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# SHELLFISH AND THE RED TIDE MENACE

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This tomato soup-colored red tide was caused by a non-toxic dinoflagellate, *Noctiluca*. Red tide was washed onto shore at Clam Bay near the town of Manchester in Puget Sound during June, 1972. Others can be expected this month. Before the water clears the stench is terrible.

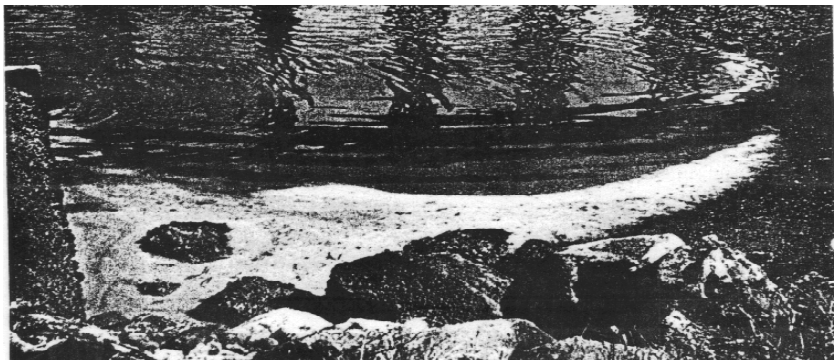
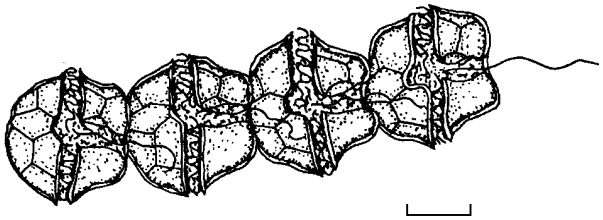


Photo by James G. Eagleton



Scale = 20 Micrometers

Blooms of tiny floating organisms can color the sea surface red. Some of these organisms, when consumed by shellfish, are harmless; others can render shellfish deadly poisonous. Both types appear in Northwest waters.

The toxin-producing dinoflagellate, Gonyaulax catenella, can be part of the diet of filter-feeding shellfish. When the toxic Gonyaulax becomes dense enough, the shellfish may accumulate enough toxin to be harmful, even deadly, to man while showing no effects of the toxin themselves. Shellfish can become toxic when Gonyaulax is not dense enough to form a visible red tide.

During periods of rapid growth "blooms," *Gonyaulax catenella* forms chains of cells. The chains are usually two to eight cells in length but are sometimes as much as 32 cells long. Each cell is an individual organism capable of living independently. Cell diameter averages about 1/500 inch.

Photomicrographs by Louisa Norris. She and Kenneth Chew are the only research team who is culturing this toxin producing *Gonyaulax* and keeping it reproducing in their UW laboratory. They supply scientists all over the world.

**What is a red tide?**

Sometimes during late spring, late summer, or fall, color appears in the water — in localized patches or streamers. These appear suddenly, last a few days, and mysteriously disappear.

In Washington waters, one sees this color issuing from channels that connect small bays with Puget Sound or the Strait of Juan de Fuca. The discolored areas are usually some shade of red and are commonly referred to as red tides. Often the red tides in central Puget Sound, for example, look like cream of tomato soup. Close inspection shows that this color stems from very small individual particles, visible to the unaided eye. They may even feel gritty when rubbed between the fingers. Each of these particles is an individual organism known as *Noctiluca* — a member of the dinoflagellates, which are one-celled and have both plant and animal characteristics. *Noctiluca* (meaning night light) is not toxic and usually gives rise to brilliant displays of bioluminescence at night when the water is disturbed.

No one knows precisely what causes this red tide to form. We do know that a "seed" population of *Noctiluca* normally exists in the plankton and that under certain water and weather conditions, *Noctiluca* will have a spurt of growth, dividing to form millions and millions of single-celled individuals. This rapid development of a dense population is often called a bloom. These cells can be further concentrated by onshore winds, which blow surface waters containing N*octiluca* against a shoreline or by converging currents, which carry the cells to where the currents meet and form a concentrated band of *Noctiluca* color.

Several kinds of red tides in Washington waters are caused by a variety of dinoflagellates and other one-celled creatures in the plankton. The red tide of *Noctiluca* is just one kind. Other red tides are similar to *Noctiluca* tides in their patchy distribution, temporary nature, seasonal occurrence from spring into fall, and mode of formation, but *Noctiluca* forms our only tomato soup tide. Other "red" tides vary in color from pink to brick red to amber or rust, depending on which plankton organism is forming the tide.

### What is the relation between red tides and poisonous shellfish?

News of a red tide strikes alarm among people who enjoy clams, mussels, and oysters because folklore and medical records tell us that red tides can cause these molluscan shellfish to be poisonous. In fact, only some of the red tides cause toxic shellfish while other red tides leave no harmful effects in the shellfish. Only one of the Washington red tide organisms, *Gonyaulax catenella*, is known to produce a toxin. This species has been the cause of outbreaks of shellfish toxicity from Alaska to California. *Gonyaulax* is microscopic in size and forms red tides that vary from amber to red-rust in color.

Filter-feeding shellfish, such as clams, mussels, and oysters, gather their food supply by filtering the plankton organisms out of the surrounding water at a remarkably high rate. For example, a large oyster can pump and filter as much as 20 to 30 quarts of water an hour. Thus, it is easy to see that shellfish can consume enormous numbers of the tiny organisms that make up a red tide, and if the red tide is caused by the toxic *Gonyaulax*, the shellfish can quickly become poisonous.

**The presence of a red tide could be a warning that the shellfish may be poisonous, but the absence of a red tide does not mean shellfish are safe to eat.** One reason is that, because of their enormous filtering capacity, shellfish can strain out enough *Gonyaulax* to become toxic even when a *Gonyaulax* bloom has not become dense enough to be visible as a red tide. Secondly, some shellfish tend to retain the toxin for varying periods of time, weeks to months depending on the kind of shellfish and the water temperature. Thus, they may be toxic long after a bloom or a visible red tide has gone. In fact, butter clams in some Alaska beaches are toxic year around.

For some reason not yet completely understood, the shellfish themselves are very seldom harmed by the toxin they have acquired, but other animals, including man, can be poisoned if they eat enough toxic shellfish. The toxin is an extremely powerful nerve poison which can cause temporary paralysis and even death if enough toxin has been consumed to paralyze the breathing mechanism.

### What protection does the public have against paralytic shellfish poisoning?

It is not possible for the shellfish-eating public to distinguish between toxic and non-toxic shellfish or to destroy the toxin by normal methods of cooking shellfish. Therefore, the Washington State Department of Health (now the

Health Services Division) and the Washington State Department of Fisheries have been cooperating for many years in an effort to reduce the potential risk to the public of paralytic shellfish poisoning by (1) regulation of sport fishing for shellfish in areas likely to have toxic shellfish and (2) a surveillance program for commercial areas and certain other sport shellfish areas. This program includes semi-monthly tests of shellfish by the Health Services Division and local health departments to determine whether they contain toxin. If the toxin content of the tested shellfish exceeds levels considered safe by federal standards, harvesting areas are closed to protect the consumer. Since this program was instituted there has been no known case of paralytic shellfish poisoning from shellfish commercially harvested in Washington.

The sport fishing regulations, which are published annually and are available in sporting good stores, state that open seasons and areas for mussels and clams, other than razor clams are:

Open year around in Willapa Harbor, Grays Harbor, and Puget Sound east of Dungeness Spit. Open November 1 through March 31 on Pacific Ocean beaches and Strait of Juan de Fuca west of Dungeness Spit.

These latter beaches with restricted open seasons have had sufficient outbreaks of shellfish toxicity in the past to warrant closure at certain seasons and are open only during the months when outbreaks are unlikely to occur. Occasionally areas which are normally open require closure and are posted. Razor clams are excluded from the regulation because the toxin is concentrated in the digestive gland, which is never eaten.

**What precautions should the public take in gathering shellfish?**

1. Gather clams, mussels and oysters only in areas known to be open. If in doubt, contact local health authorities — county health officer or sanitarian. Boaters going north should note that British Columbia waters have also had frequent outbreaks of paralytic shellfish poisoning and that complete surveillance is impossible on that extended coastline. There is no automatic closure of potentially hazardous beaches in British Columbia. Local inquiries should be made about whether shellfish are safe to eat.
2. Forget the old saying that shellfish should be eaten only during months with R in them. Many people think the saying means that shellfish are always safe to eat during the R months, but as the closure dates indicate, there have been outbreaks of shellfish toxicity in certain Washington beaches in the R months of April, September, and October. That saying originated in Europe and was based on factors connected with the reproductive events of oysters, not with paralytic shellfish poisoning. The oysters in Europe brood their young and are unpleasant to eat from May to August because of the crunchiness of the baby oyster shells in the brood chamber. In addition the spawned-out oysters of this period are generally less plump and tasty.

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