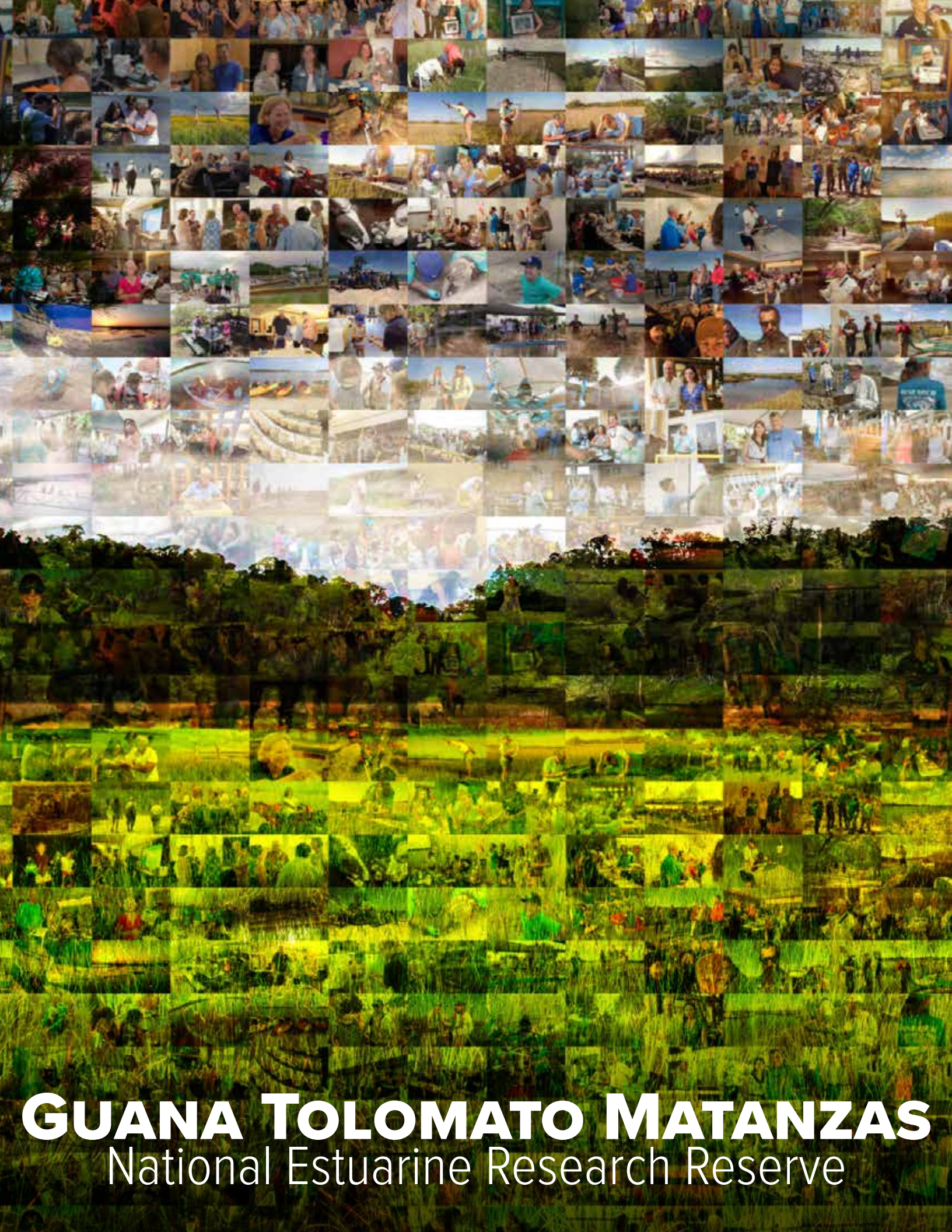

Guana Tolomato Matanzas

National Estuarine Research Reserve

Logo used 2005-2015

WELCOME

On behalf of the Friends of the GTM Reserve, we welcome you to celebrate 20 years of the beautiful Guana Tolomato Matanzas National Estuarine Research Reserve. The Friends have been honored to serve as the Reserve's nonprofit Citizen Support Organization since 2000 and will continue to champion the work being done to conserve natural and cultural biodiversity through science far into the future.

This guide has been lovingly crafted to feature the precious waterways that comprise our estuarine system and highlight the many projects and programs that have taken place within the Reserve over its history.

We hope this guide will spark insight into a project that may be new to you, or further your understanding of a more familiar one. More importantly, we hope you can see with us a bright future filled with scientific discovery, preservation of our resources, and community engagement.

This is, and will continue to be, YOUR Reserve.

Sincerely,

Ellen M. Leroy-Reed
Executive Director, Friends of the GTM Reserve
www.gtmnerr.org

DISCLAIMERS

The projects mentioned in this guide take place in the section in which they are presented, however they are not exclusive to that waterbody, in fact many occur throughout the Reserve.

Photo credits are given when available.

The Guana Tolomato Matanzas National Estuarine Research Reserve was named after three rivers, but they are not the only waterways that make up the vital estuary we protect.

Salt Run, San Sebastian River, Moultrie Creek, Moses Creek, and Pellicer Creek are distinct characters, well-known by locals who rely on those waters for fishing, boating, and the beautiful views that define this region. A complete understanding of our estuary requires studying all eight waterways to capture the myriad interactions of tides, rainfall, streets, and forests that form and impact the Reserve.

This guide will provide a glimpse into the research, education, and stewardship developed from 1999 to 2019 at the GTM Research Reserve. With all activities, we have endeavored to protect the health of the Reserve's natural and cultural resources with science. Our hope with this tour and this guide is to inspire you to learn more and provide your input on what is important for you to know. Twenty years is only a beginning for a National Estuarine Research Reserve and we look forward to growing our knowledge and serving this community for decades to come.

Contents

Look for this symbol in waterways with SWMP sites!

Guana River Marsh Aquatic Preserve

guana

Long known for its beaches, hiking, hunting and fishing, the Guana region of the Reserve has gone far beyond the days when it was a state park. With its 20,000 square feet Visitor Center, Guana serves as the headquarters for the Reserve.

Silas Tanner©

EDUCATION

With three indoor classrooms and an extensive outdoor classroom, education staff leads courses for students ages six through college. Some of the topics are beach ecology and hydrology, species identification, and marsh migration. Every year, in-service and pre-service teachers learn how they can incorporate estuarine ecology lessons into their curricula in a Teachers on the Estuary (TOTE) workshop. Staff is ramping up efforts to engage underserved communities by adding more programs for people with emotional, mental, and physical differences.

Over 5,000 people visit the Center each year to learn about estuarine ecology and conservation.

Generations of residents and visitors have enjoyed Guana's recreational opportunities, so staff at GTM endeavor to understand how this resource and its beauty will last for generations to come.

GUANA WATER QUALITY

Many locals recall the days when the Guana River was one of the best oyster harvesting spots in the region. Concerns about water quality caused the Florida Department of Agriculture and Consumer Services (FDACS) to restrict shellfish harvesting in Guana since the mid-1980s. Reserve staff is in its third year of dedicated research into the status of Guana's water quality. FDACS is determining whether shellfish harvesting can be re-opened. The Friends of the GTM Reserve has awarded a grant to the University of North Florida to fund a two-year graduate research fellowship to further investigate Guana water quality, its drivers, and its impacts. Soon we will install water flow gauges at the northern and southern ends of the lake, as well as a weather station to better understand the conditions of this water body.

GTM and FWC staff collecting water samples in Guana Lake.

SPECIES MONITORING

GTM Research Reserve staff manages over 4,000 acres of upland habitats in the Guana area in addition to the aquatic preserve, so there are multiple ongoing projects to document a variety of species. Currently, volunteers and staff monitor phytoplankton, birds, fish, sea turtle nesting, gopher tortoises and American eels. The Reserve annually hosts the Florida Fish and Wildlife Conservation Commission (FWC) Right Whale Monitoring Group and provides services to other visiting investigators who specialize in insects, fire ecology, alligators, and more.

Kaitlyn Dietz©

Sombrero Creek off Tolomato River
Jessica Lee©

tolomato

The waterway from Saint Augustine toward Palm Valley Road was historically known as the Tolomato River (or North River).

Within the Reserve boundary, the shores of the Tolomato remain relatively undeveloped as it winds its way past the Guana Wildlife Management Area to its east and Stokes Landing and Deep Creek State Forest to its west.

MANGROVE MIGRATION

When the Reserve was designated 20 years ago, mangroves were rarely spotted in this region. Today, they stretch all the way to the southern coast of Georgia. While this is not the first time in living history that mangroves have migrated this far north, there is a possibility that they are here to stay. Reserve scientists are investigating the effects of mangroves replacing saltmarsh by comparing carbon storage rates, habitat suitability for myriad species, and resilience to rising sea levels and warmer temperatures.

In 2018, warming chambers were installed in the marshes to study the effects of warming temperatures on marsh vegetation.

SHELL BLUFF & WRIGHT'S LANDING HISTORY

Even before the Intracoastal Waterway was dredged, the Tolomato was used for travel and shipping. Boats approached the Guana Peninsula via Wright's Landing, and Shell Bluff served as a homestead for centuries. From Native American communities to Juan Andreu's family, evidence of the site's history continues to be explored and monitored by the Heritage Monitoring Scouts (HMS). HMS is a collaborative program between GTM and the Florida Public Archaeology Network that trains volunteers to monitor the historic sites at Shell Bluff and throughout the Guana Peninsula.

LIVING SHORELINES

The Tolomato has been the site of multiple experiments involving the construction of living shorelines that reduce marsh erosion and support oysters and other fisheries. Initial efforts at Wright's Landing using plastic bags of recycled oyster shell and coconut fiber logs taught us that since our region is a high-energy environment, restoration efforts require stronger materials to break up boat wakes over a long period of time.

Later tests using breakwalls of crepe myrtle branches and metal oyster cages proved more successful and are leading to the development of innovative designs to protect our marshes.

Breakwalls with gabions filled with oyster shell used in a three-year collaborative project with Reserve scientists and University of Florida researchers to study living shoreline designs in the Tolomato River

Aerial footage of the Matanzas Inlet

matanzas

The waterway from the Saint Augustine Inlet to Pellicer Creek was historically known as the Matanzas River. The Intracoastal Waterway now connects it to the Halifax River through Flagler County.

As the connecting waterbody from Pellicer Creek to the Atlantic Ocean, via an inlet that remains undredged, this part of the system is one of the best representatives of a natural estuary on the east coast of Florida.

According to data collected by FWC, an average of 40,000 pounds of oysters are commercially harvested annually in St. Johns County!

OYSTER RESEARCH

The oyster beds in the Matanzas River are extensive, which makes this a key location in studying this species. Oysters are a vital part of the estuary; they clean the water, provide habitat for many fish species, and are a valued food source for this community.

Silas Tanner©

We called 2015 the “Year of the Oyster” due to the extensive focus on establishing a baseline for future oyster data collection.

Previously, northeast Florida oysters were scarcely studied and the local community expressed concern that population declines seen elsewhere were occurring here. Reserve staff kicked off multiple initiatives that year including a renewed Oyster and Water Quality Task Force, a community-based group originally formed in the late 1990s, comprised of community leaders, agency represetatives, and local business people.

The initial oyster reef surveys, which concluded in 2016, measured reef structure, oyster population structure, and community structure on 200 reefs. Without much previous data, no conclusions could be drawn about long-term trends, but anecdotal observations suggested oyster density and acreage had declined over recent years.

A volunteer collects oyster shells left out on "trees" in the estuary to monitor oyster larvae settlement

Follow-up surveys are conducted annually and there is an ongoing effort in the Reserve to monitor monthly oyster larvae settlement at sites throughout the estuary. Visiting investigators have supplemented this work with additional studies on oyster harvest, predation, and historic size and structure.

The original office of the GTM Research Reserve in Marineland still functions as our southern field office!

Sunrise at the Saint Augustine Inlet
Silas Tanner©

salt run & san sebastian

A portion of these waterways will be added to the GTM Research Reserve's boundary. Previously, the Reserve was divided into two components to the north and south of the City of St. Augustine.

Since water, nutrients, and ecology do not typically recognize political boundaries, we are excited to include data from St. Augustine to capture the full picture of our estuary.

NWLON STATION

Storm surge and sea level rise models for St. Augustine are currently based on water level information gathered at Mayport, which is a vastly different hydrologic system. The GTM Coastal Training Program has been working with city leaders to facilitate the installation of a National Water Level Observation Network (NWLON) station within the city's sovereign waters. NWLON is a network of over 200 long-term, continuously operating water level stations throughout the US and its territories that serves as the foundation of the comprehensive system for observing, communicating, and assessing the impact of changing water levels nationwide.

URBANIZATION

Moving south of the St. Augustine Inlet exists a gradient of decreasing urbanization into Flagler County. San Sebastian and Salt Run are among the most urbanized waterways within the Reserve; Moses and Pellicer are the least.

The St. Augustine waterfront

This gradient allows researchers to study how urbanization impacts water quality, fisheries health, and the ability of marshes to store carbon and absorb storm surge. We can then work with land and city managers on identifying solutions to negative impacts that are best for each area.

View towards the St. Augustine Inlet and Anastasia Island from the top of the St. Augustine Lighthouse, located in Salt Run, circa 2009

Look for this infographic on the following pages which characterizes the lands around these waterways.

= 1,000 single-family homes

41% DEVELOPED

UNDEVELOPED 59%

Overlook of Moses Creek at the Bluff Observation Point

moultrie & moses creeks

Moultrie Creek and Moses Creek are two major waterways feeding freshwater to the GTM estuarine system.

Both waterways pass through rapidly growing regions of St. Johns County, which makes these important areas to monitor for changes over time.

These winding creeks are popular with kayakers to explore on a high tide!

SHORE TO UPLAND

Moses Creek is one of the long-term, shore-to-upland vegetation monitoring sites in the GTM Research Reserve's System-Wide Monitoring Program. Though data is not collected at the same frequency as the rest of the SWMP vegetation sites, these shore-to-upland transects enable researchers to understand changes in vegetation communities in the riparian zone. These monitoring sites are of particular significance as they relate to changes observed due to rising sea levels and warmer temperatures.

HABITAT CHANGE MAPPING

Sea level rise, a changing climate, and other stressors threaten the health of saltmarshes like those found in Moses and Moultrie Creeks. Like mangrove forests, saltmarshes provide a wealth of services to our community, including carbon storage, storm surge flood reduction, and habitat for birds, fish and other animals. In 2019, researchers completed the baseline map of saltmarsh and other habitats within the reserve boundary. They will continue to assess changes in these habitats over time to develop mitigation strategies, so these resources and their services are maintained.

27% DEVELOPED

73%

= 1,000 single-family homes

View of Pellicer Creek from Faver-Dykes State Park

pellicer creek

Named for Francisco Pellicer, an early Spanish resident of the area, Pellicer Creek is one of the most undeveloped watersheds in northeast Florida that feeds directly into an estuarine system.

Along with the undredged Matanzas Inlet near the mouth of Pellicer, this part of the system is a close representation of hydrology and ecology that occurred naturally in this region. This allows researchers to investigate how natural systems respond to changes in global processes, like sea level rise.

SENTINEL SITE

National Estuarine Research Reserves around the country are participating in a place-based, national program called the Sentinel Site Application Module-1 (SSAM-1). This program is dedicated to developing a standardized approach to answering management questions across a broad geographic scale. Using SSAM-1, each Reserve will examine the interplay of water levels, elevation, and plant communities at scales relevant to local, regional, and national decision makers. The intention is to complement existing SWMP water quality, weather, and vegetation monitoring with geodetic control and water level monitoring.

FECAL COLIFORM SOURCE TRACKING

In Pellicer Creek, historical data have shown elevated levels of fecal coliforms, which are bacteria that generally originate in the intestines of warm-blooded animals. Their presence indicates the possibility of disease-causing organisms that can occur in some mammals, especially humans.

"The Usual Suspects". Fecal coliform sources typically analyzed in samples

Knowing the source of the coliforms is important, though it requires pricey tests. In 2018, GTM staff conducted a broadscale analysis across this waterway to attempt to identify the fecal coliform source. Additional testing is required over time to draw any conclusions, preliminary findings show evidence of gut bacteria from feral hogs.

PRINCESS PLACE FIELD STATION

Due to the importance of Pellicer Creek in understanding estuarine ecology and its remote location from other Reserve facilities, GTM and Flagler County were awarded a NOAA grant to construct cabins and renovate the former Legacy Schoolhouse.

Princess Place Ecocabins on opening day in November 2018

These facilities are intended to be used by researchers and provide education and training space for Reserve programs.

= 1,000 single-family homes

5% DEVELOPED

UNDEVELOPED 95%

priority research

At the GTM Research Reserve, research prioritization is based on community stakeholder input as much as biologists' observations.

SYSTEM-WIDE MONITORING

Many of the waterways discussed in this guidebook are labeled “SWMP site”. SWMP stands for System-wide Monitoring Program and is the cornerstone research project for all National Estuarine Research Reserves. The goal of SWMP is to measure short-term variability and long-term changes to gain a better understanding of estuarine function and changes over time, and predict how coastal systems respond to natural and human-induced change.

SWMP at the GTM Research Reserve is comprised of three components; water quality, weather, and vegetation. These SWMP components provide foundational data to support in-depth investigation of the research topics described below. It should be noted that many times, in-depth research requires going beyond SWMP infrastructure and locations to discover solutions that support community needs.

All SWMP data can be downloaded from nerrsdata.org.

GTM biologist taking measurements of the marsh surface elevation with the deep-rod Surface Elevation Table

GTM biologist with SWMP data sonde

MARSH & MANGROVE RESILIENCE MAPPING

Understanding and mapping the effects of sea level rise and storm effects on local marshes and mangroves helps identify key areas to prioritize for acquisition, restoration and mitigation strategies.

WATER QUALITY POLLUTION SOURCE TRACKING

Knowing the local causes, sources, and impacts of contaminants to water quality is important; for example, fecal contaminants from humans may be an indicator of other harmful contaminants. This is also very relevant to understanding and mitigating harmful algal blooms.

OYSTER HEALTH MONITORING

Tracking the health of oysters and knowing what weakens their long-term sustainability informs strategies to protect this resource for future generations.

Oyster measuring with citizen scientists

HEALTHY SHORELINE ENGINEERING

Finding non-regulatory solutions that mitigate boat wakes requires testing innovative shoreline engineering techniques that support marsh, oyster, and fish habitat.

Living shoreline restoration with oyster gabions

SEA TURTLE GENETIC TESTING

Examining the genetics of loggerhead sea turtles that nest along beaches in the southeastern U.S. provides information about how turtles select nest sites, and their fidelity to specific sites. This helps researchers inform land managers on how best to protect sea turtles by maintaining a variety of healthy nesting sites to support a genetically diverse, and therefore resilient, sea turtle population.

Sea turtle patrol monitoring on GTM beaches

Resources & links

www.nerrdsonthewater.com

nerrsdata.org

gtmnerr.org

key findings

FROM RESEARCH AT THE GTM

Research is a key component of the Reserve's mission. Included here are findings from research projects conducted within the Reserve boundary over its history that helps inform planning and land management.

If nutrient inputs from anthropogenic sources are minimized, the well-flushed nature and the prevalence of filter feeding oyster reef communities in the GTM estuary provide the system with a degree of resilience to the type of intense algal blooms observed in more restricted ecosystems, like the Indian River Lagoon. This general observation does not rule out the possibility of harmful algal blooms, particularly in parts of the GTM with less flushing, such as the Pine Island region. There is also a persistent risk of incursions of harmful algae blooms into the GTM from the Atlantic coast, as evidenced by the 2007 red tide event.

Tidal wetlands in the GTM estuary are shifting from salt marshes to mangrove forests as a result of fewer hard freezes. While we do not expect these forests to look like those in South Florida, this will change animal communities and increase carbon storage.

Saltmarshes and mangrove forests that cannot migrate to higher ground are at risk of drowning due to sea level rise. Once a marsh starts drowning, other stressors like increased crab activity and high salinity during droughts can accelerate the loss of that habitat and the ecological services it provides.

Oyster monitoring volunteers at GTM Research Reserve

Boat wakes erode and steepen shorelines along the Intracoastal Waterway. Natural options for shoreline protection have been shown to slow erosion and build habitat, but they require maintenance. A more suitable option is needed.

Oysters are important to our community and to the health of the GTM estuary. While oysters are good at filtering water, the amount they filter in nature is probably less than what was previously estimated based on lab studies. Therefore, it is even more important for us to conserve and restore oysters.

Constructed oyster reefs can increase carbon storage and habitat for fish and invertebrates.

Commercial oyster harvesting within the GTM estuary has declined over time. Some recreational harvest occurs, but the hard work of harvest and confusion about regulations may be deterrents. Local fishermen are willing to be part of oyster management planning.

Prescribed fire is important to maintain coastal strand vegetation, which is an increasingly rare habitat type that is important for coastal resilience, as well as many species like gopher tortoises and painted buntings.

Prescribed burn at GTM

Fun Finds from GTM Research

Mangrove tree crabs, previously thought to only live in mangroves, are moving north faster than the mangrove trees. They are using docks as habitat in the northern extreme of their range.

Adult alligators in Guana Lake eat fish and crustaceans from brackish waters but the juveniles prefer freshwater prey. One of the first two documented incidences of an alligator eating a sea turtle was found at the GTM Research Reserve. Puncture wounds matching alligator bite marks were discovered on a carapace found on the beach.

Eleven shark species have been observed in GTM waters during summer months.

GTM fish assemblages are similar to those in other Southeast Atlantic estuaries, but this is the only known area where bluefish spawn in the autumn.

And a special thanks to our many volunteers and partners

CITY OF PALM COAST

CITY OF ST. AUGUSTINE

FLAGLER COLLEGE

FLAGLER COUNTY

FLORIDA DEPARTMENT OF AGRICULTURE AND CONSUMER SERVICES

FLORIDA DEPARTMENT OF TRANSPORTATION

FLORIDA FISH AND WILDLIFE CONSERVATION COMMISSION

FLORIDA FOREST SERVICE

FLORIDA INLAND NAVIGATION DISTRICT

FLORIDA PUBLIC ARCHAEOLOGY NETWORK

FLORIDA SEAGRANT

FLORIDA STATE PARKS

JACKSONVILLE UNIVERSITY

NATIONAL PARK SERVICE

SMITHSONIAN ENVIRONMENTAL RESEARCH CENTER

ST. AUGUSTINE PORT, WATERWAY, AND BEACH DISTRICT

ST. JOHNS COUNTY

ST. JOHNS RIVER WATER MANAGEMENT DISTRICT

TOWN OF MARINELAND

U.S. ARMY CORPS OF ENGINEERS

UNIVERSITY OF FLORIDA

UNIVERSITY OF NORTH FLORIDA