

NORTH CAROLINA AND SOUTH CAROLINA EARLY WARNING SYSTEM
NORTH ATLANTIC RIGHT WHALE (*Eubalaena glacialis*)
AERIAL SURVEYS, 2020-2021 SEASON

FINAL PERFORMANCE REPORT TO
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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 is in the Atlantic coastal waters of the Southeastern U.S. (SEUS). A portion of the region was designated as Critical Habitat for North Atlantic right whales by the National Oceanic and Atmospheric Administration (NOAA) National Marine Fisheries Service (NMFS) in 1994 (50 CFR 226.203). In 2016, the Critical Habitat was expanded to include waters from Cape Fear, North Carolina to south of Canaveral National Seashore, Florida. The North Atlantic right whale experiences a high level of anthropogenic mortality, including collisions with vessels and entanglement in fishing gear. Within the Critical Habitat are numerous entrances to commercial shipping ports resulting in frequent usage of these waters by both North Atlantic right whales and recreational, commercial, and military vessels.

In the area from northern coastal Georgia to the North Carolina/Virginia border, commercial shipping ports are located in Savannah, GA; Charleston, SC; Wilmington, NC; and Morehead City, NC. These deep draft ports require periodic dredging to remain operational. Historically, nearshore hopper dredging in the vicinity of where right whales migrate and may calve primarily occurred during the winter to avoid mortality to endangered sea turtles; however, this is also when right whales are present in the area.

Aerial surveys have been flown to detect North Atlantic right whales in the core calving area off Georgia and Florida since the mid-1980s. Considerably less effort has been dedicated to detecting right whales in South Carolina waters, when previous aerial survey efforts ended in 2013, and especially into North Carolina coastal waters. Reestablishing dedicated aerial surveys off northern Georgia and South and North Carolina provide the opportunity to learn more about North Atlantic right whale habitat use in the northern portion, and beyond, the Critical Habitat. The additional efforts also provide coverage over the remaining coastline where nearshore dredging activities take place within the U.S. Army Corps of Engineers South Atlantic Division area of responsibility that are not currently being monitored.

To decrease the risk of impacts to the North Atlantic right whales from vessel activities in the coastal waters of North Carolina, South Carolina and north Georgia, aerial surveillance data was collected and reported. Two aerial survey teams, identified as the North Carolina Early Warning System (NCWS) and South Carolina Early Warning System (SCWS), were managed by Clearwater Marine Aquarium Research Institute (CMARI), and funded by the U.S. Army Corps of Engineers (USACE). The two aerial teams covered the nearshore continental shelf area from the North Carolina/Virginia border south to approximately Tybee Island, GA (Fig. 1). The 107 tracklines averaged 35nmi varying in distance between 10 to 52nmi. Survey teams worked in conjunction with each other, choosing a subset of transects to be flown each day, monitoring weather conditions, and considering other seasonal factors that influenced the daily decision-making process. The survey effort described in this report covers the CMARI NCWS and SCWS aerial surveys that were conducted from 22 December 2020 through 15 April 2021.

Results

Aerial Surveys

A total of 115 days were available to survey between 22 December 2020 and 15 April 2021. Eighty-eight surveys, totaling 591.3hrs of survey effort, were conducted by the NCWS (43 surveys; 282.1hrs) and SCWS (45 surveys; 309.2hrs) aerial teams (Table 1; Figure 2). Non-survey days for the NCWS team resulted from poor weather conditions (n = 60 days), aircraft maintenance or mechanical

issues (n = 11 days), and a required pilot rest day (n = 1 day). Similarly, non-survey days for the SCWS team resulted from poor weather conditions (n = 62 days), aircraft maintenance or mechanical issues (n = 7 days), and a required pilot rest day (n = 1 day). A total of 37,136.75nmi (NCWS: 17,603.78nmi; SCWS: 19,532.97nmi) of trackline were flown (Table 1). Survey effort varied among months (Fig. 3; Table 2), with the lowest effort by both teams occurring in December [total n = 3,100.53nmi flown (NCWS: n = 1,694.38nmi flown; SCWS: n = 1,406.15nmi flown)] due to a delayed start of the season and poor weather conditions. For both teams, the greatest survey effort occurred in March [total n = 10,968.18nmi flown (NCWS: n = 4,674.34nmi; SCWS: n = 6,293.84nmi)], largely due to increased daylight hours, though poor weather conditions remained a factor in the amount of survey effort conducted (Fig. 3; Table 2).

Right Whale Sightings

A total of 27 right whale sighting events consisting of 52 right whales were documented during NCWS and SCWS surveys (average = 1.9 whales per sighting, range = 1-5) (Appendix A). The first sighting of the season was on 22 December 2020 and the last sighting on 12 March 2021. Twelve of the 27 sightings were of single animals, four sightings were groups of two whales, three sightings were groups of three whales, two sightings were groups of four whales, one sighting was a group of five whales, and five sightings were mother-calf pairs (Fig. 1). Eleven of the 27 sightings occurred outside of the Critical Habitat (Fig. 1). A sighting event of four individuals off Cape Hatteras, NC on 05 January triggered a Dynamic Management Area (DMA), which was extended in duration after another sighting of five individuals off Cape Hatteras, NC occurred on 11 January. Individual survey team statistics are provided in Appendix A.

The greatest number of sighting events occurred in March (n = 9), followed by December (n = 8), January (n = 6), and then February (n = 4) (Table 2). No sighting events occurred in April. The greatest number of right whales sighted occurred in December (n = 19), followed by January (n = 16), March (n = 12), and February (n = 5) (Table 2). When survey effort is factored in, a peak in sighting events and the number of whales sighted occurred in December (SCWS) and January (NCWS) (Fig. 4).

Preliminary photo analysis of right whales sighted by the survey teams resulted in the identification of four mother-calf pairs, eight adult females, one pregnant female, 13 adult males, three juvenile females, one juvenile male, two juveniles of unknown sex, and one unidentified whale for a total of 37 individual right whales (Appendix A). Of the 37 individual right whales sighted, the largest demographic group was adult males (35%), followed by adult females (21%), females with a calf (11%), calves (11%), juvenile females (8%), juveniles of unknown sex (5%), pregnant female (3%), juvenile male (3%), and unknown individual (3%) (Fig. 5). Of known age classes, 70% of the individual whales were adults, 16% were juveniles, and 11% were calves.

A total of 17 mother-calf pairs were documented in the SEUS during the 2020-2021 calving season, wherein four pairs were sighted by the NCWS and SCWS survey teams (Appendix A). Catalog #3593 and her 2021 calf were first sighted during NCWS surveys. This individual was not sighted by any other survey team during the 2020-2021 calving season, and the sex of the mother was previously unknown due to a sparse sighting history in known right whale calving and feeding grounds. Catalog #3520, #3860, and #3942 and their 2021 calves were sighted during SCWS surveys. These mother-calf pairs were first sighted by Florida or Georgia aerial survey teams, and two of the four pair sightings were verifications from public sources of whale sightings.

Entangled Right Whales

One entangled right whale was sighted during the 2020-2021 SCWS surveys. On 27 January, the SCWS team sighted an entangled and dead right whale approximately 18nmi east of Murrells Inlet, SC.

The whale was a known entanglement case, identified as 12-year-old male Catalog #3920 ('Cottontail'). Catalog #3920 was last seen alive on 18 February by the CMARI's Georgia aerial survey team off the Palm Bay, FL area. On 18 February, the R/V Poseidon successfully attached a telemetry buoy to the entanglement configuration on the whale. At this time, the whale was described as mostly dark in color but extremely thin. Light-colored lines exiting the right jawline as well as open wounds on the peduncle were visible. No entangled right whales were sighted during the NCWS surveys.

Dead and Injured Right Whales

Dead Right Whales

The SCWS survey team observed one dead right whale (Catalog #3920; 'Cottontail') during the 2020-2021 season. On 27 February, the carcass of the entangled 12-year-old male was detected approximately 18nmi east of Murrells Inlet, SC. Upon discovery, the carcass was largely intact, positioned right-side up in the water, and a light-colored line exiting the whale's right jawline was visible. The SCWS team relocated the carcass (~17.5nmi east of Murrells Inlet) a second time on 27 February for drift analysis purposes.

On 28 February, the SCWS survey team performed a dedicated survey to relocate the carcass of Catalog #3920. The aerial team detected the carcass approximately 11nmi east of Murrells Inlet, SC, and subsequently made contact with researchers aboard the U.S. Coast Guard (USCG) Cutter Nathan Bruckenthal. The vessel-based team arrived on scene to attach a telemetry buoy to the carcass for monitoring and to retrieve line/gear. Not all gear was successfully recovered from the whale. The SCWS team remained on scene until notified that further assistance was not required.

The SCWS team relocated the carcass of Catalog #3920 an additional five times (three times performing verifications using coordinates as provided by NOAA/carcass tag and two times during normal survey efforts), throughout the month of March. This aerial support was beneficial to photo-document and monitor the rate of decomposition as well as to provide information for future drift analysis modelling. Unless otherwise noted, sharks were observed in the vicinity of and/or scavenging on the carcass at all sighting events.

- 04 March; verification search from NOAA (carcass tag)- carcass was located approximately 8nmi off Cape Island, SC. The remaining light-colored line with the telemetry buoy attached was visible from the whale's jawline area. The carcass was semi-intact and had rotated in the water towards a belly-up position. The peduncle was sub-surface, and the flukes were not visible.
- 04 March; normal survey efforts- carcass was located approximately 9nmi off Cape Island, SC. No gross changes to carcass from the earlier sighting on this day. No sharks were observed during this sighting.
- 09 March; verification search from NOAA (carcass tag)- carcass was spotted approximately 27nmi off Edisto Island, SC. The line and telemetry buoy were still visible. The carcass was semi-intact (intestines were visible) and had rotated in the water to a belly-up position.
- 09 March; normal survey efforts- carcass was approximately 26nmi off Edisto Island, SC. No gross changes to carcass from the earlier sighting on this day.
- 12 March; verification search from NOAA (carcass tag)- carcass was approximately 22nmi off Fripp Island, SC. Much of the whale was sub-surface, with only the flippers to the head portion of the body still above water.

On 24 March, the telemetry buoy was retrieved free-floating with no tissue attached by Florida Fish and Wildlife Conservation Commission (FWC-FWRI) off Jacksonville Beach, FL. No dead right whales were sighted during the 2020-2021 NCWS surveys.

Injured Right Whales

A total of three right whales of the 2020-2021 season All Points Bulletin (APB) Injured list were sighted by the NCWS and SCWS aerial survey teams. The APB Injured list is a compilation of whales provided by the New England Aquarium, updated on a semi-annual basis, to field teams for continued health assessment purposes. The NCWS team observed one injured whale, Catalog #4457, a 7-year-old juvenile male, on 11 January. The whale was engaged in a medium-energy surface active group (SAG) with four other individuals approximately 9.6nmi off Hatteras Island, NC. Catalog #4457 did not exhibit any concerning behavior during the sighting, and the small lesions on the body were only noticed during photo-analysis post-survey. This individual is being monitored due to two previous entanglement events as well as the lesions on its back. The SCWS team observed two injured whales in December. Catalog #3503 ('Caterpillar'), a 16-year-old adult female and previously known to be injured, was first sighted during a SCWS survey on 27 December. Catalog #3503 continues to be monitored for previous entanglement and vessel strike injuries. Also on 27 December, Catalog #3812, a 13-year-old adult male, was sighted by the SCWS team with large lip lesions from unknown causes. The lesions have been previously documented and are believed to have begun forming in 2019. This individual has been added to the list of APB injured whales for continued monitoring.

Whale/Vessel Co-occurrences

Neither the NCWS or SCWS team observed any co-occurrences of whales and vessels during the 2020-2021 season.

Marine Animal Sightings

NCWS Sightings

A total of 35 humpback whales (*Megaptera novaeangliae*), six fin whales (*Balaenoptera physalus*), and one sperm whale (*Physeter macrocephalus*) were sighted by the NCWS team (Table 3). On 30 March, the USCG reported a humpback whale carcass just inside Oregon Inlet, NC, and the NCWS team responded to document the sighting. On 31 March and 06 April, the aerial survey team re-sighted the humpback whale carcass in approximately the same location (Table 3). In addition to large whales, the NCWS team observed eight leatherback turtles (*Dermochelys coriacea*; Appendix B), 11 giant manta rays (*Mobula birostris*; Appendix C), one basking shark (*Cetorhinus maximus*), two great white sharks (*Carcharodon carcharias*), 22 unspecified hammerhead sharks (*Sphyrna sp.*), and 45 to 75 unknown sharks (Appendix D).

SCWS Sightings

Six humpback whales were sighted during SCWS surveys throughout the 2020-2021 season (Table 3). Additionally, 94 leatherback turtles (Appendix B), 34 great white sharks, 12 unspecified hammerhead sharks, two tiger sharks (*Galeocerdo cuvier*), one basking shark, one shortfin mako shark (*Isurus oxyrinchus*), and 10 unidentified large sharks were observed (Appendix D). No giant manta rays were sighted.

Fixed Fishing Gear Sightings

Beginning in early February, the NCWS survey team consistently sighted fishing buoys both inshore and offshore North Carolina (Table 4). Strings with 4-6 visible buoys were assigned as crab gear, while longer strings (7+) were assigned as unknown fishing gear. Throughout the 2020-2021 season (December-April), the SCWS survey team occasionally sighted and recorded fishing buoys inshore along the coasts of both South and North Carolina (Table 4).

Acknowledgements

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FIGURES

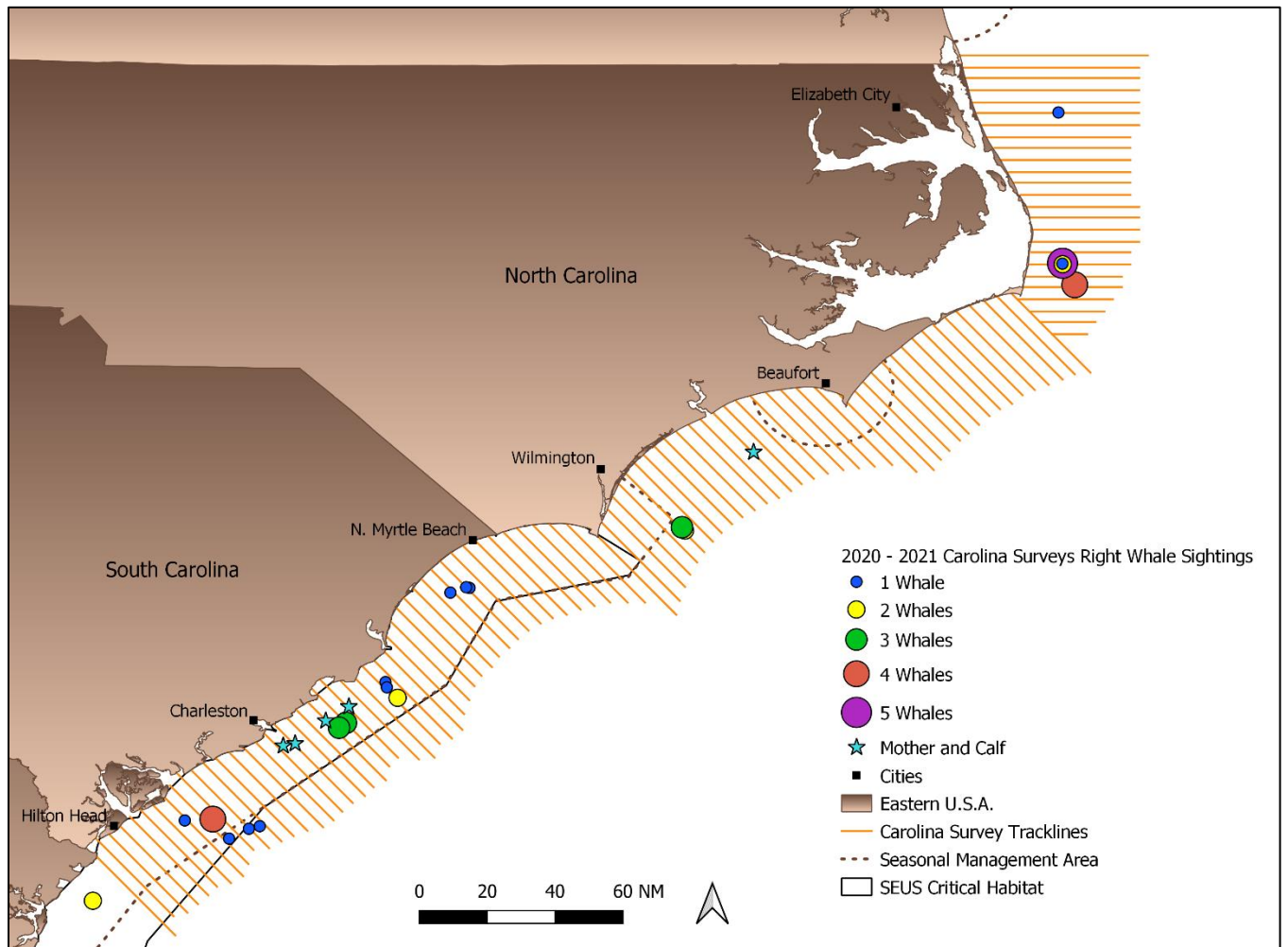


Figure 1. Carolina Surveys 2020-2021 tracklines and all right whale sightings. The Carolina Surveys were comprised of 107 tracklines, covering an area from False Cape State Park, VA to Tybee Island, GA, that were flown by two survey teams (NCWS and SCWS) from 22 December 2020 to 15 April 2021.

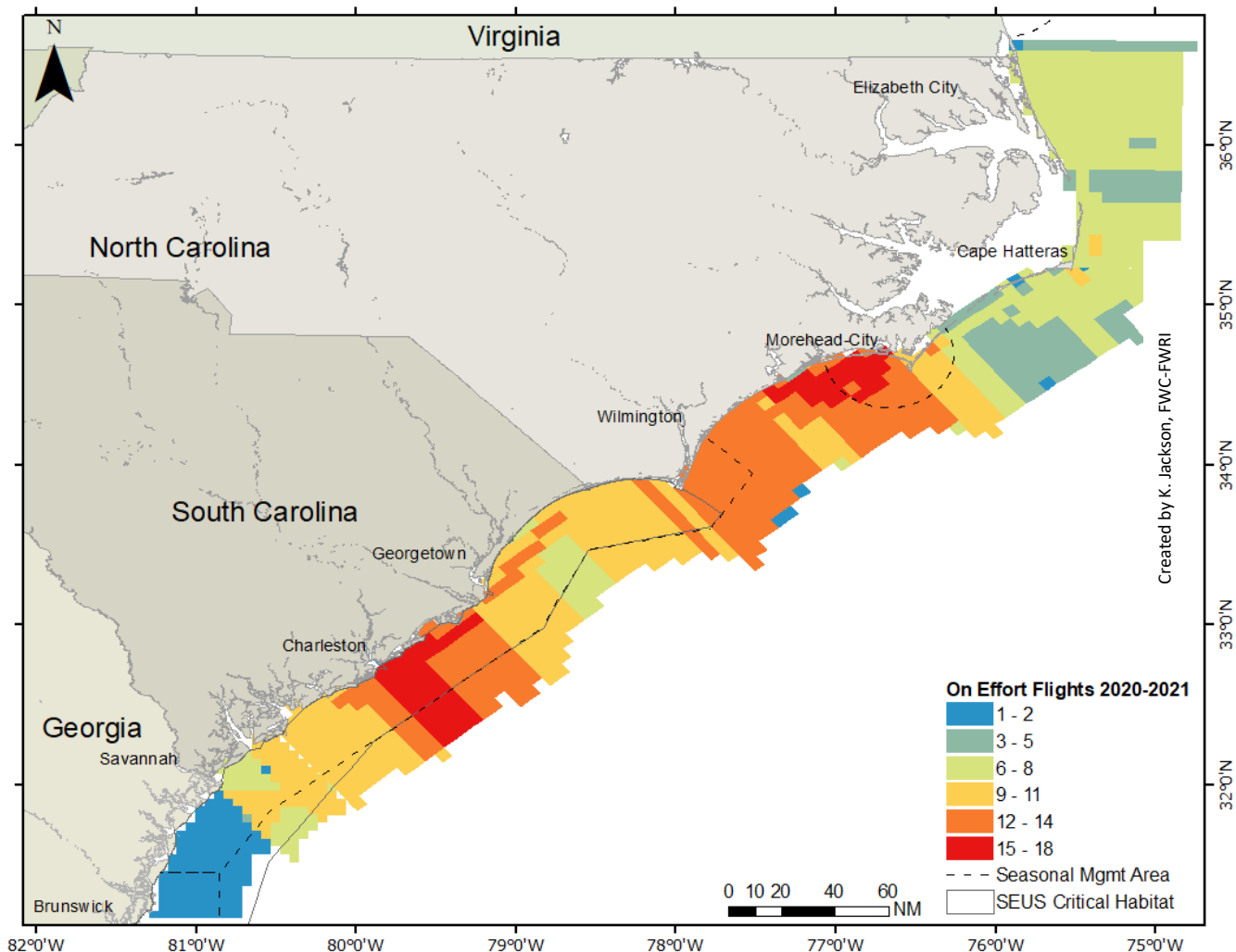
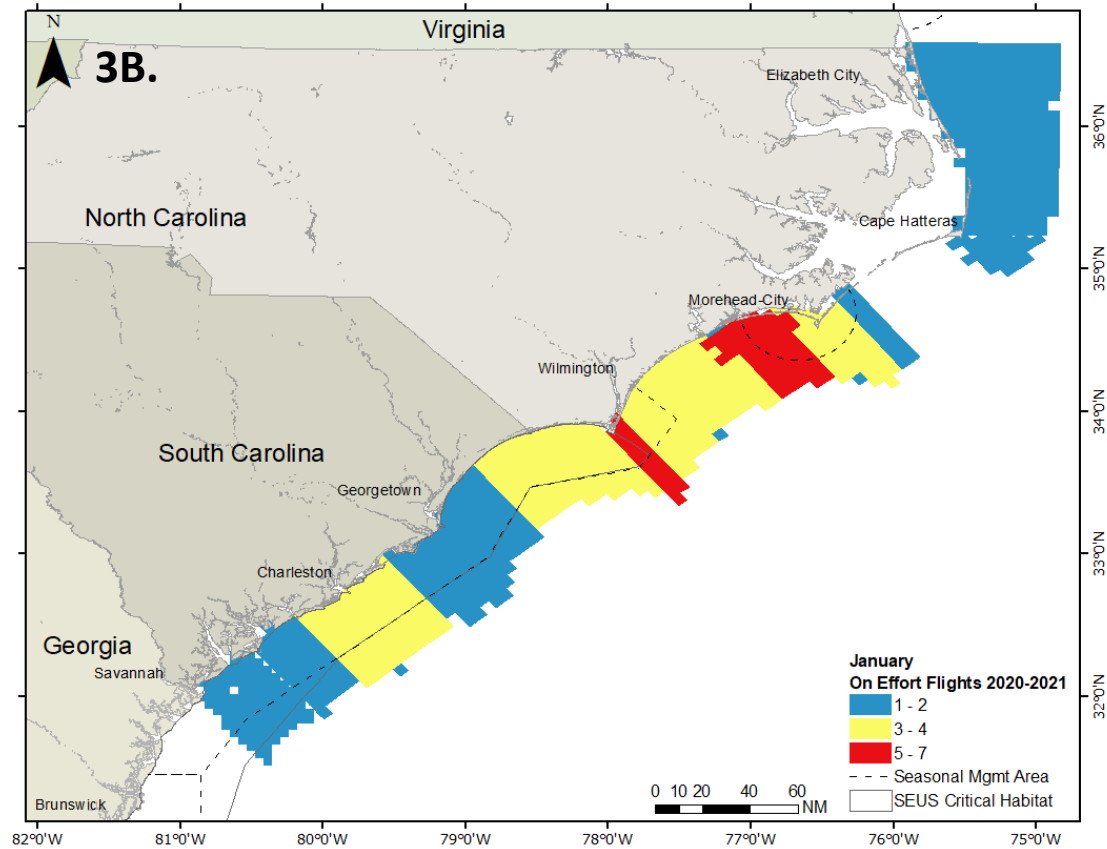
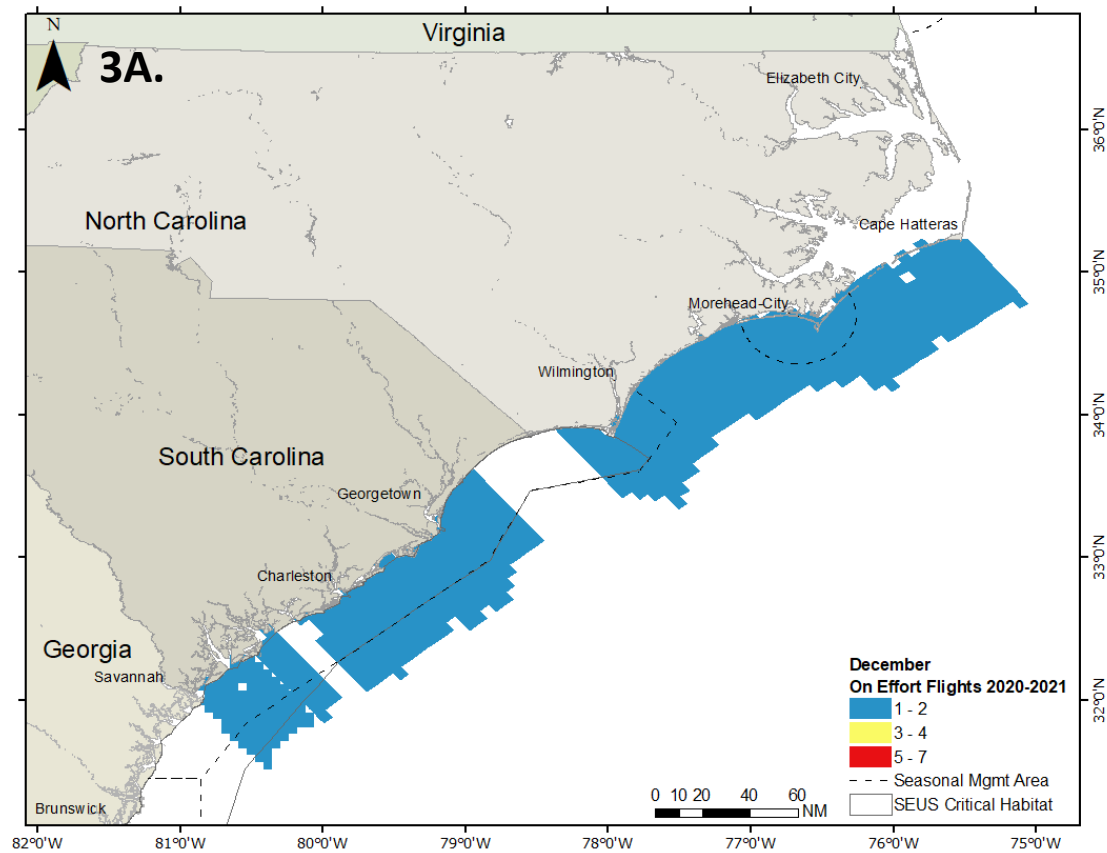
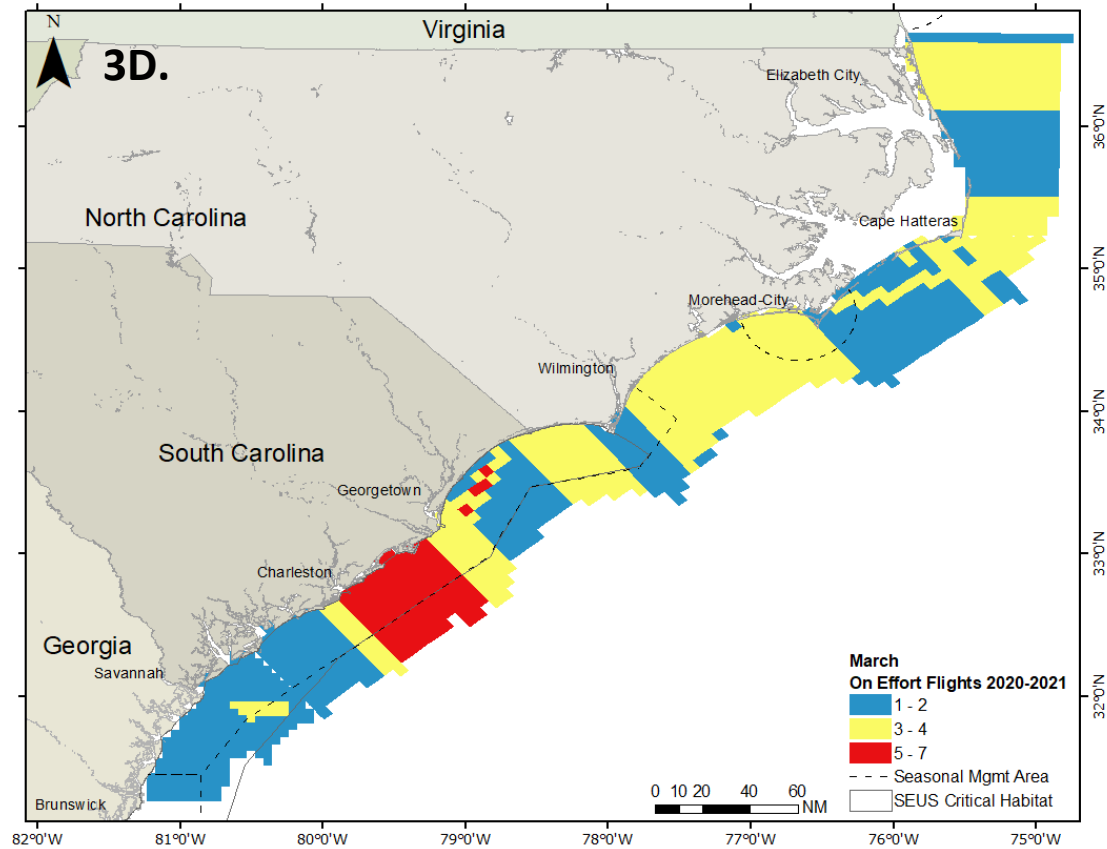
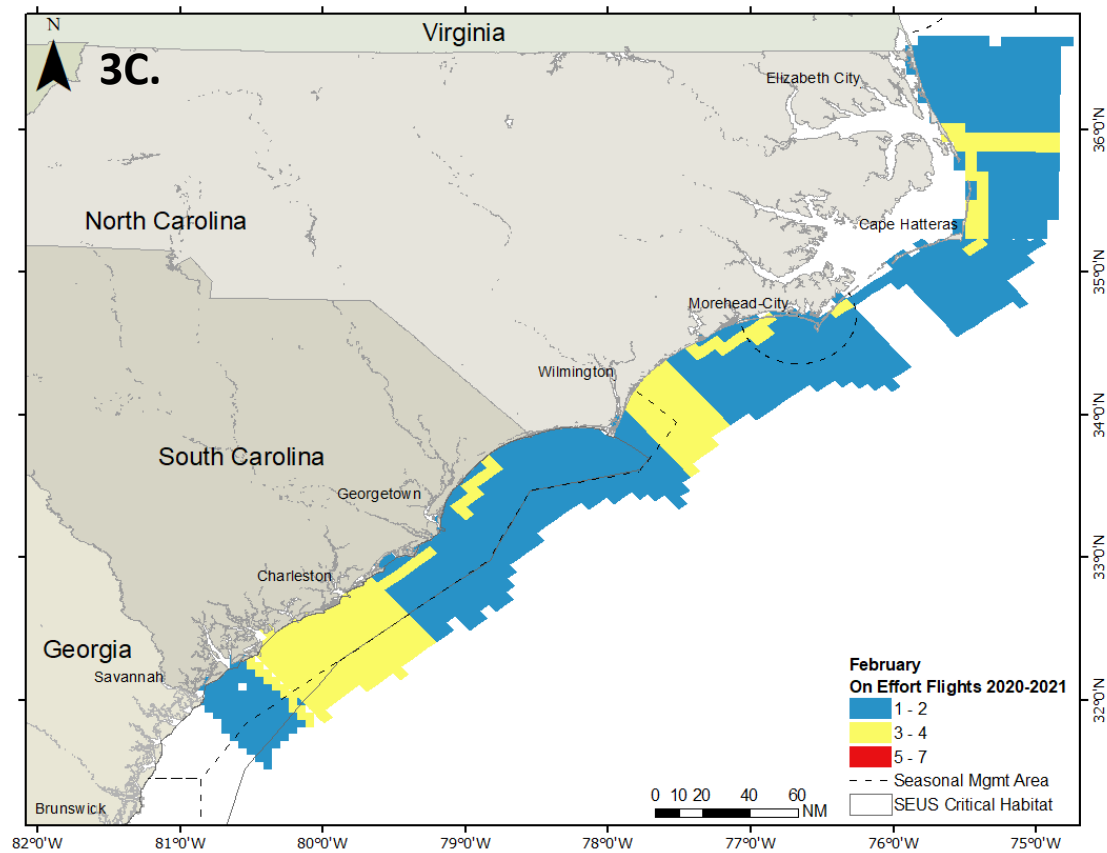


Figure 2. Carolina Surveys 2020-2021 spatial distribution of survey effort. Preliminary aerial survey effort for the 2020-2021 calving season under the following conditions: Beaufort sea state 4 or less, visibility at least 2nmi (3.7 km), and altitude < 1,200 ft (366 m). Effort for directed/verification surveys, while circling a sighting, or in transit between transects is not included. Effort is displayed in 4x4 nmi (NC and most of SC) or 3x3 nmi grid cells (GA and southern SC). *Map created by K. Jackson, FWC-FWRI.*





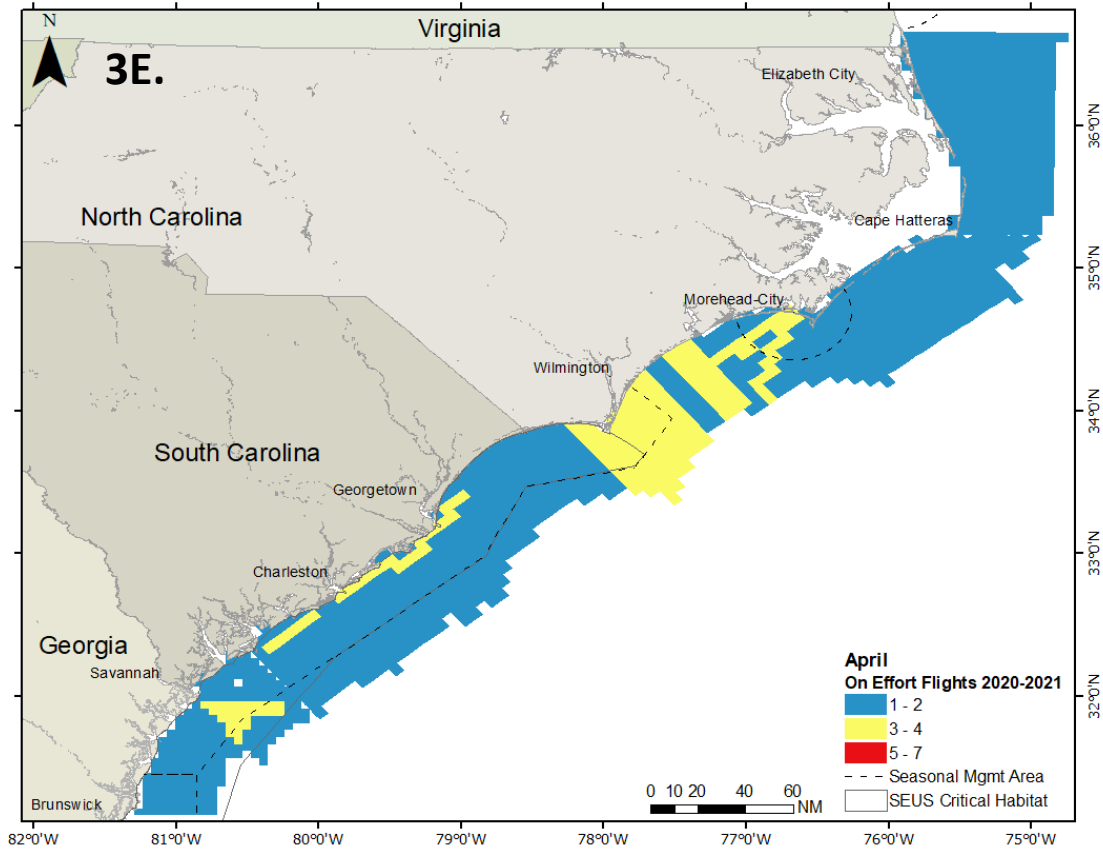


Figure 3. Carolina Surveys 2020-2021 spatial distribution of survey effort by month: December (A.), January (B.), February (C.), March (D.), and April (E.). Preliminary aerial survey effort for the 2020-2021 calving season under the following conditions: Beaufort sea state 4 or less, visibility at least 2 nmi (3.7 km), and altitude < 1,200 ft (366 m). Effort for directed/verification surveys, while circling a sighting, or in transit between transects is not included. Effort is displayed in 4x4 nmi (NC and most of SC) or 3x3 nmi grid cells (GA and southern SC). *Maps created by K. Jackson, FWC-FWRI.*

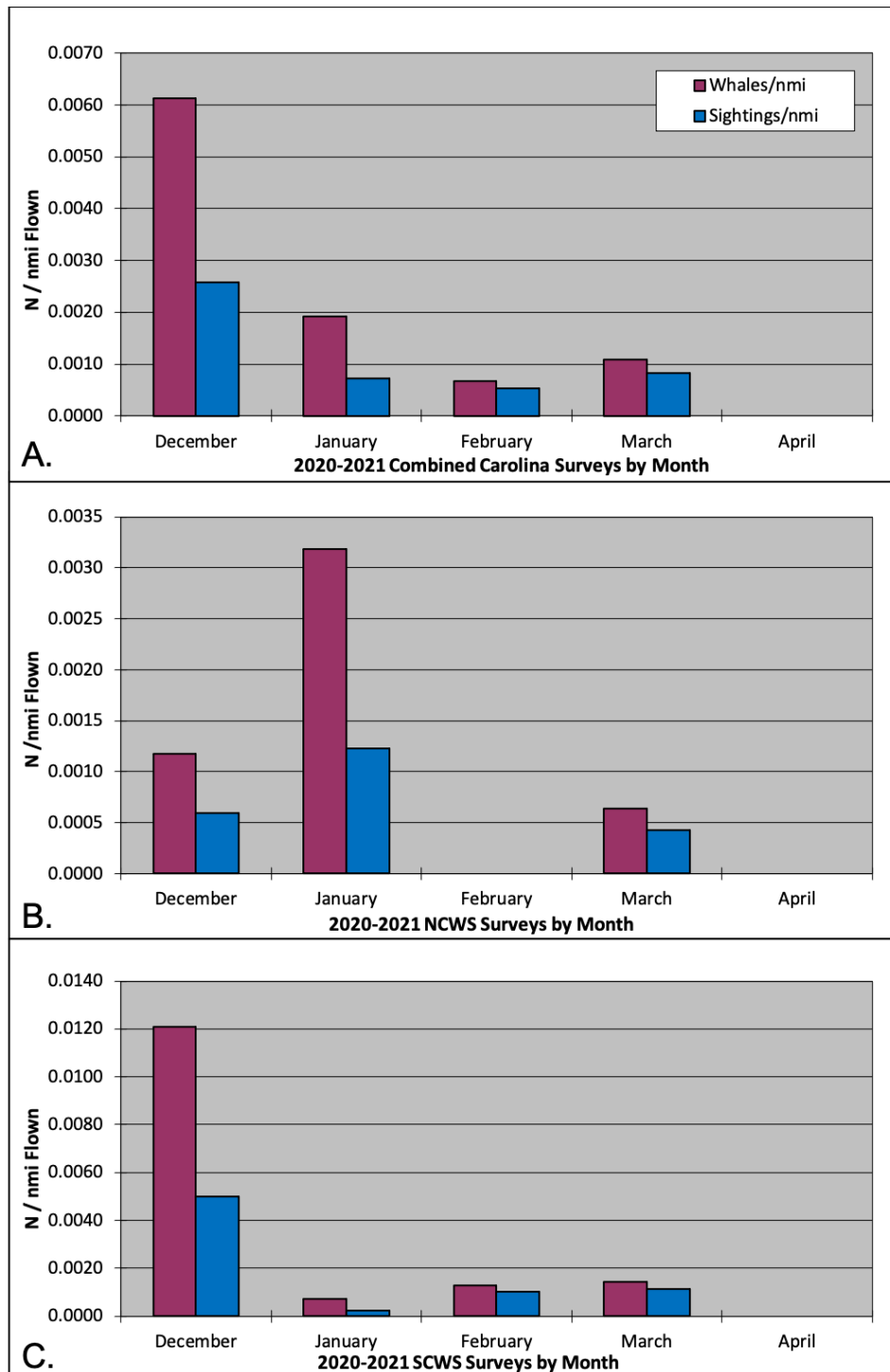


Figure 4. Carolina Surveys results during the 2020-2021 season for number of right whales and number of sightings per nautical mile (nmi) for both survey teams combined (A.), NCWS (B.), and SCWS (C.). No right whales were sighted in April by either survey team.

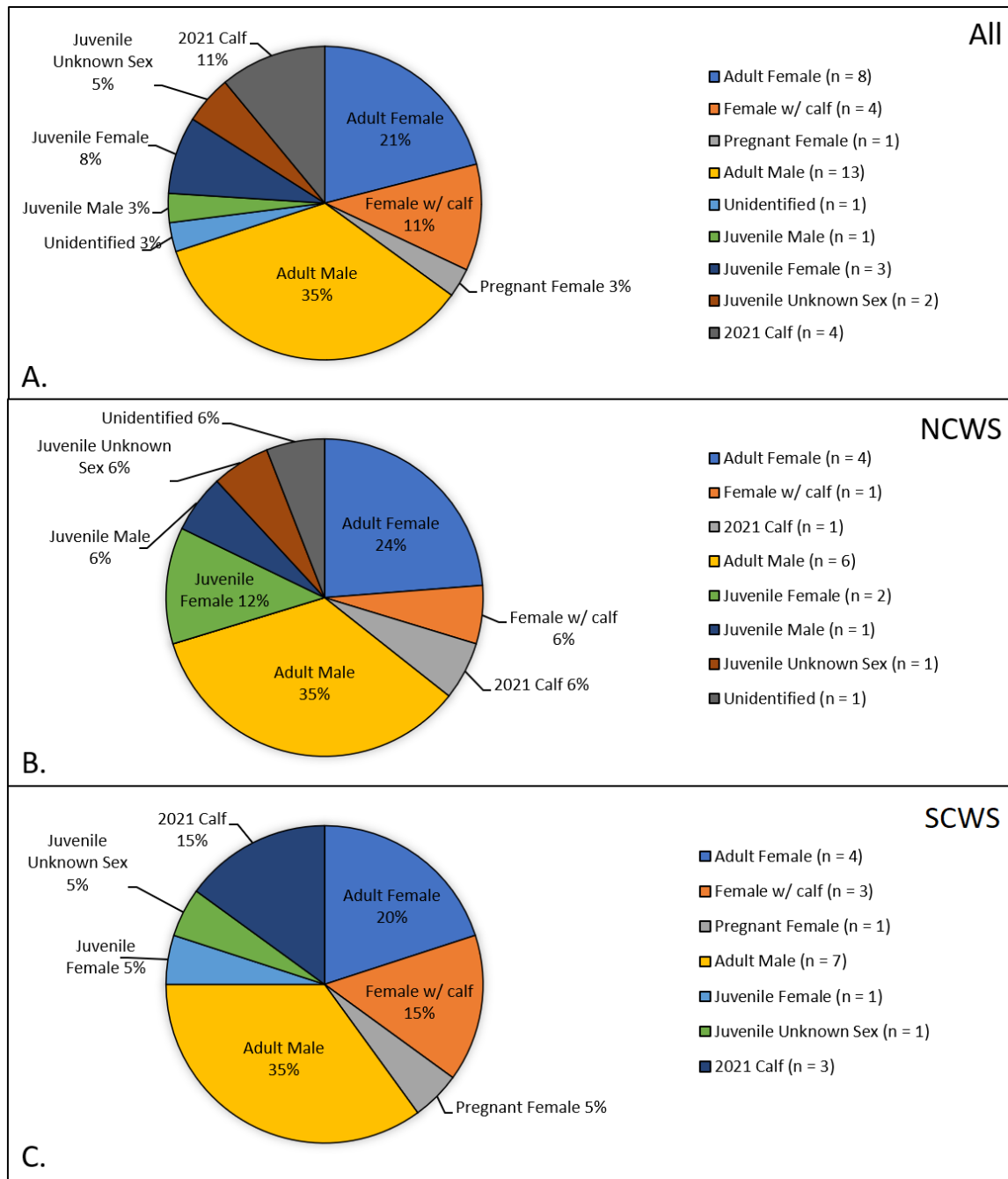


Figure 5. Demographic breakdown of right whale sightings by both Carolina survey teams combined (A.), as well as those for the NCWS (B.) and SCWS (C.) teams. The majority of individuals seen by both teams were adult males (35% combined) and adult females (21% combined).

TABLES

Table 1. Summary of the Carolina right whale surveys (NCWS and SCWS survey teams) from 22 December 2020 through 15 April 2021.

Date	Survey Name	Carolina Tracklines Intended to Fly	Carolina Tracklines Flown	Full Survey*	Partial/Reduced Survey	Survey Hobbs Time (hrs)	Total Trackline Flown (nmi)	Trackline Flown in BSS ≤ 3 (nmi)**	Number of Right Whales Sighted
12/22/20	SCWS	20-11	20-15		X	4.8	252.1	216.86	2
12/23/20	NCWS	68-57	68-57		X	3.4	226.06	207.19	0
12/23/20	SCWS	22-13	22-13		X	6.4	346.4	132.39	6
12/27/20	NCWS	68-55	68-55	X		7.1	522.91	522.91	0
12/27/20	SCWS	12-1	10-1		X	8	351.72	351.72	7
12/28/20	NCWS	54-43	54-43	X		7.8	415.58	415.58	2
12/28/20	SCWS	34-23	34-23	X		7.1	455.93	455.93	2
12/30/20	NCWS	82-69	82-69	X		6.3	529.83	529.83	0
1/4/21	NCWS	71-58	69-58		X	5.5	433.05	345.59	0
1/4/21	SCWS	12-1	16-5	X		7.4	421.25	421.25	0
1/5/21	NCWS	107-96	101-96		X	7.1	220.27	220.27	5
1/6/21	SCWS	42-35	42-35		X	3.7	280.31	280.31	0
1/7/21	NCWS	66-55	66-55		X	5.5	441.74	441.74	0
1/7/21	SCWS	54-43	54-43	X		6.9	418.18	418.18	3
1/11/21	NCWS	94-83	94-83	X		7.0	304.19	304.19	8
1/11/21	SCWS	12-1	10-1		X	6.9	352.74	352.74	0
1/13/21	NCWS	71-60	71-60		X	5.9	414.23	414.23	0
1/13/21	SCWS	24-13	24-17		X	5.1	281.04	270.61	0
1/14/21	NCWS	106-95	106-101, 98-95		X	7.7	383.46	383.46	0
1/14/21	SCWS	48-39	48-39		X	4.8	372.29	282.71	0
1/19/21	NCWS	57-46	57-46	X		6.3	518.27	459.55	0
1/19/21	SCWS	22-11	22-11	X		7.1	421.9	421.9	0
1/22/21	NCWS	71-58	71-58		X	6.7	504.36	332.98	0
1/22/21	SCWS	36-25	38-25	X		6.6	491.46	491.46	0
1/24/21	NCWS	64-53	64-53	X		5.9	477.65	467.35	0
1/24/21	SCWS	52-41	47-36	X		6	418.3	418.3	0
1/29/21	NCWS	57-46	55-46		X	5.7	381.77	348.71	0
1/29/21	SCWS	35-26	35-28		X	4.8	320.04	272.69	0
1/30/21	SCWS	24-13	26-13	X		7.7	492.47	250.44	0
2/4/21	NCWS	89-76	87-76	X		7.4	418.18	351.60	0
2/4/21	SCWS	18-7	20-7	X		7.8	493	493	0
2/8/21	NCWS	99-88	97-88		X	5.5	301.10	249.36	0
2/9/21	NCWS	107-96	107-98		X	7.1	430.60	430.60	0

Date	Survey Name	Carolina Tracklines Intended to Fly	Carolina Tracklines Flown	Full Survey*	Partial/ Reduced Survey	Survey Hobbs Time (hrs)	Total Trackline Flown (nmi)	Trackline Flown in BSS ≤ 3 (nmi)**	Number of Right Whales Sighted
2/9/21	SCWS	54-43	54-49		X	3.4	209.58	209.58	0
2/17/21	NCWS	107-94	98-86		X	6.7	359.33	21.37	0
2/17/21	SCWS	28-17	28-15	X		7.3	491.88	99.66	0
2/20/21	NCWS	66-55	57-55		X	1.9	73.40	11.20	0
2/20/21	SCWS	40-29	40-29	X		5.4	419.82	333.37	0
2/21/21	NCWS	68-57	68-57		X	5.5	409.78	201.67	0
2/23/21	SCWS	12-1	12-1	X		6.9	518.05	518.05	0
2/24/21	NCWS	107-96	105-96		X	8.3	626.61	626.61	0
2/24/21	SCWS	54-41	54-41	X		6.5	488.98	488.98	0
2/25/21	NCWS	55-44	55-44	X		6.6	518.10	490.80	0
2/25/21	SCWS	26-13	26-13	X		8.1	429.71	429.71	2
2/26/21	SCWS	14-1	14-1	X		8.0	492.98	492.98	0
2/27/21	NCWS	66-55	70-59	X		5.9	453.51	437.77	0
2/27/21	SCWS	40-27	40-31		X	6.8	354	354	2
2/28/21	NCWS	VERIFICATION	VERIFICATION		X	1.6	0.00	0.00	0
2/28/21	SCWS	VERIFICATION	VERIFICATION		X	2.8	0.00	0.00	1
3/3/21	NCWS	107-96	107-100		X	8.2	370.71	370.71	0
3/4/21	NCWS	72-57	64-57		X	5.1	263.89	251.48	0
3/4/21	SCWS	30-17	30-17	X		8.5	491.56	432.21	2
3/6/21	NCWS	80-65	80-65	X		7.8	560.86	370.61	0
3/8/21	NCWS	106-95	106-99		X	8.0	356.18	356.18	1
3/8/21	SCWS	56-41	56-43	X		8.2	564.55	564.55	0
3/9/21	NCWS	90-77	90-78	X		6.7	356.51	229.01	0
3/9/21	SCWS	14-1	12-1	X		8.6	422.85	422.85	2
3/10/21	NCWS	77-62	77-62	X		7.7	559.07	559.07	0
3/10/21	SCWS	28-13	26-13	X		8.5	491.57	491.57	2
3/11/21	NCWS	61-46	61-49		X	8.1	519.66	519.66	2
3/11/21	SCWS	28-17	24-17	X		6	280.53	280.53	2
3/12/21	SCWS	EWS 1-14	EWS 1-14	X		8.2	367.37	367.37	1
3/13/21	SCWS	30-17	30-17	X		7.5	558.96	356.25	0
3/14/21	SCWS	44-31	44-31	X		7.3	490.16	490.16	0
3/23/21	SCWS	28-17	28-17	X		5.9	432.29	387.34	0
3/24/21	SCWS	16-1	16-3	X		8.1	492.58	492.58	0
3/25/21	NCWS	92-77	92-79	X		8.8	385.96	385.96	0
3/25/21	SCWS	54-39	54-39	X		8.7	635.84	635.84	0
3/29/21	NCWS	66-55	66-55		X	6.0	409.85	409.85	0

Date	Survey Name	Carolina Tracklines Intended to Fly	Carolina Tracklines Flown	Full Survey*	Partial/ Reduced Survey	Survey Hobbs Time (hrs)	Total Trackline Flown (nmi)	Trackline Flown in BSS ≤ 3 (nmi)**	Number of Right Whales Sighted
3/29/21	SCWS	42-31	42-31	X		5.3	419.68	406.96	0
3/30/21	NCWS	107-96	107-96		X	9.2	504.70	504.70	0
3/30/21	SCWS	30-15	30-15	X		8.4	645.9	323.28	0
3/31/21	NCWS	95-82	95-83	X		7.5	386.95	297.47	0
4/3/21	SCWS	14-1	14-1	X		8.1	493.13	423.04	0
4/4/21	NCWS	107-96	107-96	X		8.4	509.15	441.42	0
4/5/21	NCWS	57-44	57-44	X		7.8	569.09	569.09	0
4/6/21	NCWS	95-86	95-84	X		6.1	326.57	321.30	0
4/7/21	NCWS	82-67	82-67	X		8.3	554.95	535.00	0
4/8/21	NCWS	66-53	66-59		X	3.7	263.19	263.19	0
4/8/21	SCWS	52-39	52-37	X		7.4	559.79	540.26	0
4/9/21	NCWS	58-47	58-47	X		6.8	459.22	459.22	0
4/9/21	SCWS	EWS 1-16	EWS 1-16	X		8.7	508.40	508.40	0
4/10/21	SCWS	32-17	32-17	X		8.0	628.55	594.27	0
4/12/21	SCWS	14-1	14-1	X		8.1	492.59	435.95	0
4/13/21	NCWS	54-43	51-43		X	5.8	337.46	318.46	0
4/13/21	SCWS	42-29	42-29	X		6.2	490.13	490.13	0
4/14/21	NCWS	70-55	70-55		X	7.7	545.83	545.83	0
4/14/21	SCWS	28-15	28-15	X		7.2	492.41	489.56	0
TOTALS	All Surveys	88		53	35	591.3	37,136.75	33,512.69	52
	NCWS Surveys	43		19	24	282.1	17,603.78	15,922.77	18
	SCWS Surveys	45		34	11	309.2	19,532.97	17,589.92	34

*Full Survey: No standard tracklines cut short and at least 12 tracklines flown out to the eastern endpoints.

**BSS: Beaufort Sea State

Table 2. Carolina Surveys right whale aerial survey effort per month for the 2020-2021 season.

Survey Month	Survey Name	# of Surveys	# of Complete Surveys	# of Partial/ Reduced Surveys	Survey Hobbs Time (hrs)	Total Trackline Flown (nmi)	Trackline Flown in BSS ≤ 3 (nmi)*	# of Right Whale Sighting Events	# of Right Whales Sighted
December	NCWS	4	3	1	24.6	1694.38	1675.51	1	2
	SCWS	4	1	3	26.3	1406.15	1156.9	7	17
January	NCWS	10	3	7	63.3	4078.99	3718.07	5	13
	SCWS	11	6	5	67	4269.98	3880.59	1	3
February	NCWS	10	3	7	56.5	3590.61	2820.98	0	0
	SCWS	10	7	3	63	3898	3419.33	4	5
March	NCWS	11	5	6	83.1	4674.34	4254.70	2	3
	SCWS	13	13	0	99.2	6293.84	5651.49	7	9
April	NCWS	8	5	3	54.6	3565.46	3453.51	0	0
	SCWS	7	7	0	53.7	3665.00	3481.61	0	0
TOTALS	All Surveys	88	53	35	591.3	37,136.75	33,512.69	27	52
	NCWS Surveys	43	19	24	282.1	17,603.78	15,922.77	8	18
	SCWS Surveys	45	34	11	309.2	19,532.97	17,589.92	19	34

*BSS: Beaufort Sea State

Table 3. Carolina Surveys 2020-2021 other large whale sightings.

Date	Survey	Time (L)	Latitude	Longitude	Whale	Heading	Comments
12/27/2020	NCWS	13:33	34.48705	-76.72070	Humpback	SW	Sighted off Topsail Island, NC
12/27/2020	NCWS	13:41	34.48254	-76.72371	Humpback	SW	Sighted off Topsail Island, NC
12/28/2020	NCWS	12:20	34.03041	-77.81300	Humpback	None	Sighted off Carolina Beach, NC
1/5/2021	NCWS	10:28	35.93833	-75.26426	Humpback	N	Sighted off Nags Head, NC
1/5/2021	NCWS	11:02	36.01210	-75.45089	Humpback	NE	Sighted off Kill Devil Hills, NC
1/5/2021	NCWS	11:02	36.01210	-75.45089	Humpback	NE	Sighted off Kill Devil Hills, NC
1/5/2021	NCWS	11:06	36.00103	-75.44872	Humpback	N	Sighted off Kill Devil Hills, NC
1/5/2021	NCWS	11:57	36.07534	-75.35787	Humpback	NE	Sighted off Kitty Hawk, NC
1/5/2021	NCWS	12:15	36.06720	-75.46499	Humpback	ESE	Sighted off Kitty Hawk, NC
1/5/2021	NCWS	12:15	36.06720	-75.46499	Humpback	ESE	Sighted off Kitty Hawk, NC
1/5/2021	NCWS	12:33	36.08090	-75.62044	Humpback	SW	Sighted off Kitty Hawk, NC
1/7/2021	SCWS	11:32	33.72362	-77.82133	Humpback	NW	Sighted off Bald Head Island, NC
1/7/2021	SCWS	11:32	33.72362	-77.82133	Humpback	NW	Sighted off Bald Head Island, NC. APB whale.
1/11/2021	NCWS	10:39	35.71006	-74.82777	Humpback	None	Sighted off Hatteras Island, NC
1/11/2021	NCWS	10:39	35.71006	-74.82777	Humpback	None	Sighted off Hatteras Island, NC
1/11/2021	NCWS	10:42	35.71172	-74.83296	Fin	None	Sighted off Hatteras Island, NC
1/11/2021	NCWS	10:42	35.71172	-74.83296	Fin	None	Sighted off Hatteras Island, NC
1/11/2021	NCWS	10:52	35.69251	-74.81699	Humpback	None	Sighted off Hatteras Island, NC
1/11/2021	NCWS	10:52	35.69251	-74.81699	Humpback	None	Sighted off Hatteras Island, NC
1/11/2021	NCWS	10:54	35.6967	-74.82013	Fin	None	Sighted off Hatteras Island, NC
1/11/2021	NCWS	11:43	35.53681	-74.82064	Humpback	SW	Sighted off Avon, NC
1/11/2021	NCWS	11:43	35.53681	-74.82064	Humpback	SW	Sighted off Avon, NC
1/11/2021	NCWS	11:49	35.52846	-74.82476	Fin	N	Sighted off Avon, NC
1/11/2021	NCWS	11:49	35.52846	-74.82476	Fin	N	Sighted off Avon, NC
1/11/2021	NCWS	12:15	35.54182	-75.19171	Humpback	N	Sighted off Avon, NC
1/11/2021	NCWS	12:15	35.54182	-75.19171	Humpback	N	Sighted off Avon, NC
1/14/2021	NCWS	15:41	35.95722	-75.43116	Humpback	N	Sighted off Nags Head, NC
1/14/2021	NCWS	15:41	35.95722	-75.43116	Humpback	N	Sighted off Nags Head, NC
1/29/2021	NCWS	14:38	34.13072	-77.7392	Humpback	N	Sighted off Masonboro Island, NC
1/29/2021	NCWS	14:38	34.13072	-77.7392	Humpback	N	Sighted off Masonboro Island, NC
2/24/2021	NCWS	11:49	36.11935	-75.50084	Humpback	NW	Sighted off Southern Shores, NC
2/24/2021	NCWS	12:42	36.20668	-75.10969	Fin	E	Sighted off Duck, NC
3/4/2021	SCWS	15:08	32.88347	-79.10344	Humpback	SE	Sighted off Cape Island, SC
3/8/2021	NCWS	11:39	36.3919	-75.03112	Humpback	N	Sighted off Corolla, NC
3/8/2021	SCWS	16:13	33.65995	-78.08168	Humpback	W	Sighted off Bald Head Island, NC

Date	Survey	Time (L)	Latitude	Longitude	Whale	Heading	Comments
3/9/2021	NCWS	14:51	34.65986	-75.45678	Humpback	N/A	Sighted off Whitehurst Island, NC
3/9/2021	NCWS	14:51	34.65986	-75.45678	Humpback	N/A	Sighted off Whitehurst Island, NC
3/14/2021	SCWS	15:45	33.79613	-78.07870	Humpback	E	Sighted off Oak Island, NC
3/25/2021	NCWS	10:58	35.61129	-74.80773	Humpback	NE	Sighted off Rodanthe, NC
3/25/2021	NCWS	11:10	35.60924	-74.82117	Humpback	W	Sighted off Rodanthe, NC
3/25/2021	NCWS	13:45	35.15714	-75.29215	Humpback	NE	Sighted off Ocracoke Island, NC
3/25/2021	NCWS	14:03	35.12057	-75.45591	Humpback	SE	Sighted off Ocracoke Island, NC
3/25/2021	NCWS	14:03	35.12057	-75.45591	Humpback	SE	Sighted off Ocracoke Island, NC
3/25/2021	SCWS	14:44	33.80244	-77.93264	Humpback	NE	Sighted off Bald Head Island, NC
3/30/2021	NCWS	14:28	35.74339	-75.53575	Humpback	None	Dead, Sighted off Oregon Inlet, NC
3/31/2021	NCWS	10:06	35.74148	-75.53595	Humpback	None	Dead, Sighted off Oregon Inlet, NC
3/31/2021	NCWS	11:17	35.53715	-74.84842	Sperm	S	Sighted off Salvo, NC
4/6/2021	NCWS	14:30	35.74306	-75.53897	Humpback	None	Dead, Sighted off Oregon Inlet, NC

Table 4. Carolina Surveys 2020-2021 fixed fishing gear sightings.

Date	Survey Name	Time (L)	Latitude	Longitude	Gear Type	Comments
12/27/20	SCWS	17:04	32.11713	-80.75858	Crab	Red buoys, 1 string, 1.0 mi off Hilton Head, SC
12/27/20	SCWS	17:46	32.15139	-80.68408	Crab	Yellow buoys, 1 string, 1.9 mi off Hilton Head, SC
2/9/21	NCWS	10:57	36.53172	-75.65939	Crab	Orange buoys, 1 string, 10 mi off Carova Beach, NC
2/9/21	NCWS	10:59	36.53237	-75.75149	Crab	Orange buoys, 1 string, 5 mi off Carova Beach, NC
2/9/21	NCWS	12:02	36.40213	-75.67037	Crab	White buoys, 1 string, 8 mi off Carolla, NC
2/24/21	NCWS	10:28	35.92987	-75.02959	Crab	Orange buoys, 1 string, 28 mi off Nags Head, NC
2/24/21	NCWS	11:00	36.00066	-75.25862	Crab	Orange buoys, 1 string, 19 mi off Kill Devil Hills, NC
2/24/21	NCWS	14:01	36.2714	-75.59893	Unknown	Orange buoys, 1 string, 9 mi off Currituck Banks, NC
2/24/21	NCWS	14:02	36.27097	-75.57267	Unknown	White buoys, 1 string, 11 mi off Currituck Banks, NC
2/24/21	NCWS	14:02	36.2707	-75.5476	Unknown	White buoys, 1 string, 12 mi off Currituck Banks, NC
2/24/21	NCWS	14:03	36.27066	-75.53557	Crab	White buoys, 1 string, 12 mi off Currituck Banks, NC
2/24/21	NCWS	14:03	36.27078	-75.51144	Crab	White buoys, 1 string, 13 mi off Currituck Banks, NC
2/24/21	NCWS	14:04	36.27098	-75.50066	Crab	White buoys, 1 string, 14 mi off Currituck Banks, NC
2/24/21	NCWS	14:05	36.27142	-75.47427	Crab	White buoys, 1 string, 15 mi off Currituck Banks, NC
2/24/21	NCWS	14:05	36.27164	-75.44427	Crab	White buoys, 1 string, 17 mi off Currituck Banks, NC
2/24/21	NCWS	14:06	36.27167	-75.4277	Crab	White buoys, 1 string, 18 mi off Currituck Banks, NC
2/24/21	NCWS	14:07	36.27145	-75.37308	Crab	White buoys, 1 string, 20 mi off Currituck Banks, NC
2/24/21	NCWS	14:08	36.2714	-75.36126	Crab	White buoys, 1 string, 21 mi off Currituck Banks, NC
2/24/21	NCWS	14:09	36.27128	-75.30986	Crab	White buoys, 1 string, 23 mi off Currituck Banks, NC
2/24/21	NCWS	14:22	36.27102	-74.82346	Crab	Orange buoys, 1 string, 47 mi off Currituck Banks, NC
2/24/21	NCWS	14:50	36.32869	-75.65307	Unknown	White buoys, 1 string, 8 mi off Corolla, NC
2/24/21	NCWS	14:53	36.33057	-75.76027	Crab	White buoys, 1 string, 3 mi off Corolla, NC
2/24/21	NCWS	15:02	36.40096	-75.66768	Unknown	Red and white buoys, 1 string, 8 mi off Corolla, NC
2/24/21	NCWS	15:03	36.39884	-75.61378	Crab	White buoys, 1 string, 11 mi off Corolla, NC
2/24/21	NCWS	15:04	36.39914	-75.59251	Crab	White buoys, 1 string, 12 mi off Corolla, NC
2/24/21	NCWS	15:06	36.40125	-75.5255	Crab	White buoys, 1 string, 15 mi off Corolla, NC
2/24/21	NCWS	15:51	36.47042	-75.68221	Unknown	Orange buoys, 1 string, 8 mi off Currituck NWR, NC
2/24/21	NCWS	15:53	36.46919	-75.73313	Unknown	White buoys, 1 string, 6 mi off Currituck NWR, NC

Date	Survey Name	Time (L)	Latitude	Longitude	Gear Type	Comments
2/24/21	SCWS	10:42	33.94992	-77.4373	Gill	1 red buoy attached to white flag buoy, 24 mi off Carolina Beach, NC
2/25/21	NCWS	12:00	34.13791	-77.83714	Crab	Orange buoys, 1 string, 0.3 mi off Masonboro Island, NC
2/25/21	NCWS	12:07	33.99754	-77.81188	Crab	White buoys, 3 strings, 5 mi off Kure Beach, NC
2/25/21	SCWS	14:39	32.99114	-79.53106	Unknown	White buoys, 1 string, 0.8 mi off White Island, SC
2/26/21	SCWS	14:55	32.47172	-80.3723	Unknown	Orange buoys, 1 string, 1.2 mi off Otter Islands, SC
2/26/21	SCWS	15:42	32.5262	-80.21757	Unknown	Orange buoys, 1 string, 1.5 mi off Pockoy Island, SC
2/27/21	NCWS	9:40	34.31883	-77.06972	Crab	Red and white buoys, 1 string, 31 mi off Hampstead, NC
3/3/21	NCWS	14:30	36.40009	-75.74042	Unknown	Orange buoys, 1 string, 4 mi off Corolla, NC
3/3/21	NCWS	14:39	36.33004	-75.71612	Unknown	Orange buoys, 1 string, 5 mi off Corolla, NC
3/3/21	NCWS	15:29	36.26958	-75.6045	Unknown	Orange buoys, 1 string, 9 mi off Currituck Banks, NC
3/3/21	NCWS	15:30	36.27057	-75.62907	Unknown	Orange buoys, 1 string, 8 mi off Currituck Banks, NC
3/3/21	NCWS	15:41	36.20139	-75.67219	Unknown	Red and white buoys, 1 string, 4 mi off Duck, NC
3/3/21	NCWS	16:11	36.13062	-74.9671	Crab	White buoys, 1 string, 37 mi off Southern Shores, NC
3/4/21	NCWS	11:31	34.64498	-77.08451	Crab	Orange buoys, 1 string, 0.2 mi off Emerald Isle, NC
3/8/21	NCWS	11:05	36.47059	-75.68296	Crab	Orange buoys, 1 string, 8 mi off Currituck NWR, NC
3/8/21	NCWS	11:06	36.47055	-75.70892	Crab	White buoys, 1 string, 7 mi off Currituck NWR, NC
3/8/21	NCWS	11:07	36.47075	-75.74826	Unknown	Yellow buoys, 1 string, 5 mi off Currituck NWR, NC
3/8/21	NCWS	11:07	36.47083	-75.75771	Unknown	Yellow buoys, 1 string, 5 mi off Currituck NWR, NC
3/8/21	NCWS	11:18	36.39999	-75.70128	Unknown	Red buoys, 1 string, 6 mi off Corolla, NC
3/8/21	NCWS	12:57	36.33052	-75.73429	Unknown	Orange buoys, 1 string, 4 mi off Corolla, NC
3/8/21	NCWS	13:50	36.27271	-75.59253	Crab	Red buoys, 1 string, 10 mi off Currituck Banks, NC
3/8/21	NCWS	15:20	36.20133	-75.5983	Unknown	Yellow buoys, 1 string, 8 mi off Duck, NC
3/8/21	NCWS	15:21	36.20104	-75.62326	Unknown	Yellow buoys, 1 string, 7 mi off Duck, NC
3/8/21	NCWS	15:57	36.07087	-74.9555	Crab	Red buoys, 1 string, 36 mi off Kitty Hawk, NC
3/8/21	NCWS	15:57	36.07075	-74.96329	Crab	Orange buoys, 1 string, 35 mi off Kitty Hawk, NC
3/8/21	NCWS	15:58	36.07066	-74.97112	Crab	Yellow buoys, 1 string, 35 mi off Kitty Hawk, NC
3/8/21	NCWS	15:58	36.07061	-74.97683	Crab	White buoys, 1 string, 35 mi off Kitty Hawk, NC
3/8/21	SCWS	13:10	33.9871	-77.89869	Unknown	Orange buoys, 1 string, 0.5 mi off Kure Beach, NC
3/9/21	SCWS	12:47	32.17481	-80.70413	Unknown	Orange buoys, 1 string, 0.25 mi off Hilton Head Island, SC

Date	Survey Name	Time (L)	Latitude	Longitude	Gear Type	Comments
3/11/21	NCWS	10:00	34.44422	-77.1937	Crab	Red buoys, 1 string, 15 mi off Surf City, NC
3/11/21	NCWS	14:52	33.91266	-77.30449	Crab	Red buoys, 1 string, 32 mi off Zekes Island Estuarine Reserve, NC
3/13/21	SCWS	10:15	33.26625	-79.17658	Unknown	White buoys, 1 string, 500ft off Collins Island, SC
3/23/21	SCWS	14:57	33.01196	-79.55374	Unknown	White buoys, 1 string, 0.5 mile off Bulls Bay, SC
3/24/21	SCWS	17:28	32.1176	-80.75858	Unknown	Orange buoys, 1 string, 1 mi off Hilton Head, SC
3/30/21	NCWS	10:21	36.6013	-75.2486	Crab	Red buoys, 1 string, 30 mi off False Cape State Park, VA
3/30/21	NCWS	10:22	36.60142	-75.23035	Crab	Orange buoys, 2 strings, 31 mi off False Cape State Park, VA
3/30/21	NCWS	10:25	36.60177	-75.09118	Crab	Red buoys, 1 string, 38 mi off False Cape State Park, VA
3/30/21	NCWS	11:05	36.53136	-75.75889	Crab	Red buoy, 1 string, 5 mi off Carova Beach, NC
3/30/21	NCWS	11:35	36.47008	-75.05955	Crab	Red buoy, 1 string, 38 mi off Currituck National Wildlife Refuge, NC
3/30/21	NCWS	12:19	36.33049	-75.70866	Crab	Red buoy, 1 string, 5 mi off Corolla, NC
3/30/21	NCWS	13:11	36.27016	-75.66325	Unknown	Orange buoys, 1 string, 6 mi off Currituck Banks, NC
3/30/21	NCWS	15:06	36.19979	-75.6879	Unknown	Red buoys, 1 string, 4 mi off Duck, NC
3/30/21	NCWS	15:09	36.20069	-75.59268	Unknown	Yellow buoys, 1 string, 8 mi off Duck, NC
3/30/21	NCWS	16:08	36.06937	-75.53187	Crab	Red buoy, 1 string, 8 mi off Kitty Hawk, NC
3/30/21	NCWS	16:50	35.99868	-75.60837	Unknown	Orange buoys, 1 string, 2 mi off Kill Devil Hills, NC
3/30/21	NCWS	16:56	35.93089	-75.5631	Unknown	Orange buoys, 1 string, 2 mi off Nags Head, NC
4/3/21	SCWS	12:39	32.0991	-80.73492	Unknown	Orange buoys, 2 strings, 6 mi off Dafuskie Island, SC
4/4/21	NCWS	12:19	36.47031	-75.74679	Unknown	Orange buoys, 1 string, 5 mi off Currituck National Wildlife Refuge, NC
4/4/21	NCWS	12:19	36.47012	-75.73714	Unknown	Orange buoys, 1 string, 5 mi off Currituck National Wildlife Refuge, NC
4/4/21	NCWS	13:14	36.40103	-75.71275	Unknown	Orange buoys, 1 string, 5.6 mi off Corolla, NC
4/4/21	NCWS	13:14	36.40102	-75.72198	Unknown	Orange buoys, 1 string, 5.2 mi off Corolla, NC
4/4/21	NCWS	13:15	36.40104	-75.73004	Unknown	White buoys, 1 string, 4.8 mi off Corolla, NC
4/4/21	NCWS	13:24	36.32991	-75.68599	Unknown	White buoys, 1 string, 6 mi off Corolla Beach, NC
4/4/21	NCWS	15:14	36.20137	-75.70816	Crab	Yellow buoys, 1 string, 2.4 mi off Duck, NC
4/4/21	NCWS	15:14	36.20135	-75.70479	Crab	Red buoys, 1 string, 2.6 mi off Duck, NC
4/4/21	NCWS	15:14	36.20128	-75.69916	Crab	Yellow buoys, 1 string, 2.9 mi off Duck, NC
4/4/21	NCWS	15:16	36.20187	-75.63447	Crab	Orange buoys, 1 string, 6 mi off Duck, NC

Date	Survey Name	Time (L)	Latitude	Longitude	Gear Type	Comments
4/4/21	NCWS	16:13	36.07303	-75.59603	Unknown	White buoys, 1 string, 4.8 mi off Kitty Hawk, NC
4/4/21	NCWS	16:14	36.07311	-75.58754	Unknown	Red buoys, 1 string, 5 mi off Kitty Hawk, NC
4/4/21	NCWS	16:14	36.07335	-75.58023	Unknown	White buoys, 1 string, 5.5 mi off Kitty Hawk, NC
4/4/21	NCWS	16:15	36.07362	-75.55509	Unknown	Orange buoys, 1 string, 6.8 mi off Kitty Hawk, NC
4/4/21	NCWS	16:57	35.99896	-75.60481	Crab	Orange buoys, 1 string, 2 mi off Kill Devil Hills, NC
4/4/21	NCWS	17:02	35.93055	-75.57367	Unknown	Orange buoys, 1 string, 1.6 mi off Nags Head, NC
4/6/21	NCWS	13:57	35.75604	-74.86014	Unknown	Orange buoys, 1 string, 36.7 mi off Pea Island, NC
4/6/21	NCWS	14:09	35.75676	-74.83323	Unknown	White buoys, 1 string, 38.6 mi off Pea Island, NC
4/6/21	NCWS	14:09	35.74151	-74.8354	Unknown	Red and white buoys, 1 string, 37.8 mi off Pea Island, NC
4/8/21	NCWS	9:14	34.62916	-76.64713	Crab	Orange buoys, 1 string, 25.2 mi off Bear Island, NC
4/8/21	NCWS	12:04	34.20955	-76.95994	Crab	White buoys, 1 string, 41.5 mi off Wrightsville Beach, NC
4/10/21	SCWS	14:49	33.10926	-79.23251	Unknown	White buoys, 1 string, 3 mi off Murphy Island, SC
4/14/21	NCWS	11:13	34.284	-77.03455	Unknown	Yellow buoys, 1 string, 35 mi off Figure Eight Island, NC
4/14/21	NCWS	11:13	34.27921	-77.02952	Unknown	Yellow buoys, 1 string, 35 mi off Figure Eight Island, NC
4/14/21	NCWS	11:13	34.27502	-77.02523	Unknown	Yellow buoys, 1 string, 35 mi off Figure Eight Island, NC

APPENDICES

Appendix A. Carolina Surveys 2020-2021 right whale sightings.

Date	Sighting #	Whale #	Time (L)	Latitude	Longitude	Right Whale Letter	NARWC ID No or Intermatch Code	Sex	Age	Time of Report (Local)	Whale Alert #	Comments	Sighting Distance (nmi)
NCWS													
12/28/20	1	1	10:56	33.87331	-77.46031	A	3401	M	17	11:54	NCWS003		0.55
12/28/20	1	2	10:56	33.87331	-77.46031	B	3250	M	>19	11:54	NCWS003	New scars	0.55
1/5/21	2	3	14:49	35.28315	-75.21399	A	1307	M	>47	15:26	NCWS011		N/A
1/5/21	3	4	15:01	35.28375	-75.22044	B	4041	F	11	15:26	NCWS011	SAG	N/A
1/5/21	3	5	15:01	35.28375	-75.22044	C	2019CalfOf3270	U	2	15:26	NCWS011	SAG	N/A
1/5/21	3	6	15:01	35.28375	-75.22044	D	4313	F	8	15:26	NCWS011	SAG	N/A
1/5/21	3	7	15:01	35.28375	-75.22044	E	3590	F	16	15:26	NCWS011	SAG	N/A
1/11/21	4	8	13:04	35.4072	-75.29033	A	3997	M	12	13:32	NCWS019	SAG	0.43
1/11/21	4	9	13:04	35.4072	-75.29033	B	4510	F	>6	13:32	NCWS019	SAG	0.43
1/11/21	4	10	13:04	35.4072	-75.29033	C	4457	M	7	13:32	NCWS019	SAG; APB whale	0.43
1/11/21	4	11	13:04	35.4072	-75.29033	D	Unknown	U	U	13:32	NCWS019	SAG	0.43
1/11/21	4	12	13:04	35.4072	-75.29033	E	4313	F	8	13:32	NCWS019	SAG	0.43
1/11/21	5	13	13:15	35.40151	-75.28943	F	3991	F	12	13:32	NCWS019	Approached SAG	0.18
1/11/21	5	14	13:15	35.40151	-75.28943	G	3420	F	17	13:32	NCWS019		0.18
1/11/21	6	15	13:27	35.40472	-75.29123	H	4129	M	10	13:32	NCWS019		0.27
3/8/21	7	16	14:09	36.27249	-75.31404	A	3380	M	>18	14:43	NCWS025		1.24
3/11/21	8	17	10:06	34.32341	-77.06595	A	3593	F	>16	10:25	NCWS027		0.37
3/11/21	8	18	10:06	34.32341	-77.06595	B	2021CalfOf3593	U	Calf	10:25	NCWS027		0.37
SCWS													
12/22/20	1	1	15:40	32.65050	-79.70134	A	3520	F	16	16:11	SCWS001		N/A
12/22/20	1	2	15:40	32.65050	-79.70134	B	2021CalfOf3520	U	Calf	16:11	SCWS001		N/A
12/23/20	2	3	10:03	32.76944	-79.40911	A	3020	F	>21	11:17	SCWS002	SAG	0.36
12/23/20	2	4	10:03	32.76944	-79.40911	B	2010	M	31	11:17	SCWS002	SAG	0.36
12/23/20	2	5	10:03	32.76944	-79.40911	C	3651	M	15	11:17	SCWS002	SAG	0.36

Date	Sighting #	Whale #	Time (L)	Latitude	Longitude	Right Whale Letter	NARWC ID No or Intermatch Code	Sex	Age	Time of Report (Local)	Whale Alert #	Comments	Sighting Distance (nmi)
12/23/20	3	6	10:59	32.74169	-79.4487	D	3020	F	>21	11:17	SCWS003	Re-sight of SCWS002	1.83
12/23/20	3	7	10:59	32.74169	-79.4487	E	2010	M	31	11:17	SCWS003	Re-sight of SCWS002	1.83
12/23/20	3	8	10:59	32.74169	-79.4487	F	3651	M	15	11:17	SCWS003	Re-sight of SCWS002	1.83
12/27/20	4	9	11:03	31.74867	-80.86362	A	3020	F	>21	11:21	SCWS004		N/A
12/27/20	4	10	11:03	31.74867	-80.86362	B	3503	F	16	11:21	SCWS004	APB whale	N/A
12/27/20	5	11	14:19	32.20961	-80.33542	C	1158	F	>40	14:31	SCWS005		0.57
12/27/20	6	12	15:30	32.21733	-80.17416	D	4190	F	10	15:44	SCWS006	SAG	1.92
12/27/20	6	13	15:30	32.21733	-80.17416	E	3701	M	14	15:44	SCWS006	SAG	1.92
12/27/20	6	14	15:30	32.21733	-80.17416	F	3812	M	13	15:44	SCWS006	SAG; APB whale	1.92
12/27/20	6	15	15:30	32.21733	-80.17416	G	1607	M	35	15:44	SCWS006	SAG	1.92
12/28/20	7	16	11:27	32.91345	-79.11228	A	2602	M	25	12:10	SCWS007	SAG	N/A
12/28/20	7	17	11:27	32.91345	-79.11228	B	2010	M	31	12:10	SCWS007	SAG	N/A
1/7/21	8	18	14:30	33.89238	-77.47794	A	2020CalfOf1612	U	1	14:49	SCWS009	SAG	0.48
1/7/21	8	19	14:30	33.89238	-77.47794	B	4617	F	5	14:49	SCWS009	SAG	0.48
1/7/21	8	20	14:30	33.89238	-77.47794	C	3790	F	14	14:49	SCWS009	SAG	0.48
2/25/21	9	21	14:49	32.86257	-79.39224	A	3860	F	13	15:23	SCWS010		0.36
2/25/21	9	22	14:49	32.86257	-79.39224	B	2021CalfOf3860	U	Calf	15:23	SCWS010		0.36
2/27/21	10	23	12:00	33.54403	-78.69881	A	3920	M	12	12:05	SCWS011	APB whale (dead)	0.56
2/27/21	11	24	16:38	33.54782	-78.71809	B	3920	M	12	16:50	SCWS012	APB whale (dead)	N/A
2/28/21	12	25	13:15	33.517	-78.80861	A	3920	M	12	13:19	SCWS013	APB whale (dead)	N/A
3/4/21	13	26	9:25	33.00376	-79.18174	A	3920	M	12	9:55	SCWS015	APB whale (dead)	N/A
3/4/21	14	27	15:25	32.97357	-79.17395	B	3920	M	12	16:08	SCWS017	APB whale (dead)	N/A
3/9/21	15	28	10:02	32.1768	-79.90437	A	3920	M	12	10:48	SCWS019	APB whale (dead)	N/A
3/9/21	16	29	16:23	32.16187	-79.96701	B	3920	M	12	16:46	SCWS020	APB whale (dead)	N/A
3/10/21	17	30	14:59	32.63817	-79.76952	A	3942	F	12	15:16	SCWS021		N/A
3/10/21	17	31	14:49	32.63817	-79.76952	B	2021CalfOf3942	U	Calf	15:16	SCWS021		N/A
3/11/21	18	32	11:20	32.78105	-79.52498	A	3942	F	12	11:48	SCWS022		0.52
3/11/21	18	33	11:20	32.78105	-79.52498	B	2021CalfOf3942	U	Calf	11:48	SCWS022		0.52
3/12/21	19	34	10:05	32.10537	-80.08063	A	3920	M	12	10:14	SCWS023	APB whale (dead)	N/A

Appendix B. Carolina Surveys 2020-2021 leatherback turtle sightings.

Survey Date	Survey	Time (L)	Latitude	Longitude	N
1/13/21	NCWS	11:51	34.54314	-76.15236	1
1/13/21	NCWS	15:29	34.38773	-76.82818	1
1/24/21	NCWS	14:20	34.05147	-76.88691	2
1/24/21	NCWS	14:20	34.05353	-76.87331	1
3/25/21	NCWS	13:55	35.13029	-75.41349	1
3/31/21	NCWS	10:17	35.73125	-75.26271	1
4/9/21	NCWS	11:07	33.90092	-77.18142	1
12/27/20	SCWS	18:12	31.77964	-80.17923	1
1/7/21	SCWS	11:13	33.4314	-77.55069	1
2/24/21	SCWS	10:38	34.04622	-77.53326	1
2/25/21	SCWS	11:54	32.42073	-79.48384	1
2/26/21	SCWS	11:36	31.92589	-80.45955	1
2/26/21	SCWS	14:43	32.19854	-80.10154	1
2/27/21	SCWS	10:40	33.54569	-78.39739	1
3/8/21	SCWS	10:31	34.30867	-77.4896	1
3/8/21	SCWS	10:31	34.32339	-77.5045	1
3/8/21	SCWS	13:30	33.50774	-77.43251	1
3/9/21	SCWS	12:43	32.09309	-80.62566	1
3/9/21	SCWS	13:53	31.99873	-80.21486	1
3/9/21	SCWS	13:54	31.98583	-80.20202	2
3/9/21	SCWS	13:59	31.87644	-80.09287	1
3/9/21	SCWS	14:13	32.09876	-80.21202	1
3/10/21	SCWS	11:13	32.35957	-79.6331	1
3/10/21	SCWS	11:43	32.56241	-79.66806	1
3/10/21	SCWS	12:15	32.5371	-79.60049	1
3/12/21	SCWS	11:09	31.88121	-80.63037	1
3/12/21	SCWS	11:23	31.83539	-80.86005	1
3/12/21	SCWS	12:01	31.73596	-80.90627	1
3/12/21	SCWS	12:52	31.58422	-80.57639	1
3/12/21	SCWS	14:12	31.38262	-80.70413	1
3/12/21	SCWS	14:16	31.38108	-80.86961	1
3/12/21	SCWS	15:26	31.33573	-81.05692	1
3/13/21	SCWS	12:08	32.75962	-79.18726	1
3/14/21	SCWS	14:26	33.51337	-78.14878	1
3/14/21	SCWS	14:28	33.46603	-78.10226	2
3/24/21	SCWS	12:30	32.51021	-80.19796	1
3/24/21	SCWS	12:32	32.48248	-80.16911	1
3/24/21	SCWS	14:05	32.16272	-80.17678	1

Survey Date	Survey	Time (L)	Latitude	Longitude	N
3/24/21	SCWS	14:52	31.99596	-80.21806	1
3/24/21	SCWS	15:02	32.23447	-80.45837	1
3/24/21	SCWS	15:04	32.27217	-80.49497	1
3/24/21	SCWS	16:27	31.92055	-80.34345	1
3/24/21	SCWS	16:36	32.12771	-80.54959	1
3/24/21	SCWS	16:53	31.98927	-80.51523	2
3/24/21	SCWS	17:08	31.66561	-80.30224	1
3/25/21	SCWS	17:46	33.65543	-78.19369	1
3/25/21	SCWS	18:51	33.49697	-78.3482	1
3/29/21	SCWS	14:00	33.59244	-78.34148	1
3/29/21	SCWS	14:22	33.58498	-78.43565	2
3/29/21	SCWS	14:24	33.61815	-78.46915	1
3/29/21	SCWS	14:25	33.64644	-78.49769	1
3/29/21	SCWS	14:26	33.67688	-78.5284	1
3/29/21	SCWS	14:41	33.66354	-78.61221	1
4/3/21	SCWS	13:15	32.05907	-80.59122	1
4/3/21	SCWS	14:15	32.16627	-80.38427	1
4/3/21	SCWS	14:55	32.199	-80.31052	1
4/3/21	SCWS	14:56	32.2175	-80.32952	3
4/3/21	SCWS	14:57	32.24301	-80.35473	2
4/9/21	SCWS	10:10	32.34793	-80.31835	1
4/9/21	SCWS	10:10	32.34793	-80.31835	1
4/9/21	SCWS	10:10	32.34793	-80.31835	1
4/9/21	SCWS	10:10	32.34793	-80.31835	1
4/9/21	SCWS	12:28	31.38499	-80.72102	1
4/9/21	SCWS	12:34	31.43309	-80.7141	1
4/9/21	SCWS	16:02	31.7856	-80.57469	1
4/9/21	SCWS	16:55	31.93126	-80.64298	1
4/9/21	SCWS	16:57	31.93241	-80.7107	1
4/10/21	SCWS	9:35	33.11608	-79.12882	1
4/10/21	SCWS	9:47	32.81639	-79.36593	1
4/10/21	SCWS	9:49	32.77885	-79.42226	1
4/10/21	SCWS	9:52	32.72586	-79.50151	1
4/10/21	SCWS	10:10	32.61586	-79.7822	1
4/10/21	SCWS	10:11	32.58803	-79.7545	1
4/10/21	SCWS	10:43	32.63097	-79.69453	1
4/10/21	SCWS	11:30	32.69243	-79.54559	1
4/10/21	SCWS	11:31	32.70674	-79.56011	1
4/10/21	SCWS	11:46	32.78647	-79.523	1
4/12/21	SCWS	10:41	31.92481	-80.66772	1
4/12/21	SCWS	10:43	31.95635	-80.69857	1

Survey Date	Survey	Time (L)	Latitude	Longitude	N
4/12/21	SCWS	12:27	32.25218	-80.47087	1
4/12/21	SCWS	12:29	32.21186	-80.42965	1
4/12/21	SCWS	12:30	32.18439	-80.40226	1
4/12/21	SCWS	13:07	32.32228	-80.43382	1
4/13/21	SCWS	13:56	33.71187	-78.44768	1
4/13/21	SCWS	14:30	33.58942	-78.44122	1
4/13/21	SCWS	17:12	33.28066	-78.86696	1
4/13/21	SCWS	17:15	33.19744	-78.78391	1
4/13/21	SCWS	17:19	33.117	-78.70308	1
4/13/21	SCWS	18:01	33.05977	-78.85692	1
4/13/21	SCWS	18:21	33.05311	-78.96646	1
4/14/21	SCWS	10:19	32.36744	-79.64081	1
4/14/21	SCWS	10:28	32.56924	-79.84274	1
4/14/21	SCWS	11:11	32.59393	-79.6575	1
4/14/21	SCWS	14:37	32.97864	-79.30442	1

*Bold italicized entries are sightings of turtles during a GPS outage. Number of turtles is known, but location data for these individuals was lost. The coordinates provided are the last recorded position prior to the GPS outage.

Appendix C. NCWS 2020-2021 giant manta ray sightings. SCWS had no giant manta ray sightings during the 2020-2021 season.

Sighting #	Date	Time (L)	Latitude	Longitude	N	Comments
1	3/9/2021	9:54	35.40012	-74.96832	1	Sighted off Hatteras Island, NC
2	3/25/2021	10:53	35.60396	-74.81743	3	Sighted off Rodanthe, NC
3	3/25/2021	10:54	35.61099	-74.8063	1	Sighted off Rodanthe, NC
4	3/25/2021	12:31	35.32937	-75.0516	1	Sighted off Avon, NC
5	3/25/2021	12:46	35.27071	-75.06055	1	Sighted off Buxton, NC
6	3/31/2021	10:32	35.68592	-74.81114	1	Sighted off Pea Island, NC
7	3/31/2021	10:33	35.67162	-74.83825	1	Sighted off Pea Island, NC
8	3/31/2021	11:14	35.58115	-74.82826	1	Sighted off Rodanthe, NC
9	4/14/2021	16:46	34.39294	-76.00051	1	Sighted off Topsail Beach, NC

Appendix D. Carolina Surveys 2020-2021 shark sightings.

Date	Team	Time (L)	Latitude	Longitude	Shark	N	Heading	Comments
12/27/2020	NCWS	10:24	34.40345	-77.47383	Unknown	1	W	13ft; Surf City, NC. Not hammerhead or basking shark.
12/27/2020	NCWS	15:59	34.41103	-76.2173	Unknown	1	E	10-12ft; Surf City, NC. Not hammerhead or basking shark.
12/30/2020	NCWS	11:19	34.67028	-75.84811	Unknown	1	W	10-12ft; Gunning Hammock Island, NC. Not hammerhead or basking shark.
12/30/2020	NCWS	11:20	34.68249	-75.86149	Unknown	1	W	10-13ft; Gunning Hammock Island, NC. Not hammerhead or basking shark.
1/11/2021	NCWS	11:39	35.55781	-74.8096	Hammerhead	1	W	13ft; Midgett Island, NC
1/13/2021	SCWS	14:35	32.34077	-79.25877	Hammerhead	1	W	10ft; St. Helena Island, SC
1/19/2021	NCWS	10:50	34.01558	-77.29546	Basking	1	NE	15ft; Pleasure Island, NC
1/19/2021	NCWS	11:50	34.16388	-77.65275	Great white	1	E	12-14ft; Masonboro Island, NC
1/22/2021	SCWS	11:30	32.88906	-78.8986	Shortfin mako	1	N	6-8ft; Bull Island, SC
1/22/2021	SCWS	13:04	33.03762	-78.62541	Unknown	1	NW	>10ft; Cape Island, SC. Possible great white shark.
1/22/2021	SCWS	13:37	33.35901	-78.83909	Unknown	1	NW	8-10ft; Debidue, SC. Possible tiger or great white shark.
1/24/2021	NCWS	14:20	34.05306	-76.87555	Unknown	1	S	10ft; Sea Breeze, NC. Not hammerhead or basking shark.
2/4/2021	NCWS	14:09	35.20137	-75.02506	Hammerhead	2	NW	15-20ft; Buxton, NC
2/4/2021	SCWS	10:31	31.97072	-80.19089	Great white	1	SW	15ft; Pritchards Island, SC
2/4/2021	SCWS	11:24	32.03334	-80.04097	Unknown	1	NE	10ft; Fripp Island, SC. Not hammerhead or basking shark.
2/4/2021	SCWS	12:14	32.1254	-79.92458	Great white	1	W	>10ft; Edisto Beach, SC
2/24/2021	SCWS	11:56	33.9935	-77.80667	Unknown	1	S	10-15ft; Kure Beach, NC. Possible tiger or great white shark.
2/24/2021	SCWS	12:18	33.6788	-77.58682	Basking	1	SSE	>20ft; Frying Pan Shoals, NC
2/25/2021	SCWS	15:38	32.52423	-79.04923	Hammerhead	1	NW	10ft; Isle of Palms, SC
2/26/2021	SCWS	11:25	31.67261	-80.27299	Unknown	1	S	>10ft; St Catherines Island, GA. Possible tiger or great white shark.
2/27/2021	SCWS	12:02	33.54774	-78.69938	Great white	7	None	10-20ft, associated with whale carcass; Murrells Inlet, SC
2/27/2021	SCWS	13:16	33.41016	-78.5784	Unknown	1	SE	<10ft; Pawleys Island, SC. Not hammerhead or basking shark.
2/27/2021	SCWS	16:36	33.5461	-78.72421	Great white	5	None	8-18ft, associated with whale carcass; Murrells Inlet, SC

Date	Team	Time (L)	Latitude	Longitude	Shark	N	Heading	Comments
2/28/2021	SCWS	13:15	33.52522	-78.80995	Great white	4	None	10-20ft, associated with whale carcass; Murrells Inlet, SC
3/4/2021	SCWS	9:42	32.99944	-79.18298	Great white	1	None	8-15ft, associated with whale carcass; Lighthouse Island, SC
3/8/2021	NCWS	12:52	36.32998	-75.56709	Unknown	1	NW	10-15ft; Corolla, NC. Not hammerhead or basking shark.
3/8/2021	SCWS	10:32	34.34451	-77.526	Great white	1	SE	10-15ft; Topsail Beach, NC
3/8/2021	SCWS	10:41	34.30109	-77.58	Great white	1	NW	10ft; Topsail Beach, NC
3/8/2021	SCWS	13:02	34.00494	-77.81679	Unknown	1	NNW	<10ft; Carolina Beach, NC. Possible tiger shark, not hammerhead.
3/9/2021	NCWS	9:50	35.39997	-74.8826	Hammerhead	1	E	12-15ft; Hatteras Island, NC
3/9/2021	NCWS	9:50	35.40042	-74.89624	Hammerhead	1	E	15ft; Hatteras Island, NC
3/9/2021	SCWS	10:27	32.1721	-79.89767	Great white	5	None	10-20ft, associated with whale carcass; Hilton Head, SC
3/9/2021	SCWS	16:27	32.16132	-79.96833	Tiger	1	None	10-15ft, associated with whale carcass; Hilton Head, SC
3/9/2021	SCWS	16:27	32.161	-79.9625	Unknown	2	None	10-15ft, associated with whale carcass; Hilton Head, SC. Possible great white shark.
3/10/2021	NCWS	11:57	34.46175	-75.95289	Unknown	1	W	10-12ft; Topsail Island, NC. Not hammerhead or basking shark.
3/10/2021	NCWS	12:09	34.43267	-76.0414	Hammerhead	2	W	10ft; Surf City, NC
3/10/2021	NCWS	15:36	34.23455	-76.46452	Hammerhead	1	N	10ft; Wrightsville Beach, NC
3/10/2021	SCWS	13:40	32.50563	-79.14634	Hammerhead	1	ESE	8-12ft; Edisto Island, SC
3/11/2021	NCWS	11:06	34.3611	-77.32171	Unknown	1	NE	10-15ft; Topsail Beach, NC. Not hammerhead or basking shark.
3/11/2021	NCWS	14:00	33.96512	-77.14548	Unknown	1	N	10-15ft; Kure Beach, NC. Not hammerhead or basking shark.
3/11/2021	NCWS	14:10	33.93068	-77.21077	Great white	1	N	10-15ft; Zekes Island, Estuarine Reserve, NC
3/11/2021	SCWS	9:20	32.61123	-79.81035	Hammerhead	1	NE	8-10ft; Folly Beach, SC
3/12/2021	SCWS	10:08	32.10828	-80.07678	Great white	3	None	10-15ft, associated with whale carcass; Hilton Head, SC
3/14/2021	SCWS	14:30	33.42791	-78.06571	Great white	1	N	10ft; Georgetown, SC
3/14/2021	SCWS	14:47	33.7327	-78.27437	Great white	1	SSW	8ft; Carolina Forest, SC
3/14/2021	SCWS	15:25	33.50847	-77.84185	Hammerhead	1	WSW	>8ft; Murrells Inlet, SC
3/24/2021	SCWS	12:03	32.09416	-79.67554	Unknown	1	ESE	8-12ft; Daufuskie Island, SC. Possible great white shark.
3/24/2021	SCWS	13:56	31.96309	-79.97075	Great white	1	NNW	15ft; Little Tybee Island, GA
3/24/2021	SCWS	14:06	32.17282	-80.18704	Hammerhead	1	SE	8-12ft; Hilton Head, SC

Date	Team	Time (L)	Latitude	Longitude	Shark	N	Heading	Comments
3/24/2021	SCWS	17:05	31.6954	-80.25759	Hammerhead	1	N	10-15ft; Black Hammock, GA
3/25/2021	NCWS	10:53	35.61204	-74.82169	Unknown	1	SW	10ft; Rodanthe, NC. Not hammerhead or basking shark.
3/25/2021	NCWS	11:16	35.52944	-74.91994	Hammerhead	1	SW	10-15ft; Salvo, NC
3/25/2021	NCWS	11:17	35.52968	-74.93098	Hammerhead	1	SW	10-15ft; Salvo, NC
3/25/2021	NCWS	11:17	35.53011	-74.94396	Hammerhead	1	W	10ft; Salvo, NC
3/25/2021	NCWS	11:52	35.4695	-74.92757	Hammerhead	1	NW	10ft; Gull Island, NC
3/25/2021	NCWS	11:52	35.46952	-74.90136	Hammerhead	1	SW	10ft; Gull Island, NC
3/25/2021	NCWS	15:51	35.06869	-75.24049	Unknown	1	SW	10ft; Ocracoke, NC. Not hammerhead or basking shark.
3/25/2021	SCWS	10:45	34.06877	-77.64268	Great white	1	NE	15ft; Carolina Beach, NC
3/25/2021	SCWS	13:09	33.61473	-77.42678	Hammerhead	1	SE	10ft; Southport, NC
3/25/2021	SCWS	13:54	33.5113	-77.44686	Hammerhead	1	SW	10-15ft; Southport, NC
3/25/2021	SCWS	14:04	33.63588	-77.65953	Great white	1	NNW	8-10ft; Southport, NC
3/29/2021	NCWS	15:01	34.40215	-77.15182	Unknown	1	W	10ft; Sloop Point, NC. Not hammerhead or basking shark.
3/30/2021	NCWS	10:41	36.53078	-74.92119	Unknown	1	S	8ft; Carova Beach, NC. Not hammerhead or basking shark.
3/30/2021	NCWS	10:43	36.53015	-75.01892	Unknown	1	NW	5-8ft; Carova Beach, NC. Not hammerhead or basking shark.
3/30/2021	NCWS	11:42	36.44409	-74.81549	Unknown	1	NE	12-20ft; Currituck National Wildlife Refuge, NC. Not hammerhead or basking shark.
3/31/2021	NCWS	9:45	35.79668	-74.87812	Unknown	1	S	10ft; Herring Shoal Island, NC. Not hammerhead or basking shark.
3/31/2021	NCWS	10:27	35.72875	-74.92447	Hammerhead	1	SE	10ft; Pea Island, NC
4/7/2021	NCWS	11:05	34.98819	-75.6482	Unknown	1	SE	10ft; Pilonary Island, NC. Not hammerhead or basking shark.
4/7/2021	NCWS	12:32	34.65904	-75.73619	Hammerhead	4	W	10-12ft; Cape Lookout National Seashore, NC
4/7/2021	NCWS	14:13	34.95582	-76.13571	Hammerhead	1	E	10-12ft; Cricket Island, NC
4/9/2021	NCWS	10:20	34.01302	-77.08316	Unknown	1	NE	10ft; Pleasure Island, NC. Not hammerhead or basking shark.
4/9/2021	NCWS	11:55	33.80585	-77.2946	Unknown	4	NE	10ft; Atlantic Beach, NC. Not hammerhead or basking shark.
4/9/2021	NCWS	14:41	33.76051	-77.57183	Hammerhead	1	W	10ft; Briarcliffe Acres, SC
4/12/2021	SCWS	13:45	32.28795	-80.1906	Hammerhead	1	W	10-15ft; Fripp Island, SC

Date	Team	Time (L)	Latitude	Longitude	Shark	N	Heading	Comments
4/13/2021	SCWS	18:16	32.92411	-78.83435	Hammerhead	1	NNW	12ft; Bull Island, SC
4/13/2021	SCWS	18:19	32.9915	-78.90312	Hammerhead	1	WNW	15ft; Lighthouse Island, SC
4/14/2021	NCWS	15:03	34.27539	-76.29667	Hammerhead	1	NE	8-10ft; Figure Eight Island, NC
4/14/2021	NCWS	15:48	34.23502	-76.1561	Hammerhead	1	NE	5-10ft; Shell Island, NC
4/14/2021	NCWS	15:56	34.27843	-76.08791	Unknown	3	SE	15ft; Figure Eight Island, NC. Not hammerhead or basking shark.
4/14/2021	NCWS	16:04	34.46062	-76.27067	Unknown	20-50	E	5-8ft; Topsail Island, NC. Not hammerhead or basking shark.
4/14/2021	SCWS	11:28	32.64685	-79.59273	Tiger	1	SSE	6-8ft; Bull Island, SC