



Unraveling the mystery of *Karenia brevis*

By Andy Lindstrom

Through the lens of a high-powered microscope, Karen Steidinger of the Florida Fish and Wildlife Conservation Commission stares down at her nemesis of the past 43 years. *Karenia brevis*, as a Danish colleague renamed this plantlike speck of algae in tribute to Steidinger's groundbreaking contributions toward unraveling the mysteries of its cloverleaf-shaped body, twin tails and – under normal circumstances – laid-back lifestyle in the warm Gulf waters off western Florida.

But every now and then something peculiar seems to come over these single-celled swimmers from the family of awesomely ancient organisms known as dinoflagellates. In an offshore ritual that marine scientists like Steidinger still don't fully understand, the otherwise benign – some say even beneficial – relatives of seaweeds and pond scum raft together in what are known as “harmful algal blooms” (HABs) that turn the

water brownish red, kill massive numbers of fish and other marine life, contaminate shellfish and can even be fatal to some humans.

Red tide it is called. Like something out of an Edgar Allan Poe horror story, billions of the *K. brevis* cells periodically join forces on the ocean floor before rising to blanket everything in their path with an overdose of deadly chemical toxins. Washing along the Florida Coast at the whim of weather and currents, they spread in their wake an aquatic nightmare of rotting fish and stinging gas.

It's a sea-spawned phenomenon of highly complex origins that costs Florida's waterfront economy an estimated \$50 million each year. And a baffling puzzle to predict or control that Steidinger, now back in the lab after a 2003 retirement from nearly four decades at the former Florida Marine Research Institute in St. Petersburg, hopes yet to solve.

“I came back because there is still so much to learn,” she told a St. Petersburg Times reporter of her long-time foe. “Basically, we know it is born at sea. Then something happens to fertilize it. As it moves toward shore, the dead fish fertilize it even more. Then it's over.”

Still spending up to 60 hours a week in her quest for answers, Steidinger at 68 now works on special contract for the University of South Florida's Florida Institute of Oceanography. Born in New York, she came to St. Pete from Connecticut in 1963 and shortly afterward took a technician's job at the marine research institute studying pink shrimp and red tide while earning her doctorate in biology at USF.

At the time, she said, scientists were all too familiar with the organism that caused Florida's brand of red tide (more than 70 toxic dinoflagellates contaminate marine life from

Scandinavia to Japan, the Caribbean and South Pacific as well as the United States). They also had a pretty good handle on its capacity for killing fish and stinking up the water.

Beyond that, little if anything, was known about the niche that *K. brevis* filled in nature's master plan, the various stages of its Jekyll-and-Hyde life, or exactly what triggered its evil outbursts. Steidinger's numerous studies – both singly and in collaboration with other marine scientists – have filled in many, but far from all, of those gaps. They also have made her a world authority in dinoflagellate research.

Officials from more than 18 countries have come to her for advice on dealing with red tide. At least 70 papers on the subject bear her name. She leads highly regarded international conferences and mentoring programs, teaches classes in identifying the culprit algae, works with others to map and animate their movement patterns and promotes further research through more than \$10 million in federal grants she's raised over the years.

Not long ago, the now-Florida Fish and Wildlife Research Institute's new auditorium (for which she also helped find the money) was named the "Karen A. Steidinger Auditorium" in recognition of her leadership and achievements. She takes a more modest view.

"I honestly feel I haven't left enough because I haven't left anything tangible," she said with characteristic understatement at the time of her retirement. Others in her field would be quick to take a different view.

Among her notable accomplishments, Steidinger co-wrote the first published life cycle of a related dinoflagellate. Still working to complete a similar description of *K. brevis*, she hopes to prove a theory of hers that the sexual stages of that cycle play a

major role in the onset of red tide. Such information, she said, might lead to more accurate predictions of when and where harmful blooms could break out.

Intangibles, perhaps. But in large part because of her work collecting countless water samples and other data, collating and classifying the results, as well as encouraging and developing cooperative programs throughout the Southeast and abroad, Steidinger has come to be known as "the mother of red tide research."

Scientists now know the blooms typically begin in the Gulf about 40 to 80 miles offshore and drift southeast toward Tampa Bay. Their toxins kill not only fish but marine mammals as big as manatees, dolphins and whales. Shellfish don't seem to show any ill effects at all, but humans who eat them often come down with symptoms such as wheezing, sneezing and tingling lips. In rare cases, it can be fatal.

And the search continues for better answers to a Florida scourge whose origins can be traced back at least 500 years to reports from the earliest Spanish explorers. The role of global warming in prompting the formation of red tides, Steidinger considered, is still under study. So too are such variables as water temperature, man-made pollution and other possible causes. Some scientists say *K. brevis* plays an important role in photosynthesis, the conversion of sunlight to chemical energy and a key component to life on earth. Steidinger remains more concerned with its dark side.

"I've got to finish the life cycle of *brevis*," she said. "I think that's where we'll find our answers."

And then what will the mother of red tide research do?

"After I finish my science projects, then I will write children's books," Steidinger said. "Or at least attempt to. If I do write them, they will be about nature, animals and lessons learned." **FW**

FWC awarded \$4.73 million for study of Florida red tide

The FWC's Fish and Wildlife Research Institute (FWRI) has been awarded a five-year, \$4.73 million grant to conduct research on nutrients and Florida's red tide from the National Oceanic and Atmospheric Administration (NOAA).

The grant from NOAA's Ecology and Oceanography of Harmful Algal Blooms (ECO HAB) program will enable scientists to explore the causes of red tide and determine how different nutrients sources affect all stages of blooms. The NOAA grant will supplement funds committed by the State of Florida for red tide research and monitoring, and will enable the purchase of cutting-edge technologies.

The Florida red tide organism, *Karenia brevis*, is a naturally occurring microscopic alga that produces

a toxin that can kill marine life and affect people. Red tide has been documented along the coast of Florida since the 1840s. Fish kills around Tampa Bay, mentioned in the logs of Spanish explorers, were likely due to red tides.



FWRI, the research arm of FWC, has studied Florida's red tide since 1955. The institute coordinates a year-round statewide comprehensive red tide monitoring program and produces weekly, statewide updates on bloom conditions. Researchers also study the causes

of red tide and its effects on Florida's fish and wildlife resources.

To learn more about FWRI's red tide research program, visit research.MyFWC.com/redtide. For information on NOAA's ECO HAB program, visit www.noaa.gov.