Red Tide in Texas

An Explanation of the Phenomenon

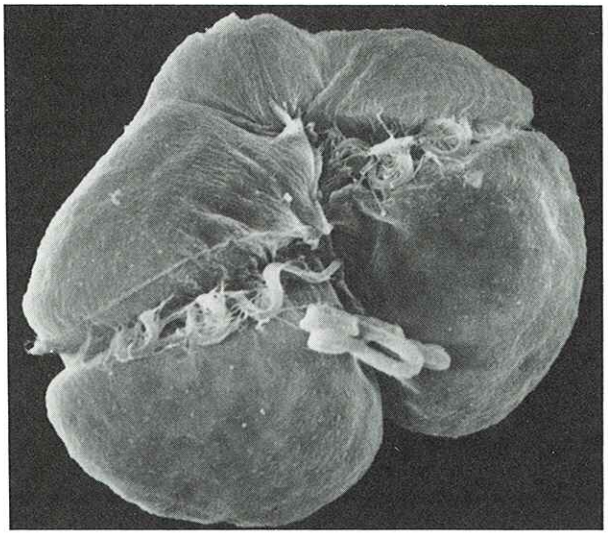
Texas A&M Sea Grant College Program

The Red Tide Organism

Red tide is a natural phenomenon caused by tiny, single-celled marine organisms called dinoflagellates. The red tide organisms are only one-thousandth of an inch in diameter, but when an unusually dense concentration or "bloom" occurs, seawater appears reddish-brown, thus the name "red tide."

Of the more than 60 species of dinoflagellates known to cause red tide, only about 30 species produce a toxin. High concen-trations of one of these toxic species can kill fish, cause an irritating aerosol in the air and contaminate shellfish.

Red tides occur occasionally throughout the world, in some places more often than in others. In Texas, major outbreaks, though rare, are similar to the phenomena elsewhere. Major outbreaks in Texas have been caused by two species: *Ptychodiscus brevis* and *Gonyaulax monilata.*



Florida Department of Natural Resources

Ptychodiscus brevis *enlarged 4600 times.*

Causes of the Sudden Bloom

Studies indicate that the red tide-causing organisms are normally present in the Gulf of Mexico as resting cysts or "seeds" on the ocean bottom. When certain conditions are right, the organisms suddenly bloom or begin increasing in numbers. Although these blooms probably occur each year, few blooms turn into major outbreaks.

The exact conditions that prompt the sudden blooms are not clearly understood, but such blooms seem to be tied to salinity, temperature and upwellings, which bring the organisms to the surface water exposing them to light. Because red tide organisms are photosynthetic, the photoperiod (or day length) also may influence the bloom.

There is no evidence that red tide blooms are caused by pollutants or oil spilled into the water. Red tide was documented long before use of man-made chemicals became commonplace.

When and Where Blooms Occur

Red tides can appear in small patches or long streamers. Visible red tides have been reported to cover up to 10 square miles.

Typically, red tide first appears several miles off the coast. Current, tides and winds may move it into the beach and bay areas where it will remain if favorable conditions exist. Texas red tide seems to be more likely than red tide in other areas to accumulate in the bays. This may be due to the high salinity of Texas bays.

Both *G. monilata* and *P. brevis* tend to bloom in the Gulf of Mexico in August and September. However, red tide can occur anytime conditions are right for a bloom.

No "typical" lasting times have been established for Texas red tide; it's estimated they can last anywhere from one week to several months.

The red tide also seems to "move "from one place to another, generally in a southwesterly direction with the coastal Gulf currents. Scientists are not sure whether the organisms actually move down the coast or if the bloom-inducing environmental conditions do the moving.

Impact on Marine Life

The most obvious manifestation of red tide is the large numbers of fish it kills. Millions of fish died in a 1986 red tide, and reports say that 2 million pounds of dead fish washed ashore in a 1935 fish kill.

Red tides can kill fish in two ways, by a toxin that is fatal to certain fish or by depleting oxygen from the water. The two Texas red tide organisms produce different toxins, but both kill fish directly or indirectly.

Slow moving, bottom dwelling fish are usually the first to be affected by red tide. Nevertheless, nearly all inshore and near-shore fishes are susceptible, depending on the density of the bloom and the length of exposure.

In Texas, menhaden and mullet seem to be the primary victims of red tide. However, the organisms have killed many other species including redfish, rays, mackerel, grouper, trout, ladyfish, mudminnows, eels and more.

P. brevis has little effect on shrimp and crabs, and although the toxin accumulates in oysters, clams and mussels, it doesn't kill them. *G. monilata*, on the other hand, often kills invertebrates. Although shellfish will "close up" in an attempt to avoid filtering the *G. monilata* organism, the toxins eventually enter the shell cavity and kill them.

Waterfowl also can be affected by red tide if they eat shellfish that have accumulated the toxin. During a Florida red tide outbreak, officials reported several thousand dead ducks and attributed their deaths to shellfish poisoning.

Impacts on Humans

Most red tides have no direct effects on humans. In Texas, *P. brevis* is the only organism that brings health-related problems for humans.

The major concern is Neurotoxic Shellfish Poisoning (NSP), which people can get by eating oysters, clams and mussels contaminated by the *P. brevis* toxin. NSP can cause nausea, dizziness, tingling sensations in the extremities, dilated pupils and hot-cold reversals. The symptoms usually disappear in a few days.

Only about 50 cases of NSP have been reported in recent history, and no known deaths have occurred.

NSP is sometimes confused with Paralytic Shellfish Poisoning (PSP), a type of poisoning that can cause death in two to three hours after eating contaminated shellfish. Red tide organisms that emit the PSP toxin have been reported on the Northeast Coast of the United States, in Alaska and in Central and South America. ***However, the organisms that cause red tide in the Gulf of Mexico do not produce the PSP toxin.***

Commercially fished bivalves usually are safe for human consumption two to six weeks after red tide has ended.

All commercially harvested shellfish in the United States are subject to federal and state monitoring to ensure that only safe, non-toxic shellfish are available to the consumer.

The Texas Water Commission, the Texas Parks and Wildlife Department and the Texas Department of Health work together to monitor and close areas along the Texas coast containing contaminated shellfish. ***Because control is at the harvest level, shellfish sold at seafood markets or served in restaurants should be free of shellfish poisoning.***

Another impact of *P. brevis* is the "aerosol effect." In addition to the toxin released into the water, toxins are transmitted into the air via sea spray. When winds blow these particles into shore, people begin to cough, sneeze and wheeze.

People with asthma or other respiratory problems often report having trouble breathing when near a bloom. Others report headaches, cold or sinus-like congestion, and watery eyes. Health officials say those who are sensitive to these problems should avoid the beaches and boat trips into red tide areas.

Although many fish are killed by red tide, fish, shrimp and crabs caught during a red tide are safe to eat. The toxin accumulates in the visceral organs of fish and, very little, if any, of the toxin is absorbed into the muscle tissue. Therefore, unless the visceral organs are eaten (as is the case with oysters, clams and mussels) the fish will not cause illness in humans.

However, red tide or not, it is never advisable to eat any fish found dead or appearing sick or lethargic.

Impact on the Economy

It's difficult to estimate the monetary damage of a red tide. The economic impact could be anywhere from a few thousand dollars to a few million dollars depending on the area affected by red tide and how long it lasts.

Probably the biggest economic impact in Texas comes to the commercial oyster industry. When oyster harvesting is closed due to red tide, the Texas economy can lose millions.

The impact is compounded when fishermen can't sell their catches because seafood wholesalers, retailers and consumers are reluctant to buy perfectly safe seafoods taken from or near red tide areas. This reluctance often continues long after the red tide organism has dissipated and shellfish are safe to eat.

Tourism, a significant industry on the Texas Coast, also is hurt by red tide. Tourists avoid the coast when they see media pictures of fish-covered beaches and they hear of the aerosol effect. And when beaches are closed, even the regular local customers go elsewhere.

Red tide also affects the bait fishing industry, city services that must spend time and money removing the dead fish from the beaches, and coastal restaurants that depend on local catch.

On the positive side, sport fishing may be bolstered immediately following red tide. Fishermen report more and bigger catches after red tide outbreaks.

The Corpus Christi Caller

Red tides sometimes prompt public beach closings by cautious officials.

Myths

Because red tide is such a mystery to the general public, many myths and fallacies have arisen about shellfish poisoning and the causes of red tide.

One of the most popular myths is that shellfish are safe to eat during months that have an "r" in them. The saying originated in Europe and was not based on red tide-induced shellfish poisoning. People should be aware that shellfish are sometimes contaminated by red tide during the "r" months in Texas.

Another fallacy concerning how to determine poisoning in shellfish is that if a silver spoon is put in a pot of cooking shellfish, it will tarnish if the shellfish are contaminated. According to the story, if the shellfish are safe, the spoon will remain bright.

In fact, it is impossible to tell if a shellfish is contaminated without a chemical test. Also, normal methods of cooking may kill bacteria, but they will not destroy the toxins that cause NSP or PSP.

Some people think they develop a tolerence to shellfish poisoning after years of eating shellfish. However, scientists have found little evidence to support this claim.

Although the presence of red tide is a warning that oysters, mussels and clams may be contaminated, the absence of discolored water does not mean they are safe to eat.

These bivalves filter dinoflagellates out of the water for food. Because they can filter large quantities of water, they can consume enough *P. brevis* to become contaminated in some cases even when the density of the organisms is not high enough to form a visible red tide.

A modern set of fallacies concerns the causes of red tide. Many people think pollution, war-time chemicals, oil spills, toxic waste or nuclear fallout are the catalysts to a red tide. However, this is not true. Red tide is sporadic, while the dumping of chemicals and pollutants into the water is a continuous occurrence. Also, red tide was documented many years before these modern problems became prolific.

History and Folklore

Red tides are not new. A phenomenon that seems to be red tide is recorded in the Bible. Also, legend has it that California Indians made the correlation between red tide and shellfish poisoning long before modern civilization made the connection in the 1920's.

In modern history, fish kills associated with discolored water were reported as early as 1844 off the coast of Florida.

In Texas, the earliest known documentation of red tide was in 1935. Although it wasn't identified as such, researchers believe it was a *P. brevis* red tide because of the reports of a major fish kill and the aerosol effect, along with discolored water.

Three other possible *P. brevis* red tides and six or seven *G. monilata* red tides have been recorded on or near Texas beaches since 1935.

Control and Prevention

Although preventing red tide outbreaks or controlling them from spreading has obvious benefits, it is impossible with our current knowledge. Several substances are known to kill the red tide organisms, but treating red tide with chemicals is not feasible for several reasons.

First, red tide generally covers such large areas, both horizontally along the coast and vertically within the water column, that treating it before it spreads would be virtually impossible.

Second, the substances (such as copper) to which the organisms are sensitive can be very expensive, especially in the large quantities needed to treat a red tide outbreak.

The third, and most important, reason it's difficult to justify using chemicals is their impact on other marine life. While killing *P. brevis* or *G. monilata*, the treatment also may kill other marine organisms or fish sensitive to the chemicals.

What can be done about red tide?

Prediction seems to be the best way to deal with red tide. Since the 1986 bloom, the scientific community has begun a concerted effort to create an efficient red tide monitoring program for Texas.

Mapping of resting cyst populations may give a better idea of when and where the organisms are likely to bloom. Regular water sampling and satellite monitoring will help locate red tides in their early stages.

Using these methods for early detection will allow officials to warn people of the health-related problems that may come with an impending red tide outbreak.

As research progresses, the methods for predicting red tide will become more accurate and reliable. In addition, efforts will continue to be directed toward minimizing the economic impact of red tide on Texas.

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Cover photo taken during 1986 red tide. Photo courtesy of the Brazosport Facts. Designed and edited by Rhonda Snider. This advisory bulletin is furnished as a service from the Texas A&M Sea Grant College Program.
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