James C. Kennedy
WATERFOWL &
WETLANDS CENTER
CLEMSON® UNIVERSITY

2024
ANNUAL REPORT

James C. Kennedy
WATERFOWL &
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Message from the DIRECTOR

Understanding the ecology and management of waterfowl are fundamental to the mission of the James C. Kennedy Waterfowl and Wetlands Conservation Center. However, wetlands are also part of the Center's name, and in my opinion, understanding wetland ecology and management is critical to proper waterfowl management. Thus, my philosophy is to focus on waterfowl management issues while simultaneously taking a broader ecosystem and species assemblage approach to studying and conserving wetland habitats for waterfowl and other species.

While not all waterfowl studies contribute to the conservation of wetlands by conserving wetlands in an ecosystem framework, we also provide habitat for waterfowl. Wetland habitat destruction and deterioration have the most significant negative and longest-lasting impact on waterfowl. I like this quote from the prolific waterfowl biologist Milton Weller, "In the past, we have tended to manage for a specific bird because of interests such as hunting or aesthetic preference, but whatever the goals, processes that result in sustainable, self-maintaining wetlands should be a primary strategy." Thus, by understanding species assemblages, ecosystem processes, and the life history of the extended biotic community, we are also contributing to waterfowl conservation.

Funding is also central to the issues we study. I use the Kennedy Center endowment funding primarily to support research and student Fellowships on waterfowl projects. Financing for the numerous other studies we do comes from external sources, such as grants, contracts, and donations. Our team works diligently to apply for grants to support the work of our students. However, donations are also critical to our success, and we appreciate all who have donated over the past year. Please get in touch with me at jta6@clemson.edu or (304) 276-8956 if you wish to discuss a donation.

I hope you enjoy reading the articles about our students and their fantastic work. I am proud of their accomplishments and our progress over the past three years, and I look forward to an even more productive year ahead for waterfowl and wetland conservation.

Take care,

James T. (Jim) Anderson, Ph.D.

Director, James C. Kennedy Waterfowl and Wetland Center
James C. Kennedy Endowed Professor of Waterfowl and Wetland Ecology

Summer INTERNSHIP

Exploration of the Relationship Between Diet and Mercury Accumulation in the American Alligator (*Alligator mississippiensis*)

Colin Baker
Junior, Wildlife & Fisheries Biology
James C. Kennedy Waterfowl & Wetlands Conservation Center

My name is Colin Baker, and I am a Junior at Clemson University. I am on track to complete my B.S. in Wildlife and Fisheries Biology with a minor in Political Science in May 2026. This summer, I worked alongside Miriam Boucher in Clemson's Creative Inquiry (CI) program, researching microplastics in the diets of the American Alligator from South Carolina. The CI program allows undergraduate students to work on research projects with Professors or Ph.D. students at Clemson. Miriam's project looks at microplastics and forever chemicals (PFAS) that end up in the diets of alligators across the Southeastern United States. Most of my research this summer has been lab work, where I have dissected the stomachs of SC Alligators and collected samples of rinsate to test for microplastics and PFAS.

However, some of my time this summer has been spent in the field collecting diet samples through gastric lavages. We also collected length measurements of the body, tail, and tail girth, as well as blood and muscle samples. Doing this requires the Alligators to be caught and restrained so that they do not harm Me, Miriam, or anyone else who may have been helping with catches. Once all of the measurements and samples have been collected, we then release the Alligators back where they were initially caught. Working for the CI program and alongside Miriam has helped with my confidence in multiple professional abilities, giving me the opportunity to get hands-on experience with research. I have learned a lot about field equipment techniques from Miriam and would feel confident enough to lead my own team in catching Alligators for research purposes.

I plan to pursue a career in Environmental Law, working towards sustainability goals for future generations. The way humans currently treat this planet and the environment is lacking heavily, and I look to change that. Maybe I can even work towards limiting the amount of Microplastics and PFAS that enter our ecosystems; who knows? What I do know is that I am super grateful for the opportunity that I have had this summer, the Creative Inquiry program for allowing undergraduate students to participate in projects such as this, and for Miriam Boucher, allowing me to work alongside on this project and learn so many new things and experiences that I can take with me in the future ahead.

Summer INTERNSHIP

Wildlife and Wetland Conservation Research in South Carolina Coastal Wetlands

Jeyda Bolukbasi
Junior, Environmental and Natural Resources
James C. Kennedy Waterfowl & Wetlands Conservation Center

My name is Jeyda Bolukbasi, and I am currently a third-year student pursuing a Bachelor of Science degree in Environmental and Natural Resources with a concentration in Conservation Biology at Clemson University. I anticipate completing my degree in May 2027.

I chose this internship because I wanted to expand my expertise in environmental conservation and discover if this aligns with my educational and career aspirations. Since childhood, I have held a keen interest in birds, making the internship's focus on waterfowl conservation particularly compelling to me.

During my internship, I had the opportunity to assist a graduate student on a research project studying Banana Water Lily (*Nymphaea mexicana*) in saline coastal South Carolina wetlands, with a focus on how the plant affects wintering and migrating waterfowl. We used field plots and exclosures to study the productivity and reproduction of Banana Water Lily under varying conditions, evaluated waterfowl and invertebrates within the field site, and determined the nutrient content of various parts of the plants under different growing conditions and within different populations. I also had the opportunity to work with Ph.D. student Miriam Boucher on her project studying how regional alligator diet and utility can be used as indicators for microplastics and other contaminants within ecosystems. I assisted her with the trapping, handling, and processing of alligators, as well as sorting and identifying items within diet contents. During the handling of the alligators, I assisted with data collection, such as measurements and tagging.

Throughout the summer, I learned how to conduct plant field sampling and data collection. I sampled plants and collected water temperature, salinity, turbidity, and pH. I also learned how to handle alligators, measure them, collect data from them, and conduct stomach flushing. Some of the equipment that I learned to use included a refractometer, field observation cameras, and more about driving and managing a boat.

This internship has taught me so much about what it is like to work in the field of natural resource conservation and research. Not only have I had some of the most amazing and memorable experiences of my life, but I have also learned more about myself and what kind of career I want. My future goals include earning an M.S. in environmental conservation and a Ph.D. in a more specific field of natural resources conservation, possibly ornithology. I am so thankful to have had the opportunity to learn and experience everything I did in the summer of 2024!

Summer INTERNSHIP

Exploration of the Relationship Between Diet and Mercury Accumulation in the American Alligator (*Alligator mississippiensis*)

Sabrina Drescher
Senior, Bachelor of Science in Wildlife & Fisheries Biology
James C. Kennedy Waterfowl & Wetlands Conservation Center

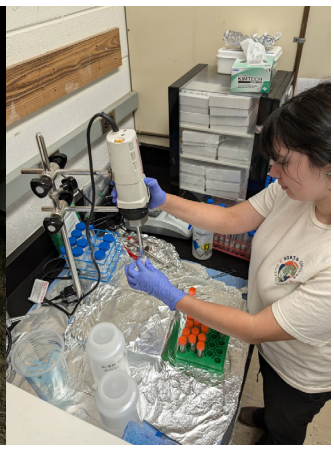
My name is Sabrina Drescher; I am currently a Senior at Clemson University, graduating in Fall 2024 with a B.S. in Wildlife & Fisheries Biology. Miriam Boucher mentors the Summer CI + UR Program further to explore American Alligators and their diets and mercury concentration. My primary focus for my study this summer included analyzing Texas, North Carolina, and Mississippi alligators and investigating contaminations in relation to diet and mercury concentration. Within this study, I will also be investigating relationships between mercury contamination and alligator sizes, diet, and their habitats. Over the summer, I continued learning various lab skills, including dissecting stomachs, conducting necropsies, and processing blood using a mercury analyzer. Within the field, I continued learning how to capture alligators, conduct blood draws, stomach flush, muscle biopsy, and gather morphometrics. This internship has continued to increase my knowledge of alligators and assist me in learning new field techniques. My future goals are to attend veterinary school to become a wildlife veterinarian and focus on researching pathology within birds of prey.

Summer
INTERNSHIP

Exploration of the Relationship Between Diet and Mercury Accumulation in the American Alligator (*Alligator mississippiensis*)

Sophia Corey
Senior, Wildlife and Fisheries Biology
James C. Kennedy Waterfowl & Wetlands Conservation Center

I am a rising senior in the Wildlife Biology program at Clemson University. I have been a part of Miriam Boucher's creative inquiry project, Belly of the Beast: Diet and Microplastics in the American Alligator, since the 2023 Fall semester . This past summer, I decided to become her UPIC intern, continuing the same research. I enjoyed my time in the Creative Inquiry, and I wanted to continue the opportunity to work with Miriam. Some of what I did this summer was a continuation of what I did throughout the semester, but there were some new aspects as well. The first half of my internship was going through alligator stomach content in the lab. I would weigh and categorize larger diet content. These data will be used to compare the diets of each state. Whatever was not large enough to be picked out was put through a 25µm sieve. We would save what did not sieve into a Whirlpak to be later analyzed for microplastics. I also had the opportunity this summer to travel to the University of Florida's PFAS (Per- and polyfluoroalkyl substances) lab. I got to work in a lab and examine the concentration of PFAS in alligators via muscle biopsies taken from the alligator.



In the field, we captured live alligators. I aided in a few captures. This experience helped me develop teamwork skills and work under pressure while prioritizing safety. When capturing, we would use wire noose capture poles and dog poles. Once captured, I was able to take measurements on live alligators, take blood from alligators, take muscle biopsy punches and scute clips, and perform a stomach lavage. This summer was the first time I was able to perform a stomach lavage, and before this summer, I had only done the previous procedures a few times. I am now confident in every step. I've also had the opportunity to take on my mini-project. I've been examining oral leeches found within alligator mouths. By the end of summer, I should have a paper together showing my findings.

This internship has taught me a lot about working with alligators or any crocodilian species. I hope to continue studying herpetology in the future. I have close to a year of experience working with alligators and have worked a field season with them. This summer, I've also developed some independence in research as I oversaw my own schedule in the lab and had the opportunity to perform independent research. After this internship, I will have a lot to add to my resume.

Research
ABSTRACT

Quantifying Habitat Use by Secretive Marsh Birds in Antebellum Rice Fields Using Drones and Autonomous Recording Units in Coastal South Carolina

Akshit R. Suthar
Doctoral Student, Clemson University
James C. Kennedy Waterfowl and Wetlands Conservation Center

Image 1: Deploying and retrieving ARUs mounted on top of a designed multi-terrain lightweight floating platform in inaccessible areas using a drone.

Secretive marsh birds, such as rails, bitterns, and gallinules, are notoriously elusive and well-camouflaged, presenting significant challenges for study using traditional methods. These birds inhabit dense vegetation in wetland habitats, making observation and study difficult. Antebellum (pre-U.S. Civil War) rice field impoundments provide essential habitat for many species of secretive marsh birds in coastal South Carolina. These rice fields, developed between the 1600s and 1800s, were primarily managed by the labor of enslaved people during the colonial era. Rice culture declined post-Civil War, and recent mapping efforts show it spans about 95,000 hectares. Currently, many of these fields are primarily managed for wintering waterfowl. Recent studies suggest constant water level management creates higher sites within an impoundment and can develop patches of saltgrass, clump cordgrass, and salt meadow cordgrass (*Distichlis spicata, Sporobolus bakeri, and Sporobolus pumilus*), providing suitable cover and nesting habitat for secretive marsh birds.

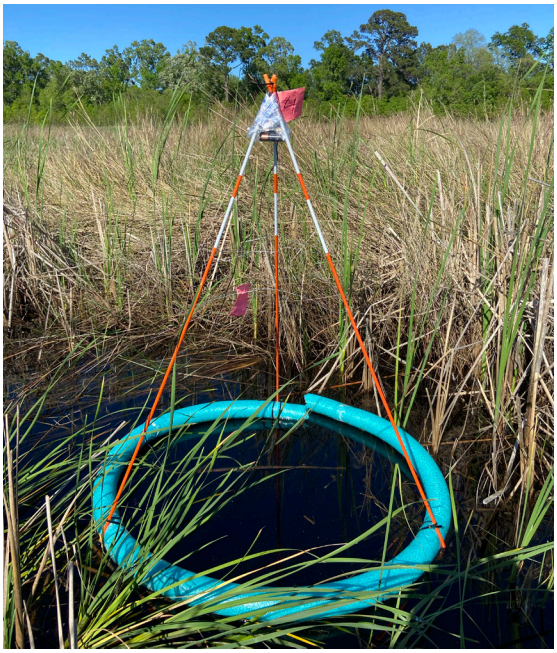


Image 2: Successfully deployed ARUs with a multi-terrain lightweight floating platform, ready to record marsh birds.

Our research aims to 1) quantify habitat use by these birds within the antebellum rice fields of coastal South Carolina and 2) Design innovative techniques for monitoring them. We employed Autonomous Recording Units (ARUs) for Passive Acoustic Monitoring (PAM) to capture the call activities of secretive marsh birds. ARUs are less invasive and reduce time and labor costs. We used Audiomoth recorders to monitor king rail (*Rallus elegans*), clapper rail (*Rallus crepitans*), Virginia rail (*Rallus limicola*), sora (Porzana carolina), black rail (*Laterallus jamaicensis*), American bittern (*Botaurus lentiginosus*) and least bittern (*Ixobrychus exilis*) during their breeding season from March to mid-June when they are notably more vocal. Our recording schedule involved capturing audio for one minute every three minutes from 5:45 PM to 9 AM for three days, aligning with the peak activity periods of the focal species.

Image 3: ARUs deployed using kayaking and on foot-based traditional methods in approachable areas.

We developed a low-cost methodology using drones to deploy and retrieve ARUs mounted on lightweight, multi-terrain floating platforms from inaccessible areas. This approach aimed to overcome the limitations of traditional deployment methods, such as data bias from unapproachable large managed and unmanaged rice field impoundments. We maintain a 200-meter distance between each ARU, effectively covering entire habitats with less time, effort, and human resources. This method allowed us to deploy ARUs in the center of impoundments and far, inaccessible and less disturbed areas, which are crucial for monitoring potential habitats of species like the black rail.

Image 4: Typical federally endangered black rail habitat with high marsh and dense vegetation cover within antebellum rice fields.

Image 5: King rail crossing impoundments via managed rice field dikes.

For data analysis, we utilized the open-source Artificial Intelligence model called BirdNet, developed by Cornell Lab. Data recorded in *.wav* format was fed into the model, which analyzed each three-second spectrogram against eBird checklists and BirdNet algorithms, providing species identification with confidence intervals. Last season, we deployed 130 ARUs, surveyed 29 rice field impoundments, recorded approximately 119,000 files, and logged around 2,000 hours of recordings. Moving forward, we plan to expand our survey efforts, double the number of impoundments surveyed, and analyze the collected data to understand better the habitat use and preferences of secretive marsh birds in these historically significant landscapes.

Image 6: Least bittern spotted in a managed rice field canal.

This research underscores the importance of integrating advanced technologies, like drones and ARUs, in secretive marsh bird monitoring and conservation. The innovative methodologies developed here enhance our understanding of secretive marsh bird populations and offer scalable habitat monitoring solutions in challenging environment.

Image 7: Virginia rail image captured by drone in the middle of a managed rice field impoundment.

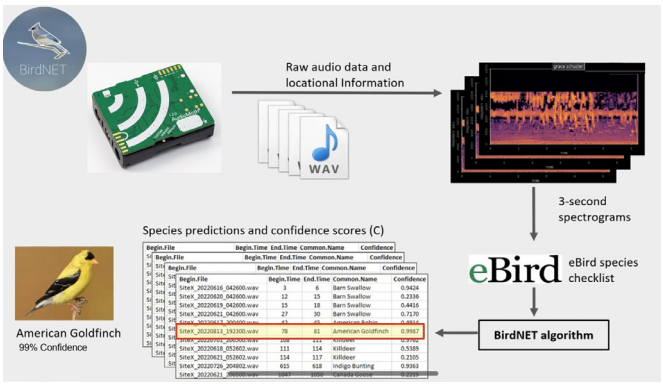


Image 8: Data analysis process flowchart using the BirdNET AI model.

Research
ABSTRACT

Understanding Waterfowl Habitat Relations with Antebellum Rice Fields Using Drones in Coastal South Carolina

Akshit R. Suthar
Doctoral Student, Clemson University
James C. Kennedy Waterfowl and Wetlands Conservation Center

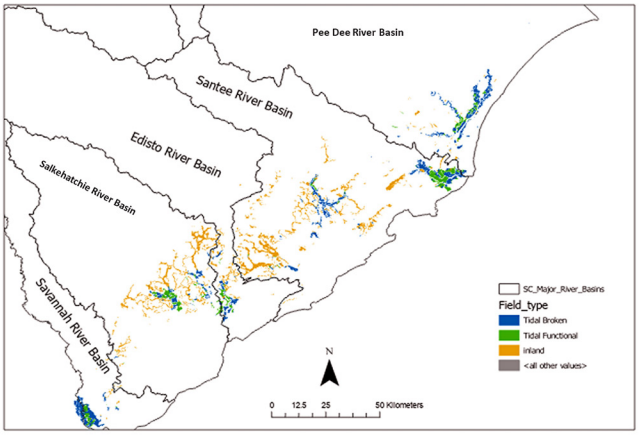


Figure 1: Map showing the location and geographic extent of identified antebellum rice fields in South Carolina.

Coastal South Carolina's antebellum (Pre-Civil War) rice field impoundments play a crucial role in waterfowl conservation. The cultivation of rice began in the 1600s, deeply intertwined with the history of enslavement and the transatlantic enslaved laborer trade. Enslaved Africans brought their knowledge and technologies of rice cultivation from West Africa to colonial South Carolina, constructing extensive dikes and canal systems by hand to create rice field impoundments. These transformations converted tidal swamps and hardwood bottomland forests into highly managed agricultural systems. Although rice cultivation declined post-Civil War, the loss of labor as former enslaved persons were freed, and subsequent hurricanes and tropical storms caused extensive damage to the agricultural rice areas. Attempts to rebuild were unsuccessful due to costs, other factors, and increasing market competition from rice produced in Texas, Louisiana, and Arkansas. Today, approximately 95,000 hectares of antebellum rice fields are mapped and categorized as Tidal Functional, Tidal Broken, and Inland (Figure 1), with many managed for waterfowl. This habitat faces significant threats from sea level rise and climate change, exacerbating the degradation of rice field infrastructure through increased tidal amplitudes and more frequent tropical storms (Figure 2). There is ongoing debate about the impact of impoundments on wetlands and waterfowl habitats. Some argue that managed impoundments are more beneficial, while others believe that tidal wetlands would suffice if impoundments didn't exist. This highlights the complexity of conservation planning. Recent research underscores the high value of antebellum rice field impoundments for waterfowl. Accurate quantification of waterfowl utilization, along with understanding the biological and environmental factors driving high abundance, is essential for efficient conservation, management, and restoration of these habitats.

Figure 2: Damaged earthen dike and wooden trunk due to sea level rise and tropical storm events.

Drones are increasingly utilized in wildlife surveys, providing an aerial perspective of the landscape and overcoming accessibility and visibility challenges, which can be particularly limiting in waterfowl surveys. Our objectives were to 1) estimate waterfowl abundance by species and guilds within these rice fields using drone 2) investigate the relationships between waterfowl and impoundment characteristics, such as average water depth and vegetation types, to understand habitat preferences 3) evaluate the efficacy of drones for future waterfowl research. We conducted preliminary surveys at the Tom

Yawkey Wildlife Center, Georgetown, during February and December 2023, utilizing a DJI Mavic 3T enterprise drone (Figure 3). We conducted aerial surveys of Tidal Functional rice field impoundments (N=2) (Blackout and Penfold) to estimate waterfowl abundance and species richness and collected high-resolution images of impoundments for modeling habitat characteristics using an ArcGIS Deep Machine Learning model. We conducted a traditional ground-based survey to compare both methodologies to count waterbirds.

Figure 3: DJI Mavic 3T drone with RGB and thermal camera.

Our findings reveal that the total average waterbird counts obtained from drone surveys were significantly higher, with an average of 2,202 birds counted. This is 347.21% higher compared to the average of 492 birds counted during ground surveys (Figure 4). Additionally, drone surveys were able to identify an average of 12 species, which is 8.7% higher than the 11 species identified through ground surveys (Figure 5). Our study demonstrates the effectiveness of drones for accurately identifying and quantifying waterbirds compared to ground surveys, especially in areas with large bird populations.

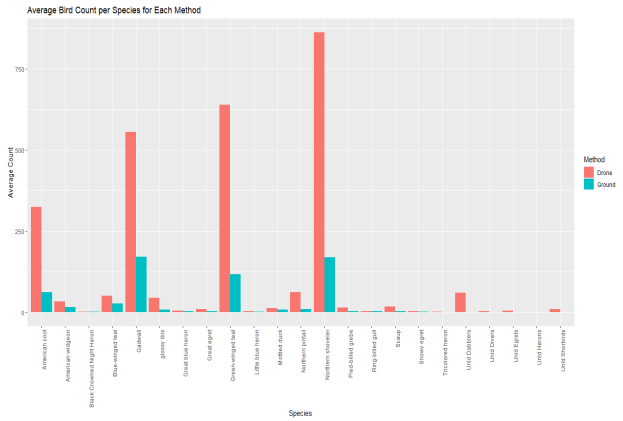


Figure 4: Graph compares the average species-wise waterbird mean counts by drone-based aerial and traditional ground survey methods.

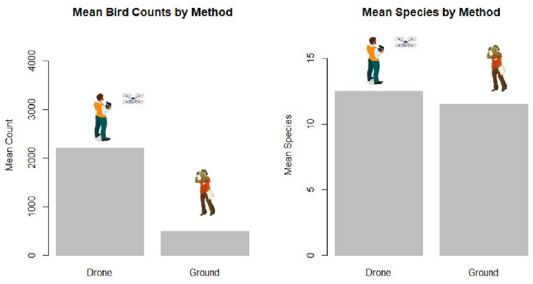


Figure 5: Graphs show mean total average waterbird counts and species richness obtained from drone-based aerial and traditional ground survey methods.

Using ArcGIS Deep Machine Learning model, we classified and categorized impoundments in emergent and submerged vegetation, open water, and dikes. Kernel density estimation was used to analyze waterbird habitat selection, while Poisson regression models determined the impact of impoundment's hydrological variables on waterfowl abundance (Figure 6). We found % submerged vegetation has a strong positive impact on waterfowl abundance across all species. % open water has positive impact with varying significance, average water level (cm) has positive impact with varying significance, % emergent vegetation has small or non-significant impact and, impoundment size (ha) has less clear impact, with some species showing negative or non-significant effects (Figure 7)). Integrating thermal and RGB images improved detection probabilities (Figure 8), demonstrating the added benefits of thermal imaging for waterfowl surveys. Our study underscores the importance of antebellum rice field impoundments in maintaining waterbird habitats and provides essential insights for conserving, managing, and restoring antebellum rice fields by focusing on key habitat features crucial for supporting waterbird populations. emphasize the need for advanced management strategies to conserve these critical waterfowl habitats amidst ongoing environmental changes.

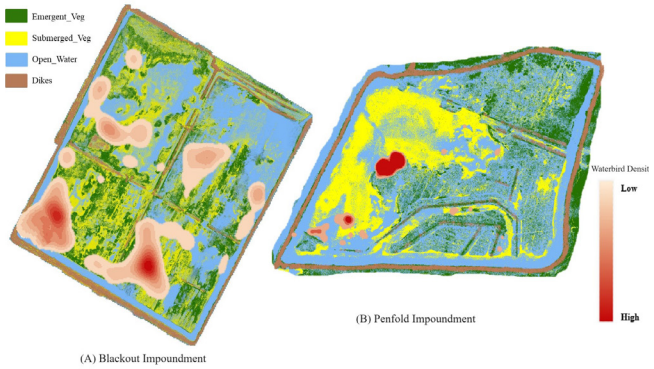


Figure 6: Maps shows impoundment habitat classification using deep machine learning and Kernel density estimation to understand waterbird habitat selection within impoundments.

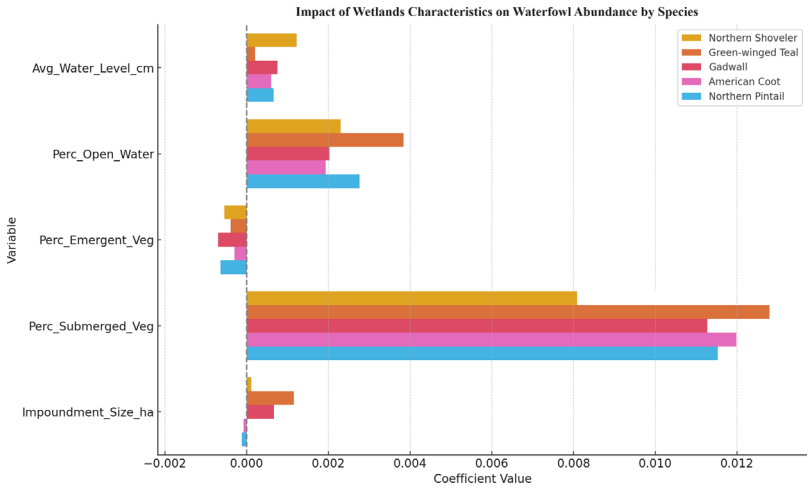


Figure 7: Graph shows the impact of impoundment's hydrological characteristics on selected species' abundance.

Figure 8: Integration of thermal images with RGB images to improve detection probability.

Research
ABSTRACT

Mercury Accumulation in Wetland-Dependent Birds Within the Bento Gomes River Watershed in the Northern Pantanal, Brazil

Aruã Yaym de Castro Ferreira
M.S. Student, Clemson University
James C. Kennedy Waterfowl and Wetlands Conservation Center

South America's Pantanal is one of the world's most extensive contiguous freshwater wetlands, spanning 160,000 km² (39.5 million acres). Consequently, its ecosystem services significantly contribute to climate regulation on a local and global scale and are dependent on the biodiversity that is a result of this biome's unique flood pulses. The Pantanal intersects Brazil, Bolivia and Paraguay, with Brazil's share (Fig. 1) accounting for approximately 80% or 140,000 km2 (35.5 million acres). Since the colonialists arrived in the Pantanal approximately 250 years ago, numerous threats, including deforestation, pollution, wildfires, and poaching, have impacted it. However, the consequences of historic gold mining have been ignored over the past 25 years. In the 1990s, researchers identified high levels of mercury in the Pantanal at different trophic levels (Lacerda et al., 1991a; Lacerda et al., 1991b; von Tümpling Jr et al., 1995; Alho & Vieira, 1997; Filho & Maddock, 1997). In recent decades, studies such as May et al. 2018 found high levels of mercury accumulation in the fur of jaguars (*Panthera onca*) in the Pantanal. The studies in the 1900s led to policies that outlawed the use of mercury in gold mining, but as May et al. (2018) displayed, mercury still lingers in the landscape. Thus, it is of utmost importance to investigate the mercury concentrations in the Pantanal.

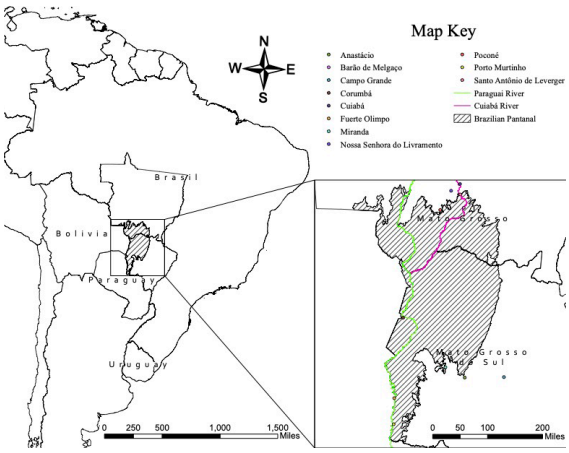


Figure 1

The largest concentration of gold mining takes place within the Bento Gomes River watershed (Fig. 1.1), where 7,463 hectares (18,441 acres) are impacted according to the latest estimate by the MapBiomas Brazil. Sitting on the northernmost edge of the Pantanal, the Bento Gomes River watershed is the best representative for evaluating mercury bioaccumulation in the Pantanal. Our goal is to determine the degree of mercury accumulation in wetland-dependent birds in the northern Pantanal, trace its geographic source, pinpoint its position in the trophic level and food web, and correlate mercury concentrations in water, sediment, and birds.

We will use birds as bioindicators because they are found higher in the trophic levels, are exposed to a wide range of chemicals, are susceptible to bioaccumulation, and are geographically widespread. To achieve our goal, we will capture wetland-dependent birds of the Anseriformes, Charadriiformes, Gruiformes, Pelecaniformes, Podicipediformes, and Suliformes clades in properties that

are along the Bento Gomes River watershed mainstream; collect and estimate mercury accumulation in the water and soil/sediment of habitats where birds were captured; define prey items consumed by the species of interest via literature review, direct observations, and DNA fecal analysis; collect and estimate mercury accumulation in the prey items consumed by the species of interest; utilize spatial analysis and the project's data set to determined potential sources of mercury accumulation and model Hg concentrations throughout the watershed. The study area and our species of interest, combined with the other variables collected in this project, can provide us with great insight into the current state of mercury bioaccumulation in the Pantanal.

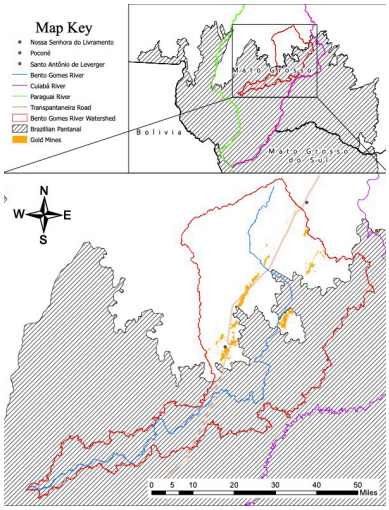


Figure 1.1

We expect Hg bioaccumulation in birds, water, soil/sediment, and prey items to exceed the accepted thresholds. Specifically, piscivorous bird species, which occupy higher trophic levels, are anticipated to exhibit significantly higher Hg concentrations than herbivorous and omnivorous species. Birds showcasing elevated Hg levels in their feathers will show signs of compromised health. Finally, Hg levels in birds are expected to correlate highly with Hg concentrations in the surrounding soil/sediment and water.

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Research
ABSTRACT

What is a Successful Head-start Program? Investigating Head-start Methods and Life History of American Crocodile (*Crocodylus acutas*) to Improve Management Techniques of Declining Crocodilian Populations

Bobby Greco
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James C. Kennedy Waterfowl and Wetlands Conservation Center

Crocodilians suffered global declines due to overhunting and habitat loss throughout the 20th century. Legal protections and conservation management plans were implemented for many crocodilian species, with some, such as American alligators (*Alligator mississippiensis*) and the Indo-Pacific crocodile (*Crocodylus porosus*), experiencing successful recovery. Various conservation management methods have been used on crocodilians to increase population numbers. Head-start has been used with many species of crocodilians worldwide.

Though there have been many different crocodilian head-start programs globally, little information is available in the literature. In most of the literature, the methods of head-starting are not detailed and, therefore, hard to replicate. Additionally, only a few accounts in the literature assess the head-start's success quantitatively. Furthermore, head-starting is rarely the central theme of the papers available. However, recovery and management programs for *C. acutus* in the Caribbean could provide valuable information to fill knowledge gaps on head-starting crocodilians.

The American crocodile (*Crocodylus acutus*)is a sizeable neotropical crocodile that occurs from the southern tip of Florida down into the Greater Antilles and the Caribbean and Pacific coasts of Mexico, Central America, and northern South America. *Crocodylus acutus* is predominately a coastal species that inhabits a variety of freshwater, brackish, and marine habitats, including estuarine sections of rivers, freshwater lakes, and reservoirs, mangrove swamps, coastal lagoons, offshore islands, and atolls. The IUCN lists *C. acutus* as "Vulnerable," and the Convention on Trade in Endangered Species of Flora and Fauna (CITES) lists them under Appendix I (Rainwater et al., 2021). Though IUCN reports that the overall population trend is increasing, many populations throughout the range are still declining and threatened with extirpation due to overhunting, pollution, and habitat loss and degradation (Rainwater et al., 2021). In the Caribbean, multiple species recovery projects have been implemented using head-starts or captive breeding in their recovery plans for *C. acutus*.

One population of *C. acutus* that is declining and threatened with extirpation is in Lago Enriquillo, Dominican Republic. Population surveys conducted by Greco et al. (2023) found that there were likely only 40–60 breeding adults left in a population that used to have 300–600 breeding adults in the 1970s and 1980s (Schubert and Santana, 1996). These findings made key stakeholders reconsider the long-term management plan for *C. acutus* in Lago Enriquillo. The Dominican Ministry of Environment and Natural Resources (MENR) and its collaborators decided that a head-start program would be beneficial for increased recruitment and population recovery. The implementation of a head-start program in Lago Enriquillo has provided us with a unique opportunity to research head-start individuals, their *Ex-situ* environments, and the natural system into which they will be released.

We are investigating the various methods that have been used for crocodilian head-start programs, different methods of quantifying success, some of the challenges that come with head-start and set some general research recommendations for managers to consider before deciding if head-starting is the proper method for population recovery. Specifically, the goals of our project are to: 1) do a literature review on crocodilian head-start programs to provide the various methods of head-start, methods of quantifying success pre- and post-release, and general management recommendations; 2) identify and quantify *Ex-situ* techniques that prove successful on head-start individuals with *C. acutus* from Lago Enriquillo; 3) conduct *In-situ* research on resource selection, home range selection, ecotoxicology, and community dynamics with wild *C. acutus* in Lago Enriquillo (with an emphasis on individuals from the same cohort as head-start individuals) to provide critical life history information, prioritize areas best suited for releasing head-started individuals, and optimize captive conditions for head-start crocodiles; 4) and analyze data to elucidate which techniques work best for head-start, quantify head-start success, and reveal *In-situ* patterns of crocodiles in Lago Enriquillo with consideration for long-term management.

We recently finished our first field season in June 2024. We collected Head-start crocodile hatchlings, administered an initial health assessment, placed them in enclosures, and monitored them daily. Simultaneously, we conducted two nocturnal eyeshine surveys by boat (one in May and one in June), captured four crocodiles and performed gastric lavage to analyze diet, collected blood and scute samples for mercury analysis, and conducted bird and aquatic biodiversity surveys. Currently, we are analyzing our data with plans to have preliminary results by the Fall 2024 semester.

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Research
ABSTRACT

Will Oysters Improve Restoration Outcomes at a Little Edisto Island Salt Marsh?

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Oysters are one of the most prevalent sessile organisms on the eastern seaboard of the United States. Oyster beds can be deployed in areas experiencing rapid shoreline erosion, but they are not a permanent fixture of coastal mitigation banks. Stakeholders are interested in the contributions of oysters to meeting restoration goals in coastal habitats, such as improvements in water quality and providing habitat structure for wildlife. Research is needed to understand better the impacts of incorporating oysters into salt marsh restoration. Christopher is investigating how the addition of oyster structures (wooden stakes, wireframes) to salt marsh restoration sites can enhance habitat quality and provide economic benefits to the site. Examples of these ecosystem services include providing habitat for fish and invertebrates (which provides food for aquatic birds) and biofiltration (for which they are interested in nitrate and phosphate reduction).

Christopher's primary research objectives are:

1. Calculate rates of biofiltration of oysters at the restoration site and compare it with rates observed at reference sites (those with oyster reefs and those without)
2. Determine the spatial extent across which we observe the benefits of oyster ecosystem services (biofiltration and habitat provision)
3. Record changes in community composition of fish and invertebrates at the restoration site following the addition of oysters to the site. Compare these communities with those seen at reference sites with varying oyster density.
4. Determine how oyster abundance at the restoration site impacts habitat usage from waterfowl, shorebirds, and wading birds.
5. Compare the recruitment and growth rates of oysters on different substrate types introduced to the restoration site.

Christopher's hypotheses for each research objective are:

1. The concentration of phosphorus and nitrate is lower at reference sites with a higher density of oysters. The concentration of phosphate and nitrate will decrease following the addition of oysters to the restoration site.
2. The spatial extent of oyster ecosystem services at the restoration site will be much lower when compared to sites with well-established oyster reefs within the time frame of the study. If the site were monitored for a more extended period (ten years or more), we would likely see a more significant overall effect of oyster addition.

3. Fish and invertebrate community composition at reference sites with high oyster density will be different from sites with low oyster density. The current community assemblage of the restoration site will be closer in composition to reference sites with low oyster density. As they continue to monitor the impoundments following the addition of new oyster cultch (shell, stone, or other structures that support oyster recruitment), Christopher expects that the biotic communities (invertebrates and fish) and water quality parameters (nitrate and phosphate concentration) will more closely resemble reference sites with oysters.
4. Bird habitat usage will increase at the restoration site over time due to changes outside of oyster habitat addition, such as hydrologic alteration. The effects of increased oyster habitat may not be significant.

No significant differences between oyster growth rates on tested oyster cultch materials (wooden stakes, wireframe reef structure) is expected. Community composition is also not expected to be significantly different between structure types.

The restoration site where the study is being conducted is located at Little Edisto Island, South Carolina. Southeast Mitigation LLC (funding source and partner) is restoring natural tidal flux to a set of six saltwater impoundments at this location by removing sections of the surrounding berms.

Christopher is comparing the habitat conditions present at the restoration site currently with multiple reference sites also found on Little Edisto Island and Edisto Island, which he places into categories depending on the density of oysters and oyster beds present at the sites.

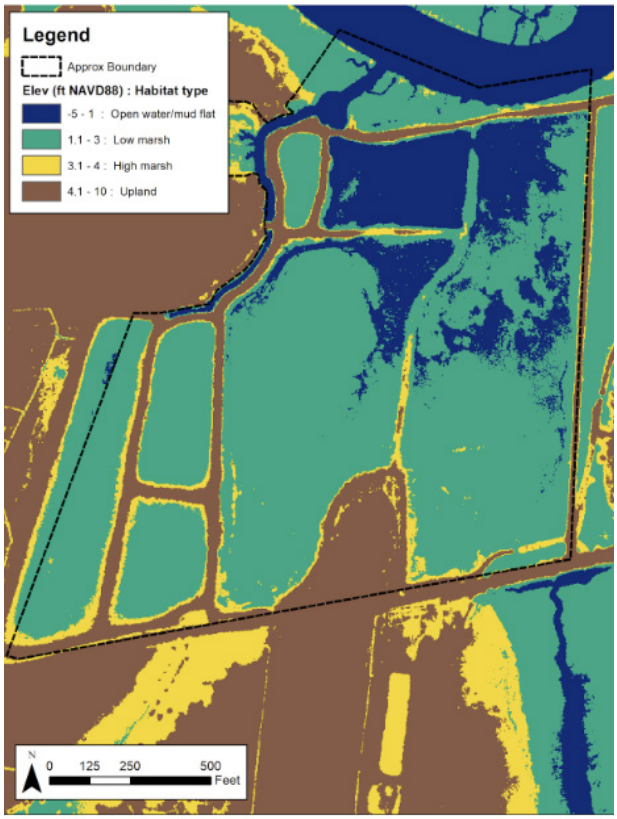
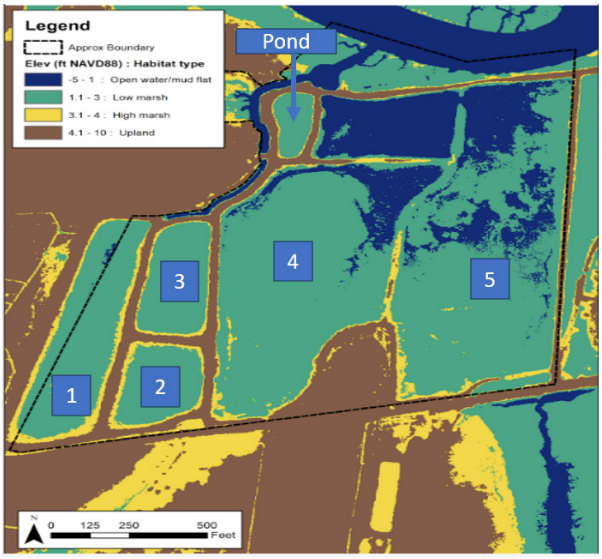


Figure 9 – Habitat types expected to occur following tidal restoration and no site regrading

Methods

Each month, Christopher records water quality parameters (water temperature, salinity, conductivity, pH, dissolved oxygen concentration). He takes water samples, which

he filters using a Millex brand 45-um filter unit, and processes in the lab to record concentrations of phosphate and nitrate. Christopher monitors bird activity at each of the impoundments during monthly surveys. For fish sampling, Christopher uses minnow traps (six per impoundment), crab traps (one per impoundment), a fifty-foot seine net (five sweeps per impoundment), and throwing an eight-foot diameter cast net (ten cast net throws per impoundment). Invertebrate surveys involve taking sediment core samples using a PVC pipe sediment trap, as well as a D-net. Christopher samples invertebrates along a transect from the most upland position in the impoundment (that is covered by water at high tide) to the deepest point (that is accessible) of the impoundment. The same survey methods are also used at each reference site where surveys of that type are possible. In a separate experiment taking place at the restoration site, Christopher will be comparing the growth and colonization rates of oysters on wireframes and wooden stakes. The goal is to determine which of the oyster structure types provides the greatest oyster growth and recruitment relative to the cost of deploying the structures. Stakeholders from Southeast Mitigation will be using the more efficient of these two methods to deploy oysters at a much larger restoration site, where they plan on creating one hundred acres of oyster habitat.



Preliminary results – Prior to restoration actions

Pre-restoration conditions at the site show that wading birds, shorebirds, and wetland-associated songbirds use the impoundments at the Little Edisto Restoration site, mainly when large numbers of birds descend onto exposed mudflat habitat at low tide. Impoundments (and portions of impoundments) that have been unconnected to any tidal influence show few signs of bird activity outside of grassland songbirds. Waterfowl are currently essentially absent from the restoration site, outside of one male-female pair of hooded mergansers present in one of the impoundments with permanent water during a winter survey. Plant communities at the restoration site reflect what are traditionally considered salt marsh plant community assemblages, with *Sporobolus alterniflorus*, *Salicornia depressa*, and *Distichlis spicata* being the three dominant species. Water quality at the restoration site varies slightly across impoundments. Still, we are expecting to see a more significant effect of season on nitrate and phosphate concentrations, with higher concentrations being detected during summer than in winter.

Research
ABSTRACT

Occurrence of Cavities and Cavities Suitable for Nesting Wood Ducks Across South Carolina Forest Types

Cindy L. Von Haugg
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Wood ducks (*Aix sponsa*) are common year-round residents of wetlands throughout the Southeastern United States. Evidence suggests that >90% of the North American wood duck population nests in tree cavities rather than in artificial nest boxes. However, few studies exist on the occurrence of natural tree cavities, particularly across their southern breeding range. We aimed to determine forest and tree characteristics indicative of cavities suitable for nesting wood duck hens to direct future studies to areas most likely to have cavities. We surveyed 20-m radius plots within the five dominant forest types of South Carolina (n = 166) on private and federally managed land and measured and inspected 4,633 trees >22 cm diameter at breast height (DBH) for cavity presence and suitability. We identified 225 potential cavities, 156 cavities, and 31 cavities suitable for nesting wood ducks. We found total cavity and suitable cavity densities (no./ha) at our study sites were greatest in oak (*Quercus* spp.), gum (*Nyssa* spp.), and cypress (*Taxodium* spp.) (19.35 ± 20.27, 4.20 ± 5.12) stands, followed by oak and hickory (*Carya* spp.) (8.37 ± 11.42, 1.36 ± 2.98), oak and pine (*Pinus* spp.) (4.90 ± 7.15, 1.17 ± 2.80), loblolly pine (*P. taeda*) (2.10 ± 4.42, 0.23 ± 1.34), and longleaf pine (*P. palustris*) (1.40 ± 3.57, 0.23 ± 1.34), which was consistent with densities at both sites individually. The best-fit model for cavity presence showed a significant positive effect for site index, DBH, and stand age and a minor negative effect for tree density. Results for suitability cavity presence also showed a significant positive effect for DBH and stand age, a significant negative effect for tree density, and no effect for basal area. We used an optimized hot spot analysis in ArcGIS to narrow down our total sample area using our findings to areas with 90% (73 ha), 95% (56 ha), and 99% (732 ha) confidence for suitable cavity occurrence, which amounted to 0.001% (73 ha), 0.001% (56 ha), and 0.008% of our total sample area (89,559 ha), respectively. This understanding of the relative abundance of cavities and cavities suitable for wood duck nesting and the identification of tree and stand forest metrics that influence the occurrence of cavities and suitable cavities promotes efficient management of nesting wood ducks, forest, and timber harvest practices.

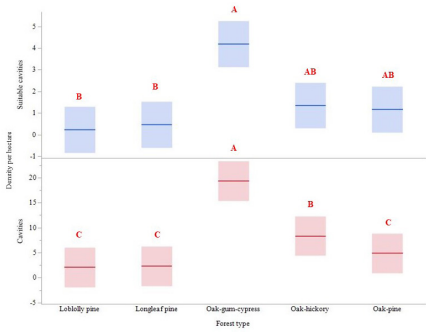

Figure 1. Densities of cavities ($F_{4, 4624}$ = 22.83; P < 0.0001) and suitable cavities ($F_{4, 4624}$ = 4.29; P = 0.0018) for wood ducks in 166 randomly selected 20-m plots by forest type (n = 5). Plot surveys were conducted in stands >50 years old at Hobcaw Barony and Francis Marion National Forest, South Carolina, USA. Error bars indicate 95% confidence intervals, and significant differences are represented with different letters.

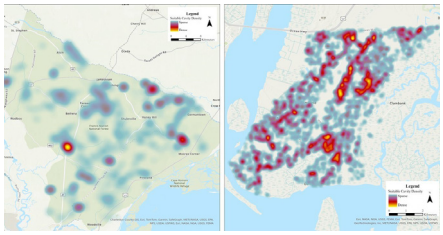

Figure 2. Heat map using estimates of relative abundance to develop optimized hot spots for areas with >95% and >99% confidence intervals for highest and lowest cavity occurrence probabilities. The abundance estimates were derived from forest surveys at randomly selected 20-m plots, stratified by forest type, at Francis Marion National Forest (left) in Berkeley and Charleston Counties, and Hobcaw Barony (right) in Georgetown County, South Carolina, USA, from February through July 2022.

Research
ABSTRACT

Using Camera Traps to Monitor Seasonal and Diel Activity Patterns of *Aix Sponsa* (Wood Duck) During the Breeding Season

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The reproductive ecology of cavity-nesting *Aix sponsa* (Wood Duck) has long gone understudied due to the secretive nature of this species and the inability to estimate the vital rates of the population. Trapping and monitoring individual activity has been successfully used to uncover the behavior and habitat selection of numerous species. However, migratory species add additional difficulty to diagnosing the proper timing of trapping efforts. Uncovering successful trapping techniques is required to maximize research efforts and increase our understanding of cavity-nesting Wood Ducks. Moreover, timing trapping effort is fundamental to successfully trapping locally nesting Wood Duck hens. Between 11 January and 30 June 2023, we monitored trap sites (n = 41). We collected trail camera images with Wood Ducks (n = 2,271 frames) to evaluate seasonal and diel activity patterns of hen, drake, and hatch-year Wood Ducks in coastal South Carolina. Our analysis of images of hen (n = 1,641), drake (n = 2,358), and hatch-year (n = 341) Wood Ducks showed that the occurrence of each differed among months, and the highest densities of hens occurred in January, February, and May. Our results suggest setting traps no earlier than 1 March to increase the chance of trapping a locally nesting hen. Our estimates also suggest the pre-breeding phase occurred from mid-January to late March; the first nesting attempts occurred from early March to late April, and the second nesting attempts began around late April. Wood Duck (96.5%) and hen-specific (96.3%) activity were highest during diurnal periods, suggesting trap site visits should be avoided at this time to minimize disturbance. Using these results as guidelines for future trapping efforts could greatly improve the trapping success of Wood Duck hens during the breeding season, thus increasing our understanding of the reproductive ecology of cavity-nesting Wood Ducks and best-informing management decisions.

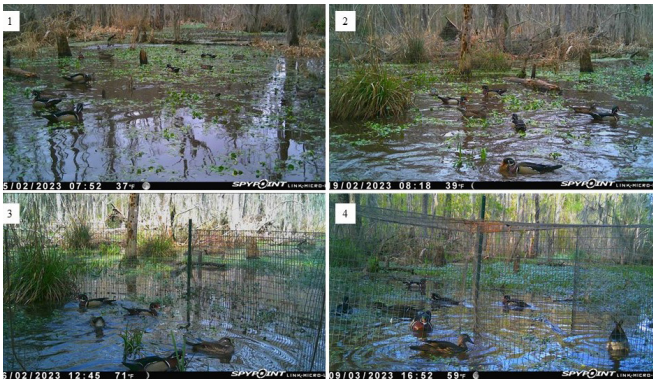

Figure 1. The four trap phases, one week per phase, were used to accustom the wood duck (Aix sponsa) to the trap site over 28 days: 1) bait only; 2) the wire was positioned linear across the trap site between the observed avenue of approach and the bait; 3) the wire was positioned in a circle or rectangle, if it was a rectangular trap, with the bait placed inside; and 4) the trap was set. The trap entrance was configured into a funnel 20 cm at the narrowest point and 1.9 cm, heavy-duty nylon mesh, poultry netting, or top panels, if it was a rectangular trap, were zip-tied across the top (North and Hicks 2017). The set trap was approximately 2.5 m in diameter or length. Trapping efforts were conducted from 11 January to 30 June 2023 at Ernest F. Hollings ACE Basin National Wildlife Refuge in Colleton, Charleston, and Beaufort Counties, Waccamaw National Wildlife Refuge in Georgetown, Horry, and Marion counties, Santee National Wildlife Refuge in Clarendon County, Clemson University's Pee Dee Research and Education Center in Darlington and Florence counties, and privately-owned Witherspoon Island in Darlington County, South Carolina, USA.

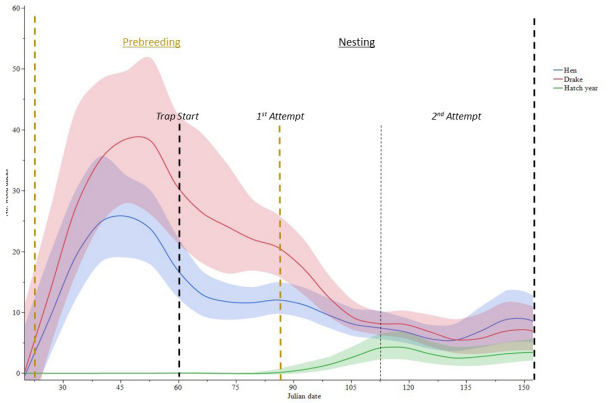

Figure 2. The number of wood duck (Aix sponsa) observed in trailcamera frames across all trap sites (n = 39). Hen-to-drake ratios and overall wood duck presence were used to estimate the generalized timing of phases (e.g., pre-breeding [gold] and nesting [black]) throughout the breeding season in the Southeastern U.S. Our data suggest setting traps no earlier than 1 March to increase the chance of trapping a locally nesting hen. Our results also indicate that the pre-breeding phase occurs from mid-January to late March; the first nesting attempts occur from early March to late April, and the second nesting attempts begin around late April. Trapping efforts were conducted from 11 January to 30 June 2023 at Ernest F. Hollings ACE Basin National Wildlife Refuge in Colleton, Charleston, and Beaufort counties, Waccamaw National Wildlife Refuge in Georgetown, Horry, and Marion counties, Santee National Wildlife Refuge in Clarendon County, Clemson University's Pee Dee Research and Education Center in Darlington and Florence counties, and privately-owned Witherspoon Island in Darlington County, South Carolina, USA

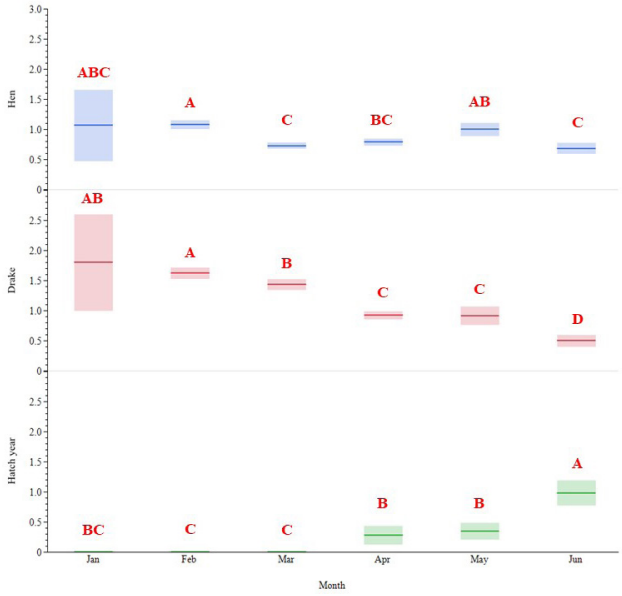

Figure 3. Tukey-Kramer Honestly Significant Difference test comparing the difference in mean number of wood duck (Aix sponsa) observed with trail cameras each month across trap sites (n = 39). Error bars indicate 95% confidence intervals, and significant differences are represented with different letters. Trapping efforts were conducted from 11 January to 30 June 2023 at Ernest F. Hollings ACE Basin National Wildlife Refuge in Colleton, Charleston, and Beaufort Counties, Waccamaw National Wildlife Refuge in Georgetown, Horry, and Marion counties, Santee National Wildlife Refuge in Clarendon County, Clemson University's Pee Dee Research and Education Center in Darlington and Florence counties, and privately-owned Witherspoon Island in Darlington County, South Carolina, USA.

Research
ABSTRACT

Method for Evaluating and Measuring Cavity Suitability for Nesting Wood Ducks

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The challenges associated with climbing trees to measure cavity dimensions have limited the accumulation of knowledge regarding wood duck (*Aix sponsa*) nesting habitat and ecology. To overcome this issue, we developed a 2-person method to measure external and internal tree-cavity dimensions from the ground. Our approach uses a telescopic pole, wireless cavity inspection camera with a monitor, and reference scale, allowing an object of known length to be viewed and recorded inside the cavity. We tested our method using simulated cavities (n = 20), assessed accuracy by comparing the estimated and actual measurements, and evaluated precision between 2 observers. The average difference (±1 SE) between estimated and actual measurements (n = 40) for entrance width (0.9 ± 0.9 cm), entrance height (0.8 ± 1.1 cm), platform width (0.1 ± 3.7 cm), and platform length (1.0 ± 3.2 cm) were ≤1 cm. There was no significant difference between observer measurements for entrance width, entrance height, platform width, or platform length. Observers overestimated cavity depth by an average of 0.1 ± 1.6 cm and there was a significant difference (1.3 ± 2.2 cm) between observers for mean cavity depth. We applied the technique to naturally occurring cavities. The time to complete a natural-cavity survey in the field (n = 37) averaged 12.2 ± 6.9 min. Our method increases the practicality, accessibility, and safety of researchers conducting cavity surveys for wood ducks and other cavity-dependent wildlife using a cost-effective, cavity-measuring tool.

Figure 1. The assembled wireless cavity monitoring system capable of measuring internal dimensions of wood duck nesting cavities using a reference scale that can be 1) stored; 2) attached to the camera; and 3) lowered into a cavity.

Figure 2. Two-person operation of a wireless cavity monitoring system capable of measuring external and internal dimensions of wood duck nesting cavities.

Research
ABSTRACT

Empowering Historic Rice Field Descendant Communities Through Community Gardens and Pollinator Education

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James C. Kennedy Waterfowl and Wetlands Conservation Center

Wetlands and the surrounding landscapes provide habitat for at-risk and endangered pollinator species such as the monarch butterfly (*Danaus plexippus*), southern plains pine bumble bee (*Bombus fraternus*), the rusty patch bumblebee (*Bombus affinis*), and a plethora of pollinators critical for ensuring sustainable gardens, agriculture, and ecological diversity in South Carolina. Among the 31 historical populations of monarch butterflies, 15 are facing the threat of extinction due to rising sea levels and excessively high temperatures caused by climate change. South Carolina is a critical stopover area for migrating monarchs, but a population of monarchs also overwinter in our area. The southern plains pine bumble bee, frequently found in the South Carolina coastal region, has experienced a significant loss in range, with a resulting 24% population decline since 2010. The rusty patch bumble bee has seen similar declines, especially with increased development and community HOA regulations that require frequent mowing during the critical emergence of this species. Community education and participation in pollinator gardens may increase pollinator abundance and diversity.

Hampton Plantation is a historical site located in the community of Germanville, South Carolina, inhabited primarily by descendants of those enslaved to work the historic rice fields. Many of the families surrounding Hampton Plantation have lived in this region for hundreds of years and continue to bury their family members within an active cemetery located on the property. The community surrounding Hampton Plantation faces food scarcity and high poverty rates due to its remote rural setting. In the US, 12.8% of households faced food insecurity in 2014, with higher rates among Black, Latino, and low-income families. Limited access to healthy food leads to health issues like depressive symptoms, diabetes, and heart disease. Food-insecure populations struggle to afford fresh food due to poor food environmentsespecially from the perspective of low-income and Black residents. The goal of this study was to use qualitative methods to better understand experiences with food access and perceptions of the food environment among low-income, predominately Black rural Louisiana residents in the United States. Data were collected from focus group discussions (FGD. Alternative programs like community gardens may address these challenges, especially where traditional supermarkets are lacking. With nearly 75% of agricultural plants relying on pollinators to produce, understanding community needs and using pollinator plants and associated pollinators provides not only ecological benefit, but can play a pivotal role in empowering underserved communities to take charge of their dietary needs.

Social surveys will be conducted to establish a baseline understanding of historically preferred foods, as well as the economic and physical barriers to gardening and the ecological knowledge of Germanville community members concerning the benefits of pollinators. Pollinator gardens will be established at both Hampton Plantation and within the Germanville community for educational purposes. Additionally, multiple food gardens will be installed in the Germanville community to facilitate agricultural education and community empowerment. Throughout the three-year study period, community education events will be organized to promote gardening concepts and actively solicit feedback on any challenges to gardening progress, enabling project adjustments to enhance the likelihood of success. A final survey will be used in year three to determine the knowledge gained, the number of participants still active in the program. If the program is deemed a success, we will work with other SC State Parks to create additional community projects around historical rice fields.

Research
ABSTRACT

The Social Influence: Antebellum Rice Field Restoration and Waterfowl Management

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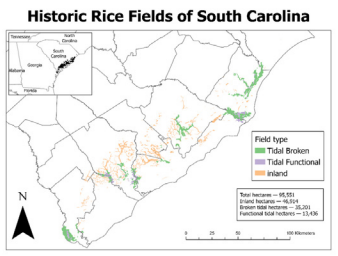
Historical antebellum rice fields in the low country of South Carolina have been deeply ingrained in the culture since the early 1700s. Through the installation of rice trunks, a large wooden apparatus that allowed the control of water levels through the rise and fall of tides, large-scale rice production was possible. Sprawling plantations brought immense prosperity to the southeast and ultimately changed our coastal geography. We understand today that tidal wetlands deliver a multitude of ecosystem services crucial for ecological well-being, as well as for the cultural and emotional well-being of residents. They offer services including the provisioning of food, fiber, fuel, and biochemical materials; climate regulation via hydrological flows, water purification, and erosion control; cultural protection and recreational opportunities; and essential ecological functions such as soil formation and nutrient cycling. Since the early 1900s, many of the 236,000 acres of antebellum rice fields across South Carolina's coast have been left to nature, reverting to natural marsh. However, many are still actively managed for a different sort of production – waterfowl populations.

Antebellum rice fields provide a critical stopover wintering habitat for many waterfowl and waterbird species. The restoration and protection of antebellum rice fields may be an essential factor in slowing the onslaught of climate change and associated ecosystem service losses, as well as ensuring adequate waterfowl habitat for future populations. However, restoration can be cost-prohibitive, and with rising sea levels, we must assess at what point the restoration and protection of these historical relics are viable.

Management decisions that fail to consider the history, knowledge, and perceptions of the community can create resistance in community support, underscoring the need to understand human knowledge and perceptions to effectively address both environmental and social dimensions of resilience. Stakeholder surveys play an instrumental part in bridging the gap between policy and people. We are addressing the human dimensions of waterfowl management in antebellum rice fields by creating an in-depth survey that evaluates stakeholder knowledge of historic rice fields, cultural influence, and perceptions of associated infrastructure, and restoration. Out stakeholders are defined as state and private waterfowl managers, area residents, and culturally significant populations.

We anticipate that state and private waterfowl managers will have a strong knowledge of the ecological significance of waterfowl management. Area residents and culturally sensitive populations will have little understanding of ecological significance. State and private waterfowl managers and culturally significant stakeholders will have a strong desire to continue current rice field management strategies for waterfowl populations. However, we anticipate those with cultural ties to the area wishing to maintain traditional irrigation management through historical rice trunk technology. In contrast, state and private waterfowl managers and area residents may seek less cost-prohibitive methods for irrigation control.

Surveys will run from October 2024 through December 2024. The analysis will begin in January, with anticipated results by May 2025. These results will then be used in conjunction with aerial drone and acoustic surveys to help develop a decision support tool for future antebellum rice field management to promote coastal resiliency and future waterfowl populations.



A total of 236,112 acres of historic rice fields were mapped, much more than previously was known. *R. Daniel Hanks, Robert F. Baldwin, Travis H. Folk, Ernie P. Wiggers, Richard H. Coen, Michael L. Gouin 1, Andrew Agha, Daniel D. Richter and Edda L. Fields-Black.*

Research
ABSTRACT

Effects of Toxins from Small-scale Gold Mining in Caimans of Suriname

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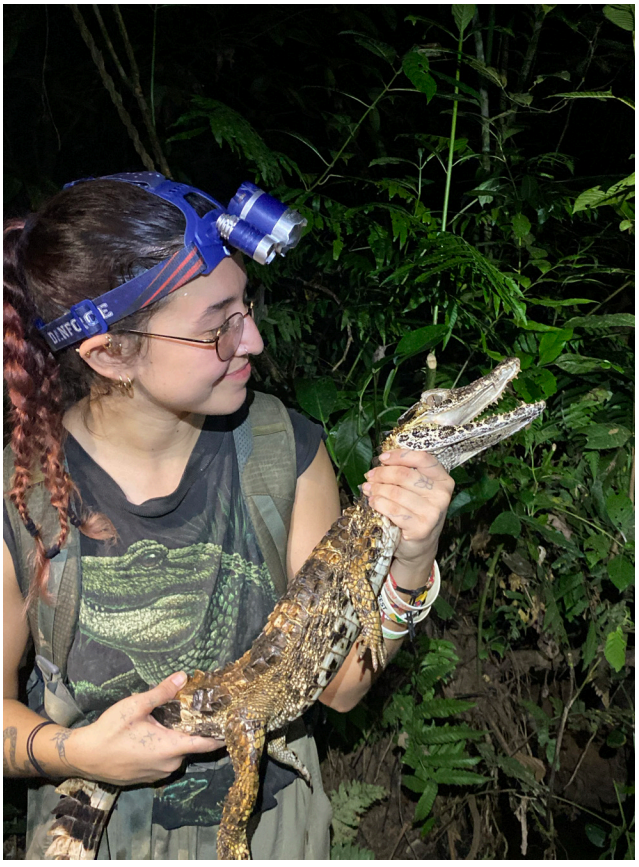
M.S. Student, Clemson University
James C. Kennedy Waterfowl and Wetlands Conservation Center

Three species of caiman currently range in Suriname: spectacled caiman (*Caiman crocodilus*), smooth-fronted caiman or Schielder's dwarf caiman (*Paleosuchus trigonatus*), and Cuvier's dwarf caiman (*Paleosuchus palpebrosus*). Very little work has been done with their populations in Suriname. The only published papers on caimans in Suriname look at population ecology of *Caiman crocodilus* (Ouboter & Nanhoe, 1987, 1988, 1989).



In recent years, ecotoxicology has been delved into more and more when it comes to crocodilians. Crocodilians have been found to be great bioindicators when it comes to heavy metal contaminants because of their longer lifespan, varied diet, and trophic level (Marrugo-Negrete et al., 2019; Nilsen et al., 2019; Schneider et al., 2013). They move through trophic levels throughout their lives, being eaten by many other animals when young, including birds and other crocodilians, to apex predators as adults. This allows for studies looking at ecotoxicology to see how heavy metal concentrations change through trophic level changes.

Small-scale gold mining using mercury amalgamation is popular in the eastern part of Suriname. As the mercury gets used to separate the gold from the sediment, it gets released into the environment. The disruption of soil through this process can also release mercury, which is a natural component of the soil (Ouboter, 2015). Studies focusing on mercury accumulation have been on the rise, with most of the focus on the southwest region of the Amazon and lacking in the northern region (Guiana Shield) (Martoredjo et al., 2024).

This project investigates the effects and amounts of heavy metals in three species of caiman in Suriname (*Caiman crocodilus*, *Paleosuchus trigonatus*, and *Paleosuchus palpebrosus*). Specifically, we want to look at mercury, lead, and selenium. Also, we will look at what each species is eating in these populations and correlate this to the amounts of metals they are accumulating.

We will look at all three species of caiman at two sites, one where there is a lot of anthropogenic impacts and one with relatively low impact. The first site is located in a remote area in west Suriname. It is a newly opened research station, and we will be some of the first to use it. The second location will be in Peperpot Nature Park. This is across the Suriname River (less than 1 kilometer away) from Paramaribo, the capital of Suriname.

For each caiman, we will take 5mm clippings from three scutes towards the tip of the tail, three nail clippings from the three longest nails, and a blood sample. Clippings will be cut with sharp claw clippers and put into plastic tubes labeled with the PIT tag number of the individual. They will be put in a freezer immediately after returning to the place of stay in the field until sent for analysis (Lemaire, Bustamante, Marquis, et al., 2021).

To learn more about the diets of these caimans and better

understand how these caimans are accumulating all these metals, we will be looking at their stomach contents using stomach flushing. This is commonly used in crocodilians to see what exactly individuals in a population are eating without dissection. There are multiple techniques for stomach flush. We chose to use a hose with Heimlich maneuvers as it was found to be the most efficient at removing all stomach contents (Fitzgerald, 1989).

We predict that there will be a difference in total mercury accumulation between the sites, with the caimans at the more remote western site having lower overall concentrations. We are looking to see a correlation between continents and diet, especially caimans that eat more fish, which accumulate mercury in high concentrations (Da Silva et al., 2005). With this, caimans that eat more terrestrial vertebrates and less fish may have lower total mercury accumulation.

This study could help push for healthier waterways not only for caimans but also for humans. In many of these areas where caimans live and eat, humans are doing the same things, with a large part of their diet being fish caught from rivers. Caimans can be used as bioindicators of mercury contamination, helping give the people who live in these areas an idea of the health effects of the fish they are eating.

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Research
ABSTRACT

Waterbird Habitat Selection in Georgetown County, South Carolina

Jordan McCall
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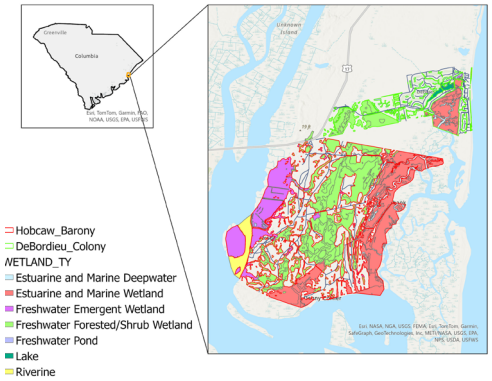
Wetland habitats are ecologically valuable due to their high biological diversity and productivity, with many avian species depending on them. Understanding how waterfowl select habitats for use is essential to successful wetland management. The southeastern coastal plain of the United States contains 27% of the wetlands within the lower 48 states. However, only about 9% of these wetlands are of high or moderate value to waterfowl and other waterbirds. The region is comprised of 7 main wetland type classifications: (1) estuarine deepwater, (2) estuarine wetland, (3) freshwater emergent, (4) freshwater forested and shrub, (5) freshwater ponds, (6) lakes, and (7) riverine wetlands. Despite the significance of the Hobcaw Barony in a region historically known as a waterfowl hunting paradise, the long history of the Belle W. Baruch Institute of Coastal Ecology and Forest Science on Hobcaw Barony and the establishment of the James C. Kennedy Waterfowl and Wetlands Conservation Center at the Baruch Institute in 2014, no comprehensive study of waterbirds has occurred on site. Thus, this study aims to form a fundamental baseline of wetland and waterbird data as the beginning of a long-term dataset. Our specific objectives were to 1) determine which wetland type is hosting the most waterbirds in terms of species diversity and abundance and 2) determine what environmental factor(s) are contributing to the most productive wetland type at Hobcaw Barony and DeBordieu Colony.



This study along the South Carolina coast began in January of 2022, encompassing extensive, conserved lands and highly developed and altered landscapes. Two field seasons have since been completed from February-July of 2022 and January-July of 2023. Research sites were at the Hobcaw Barony (~7,000 ha) and the DeBordieu Colony (~1,000 ha).

In 2022, we performed point count surveys at 95 randomly selected wetlands, varying by type, and secretive marshbird surveys at 10 emergent wetlands to estimate occupancy rates, species diversity, species abundance, and migration chronology. In 2023, we performed point counts in 98 randomly selected wetlands and secretive marshbird surveys in 8 emergent wetlands. In year 2, we readjusted and maximized sampling effort on wetland types where waterbirds were most abundant and decreased on the remaining types (based on the availability of time to survey) where few birds were observed, surveying in 98 wetlands. Wetland-level data (e.g., water quality,

water regimes, vegetation, macroinvertebrates) were also collected to model waterbird use and selection of wetlands. To determine which environmental factor(s) were driving waterbird attraction, we will perform a generalized linear mixed model with a Poisson distribution for each species guild and our top 12 detected species.

Table 1. Results from a generalized linear mixed model analysis with Poisson distribution for the waterfowl species guild on Hobcaw Barony and DeBordieu Colony in Georgetown, South Carolina, USA.

Source	DF	F Ratio	Prob > F
Location	1	42.151948	<.0001*
Wetland classification	10	18.07025	<.0001*
VDP	3	28.041422	<.0001*
Water regime	2	14.37931	<.0001*
Wind direction	8	12.715085	<.0001*
Distance to nearest wetland	1	19.272605	<.0001*
Wetland area (ha)	1	13.948976	<.0001*
Veg. species richness	1	0.1055104	0.7454
Macro. species richness	1	121.35501	<.0001*
Wind speed (mph)	1	1.4123374	0.2349
% Water cover	1	2.4961882	0.1144
% Veg. cover	1	263.99523	<.0001*

We detected 4,099 waterbirds over our two field seasons. We observed 56 species, with 34 of those species seen in both field seasons, 8 species unique to 2022 and 13 species unique to 2023. We observed 1,518 wading birds (10 species), 744 shorebirds (16 species), 844 waterfowl (13 species), 347 marshbirds (6 species), 161 gulls-terns (6 species), 445 anhingas-cormorants-pelicans (4 species), and 40 grebes (1 species). Preliminary results from the generalized linear model for waterfowl reveal that the following environmental factors have a significant effect on their presence: location, wetland classification, vegetation distribution pattern, water regime, wind direction, distance to nearest wetland, wetland area, macroinvertebrate species richness, and percent vegetation cover. Waterfowl had a significant positive relationship with DeBordieu, specifically, lacustrine limnetic unconsolidated bottom wetlands (i.e., lakes) and permanently flooded open-water wetlands. These results are no surprise as DeBordieu contains primarily this wetland type, and historically, this wetland type highly supports waterfowl species.

This study would not have been possible without funding support from the DeBordieu Colony and the James C. Kennedy Waterfowl and Wetlands Conservation Center, and logistical support from the Nemours Wildlife Foundation, Belle W. Baruch Foundation, and Clemson's Department of Forestry and Environmental Conservation. We also appreciate Jack Corbin, Anna Koon, Carly Sprott, and Blair Abernathy for their assistance in the field.

Research
ABSTRACT

Waterbird Spring Migration Chronology in Georgetown County, South Carolina

Jordan McCall
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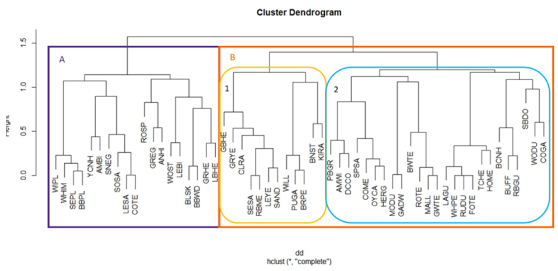
James C. Kennedy Waterfowl and Wetlands Conservation Center

The South Coastal Plain of South Carolina is essential for migrating, wintering, and breeding waterfowl and other waterbirds. Historically, 30 to 50% of Atlantic Flyway green-winged teal (*Anas crecca*), northern shoveler (*Spatula clypeatea*), mallard (*A. platyrhynchos*), northern pintail (*A. acuta*), American wigeon (*Mareca americana*), and gadwall (*M. strepera*) wintered in the region. However, recently, waterfowl have been wintering further north, possibly due to climate change and warming temperatures. Waterfowl often migrate due to changes in habitat conditions, resource availability, nesting location, breeding season, and other factors. Spring migration for waterfowl, specifically, is an essential phase of their annual cycle and can provide critical information when it comes to wetland management. Despite the significance of the Hobcaw Barony in a region historically known as a waterfowl hunting paradise, the long history of the Belle W. Baruch Institute of Coastal Ecology and Forest Science on Hobcaw Barony and the establishment of the James C. Kennedy Waterfowl and Wetlands Conservation Center at the Baruch Institute in 2014, no comprehensive study of waterfowl or waterbirds has occurred on site. Thus, this study aims to form a fundamental baseline of wetland and waterbird data as the beginning of a long-term dataset. Our primary objectives were to 1) document winter and spring temporal trends and spring migration chronology of waterbirds using wetlands on Hobcaw Barony and DeBordieu Colony (an adjacent development) and 2) determine which species have similar migration patterns.



This study along the South Carolina coast began in January of 2022, encompassing extensive, conserved lands and highly developed and altered landscapes. Two field seasons have since been completed from February-July of 2022 and January-July of 2023. Research sites were at the Hobcaw Barony (~7,000 ha) and the DeBordieu Colony (~1,000 ha).

In 2022, we performed point count surveys at 95 randomly selected wetlands, varying by type, and secretive marshbird surveys at 10 emergent wetlands to estimate occupancy rates, species diversity, species abundance, and migration chronology. In 2023, we performed point counts in 98 randomly selected wetlands and secretive marshbird surveys in 8 emergent wetlands. In year 2, we readjusted and maximized sampling effort on wetland types where waterbirds were most abundant and decreased on the remaining types (based on the availability of time to survey) where few birds were observed. To document temporal trends, we averaged species densities in each wetland and graphed them over two-week periods. We also performed a complete linkage hierarchical cluster analysis to identify which species had similar migration patterns.

We detected 4,099 waterbirds over our two field seasons. We observed 56 species, with 34 of those species seen in both field seasons, 8 species unique to 2022 and 13 species unique to 2023. We observed 1,518 wading birds (10 species), 744 shorebirds (16 species), 844 waterfowl (13 species), 347 marshbirds (6 species), 161 gulls-terns (6 species), 445 anhingas-cormorants-pelicans (4 species), and 40 grebes (1

species). On average, wading birds peaked in late March at 2.92 ± 1.09 birds/ha; shorebirds peaked in mid-May at 3.37 ± 1.35 birds/ha; waterfowl peaked in late March at 1.91 ± 1.42 birds/ha; secretive marshbirds peaked in late April at 0.83 ± 0.29 birds/ha; pelicans, anhingas, and cormorants peaked in late March at 0.89 ± 0.31 birds/ha, as well as gulls and terns at 0.43 ± 0.27 birds/ha. The cluster analysis revealed two large species clusters, cluster A, more frequently occurring from April to July, and cluster B, more regularly occurring from January to March, including almost all waterfowl species.

Of the 56 species detected, 14.3% occurred throughout our survey period, with most being herons, egrets, and anhingas. The remaining 85.7% exhibited patterns of increasing or decreasing in the study area due to rainfall, tide levels, and simply using the property as a stopover site during migration. Our study identified a very low overall density for most species, which could have been due to weather during our field seasons, such as a lack of rainfall or overall low habitat quality. When Hurricane Hugo hit these properties in 1989, it caused a decline in the total number of vegetation species present at Hobcaw, with *Phragmites* rapidly colonizing these areas. Further vegetation declines occurred between 2013 and 2015, likely due to rising sea levels and an increase in water salinity, possibly contributing to the low species densities. We recommend that future managers of these and surrounding properties use these data to know when and how to manipulate their wetlands. Future research could include performing point-count surveys during low or high tide only to standardize conditions, using drone technology to increase counts further than just the eye can see, and collecting macroinvertebrate data more often (e.g., monthly) to analyze how their population densities align with waterfowl.

This study would not have been possible without funding support from the DeBordieu Colony and the James C. Kennedy Waterfowl and Wetlands Conservation Center, and logistical support from the Nemours Wildlife Foundation, Belle W. Baruch Foundation, and Clemson's Department of Forestry and Environmental Conservation. We also appreciate Jack Corbin, Anna Koon, Carly Sprott, and Blair Abernathy for their assistance in the field.

Research
ABSTRACT

Genetic and Behavioral Divergence: A Comparative Study of Hybrid and Wild Mallards (*Anas platyrhynchos*) Across the Atlantic Flyway

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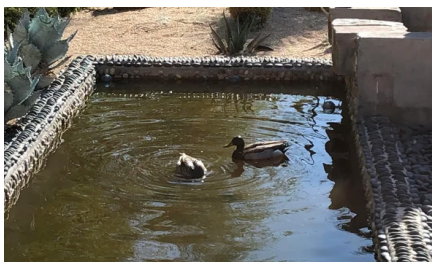
James C. Kennedy Waterfowl and Wetlands Conservation Center

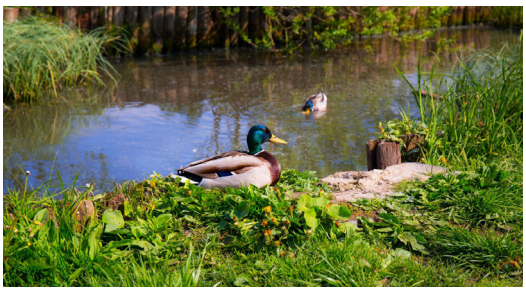
Mallards (*Anas platyrhynchos*) are a widely distributed dabbling duck species that have served as a vital food source for humans for thousands of years. Historically, these ducks nested west of the Mississippi River, with the highest nesting densities found in the Prairie Pothole regions. Due to significant human interaction, including hunting, observation, protection, domestication, and introduction to new habitats, mallards have been extensively studied and managed, particularly in Eurasia.

The introduction of mallards to eastern North America occurred through two primary mechanisms: natural breeding range expansion and game farm release. Wild mallards from western North America expanded their range eastward, while domesticated game-farm mallards, originally from Eurasia, were released starting in the 1920s. Estimates suggest that annual releases ranged from 200,000 to 500,000 individuals. While these efforts have bolstered mallard populations globally, they have also resulted in genetic hybridization due to human-induced disturbances. Increased contact between wild and domestic forms has led to a loss of genetic integrity, posing significant threats to the long-term survival of these species. The introduction of domestic genes into wild populations can diminish their adaptation to natural environments, increasing vulnerability to extinction.



Humans have been domesticating mallards since 500 BC, beginning in central China. The practice of domestic mallard supplementation has been widespread, with intensive release programs commencing in the early 20th century. Game-farm mallards are bred explicitly for release on private hunting grounds and training duck dogs. These domesticated individuals have significantly altered the genetic composition of wild mallard populations in both Eurasia and North America. The intentional or accidental release of domestic mallards has resulted in widespread introgression, threatening the genetic integrity of wild populations.

This study aims to investigate the differences between hybrid/game-farm mallards and wild-born mallards through genetic analysis, tracking migratory behavior across the Atlantic Flyway, and observing predator-prey interactions using camera traps. By analyzing the genetic differences, migration patterns, and responses to predation, we seek to understand the implications of hybridization on local adaptation and the ecological integrity of wild mallard populations. The research will employ a mixed-methods approach by conducting genetic analysis. Blood samples will be collected from both hybrid/game-farm and wild-born mallards, followed by DNA sequencing to identify genetic differences. GPS devices will be fitted to a subset of mallards to monitor their migration patterns over two years. Camera traps will be deployed at nesting sites to observe nesting success and predator interactions, focusing on behavioral differences between hybrid and wild mallards. The findings from this study will provide critical insights into the genetic, behavioral, and ecological differences between hybrid/game-farm mallards and wild-born mallards. Understanding these differences is essential for conservation efforts aimed at preserving the genetic integrity of wild mallard populations and mitigating the impacts of hybridization.



Research
ABSTRACT

Regional Alligator Diet and Utility as Indicators of Contaminants of Emerging Concern

Miriam Boucher
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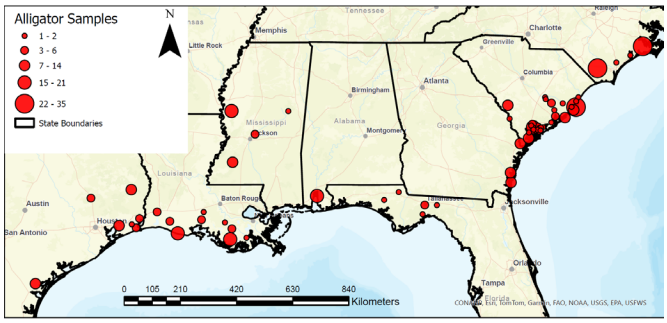
James C. Kennedy Waterfowl and Wetlands Conservation Center

Human activity is the largest contributor of environmental contaminants at the global level. In many areas, legacy contaminants like mercury and contaminants of emerging concern, including per- and polyfluorinated substances (PFAS) and microplastics, enter the environment through surface waters. These contaminants pose risks to natural resources, including water and wildlife, mainly where wildlife is consumed as part of recreational or commercial harvest. As contaminants of emerging concern, research on PFAS and microplastics is critical to addressing data gaps to quantify and understand potential impacts on wildlife; one management strategy to assess and monitor water quality is using indicator species that reflect the biotic or abiotic state of the environment.



Map showing the approximate sample locations and count of individual alligators sampled at sites throughout the Southeastern U.S. Moving through 2024 into 2025, we will increase samples in Georgia, Florida, and Alabama and add samples from collaborators in Louisiana and Texas. A minimum sample size of 30 individuals per state will be achieved by the end of the season in 2024.

American alligators (*Alligator mississippiensis*) are ubiquitous in freshwater and brackish wetlands throughout the southeastern United States, including the coastal plain of South Carolina. Alligators are currently used as indicators of exposure to contaminants, particularly metals and persistent organic pollutants. Moreover, they are a highly managed species, captured annually for research and management programs and harvested legally through public and private hunting. As such, there is potential to explore alligators as candidate indicator species for PFAS and microplastics in South Carolina and across their range.

In addition to contaminants, there is a lack of data regarding alligator diet throughout much of the range. As the primary exposure pathway for contaminants, determining trends in the alligator diet is vital to elucidating patterns of contaminant exposure in alligators.

A photo of a blue-wing teal recovered from an adult alligator stomach from Orange County, TX. Waterfowl did not appear frequently in alligator stomachs. When found, they consisted predominantly of American coots. This is the only duck recovered during diet analysis. We also recovered five wood duck web tags.

This project leverages an 8-state collaborative network to collect alligator stomach contents, blood, and tail muscle from wild alligators through live capture and stomach flushing, as well as from hunter-harvest. We have collected over 400 samples in the first two years from North Carolina, South Carolina, Georgia, Florida, Alabama, Mississippi, Louisiana, and Texas. We have analyzed preliminary data of diet for 300 alligators, finding notable differences in prey prevalence between tidal and non-tidal habitats. Although waterfowl and waterbirds are present in some stomachs, we found little evidence of duck depredation, with one blue-

win teal recovered from east Texas. However, we recovered four wood duck web tags from one adult alligator on Lake Moultrie, SC, and one web tag from Apalachee WMA, FL. These tags were deployed as part of the large wood-duck project supported by the Kennedy Center and Nemours Wildlife Foundation. We are working with B. Bauer of Nemours Wildlife Foundation to publish these results.

Miriam in the field with the U.S. Fish and Wildlife Service at the Cape Romain National Wildlife Refuge. The photo shows the deployment of a novel crocodilian jaw prop designed and used on this project. The design and testing of this device was published in the Wildlife Society Bulletin June 2024.

In conjunction with our diet data, we analyzed 100 blood, 100 muscle, 100 water, and 100 sediment samples from South Carolina for PFAS in collaboration with Dr. John Bowden at the University of Florida. Data analysis and peak integration are in progress, and this work may expand in 2025. In partnership with Dr. Kylie Rock at Clemson University, we are also analyzing the largest multistate dataset of alligator blood and muscle samples for mercury. We also engaged 12 undergraduate students on the project through a Clemson Creative Inquiry course, and three of these students completed 2024 summer internships with the Kennedy Center. The results of our diet, PFAS, and Mercury analyses will contribute to the first regional datasets of this scale for American alligators.

The Alligator Diet and Microplastic Creative Inquiry students pictured with an adult alligator sampled at Nemours Wildlife Foundation. Students have been assisting in analyzing stomach contents and have also participated in fieldwork to collect stomach flushing samples, blood, and muscle, and perform alligator necropsies.

Research
ABSTRACT

Development of a Decision Support Tool for Managing Antebellum Rice Fields in South Carolina, United States of America

Oluwatobi Emmanuel Olaniyi
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James C. Kennedy Waterfowl and Wetlands Conservation Center

Antebellum rice fields along South Carolina's coast, once key for rice farming, today provide critical habitat for bird species like warblers, shorebirds, and waterfowl. Planters used to maintain these fields for economic advantage, but they are now prized for their more comprehensive environmental benefits. With increasing sea levels threatening these places, there is an urgent need for novel management solutions that fulfill both ecological preservation and community needs. This study aims to develop a decision-support tool for managing these historic rice fields. It will involve collecting and integrating data on environmental and social aspects, assessing restoration methods, and creating a risk-benefit matrix profile to evaluate the impacts of various management actions.

This research uses a mixed-methods strategy that combines quantitative and qualitative methodologies to assess the restoration of antebellum rice fields. It uses geospatial analysis, field assessments, and socioeconomic evaluations to understand restoration results comprehensively. The Analytical Hierarchy Process (AHP) is used in the study to make multi-criteria decisions, which will aid in assessing numerous success variables and prioritizing restoration activities. The study engages a diverse group of stakeholders, including Gulla Geechee, the public, and plantation managers, focusing on ten restoration sites across key river basins. Data collection methods include GIS and remote sensing for tracking land use and cover changes, field-based ecological assessments, and socioeconomic surveys through questionnaires and focus group discussions. For data analysis, AHP will assist in evaluating and prioritizing success criteria, while geospatial analysis, machine learning models, generalized linear modeling, Bayesian Belief Networks, and Python libraries will be employed to conduct scenario analysis and develop risk-benefit matrix profiles and decision support tools.

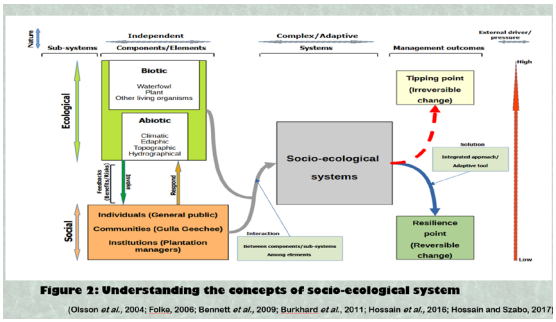
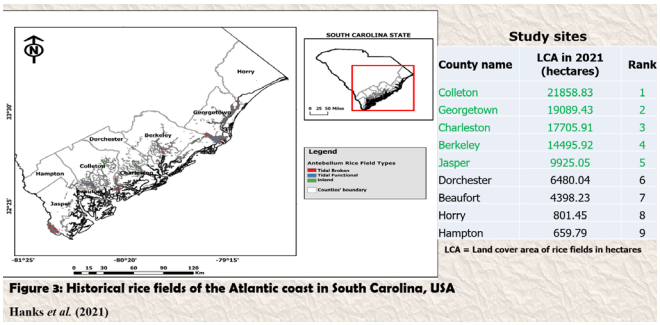


Figure 2: Understanding the concepts of socio-ecological system
(Olsson *et al.*, 2004; Folke, 2006; Bennett *et al.*, 2009; Burkhard *et al.*, 2011; Hossain *et al.*, 2016; Hossain and Szabo, 2017)

The findings are expected to reveal the effectiveness of restoration efforts, focusing on key indicators such as ecological dominance, diversity, hydrological connectivity, and socioeconomic impacts. The study will also provide insights into the risks and benefits associated with ecological and societal factors. Also, the development of a decision support tool will facilitate informed management decisions by integrating various data and analysis scenarios. Results will be summarized in tables showing restoration success and socioeconomic impacts, and figures illustrating risk-benefit analyses and the decision support tool's interface.



Study sites

County name	LCA in 2021 (hectares)	Rank
Colleton	21858.83	1
Georgetown	19089.43	2
Charleston	17705.91	3
Berkeley	14495.92	4
Jasper	9925.05	5
Dorchester	6480.04	6
Beaufort	4398.23	7
Horry	801.45	8
Hampton	659.79	9

LCA = Land cover area of rice fields in hectares

Figure 3: Historical rice fields of the Atlantic coast in South Carolina, USA
Hanks *et al.* (2021)

Research
ABSTRACT

Baseline Ecological Data of a Shrimp Farm Slated for Restoration in Coastal South Carolina

Rene Brown
M.S Student, Clemson University
James C. Kennedy Waterfowl and Wetlands Conservations Center

One of the most prevalent substances on Earth is water, which is made up of hydrogen and oxygen and is essential to all living things. It is the main component of the majority of living things, including people. Water availability is a major limiting factor for plant productivity in terrestrial ecosystems globally, even though it is abundant on Earth's surface. This emphasizes how vital water is to the survival of ecosystems in general and wetlands in particular.

Wetlands are ecosystems distinguished by soil, vegetation, and hydrological characteristics. These include certain soil types, plants that do well in damp environments, and the existence of standing water for a portion of the growth season. Another noteworthy quality of wetlands is their capacity to filter metals out of surface and groundwater, improving the quality of the environment. These characteristics highlight their significance as natural filtration systems that preserve water quality as well as biodiversity hotspots.

The Eastern oyster, or *Crassostrea virginica*, is a keystone species that offers a multitude of ecological functions and is one of the species that are essential to wetland and estuary environments. As a commercial product, oysters support coastal economies and provide food and building materials. Oysters have a significant ecological impact in addition to being economically valuable since they filter water, enhance its quality, and provide habitat for other species. Particularly in regions where anthropogenic activities have an influence, their existence increases the resilience of the ecosystem.

Plant litter decomposition in estuarine wetlands is crucial for short-term carbon storage, nutrient cycling, and coastal trophodynamics. Aquatic ecosystems depend on the decomposition of organic matter to recycle nutrients and other chemical elements, maintain vital food chains, and support primary production. Although the coastal ecosystem of Little Edisto Island is still mostly intact, problems with water quality could endanger the oyster habitats, plant communities, and fish populations. One method for developing living shorelines and stabilizing coastal systems is the restoration of native oyster

populations. Oysters are essential to these habitats because they grow in unique formations like “oyster flats” along creeks and rivers or on the edges of marshes. The former shrimp farm site S-161 on Little Edisto Island offers a chance for oyster farming and wetland restoration. Impoundments will be converted into oyster beds, new buildings will be erected, and water filtration will be improved to promote oyster development at this site.

The goal of this study is to clarify the relationships between environmental variables and the condition of these essential ecosystems. The research will improve conservation and restoration methods targeted at strengthening the resilience and sustainability of these ecosystems in the face of anthropogenic and climatic stressors by gaining an understanding of the factors that affect oyster and plant populations.

The breakdown of plant litter, an essential process for the nutrient cycle and overall health of salt marsh ecosystems, is a major area of attention for this research. In an impounded salt marsh, the decomposition rates of leaf litter from *Juncus roemerianus* and *Sporobolus virginicus* are investigated in this study. The study quantifies the decomposition process and determines the environmental conditions causing these changes by tracking mass loss over time using litter bags. When compared to natural marshes, the peculiarities of impounded marshes may change the dynamics of decomposition, affecting the availability of nutrients and the general health of the ecosystem. These results will help create better management strategies to preserve the ecological balance and productivity of reclaimed salt marshes. By integrating these different aspects of wetland ecosystems, the research aims to provide insights into ecosystem functioning and restoration, contributing to the broader goals of wetland conservation.

Research
ABSTRACT

Developing Anuran, Avian, Macroinvertebrate, and Vegetative Indices of Biotic Integrity for Isolated Carolina Bays

Scott Binger
Doctoral Student, Clemson University
James C. Kennedy Waterfowl and Wetlands Conservation Center

Wetlands are highly impactful ecosystems, providing ecosystem services including water quality and flooding regulation, carbon sequestration, and harvestable resource provisioning (Mitsch et al. 2015). However, wetlands are also some of the least protected ecosystems in many areas (Barbier 2011). Additionally, wetlands that are isolated (lacking direct connections to rivers, streams, estuaries, or the ocean) face increased vulnerability to loss and extensive disturbance (McCauley et al. 2013). Carolina Bays are unique isolated wetlands found throughout coastal South Carolina that provide important habitat for rare species but have faced extensive loss due to urbanization and agriculture (Sharitz 2003). Conservation efforts in these areas require the ability to quickly assess the biotic and abiotic conditions of these sites, and the ability to gauge how these conditions respond to human disturbance and environmental change. Indices of Biotic Integrity (hereafter referred to as IBIs) are useful tools that allow these assessments to be made using data on biological communities (Veselka and Anderson 2013). Anuran, avian, macroinvertebrate, and vegetative community compositions each respond to changes in conditions differently, and data on these compositions can be used to derive a variety of metrics that can be included in IBIs, allowing for indices that capture a range of important biotic responses to disturbance that can be easily applied across sites and used to inform wetland management decisions. This study seeks to create IBIs for Carolina Bay wetlands, with the goal of assessing how their biotic communities respond to human disturbance and creating actionable, easily interpreted research tools to assist management efforts.

This study will use a mixed-method approach, sampling 60 Carolina Bay wetlands over 2 years from 13 counties in South Carolina. For the biotic data in each wetland, we will quantify the abundance and biomass of macroinvertebrates by family or finer resolution, collect quantitative and qualitative measures of plant species presence and cover, determine relative abundances of anuran species via call surveys, and determine the abundance of avian

species via point count surveys. These sampling efforts will occur seasonally throughout the year, repeated as necessary. We will develop a disturbance gradient based on land use, hydrological alteration, and habitat alteration/development. This gradient will be used to score each site. In addition, we will measure soil and water chemistry and hydroperiod to determine abiotic variables influencing community composition. Sites will be divided into reference and stressed sites by degree of disturbance, and we will conduct comparisons of potential IBI metrics between reference and stressed sites. We will test and grade metrics by the level of overlap in the interquartile ranges of values for reference and stressed sites, and the highest-graded metrics for each taxon will be kept. We will use generalized linear models to evaluate the response of these metrics to human impairment, which will inform which metrics are combined to create IBIs for each taxonomic group and cumulatively across taxonomic groups.

We anticipate that the best performing IBIs, with regard to their response to human impairment, will use combinations of metrics that respond to a wide range of stressors, and that these IBIs will help to identify 1). high-risk taxonomic groups 2). sites of high vulnerability and 3). highly impactful stressors. We hope that, by identifying these, we can create tools that will streamline the assessment of sites and improve potential management outcomes in isolated wetlands.

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Work
STUDY

Waterbird Habitat Relations in Antebellum Rice Fields

Abby Smith
First-year student, Biology

My name is Abby Smith, and I am from Lancaster, South Carolina. I am a first-year student Biology major at Clemson University, with a strong interest in pursuing a career in environmental science. I enjoy spending time outdoors, whether it's swimming in lakes and oceans or hiking volcanoes in Guatemala. As part of my work-study program, I contribute to research at the James C. Kennedy Waterfowl and Wetlands Conservation Center, collaborating with Ph.D. student Akshit Suthar on a project investigating waterbird habitat relationships in antebellum rice fields using drone technology and acoustic monitoring. My responsibilities include data analysis, such as interpreting drone-captured aerial imagery and processing bird audio recordings using artificial intelligence tools. I am excited to explore waterfowl research and gain hands-on experience in environmental sciences, which will help me build a foundation for my future career.

Waterbird Habitat Relations in Antebellum Rice Fields

Naomi Correia
First-year student, Animal and Veterinary Science

My name is Naomi Correia, and I am from Spartanburg, South Carolina. I am a first-year undergraduate student at Clemson University, majoring in Animal and Veterinary Science. As part of my work-study program, I am working at the James C. Kennedy Waterfowl and Wetlands Conservation Center, assisting Akshit Suthar, a Ph.D. student, with his project focused on understanding waterbird habitat relationships with antebellum rice fields using drone and acoustic surveys. My role involves analyzing data, including drone-based aerial images and bird audio recordings using an artificial intelligence model. I have prior experience working at an animal clinic and aspire to become an exotic animal veterinarian. I am excited to be part of this project and gain valuable experience in the field I am pursuing. I look forward to continuing to work with this team and developing important research skills.

Creative INQUIRY

Belly of the Beast: Exploring Alligator Diet

Alligator Diet and Microplastic CI students at Nemours Wildlife Foundation in March 2024. Students learned applied alligator capture, handling, and data and sample collection techniques with Biologist Beau Bauer and Ph.D. student Miriam Boucher.

Experiential learning is a cornerstone of Clemson University's academic approach. In our alligator diet and microplastic Creative Inquiry students are sinking their teeth into alligator research and exploring the depth of alligator appetites. Our project is the first to explore the alligator diet regionally, with sampling conducted across eight southeastern states. The alligator diet is the primary route of exposure to contaminants, including microplastic. By analyzing alligator diet and processing samples for microplastic analysis using industry-leading equipment, we aim to discover ingested microplastic in alligators. With support from 38 external entities, our students interact and learn from experiences in multiple states and external institutional, private, industry, and agency collaborators. This work has brought hundreds of samples to the hands of the students and brought the students hands-on experience in the lab and the field. During sample analysis, we discovered tiny metal tags, one stomach from Lake Moultrie, SC, and one from Apalachee, FL. These tags belong to a multi-state wood duck project led by our collaborators at the Nemours Wildlife Foundation (NWF). Tagged in 2021 and 2022, these unlucky ducks ultimately ended up as part of our project and a unique student experience. In addition to web tags, students have also found bobcat claws, that alligators love blue crabs as much as we do, and even a full football! Their experience is not all lab-based. In collaboration with NWF, we took our students to the field in 2023 and 2024 to sample live alligators and build student capacity for field techniques. Three of our CI students worked as paid summer interns in 2024 and completed fieldwork and lab work in North Carolina, South Carolina, Georgia, Florida, and Alabama. With guidance from the project mentors, students pursue group and individual research outputs. They've presented their work professionally to the South Carolina Department of Natural Resources and other agency personnel at the 2023 Palmetto Alligator Research and Management Symposium and to our scientific community at the 2024 Clemson University Focus on Creative Inquiry event, the 2024 Summer CI + UR Showcase. Our students will also present four scientific poster presentations at the upcoming 2024 Southeastern Association of Fish and Wildlife Agencies Conference. Stay tuned for updates from this project and sink your teeth into student-led alligator research!

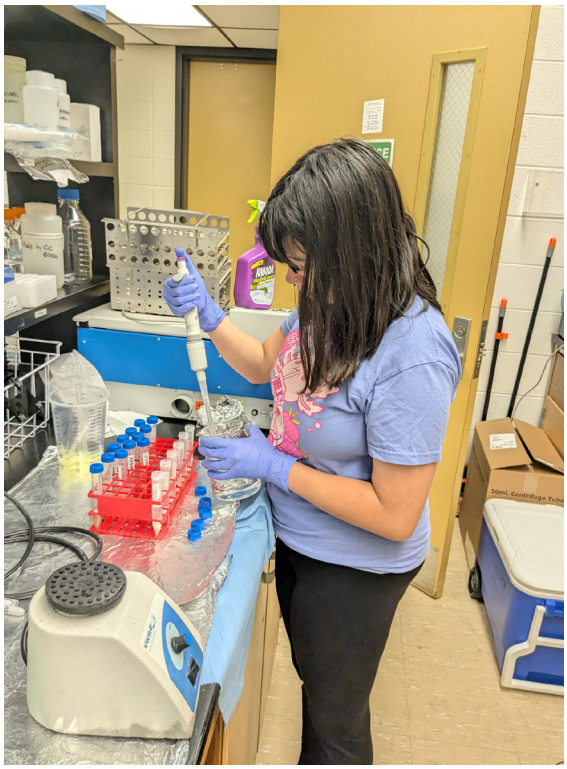
Summer CI interns Colin, Sabrina, and Sophia move an alligator back to the water after sample collection at Savannah National Wildlife Refuge.

After long days and nights in the field in Alabama, CI summer intern Sabrina is locked in on an 11' alligator captured in Daphne, AL. Samples from this alligator will be important to look at contaminant levels in an urban alligator.

CI student Sophia approaches an alligator at Nemours Wildlife Foundation with a noose pole during capture. We use these poles to apply a noose to safely pull alligators up onto the bank during capture.

CI students move an alligator along a dike at Nemours Wildlife Foundation during the spring CI field trip.

Turns out alligators love Tigers Football as much as we do! Audrey shows off an entire football recovered from an alligator stomach.



Finesse and focus are what summer CI intern Sophia is showing as she works on extracting chemical contaminants from alligator muscle samples. This work is done alongside project partner Dr. John Bowden at the University of Florida and his lab.

Creative INQUIRY

Drones, Ducks, and Decisions

At Clemson University, we offer the Drone, Ducks, and Decision Support course as part of our Creative Inquiry program. This undergraduate course provides students with hands-on experience in fieldwork, data analysis, social dimension surveys, and the use of drone technology in wetland conservation and waterfowl habitat management.

Students in the course learn about the rich history of antebellum rice fields in coastal South Carolina. These historic landscapes, once used for rice cultivation, now serve as crucial habitats for waterfowl and other wildlife. Understanding their transformation over time gives students an understanding of how these ecosystems can be managed for both ecological and societal benefits.

Students are learning Federal Aviation Administration (FAA) rules for safe drone operation, ensuring students become responsible drone pilots. They also gain experience using tools like DotDotGoose to manually count waterfowl using aerial images captured by drones. They are learning drone mission planning for habitat surveys and flight paths, selecting appropriate altitudes to minimize disturbance to waterfowl while collecting high-quality data. These skills are essential for monitoring waterfowl populations and conducting ecological surveys non-invasively.

The course emphasizes the importance of the social dimensions of conservation. This course allows students to engage with local stakeholders, such as landowners, wildlife agencies, and conservation organizations, to understand the diverse perceptions and values associated with wetland management. This allows them to develop a well-rounded perspective on conservation challenges and the need to balance ecological and social goals.

Students also gain experience in analyzing data to inform decision-making. By participating in real-world projects, students develop practical skills that prepare them for careers in environmental consulting, research, and wildlife management.

Students are learning and having hands-on experience in manually counting waterfowl from drone-based aerial images using the DotDotGoos object counting tool.

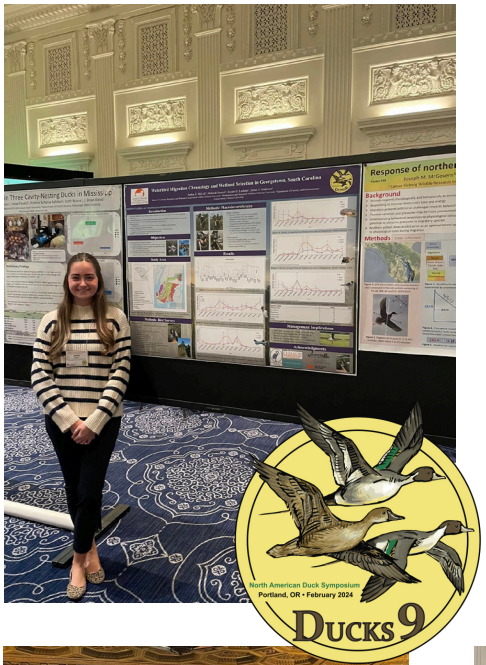
Students with hands-on training experience flying drones, mission designing and learning FAA rules and regulations.

HOBCAW, HUNTING FOR EXCELLENCE

Hobcaw Barony (The Belle W Baruch Foundation) held its annual Hunt Breakfast and Auction on January 20, 2024. The highlight of the festivities was the iconic alligator biologist Mr. Philip M. Wilkinson, who received the Hugh C. Lane, Jr. Award for Excellence in Environmental Education. The James C. Kennedy Waterfowl and Wetlands Conservation Center lends its congratulations to Mr. Phil Wilkinson for your lifetime of dedication to educating and mentoring!




THE KENNEDY CENTER DOES DUCKS 9



Clemson's Kennedy Center director, current, and past students attended the 9th North American Duck Symposium (Ducks 9) in Portland, Oregon February 2024. The Ducks 9 conference is an opportunity for academics, government and non-governmental biologists, consultants, and professionals from around the world to present and discuss current research and management issues of ducks worldwide, with a focus on North America.

Director, Dr. Jim Anderson, presented on M.S. student Cindy Von Haugg's novel method to survey natural wood duck cavities. Former Ph.D. student, Dr. Lauren Hernandez-Rubio, presented on her dissertation work highlighting students' perceptions of our online waterfowl course and assessment of credentials for a successful waterfowl career. Former M.S. student, Jake Shurba, presented on his thesis research assessing influence of shavings on wood duck reproductive ecology. Finally, current M.S. student, Jordan McCall, presented on her thesis research evaluating waterbird migration chronology and waterbird wetland selection.

Join us in congratulating our students on their hard work and dedication to the waterfowl community!


WE'LL SEE YOU AT SEWE!

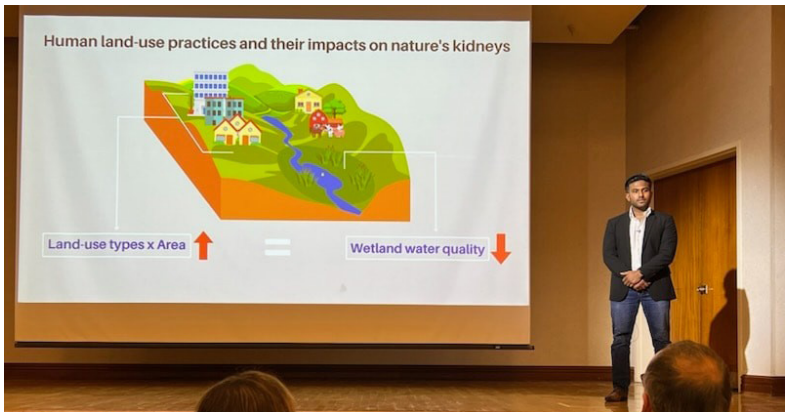
The James C. Kennedy Waterfowl and Wetlands Conservation Center collaborated once more with the Baruch Institute of Coastal Ecology and Forest Science and Clemson University during the 2024 Southeastern Wildlife Exposition in Charleston, South Carolina, from February 16 to 18, 2024. We engaged the public to highlight our research, students, and passion. Throughout the weekend we interacted with visitors having engaged discussions on critical conservation and preservation challenges while imparting knowledge about wildlife species and wetland ecosystems.

BE OUR GUEST

Dr. Jim Anderson and Kennedy Center wildlife biologist, Crystal Anderson, hosted Dr. Christy Hyman, tenure track professor from Mississippi State University and Postdoctoral Fellow at Cornell University. She has her doctorate in geography and has worked as an environmental advocate with research focused on African-America efforts toward cultural and political assertion in the Great Dismal Swamp region. Her ancestral roots brought her to South Carolina to study the Gullah Geechee people and the fragmentation of their culture, their land, and the resulting loss of identity and ecosystem services. In a collaborative effort with the James C. Kennedy Waterfowl and Wetlands Center through research grants and funding, she wishes to bring undergraduate students to our area where they can focus on collecting data to give greater understanding on how ongoing human population growth has impacted the Gullah Geechee, and work with the community to increase knowledge and support.

IN ONLY THREE MINUTES

Sindupa De Silva won second place at the Three-Minute Thesis Regional Competition in Greenville, SC. Sindupa, a Clemson University James C. Kennedy Waterfowl and Wetlands Conservation Center Student Partners Program inductee, spoke about "nature's kidneys" and how wetlands are essential for clean water. Sindupa competed against 60 contestants from East Coast schools.



THE NEXT GENERATION

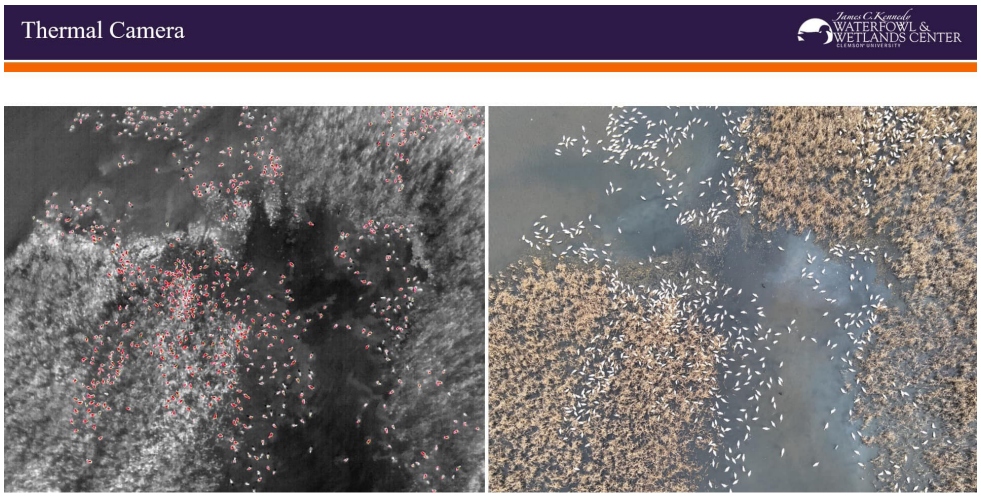
Bobby Greco, a Ph.D. student at the James C. Kennedy Waterfowl and Wetlands Conservation Center and the Crocodile Research Coalition's (CRC) program coordinator in the Dominican Republic, spoke with the Clemson chapter of The Wildlife Society. He discussed the different internship programs CRC offers, crocodile research, educational outreach, and how his experience as an intern with CRC was critical for the trajectory of his career in wildlife conservation and research. Thank you, The Wildlife Society - Clemson Student Chapter for hosting us. We look forward to coming back and presenting again!

GOING INTERNATIONAL!

In October 2023, The Foundation for Ecological Welfare (FEW), India, organized an online talk by Akshit Suthar, a PhD student at the James C. Kennedy Waterfowl and Wetlands Conservation Center. The talk, "Drones: Emerging Technology for Wildlife Research and Conservation," was held to commemorate India's National Wildlife Week 2023. This event delved into the innovative use of drones in wildlife research, highlighting their significance in conservation efforts. More than 100 participants from various backgrounds enjoyed the talk.

TAKING CONSERVATION TO NEW HEIGHTS:

DRONE-POWERED BIRDWATCHING BREAKTHROUGH AT ACE BASIN SYMPOSIUM!



White ibises

James C. Kennedy Waterfowl and Wetlands Conservation Center Ph.D. student, Akshit Suthar presented his groundbreaking research at the ACE Basin Symposium in Walterboro, South Carolina. Akshit revealed the incredible potential of drones in enhancing waterbird aerial surveys and boosting detection probability by integrating Thermal and RGB cameras.

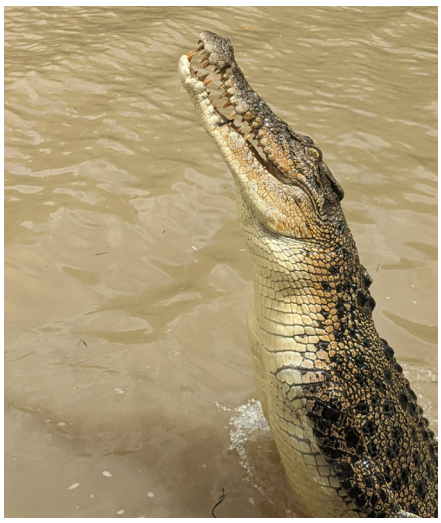
Congratulations to Akshit for advancing conservation research and bringing innovation to wildlife monitoring!

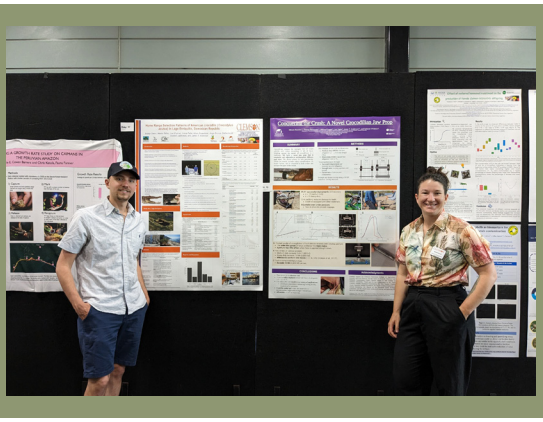
RESEARCH, IT'S IN OUR DNA

On May 16th, 2025, Dr. Philip Lavretsky from the University of Texas at El Paso presented his findings on Mallard and other waterfowl genetics across the United States this week at the James C. Kennedy Waterfowl and Wetland Conservation Center. Many game-farm mallards have been released over the last 80 years. In much of the country, and especially in the Atlantic Flyway, this has changed the majority of the wild strain mallards into hybrids of various percentages. The negative impacts to the hybrid mallards are reduced fecundity and phenotypic differences that trend towards decreases in survival through shorter migration patterns and a reduced ability to feed on a natural landscape. Models show that we can possibly reverse these trends within three to four generations.

THE KENNEDY CENTER GOES DOWN UNDA

Kennedy Center doctoral students Bobby Greco and Miriam Boucher, as well as new master's student Hallie Cowan, went down under at the IUCN - Crocodile Specialist Group Meeting in Darwin, Australia. Bobby and Miriam attended the veterinary workshop and interacted with some of the world's top crocodilian scientists, managers, veterinarians, and zoological professionals. They also linked up with colleagues from the University of Georgia's Savannah River Ecology Laboratory and the University of Hawaii, Honolulu to check out the amazing jumping crocodiles in the Adelaide River. Miriam presented her work exploring alligator diet and toxicology and a poster on the results of creating her tool to keep crocodilian jaws open. Bobby gave a lightning talk about his work on American crocodiles in the Dominican Republic to introduce the topics discussed in his poster presentation. Students received excellent feedback and support for their projects. Stay tuned for more crocodilian content as our students take their works cross-state and cross-borders into new and international territories.

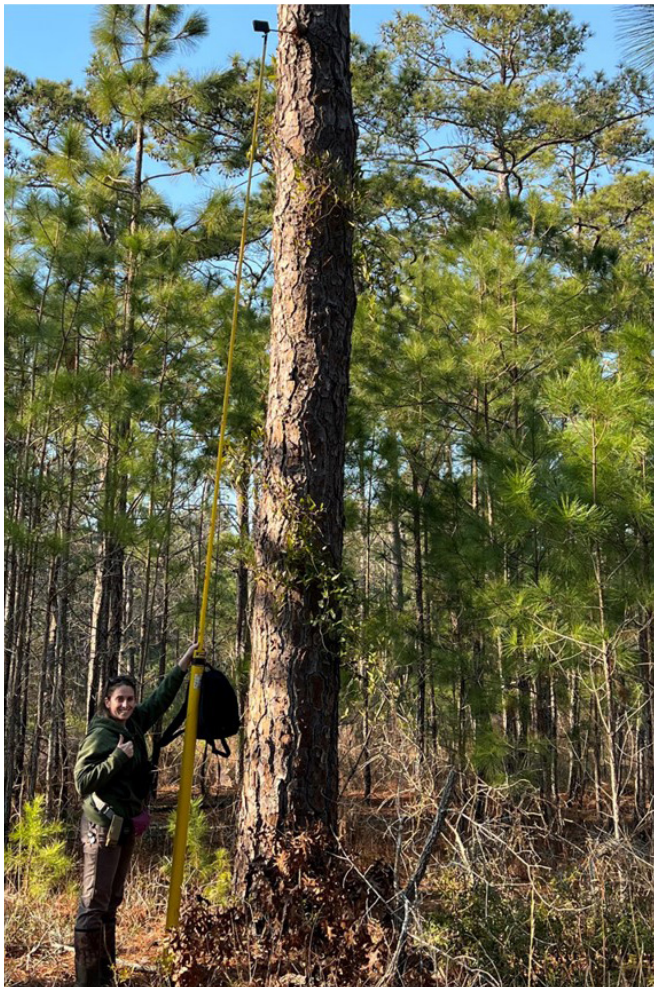




WETLANDS ON THE WEB

Akshit Suthar and Miriam Boucher, PhD students at the James C. Kennedy Waterfowl and Wetlands Conservation Center, were invited to present their ongoing research at the 2nd Annual TWS Wetland Working Group Student Research Webinar. Akshit Suthar, a 2023 TWS Wetlands Working Group Student Research Grant recipient, presented his research on quantifying habitat use by secretive marsh birds in antebellum rice fields using drones and autonomous recording units in coastal South Carolina. Miriam Boucher, a 2022 TWS Wetlands Working Group Student Research Grant recipient, provided updates on her project exploring alligators as indicators of microplastic pollution in wetlands.

DUCK DEFENDER!



Cindy Von Haugg successfully defended her master's thesis on July 10th, 2024. She worked with the iconic wood duck (Aix sponsa); a species loved by many that relies on cavities for nesting. Our understanding of Wood ducks (Aix sponsa) garner significant ecologic and economic importance as the second most harvested waterfowl species in two of the four migratory flyways in North America, but the accuracy of population monitoring, relative to other duck species, is stifled by the wood duck's secretive nature and nesting habitat. As an alternative, population models would improve current assessments, but more data on the demographic vital rates of cavity-nesting wood ducks is needed.

Cindy aimed to bridge this knowledge gap by developing a method to increase data collection efficiency. She accomplished two objectives: 1) Calculating the relative abundance of cavities and those suitable for wood duck nesting in the five most common forest types of South Carolina, and 2) Identifying tree and stand metrics that influence cavity occurrence. These objectives were designed to improve understanding of cavity-nesting wood duck reproductive ecology across the Southeast.

Cindy evaluated activity patterns across months and diel periods to optimize trapping efforts for cavity-nesting wood duck hens. The results aim to improve trap success by targeting the most effective seasonal and diel periods. This enhanced understanding of breeding behavior and cavity identification will improve population estimates and better inform regional management strategies for wood ducks.

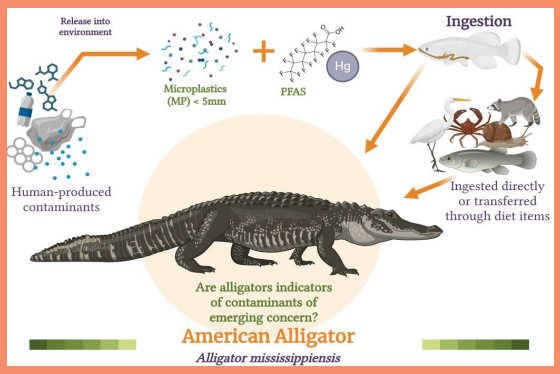
Her work was made possible by the Nemours Wildlife Foundation (Yemassee, SC, USA), the South Carolina Department of Natural Resources (Columbia, SC, USA), Clemson University's James C. Kennedy Waterfowl and Wetlands Conservation Center (Georgetown, SC, USA) and the National Institute of Food and Agriculture/U.S. Department of Agriculture (Washington, D.C., USA).

She was mentored by her graduate committee, Dr. Robert Baldwin and Dr. Don Hagan, and her Graduate Advisor, Dr. Jim Anderson, Director of the James C. Kennedy Waterfowl and Wetlands Conservation Center. She was assisted by her technicians in the field, L. A. Berardinelli and S. Mendoza.

GUTS & GLORY

Ph.D. student Miriam Boucher successfully defended her dissertation proposal before her committee and fellow students at the James C. Kennedy Waterfowl and Wetlands Conservation Center in May 2024. She is addressing gaps in knowledge by exploring connections between alligator diet, microplastic ingestion, and contaminants of emerging concern. She spoke on environmental pollution and the deleterious effect on living organisms. There are both anthropogenic and natural sources of pollution, but human pollution goes beyond the natural scale. Some man-made pollutants are referred to as Contaminants of Emerging Concern (CECs), which are of current concern to organism and ecosystem health and have little regulation nationally or internationally. These CECs studied in Miriam's project are microplastics and Per- and Polyfluoroalkyl substances (PFAS), with all roads leading to water. PFAS resists degradation due to having one of the strongest chemical bonds. The two mechanisms at play are bioaccumulation, which creates a net accumulation in body tissues, and biomagnification, which passes concentrations of these chemicals up the food web through trophic transfer. This transfer may directly impact wildlife and human health due to exposure through diet. An example of indicator species used to monitor water quality is macroinvertebrates, but they have short lifespans, which have limited comparability to human life spans. Alligators are reliable bioindicators that can potentially provide more comparative data because they are: numerous, accessible, sensitive, resident
and long-lived (60-80 years)

She is looking at these issues regionally, across eight different states in the southeast. We are excited to see the outcomes of this study and are very thankful for the partners who are making this happen.



INQUIRING MINDS

Fall of 2023 and Spring of 2024, students in the Microplastics Creative Inquiry at Clemson University analyzed stomach contents from hunter-harvested alligators from Louisiana. April 2024, they presented the results of their work at Clemson's Focus on Creative Inquiry. They were chosen to receive the People's Choice award. Congratulations to all the students for their efforts!

PLANT PATROL

June 5th, 2024, students and Interns of the James C. Kennedy Center assisted U.S. Fish and Wildlife Services with Venus Flytrap Surveys. The Venus flytrap (*Dionaea muscipula*) is a carnivorous plant native to the subtropical wetlands of the southeastern United States, particularly North and South Carolina. It is primarily found in the coastal plain, thriving in the unique wetland habitats where the soil is poor in nutrients but high in moisture.

The species is currently considered vulnerable due to habitat destruction, poaching, and environmental changes. Efforts are ongoing to protect the Venus flytrap's habitat through conservation easements, habitat management practices, and legal protection measures. Conservation strategies also involve prescribed burns to mimic natural fire cycles and maintain open, sunny conditions favorable for the plant.

Protecting the Venus flytrap is crucial not only for preserving biodiversity but also for maintaining the ecological balance of the wetland ecosystems where it thrives. The plant is an iconic species, often used to illustrate the uniqueness and importance of carnivorous plants and their role in nutrient-poor environments.

SHOWCASING INNOVATION:

2024 KENNEDY CENTER ADVISORY COUNCIL MEETING HIGHLIGHTS STUDENT RESEARCH & FUTURE PROJECTS

The annual James C. Kennedy Waterfowl and Wetlands Conservation Center Advisory Council Meeting was held on Thursday, July 11th, 2024. This is an event where our students and interns can highlight their research, and the advisory board has an opportunity to help us develop concepts for future projects.

We are grateful to every council member for your continued support of our research initiatives and fellowship at these meetings!

THIS YEAR OUR GRADUATE SPEAKER TALKS CONSISTED OF:

AKSHIT SUTHAR: Waterfowl Habitats and Antebellum Rice Fields in Coastal South Carolina: Historical Significance and Modern Management Strategies

JORDAN MCCALL: Let's Get Our Ducks in a Row: A Migration and Habitat Selection Study

CINDY VON HAUGG: Caught on Camera: Evaluating Wood Duck (Aix sponsa) Cavity Occurrence and Trapping Techniques

JULIE GRINSTEAD: Ecology of Banana Waterlily: Implications for Waterfowl Management

MIRIAM BOUCHER: Belly of the Beast: Regional Alligator Diet and Contaminants of Emerging Concern

STEPHEN CLEMENTS: Waterfowl Diets and Forage Biomass in South Atlantic Coastal Wetlands

CHRISTOPHER PETTENGILL AND RENE BROWN: Oysters with your Duck: Will Oysters Enhance Habitat Quality for Waterfowl in a Restored Salt Marsh?

CRYSTAL ANDERSON: More than Knowledge: The Human Influence in Waterfowl Management

TOBI OLANIYI: Socio-Ecological Trade-Offs: Balancing Waterfowl Conservation and Community Needs in Antebellum Rice Fields

EYES IN THE SKY

Akshit Suthar, PhD student at James C. Kennedy Waterfowl and Wetlands Conservation Center had the opportunity to attend and present his work at the first Wildlife Conservation Drones and Technologies Summit 2023 in Texas.

At the summit, Akshit shared his groundbreaking research on "Understanding Waterbird Habitat with Antebellum Rice Fields Using Drones in Coastal South Carolina." His work is at the forefront of utilizing cutting-edge drone technology to study and conserve these critical ecosystems.

During his time at the summit, Akshit had the privilege of immersing himself in the latest tools and technologies for drone-based data collection, data analysis, and a wide array of techniques essential for wildlife conservation. He even gained valuable hands-on training experience that will undoubtedly propel his research to new heights.

IN OUR OWN BACKYARD

> "The 16,000 acres of Hobcaw Barony are located in Georgetown, South Carolina, about eight miles south of Pawleys Island. The preserve covers most of the peninsula that juts down the coast at Georgetown toward Charleston, between the Waccamaw River and the Atlantic Ocean. Fittingly, Hobcaw is a Native American word meaning "between the waters... During her lifetime, Belle Baruch treasured these exceptional environmental assets. Ever since her will stipulated that the property should serve as an outdoor laboratory for research and education in the fields of forestry, wildlife, and marine science, scholars and students have treasured them as well. Her vision was remarkable in the 1960s, and her legacy grows more meaningful as each year passes."

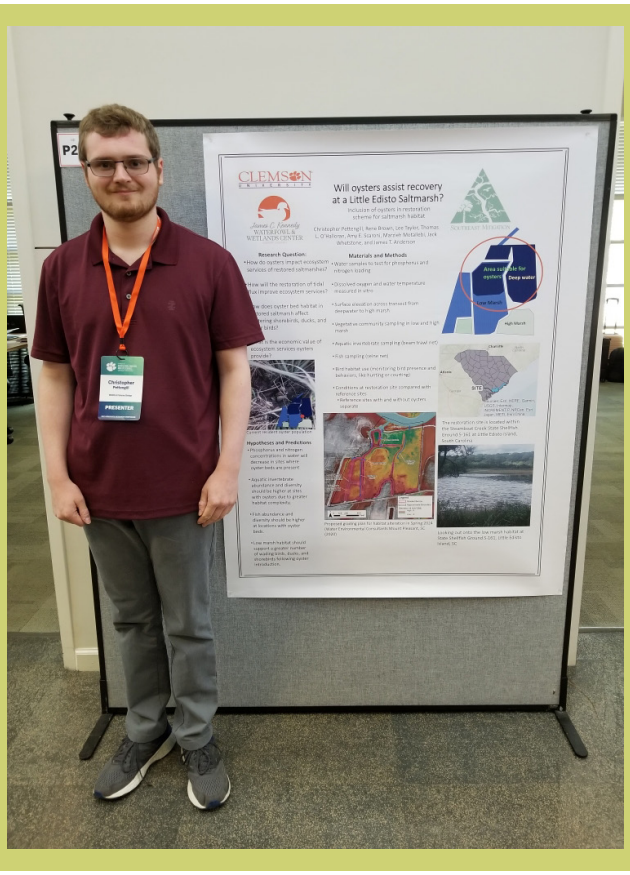
Because of the legacy that Belle Baruch left behind, the James C. Kennedy Center has the great privilege of doing research on this property. On July 12th, 2024, the wonderful staff at Hobcaw Barony hosted the Kennedy students on an official historical tour of this beautiful place. It was a great experience for our students and showed them the importance of conservation and research efforts both past and present.

MAKING A SPLASH AT THE CAFLS GRADUATE SYMPOSIUM

The Clemson University College of Agriculture, Forestry, and Life Sciences held its 2023 Graduate Student Symposium at the Baruch Institute of Coastal Ecology and Forest Science. We are thrilled to share that our James C. Kennedy Waterfowl and Wetlands Conservation Center's graduate students, Christopher Pettengill and Bobby Greco, had a fantastic experience presenting their posters of their in-progress research at this year's symposium.

Bobby Greco, a Ph.D. student, presented some of his research on the American crocodile (*Crocodylus acutus*) diet in Lago Enriquillo, a unique hypersaline lake in the Dominican Republic. Limited natural history research has been conducted on this endangered population, so Bobby is examining size and sex-related dietary patterns to assist local stakeholders in making more informed conservation management decisions for the recovery of the species.

Christopher Pettengill, a Ph.D. student, presented an overview of oyster restoration as part of saltmarsh mitigation at the Little Edisto saltmarsh. He and Rene Brown, an M.S. student at the James C. Kennedy Waterfowl and Wetlands Conservation Center, are collecting pre-restoration data to evaluate the effectiveness of planned mitigation measures for a former shrimp farm. Christopher was awarded third place on his poster!



FROM SEAFWA TO SEA TURTLES

Our investment in student training and development goes beyond Clemson University. In July, we hosted Kennedy and Kayleen, undergraduate students from Oklahoma State University, for a week of wildlife activities with Alligator Program Leader Morgan Hart, the U.S. Fish and Wildlife Service at the Cape Romain National Wildlife Refuge, and the James C. Kennedy Waterfowl and Wetlands Conservation Center. Through their involvement with the Southeastern Association of Fish and Wildlife Agencies and the Minorities in Natural Resources Conservation, they connected with PhD student Miriam Boucher and spearheaded this unique visit to the James C. Kennedy Center.

> "We had a fantastic time in South Carolina. We were given the opportunity for hands-on experience in a variety of research we would otherwise not experience in Oklahoma. From alligator satellite transmitter deployment to sea turtle nest relocation, the possibilities were endless! But what really was the best part was meeting the wonderful people that made this possible. Even though we have barely met, everyone was so kind and did everything to make sure we felt welcomed and got to experience what we wanted during our time there. It gives us so much hope for the future to meet amazing people in our future career field. We hope to return to South Carolina someday to revisit these fond memories. Thank you to everyone who made this possible!"

SEE US AT SEAFWA

Exciting News from the 77th Annual Southeastern Association of Fish and Wildlife Agencies (SEAFWA) Conference in Corpus Christi, Texas!

We're thrilled to share that our James C. Kennedy Waterfowl and Wetlands Conservation Center's graduate students, Cindy Von Haugg, Jordan McCall, Akshit Suthar, and Miriam Boucher, had the incredible opportunity to present their remarkable work at this year's conference.

The Kennedy Center made a significant presence at the 77th Annual SEAFWA Conference, showcasing our dedication to waterfowl, wetlands and dependent wildlife conservation.

CONQUERING THE CRUSH!

The James C. Kennedy Waterfowl & Wetlands Conservation Center Ph.D. student, Miriam Boucher, was selected at the 2023 Southeastern Association of Fish and Wildlife Agencies (SEAFWA) as the winner for her poster entitled, "Creation and Deployment of a Novel Tool for Crocodilian Snout Opening." With the strongest bite force of extant wildlife, this invention allows for the safe positioning of the crocodilian mouth so that research can be done without harm to the animal or the researcher. It's an original design adapted from a tool used by Luis Sigler for crocodilians dental surgeries.

REGIONAL RECOGNITION

In October 2023, The Southeastern Section of The Wildlife Society news bulletin highlighted the purpose and scope of work that the James C. Kennedy Waterfowl and Wetlands Conservation Center is a part of in the Southeast region. This publication offered a chance for the Kennedy Center to elevate itself in the scientific community as a leader in research topics that are important to our mission.

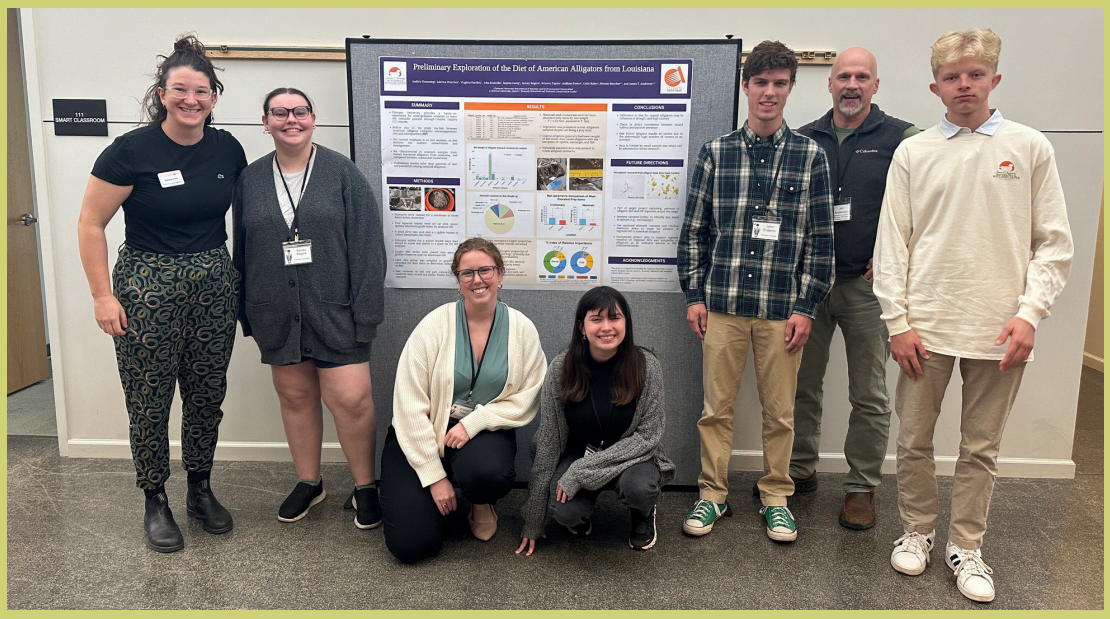
GATORS & GRAZERS

Doctoral student Miriam Boucher led alligator fieldwork in collaboration with the Rob & Bessie Welder Wildlife Foundation to conduct research on alligator diet and toxicology. The team, including Kennedy Center students Jordan McCall, Cindy Von Haugg, and Akshit Suthar caught alligators on this working cattle ranch, including in some of the cattle tanks that keep cows hydrated throughout the year. Welder Wildlife Foundation team members also pitched in to sample 7 alligators in three days at the Refuge. Diet items recovered from alligators included red river crawfish, a wood rat, insects, and fish. The team also found the next generation of Welder alligators, a female with her hatchling pod, in one of the Refuge's many wetlands. We look forward to continuing to work with the Welder Foundation in the future on this work.

WETLANDS WORLDWIDE

Dr. Jim Anderson, Director of the James C. Kennedy Waterfowl and Wetlands Conservation Center, wrote an insightful article for the June-July 2023 publication of the Jalaplavit eMagazine about the incredible work being done at the Kennedy center. In his article, Dr. Anderson delves into the importance of wetlands and waterfowl conservation. He highlights how the Kennedy Center is at the forefront of research and conservation efforts, making a significant impact in South Carolina and along the Atlantic coast.

SINKING OUR TEETH INTO ALLIGATOR RESEARCH & MANAGEMENT



Dr. Thomas Rainwater from The Baruch Institute of Coastal Ecology and Forest Science held the fifth Palmetto Alligator Research and Management Symposium. Kennedy Center Ph.D. student Miriam Boucher presented a talk on her project investigating regional alligator diet and contaminants of emerging concern. In addition, we were thrilled that six undergraduate students from the Kennedy Center-led Center Creative Inquiry course on alligator diet and microplastic attended the symposium and presented preliminary work on the alligator diet for samples they analyzed from Louisiana. These fantastic students found patterns in the diet of alligators from tidally influenced coastal sites and non-tidal inland sites, including observations of alligators eating mammals, turtles, beetles, and parasites. As they continue their work, we look forward to sharing more updates!

SITTING ON TOP

Akshit Suthar, a PhD student at the James C. Kennedy Waterfowl and Wetlands Conservation Center, was elected as the Co-chair for Student Affairs for the American Ornithological Society for the 2024-2026 term! This prestigious position recognizes Akshit's dedication to ornithology and his commitment to supporting fellow students in the field. As Co-chair, Akshit will play a vital role in advocating for student interests, organizing events, and fostering a vibrant community within the society.

NEW DIMENSIONS

Ph.D. student, Akshit Suthar, was one of the 2023 recipients of The Wildlife Society's Human Dimensions Working Group travel grant, allowing him to attend the annual TWS conference in Louisville Kentucky! He shared his experience at the event and the opportunities this grant afforded him in sharing his groundbreaking work, which was featured in the TWS HDWG May 2024 Publication.

WINGING IT:

KENNEDY CENTER GRAD STUDENTS WOW AT TWS SC MEETING WITH BIRD'S-EYE RESEARCH

James C. Kennedy Waterfowl and Wetlands Conservation Center's graduate students, Suthar Akshit and Jordan McCall, showcased their incredible research at The Wildlife Society (TWS) - South Carolina chapter's annual meeting.

Akshit Suthar, a PhD student, presented his work on "Assessing Waterbird Populations in Antebellum Rice Field Impoundments through Drone and Ground Surveys at Tom Yawkey Wildlife Center, South Carolina." His innovative methods are changing the game in waterbird conservation!

Jordan McCall, an MS student, shared her insights on "Waterbird Migration Chronology and Wetland Selection in Georgetown, South Carolina." Her work sheds light on the incredible journeys of our feathered friends.

THE KENNEDY CENTER TAKES KENTUCKY

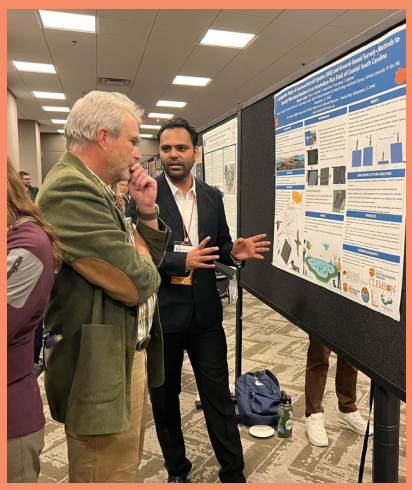
The James C. Kennedy Waterfowl and Wetlands Conservation Centre's graduate students had a great time at The Wildlife Society's 30th annual conference-2023 in Louisville, Kentucky, where they had the opportunity to present their cutting-edge research.

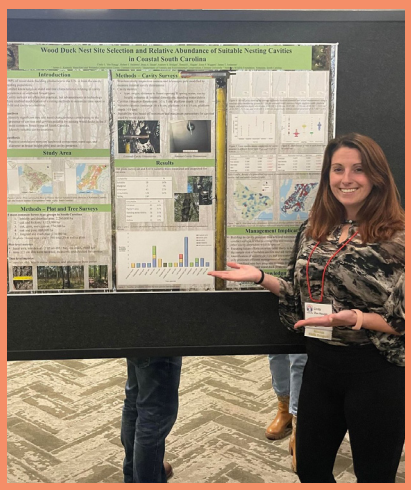
Akshit Suthar, Ph.D. student, presented his work on a comparative study of drone-based aerial and traditional ground-based survey methods to quantify waterbird numbers in antebellum rice fields in coastal South Carolina.

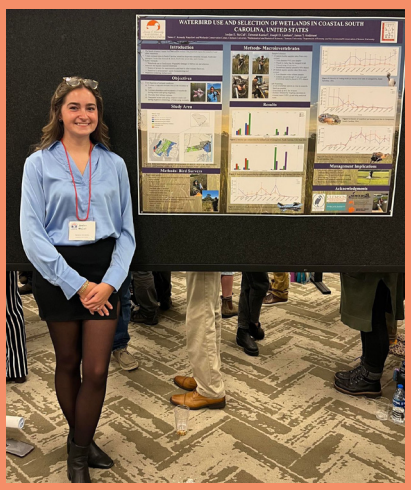
Cindy Von Haugg, M.S. Student, presented her work on wood duck nest site selection and the relative abundance of suitable nesting cavities in coastal South Carolina.

Jordan McCall, M.S. Student, presented her work on waterbird use and the selection of wetlands in coastal South Carolina.

The conference was a vibrant hub of learning and networking. Our students immersed themselves in discussions with wildlife professionals, expanding their knowledge and building valuable connections. The atmosphere was charged with enthusiasm as everyone embraced the opportunity to contribute to a better future for wildlife and their habitats.







Kennedy Center STAFF

ANDREW HOPKINS is a postdoctoral fellow at the James C. Kennedy Waterfowl and Wetland Center working with Dr. Jim Anderson. He previously completed a postdoctoral position at Purdue University, where he researched antimicrobial resistance in amoeba and canines, as well as worked on a USDA project examining the role of backyard poultry owner attitudes and perceptions in biosafety and security. Before this, he completed his Ph.D. at Purdue University in 2023, where he researched the effects of agricultural fungicides on aquatic communities. He earned his M.S. from Western Michigan University in 2019 and his B.S. from Eckerd College in 2013.

At the Kennedy Center, Andrew will be assisting with various existing projects and those in development as well as mentoring students. Additionally, Andrew will be developing independent projects examining waterfowl community ecology in wetlands as well as projects in either disease ecology or the ecology of herpetofauna.

In his free time, Andrew enjoys baking and reading, as well as exploring new areas to find local amphibians and reptiles.

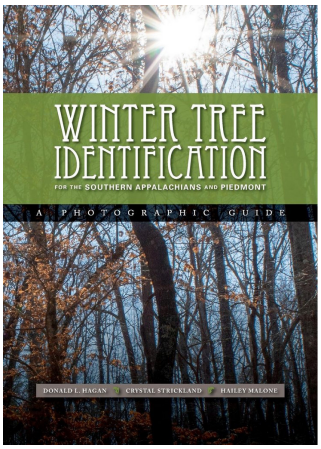
KEEGAN FOSTER was born in Massachusetts and raised in Rhode Island for most of his life. Having spent 20 years in a state that takes only an hour to drive from one end to the other, he felt as if he was ready to branch out and explore new regions. Keegan earned his bachelor's in Wildlife & Conservation Biology at the University of Rhode Island in 2023. Keegan's first experience conducting field and lab research occurred during the summer of 2022 at North Dakota State University. Here, he helped research the agriculturally beneficial Megachile rotundata (alfalfa leaf-cutting bee) relating to diapause under the guidance of a graduate student. Since then, Keegan has held multiple seasonal technician positions with an emphasis on field ornithology. Some of his previous work highlights include monitoring nesting shorebirds on Martha's Vineyard, capturing and banding wild turkeys with the Rhode Island Division of Fish and Wildlife, and banding and tracking American woodcock for the University of Rhode Island. Having these experiences under his belt, Keegan's love of fieldwork only continues to grow.

Keegan now works at the James C. Kennedy Waterfowl and Wetland Center as an entry-level wildlife biologist, eager to help graduate students with their projects and participate in the vast array of research conducted at this institution.

In his free time, Keegan loves being physically active outdoors. He has found the combination of exercise and nature to be particularly helpful in reducing stress. He loves camping, hiking, kayaking, and birdwatching.

CRYSTAL ANDERSON, a native of South Carolina, was born in the midlands and raised in the upstate near Clemson University. She currently resides in Myrtle Beach with her husband, Will, and their two children. Her extensive travels across the United States and parts of Europe have given her a deep appreciation for diverse and beautiful ecosystems and insight into various approaches to managing environmental and wildlife issues. Crystal holds a Bachelor of Science in Wildlife & Fisheries Biology and a Master of Science in Forest Resource Management. Her graduate studies focused on the human dimensions of invasive plants in recreational areas.

Crystal is a certified Wildlife Biologist with The Wildlife Society® and works for the James C. Kennedy Waterfowl & Wetlands Conservation Center in the role of wildlife biologist and grant writer, while pursuing her Ph.D. in Wildlife Biology through Clemson University. Before joining the Kennedy Center and Clemson University, she taught courses in mensuration, forest ecology, vertebrate biology and natural history, forest protection, forestry statistics, soil science and plant fertility, and recreation management for a program that offered an associate degree in forestry and wildlife.



Crystal's work as a biologist at the James C. Kennedy Waterfowl Center involves researching the human dimensions of wildlife and wetland coastal resilience. She employs surveys to investigate human-wildlife interactions, wetland conservation, climate change impacts, coastal resilience, and cultural heritage protection. Her Ph.D. research aims to enhance resilience in underserved communities through the establishment of pollinator and community gardens while also assessing the abundance and diversity of coastal pollinator species in response to changing climatic conditions. This research seeks to elucidate the impacts of pollinator decline on local ecosystems and communities.

Crystal is a published author who has co-written "Winter Tree Identification for the Southern Appalachians and Piedmont - a Photographic Guide" with Dr. Donald Hagan and Hailey Malone. Crystal used her photography skills to capture all the detailed images in this beautiful tree identification guide.

In her spare time, she is an area tour guide, environmental educator, photographer, and autism advocate.

AKSHIT SUTHAR

Ph. D. Student, James C. Kennedy Waterfowl and Wetlands Conservation Center, Clemson University

Akshit is a dedicated wildlife biologist with a passion for avian ecology and innovative technologies for wildlife monitoring. He was born and raised in rural India. He is currently a Ph.D. student under Dr. Jim Anderson at the James C. Kennedy Waterfowl and Wetlands Conservation Center, Clemson University. Akshit holds a Bachelor of Science in Chemistry from Gujarat University, India and a Master of Science in Environmental Science from Krantiguru Shyamji Krishna Verma Kachchh University, India. His research at Clemson focuses on "Understanding Waterbird Habitat Relations with Antebellum Rice Fields Using Drone and Autonomous Recording Units in Coastal South Carolina, USA", supported by the James C. Kennedy Waterfowl and Wetland Conservation Center Fellowship and a graduate research assistantship.

Akshit's journey into ecological research began during his undergraduate studies, where he worked on projects including nest box ecology of House Sparrows, Human - Sloth Bear conflicts and bear ecology, and an ecological assessment of Mugger Crocodiles. In 2014, he joined a regional organization in Gujarat's arid Kachchh landscape, leading environmental education and community-based biodiversity conservation projects focused on wetlands and waterfowl. His efforts enabled active participation from local communities and stakeholders, ensuring sustainable conservation outcomes.

In 2016, Akshit moved to central Gujarat to work with the Gujarat Ecological Society, contributing to ecological profiling, state environment atlases, and human-animal conflict mitigation projects. Notably, he rediscovered Smooth-coated Otters in Gujarat and conducted the first systematic survey on their status and conservation threats, earning recognition from the International Otter Survival Fund with the "Otter Oscar-2019" award in the research category. As a member of the Wadhvana Wetlands Advisory Committee in Gujarat, India, he played a vital role in securing RAMSAR recognition for the Wadhvana Wetland.

Beyond research, Akshit has served as a visiting faculty at Gujarat University and S.P. University, inspiring future environmentalists and conservationists. With extensive experience in diverse landscapes, quantitative ecology, ecological modeling, community-based conservation, ecosystem assessment and habitat restoration, he has published and reviewed for national and international journals. He co-chairs the American Ornithological Society's Student Affairs Committee and is an active member of organizations such as the International Union for Conservation of Nature, The Waterbird Society, The Society for Conservation Biology, The Wildlife Society, and the Society for Wetland Scientists.

ARUÃ YAYM DE CASTRO FERREIRA

M.S. Student, James C. Kennedy Waterfowl and Wetlands Conservation Center, Clemson University

Aruã Yaym de Castro Ferreira was born and raised in Brazil near the Pantanal, the largest contiguous freshwater wetland in the world. At the age of 3, he first visited his godfather's lodge and cattle ranch in the Northern Pantanal. From then on, it became a tradition to see the breathtaking landscapes of the Pantanal during school breaks and holidays to assist with cattle ranching and tours at the lodge. By 15, he developed a burning passion for the Pantanal and its traditions. Giving rise to his ultimate career goal, to become a wetland ecologist conducting research that supports local communities, conservation, sustainable development, and sustainable management in the Pantanal. By the time he turned 18 years old, he met a group of senior ecology scientists from the US (Alan Haney, Steve Apfelbaum, and John Rogner) while working at his godfather's lodge. Recognizing Aruã's passion for the Pantanal and ecology, they guided him in pursuing his dream of becoming a wetland ecologist. With their help, he ventured to the U.S. in 2018 in pursuit of high-quality education.

In 2022 he received his bachelor's degree in forestry focused on ecosystem restoration and management from the University of Wisconsin – Stevens Point. Throughout his undergraduate career, he engaged in several undergraduate research projects focused on soil science and plant taxonomy, where he gained valuable experience in developing and conducting scientific research. Following his B.S. graduation, Aruã became a field research technician under a Ph.D. student from Mississippi State University, stationed in South Carolina. Where they researched food availability in historic rice field tidal impoundments for dabbling ducks and their diet. Aruã joined the James C. Kennedy Waterfowl and Wetlands Conservation Center as an M.S. student and graduate research assistant in the spring of 2024. He is currently working on his thesis entitled "Mercury Accumulation in Wetland-dependent Birds within the Bento Gomes River Watershed in the Northern Pantanal," where he will determine the degree of mercury accumulation in wetland-dependent birds, trace its geographic source, pinpoint its position in the trophic level and food web, and investigate correlations between mercury concentrations in water, soil/sediment, and birds.

Finally, apart from research, Aruã enjoys many activities in the great outdoors, such as fishing, kayaking, hunting, birdwatching, and hiking. Alternatively, while indoors, he enjoys reading novels and manga, playing RPG video games, Dungeons & Dragons, and watching TV series.

BOBBY GRECO

Ph. D. Student, James C. Kennedy Waterfowl and Wetlands Conservation Center, Clemson University

Bobby is a Rocky Hill, CT, native with a deep passion for all things relating to herpetofauna. He is a second-year Ph.D. student in the James C. Kennedy Waterfowl and Wetland Conservation Center, advised by Dr. Jim Anderson, and a member of the Crocodile Research Coalition (CRC). Bobby's dissertation investigates head-start methods and the life history of American crocodiles in Lago Enriquillo, Dominican Republic, to provide pertinent information for the long-term conservation of the species and its habitat.

Bobby began applying his love for herpetofauna while earning a B.Sc. in Ecology and Evolutionary Biology at the University of Connecticut. During his undergraduate studies, he began assisting with herpetofauna projects in Dr. Tracy Rittenhouse's lab and the Connecticut Department of Energy and Environmental Protection (CT DEEP). After graduating, he spent a few years gaining more experience conducting research abroad with Morelet's and American crocodiles in Belize with CRC, working in husbandry with American alligators at Gator Country in Southeast Texas, conducting translocation and behavior research dunes sagebrush lizards in Northwestern Texas for Texas A&M, and assisting in managing herpetofauna populations in Connecticut with CT DEEP and Quinn Ecological (QE). While with CT DEEP and QE, he worked on a water quality project with common snapping turtles as the model species, assisted in a state-wide snake fungal disease project, conducted a state-wide spotted turtle survey, managed bog turtle habitat, and monitored rare herpetofauna populations across the state.

During his internship with CRC, he developed a close relationship with his friend and mentor Dr. Marisa Tellez. She posed an opportunity to him to assist the Dominican Ministry of Environment and Natural Resources (MENR) and local NGOs with their declining American crocodile population in Lago Enriquillo. Bobby took this opportunity and made it into his master's thesis and joined Dr. Adam Rosenblatt's lab at the University of North Florida (UNF). For his master's thesis, he conducted the first nationwide population survey of American crocodiles in the Dominican Republic (DR) since the 1980s as a large-scale collaboration with MENR, local NGOs, CRC, and UNF. Besides his thesis research, Bobby worked on various other projects in the Rosenblatt lab, most notably a diet study of American alligators in urban habitats versus natural habitats.

Between finishing his M.Sc. and beginning his Ph.D., he spent a year in the private sector with a consulting firm in Jacksonville, FL. He worked on a wide array of projects, including coral and seagrass surveys for the US Army Corps of Engineers, herpetofauna, mist net, and Bachman's sparrow surveys for the US Navy, and monitoring manatee and gopher tortoise on construction projects.

In his free time, Bobby enjoys herping, hiking, wildlife photography, music, riding his motorcycle, and travel.

CHRISTOPHER PETTENGILL

Ph. D. Student, James C. Kennedy Waterfowl and Wetlands Conservation Center, Clemson University

Christopher Pettengill is a Ph.D. student of Wildlife and Fisheries Science working with Dr. Anderson at the Kennedy Center. His research focus encompasses community ecology, ecosystem functions and services of wetlands, including how these may change in response to ecosystem disturbance. Christopher has always had an interest in wetlands, which began with exploring the ponds, creeks, and lakes near his grandfather's home and his backyard. He was fascinated by many different taxonomic groups, ranging from invertebrates and fish to plants. As an undergraduate student at the State University of New York, College at Brockport, he assisted other graduate students with their field research, predominantly students researching plant communities in forests, grasslands, and wetlands. He also conducted an independent experiment to determine how aquatic invertebrate diversity in streams correlates with the diversity of riparian vegetation. During his master's research at the University of Alabama, Christopher learned methods of collecting and identifying aquatic insects during community surveys, taking water quality data (streamflow, conductivity, pH, dissolved oxygen) and working in challenging environments. At UA, Christopher conducted a study to determine the effects of beaver dam removal on freshwater insects.

Christopher's current research project involves determining the economic value of the ecosystem services provided by oysters at a salt marsh restoration site on Little Edisto Island, South Carolina. Christopher's data collection involves monitoring abiotic conditions at the restoration site, such as water temperature, pH, salinity, conductivity, and the concentration of nitrate and phosphate. However, there is a large emphasis placed on the biotic surveys Christopher conducts at the restoration site. Christopher monitors fish communities using minnow traps, crab traps, seines, and cast netting. He uses sediment core samplers and D-nets to collect benthic invertebrates and performs transect surveys for plants using a one-square-meter quadrat. He monitors bird activity at the site and what habitat types are being utilized. Data collected prior to and after site alteration could be used to refine survey methods for restoration success in salt marshes. The project has only been possible through the cooperation of the landowner and Southeastern Mitigation LLC, and they have provided Christopher and Dr. Anderson assistance both through funding and through their experience working in the local area. Working in the salt marsh is a new experience for Christopher, so he is picking up all the information he can from people who have spent considerable time conducting field activities in this environment.

In his spare time, Christopher enjoys nature walks, fishing, kayaking, and gardening.

CINDY VON HAUGG

M.S. Student, James C. Kennedy Waterfowl and Wetlands Conservation Center, Clemson University

Cindy Von Haugg, AWB®, is a Wildlife Biology M.S. student at Clemson University's James C. Kennedy Waterfowl and Wetlands Conservation Center. She is a student veteran who served nine years in the Air Force before receiving her B.S. in Wildlife Management from the State University of New York at Cobleskill. While pursuing her undergraduate degree, she was active in New York State's Chapter of Ducks Unlimited and quickly developed a strong passion for waterfowl research. Various technician positions fostered her interest in nesting ecology. After working as a field technician on a southeast regional wood duck recruitment study through Clemson, she enrolled as a graduate student in August 2021.

Her graduate research aims to pave the way for studies on cavity-nesting wood ducks. Besides being one of the most stunning waterfowl species, wood ducks are also extremely important economically. Wood ducks are the second most harvested waterfowl species in the Atlantic and Mississippi flyways. As such, they largely contribute to the billions of conservation dollars raised by hunters to conserve and protect our wetlands and waterfowl populations. These fragile ecosystems provide crucial services such as water purification and storage and flood buffering, and their abundant diversity supports far-reaching food webs, with us included. For such a critical game species, there are still many questions left to be answered so we can ensure their population continues to thrive. One key to sustaining a healthy population is monitoring and analyzing long-term trends, so policymakers stay informed. However, wood ducks are more secretive than other waterfowl species, and that works against our efforts to monitor their population using annual breeding surveys. As an alternative, population models could improve current assessments, but more data on the demographic vital rates of cavity-nesting wood ducks is needed. She aimed to help bridge this knowledge gap by developing a method to increase data collection efficiency, identifying which forest and tree characteristics are indicative of cavities, and evaluating activity patterns to increase trap success by directing efforts to the most appropriate seasonal and diel periods. Using her results as guidelines for future trapping efforts could greatly improve the trapping success of wood duck hens during the breeding season, thus increasing our understanding of the reproductive ecology of cavity-nesting wood ducks and best-informing management decisions.

Her motivation is fueled by her love of the outdoors and the adventurous spirit she has gained from hiking, camping, fishing, and hunting with her family since her youth. She most enjoys spending quality time with her family and husband, Matt, two dogs, and a cat. You can often find them sightseeing around the country, wandering the woods, or yelling at a football game.

HALLIE COWAN

M.S. Student, James C. Kennedy Waterfowl and Wetlands Conservation Center, Clemson University

Hallie Cowan is a Latina from New Jersey with a passion for crocodilians. She is a master's student working with Dr. Jim Anderson at Clemson University. Her project involves the three species of caimans in Suriname: spectacled caiman (*Caiman crocodilus*), smooth-fronted caiman or Schielder's dwarf caiman (*Paleosuchus trigonatus*) and Cuvier's dwarf caiman (*Paleosuchus palpebrosus*). There, she will be looking at the effects of small-scale gold mining on caimans by studying total mercury in their tissue and blood. The project will also look at diet and age class to better understand the accumulation at different trophic levels. She hopes that this study will further research looking at caimans as bioindicators of waterway health in areas of Latin America where a prominent part of people's diets are the fish in their nearby rivers.

Before starting this project, Hallie spent most of her free time in the Peruvian Amazon, where she assisted the nonprofit Fauna Forever with their long-term monitoring of caimans, herps (reptiles and amphibians), mammals, bats and birds. There, she grew as a researcher and made the friends that would help her develop her master's project. She has started a growth rates study using their long-term caiman monitoring data from the past 7 years and is assisting Chris Ketola in a study looking at the mercury accumulation in the caimans on the Tambopata River.

Photography has become a large part of her conservation career. She is a writer for Photography Life magazine and a Girls Who Click ambassador. Her work has won first place in photography for the Florida Society of News Editors and is a finalist in the photo essay category with the Society of Professional Journalists. Part of her goal is to use photography to communicate research to a wide audience.

Hallie is excited to start this chapter with Clemson and get to know the amazing people working to understand wetlands!

JORDAN McCALL

M.S. Student, James C. Kennedy Waterfowl and Wetlands Conservation Center, Clemson University

Jordan McCall is an M.S. student at Clemson University's James C. Kennedy Waterfowl and Wetlands Conservation Center, nearing the completion of her thesis research. Originally from Chapin, SC, she earned her bachelor's degree in wildlife and fisheries biology from Clemson in 2021. During her undergraduate studies, Jordan gained valuable field experience contributing to the Southeastern wood duck project, maintaining wood duck boxes, and processing disease samples in the lab. This hands-on work ignited her passion for wetland and waterfowl management, opening doors for a career in the field.

She also interned with the Nemours Wildlife Foundation, where she assisted with research surveys on black rails, red-cockaded woodpeckers, and alligators. After earning her bachelor's, Jordan continued her studies at the Kennedy Center, embarking on her master's research. Her M.S. thesis focuses on establishing baseline wetland conditions at Hobcaw Barony and DeBordieu Colony, areas with limited available data. Her primary objectives include examining migration chronology and habitat selection by waterbirds and conducting point-count, secretive marsh bird, and macroinvertebrate surveys to assess wetland productivity.

Jordan has presented her research at several conferences, including South Carolina's Wildlife Society Conference, the National Wildlife Society Conference, SEAFWA, and the North American Duck Symposium (Ducks 9). In her free time, she enjoys watching documentaries, reading on her Kindle, and exploring local breweries. She especially loves spending time at the beach or lake with her husband, Peyton, playing with their puppy, Cash, and hanging out with her five siblings.

MAIYA DUNCAN

M.S. Student, James C. Kennedy Waterfowl and Wetlands Conservation Center, Clemson University

Maiya Duncan, a native of Long Beach, CA, is an alumna of Tuskegee University, where she earned her B.S. in Animal, Poultry, and Veterinary Sciences in 2021. She went on to complete her M.S. in Environmental Science at Tuskegee in 2024, focusing her research on predator behavior, particularly coyote responses to feral hogs in mesocarnivore communities. In the fall of 2024, she joined the Clemson University James C. Kennedy Waterfowl and Wetlands Conservation Center and the Department of Forestry and Environmental Conservation, where her Ph.D. research will explore the behavioral differences between farm-raised and wild-born mallards under the direction of Dr. Jim Anderson.

Maiya's academic interests span wildlife conservation, predator ecology, predator-prey dynamics, and wetland ecology. Her leadership experience stems from her dedication to educating undergraduates about natural resources and conservation. She has served as president of the Natural Resource Conservation Club and the Red Tails Ducks Unlimited chapter at Tuskegee.

Before starting her Ph.D. at Clemson, Maiya completed an AmeriCorps/ACE internship with the National Park Service at the Great Smoky Mountains National Park, where she worked with the education team to mentor high school interns during a six-week program focused on exploring careers within the park service. Maiya is excited to embark on her Ph.D. journey in Wildlife and Fisheries Biology and looks forward to contributing to the field of conservation.

MIRIAM BOUCHER

Ph.D. Student, James C. Kennedy Waterfowl and Wetlands Conservation Center, Clemson University

Miriam, a native of Canada with a deep passion for crocodilians and a love for reptiles, is a Ph.D. student under Dr. Jim Anderson at Clemson University's James C. Kennedy Waterfowl and Wetlands Conservation Center. Her academic and professional journey has taken her across the Americas. After earning her B.S. in Environmental Biology from Wingate University in North Carolina, she worked in Brazil with the NGO Iracambi in the Atlantic Forest, where she managed volunteers and led a camera-trapping program documenting wildlife on private reserves.

Her lifelong fascination with crocodilians led her from the jungles of Brazil to the shores of Belize, where she began working with American crocodiles. This experience inspired her master's research at West Virginia University under Dr. Jim Anderson, where she completed her M.S. thesis on American crocodile behavior and bioacoustics in Belize. Her work produced the first time-activity budgets for wild American crocodiles and the first dedicated study of their vocalizations.

After completing her master's, Miriam joined the Crocodile Research Coalition (CRC) in Belize, conducting nationwide population surveys of Morelet's and American crocodiles, implementing a country-wide education and outreach program, securing research funding, leading a project in Nicaragua, and mentoring interns and visiting scholars.

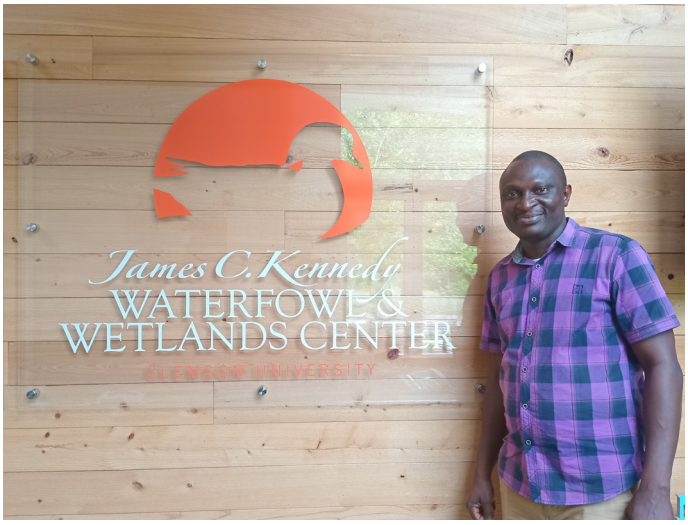
Following her work in Belize, Miriam returned to Canada to work as an environmental scientist for a consulting firm, overseeing wildlife mitigation efforts and ensuring compliance with federal and provincial wildlife regulations on major construction projects.

Miriam is thrilled to be part of the Clemson University and Kennedy Center team, where she is conducting a groundbreaking study on the diet of American alligators in the southeastern U.S. Her research will explore the prevalence and magnitude of microplastic ingestion and the presence of "forever chemicals" (PFAS) in alligator tissues. She is grateful for the support provided by the Nemours Wildlife Foundation Graduate Research Fellowship, the Clemson University Experiment Station, and the College of Agriculture, Forestry, and Life Sciences during the 2023-2024 academic year.

OLANIYI OLUWATOBI

Ph.D. Student, James C. Kennedy Waterfowl and Wetlands Conservation Center, Clemson University

Olaniyi Oluwatobi is a motivated researcher pursuing his doctorate at Clemson University in the United States. He is developing a Decision Support Tool (DST) to sustain Antebellum Rice Fields on South Carolina's Atlantic Coast. His study combines modern geospatial technology with machine learning, deep learning, and optimization techniques. This unique strategy attempts to establish a balance between farming operations and the conservation of vulnerable coastal habitats.



Olaniyi has an extensive educational background, having received a master's degree in wildlife management from the Federal University of Technology in Akure, Nigeria. He expanded his knowledge with postgraduate certifications in remote sensing and GIS from the University of Twente (Netherlands) and Kwame Nkrumah University of Science and Technology in Ghana. His academic journey has been enriched by diverse international experiences and prestigious scholarships, including the Third World Academy of Science/Universiti Putra Malaysia Research Fellowship and scholarships from WWF Prince Bernhard and A.G. Leventis Foundation.

His professional trajectory includes significant contributions to wildlife conservation and ecological resilience across Africa, Asia, and Europe. As a Researcher and Senior Lecturer at the Federal University of Technology, Akure, Nigeria, he has led various projects focusing on wetland assessments, terrestrial bird populations, and the application of machine learning in climate impact studies. His tenure as a research fellow in Peninsular Malaysia further honed his skills in using geospatial technologies for avian conservation and wetland management.

Beyond academia, Olaniyi is deeply committed to mentoring and knowledge exchange. He regularly participates in international organizations such as the American Society of Primatologists, the Society for Conservation Biology, and the Environment Science without Borders at the University of California, Los Angeles, displaying his commitment to furthering the profession and promoting variety in scientific study.

Olaniyi's current Ph.D. study at Clemson University marks a turning point in his career, perfectly matching with his love for waterfowl conservation and wetland management. His project aims to develop a robust DST for Antebellum Rice Fields and to integrate socio-environmental systems modeling to address complex ecological challenges. This work promises to contribute significantly to historical ecology, wetland management, and waterfowl conservation, bridging past agricultural practices with modern conservation efforts.

Looking ahead, Olaniyi envisions continuing his advocacy for sustainable environmental practices and expanding his leadership role in global conservation initiatives. Clemson University's distinguished academic environment and collaborative research opportunities provide an ideal platform for realizing these ambitions.

RENE BROWN

M.S. Student, James C. Kennedy Waterfowl and Wetlands Conservation Center, Clemson University

Rene Brown is a Graduate Research Assistant at the James C. Kennedy Waterfowl and Wetlands Conservation Center, Clemson University. Rene's passion for science began during her childhood in Jamaica, where she was exposed to animal husbandry on her grandfather's livestock farm. She spent countless hours observing animal behaviors, believing there was much to learn about them. She recalls catching small fish from the river and attempting to keep them as pets in a homemade aquarium. When they died within two weeks, she was puzzled and driven to understand what went wrong. This experience, combined with her growing interest in animal adaptation to different environments, fueled her pursuit of a deeper understanding of wildlife.

Rene's academic journey led her to study biology at Allen University in Columbia, SC, where she analyzed the relationship between animals and their environments. She conducted research on microRNA biogenesis in corn with her mentor and was selected to present her findings to the Allen University Board of Trustees.

In the summer of 2022, Rene volunteered at Hope Zoo in Jamaica and interned with the Caribbean Coastal Area Management. These experiences helped her develop a variety of skills, including teamwork, time management, goal setting, punctuality, effective communication, and flexibility.

Currently, at the Little Edisto S-161 restoration site in Charleston, South Carolina, Rene is researching ways to improve salt marsh restoration, bird habitats, water quality, and fish sampling. She is particularly interested in how oyster beds in the restoration plan can enhance the site's ecosystem services. She is conducting water quality tests and bird habitat studies to determine their impact on these beds and conducting different experimental approaches around leaf litter decomposition. Since joining the Kennedy Center in August 2023, Rene has gained valuable experience, which has further honed her research and presentation skills, contributing to her growth as a scientist.

Outside of research and education, Rene enjoys playing soccer, listening to podcasts and audiobooks, and nature walks.

SCOTT BINGER

Ph.D. Student, James C. Kennedy Waterfowl and Wetlands Conservation Center, Clemson University

Scott is a Ph.D. student at the James C. Kennedy Waterfowl and Wetlands Conservation Center. Growing up near Chicago, just minutes from the Cook County Forest Preserves, he spent his childhood exploring and observing wildlife. His passion for studying the natural world became evident early on, leading him to pursue an undergraduate degree at Southern Illinois University (SIU) after community college.

At SIU, Scott developed a strong interest in ecological interactions, which led him to work as a technician in a freshwater ecology lab. There, he conducted field studies on fish, amphibians, and aquatic invertebrates and began investigating parasites of fish and invertebrates. His research focused on understanding how these systems respond to environmental changes. This curiosity led him to pursue a master's degree in the same lab, where he studied the effects of phosphorus enrichment on parasite populations and developed bioenergetic models of parasite growth. During this time, Scott became increasingly interested in examining ecological changes on larger spatial scales.

This interest brought him to the Kennedy Center, where he began as a graduate assistant in the fall of 2024 under the advisement of Dr. James Anderson. Scott's current research focuses on biodiversity in Carolina Bay wetlands in South Carolina. These unique wetlands are crucial habitats for a wide range of wildlife and plant species, but human disturbances can significantly impact their availability and quality. Scott's work involves sampling macroinvertebrates, frogs, birds, and vegetation in these wetlands. He is developing a wetland disturbance gradient to assess human impact on these sites, and he will use these data to create indices of biotic integrity, which can be applied across different sites to inform wildlife management strategies.

Outside of his academic pursuits, Scott enjoys hiking, biking, fishing, playing and recording music, attending (and sometimes performing at) concerts, and cheering on the Tigers at sporting events (go Tigers!)

Student
AWARDS & ACHIEVEMENTS

We are pleased to announce fellowships, assistantships, scholarships, and other scholarly honors awarded to Kennedy Center undergraduate and graduate students during 2022–2023. Our goal is to continue to grow our student numbers, especially our graduate program. Students are our future waterfowl and wetland managers, biologists, and researchers. We are training and mentoring the future stewards of wetlands and waterfowl at the Kennedy Center and are proud of our student's accomplishments. Congratulations to all our students for their current and future accomplishments.

BOBBY GRECCO *IUCN Edge Grant 2023, Jacksonville Zoo Grant 2023, Clemson Graduate Travel Grant Spring 2024, invited to become a member of the IUCN-SSC Crocodile Specialist Group 2024, Clemson BioSci Teaching Assistantship 2023-2024, 2024-2025*

AKSHIT SUTHAR *2023 TWS Human Dimensions Working Group Travel Grant ($500), 2023 TWS Biological Diversity Working Group Travel Grant ($500), Clemson Graduate Travel Grant Summer 2023 ($750), James C. Kennedy Graduate Research Fellowship ($20,000), Clemson Forestry & Environmental Conservation Graduate Research Assistantship ($5,000), 2024 TWS Wetlands Working Group Student Research Grant ($1,000), Clemson Graduate Travel Grant Sprint 2024 ($750), elected Co-chair of Student Affairs Committee - American Ornithological Society 2024-2026 term*

MIRIAM BOUCHER *South Carolina Water Resources Grant ($34,419), IUCN Crocodile Specialist Group Student Research Assistantship Scheme Grant ($1,000), North Carolina Herpetological Society David L. Stephan Grants in Herpetology ($1,000), Best Student Poster Award, Southeastern Association of Fish & Wildlife Agencies, Corpus Christi, TX, Clemson Graduate Student Travel Grant Spring 2024 ($1,000), Clemson Graduate Travel Grant Fall 2023 ($750), Clemson University Department of Forestry & Environmental Conservation Marion Bailey Fellowship ($4,483), Clemson University College of Agriculture, Forestry & Life Sciences Interdisciplinary Fellowship ($4,000), Nemours Wildlife Foundation Graduate Research Fellowship ($30,000)*

JORDAN MCCALL, *a Kennedy Center M.S. student completed her field research and will defend her thesis evaluating migration chronology & waterbird habitat use in December 2024, James C. Kennedy Center Fellowship 2023-2024 ($18,000)*

SCOTT BINGER, *a Kennedy Center Ph.D. student, has begun research developing indices of biotoic integrity for Carolina Bay wetlands, and will start field research throughout the state in Spring 2025*

ALLIGATOR DIET & MICROPLASTIC CREATIVE INQUIRY

Clemson University Focus on Creative Inquiry People's Choice Award

CINDY VON HAUGG

defended her thesis July 2024, USDA-NRCS

CRYSTAL ANDERSON

2024 TWS Trailblazer Grant

HALLIE COWAN

Clemson BioSci Graduate Student Teaching Assistantship 2024-2025

SINDUPA DESILVA

2024 Greenville, SC Three Minute Thesis Regional Competition (2nd place)

COLIN BAKER

James C. Kennedy Undergraduate Scholarship, Creative Inquiry Summer Internship Award

CHRISTOPHER PETTENGILL

STEM Graduate Research Assistant Funding (CAFLS) ($20,000 one year stipend)

SOPHIA COREY

James C. Kennedy Undergraduate Scholarship

SABRINA DRESCHER

James C. Kennedy Undergraduate Scholarship, Creative Inquiry Summer Internship Award

MAIYA DUNCAN

James C. Kennedy Center Fellowship 2024-2025

OLUWATOBI OLANIYI

James C. Kennedy Center Fellowship 2024-2025

JEYDA BOLUKBASI

James C. Kennedy Undergraduate Scholarship

ARUÃ DECASTRO

James C. Kennedy Center Fellowhip 2024-2025 ($24,000)

2024 Advisory COUNCIL

AARON PIERCE
Director of Conservation Science & Planning, Ducks Unlimited

BUFORD MABRY
Wildlife Biologist, South Carolina Department of Natural Resources
(Retired)

ANDREW S. BRIDGES
President & CEO, Nemours Wildlife Foundation

CASTLES LELAND
Manager, Weymouth Plantation

BEAU BAUER
Wildlife Biologist, Nemours Wildlife Foundation

CRAIG SASSER
Refuge Manager, U.S. Fish & Wildlife Service

BILLY DUKES
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SHERRI FIELDS
Director of Conservation, Audubon South Carolina

THOMAS RAINWATER
Wildlife Research Scientist, Yawkey Foundation & Belle W. Baruch Institute of Coastal Ecology & Forest Science

TRAVIS H. FOLK
Wildlife Biologist, Folk Land Management, Inc.

PUBLICATIONS *(n=17)*

Abesh, B. F., J. T. Anderson, and J. A. Hubbart. 2024. Using MODFLOW to model riparian wetland shallow groundwater and nutrient dynamics in an Appalachian Watershed. Water 16:1772. https://doi.org/10.3390/w16131772

Abesh, B.F., J. T. Anderson, and J. A Hubbart. 2024. Surface water (SW) and shallow groundwater (SGW) nutrient concentrations in riparian wetlands of a mixed land-use catchment. Land 13:409. https://doi.org/10.3390/land13040409

Becker, D. N., D. J. Brown, and J. T. Anderson. 2024. Influence of wetland and landscape characteristics on freshwater turtle relative abundance and movement patterns in West Virginia, USA. Wetlands 44:19. https://doi.org/10.1007/s13157-024-01777-9

Boucher, M., T. R. Rainwater, M. Stoner, L. Sigler, S. L. Whitmire, and J. T. Anderson. 2024. Conquering the crush: A novel tool for holding crocodilian jaws open. Wildlife Society Bulletin e1534. https://doi.org/10.1002/wsb.1534

Bryzek, J. A., W. Veselka IV, and J. T. Anderson. 2024. State role and involvement in determining wetland mitigation performance standards in the United States. Ecology & Society 29(1):30. https://doi.org/10.5751/ES-14530-290130

Noe, K. L., C. T. Rota, M. W. Frantz, and J. T. Anderson. 2024. Restored wetland size and age influence small mammal communities in West Virginia, USA. Wetlands 44:48. https://doi.org/10.1007/s13157-024-01799-3

Staggs, J. M., D. J. Brown, A. F. Badje, J. T. Anderson, L. V. Carlson, C. N. Lapin, M. M. Cochrane, and R. A. Moen. 2024. Influences of aquatic and terrestrial habitat characteristics on abundance patterns of adult wood turtle. Journal of Wildlife Management 88:e22589. https://doi.org/10.1002/jwmg.22589

Tellez, M., M. Sparks, J. Triminio, and M. Boucher. 2024. Utilizing UAV Technology in Crocodile Conservation and Management in Belize. IUCN Crocodile Specialist Group Newsletter. Gland, Switzerland 42: 11 – 12.

Von Haugg, C. L. and J. T. Anderson. 2024. Method for evaluating and measuring cavities suitability for nesting wood ducks. Wildlife Society Bulletin e1531:1-12. http://doi.org/10.1002/wsb.1531

Bryzek, J. A., W. Veselka IV, C. Rota, and J. T. Anderson. 2023. Woody vegetation indicators vary with time since wetland restoration. Wetlands 43:89. https://doi.org/10.1007/s13157-023-01735-x

Greco, R., Tellez, M., Brocca, J., Perez, R.P., Rosenblatt, A.E. 2023. Population status of the American crocodile (Crocodylus acutus) in Dominican Republic. Journal of Herpetology, 57(4), 418-427.

Greco, R., Tellez, M., Brocca, J., Perez, R.P., Rosenblatt, A.E. 2023. American crocodile (Crocodylus acutus) diet in Lago Enriquillo, Dominican Republic. Herpetological Review, 54(3), 460-461.

Petrauski, L., S. Owen, G. Constantz, and J. T. Anderson. 2023. Changes in avian spring arrival dates of 115 species in the central Appalachians over 127 years. American Journal of Climate Change 12(4):527-547. https://doi.org/10.4236/ajcc.2023.124024

Rosenblatt, A. E., Greco, R., Beal, E., Colbert, J., Moore, Y., Baglin, V., & Nifong, J. C. (2023). Golf course living leads to a diet shift for American alligators. Ecology and evolution, 13(9), e10495.

Skelly, B. P., H. L. Clipp, S. M. Landry, R. Rogers, Q. Phelps, J. T. Anderson, and C. T. Rota. 2023. A flexible Bayesian approach for estimating survival probabilities from age-at-harvest data. Methods in Ecology and Evolution 14:1061-1073. http://doi.org/10.1111/2041-210X.14077

Suthar, A. R., M. Boucher, C. L. Von Haugg, J. E. McCall, A. C. Hsiung, A. MacKenzie, J. A. Bryzek, S. De Silva, and J. T. Anderson. 2023. Global Climate Change and Impacts on Wetland Fauna. In Global Climate Change and Wildlife Management. Apple Academic Press, Palm Bay, Florida USA. Book Chapter. Accepted and under review.

Thakur, T. K., M. P. Barya, J. Dutta, P. Mukherjee, A. Thakur, S. L. Swamy, and J. T. Anderson. 2023. Integrated phytobial remediation of dissolved pollutants from domestic wastewater through constructed wetlands: An interactive macrophyte-microbe-based green and low-cost decontamination technology with prospective resource recovery. Water 15(22):3877. https://doi.org/10.3390/w15223877

Thakur, T. K., M. P. Barya, J. Dutta, P. Mukherjee, A. Thakur, S. L. Swamy, and J. T. Anderson. 2023. Contaminant removal in different constructed wetland types. Scholarly Community Encyclopedia https://encyclopedia.pub/entry/51757

Oral & Poster PRESENTATIONS *(n=45)*

Anderson, J. T. 2024. My life in wetlands: Take home lessons for a fulfilling career. Society of Wetland Scientists Student Virtual Conference. Virtual. (Invited-Keynote Speaker).

Anderson, J. T., C. Anderson, M. Boucher, R. Brown, A. de Castro, S. De Silva, R. M. Greco, Jr., J. Grinstead, A. MacKenzie, J. E. McCall, O. E. Olaniyi, C. Pettengill, A. R. Suthar, and C. L. Von Haugg. 2024. Wildlife of tidal freshwater forested wetlands. Forested Wetlands of the Upper Estuary, Charleston, South Carolina. (Invited).

Baker, C., Boucher, M., and Anderson, J. 2024. Analyzing Microplastics in the Diets of American Alligators from South Carolina. 8th Annual Summer Creative Inquiry + Undergraduate Research Showcase, Clemson, SC. (Poster)

Boucher, M., T. R. Rainwater, S. L. Whitmire, J. A. Bowden, T. Farmer, and J. T. Anderson. 2024. Belly of the Beast: Regional Alligator Diet and Contaminants of Emerging Concern. 2024 Annual Council meeting, James C. Kennedy Waterfowl and Wetlands Conservation Center, Georgetown, South Carolina. (Oral)

Boucher, M., S. Whitmire T. Rainwater, T. Farmer, and J. T. Anderson 2024. Exploring alligators as indicators of microplastic pollution in wetlands. The Wildlife Society, Wetlands Working Group, Online. (Invited)

Boucher, M., T. Rainwater, M. Stoner, L. Sigler, S. L. Whitmire, and J. T. Anderson. 2024. Conquering the crush: a novel alligator crocodilian jaw prop. IUCN-SSC Crocodile Specialist Group Conference, Darwin, Australia. (Poster)

Boucher, M., T. Rainwater, S. Whitmire, J. Bowden, T. Farmer, and J. T. Anderson 2024. Leveraging alligator management to explore regional alligator diet and contaminants of emerging concern. IUCN-SSC Crocodile Specialist Group Conference, Darwin, Australia. (Oral)

Boucher, M., S. L. Whitmire, T. Rainwater, and J. T. Anderson. 2024. Exploring alligator diet and microplastic contamination in alligator-inhabited wetlands. Microplastics in the Coastal Region, Charleston, South Carolina. (Poster).

Drescher, S., Boucher, M., and Anderson, J. 2024. Exploration of the Relationship Between Diet and Mercury Accumulation in the American Alligator (Alligator mississippiensis). 8th Annual Summer Creative Inquiry + Undergraduate Research Showcase, Clemson, SC. (Poster)

Fleming, A., S. Drescher, S. Corey, B. Taylor, J. Enderlin, A. Foster, K. Bradford, C. Baker, V. Kackley, R. Luksic, J. Creswell, J. Keglovits, M. Boucher, and J. T. Anderson. Exploration of diet and parasitism of American alligators in Louisiana. 19th Annual Focus on Creative Inquiry, Clemson, South Carolina (Poster) *People's Choice Award

Fowler, T., J. T. Anderson, B. Neale, A. Wunderley, R. Huffman, and C. Brzorad. 2024. Wetlands: what are they…Why they matter…and what can you do to protect them? SC7 Resiliency Conference. Charleston, South Carolina (Invited—Panel Discussion).

Greco, R., M. Tellez, J. Espinal, J. Pena, A. Rosenblatt, J. Brocca, C. M. Bodinof Jachowski, and J.T. Anderson. 2024. Home range selection patterns of American crocodile (Crocodylus acutus) in Lago Enriquillo, Dominican Republic. IUCN-SSC Crocodile Specialist Group Conference, Darwin, Australia. (Poster)

Greco, R. 2024. Methods of crocodilian incubation. Dominican and El Salvadorian Ministry of the Environment and Natural Resources Crocodile Symposium, La Descubierta, Dominican Republic. (Oral)

Hsiung, A., B. E. Ross, H. M. Hagy, and J. T. Anderson. 2024. Identifying drivers of mallard and green-winged teal populations in North America. U.S. Fish and Wildlife Service Waterfowl Webinar, Virtual. (Invited).

MacKenzie, A., D. N. Becker, C. M. Lituma, and J. T. Anderson. 2024. Avian response to wetland restoration in Preston County, West Virginia. Audubon Society Mountaineer Chapter Annual Science in the Scope: The Latest in Bird Research by WVU Graduate Students, Morgantown, West Virginia (Invited).

MacKenzie, A., D. N. Becker, C. M. Lituma, and J. T. Anderson. 2024. Restoration impacts on flora and fauna abundance and diversity. Delaware Wetlands Conference, Wilmington, Delaware.

MacKenzie, A., and J. T. Anderson. 2024. Collaborative solutions to overcome challenges in stream and wetland mitigation. Environmental Markets Conference 2024. Pittsburgh, Pennsylvania.

McCall, J., J. D. Lanham, D. Kunkel, and J. T. Anderson. 2024. Waterbird migration chronology and wetland selection in Georgetown, South Carolina. Ducks 9 Conference, Portland, Oregon. (Poster)

McCall, J. E. and J. T. Anderson. 2024. Let's Get Our Ducks in a Row: A Migration and Habitat Selection Study. The Kennedy Center Advisory Council Meeting, Georgetown, SC. (Oral)

Miller, E. M., R. M. Kaminski, B. A. Bauer, G. K. Yarrow, K. Barrett, and J. T. Anderson. 2024. Evaluating deterrents to reduce depredation of wood duck eggs in nest boxes. Ducks 9 Conference, Portland, Oregon.

Shurba, J., K. Whitehead, B. Bauer, K. Barrett, G. Yarrow, and J. T. Anderson. 2024. The influence of shavings on wood duck reproductive ecology and eggshell bacteria. Ducks 9 Conference, Portland, Oregon.

Suthar, A. R., J. A. Elmore, E. K. Buchholtz, T. H. Folk, and J. T. Anderson. 2024. Waterfowl habitat and antebellum rice fields in coastal South Carolina: Historical significance and modern management strategies. 2024 Annual Council meeting, James C. Kennedy Waterfowl and Wetlands Conservation Center, Georgetown, South Carolina.

Suthar, A. R., M. A. McAlister, B. A. Bauer, T. H. Folk, J. Dozier, J. A. Elmore, E. K. Buchholtz, and J. T. Anderson. 2024. Eyes in the Sky: Evaluating drone as a tool for aerial waterbird survey in antebellum rice fields in Coastal South Carolina. ACE Basin Symposium, Walterboro, South Carolina.

Suthar, A. R., J. A. Elmore, E. K. Buchholtz, T. H. Folk, and J. T. Anderson. 2024. Quantifying habitat use by secretive marsh birds in antebellum rice fields using drone and autonomous recording units in coastal South Carolina. The Wildlife Society, Wetlands Working Group, Online. (Invited)

Thompson, W., A. Stegmann, B. Murry, S. De Silva, J. T. Anderson. 2024. Development of community size-spectra-based indices of biotic integrity for West Virginia wetlands. Division of Forestry & Natural Resources Research Symposium, West Virginia University. (Poster)

Von Haugg, C. L., R. F. Baldwin, B. A. Bauer, D. L. Hagan, E. P Wiggers, and J. T. Anderson. 2024. Caught on Camera: Evaluating Wood Duck (Aix sponsa) Cavity Occurrence and Trapping Techniques. Kennedy Center Advisory Council Meeting, Baruch Institute of Coastal Ecology and Forest Science, Georgetown, South Carolina. (Poster)

Von Haugg, C. L. and J. T. Anderson. 2024. Method for evaluating cavity suitability for nesting wood ducks (Aix sponsa). Ducks 9. Portland, Oregon. (Invited).

Boucher, M., M. Stoner, L. Sigler, T. Rainwater, and J. T. Anderson. 2023. Creation and deployment of a novel tool for crocodilian snout opening. Southeastern Association of Fish and Wildlife Agencies (SEAFWA) 77th Annual Conference – 2023, Corpus Christi, Texas. (Poster) *Best Poster Presentation

Boucher, M., T. Rainwater, S. Whitmire, J. Bowden, T. Farmer, and J. T. Anderson. 2023 Regional alligator diet and ecotoxicology of contaminants of emerging concern: an overview and update. 2023 Palmetto Alligator Research and Management Symposium, Georgetown, South Carolina.

Clark, J., A. S. H. Hagan, J. T. Anderson, and M. Folk. 2023. Comparison of soil organic matter depth among reference sites and two restored wetlands in the Coastal Plain of South Carolina. Forestry and Environmental Conservation Graduate Seminar Poster Session, Clemson, South Carolina (Poster).

Fleming, A., S. Drescher, V. Kackley, J. Enderlin, S. Corey, S. Rogers, B. Taylor, A. Foster, C. Baker, M. Boucher, and J. T. Anderson. 2023. Preliminary exploration of the diet of American alligators from Louisiana. 2023 Palmetto Alligator Research and Management Symposium, Georgetown, SC. (Poster)

Greco, R., A.E. Rosenblatt, M. Tellez, J. Brocca, and J.T. Anderson. 2023 A snapshot of American crocodile (Crocodylus acutus) diet in the hypersaline conditions of Lago Enriquillo, Dominican Republic. Clemson University College of Agriculture Forestry and Life Sciences Graduate Symposium, Georgetown, SC. (Poster)

McCall, J., D. Kunkel, J. D. Lanham, and J. T. Anderson. 2023. Waterbird migration chronology and wetland selection in coastal South Carolina, USA. Southeastern Association of Fish and Wildlife Agencies (SEAFWA) 77th Annual Conference – 2023, Corpus Christi, Texas. (Poster)

McCall, J., J. D. Lanham, D. Kunkel, and J. T. Anderson. 2023. Waterbird migration chronology and wetland selection in Georgetown South Carolina. South Carolina Chapter of The Wildlife Society (TWS) meeting – 2023, Columbia, South Carolina.

McCall, J., J. D. Lanham, D. Kunkel, and J. T. Anderson. 2023. Waterbird use and selection of wetlands in coastal South Carolina, USA. The Wildlife Society 30th Annual Conference, Louisville, KY. (Poster)

Pettengill, C., R. Brown, L. Taylor, T. L. O'Halloran, A. E. Scaroni, M. Motallebi, J. Whetstone, and J. T. Anderson. 2023. Will oysters assist recovery at a Litte Edisto saltmarsh? Clemson University College of Agriculture Forestry and Life Sciences Graduate Symposium, Georgetown, South Carolina. (Poster) *Third Place Poster Presentation

Sanchez, N. K., S. S. Li, M. Boucher, T. Rainwater, J. T. Anderson, and M. P. Sullivan. 2023. Alligator webs: Linking alligator nutritional subsidies, food webs, and ecosystem functions in coastal South Carolina. 2023 Palmetto Alligator Research and Management Symposium, Georgetown, South Carolina. (Poster)

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