FINAL REPORT
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South Carolina Department of Natural Resources
October 1, 2022 – September 30, 2024

Project Title: Conservation of Seabirds, Shorebirds, and Wading Birds in South Carolina, IV

Prepared by: Felicia Sanders, Christy Hand, Janet Thibault, and Mary Catherine Martin

Abstract:

Many of the seabird, shorebird, and wading bird species that utilize South Carolina's coastal habitats throughout the year are of conservation concern due to small and threatened populations. This grant funded efforts from October 2022 – September 2024 to reduce human disturbance at key seabird colonies and to conduct nest counts and population surveys of many waterbird species. These count data are incorporated into a long-term database to allow the agency to make informed management decisions as well as contribute to regional and global knowledge of the species. Survey, research, and management activities were shared on webpages, in press releases, and at outreach events so results were made available to partners. Four scientific manuscripts were published.

SCNDR staff coordinated with private, federal, state, and county-owned beach managers to close part of the beach for nesting seabirds and shorebirds at 29 beaches during summer months and at 2 sites during the winter. Educational signs were placed at boat ramps and on some beach entrances. Annual seabird nest counts were conducted for Black Skimmer, Brown Pelican, Common Tern, Forster's Tern, Gull-billed Tern, Least Tern, Sandwich Tern, and Royal Tern. Counts consisted of on-the-ground estimates or estimates from aerial photographs taken from SCDNR Law Enforcement planes or Unmanned Aerial Vehicles (UAVs or drones). Least Tern nests were monitored at natural beach sites and on artificial sites that mostly consist of pebbled roofs in industrial areas. Peak statewide nest estimates for this project period were: Black Skimmer (2023) 767, Brown Pelican (2024) 4,285, Common Tern (2024) 9, Forster's Tern (2024) 26, Gull-billed Tern (2024) 244, Royal Tern (2024) 7,354, Sandwich Tern (2024) 2,325, and Least Tern (2023) 989.

Wading birds—including egrets, herons, ibis, and storks—were surveyed and monitored in colonies throughout the Coastal Plain. Wood Storks had a very productive nesting season during 2023. The number of nests counted (3,935 nests at 28 active colonies) far exceeded the previous record high count in the State. During 2024, approximately 1,000 fewer nests (2,915 nests in 29 colonies) were counted compared to the record highs set in 2022 and 2023, but numbers were still relatively high compared to pre-2020 surveys. At index colonies, individual stork nests were mapped as they were initiated and were monitored from a distance (using a spotting scope or binoculars) approximately once per week from the time that egg laying began until the chicks reached fledging age. During 2023, a total of 266 stork nests were monitored in five colonies. An average of 1.1 chicks fledged per nest site. During 2024, a total of 92 nests were monitored in two colonies. An average of 2.2 chicks fledged per nest site, exceeding the recovery criteria of 1.5 fledglings per nest.

Objective 1:

Seabird and Shorebird Components

a) Reduce disturbance of beach nesting seabirds and shorebirds on public and private islands.
b) Annually assess population trends for colonial nesting seabirds: Black Skimmer, Brown Pelican, Gull-billed Tern, Least Tern, Sandwich Tern, Royal Tern, Forster's Tern, and Common Tern. This information is essential for oil spills, wind energy, and climate change planning.
c) Increase nesting productivity, especially for Least Terns.
d) Assess migratory shorebird trends in South Carolina in key sites.

Accomplishments:

a) Reduce disturbance of beach nesting seabirds and shorebirds on public and private islands.

We coordinated with private, federal, state, and county owned beach managers to close part of the beach for nesting seabirds and shorebirds. This involved 2-10 site visits at each property, depending on the partnership with the land manager. Site visits included meetings with managers to discuss the importance of nest protection and monitoring; visits to beach to place, maintain, and remove signs; and nest monitoring. Educational signs were placed at boat ramps and at some beach entrances. We placed closure signs at nesting sites on 29 beaches and at 2 beaches during the winter to protect roosting migratory shorebirds (Figure 1).

Crab Bank Seabird Sanctuary was rebuilt in late 2021 with material taken from the Charleston Harbor Post 45 Deepening Project. The island is an approximately 32-acre sand bar at the mouth of Shem Creek. The second nesting season in 2023 was productive for numerous seabird species (528 Black Skimmer nests and 152 Gull-billed Terns) and 14 pairs of American Oystercatchers. In 2024, the third year of nesting, 397 Black Skimmer and 92 Gull-billed Tern nests were counted and 17 pairs of American Oystercatchers nested on the island (Table 1). The restored island is closed to the public from March 15 – October 15 so it provides an undisturbed place for birds to nest and roost.

b) Annually assess population trends for colonial nesting seabirds: Black Skimmer, Brown Pelican, Gull-billed Tern, Least Tern, Sandwich Tern, Royal Tern, Forster's Tern, and Common Tern. This information is essential for oil spills, wind energy, and sea-level rise planning.

To determine the abundance and distribution of nesting populations of seabirds in South Carolina, all active seabird colonies were surveyed over the study period. Nest estimates at some colonies were a result of an actual count of nests. Counts occurred during the peak incubation period for each species. To minimize disturbance to nesting birds or if ground counts were not possible, staff used binoculars or spotting scopes to count the number of adults sitting in incubation postures as a proxy for nest counts.

Nest counts of large colonies, such as Brown Pelican colonies, can be difficult because of the wide geographical area. Large colonies were counted using aerial photographic surveys. Flights were conducted by a SCDNR Law Enforcement pilot in a Cessna aircraft. SCDNR biologists accompanied the pilot: one to help direct the pilot over pelican colonies and the other to take photographs of the colonies through the window in the aircraft. Survey altitude was primarily 1,000 ft. – 700 ft. and the aircraft often made several passes over the colonies to ensure complete photographic coverage. Photographs were taken using a Canon EOS 7D Mark II digital SLR camera.

Counts from digital images were made using Image J, an image processing program which allows the user to tag items (nests) for automatic count tallying. The number of nests counted are reported in Table 1.

To help answer questions about Black Skimmer population ecology and trends in South Carolina, 82 pre-flighted chicks were uniquely banded on Crab Bank in 2024. Having marked individuals of known age will help determine post breeding dispersal, wintering areas and survivorship for this declining species.

c) Increase nesting productivity, especially for Least Terns.

In South Carolina, Least Terns nest on natural beach sites and a variety of artificial sites including gravel roof tops, dredge spoil areas, and industrial sites. The variable nesting habitats require unique management strategies. Ground sites are defined as sites on natural beaches. Artificial sites are manmade and require management such as intensive vegetation control or fences at the edge of a roof to prevent chicks from falling off the building. Each year, SCDNR estimates the number of Least Tern nests in South Carolina to monitor population trends and to guide management strategies of nesting sites.

In 2023, the nest estimate for Least Terns in South Carolina was 989 (Table 2). 552 (56%) nests were on natural beaches and 442 (44%) were at artificial sites (Table 2). All ground sites (8) were accessed by boat except for Isle of Palms, Hunting Island State Park, and Botany Bay Plantation which were accessed by vehicle and foot (Table 3). All artificial sites (14) were accessed by vehicle over a 7-county area comprising Charleston, Berkeley, Williamsburg, Sumter, Georgetown, Horry, and Jasper counties (Table 4).

In 2023, all ground sites were unsuccessful (<50% of the nests in a colony survived) and only 3 of 14 artificial sites were considered successful (>50% of the nests in a colony survived). Negative impacts on failed colonies included predation, tidal wash-over, and human/dog disturbance. In 2023, 3 (14%) colonies were successful, and 19 (86%) colonies were unsuccessful (Table 2).

In 2024, the nest estimate for Least Terns in South Carolina was 747 (Table 2). 488 (65%) nests were on natural beaches and 259 (35%) were at artificial sites (Table 2). Six natural beach sites were accessed by boat. Huntington Beach State Park, Hunting Island State Park, Botany Bay Plantation, Edingsville Beach, South Island, and Kiawah Island were accessed by vehicle and

foot (Table 3). All artificial sites (13) were accessed by vehicle over a 7-county area comprising Charleston, Berkeley, Williamsburg, Sumter, Georgetown, Horry, and Jasper counties (Table 4).

In 2024, 4 of 13 ground sites were successful and 3 of 12 artificial sites were successful (>50% of the nests in a colony survived). Negative impacts on failed colonies included human/dog disturbance, predation, and tidal wash-over. In 2024, 7 (28%) colonies were successful, and 18 (72%) colonies were unsuccessful (Table 2).

d) Assess migratory shorebird trends in South Carolina, especially for listed species.

Red Knot

Georgia and South Carolina DNR staff participated in aerial surveys of Red Knots on the Atlantic Coast of the US. Flights were conducted in late April and early May in 2023 and 2024. Only the southern half of South Carolina was covered and all of Georgia. Photographs were taken of roosting flocks during the flights and birds were counted manually from the photographs. During the flights in 2023, on April 20/21st a total of 10,324 knots were counted and on May 8th, a total of 13,235 knots were counted in both states. In 2024, 4,935 knots were counted on April 29 and 5,247 knots were counted on May 8 in South Carolina (numbers are preliminary and subject to change). Numbers of knots counted in Georgia for 2024 are still being compiled and not available for this report.

In spring 2023 and 2024, in partnership with the Georgia Department of Natural Resources, Manomet, and US Fish and Wildlife Service, 3 (in 2023) and 12 (in 2024) Red Knots were captured and outfitted with a “Sunbird” solar-powered satellite transmitter that was glued directly on the back of the knot. These light-weight Sunbird tags use new technology that enables location data to be viewed daily. All satellite tagged Red Knots were recorded on nesting grounds above the Artic Circle, and most included partial southward migration post-breeding. Figure 2 shows the migration routes of the 3 tagged knots in 2023.

We also partnered with Georgia DNR, Manomet, and partners on Kiawah and Seabrook Islands to continue resighting individually marked Red Knots in the spring. The observations were collected in a standardized way to add to international studies of population trends and movement. Resighting of knots also added to our knowledge of local population estimates and the amount of time birds spend in South Carolina. Knots were observed from banding projects in South Carolina, many other Atlantic US states, and countries in South America.

Whimbrel

Partnering with University of Massachusetts researchers, we deployed additional PinPoint GPS transmitters on Whimbrel roosting on Deveaux Bank. With highly accurate fixes collected every 10-15 minutes, these transmitters revealed fine-scale Whimbrel habitat use. The graduate student’s movement analyses showed that Whimbrel are traveling daily from as far as 50km away to roost on Deveaux Bank. See Publications for a citation of a manuscript describing foraging site fidelity in South Carolina. Maina Handmaker, the PhD graduate student, recovered migration locations that have important conservation implications such as that Deveaux Bank supports Whimbrel from multiple breeding populations and different wintering sites in South America.

International Shorebird Surveys
International shorebird surveys (ISS) are surveys of shorebird numbers at designated sites conducted monthly year-round or every 10 days during migration. ISS are conducted at important shorebird areas across North, Central, and South America. The purpose of these surveys is to describe shorebirds' distribution, abundance, and habitat relationships; monitor trends in shorebird population size; monitor shorebird numbers at stopover locations; and assist local managers in meeting their shorebird conservation goals. Shorebird surveys were conducted approximately once a month from September through March at Capers Island Heritage Preserve, Bird Key Stono Seabird Sanctuary, and North Island (part of Yawkey Wildlife Center).

Significant deviations:

None.

Objective 2:

Wading Bird Components
a) Assess population trends for Wood Storks.
b) Annually assess Wood Stork nesting success.
c) Monitor the distribution of active egret and heron colonies and maintain current records that can be considered by planners, managers, and property owners.

Accomplishments:

a) Assess population trends for Wood Storks.

Wood Stork Surveys
During 2023 and 2024, respectively, we completed aerial surveys of 53 and 41 wading bird colonies, including 36 and 32 colonies that were previously used by nesting Wood Storks. We counted a total of 3,935 Wood Stork nests in 28 active colonies during 2023, once again setting a record high number of stork nests for the State (Figures 3 – 5, Table 5). During 2024, we counted a total of 2,915 Wood Stork nests in 29 active colonies (Table 6), approximately 1,000 fewer nests compared to the record highs set in 2022 and 2023, but still relatively high compared to pre-2020 surveys.

All aerial surveys were point-to-point flights conducted from fixed-wing aircraft (Cessna 206, Cessna 210, and Vulcan Air P68) owned and operated by the SCDNR Law Enforcement Division. While the plane circled each colony at between 500 – 800 feet above ground level, photographs were taken using a Canon EOS 7D Mark II digital SLR camera with a 70-300 mm or 100-400 mm lens.

b) Annually assess Wood Stork nesting success.

Wood Stork Nest Monitoring

During 2011, SCDNR began monitoring a sub-set of the stork nests in index colonies to determine how successful the storks are at raising young in South Carolina. During 2023, SCDNR staff and Spring Island Land Trust staff monitored nests at five colonies located between Savannah and Charleston. One of the index colonies is on land managed by SCDNR (Dungannon Plantation Heritage Preserve), and the other four colonies are on private land. Two colonies on private land were monitored during 2024.

At each colony, individual stork nests were mapped as they were initiated and were monitored from a distance (using a spotting scope or binoculars) approximately once per week from the time that egg laying began until the chicks reached fledging age (mature enough to fly, which is about 7-8 weeks after hatching). The average number of chicks that survived to fledging age per nest was determined for each colony. A detailed protocol was followed to standardize monitoring techniques (protocol available by request).

During 2023, a total of 266 nests were monitored. An average of 1.10 chicks fledged per nest site and 2.03 chicks per successful nest site (Table 7). During 2024, a total of 92 nests were monitored. An average of 2.2 chicks fledged per nest site and 2.6 chicks per successful nest site (Table 8). The federal recovery goal for Wood Storks is an average of 1.5 fledglings per nest. Table 9 provides a comparison of nest monitoring data from 2011 – 2024. During the 13 years when nest monitoring was completed in South Carolina, the annual average met or exceeded 1.5 fledglings per nest in all but three years (2012, 2013, and 2023; Figure 6, Table 9).

On May 28, 2023, the Coastal Plain received 2-3” of rain and up to 45 mph winds during the Memorial Day Weekend Coastal Storm. In many nests where chicks were 2-4 weeks old, chicks perished. We observed dead chicks in many nests when we returned for nest monitoring in the days following the storm, and very few adults were present in the colony. Similar storms (Tropical Storm Beryl on May 29, 2012 and Tropical Storm Andrea on June 7, 2013) occurred during late May or early June during the prior two years when fledging was below the recovery goal. These tropical storms were particularly detrimental due to the stage of nesting in SC. Many chicks were old enough to have high food demands but not old enough to thermoregulate through heavy rainfall and wind. Although these storms caused lower nesting success across many colonies, they rarely resulted in the failure of entire colonies.

Wood Stork Colony Fate Surveys

During mid-June, additional point-to-point flights were used to determine if storks were successful at raising chicks or if the colonies had failed during the nesting season. Colonies were considered to be successful if large stork chicks and/or recent fledglings were observed in the majority of the number of nests counted during the annual census. Storks successfully fledged chicks in at least 27 of the 28 colonies resurveyed during 2023 and at least 22 of the 28 colonies resurveyed during 2024.

The nesting habitat in colonies where storks failed to raise chicks consisted of shrubs growing on the edge of small ponds on golf courses. Mammalian predation is believed to be the primary cause of reproductive failure at unsuccessful colonies where storks nest in shrubs along the edges of ponds in residential communities. Wood Storks typically nest in trees in flooded forests or on small islands surrounded by water. If there is adequate water, alligators below the nests deter

predators such as raccoons from swimming to trees containing nests and eating stork eggs and/or chicks.

Other potential causes of colony failure for storks include inadequate or inaccessible food during the chick rearing period and disturbance. If adult storks are disturbed and leave their nests, crows and other predators have the opportunity to depredate eggs and small chicks. Even where predators are not a threat, disturbance can result in nest failure because eggs and small chicks are vulnerable to overheating when adults are not able to shade their nests.

Cuban Bulrush (*Oxycaryum cubense*) poses a new emerging threat to Wood Storks in South Carolina. This very aggressive invasive species has colonized at least two Wood Stork colonies in the ACE Basin, forming dense expansive floating mats of grass-like vegetation. The high nutrient levels and floating mats of aggressive native plants appear to be providing optimal nursery habitat for it to become established. Once established, it is likely to allow raccoons to access nests without swimming through water and may lead to nest and colony failure. SCDNR is working to develop an effective strategy to control Cuban Bulrush at the Donnelley Wildlife Management Area and other ACE Basin properties.

Conclusions from Wood Stork Surveys and Nest Monitoring
Overall, nesting effort has been increasing in South Carolina. Nesting success during 2023 was lower than average; however, the number of chicks produced still was exceptionally high due to the record-breaking number of nests. Fewer nests were counted during 2024; however, the number of chicks fledged per nest was very high.

South Carolina stork colonies continue to play an important role in the recovery of the species. The diverse and extensive wetlands in the coastal region of South Carolina provide more consistent prey throughout the nesting season compared to most areas of the Southeastern US. Managed tidal impoundments provide concentrated prey as water levels are lowered, and tidal creeks concentrate prey during low tides due to the high tidal amplitude along the coast.

c) Monitor the distribution of active egret and heron colonies and maintain current records that can be considered by planners, managers, and property owners.

As described above, aerial surveys of 53 wading bird colonies in South Carolina were completed during 2023 to monitor Wood Stork population trends and the distribution and relative size of wading bird colonies. During 2023, 43 of the 53 colonies surveyed were active. Aerial photographs, which were later used to determine species and approximate nest numbers, were taken of all active colonies. During 2024, 37 of 38 colonies were active. The flights were timed to coincide with peak nesting for Wood Storks and Great Egrets in the coastal region.

During the surveys, we identified nests for the following species: Anhinga, Black-crowned Night Heron, Cattle Egret, Great Blue Heron, Glossy Ibis, Great Egret, Little Blue Heron, Snowy Egret, Tricolored Heron, White Ibis, and Wood Stork. No Roseate Spoonbill or Reddish Egret nests were found during the 2023 and 2024 surveys. Yellow-crowned Night Herons and Green Herons often nest in small inconspicuous colonies and were rarely located during surveys.

Updated colony location and species composition data from the 2023 and 2024 surveys will be added to the SCDNR Heritage Trust Database, which is used by permit reviewers, land use planners, conservation easement advocates, landowners, consultants, and other agencies and individuals who are interested in considering wading bird conservation in their land use decisions.

Significant deviations:

The project leader was unexpectedly absent during much of the spring and summer. Nests in two Wood Stork colonies were monitored rather than three due to the temporary reduction in staffing. The project otherwise was completed as planned.

Objective 3:

Components for All Species Groups

a) Build awareness in South Carolina of shorebird, seabird, and wading bird conservation needs.
b) Link regional and local conservation goals.
c) Provide guidance about waterbird conservation needs and opportunities to public and private landowners and managers.

Accomplishments:

a) Build awareness in South Carolina of shorebird, seabird, wading bird and marsh bird conservation needs.

- SCDNR maintains a webpage about seabirds and shorebirds. The webpage includes information about species and statuses and an overview of SCDNR's projects. The web site also includes resources such as educational signs and brochures, links to partners, and ways for the public to get involved.
- SCDNR maintains a webpage for the Wading Bird Project. The webpage includes information about species and statuses, an overview of SCDNR's activities, guidance about viewing wading birds, and management recommendations for nesting and foraging areas. Private land managers are encouraged to contact SCDNR for additional guidance. The biologist responded to various inquiries from the public about wading bird ecology throughout the year.
- SCDNR was contacted by city, county, state, and federal employees, as well as private companies and contractors, who requested information about wading bird colony locations and statuses. This grant allowed SCDNR to collect data about wading birds and to provide it to a variety of organizations. Detailed information about colony boundaries is provided to organizations working near specific stork colonies to ensure compliance with the Endangered Species Act.
- Wading Bird Rookery data was updated in the SCDNR Heritage Trust Database used by land managers, permit reviewers, power companies, and other organizations to plan projects. The database provides portals to state and federal partners as well as to consultants and other individuals involved in making land management decisions. Colony locations are not

available to the public due to concerns about the privacy of the property owners and potential disturbance to the birds.

- SCDNR maintains and manages a website about South Carolina Coastal Bird Conservation Fund highlighting needs, projects, and regular updates of initiatives funded through this effort including the renourishment of Crab Bank Seabird Sanctuary, Cape Romain Bird Steward, and Red Knot protection and outreach on Kiawah Island.
- Staff worked with the SCDNR Public Information Office/Social Media office and SCDNR videographers to develop a Seabird Sanctuary video highlighting the management and monitoring of these islands by SCDNR staff. This information was used on social media during the spring and summer of 2023. It is permanently housed on the SCDNR YouTube channel and is regularly shared with partners, stakeholders, and reporters.
- Staff participated in the organization of the first two-day Sea Islands Shorebird Festival on Kiawah and Seabrook Islands in May 2023. In 2024 the festival was expanded to multiple offerings across the South Carolina and Georgia coasts. Staff led presentations, hosted field trips, and distributed materials related to Red Knots and conservation of shorebirds in South Carolina.
- Staff organized annual meetings for partners and stakeholders of coastal birds in South Carolina to present new and ongoing research and outreach efforts done by SCDNR staff. Over 40 people were in attendance in 2023 and 2024, which provided networking opportunities for further collaboration.
- Staff distributed SC Best Management Practices (BMPs) for Use of Vehicles especially used for Sea Turtle Nest Protection projects. We presented seabird and shorebird conservation messages at sea turtle nest protection meetings that were attended by 100s of volunteers and by staff at beach sites, such as county and state parks, USFWS, and private islands. We worked with sea turtle projects at some locations to delineate areas of the beach to avoid driving on because of the high concentrations of nesting birds.
- We continued the development of the Seabird Stewardship Program in Cape Romain National Wildlife Refuge, which annually hosts 30% of SC's seabird nesting. Additionally, worked to expand the Shorebird Steward program targeting protection of migratory Red Knots on Seabrook and Kiawah Islands.
- Staff placed cameras at seabird colonies on Deveaux Bank, Crab Bank, Tomkins Island, and in Cape Romain NWR to monitor nesting colonies. The acquired video and photos were used for outreach and to guide management of the colonies.
- SCDNR developed a website for the South Carolina Shorebird Project (SCSP). The SCSP unites organizations, entities, and people supporting shorebird and seabird populations in the Palmetto State. The new website has resources for partners including volunteer opportunities, trainings, and outreach materials.

Media Coverage

- *Migrating Together*- blog post by Coastal Expeditions (02/24/2023)
- *Sea Islands Shorebird Festival*- article by the Island Connection (03/15/2023)
- *Least Terns making their way to the Grand Strand for nesting season*- article by SBGTV (04/05/2023)
- *Celebrate Shorebirds at the May 11-12 Sea Islands Shorebird Festival*- Blog post by Tidelines (04/29/2023)

- *An island in South Carolina provides much needed sanctuary for shorebirds*- Radio Story by South Carolina Public Radio (06/12/2023)
- *Coastal Birds | What's Wild!*- Short Documentary by SC ETV (07/20/2023)
- *Satellite Tagged Red Knots Are Headed Back From the High Canadian Arctic*- Article by the Seabrooker (08/17/2023)
- *Editorial; Deveaux Bank is critical habitat. We must protect it*. -Editorial article by Post & Courier (10/05/2023)
- *Renourishment pays dividends for Crab Bank*- Article by Post & Courier (10/25/2023)
- *Commentary: 3 steps to save SC's imperiled seabirds*- Commentary by Post & Courier (11/13/2023)
- *SCDNR closes portions of Deveaux Bank to protect nesting coastal birds* – Count on 2 News (April 24, 2024)
- *As a stunning shorebird sanctuary vanishes, SC wildlife officials resist protections* – Charleston Post and Courier (April 26, 2024)
- *SCDNR keeping close eye on bird species, habitats following Debby aftermath* – Live 5 News (August 23, 2024)
- *Brown pelicans are SC's official state seabird. Do they really go blind from diving?* Charleston Post and Courier (November 18, 2024)
- *South Carolina Department of Natural Resources count this season's seabird nests* – Live 5 News (November 26, 2024)

Press Releases

- April 30, 2023 – Nesting season has begun for coastal birds on South Carolina islands, beaches
- May 10, 2023 – Recent research shows importance of SC islands in migration of threatened red knots
- September 14, 2023 – Tropical storm Idalia dramatically alters Deveaux Bank Seabird Sanctuary
- May 7, 2024 - Temporary complete closure set at Deveaux Bank Seabird Sanctuary
- April 24, 2024 - SCDNR temporarily closes Deveaux Bank Seabird Sanctuary to protect nesting birds

Publications

Smith AD, Sanders FJ, Lefevre KL, Thibault JM, Kalasz KS, Handmaker MC, Smith FM, Keyes TS. Spring migration patterns of red knots in the Southeast United States disentangled using automated telemetry. Sci Rep. 2023 Jul 10;13(1):11138.

Sanders, F. J., A. D. Smith, J. M. Thibault, D. L. Carter, M. C. Handmaker, and F. M. Smith. 2023. South Atlantic Bight – a final stop for Ruddy Turnstones migrating to the Arctic. Journal of Field Ornithology 94(2):5.

Handmaker, M. C., F. J. Sanders, A. D. Smith, E. P. Shealy, N. Fontaine, M. B. Kaplin, J. M. Thibault, M. C. Martin, C. Duquet, A. V. Sterling, and N. R. Senner (2024). Individual

foraging site fidelity persists within and across stopover seasons in a migratory shorebird, *Numenius phaeopus* (Whimbrel). Ornithology 141:ukae021.

Ellen G. Jamieson, Felicia Sanders, Erica Nol. 2024. Non-Breeding Shorebird Ecology and Behavior on a Habitat Mosaic in Southeastern U.S. Waterbirds. 47:1-16

b) Link regional and local conservation goals.

- Staff participated in the annual national Waterbird Society Conference in Fort Lauderdale, FL. We attended presentations and working groups, for example about innovative new approaches for surveying colonial waterbirds. The biologist gave an oral presentation about SCDNR's Wood Stork monitoring, the important role South Carolina is playing in the recovery of the population, and the threats faced by Wood Storks nesting in South Carolina. (Presentation Title: Status update for the Wood Stork in South Carolina: successes and emerging threats). The biologist gave a presentation on Red Knot tracking with nanotags (Presentation Title: Spring migration patterns of Red Knots in the Southeast United States).
- Staff participated in local and regional planning of Motus. The Motus Wildlife Tracking System (Motus) is an international collaborative research network that uses coordinated automated radio telemetry to facilitate research and education on the ecology and conservation of migratory animals. We participated in strategy development for tower placement in South Carolina and opportunities to share shorebird movement data locally and internationally for scientific and educational advancement.
- Staff attended and presented at the American Oystercatcher Working Group 2023 and 2024 meetings and initiatives. This species has been identified as an "extremely high priority" shorebird by the working group for the Southeastern Coastal Plain as part of the US Shorebird Conservation Plan. Approximately 40 biologists from Atlantic and Gulf coast states attend the annual meeting to coordinate research and conservation goals for oystercatchers and other beach nesting seabirds and shorebirds.
- We attended the 2023 Atlantic Coast Piping Plover and Least Tern Workshop at the National Conservation Training Center in Shepardstown, WV. The purpose of this meeting was to disseminate new information on research and conservation activities of Piping Plover, Least Tern, Red Knot and other beach-dependent species.
- We attended a virtual meeting about Black Skimmers with partners from the Atlantic and Gulf Coast regions. The purpose of the meeting was to form a Black Skimmer Working Group and to discuss ongoing research, banding and resighting, and productivity across the range of this seabird.
- Staff attended and helped organize the 2023 and 2024 Southeast Red Knot working group meetings. Biologists from SC, GA, and FL met to prioritize research, monitoring and conservation actions for Red Knots in the Southeast.

c) Provide guidance about waterbird conservation needs and opportunities to public and private landowners and managers.

- SCDNR owns two properties with consistently active Wood Stork rookeries: Dungannon Plantation Heritage Preserve and Donnelley Wildlife Management Area. The wading bird

biologist worked with the SCDNR biologists managing the properties to plan for and implement vegetation management within the rookeries.
- We continued to educate and connect with private and public managers of beach properties and communities to protect nesting and migratory coastal birds. Figure 1 identifies the range of sites where we partner with land managers.
- We collaborated with a SCDNR drone operator and SCDNR botanist to document habitat changes on Crab Bank Seabird Sanctuary in Charleston Harbor for the second and third year post-construction. The SCDNR drone operator obtained aerial photography after tropical storm Idalia in late August to measure habitat losses and gains after tidal inundation. The SCDNR botanist identified desirable and undesirable vegetation growing in September 2023 and November 2024.

Significant deviations:

None.

Federal Cost: $ 275,003.95 (Oct 1, 2022 – September 30, 2024)

Recommendations: Close the grant.

Acknowledgments:

This project could not have been completed without the work of many SCDNR biologists, botanists, technicians, pilots, administration staff, and volunteers. We also received support from staff at USFWS, County and State Parks, Clemson University, The University of South Carolina, University of Massachusetts, Audubon Societies, the Wood Stork Working Group, private landowners, and many other organizations.

Special thanks to the seasonal and year-round team members (Cami Duquet, Mikayla Thistle, Mary Bresnihan, Evelyn Stephens, David Cole, and Maina Handmaker) and SCDNR pilot (Owen Barker) who dedicated their time and talents to the waterbird project.

Figures and Tables:

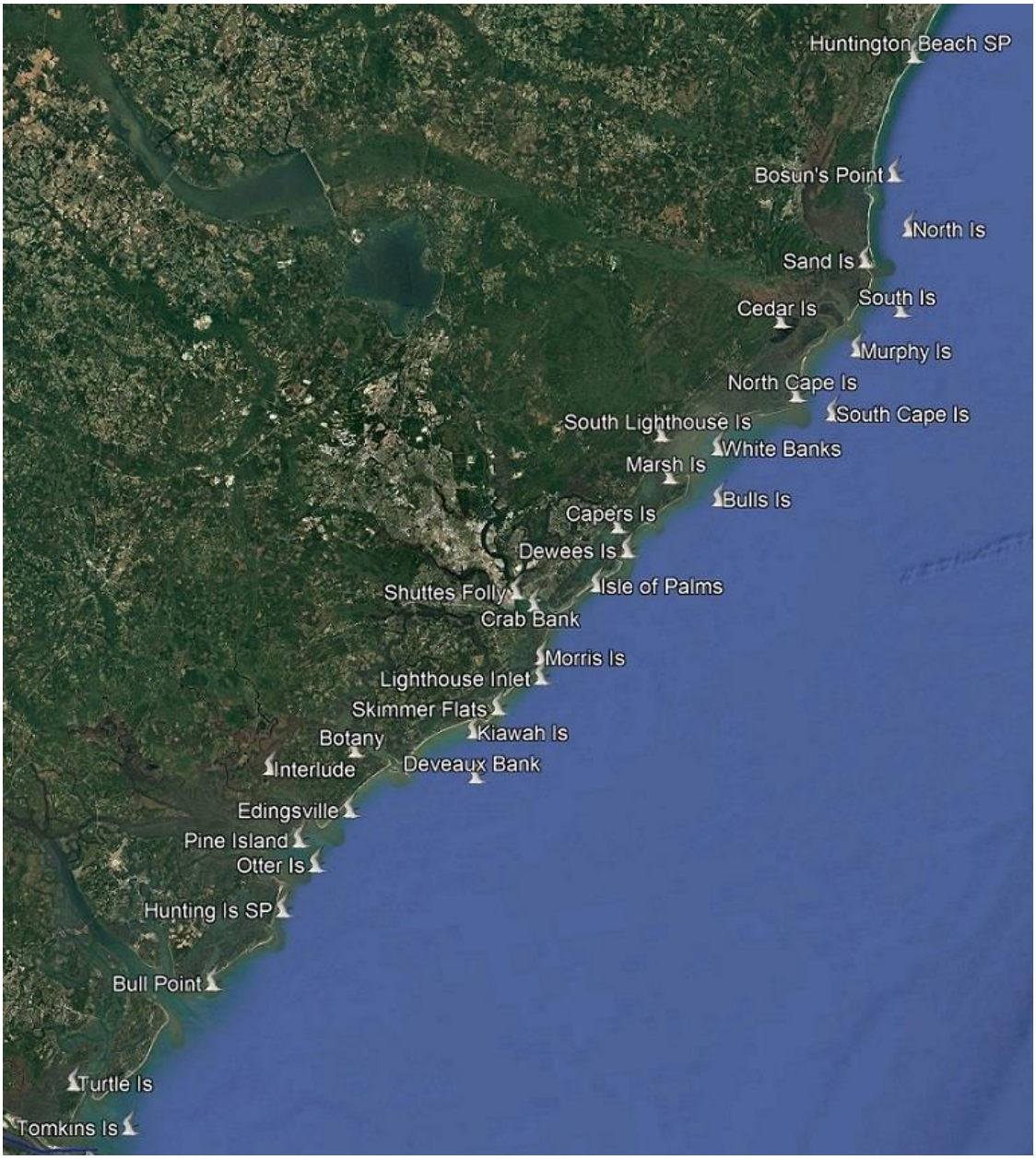

Figure 1. Locations of 31 sites (indicated by bird icons) in South Carolina where signs were placed in 2023 and/or 2024 to indicate beach closures. Closures help minimize human/dog disturbance to beach-nesting birds and migratory shorebirds.

Figure 2. Map of migration routes of 3 Red Knots outfitted with satellite transmitters on Kiawah Island, South Carolina in May 2023. This project is a collaboration between SCDNR, GADNR, USFWS and Manomet.

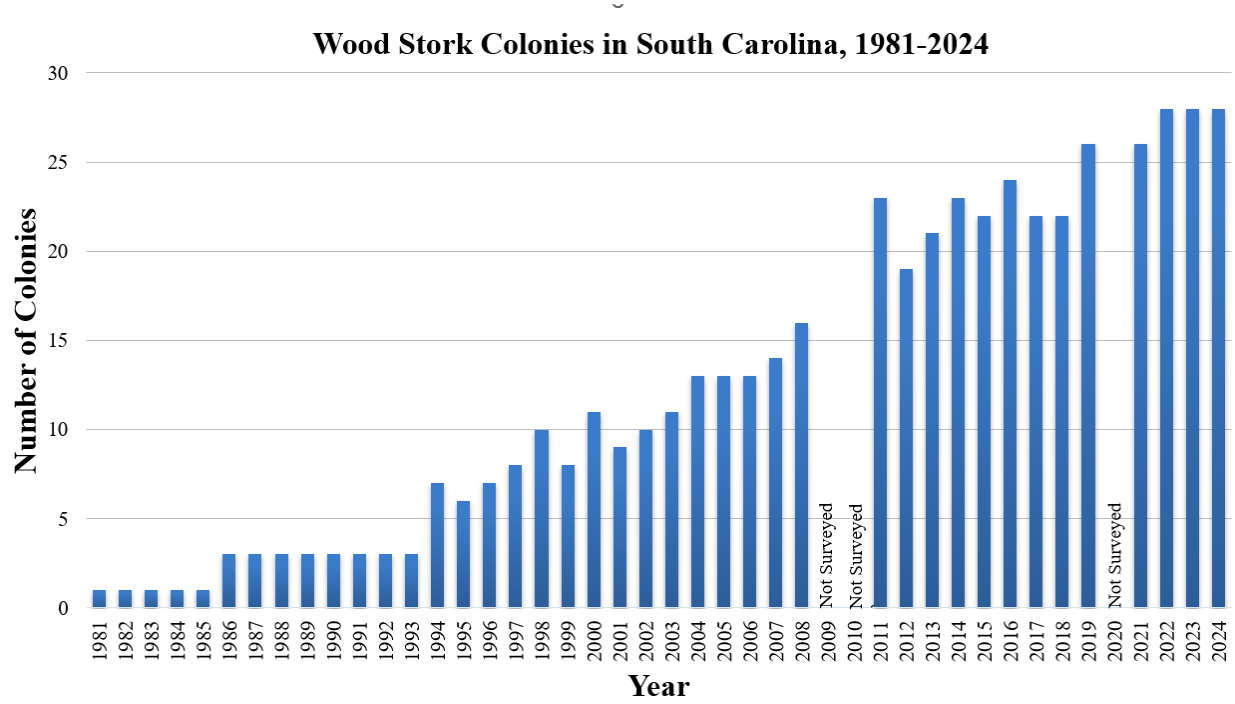

Figure 3. Number of active Wood Stork (*Mycteria americana*) colonies counted in South Carolina during annual censuses from 1981 – 2024.

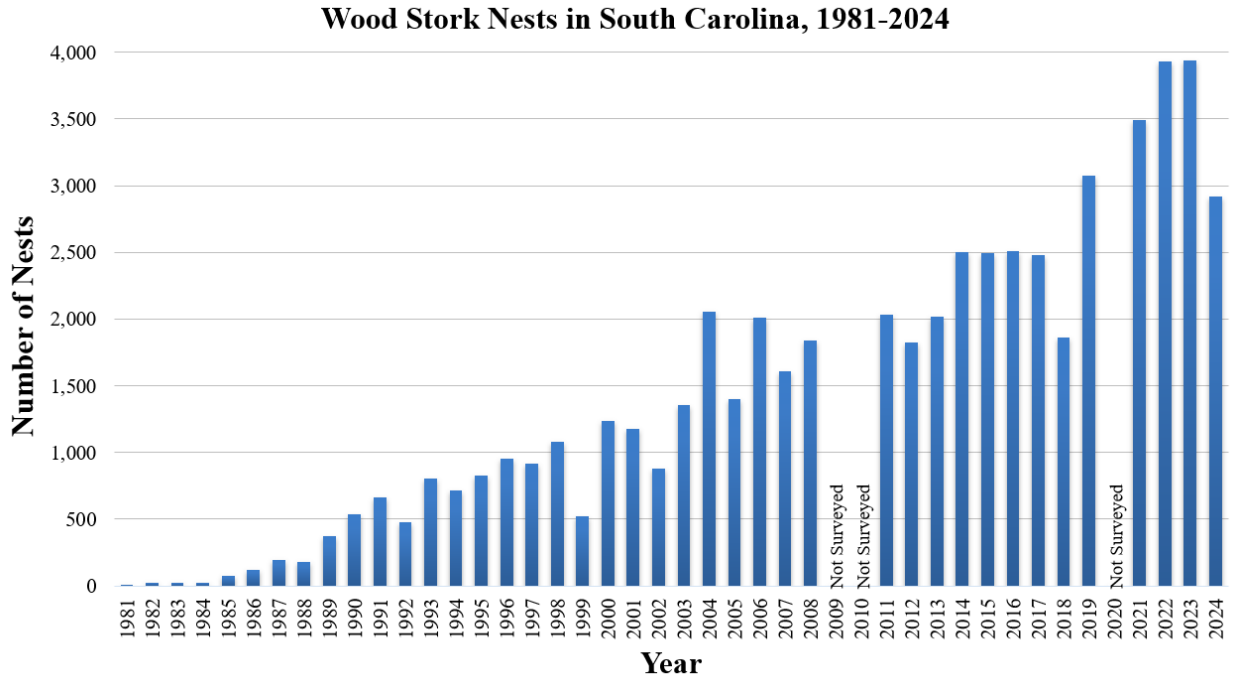

Figure 4. Number of Wood Stork (*Mycteria americana*) nests counted in South Carolina during annual censuses from 1981 – 2024.

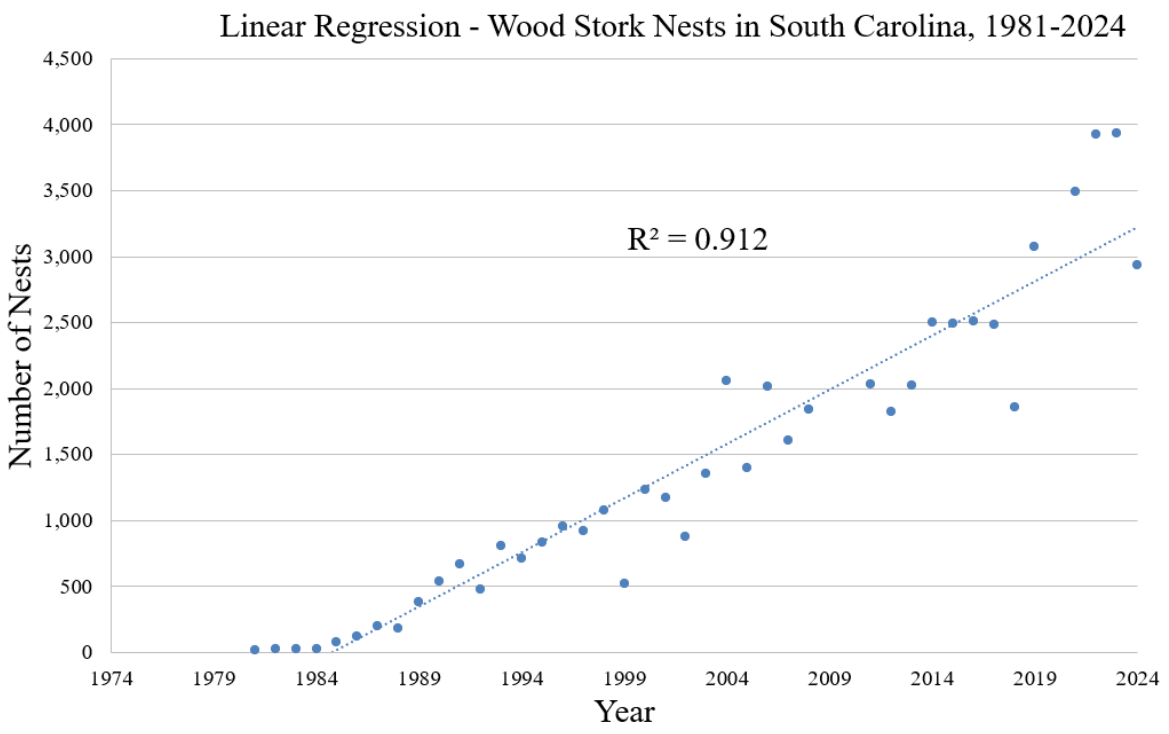

Figure 5. Linear regression of the number of Wood Stork (*Mycteria americana*) nests counted in South Carolina during annual censuses from 1981 – 2024.

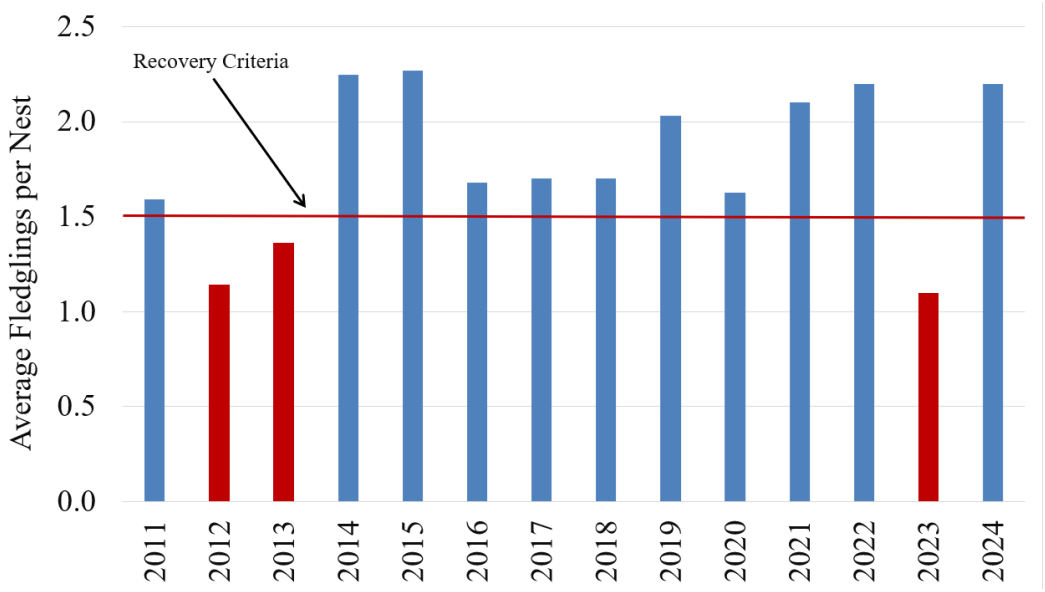

Figure 6. Average number of Wood Stork (*Mycteria americana*) fledglings per monitored nests in South Carolina. Years when the average was lower than the federal recovery goal (1.5 fledglings) are indicated in red. Severe storms during late May or early June occurred during the years when the recovery goal was not attained.

Table 1. Number of nests at all known seabird colonies in South Carolina for 2023 and 2024. Data were collected during peak nesting dates. Numbers are from ground counts except for Brown Pelican, Royal Tern, and Sandwich Tern nest numbers. These species were counted from digital images from aerial flights in a SCDNR law enforcement aircraft or unmanned aerial vehicle (drone). Least Tern nests are reported separately.

SPECIES SITE	**2023 NESTS**	**2024 NESTS**
BLACK SKIMMER	**767**	**678**
NORTH CAPE ISLAND	82	
N CAPE SANDBAR	19	
SOUTH CAPE ISLAND		94
LIGHTHOUSE ISLAND	138	
RACCOON KEY		101
WHITE BANKS		85
CRAB BANK	528	397
DEVEAUX BANK		1
BROWN PELICAN	**4206**	**4285**
CASTLE PINCKNEY	375	849
DEVEAUX BANK	3091	2148
MARSH ISLAND	740	1063
TOMKINS ISLAND		225
COMMON TERN	**7**	**9**
LIGHTHOUSE ISLAND	7	
WHITE BANKS		1
SOUTH CAPE ISLAND		6
RACCOON KEY		2
FORSTER'S TERN	**21**	**26**
MARSH ISLAND	21	26
GULL-BILLED TERN	**237**	**244**
DEVEAUX BANK		8
NORTH CAPE ISLAND	7	
N CAPE SANDBAR	1	
SOUTH CAPE ISLAND		10
LIGHTHOUSE ISLAND	19	
RACCOON KEY		26
WHITE BANKS		21
MARSH		87
CRAB BANK	152	92
SAVANNAH SPOIL SITE	58	
ROYAL TERN	**5555**	**7354**
CASTLE PINCKNEY	793	707
DEVEAUX BANK	198	148
MARSH ISLAND	2665	1827
TOMKINS ISLAND	1899	4672
SANDWICH TERN	**1490**	**2325**
CASTLE PINCKNEY	12	13

SPECIES SITE	2023 NESTS	2024 NESTS
DEVEAUX BANK	7	11
MARSH ISLAND	889	876
TOMKINS ISLAND	582	1425

Table 2. Least Tern nests in 2023 and 2024 in South Carolina. Ground sites are natural beach nesting areas. Artificial sites are nesting sites such as flat gravel-covered roofs and dredge spoil areas. Success is defined by a colony with >50% of the nests surviving.

YEAR	TOTAL NESTS	GRD SITES (#nests/#sites)	ART SITES (#nests/#sites)	TOTAL SITES	SUCCESSFUL COLONIES	FAILED COLONIES
2023	989	552/8	442/14	22	3 (14%)	19 (86%)
2024	747	488/13	259/12	25	7 (28%)	18 (72%)

Table 3. Least Tern nesting in 2023 at 8 beach sites and in 2024 at 13 beach sites.

SITE NAME	LOCATION	2023 NESTS	2024 NESTS
Huntington Beach	Huntington Beach SP		35
South Island	Yawkey Wildlife Management Area		**3**
N. Cape Island-north end	Cape Romain National Wildlife Refuge	49	
N. Cape Island – south end	Cape Romain National Wildlife Refuge		198
N. Cape Island-sandbar	Cape Romain National Wildlife Refuge	75	
Lighthouse Island-south	Cape Romain National Wildlife Refuge	22	
Crab Bank	Charleston Harbor	212	23
Skimmer Flats	Stono Inlet		29
Kiawah Island	Kiawah Island		25
Interlude	Botany Bay Plantation WMA		12
Edingsville Beach	Edisto Island		75
Botany Bay	Botany Bay Plantation WMA	23	6
Otter Island	Otter Island		8
Bull Point	Little Capers Island		12
Hunting Island	Hunting Island State Park	36	9
Morris Island	Morris Island	128	53
Isle of Palms	50 to 51st Avenues Beachfront	7	

Table 4. Least Tern nesting at artificial sites in 2023 and 2024. 13 sites are flat gravel-covered roofs; one site is a gravel-covered dike around impoundments at an industrial site (INEOS), and 3 sites are dredge spoil areas.

SITE NAME	SUBSTRATE	2023 NESTS	2024 NESTS
Garden City Chapel	Gravel Roof	19	8
Pavillion Roof	Gravel Roof	24	8
117 South Surfside Drive	Gravel Roof	35	
Horry-Georgetown Tech	Gravel Roof	81	55
Georgetown High School	Gravel Roof	11	4
Century Aluminum	Gravel Roof	8	5
Mt Pleasant Belk	Gravel Roof	4	19
Summerhouse Condos	Gravel Roof		1
Crescent Condos	Gravel Roof	17	
Myrtle Beach Post Office	Gravel Roof	40	94
Tupperware Plant	Gravel Roof	11	
High Hills Elem. School	Gravel Roof	5	
30 Hengst Blvd	Gravel Roof		2
INEOS	Industrial/Dike	17	46
Savannah Spoil Site 12A	Dredge Spoil	41	
Savannah Spoil Site 13A	Dredge Spoil	124	
Jones Oyster Bar	Dredge Spoil		17

Table 5. Numbers of Wood Stork (*Mycteria americana*) nests counted in South Carolina during April – May 2023 and Colony Outcomes determined during follow-up surveys during mid-June 2023. Colonies are listed in the order that they were first known to be active. Colonies that have not been active since the 1990s were not surveyed. Active colonies were considered to be successful if large chicks and/or fledglings were observed during June follow-up surveys.

Colony	County	2023	2023 Status
Colony 01	Colleton	No Survey	
Colony 02	Colleton	No Survey	
Colony 03	Hampton	0	
Colony 04	Colleton	0	
Colony 05	Colleton	No Survey	
Colony 06	Colleton	382	Successful
Dungannon Pltn HP	Charleston	178	Successful
Washo Reserve	Charleston	115	Successful
Colony 09	Hampton	8	Successful
Colony 10	Bamberg	283	Successful
Colony 11	Jasper	No Survey	
Colony 12	Georgetown	No Survey	
Colony 13	Horry	56	Successful
Colony 14	Berkeley	No Survey	
Colony 15	Colleton	No Survey	
Wannamaker County Park	Charleston	0	
Colony 17	Horry	No Survey	
Colony 18	Charleston	59	Unknown
Colony 19	Georgetown	312	Successful
Colony 20	Colleton	348	Successful
Colony 21	Georgetown	321	Successful
Colony 22	Beaufort	No Survey	
Colony 23	Charleston	355	Successful
Colony 24	Beaufort	No Survey	
Donnelley WMA	Colleton	88	Successful
Hunting Island State Park	Beaufort	34	Successful
Colony 27	Horry	No Survey	
Colony 28	Charleston	164	Successful
Colony 29	Beaufort	0	
Colony 30	Jasper	71	Successful
Colony 31	Beaufort	No Survey	
Pinckney Island NWR	Beaufort	0	
Colony 33	Horry	No Survey	

Colony	County	2023	2023 Status
Colony 34	Beaufort	52	Successful
Colony 35	Charleston	61	Successful
Colony 36	Williamsburg	No Survey	
Colony 37	Jasper	No Survey	
Colony 38	Beaufort	0	
Colony 39	Beaufort	94	Successful
Colony 40	Berkeley	No Survey	
Colony 41	Beaufort	No Survey	
Colony 42	Beaufort	0	
Colony 43	Beaufort	No Survey	
Colony 44	Beaufort	0	
Colony 45	Beaufort	No Survey	
Colony 46	Beaufort	No Survey	
Colony 47	Horry	140	Successful
Colony 48	Horry	279	Successful
Colony 49	Berkeley	196	Successful
Colony 50	Charleston	63	Successful
Colony 51	Jasper	155	Successful
Colony 52	Beaufort	5	Successful
Colony 53	Beaufort	29	Successful
Colony 54	Beaufort	No Survey	
Colony 55	Beaufort	60	Successful
Colony 56	Beaufort	13	Successful
Colony 57	Beaufort	14	Successful
Statewide Total		**3,935**	

Table 6. Numbers of Wood Stork (*Mycteria americana*) nests counted in South Carolina during April – May 2024 and Colony Outcomes determined during follow-up surveys during early July 2024. Colonies are listed in the order that they were first known to be active. Colonies that have not been active since the 1990s were not surveyed. Active colonies were considered to be successful if large chicks and/or fledglings were observed during June follow-up surveys.

Report Name	County	2024 Nest Count	2024 Outcome
Colony 01	Colleton	No Survey	No Survey
Colony 02	Colleton	No Survey	No Survey
Colony 03	Hampton	0	Not Active
Colony 04	Colleton	0	Not Active
Colony 05	Colleton	No Survey	No Survey
Colony 06	Colleton	129	Successful
Dungannon Pltn HP	Charleston	139	Successful
Washo Reserve	Charleston	146	Successful
Colony 09	Hampton	17	Successful
Colony 10	Bamberg	178	Successful
Colony 11	Jasper	No Survey	No Survey
Colony 12	Georgetown	No Survey	No Survey
Colony 13	Horry	27	Successful
Colony 14	Berkeley	No Survey	No Survey
Colony 15	Colleton	No Survey	No Survey
Wannamaker County Park	Charleston	No Survey	No Survey
Colony 17	Horry	No Survey	No Survey
Colony 18*	Charleston	No Survey. Status Unknown.	Status Unknown
Colony 19	Georgetown	231	Successful
Colony 20	Colleton	295	Successful
Colony 21	Georgetown	204	Successful
Colony 22	Beaufort	No Survey	No Survey
Colony 23	Charleston	269	Successful
Colony 24	Beaufort	No Survey	No Survey
Donnelley WMA	Colleton	81	Successful
Hunting Island State Park	Beaufort	27	Successful
Colony 27	Horry	No Survey	No Survey
Colony 28	Charleston	148	Successful
Colony 29	Beaufort	No Survey	No Survey
Colony 30	Jasper	60	Unknown
Colony 31	Beaufort	No Survey	No Survey
Pinckney Island NWR	Beaufort	0	Not Active
Colony 33	Horry	No Survey	No Survey

Report Name	County	2024 Nest Count	2024 Outcome
Colony 34	Beaufort	65	Successful
Colony 35	Charleston	56	Successful
Colony 36	Williamsburg	No Survey	No Survey
Colony 37	Jasper	No Survey	No Survey
Colony 38	Beaufort	0	Not Active
Colony 39	Beaufort	55	Unknown
Colony 40	Berkeley	No Survey	No Survey
Colony 41	Beaufort	No Survey	No Survey
Colony 42	Beaufort	0	Not Active
Colony 43	Beaufort	No Survey	No Survey
Colony 44	Beaufort	No Survey	No Survey
Colony 45	Beaufort	No Survey	No Survey
Colony 46	Beaufort	No Survey	No Survey
Colony 47	Horry	90	Successful
Colony 48	Horry	217	Successful
Colony 49	Berkeley	125	Successful
Colony 50	Charleston	48	Successful
Colony 51	Jasper	88	Unknown
Colony 52	Beaufort	2	Unknown
Colony 53	Beaufort	46	Unknown
Colony 54	Beaufort	No Survey	No Survey
Colony 55	Beaufort	69	Unknown
Colony 56	Beaufort	35	Successful
Colony 57	Beaufort	59	Successful
Colony 58	Georgetown	25	Successful
Statewide Total		**2,931**	

*Colony 18 was active during 2023 but was not surveyed during 2024 due to airspace restrictions and a staff absence.

Table 7. Summary of Wood Stork (*Mycteria americana*) nest monitoring data collected by South Carolina Department of Natural Resources staff and volunteers during 2023.

Colony Number and County	**Colony 6 Colleton**	**Colony 7 Charleston**	**Colony 20 Colleton**	**Colony 23 Charleston**	**Colony 34 Beaufort**	**All Monitored Colonies**
Ownership	Private	SCDNR	Private	Private	Private	
Total Number of Stork Nests in Colony*	382	178	348	355	52	**1,315**
Number of Monitored Nest Sites	93	38	61	36	38	**266**
Average Fledglings per Nest Site	0.73	1.47	0.97	2.03	0.95	**1.10**
Average Fledglings per Successful Nest Site	1.74	2.15	1.79	2.61	2.00	**2.03**
0 Fledglings	54	12	28	8	20	**122**
1 Fledgling	14	5	11	3	5	**38**
2 Fledglings	21	12	18	7	8	**66**
3 Fledglings	4	9	4	16	5	**38**
4 Fledglings	0	0	0	2	0	**2**
				0	0	
% SUCCESSFUL	**42%**	**68%**	**54%**	**78%**	**47%**	**54%**

*Total number of nests counted in the colony during the annual colony survey.

** Number of successful nest sites divided by the total number of nest sites that were monitored. Successful is defined as producing at least one fledgling. A chick was considered to be a fledgling if it survived to at least 7 weeks of age.

Table 8. Summary of Wood Stork (*Mycteria americana*) nest monitoring data collected by South Carolina Department of Natural Resources staff and volunteers during 2024.

Colony Number and County	**Colony 20 Colleton**	**Colony 23 Charleston**	**All Monitored Colonies**
Ownership	Private	Private	
Total Number of Stork Nests in Colony*	295	269	
Number of Monitored Nest Sites	53	39	92
Average Fledglings per Nest Site	2.02	3	2
Average Fledglings per Successful Nest Site	2.49	2.88	2.63
0 Fledglings	10	5	15
1 Fledgling	5	1	6
2 Fledglings	16	9	25
3 Fledglings	18	17	35
4 Fledglings	4	7	11
% SUCCESSFUL	**87%**	**89%**	**84%**

*Total number of nests counted in the colony during the annual colony survey.

** Number of successful nest sites divided by the total number of nest sites that were monitored. Successful is defined as producing at least one fledgling. A chick was considered to be a fledgling if it survived to at least 7 weeks of age.

Table 9. Summary of Wood Stork (*Mycteria americana*) nest monitoring data collected by South Carolina Department of Natural Resources staff and volunteers during 2011-2024.

Year	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**All Years**
Number of Monitored Colonies	**2**	**7**	**9**	**8**	**7**	**7**	**6**	**4**	**6**	**4**	**5**	**4**	**5**	**2**	
Number of Monitored Nest Sites	81	311	427	396	415	322	232	153	262	138	191	346	266	92	3632
Average Fledglings per Nest Site	1.6	1.1	1.4	2.2	2.3	1.7	1.7	1.7	2.0	1.6	2.1	2.2	1.1	2.2	1.8
Average Fledglings per Successful Nest Site	2.1	1.9	2.0	2.6	2.5	2.3	2.0	2.2	2.4	2.4	2.3	2.4	2.0	2.6	2.3
0 Fledglings	18	122	144	49	48	88	52	37	42	44	23	26	122	15	830
1 Fledgling	11	53	55	28	26	42	23	12	31	11	21	31	38	6	388
2 Fledglings	38	107	163	126	144	98	100	64	74	39	68	151	66	25	1263
3 Fledglings	14	28	59	163	168	73	51	39	95	39	76	122	38	35	1000
4 Fledglings	0	1	6	30	29	21	6	1	20	5	3	16	2	11	151
% Successful*	77%	61%	66%	88%	89%	74%	79%	76%	84%	68%	88%	92%	54%	84%	77%

* Number of successful nest sites divided by the total number of nest sites that were monitored. Successful is defined as producing at least one fledgling. A chick was considered to be a fledgling if it survived to at least 7 weeks of age.