CHARLES H. BRONSON, COMMISSIONER OF AGRICULTURE
FLORIDA DEPARTMENT OF AGRICULTURE AND CONSUMER SERVICES

Red Tide

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Red Tide Facts

- Can occur anywhere in the Gulf and South Atlantic.
- Composed of 40 species of naturally occurring marine microalgae.
- Common in the late summer and early fall.
- Can kill fish, birds, marine mammals and shellfish.
- Source of Neurotoxic Shellfish Poisoning.

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Red Tide: Monitoring the Bay

Apalachicola Bay was closed by the Department on October 16th for shellfish harvesting due to the presence of red tide. Since that day red tide has been detected in Indian Lagoon and St. Joseph Bay. Those areas have also been closed to shellfish harvesting.

The Department was contacted by the Florida Marine Research Institute when they identified, by satellite, a red tide threatening the Bay. The Department began a water sampling program near the inlets to the harvesting areas. When the number of red tide organisms exceeded approximately 5,000 per quart, the Bay was closed as required by the Interstate Shellfish Sanitation Conference, National Shellfish Sanitation Program.

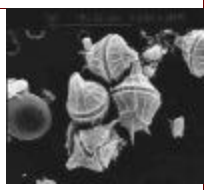
During the closure the Department continued to collect water samples, twice a week, near the inlets. When the cell count fell below approximately 1,000 per quart the Department began collecting oysters in the harvest areas. The oysters were sent to the Florida Marine Research Institute for a bioassay. This test indicates the amount and strength of toxin concentrated in the oyster meats.

The bioassay results continue to prove that oysters harvested from the closed areas pose a threat to human health. As soon as the bioassay results show shellfish are free of toxin , the Bay and other closed areas will be opened.

Red Tide: A New Phenomenon in Apalachicola Bay

Red tide is not a common occurrence in North Florida waters; however, it is common to the central and southwest Gulf Coast (Charlotte Harbor has been closed since August). The Department has limited details on red tide outbreaks prior to 1995 when red tide closed Apalachicola Bay for 59 days from August 22 to October 21. Since 1995 the Bay has been closed two more times. In 1996, the Bay was closed from June 4 to July 9 and, as a precautionary action, the Bay was closed for four days in 1999 when red tide was detected outside Indian Pass. Since the last closure, the Department has detected red tide several times in offshore waters; however, cell counts did not exceed approximately 5,000 per quart near the inlets.

Red Tide: What is it?



Red tides are harmful algal blooms (HABs) that occur when toxic microscopic algae in seawater proliferate to higher-than-normal concentrations (bloom), often discoloring the water red, brown, green, or yellow. More than 40 species of toxic microalgae live in the Gulf of Mexico. The most common, the Florida red tide organism, is the toxic dinoflagellate *Karenia brevis*. The Florida red tide organism was identified in 1947, but anecdotal reports of red tide effects in the Gulf of Mexico date back to the 1530s. Florida red tides

(Continued on page two)

Red Tide: Where it comes from

Prior to the early 1970s, Florida red tides were believed to originate inshore because discolored water, fish kills, and respiratory irritation were most often observed around passes and barrier islands. However, later review of the historical data compiled from research cruises showed that Florida red tides begin, instead, in nutrient-poor water 10 to 45 miles offshore. Resting populations of *Karenia brevis* are believed to exist in the water column or sediments in specific areas on the west Florida continental shelf.

Blooms develop in four stages. The initiation stage occurs when a *Karenia brevis* population is introduced into an area. The second stage is growth, during which the population steadily increases.

Within a few weeks, *K. brevis* concentrations may be high enough to kill fish. The third stage is maintenance, during which the bloom may be maintained in a circulation feature offshore or moved inshore by wind and currents. If the bloom moves inshore, increased nutrient levels there allow the cells to multiply and physical factors like currents may concentrate the bloom even further. A bloom may linger in coastal areas for days, weeks, or even months. The fourth stage is dissipation/termination. Mechanisms that contribute to this stage, such as winds and currents, may disperse the cells, introduce new water masses, or move the bloom to a different area.

Red Tide: What is it?

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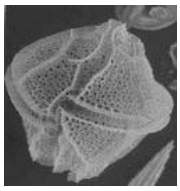
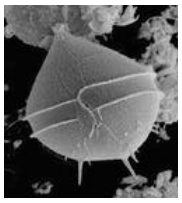
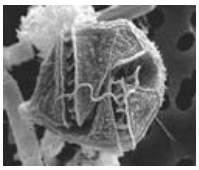


bloom in the Gulf of Mexico almost every year, generally in the late summer or early fall. They are most common off the central and southwest coasts of Florida between Clearwater and Sanibel Island, but they may occur anywhere in the Gulf. They also occur, but are

less common, along the southeastern Atlantic Coast as far north as North Carolina. Most blooms last three to five months and may affect hundreds of square miles. Occasionally, blooms continue sporadically for 18 months and may affect thousands of square miles. Red tides can kill fish, birds, and marine mammals, cause health problems for humans, and adversely affect local economies. Pictured in this article are some of the microalgae associated with red tide.

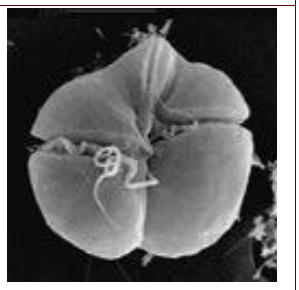




A Culprit: *Karenia brevis*

Karenia brevis is a common, unarmored, photosynthetic dinoflagellate found year-round throughout the Gulf of Mexico at concentrations of approximately 1,000 per quart or less. Each cell is typically .0008 to .002 inches long, .0004 to .0006 inches deep, and slightly wider than long. It has two whip-like appendages, or flagella, that propel and direct it through the water at a speed of three feet per hour. The cell contains a nucleus, numerous chloroplasts, and other organelles. In Florida waters, *K. brevis* thrives in high-salinity areas, but it can tolerate a wide salinity range. It survives most temperatures common to the Gulf of Mexico. The species is able to out compete or exclude other phytoplankton and forms blooms entirely composed of *K. brevis*.

Karenia brevis



Red Tide: Toxic impact

Red tide fish kill

Karenia brevis produces brevetoxins that are capable of killing fish, birds, and other marine animals. Brevetoxins may also cause health problems in humans. The toxins accumulate in shellfish that are filter-feeders, like oysters, clams, and coquinas, and may reach levels capable of causing neurotoxic shellfish poisoning (NSP) when ingested.

NSP is a temporary illness characterized by gastrointestinal and neurological distress. Symptoms include nausea and diarrhea, dizziness, muscular aches, and tingling and numbness in the tongue, lips, throat, and extremities.

Symptoms of NSP usually appear within a few hours after eating contaminated shellfish and disappear within a few days. Brevetoxins can also irritate eyes and respiratory systems when the toxins become airborne in sea spray; the irritation disappears once a person is no longer exposed. Other public health effects caused by red tides include puncture wounds from spines when beaches are littered with dead fish and, rarely, contact dermatitis from exposure to brevetoxins in seawater.

During the 1980s, to reduce the public health risks associated with red tides, the State of Florida formalized a federally approved biotoxin control plan that regulates shellfish harvesting during *Karenia brevis* blooms. Under this plan, guidelines were established for monitoring cell concentrations and closing shellfish beds when *K. brevis* populations reach dangerous levels.

Red Tide: Shellfish harvesting regulations

As required by the Interstate Shellfish Sanitation Conference, National Shellfish Sanitation Program, harvesting of bivalve (filter-feeding) shellfish is prohibited in a defined bloom area when concentrations in the area reach approximately 5,000 *K. brevis* cells per quart. When the bloom terminates and the *K. brevis* population drops below approximately 5,000 per quart, shellfish usually purge the toxins from their systems in two to six weeks. The shellfish meats are tested for toxicity during that period, and the harvesting ban is lifted when test results verify that bivalves in the area are again safe for human consumption.

Harvesting bans are not applied to crabs, shrimp, lobsters, or fish, which are safe to eat even during red tide blooms, because brevetoxins do not accumulate in the parts consumed by humans.

Shellfish-harvesting businesses lose income when shellfish beds must be closed. Tourism, recreational activities, and other businesses not actually at the bloom site may be adversely affected. A study of three red tide blooms that occurred in the 1970s and 1980s estimated losses from each event at between $15 million and $25 million.

Red Tide: The future

Niskin sampling bottle

Red tides are a part of Florida's history and will most likely remain a part of its future. Scientists continually strive to learn more about factors affecting the growth and intensity of *Karenia brevis* blooms. Although the biology of the organism and the role that red tides play in the dynamics of the Gulf of Mexico ecosystem are still not fully understood, predictive two- and three-dimensional models are being developed and tested. The data generated through traditional environmental sampling and monitoring in combination with the data generated through newer approaches like remote sensing and modeling may give us the ability to forecast red tide events and mitigate, or even eliminate, their impacts.

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Our thanks to the Florida Marine Research Institute and Bureau of Seafood and Aquaculture Marketing for providing information and images.

Safeguarding the public and supporting Florida's agricultural economy.

Visit http://www.FloridaAquaculture.com for more red tide information.

NSP: Just the Facts

Species that cause Neurotoxic Shellfish Poisoning (NSP)
- *Karenia brevis*

Toxins
- Brevetoxins and derivatives

Human Symptoms/Illness
- Symptoms appear within hours and disappear within a few days

Factors Affecting Degree of Toxicity
- Amount of toxin ingested
- Rate of toxin elimination
- Health of victim

Symptoms
- Tingling and numbness of tongue, lips, throat
- Muscular aches
- Gastrointestinal distress
- Dizziness

Seafood Associated with NSP
- Clams, scallops, mussels and oysters

NSP Cases in USA
- Florida and North Carolina
- Neurotoxins found in shellfish in Texas (but no reports of human illness)

NSP Cases in the Gulf of Mexico
- Yes (recent cases have been associated with prohibited shellfish harvesting)

Interstate Shellfish Sanitation Conference and National Shellfish Sanitation Program

Because shellfish harvested from polluted water may cause human illness, the sanitary control of the shellfish industry is necessary. Florida is a member of the Interstate Shellfish Sanitation Conference (ISSC), a voluntary, cooperative association of states, U.S. Food and Drug Administration (FDA), National Marine Fisheries Service (NMFS), Environmental Protection Agency (EPA) and shellfish industry.

State responsibilities include adopting laws and regulations for the sanitary control of the shellfish industry, formulating comprehensive shellfish harvesting area surveys and adopting control measures to ensure that shellfish are grown, harvested and processed in a safe and sanitary manner. FDA reviews methods for classification and management of shellfish areas proposed by the ISSC, and incorporates those methods consistent with standard health practice into the National Shellfish Sanitation Program (NSSP) Manuals of Operations. FDA is also responsible for the annual review of each state shellfish control program to determine conformity with the NSSP standards and guidelines. Shellfish industry responsibilities include commenting to the ISSC Conference, obtaining shellfish from safe sources, maintaining sanitary operating conditions and making records available that document location of harvest and sale of all shellfish.

The goal of shellfish harvesting area classification and management is to provide maximum utilization of shellfish resources and to reduce the risk of shellfish-borne illness. The Department is responsible for 1,200 bacteriological sampling stations in 37 shellfish harvesting areas, encompassing 1,421,479 acres.

In Florida, oysters and clams are an economically important seafood resource. The annual value of shellfish to the seafood industry in Florida exceeds 20 million dollars, with as many as 2,500 people employed in the harvesting, processing and distribution of shellfish. The Florida Department of Agriculture and Consumer Services, FDA and the shellfish industry must fulfill their responsibilities to a high degree, thus ensuring the shellfish harvested in Florida are safe and wholesome.