GUANA TOLOMATO MATANZAS NATIONAL ESTUARINE RESEARCH RESERVE

2017

THE GTM RESEARCH RESERVE WAS ESTABLISHED IN 1999 BY THE NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION AND IS ONE OF 28 NOAA COASTAL ESTUARINED RESERVES. THIS DOCUMENT INCLUDES INFORMATION REPRESENTING SELECT CURRENT AND LONG-TERM RESEARCH AND COMMUNITY PROGRAMS TAKING PLACE AT THE RESERVE.

GTM Research Reserve

GTM Research Reserve

GTM Research Reserve Watershed

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RESEARCH RESERVE

STATE OF THE RESERVE

GUANA TOLOMATO MATANZAS NATIONAL ESTUARINE RESEARCH RESERVE

PRESENTATIONS AND PROGRAMS SUMMARY

FEBRUARY 3, 2017

The GTM Research Reserve is comprised of a network of public lands managed by the Research Reserve, Florida Fish & Wildlife Conservation Commission, Flagler County, St. Johns River Water Management District, Florida State Parks, The Florida Forest Service, and the National Park Service. The map to the left illustrates managed areas that fall within the Reserve boundaries and the watershed area.

For more information, contact the

GTM Research Reserve Environmental Education Center

904-823-4500

www.gtmnerr.org

www.dep.state.fl.us/coastal/sites/gtm

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Program Printing *by Foxtrot Creative Studio*

A LETTER FROM THE ENVIRONMENTAL ADMINISTRATOR

The theme for this year's State of the Reserve is "Working Waters." The presentations and posters highlight projects within the Research Reserve that showcase the natural services the estuaries provide including filtration, buffering, habitats, migratory routes and seafood nursery, along with the efforts being made to restore these services. A portion of the symposium examines the impacts of storms, including Hurricane Matthew.

Applied research conducted by Research Reserve staff, volunteers and visiting scientists is informing management decisions to improve harvest of oysters, protecting water quality and restoring habitats. This research is also helping us learn how nature responds to disturbances such as marsh die-offs and hurricanes. This information is needed for planning successful restoration projects.

An important baseline dataset supporting the visiting scientists and setting restoration priorities is the Research Reserve's System-Wide Monitoring Program (SWMP). Water quality and meteorological data gained by SWMP also help scientists and educators interpret the links between weather and water quality. This data is helping scientists to understand how Hurricane Matthew affected water quality, species and habitats within the Reserve.

A project by NOAA's National Centers for Coastal Ocean Science, Coastal Ecology Program, led by Dr. Len Balthis, was completed in 2016. The results of this project will help establish a baseline for measuring how the Research Reserve's overall ecosystem health may be changing over time. The data from this project will be accessible online. Projects like this may also guide statewide resource condition assessments.

Another noteworthy project underway by the University of Florida, with Dr. Christine Angelini as principal investigator, had the unique opportunity of being put to the test by Hurricane Matthew. The success of structures engineered to reduce shoreline erosion along the Tolomato will guide future shoreline restoration efforts.

I offer my sincere thanks to everyone for taking the time to attend the State of the Reserve. Continuing and enhancing existing projects, and initiating new projects, are only possible with the generous support and hard work of many dedicated community leaders, volunteers, scientists and educators. Special thanks this year goes to the University of North Florida Coastal and Marine Biology Flagship Program for co-sponsoring this event along with the Friends of the GTM Reserve.

GTM

Michael Shirley, PhD
Environmental Administrator, GTM Research Reserve

FEATURED PROJECTS OF 2016

These projects were presented as featured projects of 2016 at the 2017 State of the Reserve

EFFECTS OF OYSTER HARVESTING ON SHELL AVAILABILITY IN THE MATANZAS RIVER, NORTHEAST FLORIDA

Harvesting on oyster reefs can impact oyster populations by removing shell and reducing substrate availability for spat settlement. Availability of cultch (dead shell) is a determinant of reef sustainability and fisheries impact on an oyster population. The objective of this project was to investigate effects of hand harvesting on cultch density within two regions of the Matanzas River in Northeast Florida, Salt Run and Fort Matanzas, of which both regions have extensive intertidal oyster reefs. Assuming environmental conditions were analogous regionally, it was expected that cultch density be greater in non-harvested areas than harvested areas. Replicate oyster reefs were sampled within each region, in and outside of harvest areas, during the winter of 2015 through 2016. Surficial cultch was hand collected at three random locations along a transect on each reef and cultch weight per 0.0625 m^2 was determined in the lab. Both region and harvest zone were influential in determining the amount of cultch. Differences in availability of dead shell were observed in Salt Run, but not Fort Matanzas, possibly because Salt Run was more heavily harvested. Site accessibility also potentially affected results. Given the results of this study, future management efforts may consider shell supplementation in harvest zones to ensure oyster population sustainability.

Tanner sampling oysters

PRESENTER: **J. Silas Tanner,** *Coastal Biologist, GTM Research Reserve*

Silas Tanner received a BS in biology from the University of North Florida with a major in coastal biology and a minor in environmental studies. While at UNF, he studied the effects of oyster harvesting on shell availability in the context of sustainable fisheries. Tanner is currently the System-Wide Monitoring Program (SWMP) technician at the GTM Research Reserve. He conducts nutrient and chlorophyll sampling and analysis, oversees the maintenance of the monitoring instruments used by SWMP program, as well as, documentation of standardized forms, weather station maintenance and other tasks as needed.

Project Co-Authors: *Dr. Nikki Dix;* ***Additional Project Assistant:*** *Pamela Marcum*

DEMOGRAPHIC RATES OF THE EASTERN OYSTER (*CRASSOSTREA VIRGINICA*) WITH THE ADVANCING THREAT OF CROWN CONCH (*MELONGENA CORONA*) IN THE MATANZAS RIVER

Loaded sampling boat

The Eastern oyster (*Crassostrea virginica*) creates conspicuous intertidal reefs throughout the Matanzas River estuary. The habitat created by these reefs is very important for estuary health. Oyster reefs provide nursery habitat for many other species, maintain water quality through suspension feeding, remove excess nitrogen that can lead to eutrophication, buffer coastal erosion, and in some cases, sequester carbon. However, the oyster reefs and consequently the health of this system may be compromised by large aggregations of the predatory crown conch (*Melongena corona*). From 2010-2012, we observed a strong gradient in the abundance of crown conchs (N to S). The effects of this predation likely created reefs with fewer oysters that were of smaller sizes as one moved southward. To study the temporal stability of this pattern and to describe the predation effect on oysters, we began paired monitoring and field manipulation experiments from 2014-2016. Using the Matanzas Inlet as the N-S dividing line, we selected three northern sites without crown conch and three southern sites with crown conch. While there was no clear difference in juvenile oyster growth among sites, there was variation in both the mean oyster length and abundance among sites. There was a clear reduction in both the size and abundance of adults at the southern sites, which had the highest densities of conch and substantially larger mortality due to predation than the northern sites. Conch density showed a seasonal fluctuation, with the highest densities during the summer months and very few to no conchs during the winter months. Puksack's research shows that while there is yearly and among site variation on reefs sampled, the southern sites are substantially affected by crown conch predation. Thus, further expansion northward will seriously compromise the procurement of oyster reef services in the Matanzas River estuary.

PRESENTER: **Dr. Timothy Pusack,** *Postdoctoral Scholar, University of South Florida*

Dr. Timothy Pusack is a postdoctoral scholar at the University of South Florida (USF) College of Marine Science working with Dr. Chris Stallings. At USF, he studies population dynamics and species interactions on North Florida oyster reefs. He also participates in research investigating the effect of artificial reefs on Gulf of Mexico fishes. Before coming to USF, Dr. Pusack completed his dissertation with Dr. Mark Hixon studying coral reef ecology. Specifically, he used population genetics to document dispersal patterns of a coral reef fish metapopulation, as well as characteristics and effects of the lionfish invasions. He studied the population dynamics of lionfish as well as their interactions with native predators and competitors. Dr. Pusack has studied many systems, aquatic and marine, in both the Pacific and Atlantic oceans. He is interested in using an interdisciplinary approach to answer pertinent and pressing questions related to marine conservation.

Project Co-Authors: *Dr. David Kimbro;* ***Additional Project Assistants:*** *Owen Stokes-Cawley, Matt Farnum*

THE EFFECT OF *SPARTINA ALTERNIFLORA* HARVEST INTENSITY ON RECOVERY IN DONOR MARSH

Salt marsh communities worldwide are diminishing due to erosive stressors such as wave energy from large boat wakes and sea level rise. To offset these losses, restorationists build new marsh and stabilize threatened shorelines through transplantation of *Spartina alterniflora*, the dominant marsh vegetation in low salt marsh. Sourcing plugs from adjacent donor marsh results in higher success and lower project costs, thus making it favorable for restoration efforts in many instances. To employ best management practices during harvest, it is necessary to determine the most efficient rate of harvest possible without long-term damage to donor marsh.

Sampling quadrat

This study examines the effects of harvest seasonality and intensity on the recovery of salt marsh along the Guana River at the GTM Research Reserve. Six harvest intensity treatments (based on Braun-Blanquet vegetation cover classes) were applied to 0.5 m^2 permanent quadrats. Each treatment was replicated three times in both fall and spring, for a total of 36 sampled sites. Sampling occurred prior to treatment and then monthly for 12 months. Measurements included were average culm height, total stem density, and percent cover determined from analysis of digital photos analyzed with Sample Point.

Using stem density as an indicator, both harvest intensity and seasonality had significant effects on recovery rates. Plots harvested in the fall returned to pre-treatment stem densities at a faster rate than those harvested in spring. In both seasons, the most intensively harvested plots did not return to pre-treatment densities within the 12-month frame of this study. However, recovery rates for the four less intensely harvested plots rates were not significantly different from each other in either season. These findings can advise best management practices and ultimately contribute to the establishment of a larger and more resilient marsh community within the GTM Research Reserve.

PRESENTER: **Cheryl Mannel,** *Restoration Coordinator, Northeast Florida Aquatic Preserves*

Cheryl Mannel is the restoration coordinator for Northeast Florida Aquatic Preserves where she has worked for nearly three years. Her program duties include water quality monitoring, stabilization of eroding marsh margins with living shorelines treatments, and serving on the steering committee of the Northeast Estuarine Restoration Team. Her background is in grassland restoration and in addition to wetland restoration, her professional interests include fire ecology and soil dynamics.

Project Co-Author & Co-Presenter: *Brian Alexander*

ARE FORAGING BIRDS ENHANCING SALT MARSH RESILIENCE TO VEGETATION DIEBACK?

Foraging birds in salt marsh

During salt marsh dieback events, large expanses of the dominant marsh-building plant, smooth cordgrass (*Spartina alterniflora*), die and senesce as a result of drought, grazing, wrack smothering, and/or pathogen stress. Though wading birds and shorebirds commonly use salt marsh habitat, little is known about how they use these dieback areas or how they affect salt marsh resilience, including their effects on plant recovery, infauna and nutrient cycling. Here, Sharp investigated which bird species use dieback areas and how often and if their foraging activities affect local infauna densities, soil and porewater chemistry, and/or cordgrass growth and recolonization. Sharp surveyed bird usage in denuded salt marsh areas (bare mudflat created by dieback) within the GTM Research Reserve coupled with field experiments where the project controlled for the effects of foraging birds with bird exclusion cages, or manipulate nutrient enrichment and mechanical soil probing to tease apart the drivers of plant, soil and infauna responses observed. Sharp found that denuded salt marsh areas attract soil-probing and surface-grazing birds as the lack of standing vegetation facilitates unobstructed pecking and provides an open view for visual feeders. The project predicts these feeding guilds will facilitate cordgrass recovery by increasing porewater flushing and supplying limiting nutrients to recovering plants, respectively. Alternatively, guano deposition and bill probing could stimulate marsh peat decomposition and thereby drive a loss in marsh elevation (subsidence) and oxygen availability, hampering cordgrass recolonization of diebacks. With climate change expected to amplify the frequency and severity of drought and hence occurrence of salt marsh dieback, it is imperative that we continue identifying factors that drive variation in salt marsh resilience. Our bird surveys and field experiments will generate important information for the management of coastal systems and provide insights regarding salt marsh resilience to future climate change scenarios.

PRESENTER: **Sean J. Sharp,** *PhD candidate, University of Florida*

Sean is a PhD candidate studying salt marsh ecosystems of the southeastern United States. Sharp is interested in the impacts physically destructive disturbances, like those caused by the rooting and wallowing of exotic feral hogs, have on biogeochemical processes, hydrology and overall salt marsh health and function. He is also interested in what players in the community and environment most facilitate or inhibit salt marsh vegetation recovery after disturbance. He hopes to continue researching coastal ecosystems through better understanding of their resilience to future disturbance and by improving and streamlining our management strategies of these beautiful and invaluable places. *Support for work is from the Timucuan Ecological and Historic Preserve student research grant, Society of Wetlands chapter research award, The Wetland Foundation research grant, and the HT Odum graduate fellowship research scholarship.* *His work has recently been featured in an article by Hakai magazine, a publication focused on coastal science and societies.*

Project Co-Authors: *Dr. Christine Angelini;* ***Project Assistants:*** *Emma Johnson*

REENGINEERING LIVING SHORELINES TO HALT EROSION AND RESTORE COASTAL HABITAT FUNCTIONING IN HIGH-ENERGY ENVIRONMENTS

Installation of the gabion-breaks during pilot study

In estuaries worldwide, loss of salt marshes and oyster reefs has been alarming, especially along high-energy coastlines. To dampen boat wake/wave stress, mitigate erosion, and restore oysters, managers have been building living shorelines adjacent to salt marsh edges (e.g., coir mat, biolog, oyster shell bag deployment), efforts that, thus far, have been largely unsuccessful in achieving coastal management goals under the most destructive, high-energy conditions. Here Angelini presents early results from an in-depth, experimental study that utilizes engineering and ecological approaches to optimize the design of living shorelines across an energy gradient in the GTM Research Reserve. Specifically, Angelini profiles wave/wake forces and marsh erosion rates and uses these data to calculate the size and orientation of living shoreline structures needed to break waves/wakes across an energy gradient. In a pilot-scale field experiment deployed in spring 2016, the team of engineers, ecologists, and end-users tested the efficacy of gabions positioned behind wave/wake breaks - a new hybrid method for building living shorelines - in dampening waves, slowing marsh erosion, and facilitating oysters. In the coming year, the team will refine the gabion-break design to optimize its ability to stabilize salt marshes and restore oysters at different wave/wake energy levels. This work is culminating in a training module for restoration practitioners, a video-based manual for the NERRS network, an interactive educational display and multiple peer-reviewed publications. This research addresses the NERRS Science Collaborative and GTM Research Reserve core priorities of stabilizing shorelines, restoring estuarine habitat and improving biodiversity conservation. In the presentation, the project lead will present the preliminary results and provide an overview of the project's upcoming implementation and monitoring.

PRESENTER: Dr. Christine Angelini, *Assistant Professor, University of Florida*

Dr. Christine Angelini is an assistant professor in Environmental Engineering Sciences and Engineering School of Sustainable Infrastructure and Environment at the University of Florida. She received her BS in marine ecology from Brown University in 2007 and PhD in biology from the University of Florida in 2014. Her research interests include community and conservation ecology and restoration engineering and she focuses much of her work in coastal ecosystems. Much of Dr. Angelini's work utilizes field experiments and larger scale correlational surveys to expose mechanisms regulating ecosystem resilience and recovery that operate across a range of spatial and temporal scales.

Project co-authors: *Ada Bersoza, Dr. Nikki Dix, Tina Gordon, Andrea Noel, Kenneth Rainer, Alex Sheremet, Raymond Grizzle, Emily Astrom, Scott Wasman, Tjisse van der Heide, Tjeerd Bouma, Leon Lamers*

SHORT-TERM VARIABILITY IN WATER QUALITY AND WEATHER AS AN EFFECT OF TROPICAL CYCLONE EVENTS IN THE SOUTHEASTERN UNITED STATES

Dunnigan and Erin Rowley at the meteorological station

Long-term monitoring networks, such as the System-Wide Monitoring Program (SWMP) with the National Estuarine Research Reserve System (NERRS), provide opportunities to examine the effects of storm events within a relevant time frame. Each NERR has at least four water quality stations, which contain a data logger that continuously measures a variety of parameters every 15 minutes, from water temperature and salinity to dissolved oxygen and pH. Additionally, each reserve has a weather station that directly measures rainfall, wind speed and direction, and more. The effects of recent storms (particularly Hurricanes Hermine and Matthew) on water quality were analyzed using SWMP data from the GTM Research Reserve. Results were compared to findings from the active tropical storm season of 2004. Additionally, SWMP data from six other NERRs (Apalachicola, FL; Rookery Bay, FL; Sapelo Island, GA; ACE Basin, SC; North Inlet-Winyah Bay, SC and North Carolina) were analyzed to track water quality and weather changes due to the passage of the storms in late 2016. Overall storms tended to reduce pre-storm salinity ranges, increase strong northeasterly winds, as well as result in large drops in salinities due to high rainfall levels during each storm. In general, studying storm effects on water quality helps us to understand how natural events impact short-term variability so that ultimately researchers have the ability to detect anthropogenic or long-term drivers of change in our estuaries.

PRESENTER: Shannon Kelley Dunnigan, *SWMP Manager, GTM Research Reserve*

Shannon Dunnigan is the System-Wide Monitoring Program manager at the GTM Research Reserve. She received her BS from Florida State University in Tallahassee, FL and her MS from the University of North Florida in Jacksonville, FL. Her background lies within studying the ecology of fishes, particularly how habitat setting affects their abundance, distribution, and behavior. While at UNF, she studied the habitat value of an artificial intertidal oyster reef constructed within the Research Reserve on juvenile fish and benthic macroinvertebrate assemblages. With a love for large data sets, an understanding of the importance of water quality for the distribution of estuarine organisms, and a deep obsession with organization and color coding, she assumed the role of the SWMP manager at the GTM Research Reserve where she oversees the long-term weather and water quality monitoring of the Reserve.

Project co-authors: *Kathryn M. Petrinec, Dr. Nikki Dix*

INFORMATION AND ASSESSMENT TOOLS TO SUPPORT MANAGEMENT AND RESEARCH PRIORITIES IN THE GTM RESEARCH RESERVE

Taking a sample over water

NOAA's National Centers for Coastal Ocean Science, Coastal Ecology Program, has conducted a series of regional ecological assessments throughout many estuarine and coastal shelf areas of the southeastern U.S., including NERRS. In 2014, Balthis completed an ecological assessment of the GTM Research Reserve at 30 stations throughout submerged habitats of the northern and southern Reserve and St. Augustine area. The study incorporated a probabilistic sampling design, with synoptic collection of multiple ecological indicators to provide unbiased estimates of current ecosystem condition, and help to establish a baseline for measuring how some conditions may be changing over time. The assessment data are accessible online and can directly support Reserve management plans and condition reports. Balthis recently developed an approach for evaluating the overall health of subtidal ecosystems based on indicators of water quality, sediment quality, and benthic biological condition. This straightforward technique brings together several different ecological parameters into a single broad index, and provides an easily-interpretable classification (good-fair-poor) of overall ecosystem health that reflects the relative influence of each of the component factors. Results of the 2014 GTM Research Reserve assessment will be used to update and refine a previous integrated assessment of habitat quality of NERRs in the southeastern U.S. Drawing on 40+ years of monitoring data collected throughout the GTM Research Reserve, Balthis is currently working with the Reserve to develop visualization tools and analysis products to inform decisions regarding shellfish closures in areas impaired due to fecal coliform contamination and to help identify and prioritize areas for further study and remediation. The tools and information described above can be used by coastal managers to help evaluate the ecosystem condition in certain areas, to identify potential stressors or areas having impaired water or sediment quality and/or benthic biological condition, and to target areas where additional research is needed.

PRESENTER: Dr. Len Balthis, *Marine Biologist, NOAA National Center for Coastal Ocean Science*

Len Balthis is a marine biologist with NOAA's National Centers for Coastal Ocean Science. His work has focused primarily on integrated assessments of ecological conditions in estuarine and coastal shelf environments, with an emphasis on linkages between the health of benthic infaunal communities and indicators of water and sediment quality. Dr. Balthis completed a BS in marine science at the University of South Carolina and a PhD in biostatistics and epidemiology at the Medical University of South Carolina. His recent interests include the development and validation of new indicators and methods for evaluating biological responses to human and natural stressors in coastal ecosystems.

EVALUATION OF THE LONG-TERM SPATIOTEMPORAL PATTERNS OF MARINE NESTING TURTLES AND REPRODUCTIVE SUCCESS ON AN UNDEVELOPED BEACH IN NE FLORIDA

Florida's sandy beaches are critical nesting habitat for multiple marine turtle species, all of which are federally listed as either endangered or threatened. Since 1989, marine turtle nesting surveys have been conducted daily from May 1 through October 31 on the 12.4 km of coastline in the GTM Research Reserve, Ponte Vedra Beach, FL.

Volunteer, Joan Becker, photographs a nesting turtle

Spatiotemporal nesting patterns, nesting success, and hatching success, as well as habitat characteristics such as tidal inundation and nest depredation, were examined over the 26-year study period for three species of marine turtles: loggerhead sea turtle (*Caretta caretta*), Atlantic green turtle (*Chelonia mydas*) and the leatherback sea turtle (*Dermochelys coriacea*). All three species demonstrated an overall increase in the number of nests throughout the study period. Loggerhead nests made up the majority (> 90%) of total nests observed and were most abundant in the months of June and July. Nesting success and hatching success was highly variable and dependent upon beach conditions, primarily beach width, slope and environmental events. Clutch size varied among and within species each season, but not between years. Together, these data provide a comprehensive, long-term assessment of the temporal patterns and reproductive success of marine turtle nesting on an undeveloped stretch of coastline. Gaining a better understanding of marine turtle nesting and reproduction in these increasingly rare undeveloped habitats may help managers and scientists discern critical factors influencing turtles nesting on more developed or urbanized tracts within their range.

PRESENTER: Scott Eastman, *Graduate Student, University of Florida*

Scott Eastman is a second-year Interdisciplinary Ecology MS student in the School of Natural Resources and the Environment at the University of Florida. Eastman is a member of the University of Florida, Archie Carr Center for Sea Turtle Research, a Center of Excellence, that is dedicated to seeking innovative solutions for sea turtle conservation through research and education. He is also the executive director for Eastman Environmental, a non-profit, 501 (c)(3) organization dedicated to protecting, restoring and conserving coastal and marine habitats through research, education and community involvement initiatives. Additionally, he is a contractor with The Ocean Conservancy working to identify stressors for the development of spatially-based cumulative impact score across the Gulf of Mexico for loggerhead and Kemp's ridley sea turtle species.

Project co-author: *Dr. Todd Z. Osbourne, Dr. Matthew E. Kimball, Dr. Raymond R. Carthy*

COMPARISON OF THE NEARSHORE AND NEKTON FISH COMMUNITIES IN THE MATANZAS RIVER ESTUARY

Observation of species from the nekton trawl

Estuaries serve a variety of roles for the aquatic organisms that inhabit them such as providing shelter, food resources and nursery areas. Within an estuary, the habitats are not homogenous, and therefore, the aquatic communities will differ by the area being sampled. Efforts have been underway for several years to monitor the nearshore fish community, but little work has been done recently to catalogue and monitor the nekton community of the Matanzas River estuary. To this end, a bi-monthly nekton survey was initiated in October 2016 as a collaboration between Flagler College and the GTM Research Reserve. Preliminary results indicate that an average of 3.7 ± 2.8 species are caught per trawl, and an average of 26.5 ± 16.8 individuals are caught in each trawl. The three most numerically dominant species captured were bay anchovy (*Anchoa mitchilli*): 63.6%, mojarras: 16.4%, and Atlantic brief squid (*Lolliguncula brevis*): 10.5%. Bay anchovy and mojarras are often caught in the nearshore fish community, but Atlantic brief squid are absent from this community during the day, indicating they are making a diel migration from the channel to the shallower nearshore community. This information will prove useful to determine how fish use each habitat seasonally, and as they mature.

PRESENTER: Dr. Ed McGinley, *Assistant Professor, Flagler College*

Dr. Ed McGinley grew up in Pennsylvania, where his parents inspired a love of learning and reading from an early age. His family watched ocean documentaries together, which led him to pursue a BS in marine biology from St Francis University (PA). After graduating, he worked as a technician on an oyster farm before knowing what he wanted to be when he grew up. His passion for the ocean was mostly directed to the life that lived within it, especially fish. As part of his masters and doctoral research, he has studied both fresh and saltwater fish. Those experiences, along with the opportunity to teach, has brought him to Flagler College. Between the small class sizes and the proximity to an estuary, Flagler College has been a perfect destination for McGinley. McGinley's current research investigates which fish and crab species inhabit the local estuary and what factors influence their distribution. McGinley strives to involve undergraduates in all his projects to expose them to every facet of the research process.

Project co-author: *Kenneth Rainer*

Plastic pollution in the oceans is an increasing environmental problem. Microplastics (plastic pieces smaller than 5 mm in size) are being found in fish and invertebrates. The Florida Microplastic Awareness Project aims to raise awareness about microplastics, in part by having citizen scientists collect and analyze coastal water samples for the presence of microplastics. Volunteers and others in the community are asked to reduce their consumption/disposal of plastics.

Volunteer collecting water sample for microplastic filtering

Sixteen coordinators around the state gave presentations about microplastics to potential volunteers, then conducted hands-on trainings to show water collection and analysis techniques. Volunteers are asked to collect at least four samples during the year, filter them, and observe the filters to count the number of pieces of plastic present. Data are used to populate a Google Map. People who learn about the project are asked to take a pledge to reduce their plastic waste.

Data from over 700 water samples show that 89% contain at least one plastic item. On average, there are eight pieces of plastic in a liter of coastal water. Of all plastic items recorded, 82% are fibers/filaments. On average, people are pledging to make 3.5 of the suggested eight behavior changes to reduce plastic waste. In follow-up surveys, people are reporting they have made an average of three behavior changes.

People learning about microplastics are willing to take steps to reduce their contribution to the problem, but improvements in wastewater treatment plant filtration technology may be needed to address this issue.

PRESENTER: Dr. Maia McGuire, *Extension Agent, UF/IFAS Extension, Florida SeaGrant*

Dr. Maia McGuire is the UF/IFAS Extension Sea Grant Agent for St. Johns and Flagler counties. She has a PhD in marine biology from the University of Miami. Over the past 16 years, she has led education programs in northeast Florida related to marine debris, climate change, invasive species and protecting coastal habitats. In 2015, she began the Florida Microplastic Awareness Project with a grant from NOAA's Marine Debris Program. This project involves citizen scientists in the collection of water samples and the analysis of those samples for the presence of tiny plastics. It also strives to educate people about the sources of microplastics and the dangers that microplastics pose to our natural environment.

Project co-authors: *Justina Dacey, Kenneth Rainer, Char Truxall, Holly Abeels, Lara Milligan, Laura Tiu, Chris Verlinde, Rick O'Connor*

ADDITIONAL RESEARCH AT THE GTM RESEARCH RESERVE IN 2016

These projects were presented as posters at the 2017 State of the Reserve

Heritage Monitoring Scouts: A Pilot Program in Citizen Science Site Monitoring at the GTM Research Reserve

Along Florida's 8,000 miles of shoreline, nearly 4,000 archaeological sites and over 600 recorded historic cemeteries are at risk from coastal erosion and rising sea levels. The Florida Public Archaeology Network (FPAN) started the Heritage Monitoring Scouts program (HMS Florida) to help track and prepare for these climate change impacts by engaging the public to monitor cultural resources. Data collected from the sites includes verifying basic site information, assessing overall conditions, and recording the types of threats each site faces. This information will help guide site management, prioritize sites based on risk, and keep track of changes at site and regional levels. In 2016, the GTM Research Reserve partnered with FPAN to start a pilot program at the Reserve. The program consists of four workshops to train Scouts in best practices for site monitoring as well as completing monitoring at sites.

Emily Jane Murray *et al., Florida Public Archaeology Network*

Cataloguing the St. Augustine Municipal Marina Green Sea Turtle Population

The goal of this study was to use photo identification to identify the green sea turtles that seek shelter and prey at the St. Augustine Municipal Marina. Unique photo identification characteristics such as number of barnacles, scars and drastic coloring were used to help identify or count these turtles. Preliminary data suggest there are two different turtles who have returned to the marina at least once. The names designated to these turtles are *Cm*16_001 and *Cm*16_002, both identified by the unique characteristics they present. Green sea turtles are an endangered species that must be carefully monitored and protected. Thus, it is important to find the number of turtles that use the marina for their own benefit and get an estimate of how many are at risk of being stricken by a recreational water craft such as a boat.

Trinity Hopkins *et al., Flagler College*

Long-term intertidal oyster reef monitoring within the GTM Research Reserve: the first years

The Eastern oyster, *Crassostrea virginica*, is a keystone species throughout estuaries of the southeastern United States and beyond. The bar-built estuaries of northeast Florida contain large expanses of intertidal oyster reefs, which provide numerous ecosystem services. Despite their importance, little is known about oyster population structure and overall resource condition in northeast Florida. The GTM Research Reserve is developing a long-term oyster monitoring program to assess abundance and population structure, reef condition, associations with other sessile fauna, and environmental drivers. Starting in 2014, over 170 reefs have been sampled biannually throughout the estuaries of the Guana, Tolomato, and Matanzas rivers and surrounding tributaries. Initial results indicate that both regional- and seasonal-scale drivers influence oyster reef structure and provide an important baseline to assess change in the future.

Pam Marcum *et al., GTM Research Reserve*

Oysters as Filter Feeders: The Role of Density and Reef Height

Because oysters are filter feeders, they also contribute to local water quality. It may be important to quantify this service for use in management and restoration decisions. However, estimates of oyster filtration often rely on lab and modeling results that may not effectively capture the additional influence of both environmental factors as well as the interaction of oysters. Schuman's project used biodeposition methods, which employed sediment traps to estimate in-field clearance rates, while also examining the effect of low and high positions on reefs within the Reserve. Additionally, a seawater flow-through system was used to explore the effect of oyster density on clearance.

Carrie Schuman *et al., University of Florida*

Restoring the Eastern oyster: how much progress has been made in nearly 25 years of effort?

Coastal ecosystem restoration is ramping up worldwide as a means of enhancing shoreline protection, carbon storage, fisheries, and biodiversity. Although over $49 million has been invested between 1991-2015, it is uncertain how oyster restoration scale, pace, approach and cost have evolved, and these assessments are essential to directing future restoration investment. A synthesis of 957 oyster restoration projects reveals that efforts have been concentrated in Chesapeake Bay (79% of projects), dependent on oyster shell (73% of projects), and costly with 53% of projects exceeding $500,000 per hectare. Cumulatively, 1,447 hectares of reef have been created, representing <0.05% of oyster habitat estimated to have been lost in U.S. estuaries. Our review indicates that improving site selection, reducing reef construction costs, and tracking restoration success through standardized monitoring are challenges that must be overcome to re-establish oysters at scale.

***Ada Bersoza**, University of Florida*

Reef Scale Variability of Oyster Settlement in Relation to Immersion Time and Post Settlement Processes

To better understand how tidal range and immersion times affect spat settlement and recruitment on a reef, this project compared two treatments for monitoring spat settlement along gradients of a reef. Treatments, spat trees, and loose bagged shell and controls were placed at the lowest edge, the middle, and the top of the reef with water level data loggers. The treatments were compared to the control which was 0.125- m^2 of the natural reef. When comparing the treatment locations and immersion time, there was no significant difference of settlement. When comparing the two treatments, the spat trees showed significantly higher recruitment of oyster larvae than the loose shell mesh bags.

***Mathew Monroe** et al., GTM Research Reserve*

Mangroves may alleviate founder effects through long distance dispersal

Climate-driven encroachment of tropical species into more temperate ecosystems has been documented worldwide. This is of particular relevance to the Southeastern North American coastline due to the encroachment of mangroves into the saltmarsh habitats of this region. Range expansions are often accompanied by a loss of genetic diversity at the leading edge, which can affect the ability of populations to respond to change. However, these effects may be avoided if migration is maintained with other populations. Here, using microsatellite molecular markers, the project genotyped newly-discovered leading edge mangroves along the Atlantic Florida coastline, identifying their likely parental point of origin from established reference populations. This project found that not all leading edge mangroves originate from the nearest 'local' population and that long-distance dispersal is playing a significant role in leading edge expansion in mangroves.

***Dr. Matthew Hayes**, Smithsonian Environmental Research Centre*

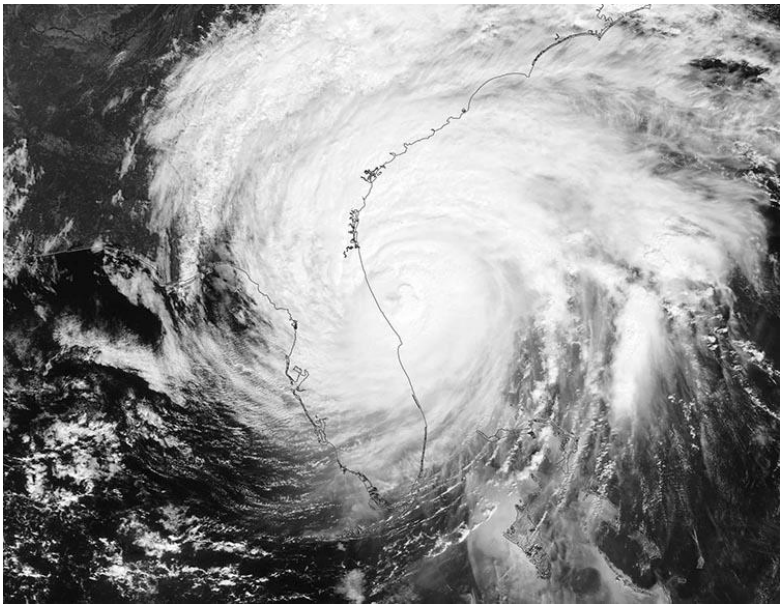
Vertical distribution of meroplankton in a well-mixed estuary

The ability of planktonic larvae to migrate vertically can be crucial in strengthening dispersal potential as it allows the larvae to somewhat control dispersal. Vertical distributions of planktonic larvae were assessed by using depth-specific sampling at two sites along the Intracoastal Waterway of northeastern Florida. Preliminary results provide insight into the differing behaviors and environmental responses of various meroplankton taxa inhabiting a shallow, well-mixed estuary. Preliminary data show bivalves, polychaetas, gastropods, barnacles and tunicates were most abundant near-surface at night. Crab and shrimp were found to be most abundant at midwater during the day. Other factors that could influence vertical migration were also examined, such as, tide (neap vs. spring), tidal current (ebb vs. flow), temperature, salinity and fluorescence.

***Jennifer Raabe** et al., University of North Florida*

EFFECTS OF HURRICANE MATTHEW ON NORTHEAST FLORIDA WATERS

BY SHANNON K. DUNNIGAN, KATHRYN M. PETRINIC, AND DR. NIKKI DIX



MODIS satellite image of Hurricane Matthew on October 7th, 2016 off the coast of St. Augustine, FL. At the time, Matthew was a Category 3 storm with 120 mph winds. Image credit: NASA

The 13th named storm in 2016, and the strongest of the Atlantic season, Hurricane Matthew formed on September 28 and dissipated on October 10. It charted a path across the Caribbean and up the coast of the southeastern U.S. leaving billions of dollars in damage behind it. Flood waters affected much of our community, ruining possessions, but building relationships and resilience.

On October 7, the eye of Category 3 Hurricane Matthew came within 40 miles of St. Augustine at high tide. It resulted in several record breaking storm surge levels in the southeastern coastal United States (7.7' in Fort Pulaski, GA; 6.4' in Fernandina Beach, FL). Additionally, Matthew set a new all-time record for highest water level (measured relative to high tide, MHHW) at the Mayport, Florida tide gauge (3.28'), which was previously 2.47' during Hurricane Jeanne in September 2004.

At the Research Reserve, we observed the effects of Matthew through the lens of the System-Wide Monitoring Program (SWMP): four long-term water quality stations (Pine Island, San Sebastian, Fort Matanzas, and Pellicer Creek) measuring temperature, salinity, dissolved oxygen, pH, and turbidity every 15 minutes and one weather station located within Princess Place Preserve that measures rainfall, wind speed and direction, and more.

"At the Research Reserve, we observed the effects of Matthew through the lens of the System-Wide Monitoring Program…"

Long-term monitoring networks, such as SWMP, provide opportunities to examine the effects of storm events within a relevant time frame. Water quality metrics collected at 15-minute intervals revealed patterns that followed the formation, passing, and dissipation of Hurricane Matthew. For example, temperatures rose prior to the storm, dropped when the storm made landfall, then increased again after it passed. Water depths increased by almost 3 feet above the high tide.

One of the most revealing water quality metrics is salinity. A natural range of salinities occur within estuarine waters as tides move into and out of the system. Incoming tides bring fresh ocean water and outgoing tides move freshwater farther down into the estuary, carrying nutrients and organic matter along with it. Rainfall and subsequent run-off increase the amount of freshwater entering the estuary. Typical ocean water has a salinity around 35 ppt (parts per thousand). Pine Island and Pellicer Creek, the two sites farthest away from inlets, experience more freshwater input and tend to have larger salinity ranges than San Sebastian or Fort Matanzas.

The GTM Research Reserve weather station recorded a cumulative rainfall of 5.6 inches on October 7 and Pellicer Creek experienced the largest drop in salinity after Matthew, going from 32 ppt before the storm to 8 ppt immediately after and 1 ppt a week later. It was more than a month before salinities returned to pre-storm levels.

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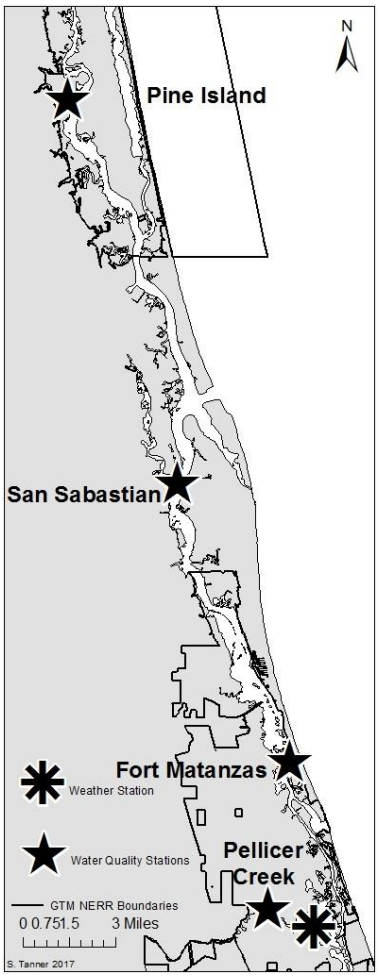

GTM Research Reserve System-Wide Monitoring Program station locations. Image credit: J. Silas Tanner

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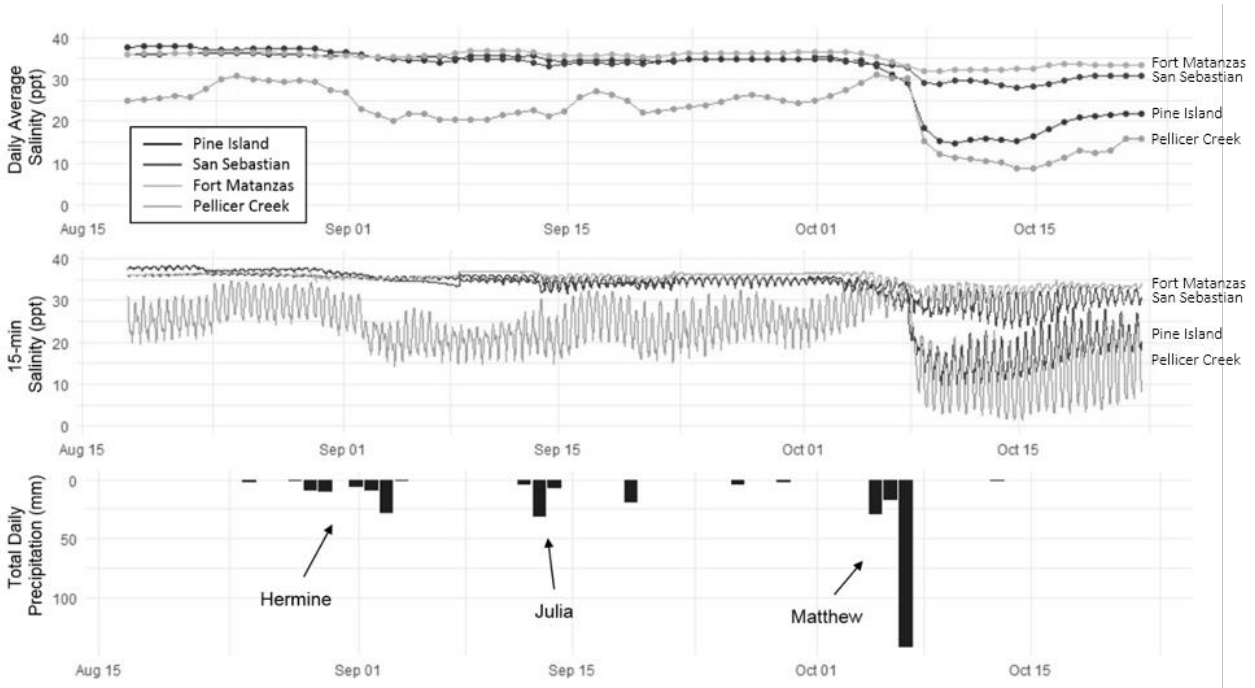
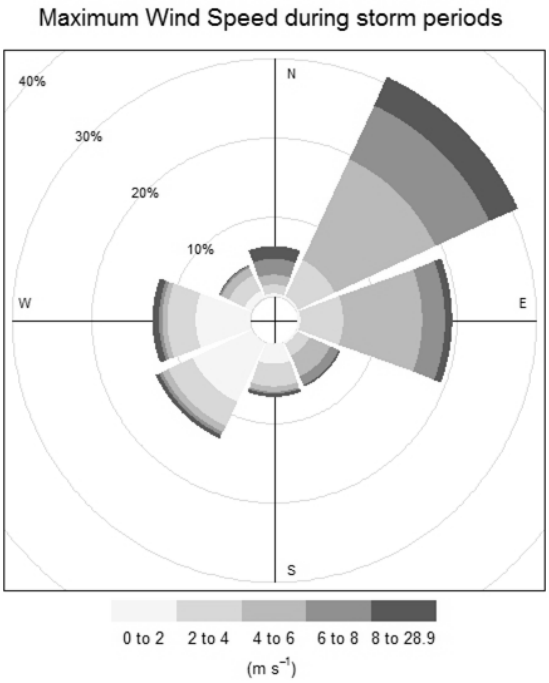


Salinity and rainfall at GTM Research Reserve long-term monitoring sites Aug – Oct, 2016.

In addition to tides and currents, winds also contribute to water movements. At the GTM weather station, located approximately 1 mile inland, winds reached a maximum of 65 mph during Matthew and predominantly originated from the northeast.



Maximum wind-speed and direction at the GTMNERR weather station Aug – Oct 2016.
1 meter per second is equal to approximately 2.24 miles per hour.

"…winds reached a maximum of 65 mph during Matthew..."

While storm surge impacts throughout northeast Florida were great, Matthew did not bring as much rain or wind compared to the locally infamous Hurricane Dora. Dora was the first tropical cyclone on record to make landfall on Florida's East Coast, just after midnight on September 10, 1964 as a category 3 storm. The highest sustained winds during the hurricane were estimated around 125 mph and occurred in St. Augustine, immediately following the center of the storm. Nearby, Jacksonville also experienced sustained full hurricane force winds (82 mph) for the first time in 80 years of record (since 1885). Dora's long-duration, onshore winds resulted in unusually high tides. An estimated tide of 14 feet (4 feet higher than previously known) swept across Anastasia Island. One street in Jacksonville Beach was inundated with about 6 feet of storm surge. Flooding was also increased by heavy rains following the storm (up to 7.1 inches in St. Augustine; USCOMM-WB, 1964).

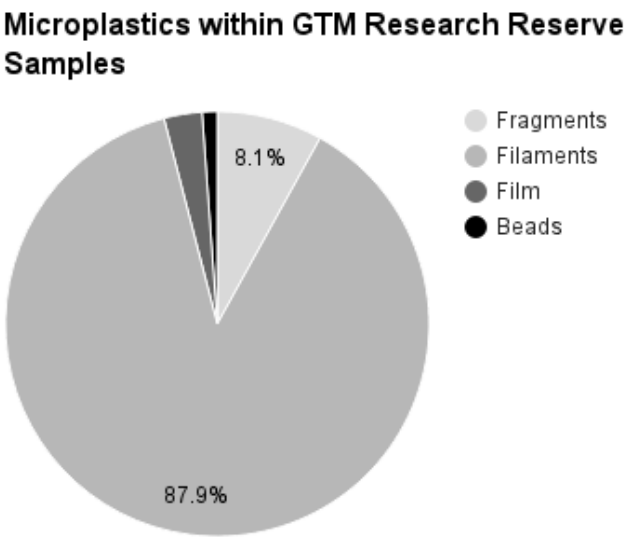
Over the last decade, GTM Research Reserve's long-term monitoring has produced a paradigm about the effects of tropical storms on estuarine waters, which has improved our understanding of how estuaries function and change over time in general. Dix et al. (2008) examined water quality changes within the GTM Research Reserve associated with four tropical storms in 2004: Charley (rainfall: 5.1 in, max wind speed: 40 mph), Frances (8.1 in, 42 mph), Ivan (1.4 in, 23 mph), and Jeanne (2.4 in, 41 mph). Similar patterns in water quality and weather were observed during these storms as those just experienced during Matthew: reduced pre-storm salinity ranges and strong northeasterly winds, as well as large drops in salinities as a result of high rainfall levels during each storm.

To graph or download GTM Research Reserve SWMP data, visit www.nerrsdata.org. All SWMP data collected at the Pellicer Creek water quality and weather stations are transmitted via satellite telemetry and are available for viewing online in real-time. For all other SWMP inquiries, please contact Shannon Dunnigan at shannon.dunnigan@dep.state.fl.us or Katie Petrinec at kathryn.petrinec@dep.state.fl.us.

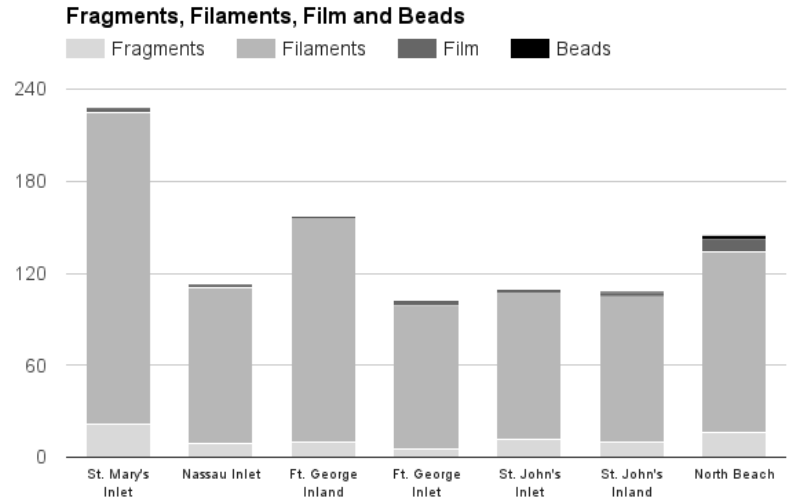
*****U.S. Department of Commerce Weather Bureau. 1964. Hurricane Dora August 28 – September 16, 1964: Preliminary Report with Advisories and Bulletins Issued.

***** Dix N.G., E.J. Phlips and R.A. Gleeson. 2008. Water quality changes in the Guana Tolomato Matanzas National Estuarine Research Reserve, Florida, associated with Four Tropical Storms. *Journal of Coastal Research SI (*55*): 26-37*

Since October 2015, the GTM Research Reserve researchers, Northeast Florida Aquatic Preserves and volunteers have collected, filtered and counted microplastics in 185 1L water samples. Monthly samples are taken from 14 sites between St. Mary's and Pellicer Creek.



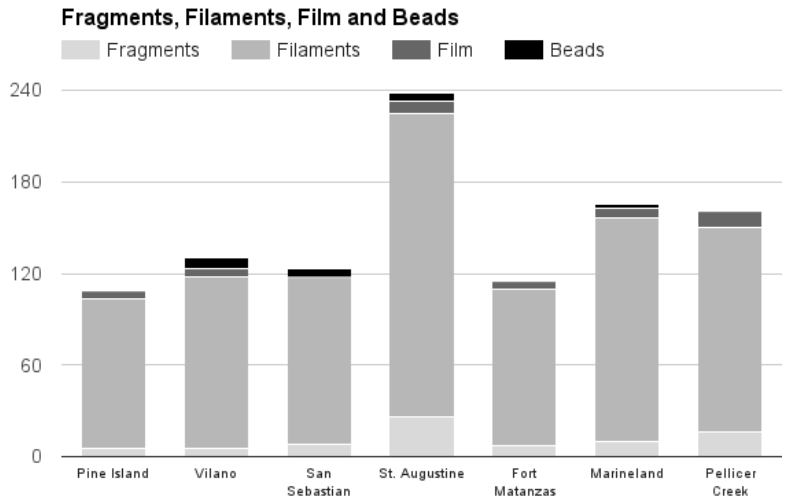
Each sample of water averaged 11 pieces of microplastics including fragments, filaments, film and beads. While the project expected to see an abundance of microbeads from personal care products, including facial scrubs, body washes, toothpaste and make-up, the most abundant microplastics found within the water samples were microfilaments. Of all microplastics found in the GTM Research Reserve samples, 88 percent of microplastics observed were microfilaments, followed by fragments, film and beads.



Common methods of microplastic transportation include runoff from landfills or industrial sites and effluent from wastewater treatment facilities. The microfibers found within the water samples collected could be attributed to synthetic fibers, such as polyester, that are washed off of clothing during regular washing cycles. Browne et al. (2011) determined that during a single washing, one piece of synthetic fabric, for example, a microfiber fleece pullover, can lose 1,900 fibers.

Florida Microplastic
AWARENESS PROJECT

Learn more about the Florida Microplastics Awareness Project at www.plasticaware.org



Browne, M.A., P. Crump, S.J. Niven, E. Teuten, A. Tonkin, T. Galloway, and R. Thompson. 2011. "Accumulation of Microplastic on Shorelines Worldwide: Sources and Sinks." Environmental Science & Technology 45:9175-9179.

OYSTER SHELL RECYCLING

Community Oyster Shell Recycling Program: 2016 Update

We have just completed our fifth-year recycling oyster shell. With continued support from our volunteers, restaurants and oyster roasts, our five-year total is over **265,000 pounds (120 tons)** of shell that was diverted from local landfills. Thank you not only to everyone who helped in the collection, but to all the volunteers for the hours spent bagging shell and building reefs. Since 2012, 76 percent of the recycled shell collected has gone back into the water with restoration projects to create habitat.

EAT. **RECYCLE.** RESTORE.

In 2016, efforts began to develop a second recycling location in Flagler County. While the quarantine sites were built, these plans were put on hold due to impacts from Hurricane Matthew. Our location was covered by sand and one of our participating restaurants, Matanzas Inlet, was demolished with no plans to reopen. Our goal is to continue to expand the recycling efforts and we hope to share new locations in 2018.

Year	Pounds Recycled	Pounds Installed
2012	51,996	47,996
2013	78,048	76,128
2014	61,011	62,816
2015	35,073	12,480
2016	39,355	2,868
TOTAL	**265,483**	**202,288**

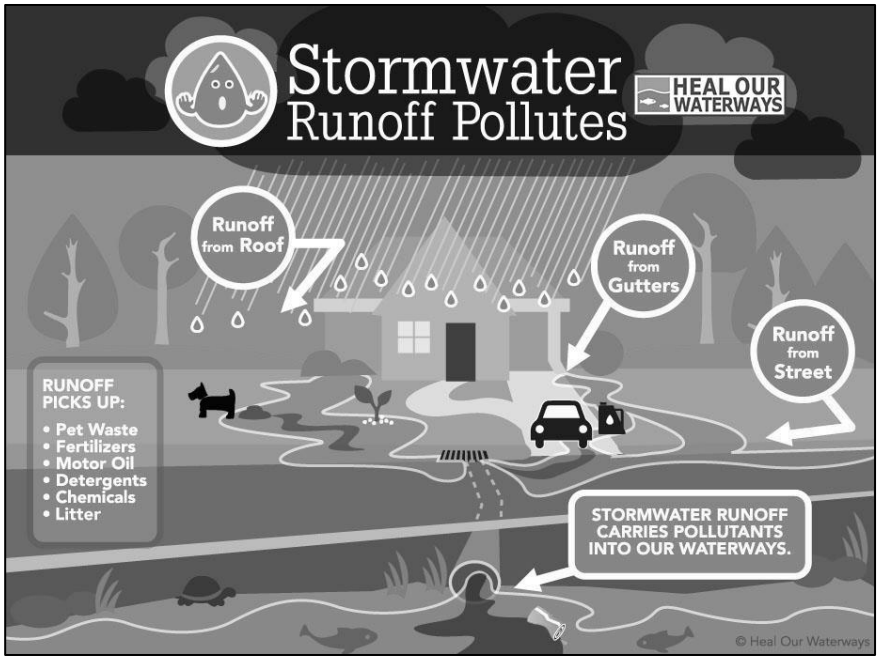
Recycled shell is used for numerous restoration projects.

If your organization or class is interested in volunteering for shell bagging efforts, please contact Shannon Rininger, Volunteer Coordinator, Shannon.Rininger@dep.state.fl.us.

LOW-IMPACT DESIGN: VOLUME REDUCTION

In fall 2016, the GTM Research Reserve's Coastal Training Program hosted a two-day workshop on green infrastructure and low-impact design. This workshop was designed for local municipalities and professionals. This portion of the program shares the importance and techniques of low-impact design.

Low-impact design is an innovative stormwater management approach that mimics the natural water flow of the watershed pre-development. This approach is important because urban development has altered the natural flow of the watershed preventing stormwater to soak into the ground the same before the land was developed. The impervious surfaces of driveways, roadways, parking lots and roofs of buildings direct stormwater from the surfaces into stormwater drains and eventually coastal waters. That stormwater runoff carries the pollutants, excess nutrients and bacteria from the impervious surfaces into the waters. The polluted runoff is harmful because it can cause elevated nutrient and bacterial levels in waterways, swimming advisories, closures to shellfish harvesting areas, and hazardous flooding of roadways.



Source: City of Wilmington, North Carolina Heal Our Waterways

A challenge with reducing the pollutants, excess nutrients and bacteria is that they are often non-point source pollutants. Finding the direct source can be challenging. Low-impact design addresses that challenge with the volume reduction technique. Volume reduction techniques reroute the polluted stormwater by mimicking the natural water flow of the watershed. It allows the polluted waters to run through gardens, slowly percolate through soils, and reduce the amount of pollutants flowing into recreational waterways.

Homeowners, developers, and planners can all practice volume reduction techniques.

Rain Gardens

- Shallow, vegetated areas that capture rain during storms
- Lower than surrounding lawns
- Reduce stormwater runoff by 90%

Rain Barrels

- Container that collects and stores rainwater from you roof
- Placed under roof gutters and downspouts
- ¼ inch of rain runoff can fill a rain barrel

Native Landscaping & Trees

- Native plants require little care
- Plants absorb and slow runoff, prevent erosion, and increase soil permeability
- Options include tree boxes as well

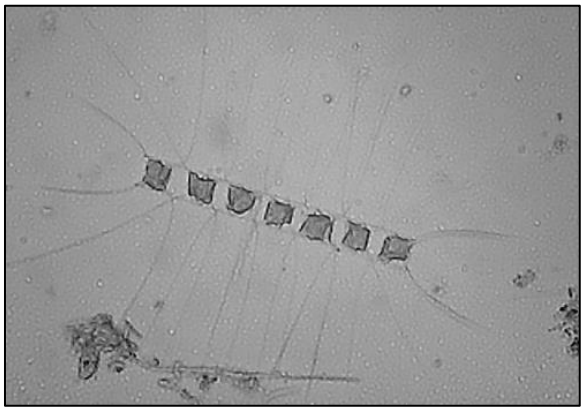
Reroute Downspouts

- Downspouts directed on driveways and sidewalks increases runoff by 50%
- Can save 40% of lawn and garden maintenances and watering
- Redirecting 56,000 downspouts reduced 1.2 billion gallons in Portland, Oregon

Learn more about low-impact design techniques and request workshops for your community or organization at www.gtmnerr.org/education-and-training/coastal-training-program/.

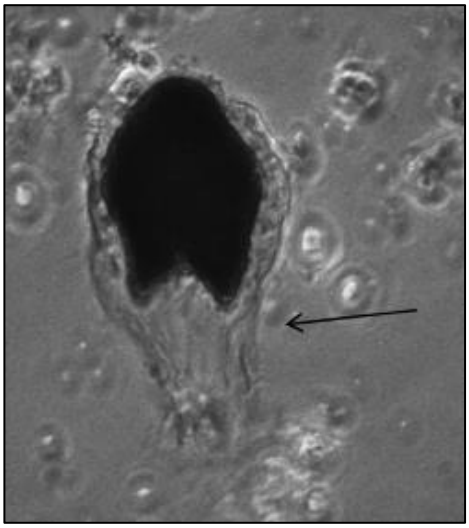
PHYTOPLANKTON MONITORING, *DR. NIKKI DIX*

In early January, GTMNERR phytoplankton monitoring volunteers discovered a bloom of the diatom *Chaetoceros* in Guana Lake. *Chaetoceros* species are a common occurrence in estuarine samples, but bloom levels can be harmful to fish. The long spines of *Chaetoceros* can clog the gills of water breathers. The detection of potentially harmful algal blooms is exactly the purpose of the Phytoplankton Monitoring Network (PMN) for which volunteers visit the GTM twice each month. In fact, volunteers contributed over 600 hours to plankton monitoring in 2016! Samples with potentially harmful species are sent to NOAA for confirmation and all data is entered in the national PMN database. Some of the most experienced volunteers have also been developing a plankton identification guide, which is available at http://www.inaturalist.org/guides/1633.



(Left) Chaetoceros sp*. (Right) Volunteer Joan Sams scans a plankton sample for harmful species*

A similar plankton bloom could've been the cause of a fish kill in Guana Lake in August 2016. Samples collected a couple days after large numbers of menhaden and shad washed up on the shores of Guana Lake contained *Chaetoceros* spp. and various dinoflagellates. Research staff investigated by taking water quality readings and plankton samples. They found that salinities were abnormally high (36 ppt) for the lake. Most interesting was an abundance of *Akashiwo sanguinea* covered in mucous, which has been associated with fish kills in the past. It is thought that this dinoflagellate produces mucous when it finds itself in stessful conditions, like elevated salinities.



Left: Akashiwo sanguinea *covered in mucous designated by the arrow (from Badylak et al. 2014, Algae 29(3): 197-201); Right: the shores of Guana Lake during fish kill*

11th Annual First Coast Air Potato Round-up

Come Join the Fun and Help Preserve Our Conservation Lands !

Volunteers are needed to help rid our natural areas of Air Potato vine and other invasive plants. Invasive species smother our native plants and are one of the **greatest ecological threats to natural communities in Florida**.

Gather all your friends and family & participate in this fun event! No registration necessary unless you're bringing a large group. Just grab your garden gloves and head over to one of the many work sites! ***All participants will be entered into a random drawing for great prizes!***

Event Work Sites:

Jacksonville Zoo & Gardens
370 Zoo Parkway
Jacksonville, FL 32218
Volunteers meet @ the zoo Picnic Grove at the back of the main parking lot.
Site Captain: Chris Dailey
daileyc@jacksonvillezoo.org

St. Johns River State College
Orange Park Campus
283 College Drive
Orange Park, FL 32065
Park & meet in the Health Bldg parking lot
Site Captain: Karen Meyer
KarenMeyer@sjrstate.edu

Egans Creek Greenway
2500 Atlantic Ave.
Fernandina Beach, FL 32034
Site Captain: Kathy Russell
krussell @fbfl.org

St. Johns River State College
St. Augustine Campus
2990 College Drive
St Augustine, FL 32084
Park in small lot next to A Bldg. See campus map:
http://www.sjrstate.edu/sjrstateimages/mapus/campussac.jpg
Site Captain: Longin Kaczmarsky
LonginKaczmarsky@sjrstate.edu

Jacksonville Arboretum & Gardens
1445 Millcoe Rd.
Jacksonville, FL 32225
Site Captain: Merrill Varn
info@jacksonvillearboretum.org

Tree Hill Nature Center
7152 Lone Star Road
Jacksonville, FL 32211
Site Captain: Mark Mummaw
mark@treehill.org

Walter Jones Historical Park
11964 Mandarin Road
Jacksonville, FL 32223
Site Captain: Gabriele Dempsey
gkdjax@gmail.com

Kathryn Abbey Hanna Park
500 Wonderwood Drive
Jacksonville, FL 32233
Stop at park office and identify as a round-up participant.
Site Captain: Jolie Schlieper
JSchlieper@coj.net

Saturday February 25, 2017
9 a.m. - 12 p.m.

For more information contact Jessica Spencer at 904-232-1696 or Jessica.E.Spencer@usace.army.mil
For information on a specific site, please contact the listed site captain.
To learn more about invasive plants, visit: www.floridainvasives.org; www.fleppc.org or www.plants.ifas.ufl.edu

THE UNF COASTAL AND MARINE BIOLOGY FLAGSHIP PROGRAM AND THE GTM RESEARCH RESERVE

What is the UNF Coastal and Marine Biology Flagship Program?

The **UNF Coastal and Marine Biology Flagship Program** is an educational and research program of the University of North Florida's Department of Biology that focuses on the study of aquatic life, ranging from the tiniest microbes to the largest marine vertebrates living in the rivers to the seas.
Our mission is to discover and educate others about coastal and marine life with the goal of preserving it for future generations.

The Coastal and Marine Biology Program was awarded **UNF Flagship Program status** in 2006, establishing it as a center for excellence in this field. It is 1 of only 6 UNF programs to receive this prestigious distinction, which is awarded to academic programs that have achieved levels of national prominence.

What does the program do?

Our lives revolve around water. It makes up 71 percent of the Earth's surface and up to 78 percent of the human body. It is required for life and provides us with food, jobs, medicine, innovation, and enjoyment.

However, Earth's water resources are at growing risk from a variety of stressors such as coastal development, climate change, pollution, overfishing, invasive species, and much more.

Faculty members in UNF's Coastal and Marine Biology Flagship Program **conduct research** on a diverse array of marine organisms and a broad range of issues critical to our understanding of the Ocean. Our work is important because it helps us maximize human benefits from the Ocean while still conserving Earth's water resources in a responsible manner.

The Flagship Program also **educates undergraduate and graduate students** pursuing degrees in Coastal and Marine Biology at UNF. Our students have the benefit of working directly with accomplished faculty members conducting research on a broad range of exciting and important topics in coastal and marine biology. Students have the opportunity to take all the courses needed for a successful career in coastal and marine biology, including several field-intensive courses, and can gain hands-on experience and academic credit by interning with local zoos and aquariums, state and federal fishery management agencies, conservation groups, and other marine science institutions.

Last, the Flagship Program the UNF Coastal and Marine Biology Flagship Program is committed to increasing public awareness about coastal and marine biology and the threats that our Oceans face. We do this by participating in local school programs, environmental festivals, public lecture series, summer camps, and other community events.

THE UNF COASTAL AND MARINE BIOLOGY FLAGSHIP PROGRAM AND THE GTM RESEARCH RESERVE

The UNF Coastal and Marine Biology Flagship Program and the GTM Research Reserve work closely together to conduct several research activities and educational initiatives important for the conservation of the reserve. Several of these activities are described below.

What is the status of the American eel population? Several nights a week from early January to early March, several UNF Flagship Program faculty and students and GTM Research Reserve staff and volunteers team up to monitor the abundance of juvenile American eels, also known as glass eels, at the Guana River Dam. As a *catadromous* fish, these eels are born in saltwater and make their way to freshwater habitats like the Guana River to live until they return to the sea to spawn and die. They are a commercially important fish, highly valued for use in aquaculture. Therefore, surveys such as ours is important for monitoring the size and health of the North American eel population.

Are restorations programs effective? UNF Flagship Program faculty and students contribute significantly to habitat restoration projects conducted at the GTM Research Reserve, such as the Oyster Shell Recycling and Living Reef Construction Project. One of our key roles in this and similar projects is to monitor aquatic wildlife populations at control and restoration sites to determine if restoration procedures are useful for improving habitat quality and ecological health.

What influences shellfish recruitment? UNF faculty and students have used the GTM Research Reserve as an important field site for conducting research on how environmental variables influence the transport, settlement, survival, and eventual success of shellfish larvae. This work is important because it helps us understand the factors that lead to the sustainability of ecologically and economically important species as well as the unwanted growth of ecologically destructive ones, such as invasive species.

Is the GTM NERR a shark nursery? Since 2010, faculty and students in the UNF Shark Biology Program have been monitoring shark diversity and abundance in portions of the GTM Research Reserve to determine whether it serves as a "nursery" for juvenile sharks, habitat critical for their survival because it provides food for growth and development and/or protection from predators. Our work has demonstrated that the Tolomato River serves as nursery habitat for a number of commercially-important species, most notably the scalloped hammerhead shark, which is critically endangered in some portions of its range due to overfishing. Work of this nature is critical for the management and conservation of U.S. shark populations.

The GTM Research Reserve is also an important site for a number of other Flagship Program activities such as our **Field Studies in Marine Science** course. This is a hands-on course offered by a number of Florida state universities that provides unique field experiences to college students in coastal and marine habitats throughout Florida, taking them from the wetlands of the GTM Research Reserve to the Florida Keys to the open waters of the Gulf of Mexico.

THANK YOU WITH THE HURRICANE MATTHEW RECOVERY EFFORTS!

Estuarine communities throughout the southeast were impacted by Hurricane Matthew's passage in October. This time it was St. Augustine's turn to take the brunt of the impact. While many homes and businesses are still being repaired, at the local National Estuarine Research Reserve, we turn our attention to the natural environment. Thankfully our continuous monitoring equipment was unharmed and we are able to report on some of the storm's characteristics and water quality impacts. After the storm, the GTM Research Reserve staff and volunteers worked around the clock to restore the trail system, beaches, boardwalks, and the surrounding community. Thank you to those who supported the GTM Research Reserve during the recovery process.

NERRDS ON THE WATER

NERRDS
ON THE WATER

Get to know the field work, data analysis, and life within northeast Florida through the researcher's eyes.

The GTM Research Reserve research staff blog shares the stories of the research staff, visiting investigators, and historical background that will leave you on the edge of your seat.

Subscribe to the NERRds on the Water blog today!

https://nerrdsonthewater.com/

HERITAGE MONITORING SCOUTS

Heritage Monitoring Scouts (HMS Florida) is a public engagement program focused on tracking changes to archaeological sites at risk, particularly those impacted by climate change in the form of erosion and sea level rise.

Become a Scout today and learn the techniques needed to monitor these archaeological sites. Upcoming training is on March 30th!

http://fpan.us/projects/HMSflorida.php

Contact Emily Jane Murray,
Public Archaeology Coordinator
Email: hmsflorida@fpan.us

FLORIDA PUBLIC ARCHAEOLOGY NETWORK
HERITAGE MONITORING SCOUTS

On behalf of the board of directors and members of the Friends of the GTM Reserve, I'd like to welcome you to the 2017 State of the Reserve!

Since its inception, the Friends have sponsored this symposium and reception because we believe sharing the Reserve's findings with community stakeholders will ensure the decisions we make about our coastal ecosystems are based on science and fact. A very special thank you to our donors who give generously year after year to fund programs like State of the Reserve.

This year's theme, "Working Waters," should be of interest to all of us. As private citizens, we are given the opportunity to be champions for our oceans and estuaries, but it is our responsibility to fully understand how the waters benefit us – economically, recreationally, and functionally. In the face of events like Hurricane Matthew, we may emerge with more questions than answers, and we rely on researchers to delve into the science related to issues like coastal resiliency and habitat loss. This is what the GTM Research Reserve does and why it is so important to our region. It is also why the Friends members are committed to supporting their work.

We sincerely hope you enjoy your time at the Reserve today and that you leave committed to being a champion for our Working Waters. Whether you are a scientist, educator, community leader, or private citizen, the future of our precious estuary is in your hands. Thank you for your commitment, leadership, and support.

Ellen M. Leroy-Reed, *LEED AP*
Executive Director
Friends of the GTM Reserve

The Friends of the GTM Reserve is the nonprofit citizen support organization for the GTM Research Reserve. Friends members provide invaluable volunteer and financial support that fuels education, stewardship, and research programs at the Reserve. With your support, the GTM Research Reserve can help us all make science-based decisions about the future of our precious coastal ecosystems.

To become a Friend,
visit www.gtmnerr.org
or call (904) 823-4526.

Friends of GTM
RESEARCH RESERVE

ACKNOWLEDGEMENTS

Along with the GTM NERR staff, the following groups aided in providing information, education and recreation to more than 270,000 visitors in 2016:

The GTM Research Reserve Management Advisory Group is composed of representatives from agencies affiliated with the Reserve, landowners within the Reserve, and concerned citizens. The group meets four times a year to advise, report and review activities within the Reserve. The current MAG members and their affiliations are:

Commissioner Barry Benjamin, St. Augustine Port, Waterway, and Beach District
The Honorable Carl Blow, Florida Inland Navigation District
Jan Brewer, on behalf of St. Johns County Commission
Donald Crichlow, City of St. Augustine
Michael Cullum, St. Johns River Water Management District
Jeffrey Darr, Florida Department of Agriculture and Consumer Services, Division of Forestry
Kimberly Decker, St. Johns County Citizen
Justin Ellenberger, Florida Fish & Wildlife Conservation Commission
Chris Farrell, St. Johns County Citizen Representative
Michael Lagasse, Town of Marineland
Dr. Kelly Rankin Legault, Army Corp of Engineers
Ellen Leroy-Reed, Friends of the GTM Reserve
Dr. Maia McGuire, UF-IFAS SeaGrant
Debrah Miller, Florida Department of Transportation
Dr. Todd Osborne, Flagler County Citizen
Renee Paolini, Florida Department of Environmental Protection, Division of Recreation & Parks
Pierre Pierce, St. Johns County Citizen, Vice Chair
Dr. Eric J. Smith, St. Johns County Citizen
Dr. Kelly J. Smith, Duval County Citizen
Steve Swann, Duval County Citizen
Tim Telfer, Flagler County Citizen
Frank Usina, St. Johns County Citizen
Gordon J. Wilson, National Park Service
Eric Ziecheck, St. Johns County Citizen, Chair

In memorium, *we thank The Honorable Frank Meeker, Flagler County Commissioner, for his years of service, dedication, and support for the GTM Research Reserve.*

The Friends of the GTM Reserve is a non-profit citizen support organization established to support and enhance environmental education, stewardship of natural and cultural resources, and scientific research of the GTM NERR through volunteer initiatives, citizen involvement and community partnership. They are the hosts of the reception at the 2017 State of the Reserve. The current board members are:

Deborah Brennan Magri, President
Staci Janel Biting, Vice-President
Karen Ford, Secretary
Rachel Bennett
Maggie Cabral-Maly
Angie Christensen
David Johnson
Tamara Renuart
Mark Ryan
Eric Smith
Ellen Leroy-Reed, Executive Director
Brooke Ellis, Administrative Assistant

NATIONAL ESTUARINE RESEARCH RESERVES

The Guana Tolomato Matanzas National Estuarine Research Reserve in Florida is part of the National Estuarine Research Reserve System (NERRS), established by Section 315 of the Coastal Zone Management Act, as amended. Additional information about the system can be obtained from the Office of Coastal Management, National Oceanic and Atmospheric Administration, US Department of Commerce, 1305 East West Highway- N/ORM5, Silver Spring, MD 20910.

GTM RESEARCH RESERVE

GUANA TOLOMATO MATANZAS NATIONAL ESTUARINE RESEARCH RESERVE

ENVIRONMENTAL EDUCATION CENTER

505 GUANA RIVER ROAD, PONTE VEDRA BEACH, FL 32082

TEL: 904.823.4500 FAX: 904.825.6829

Florida Department of Environmental Protection

NOAA National Oceanic and Atmospheric Administration U.S. Department of Commerce

Friends of GTM RESEARCH RESERVE

UNF Coastal and Marine Biology Flagship Program College of Arts and Sciences