State of the Reserve 2014
"Changing Tides"

The studies in this document represent but a few of the many research, monitoring, education and conservation activities that have taken place over the past year at the GTM NERR. Some programs are of a short duration while most are long-term and lend themselves to future research and monitoring needs and practices, and all contribute to the growing body of scientific knowledge.

“NORTHEAST FLORIDA'S PERCEPTIONS OF THE ESTUARY”
Presenter: Kenneth Rainer, Education Coordinator, GTM NERR

Estuarine systems have suffered greatly from anthropogenic impact. Florida’s human population is increasing every year. As a result, more individuals each year utilize estuaries for commercial and recreational purposes. The Guana Tolomato Matanzas National Estuarine Research Reserve is working diligently to protect these fragile areas. To ensure a healthy estuary, area residents need to be informed of the wise use of our natural resources, thus empowering them to become environmental stewards. Without community commitment to environmental stewardship, the area will continue to suffer from habitat loss, water quality problems, boating impacts, and other debilitating effects of overuse.

The GTM NERR strives to educate students through a combination of classroom curriculum and hands-on activities about the importance of the estuarine habitat and its protection within the Reserve’s boundaries. Our Educational Programs also empower students to act as environmental stewards through the choices they make in their daily lives. These programs include the Estuary Explorer’s Program (Elementary) and the Living Lab Series (Secondary/Post-Secondary). School groups are surveyed pre- and post- to determine if the programs have increased knowledge and awareness of principles built around Estuarine Literacy.

Additionally, the secondary students are asked questions to measure their attitudes toward oceanic and estuarine habitats. Teachers and chaperones accompanying the students are asked similar questions in order to measure their attitudes toward oceanic and estuarine habitats. Out of 215 randomly selected pre- and post-visit surveys, students attending our Estuary Explorer’s program increased in estuarine literacy by 13.6%. Out of 845 randomly selected pre- and post- visit surveys,

students attending our Living Lab Series increased in estuarine literacy by 11.46%. Teachers, chaperones, and students surveyed regarding their attitudes generally had positive outlooks regarding environmental protection and conservation.

Bio: For the past two years Kenneth Rainer has worked diligently and enthusiastically as the GTM NERR's Education Coordinator. He holds an MS degree in Biology from Texas A&M University, Corpus Christi, with a focus in marine population genetics, and a BS degree in Biology from Texas A&M University at Galveston with a focus in marine biology.

"SURVEY OF THE CAROLINA DIAMONDBACK TERRAPIN (*Malaclemys terrapin centrata*) distribution in the Guana Tolomato Matanzas National Estuarine Research Reserve"
Presenter: Joseph Butler, PhD, University of North Florida, Department of Biology

The Carolina diamondback terrapin inhabits brackish waters along much of the Atlantic Coast in the southern United States including northeast Florida. Terrapin populations are known in both Nassau and Duval counties, however, no published records or museum specimens exist from St. Johns County where the GTM NERR is primarily located. During 13 day-long field trips held between May 7 and August 6, 2013, surveys for terrapins were done between County Road 210 in northern St. Johns County, south through St. Augustine, and all the way to Marineland in Flagler County. The surveys involved taking a boat into tidal creeks, islands, and shorelines where the team searched on foot not only for live terrapins, but also for signs of terrapin presence such as depredated and intact nests, terrapin remains, and terrapin crawls. The water surface was searched for terrapins coming up for air. Minimal evidence of terrapin presence was recorded, but most records showed terrapin occurrence near and around the Francis and Mary Usina Bridge with scattered traces elsewhere. Only one live terrapin was captured as it nested on a marsh island adjacent to Hospital Creek; her nest contained three eggs. Most records came in the form of 11 depredated nests, which were found at Fort Mose and Kurtis Island in Robinson Creek, the dunes on Anastasia Island, and San Julian and Sombrero creeks. Terrapin bones and other remains were collected at the

Vilano boat ramp, Anastasia and Kurtis islands, and an island in San Julian Creek. Finally, terrapin heads were seen at the water surface in Sombrero, Robinson, and Hospital creeks, as well as an unnamed creek on Anastasia Island.

Bio: Joseph Butler, PhD, began his career at the University of North Florida in 1989. As a herpetologist, he has studied the ecology of numerous reptiles; however, turtles have been his main focus. He conducted an ongoing study of the gopher tortoises at UNF for over 20 years and has involved numerous students in that project. While on a one-year sabbatical he studied sea turtle nesting on the Caribbean island of St. Kitts. However, his main contribution has been the study of the ecology of diamondback terrapins since 1995. His terrapin work has taken him from northeastern Florida to the Everglades, and to the Big Bend on the Gulf coast. He has also worked on Jekyll Island in Georgia. The terrapin project presently centers on terrapin populations from the GTM NERR south.

"MANGROVE EXPANSION INTO SALT MARSH HABITATS: Causes and consequences"
Presenter: Ilka C. Feller, PhD, Ecologist, Smithsonian Environmental Research Center, Smithsonian Institution

Climate change is altering the range, abundance, and phenology of species worldwide. Temperate and tropical plants and animals are expanding poleward in response to global warming, thereby displacing native species, altering biodiversity patterns, and impacting ecosystem structure and function. Moreover, climate change is suspected to be a key mechanism behind recent increases in the frequency and intensity of severe weather events that add to erosion and destabilize shorelines. In coastal wetlands at the temperate-tropical ecotone, salt marshes are being displaced by mangroves, which already dominate in the tropics.

The mechanisms behind the encroachment of mangroves into salt marshes remain obscure and are thought to involve multiple interacting factors, including global warming, changes in rainfall patterns, land-use change, and increases in nutrient levels and sedimentation. Given that these shifts entail the replacement of one

critically important foundation species with a dissimilar though equally important foundation species, there are likely to be large, relatively unstudied consequences. The research focuses on the mechanisms driving the current and future expansion of mangroves along the Atlantic coast of Florida, as well as other coastlines at the transitions between temperate and tropical zones around the world. The project is investigating the ecology of shifting wetland ecotones, such as the effects on community composition, food web dynamics, nutrient cycling, carbon sequestration, and buffering capacity against shoreline erosion.

Bio: Dr. Feller is an ecologist at the Smithsonian Environmental Research Center where she is the Lead Scientist in the Animal-Plant Interaction Laboratory. Her research focuses on mangrove forests that provide the foundation for complex marine ecosystems with spatial differences in structural complexity, biodiversity, biogeochemistry, and hydrology, which vary at local and regional scales. Although mangroves provide critical ecosystem goods and services, they are threatened globally by changes in climate and nutrient over-enrichment of the coastal zone. Feller studies mangrove forests around the world, using latitude and tidal elevation as proxies for climate change and sea level rise to determine how excess nutrients interact with these consequences of global change to alter community structure, food webs, and patterns of herbivory in mangrove ecosystems.

"**ASSESSING COASTAL RESTORATION FOR SCIENCE AND EDUCATION:** Meeting both objectives"
Presenter: Kelly J. Smith, PhD, Associate Professor, University of North Florida

There is a growing need for coastal restoration, but restoration costs can be very high. There are numerous shoreline restoration projects completed, but which lacked objective post-restoration monitoring to determine whether restoration goals have been met. Integrating a novel method of restoration for this region within an educational framework, students and public volunteers are engaged in testing how different living shoreline approaches can influence shoreline erosion rates and biological diversity. This project will build upon the GTM NERR completed oyster reef restoration project near Wright's Landing on the Tolomato River. The

hope is that this restoration project will be used in long-term training of students and volunteers in environmental monitoring protocols, leading to valuable information on restoration success. This project is in the early stages, with actual creation of the newly restored habitats planned for April, 2014. Background information on such faunal utilization patterns will be addressed along with planned restoration design.

Bio: Kelly Smith, PhD, has been a faculty member at the University of North Florida since 1999, and has been involved in estuarine research within the boundaries of the GTM NERR since 2000. Much of her research focus relates to habitat use by fishes and human impacts on coastal systems. Her previous research, prior to arriving at UNF, involved salt marsh restoration. She is currently involved in a project to assess combined living shoreline methods for restoring a coastal marsh in the northern section of the GTM NERR.

“INTERTIDAL MARSH VEGETATION MONITORING IN THE GTM NERR”
Presenter: Jason Lynn, Biologist, GTM NERR

Intertidal marsh habitats are of particular importance in estuarine ecosystems because they link marsh and sub-tidal habitats during periods of tidal inundation. The extensive and direct land-water interactions created by these habitats make them vulnerable to impacts from such forces as climate change, pollution, and erosion. A monitoring program has recently been established in the GTM NERR as

part of a NERR system-wide effort to understand how emergent marsh vegetation changes in response to various environmental factors. Monitoring was conducted during summer and fall of 2012 and 2013. In accordance with NERR protocols, vegetation species cover and canopy height were estimated within 90 plots throughout the Reserve (six sites, three platforms at each site, and five 1-m2 plots at each platform). The first questions addressed by this emerging dataset include: 1) What are the structural characteristics of these plant communities in terms of species composition, abundance, and canopy height?; 2) What are the short-term patterns in vegetation community structure over time and space?

Results suggest that intertidal marshes in the GTM NERR are largely dominated by *Spartina alterniflora* followed by *Juncus roemerianus, Batis maritima,* and *Sarcocornia ambigua*, with the latter three species increasing in abundance away from the water's edge. Single black mangrove (*Avicennia germinans*) specimens were found in three plots at one site. In the future, results will be related to complementary work in progress, including marsh elevation monitoring via deep rod Surface Elevation Tables (SETs) and feldspar clay accretion plots, surveys of vegetation and elevation sites into local elevation networks, and mangrove monitoring along the salt marsh-mangrove ecotone. Through such efforts, the GTM NERR will help all NERRs serve as a network of sentinel sites for the detection of natural and anthropogenic impacts in estuaries nationwide.

Bio: Jason Lynn received his BS degree at the University of North Florida in Coastal Environmental Science. He completed an internship with the GTM NERR research team in the summer of 2011 in which he helped with benthic sampling, a native bee survey, gopher tortoise surveys, and marsh platform construction. Jason is currently a Biological Monitoring Assistant working on emergent vegetation and surface elevation monitoring at six sites throughout the GTM Research Reserve.

"ESTIMATING THE DISPERSAL CAPACITY OF THE INTRODUCED GREEN MUSSEL (*Perna viridis*) from field collections and oceanographic modeling of the GTM NERR"
Presenter: Matthew Gilg, PhD, Department of Biology, University of North Florida

Introduced species can often cause negative environmental and economic effects by competing with native species, damaging habitats, and requiring costly control measures. Control of invasive species can be bolstered by development of an ecological niche model that can be used to identify habitats that are vulnerable to invasion by certain species and predicting how long it will take those species to expand into those new areas. The green mussel (*Perna viridis*) was introduced to the waters of the Caribbean and Florida from the Indo-Pacific and can be found in the Intracoastal Waterway (ICW) throughout the GTM NERR system. The present study is aimed at identifying factors that influence the spatial and temporal patterns of green mussel larval settlement throughout the GTM NERR, and estimating dispersal distance using both field observations and a hydrographic model. Recently settled green mussel larvae (spat) were collected from sites within the ICW on a monthly basis for much of 2007, 2008, and 2010. A particle tracking model was used to predict larval movement during observed settlement periods from 2007. Settlement typically occurred during the summer months and was correlated to water temperature but not salinity or chlorophyll *a* concentration. Habitat also significantly influenced settlement patterns since most settlement occurred within the main channel of the ICW and not in adjacent feeder creeks. Observed settlement patterns suggested that green mussel larvae were capable of dispersing at least 18 km, but model projections suggested dispersal distance could often exceed 100 km. Results of the particle tracking model did not accurately reflect field observations, suggesting a need for a better understanding of green mussel larval behavior to make more accurate predictions.

Bio: Dr. Gilg is an ecological geneticist from the University of North Florida that works primarily with marine invertebrates. His work encompasses many evolutionary and ecological questions where he uses genetic markers to detect and measure natural selection and migration in natural populations. He has studied invasive species such as the Asian green mussel and the Titan Acorn barnacle in northeastern Florida for about eight years, documenting their dispersal patterns, origins and tolerance to cold temperatures. Dr. Gilg earned his MS degree at Eastern Illinois University and his PhD at the University of South Carolina. He teaches courses in Genetics, Evolution and Population Genetics.

"UNDERGRADUATES AND FISH: Working with Flagler College student volunteers to measure biodiversity in the GTMNERR"
Presenter: Ed McGinley, PhD, Assistant Professor of Natural Sciences, Flagler College

Recently, a monthly beach seine survey was established within the GTM NERR to measure the seasonal biodiversity of fish and select crab species. Undergraduate students from Flagler College helped initiate this project as part of their Independent Study research course, and Dr. McGinley has been recruiting student volunteers to continue the monthly surveys. One purpose of this project was to record fish species in the area and evaluate how the community changes from month to month. This baseline information is invaluable when trying to determine the effects of human activities on aquatic life. The second purpose was to provide undergraduate students with an opportunity to perform field work and acquire hands-on experience pursuing research. Students are able to develop research questions around issues that interest them. They can investigate those questions either in their senior capstone research class or during an Independent Study completed during the summer.

Ten sites were sampled from the GTM NERR Environmental Education Center in Ponte Vedra to Washington Oaks Gardens State Park, using a 50-foot seine net with ¼ inch diameter mesh. The net was pulled twice per site. All fish, along with select crabs, were identified and measured (mm). Measurements of salinity, dissolved oxygen, and temperature were also recorded. Samples from May – October 2013 have yielded 60 species of fish and crabs and a total of 15,001 individuals. The average number of species caught per site has shown a distinct monthly pattern, while the average number of individuals caught per site has been more variable month to month. The monthly seine survey has already generated two undergraduate research projects completed in December 2013, and another one is set to take place in the spring of 2014.

Bio: Dr. McGinley earned his BS in Marine Biology from Saint Francis University and his MS in Wildlife and Fisheries from Frostburg State University. His interests in

research and teaching led him to pursue his PhD in Wildlife and Fisheries at West Virginia University. Throughout his education, his research has centered on aquatic food webs with a special focus on fish. After completion of his PhD, Dr. McGinley was part of a research expedition studying the impacts of climate change on endangered salmonids in Mongolia. His research interests at Flagler College are designed to investigate local fisheries food webs and disturbances that may affect them. One of the supplemental goals of his research program is to involve undergraduates from the Coastal Environmental Science major at Flagler College. Students have been involved with project design, data analysis, and dissemination of the results.