606	31.03373	-80.89437	1
12-Mar-11	154626	31.03363	-80.90503	1
12-Mar-11	162236	31.10055	-80.77492	1
12-Mar-11	173958	31.28337	-80.66409	1
12-Mar-11	174218	31.33292	-80.66721	1
12-Mar-11	182449	31.43295	-80.64072	1
12-Mar-11	182549	31.43382	-80.67137	1
12-Mar-11	185931	31.48355	-80.71055	2
12-Mar-11	190101	31.48367	-80.66235	1
12-Mar-11	190141	31.48350	-80.64084	1
12-Mar-11	190151	31.48363	-80.63551	1
12-Mar-11	190211	31.48355	-80.62487	1
13-Mar-11	163049	31.01252	-80.90295	1
13-Mar-11	170320	31.09475	-80.90072	1
14-Mar-11	132436	30.88352	-80.79874	1
14-Mar-11	132506	30.88383	-80.78228	1
14-Mar-11	132806	30.93212	-80.80393	1
14-Mar-11	132826	30.93255	-80.81509	1
14-Mar-11	132836	30.93297	-80.82061	2
14-Mar-11	132926	30.93373	-80.84750	2
14-Mar-11	133026	30.9338	-80.87898	1
14-Mar-11	141957	30.98379	-80.79113	1
14-Mar-11	142327	31.03187	-80.81097	1
14-Mar-11	142337	31.03183	-80.81622	3
14-Mar-11	142407	31.03278	-80.83186	1
14-Mar-11	142417	31.03323	-80.83704	1
14-Mar-11	142427	31.03358	-80.84225	1
14-Mar-11	150117	31.08397	-80.80293	1
14-Mar-11	150137	31.08393	-80.79216	1

Survey Date	Time (GMT)	Latitude	Longitude	Number of Leatherback Turtles Sighted
14-Mar-11	150318	31.11705	-80.76987	2
14-Mar-11	150338	31.12687	-80.76890	1
14-Mar-11	150348	31.13148	-80.77029	1
14-Mar-11	150418	31.13463	-80.78493	2
14-Mar-11	150508	31.13228	-80.81152	1
14-Mar-11	181528	31.38485	-80.62790	1
14-Mar-11	185420	31.48412	-80.64993	1
14-Mar-11	190351	31.53362	-80.71900	1
15-Mar-11	133751	30.93492	-80.83082	1
15-Mar-11	133831	30.93517	-80.85300	1
15-Mar-11	142043	30.98487	-80.79072	1
15-Mar-11	142103	30.98422	-80.77982	1
15-Mar-11	142123	30.99053	-80.77187	1
15-Mar-11	142153	31.00655	-80.77107	1
15-Mar-11	142203	31.01205	-80.77075	1
15-Mar-11	142323	31.03268	-80.79502	1
15-Mar-11	142333	31.03213	-80.80038	1
15-Mar-11	151344	31.10526	-80.76940	1
15-Mar-11	151404	31.11503	-80.76870	1
15-Mar-11	151424	31.12512	-80.76804	1
15-Mar-11	151444	31.13298	-80.77525	1
15-Mar-11	164047	31.3336	-80.95555	1
21-Mar-11	173612	31.03138	-80.77632	1
21-Mar-11	173753	30.98652	-80.76781	1
22-Mar-11	151314	31.28367	-81.03873	1
22-Mar-11	153755	31.21493	-80.72212	1
22-Mar-11	165558	31.03399	-80.79044	1
22-Mar-11	170358	30.98232	-80.96401	1
22-Mar-11	173638	30.9113	-80.76753	1
22-Mar-11	173858	30.8835	-80.81403	1
22-Mar-11	174339	30.88372	-80.96419	1
26-Mar-11	131324	30.88345	-81.15655	1
26-Mar-11	131835	30.88342	-80.98186	1
26-Mar-11	132624	30.92835	-80.77109	2
26-Mar-11	132635	30.93207	-80.77335	1
26-Mar-11	132745	30.93107	-80.80891	1
26-Mar-11	132805	30.93182	-80.81969	1
26-Mar-11	132815	30.93225	-80.82507	1
26-Mar-11	133616	30.93368	-81.08225	1
26-Mar-11	140956	30.98345	-81.04066	1
26-Mar-11	141006	30.98347	-81.03502	1
26-Mar-11	141226	30.98335	-80.95582	1
26-Mar-11	141316	30.98407	-80.92758	1

Survey Date	Time (GMT)	Latitude	Longitude	Number of Leatherback Turtles Sighted
26-Mar-11	141336	30.98432	-80.91630	1
26-Mar-11	141826	31.00312	-80.77354	1
26-Mar-11	141836	31.00751	-80.77405	1
26-Mar-11	141846	31.01212	-80.77471	1
26-Mar-11	141856	31.01688	-80.77503	1
26-Mar-11	141916	31.02688	-80.77515	1
26-Mar-11	142036	31.03313	-80.81631	1
26-Mar-11	142316	31.02158	-80.88834	1
26-Mar-11	142446	31.03345	-80.90514	1
26-Mar-11	142456	31.03368	-80.91053	1
26-Mar-11	142636	31.03448	-80.96445	1
26-Mar-11	150349	31.08298	-80.92965	1
26-Mar-11	150609	31.08278	-80.85153	1
26-Mar-11	150817	31.0836	-80.78088	1
26-Mar-11	150837	31.08834	-80.77285	1
26-Mar-11	150847	31.09255	-80.77375	1
26-Mar-11	150907	31.1013	-80.77530	2
26-Mar-11	150917	31.10588	-80.77470	1
26-Mar-11	150937	31.11525	-80.77341	1
26-Mar-11	150947	31.1201	-80.77298	1
26-Mar-11	151727	31.13315	-81.01280	1
26-Mar-11	154059	31.1832	-80.95450	1
26-Mar-11	154549	31.18287	-80.79247	1
26-Mar-11	154649	31.18287	-80.75924	1
26-Mar-11	155850	31.23327	-81.04213	1
26-Mar-11	175012	31.48557	-80.55946	1