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Red Tide Regulations

Technical Bulletin Number 1

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Regulatory Facts

- Filter feeding shellfish (clams oysters and mussels) concentrate red tide associated toxins.
- Red tide associated toxins can kill fish, birds, marine mammals and shellfish and can cause Neurotoxic Shellfish Poisoning in humans.
- Shellfish harvesting areas are closed when red tide cell counts exceed 5,000 per quart.
- Shellfish meats are rigorously tested for the presence of the toxin which may require two to six weeks to clear after red tide is gone from a harvest area.

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Red Tide Program

As required by the Interstate Shellfish Sanitation Conference, National Shellfish Sanitation Program, harvesting of bivalve (filter-feeding) shellfish is prohibited in an area when concentrations of red tide organisms reach 5,000 *Karenia brevis* cells per quart.

K. brevis produces brevetoxins capable of killing fish, birds, and other marine animals. Brevetoxins may also cause health problems in humans. The toxins accumulate in shellfish and may reach levels capable of causing Neurotoxic Shellfish Poisoning (NSP) when eaten. 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. High doses of NSP have resulted in human respiratory failure (patients are placed in a ventilator to survive).

NSP symptoms 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.

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 are tested for toxicity during that period, and the harvesting ban is lifted when test results verify that bivalves are safe to eat.

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

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

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Regulatory Agencies and Programs

The goal of the Division of Aquaculture's shellfish harvesting area classification and management program is to provide maximum utilization of shellfish resources and to reduce the risk of shellfish-borne illness.

To achieve this goal, and be able to ship shellfish nationally and internationally, Florida is a member of the Interstate Shellfish Sanitation Conference (ISSC). The ISSC is 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.

FDA's role is to review methods for classification and management of shellfish areas proposed by the ISSC, and incorporate 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.

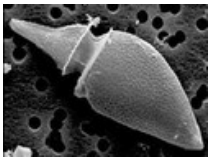
Florida, as an ISSC member, must adopt laws and regulations for the sanitary control of the shellfish industry, formulating comprehensive shellfish harvesting area surveys and adopt control measures to ensure that shellfish are grown, harvested and processed in a safe and sanitary manner. An essential part of that responsibility is the operation and maintenance of 1,200 bacteriological sampling stations in 38 shellfish harvesting areas, encompassing over 1.4 million acres of coastal waters.

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.

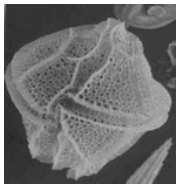
The Division of Aquaculture, FDA and the shellfish industry must fulfill their responsibilities to a high degree, thus ensuring the shellfish harvested in Florida are safe and wholesome.

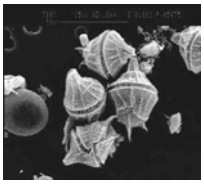
Red Tide: What is it?

(Continued from page one)

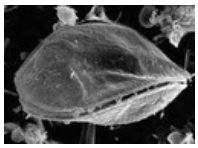


bloom in the Gulf of Mexico almost every year, generally in the late summer or early fall. They are most common off the central and southwest coasts of Florida between Clearwater and Sanibel Island, but they may occur anywhere in

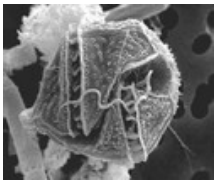




the Gulf. They also occur, but are less common, along the southeastern Atlantic Coast as far north as North Carolina. Most blooms last three to five months and may affect hundreds of square miles. Occasionally, blooms



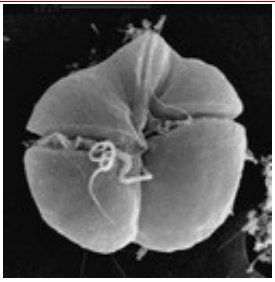
continue sporadically for 18 months and may affect thousands of square miles. Red tides can kill fish, birds, and marine mammals, cause health problems for humans, and adversely affect local economies. Pictured in this article are some of the microalgae associated with red tide.



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

Karenia brevis



common to the Gulf of Mexico. The species is able to out compete or exclude other phytoplankton and form blooms entirely composed of *K. brevis*.

Marine Biotoxin Contingency Plan

The National Shellfish Sanitation Program Model Ordinance requires that the Division of Aquaculture develop and implement a marine biotoxin contingency plan.

The goal of this plan is to achieve maximum public health protection against *Karenia brevis* marine biotoxin. To attain this goal the following objectives must be met: 1) maintain an early warning system, 2) define the severity and extent of the occurrence, 3) minimize illness, 4) monitor harvest areas, and 5) reclaim contaminated areas for harvesting.

Early Warning
Offshore blooms are generally concentrated enough to yield a red to brownish discoloration of surface waters and massive fish kills. Such offshore events are reported by the Florida Fish and Wildlife Conservation Commission (FWC), U.S Coast Guard, commercial and charter boat fishermen, or recreational fishermen. Seasonal current patterns and meteorological events are monitored to predict possible offshore bloom movement. Sampling is initiated to count the number of organisms in the water. Sampling is conducted by the Division of Aquaculture and Florida Marine Research Institute personnel.

Occurrence Severity
When cell counts exceed 1,000 per quart the initial sampling program is expanded. Sampling is conducted at predetermined stations to monitor the increase or decrease in cell concentrations. Sampling results, field reports, and hydrographic and meteorological data are evaluated to determine the severity and extent of the bloom.

When cell concentrations exceed 5,000 cells per quart or nearshore water discoloration, massive fish kills, or respiratory irritation is noted, the adjacent shellfish harvesting areas are temporarily closed to harvesting at sunset the day of the test results. Hydrographic and meteorological factors are evaluated to predict the transport direction and distribution of a bloom. If it is determined that additional shellfish harvesting areas will be impacted, those waters are temporarily closed.

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.

Minimize Illness
The Division restricts harvest and suspends sale of bivalve shellfish from areas impacted by red tide. The Division notifies shellfish harvesters and processors, health agencies, FWC Division of Law Enforcement and the public.

Embargoing Potentially Toxic Shellfish
The Division has the authority to examine shellfish records and requires all certified shellfish dealers to maintain adequate records in order to determine the distribution of product. Once the Division determines affected shellfish is in commerce, stop sale and recall is immediate and destruction is determined on a case-by-case basis.

Harvest Area Monitoring
When cell counts fall to less than or equal to 5,000 cells per quart, shellfish will be gathered for toxicity analysis. Shellfish are collected at sampling stations where shellfish are most likely impacted. Sampling is accomplished by the Division of Aquaculture or the Florida Marine Research Institute. Toxin extraction and toxicity is determined by the Florida Marine Research Institute. The present method of determining toxicity is by mouse bioassay. If less than 20 mouse units are recorded , the shellfish from the area are considered nontoxic and the area is reopened (please read “Mouse Bioassay” for an explanation of

Reopening Closed Waters

When red tide cell counts fall below 5,000 per quart and the mouse bioassay results fall below 20 mouse units, the shellfish from the temporally closed area, or areas, are considered non-toxic. Harvest areas are opened for harvest beginning at sunrise the following day. As part of the process of reopening a closed area, the Division notifies shellfish harvesters and processors, health agencies, FWC Division of Law Enforcement and the public.

If red tide persists in a region or a new bloom appears, then the process of monitoring, sampling and testing that may result in harvest area closure is repeated. There are no guarantees that newly opened harvest areas will remain open nor that an area may be immediately closed. The Division responds as dictated by the presence of red tide and the potential for shellfish to concentrate brevetoxin and threaten human health.

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Our thanks to the Florida Marine Research Institute for providing information and images.

Safeguarding the public and supporting Florida's agricultural economy.

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

Mouse Bioassay

The mouse bioassay is the only method recognized for determining brevetoxin toxicity by the U.S. Food and Drug Administration and nations receiving Florida shellfish as a food product. The actual test is completed by Florida Marine Research Institute at the request of the Division of Aquaculture. This method was developed and adopted by the American Public Health Association and is fully described in *Laboratory Procedures for the Examination of Seawater & Shellfish, Fifth Edition.*

Shellfish are tested when *K. brevis* cell counts reach 5,000 cells per quart of seawater. The test is based upon the relationship of dose to death time for mice injected with a fat-soluble toxin residue extracted from shellfish. Relative toxicity is expressed in mouse units. One unit is the amount of crude toxin that, on the average, will kill 50 percent of the test animals in 930 minutes. The test is a very conservative one as appropriate for protecting human health. Any detectable level of toxin found as a result of this test renders the shellfish potentially unsafe for human consumption.

Numerous mice are used to ensure the test is accurate and that differences between mice does not confound the results.

Collecting, Counting and Testing

To satisfy the ISSC guidelines, collecting samples and determining red tide cell counts and brevetoxin toxicity are procedures completed by the Division of Aquaculture or Florida Marine Research Institute personnel.

Critical to the collection of samples, water or shellfish, is the correct handling and documentation of those samples to insure the validity and accuracy of the results. Water is collected in 100 milliliter whirlpacks at 18 inches below the surface. Water quality data is collected (temperature, salinity, dissolved oxygen) with location (GPS), tidal stage and wind direction. Samples of water or shellfish are shipped overnight, express courier to the laboratories. If *Karenia brevis* cells are subjected to extreme cold they will lyse or break into pieces. Shipping must be rapid and handling time reduced to a minimum.

A live count method is used to determine cells per quart or liter. Background levels, the presence of *K. brevis* throughout the year, are usually 1,000 cells or less per quart of seawater. At these levels, the volume of water examined for live cells may have to be increased. During bloom conditions, greater than 5,000 cells per quart and higher (bloom cell numbers can exceed 1 million per quart), the original sample may have to be diluted so that accurate counts can be made. Live cells are preferred to enhance the technician's ability to detect them in the sample.

Approximately, one gallon of live shellfish is collected for the mouse bioassay. The sample is shipped, without ice to preserve the toxin within the red tide organism, by overnight, express courier to the laboratory. A specific type and weight of mouse is used and the test is repeated to eliminate false results.