



# COASTAL SCIENCE SYMPOSIUM 2023 PROCEEDINGS

**Hosted by the Department of Natural Sciences,  
School of Arts and Sciences, College of Coastal Georgia**

Friday, December 1  
9:00 am – 12:00 pm  
Stembler Theatre and Campus Center Lobby

## **WELCOME**

Welcome to Coastal Science Symposium 2023, hosted by the College of Coastal Georgia Department of Natural Sciences. The annual event brings together students, faculty, collaborators, and community members to explore coastal and marine research, management, conservation, and more! This year’s keynote address will be delivered by Indie Lewis of White Oak Conservation, a state-of-the-art scientific education and conservation center in Yulee, FL. The symposium features the work of Coastal Georgia students, who will present posters on their research and experiential learning in biology and environmental science. Community partners will also provide educational exhibits and opportunities to get involved in science and conservation on the Georgia coast and beyond.

Thank you for participating and for supporting our students!

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## SYMPOSIUM PROGRAM

### Campus Center Lobby

9:00 Student Poster Presentations

### Stembler Theatre

9:30 Welcome

**Dr. Michelle Johnston**, President

**Dr. Tate Holbrook**, Professor of Biology

9:45 Keynote Address: Reimagining Wildlife in Human Care

**Indie Lewis**, Capacity Building & Training Lead, White Oak Conservation

Followed by Q&A

### Campus Center Lobby

10:45 Student Poster Presentations

Partner Exhibits

Refreshments

## KEYNOTE PRESENTATION ABSTRACT

Presenter(s) in bold

### **Reimagining Wildlife in Human Care**

**Indie Lewis** & Brandon Speeg, White Oak Conservation

Since 1970, we have seen an average population decline of 69% across species globally. Just this past October, the USFWS delisted 21 species from the Endangered Species Act due to extinction. We are facing unprecedented climate and extinction challenges that require creativity, passion and community-building to overcome. We will explore how wildlife at White Oak contribute to saving species, how wildlife in human care transition back to wild habitats, and the highs and lows of reintroduction programs.

## POSTER PRESENTATION ABSTRACTS

Presenter(s) in bold

### **Internship at Tidelands 4-H Nature Center**

**Kaylee Alexander**, Department of Natural Sciences, College of Coastal Georgia

Tidelands 4-H Nature Center works to educate the next generation in various programs involving environmental sciences. They also keep an assortment of educational ambassador animals in the center itself. During my internship, I led and assisted with a number of educational programs including herpetology, marsh exploration, dock or fouling community study, and kayak tours in the intercoastal waterways. When we weren't teaching programs, I assisted in the husbandry for all resident animals which included water changes, feedings, enrichment, and vet visits. During my internship, we released a loggerhead sea turtle that was head-started jointly by Tidelands and Camp Jekyll 4-H centers. I had the pleasure of presenting at this release and attending the animal's pre-release vet visit. This internship has given me great experience in public speaking, reptile and marine animal care, and allowed me to make connections with local organizations.

### **Marine Extension and Georgia Sea Grant Coastal Ecology Lab Internship**

**Tanner Barwick**, Department of Natural Sciences, College of Coastal Georgia

I interned with UGA Marine Extension and Georgia Sea Grant (MAREX) in the Coastal Ecology Lab led by Dr. Kimberly Andrews. The mission of the MAREX Coastal Ecology Lab is to contribute to the persistence of healthy native ecosystems and their resident wildlife populations. I primarily contributed to the lab's gopher tortoise project. The gopher tortoise is recognized as a threatened species and as a keystone species whose burrows provide housing to other native species like the eastern indigo snake, which is also threatened. I participated in a variety of activities including data analysis, husbandry of their educational live collection, and field work. During my time with MAREX I gained valuable skills such as professional communication, time management, critical thinking, and proper etiquette while working with captive animals. I also learned the importance of community engagement and partnership building in solving environmental problems.

### **Using Rock Tumblers to Scarify Legume Seeds for Conservation Planting**

**Evie Boast<sup>1</sup>**, **Sa'Maya Ivy<sup>1</sup>**, **Kelsey Leedle<sup>1</sup>**, **Eamonn Leonard<sup>2</sup>**, & **C. Tate Holbrook<sup>1</sup>**

<sup>1</sup>Department of Natural Sciences, College of Coastal Georgia; <sup>2</sup>Georgia Department of Natural Resources

Legumes (Fabaceae) are important members of coastal plant communities because they provide food and shelter to native wildlife and help facilitate the spread of prescribed fires. The Georgia Department of Natural Resources (GADNR) therefore seeks to restore legume ground cover on conservation properties in coastal Georgia. However, many legumes possess a hard seed coat that must be broken down (= scarification) before their seeds will germinate. Seeds are naturally scarified when they are consumed and pass through animals' digestive tracts or when they are walked over and worn down, but scarification can be artificially mimicked using chemical or

mechanical treatments such as rock tumblers. We collaborated with GADNR to develop and test methods of using rock tumblers to scarify legume seeds in preparation for conservation planting. Specifically, we sought to determine how long seeds should be tumbled to optimize germination. We conducted a pilot experiment using *Lespedeza cuneata*, a non-native legume that is representative of native species. We placed seeds in rock tumblers with water, pea gravel, and 220 grit, ran them for 1, 3, or 5 days, and checked seeds for germination daily for 1 week after removing them from the tumblers. We discovered that 1 day of tumbling was most effective at breaking down the seed coat and promoting germination; longer durations, such as 5 days, completely degraded the seeds. These findings will guide GADNR and other conservation partners in their efforts to restore native legume populations and protect associated biodiversity.

### **Invasive Plant Monitoring and Management on St. Simons Island**

**Kat Breitenbach<sup>1</sup>, Elizabeth McGovern<sup>1</sup>, Rebecca Cushing<sup>2</sup>, & C. Tate Holbrook<sup>1</sup>**

<sup>1</sup>Department of Natural Sciences, College of Coastal Georgia; <sup>2</sup>St. Simons Land Trust

The St. Simons Land Trust (SSLT) aims to conserve and protect the natural habitats, historical sites, and scenic character of St. Simons Island. One way they do this is through monitoring and managing invasive plant species, which are non-native species that overtake and displace native plants, disrupting coastal ecosystems. For this reason, identifying, assessing, and controlling invasive plant species is critical for the health of the environment. With aid from SSLT, we surveyed seven of their protected properties for invasive plant species. Once an invasive species was identified, it was mapped and either pulled up or, if too large, treated with glyphosate. The data will be analyzed to determine which invasive species are most dominant within and across conservation properties, how many previously treated plants have regrown, and whether the number or spatial coverage of invasive plants has changed since previous surveys. Besides monitoring and management, we are also participating in educational outreach about native and invasive plant species, which can aid in the reduction of invasive plants and their harmful impacts at both local and global scales.

### **Estimate of Ghost Shrimp Populations on Jekyll Island's Great Dunes Beach**

**Jacalyn Brown, Jae Clery, Marshall Ferrell, Alina Lasseter, Ollie Mercer, & James B. Deemy**

Department of Natural Sciences, College of Coastal Georgia

Ghost shrimp (*Biffarius biformis*) occupy burrows in sand on beaches of the southeast, such as Great Dunes Beach (Jekyll Island), and contribute to the structure and function of the beach ecosystem. Their burrows serve as a habitat for other small animals, contribute to nutrient cycling and ecosystem function. Our objectives were to: 1) count the ghost shrimp burrows on Great Dune Beach, Jekyll Island, and 2) estimate the ghost shrimp population on Great Dune Beach, Jekyll Island. To estimate the population density of shrimp, we sampled ten 1-m<sup>2</sup> plots along five 25-meter transects established parallel to the shoreline. Our density was multiplied by the estimated area of Great Dunes Beach (240,000 m<sup>2</sup>). We found ghost shrimp burrows to occupy the area within 48 m perpendicular to the shore. Median density was 18 burrows / m<sup>2</sup> and a mean of 16.5 burrows / m<sup>2</sup> with a standard deviation of 7.5 burrows / m<sup>2</sup>. We estimated

the number of ghost shrimp burrows at Jekyll Island's Great Dune Beach to be  $4.32 \times 10^6$ . These data have implications for sediment turnover, small invertebrate habitats availability, and biogeochemical cycling on the beach.

### **Modeling The Impact of Chicken Populations due to Avian Flu Using STELLA**

**Lauren E. Cooper, Bruce T. Proman, Kaylee E. Logan, & James B. Deemy**

Department of Natural Sciences, College of Coastal Georgia

Many American citizens consume eggs in their daily life and have recently experienced a skyrocket in egg prices across the nation. This is likely driven in part by recent widespread Avian Flu infections and flock management to prevent disease spread. Avian flu is a lethal virus for many domesticated and wild bird species that can substantially impact chicken mortality rates, egg production, and farming practices. The mortality rate in chicken in standard poultry farms in the U.S. is calculated to be 1-5% without the effect of bird flu, in contrast the mortality rate of chickens infected by bird flu is approximately 90-100% in the United States. Our objectives were to 1) build a simple systems model to simulate egg production in the United States; 2) estimate the impact of Avian Flu based chicken mortality on egg production in the United States. The base model was built to incorporate the standing stock of U.S. egg laying hens (~380 million), eggs produced per hen (250), hatch rates (3.2%), base mortality (5%). Avian flu is assumed to have a %100 mortality rate. The model can be modified to incorporate additional factors such as preventative culling.

### **Artistic Outreach for Project Dragonfly and Jacksonville Zoo and Gardens**

**Lauren Cooper<sup>1</sup>, Sharon Spencer<sup>2</sup>, & Robin McLachlan<sup>1</sup>**

<sup>1</sup>Department of Natural Sciences, College of Coastal Georgia; <sup>2</sup>Adult Education Specialist, Jacksonville Zoo and Gardens

This project is a semester-long partnership between student Lauren Cooper and community partner Project Dragonfly and Jacksonville Zoo and Gardens in which Lauren will produce a communication-based final product that promotes Project Dragonfly and the Zoo through educational stickers and an e-newsletter. This artistic work can be shared online and through tangible stickers. These deliverables will reflect topics discussed in class (tailoring messages to a specific audience, engaging graphic design, encoding/decoding messages in media). Project Dragonfly has an international network of community partnerships including the Advanced Inquiry Program at Jacksonville Zoo and Gardens. This program immerses students in collaborative in collaborative inquiry and action as they champion change. It requires effective outreach and educational media. Lauren will work with Sharon Spencer to promote the program and increase community involvement.

## **Using Camera Traps to Monitor Native and Non-Native Deer Populations on Little St. Simons Island**

**Julia Couey<sup>1</sup>, Kirsten Pope<sup>1</sup>, Dalas Roberts<sup>1</sup>, Shelby Yarbrough<sup>1</sup>, Scott Coleman<sup>2</sup>, Aurora Fowler<sup>2</sup>, & C. Tate Holbrook<sup>1</sup>**

<sup>1</sup>Department of Natural Sciences, College of Coastal Georgia; <sup>2</sup>Center for Coastal Conservation, Little St. Simons Island

Little St. Simons Island (LSSI) is one of the most ecologically intact barrier islands along the Georgia coast, supporting many native species of flora and fauna. The LSSI Center for Coastal Conservation is dedicated to preserving and restoring the island to its natural state. Non-native European fallow deer (*Dama dama*) were introduced to the island in the early 1900's for hunting and have since caused a decline in native vegetation due to their grazing habits. The LSSI Center for Coastal Conservation has worked to control the fallow deer population and minimize their harmful ecological impacts. Recently, native white-tailed deer (*Odocoileus virginianus*) have swum over to LSSI from surrounding areas. We partnered with LSSI to assess the current populations of both deer species, which had not been systematically monitored. We designed and conducted a pilot camera-trap survey in fall 2023 using 16 trail cameras deployed across three different habitats: live oak maritime forest, pine forest, and grassland. We are now analyzing three weeks of camera data, identifying each individual deer to species, age, and sex when possible. We will then estimate total abundance, sex ratios, and age structure by species and test for differences in habitat use. The results will be used to guide future efforts to manage deer and conserve biodiversity on LSSI.

## **Zookeeper Internship at Xtreme Exotics Wildlife Foundation**

**Abbey Crossman**, Department of Natural Sciences, College of Coastal Georgia

During the summer of 2023, I served as a zookeeper intern at Xtreme Exotics Wildlife Foundation (XEFW), a 501(c)3 non-profit wildlife park in St. Augustine, Florida that was founded in 2018 and is home to over 300 different animals. XEFW's mission is to educate the public on the importance of wildlife conservation and annually breed vulnerable species listed on the IUCN Red List while maintaining genetic diversity in captive populations. Through my internship, I gained knowledge and skills in exotic animal husbandry (general care, diet, behavior, enrichment, socialization, and training), got exposure to zoo operations and management, and prepared for a future career in animal-related professions. This internship allowed me the opportunity to apply learned skills, theories, methods, and different biological principles in a real-world setting working with exotic species.

## **Behavioral Responses of Captive Red Foxes (*Vulpes vulpes*) to Environmental Enrichment**

**Abbey Crossman & C. Tate Holbrook**

Department of Natural Sciences, College of Coastal Georgia

Environmental enrichment is essential for the wellness of captive animals, as it provides mental and physical stimulation, reduces stress and stereotypic behavior, and promotes exercise, social interaction, and overall activity. Among captive canids in particular, enrichment may elicit

instinctual behaviors, including hunting, foraging, exploring, and socializing, that improve overall quality of life. We conducted an experiment to test how environmental enrichment affects the behavior of captive red foxes (*Vulpes vulpes*) at Xtreme Exotics Wildlife Foundation in St. Augustine, Florida. Six individual foxes, housed in pairs, were provided with four different enrichment objects (one per day): a suspended feather-rope toy, a beef femur bone, a hanging PVC pipe puzzle containing quail eggs, and a sand box. Individual behavior was observed for 30 minutes before and after each object was introduced. We predicted that foxes would interact directly with the novel objects and that enrichment would increase social interactions, reduce stress behaviors, and increase other activity, although the strength of behavioral responses might vary between objects that stimulate different senses. A linear mixed-effects model revealed that all enrichment objects elicited direct interactions and increased activity, while the sand box and PVC puzzle had greater positive effects on social interactions. Stress behaviors were rare and not affected by enrichment. Our findings underscore the importance of enrichment in captive animal husbandry and can guide further research and management of captive canids.

### **Global Biodiversity Loss due to Anthropogenic Interactions**

**Abbey Crossman, Jakob Koehn, Christine Lubin, & James B. Deemy**

Department of Natural Science, College of Coastal Georgia

As more is known about climate change, more environmental shifts have been identified as a result of this issue, one of them being a loss of biodiversity from anthropogenic extinctions and other human interactions. In order to better understand how much global biodiversity loss is attributed to humans, a literature review was conducted. The data pulled from literature was used in models to understand the percentage role that humans play in each of the main contributors to biodiversity loss, and then we calculated an overall loss of biodiversity due to human interaction. Each of the main contributors to the loss of biodiversity were analyzed to determine the proportion of loss due to humans and the proportion lost due to naturally occurring declines. The main contributors to global biodiversity loss include habitat loss/ destruction (44%), pollution (4%), invasive species (5%), disease (2%), and over-exploitation and poaching (37%). From the literature review, it was determined that human activity is frequently the direct and indirect factor causing biodiversity decline. Loss of biodiversity is having a negative impact on the planet in more ways than we are able to comprehend at this point in time. It is crucial for our planet's future to understand the role that humans play in this loss to further prevent damage and restore biodiversity to its historical state.

### **Monitoring Shorebird Populations to Reduce Human Disturbances on St. Simons Island**

**Abbey Crossman<sup>1</sup>, Megan Mathis<sup>1</sup>, Maya Biggee<sup>1</sup>, Emily Davis<sup>1</sup>, Abby Sterling<sup>2</sup>, & C. Tate Holbrook<sup>1</sup>**

<sup>1</sup>Department of Natural Sciences, College of Coastal Georgia; <sup>2</sup>Manomet

Manomet is a nonprofit conservation organization whose goal is to improve the health of migratory shorebirds and coastal ecosystems along the Atlantic coast of the Americas. Positioned along the Atlantic Flyway, Georgia beaches are vital habitats for migratory shorebirds, but these species are vulnerable to human disturbances when trying to rest, feed, or nest. To assess the



effects of human disturbance on focal shorebird species, Manomet participates in the Atlantic Flyway Disturbance Project (AFDP). We supported this effort by conducting AFDP surveys along the beaches of St. Simons Island, Georgia for six weeks during the fall of 2023, following a standardized protocol to collect data on potential disturbance types, shorebird distribution and abundance, shorebird behavior, breeding productivity, and management activities. We are also analyzing year-long survey data to identify broader trends in shorebird activity on local beaches. Survey results will be used to evaluate the effects of human and nonhuman interactions (e.g., vehicles, dogs, and predatory birds) on shorebird distributions and behavior, to guide the management of human disturbance in valuable shorebird habitats, and to educate the public about the importance of sharing the beach with shorebirds.

### **Estimation of Ghost Burrows as a Proxy for Ghost Shrimp Populations on St. Simons Island**

**Abigael David**, William Booth, Emma Robison, Guy Haller, Bradly Cooper, Dylan Cantrell, & James B. Deemy

Department of Natural Sciences, College of Coastal Georgia

Ghost shrimp are beach invertebrates that inhabit burrows within the intertidal zone. These invertebrate detritivores contribute to bioturbation of beach sediment, organic matter processing, and are a component of beach trophic dynamics. Our objectives were to mathematically estimate the population of ghost shrimp along the shore. The focal beaches for this study were two locations on St. Simons Island: East Beach and Gould's Inlet. The density of ghost shrimp burrows was measured using a 1 m<sup>2</sup> quadrat placed at five meters intervals along six 5 meter transects parallel to the water line at each location. Total burrows were estimated using the approximate area of the intertidal zone at each location multiplied by mean, mean + standard deviation, mean - standard deviation and median 1 m<sup>2</sup> densities. The mean burrow density found along East Beach was 17.67 per m<sup>2</sup> with a median of 18 per m<sup>2</sup>. Goulds Inlet had a mean population density of 3.66 per m<sup>2</sup> with a median of 3.5 per m<sup>2</sup> given the data collected at our transects. Now that we have our densities per square meter, we multiply these numbers by the approximate areas of each location to get an approximate total population density along the shore. East Beach is approximately 2,168.22 meters (about 1.35 mi) and Goulds Inlet is approximately 428.93 meters (about 1407.25 ft) in length. A range of estimates was calculated to account for sampling error / uncertainty. Our findings can be used in conjunction with further research to quantify the contributions of ghost shrimp to beach ecosystem structure and function on system.

### **Mussel Population and Biomass Estimates on Driftwood Beach**

**Damian Elmore**, **Samuel Hoover**, Mason Hill, Olivia Ingram, Hannah Langborgh, Hannah Kay, & James B. Deemy

Department of Natural Sciences, College of Coastal Georgia

Rocky shorelines and hard substrates, such as those created by erosion control structures, create habitat for a variety of sessile invertebrate species. A variety of sessile invertebrate species (oysters, mussels, anemones, etc) are commonly found among the erosion control rocks on Jekyll

Island. Our objectives were to 1) quantify the mussel population on Driftwood Beach; 2) estimate biomass of mussels on the rocks at Driftwood Beach; and 3) estimate the daily water filtering potential of mussels on Driftwood Beach. Mussel population density was measured along three 30 m transects at different points along the beach at 3 m intervals by counting mussels within a 1 m<sup>2</sup> quadrat. Using Google Earth we then estimated the area of rocky habitat at our study location to be used in conjunction with various sampling density metrics to estimate population ranges (mean:11.24, mean+standard deviation:18.31, mean-standard deviation:4.16, and median:11.067 mussels per square meter.) We then used these population estimates to determine potential biomass (100.6167mg) and potential water filtering (25 L / mussel) of the extant mussel population on Driftwood Beach using from literature estimates of average mass and water filtering by individual mussels. We estimated the population to be approximately 13,486±8489 mussels, with a total biomass of 1,356,931.846±854,110.692 milligrams, and 337,153.8462±212,218.989 liters of water filtered daily using a standard 24 hour time reference.

### **An Exploratory Analysis of Several Juvenile Georgia Estuarine Species Total Length**

**Harrison Faulk<sup>1</sup>, Bryan Fluech<sup>2</sup>, Lisa Gentit<sup>2</sup>, Rachel Guy<sup>3</sup>, & James Deemy<sup>1</sup>**

<sup>1</sup>Department of Natural Sciences, College of Coastal Georgia; <sup>2</sup>University of Georgia Marine Extension and Georgia Sea Grant; <sup>3</sup>Sapelo Island National Estuarine Research Reserve

Estuaries serve as important nursery habitat for a wide variety of fish and invertebrates. Monitoring efforts directed towards clarifying the long-term trends and population statistics of estuarine communities can promote better management and understanding of these systems. Our objectives were to investigate total length data (mm) collected of four estuarine species common to three sounds on the Georgia Coast (Altamaha, Doboy, and Sapelo). Data were collected by the monthly research trawls of the Estuarine Fish Monitoring Cooperative (EFMC) between the years of 2021 to 2023. The selected species were chosen from an assortment of ecological roles and included the bay anchovy (*Anchoa mitchilli*), American stardrum (*Stellifer lanceolatus*), weakfish (*Cynoscion regalis*), and Atlantic white shrimp (*Litopenaeus setiferus*). Statistical analysis was done in the R programming environment and indicated significant differences in total length for the bay anchovy across all sites, while the American stardrum and Atlantic white shrimp lengths were significantly greater within the Doboy and Sapelo Sounds respectively. Weakfish total length was not found to differ significantly between sites. Future work will continue to investigate potential mechanisms for observed differences and similarities of total length data across the sounds such as habitat characteristics and life stage utilization.

### **An Investigation of Freshwater Macroinvertebrate Diversity under Varying Coastal Georgia Pond Salinities**

**Harrison J. Faulk & Kimberly K. Takagi**

Department of Natural Sciences, College of Coastal Georgia.

Macroinvertebrates are a key group of organisms in many freshwater habitats. Salinization of freshwater habitats through natural events such as storm surge or from human action such as saline wastewater disposal is a growing concern believed to impact sensitive freshwater communities. Our objectives were to compare macroinvertebrate diversity (Shannon's Index and

Simpson's Reciprocal Index) from three former golf course ponds within Sea Palms West, St. Simons Island Georgia with varying average 2023 salinities (55.8, 0.48, and 0.16 ppt). Data were collected through macroinvertebrate surveys at each site. Statistical analysis using R indicated that the mean Shannon's Index values differed significantly between the highest and middle salinity ponds. In contrast, statistical analysis of Simpson's Reciprocal Index indicated no significant differences across all three sites. The analysis of the relative abundance based Shannon's Index may preliminarily suggest that macroinvertebrate relative abundances in coastal Georgia may be affected by salinity while the results of the species richness weighted Simpson's Reciprocal Index may indicate that macroinvertebrate richness may not be significantly impacted as observed in other study locations. Future macroinvertebrate surveys at different locations in each pond would help to clarify these observations which could better gauge how freshwater macroinvertebrates in coastal Georgia will respond to salinization from rising sea levels and storm surge events.

### **Coastal Ecology Internship with Georgia Department of Natural Resources Coastal Resources Division**

**Victoria Gordon**, Department of Natural Sciences, College of Coastal Georgia

My Coastal Ecology internship with the Georgia Department of Natural Resources Coastal Resources Division this summer was truly eye-opening. The mission of the Coastal Resources Division is to balance coastal development and the preservation of natural resources and wildlife. It introduced me to a variety of experiences, including assessing aquatic passages for wildlife movement, mastering measurement techniques, navigating challenging marshes, and contributing to the removal of invasive species. We collected data on aquatic passages to help SARP (Southeastern Aquatic Resources Partnership) score each site and determine which sites need the most funding and resources to fix. This internship solidified my interest in conservation and environmental policy, helping me carve out a clearer career path. While I encountered some challenges, like developing the plant guidebook, I learned to adapt and manage my time more effectively. Valuable feedback from my supervisor improved my communication and time management skills, proving beneficial both during my internship and in my academic pursuits. This internship is closely aligned with service-learning objectives, enriching my community engagement, critical thinking abilities, and future career prospects.

### **Ocean Acidification and Reducing Atmospheric Carbon**

**Alana L. Johnson, Lacy D. Hively, Amber D. Tankersley, & James B. Deemy**  
Department of Natural Sciences, College of Coastal Georgia

Ocean acidification is the decrease in pH of the Earth's oceans. The ocean absorbs 30% of the Earth's carbon dioxide emissions annually. Human activities such as concrete production, burning fossil fuels, and deforestation have had the greatest impact on our ocean's rising atmospheric carbon dioxide levels and ocean acidification. The ocean is a carbon sink, meaning it absorbs more atmospheric carbon than it releases, and over time will continue to absorb more carbon and become more acidic. Reforestation stands to reduce atmospheric carbon and thus reduce the atmospheric carbon dioxide diffusion into the ocean. Our objectives were to 1)

determine carbon sequestration potential of planted pine species; 2) estimate the carbon sequestration potential of a range of reforestation scenarios; and 3) modify a model of the carbon cycle to determine the potential reduction of carbon dioxide exchange with the ocean. One loblolly pine sequesters 7.16 kg of carbon dioxide per year. On average 576 loblolly pines can be planted on one acre (582 if planted by hand and 570 if planted by machine). A single acre of planted loblolly pine sequesters an average of 4,150.37 kg of CO<sub>2</sub> per year. Using these values we modified an existing model of the carbon cycle to quantify the reduction in carbon dioxide diffusion into the ocean under a range of reforestation scenarios.

### **Anemone Population Estimate at Driftwood Beach, Jekyll Island**

**Reid Kroken, Sage Christman, Kaylee Logan, Lacy Hively, Ariel Cline, Michael Helton, & James B. Deemy**

Department of Natural Sciences, College of Coastal Georgia

Sea anemones are sessile marine invertebrates that attach themselves to a substrate and depend on water for respiration, feeding, and reproduction. They are often found in the intertidal zone where they anchor onto rocks or sand and spend half of their time underwater and the other half exposed to air. Such an environment can be found at Driftwood Beach on Jekyll Island where rocks have been intentionally placed along the shoreline to prevent beach erosion. Our objective was to estimate the population of anemones at Driftwood Beach. We sampled anemone density using a 1 m<sup>2</sup> quadrat every 5 m along a 120 m transect established 2 m from the low tide. We then used Google Earth to estimate the size of the rocky intertidal zone at Driftwood Beach to be 5537.87 m<sup>2</sup>. Subsequently, we calculated the potential population by multiplying the mean and median anemone densities by the area of Driftwood Beach. We also generated a 95% confidence interval to account for sampling uncertainty. We found that the population of sea anemones on Driftwood Beach is most likely within the range of 4,431 – 17,722 individuals. This estimate is low compared to estimates from the U.S. West Coast, but is similar to those on the East Coast, most likely meaning that it is a reasonable estimate for our coastline.

### **Invertebrate Biometric Analysis between Three Intertidal Invertebrates**

**Richard Livermore & Preston Peralta**

Department of Natural Sciences, College of Coastal Georgia

Biometrics, specifically invertebrate biometrics, is an emerging field that enables the ability to properly identify and distinguish individual invertebrate species solely on key unique characteristics. This study involves a deeper exploration into invertebrate biometrics by sampling three invertebrates, the Fiddler Crab, the Atlantic Ghost Crab, and the Periwinkle Snail, located almost exclusively in Estuarine ecosystems. The underwhelming amount of research on these three animals, specifically in biometrics, made them a good fit for this experiment. By means of field tests and lab assessment, we found a statistically significant correlation between claw length and body length for both crabs regardless of gender with definite significance within the relationship between the shell width and length of Periwinkle snails. These findings show potential for maintaining accuracy, migratory factors, and even indicate species distribution over time.

## **Lowcountry Shrimp Project Internship with Sapelo Island National Estuarine Research Reserve**

**Megan Mathis**, Department of Natural Sciences, College of Coastal Georgia

Over the summer of 2023, I was able to work with Sapelo Island National Estuarine Research Reserve. SINERR is a branch of NOAA that monitors and researches estuarine systems. Some objectives of this internship included assisting SINERR in their role in the Lowcountry Shrimp project, participating and assisting with the Estuarine Fish Monitoring Collaborative Trawls, and assisting the SINERR staff with their role in the Drone the Oysters Project. For the Lowcountry Shrimp Project and the Estuarine Fish Monitoring Collaborative Trawls, some tasks included identifying fish species, weighing and measuring fish species, and maneuvering the trawl net to conduct surveys. These experiences broadened my horizons in the world of science. This experience allowed me to network and enhance my knowledge of conducting science on the coast.

## **Assessing Water Quality Dynamics in Six Greenspace Ponds at Sea Palms West, St. Simons Island, GA**

**Megan Mathis, Maya Biggee, Kirsten Pope, & Kimberly K. Takagi**  
Department of Natural Sciences, College of Coastal Georgia

Freshwater ecosystems are a type of ecosystem in which the area is saturated by a large amount of freshwater for extended periods. They are a critical habitat for many aquatic and semi-aquatic animals, plants, and migratory species that are only found in freshwater habitats. Sea Palms West is a community on Saint Simons Island that purchased a golf course and converted it into a greenspace in 2018. Due to the nearby housing and maintenance of the greenspace, water parameters could be affected by fertilizer use and runoff. The objective of this study was to compare the water quality between six ponds at Sea Palms West. In particular, we assessed dissolved oxygen, ammonia, and nitrate weekly at each pond for 11 weeks. These parameters were chosen because they will give the best overview of pond health. We then compared the results among each pond to assess the differences between them. We expect to find a gradient of nutrient concentrations based on preliminary observations of differences in surrounding pond characteristics. This knowledge would allow the community of Sea Palms West to make educated decisions regarding their future maintenance plans.

## **Estimating the Area of Impervious Surface Cover and Stormwater Runoff on College of Coastal Georgia's Campus**

**Ollie Mercer & James B. Deemy**  
Department of Natural Sciences, College of Coastal Georgia

Impervious surfaces are any surfaces that do not allow for precipitation to pass through or infiltrate into the ground beneath them. This prevention of infiltration can create management issues for storage and potential treatment of stormwater runoff. My objectives were to 1) determine the area of impervious surfaces on College of Coastal Georgia's campus and 2) estimate the quantity of runoff during storms of various magnitudes. Using ArcGIS Pro, I

digitized all impervious surfaces within the campus to determine the total impervious cover. To determine the amount of runoff generated by rainfall, precipitation depths were multiplied against the impervious cover to determine the runoff volume with depths of 2.54 cm, 5.08 cm, and 25.4 cm to simulate a typical precipitation event, a 25-year storm, and a hurricane event, respectively. I found that roughly 195,416.3 m<sup>2</sup> of campus is covered by impervious surfaces, which is approximately 18.2% of the total campus area. Using the chosen rainfall depths, I found runoff for 2.54 cm storms to be 4,963.6 m<sup>3</sup>, 5.08 cm to be 9,927.2 m<sup>3</sup>, and 25.4 cm to be 49,635.7 m<sup>3</sup>. These findings allow predictions to be made for stormwater runoff rates, which can better inform management decisions as our campus grows.

### **Microfossils in Clark Quarry**

**Zoë Metz & Robin McLachlan**

Department of Natural Sciences, College of Coastal Georgia

Clark Quarry is a fossil excavation site in-between the Altamaha and Turtle Rivers near the historic Brunswick Canal. Two Pleistocene-age barrier island ridges, the Palmico Terrace and the Princess Anne Terrace, are on either side of Clark Quarry. Past research including ground penetrating radar, digital elevation models, and fossil species identification has shown that the quarry environment was once a river system where meandering channels transitioned to braided channels. So far, discovered fauna include *Amphiumas* (salamanders), *Mammuthus columbi* (Columbian mammoth), *Bison latifrons* (long-horned bison), and *Glaucomys volans* (southern flying squirrel). These species would have thrived in and around the braided river. While many large species have been recovered and identified, there are still many more to be uncovered by examining microfossils. Some of the issues that arise when identifying smaller fossils are that some of the identifying features are minute and can be eroded during deposition, making it harder to identify to the species level. For this project, sediment samples were taken from Clark Quarry and then sifted to remove excess sediment. Each specimen was examined under the microscope, measured, and sorted into categories based on hypothesized taxonomy (e.g., fish, mammal, frog). While most fossils were unidentifiable to a lower taxonomic order, several have been identified including drum vertebra and gar scales and teeth. So far 39 fish, 2 amphibian, 2 reptile, 4 bird, and numerous fragmentary fossils and shells have been found, which indicate that during the late Pleistocene, this region likely transitioned between terrigenous rivers and brackish estuaries.

### **Urban Tree Planning with The Nature Conservancy and Brunswick Tree Board**

**Anna Palmieri<sup>1</sup>, Emily Yousey<sup>1</sup>, Tanner Barwick<sup>1</sup>, Ashby Worley<sup>2</sup>, & C. Tate Holbrook<sup>1</sup>**

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The City of Brunswick (GA) Tree Board's purpose is to investigate, counsel, and assist in planning for the care, preservation, and maintenance of trees and shrubs in parks, along streets, and in other public areas. In collaboration with the Brunswick Tree Board and The Nature Conservancy, we assessed the current status of tree coverage and preservation efforts in the city. We interviewed community partners, including Keep Golden Isles Beautiful and Forward

Brunswick, to document their goals and activities involving tree preservation and to identify opportunities for coordination between organizations. Available data such as the Tree Equity Score were analyzed and visualized to highlight priority areas for future tree conservation. These and other sources were synthesized to provide further guidance for urban tree planning that supports biodiversity, climate resilience, and environmental justice.

### **Mussel, Oyster, and Anemone Population Estimates on the Rocky Shoreline of Driftwood Beach, Jekyll Island, Georgia**

**James Ramsey, E. Highland, Lindsey Lawing, Heather Tucker, Karissa Garrett, Zee Thrift, Spenser Chiarito, & James B. Deemy**

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Jekyll Island, a 5,529-acre barrier island in Georgia, is renowned for its rich biodiversity and captivating historical importance. Marine invertebrates are critical to the structure and function of coastal ecosystems, and contribute to water quality improvement, nutrient cycling, and habitat engineering among other functions. Our objectives were to: 1) estimate the populations of mussels, oysters and anemones at Driftwood Beach on Jekyll Island and 2) quantify spatial variation within each population and among populations. We measured the density of mussels, oysters, and anemones using a 1 m<sup>2</sup> quadrat at 11 equidistant locations along five 50 m transects spaced at 1 m intervals parallel to the water line during low tide. There was an average of 1 anemone, 10 oysters, and 26 mussels per m<sup>2</sup>. The oysters, mussels, and anemones were more heavily concentrated in the transects further rather than closer to the water line. This could potentially be due to higher wave energy at the low tide shoreline being dissipated by other rocks at the transects higher on the beach allowing for more successful sessile invertebrate recruitment.

### **Does Road Distance Affect Nutrient Concentrations Within the Ponds of Sea Palms West?**

**Ashlynn Runyon<sup>1</sup>, Shelby Yarbrough<sup>1</sup>, Kimberly Takagi<sup>1</sup>, & Diane Waldron<sup>2</sup>**

<sup>1</sup>Department of Natural Sciences, College of Coastal Georgia; <sup>2</sup>Sea Palms West Community Association Board

Nutrients within water help to support a healthy aquatic ecosystem but can have adverse effects like algal blooms if concentrations are too high. Pesticides, fertilizers, and car emissions are a main contributor to throwing off nutrient concentrations when they encounter runoff. From September 7th to November 17th, Dr. Kimberly Takagi's Aquatic Ecology class collected water quality data weekly from the ponds of Sea Palms West for analysis. Water quality parameters for this study were Nitrate, Nitrite, Phosphorus, and Ammonia due to them being nutrients for aquatic ecosystems. Data was separated by each parameter from ponds and compared by the distance to the main road (Frederica Road, St. Simons Island). Results found that it was possible that distance to the main road can affect the nutrient concentrations of the ponds. Further studies would need to be made to prove if the main road is a main contributor to the nutrient levels. It is important to assess nutrient concentrations as they are an indicator of the pond's overall health.

### **Measuring Accretion and Erosion on the coastline of Little St. Simons Island**

**Sarah Tarajos<sup>1</sup>, Robin McLachlan<sup>1</sup>, & Aurora Fowler<sup>2</sup>**

<sup>1</sup>Department of Natural Sciences, College of Coastal Georgia; <sup>2</sup>Center for Coastal Conservation, Little St. Simons Island

This service-learning independent study was conducted with the Center for Coastal Conservation on Little St. Simons Island. I collaborated with Aurora Fowler, the Ecological Coordinator, to monitor accretion and erosion on the northern tip of the island. A permanent time-lapse system was installed in this area and took images of the beach every 30 minutes. We compiled these images into a timelapse video and analyzed the changes in the beach geomorphology. We also installed camera stations at which a photo was taken weekly at 6 different transects, we then used these images to create an elevation profile. With the elevation profile was used to view a cross section of the landscape. In addition to image collection, we processed sediment samples to correlate the sediment composition to the changes in the beach geomorphology.

### **Saltwater Intrusion: A study in Prevention and Restoration in Glynn County using Stella Architect**

**Heather D. Tucker, Lindsey G. Lawing, Emily Weber, & James B. Deemy**

Department of Natural Sciences, College of Coastal Georgia,

Saltwater intrusion is the migration of saline water into freshwater aquifers. This is a common problem found in coastal areas such as Glynn County. Saltwater intrusion poses a threat to infrastructure as well as human health. Here in Glynn County, we use the Upper Floridan aquifer which has been identified as having intrusion issues. Water resources need to be monitored for effective management to prevent long term issues. Our objectives were to 1) run a scenario in an excel model that simulates aquifer drawdown and saltwater intrusion under a variety of pumping scenarios; 2) simulate the effects of treated water injection wells; and 3) use these simulations to determine the relative difference between an injection well and a pumping well necessary to prevent saltwater intrusion for preventative measures. It was found that as we increase pumping well pressure, the level of freshwater decreases causing room for saltwater to intrude into the aquifer. To offset the cone of depression an injection well needs to be added to generate a positive pressure that blocks intrusion of saltwater.

### **Determining the Impact of Sediment Properties on Rates of Geomorphic Change: Little Cumberland Island, GA**

**Jonathan Warehime & Robin McLachlan**

Department of Natural Sciences, College of Coastal Georgia

Residents of Little Cumberland Island, GA have witnessed dynamic beach morphology changes over the past several decades which threatens property and habitats. Most sections of the beach are eroding rapidly (5m/year), but others have visible accretion and prograding dune systems. To determine modern rates of erosion and accretion, cross-shore elevation surveys were conducted every 1-2 months starting in September 2022. To determine the impact of sediment composition, grain size, angularity, and organic matter content on erosion rates, surface sediment samples



were collected along the transects. Portions of samples were weighed and burned in a muffle furnace to calculate the mass percent of volatile organic compounds. Remaining sample portions were microscopically analyzed for physical properties. These qualities were correlated with morphology rate of change. Quantifying the relationship between physical properties, organic matter content, and erosion rates can aid in future projections of island morphology when considered with the impacts of sea-level rise, human development, and natural island migration.

### **Vertical Hydrologic Flux of Lake Teel**

**Rebekah L. Wulff**, Katie Wilkinson, **Raymond Schwendy**, **Zoë Metz**, **Kensly Love**, & James B. Deemy

Department of Natural Sciences, College of Coastal Georgia

The vertical hydrologic flux is an important calculation due to its importance in understanding water balance in ponds and lakes. Vertical flux is calculated as the balance of precipitation and evapotranspiration multiplied by the free water surface area of water body. Our objectives were to 1) estimate the vertical hydrologic flux across the surface of Lake Teel on the College of Coastal Georgia campus; 2) determine the relative water balance of the lake; and 3) create a simulation model of the annual water balance. To determine using the evapotranspiration we used Thornthwaite's equation, a commonly accepted method of estimated evapotranspiration based on mean monthly air temperature. Precipitation data was downloaded for the Brunswick, Georgia area using weatherspark.com (total annual precipitation is approximately 1016-1524 mm). We used Google Earth to find the area of Lake Teel, which is about 19809.0649 m with a volume of 1.9016E+7 meters. We calculated the annual evaporation rate at 1397 mm. Using STELLA Architect, we modeled the cycle of the hydrologic flux of the lake using the precipitation data and evapotranspiration data.

### **The Relationship of DO, Turbidity, Salinity, and pH on Macroinvertebrate Populations in Green Space Ponds in Sea Palms West, St. Simons Island, GA**

**Shelby Yarbrough** & Kimberly Takagi

Department of Natural Sciences, College of Coastal Georgia

Sea Palms West is a golf course turned green space by the residents of the community. Green spaces are important because they can provide biodiversity to the environment and can serve as a healthy natural environment for all kinds of fauna. In this study, we assess the relationship between water quality parameters (DO, turbidity, salinity, and pH) to the approximate average of macroinvertebrates found at two sampling points in the same pond. We found that the water quality parameters between the two sites did not have a significant difference. Turbidity had the lowest p-value between the two sites but had no significant difference. The macroinvertebrates between the two sites did not have a significant difference. The ponds did favor a single Order of organisms in each site. 8A had 174 *Coleoptera* spp. found and 8C had 85 *Amphipoda* spp. Since, *Coleoptera* prefers low turbidity for feeding grounds, the water *Coleoptera* were largely found in site 8A which had an average turbidity of 3.46 FNU. In contrast, site 8C had an average turbidity of 5.67 FNU which is optimal for *Amphipoda*. Further research may be necessary due to the similarities in this study.

## **Video Promotion of a 501 (c) (3) Nonprofit Organization: The Change in Participation**

**Logan A. Zimmerman<sup>1</sup>, Robin McLachlan<sup>1</sup>, & Lea King-Badyna<sup>2</sup>**

<sup>1</sup>Department of Natural Sciences, College of Coastal Georgia; <sup>2</sup>Executive Director, Keep Golden Isles Beautiful

As an active member and volunteer of the Keep Golden Isles Beautiful organization, I noticed the lack of community members involved in the organization's clean-up efforts and wanted to make a change. KGIB is a volunteer and community based educational organization. Volunteers contribute their time and effort each year in the organization's efforts programs and initiatives. I created promotional videos highlighting the organization's Fall events and re-capping the impact they made on the community as a whole. Event flyers and photos made by KGIB captured volunteers enjoying their work with the organization, which helped recruit others needed to tackle the environmental management the community needs to stay healthy. The 5 videos (3 events, 1 program highlight, and 1 re-cap video) I have produced have increased community help and awareness for this nonprofit organization. Specifically, there has been a 12% increase in volunteers from 2022 with no promotional videos to 2023 with promotional videos.

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