

Bald Head Island Conservancy Sea Turtle Protection Program 2023 Annual Report

Written by
Paul Hillbrand, Sea Turtle Biologist



The 2023 Sea Turtle Protection Team (Ali, Kelsey, Kayla, Abby, & Bo) with Sandy after the application of a satellite tag

700 Federal Road
Bald Head Island, North Carolina 28461
seaturtle@bhic.org



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2023 Nesting Season Executive Summary

**All data subject to change.*

The 2023 sea turtle nesting season on Bald Head Island (BHI) was highlighted by the deployment of four satellite tags on nesting turtles and surpassing the 100-nest mark for the fourth time in the last five seasons. The Bald Head Island Conservancy's (BHIC) Sea Turtle Protection Team (STPT) patrolled the beaches of BHI for 168 days/nights (35 dawn, 60 partial nights, and 72 full nights), observing 122 nests, of which 46 (37.7%) were relocated, and 220 false crawls. The first nesting activity occurred on 15 May and the last on 18 August. For the first time since 2013, the STPT recorded 3 green sea turtle (*Chelonia mydas*) activities that included one nest and two false crawls. At least 63 genetically distinct females were responsible for the 342 nesting activities observed. The STPT also observed the return of 9 Legacy turtles (*Billie, Fluffy, Gigi, Granny, Mary Jane, Sandy, Scarlett, Thomasina, & Turquoise*) and named 2 new Legacy turtles (*Lee Ann & Strawberry*). The first hatching event was observed on 30 July, while the last nest was excavated on 25 October. The average incubation time for the 122 nests was 55.2 days. Approximately 13,588 eggs were laid on BHI, with an estimated 10,104 hatchlings making it to the water. Mean hatch success was 79.9%, while mean emerge success was 70.2%. Our most productive mom was a vagabond remigrant, FFK802, who laid 657 eggs that produced 530 hatchlings. Our most efficient mom was Billie, with a hatch success of 96.4% and an emergence success of 94.1%. With a highly active Atlantic hurricane season, BHI was fortunate to have lost only one nest to Hurricane Idalia. However, a total of 30 nests were impacted by a combination of hurricanes, tropical storms, and king tides. Additionally, one nest fell victim to coyotes, and a total of 10 nests were affected by a mixture of island predators, accounting for the loss of 442 eggs (3.2%).

The STPT embarked on two projects this season. First, we deployed four satellite tags, outfitting KKD855, KKK238, Sandy, and Scarlett, to better understand post-nesting migration. This project aims to enhance our understanding of their movements across different habitats, including proposed wind farm properties. Second, in collaboration with UNCW post-doctoral researcher Dr. Matt Ware, we are investigating the impact of environmental parameters on nesting habitat suitability and distributions.

This research reflects the Conservancy's commitment to comprehensive conservation efforts. All sea turtle monitoring and research were performed pursuant to North Carolina Wildlife Resources Commission Endangered Species Permit #23ST14.



KKK238 returning to the ocean after being outfitted with a satellite tag.

Sea Turtle Protection Program Overview

The Bald Head Island Conservancy's (*BHIC*) Sea Turtle Protection Program (*STPP*) was established in 1983 in cooperation with the North Carolina Wildlife Resources Commission (*NCWRC*) and the National Marine Fisheries Service (*NMFS*). Unofficially, monitoring of nesting sea turtles, their respective nests, and hatchlings began on BHI in 1980 with a group of island residents. Considered by NMFS as an "index" and "saturation tagging" beach, BHI and the Conservancy are nationally recognized for their long-term sea turtle monitoring program. As a saturation tagging beach, the Conservancy's Sea Turtle Protection Team (*STPT*) monitors the beaches of BHI nightly from May to September. During nightly patrols, the STPT's goal is to tag and identify every individual nesting turtle that comes ashore using a standardized data collection protocol. Nesting season begins with dawn patrols (*0600 – 0730 EDT*) on 1 May until the first nest is observed, after which full night patrols commence and continue through the middle of August. Nightly patrols for nesting mothers are conducted from 2100 - 0700 EDT and include the application of Inconel flipper tags (*began in 1991*), passive integrated transponder tags (*PIT; began in 2002*), and the collection of tissue biopsies (*began in 2002*) for genetic analysis and eggs for stable isotope analysis (*SIA; began in 2010*). These activities have produced an invaluable 35+ year dataset that allows the Conservancy's biologists and collaborators to track and conduct studies on the reproductive ecology, migration, and population trends of nesting loggerhead (*Caretta caretta*), green (*Chelonia mydas*), leatherback (*Dermochelys coriacea*) and, Kemp's ridley (*Lepidochelys kempii*) sea turtles.

Nesting Activities: Caretta caretta & Chelonia mydas

*All data subject to change.

The 2023 sea turtle nesting season on Bald Head Island (BHI) was highlighted by surpassing the 100-nest mark for the fourth time in the last five seasons. The Conservancy’s Sea Turtle Protection Team (STPT) observed 63 nesting females who were responsible for 342 nesting activities: 122 nests and 220 false crawls (Figure 1). All but three nesting activities were determined to be loggerhead (*Caretta caretta*) sea turtles. The remaining three activities consisted of one nest (the third in as many years) and two false crawls by green (*Chelonia mydas*) sea turtles. The 122 nests produced 10,104 hatchlings with hatch and emergence success rates of 79.9% and 70.2%, respectively. Due to the proximity to the high tide line or an escarpment,

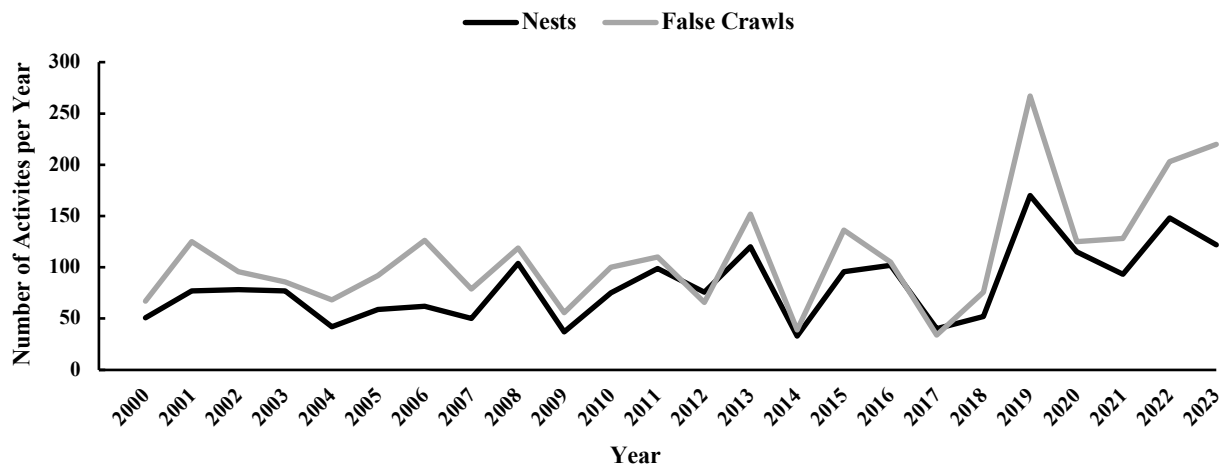


Figure 1. Bald Head Island nesting activities, 2000 – 2023.

46 (37.7%) imperiled nests were relocated. All nesting activities were observed between 15 May and 18 August, with a temporal distribution consistent with the last four seasons where most nesting activities occurred in July (52.6%, Figure 2). Although South Beach had the most activities (130; nests 71 and false crawls 159; Figure 2), East Beach produced 28.7 nests (43) per mile, surpassing South Beach’s 20.3 nests per mile. This highlights the importance of East Beach, which plays an equally crucial role to South Beach in supporting nesting activity. An additional 8 nests were laid on West Beach.

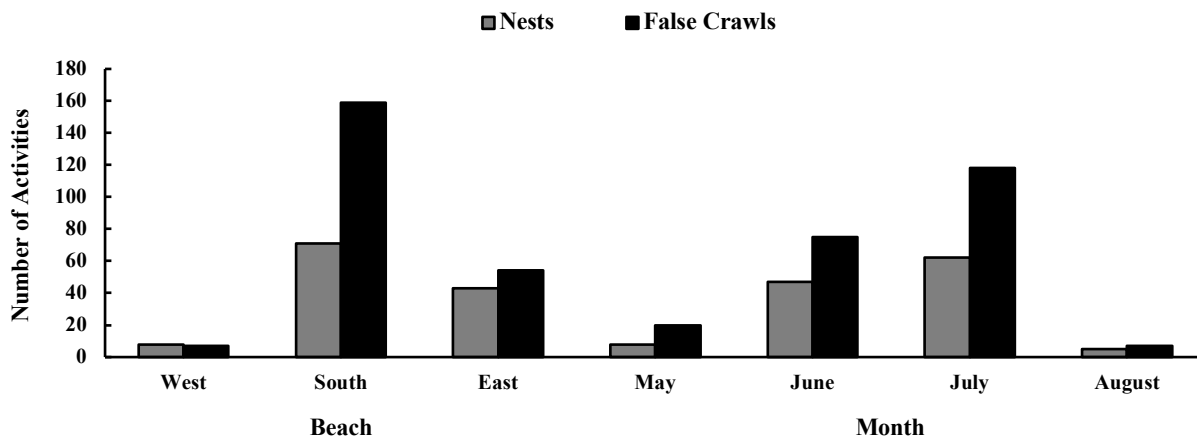


Figure 2. Temporal & Spatial distribution of Bald Head Island's 2023 sea turtle nesting activities.

Nesting Females

Sixty-three individual nesting females were identified during night patrols by the STPT and were verified via tag observations and genetic analysis: 62 loggerheads and 1 green (*Figure 3*). Of the 63 nesters identified, 36 (57.1 %) are thought to be neophytes (*i.e.*, no tags or genetics on record) and 27 (42.9%) are remigrants. After further research, it was determined that 26 of 63 nesting females were “vagabond” nesters (5 neophytes and 21 remigrants; *Figure 3*), meaning that they have been identified (*by tags or genetics*) nesting on other beaches along the southeastern seaboard. In addition to the nests laid on BHI, 24 of the 26 vagabonds laid another 44 nests on neighboring beaches that produced ~3,524 hatchlings. Remigrants laid an average of 2.9 ± 1.8 nests each (72) on BHI, while neophytes laid an average of 1.6 ± 1.0 nests each (50 total) on BHI. Nine Legacy turtles returned; Legacy turtles are remigrants with an extensive and rich nesting

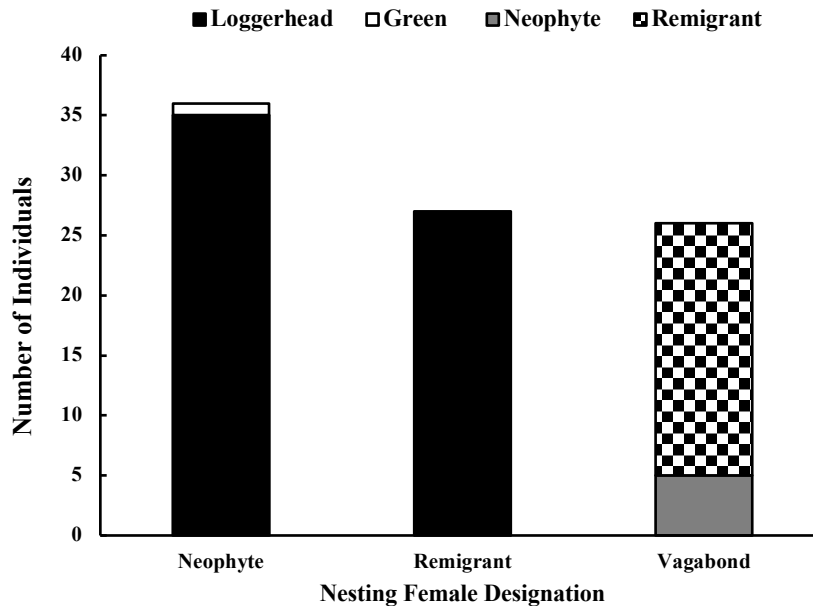


Figure 3. The number of neophytes, remigrants & vagabonds identified during the 2023 nesting season.

history on BHI, having previously laid ≥ 3 nests on BHI over 3 or more nesting seasons. Billie (3 BHI nests; 2 Fort Fisher nests), Fluffy (1 BHI nest), Gigi (5 BHI nests), Granny (5 BHI nests), Mary Jane (1 BHI false crawl; 1 Fort Fisher nest), Sandy (5 BHI nests), Scarlett (5 BHI nests), Thomasina (3 BHI nests), & Turquoise (5 BHI nests; 1 Fort Fisher nest) and Legacy status was assigned to two turtles: Lee Ann (3 BHI nests; 2 Fort Fisher nests), & Strawberry (1 BHI nest; 2 Caswell Beach nests). The most prolific nester in 2023 was FFK802, a vagabond remigrant who laid 6 nests, resulting in 657 eggs that produced 530 hatchlings. The most successful nester was KKK335, a neophyte who laid 4 nests that produced a 94.9% hatch success and a 93.8% emergence success. These data demonstrate that BHIC is not only protecting nesting turtles exclusive to BHI but also individuals associated with the larger Northern Recovery Unit (NRU) subpopulation of loggerhead sea turtles. Standard carapace measurements were recorded at every nest deposition, when possible. The mean curved notch-to-tip length of nesting loggerheads during the 2023 nesting season was 99.7 ± 6.2 cm (*range* = 114.9 – 86.9 cm; *n* = 37, *Table 1*). Remigrants, on average, were significantly larger than neophytes in all categories except for straight width (*Table 1*).

There were 78 Inconel flipper tags and 30 PIT tags applied during the 2023 nesting season. Of the 78 flipper tags, 38 were applied to the left front flipper and 40 were applied to the right front flipper.

	<i>CNT</i>	<i>CNN</i>	<i>CW</i>	<i>SNT</i>	<i>SNN</i>	<i>SW</i>
<i>All</i>	99.7	97.9	92.6	92.2	90.4	71.5
<i>Remigrants</i>	102.2	100.6	94.4	94.7	92.8	72.6
<i>Neophytes</i>	96.7	94.8	90.4	89.1	87.3	70.0
<i>p-value</i>	0.003*	0.002*	0.01*	0.001*	0.001*	0.06
<i>t-stat</i>	3.1	3.2	2.5	3.5	3.5	1.9

Table 1. Season averages for standard carapace measurements (cm). *CNT* = curved notch-to-tip, *CNN* = curved notch-to-notch, *CW* = curved width, *SNT* = straight notch-to-tip, *SNN* = straight notch-to-notch, *SW* = straight width.

*Denotes significant difference between age classes.

Nest Success

Relocations were conducted on 46 nests (37.7%) with an estimated 5,125 eggs moved. There was no difference in the hatch or emergence success of relocated nests compared to *in situ* nests. The first nest hatched on 28 July and the last hatched on 16 October. Incubation periods ranged from 48 to 72 days, with an average incubation period of 55.4 ± 4.8 days. Nest excavations (*Table 2*). Average hatch success was 79.9%, with an average emergence success of 70.2%.

	<i>HE</i>	<i>UE</i>	<i>PE</i>	<i>LH</i>	<i>DH</i>	<i>TC</i>
<i>2023 Average</i>	89.1	17.7	3.9	4.6	6.3	111.4
<i>2023 Total</i>	10867	2145	136	562	763	13588
<i>Decadal Average (2013 - 2022)</i>	7390	2036	140	437	160	9944

Table 2. Nest inventory data. *HE* = hatched eggs, *UE* = unhatched eggs, *PE* = dead pipped eggs (partially emerged from eggshell), *LH* = live hatchlings, *DH* = dead hatchlings, *TC* = total clutch.

Threats

Thirty nests were impacted by a combination of hurricanes, tropical storms, and king tides. However, BHI was fortunate to have only lost one full nest to Hurricane Idalia. Additionally, one nest fell victim to coyotes, and a total of 10 nests were affected by a mixture of island predators, including coyotes, ghost crabs, and fire ants. Of note, fire ant predation is not commonly observed on BHI and was restricted to three nests laid near Captain Charlie's cottages. Predators accounted for the loss of 442 eggs (3.2%).

The most prominent threat to successful nesting this season was anthropogenic changes to the beach morphology on both ends of South Beach. On the east end, 10 false crawls can be credited to the sandbags in front of the Shoals Club. Another 45 (20.5%) false crawls can be attributed to an escarpment that formed on the west side of South Beach, stretching from beach accesses 18 to 13. With a height fluctuating between 2-4 feet, the nesting females had extreme difficulty navigating it. On two separate occasions, nesting females were assisted in climbing over the escarpment by the STPT. Both activities resulted in successful nests and the individual returning to the water safely.

Research, Presentations, & Publications

The Conservancy’s STPT began data collection on two significant projects this season. First, we deployed four satellite tags, outfitting KKD855, KKK238, Sandy and Scarlett with the devices (*Figure 4*). These tags will enhance our understanding of their movements across different habitats, including proposed wind farm properties. Additionally, a tag that was deployed in 2022 in collaboration with Dr. Simona Ceriani is also still sharing the whereabouts of Willine.

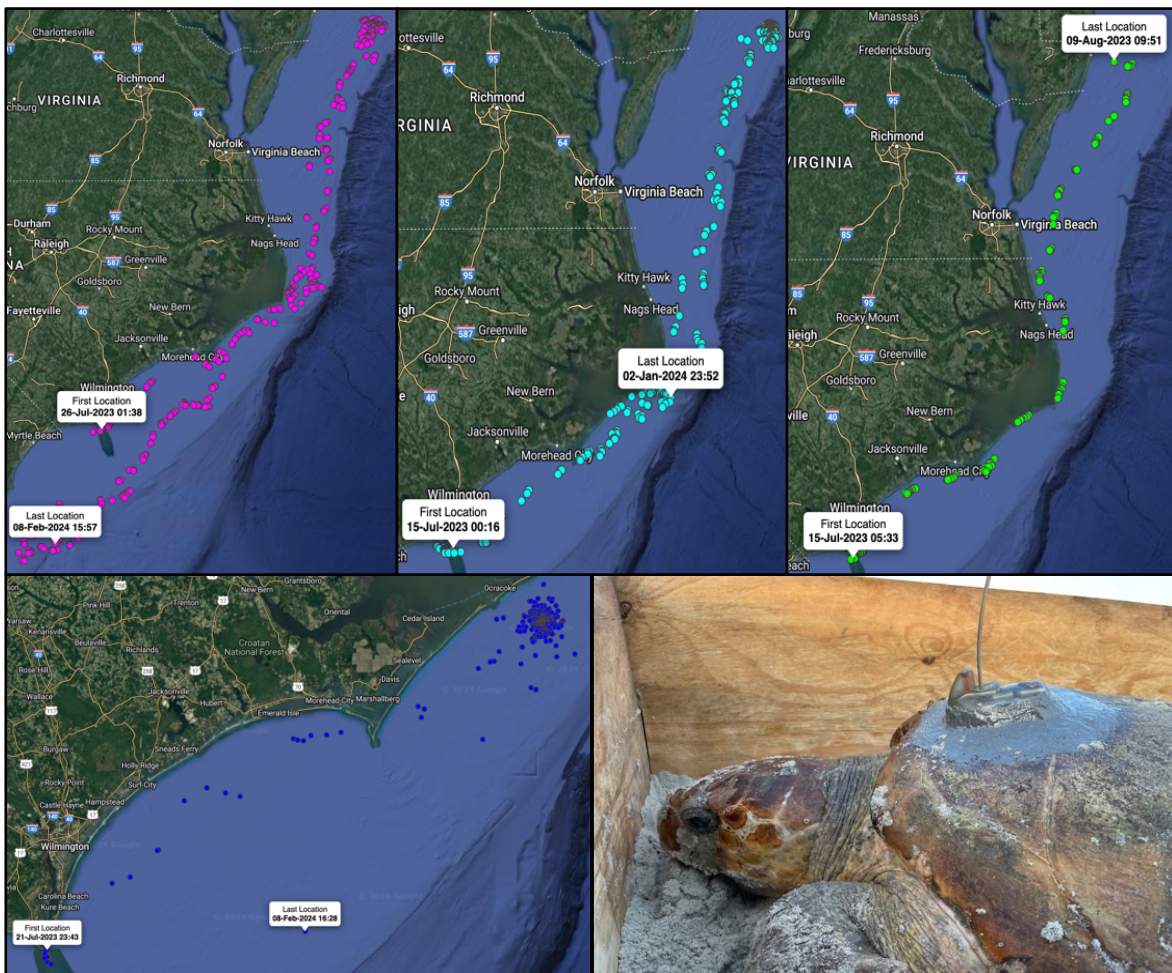


Figure 4. Satellite Tracks: Top Left: Scarlett; Top Middle: KKK238; Top Right: KKD855; Bottom Left: Sandy; Bottom Right: KKK238 with satellite tag attached.

Second, in collaboration with UNCW post-doctoral researcher Dr. Matt Ware, we are investigating the impact of environmental parameters on nesting habitat suitability and distributions.

Intern Projects

Abby Parker, Bo Huff, Kelsey Poehlein, & Kayla Kennicker worked together on two group projects:

1. “*Quantifying Artificial Light on BHI Beaches*”
2. “*Impact of Foraging Areas on the Reproductive Success of Loggerhead Sea Turtles (Cc) on Bald Head Island*”.

Conference Posters

1. **Darrow, E.S. & Hillbrand, P.A.** *Predator exclusion cages are the most widely used predator management method on NC nesting beaches.* Southeast Regional Sea Turtle Networks 2023 Meeting. 1 March
2. **Hillbrand, P.A., Darrow, E.S.,** Jobe, S., Urbanek, R.E., & Abernathy, E. *Designing a Nest Cage for Coexistence: Living with a Non-Native Predator, Canis latran.* Southeast Regional Sea Turtle Networks 2023 Meeting. 1 March
3. **Johnson, A.M., Hillbrand, P.A., & Darrow, E.S.** *Me First! An analysis of Loggerhead (Cc) hatchling size and mass on emergence order.* Southeast Regional Sea Turtle Networks 2023 Meeting. 1 March
4. **Szympruch, K.R., Hillbrand, P.H.,** Wolcott, D.M., Weber, S., & **Darrow, E.S.** *Between the Calipers: An assessment of nesting experience on reproductive output.* Southeast Regional Sea Turtle Networks 2023 Meeting. 1 March
5. **Wiggen, J.L.** *Bald Head Island Conservancy’s Turtle Walk Program.* Southeast Regional Sea Turtle Networks 2023 Meeting. 1 March

Invited Presentations

1. **Hillbrand, P.A.** *BHIC Red Light Initiative.* Lighting Workshop, North Carolina Sea Turtle Meeting. 14 January
2. **Hillbrand, P.A.** *Sea Turtle Conservation on Bald Head Island.* NatureFest, Southport, NC. 24 January
3. **Hillbrand, P.A.** *Sea Turtle Conservation on Bald Head Island.* Bald Head Island Association’s Potluck, Bald Head Island, NC. 13 February
4. **Hillbrand, P.A.** *Sea Turtle Conservation on Bald Head Island.* Holly Springs High School, Virtual. May & Oct

Publications

1. Ceriani, S. A., Murasko, S., Addison, D. S., Anderson, D., Curry, G., Desjardin, N. A., Eastman, S.F., Evans, D.R., Evou, N., Fuentes, M., Godfrey, M.H., Hart, K.M, **Hillbrand, P.A.**, Hirsch, S.E., Mott, C.R., Mansfield, K.L., Mazzarella, K.T., Norris, S.V., Pate, S.M., Phillips, K.F., Rusenko, K.W., Shamblin, B.M., Stevenson, A., Sloan, K.A., Tucker, A.D., Welsh, R.C., & Casale, P., 2023. *Monitoring population-level foraging distribution of a marine migratory species from land: strengths and weaknesses of the isotopic approach on the Northwest Atlantic loggerhead turtle aggregation*. *Frontiers in Marine Science*, 10, 1189661.
2. Jobe, S., Urbanek, R. E., **Hillbrand, P.A.**, **Darrow, E. S.**, & Abernethy, E., 2023. *Predator exclusion cages as visual attractants to coyotes*. *Urban Ecosystems*, 1-9.