

Red tide may be 'natural' but scientists believe coastal pollution is making it worse

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Vince Lovko, a phytoplankton ecologist at Mote Marine Lab, crisscrossed the waters off Longboat Key in his lab's Yellowfin fishing boat with a crew of researchers, sampling sea water from a red tide that has slushed around Southwest Florida for nearly a year and littered beaches with dead manatees, sea turtles and rotting marine life.

Every few yards, dead herring, grass eels and pinfish floated by, peppering the [water](#) like a toxic stew. The water, cloudy and yellowish, looked like it was flushed from a toilet.

Lovko is part of a team tracking the tide and trying to fine-tune widely circulated satellite maps that show much of the state's Gulf coast glowing bright red with toxic tide. But as Florida's summer of slime winds into fall, scientists like Lovko have also found themselves caught in an uncomfortable position: trying to referee a complicated and contentious political fight amid a heated election year where their research is getting twisted by competing interests—and sometimes leaving the public confused.

Just after Lake Okeechobee exploded with a massive blue-green algae bloom and water managers began flushing it to the coast, the [red tide](#) that started months earlier deepened, with the worst of the fish kills appearing in coastal waters fed by the vast lake's western relief outlet, the Caloosahatchee River.

The agriculture industry and some state regulators pushed back on any

connection, calling red tide "naturally occurring." That's true. Outbreaks have been reported for centuries.

But a federal study going back more than a decade concluded man-made pollution worsens red tide. That makes the lake, laced with high levels of the fertilizer nutrients phosphorus and nitrogen, a likely source. What's not clear, since the same nutrients get flushed from the coast, is whether it's definitely a source.

"That's some of the work that still needs to be done to conclusively answer, or at least somewhat conclusively answer," Lovko said.

One reason for that continuing uncertainty: Despite decades of recurring problems, the state has focused mostly on tracking red tides once they arrive, not on the pollution that's driving them. Over the last decade, the state gutted water quality monitoring that might help scientists understand red tide dynamics while shrinking agencies that investigate water and regulate pollution. Even those satellite maps Lovko is working on contain a fair amount of inaccuracy when toxic waters wash ashore.

"We think we understand this but we're flying blind," said University of South Florida oceanographer Bob Weisberg, echoing the frustration felt by University of Florida blue-green algae expert Karl Havens last month. "We've never been able to get the state of Florida to commit and it's further hampering our ability to predict red tide."

Too much money gets spent on bureaucracy, he said, and too little on actual investigation.

"That's been the problem in Florida as long as I've lived here," said Weisberg, whose lab issues annual red tide forecasts. "It's all political."

That's because some of the state's biggest political players have also been

blamed for some of its worst pollution.

U.S. Sugar issued a press release last month insisting lake water had nothing to do with the red tide.

"The Florida Fish and Wildlife Conservation Commission(FWC) states in its frequently asked questions that red tide is not caused by nutrient pollution (urban or agricultural) and additionally, is not made worse by it, either," the release said. It also quoted Mote scientists from a Palm Beach Post story saying lake water did not "initiate" the tide.

In fact, FWC's web page clearly states that once red tides near shore, "they are capable of using man-made nutrients for their growth." And two days later, Mote environmental engineer Tracy Fanara tweeted a clarification saying lake releases could help sustain a bloom.

"If you have a (freshwater) cyanobacteria bloom, you know you have excess nutrients but (the cyanobacteria) might be lessening it as it gets out," she said. "But it's still a sign. That's an environmental ecological response to high nutrients."

Scientists widely agree red tide, made up of *Karenia brevis* algae, gets seeded offshore at the bottom of the Florida shelf, then carried inshore by bottom currents. As the algae gets close to coastal waters polluted by a host of sources, from farm and lawn fertilizer to leaky septic tanks, it can grow more intensely and create toxic blooms.

"Once it's blooming, it does require nutrients to sustain a bloom," Weisberg said. Rotting fish can help feed it, but algae can also use nutrients flowing off land, he said. "So the lake run-off will not cause the red tide, but it can help sustain a red tide."

After a 2005 red tide exploded and persisted for 17 months, spreading

fish kills across three states including Florida, the National Oceanic and Atmospheric Administration launched a six-year research project. Researchers concluded the sources of nutrients that feed red tides are "multiple, diverse and complex," and included run-offs from estuaries like the one fed by the Caloosahatchee.

What's not well understood is why and how much those coastal nutrients influence outbreaks, Weisberg said.

In a 2007 study, Larry Brand, a University of Miami Rosenstiel School of Marine and Atmospheric Science phytoplankton ecologist argued that increasing pollution has worsened red tide.

"It's a natural thing. You can go back 500 years. What I argue is that it's much worse today and that's the result of human-generated nutrients," he said. "Obviously, it's political. There's no one source and obviously some sources are more important than others."

But Lovko, the Mote ecologist, isn't convinced and said Brand reached his conclusion based on records that included inconsistent sampling.

"One of the things we don't know because there's not measurements, or sufficient measurements of it, is how much, for example, nutrients flowing through the Caloosahatchee from Lake Okeechobee actually make it out to the coastal system," he said. "It's easy to make the assumption. ... That's what the public has been assuming. But we can't. That's not how science works."

But in his study, Brand said he accounted for differences in sampling methods and potential increase in monitoring that might skew numbers. And he still found that between 1954 and 1963 and 1994 and 2002, algae amounts increased by 13 to 18 times.

What's not well understood, Brand said, is why red tide explodes some years and not other years, and whether other species of phytoplankton are beating the red tide to the nutrient soup.

Ocean water is filled with a host of phytoplankton that can consume nutrients and battle each other for dominance. *Karenia brevis*, named for retired algae expert Karen Steidinger who spearheaded research at the state's St. Petersburg marine lab, exists throughout Gulf waters, not just on the bottom offshore. Scientists routinely find it at background concentrations near shore in years where there are no fish kills.

"We don't have a good understanding of what exactly is controlling the outcome of that competition, so that explains the year to year variability," Brand said. "There's no consensus at this point."

But understanding why is not what the state of Florida is paying Mote to do.

"What we're funded to do is monitor. We're not funded to answer specific questions," Fanara said.

Lovko says there are also unanswered questions about the relationship between offshore and inshore populations of red tide phytoplankton.

"What we don't know is how the offshore population is any different, the supposed seed population that initiates and starts moving toward shore as opposed to the cells we already have increasing," he said.

Which is exactly the kind of information could help Weisberg, who bases his yearly forecast on the pattern of currents that carry algae ashore. When the Gulf's shifting Loop Current crosses the West Florida Shelf, it pushes nutrients from the deeper bottom onto the shelf to fuel the *Karenia* algae, he said.

"What is terribly missing is the ability to go offshore on a regular basis where we believe the red tide forms and sample the organism itself as well as the nutrients," he said.

There are other knowledge gaps.

Scientists use satellite imagery that looks at surface water to monitor the density of red tide, but images tend to be less precise the closer they get to shore, where information is most needed. Near shore, tannins from mangroves and shoreline vegetation and other organic molecules can interfere, Lovko. And it only works on sunny days.

This year's red tide first appeared in October off Sarasota. In June, it deepened. Massive fish kills began littering beaches and clogging canals with bait fish and larger marine life, including sea turtles, dolphins, manatees and even a whale shark.

The turn for the worse followed record-breaking rain that prompted the U.S. Army Corps of Engineers to begin flushing water from the lake, already filled with blue green algae, down the Caloosahatchee River. Water from sugar fields on the east side of the lake was also allowed to backflow into the lake from swelling canals, enough to cover about 48-square miles with a foot of water. The tides also coincided with a wave of Saharan dust, another source of nutrients for different algae that can feed red tide.

"Last year we had a bloom and it never fully went away," Weisberg said. "What's happening this year is the confluence of two things: residual cells from last year and new cells coming to the coast from the middle of the Continental Shelf where conditions were conducive to bloom development."

Beyond polluted runoff from yards, farms, ranches and even phosphate

mines, researchers are examining other suspects that could have helped feed the latest bloom.

- One notion is that Saharan dust, the same wind-borne material that can dry out potential tropical storms, could play a role. Researchers say the iron-rich dust can feed *Trichodesmium*, a saltwater cyanobacteria that pulls nitrogen from the air allowing it to grow in water with few nutrients. When African dust is heavy, it can fuel *Trichodesmium*, which can then become food for red tide algae both offshore and inshore.

The problem is the theory has never been tested, said Joe Prospero, a professor emeritus at the University of Miami's Rosenstiel School of Marine and Atmospheric Science who is nicknamed the "father of dust."

"We have these various pieces and there have been measurements of iron, and it's been modeled. But in real life there's been no close study," said Prospero, who was among the first scientists to recognize the global impacts of African dust. "It's just based on the fact that we have seasonally measured dust here in Miami. But no one has gone, to my knowledge, to the west coast of Florida and actually seen if there's a response and an increase of iron in water.—Some scientists also believe that hurricanes, like Irma, may have an influence. In addition to dumping heavy rain and washing nutrients off land, a hurricane, especially one as large as Irma, can move huge amounts of water around the Gulf. As Irma headed up the Gulf coast for a second landfall on Marco Island, it sucked water off the southwest coast, said Rosenstiel oceanographer Nick Shay. When water flowed back ashore, it came from the bottom layers where *Karenia brevis* thrive.

"We have to understand not only the surface currents, but the bottom currents," he said. "When we start piecing this together, maybe the whole Irma thing was a preconditioning state."

Deepwater oscillations generated by hurricanes can also continue for a prolonged period and potentially push more algae toward the coast, he said.

"So while the surface layer may be back to normal, what's happening in the deeper layers can last a month or more," he said.

Whether the lake releases worsen red tide or not, scientists stress that the damaging blue green algae blooms fouling inshore waters alone argue for an overhaul of water quality research and standards and the solutions to each may be different.

"You take red tide out of that picture completely and it doesn't in any way lessen the compelling argument for reducing (pollution) in Lake Okeechobee," Lovko said. "That's something that needs to happen."

Scientists instead say more research needs to be directed at finding causes and not just monitoring. Since this year's red [tide](#) evolved into a full-scale crisis damaging businesses and drawing national headlines, Scott has declared a state of emergency and ordered \$6 million spent to help with clean-up and tourism. But Weisberg worries that's just election-year grandstanding.

"I've been very successful at making people mad at me, but at some point how do you make a change? It's politics. Mote got a bunch of money. Why? Because they're plugged in," he said. "Unless we get more in-depth reporting on serious problems, we're never going to make a change."

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