

What is Florida's red tide?

Florida's red tide is a dense concentration ("bloom") of a single-celled, plant-like marine organism that measures 1/1000 inch and produces toxins. In great numbers, it can make the seawater appear reddish-brown or even green and can kill fish, which wash ashore and litter beaches. Red tide is one type of what is now called harmful algal blooms.

What causes red tide?

The Florida red tide is caused by a dinoflagellate called *Karenia brevis* (*K. brevis*). It has also been known as *Gymnodinium breve* and *Ptychodiscus brevis*. Because of its plant-like nature, *K. brevis* responds to various environmental factors such as light, temperature, salinity, and nutrients. These factors, along with winds, tides, and currents, determine how and where a bloom develops. Offshore, *K. brevis* blooms as a normal part of its growth cycle. Similar harmful microalgae cause other types of blooms worldwide. Each species can produce a different group of toxins; some species share common effects, such as fish kills.

When and where do Florida red tides occur?

Red tide outbreaks are most common in late summer and fall, but they have been reported in every month of the year. Red tides begin in the Gulf of Mexico 10 to 40 miles off central and southwest Florida. When large numbers of *K. brevis* are concentrated, they can be transported inshore or alongshore by winds and currents. *Karenia brevis* occurs only in the Gulf of Mexico, along the southeastern U.S. coast, and in parts of the Caribbean.

- For current Florida red tide information, call 1-866-300-9399 (toll-free inside Florida only).

Are humans affected by red tide?

Red tides that move inshore may cause stress to individuals and coastal communities in several ways. Beached dead fish create offensive odors and health hazards. Removing or burying dead fish is costly. People on beaches may suffer temporary respiratory irritation from exposure to red tide particles and toxins in sea spray (carried by winds). Wearing a surgical mask can filter out these particles. Moving away from the beach to an enclosed, air-conditioned area will also provide relief. Symptoms are temporary and typically disappear within a few hours after exposure

is discontinued, although some individuals report having symptoms for several days. People who suffer from severe or chronic respiratory illnesses should avoid beach areas when red tide is present. For more information about red tide's effects on humans, contact the Florida Department of Health (www.doh.state.fl.us).

Filter-feeding shellfish such as oysters and clams can accumulate high concentrations of red tide toxins when *K. brevis* is present. Illness could result if shellfish are consumed during or shortly after a red tide bloom. Therefore, local shellfish are banned from human consumption when a red tide bloom is present. Shellfish can remain toxic up to eight weeks after a red tide bloom has left the area, occasionally longer, depending upon the extent of exposure to the red tide organisms.

Fish caught recreationally and commercially in areas affected by red tide are safe to eat if the fish behave normally (fight the hook) when caught and only the white (filet) meat is eaten. *Karenia brevis* red tides do not affect the quality of seafood, including shellfish sold in Florida markets and restaurants because this seafood is regulated and inspected.

Questions concerning local shellfish harvesting during red tides may be answered by the Florida Department of Agriculture and Consumer Services (1-850-488-5471 or www.floridaaquaculture.com).

Are all marine animals killed in a red tide?

Slow-moving or bottom-dwelling fish offshore are usually the first to die in a red tide. However, nearly all fishes are susceptible, depending on the density of the bloom, the length and mode of exposure, and other factors. *Karenia brevis* produces nerve toxins that paralyze the fish's gills and cause its death from respiratory failure. Red tide toxins are thought to affect invertebrate animals such as crabs, shrimp, and lobsters, but to what extent is unknown. Dolphins and manatees can suffer the effects of red tide. During the particularly severe red tide bloom in 2005, there was an animal die-off, which included manatees, sea turtles, and dolphins, along the southwest Florida coast. Cormorants and other marine birds have also been victims of red tide.

Could nutrient or other pollution be a trigger for red tide?

As early as the 1500s, Spanish explorers recorded extensive fish kills in the Gulf of Mexico. In 1844, U.S. government coastal-survey teams documented fish

kills and discolored water. These examples predate coastal nutrient pollution and the widespread use of fertilizers. Florida red tide originates offshore, and field studies show an association with oceanic and meteorological events. Excess nutrients added to the water could, however, affect the duration and intensity of a bloom inshore.

How are red tides predicted and tracked?

Several methods for predicting and tracking red tides are being pursued:

- Computer forecasting models, like a weather model, are being developed to predict the movement and landfall of red tides. Some of the models require satellite detection of surface water with intense ocean color (indicating high chlorophyll concentrations). The suspected red tide must be confirmed as *K. brevis* by sampling the water because there are other blooms that are not red tide and are not a risk. Florida Fish and Wildlife Conservation Commission's (FWC) Fish and Wildlife Research Institute (FWRI) maintains a volunteer network of charter-boat captains and anglers who provide water samples for analyses to determine whether *K. brevis* cell concentrations are increasing offshore.
- Genetic and optical technologies are also being fitted to buoys, gliders, and other platforms to detect *K. brevis*.

Can red tides be eliminated?

The subject of eliminating red tide is controversial. Many scientists agree that totally eradicating Florida red tide is not feasible because of the following factors:

- **Area and volume**—A red tide bloom can cover hundreds, even thousands, of square miles and may be transported great distances along the coast. Red tides have traveled from Florida's west coast through the Florida Straits, then northward, resulting in localized blooms as far as North Carolina. As in several previous years, in the winter of 2002–2003, there were three concurrent blooms in Florida's waters—along the northwest, southwest, and east coasts.
- **The role of red tides in the marine ecosystem**—The function of red tide in the marine ecosystem is not fully understood. Although a bloom may cause massive fish kills, anglers report that shrimp and crab catches can be greater following a red tide. As a natural phenomenon, red tides may act the way forest fires do on land, by "cleansing" the ecosystem.

Can red tide be controlled?

FWRI is administering a competitive grant program that accepts proposals to explore environmentally acceptable techniques or technologies for potential control or mitigation of red tides and their effects in Florida. Topics that are eligible for funding include mechanical, chemical, physical, biological, genetic, and environmental efforts to reduce or contain a red tide bloom or its toxicity; public education and outreach; strategies for reducing impacts on human health, wildlife, natural resources, and coastal economies; and tools for more efficient cost-effective monitoring.

Proposals are evaluated by an independent panel consisting of representatives from various government and non-government agencies. For more information, visit <http://research.MyFWC.com/redtide>.

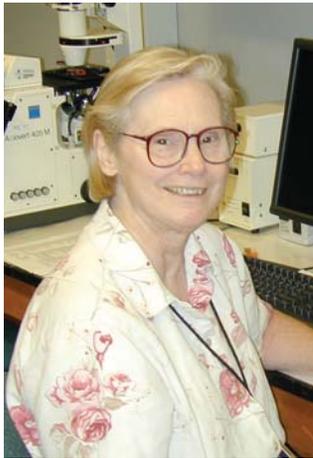
What is FWRI's role in red tide monitoring, response, and research?

Since the 1960s, Florida has become a world leader in red tide research. Scientists at FWRI have greatly contributed to the current understanding of the biology and ecology of red tide organisms. FWRI red tide activities are based on monitoring, response, and research. Monitoring is accomplished by a network of volunteers as well as FWC and other state or local agency personnel. Sampling extends from offshore locations to along Florida's coastline. FWRI research includes the following goals:

- interpreting *K. brevis* distribution patterns and development of bloom stages, pinpointing the fate and effects of its toxins in the environment;
- developing new detection technologies; and
- determining the role of nutrients in blooms.

FWRI cooperates with many other scientists and institutions studying red tides. Just as people constantly strive to cope with other natural disturbances, our expanding knowledge of red tide will eventually allow us to develop the techniques to deal successfully with the problems resulting from this natural event.

When an active red tide has been identified in Florida's waters, information on location and intensity can be found on FWRI's Web site at <http://research.MyFWC.com>.



Dr. Karen A. Steidinger

Florida's red tide organism, formerly known as *Gymnodinium breve* and *Ptychodiscus brevis*, was given a new name in 2000. The scientific community accepted a proposal to change the name of the dinoflagellate to *Karenia brevis* in honor of Dr. Karen A. Steidinger (pictured left). She is an internationally respected scientist who has dedicated part of her career to the study of dinoflagellates and harmful algae. Dr. Steidinger was a staff member of the Fish and Wildlife Conservation Commission's Fish and Wildlife Research Institute from 1964 to 2003 and was Chief of Marine Research for 13 years. She is currently a Harmful Algae Specialist.

ON THE COVER

Background—Red tide off Pinellas County, summer 2005. Dark area represents *K. brevis* bloom.

Inset—*Karenia brevis*, magnified 1,400 times.

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