# Loggerhead Turtle Nesting in Georgia, 2023.

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## Introduction

The loggerhead turtle (*Caretta caretta*) was listed as threatened under the Endangered Species Act in 1978 as a result of declines in nesting and persistent threats from commercial fishing activity and habitat loss. *The Recovery Plan for the Northwest Atlantic Population of Loggerhead Turtle* Caretta caretta (NMFS-USFWS, 2008) identifies actions required to recover and/or protect loggerhead turtle populations. Monitoring nesting activity is considered a high priority action and is necessary to evaluate population status and the effectiveness of nest protection measures. In this report, we present an overview of loggerhead turtle nesting in Georgia in 2023.

## Methods

### Survey Methodology

Georgia Department of Natural Resources (GADNR) coordinated a group of volunteers, researchers, and government employees to conduct nest protection and management activities on Georgia beaches. This group is known collectively as the *Georgia Sea Turtle Cooperative*.

During 2023, cooperators conducted daily nesting surveys of all barrier island beaches (~91% of the Georgia coast) with the exception of Little Tybee, Williamson Island, Pine Island, Raccoon Key, Wolf Island, and Egg Island (Fig. 1). Standardized surveys were not conducted on these islands because of historically low loggerhead nesting densities, poor habitat quality, and the logistical difficulty of maintaining nest survey protocols. Cooperators generally visited these sites opportunistically or when a report was received of sea turtle nesting activity.


Figure 1. Map of study area including Georgia barrier islands, 2023.

The protocols for daily nesting surveys included: 1) surveys must be initiated between May 1- May 15 and continued through the end of the nesting season (August 31), 2) surveys must be conducted daily although 1-2 days may be missed due to logistical difficulties including equipment malfunctions or hurricane evacuations, and 3) survey area must be standardized throughout the length of the study, although we allow for small annual changes in beach profiles due to accretion or erosion ($\pm$ 0.5 km).

Cooperators conducted surveys at dawn unless access to the beach was restricted by high tides (Table 1). On Wassaw and Jekyll Islands, cooperators collected nesting data during nightly patrols associated with research activity (saturation tagging). Researchers conducted night surveys on Wassaw Island

from 7 May through 6 August. On Jekyll, researchers surveyed at night approximately 6 nights per week from 19 May through 1 August.

Table 1. Barrier Island ownership and loggerhead nest protection activities in Georgia, 2023.

| | | | Survey Method | | Nest Protection | | | Predator Control | |
|---|---|---|---|---|---|---|---|---|---|
| Island | Ownership | Nest Protection Project | Standard daily survey (dawn) | Night survey-(tagging) | Flat screen or cage (metal) | Flat screen or cage (Plastic) | small mesh screen | Predator removal-trapping | Predator removal-hunting |
| Tybee Island | Private | Tybee Marine Science Center | X | | X | X | | | |
| Little Tybee/ Myrtle Island | GADNR | Little Tybee Sea Turtle Project | X | | | X | X | | |
| Little Tybee/ Williamson Island | GADNR | None | | | | | | | |
| Wassaw Island | USFWS | Caretta Research Project | X | X | | X | X | | |
| Racoon Key | GADNR | None | | | | | | | |
| Ossabaw Island | GADNR | GADNR Staff | X | | | X | X | X | X |
| St. Catherine's Is. | Private | St. Catherines Island Foundaton Sea Turtle Project | X | | | X | X | X | X |
| Blackbeard Island | USFWS | USFWS, Savannah Coastal Refuges staff | X | | X | X | X | X | X |
| Sapelo Island | GADNR | GADNR Staff | X | | | X | X | X | X |
| Wolf Island | USFWS | None | | | | | | | |
| Egg Island Bar | GADNR | None | | | | | | | |
| Little St. Simons Is | Private | Little St. Simon's Is. Staff | X | | | X | X | X | |
| Sea Island | Private | Sea Island Co. Staff | X | | | X | X | | |
| St. Simon's Island | Private | St. Simons Island Sea Turtle Project | X | | | | | | |
| Jekyll Island | State of Georgia | Georgia Sea Turtle Center Staff | X | X | | X | X | | |
| Little Cumberland Is | Private | LCI Homeowners Assoc.-Caretta Foundation | X | | | X | X | X | |
| Cumberland Island | USNPS | Cumberland National Seashore Staff | X | | X | X | | X | X |

Cooperators surveyed nesting habitat by truck, ATV, bicycle, or on foot, monitoring for signs of loggerhead turtle nesting activity. When an emergence was located, observers used field signs (presence of a body pit and thrown sand) to determine if the emergence was a nest or non-nesting emergence. Cooperators confirmed the presence of eggs by probing with a blunt dowel or digging by hand to locate the egg chamber. Cooperators marked each nest with a wooden stake. If definitive field signs of nesting were present but eggs were

not found, the emergence was categorized as a “possible nest.” Cooperators marked and monitored possible nests through the nesting season. If no hatch was observed, the possible nest was re-categorized as a non-nesting emergence. Observers recorded the date, time, and location (latitude and longitude) of all emergences using a hand-held GPS receiver. Cooperators categorized non-nesting emergences relative to the previous night’s high tide line (landward or seaward of the high tide).

Cooperators relocated all nests deposited below the spring tide line (low beach elevation) to the primary dune to minimize the effects of tidal inundation on embryo development. Cooperators were asked by GADNR to view nest relocation as a management tool of last resort; only nests in danger of frequent inundation were to be moved. Cooperators relocated nests to a nearby dune with a vegetation-free seaward facing slope. Cooperators attempted to move all nests within 12 hours of deposition (prior to 10:00 am the following morning). Observers were careful to maintain the vertical orientation of the eggs during transport. For each relocated nest, observers recorded the date, time, and location (latitude and longitude) using a GPS receiver.

Nest protection protocols and survey effort varied between islands (Table 1). On most undeveloped islands, feral hogs, raccoons, and coyotes were removed by trapping and hunting. In addition, cooperators placed 120 cm x 120 cm sections of 5 cm x 10 cm mesh welded-wire or 4.1 cm x 4.1 cm plastic mesh fencing over nests to protect from mammalian predation. Fence sections were secured with steel pencil rod at the corners. On some islands, a combination of standard flat screen and wire cage were used to further deter raccoons. On most islands, cooperators used plastic screen (4.1 cm x 4.1 cm mesh) because of concerns over the high magnetic permeability of metal cages/screens and the possibility of altering the local magnetic field in the area around the nest (Irwin et al. 2004).

Cooperators visually inspected each nest daily for signs of depredation and hatchling emergence on all islands with the exception of Cumberland Island. On Cumberland, nests were checked every other day until 50 days after which nests were checked daily for signs of emergence. Cooperators recorded all nest depredations and tidal inundation events. Cooperators estimated the number of eggs lost to predators by counting depredated eggs around the nest after depredation events.

Cooperators documented hatchling orientation by observing the direction of hatchling tracks on emergence. Hatchling tracks observed outside a 45-degree cone either side of the shortest diagonal line drawn from the nest to the ocean were considered either misoriented or disoriented. Hatchlings maintaining a constant directional movement outside the 45-degree cone (orienting but in the wrong direction) were considered misoriented. Hatchlings that could not maintain a constant directional movement (circling, zig-zagging) were considered disoriented. Hatchling tacks were documented by category for all nests where tracks were visible. Hatchling orientation was not assess for all nests, particularly when hatchling tracks were obscured by heavy wind or rain events. The misorientation events documented in this report represent a minimum count of hatchling misorientations.

Cooperators conducted nest inventories 5 days after the first emergence of hatchlings. The only exception was if fire ants were observed in the nest following emergence. In this case, the nest was excavated immediately. If no hatchling emergence was observed, cooperators inventoried nests 70 days after deposition. Cooperators conducted most nest inventories during daylight hours, except on Tybee, Wassaw and Sea Islands where excavations were conducted at night. During inventories, personnel carefully dug into the nest chamber and removed the contents. If a large number (>10) of live hatchlings were encountered in the upper chamber, cooperators reburied the hatchlings and continued to monitor the nest allowing hatchlings the chance to emerge on their own. If a small number of live hatchlings were encountered near the bottom of the nest chamber, cooperators counted and released them several meters landward of the high tide line following inventory. All active nests on barrier island beaches were inventoried with the exception of Cumberland Island. Cumberland Island staff inventoried 50% of all nests (odd numbered) due to staff limitations in 2023.

Nest contents were categorized by type including hatched eggs, unhatched eggs, dead hatchlings, and live hatchlings. Cooperators determined the total number of eggs by adding total eggshells (≥50% of the shell intact in nest at inventory) and the number of unhatched eggs. In the case of relocated nests, the total number of eggs was documented during the nest relocation process. Following the nest evaluation, project personnel removed the nest contents and buried them behind the primary dunes to ensure the contents were not confused with those of active nests.

In 2023, cooperators submitted daily nesting data to Georgia DNR through an on-line sea turtle nesting database management system on the website www.seaturtle.org. The Sea Turtle Nest Monitoring System (STNMS) was developed by biologists at GADNR, South Carolina DNR and North Carolina Wildlife Conservation Commission in collaboration with Dr. Michael Coyne at www.seaturtle.org, a non-profit organization dedicated to supporting sea turtle research and conservation worldwide. The STNMS allowed cooperators to manage nesting data and provided detailed nest summaries to the public in near real-time.

We calculated hatching and emergence success using the following formulas:

Hatching Success = (Hatched Eggs/Total Eggs)*100.

Emergence Success =(Hatched Eggs-(Dead Hatchlings +Live Hatchlings))/Total Eggs*100.

For in-situ nests, we determined the egg total by adding the hatched eggs (≥50% of the shell intact in nest at inventory), unhatched eggs, and eggs documented as lost during incubation (depredation events). For relocated nests, nest egg total was determined by counting eggs during relocation. The statewide hatching and emergence success was calculated by multiplying each beach

mean hatching and emergence success by the number of nests, summing the total and dividing by the total nests in the state.

Time series data was modeled using the approach developed by Box and Jenkins (1976). We used R (version 2.15.3) for model selection (autoregressive and moving average components), parameter estimation, and model checking.

## Results and Discussion

### Status

Sea turtle cooperators located a total of 3,431 loggerhead turtle nests on Georgia beaches in 2023, the third highest nest total since comprehensive surveys were established in 1989 (Figure 2). The 2023 nest total exceeded the recovery goal set for Georgia loggerheads in the NMFS/USFWS Recovery Plan for the Northwest Atlantic Population of the Loggerhead Sea Turtle of 2,800 nests but was below the 14,000 nest recovery goal for the Northern Recovery Unit of loggerheads (Georgia, South Carolina, North Carolina- 11,644 nests). At the time of writing this report, there were 33 nests that could not be identified to species. Some of these nests will be identified through genetic analysis of egg samples collected at inventory, and the final nest totals may change slightly.

We examined trends in nesting using two time series including a short-term comprehensive dataset (all beaches, 35 years) and a long-term dataset (3 beaches, 51 years). For the short-term dataset, we detected a significant increasing trend of 4.2 % annually using log-linear regression with autocorrelated error structure ($t = 7.30$, $df=33$, $P< 0.0001$; Fig. 2).

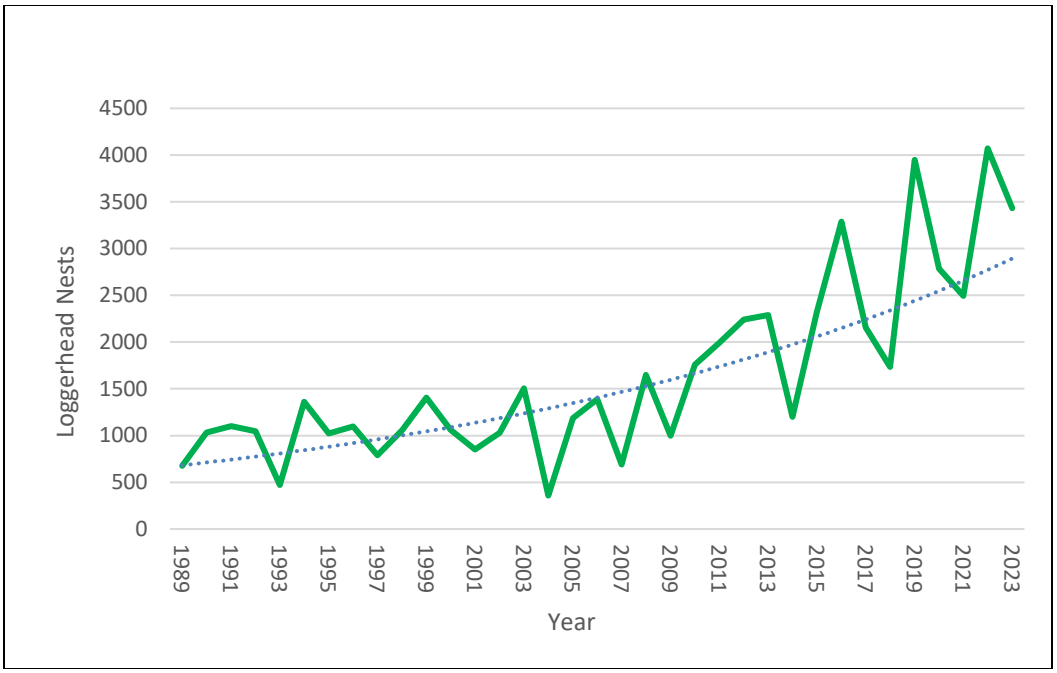


Figure 2. Loggerhead turtle nest totals from standardized daily survey beaches in Georgia, 1989-2023. Standardized daily surveys were not conducted on Little Tybee, Williamson, Pine, Raccoon Key, Egg, and Wolf Islands.

To examine long-term nesting trends (>45 years) we used combined nest totals from the 3 islands with long-running nest protection programs including Wassaw, Blackbeard, and Little Cumberland Islands. A second order polynomial (quadratic) model was determined to be the best model fit for the time series ($r^2$ = 0.65, n=51, P < 0.0001; Fig. 3). The significant non-linear model suggests a decline in nesting from 1973 to 1992 (minima) followed by a period of increasing nesting. The 2023 nest total was the fourth highest for the time-series and roughly twice the total number of nests documented in the early 1970's. One caution regarding the long-term dataset is that the islands used in the analysis were not randomly selected from the population of nesting sites. Although nest totals from the 3 islands represent approximately 25% of Georgia's statewide nesting annually, they may not be representative of statewide nesting trends.

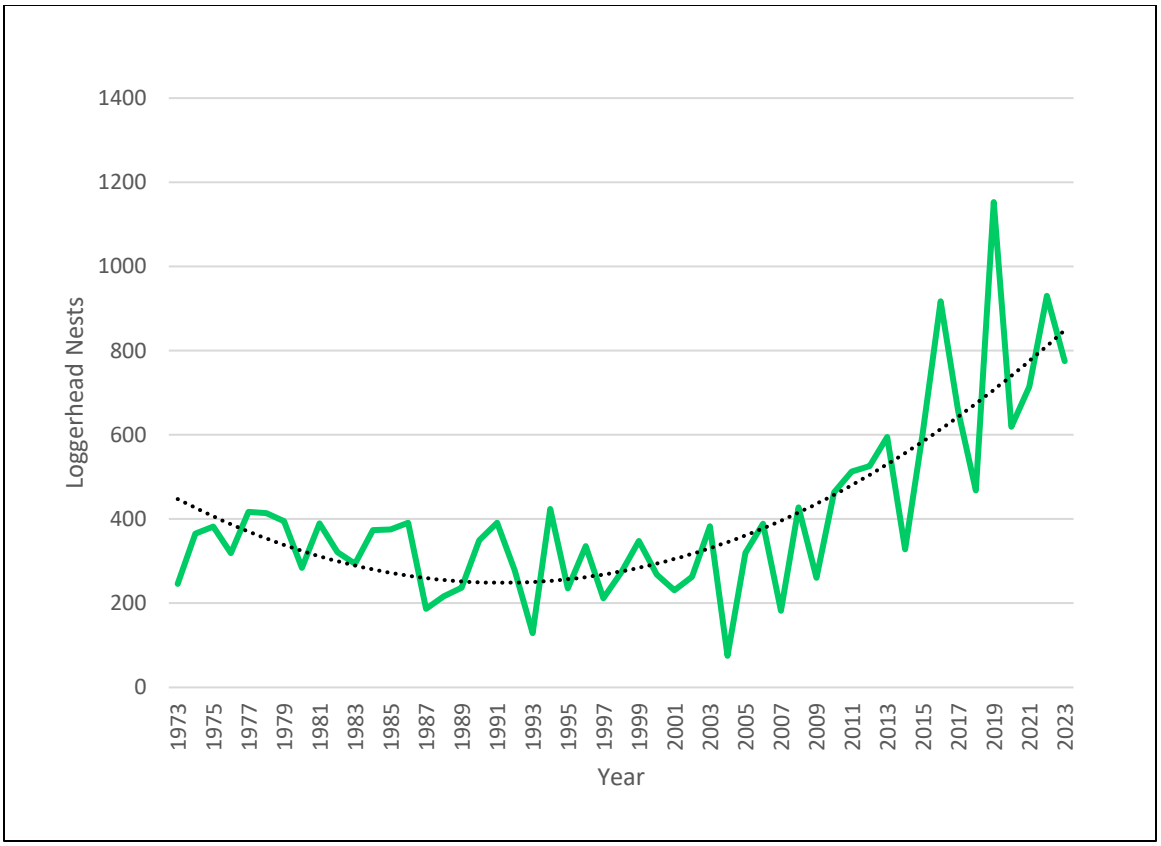


Figure 3. Combined loggerhead turtle nest counts from 3 Georgia beaches (Wassaw, Blackbeard, Little Cumberland), 1973-2023.

Sea turtle cooperators surveyed a total of 15,239 km of nesting habitat between 15 May and 31 August, 2023. This compares with 15,384 km and 15,214 km of nesting habitat surveyed during the same period in 2021 and 2022, respectively. Overall, survey effort has been comparable between years since we began collecting effort data in 2003 (± 5%).

Loggerhead nesting totals were highest on Cumberland, Blackbeard, and Ossabaw Islands which represented 56% of total statewide nesting (Table 2).

Table 2. Loggerhead turtle nesting in Georgia, 2023. Standardized daily surveys were not conducted on Little Tybee, Williamson, Racoon Key, Wolf and Egg Islands.

| Island | Surveyed Beach Length (km) | No. of nests | Nesting density (Nests/km) | Non-nesting emergences-above high tide (NEA) | Nesting success (Nests/ (nests+ NEA)) | Nests relocated | % of total nests relocated |
|---|---|---|---|---|---|---|---|
| Tybee Island | 7.7 | 31 | 4.0 | 13 | 0.7 | 18 | 58.1 |
| Little Tybee/Myrtle Island | 1.6 | 2 | 1.3 | 5 | 0.29 | 1 | 50.0 |
| Williamson Island* | 1.3 | | | | | | |
| Wassaw Island | 10.5 | 267 | 25.4 | 92 | 0.74 | 137 | 51.3 |
| Raccoon Key* | 0.7 | | | | | | |
| Ossabaw Island | 17.2 | 461 | 26.8 | 432 | 0.52 | 75 | 16.3 |
| St. Catherines Island | 16.7 | 317 | 19.0 | 253 | 0.56 | 143 | 45.1 |
| Blackbeard Island | 13.7 | 399 | 29.1 | 521 | 0.43 | 78 | 19.6 |
| Sapelo Island | 8.9 | 244 | 27.4 | 166 | 0.6 | 119 | 48.8 |
| Wolf Island* | 4.3 | | | | | | |
| Egg Island* | 2.8 | | | | | | |
| Little St. Simons Island | 11.1 | 169 | 15.2 | 139 | 0.55 | 26 | 15.4 |
| Sea Island | 7.1 | 130 | 18.3 | 56 | 0.7 | 31 | 23.9 |
| St. Simons Island | 4 | 13 | 3.3 | 7 | 0.65 | 10 | 76.9 |
| Jekyll Island | 12.2 | 216 | 17.7 | 196 | 0.52 | 60 | 27.8 |
| Little Cumberland Island | 4.8 | 109 | 22.7 | 70 | 0.61 | 64 | 58.7 |
| Cumberland Island | 27.4 | 1,073 | 39.2 | 574 | 0.65 | 269 | 25.1 |
| Statewide Totals | 152.0 | 3,431 | 22.6 | 2,524 | 0.58 | 1,031 | 30.1 |

The coastwide average nesting density was 22.6 nests/km (Table 2). Nesting densities were variable between regularly surveyed islands and ranged from 3.3 nests/km on St. Simons Island to 39.2 nests/km on Cumberland Island. Nesting success (% of emergences above high tide that resulted in a nest) ranged from 43% on Blackbeard Island to 74% on Blackbeard Island (statewide avg. = 58%; Table 2). Nesting success is generally lower (higher proportion of non-nesting emergences) on islands with poor quality habitat such as erosional scarps, tree boneyards, and washover fans.

The spatial distribution of nests was similar to previous years, with loggerhead turtles nesting on all surveyed barrier island beaches in Georgia (Figure 4).

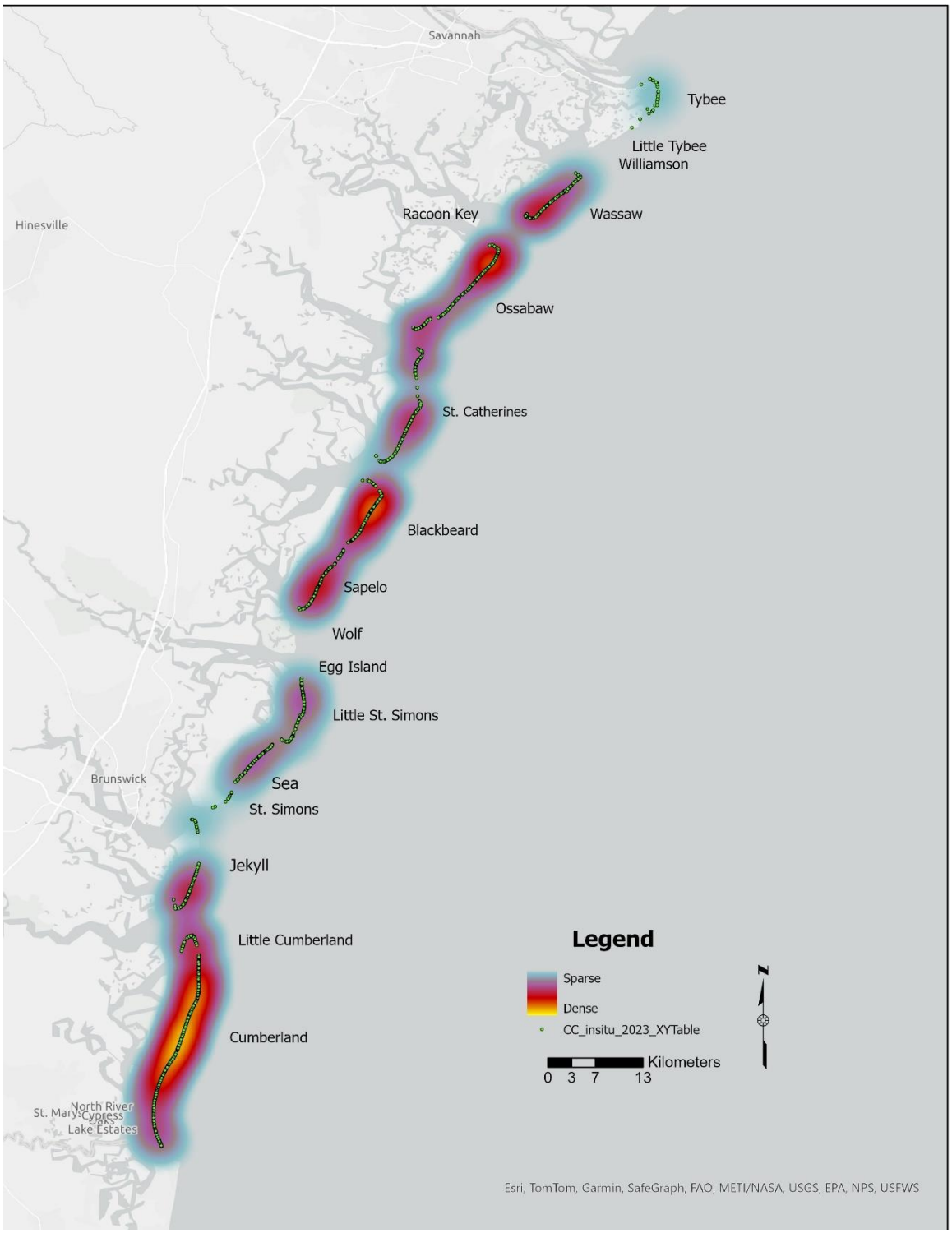


Figure 4. Loggerhead turtle nest locations and nest densities in Georgia, 2023.

The highest nesting densities were found on Cumberland, Blackbeard, and Ossabaw Islands (Figure 4). Sea turtles were prevented from nesting along sections of Jekyll (3.5 km) and St. Simons (3.1 km) beaches as a result of

shoreline stabilization structures (rock armoring). No major changes to the total km of nesting habitat were noted, although anecdotal observations from satellite imagery suggest continued erosion of the south end of Sea Island resulting in the annual small-scale loss of sea turtle nesting habitat.

The first and last nests of the 2023 loggerhead nesting season were found on Blackbeard Island on 1 May and 31 August, respectively. The temporal distribution of loggerhead nests followed the same general pattern documented in previous years (Fig. 5). Daily nest totals increased from early May through June 1st. Nesting totals remained consistent at between 40 and 70 nests per day through the first week of July and then declined precipitously. In 2023, nesting was consistently above the 10-year average during the second half of the season (July and August).

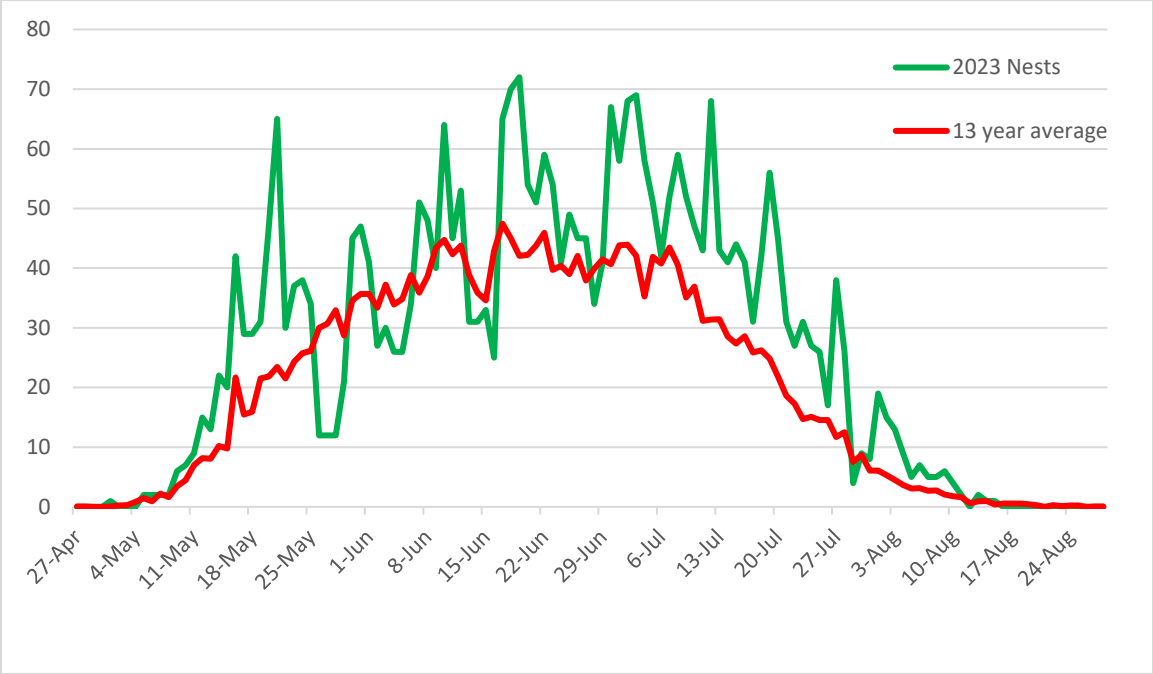


Figure 5. Temporal distribution of loggerhead nests in Georgia 2023 and 13-year daily average.

Non-Loggerhead Nesting Records

Cooperators located 14 green turtle nests in Georgia in 2023. Green turtle nests were found on Cumberland (9), Sapelo (2), Blackbeard (1), Ossabaw (1), and Wassaw Islands (1). Green turtle hatching and emergence success was 56.9% and 54.9%, respectively. No nests were lost to storm erosion and 1 nest was partially depredated by a racoon on Blackbeard Island. Overall, green turtles have nested at very low densities in Georgia over the last 20 years with an average of 4.8 nests per year (Figure 6). Genetic information for the green turtles using the Georgia coast for nesting was not available at the writing of this report.

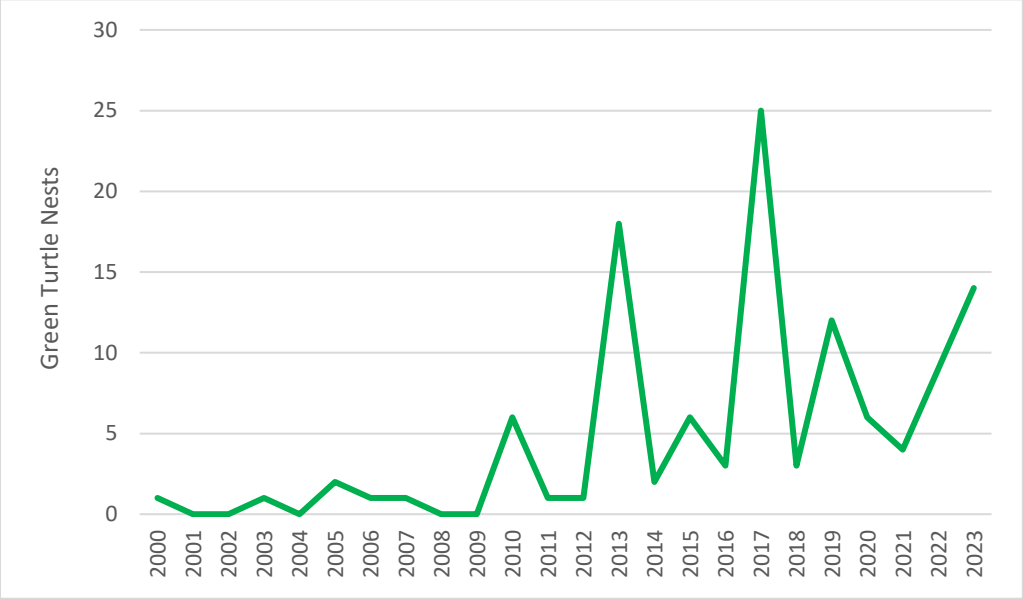


Figure 6. Green turtle nesting in Georgia, 2000-2023.

No Kemp's ridley or leatherback nests were documented nesting in Georgia in 2023.

Nest Protection and Management

Statewide loggerhead mean hatching and emergence success were 54.5% and 52.2%, respectively (Table 3). Hatching success was variable

Table 3. Estimated loggerhead turtle nest mean hatching and emergence success, 2023.

| Island | Surveyed Beach Length (km) | No. of nests | Sampled Nests | Overall Mean % Hatch Success | Overall Mean % Emergence Success |
|---|---|---|---|---|---|
| Tybee Island | 7.7 | 31 | 30 | 67.5 | 61.3 |
| Little Tybee/Myrtle Island | 1.6 | 2 | 2 | 0 | 0 |
| Williamson Island* | 1.3 | | | | |
| Wassaw Island | 10.5 | 267 | 264 | 65.3 | 57.2 |
| Raccoon Key* | 0.7 | | | | |
| Ossabaw Island | 17.2 | 461 | 453 | 47.9 | 46.5 |
| St. Catherines Island | 16.7 | 317 | 298 | 44.5 | 42.9 |
| Blackbeard Island | 13.7 | 399 | 397 | 36.2 | 34 |
| Sapelo Island | 8.9 | 244 | 243 | 39.4 | 37.6 |
| Wolf Island* | 4.3 | | | | |
| Egg Island* | 2.8 | | | | |
| Little St. Simons Island | 11.1 | 169 | 159 | 57.6 | 55.8 |
| Sea Island | 7.1 | 130 | 129 | 65.5 | 62.5 |
| St. Simons Island | 4 | 13 | 12 | 79.1 | 75 |
| Jekyll Island | 12.2 | 216 | 216 | 67.4 | 65.7 |
| Little Cumberland Island | 4.8 | 109 | 109 | 68.3 | 65.4 |
| Cumberland Island** | 27.4 | 1,073 | 530 | 68.4 | 67.3 |
| Statewide Totals | 152 | 3,431 | 2,842 | 54.5 | 52.2 |

among regularly surveyed islands ranging from 36% on Blackbeard to 79% on St. Simons Island. Overall, the hatching and emergence success in Georgia were comparable with the 21-year average of 63% and 58% (Figure 7). Hatching and emergence success have been variable since electronic records have been collected (1999-present) but have generally ranged between 50% and 70%, statewide.

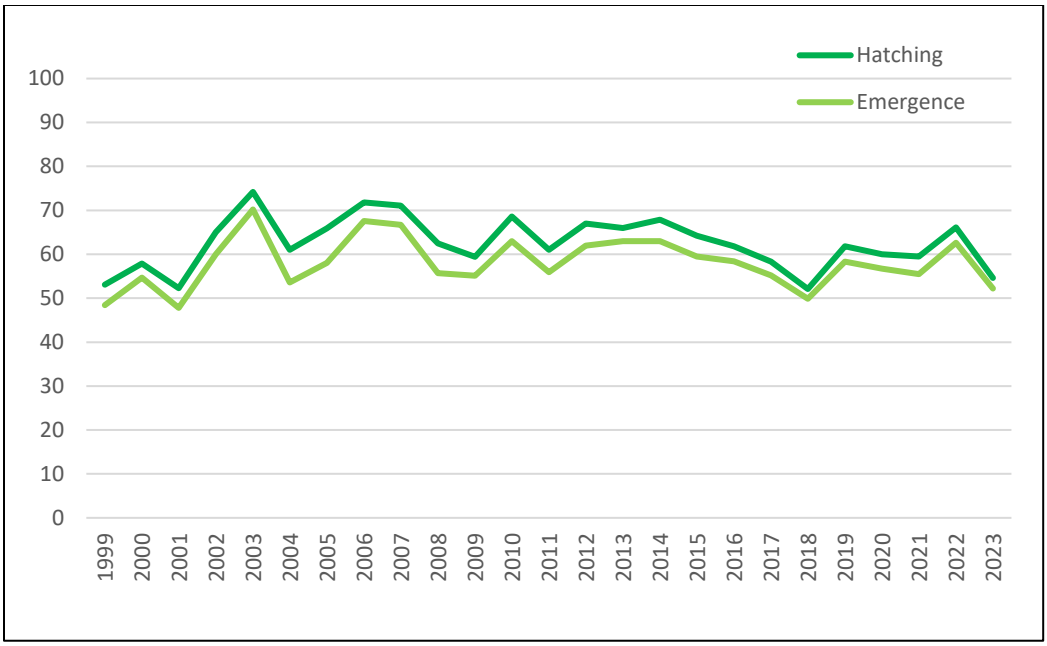


Figure 7. Statewide loggerhead hatching and emergence success in Georgia, 1999-2023.

A sample of randomly selected nests on Sapelo Island were left in-situ with no nest management (nest relocation or predator screening) to assess the effectiveness of nest protection activities statewide. The hatching and emergence success for control nests with no nest management was 25.9% and 23.8% (n=59), respectively. Coyote nest predation was relatively high in 2023 on Sapelo with 12 nests completely lost and an additional 79 nests partially depredated by coyotes. A randomly selected sample of nests with predator screens including both in-situ and relocated nests (n=112) had a hatching and emergence success at 53.2% and 50.9%, respectively.

Georgia beaches produced an estimated 159,445 hatchlings during the 2023 nesting season for an average of 1,083 hatchlings/km (Table 4). The number of hatchlings produced per nest on regularly surveyed islands ranged from 35 to 77 hatchlings/nest (Table 4).

Table 4. Loggerhead turtle hatchling production in Georgia based on nest inventories, 2023. Hatchling production on Cumberland was estimated by summing hatchling production documented during nest inventories and using the average hatchling total for non-inventoried nests.

| Island | Surveyed Beach Length (km) | No. of nests | Total hatchlings produced | Hatchlings/km | Hatchlings/nest |
|---|---|---|---|---|---|
| Tybee Island | 7.7 | 31 | 2,080 | 270 | 67 |
| Little Tybee/Myrtle Island | 1.6 | 2 | 0 | 0 | 0 |
| Williamson Island* | 1.3 | | | | |
| Wassaw Island | 10.5 | 267 | 17,347 | 1,652 | 65 |
| Raccoon Key* | 0.7 | | | | |
| Ossabaw Island | 17.2 | 461 | 22,238 | 1,293 | 48 |
| St. Catherines Island | 16.7 | 317 | 14,651 | 877 | 46 |
| Blackbeard Island | 13.7 | 399 | 14,039 | 1,025 | 35 |
| Sapelo Island | 8.9 | 244 | 9,821 | 1,103 | 40 |
| Wolf Island* | 4.3 | | | | |
| Egg Island* | 2.8 | | | | |
| Little St. Simons Island | 11.1 | 169 | 9,273 | 835 | 55 |
| Sea Island | 7.1 | 130 | 8,178 | 1,152 | 63 |
| St. Simons Island | 4 | 13 | 1,006 | 252 | 77 |
| Jekyll Island | 12.2 | 216 | 14,666 | 1,202 | 68 |
| Little Cumberland Island | 4.8 | 109 | 7,795 | 1,624 | 72 |
| Cumberland Island** | 27.4 | 1,073 | 76,702 | 2,799 | 72 |
| Statewide Totals | 152 | 3,431 | 159,445 | 1,083 | 55 |

Overall, loggerhead turtle nest incubation duration in Georgia averaged 57.0 days. Average incubation durations by island ranged from 53.2 days on Tybee Island to 59.7 days on Blackbeard Island (Table 5).

Table 5. Loggerhead turtle nest incubation durations (deposition to emergence) in Georgia, 2023.

| | | Incubation duration (days) | | | |
|---|---|---|---|---|---|
| Island | n | Mean-relocated nests | n | Mean-*in-situ* nests | n | Overall mean |
| Tybee Island | 18 | 52.6 | 13 | 54.3 | 31 | 53.2 |
| Little Tybee/Myrtle Island | | | | | | |
| Williamson Island* | | | | | | |
| Wassaw Island | 137 | 54.5 | 130 | 60.6 | 267 | 57.8 |
| Raccoon Key* | | | | | | |
| Ossabaw Island | 75 | 51.8 | 386 | 56.4 | 461 | 55.4 |
| St. Catherines Island | 143 | 56.9 | 174 | 58.3 | 317 | 57.5 |
| Blackbeard Island | 78 | 58.8 | 321 | 60.1 | 399 | 59.7 |
| Sapelo Island | 119 | 54 | 125 | 56.6 | 244 | 55 |
| Wolf Island* | | | | | | |
| Egg Island* | | | | | | |
| Little St. Simons Island | 26 | 54.4 | 143 | 57.6 | 169 | 57.1 |
| Sea Island | 31 | 57.5 | 99 | 54.6 | 130 | 55.3 |
| St. Simons Island | 10 | 51.6 | 3 | 61 | 13 | 53.9 |
| Jekyll Island | 60 | 53.1 | 156 | 57.5 | 216 | 56.1 |
| Little Cumberland Island | 64 | 57.3 | 45 | 58.6 | 109 | 57.7 |
| Cumberland Island | 269 | 54.7 | 804 | 58.4 | 1,073 | 57.3 |
| Statewide Totals | 1031 | 55.1 | 2,400 | 58 | 3,431 | 57.0 |

Approximately 30% of loggerhead nests were relocated by cooperators in 2023 to protect eggs from tidal inundation as compared with 22% in 2022 (Table 2). Relocation rates were variable among nest protection projects and ranged from less than 15.4% on Blackbeard Island to 77% on St. Simons Island (Table 2). High relocation rates are more common on islands with poor habitat quality (low beach elevation and scarping) or on islands with renourished beaches. Approximately 50% of nests are relocated each year on Sapelo Island as a result of a long-term research project to estimate the effectiveness of predator screening and nest relocation on hatching success.

Very few nests were lost to storm erosion in 2023 (Table 6). A total of 120 nests were lost statewide with most of the loss occurring on Blackbeard and Ossabaw Islands (60). However, approximately 20% of nests were tidally inundated at least once during incubation (Table 6). Three significant tidal events occurred during the 2023 nesting season that had an effect on emergence success. Abnormally high full moon tides in early June, August and September (0.40-0.60 m higher than predicted) resulted in repeated inundation for some nests. The effect of the inundation events on hatching success is hard to directly quantify; however, poor hatch success was documented in many of the nests that were washed over during these three events.

Table 6. Tidal inundation of loggerhead turtle nests in Georgia, 2023.

| Island | No. of nests | Nests Sampled | Nests subjected to tidal washover | % washed over | Nests lost to storm events (erosion) | % nests lost to storm events |
|---|---|---|---|---|---|---|
| Tybee Island | 31 | 30 | 8 | 26.7 | 1 | 3.2 |
| Little Tybee/Myrtle Island | 2 | 0 | | | 1 | 50.0 |
| Williamson Island* | | | | | | |
| Wassaw Island | 267 | 244 | 28 | 11.5 | 14 | 5.2 |
| Raccoon Key* | | | | | | |
| Ossabaw Island | 461 | 376 | 118 | 31.4 | 22 | 4.8 |
| St. Catherines Island | 317 | 194 | 41 | 21.1 | 1 | 0.3 |
| Blackbeard Island | 399 | 340 | 108 | 31.8 | 38 | 9.5 |
| Sapelo Island | 244 | 216 | 64 | 29.6 | 11 | 4.5 |
| Wolf Island* | | | | | | |
| Egg Island* | | | | | | |
| Little St. Simons Island | 169 | 133 | 64 | 48.1 | 15 | 8.9 |
| Sea Island | 130 | 123 | 41 | 33.3 | 5 | 3.8 |
| St. Simons Island | 13 | 11 | 0 | 0.0 | 0 | 0.0 |
| Jekyll Island | 216 | 208 | 32 | 15.4 | 1 | 0.5 |
| Little Cumberland Island | 109 | 106 | 22 | 20.8 | 1 | 0.9 |
| Cumberland Island | 1,073 | 1,003 | 55 | 5.5 | 10 | 0.9 |
| Statewide Totals | 3,431 | 2,984 | 581 | 19.5 | 120 | 4.0 |

A total of 356 nests were documented with misoriented hatchlings (disrupted sea-finding behavior) representing approximately 10% of total nests.

Table 7. Sea turtle hatchling misorientation events in Georgia, 2023. Misorientation events include nests with 10 or greater hatchling misorientation tracks.

| Island | Surveyed Beach Length (km) | No. of nests | Sampled nests | Misoriented nests ≥ 10 hatchlings | % |
|---|---|---|---|---|---|
| Tybee Island | 7.7 | 31 | 28 | 2 | 0.07 |
| Little Tybee/Myrtle Island | 1.6 | 2 | 0 | | |
| Williamson Island* | 1.3 | | | | |
| Wassaw Island | 10.5 | 267 | 166 | 8 | 0.05 |
| Raccoon Key* | 0.7 | | | | |
| Ossabaw Island | 17.2 | 461 | 216 | 43 | 0.20 |
| St. Catherines Island | 16.7 | 317 | 159 | 12 | 0.08 |
| Blackbeard Island | 13.7 | 399 | 182 | 9 | 0.05 |
| Sapelo Island | 8.9 | 244 | 72 | 7 | 0.10 |
| Wolf Island* | 4.3 | | | | |
| Egg Island* | 2.8 | | | | |
| Little St. Simons Island | 11.1 | 169 | 96 | 33 | 0.34 |
| Sea Island | 7.1 | 130 | 100 | 15 | 0.15 |
| St. Simons Island | 4 | 13 | 9 | 1 | 0.11 |
| Jekyll Island | 12.2 | 216 | 174 | 4 | 0.02 |
| Little Cumberland Island | 4.8 | 109 | 83 | 8 | 0.10 |
| Cumberland Island | 27.4 | 1,073 | 496 | 8 | 0.02 |
| Statewide Totals | 152 | 3,431 | 2,755 | 150 | 0.05 |

Of those, 150 nests (5% of total nests) were considered significant misorientation events with at least 10 or more hatchlings that were misoriented (Table 7). Nests having less than 10 misoriented hatchlings are generally considered minor misorientation events and may be due to the physical characteristics of the beach (slope or dune height) or hatchling deformities. Hatchling misorientations were documented on all beaches with significant nesting (Figure 8). The highest density of misorientations were on Ossabaw, Little St. Simons Island, and Sea Island. Misorientations on undeveloped beaches with no artificial light sources are suspected to be a result of skyglow from distant coastal residential and commercial development (mainland). One caveat regarding the misorientation data is that it represents a minimum count of misoriented hatchlings. Not all nests are evaluated because hatchling tracks may be lost due to high winds or rain.

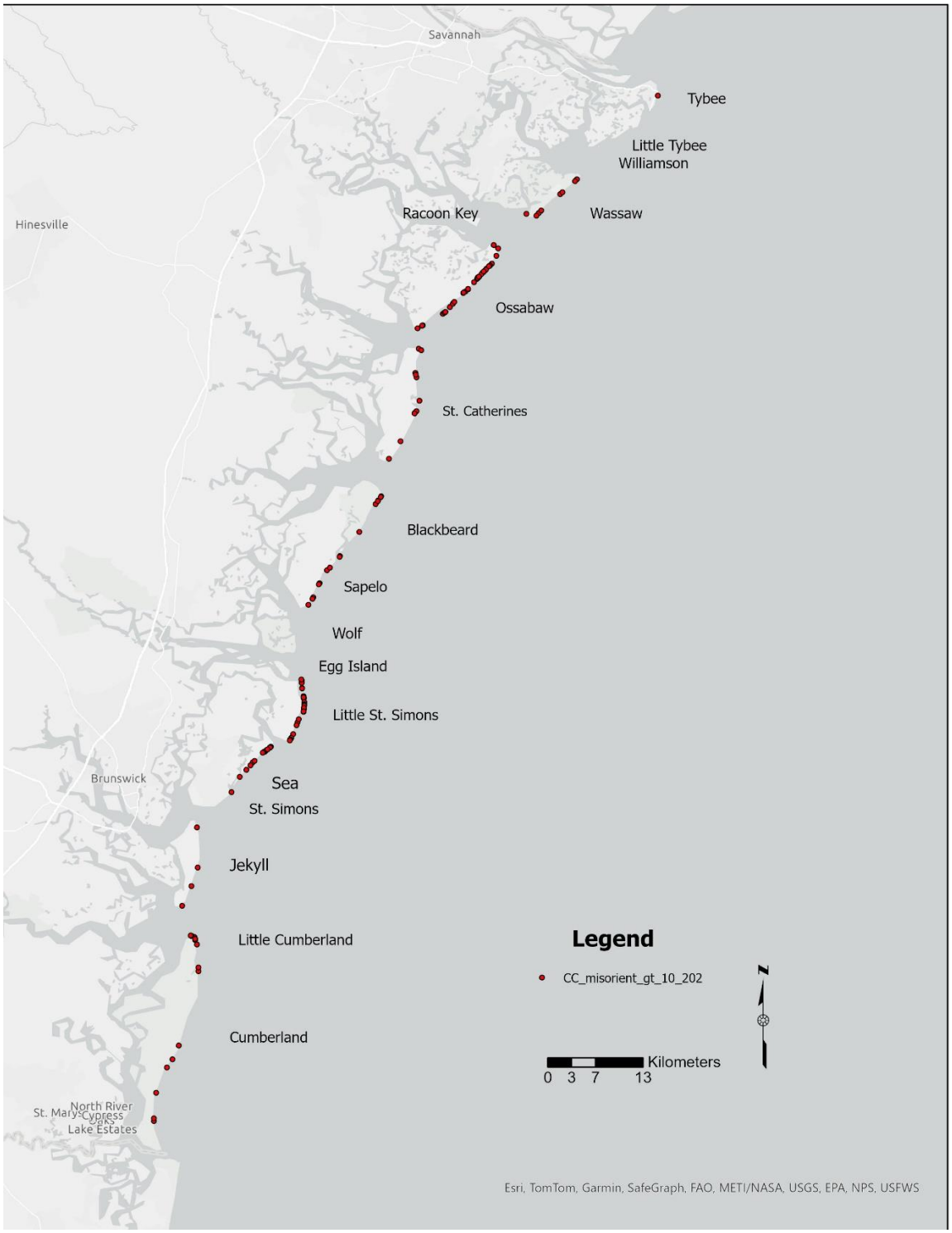


Figure 8. Loggerhead turtle nests with 10 or more misoriented hatchling tracks in Georgia, 2023.

Complete nest depredations were relatively low in 2023 representing 5% of nests statewide (Table 7). Feral hogs accounted for 71% of complete depredations and occurred primarily on the remote barrier islands (St. Catherines and Ossabaw). Feral hog depredation was particularly high on St. Catherines Island with 33% of nests completely destroyed.

Table 7. Complete loggerhead nest depredations in Georgia, 2023.

| | | No. of complete nest depredations | | | | | |
|---|---|---|---|---|---|---|---|
| Island | No. of nests | Feral hog | Raccoon | Coyote | Unknown predator | Total | % |
| Tybee Island | 31 | 0 | 0 | 0 | 0 | 0 | 0.0 |
| Little Tybee/Myrtle Island | 2 | 0 | 0 | 1 | 0 | 1 | 50.0 |
| Williamson Island* | | | | | | | |
| Wassaw Island | 267 | 0 | 0 | 2 | 0 | 2 | 0.7 |
| Raccoon Key* | | 0 | 0 | 0 | 0 | 0 | 0.0 |
| Ossabaw Island | 461 | 44 | 1 | 2 | 2 | 49 | 10.6 |
| St. Catherines Island | 317 | 104 | 3 | 0 | 1 | 108 | 34.1 |
| Blackbeard Island | 399 | 0 | 16 | 0 | 8 | 24 | 6.0 |
| Sapelo Island | 244 | 0 | 0 | 12 | 4 | 16 | 6.6 |
| Wolf Island* | | | | | | | |
| Egg Island* | | 0 | 0 | 0 | 0 | 0 | |
| Little St. Simons Island | 169 | 0 | 0 | 0 | 1 | 1 | 0.6 |
| Sea Island | 130 | 0 | 0 | 0 | 0 | 0 | 0.0 |
| St. Simons Island | 13 | 0 | 0 | 0 | 0 | 0 | 0.0 |
| Jekyll Island | 216 | 0 | 1 | 0 | 0 | 1 | 0.5 |
| Little Cumberland Island | 109 | 0 | 0 | 0 | 1 | 1 | 0.9 |
| Cumberland Island | 1,073 | 13 | 9 | 1 | 2 | 25 | 2.3 |
| Statewide Totals | 3,431 | 161 | 30 | 18 | 19 | 228 | 6.6 |

The proportion of partially depredated nests varied among islands and ranged from 2.3% on Sea Island to 50% on Sapelo Island (Table 8). Ghost crabs accounted for the highest number of partially depredated nests (32%). In general, ghost crab depredation did not influence overall hatching success because a relatively small number of eggs were removed during predation events (<5 eggs per nest). By contrast, nests partially depredated by raccoons, coyotes, and feral hogs resulted in the loss of a substantial portion of the clutch.

Table 8. Summary of loggerhead turtle partial nest depredations in Georgia, 2023.

| | | Number of partially depredated nests | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Island | No. of nests | Feral hog | Raccoon | Ghost Crab | Armadillo | Coyote | Fox | Total | % |
| Tybee Island | 31 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.0 |
| Little Tybee/Myrtle Island | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.0 |
| Williamson Island* | | | | | | | | | |
| Wassaw Island | 267 | 0 | 0 | 7 | 0 | 0 | 0 | 7 | 2.6 |
| Raccoon Key* | | | | | | | | | |
| Ossabaw Island | 461 | 78 | 3 | 51 | 3 | 32 | 0 | 167 | 36.2 |
| St. Catherines Island | 317 | 8 | 3 | 6 | 3 | 2 | 0 | 22 | 6.9 |
| Blackbeard Island | 399 | 1 | 94 | 20 | 0 | 12 | 0 | 127 | 31.8 |
| Sapelo Island | 244 | 1 | 0 | 43 | 0 | 78 | 0 | 122 | 50.0 |
| Wolf Island* | | | | | | | | | |
| Egg Island* | | | | | 0 | 0 | 0 | 0 | |
| Little St. Simons Island | 169 | 0 | 7 | 13 | 0 | 0 | 0 | 20 | 11.8 |
| Sea Island | 130 | 0 | 2 | 0 | 1 | 0 | 0 | 3 | 2.3 |
| St. Simons Island | 13 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 7.7 |
| Jekyll Island | 216 | 0 | 9 | 13 | 0 | 0 | 0 | 22 | 10.2 |
| Little Cumberland Island | 109 | 0 | 5 | 2 | 0 | 0 | 0 | 7 | 6.4 |
| Cumberland Island | 1,073 | 4 | 38 | 41 | 1 | 37 | 0 | 121 | 11.3 |
| Statewide Totals | 3,431 | 92 | 161 | 197 | 8 | 161 | 0 | 619 | 18.0 |

## Summary

Overall, loggerhead nesting in 2023 was the third highest recorded in Georgia since comprehensive surveys began in 1989. Standardized comprehensive surveys show a 4.1% increase in nesting over the last 34 years. The long-term nesting data suggests a decline in nesting from 1973 to 1993 (minima) followed by a period of increasing nesting. The 2023 nest total exceeded the recovery goal set for Georgia loggerheads in the NMFS/USFWS Recovery Plan for the Northwest Atlantic Population of the Loggerhead Sea Turtle of 2,800 nests but was below the recovery goal for the Northern Recovery Unit of loggerheads (Georgia, South Carolina, North Carolina) of 14,000 nests (11,644). High nest densities were found on Ossabaw, Blackbeard and Cumberland Islands. Significant efforts were made to protect nests and improve hatching success.

Hatching and emergence success was substantially higher on beaches with nest management activities (nest relocation and predator control) than randomly selected nests with no management. Significant hatchling misorientation events are still relatively infrequent on Georgia beaches but are a concern as development increases on the Georgia coast.

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