

State of the Reserve 2010
“Celebrating the 10th Anniversary of the Reserve”

Summary

The studies in this document represent but a few of the many research, monitoring, education and conservation activities that take place or have taken place over the past ten years at the GTM NERR. Some programs are of a short duration, but most are ongoing and lend themselves to future research and monitoring needs and practices, and they contribute to the growing body of scientific knowledge.

For further reading, the Site Profile of the Guana Tolomato Matanzas National Estuarine Research Reserve, published August, 2009, Frazel, Inc., provides an environmental overview of the GTM NERR estuaries and terrestrial ecosystems represented within the reserve; outlines ongoing research and monitoring; and identifies site-specific needs and practices. The Site Profile also includes a description of biotic habitats; an overview of the reserve programs and partnerships; a summary of research conducted within the reserve; and suggestions for future research and monitoring. The GTM NERR Management Plan can be found online via a web search under GTMNERR.

“Application of the flow way concept for water quality protection”

Presenter: Matt Love

There is a need to protect the integrity of the estuarine habitats within the GTM NERR estuary. Addressing this need will potentially reduce the impact of land development within coastal watersheds through incorporating natural storm water runoff patterns that will reduce the non-point source pollutant loading from landuse delivered to estuarine areas.

GTM NERR wanted to know if high resolution topography adequately defines the natural flow paths of surface water within the GTM NERR watershed to enable its use for site planning purposes and development.

To address the question, LIDAR data for St Johns and Flagler counties were used as a data source for watershed flow characteristic analysis. The team compared the flow paths derived from that data set to that derived from the original lower resolution digital elevation model developed by the St. Johns River Water Management District, which GTM NERR used to create the watershed flow way map.

As a result, the team learned that, in the absence of site verification, wetland maps and terrain data sources preliminarily show that topography does dictate the flow of surface water drainage within the watershed.

Our conclusion was that these data will be used as a source of information for guiding site development plans within the Matanzas Special Basin and potentially within the GTM NERR watershed, thus protecting the integrity of the estuarine habitats.

Biography:

Matt Love has worked in the environmental sciences for 13 years, studying topics of endangered species ecology, continental slope ichthyofauna, landscape ecology,

geographic information systems, and restoration of the greater Everglades ecosystem. He obtained his B.S. degree from Auburn University in Marine Biology and his M.S. degree in Biology from the University of Central Florida. Matt currently works as the lead biological scientist for the GTM NERR, investigating watershed hydrology, resource mapping and wetland restoration issues for the reserve.

“SWMP (System-Wide Monitoring Program)”

Presenter: Katie Petrinec

In an effort to gain a better understanding of how estuaries function and change over time and to better predict how coastal systems respond to natural and human-induced change, the NERR system established the System-Wide Monitoring Program (SWMP pronounced "swamp") in 1995. The NERRs serve as living laboratories for staff, students, visiting scientists and anyone interested in learning more about coastal ecosystems. Research conducted throughout the reserve system enables scientists to address specific coastal management needs that can guide national, regional and local research efforts and promote conservation of estuarine habitats.

Because long-term, standardized, quantitative measures on GTM NERR conditions were needed, the reserve began participating in the NERR SWMP program in 2001 in an effort to provide researchers, resource managers, educators, and other coastal decision makers with reliable information.

To proceed with gathering data, the GTM NERR SWMP was established with three major components: (1) water quality; (2) weather; and (3) nutrient analysis. The water quality component is comprised of four water quality monitoring stations (Pine Island, San Sebastian, Fort Matanzas and Pellicer Creek) at which automated instruments called Data Sondes are deployed to collect information on water temperature, salinity, dissolved oxygen, depth, pH, and turbidity at 15 minute intervals. The GTM NERR weather station,

located in Pellicer Creek, concurrently measures meteorological parameters including temperature, relative humidity, atmospheric pressure, rainfall, wind speed and direction, and photosynthetically active radiation (PAR), also collected at 15 minute intervals. The nutrient component of SWMP involves collecting water samples at each of our four stations monthly with additional diel sampling occurring at the Pellicer Creek station. Water samples are collected and analyzed for orthophosphate, ammonium, chlorophylla, nitrite, nitrate, total nitrogen, orthophosphate, total phosphorus, and various other analytes. Data collected at both the water quality station and weather station located in Pellicer Creek are transmitted via telemetry and are available for viewing online in Real-time. All of the NERRS SWMP data is stored and available for download through the NERR Centralized Data Management Office (CDMO) (www.nerrsdata.org). Also see www.estuaries.gov/estuaries101/ScienceData/RealTimeData.aspx?s=gtm.

As a result of SWMP, the GTM NERR has nearly 10 years of data collected at each of the four water quality sites and the weather station. Since the dataset is so extensive, the GTM NERR is still analyzing data for long-term trends. However, short-term observations have been made during storm events (Nor'easters, tropical storms, and hurricanes). One example of short-term variability observed at our Pellicer Creek water quality station and weather station enabled former Graduate Research Fellow, Nikki Dix (Dix et al 2008), to research and publish the effects of extreme wind and rainfall conditions associated with tropical storms.

A long-term baseline of data provided by SWMP can provide a reference for water quality conditions within the reserve. The GTM NERR continues to participate in the System-Wide Monitoring Program. The goal is to maintain the GTM NERR high quality standard of monitoring efforts by staying current on new policies and procedures and improving the reserve's collection methods through annual training provided by the NERR. As a result, data collected serves as a platform for long-term research and monitoring and will provide a better understanding of how the reserve's estuaries function and change over time. Due to events such as oil spills, baseline data showing "normal" conditions can be beneficial to decision makers.

Biography:

Katie Petrinec earned her B.S. degree in Marine Science from Jacksonville University in Florida. She interned and then worked for Tree Hill Nature Center for five years, serving as assistant naturalist and Educational Coordinator. She later moved to Madison, Wisconsin and worked for two years as microbiologist for the University of Wisconsin Veterinary Diagnostic Laboratory where she performed multiple states of diagnostics including

analyzing specimens for the presence of prion pathogens in the Transmissible Spongiform Encephalopathy (TSE) Laboratory. In 2006 she moved to Florida and began working at GTM NERR as a research assistant. Katie is responsible for the water and weather components of the SWMP program which measure changes in estuarine water quality over the long term.

“20 Years of nesting marine turtles; trends and continuing questions”

Presenter: Scott Eastman

All five species of marine turtles that nest in Florida are either listed as threatened or endangered. Three of these species regularly nest on GTM NERR beaches including the loggerhead turtle (*Caretta caretta*), the green turtle (*Chelonia mydas*) and the leatherback turtle (*Dermochelys coriacea*). Understanding the population trends, reproductive success, and threats is essential to the recovery of these species.

To assist in the recovery of these turtles, reserve biologists are attempting to understand trends in marine turtle species population, success, and distributions utilizing GTM NERR nesting data.

To gain more information, from May 1st to October 31st of each year since 1987 the GTM NERR's beaches have been monitored daily for marine turtle nesting activity. Volunteers and/or staff conduct surveys recording data such as GPS nest location, date of nest to determine incubation periods, and any human or animal nest disturbances. Post-hatching nest inventories are conducted where nest success is determined and recorded. The GTM NERR contributes data to the Florida Fish and Wildlife Conservation Commission's Index Nesting Beach and State Nesting Beach programs. The Index Nesting Beach program focuses on consistency in survey methods and reporting to assess trends over time between and within beaches. The goal of the State Nesting Beach Program is to gather the largest scope of temporal and geographic datasets of nesting activities on the state of Florida's beaches.

Given the enormous quantity of data, analysis will be ongoing. Since 1998, Florida's statewide loggerhead nesting has decreased by 41 percent. Statewide nesting for green and leatherback turtles is currently the highest since monitoring was initiated for the state in 1989. This is similar to the trends currently being analyzed from local datasets. The largest identifiable threats to "hatch-out" on GTM NERR beaches include predation by fire ants or mammalian predators, inundation by named storms, and/or lunar high tides. Quantifiable anthropogenic threats to marine turtles nesting on the beaches of the GTM NERR include artificial lighting, personal items left from beachgoers, or active disturbance.

Results to date show that to aid in the recovery of these turtles, management practices such as coastal armoring, artificial lighting and beach nourishment can be guided by the science-based recommendations yielded from this long-term monitoring effort. Analysis of data from this project can provide recommendations for up-listing or de-listing a species. This information can also be used by agencies and universities managing and researching oceanic waters in Northeast Florida to gain a better understanding of the abundance and diversity of marine reptiles and overall ocean health.

Biography

Scott Eastman is a biological scientist at the GTM Research Reserve. He holds the reserve's Marine Turtle Permit and is responsible for marine nesting surveys and all sea turtle stranding and salvage activities within the GTM NERR. He also served as beach lighting officer for St. Johns County where he investigated marine turtle disorientation events. He received a B.A. degree in Psychology from Florida Atlantic University with an emphasis in

Psychobiology focusing on animal behavior. His research interest is in understanding the population dynamics and nest site fidelity of loggerhead marine turtles.

“Marsh Bird Monitoring”

Presenter: Andrew Thornton

Marsh birds are a secretive group of birds that use a declining habitat type. As a whole, marsh birds are understudied and very little information on their population dynamics is known. A study of the birds and their habitat within the GTM NERR has been initiated to help understand the population trends.

By performing monitoring, the reserve hopes to gain a better understanding of marsh bird populations in the GTM NERR tidal and freshwater marshes.

To gain needed data, call-broadcast surveys are conducted during the early parts of the breeding season for the various marsh birds of our area. This method of surveying allows for a much higher rate of detection than passive methods, as it provokes a response from territorial birds. Over years of surveys, population dynamics will begin to take shape.

Results of the study to date indicate that the GTM Research Reserve area seems to support some of the highest densities of clapper rails (*Rallus longirostris waynei*) in the country. While there is too little information to work with trends as yet, the intention is to keep a close eye on this sensitive habitat type by monitoring birds that are dependent upon the marshes for their breeding grounds.

The knowledge gained at GTM NERR is pooled with other coastal NERRs. As knowledge of population dynamics and trends increases, management decisions can be aided and influenced.

Biography

Andrew Thornton, field biologist for the GTM NERR and Anastasia Mosquito Control District, works with various wetland projects at the reserve. Some of these involve restoration of the freshwater marsh by way of surveying aquatic invertebrates, night-flying insects, and mosquitoes. He is in charge of marsh bird monitoring at the reserve, including both freshwater and tidal marsh areas. His programs are all tied into non-target impacts of mosquito control, which is the study of any organism living in the same habitat as mosquitoes that could be exposed to treatments due to mosquito population control measures. Andrew graduated with a degree in environmental studies from Northland College, followed by travel in the Eastern US while taking seasonal field jobs, usually

concentrating on ornithology and entomology. He has been at GTM NERR for the last two years.

“Hydrodynamic Modeling of the GTM Estuarine System”

Presenter: Bilge Tutak

There is a need to better understand the circulation and transport of waters within the GTM NERR estuarine system, especially during extreme weather events.

The problem is how to assess the response of the reserve to such extreme events as tropical storms or hurricanes. For a response assessment, researchers first want to determine what types of changes occur in hydrodynamic and environmental conditions during extreme events, for example, to understand sharp changes that take place in salinity and temperature.

To determine an adequate response to such events, the project utilized all available observed data within the system and synthesized the data using numeric models of estuarine hydrodynamics. With the use of the models, large scale hydrodynamic conditions could be obtained.

The model results revealed that the GTM NERR estuarine system goes through dramatic changes during extreme events. It was also determined that transport within the system is mostly dominated by the St. Augustine Inlet, and that the residence time of waters within the system is mostly determined by the tides.

In conclusion, this research project is leading to a better understanding of the reserve system hydrodynamics, which in turn will help other researchers who are investigating various issues within the reserve, for example, those studying larvae, water quality, and residence time.

Biography

Bilge Tukak is a senior PhD student and a GTM NERR graduate research fellowship scholar at the University of Florida. His research focuses on numerical modeling of estuarine circulation, storm surge and impact of extreme events on estuarine hydrodynamics.

“Oysters as indicators of nutrient pollution”

Presenter: Nikki Dix

A major coastal management issue is the challenge of assessing effects of excess nutrient levels in estuarine systems. Nutrients, particularly nitrogen and phosphorus, are found naturally in coastal waters, but concentrations are artificially elevated near developed coastlines. Stormwater runoff and untreated wastewater contain high levels of nitrogen and phosphorus that can negatively affect water quality and ecosystem health. Measuring the impact of nutrient pollution can be difficult in highly flushed waterways because short term changes are hard to detect. However, since oysters filter the water while submerged in the estuary for long periods of time, they offer a way to measure nutrient pollution in dynamic environments.

The problem was to determine if oysters could be used as indicators of nutrient pollution in the GTM NERR and other highly flushed estuaries.

To test if oysters responded to differences in nutrient loading, oyster populations were compared between regions of the GTM NERR that had similar physical properties (water flow, salinity, etc.) but different degrees of coastal development and different histories of nutrient loading.

Comparing oysters from regions with different concentrations indicated that oysters in a region of the estuary receiving higher nutrient loads were larger in size and more densely populated than those in a region receiving lower nutrient loads. It is thought that nutrient

enrichment caused elevated plant/algal growth, which made more food available to oysters. The highly flushed nature of the estuary may buffer it from the detrimental effects of nutrient pollution. However, further increases in nutrient load could be damaging to local oyster populations if low oxygen events and toxic algal blooms were to increase in frequency.

The conclusion drawn from this study is that oysters are promising indicators of water quality in highly flushed estuaries. Oyster monitoring is recommended to complement water quality monitoring programs in NERRs around the nation's coasts since changes in oyster populations reflect short term changes in water quality that are more difficult to capture.

Biography

Nikki Dix was awarded a GTM NERR graduate research fellowship in December 2006 and has been working toward her PhD since then. She graduated from Florida State University with a B.S. degree in Biology and Science Education. She then worked in environmental services with a planning firm in Orlando where she gained experience in wetland delineation and monitoring, endangered species surveying, and technical report writing. She earned an M.S. degree in the University of Florida's Department of Fisheries and Aquatic Sciences. Her master's research examined the effects of 2004 hurricanes on water quality in Pellicer Creek within the GTM NERR, which is designated as an Outstanding Florida Water. Her doctorate research investigated how biological components within the well-mixed, highly flushed Matanzas River estuary responded to differences in nutrient loading. Nikki is now writing her dissertation and looking forward to a career in coastal research and management.

“Environmental Education; Changing Behaviors One Program at a Time: An Education Team Presentation as one Means of Affecting Change”

Presenters: Angie Golubovich and Linda Krepp

A general lack of awareness is one of the reasons why many people do harmful things to the environment. The GTM NERR education team realizes that the public may not understand that their everyday behaviors can have negative effects on their natural surroundings. It was determined that since scientific and environmental organizations are continuously acquiring new information about the natural world and the critical need for maintaining its health, and if such knowledge is to have a practical effect in the real world,

then translating and presenting that information to the public must be a core educational objective.

The problem is how to motivate people to change their behaviors. Educators across the country are trying to determine what type of programs will effectively change public behavior in a manner consistent with sustaining their natural surroundings. To that end, a number of programs have been implemented by many organizations with varying degrees of success. The GTM NERR education team, along with Florida Sea Grant Agent, Dr. Maia McGuire, has perhaps found a model that works, based on feedback from survey participants.

One solution to the problem was approached by teaching environmentally intensive week-long programs to 20 adults at a time, twice a year. The program has a dynamic agenda covering a variety of natural history and environmental topics, and includes pertinent suggestions on how participants can lessen their impact on natural systems.

To date, surveys indicate that attendees do intend to change their behaviors as a direct result of participating in the program. For example, 66.7% of participants report reducing sprinkler use; 78.3% say they have switched from using plastic bags to reusable shopping bags; and 61.2% are now helping to spread the word by becoming volunteers with environmental or science based organizations.

The program led instructors to believe that future education programs can be developed throughout the NERR system based on focused, small group, hands-on, intensive instruction. Such programs could yield a higher number of people actually taking acquired knowledge and applying it to their daily lives for greater sustainability of natural resources.

Biographies:

Angie Golubovich, Education Coordinator at the GTM Research Reserve, has worked in the environmental field for ten years with a variety of organizations including the Florida Aquarium, Pacific Whale Foundation, the Ocean Conservancy, and more. Angie earned her B.S. degree in Environmental Science Policy with a minor in Communications and 75+ hours in biology with a focus in marine science. She is dedicated to translating scientific and conservation information into understandable terms for public consumption so that current and future citizens are interested, motivated, and inspired to take an active role in

conserving the coastal environments, which she finds so vital to the long-term sustainability of animal, plant, and human life.

Linda Krepp, Sustainable Living Educator at the GTM Research Reserve, developed and teaches a host of the Think Eco-Logically Sustainability Programs at the reserve, which entails educating local coastal communities on how human activities impact the environment, and provides residents with ways to live “greener” lifestyles. The program introduces sustainable living practices to homeowners and helps them to adopt those practices in their daily lives. Linda spent over 20 years of her professional life working for Bellsouth and B.F. Goodrich Chemical in sales, marketing and technical support. More recently, she taught middle school science and art for eight years, always with an environmental perspective in mind. Linda is a graduate of Kent State University.

“Predator-prey interactions of the American alligator in Southeastern salt marshes”

Presenter: James Nifong

Populations of top predators across the world have and are currently suffering from overexploitation and loss of habitat. The importance of predators in the regulation of community interactions and ecosystem function is currently a heated debate that could benefit from real world examples.

The problem was addressed by asking, can American alligators (*Alligator mississippiensis*), for example, influence the feeding behavior of the blue crab (*Callinectes sapidus*)? What is the relative strength of direct versus indirect trait-mediated interactions?

The question was approached by using experimental mesocosms to analyze the relative strengths of direct versus indirect interactions between alligators and blue crabs in the salt marsh food web.

Experimental results show a significant negative effect of direct alligator interactions on blue crab and ribbed mussel survival and a significant positive effect on snail survival. Indirect interactions are currently being analyzed, but preliminary results suggest positive effects on snail survival and negative effects on ribbed mussel survival.

It was determined from the experiments that predator scarcity in ecologically and economically important habitats, such as salt marshes, is becoming a great concern and the reestablishment of predators in the future is a potentially useful tool for restoration. To conserve these important community members and the services they provide we must first understand their role in the regulation of community and population dynamics.

Biography:

James Nifong is currently pursuing a PhD from the Biology Department, University of Florida. His research is based on the integration of community ecology, herpetology, natural history, and the use of modern analytical techniques to inform management decisions in coastal habitats of the southeastern US. In 2007, he received a B.S. degree from the University of Florida, Department of Zoology, graduating summa cum laude. In

2009 he began his graduate studies and in 2010 he was awarded a graduate research fellowship from the GTM NERR.