

Lee team tracks rampant algae Aquatic sleuths look for outbreaks' cause

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Photos by Valerie Roche/news-press.com
Justin McBride, left, and Chris Koepfer of the Lee County Division of Natural Resources collect specimens of red and green algae 60 feet below at Sherman's Reef, several miles west of Sanibel Island. The algae will be identified and sent to Harbor Branch Oceanographic Institution for further study.

Like subaquatic gardeners, Justin McBride and Chris Koepfer skimmed through the cold, greenish water recently, plucking red seaweed from the barge at Sherman's Reef 60 feet deep in the Gulf of Mexico.

Back aboard the Lee County Division of Natural Resources research vessel, McBride, a senior environmental specialist, held up a glob of red alga and declared: "This is pure evil."

Actually, nothing is inherently evil about the alga in question. It and other algae are a natural part of the Gulf ecosystem, but over the past year, massive algal blooms have covered the county's artificial reefs and washed up on beaches to form dense, stinking mats that can stretch for miles.

To determine what causes the algal blooms, county scientists are collecting algae samples from 10 artificial reef sites over the next two years and sending them to macroalga expert Brian Lapointe of Harbor Branch Oceanographic Institution in Fort Pierce.

The Florida Legislature appropriated \$650,000 for the project.

The trouble with algae

While many algal species are native to Lee County's Gulf waters, of particular concern are red drift algae, also known as rhodophytes.

These algae should not be confused with red tide: Rhodophytes are macroalgae, which means they can be seen with the unaided eye.

Red tide is caused by a microalga — visible only through a microscope — that produces a powerful toxin.

While macroalgae are natural, some scientists say the Gulf of Lee County is undergoing unusually large and long-lasting algal blooms that are caused by excess nutrients, particularly nitrogen and phosphorus, flowing into the waterways from shore.

"It seems as though nutrient concentrations on the Lee County coast are reaching a tipping point at which we begin to see massive blooms of red algae," Lapointe said.

"These are native species of seaweed, capable of exponential growth, doubling in biomass in a few days when conditions are right — warm water temperatures, high light and concentrations of nutrients."



Detail of a red macroalgae growing 60 feet below on Sherman's Reef, several miles west of Sanibel Island in the Gulf of Mexico. These algae differ from red tide, which is a microscopic organism.

These large blooms can completely cover a habitat — artificial reef or natural ledge — making it unsuitable for fish and invertebrates.

When the algae die or are torn from the habitat by storms, they drift to shore and foul beaches. This year's macroalgal blooms — of several species — have been particularly bad in Lee County.

A green alga called *Enteromorpha* smothered hundreds of acres of seagrass in southern Pine Island Sound in January and showed up in the northern part of the bay the following month.

In April, Division of Natural Resources divers found reefs coated with a green, filamentous alga called *Cladophora*.

"It was huge, from the shoreline out to 60 feet of water," Koepfer said. "It was on reefs, in the water column, everywhere. I hope we don't see it again. It's nasty. You come out of the water, and you're covered with it."

By late spring, other algae species moved in — and stayed through the summer and into the fall.

"The reefs were algal reefs," Koepfer said. "It's started to die back as the water cools, but it's still there. It's possible it will come back in the spring if we have clear water: The nutrients are still here in the sediments."

Nutrients

Nutrients are the key: Algae need nutrients to grow, and under normal nutrient levels, macroalgae appear in normal amounts; when nutrient levels are higher than normal, algae populations can explode.

The question: Where are the extra nutrients coming from? That's where Lapointe comes in.

Lapointe did his doctoral dissertation at the University of South Florida on the effects of light, temperature and nutrients on macroalgal growth rates and has studied the effect of increasing nutrients on algae at Looe Key since 1983.

"We've documented more than a 100 percent increase in concentrations of nitrogen and phosphorus in the water from the 1980s to the '90s," Lapointe said. "We plot the nutrient concentration versus the algal growth rate. Coral disease went up, and macroalgae went up."

"We believe the reef has become saturated with nutrients with respect to macroalgal growth. That's good for macroalgae but bad for corals."

Since 2001, Lapointe has also studied the effect of nutrients on a non-native alga, *Caulerpa brachypus*, which has become a major problem, covering sponges and corals on the east coast and forcing fish and lobsters from large areas of reef habitat.

Lapointe's work on the east coast attracted the attention of state marine scientists.

"We said, 'Gee, it would be interesting for you to continue that work on the west coast and address some of the problems they've had,'" said Bill Richardson, a research associate at the Florida Fish and Wildlife Research Institute. "The information he's collecting will be critical to improving the basic understanding of what makes these blooms develop and what maintains them. And it could play into future attempts to control them."

The first step is collecting algae: County divers are taking samples during different times of the year and from sites as close to shore as four miles in 30 feet of water and as far as 28 miles out in 90 feet of water.

In the lab

Then Lapointe's Harbor Branch team takes over.

One part of the process is determining the carbon-to-nitrogen ratio, carbon-to-phosphorus ratio and nitrogen-to-phosphorus ratio in the samples.

Shifts in the ratios can indicate the origin of the nutrients that feed the algae.

A drop in carbon-to-nitrogen ratios — that is, if carbon content in algae tissues goes down while nitrogen content goes up — during the wet season, for example, would suggest that nutrients are flowing into the system as water runs off the land after rain storms.

Algal blooms would be linked to human activities — fertilizers from agriculture areas, lawns and golf courses are a major source of nutrients. Nitrogen and phosphorus ratios will also show which of the nutrients algae prefer.

“If you don’t know that, and you try to control nutrients entering the system, you can shoot yourself in the foot by removing the wrong nutrient,” Lapointe said. “Then the priority nutrient goes in and makes the situation worse. You have to understand the nutrition of algal blooms.”

Lapointe will also look at nitrogen isotope ratios in the algal samples.

Isotopes are two or more forms of the same element with the same number of protons and different numbers of neutrons — more than 99 percent of natural nitrogen, known as nitrogen-14 or N-14, has seven neutrons; the isotope nitrogen-15, or N-15, has eight.

By determining the ratio of N-14 to N-15 in algal tissues, the Harbor Branch team can determine the source of the nutrient.

A high ratio of N-15 to N-14 would indicate that the nutrient source was pollution rather than natural nitrogen because pollution, such as sewage, has a higher percentage of N-15 than seawater.

Moderating blooms



Justin McBride, left, and Chris Koepfer of the Lee County Division of Natural Resources read information from an instrument that indicates water samples’ quality — specifically salinity — percentage of dissolved oxygen and pH.

Much has been said and written over the past year about macroalgal and microalgal blooms in Lee County’s inshore and offshore waters.

Some people insist the whole problem is nutrient-rich freshwater releases from Lake Okeechobee down the Caloosahatchee River.

Lapointe will make no declarations until he has finished the science. Ultimately, knowledge of algal nutrient sources can lead to better water management.

If treated sewage discharges turn out to be an important nutrient source for algal blooms, then water managers and local governments can take steps to improve sewage treatment and disposal.

If it’s agricultural pollution, either flowing into the Caloosahatchee from Lake Okeechobee or from downstream, then managers can address use of agricultural fertilizers.

“Obviously, we’re not going to eliminate the problem, but we can certainly moderate the problem,” Lapointe said. “What we’re talking about is moderating nutrient loads to return the system to the state it was in years ago when it supported a healthy fishery and recreation.

“But you can’t just sit there and wave your arms. You’ve got to have rigorous scientific facts behind you.”