

DIVING DEEP

FGCU launches holistic
approach to solving water woes

SPECIAL SECTION



“
**WE ARE NOT
SEPARATED
BY LAND;
WE ARE ALL
CONNECTED
BY WATER.**

—Polynesian saying



Water, water everywhere

... and many mysteries to solve

BY KEVIN LOLLAR

Florida is a wonderfully wet world, a fluid and dynamic habitat for a dazzling variety of plants and animals – including humans – all connected to and dependent on water.

From the eastern end of FGCU's service area – Charlotte, Collier, Glades, Hendry and Lee counties – with the 730-square-mile Lake Okeechobee, to the Gulf of Mexico, Florida has hundreds of miles of rivers and creeks, thousands of square miles of wetlands, more than 1,000 square miles of estuaries and more than 100 miles of coastline.

Water drives the region's economy as locals and visitors play on the white beaches of the barrier islands, paddle kayaks and canoes on inland creeks, hike through wetlands, fish estuaries, dive and fish wrecks, ledges and artificial reefs in the Gulf.

In Lee County alone, 5 million tourists a year add \$3 billion to the economy, and they come for the water; one study shows that Lee County's artificial reefs generate more than \$100 million, another shows that fishing for a single species – tarpon – kicks in another \$100 million.

"There's passion about water in this area," says Greg Tolley, chairman of FGCU's Department of Marine and Ecological Sciences and leader of The Water School at FGCU (*see story page 11*). "People move here for the water, for the fishing, for beaching, for birding, for boating, all those kinds of things."

But all is not well with Southwest Florida's water; red tide in the Gulf of Mexico and estuaries, blue-green algae in the Caloosahatchee River, loss of sea grasses and oyster reefs, too much salinity during parts of the year and too little during other parts of the year, and the environmental Damoclean sword of climate change.

With two decades of marine research into the region's most important water issues, FGCU is uniquely qualified to tackle the problems that now face Southwest Florida, the state and other regions when it comes to water. For that reason, it has formed The Water School at FGCU (*see story on page 11*) and entered into a partnership with Mote Marine Laboratory (*see page 10*) to combat harmful algal blooms as well as protect this important resource.

TOXIC ALGAE BLOOMS

Over the past year, nutrients from agriculture and residential areas that flow into Lake Okeechobee have been released down the Caloosahatchee River, which receives even more nutrients from the rest of its watershed, and these nutrients created a toxic blue-green algal bloom that Mike Savarese, professor of marine science, picturesquely calls "Okeechobee guacamole."

The blue-green algal bloom turned water fluorescent green, killed fish, caused beach closures, and put a major hit on area tourism.

Even as the blue-green algal bloom turned the Caloosahatchee to toxic guacamole, a severe red tide ravaged Southwest Florida's coast and estuaries.

Red tide is a saltwater phenomenon caused by a single-celled alga called *Karenia brevis*, which produces a powerful neurotoxin, known as brevetoxin. Under normal conditions, *Karenia* populations are 1,000 cells or fewer per liter of seawater, and no harm is done. Sometimes, however, for reasons that are not well understood, *Karenia* populations bloom, and concentrations can exceed 100 million cells per liter. The excess toxin in the water renders filter-feeding mollusks poisonous, kills wildlife and causes respiratory irritation in humans.



The commitment is inherent in our name. We're Florida Gulf Coast University. What more can you say? That's what we have a responsibility for: to this community and to this region, to make sure that we are doing everything we can to support all of the factors that impact the viability and the health and the welfare of the people in this community.

*James Llorens,
provost and vice
president for
academic affairs*

The recent red tide, which started in November 2017, extended from Tampa Bay to Collier County, killing millions of fish as well as hundreds of sea birds, sea turtles, bottlenose dolphins and manatees.

FGCU researchers were active during the red tide, taking water samples inshore and offshore, and FGCU divers documented a dead zone on Lee County's artificial reefs – red tide dead zones occur when massive amounts of fish die, and the decomposition process sucks the oxygen out of the water, so organisms not normally affected by brevetoxin, such as mollusks, suffocate.

The extent to which nutrients from land feed *Karenia* blooms is unknown – current scientific consensus indicates that nutrients from land-based sources can make blooms larger and last longer but much is still unknown about the interplay between human activities and red tides. FGCU researchers are seeking \$9 million from the state to further explore the effects of land-based nutrients on red tide. If the proposal is funded, researchers will also study red tide's environmental and economic impacts and its effects on human health.

HUMAN HEALTH THREATS

Severe algal blooms don't just harm Florida's economy. Researchers have shown that red tides can land people with asthma or other chronic lung diseases in emergency rooms and cyanotoxins in blue-green blooms can cause everything from mild skin rashes to serious illness or death.

During the blue-green algae bloom, Mike Parsons, director of FGCU's Coastal Watershed Institute and Vester Marine Field Station, conducted a study that showed humans can inhale blue-green algae toxins, called cyanotoxins, deep into their lungs.

Mercury poisoning in humans might not be as big an issue as red tide or blue-green algae, but it's important enough for the Florida Department of Health to put out an advisory concerning how much of every edible fish species in the state people can consume safely.

Darren Rumbold, professor of marine and ecological sciences, is studying methylmercury, the poisonous form of the element.

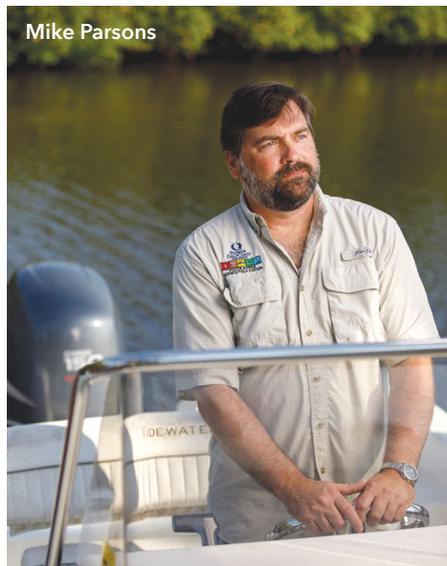
Methylmercury works its way up the food web through bioaccumulation: Pinfish

eat shrimp that have methylmercury in their tissues, and that methylmercury accumulates in the pinfish; a snook eats a bunch of those pinfish and absorbs all their mercury, and so on through the food web, until a person eats a fish that has accumulated enough methylmercury to make him sick – symptoms of mercury poisoning include nausea and vomiting, loss of motor skills, tremors, difficulty breathing and memory problems.

“We’re interested in mercury because of its health threats,” Rumbold says. “Mercury is stored in things we like to eat: filets of fish. We should be eating fish. We need to be eating fish. We just need to pick the right fish. Looking at the whole food web, we can develop models to predict how mercury is transferred to the next level. We’ve got to understand the whole picture to make management decisions.”

COMPETING WATER MANAGEMENT GOALS

Another big problem starts at Lake Okeechobee: Water managers want to keep the lake between 12.5 feet and 15.5 feet above sea level; levels below 12.5 feet cause environmental damage to the lake’s ecosystems, and levels above 15.5 could cause a breach in the aging Herbert Hoover Dike, which surrounds the lake and protects tens of thousands to millions of residents from harm.



Mike Parsons

PHOTO BY BRIAN TIETZ

When water levels approach or exceed 15.5 feet following major rain events, water managers release billions of gallons of fresh water down the Caloosahatchee; in addition to bringing algal bloom-fueling nutrients down the river, all that fresh water can kill seagrasses and oysters in the lower Caloosahatchee, where water is naturally brackish – water that has a salinity between that of seawater – 35 parts per thousand – and freshwater.

During dry periods, water managers don’t release water from the lake, so brackish water moves up the Caloosahatchee and kills freshwater vegetation.

Oysters and fresh- and saltwater grasses are extremely important parts of the Caloosahatchee ecosystem. They provide habitat for juvenile fish and benthic (bottom-dwelling) organisms and are food for many animals, including birds, manatees and turtles. They also stabilize the river bottom and trap sediments.

Win Everham, professor of environmental studies, is experimenting with ways of planting grasses in the upper Caloosahatchee.

“People ask, ‘Why are you planting seagrass if the water’s not right?’” he says. “If we can get grasses established and living long enough to fruit, that will invigorate the seedbank. If we get healthy vegetation in the river, releases from Lake Okeechobee won’t matter. I could be wrong about the math, but that’s my hopeful statement.”

Oysters provide important habitat, too: FGCU researchers have determined that local oyster reefs are home to or foraging grounds for more than 300 invertebrate and vertebrate species, including some of the area’s most popular recreational fish, such as snook, redfish, spotted seatrout and sheepshead.

In addition to providing habitat, oyster reefs are highly efficient filtering systems: A single oyster can remove impurities (nutrients, detritus, bacteria and algae, including *Karenia brevis*) from 50 gallons of water in a day. So, even a small oyster reef of 1,000 live oysters will filter 50,000 gallons of water every 24 hours.

In terms of solving a problem, first you need to know what the problem is, be aware of it, and you need to study what is causing the problem. And, so, a lot of that is just basic science, doing the research, and understanding the system or the problem, but then coming up with potential solutions.

Mike Parsons, professor of marine science and director of the Coastal Watershed Institute and Vester Marine Field Station

FGCU researchers have been very involved with restoring oyster reefs in the river and elsewhere.

“We were not restoring them for food purposes, as has traditionally been done in the northern Gulf of Mexico and Chesapeake Bay, for example, but because they are so important to the ecosystem.”

FIXING WHAT'S BROKEN

When Europeans started moving to South Florida in the early 19th century, they thought this would be a great place to live if not for all those pesky wetlands, so, for decades, the area was ditched and diked and drained and filled for agriculture and development.

Then we started to realize how important wetlands are, and efforts to restore them have become increasingly popular – the ongoing effort to fix the Everglades is the biggest wetlands restoration project in history. Bill Mitsch, eminent scholar and director of FGCU's Everglades Wetland Research Park, is actively involved in wetlands restoration

using a multidisciplinary approach called ecological engineering.

At the same time, Everham is working with Corkscrew Swamp Sanctuary to monitor the 55,000-acre Picayune Strand Restoration Project undertaken by the South Florida Water Management District and Army Corps of Engineers, which includes plugging 48 miles of canals and removing 250 miles of roads. Everham's goal is to determine how fish, frogs and macroinvertebrates (animals without a spine but large enough to be seen with the naked eye, such as snails, clams and crayfish) are adjusting to the restoration.

PREPARING FOR A NEW CLIMATE

Of course, the biggest water story of the 21st century is climate change, and Southwest Florida, with all its interconnected waterways from the Gulf to Lake Okeechobee, will feel the effects as much as any place in the nation. Sea level rise will threaten property and infrastructure as well as natural habitats;

“It's clear we have water issues here. Everybody knows how important water is in Southwest Florida. I hope The Water School will use water as the focus on the large question of what we want Southwest Florida to look like in 50 years. More specifically, I'm hoping that the school captures this piece of who FGCU is in terms of interdisciplinary study.”

*Win Everham,
professor of
environmental
studies*



Win Everham

PHOTO BY BRIAN TIETZ



warmer oceans could mean more and more powerful hurricanes; increased acidification in the water, caused by more carbon dioxide in the atmosphere, could prevent oysters, clams, conchs, and whelks from building shells.

And, of course, FGCU researchers are getting involved.

“We’ve already been doing research in climate change,” Tolley says. “That’s everything from my research – which looks at the effects of changes in temperature and salinity on the physiology of animals – to people like (associate professor of marine science) Felix Jose’s research that looks at storm surge modeling for hurricanes. Jo Muller (associate professor of marine science) uses cores to go back and track hurricanes through time over the last 5,000 years. Mike Savarese has been doing a lot of work in terms of how oyster reefs respond to rising sea level and how coastlines retreat and erode with rising sea level over the last 5,000 years.”

Research on climate change by FGCU faculty and students can have a positive impact on future generations, Tolley says.

“We have an opportunity for us and our students to actually do something about it,” he says. “And I think that 50 years from now, we won’t have that opportunity if we don’t do something about it now. There’s a window of opportunity now where we need to be investing in these kinds of things if we’re going to continue to see the quality of life and the kind of life we have right now.”

PROTECTING OUR WATERS

With so many water issues in Southwest Florida and so many FGCU researchers working on them, it’s only logical that

the university establish a school dedicated entirely to the study of water. Called simply The Water School, it will address water issues through research, teaching and outreach and would include not only water sciences but also other disciplines such as human health, chemistry, physics, engineering and economics.

“I see two goals of this school,” Parsons says. “One would be immersing ourselves more in water issues in Southwest Florida. There is a lot of local interest. We can see it in terms of blue-green algae, sea-level rise, red tide, and so forth. And so, we should really be part of the solution on these issues. And, doing that, the second main point would be the students and training the students, as our next generation of scientists, to really tackle these issues and, hopefully, if we can’t solve them, they’ll be a lot farther along.”

Southwest Florida is all about water – lakes and rivers, streams and creeks, freshwater swamps and saltwater marshes, estuaries and the Gulf of Mexico, fish and frogs, oysters and turtles, water birds and marine mammals, and humans.

And FGCU researchers helping to protect that precious stuff that connects us all.

“Water is bigger than ever in the public eye, from Everglades restoration, to red tide, to hurricanes, to climate change,” Tolley says. “You can’t pick up a newspaper these days without reading about some kind of water issue in the area. One of the first responsibilities of any university is service to its own community and service to the region. That’s one of the reasons we’re here, one of the reasons we’re invited to be here.” ■

“Our water and natural resources are the foundation of our economy and our way of life in Florida. The protection of water resources is one of the most pressing issues facing our state.”

Florida Gov.
Ron DeSantis

CURRENT WATER-RELATED RESEARCH AT FGCU

CIGUATERA

Mike Parsons, director of FGCU's Coastal Watershed Institute and Vester Marine Field Station, is the principal investigator on a project financed by a \$5.9 million grant from the National Science Foundation and the National Institute of Environmental Health Sciences, to determine what causes outbreaks of ciguatera poisoning, the most common seafood poisoning in the world. It occurs when people eat fish laced with toxic algae from the genus *Gambierdiscus*. Ciguatera poisoning symptoms include abdominal cramps, nausea, vomiting, diarrhea, chills, hot and cold temperature reversal, weakness, dizziness, wheezing, blurred vision, abnormal sensitivity to light, muscle aches and joint pain. "Fifty thousand cases a year is a conservative estimate," Parsons says. "It's probably misdiagnosed and under-reported, so there might be hundreds of thousands of cases. We don't really know."



Greg Tolley

got terrestrial situations or wetlands that we can't get bass out of, so we're going to be using pythons," he says.

SEA LEVEL RISE

FGCU researchers are working on climate change. Greg Tolley, professor of marine science and chair of the Department of Marine and Ecological Sciences, is exploring the effects of changes in temperature and salinity on the physiology of animals, and Win Everham, professor of environmental studies, is monitoring the effects of Hurricane Irma on mangrove forests. For Mike Savarese, professor of marine science and program leader in environmental studies, outreach to local communities is an important part of FGCU's climate change efforts. As part of a BP settlement grant, along with the University of Florida, University of Miami and the U.S. Geological Survey, Savarese is developing models to show decision makers in Collier County what the coastline will look like at various times in the future as sea levels rise. "The project is providing them with insights, helping them use tools to plan for adaptation," he says. "How will Collier County adapt to what 2060 looks like in terms of mangrove wetlands, mangrove forests, dune systems? You name it: It's all in there."

AQUATIC GRASSES

Seagrasses are an integral part of Southwest Florida's estuary system. They provide food and habitat for many vertebrate and invertebrate species; they stabilize the estuary bottom; they help maintain water quality. James



James Douglass

Douglass, associate professor of marine and ecological studies, is part of an international project studying seagrasses in Bermuda, Panama and throughout the Gulf of Mexico. Douglass does his work in the lush grass beds of Pine Island Sound near Sanibel. At all sites, researchers put cages around plots of seagrass. Then they document various parameters, such as whether grasses around the cages are being grazed down by parrotfish, sea turtles and other sea life, what happens to the grass when nutrients are added to simulate nutrient pollution. Meanwhile, Win Everham, professor of environmental studies, is experimenting with planting freshwater grasses in the upper Caloosahatchee.

GREEN CHEMISTRY

Two FGCU researchers are using two very scientific-sounding materials to extract water from the air. Gregory McManus, assistant professor of chemistry, is following a study by MIT and University of California-Berkeley scientists that used metal-organic frameworks (MOFs) to extract moisture from the air (in the MIT-Berkeley study, one kilogram of MOF powder captured three quarts of water in 12 hours). "They used the materials that I work with and showed that they could do this. They could go and harvest water from arid conditions. Here in Florida, if you want to harvest water from the air, it's doable because it's so humid in Florida. If you're in a desert, good luck finding drinking water. They were able to build a device that was able to do it without any electricity. It was a box you could plop in the desert, and you could use the power of the sun to be able to go through and provide clean drinking water." Meanwhile, Arsalan Mirjafari, associate professor of chemistry, is working with ionic liquids (ILs), which are salts in liquid form. "We're pretty sure if we can

incorporate his materials into my materials, the integration of our two materials together will be even more effective," McManus said. "The only problem was the material they made was very expensive; it was too expensive to be applicable. We're trying to make it cheap. Harnessing the power of the material I work with and the material that Dr. Mirjafari works with will be even better."

HURRICANE IMPACTS

Paleoclimatologist Jo Muller, of the Department of Marine and Ecological Sciences, does her research into the history of hurricanes by digging deep into the earth - hand driving a hollow tube deep into the ocean floor - to study storm sediment from centuries past.

She and her students analyze that sediment and, based on their findings, they can determine the strength and intensity of storms from as far back as 1,000 years. From that, they can make predictions about the intensity of future storms.

SOCIAL ATTITUDES

Although previous studies have shown that people tend to avoid beaches during major red tide events, that many people believe red tides are becoming worse in duration and severity, and that human activity is making the red tide problem worse, researchers have never looked at people's attitudes toward long red tides. Until now. Diane Sasnett-Martichuski, assistant professor of psychology, is using quantitative methods (cold, hard facts) and qualitative methods (impressions and opinions) to determine current attitudes about the lingering red tide in Southwest Florida. "The



Jo Muller

goal of this research is to assess whether or not people are aware of the problem, figure out ways to increase awareness and include some solutions for what people in the community can do to help alleviate the problem for the environment," she says.

SHORE BIRDS

Over the summer and fall of 2018, something made many shore birds sick and killed many others in Southwest Florida. Working with Audubon of Florida, Kara Lefevre, assistant professor and program coordinator for environmental studies, is trying to find out what.

Working mostly in the Marco Island area, Lefevre collected sick and dead birds, mostly royal, Sandwich and common terns. The sick birds were sent to the von Arx Wildlife Hospital at the Conservancy of Southwest Florida in Naples or to the Clinic for the Rehabilitation of Wildlife on Sanibel; the dead ones were sent to the Florida Fish and Wildlife Conservation Commission for necropsies. The incidences of sick and dead birds coincided with a serious red tide event that plagued Southwest Florida for more than a year, and the sick birds' symptoms were similar to red-tide symptoms. "The sick birds were slow-moving," Lefevre said. "When they normally flush, they were slow to react. Some were unable to move. They risked drowning because they couldn't move away from lapping waves. Some had lolling heads. It seems neurological." Lefevre is waiting for necropsy results to determine the cause of the illnesses and deaths.

OYSTER RESTORATION

Mention high-volume releases from Lake Okeechobee down

the Caloosahatchee River, and many people think of blue-green algae caused by nutrients in the water. But FGCU graduate student Bass Dye, now at the University of Oregon, wrote his master's thesis on what all that fresh water means to oyster larvae in the river. Dye's thesis advisor was Felix Jose, associate professor and program leader for marine science. "It's kind of a no-brainer," Jose says. "Too much fresh water washes out the larvae before they have time to settle out on oyster reefs." But Dye's research goes beyond the no-brainer stage. "Interestingly, our study found that larvae spawning in Caloosahatchee River/San Carlos Bay were not only transported within San Carlos Bay (and some flushed out into the Gulf) but also transported to Matlacha Pass and Pine Island Sound," Dye says. "This suggests that Matlacha Pass and Pine Island Sound could serve as potential oyster restoration sites apart from solely focusing restoration efforts on locations within the bay."

CLIMATE CHANGE EDUCATION

Although some government officials deny human-caused climate change, the scientific community agrees that the threat is real, and FGCU educators are making sure the word gets out. Molly Nation, assistant professor of environmental studies, is even taking the message to the classroom. One of her lessons for high school juniors and seniors, for example, is called "Measuring the Greenhouse Effect Through Simulation Lab." "Climate change is perhaps the most serious issue society is facing over the next decade, and our educated youth are not being prepared to make informed decisions



regarding this complex problem," she says. "It is important for the future of our children that we take a closer look at the type of climate change education happening within our science classrooms, the types of curriculum being taught, and the teachers that are instructing."

REAL ESTATE

Shelton Weeks, chair of FGCU's Department of Economics & Finance and Lucas Professor of Real Estate, and Napoleon Bonaparte Broward, Florida's governor from 1905 to 1909, would probably have had lively conversations about water and real estate. According to Broward, "Water is the common enemy of the people of Florida." According to Weeks, "The economic impact of water in Southwest Florida is huge, from recreational use to just sustaining life here." People move here for the water. Having access to the water is great; living near the water is better; living on the water is best. Weeks is working with Tim Allen, Alico Chair of Finance, on a paper that examines the impact on property values of

float distance in Cape Coral canals to the Caloosahatchee River. "We've always heard people that are selling homes talk about, 'Oh, you're just five minutes to the river,' and it seems like every home in Cape Coral on all 400-plus miles of canals is five minutes to the river, so the name of our paper is 'One Beer to the River,' and it looks at this spatial component of residential property values related to access to open water and how it directly impacts property values."

WETLACULTURE

Bill Mitsch, director of FGCU's Everglades Wetland Research in Naples, has a way to save South Florida from fertilizers, which he calls "the opiate of agriculture," and, because the nutrients in fertilizers cause massive micro- and macro-algal blooms, he could help save Southwest Florida's freshwater systems, estuaries and near shore Gulf of Mexico. The process is called wetlaculture, a portmanteau word from wetlands and agriculture. It starts with Everglades stormwater treatment areas (STAs), which

are man-made wetlands whose plants remove and store nutrients, particularly phosphorus, from agricultural water (so far, 57,000 acres of STAs have been built south of Lake Okeechobee). "Those wetlands will eventually become saturated with phosphorus," Mitsch says. "With wetlaculture, we'd swap those wetlands to the sugar industry or other ag interests, and they'd convert them to agriculture, and they'd give us areas of ag land that we'd flip to wetlands." A major benefit to this idea is that the wetlands that the agriculture industry flips to ag fields would never need fertilizers because they'd already be saturated with nutrients. Mitsch says we need 100,000 acres of STAs for the idea to work. "Since SFWMD (the South Florida Water Management District) recently announced that they are increasing the area of the current STAs/treatment wetlands that already exist by 6,000 acres, I am now suggesting that we need 94,000 additional acres," he says. "So, they are making tiny progress." ■

FGCU, MOTE MARINE TEAM UP TO BATTLE TOXIC ALGAE

Operating on the premise that the expertise of two institutions will strengthen the efforts of both, Florida Gulf Coast University and Mote Marine Laboratory & Aquarium have begun a partnership to address the impacts of harmful algal blooms in Florida.

Leaders of the two institutions signed a Memorandum of Understanding in early April to begin collaborating on problems associated with red tide, blue-green algae and other toxic algal blooms present in area waters.

"Our joint goal is to not just gain a greater understanding about the ecological forcing functions of red tide and other harmful algal blooms," said Mote President and CEO Michael P. Crosby, "but to actually do something to decrease the devastating impact of harmful algal blooms to our environment, our economy and our quality of life."

FGCU Provost James Llorens said, "We'll research together, fundraise together and teach together. It's a true collaboration."

Sarasota-based Mote and The Water School at FGCU will pursue collaborative scientific research, innovative technology development and undergraduate and graduate education with a focus on these

harmful algal blooms.

"FGCU is very pleased to formalize an ongoing partnership with Mote Marine," FGCU President Mike Martin said. "Most assuredly working together, and with other colleagues across the state and nation, we can bring science to bear on the challenges of maintaining Florida's critical water resources." ■





HOW TO GIVE

For information on how to support **The Water School at FGCU** and the important research it does, contact **Tony Lee** at alee@fgcu.edu or (239) 590-1068.

Connecting the drops

The Water School at FGCU will take holistic approach to water problems, solutions

BY NADINE SLIMAK

People live, work and play in Florida because of the water, but as water quality declines, leading business sectors – from tourism, to agriculture, from recreation to real estate – suffer regularly from devastating losses.

Situated in the midst of critical fresh and salt water systems, FGCU's scholars are uniquely positioned to take on these pressing issues and develop comprehensive solutions to the water problems we face, says Bob Gregerson, dean of FGCU's College of Arts & Sciences.

"A drop of rain falls in central Florida and makes its way down to the coast and

out into the estuaries and then to the Gulf," Gregerson says. "What we're talking about is a school that has a comprehensive approach to water. It's not just that we're really focused on the Gulf of Mexico, or we're really focused on Lake O, or we're really focused on the Everglades. It's a comprehensive approach because all those components are integrated."

A BIG IDEA

"Philosophically, a couple of years ago, we as an institution started looking in the mirror and asking the question: What are we going to be known for?" Gregerson says. One of the

The health of our Southwest Florida waterways and ecosystems is vital to our economy - in addition, the physical harm to people living in proximity to toxic algae is of great concern. We must make every effort possible to mitigate harmful effects of red tide and toxic algae and we must also take the steps necessary to eliminate the root causes of these outbreaks."

Congressman Francis Rooney

ideas that coalesced was this idea of The Water School, as a shining example of how we do all the things that impact our greater community, allow us to do cutting-edge research and scholarship, and train students, and be an integral part of our greater community.

“With 400 acres of protected habitat and LEED-certified buildings, FGCU is already a living environmental lab with sustainability at the core of our mission. We have award-winning initiatives in education, energy production, research and sustainable practices that make us one of the nation’s greenest campuses. It’s the perfect place to develop a new school dedicated to developing a comprehensive understanding of water problems that also moves beyond traditional boundaries to develop solutions.”

Obviously, researchers from FGCU’s Department of Marine and Ecological Sciences would become a part of The Water School, but it will go well beyond those disciplines to draw in engineering, economics, education, healthcare, psychology, physics and chemistry.

“This is not a science solution to our water problems,” says FGCU President Mike Martin. “This is a university solution. The Water School is a cross-cutting, interdisciplinary activity that integrates across every unit in the university. It’s not just about the water – it’s what the water enables us to do. It’s about an integrated opportunity for us to think about water and health, water and policy, water and economics, water and engineering. It’s about something that brings the entire region together and impacts every element of our lives.”

BIG SOLUTIONS

The Water School will offer bachelor’s degrees in environmental studies, environmental geology and marine science, and master’s degrees in environmental science and environmental studies.

One difference between the FGCU school and that of other institutions is that much of the research will focus on watershed issues, says Greg Tolley, professor of marine sciences who will lead The Water School.

“The University of South Florida is blue water. The University of Miami is blue water,” he says. “We’re focused on the

connection of that drop of water that hits the landscape, which gets changed as it comes down through our local watersheds and ends up on the Continental Shelf, in the shallow waters of the Gulf of Mexico.”

Water School researchers will focus on five major themes:

- ▶ Climate change
- ▶ Restoration and remediation, for example: oyster reef restoration and seagrass planting;
- ▶ Human health – including ciguatera and mercury poisoning and the effects of red tide and blue-green algae on humans;
- ▶ Natural resources, which include fisheries, mangrove forests, beaches and seagrass beds;
- ▶ Ecosystem integrity – looking at ways to maintain healthy ecosystems.

Plans for The Water School include:

- ▶ State-of-the-art facilities housed in the proposed Integrated Watershed and Coastal Studies Building – 116,000 square feet of much-needed space that will serve as a center of STEM activity and will help solve Florida’s water problem.
- ▶ New funding for scholarships, fellowships, symposiums and more that will attract and retain the best and brightest students, fellows and faculty.

BIG SOLUTIONS NEED BIG SHOULDERS

The success of The Water School will hinge on FGCU’s ability to secure an additional \$25 million in funding – the state legislature has already earmarked \$30.5 million – from individuals, corporations, foundations and the state of Florida to expand the university’s infrastructure, establish scholarships and fellowships and realign new and current graduate and undergraduate programs within the school, says Martin.

“More and more people are recognizing the importance of the integration of the water into the lifestyle here in Southwest Florida,” he said. “We’re seeing it in local initiatives and we’re seeing it in the state legislature. The time is right for the community to invest in solutions to our water problems and FGCU is uniquely positioned to lead the way.” ■

“Water is important, no matter where you’re at. It has an increased importance in Florida because of the amount of water around the state. It impacts tourism, boating, agriculture. All of those things are connected.”

*John Woolschlager,
professor of
environmental
engineering and
Backe Chair*

Gulf of Mexico reef will provide realistic research environment

BY KEVIN LOLLAR

The best way to teach students about the marine environment is to put them in the water.

To that end, FGCU's Department of Marine and Ecological Sciences plans to deploy an artificial reef in 30 feet of water 8½ miles offshore, where students will learn to conduct real underwater science. "Everybody's excited about this reef," says Bob Wasno, manager of FGCU's Vester Marine Field Station. "It will be an opportunity for people to do great research." The department is in the process of seeking funding for the project.

Artificial reefs are often created by simply dumping material, such as concrete rubble or concrete culverts, off a barge, but the FGCU reef will consist of four structures made from 20-foot-long concrete pilings, donated by Cement Industries Inc. of Fort Myers, that will be fastened together to form what Wasno calls "Lincoln Log" units.

These structures, measuring 10 feet in height, will be carefully lowered to the sea

floor 150 feet apart, each structure at the corner of a one-half-acre square.

Researchers will be able to modify three of the structures for projects, while the fourth structure will remain unmodified as a control.

Individuals and groups already showing interest in the reef:

► **Florida Fish and Wildlife Conservation Commission** researchers want to place receivers on one of the structures as part of a network of receivers that tracks fish carrying surgically implanted transmitters.

► **Bonefish & Tarpon Trust** wants to use the reef to capture, tag and release permit, a popular game fish closely related to the pompano.

► **John Stevely, Florida Sea Grant agent** for Manatee and Sarasota counties, plans to grow sponges on one of the structures.

► **Mike Parsons, director of FGCU's Coastal Watershed Institute**, wants to grow seagrass on a structure to determine how *Gambierdiscus*, the organism that causes ciguatera poisoning, accumulates on aquatic vegetation. He'll also monitor algae growing naturally on the reef for the same purpose.

But the reef is really aimed at students, who will start off by learning underwater navigation on the site, then learn other research skills, such as how to set site transects, identify local fish and biofouling organisms and conduct fish counts for stock assessments.

"This is going to be a popular program for students," Wasno says. "It should be a big selling point. It will attract students who have a sense of what they want to do in marine science. They'll understand what it is to do research in scuba gear, actually doing research in the water as opposed to topside on a boat or in a classroom." ■



Bob Wasno

FGCU FILE PHOTO

“One of the most important things is that we really don't have a local group that can handle and have the perspective of water in Southwest Florida. You've got Florida International University from the other coast; you've got Mote (Marine Laboratory) from up the coast. We really do need an entity in Southwest Florida to address these local water concerns.”

Darren Rumbold,
professor of
marine science

THE WATER SCHOOL WILL BRING TOGETHER ITS MANY PROGRAMS DEDICATED TO WATER ISSUES, INCLUDING:

CENTER FOR ENVIRONMENTAL AND SUSTAINABILITY EDUCATION

The center's mission is to work "toward realizing the dream of a sustainable and peaceful future for Earth through scholarship, education and action." As it becomes part of The Water School at FGCU, the center will focus on outreach by translating research done by The Water School to audiences outside FGCU, including K-12 students, non-profit organizations and the general public. The center will also continue its Student Associates for a Greener Environment (SAGE), a grant program whose purpose is to build a new generation of environmental educators and environmental scientists who will work toward sustainability.

THE KAPNICK CENTER AND EVERGLADES WETLAND RESEARCH PARK

Established in 2013 at the Kapnick Center of the Naples Botanical Garden, the Research Park's mission is to understand how wetlands work and whether and how wetlands can be created and restored. Along with teaching and service, research is a major focus for the park, as faculty, post-doctoral researchers, graduate students, staff, student interns and visiting scholars conduct projects in Southwest Florida's wetlands. Recent projects include "Nutrient Removal Efficacy of Wetland Plant Communities in the Florida Everglades," "Ecosystem Services of Coastal Mangrove Wetlands" and "Carbon Fluxes in Subtropical Wetland Ecosystems."

COASTAL WATERSHED INSTITUTE

The institute is an interdisciplinary group of FGCU researchers, graduate students, undergraduates



and community partners with a collaborative focus on watershed-related concerns and their impacts on the coastal environments of Southwest Florida. In the past five years, CWI members have been co-authors on more than 50 publications on subjects ranging from Late Holocene sea-level fluctuation to the bioaccumulation of red-tide toxin in Eastern oysters and from mercury accumulation in Southwest Florida's coastal sharks to the rates of warming and the global sensitivity of shallow water marine invertebrates to elevated temperature. Recent institute projects include restoration of aquatic vegetation in the Caloosahatchee River, the impacts of freshwater releases on oysters, beach profiles and adaptation to sea level rise, and oil spill impacts in the Gulf of Mexico.

VESTER MARINE FIELD STATION

Named for Norm and Nancy Vester, who owned and operated the property as the Bonita Beach Plantation Resort and donated more than \$1 million to FGCU, enabling the university to buy the .86-acre site. At the field station's aquaculture facility, researchers study native and non-native marine and estuarine organisms in a series of flow-through tanks and raceways. The field station also has a 400-square-foot dry

laboratory and 1,000-square-foot wet lab, which are equipped with desktop computers, microscopes, dissecting scopes, a fume hood, UV filtration, autoclaves, incubators and refrigerated centrifuges. In the labs, researchers can study harmful algae, ecotoxicology, seagrass ecology and specimens collected in local waters. To get researchers onto area waters, the lab has a fleet of seven research vessels.

ROOKERY BAY NATIONAL ESTUARINE RESEARCH RESERVE FACULTY LIAISON

FGCU has a long history of collaboration that includes education, outreach and graduate fellowship internships.

THE ENVIRONMENTAL EDUCATION AND OUTREACH PROGRAM

This partnership with the Conservancy of Southwest Florida includes a faculty position whose appointment is split between FGCU and the Conservancy. It includes the Environmental Education Alliance of Southwest Florida, a network of environmental educators from FGCU's five-county service area who come together to share innovative ideas, best practices and more.

For more information on
The Water School, visit
fgcu.edu/thewaterschool.

7

NUMBER OF FLORIDA COUNTIES (LEE, CHARLOTTE, COLLIER, SARASOTA, PINELLAS, HILLSBOROUGH AND MANATEE) FOR WHICH GOV. RICK SCOTT **DECLARED STATES OF EMERGENCY IN 2018 DUE TO RED TIDE**

\$82 MILLION

annual economic losses to U.S. seafood, restaurant and tourism industries from harmful algal blooms (HAB) events

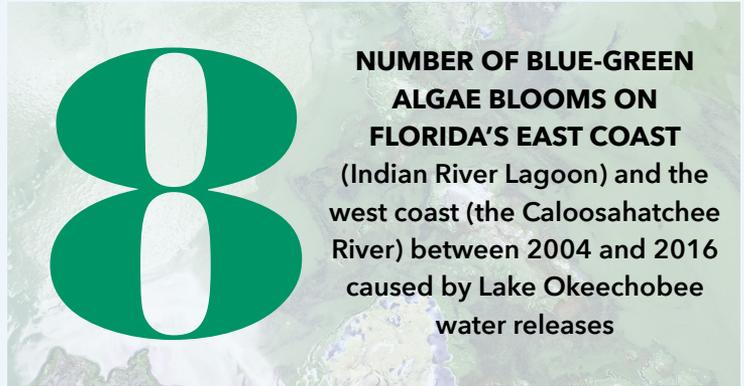
\$78 MILLION

value of Florida's aquaculture industry, including clam farming



1.3M

NUMBER OF JOBS IN THE LEISURE AND HOSPITALITY INDUSTRIES (DECEMBER 2018)



NUMBER OF BLUE-GREEN ALGAE BLOOMS ON FLORIDA'S EAST COAST (Indian River Lagoon) and the west coast (the Caloosahatchee River) between 2004 and 2016 caused by Lake Okeechobee water releases

589



SEA TURTLES KILLED BY RED TIDE, 2017-2018

\$2.5 BILLION

AMOUNT FLORIDA GOV. RON DESANTIS HAS PLEDGED TO **SPEND ON FLORIDA'S WATER RESOURCES OVER THE NEXT FOUR YEARS**

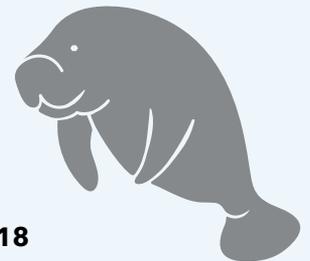


127

BOTTLENOSE DOLPHINS KILLED BY RED TIDE, 2017-2018

213 MANATEES

KILLED BY RED TIDE, 2017-2018



Water. Clean, healthy, dependable water is essential to our way of life in Southwest Florida. At Florida Gulf Coast University, we don't sit still. We have the **opportunity and responsibility**, right now, to bring all of our resources to bear on these issues and to **be the catalyst** that can **help our communities change** the course of their futures. **That's what The Water School at FGCU is all about."**

*- Michael V. Martin
President of Florida Gulf Coast University*



FLORIDA
GULF COAST
UNIVERSITY

fgcu.edu/thewaterschool