FINAL REPORT
South Carolina State Wildlife Grant SC-T-F20AF11231-00
South Carolina Department of Natural Resources
October 1, 2020 – September 30, 2022

Project Title: Conservation of seabirds, shorebirds, wading birds, and marsh birds in South Carolina III

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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 spill, wind energy, and sea-level rise planning.
c) Increase nesting productivity, especially for Least Terns.
d) Assess migratory shorebird trends in South Carolina, especially for listed species (Red Knot and Piping Plover).

Accomplishments:

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

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 meeting 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 on some beach entrances. We placed closure signs at nesting sites on 27 beaches and at 2 beaches during the winter to protect roosting migratory shorebirds (Figure 1).

Crab Bank Seabird Sanctuary was rebuilt late 2021 with material taken from the Charleston Harbor Post 45 Deepening Project. The island is approximately a 32-acre sand bar at the mouth of Shem Creek. The first nesting season in 2022 was successful for numerous seabird species and American Oystercatchers. This 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 spill, 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 SCDNR Law Enforcement pilots in a twin engine fixed-wing Partenavia aircraft during 2021 and in a Cessna during 2022. Two SCDNR biologists accompanied the pilot: one to help direct the pilot over pelican colonies and the other to take photographs of the colonies through bomb bay doors or windows 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 or estimated in 2021 and 2022 are reported in Table 1.

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 islands, an adapted pier, 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 2021, the nest estimate for Least Terns in South Carolina was 965 (Table 2). 629 (65%) nests were on natural beaches and 336 (35%) were at artificial sites (Table 2). All beach sites (18) were accessed by boat except for Kiawah Island, Seabrook Island, Huntington Beach State Park, Isle of Palms, Hunting Island State Park, and Edisto Beach State Park sites which were accessed by vehicle and foot (Table 3). All artificial sites (17) were accessed by vehicle over a 5-county area comprising Charleston, Berkeley, Williamsburg, Georgetown, and Horry counties (Table 4).

In 2021, 446 (71%) nests at beach sites were successful (>50% of the nests in a colony survived) and 183 (29%) nests were unsuccessful, < 50% of the nests survived. Negative impacts on failed colonies included human/dog disturbance, predation, and tidal wash over. In 2021, 123 (37%) nests at artificial sites were successful, and 213 (63.4%) nests were unsuccessful. Colony failure at artificial sites was primarily due to avian predation.

In 2022, the nest estimate for Least Terns in South Carolina was 1,052 (Table 2). 377 (36%) nests were on natural beaches and 675 (64%) were at artificial sites (Table 2). All beach sites

(16) were accessed by boat except for Huntington Beach State Park, Isle of Palms, Hunting Island State Park, Botany Bay Plantation, and Edisto Beach State Park which were accessed by vehicle and foot (Table 3). All artificial sites (15) were accessed by vehicle over a 5-county area comprising Charleston, Berkeley, Williamsburg, Georgetown, and Horry counties (Table 4).

In 2022, 121 (32%) nests at beach sites were successful (>50% of the nests in a colony survived) and 256 (68%) nests were unsuccessful (< 50% of the nests survived). Negative impacts on failed colonies included human/dog disturbance, predation, and tidal wash over.
In 2022, 231 (34%) nests at artificial sites were successful, and 444 (66%) nests were unsuccessful. Colony failure at artificial sites was primarily due to avian predation.

d) Assess migratory shorebird trends in South Carolina, especially for listed species (including but not limited to Red Knot and Piping Plovers).

Piping Plover
Based on past monitoring cycles, we anticipated a 2021 USFWS Piping Plover statewide winter estimate survey, but it did not occur during the life of this grant.

Red Knot and Ruddy Turnstone
Nanotags were purchased in 2020 to place on Red Knots during April and May, however COVID-19 restrictions prevented trapping and tagging in 2020 so nanotags were held in storage. In 2021, we trapped Red Knots and Rudy Turnstones in the spring at 2 locations in South Carolina and at 1 location in the fall in Georgia with the assistance of Georgia Department of Natural Resources (GADNR) biologists. A total of 49 nanotags were placed on birds during spring and fall migration. We used an existing array of MOTUS towers to determine migratory routes with this tagging effort. Additionally, GADNR assembled an additional MOTUS tower near the trapping location in Georgia to add to the array of data collection of migratory shorebirds in the Southeastern United States. The nanotag data are currently being summarized in a manuscript that will be submitted for publication early 2023.

April 2022 SCDNR biologists partnered with Dr. Larry Niles and Stephanie Feigin at Wildlife Restoration Partnerships in New Jersey to deploy 15 satellite transmitters on Knots at Kiawah Island. This is part of a larger Wildlife Restoration Partnerships' research project to understand knot migration along the Atlantic coast. We banded 145 knots during this capture.

We coordinated with the Environmental Research Section (ERS) of SCDNR to sample Red Knot foraging locations at Seabrook Island. Benthic and sediment samples were obtained to characterize prey community and beach composition for a study the ERS section is completing in 2021.

We conducted a spring coordinated count of Red Knots in the Captain Sam's Inlet vicinity. The goal is to obtain a "snapshot" of how many Knots are roosting in this one area at one time. A peak of approximately 4,000 knots were counted in this area in April 2021.

Whimbrel

In 2021 "Discovery at Deveaux," a short film produced by the Cornell Lab's Center for Conservation Media about Whimbrel roosting on Deveaux Bank, reached nearly 70,000 viewers. This video led to additional coverage by local and national media outlets, including a feature story on the television show CBS Sunday Morning that reached five million viewers. Renowned science writers Deborah Cramer and Scott Weidensaul drew attention to the importance of Deveaux Bank as well and called for the protection and creation of similar barrier island habitats elsewhere in the flyway with stories published in the New York Times and Living Bird magazine. This media attention has been instrumental in moving shorebird conservation forward in South Carolina. These stories reached conservation partners, coastal land managers, local communities, elected officials, and policy makers, including the governor of South Carolina, Henry McMaster.

Partnering with the University of South Carolina (now located at the University of Massachusetts) researchers, we deployed additional PinPoint GPS transmitters on Whimbrel roosting on Deveaux Bank in 2021 and 2022. With highly accurate fixes collected every 10-15 minutes, these transmitters have revealed fine-scale Whimbrel habitat use. The graduate student's movement analyses have revealed that Whimbrel are traveling from as far as 50km away to roost on Deveaux Bank. Also, tracking data indicate that individuals that feed farther away from Deveaux Bank may have larger foraging home ranges and spend less time roosting each night, patterns that Maina Handmaker, PhD graduate student, will explore in upcoming research. Returning Whimbrel allowed researchers to recover tracks that revealed important conservation implications such as that Deveaux Bank supports Whimbrel from multiple breeding populations and identification of 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 once a month from September through March at Capers Island Heritage Preserve, Bird Key Stono Seabird Sanctuary, and Sand 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 2021, SCDNR completed aerial surveys of 56 wading bird colonies in the coastal region and coastal plains where potentially suitable stork nesting habitat was known to exist. These surveys included 36 previously occupied Wood Stork colonies. We found nesting Wood Storks in 26 colonies (Table 5, Figure 2).

Nests were counted from photographs taken during aerial surveys or during surveys from canoes. We counted 3,493 Wood Stork nests (Figure 3) during 2021, far exceeding the previous record high count of 3,075 nests during 2019, which was the most recent year aerial surveys were completed due to COVID-19 restrictions during 2020.

During 2022, we completed aerial surveys of 68 wading bird colonies, including 46 colonies that were previously used by nesting Wood Storks. We counted a total of 3,928 Wood Stork nests in 28 active colonies, once again setting a record high number of stork nests for the state (Table 6).

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 2021, SCDNR staff and a trained volunteer monitored nests at five index 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. SCDNR staff monitored four index colonies during 2022.

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 2021, a total of 191 stork nests were monitored. An average of 1.8 chicks fledged per nest site and 2.3 chicks per successful nest site (Table 7). During 2022, a total of 346 nests were monitored. An average of 2.2 chicks fledged per nest site and 2.4 chicks per successful nest site (Table 8). Table 9 provides a comparison of nest monitoring data from 2011 – 2022. The federal

recovery goal for Wood Storks is an average of 1.5 fledglings per nest. During the 11 years when nest monitoring was completed in South Carolina, the annual average met or exceeded 1.5 fledglings per nest in all but two years (2012 and 2013).

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 25 of the 26 colonies that were resurveyed during 2021 and 26 of the 28 active colonies during 2022. 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 eradicate Cuban Bulrush from the Donnelley Wildlife Management Area and other ACE Basin properties.

Wood Stork Nestling Banding Project
Beginning during 2013, SCDNR banded stork nestlings as part of a regional project. During 2021 and 2022, SCDNR banded 46 stork nestlings, bringing the 2013-2021 South Carolina total to 409 banded nestlings (including 376 nestlings banded with metal USGS and field-readable orange and black plastic auxiliary bands).

Conclusions from Wood Stork Surveys and Nest Monitoring
Nesting effort has been consistently increasing in South Carolina (Figure 4), and storks had exceptionally productive nesting seasons during 2021 and 2022.

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 U.S.

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 51 wading bird colonies in South Carolina were completed during 2021 to monitor Wood Stork population trends and the distribution and relative size of wading bird colonies. During 2022, 48 of the 68 colonies surveyed were active. The flights were timed to coincide with peak nesting for Wood Storks and Great Egrets in the coastal region. Aerial photographs, which were later used to determine species and approximate nest numbers, were taken of all active colonies.

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 2021 and 2022 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 2021 and 2022 surveys have been 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: None.

Objective 3:

Marsh Bird Components

a) Determine if Black Rails are present in substantial numbers in coastal South Carolina during the nonbreeding season. Document timing of arrival and departure of wintering rail species.

Accomplishments:

a) Determine if Black Rails are present in substantial numbers in coastal South Carolina during the nonbreeding season. Document timing of arrival and departure of wintering rail species.

Nonbreeding Season Call-response Surveys for Black Rails were completed twice at 32 survey points during September – October 2022. Black Rails were detected at four of the points – two points in September and two points in October.

Between 1 October 2020 – 1 March 2021, SCDNR deployed and maintained 10 or more camera traps organized into two to six arrays (groupings of five or more camera traps) in two wetlands occupied by Black Rails during the 2020 breeding season. Sampling effort varied throughout the season because it was necessary to flood Wetland 1 (managed tidal impoundment; maximum of

>20 cameras) from 2 November 2020 – late February 2021 to control encroachment by woody vegetation. Camera traps operated continuously throughout the sampling period in Wetland 2 (tidal marsh; maximum of 24 cameras). We collected over 115,000 photographs including photographs of Black Rails (2,543), Soras (2,032), and Virginia Rails (11,908). Black Rail detections in Wetland 2 sharply declined during November – January (days with detections: October = 16; November = 4; December = 0; January = 4).

In addition to collecting new data, we addressed this objective by analyzing our existing October 2018 – August 2020 dataset from the one array in Wetland 1 and the two arrays in Wetland 2, where our sampling effort was relatively consistent throughout the seasons (Figures 5 and 6).

Significant deviations: None.

Objective 4:

Components for All Species Groups

a) Build awareness in South Carolina of shorebird, seabird, wading bird and marsh 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.
- Updated Wading Bird Rookery data 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 general public due to concerns about the privacy of the property owners and potential disturbance to the birds.

- Continued to work with Joe Lemeris, SCDNR Heritage Trust Database Manager, to incorporate Eastern Black Rail distribution data into the SCDNR Heritage Trust Database. Inclusion of these data will facilitate consideration of the species during regulator decisions and permit review. The subspecies was given federal protection under the Endangered Species Act during November 2020, resulting in new requirements for evaluating potential impacts.
- Gave presentation about the status, ecology and conservation needs of Black Rails at the 2020 South Carolina Chapter of The Wildlife Society meeting.
- Provided photographs to the US Fish and Wildlife Service, Post and Courier, and Associated Press for outreach and reporting efforts related to the announcement that the Eastern Black Rail would receive federally threatened status under the Endangered Species Act.
- Gave presentations about shorebird and seabird conservation issues and research at Coastal Discovery Museum lecture series, at the monthly meeting of the Waccamaw Audubon Society, Port Royal Sound Education Series, SCDNR's "Bringing the Outside In" series, and at Seabrook Island Birders Group and Fripp Audubon Club.
- Worked with SCDNR Public Information Office/Social Media office and SCDNR Marketing Director to develop a PSA concerning dogs on beaches and the harm caused to birds living on coastal beaches. This information was used in social media during the spring and summer of 2021.
- Attended Bird Fest at Old Santee Canal Park in October 2021; distributed educational materials and discussed issues and items related to conservation of shorebirds with the public.
- Distributed SC Best Management Practices (BMPs) for Use of Vehicles, especially those used for Sea Turtle Nest Protection projects. Presented seabird and shorebird conservation message 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 lands, and private islands. We worked with sea turtle projects at some locations to delineate areas of the beach to avoid driving because of the high concentrations of nesting birds.
- Continued development of 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.
- Attended multiple SCDNR Board, SCDNR Wildlife and Freshwater Fisheries Advisory Board and Marine Advisory Board meetings. Presentations on shorebird and seabird protection were given or topics related were discussed at these meetings.
- Placed cameras in the Black Skimmer colonies at Deveaux Bank and Crab Bank to monitor the colonies. Some of the acquired video was used for a Facebook post encouraging the public to respect closed areas and to update the public on nesting at the newly refurbished Crab Bank. The video received over 1.4 million views.
- Developed a virtual shorebird and seabird identification presentation, offered to ecotour operators in South Carolina. Then cohosted a field trip to Capers Island as part of the SCDNR Coastal Exploration Series for in-the-field bird identification.

- Presented the work of the Coastal Bird Program to SCDNR staff at the August 2022 "Lunch & Learn" series.

Deveaux Bank Whimbrel Roost Media Coverage

- *Deveaux Bank South Carolina Whimbrel Announcement* - video produced by Cornell Lab of Ornithology, online, over 70,000 viewers
- *Deveaux Bank: Reflections of a Cultural Ornithologist* - video produced by Cornell Lab of Ornithology, online
- *Discovery at Deveaux* Squarespace web site, online - resource with videos, images, and facts
- *Discovery at Deveaux Virtual Celebration* - online presentation, over 1,500 participants
- CBS Sunday Morning - *Tagging Whimbrel shorebird*, over 5 million viewers
- Charleston Magazine - *How scientists discovered the world's largest whimbrel roost on Deveaux Bank*
- The New York Times - *Leave This Wondrous Island to the Birds*
- Garden and Gun - *The Wild Story of a Whimbrel Migration Mystery*
- Charleston Post and Courier - *Researchers discover largest-known flock of declining shorebird roosting in coastal SC*
- BirdWatching - *World's largest Whimbrel roost discovered*
- Living Bird - *Wildness on a Whim: Reflections on Whimbrel in the South Carolina Lowcountry*
- Living Bird - *A Miracle of Abundance as 20,000 Whimbrel Take Refuge on a Tiny Island*
- The Wildlife Society - *Watch: For a declining shorebird, a South Carolina Island is a crucial refuge*
- Birding Wire - *Whimbrel Mega-Roosting Site Discovered*
- South Carolina Nature-Based Tourism Association - *World's Largest Whimbrel Roost Discovered in South Carolina*
- Texas News Today - *Odyssey of movement: Tagging whimbrels*
- World Republic News - A migration odyssey: Tagging whimbrel shorebirds

SCDNR Press Releases

- October 1, 2020 – Behind "Ghost Bird": Key Discoveries about the Elusive Black Rail (SCDNR Blog)
- April 15, 2021 – Crab Bank Restoration – Adjustment to Footprint
- October 11, 2022 - Successful shorebird nesting season on a newly restored Crab Bank

Publications

Hand, C. E. and R. E. Bonafilia. 2020. First Record of Roseate Spoonbills (*Platalea ajaja*) Nesting in South Carolina. Chat 84: 103–104.

Hand, C. E., W. Gabel, G. R. DiPetto, R. E. Bonafilia, J. M. Thibault, and E. Znidersic. 2021. A Window into the Breeding Ecology and Molt of the Eastern Black Rail (Laterallus jamaicensis jamaicensis). Waterbirds (44)2: 207-221.

Lamarre J-F, Gauthier G, Lanctot RB, Saalfeld ST, Love OP, Reed E, Johnson OW, Liebezeit J, McGuire R, Russell M, Nol E, Koloski L, Sanders F, McKinnon L, Smith PA, Flemming SA, Brown SC, Lecomte N, Giroux M-A, Bauer S, Emmenegger T and Bêty J. 2021. Timing of Breeding Site Availability Across the North-American Arctic Partly Determines Spring Migration Schedule in a Long-Distance Neotropical Migrant. Frontiers in Ecology and Evolution. 9:710007. doi: 10.3389/fevo.2021.710007.

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Pelton, Mary Margaret, Sara R. Padula, Julian Garcia-Walther, Mark Andrews, Robert Mercer, Ron Porter, Felicia Sanders, Janet Thibault, Nathan Senner, Jennifer A. Linscott. 2022. Kiawah and Seabrook islands are a critical site for the rufa Red Knot. Wader Study 129: 105 – 118.

Sanders, F.J., M.C. Handmaker, A.S. Johnson & N.R. Senner. 2021. Nocturnal roost on South Carolina coast supports nearly half of Atlantic coast population of Hudsonian Whimbrel Numenius hudsonicus during northward migration. Wader Study 128: 117–124.

Stevens, B. S., C. J. Conway, K. Luke, A. Weldon, C. E. Hand, A. Schwarzer, F. Smith, C. Watson, and B. D. Watts. 2022. Large-scale distribution models for optimal prediction of Eastern black rail habitat within tidal ecosystems. Global Ecology and Conservation 38. https://doi.org/10.1016/j.gecco.2022.e02222.

Takahashi, Fumika, Felicia J. Sanders, Patrick G.R. Jodice. 2021. Spatial and temporal overlap between foraging shorebirds and spawning horseshoe crabs (*Limulus polyphemus*) in the Cape Romain-Santee Delta Region of the U.S. Atlantic coast. The Wilson Journal of Ornithology 133: 58-72.

b) Link regional and local conservation goals.

- Reviewed and provided comments on the USFWS Wood Stork Species Status Assessment. This document will provide foundational science for informing listing determinations, consultations, grant allocations, permitting, and recovery planning.
- Served on the Avian Knowledge Network Colonial Waterbird Data Management Team. This team is working to develop a plan to integrate waterbird data from the Atlantic Flyway into a national database.
- Participated in annual Wood Stork Working Group meetings. South Carolina nesting data and an overview of the current management projects were presented to the group of researchers who make decisions about future priorities to promote the recovery of the species.
- Gave presentation at the annual national The Wildlife Society Conference during the symposium titled “Ecology and Conservation of Eastern black rail: Road to Recovery through Management” (Presentation Title: Eastern Black Rail Ecology and Habitat Management in South Carolina).

- Shared pre-recorded presentation about the SCDNR Black Rail Project's objectives and accomplishments for the Florida Black Rail Working Group meeting and participated in discussions. Over 60 people attended this virtual meeting.
- Gave presentation about the SCDNR Black Rail Project goals and accomplishments for the Black Rail webinar for South Carolina NWRs. Provided feedback and recommendations during discussion of upcoming grant-funded projects, assessment of project sites, management strategies, and monitoring approaches.
- Shared presentation about the SCDNR Black Rail Project goals and accomplishments at the North Carolina Black Rail Working Group meeting and participated in discussions.
- Organized a virtual meeting with biologists throughout the Atlantic and Gulf coasts to share information and ideas about the use of irrigation to create habitat for Eastern Black Rails. Learned about projects throughout the subspecies' range.
- Participated in a two-day virtual workshop for the ACJV Eastern Black Rail Adaptive Management Project. Contributed knowledge of Black Rail ecology, habitat requirements, and habitat management logistics. Participated in additional virtual meetings to discuss and provide feedback on the project framework and to identify management projects for a multistate Competitive State Wildlife Grant Proposal. Developed plans for a project to experimentally implement irrigation on a SCDNR property.
- Participated in monthly virtual meetings for the Firebird Project (Gulf Coast rails), which included the discussion of survey protocols and acoustic sampling. Shared protocols developed by SCDNR's Black Rail Project. Prepared and shared example Black Rail call type audio files and spectrograms to aid in the standardization in terminology throughout the subspecies range.
- Initiated and co-led the first range-wide Eastern Black Rail Autonomous Recording Unit (ARU) Team meeting. Presented SCDNR's six years of research using ARUs and offered suggestions to other organizations. Participated in a virtual meeting with Cornell/BirdNET scientists and Black Rail researchers from several states to plan for ARU file review. SCDNR's extensive dataset from wetlands occupied by Black Rails will be used for testing the capabilities of BirdNET, a research platform using computer learning to identify bird calls within large acoustic datasets. If the platform produces accurate results, it may be used to analyze past and future recordings to determine site occupancy.
- 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. Participated in strategies for tower placement in South Carolina and opportunities to share shorebird movement data locally and internationally for scientific and educational advancement.
- Participated in person and virtually in the American Oystercatcher Working Group 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 U.S. 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.

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 closely with the SCDNR biologists managing the properties to plan for and implement vegetation management within the rookeries.
- Assisted colleagues within and beyond South Carolina who have initiated or are planning projects to monitor Black Rails. Advised colleagues about equipment SCDNR uses to study and monitor Black Rails: automated playback unit design, autonomous recording unit models and scheduling, and camera models and techniques.
- Provided comments about beach renourishment projects at Kiawah Island and Dewees Island and their effects on shorebird and seabird habitat. Provided input on biological monitoring associated with placement of material and construction design.
- 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.
- Collaborated with SCDNR's drone operator, the SCDNR Marine Division, and Audubon South Carolina staff to document habitat changes on Crab Bank Crab Bank Seabird Sanctuary in Charleston Harbor. SCDNR staff obtained aerial photography, benthic samples, and GPS points of Crab Bank during pre-construction (before dredge material was deposited on the island). Additional data will be collected post construction to inform managers about habitat changes of islands constructed with dredge material.
- Gave a presentation in June 2022 to the Kiawah Island Shorebird Stewardship group about Black Skimmer ecology and what the SCDNR Coastal Bird Program does to protect and manage this species.

Significant deviations: None.

Literature Cited:

Krogh, Michael G. and Sarah H. Schweitzer. 1999. Least terns nesting on natural and artificial habitats in Georgia USA. Waterbirds 22(2): 290-296.

Federal Cost: $ 265,508.00 (Oct 1, 2020 – September 30, 2022)

Recommendations: All objectives have been completed. Close the grant.

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

Special thanks to the seasonal and year-round team members (Cami Duquet, Rachel Bonafilia, Natalie Donofrio, Kirsten Steininger, Spencer Weitzel, Jennifer Cahill and Maina Handmaker), long-term volunteers (Buddy Campbell), and SCDNR pilots (Owen Baker and Ryan Wilbanks) who dedicated their time and talents to the waterbird project.

Figures and Tables:

Figure 1. Locations of 27 sites (indicated by bird icons) in South Carolina where signs were placed in 2021 and 2022 to indicate beach closures. Closures help minimize human disturbance to beach-nesting birds and migratory shorebirds.

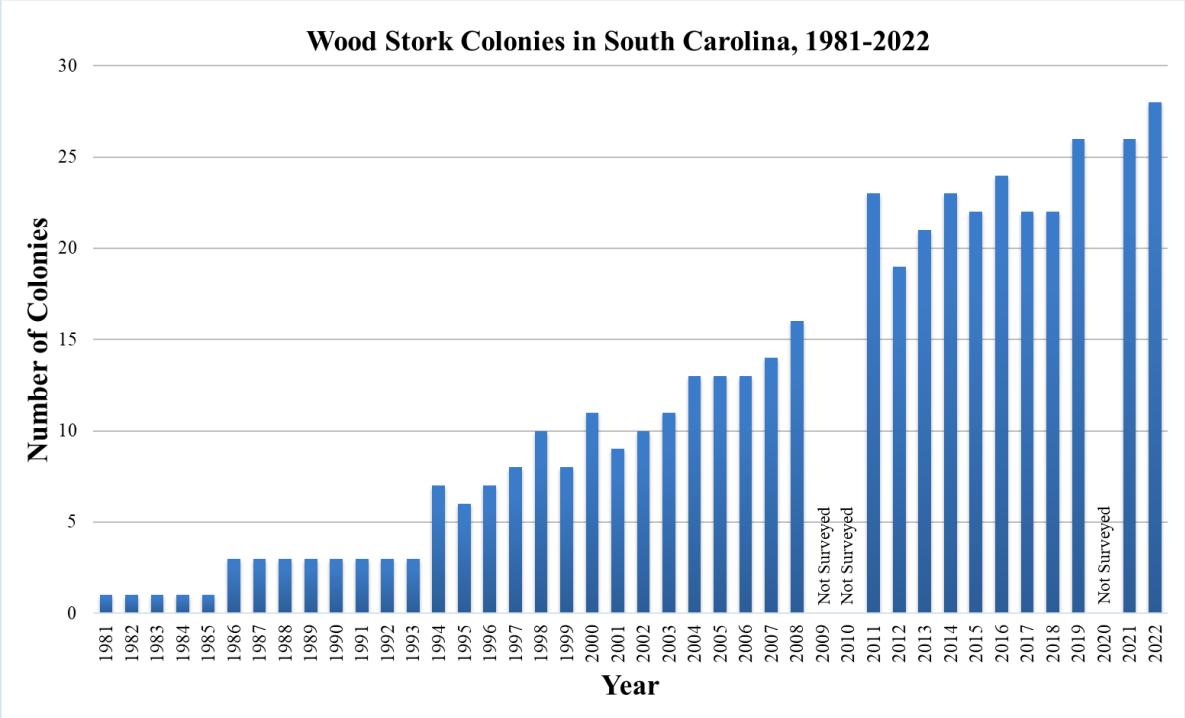

Figure 2. Number of colonies in which Wood Storks (*Mycteria americana*) nested in South Carolina from 1981 – 2022.

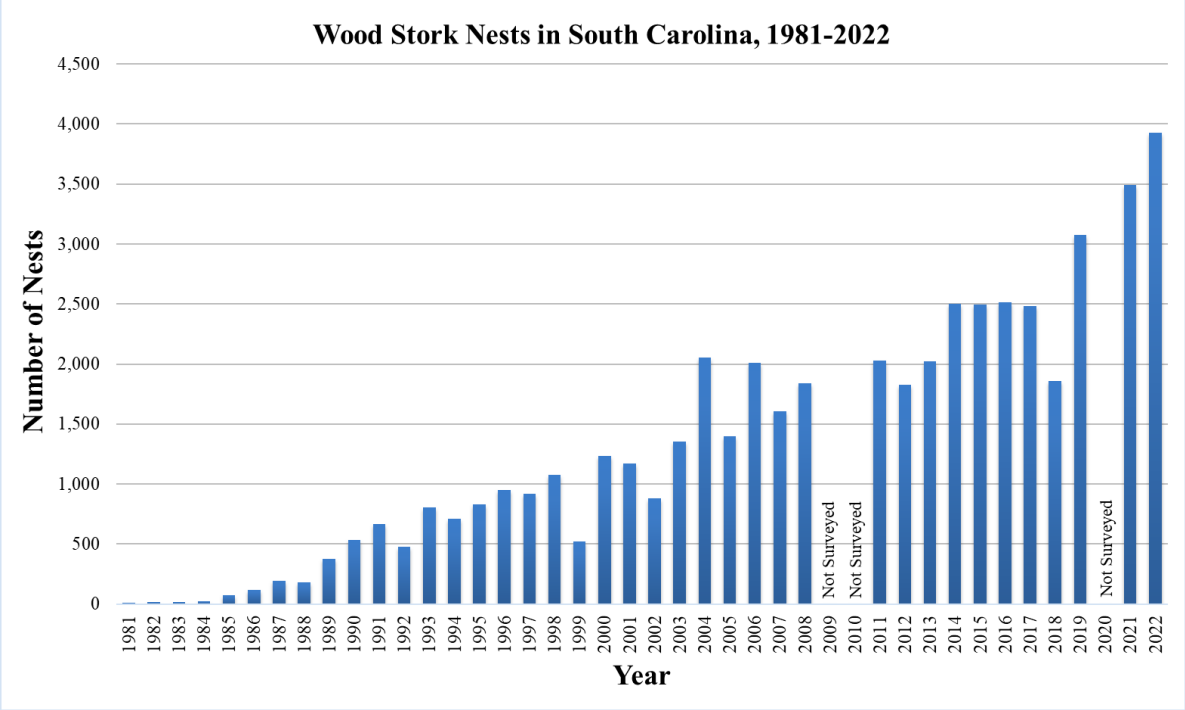

Figure 3. Number of Wood Stork (*Mycteria americana*) nests counted in South Carolina during annual censuses from 1981 – 2022.

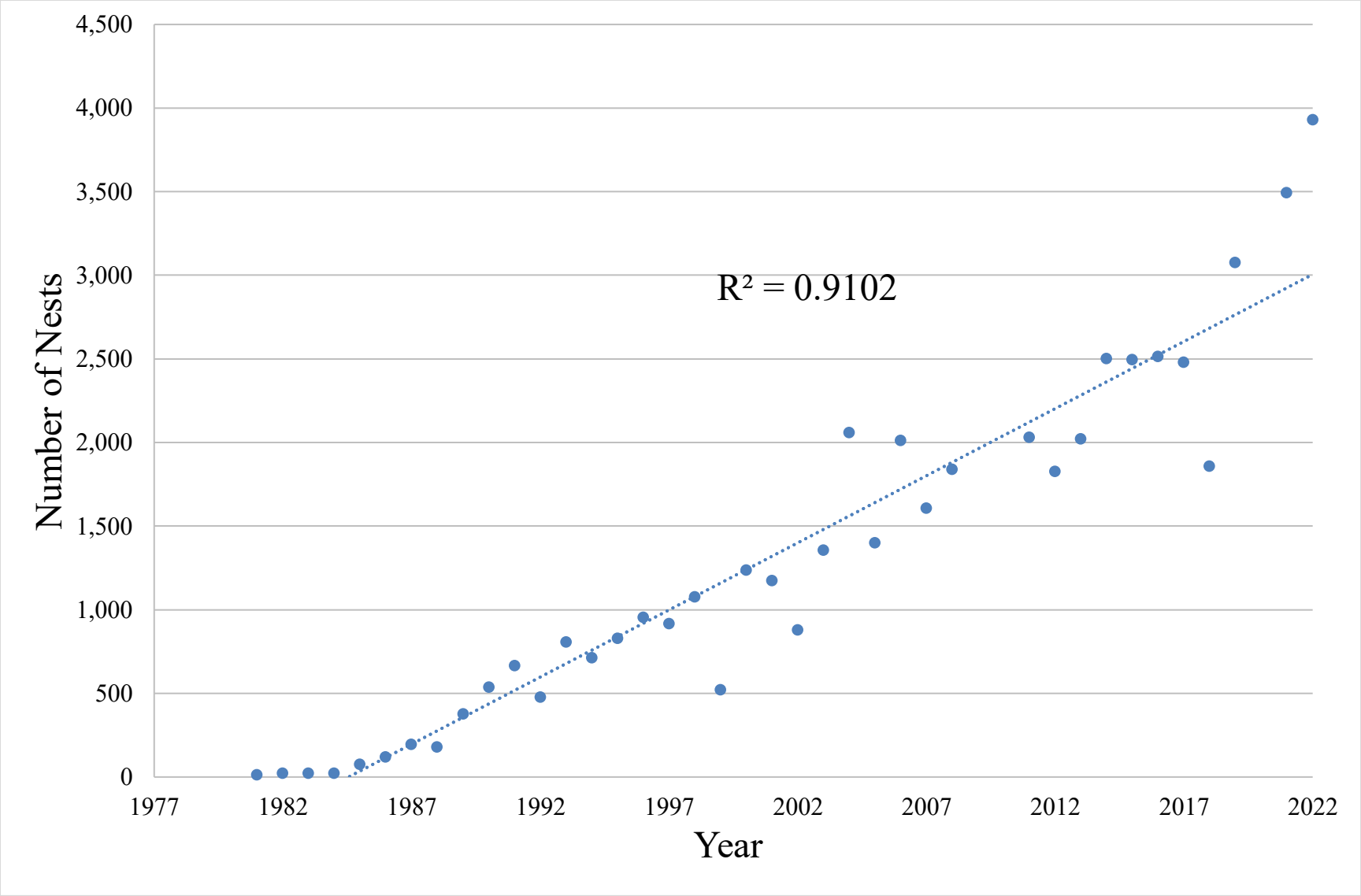

Figure 4. Linear regression of the number of Wood Stork (*Mycteria americana*) nests counted in South Carolina during annual censuses from 1981 – 2022.

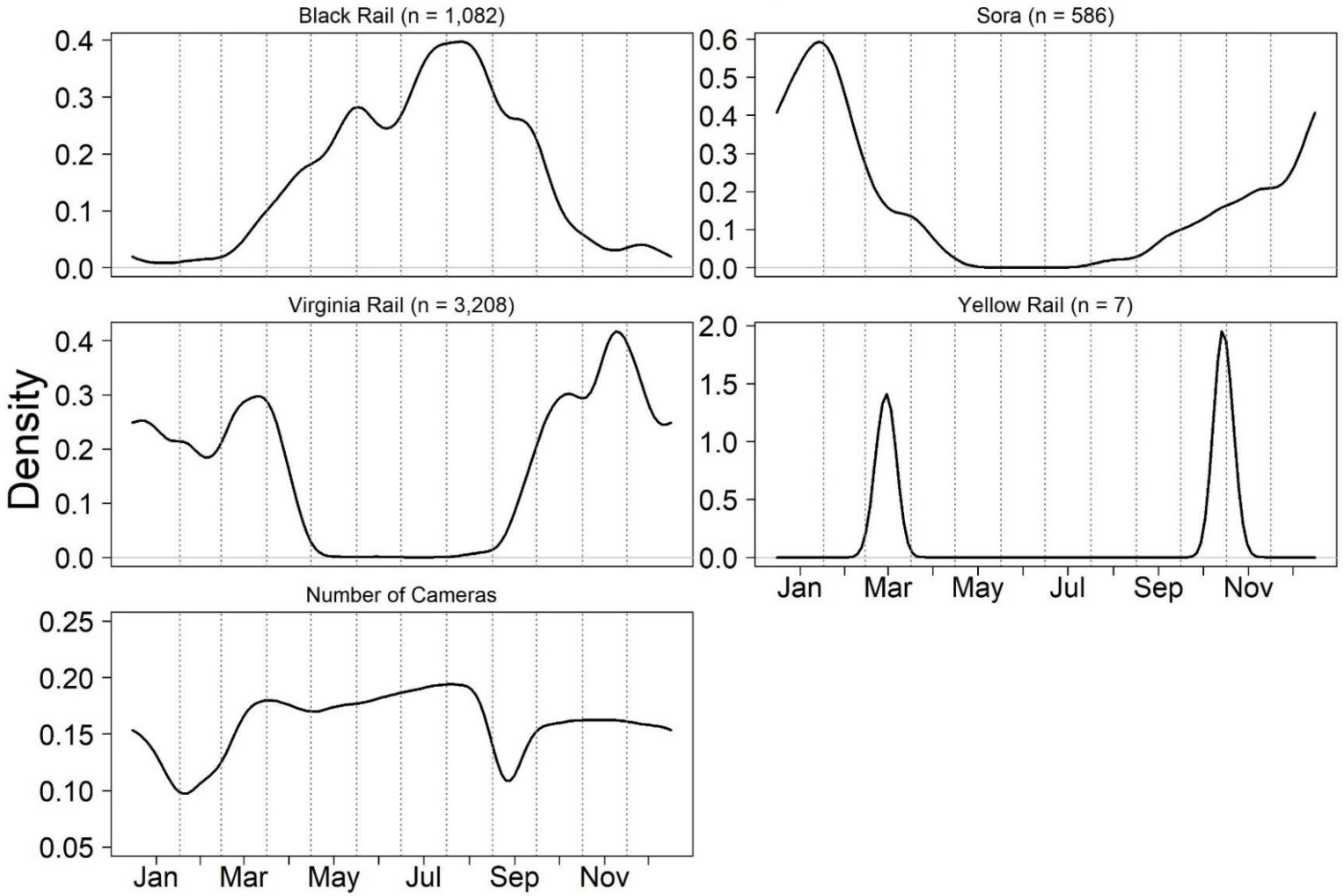

Figure 5. Comparison of seasonality of detections of Eastern Black Rails (*Laterallus jamaicensis jamaicensis*), Soras (*Porzana carolina*), Virginia Rails (*Rallus limicola*), and Yellow Rails (*Coturnicops noveboracensis*) in Colleton County, South Carolina during 2018 – 2020. Figures show the number of independent detections (detection events separated by 60 minutes) captured by camera traps and their respective time of year.

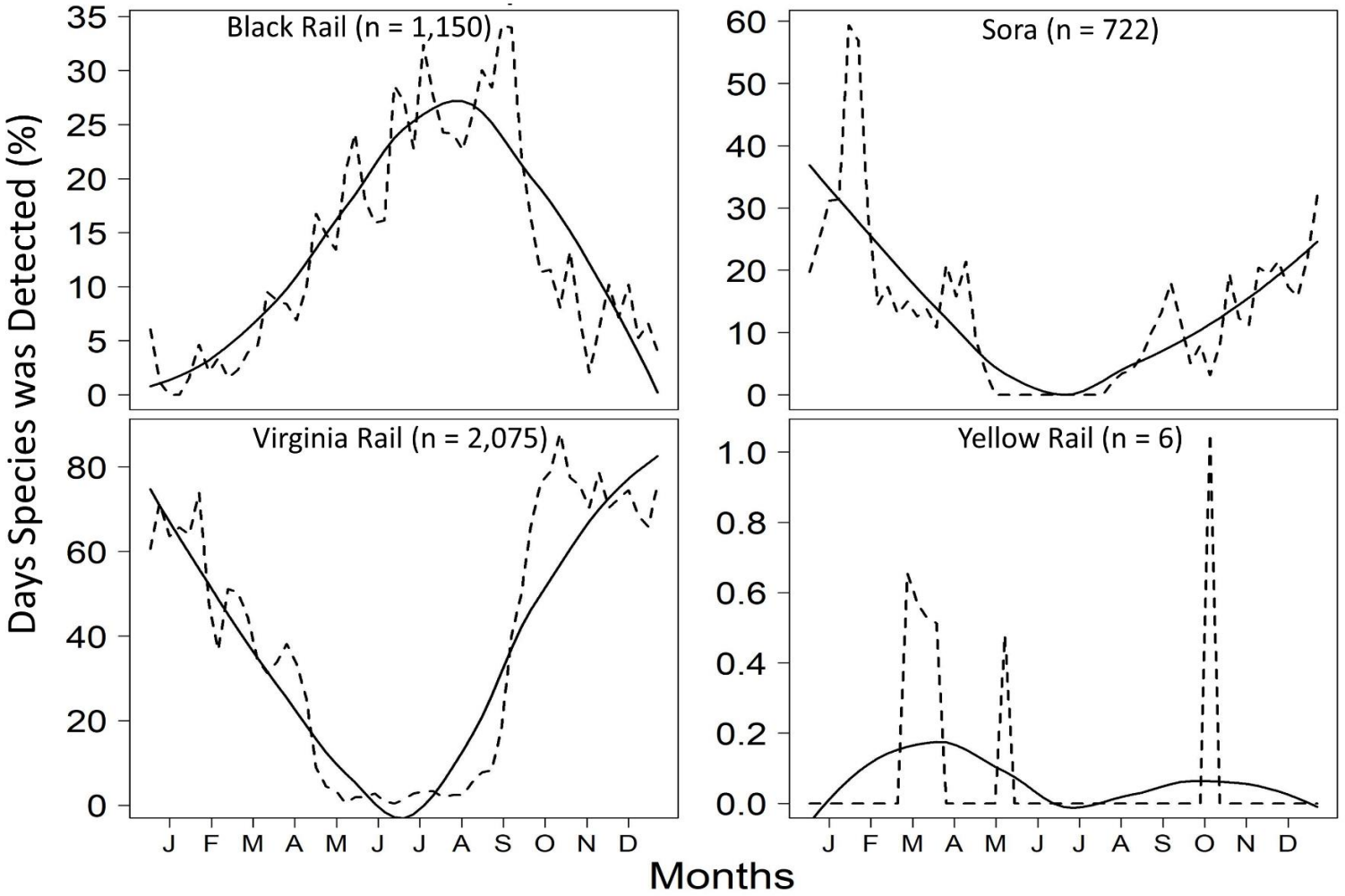

Figure 6. Seasonal occurrences of the Eastern Black Rail (*Laterallus jamaicensis jamaicensis*), Sora (*Porzana carolina*), Virginia Rail (*Rallus limicola*), and Yellow Rail (*Coturnicops noveboracensis*) in Colleton County, South Carolina. Arrays of five camera traps were deployed in two wetlands between October 2018 – September 2020. Detections are presented as a percentage of days a species was detected within each array divided by the cumulative number of days each array was active within the week to control for differences in sampling effort during the sampling period.

Table 1. Number of nests at all known seabird colonies in South Carolina for 2021 and 2022. 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	**2021 NESTS**	**2022 NESTS**
BLACK SKIMMER	**789**	**560**
CASTLE PINCKNEY	213	0
DEVEAUX BANK	490	90
KIAWAH ISLAND	20	0
NORTH CAPE ISLAND	0	66
WHITE BANKS	66	121
CRAB BANK	0	283
BROWN PELICAN	**5978**	**5332**
CASTLE PINCKNEY	670	323
DEVEAUX BANK	2190	2237
MARSH ISLAND	1080	1054
SKIMMER FLATS	2038	1718
TOMKINS ISLAND	0	0
COMMON TERN	**6**	**9**
WHITE BANKS	6	9
FORSTER'S TERN	**2**	**15**
MARSH ISLAND	2	15
GULL-BILLED TERN	**216**	**278**
CASTLE PINCKNEY	101	0
DEVEAUX BANK	45	28
KIAWAH ISLAND	12	0
MARSH ISLAND	23	0
CRAB BANK	0	192
WHITE BANKS	58	58
ROYAL TERN	**7163**	**6260**
CASTLE PINCKNEY	1030	947
DEVEAUX BANK	1203	2711
MARSH ISLAND	4930	2602
SKIMMER FLATS	0	0
TOMKINS ISLAND	0	0
SANDWICH TERN	**2775**	**2651**
CASTLE PINCKNEY	189	210
DEVEAUX BANK	138	643
MARSH ISLAND	2448	1798
SKIMMER FLATS	0	0
TOMKINS ISLAND	0	0

Table 2. Least Tern nests in 2021 and 2022 in South Carolina. Ground sites are natural beach nesting sites. Artificial sites are nesting sites such as flat gravel-covered roofs and dredge spoil islands. Success is defined by >50% of the nests in a colony surviving.

YEAR	# NESTS	GRD SITES	ART SITES	# SITES	SUCCESS	FAIL
2021	965	629 (65%)	336 (35%)	36	60%	40%
2022	1052	377 (36%)	675 (64%)	31	30%	70%

Table 3. Least Tern nesting in 2021 at 18 beaches and in 2022 at 16 beaches. 6 sites were in Cape Romain National Wildlife Refuge, a federally managed property. 11 sites were on state owned properties: North Island, Sand Island, South Island, North Santee Bar, Capers Island, Deveaux Bank (2 areas), and Botany Bay are managed by the South Carolina Department of National Resources, and Huntington Beach, Hunting Island, and Edisto Beach are managed by South Carolina State Parks. Lighthouse Inlet is part of the Lighthouse Inlet Heritage Preserve owned by Charleston County Parks. Morris Island is owned by the City of Charleston. Bull Point, Isle of Palms, Seabrook Island, and Kiawah Island are privately owned locations.

SITE NAME	LOCATION	2021 NESTS	2022 NESTS
Deveaux Bank	Deveaux Bank-N. Edisto R.	36	
Deveaux Bank	Sandbar	40	
White Banks	Cape Romain National Wildlife Refuge		5
Bulls Island	Cape Romain National Wildlife Refuge	5	7
N. Cape Island-north end	Cape Romain National Wildlife Refuge	8	30
N. Cape Island-south end	Cape Romain National Wildlife Refuge	119	83
N. Cape Island-midway	Cape Romain National Wildlife Refuge	45	11
Lighthouse Is.-midway	Cape Romain National Wildlife Refuge	42	
North Island	Tom Yawkey Wildlife Center		17
Sand Island	Tom Yawkey Wildlife Center	32	7
South Island	Tom Yawkey Wildlife Center	8	
North Santee Bar	North Santee River Inlet		19
Capers Bar	Capers Island	4	
Botany Bay	Botany Bay Plantation WMA		15
Huntington Beach	Huntington Beach State Park	35	12
Kiawah	Kiawah Is.-east end	125	

Seabrook Island	Seabrook Is.-north	12	
Hunting Island	Hunting Island State Park	36	62
Edisto Beach	Edisto Beach State Park	6	1
Morris Island	Morris Island		50
Lighthouse Inlet	Folly Island	20	16
Bull Point	Little Capers Island	48	12
Isle of Palms	50 to 51st Avenues Beachfront		30
Isle of Palms	Ocean Point	8	

Table 4. Least Tern nesting at 16 artificial sites in 2021 and at 15 sites in 2022. 16 sites are flat gravel-covered roofs; one site is a pier with gravel (Pier Romeo), one site is a gravel-covered dike around impoundments at an industrial site (INEOS), and 2 sites are dredge spoil islands.

SITE NAME	SUBSTRATE	2021 NESTS	2022 NESTS
Dunes Realty	Gravel Roof	8	20
Garden City Chapel	Gravel Roof	4	42
Pavillion Roof	Gravel Roof		15
Carolina Forest Kroger	Gravel Roof	54	
Horry-Georgetown Tech	Gravel Roof	46	40
Georgetown High School	Gravel Roof	6	16
Dollar Tree	Gravel Roof	34	
Century Aluminum	Gravel Roof	58	61
Pier Romeo	Adapted Pier	26	
4750/4760 Goer Drive	Gravel Roof	41	
INEOS	Gravel Dike	6	10
Myrtle Beach Resort	Gravel Roof	6	
Sun News	Gravel Roof	13	6
Mt Pleasant Belk	Gravel Roof	11	6
AT&T	Gravel Roof	16	5
Citadel Mall	Gravel Roof	1	25
Crescent Condos	Gravel Roof	6	11
Crab Bank	Dredge Spoil		107

Savannah Spoil Site-12A	Dredge Spoil		269
Tupperware Plant	Gravel Roof		42

Table 5. Numbers of Wood Stork (*Mycteria americana*) nests counted in South Carolina during April – May 2021 and Colony Outcomes determined during follow-up surveys during mid-June 2021. 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 old chicks and/or fledglings were observed during June follow-up surveys.

Colony Name	County	2021 Nest Count	2021 Outcome
Colony 01	Colleton	No Survey	
Colony 02	Colleton	No Survey	
Colony 03	Hampton	309	Successful
Colony 04	Colleton	0	
Colony 05	Colleton	No Survey	
Colony 06	Colleton	292	Successful
Dungannon Pltn HP	Charleston	154	Successful
Washo Reserve	Charleston	164	Successful
Colony 09	Hampton	No Survey	
Colony 10	Bamberg	225	Successful
Colony 11	Jasper	No Survey	
Colony 12	Georgetown	No Survey	
Colony 13	Horry	51	Successful
Colony 14	Berkeley	No Survey	
Colony 15	Colleton	No Survey	
Wannamaker County Park	Charleston	0	
Colony 17	Horry	No Survey	
Colony 18	Charleston	No Survey	
Colony 19	Georgetown	187	Successful
Colony 20	Colleton	284	Successful
Colony 21	Georgetown	299	Successful
Colony 22	Beaufort		
Colony 23	Charleston	212	Successful
Colony 24	Beaufort	0	
Donnelley WMA	Colleton	119	Successful
Hunting Island State Park	Beaufort	42	Successful
Colony 27	Horry	No Survey	
Colony 28	Charleston	172	Successful
Colony 29	Beaufort	0	
Colony 30	Jasper	53	Successful

Colony 31	Beaufort	0	
Pinckney Island NWR	Beaufort	0	
Colony 33	Horry	No Survey	
Colony 34	Beaufort	43	Successful
Colony 35	Charleston	39	Successful
Colony 36	Williamsburg	No Survey	
Colony 37	Jasper	No Survey	
Colony 38	Beaufort	62	Successful
Colony 39	Beaufort	53	Successful
Colony 40	Berkeley	No Survey	
Colony 41	Beaufort	0	
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	157	Successful
Colony 48	Horry	211	Successful
Colony 49	Berkeley	101	Successful
Colony 50	Charleston	42	Successful
Colony 51	Jasper	85	Successful
Colony 52	Beaufort	Not Found	
Colony 53	Beaufort	34	Successful
Colony 54	Beaufort	7	Failed
Colony 55	Beaufort	96	Successful
Statewide Total		3,493	

Table 6. Numbers of Wood Stork (*Mycteria americana*) nests counted in South Carolina during April – May 2022 and Colony Outcomes determined during follow-up surveys during mid-June 2022. 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 old chicks and/or fledglings were observed during June follow-up surveys.

Colony Name	County	2022 Nest Count	2022 Outcome
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	474	Successful
Dungannon Pltn HP	Charleston	169	Successful
Washo Reserve	Charleston	114	Successful
Colony 09	Hampton	0	
Colony 10	Bamberg	272	Successful
Colony 11	Jasper	0	
Colony 12	Georgetown	No Survey	
Colony 13	Horry	22	Successful
Colony 14	Berkeley	0	
Colony 15	Colleton	0	
Wannamaker County Park	Charleston	0	
Colony 17	Horry	0	
Colony 18	Charleston	66	Successful
Colony 19	Georgetown	374	Successful
Colony 20	Colleton	452	Successful
Colony 21	Georgetown	280	Successful
Colony 22	Beaufort	0	
Colony 23	Charleston	307	Successful
Colony 24	Beaufort	12	Successful
Donnelley WMA	Colleton	0	
Hunting Island State Park	Beaufort	48	Successful
Colony 27	Horry	0	
Colony 28	Charleston	173	Successful
Colony 29	Beaufort	0	
Colony 30	Jasper	17	Successful
Colony 31	Beaufort	0	
Pinckney Island NWR	Beaufort	0	
Colony 33	Horry	0	
Colony 34	Beaufort	50	Successful

Colony Name	County	2022 Nest Count	2022 Outcome
Colony 35	Charleston	41	Successful
Colony 36	Williamsburg	No Survey	
Colony 37	Jasper	0	
Colony 38	Beaufort	15	Failed
Colony 39	Beaufort	77	Successful
Colony 40	Berkeley	0	
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	278	Successful
Colony 48	Horry	225	Successful
Colony 49	Berkeley	129	Successful
Colony 50	Charleston	46	Successful
Colony 51	Jasper	128	Successful
Colony 52	Beaufort	3	Successful
Colony 53	Beaufort	63	Successful
Colony 54	Beaufort	7	Failed
Colony 55	Beaufort	84	Successful
Colony 56		2	Successful
Statewide Total		3,928	

Table 7. Summary of Wood Stork (*Mycteria americana*) nest monitoring data collected by South Carolina Department of Natural Resources staff and volunteers during 2021.

Colony Number and County	**Colony 6 Colleton**	**Colony 7 Charleston**	**Colony 20 Colleton**	**Colony 23 Charleston**	**Colony 34 Beaufort**	**All Monitored Colonies**
Ownership	Private	Dungannon HP	Private	Private	Private	
Total Number of Stork Nests in Colony*	292	154	284	212	43	**985**
Number of Monitored Nest Sites	79	24	34	28	26	**191**
Average Fledglings per Nest Site	2.42	2.10	2.55	2.25	2.26	**2.32**
Average Fledglings per Successful Nest Site	2.24	1.83	2.32	1.93	1.65	**2.05**
0 Fledglings	6	3	3	4	7	**23**
1 Fledgling	9	4	0	5	3	**21**
2 Fledglings	24	11	15	10	8	**68**
3 Fledglings	40	6	15	7	8	**76**
4 Fledglings	0	0	1	2	0	**3**
% SUCCESSFUL	**93%**	**88%**	**91%**	**86%**	**73%**	**88%**

*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 during 2022.

Colony Number and County	**Colony 6 Colleton**	**Colony 7 Charleston**	**Colony 20 Colleton**	**Colony 23 Charleston**	**All Monitored Colonies**
Ownership	Private	Dungannon HP	Private	Private	
Total Number of Stork Nests in Colony*	474	169	452	307	**1402**
Number of Monitored Nest Sites	113	52	112	69	**346**
Average Fledglings per Nest Site	2.34	1.94	2.20	2.20	**2.21**
Average Fledglings per Successful Nest Site	2.44	2.30	2.37	2.38	**2.38**
0 Fledglings	5	8	8	5	**26**
1 Fledgling	10	5	9	7	**31**
2 Fledglings	49	22	51	29	**151**
3 Fledglings	40	16	41	25	**122**
4 Fledglings	9	1	3	3	**16**
% SUCCESSFUL	**95%**	**85%**	**93%**	**93%**	**92%**

*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 2011-2021.

Year	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**All Years**
Number of Monitored Colonies	**2**	**7**	**9**	**8**	**7**	**7**	**6**	**4**	**6**	**4**	**5**	**4**	
Number of Monitored Nest Sites	81	311	427	396	415	322	232	153	262	138	191	346	3274
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	
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	
0 Fledglings	18	122	144	49	48	88	52	37	42	44	23	26	693
1 Fledgling	11	53	55	28	26	42	23	12	31	11	21	31	344
2 Fledglings	38	107	163	126	144	98	100	64	74	39	68	151	1172
3 Fledglings	14	28	59	163	168	73	51	39	95	39	76	122	927
4 Fledglings	0	1	6	30	29	21	6	1	20	5	3	16	138
% Successful*	77%	61%	66%	88%	89%	74%	79%	76%	84%	68%	88%	92%	79%

* 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.

Note: These data were collected as part of an ongoing monitoring project by the South Carolina Department of Natural Resources (SCDNR). Data are preliminary and may be revised. Please contact Christy Hand (handc@dnr.sc.gov) at SCDNR prior to using these data in reports or publications.