FINAL REPORT TO
GEORGIA DEPARTMENT OF NATURAL RESOURCES

# NORTHERN AND REVISED EARLY WARNING SYSTEM SURVEYS FOR RIGHT WHALES

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WILDLIFE TRUST
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## 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. The area designated as the Southeastern United States Critical Habitat (SEUS) by NOAA Fisheries in 1994 encompasses the waters from Altamaha Sound, Georgia to Sebastian Inlet, Florida out to 5-15 nm from the shoreline (50 CFR Part 226). Minimizing sources of human-caused death, injury and disturbance is the first objective of the 1991 northern right whale (*Eubalaena glacialis*) recovery plan as well as the updated draft recovery plan (NMFS 1991, 2001). Within this objective, reducing ships strikes is the first point addressed. Vessel collisions are the greatest threat to right whale survival. The SEUS calving ground includes entrances to four major shipping channels, resulting in frequent usage of these waters by large commercial and military vessels. In hopes of eliminating the risk of collision, the Early Warning System (EWS) was created to alert military and commercial vessels in the area of the presence of right whales. Early Warning System surveys were initiated in 1994 to cover areas of high whale density along the coastline from Brunswick, Georgia to St. Augustine, Florida. Data collected since that time indicates that right whales regularly utilize waters outside of the initial EWS study area. In 2002 NMFS redesigned the EWS system to include two additional survey areas to the north and south of the primary EWS coverage area. This survey effort covers waters north of that area.

The prioritized objectives of this study were to: locate right whales in their winter calving area and report those locations in near-real time to mariners operating commercial, military, and other vessels in those areas so they may elect to take actions to reduce the likelihood of collisions with right whales; determine the spatial and temporal distribution of right whales and ships occurring in the study area; and determine the number of calves produced by the population. This report examines the results of Wildlife Trust aerial survey efforts within the Northern Early Warning System (NEWS) survey area and Wildlife Trust, New England Aquarium and Florida Marine Research Institute aerial survey efforts within the Revised Early Warning System (REWS) survey area for the 2002/2003 calving season.

## Methods

*Study Area*

The Northern Early Warning System surveys (NEWS) began on 01 December 2002 and concluded on 26 January 2003. The aerial survey accident on 26 January 2003 resulted in the termination of surveys in the NEWS area and the resumption of surveys two weeks later in a revised survey area. Surveys in the revised area (REWS) were conducted from 11 February 2003 through 31 March 2003. The NEWS survey area extended from the southern end of Cumberland Island, GA north to the southern end of Sapelo Island. Fourteen east/west transect lines of varied lengths (27.0 – 31.0 nm) were flown at 3nm intervals (Figure 1). The complete survey covered 417.5nm of trackline, excluding all miles flown in transit to, from, and between transect lines in the survey area. The survey aircraft departed from Malcolm McKinnon airport on St. Simons Island, GA and returned to the same airfield each day. Survey time was approximately 5 hours without any whale sightings. The REWS survey area extended from 7 nm north of St. Augustine, FL to St. Simon's Island, GA. Twenty-four east/west transect lines of varied lengths (11.9 – 22.8 nm) were flown at 3 nm intervals (Figure 2). The complete survey covered 452.5 nm of trackline, excluding all miles flown in transit to, from, and between transect lines in the survey area. The survey aircraft departed from St. Augustine airport in St. Augustine, FL and returned to the same airfield each day. Survey time was approximately 6 hours without any whale sightings.

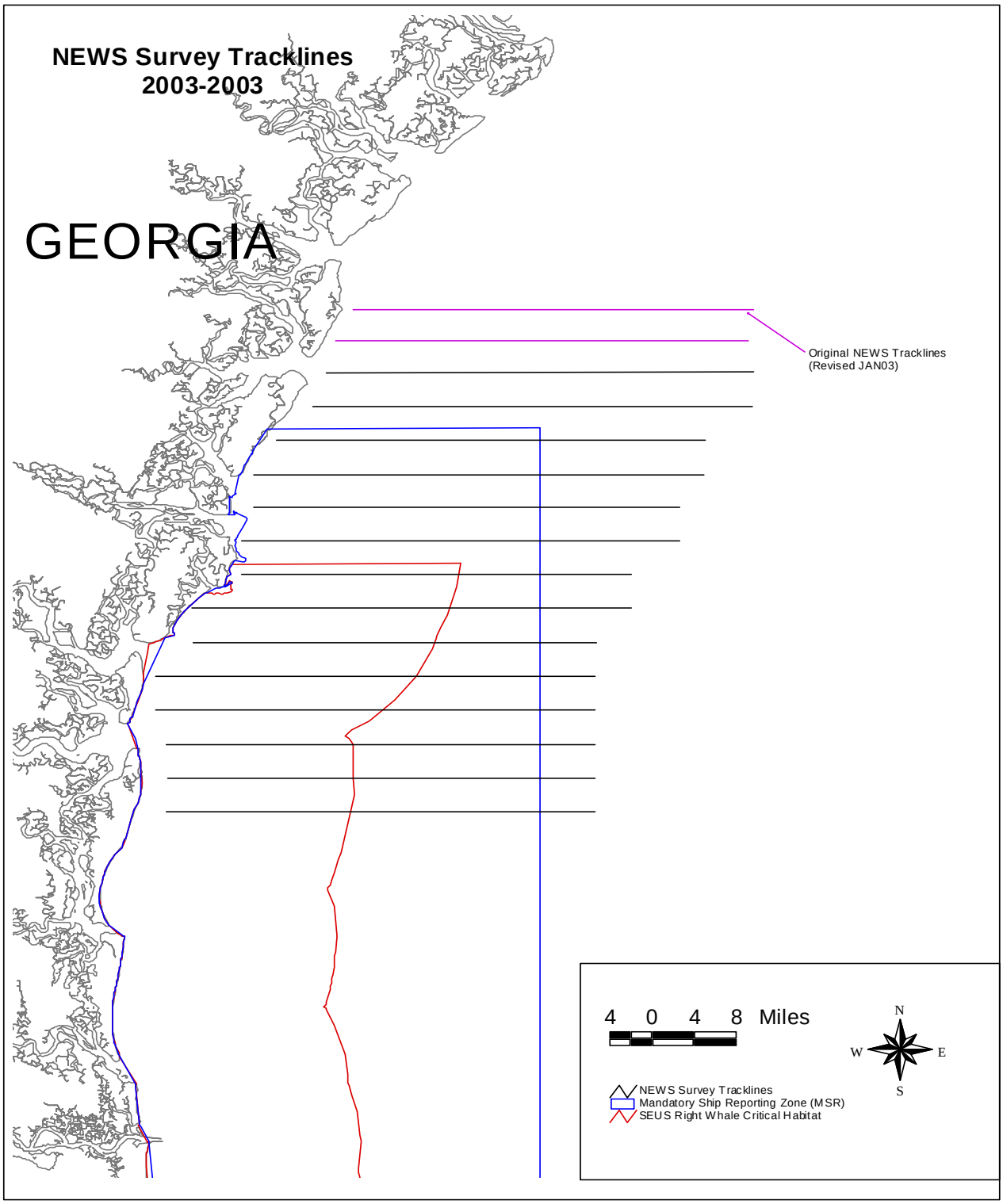


Figure 1. Map of NEWS survey tracklines flown from 01 December 2002 through 26 January 2003, including designated critical habitat and Mandatory Ship Reporting (MSR) zone.

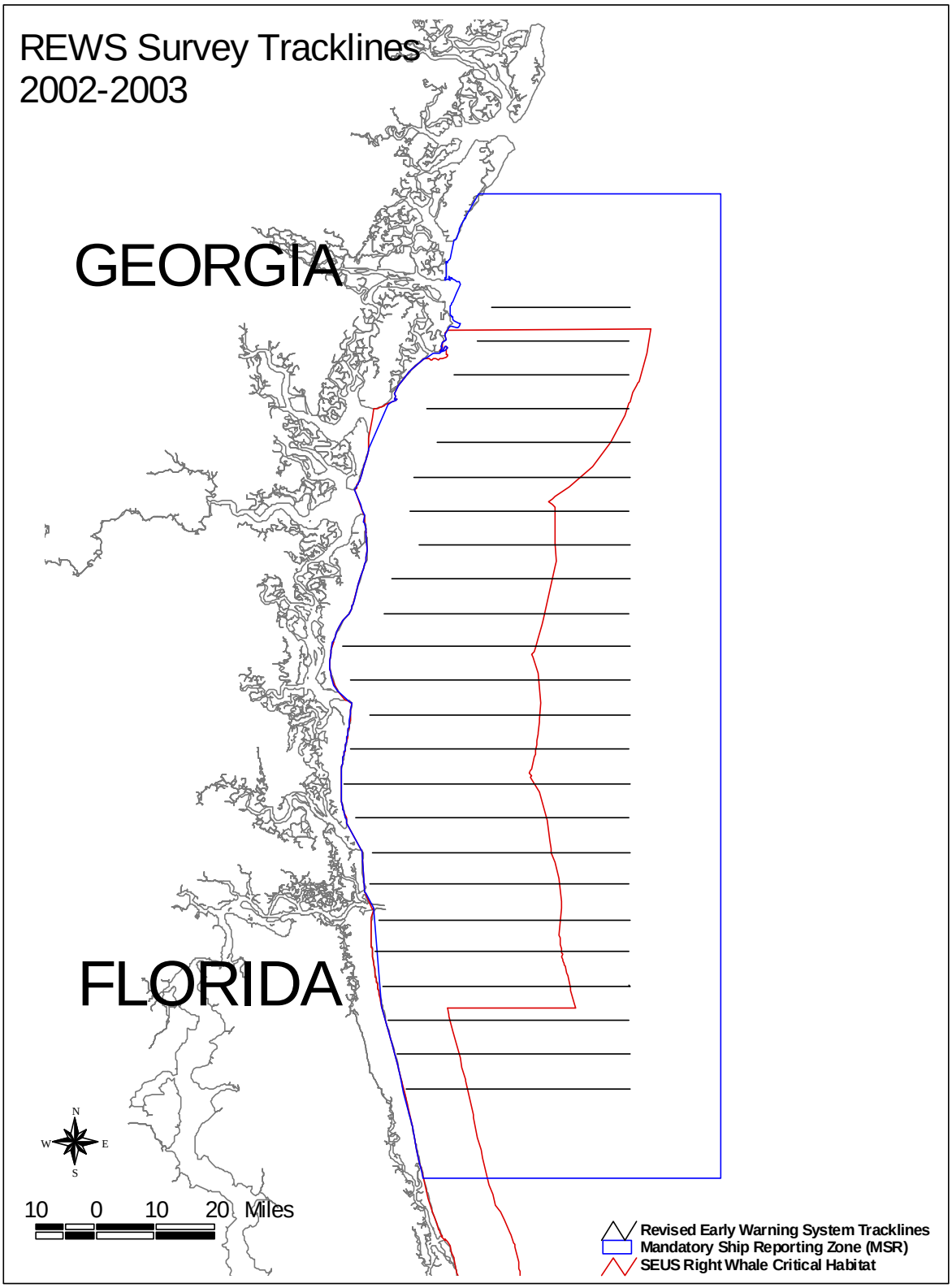


Figure 2. Map of REWS survey tracklines flown from 11 February 2003 through 31 March 2003, including designated critical habitat and Mandatory Ship Reporting (MSR) zone.

*Aerial Surveys*

Surveys were scheduled to be flown daily from 01 December 2002 through 31 March 2003, weather permitting, under VFR (visual flight rules) conditions. Surveys were conducted in a NOAA owned and operated DeHaviland Twin Otter aircraft. The aircraft was equipped with Global Positioning System navigation aids, radar, aviation VHF radio, marine VHF radio, a life raft, PFDs, survival suits, flares, EPIRB, and a satellite telephone. Surveys were flown at an altitude of 1000ft (304.8m) at a ground speed of 100knots. North or South start point was determined based on weather conditions throughout the survey area and other survey factors. Conditions necessary for survey flight included a minimum ceiling of 366m, visibility greater than 2nm, wind speed less than 20knots, and Beaufort sea state of 4 or less. The survey crew consisted of a pilot and co-pilot, two observers, data recorder, and rest position/photographer. Positions were rotated approximately every four tracklines throughout the duration of the survey with the exception of the data recorder. The observers were positioned on either side of the aircraft at the forward bubble windows and all sightings of marine animals were reported to the data recorder. The data recorder used a laptop computer to log all sightings into Logger 2000, a software program designed for marine data entry. Time, location, number, and species of all marine mammals, sea turtles, and some fish were recorded. In addition, all types of vessels observed in the survey area were recorded. Sighting angles were recorded using a digital inclinometer for all large vessels. Sighting distance for all large whales was calculated from exact overhead GPS locations. When a right whale was observed, a GPS position was recorded along the trackline at the point of observation. The survey aircraft then broke track and flew directly over the right whale to obtain an exact GPS location. The aircraft circled over each right whale encountered to obtain photographs and sketches. After right whales were documented the aircraft returned to the trackline at the point of departure to continue the survey.

Following the aerial survey accident on 26 January 2003 the three Early Warning System survey teams merged to form the REWS survey team. Staff from the Florida Marine Research Institute, the New England Aquarium, and Wildlife Trust were utilized to conduct the REWS surveys through 31 March 2003.

*Determination of Sighting Distance*

Sighting distance of right whales observed was calculated whenever possible, using the lat/long position on the trackline perpendicular to the position of the whale sighting ($lat_1$,$long_1$), and the lat/long exact overhead position of the right whale ($lat_2$,$long_2$). The whale's distance in nautical miles from the trackline was determined by subtracting the distance between the two latitude positions, as 1 minute of latitude=1nm in the study area (Figure 3).

Sighting distance of large military and commercial ships was determined using angles obtained from a digital inclinometer at the time of the sighting. The angle was obtained when the vessel was directly perpendicular to the point on the trackline where the location was marked. Using the altitude of the aircraft, and the known angle, A, of the object, the distance, x, of the object from the trackline could be determined from the following equation (Figure 3):

$$x=y(\tan A), \text{ where } y=\text{aircraft altitude in meters}$$

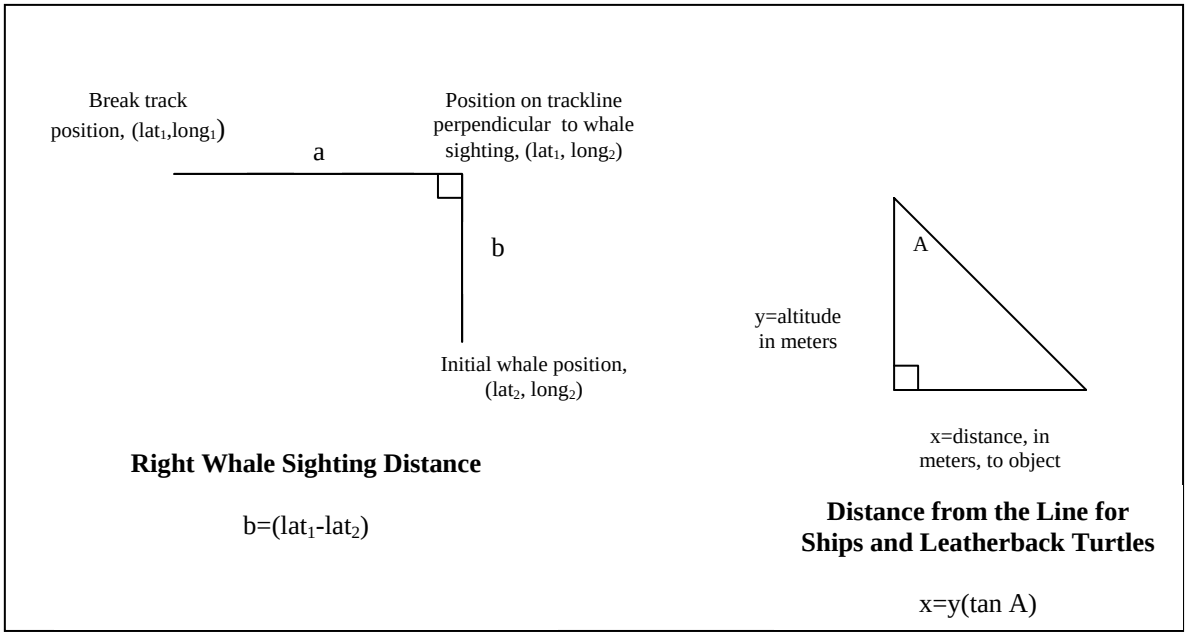


Figure 3. Diagram of methods for determining sighting distance of right whales and distance from the trackline for large military and commercial vessels during the 2002/2003 NEWS/REWS aerial surveys.

*Notification of Right Whale Sighting Information*

Upon completing data collection for each right whale sighting, the aircraft would immediately attempt to contact FACSFACJAX (Fleet Area Control and Surveillance Facility) at Naval Air Station Jacksonville. This was usually accomplished via satellite phone or cell phone. If neither method was successful, the information was either relayed via another survey aircraft or telephoned in immediately after the survey aircraft was on the ground. Information, including date, time, latitude and longitude, direction of movement if applicable, and number of animals and age class, was reported to the dispatcher. FACSFACJAX has the capability to contact all military ships and aircraft almost instantaneously with right whale location information. In addition, the facility notifies all other military and non-military interests via an alphanumeric pager system (Taylor and Brooks 2002). This includes all aerial survey teams, ship channel pilots, USCG NAVTEX, and state agencies. They receive notification of all incoming right whale sightings in near real-time via an alphanumeric pager. This supports real time notification of right whale presence to ships in hopes of eliminating right whale deaths due to ship strike. It also allows aerial survey teams to verify sightings reported from other sources such as military ships and aircraft.

*Photographic Identification*

Right whales are identified by the patterns of cornified skin primarily located on the top of the head between the tip of the rostrum and the blowhole (Payne *et al.* 1983; Kraus *et al.* 1986). All right whales observed were photographed and sketched to identify individual animals. The rest position (or the right observer in the absence of a fourth (rest) survey crewmember), shifted back to the left rear seat, equipped with a removable window. The aircraft would decrease altitude to 500ft (152.4m) while animals were photographed through the open window. Photographs were taken of callosity patterns and any body scarring using a Canon D60 digital camera with a fixed 300mm lens. The right observer was the secondary photographer using a Nikon camera with a fixed 300mm lens and either 200ASA Kodak Elitechrome or 400ASA Kodak Ektachrome slide film. This system was developed to test the use of digital cameras for right whale identification. If the digital camera images were not adequate, the slide film from the second camera was available for documentation. The left observer sketched the right whales being photographed, including callosity patterns and body scarring, and recorded observed behaviors. Photographs of right whale callosity patterns and other features, including scars, are used for identification and cataloging of individuals. Through the use of photographs, observers were able to document the number of individual whales encountered. All photographs of individual animals will be matched to the New England Aquarium's catalog of North Atlantic right whales and verified by researchers at the New England Aquarium.

Following the aerial survey accident on 26 January 2003, protocols for obtaining photographs of whales were modified due to safety concerns. Photographs were obtained from 1000ft rather than decreasing altitude to 500ft, and the amount of time allowed for circling was limited to 15min. During rare instances, for example while photographing a close call between a whale and a large vessel, the circling time was extended.

## Results

*Surveys*

The NEWS and REWS surveys had 106 available fly days during the 2002/2003 calving season (excluding 27 January through 10 February while all aircraft were grounded). Full or partial surveys were flown on 60 of these days (36 NEWS surveys and 24 REWS surveys). There were 38 complete surveys and 22 partial surveys. Partial surveys and days with no survey effort were mostly due to unacceptable weather conditions. Other factors contributing to no fly days were required rest for survey pilots after 6 days of flying, and grounded aircraft due to required 100-hour safety inspections and other maintenance. The sixty surveys covered a total of 21,935nm of trackline. Of these trackline miles, 13,701 (62%) of them were flown in a Beaufort sea state of 3 or less (Table 1).

Table 1. Survey effort for the NEWS/REWS surveys for the 2002/2003 right whale calving season.

| **2002/2003 NEWS/REWS** | **Available Days** | **Surveys Attempted** | **Complete Surveys** | **Partial Surveys** | **Total trackline miles flown** | **Trackline miles flown in Beaufort SS $\leq$ 3** |
|---|---|---|---|---|---|---|
| December | 31 | 22 | 16 | 6 | 8002 | 1618.1 |
| January | 26 | 14 | 10 | 4 | 5179 | 1759.6 |
| February | 18 | 9 | 5 | 4 | 3338 | 2065.9 |
| March | 31 | 15 | 7 | 8 | 5416 | 1269.0 |
| | | | | | | |
| Total | 106 | 60 | 38 | 22 | 21935 | 6712.6 |

*Right Whale Sightings and Identifications*

Forty-four right whale sightings were documented on the NEWS surveys and 46 sightings were documented on the REWS surveys, for a total of 90 sightings consisting of 167 animals (including 52 calves). Fifty-two cow/calf pairs, 23 single animals, and 15 groups of 2 or more adult/juvenile right whales were documented. Seven sightings (consisting of ten animals) resulted in no photographic documentation due to elusive behavior of the animals or limited circling time. Preliminary photoanalysis by the Wildlife Trust and New England Aquarium has resulted in the identification of 16 cow/calf pairs and 19 adult/juvenile animals. Twenty-four individuals (including one cow/calf pair) have yet to be identified. Many of these individuals may be duplicates of previous sightings. Identification information is included in Table 2. This information will not be considered confirmed until the New England Aquarium completes the confirmation process. All images from the 2002-2003 NEWS and REWS surveys have been forwarded to the New England Aquarium for final confirmation. Locations of the 44 NEWS right whale sightings are depicted in Figure 4 and the 46 REWS right whale sightings are depicted in Figure 5.

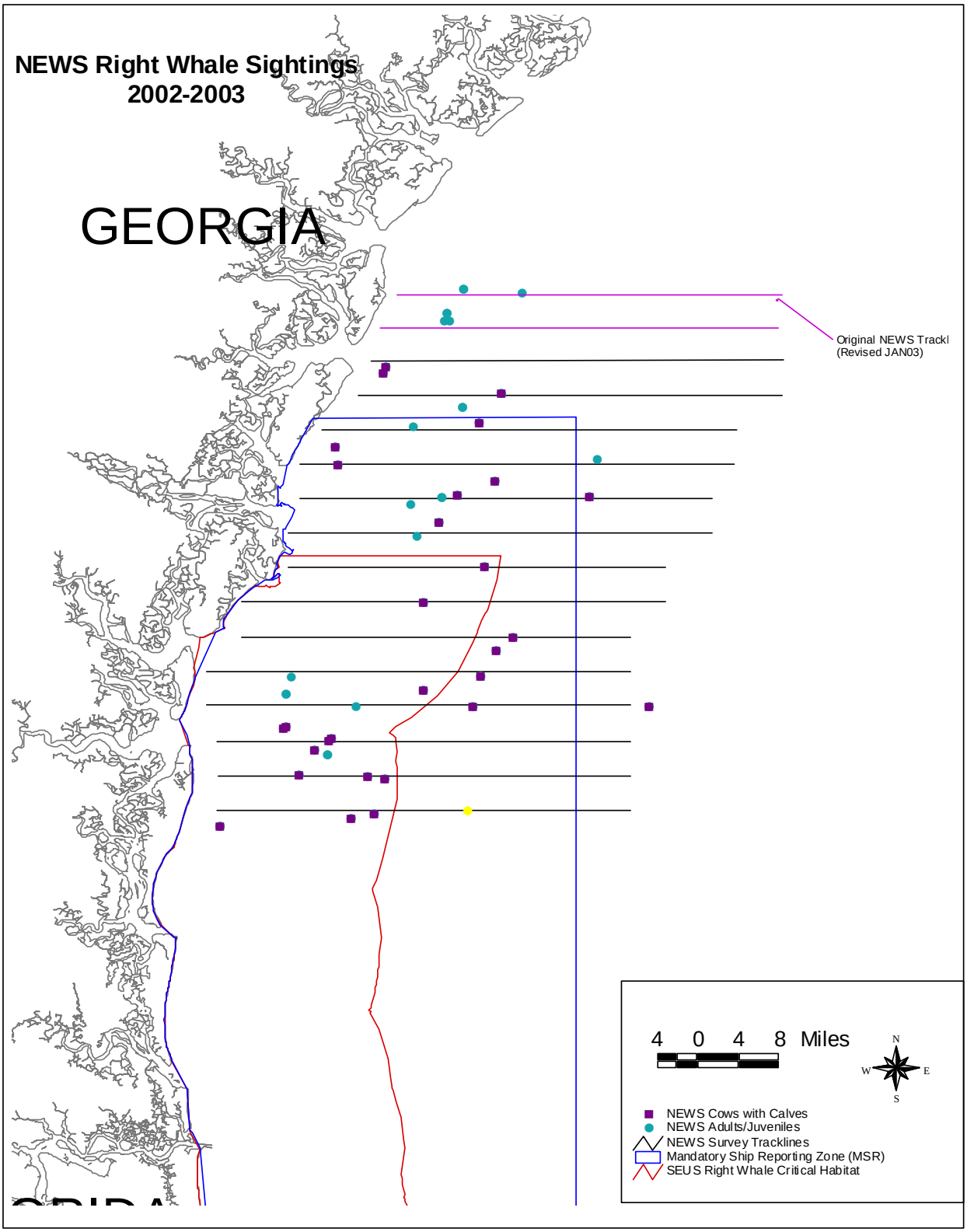


Figure 4. Right Whale sightings documented during the 2002/2003 NEWS right whale aerial surveys. The yellow circle represents the ship/whale interaction discussed on page 14.

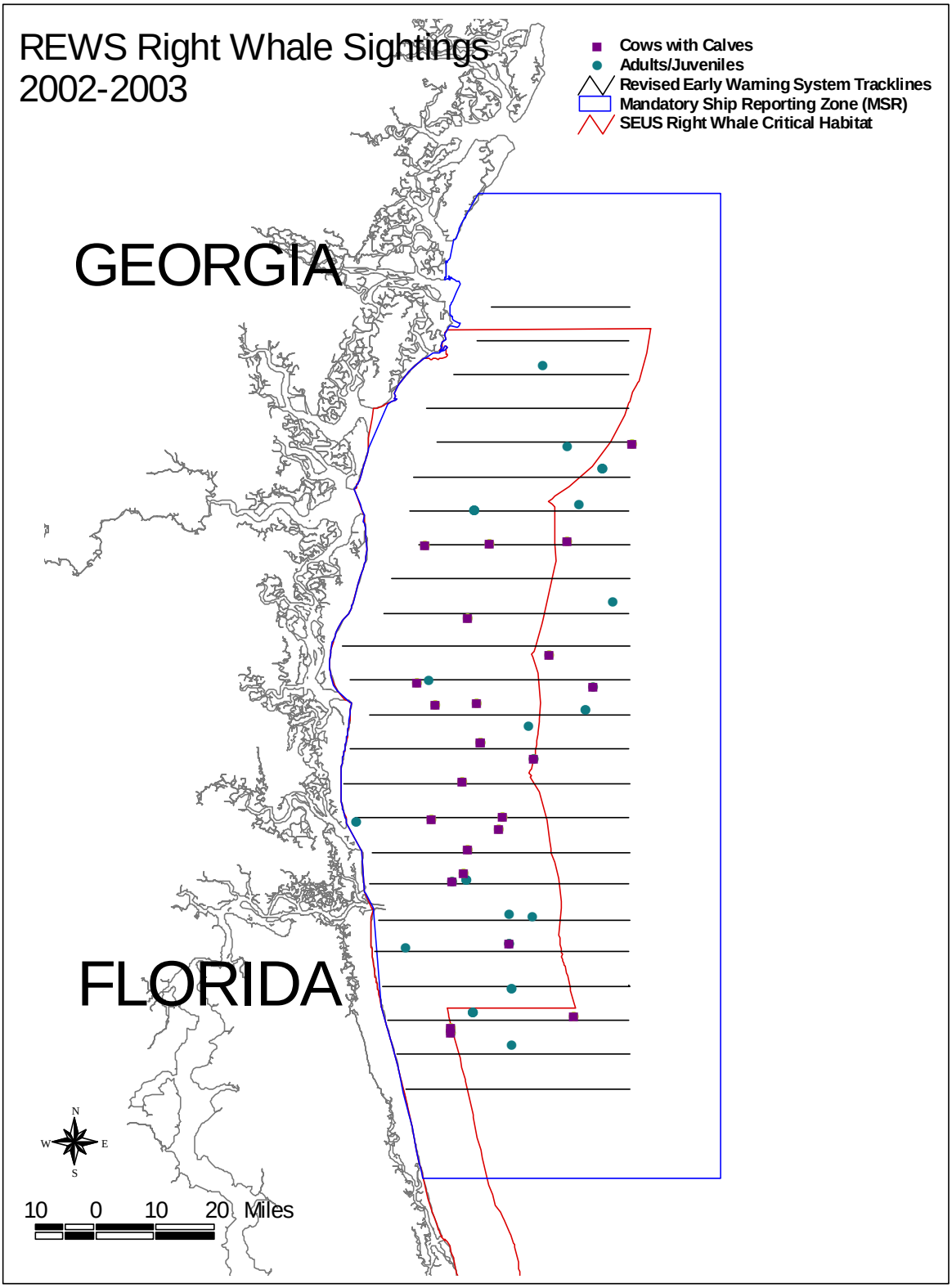


Figure 5. Right whale sightings documented during the 2002/2003 REWS right whale aerial surveys.

Table 2. Right whale survey and sightings generated by the NEWS/REWS survey team during the 2002/2003 calving season.

| Survey Number | Month | Day | Year | Survey Hobbs Time | Time | Lat Deg | Lat Min | Long Deg | Long Min | # of Egs | Cow - calf? | IDNO | Sight Dist. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| NEWS001 | 12 | 1 | 2002 | 4.5 | | | | | | | | | |
| NEWS002 | 12 | 02 | 2002 | 5.3 | 1019 | 31 | 20.22 | 81 | 1.8 | 2 | Y | 1151 | .21 |
| NEWS003 | 12 | 03 | 2002 | 4.7 | | | | | | | | | |
| NEWS004 | 12 | 06 | 2002 | 2.8 | | | | | | | | | |
| NEWS005 | 12 | 07 | 2002 | 5.8 | | | | | | | | | |
| NEWS006 | 12 | 08 | 2002 | 5.6 | | | | | | | | | |
| NEWS007 | 12 | 09 | 2002 | 3.2 | 956 | 30 | 55.62 | 81 | 6.78 | 2 | Y | no photos | N/A |
| NEWS008 | 12 | 11 | 2002 | 3.9 | 1500 | 31 | 37.8 | 80 | 56.3 | 1 | N | 1303 | .23 |
| NEWS009 | 12 | 12 | 2002 | 6.8 | 1020 | 31 | 3.42 | 81 | 4.68 | 2 | Y | 1151 | .04 |
| NEWS010 | 12 | 15 | 2002 | 6.3 | 1407 | 30 | 55.92 | 81 | 9.42 | 2 | Y | 1243 | .01 |
| NEWS011 | 12 | 16 | 2002 | 6.1 | 1400 | 30 | 8.1 | 81 | 12.4 | 2 | Y | 2029 | .12 |
| NEWS012 | 12 | 17 | 2002 | 6.2 | 1030 | 31 | 38.1 | 81 | 1.2 | 2 | N | 3139/3101 | .17 |
| NEWS012 | 12 | 17 | 2002 | | 1117 | 31 | 35.28 | 81 | 2.88 | 2 | N | 2413/UNK1 | .08 |
| NEWS013 | 12 | 18 | 2002 | 3.3 | | | | | | | | | |
| NEWS014 | 12 | 21 | 2002 | 5.7 | 1247 | 31 | 10.92 | 81 | 4.68 | 2 | Y | 1243 | .26 |
| NEWS015 | 12 | 22 | 2002 | 5.8 | 919 | 31 | 24.42 | 81 | 12.1 | 2 | Y | 1243 | .05 |
| NEWS016 | 12 | 23 | 2002 | 6.5 | 1032 | 31 | 35.94 | 81 | 2.64 | 2 | N | 1968/1503 | .13 |
| NEWS016 | 12 | 23 | 2002 | | 1127 | 31 | 30.78 | 81 | 8.1 | 2 | Y | 1711 | .23 |
| NEWS016 | 12 | 23 | 2002 | | 1134 | 31 | 31.38 | 81 | 7.8 | 2 | Y | 2114 | .1 |
| NEWS016 | 12 | 23 | 2002 | | 1231 | 31 | 26.22 | 81 | 5.58 | 1 | N | 3101 | .04 |
| NEWS016 | 12 | 23 | 2002 | | 1316 | 31 | 22.92 | 81 | 11.9 | 2 | Y | 1243 | .22 |
| NEWS017 | 12 | 26 | 2002 | 6.2 | 1258 | 31 | 4.62 | 80 | 59.8 | 2 | Y | 1151 | N/A |
| NEWS017 | 12 | 26 | 2002 | | 1415 | 31 | 0.12 | 81 | 16.3 | 2 | Y | 1243 | .37 |
| NEWS018 | 12 | 27 | 2002 | 7.8 | 1142 | 31 | 17.88 | 81 | 3.3 | 2 | Y | 2114 | .86 |
| NEWS018 | 12 | 27 | 2002 | | 1430 | 31 | 3 | 81 | 16.3 | 2 | N | UNK1/2413 | 1.96 |
| NEWS018 | 12 | 27 | 2002 | | 1540 | 30 | 55.98 | 81 | 15.2 | 2 | Y | 1243 | .09 |
| NEWS018 | 12 | 27 | 2002 | | 1624 | 30 | 52.2 | 81 | 10.8 | 2 | Y | 1151 | .82 |
| NEWS019 | 12 | 28 | 2002 | 6.6 | 1147 | 31 | 21.42 | 80 | 58.6 | 2 | N | 1303/1158 | .17 |
| NEWS020 | 12 | 29 | 2002 | 7.5 | 1122 | 31 | 20.1 | 80 | 50.5 | 2 | Y | 1301 | .04 |
| NEWS020 | 12 | 29 | 2002 | | 1452 | 30 | 58.2 | 81 | 13.9 | 2 | Y | 1243 | .64 |
| NEWS020 | 12 | 29 | 2002 | | 1602 | 30 | 51.6 | 81 | 21.9 | 3 | Y | 2114/UNK3 | 1.13 |
| NEWS021 | 12 | 30 | 2002 | 7.1 | 1034 | 31 | 27.78 | 81 | 1.32 | 2 | N | 1158/1303 | 1.15 |
| NEWS021 | 12 | 30 | 2002 | | 1407 | 31 | 1.92 | 80 | 45.5 | 2 | Y | 1301 | 2.99 |
| NEWS021 | 12 | 30 | 2002 | | 1635 | 30 | 52.62 | 81 | 8.82 | 2 | Y | 1243 | .35 |
| NEWS022 | 12 | 31 | 2002 | 5.4 | | | | | | | | | |
| NEWS023 | 01 | 02 | 2003 | 5.5 | | | | | | | | | |
| NEWS024 | 01 | 04 | 2003 | 5.6 | 1327 | 31 | 1.92 | 81 | 0.42 | 2 | Y | 1208 | .09 |
| NEWS024 | 01 | 04 | 2003 | | 1631 | 31 | 29.1 | 80 | 58 | 2 | Y | 1151 | .19 |
| NEWS025 | 01 | 05 | 2003 | 6.6 | 1245 | 31 | 7.92 | 80 | 57 | 2 | Y | 1802 | .08 |

| Survey Number | Month | Day | Year | Survey Hobbs Time | Time | Lat Deg | Lat Min | Long Deg | Long Min | # of Egs | Cow-calf? | IDNO | Sight Dist. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| NEWS025 | 01 | 05 | 2003 | | 1433 | 30 | 58.92 | 81 | 12.7 | 2 | Y | 1208 | .01 |
| NEWS026 | 01 | 06 | 2003 | 5.9 | 1049 | 31 | 26.52 | 80 | 59.9 | 2 | Y | 1946 | .68 |
| NEWS026 | 01 | 06 | 2003 | | 1252 | 31 | 6.78 | 80 | 58.5 | 2 | Y | 1151 | 1.12 |
| NEWS027 | 01 | 10 | 2003 | 5.5 | 1238 | 31 | 1.92 | 81 | 10.4 | 1 | N | no photos | .14 |
| NEWS028 | 01 | 11 | 2003 | 6.6 | 1241 | 31 | 19.98 | 81 | 3.12 | 2 | N | 1408 | .02 |
| NEWS028 | 01 | 11 | 2003 | | 1638 | 30 | 52.92 | 81 | 0.9 | 1 | N | 2123 | .18 |
| NEWS029 | 01 | 13 | 2003 | 4.9 | | | | | | | | | |
| NEWS030 | 01 | 14 | 2003 | 5.5 | 1131 | 31 | 14.1 | 80 | 59.5 | 2 | Y | 2520 | .09 |
| NEWS031 | 01 | 15 | 2003 | 0.8 | | | | | | | | | |
| NEWS032 | 01 | 16 | 2003 | 5.4 | | | | | | | | | |
| NEWS033 | 01 | 18 | 2003 | 6.1 | 1252 | 31 | 4.5 | 81 | 15.9 | 1 | N | UNK6 | .51 |
| NEWS034 | 01 | 21 | 2003 | 6.6 | 1304 | 31 | 0.06 | 81 | 16.5 | 2 | Y | 1711 | .97 |
| NEWS034 | 01 | 21 | 2003 | | 1405 | 30 | 57.78 | 81 | 12.8 | 2 | N | 1158/1303 | 1.66 |
| NEWS035 | 01 | 25 | 2003 | 6.0 | 1131 | 31 | 16.68 | 81 | 5.22 | 1 | N | no photos | N/A |
| NEWS036 | 01 | 26 | 2003 | 6.0 | 1031 | 31 | 23.28 | 80 | 49.9 | 1 | N | 1950 | N/A |
| NEWS036 | 01 | 26 | 2003 | | 1115 | 31 | 19.5 | 81 | 5.7 | 1 | N | 2002 calf of 2040 | .31 |
| REWS001 | 02 | 11 | 2003 | 6.5 | 1329 | 30 | 46.2 | 81 | 7.5 | 2 | Y | 2123 | N/A |
| REWS002 | 02 | 12 | 2003 | 6.8 | 1309 | 30 | 34.98 | 81 | 15.5 | 2 | Y | 2123 | .04 |
| REWS002 | 02 | 12 | 2003 | | 1337 | 30 | 37.02 | 81 | 8.88 | 2 | Y | 2301 | 1 |
| REWS002 | 02 | 12 | 2003 | | 1412 | 30 | 41.22 | 81 | 4.2 | 1 | N | 1909 | .08 |
| REWS003 | 02 | 13 | 2003 | 6.2 | 1628 | 30 | 26.22 | 81 | 15.1 | 1 | N | 1909 | .15 |
| REWS003 | 02 | 13 | 2003 | | 1641 | 30 | 26.16 | 81 | 16.4 | 2 | Y | 1301 | .17 |
| REWS004 | 02 | 14 | 2003 | 6.9 | 1016 | 30 | 12.78 | 81 | 16.6 | 2 | N | UNK1/2413 | 1.79 |
| REWS004 | 02 | 14 | 2003 | | 1049 | 30 | 20.64 | 81 | 11.2 | 2 | Y | 2123 | .58 |
| REWS004 | 02 | 14 | 2003 | | 1224 | 30 | 38.46 | 81 | 13.8 | 2 | Y | 2301 | .43 |
| REWS004 | 02 | 14 | 2003 | | 1457 | 31 | 11.76 | 81 | 8.04 | 1 | N | | .68 |
| REWS005 | 02 | 15 | 2003 | 6.2 | | | | | | | | | |
| REWS006 | 02 | 18 | 2003 | 6.6 | 1133 | 30 | 14.52 | 81 | 14.6 | 4 | N | 3208 | .17 |
| REWS006 | 02 | 18 | 2003 | | 1636 | 30 | 30.78 | 81 | 12.1 | 2 | Y | no photos | .82 |
| REWS007 | 02 | 19 | 2003 | 6.7 | 1119 | 30 | 11.2 | 81 | 16.8 | 3 | N | | .17 |
| REWS007 | 02 | 19 | 2003 | | 1122 | 30 | 11.8 | 81 | 16.1 | 1 | N | | .3 |
| REWS007 | 02 | 19 | 2003 | | 1126 | 30 | 11.9 | 81 | 16.9 | 1 | N | | .12 |
| REWS007 | 02 | 19 | 2003 | | 1225 | 30 | 17.2 | 81 | 4.4 | 2 | Y | 1208 | .18 |
| REWS007 | 02 | 19 | 2003 | | 1401 | 30 | 38 | 81 | 8.4 | 2 | N | 1158 | .53 |
| REWS007 | 02 | 19 | 2003 | | 1450 | 30 | 45 | 81 | 21.3 | 2 | Y | 1946 | .39 |
| REWS007 | 02 | 19 | 2003 | | 1601 | 30 | 59 | 81 | 14.4 | 5 | N | | N/A |
| REWS008 | 02 | 20 | 2003 | 6.6 | 1015 | 30 | 11.7 | 81 | 10.9 | 1 | N | no photos | .31 |
| REWS008 | 02 | 20 | 2003 | | 1042 | 30 | 13.2 | 81 | 16.6 | 2 | Y | 1151 | .2 |
| REWS008 | 02 | 20 | 2003 | | 1100 | 30 | 14.22 | 81 | 5.22 | 2 | Y | 1301 | 1.23 |
| REWS008 | 02 | 20 | 2003 | | 1130 | 30 | 16.62 | 81 | 10.9 | 2 | N | ?/3120 | .64 |

| Survey Number | Month | Day | Year | Survey Hobbs Time | Time | Lat Deg | Lat Min | Long Deg | Long Min | # of Egs | Cow-calf? | IDNO | Sight Dist. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| REWS008 | 02 | 20 | 2003 | | 1246 | 30 | 28.98 | 81 | 15 | 2 | Y | 2520 | .08 |
| REWS008 | 02 | 20 | 2003 | | 1312 | 30 | 31.62 | 81 | 18.3 | 2 | Y | 2123 | .56 |
| REWS008 | 02 | 20 | 2003 | | 1322 | 30 | 31.38 | 81 | 25.3 | 3 | Y | 1946 | .27 |
| REWS008 | 02 | 20 | 2003 | | 1443 | 30 | 43.32 | 81 | 3.42 | 1 | N | no photos | N/A |
| REWS009 | 02 | 26 | 2003 | 1.7 | | | | | | | | | |
| REWS010 | 03 | 02 | 2003 | 4.5 | 1624 | 30 | 49.38 | 81 | 15 | 2 | Y | 1208 | .57 |
| REWS011 | 03 | 03 | 2003 | 7.0 | 1436 | 30 | 22.98 | 81 | 9 | 1 | N | no photos | .21 |
| REWS012 | 03 | 05 | 2003 | 4.3 | 1456 | 30 | 23.28 | 81 | 11.2 | 1 | N | | .19 |
| REWS012 | 03 | 05 | 2003 | | 1519 | 30 | 26.88 | 81 | 15.4 | 2 | Y | 1233 | .77 |
| REWS012 | 03 | 05 | 2003 | | 1552 | 30 | 31.8 | 81 | 11.8 | 2 | Y | 1503 | .16 |
| REWS012 | 03 | 05 | 2003 | | 1642 | 30 | 41.82 | 81 | 14.2 | 2 | Y | 1817 | .71 |
| REWS013 | 03 | 06 | 2003 | 6.6 | 1134 | 30 | 55.8 | 81 | 18.9 | 2 | Y | 2123 | .59 |
| REWS013 | 03 | 06 | 2003 | | 1244 | 30 | 43.68 | 81 | 19.7 | 2 | Y | 1950 | .43 |
| REWS014 | 03 | 10 | 2003 | 6.0 | 1306 | 31 | 2.7 | 81 | 2.58 | 4 | N | 1327/1409 | .81 |
| REWS014 | 03 | 10 | 2003 | | 1452 | 30 | 43.92 | 81 | 18.6 | 1 | N | | .65 |
| REWS014 | 03 | 10 | 2003 | | 1542 | 30 | 39.9 | 81 | 9.42 | 1 | N | no photos | .93 |
| REWS015 | 03 | 11 | 2003 | 6.7 | 1108 | 30 | 20.22 | 81 | 20.7 | 1 | N | | N/A |
| REWS015 | 03 | 11 | 2003 | | 1301 | 30 | 41.7 | 81 | 18 | 2 | Y | 1503 | N/A |
| REWS016 | 03 | 12 | 2003 | 7.1 | 1023 | 31 | 4.5 | 81 | 5.82 | 1 | N | | .44 |
| REWS016 | 03 | 12 | 2003 | | 1131 | 30 | 56.22 | 81 | 5.82 | 2 | Y | 2123 | .27 |
| REWS017 | 03 | 14 | 2003 | 7.0 | 1014 | 31 | 4.74 | 80 | 59.8 | 2 | Y | 1301 | .3 |
| REWS018 | 03 | 17 | 2003 | 4.9 | 1021 | 30 | 50.88 | 81 | 1.68 | 1 | N | 1909 | .81 |
| REWS019 | 03 | 18 | 2003 | 6.4 | 1334 | 30 | 59.46 | 81 | 4.8 | 1 | N | 1909 | .49 |
| REWS020 | 03 | 19 | 2003 | 5.8 | 1254 | 30 | 55.98 | 81 | 13 | 2 | Y | | N/A |
| REWS021 | 03 | 26 | 2003 | 6.4 | | | | | | | | | |
| REWS022 | 03 | 27 | 2003 | 3.5 | | | | | | | | | |
| REWS023 | 03 | 28 | 2003 | 2.2 | | | | | | | | | |
| REWS024 | 03 | 29 | 2003 | 5.7 | | | | | | | | | |

*Temporal and Spatial Movements of Right Whales*

Four cow/calf pairs were seen more than three times during the NEWS and REWS surveys. Maps of the movements of these animals through the region are included in Appendix 2. Right whale number (EGNO) 1301 was sighted two times during the NEWS surveys and three times during the REWS surveys. Four out of five sightings of this animal occurred outside of the critical habitat, and two of the sightings were outside the Mandatory Ship Reporting (MSR) Zone. EGNO 1301 was seen from 29 December 2002 through 14 March 2003 for a residency time of at least a 2.5 months.

EGNO 1243 was sighted eight times by the NEWS team from 15 December through 30 December 2002. Five of the eight sightings were in very close proximity to each other, and all eight sightings were within 30nm of each other. Twelve surveys were flown from 15 December through 30 December, so assuming EGNO 1243 was within the survey area the entire time, the survey team sighted this cow/calf pair 67% of the time. It is possible that this cow had recently given birth to the calf and as a result was not traveling extensively and was spending more time at the surface, increasing sightability.

EGNO 2123 was sighted eight times by the NEWS/REWS team during the 2002-2003 season. The only sighting by the NEWS team of EGNO 2123 occurred on 11 January 2003 without a calf. EGNO 2123

was sighted seven more times by the REWS team with a calf from 11 February through 12 March 2003. Three sightings of this cow/calf pair occurred outside the critical habitat.

EGNO 1151 was sighted six times by the NEWS team between 02 December 2002 and 06 January 2003. This animal was the first documented cow/calf pair of the season. Four of the six sightings occurred outside the critical habitat. EGNO 1151 was sighted for the last time by the REWS team on 20 February 2003, substantially further south than the initial six sightings.

Two adult female right whales, EGNO 1158 and 1303, were closely associated with each other this season. EGNO 1303 was sighted on 11 December 2002 alone, but after that initial sighting this animal was seen four more times with EGNO 1158. Maps of sighting locations for these animals can be seen in Appendix 2.

*Sighting Distances for Right Whales*
Sighting distances were calculated whenever possible, and average sighting distance for all right whale sightings was 0.449nm (SD=0.503).

*Sighting Distances for Large Vessels*
Sighting angles were obtained for all large commercial and military ships whenever possible, and used to calculate distance from the trackline. Average distance from the trackline for all large vessels was 3769.32m (SD=4846.84). See Appendix 1 for all sightings of large ships during the 2002-2003 NEWS and REWS surveys.

*Marine Animal Sightings*
All cetaceans, sea turtles, sharks, rays, and certain fish species were recorded while conducting these surveys. Date, time, lat/long position, species and number, aircraft heading and altitude, and environmental conditions such as Beaufort sea state, glare, and visibility were entered into the data logger. Table 3 summarizes all marine mammal sightings for all attempted surveys.

Table 3. Summary of other marine animal sightings during the 2002/2003 NEWS-REWS right whale surveys.

| Survey Date | LETU | LOTU | RITU | UNTU | BODO | ASDO | UNDO | OCSU | UNSH | BASH | UNRA | CNRA | MARA | UNLW | HUWH |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **12/01/2002** | 7 | 723 | 0 | 7 | 17 | 0 | 3 | 1 | 0 | 0 | 0 | 125 | 0 | 0 | 0 |
| **12/02/2002** | 42 | 113 | 6 | 65 | 106 | 0 | 65 | 1 | 6 | 0 | 3 | 500 | 0 | 0 | 0 |
| **12/03/2002** | 37 | 58 | 0 | 39 | 101 | 0 | 57 | 6 | 0 | 0 | 0 | 80 | 0 | 0 | 0 |
| **12/06/2002** | 0 | 20 | 0 | 1 | 6 | 0 | 0 | 1 | 0 | 0 | 0 | 800 | 0 | 0 | 0 |
| **12/07/2002** | 1 | 16 | 0 | 2 | 2 | 0 | 3 | 17 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **12/08/2002** | 1 | 50 | 2 | 10 | 12 | 0 | 0 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **12/09/2002** | 0 | 6 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 240 | 0 | 0 | 0 |
| **12/11/2002** | 0 | 9 | 0 | 0 | 7 | 0 | 0 | 4 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| **12/12/2002** | 0 | 25 | 0 | 2 | 39 | 0 | 1 | 2 | 0 | 0 | 0 | 20 | 0 | 0 | 0 |
| **12/15/2002** | 0 | 41 | 0 | 5 | 25 | 0 | 1 | 28 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **12/16/2002** | 0 | 6 | 0 | 0 | 15 | 0 | 17 | 9 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **12/17/2002** | 0 | 11 | 0 | 2 | 24 | 0 | 1 | 0 | 0 | 0 | 0 | 85 | 0 | 0 | 0 |
| **12/18/2002** | 0 | 13 | 0 | 2 | 8 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **12/21/2002** | 3 | 29 | 0 | 6 | 71 | 0 | 35 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **12/22/2002** | 0 | 4 | 0 | 1 | 16 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| **12/23/2002** | 1 | 53 | 0 | 9 | 135 | 1 | 39 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **12/26/2002** | 0 | 26 | 0 | 8 | 34 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **12/27/2002** | 2 | 23 | 0 | 3 | 110 | 0 | 31 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

| Survey Date | LETU | LOTU | RITU | UNTU | BODO | ASDO | UNDO | OCSU | UNSH | BASH | UNRA | CNRA | MARA | UNLW | HUWH |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **12/28/2002** | 0 | 30 | 0 | 0 | 64 | 0 | 8 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **12/29/2002** | 0 | 15 | 0 | 5 | 80 | 0 | 14 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **12/30/2002** | 0 | 58 | 1 | 10 | 122 | 40 | 17 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **12/31/2002** | 0 | 15 | 0 | 5 | 59 | 5 | 10 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 |
| **01/02/2003** | 0 | 12 | 0 | 1 | 8 | 2 | 12 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **01/04/2003** | 0 | 7 | 0 | 7 | 20 | 0 | 25 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **01/05/2003** | 0 | 14 | 0 | 4 | 142 | 0 | 32 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **01/06/2003** | 0 | 1 | 0 | 0 | 23 | 0 | 20 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **01/10/2003** | 0 | 00 | 0 | 1 | 18 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **01/11/2003** | 0 | 13 | 0 | 8 | 34 | 3 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **01/13/2003** | 0 | 4 | 0 | 0 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **01/14/2003** | 0 | 10 | 0 | 0 | 27 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| **01/15/2003** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **01/16/2003** | 0 | 6 | 0 | 0 | 91 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **01/18/2003** | 0 | 5 | 0 | 0 | 47 | 0 | 7 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| **01/21/2003** | 0 | 0 | 0 | 0 | 19 | 0 | 11 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **01/25/2003** | 0 | 21 | 0 | 8 | 64 | 0 | 6 | 1 | 35 | 0 | 0 | 0 | 0 | 0 | 0 |
| **01/26/2003** | 0 | 4 | 0 | 5 | 56 | 0 | 23 | 0 | 36 | 0 | 0 | 0 | 0 | 0 | 0 |
| **02/11/2003** | 1 | 47 | 1 | 4 | 240 | 0 | 16 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| **02/12/2003** | 0 | 35 | 1 | 0 | 487 | 0 | 0 | 5 | 0 | 3 | 0 | 0 | 0 | 0 | 0 |
| **02/13/2003** | 0 | 17 | 0 | 6 | 71 | 0 | 2 | 2 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| **02/45/2003** | 0 | 38 | 0 | 4 | 267 | 0 | 0 | 2 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| **02/15/2003** | 0 | 53 | 2 | 2 | 197 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **02/18/2003** | 0 | 27 | 0 | 0 | 96 | 0 | 13 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| **02/19/2003** | 2 | 61 | 6 | 11 | 100 | 0 | 1 | 3 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| **02/20/2003** | 0 | 43 | 1 | 5 | 96 | 0 | 0 | 2 | 1 | 0 | 0 | 0 | 0 | 1 | 0 |
| **02/26/2003** | 1 | 25 | 0 | 5 | 78 | 0 | 1 | 6 | 3 | 11 | 0 | 0 | 0 | 0 | 0 |
| **03/02/2003** | 0 | 11 | 0 | 1 | 34 | 0 | 2 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| **03/03/2003** | 0 | 15 | 4 | 1 | 52 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| **03/05/2003** | 0 | 97 | 18 | 23 | 183 | 0 | 7 | 4 | 0 | 4 | 0 | 0 | 0 | 0 | 0 |
| **03/06/2003** | 1 | 41 | 9 | 4 | 164 | 0 | 4 | 2 | 0 | 1 | 0 | 486 | 0 | 0 | 0 |
| **03/10/2003** | 0 | 19 | 0 | 1 | 68 | 0 | 6 | 3 | 0 | 3 | 0 | 0 | 0 | 0 | 0 |
| **03/11/2003** | 0 | 224 | 8 | 70 | 152 | 0 | 3 | 5 | 0 | 8 | 0 | 211 | 0 | 0 | 0 |
| **03/12/2003** | 0 | 290 | 30 | 117 | 171 | 0 | 3 | 23 | 0 | 13 | 0 | 2065 | 0 | 0 | 0 |
| **03/14/2003** | 1 | 104 | 0 | 10 | 95 | 0 | 4 | 6 | 0 | 1 | 0 | 1530 | 0 | 0 | 0 |
| **03/17/2003** | 6 | 211 | 28 | 19 | 286 | 0 | 1 | 17 | 0 | 0 | 0 | 179 | 0 | 0 | 0 |
| **03/18/2003** | 2 | 180 | 7 | 61 | 146 | 0 | 1 | 3 | 0 | 1 | 0 | 1821 | 0 | 0 | 0 |
| **03/19/2003** | 0 | 63 | 9 | 7 | 40 | 0 | 2 | 7 | 0 | 0 | 0 | 810 | 0 | 0 | 0 |
| **03/26/2003** | 35 | 642 | 19 | 18 | 267 | 0 | 0 | 10 | 8 | 0 | 8 | 21842 | 0 | 0 | 0 |
| **03/27/2003** | 0 | 28 | 1 | 0 | 16 | 0 | 0 | 8 | 0 | 1 | 0 | 240 | 0 | 0 | 0 |
| **03/28/2003** | 0 | 15 | 0 | 0 | 26 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **03/29/2003** | 0 | 358 | 13 | 12 | 93 | 0 | 17 | 17 | 10 | 0 | 1 | 3937 | 0 | 0 | 0 |
| **Totals** | **143** | **4085** | **166** | **598** | **5033** | **51** | **534** | **205** | **101** | **52** | **13** | **34971** | **2** | **1** | **2** |

LETU=leatherback turtle; LOTU=loggerhead turtle; RITU=ridley turtle; UNTU=unidentified turtle; BODO=bottlenose dolphin; ASDO=Atlantic Spotted Dolphin; UNDO=unidentified dolphin; OCSU=ocean sunfish; UNSH = unidentified shark; BASH = basking shark; UNRA=unidentified ray; CNRA=cownose ray; MARA=manta ray; UNLW=unidentified large whale; HUWH=humpback whale

*Whale/Ship Interactions*
One whale/ship interaction ("close call") was observed during an REWS survey on 03 March 2003. The encounter involved a Navy destroyer and a single adult right whale. A synopsis of the incident is outlined below:

03/03/2003, 1436h: A single right whale was first sighted by the port observer at 30 22.67 N and 81 09.25 W. The plane immediately broke track and began circling the whale. The whale was resighted once and then submerged. While the whale was at the surface, one of the pilots noted that a large Navy ship (destroyer) was heading directly towards the whale. The vessel had been recorded earlier on the track line and it was determined that the location of the whale was starboard of the ship's course.

1438h: The starboard observer reported the sighting (time, location and number of whales) to FACSFACJAX in hopes that it would be relayed in time for the ship to alter its course. The call was completed at 1440 and the page was received at 1450. The data recorder attempted to hail the vessel via VHF channel 16. No response was received.

1444h: The whale resurfaced approximately ¼ mile forward of the starboard bow. All port observers maintained visual contact of the animal, from the time it resurfaced, until just after the ship passed.

1445h: The ship passed at less than 0.25mi when it was abeam of the animal. As noted, the whale was sighted after the ship passed, but it soon submerged. The whale was observed in the wake of the ship and appeared to be heading NNW. The ship was heading directly W at an estimated 20 knots. The survey plane continued to circle for a total of 30 minutes at a one mile radius from the last recorded position of the animal. The right whale was not resighted during that time. The survey plane then left the area at 1506h to resume survey effort.

## Discussion and Recommendations

The right whale calving ground is extremely important to the reproducing population of the North Atlantic right whale and is vital to military and commercial shipping interests. The EWS system attempts to provide protection for right whales from ship collisions within this region. While there have been no documented right whale mortalities due to ship collision in the SEUS in many years, we do not have adequate means of quantifying the success of the EWS system. The expansion of the EWS system this calving season to include more daily survey coverage to the north and south of the primary EWS area likely provides more protection for right whales from interactions with large vessels. However, limitations of these aerial survey efforts must be addressed. If our goal is to provide maximum protection for right whales, we must investigate new technologies that may provide a more reliable means for detecting and protecting right whales throughout their range. We must also pursue appropriate shipping management measures. Without moving forward on these fronts it is unlikely that we will ever reach a potential biological removal level of zero for North Atlantic right whales, as calculated by NMFS in the right whale recovery plan.

While we highly recommend identifying other methods of right whale detection and protection, we recognize that in the interim the current survey program is the most effective method we have for protecting right whales from ship collisions. We recommend continuing daily Northern Early Warning System surveys from 1 December 2003 through 31 March 2004. Data collected during these surveys

continue to support expansion of the currently designated critical habitat boundary. Following the aerial survey accident on 26 January 2003, we must focus on modifying our survey efforts to make them as safe as possible. Minimum altitudes, minimum speeds, limited circling times, required safety equipment, pilot and observer training, and minimum aircraft standards must be established. Studies to determine optimal and maximum aircraft altitudes, speeds, etc. should be established to determine the safest practices that can be followed while still gathering the data needed.

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Appendix 1. Large commercial and military vessel traffic recorded during the 2002-2003 NEWS and REWS right whale aerial surveys.

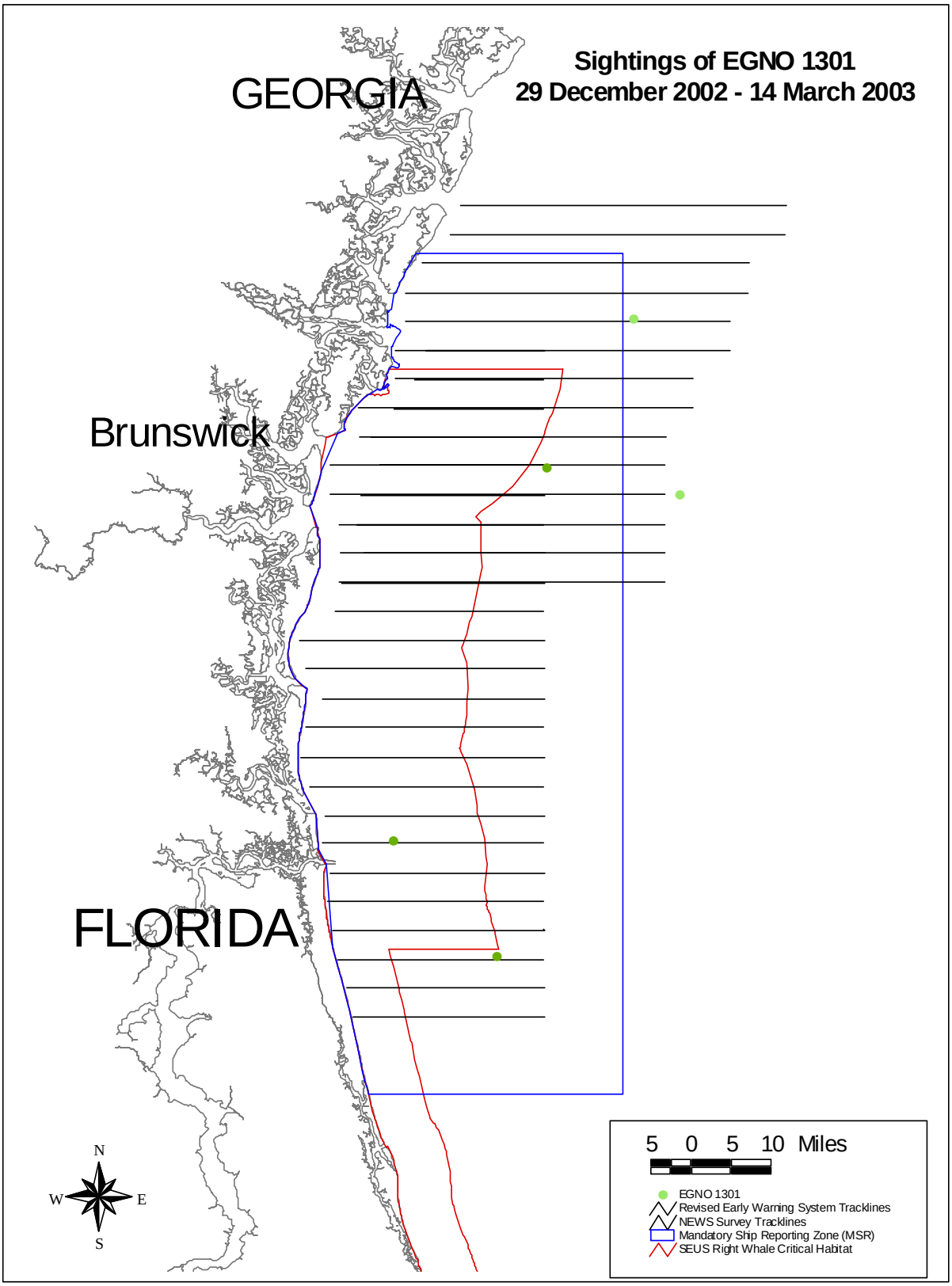
| Date | Time | Latitude | Longitude | Altitude | Heading | Vessel | Angle | Observer | Distance from Line (m) |
|---|---|---|---|---|---|---|---|---|---|
| 12/1/2002 | 180128 | 31.084 | -81.33984 | 1067 | 263 | DR-W | 80 | S | 1728.22 |
| 12/1/2002 | 180839 | 31.034 | -81.23766 | 1066 | 86.8 | MV-L | 64 | S | 624.84 |
| 12/1/2002 | 175808 | 31.087 | -81.235 | 1124 | 274.3 | MV-L | 89 | P | 17461.99 |
| 12/2/2002 | 172357 | 31.122 | -80.77016 | 1000 | 177 | MV-S | | P | |
| 12/2/2002 | 180953 | 31.01133 | -80.76299 | 1000 | 165.7 | MY-S | | P | |
| 12/2/2002 | 183448 | 30.93383 | -81.29317 | 1000 | 91.6 | MY-S | | P | |
| 12/3/2002 | 155131 | 31.18867 | -80.7795 | 1106 | 261.6 | MV-B | 66 | S | 685.8 |
| 12/3/2002 | 164833 | 31.08267 | -81.25867 | 1112 | 272.5 | MV-L | 85 | P | 3483.64 |
| 12/3/2002 | 165128 | 31.08467 | -81.35316 | 1142 | 274.6 | MV-T | | S | |
| 12/3/2002 | 165052 | 31.08417 | -81.334 | 1078 | 271.5 | MV-T | 58 | P | 545.28 |
| 12/3/2002 | 155751 | 31.18133 | -80.9735 | 1121 | 267.8 | MY-S | | S | |
| 12/3/2002 | 142416 | 31.43217 | -81.12 | 1113 | 83.3 | MY-S | | S | |
| 12/3/2002 | 142605 | 31.434 | -81.05833 | 1064 | 87.6 | MY-S | | S | |
| 12/7/2002 | 192447 | 31.09233 | -81.38267 | 1145 | 19.4 | MV-C | | P | |
| 12/7/2002 | 145709 | 31.53467 | -81.0545 | 1032 | 91.3 | MY-S | | S | |
| 12/8/2002 | 183139 | 30.985 | -81.1255 | 1107 | 267.8 | MV-L | | P | |
| 12/8/2002 | 175558 | 31.08267 | -81.32366 | 911 | 272.4 | MV-T | | S | |
| 12/9/2002 | 170632 | 31.10567 | -81.35617 | 1596 | 347.5 | MV-C | | S | |
| 12/11/2002 | 205751 | 31.62217 | -80.64267 | 957 | 163.2 | MV-C | | | |
| 12/12/2002 | 194758 | 31.13267 | -81.27299 | 1034 | 87 | MV-L | | S | |
| 12/15/2002 | 180358 | 31.08467 | -81.3475 | 1021 | 271.9 | MV-B | | S | |
| 12/15/2002 | 193341 | 30.9365 | -80.95183 | 989 | 92.3 | MV-C | 62 | P | 573.02 |
| 12/15/2002 | 162515 | 31.32033 | -80.7685 | 1224 | 164.6 | MY-S | | P | |
| 12/16/2002 | 184400 | 31.02867 | -80.77317 | 1083 | 134.8 | CG-C | | S | |
| 12/16/2002 | 195601 | 30.93467 | -80.8885 | 1104 | 95 | MV-B | 84 | P | 2898.65 |
| 12/16/2002 | 154124 | 31.5335 | -80.70234 | 1084 | 86.5 | MY-L | | P | |
| 12/16/2002 | 184620 | 30.98566 | -80.7875 | 1145 | 255.1 | MY-L | 89 | P | 17461.99 |
| 12/16/2002 | 183607 | 31.03317 | -81.06333 | 1111 | 94.7 | MY-L | | P | |
| 12/16/2002 | 194741 | 30.93333 | -81.19383 | 1150 | 90.8 | MY-L | | P | |
| 12/16/2002 | 202629 | 31.12583 | -81.39017 | 1131 | 341.9 | MY-S | | P | |
| 12/17/2002 | 161044 | 31.582 | -80.93033 | 1082 | 274.5 | MY-L | | P | |
| 12/18/2002 | 184652 | 31.11883 | -81.35 | 1168 | 64.9 | MV-T | | S | |
| 12/18/2002 | 184701 | 31.1205 | -81.34583 | 1145 | 66.1 | MV-T | | S | |
| 12/21/2002 | 161849 | 31.43183 | -81.0485 | 1220 | 90.5 | MV-B | 45 | S | 304.8 |
| 12/21/2002 | 183053 | 31.13583 | -80.946 | 1092 | 83.7 | MV-B | 77 | P | 1319.78 |
| 12/23/2002 | 211827 | 30.9315 | -81.24333 | 1216 | 87.8 | MV-T | 77 | P | 1319.78 |
| 12/26/2002 | 161815 | 31.3325 | -80.99117 | 1063 | 84.7 | MV-B | 84 | S | 2898.65 |
| 12/26/2002 | 200128 | 30.88367 | -81.0075 | 1169 | 275.1 | MY-S | | P | |
| 12/27/2002 | 215736 | 31.12407 | -81.36929 | 814 | 323.8 | MV-L | | P | |
| 12/27/2002 | 211444 | 30.88413 | -80.90428 | 959 | 275.9 | MV-L | 89 | P | 17461.99 |
| 12/27/2002 | 215626 | 31.11178 | -81.34532 | 1109 | 310.8 | MV-L | | P | |
| 12/27/2002 | 190151 | 31.1308 | -81.06618 | 1022 | 88.1 | MV-S | 82 | S | 2170.18 |
| 12/27/2002 | 194953 | 31.08377 | -81.32802 | 1179 | 271.5 | MY-L | | S | |
| 12/27/2002 | 152540 | 31.48358 | -80.9355 | 1081 | 263 | MY-S | | S | |
| 12/27/2002 | 190511 | 31.13385 | -80.9393 | 1064 | 93.2 | MY-S | | S | |
| 12/28/2002 | 183030 | 31.18252 | -81.08623 | 940 | 267.5 | MV-B | 77 | P | 1319.78 |
| 12/28/2002 | 210851 | 30.88049 | -80.92347 | 964 | 303.7 | MV-B | | P | |
| 12/28/2002 | 173138 | 31.33353 | -81.18764 | 862 | 85 | MV-B | 89 | S | 17461.99 |
| 12/28/2002 | 181820 | 31.18217 | -80.78268 | 984 | 274 | MV-B | 88 | P | 8729.47 |
| 12/28/2002 | 182937 | 31.18397 | -81.05842 | 889 | 267.1 | MY-S | | P | |
| 12/29/2002 | 192315 | 31.03183 | -81.13911 | 882 | 98.1 | MV-L | 63 | S | 597.41 |
| 12/29/2002 | 190806 | 31.08518 | -81.183 | 1082 | 265.1 | MY-L | | S | |
| 12/30/2002 | 194225 | 31.08192 | -81.34928 | 1051 | 267.6 | MV-B | | S | |
| 12/30/2002 | 190244 | 31.08837 | -80.7806 | 910 | 265.8 | MV-B | 79 | P | 1566.67 |
| 12/30/2002 | 193804 | 31.0844 | -81.21007 | 1166 | 275.7 | MV-L | 84 | P | 2898.65 |
| 12/30/2002 | 194044 | 31.0829 | -81.29298 | 1122 | 266.8 | MV-S | | | |
| 12/30/2002 | 144302 | 31.6324 | -80.70943 | 1056 | 90.8 | MY-S | | P | |
| 12/30/2002 | 171947 | 31.23332 | -81.04716 | 1083 | 85.4 | MY-S | | P | |
| 12/31/2002 | 181729 | 31.03433 | -81.2225 | 1313 | 94.8 | MV-L | 70 | S | 838.2 |
| 1/4/2003 | 180203 | 30.98348 | -81.25249 | 1095 | 90.2 | MV-T | | S | |
| 1/5/2003 | 185022 | 31.085 | -81.35792 | 1063 | 273.2 | MV-B | 84 | S | 2898.65 |
| 1/5/2003 | 184952 | 31.08367 | -81.34077 | 1052 | 279.9 | MV-U | | P | |
| 1/5/2003 | 162709 | 31.33575 | -81.00468 | 1048 | 84.6 | MY-S | | P | |
| 1/6/2003 | 144236 | 31.63417 | -80.85268 | 1056 | 95.1 | MY-L | | S | |

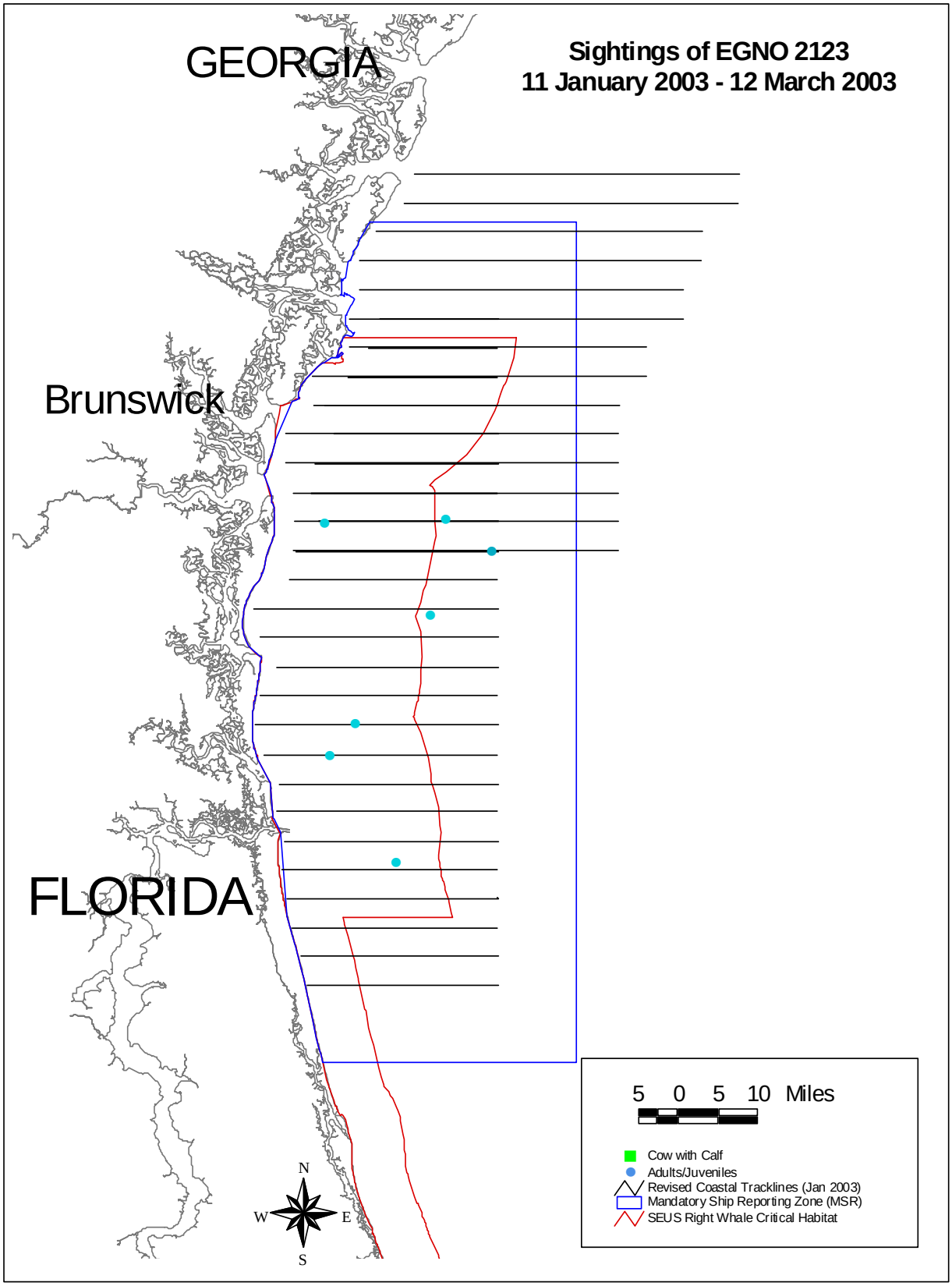
| Date | Time | Latitude | Longitude | Altitude | Heading | Vessel | Angle | Observer | Distance from Line (m) |
|---|---|---|---|---|---|---|---|---|---|
| 1/10/2003 | 162416 | 31.23348 | -80.98798 | 1092 | 90.4 | MY-L | | S | |
| 1/10/2003 | 170257 | 31.13458 | -81.05357 | 1162 | 89.3 | MY-S | | S | |
| 1/11/2003 | 211938 | 30.93245 | -81.0593 | 1082 | 84.8 | MV-L | 86 | P | 4358.64 |
| 1/13/2003 | 192648 | 30.88365 | -81.33765 | 1036 | 270.9 | MV-T | | S | |
| 1/14/2003 | 175746 | 31.0841 | -81.30148 | 1077 | 272.2 | MV-L | 82 | P | 2170.18 |
| 1/16/2003 | 163926 | 31.18318 | -80.73569 | 1030 | 91.3 | MV-T | 87 | P | 5815.58 |
| 1/25/2003 | 183727 | 31.08352 | -81.36167 | 1012 | 270.5 | MV-B | | S | |
| 1/25/2003 | 152822 | 31.4338 | -80.79243 | 1065 | 91.5 | MY-L | | S | |
| 1/25/2003 | 180106 | 31.12958 | -81.29871 | 1070 | 87 | MY-L | | S | |
| 1/26/2003 | 182255 | 31.08087 | -81.28532 | 1022 | 263.3 | MV-L | | S | |
| 1/26/2003 | 145320 | 31.48432 | -80.89798 | 1110 | 267.3 | MY-S | | S | |
| 2/11/2003 | 151012 | 30.124898 | -81.02008 | 1015 | 279.3 | MV-B | | P | |
| 2/11/2003 | 175537 | 30.676836 | -81.20339 | 1024 | 89.5 | MV-B | | P | |
| 2/11/2003 | 161945 | 30.376899 | -81.30793 | 1100 | 92.9 | MV-C | 81 | P | 1922.03 |
| 2/11/2003 | 202621 | 31.127631 | -81.34648 | 1034 | 267.6 | MV-L | 81 | P | 1922.03 |
| 2/11/2003 | 200341 | 31.075784 | -81.33222 | 1044 | 94.2 | MV-L | 83 | P | 2481.07 |
| 2/11/2003 | 161835 | 30.376749 | -81.34829 | 1102 | 89.5 | MV-L | 80 | P | 1728.22 |
| 2/11/2003 | 164201 | 30.427465 | -81.35093 | 1120 | 266 | MY-L | | P | |
| 2/11/2003 | 164135 | 30.427665 | -81.33699 | 1117 | 274 | MY-L | | S | |
| 2/11/2003 | 150532 | 30.074567 | -81.05899 | 1075 | 91.5 | MY-L | | P | |
| 2/12/2003 | 165225 | 30.333349 | -81.35146 | 1067 | 269.2 | MV-B | 85 | S | 3483.64 |
| 2/12/2003 | 210007 | 31.089216 | -81.30578 | 1122 | 87.9 | MV-B | | P | |
| 2/12/2003 | 192609 | 30.683483 | -81.01453 | 1125 | 94.8 | MV-B | 88 | P | 8729.47 |
| 2/12/2003 | 205542 | 31.034534 | -81.24071 | 1113 | 268 | MV-L | 70 | S | 838.2 |
| 2/12/2003 | 165715 | 30.381493 | -81.30690 | 1107 | 87.1 | MY-L | | P | |
| 2/12/2003 | 171825 | 30.433349 | -81.30896 | 1101 | 269 | MY-L | | P | |
| 2/13/2003 | 212501 | 30.429435 | -81.3384 | 798 | 91.5 | MV-B | 88 | S | 8729.47 |
| 2/13/2003 | 191708 | 30.883983 | -81.31808 | 1040 | 273 | MV-B | 84 | S | 2898.65 |
| 2/13/2003 | 212601 | 30.429899 | -81.30107 | 572 | 90.4 | MV-B | 89 | P | 17461.99 |
| 2/13/2003 | 212530 | 30.429597 | -81.31893 | 614 | 89 | MV-B | 88 | P | 8729.47 |
| 2/13/2003 | 212411 | 30.432750 | -81.36775 | 1101 | 105.5 | MV-O | 87 | P | 5815.58 |
| 2/13/2003 | 221251 | 30.332584 | -81.25843 | 1169 | 93.5 | MV-T | 79 | P | 1566.67 |
| 2/14/2003 | 162643 | 30.435615 | -81.32830 | 1150 | 262.5 | MV-B | | P | |
| 2/14/2003 | 173841 | 30.685497 | -81.32634 | 1142 | 87.2 | MV-L | | P | |
| 2/14/2003 | 160642 | 30.383501 | -81.30629 | 1141 | 90.4 | MV-L | | P | |
| 2/14/2003 | 164532 | 30.510066 | -80.98886 | 1145 | 342 | NV-L | | | |
| 2/14/2003 | 153211 | 30.285383 | -81.28533 | 1083 | 94 | NV-L | | P | |
| 2/14/2003 | 174115 | 30.684534 | -81.23960 | 1068 | 88 | NV-S | | | |
| 2/14/2003 | 174304 | 30.684684 | -81.17729 | 1071 | 88 | NV-U | | P | |
| 2/15/2003 | 145641 | 30.235200 | -81.10211 | 1133 | 280 | MV-B | 85 | S | 3483.64 |
| 2/15/2003 | 181836 | 30.984281 | -81.28691 | 1107 | 92 | MV-B | 44 | S | 295.66 |
| 2/15/2003 | 153411 | 30.384550 | -81.30702 | 994 | 89 | MV-B | 78 | S | 1432.56 |
| 2/15/2003 | 173825 | 30.814334 | -80.97730 | 1022 | 17 | MV-B | 82 | S | 2170.18 |
| 2/15/2003 | 153131 | 30.366935 | -81.39183 | 1051 | 4 | MV-B | | P | |
| 2/15/2003 | 153442 | 30.384632 | -81.28893 | 1026 | 90 | MV-C | | P | |
| 2/15/2003 | 184102 | 31.083635 | -81.29314 | 1124 | 84 | MV-L | 42 | P | 274.32 |
| 2/15/2003 | 160302 | 30.484781 | -81.32399 | 988 | 86 | MV-L | 80 | S | 1728.22 |
| 2/15/2003 | 170244 | 30.684000 | -81.20051 | 1054 | 94 | MV-S | | P | |
| 2/15/2003 | 155942 | 30.437101 | -81.38020 | 1089 | 306 | MV-T | 81 | P | 1922.03 |
| 2/15/2003 | 153321 | 30.382665 | -81.33554 | 990 | 85 | MV-T | 88 | S | 8729.47 |
| 2/15/2003 | 183222 | 31.036757 | -81.09599 | 1096 | 263 | MV-T | | S | |
| 2/15/2003 | 170454 | 30.683666 | -81.12875 | 1069 | 103 | NV-U | 74 | S | 1063.75 |
| 2/15/2003 | 170403 | 30.684900 | -81.15618 | 1065 | 77 | NV-U | 81 | S | 1922.03 |
| 2/15/2003 | 164843 | 30.631950 | -81.19818 | 1047 | 265 | NV-U | 79 | P | 1566.67 |
| 2/18/2003 | 172208 | 30.380048 | -81.32707 | 1116 | 99 | MV-B | 46 | S | 316.99 |
| 2/18/2003 | 201943 | 31.036100 | -81.15853 | 1013 | 270 | MV-C | 43 | P | 283.46 |
| 2/18/2003 | 190551 | 30.733983 | -81.31968 | 1063 | 268 | MV-C | 56 | S | 451.10 |
| 2/18/2003 | 172127 | 30.385416 | -81.35244 | 1187 | 97 | MV-C | 66 | P | 685.8 |
| 2/18/2003 | 155136 | 30.083784 | -81.10779 | 1047 | 88 | MY-L | | S | |
| 2/18/2003 | 172306 | 30.379398 | -81.29141 | 1136 | 92 | MY-L | | P | |
| 2/18/2003 | 174338 | 30.433399 | -81.327018 | 1124 | 270 | MY-L | 76 | S | 1222.25 |
| 2/18/2003 | 170657 | 30.332084 | -81.080596 | 1091 | 273 | NV-L | 89 | S | 17461.99 |
| 2/19/2003 | 160336 | 30.103282 | -80.991966 | 1146 | 317 | MV-B | 69 | S | 795.53 |
| 2/19/2003 | 181800 | 30.484249 | -81.255805 | 1075 | 97 | MV-B | 75 | S | 1136.90 |
| 2/19/2003 | 194751 | 30.734432 | -81.334304 | 1087 | 272 | MV-C | 25 | S | 143.27 |
| 2/19/2003 | 174519 | 30.333316 | -81.297752 | 1023 | 269 | MV-L | 85 | S | 3483.64 |
| 2/19/2003 | 191531 | 30.646032 | -81.188072 | 1016 | 260 | NV-U | 81 | P | 1922.03 |
| 2/20/2003 | 172032 | 30.415483 | -81.268020 | 1159 | 10 | MV-L | 81 | P | 1922.03 |
| 2/20/2003 | 173902 | 30.451049 | -81.34441 | 1121 | 269 | MV-O | 82 | P | 2170.18 |
| 2/20/2003 | 185025 | 30.583484 | -81.054129 | 1251 | 277 | NV-U | 79 | S | 1566.67 |

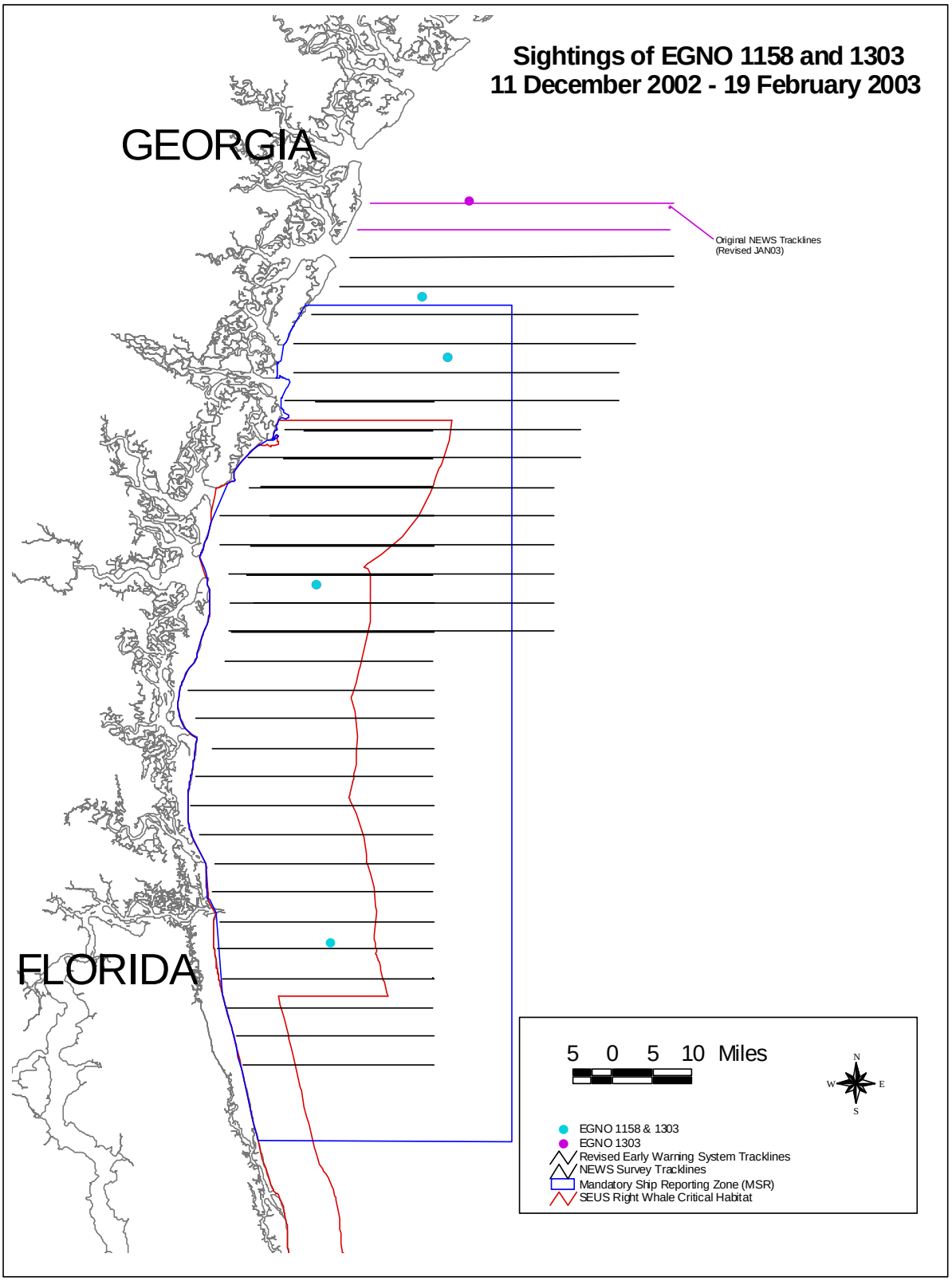
| Date | Time | Latitude | Longitude | Altitude | Heading | Vessel | Angle | Observer | Distance from Line (m) |
|---|---|---|---|---|---|---|---|---|---|
| 2/20/2003 | 171212 | 30.376949 | -80.991432 | 1176 | 336 | NV-U | 82 | S | 2170.18 |
| 2/20/2003 | 193135 | 30.683732 | -81.261337 | 1106 | 101 | NV-U | 87 | P | 5815.58 |
| 2/26/2003 | 151546 | 30.338204 | -80.998550 | 1142 | 338 | MV-C | 70 | S | 838.2 |
| 3/2/2003 | 192113 | 30.382068 | -81.32593 | 1170 | 91.5 | MV-B | 40 | P | 256.03 |
| 3/2/2003 | 194343 | 30.449531 | -81.361534 | 1137 | 0 | MV-L | 56 | P | 451.1 |
| 3/3/2003 | 201714 | 30.367198 | -81.372406 | 1179 | 193 | MV-B | 81 | S | 1922.03 |
| 3/3/2003 | 191812 | 30.430351 | -81.320846 | 1080 | 91 | MV-B | 71 | P | 883.92 |
| 3/3/2003 | 163247 | 31.034151 | -81.233169 | 1178 | 92 | MV-C | 54 | P | 420.62 |
| 3/3/2003 | 165228 | 30.982902 | -81.286735 | 1045 | 269.5 | MV-L | 87 | S | 5815.58 |
| 3/3/2003 | 163317 | 31.033893 | -81.216018 | 1195 | 90 | MV-L | 84 | S | 2898.65 |
| 3/3/2003 | 172719 | 30.835535 | -81.189155 | 1074 | 87 | MV-O | 84 | P | 2898.65 |
| 3/3/2003 | 151915 | 30.463367 | -81.375 | 1146 | 357 | MV-O | 89 | S | 17461.99 |
| 3/3/2003 | 193312 | 30.38356 | -81.07889 | 1090 | 272 | NV-L | 82 | P | 2170.18 |
| 3/3/2003 | 201619 | 30.380949 | -81.350448 | 1100 | 273 | NV-S | | S | |
| 3/5/2003 | 220633 | 30.407918 | -81.372383 | 1170 | 181 | MV-B | 89 | P | 17461.99 |
| 3/5/2003 | 191548 | 30.237785 | -81.126701 | 1064 | 269 | MV-B | 80 | S | 1728.22 |
| 3/5/2003 | 202950 | 30.435001 | -81.324234 | 1141 | 269.5 | MV-B | 84 | P | 2898.65 |
| 3/5/2003 | 194329 | 30.332666 | -81.27591 | 1012 | 271 | MV-C | 83 | S | 2481.07 |
| 3/5/2003 | 185148 | 30.137468 | -81.063346 | 1153 | 255 | MV-C | 84 | S | 2898.65 |
| 3/6/2003 | 194416 | 30.385749 | -81.354087 | 1051 | 250 | MV-B | 76 | S | 1222.25 |
| 3/6/2003 | 145848 | 30.398534 | -81.364089 | 1065 | 353 | MV-B | 81 | S | 1922.03 |
| 3/6/2003 | 192116 | 30.437252 | -81.320198 | 1039 | 79.5 | MV-L | 83 | S | 2481.07 |
| 3/6/2003 | 151839 | 31.147382 | -81.322502 | 1071 | 28.5 | MV-L | 89 | P | 17461.99 |
| 3/6/2003 | 165502 | 30.888635 | -80.986228 | 1092 | 187 | MV-L | 67 | P | 719.33 |
| 3/6/2003 | 194847 | 30.337068 | -81.242233 | 1010 | 91.5 | NV-L | 85 | P | 3483.64 |
| 3/6/2003 | 180824 | 30.682950 | -81.007115 | 1067 | 282 | NV-U | 79 | P | 1566.67 |
| 3/10/2003 | 171102 | 31.134151 | -81.345916 | 1138 | 33 | MV-B | 72 | P | 938.78 |
| 3/10/2003 | 221510 | 30.374849 | -81.385765 | 1131 | 176.5 | MV-B | 79 | P | 1566.67 |
| 3/10/2003 | 164941 | 30.331233 | -81.367752 | 1158 | 353 | MV-B | 87 | S | 5815.58 |
| 3/10/2003 | 215119 | 30.520683 | -81.229851 | 1152 | 86 | MV-C | 74 | S | 1063.75 |
| 3/10/2003 | 165851 | 30.673933 | -81.381500 | 1161 | 360 | MV-C | 86 | S | 4358.64 |
| 3/10/2003 | 171041 | 31.122533 | -81.353118 | 1141 | 21.5 | MV-C | 67 | P | 719.33 |
| 3/10/2003 | 171011 | 31.104032 | -81.358314 | 1146 | 5 | MV-L | 87 | S | 5815.58 |
| 3/10/2003 | 220959 | 30.484264 | -81.320718 | 1102 | 272 | MV-L | 84 | P | 2898.65 |
| 3/10/2003 | 221019 | 30.484714 | -81.332077 | 1107 | 272 | MV-L | 87 | P | 5815.58 |
| 3/10/2003 | 175433 | 31.082132 | -81.260063 | 1066 | 273.5 | MV-L | 85 | P | 3483.64 |
| 3/10/2003 | 172412 | 31.178800 | -80.996665 | 1112 | 286 | MV-L | 62 | S | 573.02 |
| 3/10/2003 | 165051 | 30.373847 | -81.371070 | 1127 | 0 | NV-L | 88 | S | 8729.47 |
| 3/10/2003 | 170031 | 30.736616 | -81.382095 | 1157 | 360 | NV-U | 89 | S | 17461.99 |
| 3/11/2003 | 155416 | 30.331066 | -81.271049 | 1154 | 266 | MV-C | 84 | S | 2898.65 |
| 3/11/2003 | 203434 | 31.107601 | -81.364234 | 1143 | 200 | MV-L | 78 | | 1432.56 |
| 3/11/2003 | 163258 | 30.382532 | -81.280677 | 1099 | 86 | MV-L | 75 | P | 1136.90 |
| 3/11/2003 | 163407 | 30.385480 | -81.243446 | 1081 | 92 | MV-L | | S | |
| 3/11/2003 | 203534 | 31.072216 | -81.376052 | 1043 | 192 | MV-T | | P | |
| 3/11/2003 | 165307 | 30.436750 | -81.300079 | 1124 | 268 | MY-L | | P | |
| 3/11/2003 | 165328 | 30.436483 | -81.31123 | 1125 | 268 | MY-L | | S | |
| 3/11/2003 | 163437 | 30.385583 | -81.227333 | 1102 | 92 | NV-L | 85 | P | 3483.64 |
| 3/11/2003 | 155337 | 30.33368 | -81.248832 | 1171 | 262 | NV-L | 50 | S | 362.71 |
| 3/12/2003 | 194044 | 30.383764 | -81.326808 | 1165 | 272 | MV-B | 84 | P | 2898.65 |
| 3/12/2003 | 140604 | 30.309247 | -81.360847 | 1003 | 358 | MV-B | | P | |
| 3/12/2003 | 140755 | 30.385049 | -81.366981 | 4354 | 337 | MV-B | 83 | S | 2481.07 |
| 3/12/2003 | 194944 | 30.332864 | -81.226753 | 1086 | 89 | MV-B | 89 | S | 17461.99 |
| 3/12/2003 | 195304 | 30.333930 | -81.118080 | 1084 | 92 | MV-C | 81 | S | 1922.03 |
| 3/12/2003 | 192354 | 30.433715 | -81.13520 | 1191 | 91 | MV-L | 86 | S | 4358.64 |
| 3/12/2003 | 173811 | 30.734119 | -81.35856 | 1157 | 91 | MV-S | | S | |
| 3/12/2003 | 191713 | 30.432901 | -81.359252 | 1198 | 91 | MY-L | 87 | S | 5815.58 |
| 3/12/2003 | 181142 | 30.633914 | -81.286987 | 1052 | 91 | MY-L | | P | |
| 3/12/2003 | 142905 | 30.713081 | -81.401435 | 1941 | 359 | MY-S | | S | |
| 3/12/2003 | 140825 | 30.399133 | -81.376495 | 1550 | 341 | NV-L | 89 | S | 17461.99 |
| 3/12/2003 | 193644 | 30.383350 | -81.197853 | 1150 | 268 | NV-L | | P | |
| 3/12/2003 | 173641 | 30.733816 | -81.40764 | 1275 | 87 | NV-S | | S | |
| 3/12/2003 | 182422 | 30.583150 | -81.017982 | 1123 | 276 | NV-U | 84 | P | 2898.65 |
| 3/14/2003 | 141614 | 30.380748 | -81.363693 | 1114 | 352 | MV-B | 73 | S | 996.70 |
| 3/14/2003 | 141804 | 30.446166 | -81.374534 | 1044 | 346.5 | MV-B | 89 | S | 17461.99 |
| 3/14/2003 | 190722 | 30.382682 | -81.363914 | 1090 | 268 | MV-B | 80 | P | 1728.22 |
| 3/14/2003 | 190602 | 30.383649 | -81.313583 | 1082 | 270 | MV-L | 58 | S | 545.28 |
| 3/14/2003 | 201414 | 30.133666 | -81.078544 | 1103 | 91 | MV-O | 84 | P | 2898.65 |
| 3/17/2003 | 172318 | 30.434265 | -81.33023 | 1146 | 87 | MV-B | 86 | S | 4358.64 |
| 3/17/2003 | 144514 | 30.365697 | -81.374565 | 1026 | 351.5 | MV-B | 86 | S | 4358.64 |
| 3/17/2003 | 175149 | 30.333833 | -81.217681 | 1061 | 90 | MV-L | 79 | S | 1566.67 |

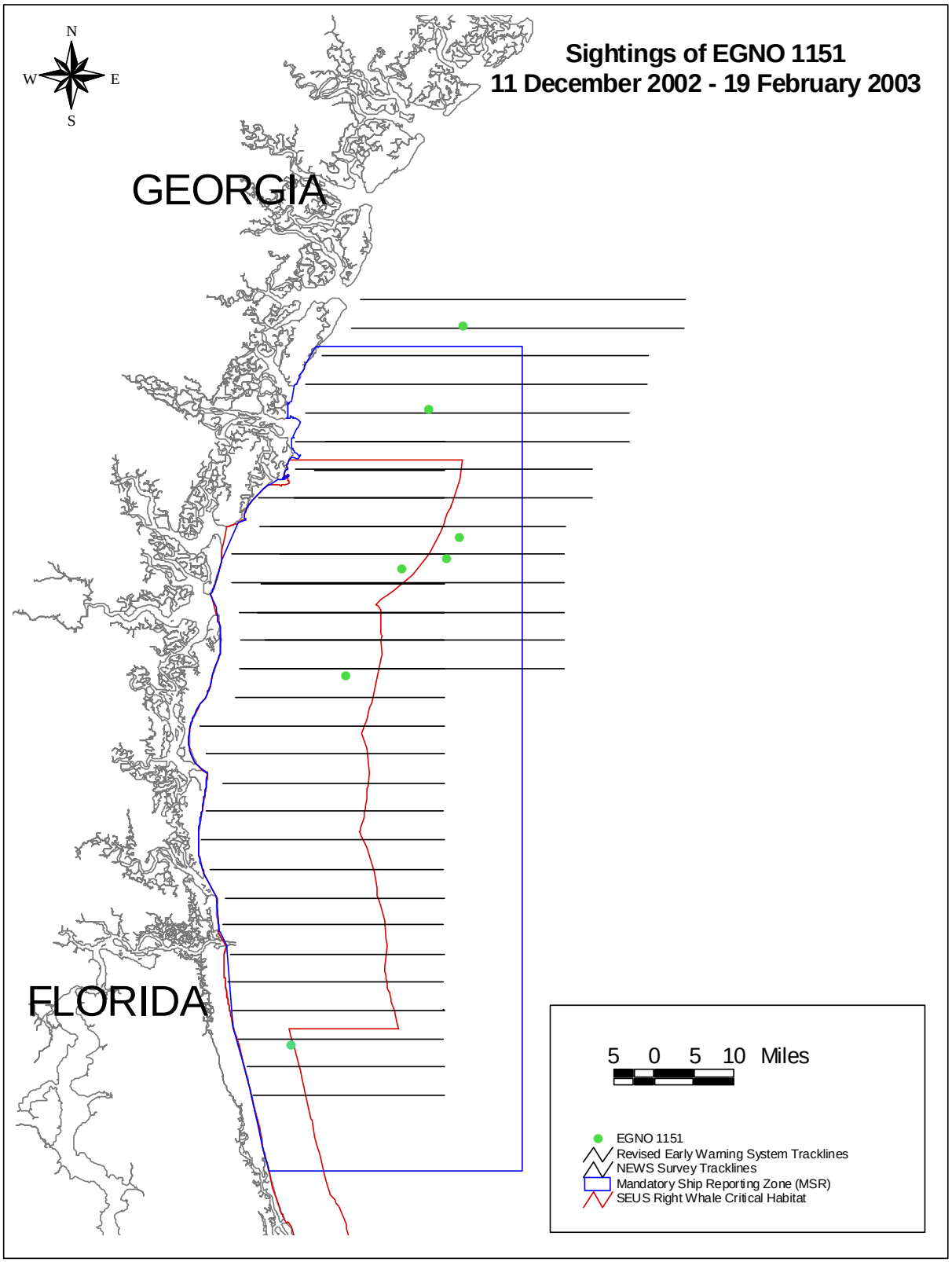
| Date | Time | Latitude | Longitude | Altitude | Heading | Vessel | Angle | Observer | Distance from Line (m) |
|---|---|---|---|---|---|---|---|---|---|
| 3/17/2003 | 144544 | 30.387199 | -81.376999 | 1023 | 356 | MV-L | 89 | S | 17461.99 |
| 3/17/2003 | 172128 | 30.434883 | -81.387199 | 1070 | 95 | MV-L | 89 | S | 17461.99 |
| 3/17/2003 | 174909 | 30.334615 | -81.307014 | 1062 | 91 | MY-L | 77 | P | 1319.78 |
| 3/17/2003 | 173628 | 30.384965 | -81.118286 | 1172 | 272 | NV-L | 77 | P | 1319.78 |
| 3/18/2003 | 152704 | 30.385217 | -81.347999 | 1052 | 97 | MV-B | 57 | S | 469.39 |
| 3/18/2003 | 152804 | 30.382251 | -81.313400 | 1028 | 94 | MV-B | 71 | P | 883.29 |
| 3/18/2003 | 152734 | 30.383634 | -81.33066 | 1049 | 95 | MV-B | 45 | P | 304.8 |
| 3/18/2003 | 200311 | 30.358531 | -81.376800 | 1173 | 177 | MV-B | 79 | P | 1566.67 |
| 3/18/2003 | 155145 | 30.436035 | -81.365730 | 1066 | 270 | MV-L | 60 | P | 527.30 |
| 3/18/2003 | 151843 | 30.334716 | -81.200347 | 1030 | 267 | MV-L | 87 | S | 5815.58 |
| 3/18/2003 | 163746 | 30.632051 | -80.980865 | 1057 | 312 | MV-L | 62 | P | 573.02 |
| 3/18/2003 | 155124 | 30.435949 | -81.354682 | 1057 | 272 | MV-L | 80 | P | 1728.22 |
| 3/18/2003 | 153304 | 30.384301 | -81.129615 | 1042 | 91 | MV-L | 84 | S | 2898.65 |
| 3/19/2003 | 203152 | 30.435335 | -81.360435 | 1075 | 86 | MV-B | 86 | S | 4358.64 |
| 3/19/2003 | 210253 | 30.332918 | -81.212783 | 1055 | 92 | MV-B | 80 | S | 1728.22 |
| 3/19/2003 | 203242 | 30.433382 | -81.332839 | 1059 | 96.5 | MV-L | 59 | P | 505.99 |
| 3/19/2003 | 205353 | 30.384349 | -81.316154 | 1078 | 270 | NV-L | 76 | P | 1222.25 |
| 3/26/2003 | 170534 | 30.68313 | -81.24779 | 1000 | 89.1 | MV-B | 45 | P | 304.8 |
| 3/26/2003 | 142739 | 30.13678 | -81.03688 | 1000 | 265.3 | MV-B | 83 | | 2481.07 |
| 3/26/2003 | 153521 | 30.3837 | -81.2866 | 1000 | 95.7 | MV-C | 87 | | 5815.58 |
| 3/26/2003 | 200208 | 30.35618 | -81.37711 | 1000 | 174.9 | MV-L | 85 | P | 3483.64 |
| 3/26/2003 | 153451 | 30.38492 | -81.3032 | 1000 | 92.7 | MV-L | 79 | P | 1566.67 |
| 3/26/2003 | 155752 | 30.43327 | -81.34938 | 1000 | 268.2 | MV-O | | S | |
| 3/26/2003 | 164403 | 30.59703 | -80.98441 | 1000 | 358.8 | NV-U | 78 | P | 1432.56 |
| 3/27/2003 | 151425 | 30.383134 | -81.379981 | 1101 | 100 | MV-C | 72 | P | 938.78 |
| 3/27/2003 | 164558 | 30.734231 | -81.322166 | 1010 | 268 | MV-C | 21 | S | 115.82 |
| 3/27/2003 | 151746 | 30.383350 | -81.274063 | 1029 | 91 | MV-L | 82 | P | 2170.18 |
| 3/27/2003 | 153256 | 30.434215 | -81.369720 | 1007 | 276 | MY-L | 78 | P | 1432.56 |
| 3/27/2003 | 153336 | 30.439334 | -81.393531 | 962 | 328 | MY-L | 76 | P | 1222.25 |
| 3/28/2003 | 175840 | 30.283182 | -81.235687 | 1060 | 272 | MV-B | 87 | S | 5815.58 |
| 3/28/2003 | 184321 | 30.083269 | -80.990600 | 1051 | 245 | MV-C | 80 | S | 1728.22 |
| 3/28/2003 | 174430 | 30.332218 | -81.139381 | 1082 | 90 | NV-S | 12 | P | 64.01 |
| 3/29/2003 | 183810 | 30.400350 | -81.383934 | 1040 | 353 | MV-B | 63 | | 597.41 |
| 3/29/2003 | 180239 | 30.234231 | -81.181472 | 1062 | 270 | MV-B | 83 | | 2481.07 |
| 3/29/2003 | 183511 | 30.384707 | -81.305568 | 1040 | 267.5 | MV-L | 78 | | 1432.56 |
| 3/29/2003 | 184541 | 30.689815 | -81.407051 | 1097 | 7267 | MV-T | | | |
| 3/29/2003 | 183439 | 30.385335 | -81.288993 | 1044 | 267 | MV-U | 30 | | 176.78 |
| | | | | | | | | Average | 3769.32 |

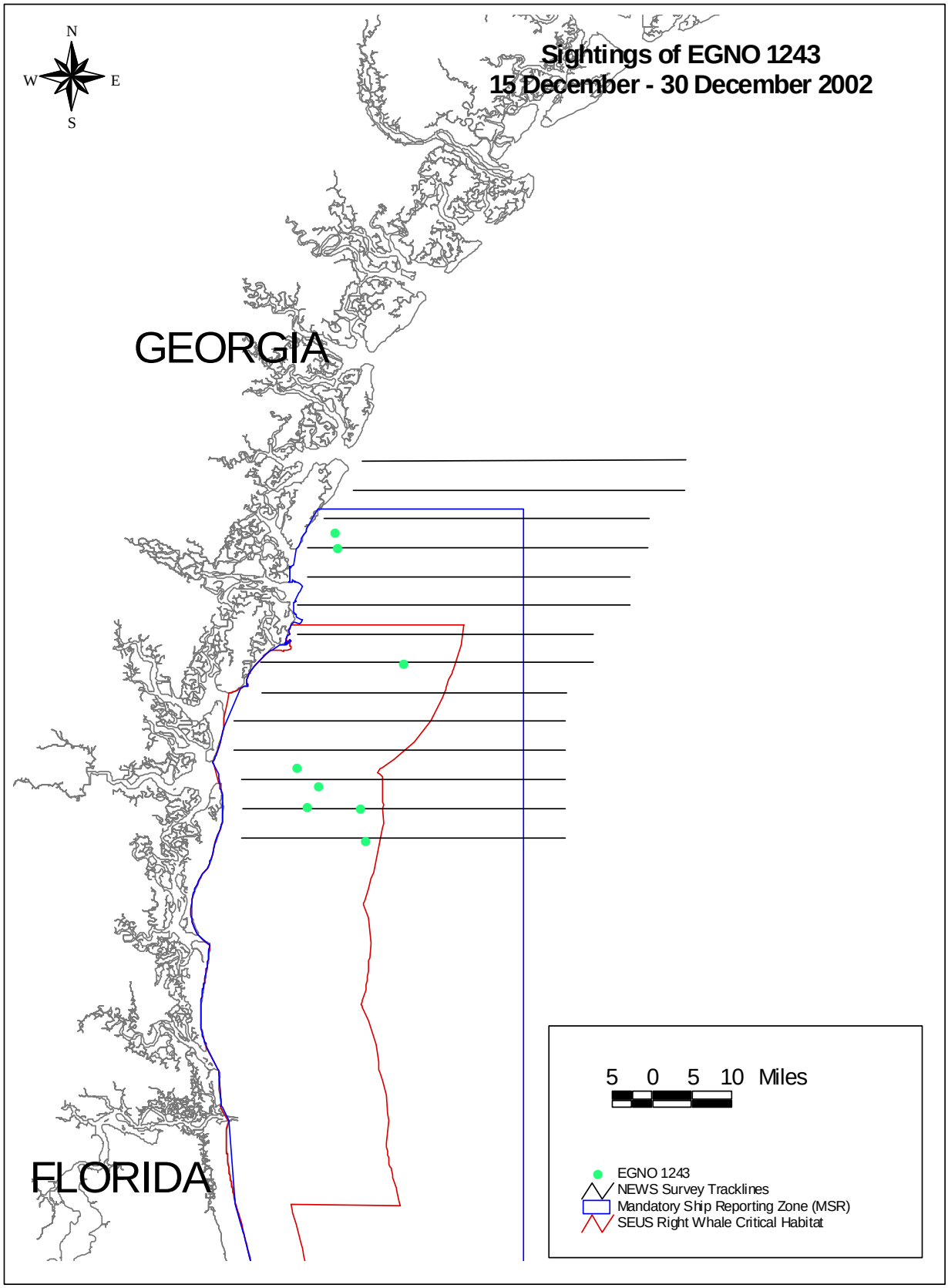
Appendix 2. Maps of individual right whale movements during the 2002-2003 season.




GEORGIA
Sightings of EGNO 2123
11 January 2003 - 12 March 2003
Brunswick
FLORIDA
5 0 5 10 Miles
Cow with Calf
Adults/Juveniles
Revised Coastal Tracklines (Jan 2003)
Mandatory Ship Reporting Zone (MSR)
SEUS Right Whale Critical Habitat
N
W
E
S


Sightings of EGNO 1158 and 1303
11 December 2002 - 19 February 2003
GEORGIA
FLORIDA
Original NEWS Tracklines
(Revised JAN03)
5 0 5 10 Miles
N
W
E
S
EGNO 1158 & 1303
EGNO 1303
Revised Early Warning System Tracklines
NEWS Survey Tracklines
Mandatory Ship Reporting Zone (MSR)
SEUS Right Whale Critical Habitat


Sightings of EGNO 1151
11 December 2002 - 19 February 2003
N
W
E
S
GEORGIA
FLORIDA
5 0 5 10 Miles
EGNO 1151
Revised Early Warning System Tracklines
NEWS Survey Tracklines
Mandatory Ship Reporting Zone (MSR)
SEUS Right Whale Critical Habitat


Sightings of EGNO 1243
15 December - 30 December 2002
N
W
E
S
GEORGIA
FLORIDA
5 0 5 10 Miles
EGNO 1243
NEWS Survey Tracklines
Mandatory Ship Reporting Zone (MSR)
SEUS Right Whale Critical Habitat