Florida LAKEWATCH

Dedicated to Sharing Information About Water Management and the Florida LAKEWATCH Program Volume 59 (2012)

LAKEWATCH Volunteer Trophic State Data Provide Understanding of the Past and Insight for the Future

LAKEWATCH volunteers at the Highlands County Regional Meeting receiving their "Outstanding Volunteer " paddle for their long-term commitment to Florida LAKEWATCH.

Some volunteers have been a part of the Florida LAKEWATCH team since the inception of the program in 1986. Many volunteers joined thereafter and together have collected a spectacular database that includes measures of the biological productivity in lakes (i.e., total phosphorus, total nitrogen, chlorophyll concentrations, and water clarity as measured by the use of a Secchi disk). Since 1986, the Florida LAKWATCH volunteers have sampled over 1,500 Florida lakes! The diligent efforts of the volunteers is further highlighted by the long records that exist for many of the Florida lakes (Figure 1), meaning monthly data have been collected since 1986 and continue to be collected today.

There are two purposes of this article. The first, and most important, purpose is to extend a **sincere thanks to all of the Florida LAKEWATCH volunteers** that have and continue to contribute their time and efforts to collect this wonderful database for the State of Florida. The second purpose is to share some interesting findings about how and if measures of biological productivity, or measures of trophic state, have changed in

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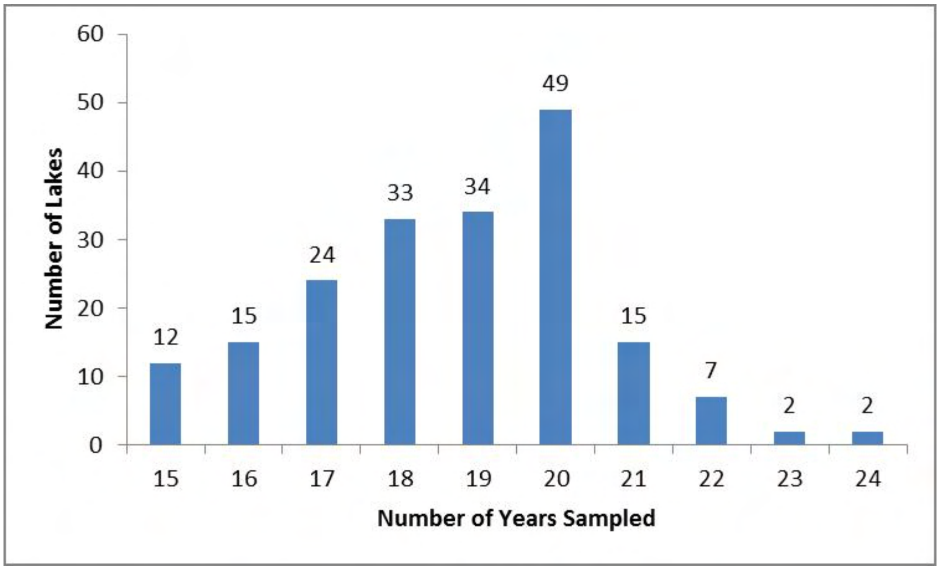

Figure 1. Number of years and number of lakes (N=193 Florida lakes) that were sampled by Florida LAKEWATCH volunteers.

Florida lakes over the past two decades using the long record of Florida LAKEWATCH data.

Interesting Finding 1:
Determination of whether or not measures of trophic state have changed over time in Florida lakes depends on the statistical method used.

Understanding whether temporal changes (changes over time) have occurred in lakes is a frequently asked question by scientists and society. As eutrophication (the movement of water towards a more biologically productive system) is an issue of concern, especially due to the exponential increase of the human population exacerbating stresses on our freshwater ecosystems. Consistent monthly, and long record (many years of data collection) data are invaluable to identify whether temporal changes occur in concentrations of total phosphorus, total nitrogen, chlorophyll and measures of water clarity. Records of data that span decades well-account for stochastic events (e.g., hurricanes, droughts, etc.) that may induce a change in the measures of trophic state variables, but only for a given period of time, such as a few years. Sometimes these shorter-term changes do not reflect patterns of measures of trophic state over a longer period of time. Because of the LAKEWATCH volunteer efforts, good estimations of temporal change were made for the measures of trophic state for 27 Florida lakes (20 or more years of monthly data), which were included in a larger population of 193 Florida lakes (at least 15 years of data) (Figure 2).

Scientists commonly use statistics to identify if data patterns move in a trend-like fashion over time. Yet, there are many different statistics that can be used to identify trends. Different statistics can also give different answers. For example, various statistical methods, ranging from simplistic to complex, were used to identify whether there was a significant trend in annual average total phosphorus concentrations over the 24-year period of record for Little Lake Santa Fe located in Alachua County, Florida (Figure 3). Depending on the statistical method used, an increasing trend (increasing movement of annual means over time) was detected or no trend (the annual means were not different from other annual means over time) was detected. Lakes are ephemeral and different statistical methods may estimate the variability in the data differently. The different statistical identification of trends using the same data show that although statistics are a great tool, it is important to plot and visually examine the raw data before using statistical methods (like the quarterly reports sent out by the LAKEWATCH staff for your lake).

Interesting Finding 2:
For a population of 193 Florida

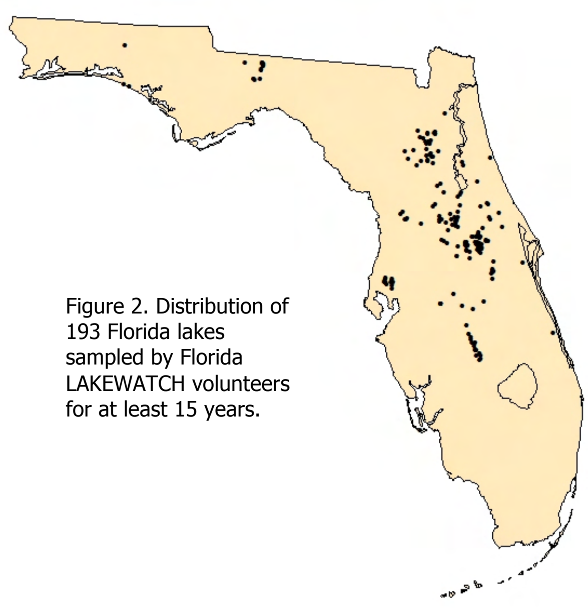

Figure 2. Distribution of 193 Florida lakes sampled by Florida LAKEWATCH volunteers for at least 15 years.

lakes, increasing trends were detected in 21% of the lakes for total phosphorus, 26% for total nitrogen, and 12 % for chlorophyll concentrations. Decreasing trends were detected in 4% of the lakes for water clarity measurements.

Due to the postulated human-induced worsening conditions of freshwater systems, the expectation is that measures of trophic state reflect these conditions by exhibiting increasing trends in nutrients (total phosphorus and total nitrogen), which leads to an increasing trend in algal biomass (estimated by chlorophyll concentrations). An increase in algae leads to decreasing trends in water clarity. Lakes with trends in all four measures of trophic state (also referred to as lakes that follow trophic state theory), would be the lakes with the greatest recognizable change and lakes where research and management efforts would be best allocated to understand the reasons for the changing conditions.

Given that the human population of the State of Florida has grown 3000% since 1900 and about 350% over the past two decades (1986-2009), it was anticipated that the majority of the examined 193 Florida lakes would show trends following trophic state theory. The results, however, were surprising. About half of the 193 Florida lakes (54%) had at least one trend (i.e., increasing trend in total phosphorus, total nitrogen, chlorophyll concentrations, or decreasing trend in water clarity) identified over the examined record of at least 15 years. This means there were 88 Florida lakes that did not have trends in any of the measures of trophic state. Of the 193 Florida lakes, there were only 9 lakes (5%) that showed trends in all four measures of trophic state. In fact, there were two lakes that showed improving trends in all four measures of trophic state, meaning decreasing trends in total phosphorus, total nitrogen, and chlorophyll concentrations and increasing trends in water clarity.

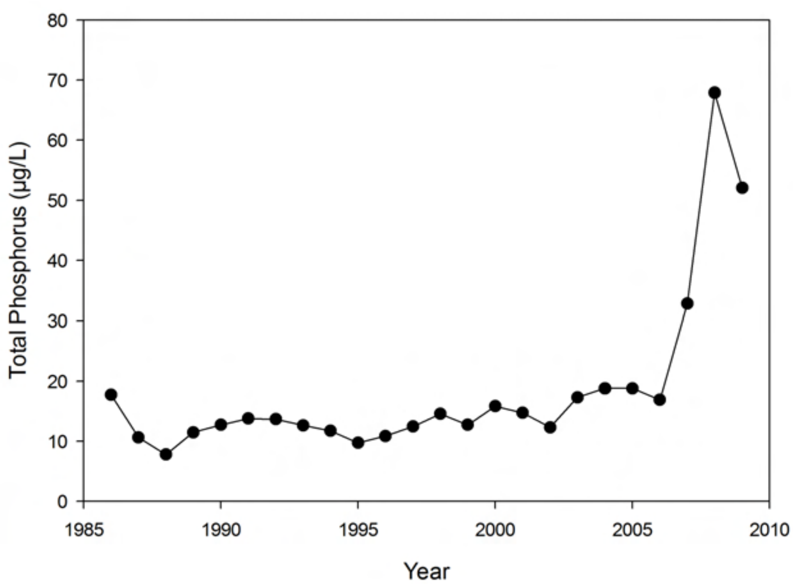

Figure 3. Annual mean total phosphorus (µg/L) in Little Lake Santa Fe (Alachua County) over a 24-year record (1986-2009).

The distribution of the lakes that showed one, two, three, or four trends in total phosphorus (TP), total nitrogen (TN), chlorophyll (CHL), and water clarity (SD) across the State of Florida showed clusters of lakes with similar groupings of trends (Figure 4). The reasons for these clusters of lakes have not been identified, but offer a great opportunity to focus future research and management efforts.

Interesting Finding 3:
Seasonal patterns of algae followed annual patterns of growth and death with elevated algae concentrations from June through October, which followed annual air temperature and rainfall patterns.

With frequent opportunities to gaze at a lake, the changes in the amount of algae can be seen during the course of a year. The amount of algae, or primary production, is a normal function of a lake but from a statistical standpoint adds variability within a given year. When trends in chlorophyll concentrations (used as an estimate of algal biomass) are assessed, this seasonal variability is many times removed before statistical analysis. But, seasonal patterns may reveal a lot about the magnitude of change occurring in lakes both within a year (inter-annual) and among years (intra-annual).

Analysis of the Florida LAKEWATCH database of 27 Florida lakes with monthly measurements collected for at least 20 years showed that patterns of monthly mean chlorophyll concentrations (represented as a % from the annual mean) were higher in the months June through October (positive mean % difference) and lower in the months of November and May (negative mean % difference) (Figure 5). The identified seasonal patterns

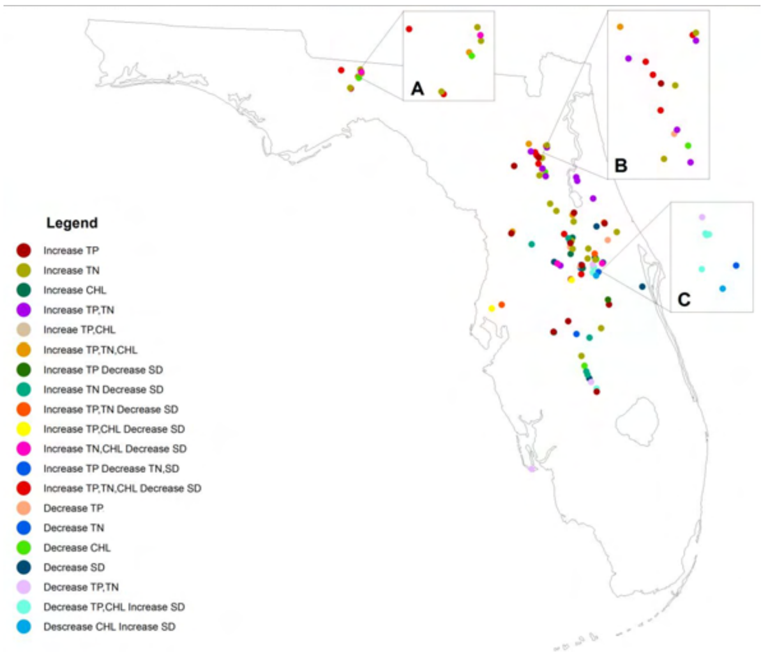

Figure 4. Florida lakes (N=105 lakes) with detected groups of trends (Group 1: increasing trends in TP, TN, CHL, and decreasing trends in SD; Group 2: decreasing trends in TP, TN, CHL, and increasing trends in SD). Spatial clusters of lakes with similar group 1 trends were identified (A and B) and group 2 trends (C).

of chlorophyll concentrations in the examined Florida lakes followed patterns of mean air temperature, with higher (positive mean % difference) values occurring in the months when the temperature exceeded 23 C (~73 F) (Figure 6).
Monthly chlorophyll concentrations were also related to monthly rainfall accumulation. Lakes showed relationships of either increased chlorophyll with increased rainfall (N=19 lakes) or decreased chlorophyll with increased rainfall (N=5 lakes). There were three lakes where no pattern between monthly chlorophyll concentrations and monthly rainfall accumulation was identified. The reason for these differences is most likely related to the surrounding watershed and flushing rate of the lake. Yet, it was interesting to recognize that rainfall influenced the concentrations of chlorophyll in 24 of the 27 examined Florida lakes.

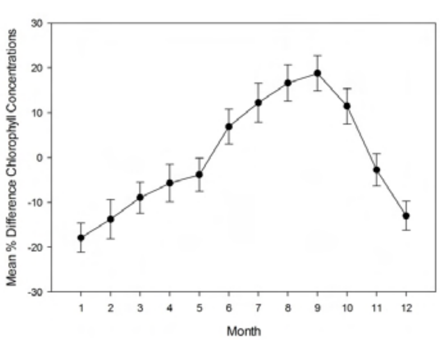

Figure 5. The mean percent (%) difference of monthly chlorophyll concentrations over an annual cycle for the 27 Florida lakes. The bars represent the 95% confidence intervals around the mean of the monthly percent differences.

Overall, the results from the examination of these Florida lakes with long, monthly data records collected by the Florida LAKEWATCH volunteers showed the status of the examined Florida lakes might not be as bad as projected. Many of the examined Florida lakes did not show an increase in nutrients (total phosphorus and total nitrogen) and chlorophyll or a decrease in water clarity over the past two decades. This is good news! There were some lakes, however, with trends in the measures of trophic state over the past two decades. Florida LAKEWATCH and others are working to understand why these changes occurred/continue to occur in these lakes. Gaining insight into the seasonal patterns of primary production, for example, will facilitate the efforts to understand lake change.

As the future years present a new set of challenges with global changes, there is a great value to continue to build the Florida LAKEWATCH database. You, a citizen scientist, immensely contribute to understanding the changes that have historically occurred and, with your continued monitoring efforts, may occur in our Florida lakes. Thank you again Florida LAKEWATCH volunteers for all your hard work!

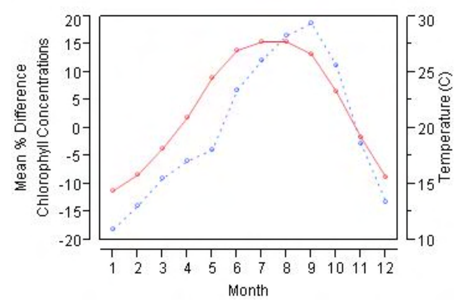

Figure 6. Monthly air temperature (C) averaged over a 24-year period (solid line) and the corresponding mean % difference of monthly chlorophyll concentrations over an annual cycle (dotted line) for the 27 Florida lakes.

If interested in the results for an individual Florida lake, please contact Dana Bigham for more information

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Non-Native Fishes: What Are The Risks?

By Jeffrey E. Hill, Ph.D., Assistant Professor and Extension Specialist in Fisheries and Aquatic Sciences at the UF Tropical Aquaculture Laboratory, jeffhill@ufl.edu

This South American armored catfish, Orinoco Sailfin Catfish (*Pterygoplicththys multiradiatus*), has been established in southeastern Florida since about 1971. Its presence is most likely the result of escapes or releases from fish farms.

A warm climate and abundant waterways make Florida an attractive travel destination and home for people from all over the world. Non-native fishes also find Florida to their liking. In fact, Florida has more established exotic fishes, those from other countries, than any other state in the USA. In Florida south of the Suwannee River, there are at least 34 species with reproducing populations.

Some non-native species cause problems for humans or the environment: these are invasive species. For example, some fish farmers in Florida suffer economic losses due to walking catfish crawling into their ponds and eating their fish. Homeowners in some south Florida subdivisions experience loss of property due to increased erosion from burrowing armored catfish. Other species are potential pests, causing concern over possible negative impacts. Bass anglers worry that snakeheads will eat the largemouth bass they so enjoy catching. National Park Service and National Wildlife Refuge staff are concerned over swamp eels and snakeheads entering their parks.

On the other hand, many non-native species benefit Floridians. Some, like oscars and Mayan cichlids, are sought by recreational anglers. Butterfly peacock bass were intentionally stocked by the state to benefit anglers in southeast Florida. Tilapia and brown hoplos are caught in commercial fisheries. Non-native fishes support most of Florida's large aquaculture industry.


UF Tropical Aquaculture Labarotory

Master of Science students Larry Lawson and Emily Haug holding bullseye snakeheads.

Although some non-native species are invasive, most seem to have little negative effect on our economy or on native species. Resources for managing non-native fishes are scarce so it makes sense to use those resources where they will do the most good, that is, trying to prevent the introduction of invasive species or managing populations that are truly pests. Benefits of non-native species and personal freedom also factor into management. How do we distinguish the relatively few problem species from the majority of non-native species? The answer is risk analysis.

Risk analysis is a way for scientists, agencies, and stakeholders to assess and manage risks. Risk is a function of some-thing happening (in this case, the establishment of a non-native fish) and the consequences if the event happens (the negative effects of the fish). Risk assessment identifies the risk factors, estimates the likelihood that the non-native species will establish, and predicts the severity of impacts. Risk management attempts to reduce risks to acceptable levels.


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Walking catfish (Clarias batrachus)

A series of steps must occur for a non-native species to establish a self-sustaining population. First, the species must be introduced into the environment. The main pathway in Florida is the release of aquarium fish by hobbyists, though some species are introduced from other pathways such as aquaculture, the live food fish trade, and even ceremonial release. Individual fish must survive the introduction event, find food, escape predators, and reproduce. Enough offspring must survive to adulthood and reproduce themselves. The climate and habitat must be conducive to long-term survival as well. Climate is a major limiting factor in Florida because so many of our introduced fishes are tropical.

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Jeff Hill holding a barramundi, an Australian species considered for aquaculture in Florida .

Florida has a warm climate but periodic cold winters such as in 2009-2010 can eliminate populations of non-native fish or reduce their range in Florida.

Once established, non-native fishes may prey on native species, compete with them for food or other resources, change the habitat, or introduce disease. The actual impact that a non-native species will have on Florida's aquatic environments is difficult to predict because the environment is very complex.

Risk assessors rely on knowledge of Florida's waters and native species, the history of invasiveness of species elsewhere, certain characteristics of concern common to invasive fishes, data from previously established non-native fishes in Florida, and scientific theory to aid in their predictions. For example, large predators such as flathead catfish, a fish that can grow to over 100 lbs., reduces the abundance of redbreast sunfish and some native catfish in the Apalachicola River. Therefore, risk assessors would rate this species and large predators in general as having added risk. Unfortunately, little is known about the impacts of many non-native fishes in Florida, though most evidence suggests that impacts are localized with a few exceptions.

Programs at the Tropical Aquaculture Laboratory develop data to better assess risks of non-native fishes. Research on the ability of native predators to reduce the success of non-natives informs risk assessors about establishment potential (see "Alien Vs. Predator" p 8). Limiting habitat and climate factors (e.g., salinity tolerance) give information on habitat needs, spread, and potential range in Florida. Field and laboratory studies of diet and prey help evaluate competition. Development of new methods for risk assessment including rapid screening tools, reduces costs and improves accuracy. These programs are collaborative with the Florida Fish and Wildlife Conservation Commission, Florida Department of Agriculture and Consumer Services, U.S. Department of Agriculture, U.S. Fish and Wildlife Service, and U.S. Geological Survey as well as the Centre for Environment, Fisheries & Aquaculture Science in the United Kingdom.

"Alien vs. Predator": Non-native Fish Interactions With Native Fish Predators

African jewel cichlid

Many established non-native aquarium fish in Florida are relatively large-bodied (over 6 inches or so as adults). The one major exception is the African jewel cichlid, which grows to ~4 inches in total length and can be found across the state. Why does this fish succeed while no other exotics of its size seem to persist?

Behavior is an important determinant in whether species will become established when introduced into a novel environment. My research focuses on predator/prey interactions between native and non-native fish species, specifically how small-bodied, ornamental fish react to the presence of native largemouth bass and eastern mosquitofish. Does anti-predator behavior play a role in whether small, non-native, ornamental fish are likely to become established when introduced into a new environment?

Prior work in Dr. Hill's lab has established that largemouth bass and mosquitofish are effective predators of small fishes and may interact to have a greater effect than either predator alone. Interestingly, largemouth bass also eat mosquitofish, so there is intraguild predation, meaning that two species eat the same prey but one predator also eats the other. So, sometimes largemouth bass actually interfere with the effect of mosquitofish as predators. The effect of the two predators on each other and on their shared prey has a lot to do with the habitat as well as the behavior of the prey. My study uses video recordings of several ornamental species taken under different predator regimes to examine anti-predator behavior. These take place in a series of tanks that contain various combinations of largemouth bass, eastern mosquitofish and small ornamental fish. Over the course of several days, I periodically record their behavior and count the remaining (uneaten) fish, scoring any damage to their caudal fins due to harassment by mosquitofish. The purpose of this is to explore the possibility that predation might explain the lack of small-bodied, non-native fish found in peninsular Florida.

Fancy guppies (Poecilia reticulata), non-native aquarium fish

This article was written by Emily Haug, M.S. student in Fisheries and Aquatic Sciences (Jeff Hill, Advisor)

Volunteer Bulletin Board

Notice to all Florida LAKEWATCH active Samplers

Keep those samples flowing! Please be sure to deliver all frozen water and chlorophyll samples to your collection center as soon as possible. This will allow us to collect and process them in a timely manner. Thanks for you help!

From the Water Lab

Before finishing your lake monitoring duties, please check your data sheets and water bottles for accuracy. Be sure to double-check the stations locations and their numbers and remember that sampling stations should be consistent for each sampling event. In other words: Stations 1, 2 and 3 do not simply refer to the order in which you happen to collect water on a given day, but should instead refer to fixed GPS locations. Thanks you and keep up the good work!

No longer sampling?

If you are no longer able to monitor your lake, please let us know as soon as possible so that we can find a new volunteer to train and continue the work that you have started! It will also enable us to maintain consistent data if we can train someone before the next sampling date arrives.

Kit Roundup

If you are no longer able to sample and you have sampling materials that are in your way, collecting dust, let us help! Please give us a call and we'll make arrangements to pick up the materials so that we can revamp them and re-use them. Like everything else these days, the kits have become more expensive, so we need to be more diligent in collecting and re-circulating the unused materials. Thanks for your help!

Update Your Information

We are updating our records. If you are not a primary sampler but would like to remain on our mail list, please call 1-800-525-3928 so that we can update your information. We periodocially purge our mail list and remove any non-primary samplers from the mail list unless we hear from them.

Thank you,

The LAKEWATCH Crew

UF, Old Dominion launch project to restore sponges in barren parts of Florida Bay

GAINESVILLE, Fla. — Marine sponges may not look like apartment buildings, but to shrimps, juvenile lobsters and other animals in Florida Bay, the puffy filter-feeders provide one of the few safe places to live.

In 2007, harmful algae blooms killed sponges in large tracts of the shallow lagoon, where fresh water draining from the Everglades meets the Gulf of Mexico. University of Florida and Old Dominion University researchers are trying to restore the invertebrates by slicing up healthy sponges, then planting the cuttings in affected areas to grow and reproduce.

The results of the study will lay the groundwork for larger restoration efforts that would boost populations of economically important seafood species that depend on sponges, help the state's commercial sponge industry and improve water quality, said Don Behringer, a research assistant professor with UF's Institute of Food and Agricultural Sciences.

"Sponges don't get as much attention as other, more charismatic marine species," said Behringer, co-leader of the project. "But in hard-bottom habitats they dominate the biomass and are important to ecosystem health."

In Florida Bay, the seabed is a mixture of hard-bottom areas, sea grass meadows and almost featureless sand and mud areas. Within the hard-bottom, marine sponges, some of them several feet in diameter, are the dominant source of structure and shelter, he said. In parts of the bay the animals were so abundant prior to the algae blooms that they were estimated to filter all surrounding water every three days, straining out bacteria they consume as food.

The 2007 algae blooms impacted about 200 square miles of the 1,100-square-mile bay, wiping out nearly every sponge in some areas. Similar blooms may have occurred for at least a century, but hard evidence is lacking, Behringer said.

Armed with $157,000 in grants from The Nature Conservancy – National Oceanic and Atmospheric Administration Community-Based Restoration Program and Everglades National Park, the researchers will try to reintroduce sponges in the Everglades National Park and the Florida Keys National Marine Sanctuary areas of Florida Bay.

In this feasibility study, four species will be used: loggerhead and vase sponges, large species that provide habitat for sea animals; and glove and yellow sponges, important to Florida's commercial sponge fishing industry, said Mark Butler, a professor with ODU's biological sciences department and the project's other leader.

Two UF researchers inspect a marine sponge off Long Key (Thursday, Aug. 13, 2009).

Florida is one of the world's major marine sponge providers, producing 60,000 to 70,000 pounds annually.
Butler said the exact methods used for placing sponge cuttings are still being developed, but it's likely that small sections will be attached to weighted bases and placed on the sea floor. Then, for three years, researchers will assess the cuttings' survival, growth and reproduction.

The project came about partly because sponges are little-studied, Butler said. He has studied lobsters for 25 years and appreciates how sponges provide habitat for the crustaceans.

Another reason is that sponge populations spread slowly-larval sponges are free-swimming, but anchor after a few hours and spend the rest of their lives in one place.

Sponge die-offs are an emerging problem worldwide, said Joseph Pawlik, a professor with the University of North Carolina Wilmington's Center for Marine Science.

Scientists have only recently begun to understand the need for sponge restoration, Pawlik said. He called the restoration project important, particularly because loss of marine sponges may enhance harmful algae blooms.

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UF forms task force to address Apalachicola Bay oyster fishery collapse

GAINESVILLE, Fla. — Responding to the oyster fishery collapse in Apalachicola Bay, experts with the University of Florida's Institute of Food and Agricultural Sciences and Florida Sea Grant will join forces with local seafood producers to find ways of restoring sustainable populations of the area's world-famous oysters.

"We're extremely concerned and want to help however we can," said Jack Payne, UF's senior vice president for agriculture and natural resources. "An estimated 2,500 people work in Franklin County's oyster industry and businesses closely allied with it. Many of them are now wondering how to put food on the table."

In August, the Florida Department of Agriculture and Consumer Services issued a report with bleak projections for the 2012-13 oyster harvest.

When Florida's oyster season opened Sept. 1, Apalachicola Bay oystermen found few harvestable oysters. Since then, Gov. Rick Scott has requested federal aid for the community and reports of oyster declines have come in from Dixie, Levy and Wakulla counties.

In recent years, Apalachicola Bay has produced about 10 percent of the U.S. oyster supply, and accounted for 90 percent of Florida's harvest. The dockside value of Franklin County's 2011 oyster harvest was $6.6 million.
On September 14, Payne announced formation of the UF Oyster Recovery Task Force and named Karl Havens to lead it.

Havens is director of Florida Sea Grant.
The task force has multiple priorities, including: learning why oyster populations declined, finding ways to help them bounce back, and identifying solutions for social and economic impacts, Havens said.

Franklin County has long hosted UF/IFAS and Florida Sea Grant oyster and ecosystem research projects. It's home to a UF laboratory dedicated to post-harvest processing that safeguards raw oysters from Vibrio vulnificus bacteria, he said.

Karl Havens, director of Florida Sea Grant, will lead the University of Florida's Oyster Recovery Task Force.

Members of affected coastal communities and industry will be invited to participate in the task force in the coming weeks, he said.

"In order for this process to be effective, it must be a partnership between the affected communities and the experts at UF, because local knowledge is critical to getting to the bottom of what caused this problem and finding a practical solution," Havens said.

The task force includes UF experts on mollusk biology, aquaculture, commercial seafood processing, food and resource economics, water chemistry, environmental toxins, marine ecology, public health and more. Among them are Chuck Adams, Tom Frazer, Peter Frederick, Andrew Kane, Bill Mahan, Glenn Morris, Tom Obreza, Steve Otwell, Bill Pine, Leslie Sturmer, Craig Watson and Anita Wright.

Many of the UF faculty members involved also were part of a university-wide task force that addressed the 2010 Gulf oil spill. Havens said the challenges today are about as complex as those facing researchers two years ago.

"There are many factors we have to look at, particularly in terms of how we can help to ensure a lasting increase of the oyster populations," he said. "The good news is that UF has the unique expertise needed to address a multifaceted ecological issue of this magnitude."

The Apalachicola Bay system covers almost 210 square miles, neatly fenced off from the Gulf of Mexico by long, narrow islands. The Apalachicola River empties into the center of the bay, providing a steady influx of fresh water; it lowers the bay's salinity to a range oysters find agreeable.

Recent reduced flow in the Apalachicola River may play a role in oyster population declines, Havens said, but other causes have been suggested, including increased fishing pressure in recent years. In response to concerns raised by the communities, the task force initially will test for the presence of contaminants, pathogens and other factors affecting oyster growth and development, in order to narrow down the possible cause of the decline.
The task force is expected to officially begin work in late September but preliminary activities have already begun.

Currently, Havens is taking inventory of the expertise available at UF, and assigning faculty members to address topics of concern for producers, citizens, reporters and the public.

Florida Sea Grant expects to provide funding for rapid-response research in a number of areas. Additional funding for the task force will be provided by UF/IFAS, Payne said.

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Florida
LAKEWATCH

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"We are committed to seeing this project through and establishing stewardship practices to keep the

Apalachicola Bay oyster industry sustainable in years to come," he said. "Apalachicola oysters are an iconic symbol of real
Florida. It would be a tremendous loss if consumers were no longer able to enjoy them."

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This Cedar Key-area oyster bed is typical of Florida's Gulf Coast oyster habitat.