

# Shellfish Safety

## Summary

Washington State is a national leader in the production of commercial oysters and clams. Hundreds of thousands of people also harvest these shellfish recreationally from public beaches. If pathogenic bacteria, viruses, or man-made or natural toxins are in the growing waters, they can accumulate in shellfish tissue and cause illness in people. The Department of Health regulates the harvest of shellfish from commercial growing areas and works with other agencies to inform the public about the safety of harvesting shellfish from public beaches. Various agencies and tribes sample both water and shellfish and regulate pollution sources to protect the growing areas from contamination. In 2006, Washington had a record number of gastrointestinal illnesses caused by *Vibrio parahaemolyticus*, a naturally occurring bacterium prevalent in marine waters during warm weather.

## Introduction

Bivalve shellfish—such as clams (including geoduck), oysters, scallops, and mussels—filter their food from seawater. These shellfish are a healthy and safe food source except when the water is contaminated. Shellfish can concentrate contaminants in their tissues and become unsafe to eat. Eating unsafe shellfish can affect the health of any person. But young children, the elderly, and people with compromised immune systems are more likely to become sick and experience more severe symptoms. Shellfish contaminants fall into three categories: bacteria and viruses, marine biotoxins, and chemicals.

**Bacteria and viruses.** Pathogenic bacteria and viruses that accumulate in shellfish do not harm the shellfish but can cause illness in humans.

---

**Definitions:** Commercial and recreational shellfish harvesting areas are classified based on pollution source evaluations and water quality monitoring. **Approved (Open)** areas are those where pollution source evaluations and bacteriological water quality data show that fecal contamination and other harmful substances are not present in unsafe amounts. **Conditionally Approved (Conditional)** areas are those that meet the Approved criteria except when known pollution conditions exist, for example, following a heavy rainfall. An area is classified as **Prohibited (Closed)** when contamination may be present in dangerous concentrations.

---

Thorough cooking of infected shellfish can reduce the number of microorganisms, but most people prefer to eat shellfish raw or lightly cooked. Some bacteria produce toxins that are not destroyed by cooking.

Norovirus is the most common fecal contaminant found in shellfish growing waters.<sup>1</sup> Cooking shellfish thoroughly will inactivate this virus.

*Vibrio parahaemolyticus* (*Vp*) is a naturally occurring marine water bacterium that can cause illness if people eat raw or undercooked shellfish. *Vp* levels increase in warmer weather. Levels of *Vp* in marine water are not related to contamination or to the presence of shellfish. Oysters are particularly likely to contain harmful amounts of *Vp* because they grow on the warmer surface of beaches rather than in the cooler sediment where clams grow. In most years, *Vp* is the leading cause of shellfish illnesses in Washington State. Symptoms are generally moderate, typically lasting 1-7 days and characterized by watery diarrhea and abdominal cramps. Illnesses can be minimized if shellfish are harvested soon after the tide recedes and then kept cold until eaten. Moderate cooking destroys these bacteria. Regulatory provisions for commercial shellfish operations may not be adequate to assure the safety of eating raw shellfish in the summer. The best prevention measure is to cook shellfish at this time of year.

**Natural marine biotoxins.** Washington routinely closes commercial and recreational shellfish areas when natural marine biotoxins are present. Two types are found in Washington. Both are produced when environmental conditions allow algae to reproduce rapidly or “bloom.” The most common group of biotoxins, which causes paralytic shellfish poisoning (PSP), is sometimes called “red tide.” PSP toxin temporarily interferes with the transmission of nerve impulses, resulting in numbness of the lips, tongue, and face, lack of coordination, and difficulty talking and breathing.<sup>2</sup> In severe cases, artificial

respiration is required. The second most common biotoxin, domoic acid, causes amnesic shellfish poisoning (ASP). Symptoms include diarrhea and vomiting, and in more severe cases, loss of short-term memory and coma. There is no antidote for either biotoxin. The timing for both types of algae “blooms” is unpredictable, but PSP generally occurs more often in the late summer.

All filter feeders, as well as the crabs and snails that eat them, can accumulate these two toxins in their bodies. Harvest areas are closed and warnings are issued to the public when biotoxin levels in sampled shellfish are elevated.

Cooking does not provide protection from biotoxins.

**Chemicals.** Many sources of chemical contaminants can pollute waterways: industrial outfalls, sewer outfalls, storm water run-off in urban or industrial areas, airborne contaminants that are deposited into waterways, and spills from commercial boats. Some chemicals end up in sediment where shellfish live and remain for years, making the shellfish that live there unsafe to eat. The Department of Health has issued shellfish consumption advisories in three locations because of chemical contamination: Port Angeles Harbor, the Lower Columbia River, and the Lower Duwamish River. Local health departments may also issue shellfish consumption advisories based on chemical or biological contamination. To get links to local health departments and updated shellfish consumption advisory information visit <http://www.doh.wa.gov/LHJMap/LHJMap.htm>.

## Description of Indicators

**Hazard indicators.** Sanitary surveys of growing areas provide hazard indicators for unsafe shellfish use. These surveys include analysis of water samples, assessment of all potential sources of pollution, and an evaluation of how tides and currents might distribute contaminants. Both commercial shellfish growing areas and public beaches (recreational beaches) are assigned classifications. (See Definitions.)

One hazard indicator is the level of fecal contamination by human and animal wastes. Surveyors collect marine water samples and evaluate septic systems, sewage treatment plants, storm water, agricultural runoff, and other potential sources of pollution. The samples are

analyzed to determine the levels of fecal coliform bacteria.

Another hazard indicator is the level of *Vp* bacteria found in shellfish tissue. Because levels are closely related to water and air temperatures, monitoring is conducted only between May and October. Monitoring is limited to those areas where illnesses have occurred in recent years.

The level of PSP toxin and domoic acid in shellfish tissue is a hazard indicator. Toxic varieties of phytoplankton in marine water could be used as a hazard indicator for marine biotoxins. But *directly* determining the levels in the tissue is a better indicator of risk. Samples of various molluscan shellfish are routinely collected for analysis to monitor biotoxin levels.

Some information exists on the concentrations of chemical contaminants in shellfish growing waters, but chemical analyses are not routinely done.

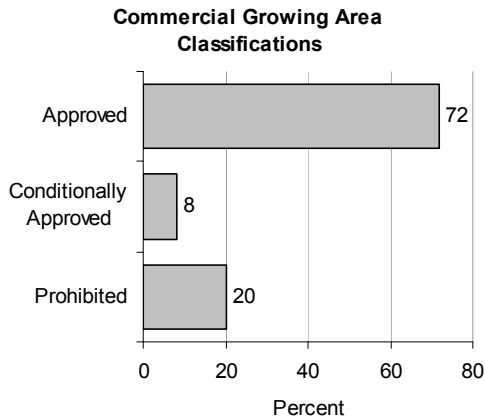
**Exposure indicators.** There is little information on the amount of shellfish consumed, and so it is difficult to determine exposure. It is also not feasible to directly monitor levels of chemicals or biotoxins in people.

**Protective indicators.** At a minimum, the marine water in each shellfish growing area is sampled at least six times each year for fecal coliform bacteria. Over the year, changes in known pollution sources are also noted. The proportion of sanitary surveys reviewed each year could be used as a protective indicator. The number of public education campaigns and other outreach efforts regarding shellfish safety could also be used as protective indicators.

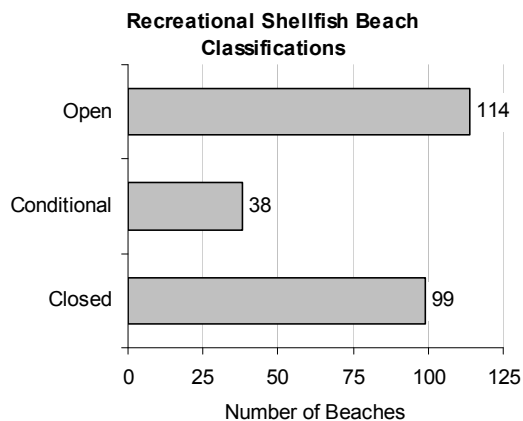
**Health outcome indicators.** The Department of Health tracks illnesses associated with eating contaminated shellfish. *Vp* causes most shellfish-related illnesses reported in Washington. In most years no illnesses due to fecal contamination of Washington's shellfish are reported. Though they rarely occur, illnesses related to PSP and domoic acid are also tracked.

## Classification of Growing Areas

**Commercial areas.** In 2006, about 250,000 acres were classified as Approved or Conditionally Approved for commercial shellfish harvesting. More than 60,000 acres were classified as Prohibited. (See Definitions.) The amount of commercial areas in each classification is a good indicator of the overall levels of contamination in Washington's shellfish growing waters.

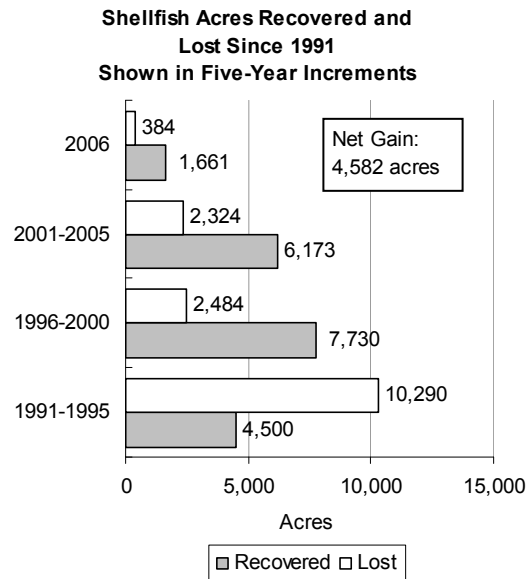


**Recreational growing areas.** In 2006, Washington listed 1,396 public beaches. About 18% (251) of those beaches had sufficient numbers of shellfish and harvesters to merit conducting a sanitary survey. Of the beaches that were assessed, 60% were classified as “Open” or “Conditional.”

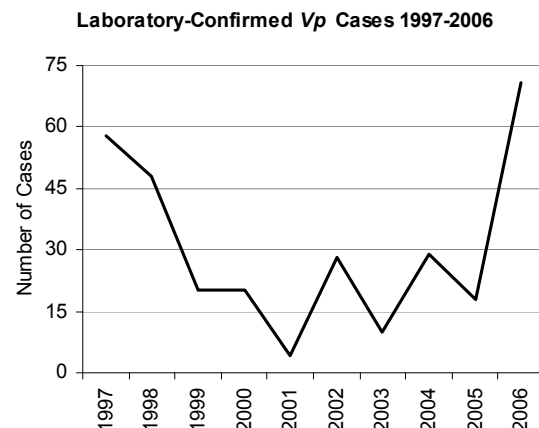


### Time Trends

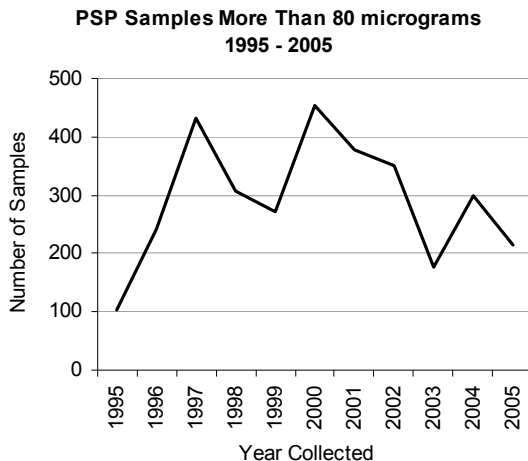
**Classification.** Since 1991, the Department of Health has used a consistent approach to the classification of commercial growing areas, and so classifications can be compared over time. From 1991 through 2006, about 15,500 acres of shellfish growing areas were lost to production because their classification was downgraded. But during the same period, more than 20,000 acres of commercial shellfish areas were recovered because environmental conditions improved.



**Vibrio parahaemolyticus.** For the past 10 years, the annual number of laboratory-confirmed cases of *Vp* has varied from 4 to 71. Numbers were highest in 2006, when Washington experienced an unusually dry and warm summer. The majority of *Vp* illnesses are not reported because they are not severe.



**Marine biotoxins.** Since 1995, about 3,000 shellfish samples have been submitted each year for analysis of paralytic shellfish poison levels. Washington closes shellfish harvests when more than 80 micrograms of PSP are found per 100 grams of tissue. The number of samples above this level ranged from a low of 102 in 1995 to a high of 454 in 2000.



### Geographic Variation

Commercial shellfish harvest area classifications are determined in part by proximity to potential sources of pollution. Urban areas typically have many more sources of pollution. So most approved commercial harvest areas are located away from urban areas as are recreational shellfish beaches.

Strains of the *Vp* bacteria found in the Pacific Northwest appear to be more virulent than those found in other parts of the United States.

### **High Risk Populations**

There is little demographic information on residents who consume shellfish. But some American Indian tribal members and some people of Asian descent collect and consume much more shellfish than other groups, which suggests they might be at higher risk for shellfish-associated illness.

People might not be aware of unsafe recreational shellfish harvesting areas if this information is not provided in a language they understand or if they cannot read posted warning signs.

As with most foodborne illnesses, young children, the elderly, and people with compromised immune systems face the highest risk of significant illness.

### Intervention Strategies

The prevention of illnesses and the protection of shellfish growing areas are the responsibility of the shellfish industry, various regulatory agencies, and the general public.

The principal control measures include:

- Closing contaminated commercial and recreational areas
- Educating the public about when and where to safely collect shellfish for consumption and about the hazards associated with eating raw shellfish
- Maintaining local and state agency capacity to monitor water and shellfish
- Protecting water from contamination
- Conducting prompt, coordinated response to and public notification of known emergencies (e.g., PSP warnings)
- Reviewing the adequacy of regulations that address *Vp*.

**See Related Chapter:** [Foodborne Illnesses](#)

#### **Data Sources**

Department of Health 2005 Annual Inventory of Commercial and Recreational Shellfish Areas  
 Department of Health Biotoin Database  
 Department of Health Shellfish *Vibrio* Database  
 Department of Health Shellfish Water Quality Database

#### **For More Information**

PSP toll-free hotline (800) 562-5632  
 Department of Health Marine Biotoin Bulletin  
 Department of Health website for shellfish safety information:  
<http://ww4.doh.wa.gov/scripts/esrimap.dll?name=bioview&Cmd=Map&Step=1>  
 U.S. Centers for Disease Control and Prevention website for shellfish safety information:  
[http://www.cdc.gov/ncidod/dbmd/diseaseinfo/marinetoxins\\_g.htm](http://www.cdc.gov/ncidod/dbmd/diseaseinfo/marinetoxins_g.htm)

#### **Endnotes**

<sup>1</sup> Retrieved August 16, 2007 from <http://www.cdc.gov/ncidod/dvrd/revb/gastro/norovirus.htm>.

<sup>2</sup> Retrieved August 16, 2007 from [http://www.cdc.gov/ncidod/dbmd/diseaseinfo/marinetoxins\\_g.htm](http://www.cdc.gov/ncidod/dbmd/diseaseinfo/marinetoxins_g.htm).