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Gathering Safe Shellfish in Washington

Avoiding Paralytic Shellfish Poisoning

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Fond of shellfish? Washington waters offer a delectable variety of clams, oysters, mussels and scallops, readily available to be gathered and enjoyed. For seafood lovers, opportunities abound at many locales and most seasons of the year. “When the tide is out, the table is set,” as one beachcomber’s adage maintains.

At certain times, however, some shellfish may become unsafe to eat because they contain a poison harmful to human beings. Paralytic shellfish poisoning, commonly known as PSP, is a danger that you as a shellfish consumer can avoid by being well informed and by observing certain basic precautions.

This publication provides information about PSP, its symptoms and treatment and its relationship to so-called “red tides.” It also explains what is being done to protect recreational harvesters from this hazard, so that they — and you — can safely enjoy the bounty of Washington seashores.

Note: All commercially harvested shellfish must meet rigorous health standards established by the state. At seafood markets and grocery stores in Washington, consumers can purchase nutritious, delicious and safe shellfish that have been certified for sale throughout the year.

Acknowledgements

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Paralytic Shellfish Poisoning

Paralytic shellfish poisoning (PSP) is a potentially fatal illness caused by eating shellfish that have consumed significant amounts of a microscopic, single-celled organism known by its scientific name, *Alexandrium catenella*. The toxins in this organism are extremely potent nerve poisons. As little as one milligram (0.000035 ounce) can be enough to kill an adult. The poison acts very rapidly, and, to date, no antidote has been discovered.

Tingling of the lips and tongue, which may begin within minutes or hours of eating shellfish, is an early symptom of PSP. Depending on the amount of toxin ingested with the shellfish, the symptoms may progress to tingling of the fingers and toes, loss of control of arms and legs and, finally, difficulty in breathing. Some people who have survived PSP report a sense of floating, while other PSP patients became nauseated. If enough of the poison is consumed, death from paralysis of the breathing mechanism can result in as little as two hours. Approximately 15 percent of the reported cases of PSP have resulted in death.

Allergic reactions and gastrointestinal problems can also be experienced from eating shellfish. These can be carefully distinguished from the PSP symptoms described above.

It is *essential* to begin treating PSP *immediately* — as soon as the lips or tongue begin to tingle. Induce vomiting by using syrup of ipecac or some other means and give a brisk laxative to remove the toxic shellfish from the digestive tract. Get the patient to a doctor at once. If this is not possible, prepare to administer artificial respiration for as long as necessary.

Alexandrium — Poison Producer

When and where do PSP outbreaks occur? A brief description of *Alexandrium catenella*, the poison-producing organism, will help to explain the seasonal occurrence of shellfish containing PSP toxins and the differences in timing of toxicity in different shellfish. *A. catenella* belongs to a group called dinoflagellates, which have both plant and animal characteristics, can manufacture their own food and can swim.

Each cell of *A. catenella* can live independently, but during periods of rapid growth and division, the cells remain attached to each other in chains (hence the name *catenella* or "little chain"). Each cell is equipped with two tiny whips used in swimming. At times, some of the swimming cells drop their whips and form non-swimming, heavy-walled resting cells, or cysts. The cysts settle to the bottom and can lie dormant in the bottom sediment through low winter temperatures. Many of the cysts are eaten by bivalve shellfish and other animals, or they become buried by sediments. These cysts are several times more toxic than the free-swimming forms. Some will germinate when environmental conditions are favorable, giving rise to another population of swimming cells.

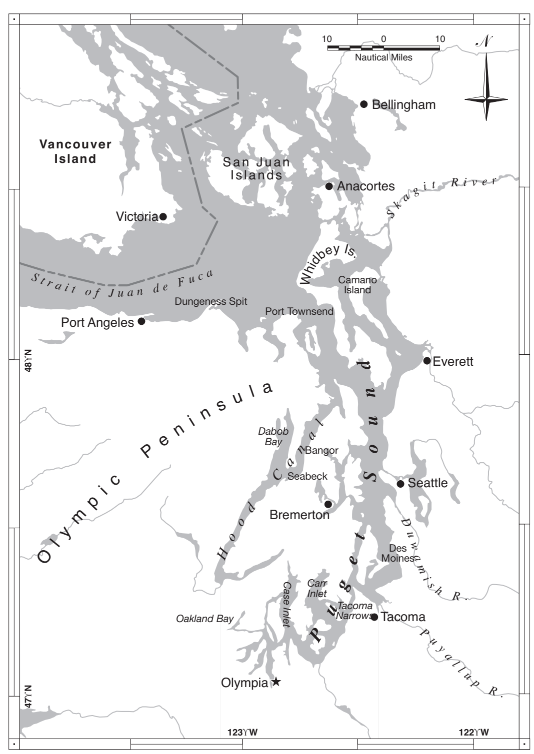
In general, PSP outbreaks in most shellfish are more likely in late spring through fall than in winter. However, one should be aware that some shellfish species — particularly butter clams, geoducks and scallops — tend to be toxic for longer periods of time, even throughout the year in some areas. This is thought to be due to either retention of toxins in the tissues or consumption of cysts from the sediments.

The late spring onset of PSP outbreaks is the result of several factors. Longer days and warmer waters stimulate faster growth of the swimming cells. Longer periods of relatively mild weather and calm seas permit the accumulation of these cells in the water layer in which shellfish are feeding. Shellfish feed faster in warmer water, thus concentrating the toxins. These factors, when combined, may lead to PSP levels that require closures of shellfish beds — often when the first good clamming tides of spring occur — causing disappointment and frustration for eager diggers.

Areas of PSP Occurrence

The accumulation of PSP toxins in shellfish is not a new phenomenon nor is it one confined to Washington state. It has been occurring for hundreds of years in many parts of the world, primarily in temperate waters. Along the Pacific Coast, poisonous shellfish have been found all the way from Alaska to California. Several members of Captain Vancouver's crew died in 1793 after eating toxic shellfish — the first recorded PSP deaths in the Pacific Northwest. Native Americans were undoubtedly aware of the problem long before that.

Since 1942, there has been an annual regulatory closure for mussels and all clams except razor clams in effect for the Strait of Juan de Fuca west of Dungeness Spit, as well as the ocean beaches from April through October because of the occurrence of PSP. In April 2002, the annual closure for the Strait of Juan de Fuca was rescinded and replaced with a shellfish monitoring program. However, the annual closure of ocean beaches has stayed in effect.



Along the Pacific Coast, poisonous shellfish have been found all the way from Alaska to California.

Common Washington Shellfish

In Washington, many kinds of shellfish are abundant, tasty and nutritious. Here are brief profiles of those most commonly sought by recreational harvesters.

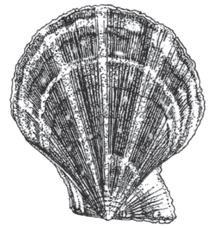
Pink scallop

Chlamys rubida

Size: Small, to 2 inches across

Shape: More or less circular with ribs radiating from the hinge

Other characteristics: Pinkish, with radiating ridges and no spines.



Spiny scallop

Chlamys hastata

Size: Medium, to 2 inches

Shape: More or less round with ridges radiating from the hinge

Other characteristics: Distinct radiating ridges with tiny spines on ridges; color varies.

Manila or Japanese littleneck clam

Tapes phillipinarum or *Venerupis japonica*

Size: Medium, to $2\,^{1}/_{2}$ inches

Shape: Oblong

Other characteristics: External surface with radiating and concentric ridges; may have angular brown and white pattern or be white only; inner surface white, sometimes with small bumps along margin.

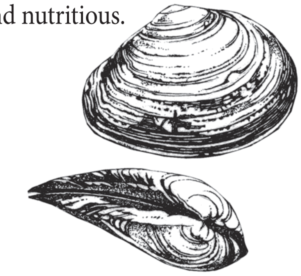
Native littleneck clam

Protothaca staminea

Size: Medium, to $2\,^{1}/_{2}$ inches

Shape: Oval to round

Other characteristics: External surfaces sculpted with radiating and concentric ridges; may have angular brown and white patterns. Inner surface is white, sometimes with small bumps along margin.



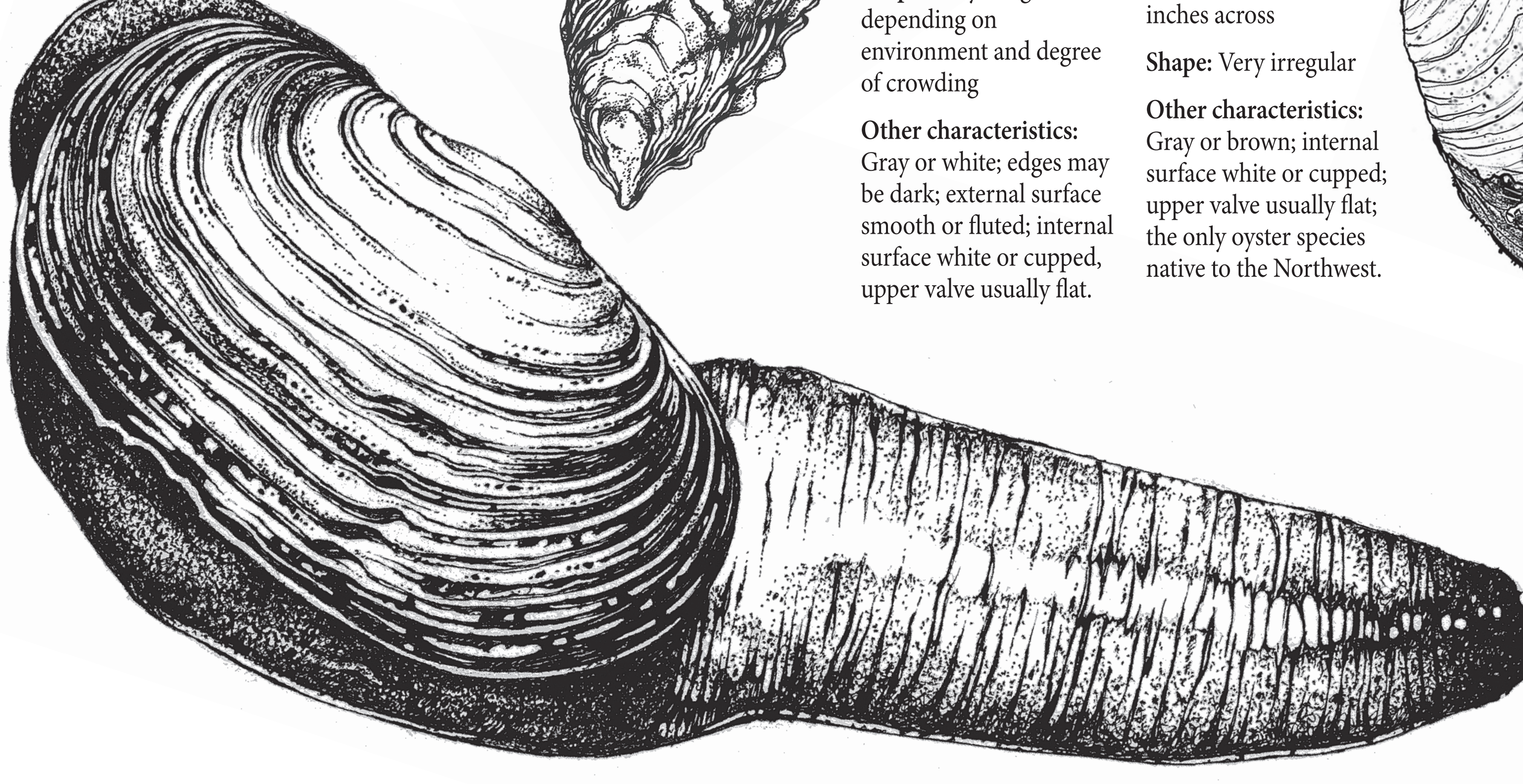
Bent-nosed clam

Macoma nasuta

Size: Small, 1 to 2 inches

Shape: End of the valve is bent.

Other characteristics: Small concentric rings; found in mud and silted areas.



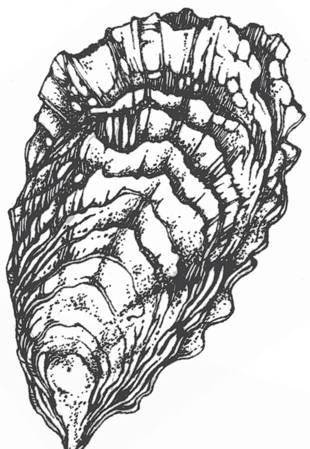
Geoduck

Panopea abrupta

Size: Large, to 9 inches

Shape: Oblong, rounded at one end, appearing cut off at other, gaping except at hinge area

Other characteristics: Shells heavy; external surface with rough concentric sculpture, gray-white with yellow covering; internal surface dull with deeply impressed muscle scars.



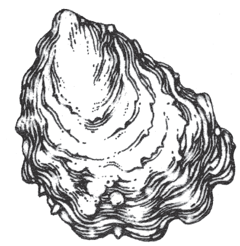
Pacific oyster

Crassostrea gigas

Size: Large, to 12 inches in length, but more commonly 3-4 inches

Shape: Very irregular, depending on environment and degree of crowding

Other characteristics: Gray or white; edges may be dark; external surface smooth or fluted; internal surface white or cupped, upper valve usually flat.



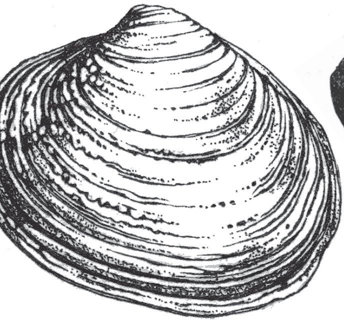
Olympia oyster

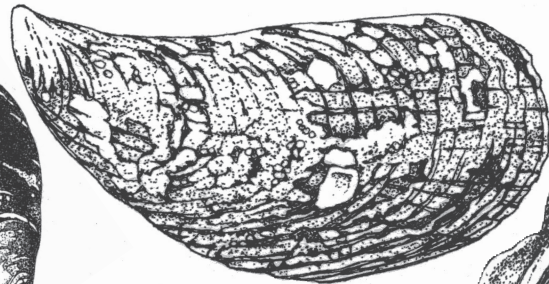
Ostrea lurida

Size: Small, less than 2 inches across

Shape: Very irregular

Other characteristics: Gray or brown; internal surface white or cupped; upper valve usually flat; the only oyster species native to the Northwest.





Butter clam
Saxidomus giganteus

Size: Large, to 5 inches

Shape: Square to oval

Other characteristics: Heavy, solid shells; slight gape at one end in adults. External surfaces with prominent concentric ridges; yellow when young, gray-white when adult.

Bay or Blue mussel
Mytilus edulis

Size: Small, to 3 inches

Shape: Elongate, hinge end pointed, concentric lines

Other characteristics: External surface covered with fine, concentric sculpture; shell covering blue or black; internal surface dull blue.

California mussel
Mytilus californianus

Size: Large, to 8 inches

Shape: Elongate, radiating rays and concentric lines

Other characteristics: Usually a thicker, tougher shell than bay mussel.

Heart cockle
Clinocardium nuttallii

Size: Large, to 4 inches

Shape: Round, with about 35 distinctive ribs radiating from the hinge region.

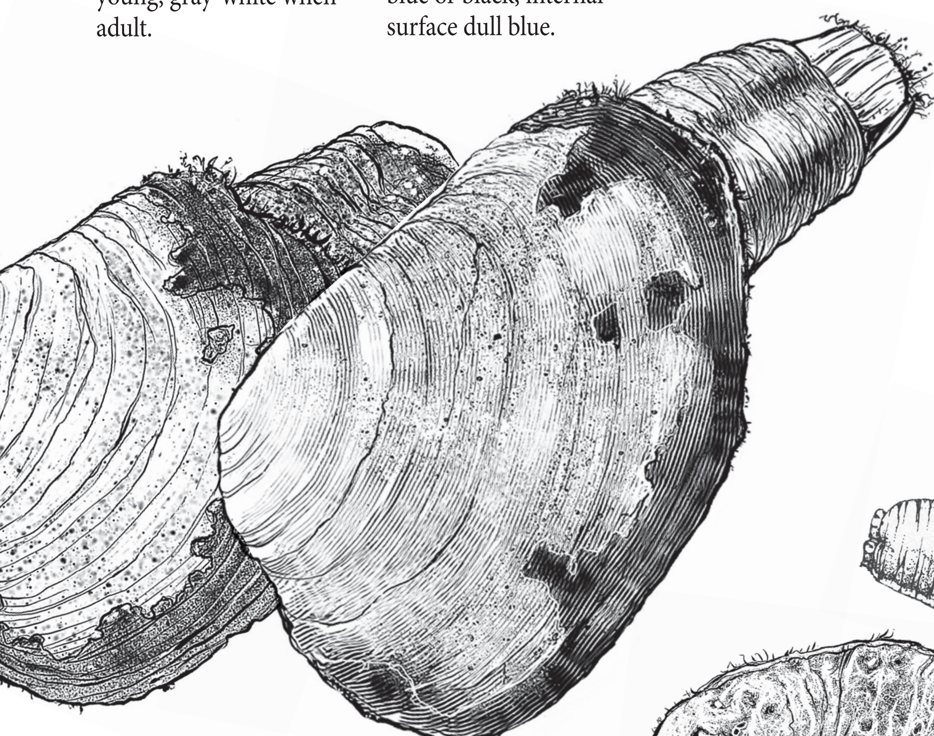
Other characteristics: Young cockles are pale tan, with faint mottling; adult coloration is darker and uniform

Softshell clam
Mya arenaria

Size: Large, to 6 inches

Shape: Elliptical, pointed on siphon end, rounded on other end

Other characteristics: Soft shell easily broken; external surface with uneven concentric sculpture, white or gray, sometimes yellow to brown.

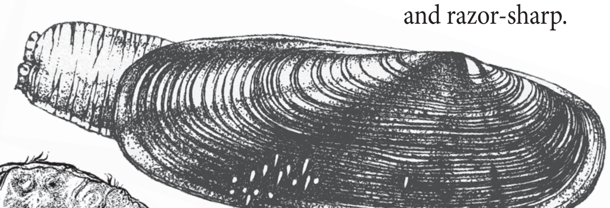


Razor clam
Siilqua patula

Size: Up to 6 inches

Shape: Large and oblong

Other characteristics: Oblong, with concentric rings; shells are very thin and razor-sharp.

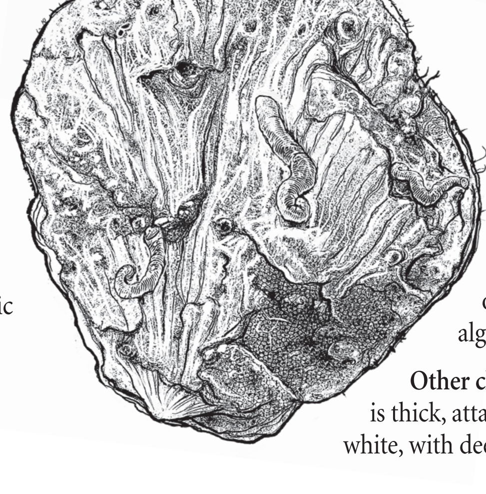


Horse clam
Tresus capax (left) and *Tresus nuttallii (right)*

Size: Large, to 8 inches long and 6 inches high

Shape: *T. capax* is elliptical, more round on one end and wider than *T. nuttallii.*

Other characteristics: Shells gape widely at one end; exterior shell white or yellow, with smooth concentric sculpture and varying amounts of black or brown covering that peels off; interior chalky or pearly.



Purple-hinged rock scallop
Hinnites giganteus

Size: Large, to 6 inches

Shape: Irregular, with coarse veins, often colonized by sponges, coralline algae and other encrusting organisms.

Other characteristics: Mostly subtidal; shell is thick, attached firmly to rocks; shell interior is white, with deep purple blotch close to the hinge.

The term "red tide" is a misnomer, because red tides are not tides at all, and many of them are not even red.

In the early 1970s, poisonous shellfish were found in the San Juan Islands and in the Bellingham area. However, no cases of poisoning from shellfish harvested in Puget Sound east and south of Port Townsend had been reported, even though sparse populations of *A. catenella* were known to occur there. In the fall of 1978, extraordinarily high levels of PSP were detected in shellfish throughout the area between Whidbey and Camano islands. It is believed that, as water from that area flowed southward around Whidbey Island, enormous numbers of *A. catenella* were carried into the main basin of Puget Sound. That is evident from the detection of toxic shellfish, for the first time as far south as Des Moines.

In 1979, toxic shellfish were found in the Tacoma Narrows. Low levels of PSP were found in shellfish harvested just south of the Narrows in 1980 and throughout most of the southern basin, south of the Narrows in 1981. In 1988, high levels of toxins necessitated the first PSP closure of shellfish sites in the southern basin, in Case and Carr inlets.

In Hood Canal, low levels of PSP have been found as far south as Bangor since 1978. Closures for PSP were not necessary in the Canal until 1992, when higher concentrations of toxins occurred as far south as Seabeck and Dabob Bay.

As of Spring 2015, the only Washington waters that have never been closed to shellfish harvesting because of high levels of PSP are in Oakland Bay in South Puget Sound.

Shellfish Subject to PSP

Unfortunately, all species of bivalve shellfish (clams, oysters, mussels and scallops) commonly eaten in Washington have the potential to take up PSP toxins when *A. catenella* swimmers or cysts are present. (Descriptions of some of the shellfish sought by recreational diggers are provided on the center spread of this document.) Different shellfish species vary considerably, however, in the rates at which they become toxic, the total amounts of toxins they take up, how the toxins are distributed in their bodies, and the speed with which they purge themselves of the toxins.

Some kinds of shellfish are highly tolerant of PSP and can feed normally when *A. catenella* is abundant. This causes them to become very poisonous rapidly. Other kinds have low tolerances to PSP and tend to reduce their feeding rates when *A. catenella* is abundant. Such species are less likely to become highly toxic. It is very rare that shellfish themselves are killed by the PSP toxins they consume.

In butter clams, much of the PSP toxins tends to become concentrated in the black tip of the siphon and is held there for varying lengths of time. This retention (and also the consumption of cysts) is probably what causes butter clams to be poisonous throughout the year in certain areas. Razor clams tend to concentrate PSP toxins in their gut, which should be removed prior to consumption. Mussels tend to take up and lose the toxins rapidly. Because mussels normally colonize rocks and pilings, they are above the sediments where cysts accumulate. As a result, PSP in mussels is generally related to an abundance of swimming forms of *A. catenella* and, thus, more likely to occur during the warmer months. Nevertheless, be forewarned that mussels can become poisonous at other times, if storms stir up the bottom-dwelling cysts.

Paralytic shellfish toxins have also been found at low concentrations in limpets, shore snails, moon snails, hairy tritons and several other kinds of marine life that some people like to eat. Several species of crabs have been found to contain small amounts, but not enough to cause concern. In Dungeness crabs, for example, the toxins have been found in the digestive tract.

PSP and Red Tides

There is much misunderstanding about the relationship between red tides and poisonous shellfish — including a widespread tendency to equate the two. The term "red tide" is a misnomer, because red tides are not tides at all, and many of them are not even red. Scientists use this term to describe an area of discolored water — usually amber, brown, purple, red or pink — that is formed by accumulations of large numbers of planktonic organisms. A discolored area or red tide may be confined to relatively small patches, or it may cover several acres or even many square miles of the sea.

Unfortunately "red tide" is often used by non-scientists to indicate the presence of poisonous shellfish, when, in fact only a very small percentage of the visible red tides cause shellfish to be unsafe. In Washington, most outbreaks of poisonous shellfish occur when there has been no discoloration of the water at all.

In the Pacific Northwest, there are many species of plankton that cause red tides. One of those is *Mesodinium*, a one-celled animal that frequently causes a red tide varying in color from brick red to purple. Another red tide often seen is the color of tomato soup. It is caused by *Noctiluca*, another dinoflagellate. *Noctiluca*, which means "night light," often produces a brilliant display of bioluminescence when the water is disturbed at night. Because it is very buoyant, it is frequently blown into windrows on the water or into bands of orange-red scum along the shore. Both of these red tides are harmless.

Of the many species that form red tides in Washington waters, *A. catenella* is the only one known to cause PSP. Water discolored by A. *catenella* varies from the color of weak tea to rusty red, but "red tides" caused by this species are unusual in Washington waters. Because shellfish filter great volumes of water, *A. catenella* populations do not need to be very dense for the shellfish to collect enough poison to require that the beaches be closed to harvesting. In fact, most outbreaks of PSP in shellfish from Washington to Alaska occur when *A. catenella* is relatively sparse, not dense enough to discolor the water.

Keep in mind, then, that although a red tide *may* indicate that shellfish are toxic, it is dangerous to assume that lack of a red tide means that shellfish are safe to eat. Determining what shellfish gathering areas in Washington are safe or unsafe is the responsibility of state and/or local health jurisdictions.

PSP Program in Washington

The Washington Department of Health began intermittent testing of shellfish for PSP in the 1930s, when there were many PSP illnesses and deaths in California. In 1942, as a result of testing after three deaths in the Strait of Juan de Fuca, harvesting of geoducks, horse clams, hardshell clams and mussels was prohibited on all beaches from Dungeness Spit to the Columbia River from April 1 through October 31. This closure, based on annual reoccurrences of toxic shellfish, was in effect until 2002, when it was rescinded for the Strait of Juan de Fuca and replaced by a monitoring program. The remainder of the coastal closure is still in effect. Razor clams are excluded from this closure and are monitored for toxins under a separate program.

Warnings about poisonous shellfish on other Washington beaches are provided by a PSP monitoring program begun in 1957, after PSP deaths occurred in British Columbia. Under this program, local health jurisdictions, tribes and volunteer groups work closely with the state to ensure that public beaches are sampled and tested for PSP. Closure of recreational beaches is coordinated by state and local health agencies. Monitoring and regulation of commercially harvested shellfish is the responsibility of the state.

Testing schedules vary, depending on the particular growing area and on the agency responsible. In general, some level of testing occurs from April through October at two-week intervals. Some areas are tested less frequently, whereas others are monitored regularly throughout the year. The state has initiated an early warning detection system using caged mussels to help predict outbreaks of PSP in other species of shellfish.

Shellfish samples are sent to the state's Public Health Laboratory for determination of toxin content by a bioassay method, the only one presently approved by the U.S. Food and Drug Administration (FDA). When toxin levels reach 80 micrograms per 100 grams of shellfish meat, harvesting must cease, according to FDA regulations. The state closes commercial harvesting on an area-by-area basis, and state and local health jurisdictions close recreational harvesting areas as necessary. Sometimes in a particular location, closures apply to only one or two species of shellfish, but not to other species with acceptable levels of PSP. The news media are notified of closures, and some — although not all — heavily used beaches are posted with closure signs.

Commercially harvested shellfish are routinely tested for PSP toxins. Despite a vast increase in areas subject to PSP outbreaks and intermittent episodes of extraordinarily high PSP levels, there have been only a few isolated cases of PSP from commercially harvested shellfish.

Importance of Closures

Because an average person can eat a meal of shellfish containing 80 micrograms of toxin and as much as 200 micrograms of toxin per 100 grams of shellfish meat without experiencing any PSP symptoms, many people think that the closure of beaches at the 80-microgram level set by the FDA is overprotective, and they ignore closure warnings. There are several important reasons, however, that make it prudent to set the closure level at 80 micrograms per 100 grams of meat.

Distribution of *A. catenella* can be patchy and is generally not predictable in either timing or location. If some shellfish contain 80 micrograms on the day of testing, it is quite possible that they will contain more toxins a few days later, or that shellfish on a nearby beach will have much higher levels of toxins. A program based on higher closure levels would require that shellfish sampling be very closely spaced (every half-mile in some situations) and done as often as two or three times per week. Clearly, this is not feasible, because the cost of collecting and testing each sample currently is well over $100. This is also infeasible because sampling more often than every two weeks, when low tide series occur, would be very difficult.

As explained, different species of shellfish vary in their rates of uptake and loss of toxins. It simply is not practical in all cases to sample the species with the fastest uptake and the slowest loss rates. Another important factor is that people who eat shellfish differ markedly in weight, appetite and response to the toxins. Consumption of alcohol is thought to increase the effect of the toxins, adding still another variable. All of these factors have been considered in establishing the level of acceptable toxins in shellfish tissue.

Determining what shellfish gathering areas in Washington are safe or unsafe is the responsibility of state and/or local health jurisdictions.

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Safety Precautions

Please remember—

You can't rely on the color of the water to indicate the presence of PSP, because shellfish may be unsafe even if there is no discoloration of the water.

You can't tell if shellfish are toxic:

- by examining them, since poisonous shellfish do not look, taste or smell any different from nontoxic ones;
- by cooking them with a clove of garlic or a silver spoon to see if the garlic or spoon turns black — this is folklore and entirely untrue;
- by using a field or home testing kit because, to date, no reliable kit has been developed;
- by using a "sample and see" method, since a single shellfish will occasionally contain enough poison to kill an adult. Even if a single shellfish does not cause PSP symptoms, a whole meal could contain a potentially lethal dose.

You can't be sure of getting rid of enough of the poison by any method tried so far:

- Boiling does not destroy the toxin.
- Discarding the water in which the shellfish have been cooked will remove only a small part of the poison.
- Cutting off and discarding the black tip of a butter clam's neck removes much of the toxin, but the rest of the clam could still contain hazardous amounts of the toxin.
- Soaking live shellfish in water from a PSP-free area to purge them is unreliable.

So please—

- Remember that the PSP program carried on by state and local health jurisdictions offers the best information about areas where shellfish should not be harvested because of PSP.
- Call the PSP hotline (see numbers at right) before gathering shellfish.
- Observe all beach closures.

PSP Hotline

The state of Washington maintains a hotline and a website with current information on closures for recreational gathering of shellfish. The recordings and website are updated whenever changes in closures are made. You are urged to consult these sources *each time* before gathering shellfish.

The hotline numbers of Washington, British Columbia, California, and Oregon, as well as the website address for Washington, are listed below.

Washington **800.562.5632**

www.doh.wa.gov/shellfishsafety.htm

British Columbia **604.666.2828**

California **800.553.4133**

Oregon **800.448.2474**