# Shellfish Foraging Guide to Port Susan and South Skagit Bay

*"When the tide goes out*
*the table is set."*
A Tlingit saying

Compiled and edited by the Pacific Shellfish Institute
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*Supported with funds from the Stillaguamish River Clean Water District of Snohomish County*

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**Acknowledgements**

This manual provides an introduction to recreational shellfish harvesting for the Port Susan and the South Skagit Bay areas, along with information on bivalve shellfish biology, ecosystem services, and water quality. The preparation of this guide was funded with a Discretionary Fund grant from the Stillaguamish River Clean Water District (CWD) of Snohomish County. We would like to thank the CWD for its support of clean water and healthy shellfish populations in Snohomish County.

For more information about the CWD and the Discretionary Fund, visit the CWD website: http://cwd.surfacewater.info.

# Recreational Shellfish Harvest in Washington State

Each year, thousands of residents and visitors flock to ocean beaches and estuaries with shovels, rakes and buckets in hand to take part in the West Coast's vibrant bivalve shellfish sport fishery. In most states, recreational shellfish harvest is only permissible in designated public harvest areas and requires recreational harvesters to obtain a license. Maps of public harvest areas and information for obtaining necessary permits can be found online.

Washington State is unique among the West Coast states in that it allows for private ownership of tideland areas. Private tideland owners are able to harvest bivalve shellfish from their beaches without a license and can even participate in small-scale, non-commercial shellfish aquaculture or "gardening" to grow shellfish for personal consumption.

This guide offers harvesting tips for common shellfish species in the South Skagit Bay and Port Susan region of Puget Sound. It is important to know the water quality of the harvest area in order to insure your shellfish are safe to eat. The following information will help insure your foraging experience is enjoyable and rewarding.

# Shellfish and Water Quality in Port Susan and South Skagit Bay

**Shellfish and Water Quality**

Because bivalve shellfish are efficient filter feeders, they may accumulate pollutants and biotoxins from the environment. Treated wastewater from city sewer outfalls and leachates from septic tanks can contain high concentrations of nutrients, bacteria, viruses, oil and grease, heavy metals and pesticides. Additional sources of pollutants can be recreational and commercial boating activity (particularly near marinas and heavily used anchorages) and storm runoff. Storm runoff contains bacteria and other pollutants that are carried to

shellfish beaches via streams and overland flow. Most of the bacteria are derived from the soil; however, indicator organisms derived from feces of cows, chickens, dogs, cats, and wild animals can also occur in land runoff, resulting in the potential for closure of shellfish beds.

Any or all of these pollutants have the potential to adversely affect shellfish growth and survival and/or make shellfish unfit for human consumption. Even if the shellfish itself is not visibly affected, contaminants concentrated in their tissues may result in a public health hazard, preventing commercial harvesting of the crop or restricting subsistence and recreational harvests. Water polluted by human sewage is particularly hazardous because serious diseases such as salmonella and hepatitis can be transmitted. Indicator organisms of these diseases (so-called because they indicate the presence of vertebrate fecal matter and other human health pathogens) are measured by public health agencies and correlated with the number of pathogens in a water sample. The standards for shellfish growing areas are strict and are equivalent to or exceed drinking water standards.

**Shellfish Growing Area Classification**

To protect human health, all commercial shellfish growing areas are carefully monitored by the Washington Department of Health (WDOH), Office of Shellfish and Water Protection, in response to formal requests from certified commercial shellfish harvesters or tribes.

Growing areas are classified as follows:

- **Approved** - for commercial shellfish harvesting -- shellfish may be cultured and harvested year-round.
- **Conditional approval -** occasional closures resulting from increases of bacteria, usually due to rainfall events.
- **Restricted approval -** marginally acceptable and shellfish must be transferred or relayed to approved waters prior to harvest.
- **Prohibited** - closed to commercial shellfish harvesting, decertified and uncertifiable waters that would produce shellfish unsafe for human consumption.
- **Unclassified -** closed to commercial harvest. An area becomes Unclassified when the Washington Department of Health does not receive a request for classification review. For the purpose of commercial shellfish harvest, Unclassified areas are equivalent to areas that are classified as Prohibited. For recreational harvest Unclassified status does not mean that the water quality is unsafe for shellfish harvest. It simply means that WDOH either does not have enough samples (30) to warrant an evaluation or a classification evaluation has not yet been requested. Water quality can be perfectly adequate for recreational shellfish harvest in Unclassified areas. For Warm Beach residents, there are several resources available to help you determine if water quality conditions in your area are safe for shellfish harvest.

Classification decisions are based on the findings and recommendations from *shellfish sanitary surveys*, which examine pollution sources, marine water quality data, and analyses of relevant environmental factors. In most areas, the WDOH is primarily concerned about bacterial pollution.

**History of Shellfish Classification in Port Susan/South Skagit Bay**

In recent years considerable progress has been made toward improving local bacterial water quality conditions in and around the Port Susan and South Skagit Bay area. These improvements are exemplified by the WDOH upgrades of the South Skagit Bay and Port Susan commercial shellfish growing areas. In 2009 the Approved South Skagit Bay shellfish area was expanded from 1,350 acres to 2,200 acres. Then on April 2, 2010 1,600 acres of the Port Susan shellfish area were upgraded from Unclassified to Approved in response to marine water quality improvements detected by the Stillaguamish Tribe monitoring program. Ambient water quality monitoring by Snohomish County and the Washington Department of Ecology has also detected improving freshwater quality conditions in the Stillaguamish River.

**Shellfish growing area classification changes in the Port Susan/South Skagit Bay area over the past several decades:**

- **1987 -** 6,140 acres of South Skagit Bay commercial shellfish growing area are downgraded from Approved to Restricted.
- **1987 –** 11,900 acres of the southern Port Susan growing area are downgraded to Restricted
- **1993 -** 2,280 acres of South Skagit Bay are upgraded from Restricted to Conditionally Approved.
- **2006 -** South Skagit Bay growing area is upgraded from Conditionally Approved to Approved, but reduced in size to 1,344 acres.
- **2009 -** South Skagit Bay shellfish growing area was expanded from 1,344 acres to 2,200 acres.
- **2010 –** 1,600 acres of the Port Susan growing area were upgraded from Unclassified to Approved.
- **2014 –** Previously Unclassified areas of McKees Beach and Warm Beach to Kayak Point (with the exception of a closure zone at the mouth of Greenwood Creek) were upgraded to Approved

The recent upgrade of the Port Susan shellfish growing area marks an important milestone for all shellfish stakeholders because most of the northern half of Port Susan had been closed to commercial shellfish harvest for more than two decades. After the initial closure of the Port Susan shellfish area in 1987, WDOH received no requests for classification review, so the area lapsed to Unclassified status in the early 1990s. For the purpose of commercial shellfish harvest, Unclassified areas are equivalent to areas that are classified as Prohibited because commercial harvest cannot occur. To regain classification, the

Stillaguamish Tribe started collecting marine water samples in the Port Susan shellfish area in 1998 and WDOH began analyzing the Tribe's Port Susan samples in 2002. The Tribe submitted a formal request for WDOH classification review of Port Susan in 2007. In the fall of 2014 WDOH announced that the marine shoreline from Tulalip Bay north to Warm Beach will be classified as Approved. This includes the shoreline between Kayak Point and Warm Beach, which was previously Unclassified.

Maintaining or upgrading commercial shellfish growing area classifications requires regular marine water quality sampling to monitor fecal coliform bacteria levels within the growing areas. WDOH requires at least 30 water samples to consider a growing area upgrade, which usually takes 3-5 years depending on the sampling frequency. If an area is 'Approved' or 'Conditionally Approved', it is then sampled at least 6 times each year each subsequent year. The WDOH evaluates the shellfish areas annually by reviewing the prior year's water quality data and assessing potential pollution sources to determine whether the existing classifications are warranted. The annual evaluation results are summarized in a brief report for each shellfish area. Every 12 years the WDOH also conducts shoreline surveys to identify direct, indirect, and potential sources of bacterial pollution that might impact the classification of shellfish growing areas.

In addition to the individual shellfish growing area reports, the WDOH prepares an Early Warning System (EWS) summary report for each county. The EWS identifies individual water sampling stations, within each shellfish growing area, where water quality has a *threatened* or *concerned* status. *Threatened* areas could soon be downgraded in classification because water quality is close to failing the standard, or because existing pollution sources may impact public health. *Concerned* areas still meet the standard for their current classification, but the water quality is declining.

Washington Department of Health sends the EWS summary reports to local counties, conservation districts, health districts, and tribes. The EWS summary reports for the South Skagit Bay and Port Susan shellfish growing areas are sent to Snohomish County's Surface Water Management Director, who is responsible for administering the CWD shellfish protection program. The 2014 Early Warning System summary report for Snohomish County is provided as an example in Appendix C.

**Stillaguamish Shellfish Protection Program**

The purpose of the Stillaguamish Shellfish Protection Program is to define goals, objectives, and actions for bivalve shellfish harvest protection within the CWD. Until recently, on-going problems with upland freshwater bacterial pollution contaminating the marine waters at the mouth of the Stillaguamish River have led to WDOH restrictions on commercial shellfish harvest in South Skagit Bay and Port Susan. Snohomish County made water quality and shellfish protection in this area a priority by establishing the CWD in 1993. One of the goals of the CWD is to "Restore water quality in saltwater tidelands to allow the upgrading of conditionally approved, restricted, and prohibited shellfish beds." The CWD's Stillaguamish Shellfish Protection Program defines four shellfish protection goals:

1. Improve bacterial water quality to allow shellfish growing areas adjacent to the CWD in South Skagit Bay and Port Susan to be opened and maintained for commercial, tribal, and recreational harvest.
2. Foster self-sustaining and harvestable populations of shellfish adjacent to the CWD.

3. Raise public awareness about the status and trends of water quality and shellfish in and adjacent to the CWD.
4. Monitor progress and adaptively manage work programs to achieve the goals listed above.

For more information on the Stillaguamish Shellfish Protection Program or status of the shellfish growing areas in Snohomish County, contact Sean Edwards, Snohomish County Public Works (see Appendix A: Contact Information)

**Water Quality Indicators for Warm Beach**

Figure 1. Southern boundary of the Prohibited area

Figure 2. Prohibited area

The northernmost section of Warm Beach is Prohibited for shellfish harvest (Figure 1-2) due to proximity to the Warm Beach Christian Camp Water Reclamation Facility and natural conditions. This shellfish closure zone is relatively long (approximately 1.3 miles along the shoreline channel). Warm Beach Christian Camp and Snohomish County are exploring the potential for WDOH to reduce the southern extent of the shellfish closure zone. The most

current data from water quality monitoring at stations in the Port Susan/Possession Sound and South Skagit Bay area can be found in the Annual Growing Area Review Reports, which are available on the WDOH website (www.doh.wa.gov) or by contacting Scott Berbells with the WDOH, Office of Shellfish and Water Protection (360-236-3324, scott.berbells@doh.wa.gov).

The WDOH, Office of Shellfish and Water Protection currently maintain marine water quality data for Warm Beach and surrounding areas. The standard for approved shellfish growing waters is fecal coliform geometric mean not greater than 14 organisms/100 ml and an estimate of the 90th percentile not greater than 43 organisms/100 ml. Figures 3 and 4 shows the water quality stations in the classified Port Susan/Possession Sound growing areas. Stations within the Approved shellfish growing areas in Port Susan and Possession Sound all meet the standard for approved shellfish growing waters.
While station #299 is associated with the Warm Beach Christian Camp Water Reclamation Facility Prohibited zone, water quality data from this station can also be useful to Warm Beach residents in the Unclassified area. Based on samples collected by WDOH from 2009 to 2014, the water quality in this area meets the standard for approved shellfish growing waters. Monthly Plant Monitoring Reports for the Warm Beach WRF from January 2010 to June 2012 show that fecal coliform levels in the treated effluent area effectively zero. This data alone will not result in an upgrade in the classification and tideland owners within this Prohibited area should not consume shellfish from their beaches. However, when combined with water quality data from other stations, this data is a good indicator for Warm Beach residents south of the Prohibited zone.

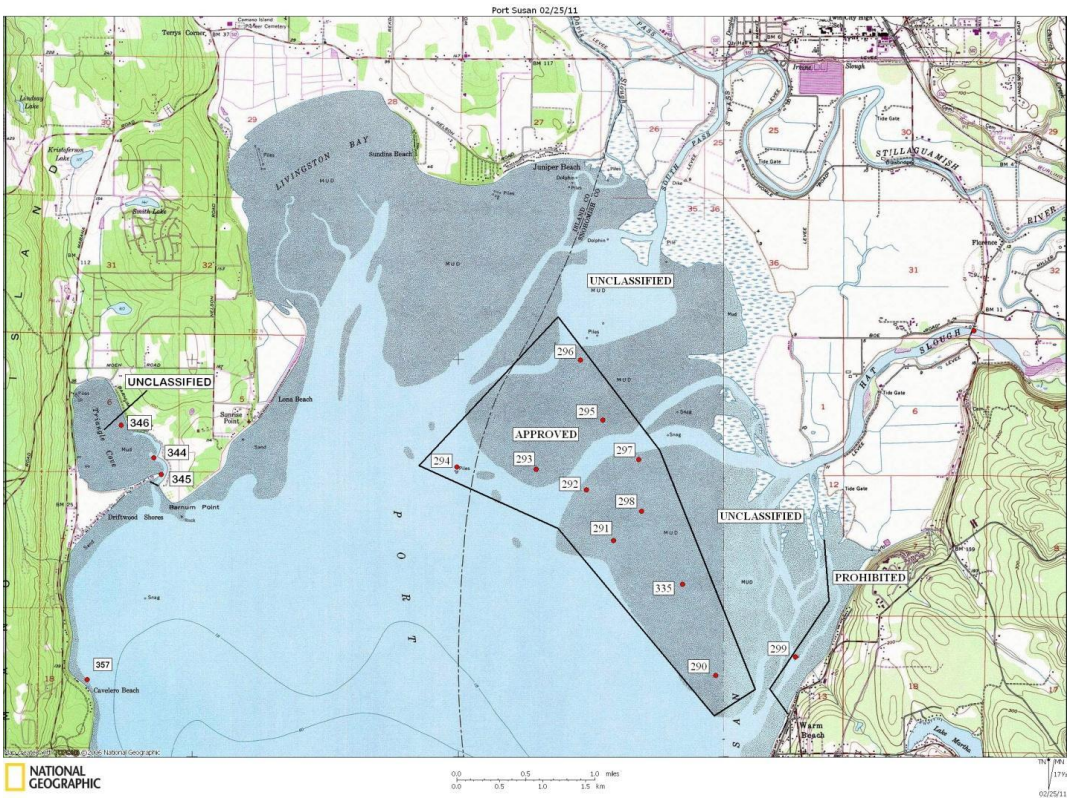



**Figure 3. Port Susan water quality monitoring stations**

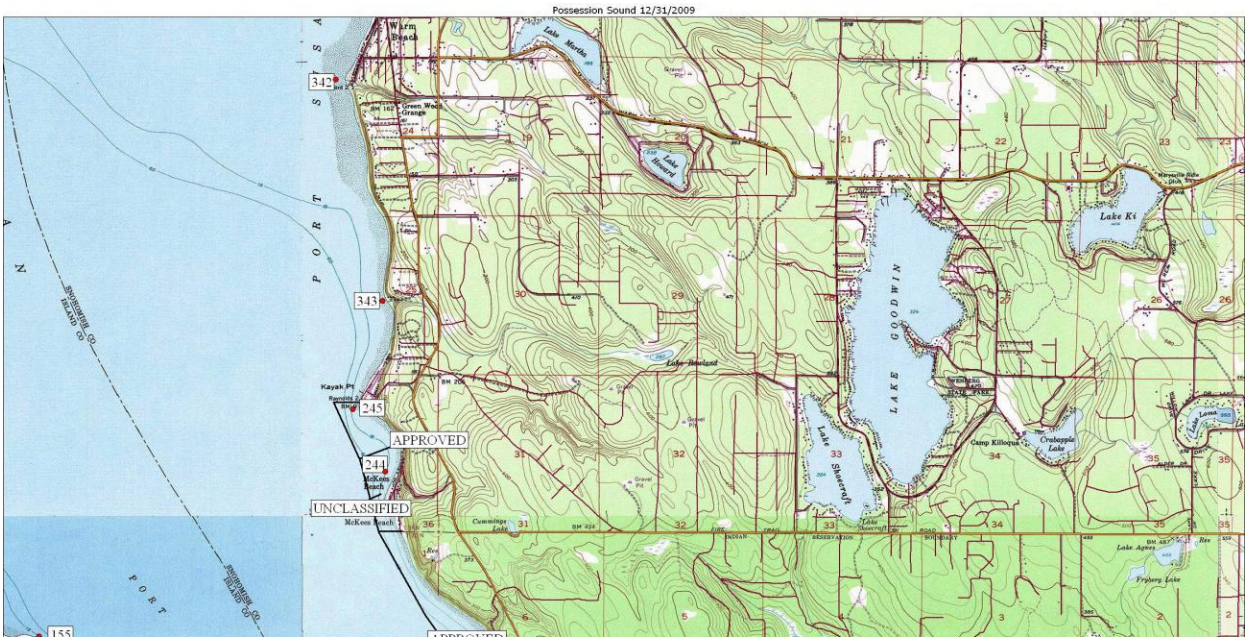



**Figure 4. Possession Sound water quality monitoring stations**

# Nutritional Value of Shellfish

Maintaining good health and a sense of well-being are top priorities in today's hectic and stressful world. People are paying more attention to their diets and turning to healthy, sustainable shellfish. A University of Washington study confirms that shellfish are a healthy addition to a balanced low-fat diet. Shellfish are much lower in saturated fat than pork or beef and provide high quality protein. In addition, shellfish contain significant amounts of heart-healthy omega-3's, are excellent sources of protein, and are especially good sources of iron, zinc, copper, and vitamin B12 (Figure 5).

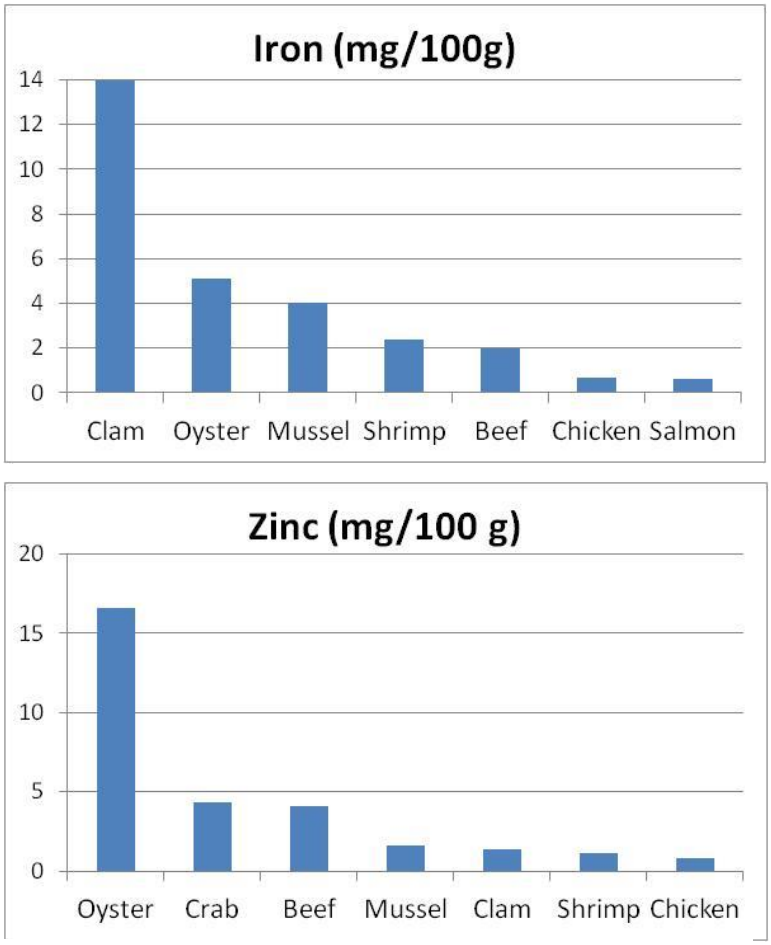



Figure 5. Nutritional Values of Shellfish

# Shellfish Ecosystem Services

Shellfish are well recognized in scientific literature for the critical environmental services they perform in the ecosystem, including improving water quality, sequestering carbon, enhancing estuarine sediment, recruitment of eelgrass seeds, and formation of three-dimensional structure which provides critical habitat for several species of marine flora and fauna. As noted by the Puget Sound Action Team:

> *"Shellfish are integral components of the coastal ecosystem, so much so that some ecologists view oyster beds and oyster reefs as the outstanding communities of the estuary. The interactions between shellfish beds and other organisms and elements of the coastal ecosystem are numerous and complex. Environmental factors, such as water temperature, salinity, food availability, substrate and predators determine the distribution, abundance and condition of different shellfish species. In similar but reverse fashion, shellfish exert a dramatic influence on the character and condition of the estuarine environment, providing three dimensional structure and habitat for plant and animal life of all kinds and playing particularly important roles in the uptake and recycling of energy and nutrients."*

Shellfish significantly enhance water quality and clarity through the role they play as efficient filter feeders. One large Pacific oyster can filter as much as 32 gallons of water each day as they feed off the phytoplankton that occurs naturally in marine waters. For comparison, it has been estimated that a single Manila clams filters approximately 8 gallons of water; a mussel up to 13 gallons; and a geoduck clam up to 32 gallons. This process removes or reduces nutrients (e.g. nitrogen and phosphorus), silt, bacteria, and viruses, and improves water clarity, which enhances habitat for seagrasses and other aquatic vegetation.

This filtration function is particularly critical given the poor health many of our marine waters are in today. The Chesapeake Bay on the East Coast and Hood Canal on the West Coast are two prime examples of water bodies periodically suffering from hypoxic conditions, with historically high levels of nutrients (such as nitrogen) causing excessive algae growth. When algae dies, the decomposition process consumes oxygen, leading to dangerously low levels of dissolved oxygen in the water column, which can negatively impact marine plants and animals. Sources of excess nutrients in marine waters can come from a number of sources, including sewage treatment plant outfalls, boater sewage, failing on-site septic systems, runoff from pet waste and agricultural production, and waste from wild animals such as birds or marine mammals.

In some parts of the world, such as Sweden, the ecosystem services provided by shellfish has led to the integration of shellfish aquaculture into local water quality improvement programs. Because bivalve shellfish are roughly 1% nitrogen, it can be concluded that for each kg of shellfish meat harvested from an actively growing shellfish bed or farm, 13.6 g of nitrogen is harvested (permanently removed) from the growing waters.

# Recreational Harvest Species

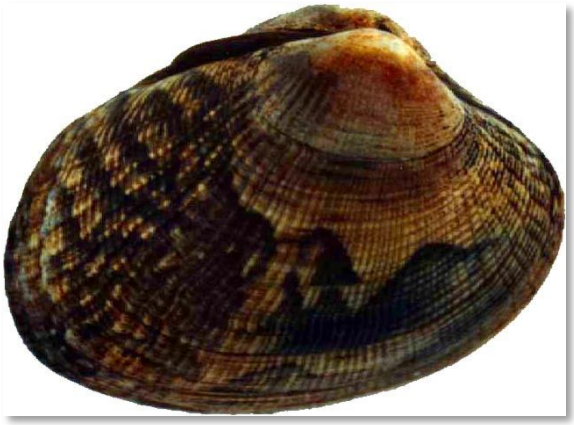
Clam digging and shellfish harvest is a popular recreation in Washington State. The most commonly sought after species are Pacific oysters (*Crassostrea gigas*), Manila clams *(Venerupis philippinarum)*, and native littleneck clams (*Leukoma/Protothaca staminea).* South Skagit Bay and Port Susan area have large populations of purple varnish clams (*Nuttalia obscurata*) and eastern softshell clams (*Mya arenaria*), which can be harvested as well.

## Pacific Oysters

Originally from Japan in the 1900s, Pacific oysters (*Crassostrea gigas*) are the most common and commercially important species in Puget Sound and along the West Coast. Pacific oysters are extremely hardy, with a high tolerance to a range of temperature and salinity fluctuation. Pacific oysters produce a grayish-white shell, which can vary in shape depending on the environmental conditions and the growing method used. Pacific oysters can reach 4 to 6 inches in 2 - 4 years and can continue to grow larger if left to their own devices on the beach. Oysters can typically be found on firm or rocky beaches. Harvest regulations allow 18 oysters to be harvested per day, and they must be shucked on the beach and the shells left on the same beach, at the same tide height they were taken.

## Manila clams

Manila clams *(Venerupis philippinarum)* are a popular species among shellfish foragers. Manila clams are also one of the easiest clams to harvest, burrowing only 2-4 inches into the sediment compared to 6-10 inches for native littleneck clams and 4-12 inches for butter clams. Manila clams prefer higher intertidal areas, compared to littleneck and butter clams, which can provide easier access to clams for harvesting. Harvest regulations for manila clams is 40 clams or 10 lbs per day, and the minimum size is 1 ½".



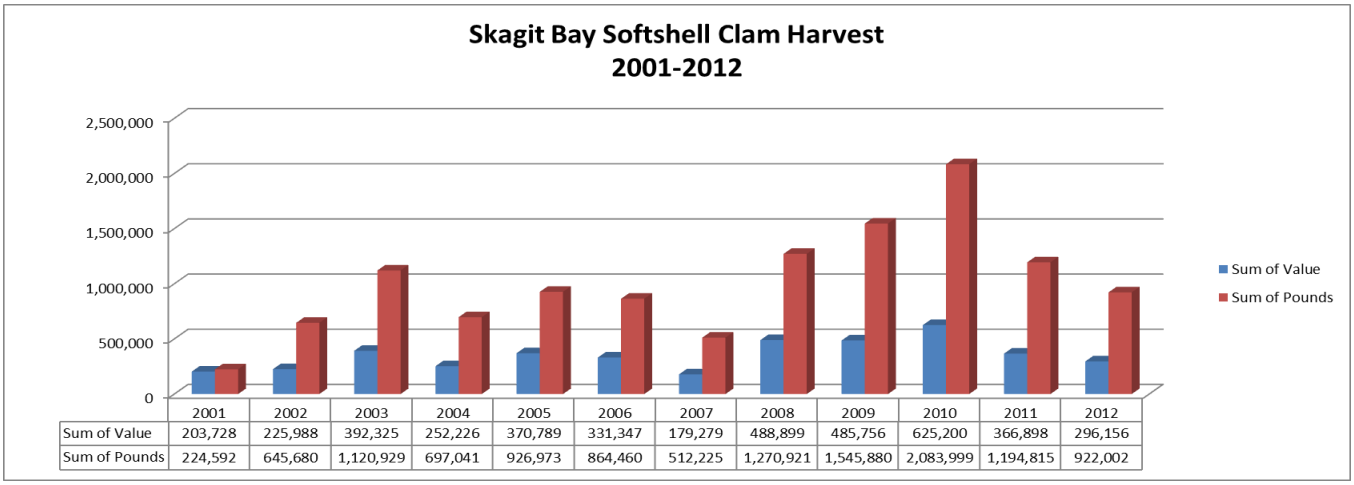
## Purple Varnish Clams

The purple varnish clam, (*Nuttalia obscurata*) also called dark mahogany or savory clam, is an invasive species found in Puget Sound and are now abundant in the Warm Beach area. Varnish clams are smaller and flatter than Manila clams and generally occupy the same depth (1-2 inches). Varnish clams are commonly found in the upper intertidal zone, and occasionally in the middle and lower intertidal zone. The varnish clam is more freshwater tolerant than other species, and the most abundant populations are found in areas where there are significant influxes of fresh water runoff. Varnish clams can be harvested recreationally in British Columbia, Washington and Oregon.

While not as popular as Manila clams, varnish clams are quite edible and are even used by some seafood restaurants in Washington. If you plan to harvest varnish clams from your beach, however, be aware that these clams concentrate biotoxins at higher levels than other clams and they hold onto the toxin for longer periods of time. Varnish clams are unique in that they are bimodal benthic feeders, meaning they can filter nutrients out of the sand while they wait for the tide to come in, which may account for the higher toxin levels typically observed in this species. The Department of Fish and Wildlife's website provides detailed information on the varnish clam and other recreational species as well as human health concerns: http://wdfw.wa.gov/fishing/shellfish.

## Eastern Softshell Clam

The Eastern Softshell clam (*Mya arenaria*) is abundant in the South Skagit Bay/Port Susan area, and currently supports a commercial shellfishery (Figure 6). Although, this species is highly sought after on the eastern coast of the United States, the west coast recreational harvest is rather small. This clam was first seen on the west coast in San Francisco Bay in 1874. It is believed to have been introduced from the Atlantic coast with Eastern oysters (*Crassostrea virginica*). It has spread north, reaching Alaska in the 1950's. The Eastern Softshell clam thrives in areas of low salinity and can survive several days in an anaerobic environment, which makes it tolerant of being covered with silt.




| | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Sum of Value | 203,728 | 225,988 | 392,325 | 252,226 | 370,789 | 331,347 | 179,279 | 488,899 | 485,756 | 625,200 | 366,898 | 296,156 |
| Sum of Pounds | 224,592 | 645,680 | 1,120,929 | 697,041 | 926,973 | 864,460 | 512,225 | 1,270,921 | 1,545,880 | 2,083,999 | 1,194,815 | 922,002 |

**Figure 6. Skagit Bay Soft Shell Clam Harvest Data from Washington State Department of Fish and Wildlife.**

In PSI's follow-up to the 2012 Shellfish Gardening Workshop it was found that some areas of south Skagit Bay and Port Susan may not be suitable for oyster gardening. The Warm Beach area in particular has very low salinity, which makes for very slow growing oysters and Manila clams. There is also a lot of sediment from the Stillaguamish River, which makes gardening in this area very labor intensive. These same conditions make the area ideal for Eastern Softshell clams, so PSI recommends that residents harvest the wild clams rather than attempting oyster or Manila clam gardening.

The medium-sized Eastern softshell clam is distributed on the west coast of North America from Alaska to California. The shell is thin and brittle, rounded at the foot end and rather pointed at the siphon end. Eastern Softshells are normally found in sand and mud, and are most abundant in the upper half-tide level near river mouths or heads of bays where low salinity water occurs. Eastern Softshells normally bury to a depth of 8-14 inches, and can be harvested with shovels or hand rakes.

The same harvesting guidelines and precautions described above also apply to the Eastern Softshell clam. These clams are very delicate so when harvesting be careful to dig around the clam to avoid breaking the shell. The Washington State Department of Fish & Wildlife requires that all clams dug up must be kept, regardless of size. These clams will not survive being put back, so you must keep what you dig. Daily limits of Eastern Softshell clams are 40 clams or a maximum of ten pounds. Below are some harvesting tips, which can also be found on the Oregon Department of Fish and Wildlife website. These harvesting guidelines can be used in foraging for Eastern Softshell or varnish clams.

1. Identify the show (siphon hole-Figure 7). Softshell clams have variable shows, but they are generally round.

2. Dig around the show in order to not break the delicate shell. You can also use your hands to avoid damage to the shells (Figure 8).

3. Collect your prize!

Figure 7. Eastern Softshell Clam shows (siphon holes).

Once harvested it is recommended you allow the clams to soak in seawater for several hours or overnight, so they will purge out any silt or mud that might be in them. After they have soaked you can use them in your favorite recipe or try one of the recipes included on the following page.

Figure 8. A clam digger using his hands to extract the clam.

Figure9. English Boom Historical Park

## Snohomish County Recreational Harvest Areas

There is very little public access for recreational harvesting of shellfish in Snohomish County. Many of the parks have been closed due to pollution or because the area has been overharvested, and the Washington State Department of Fish and Wildlife is giving the beach some time to replenish. English Boom Historical Park on the north Shore of Camano Island does have a healthy population of soft shell clams, and is a Department of Health approved harvest area.

**Steamed Clams**

Serves: 4-6

**Ingredients:**

3-4 pounds of clams (Manila, Littleneck, Softshell, or Varnish clams)
½ cup of melted butter

**Preparation:**

Pour about 1 inch of water (beer can also be used) in the bottom of a large pot. Put a steamer rack in the pot and then add the clams. If you don't have a steamer rack you can put the clams directly into the beer. Cover the pot, bring to a boil, and steam the clams for 5-10 minutes (Cooking time may vary depending on the size of the clam) or until all the clams are open. Discard any clams that do not open.

Carefully remove the clams from the pot and place them in a serving bowl. The liquid left in the pot can be used as a dipping sauce along with the melted butter.

To eat: Remove the clam from the shell, for Softshell clams - use your fingers to remove the skin covering the siphon. Dip the clam in the broth and/or the melted butter and eat.

**Fried Softshell Clams**

Serves: 4

**Ingredients:**

4 lbs medium sized soft shell clams
1 can of evaporated milk or an equal amount of buttermilk
1 quart canola or corn oil
1 cup all-purpose flour
1 cup masa harina (fine ground yellow cornmeal)
1 teaspoon baking powder
1 teaspoon salt
1 cup tartar sauce

**Preparation:**

Fill a large pot with water and bring to a boil. Add the clams, reduce heat to low and let the clams sit for 3-4 minutes. Drain and place the clams in a bowl of cold water. When cool, open each shell and remove the clam. You may need to use a small knife to cut them out. Discard the black mantle covering the neck. Soak the clams in a bowl with evaporated milk or buttermilk.

In a heavy skillet or deep fryer, heat the oil to 360 degrees. Meanwhile, remove the clams from the milk and drain. Combine the flour, masa harina, baking powder and salt. When the oil is hot, toss the clams in the flour mixture to coat. Shake off any loose flour and immediately put the clams into the oil. Do not let floured clams sit or they will not be crisp when fried. In a minute or two, when the clams are a little darker than cornflakes, remove them, drain on paper towels and serve with tartar sauce.

# Human Health Considerations

Shellfish harvesters need to be aware of the water quality conditions that affect the tidelands they are harvesting from. Shellfish are filter feeders, eating the microscopic plants (phytoplankton) that are floating in the water column. Besides taking in the plankton, shellfish also have the potential to concentrate harmful bacteria including fecal coliform or vibriosis or marine biotoxins, which can lead to Paralytic Shellfish Poisoning (PSP) and other illnesses. This can make the shellfish unsafe for human consumption. Contaminants in Puget Sound come from a variety of natural and anthropogenic sources. Sources of bacterial contamination can include sewage treatment plant outfalls, boater sewage, failing on-site septic systems, runoff from pet waste and agricultural production, and waste from wild animals such as birds or marine mammals.

As noted earlier, the WDOH certifies commercial growing areas to assure they are safe and uncontaminated by pollution sources. WDOH also tests commercially produced shellfish to assure it is free of any marine biotoxins. Some recreational beaches are also certified by the WDOH. **Always check with the WDOH prior to harvesting and eating shellfish off your beach.** For areas such as Warm Beach, which is not in an Approved shellfish growing area, we recommend that you thoroughly cook all shellfish harvested from your beach. Cooking will destroy harmful bacteria associated with pollution sources but it will not destroy all biotoxins. For this reason it is important to call the WDOH Marine Biotoxin Hotline at (800) 562-5632 before harvesting to assure your beach has not been closed due to detection of biotoxins.

**Harmful Bacteria**

**Fecal coliform**

Many freshwater and marine areas in Washington are contaminated with fecal coliform bacteria. Fecal coliform is an indicator of bacterial contamination from humans and other warm-blooded animals such as livestock, pets, and wildlife. Coliform bacteria will not likely cause illness, however, their presence in water systems indicates that disease-causing organisms (pathogens) could also be in the water. If ingested when swallowed with water or eaten in contaminated shellfish, these pathogens can lead to illness in humans. Symptoms of illness related to fecal coliform pathogens are relatively minor, and could include upset stomach, diarrhea, ear infections, and rashes. However, some pathogens, such as E. coli, hepatitis, and Salmonella, can have very severe health effects. Fecal coliform levels are monitored by the WDOH and water quality data for your area is available from the WDOH, Office of Shellfish and Water Protection. To prevent illness associated with these pathogens, thoroughly cook all shellfish harvested from your beach. Keep shellfish cold after harvesting and never rinse cooked food with seawater.

### Vibriosis

Vibriosis is an intestinal disease caused by bacteria called vibrio, which are found in both fish and shellfish. Vibrio occurs naturally in marine coastal waters, but is more common in the warmer summer months. Although there are several types of vibrio, *V. parahaemolyticus (Vp)* is the most common in Washington waters. Most cases of vibrio-related illness occur from eating raw or undercooked fish or shellfish and can result in diarrhea, abdominal cramps, nausea, vomiting, headache, fever, and chills. While the illness is typically mild or moderate, severe cases can sometimes require hospitalization. Failure to keep shellfish cold after harvesting can contribute to the growth of the bacteria. Poor food handling practices during preparation or improper refrigeration of prepared seafood can also lead to illness. To prevent vibrio related illness, thoroughly cook all shellfish harvested from your beach, particularly in the summer months. Keep shellfish cold after harvesting and never rinse cooked food with seawater.

## Biotoxins

Prior to eating shellfish from you beach, always check with the WDOH for Biotoxin Closures through their website: www.doh.wa.gov/shellfishsafety.htm (clickable maps), or call the 24-hour Biotoxin Hotline at 1-800-562-5632. Bivalve shellfish can accumulate biotoxins from naturally occurring microscopic toxic algae that are periodically present in marine waters. **Biotoxins are not destroyed by cooking or freezing shellfish.** Shellfish containing biotoxins do not look or taste any different from shellfish that are safe to eat. Biotoxin levels can also change rapidly, and there can be multiple closures within the same day. However, when the toxic algae are no longer present in the water, shellfish will eventually purge the toxin from their system and will once again be safe to eat. The three major shellfish biotoxin groups that pose a threat to human health are listed below.

### Okadaic acid - Diarrhetic Shellfish Poison (DSP)

Okadaic acid is a naturally occurring toxin found in microscopic algae, specifically, the dinoflagellate *Dinophysis*. Shellfish eat these algae and can retain the toxin, sometimes at levels that can make people sick. Okadaic acid causes Diarrhetic Shellfish Poisoning (DSP) in humans who eat shellfish contaminated with the toxin. All species of shellfish including clams, mussels, oysters, geoduck, and scallops can accumulate DSP toxin. DSP causes nausea, vomiting, abdominal pain, and diarrhea, but is non-lethal to humans.

### Paralytic Shellfish Poisoning (PSP)

Paralytic shellfish poisoning (PSP) is caused by eating shellfish contaminated with algae that contains a toxin harmful to humans. When this algae increases to high numbers in marine waters, it is referred to as a harmful algal bloom (HAB) or a "red tide." Despite the name, HABs that produce PSP are rarely associated with red colored water and in fact, can be present in large amounts even if the water looks clear. The toxin can also remain in shellfish long after the algae bloom is over. All bivalve shellfish including clams, mussels, oysters, geoduck and scallops can

accumulate PSP. Early symptoms include tingling of the lips and tongue, which may begin within minutes of eating poisonous shellfish or may take an hour or two to develop. Death can result in as little as two hours, as muscles used for breathing become paralyzed.

**Domoic acid - Amnesic Shellfish Poisoning (ASP)**
Domoic acid is a naturally occurring toxin produced by microscopic algae, specifically the diatom species *Pseudo-nitzschia*. Bivalve shellfish and crab ingest this algae, where the toxin concentrates. Significant amounts of domoic acid can cause Amnesic Shellfish Poisoning (ASP) in humans when contaminated shellfish are consumed. Unsafe levels of domoic acid have been detected in razor clams and Dungeness crab in coastal waters and mussels, clams, and oysters in Puget Sound areas. Symptoms include vomiting, nausea, diarrhea and abdominal cramps within 24 hours of ingestion. In more severe cases, neurological symptoms develop within 48 hours and include headache, dizziness, confusion, disorientation, loss of short-term memory, motor weakness, seizures, profuse respiratory secretions, cardiac arrhythmias, coma and possibly death. Short term memory loss is permanent. As there is no antidote for ASP, prevention is the best protection.

**Are My Shellfish Safe to Eat?**
Always check to make sure shellfish from your beach are safe to consume. The WDOH Recreational Shellfish Program also provides information to the public about where and how to harvest shellfish that are safe to eat (from most recreational harvest areas). Kayak Point currently meets public health standards, however, the area is closed to recreational harvest due to declining populations of softshell clams. Shellfish in both recreational and commercial harvest areas are routinely tested for biotoxins such as PSP and ASP. When toxins are detected at dangerous levels, WDOH closes the harvest area.

Cooking clams and oysters will destroy harmful bacteria associated with pollution sources (e.g. fecal coliform) and vibrio but it will not destroy biotoxins. Again, always check the health status of your beach at www.doh.wa.gov/shellfishsafety.htm (clickable maps), or call the Biotoxin Hotline (1-800-562-5632 (ww4.doh.wa.gov/gis/mogifs/biotoxin.htm).

**Storing and Preparing Shellfish**
Always keep shellfish cool after harvesting. If the temperature of shellfish is allowed to rise, bacteria will grow and the shellfish can become unsafe to eat. Upon harvest, always store your shellfish in an open container in the refrigerator. Never store shellfish in fresh water as they will die and may spoil. Throw out any dead shellfish that are open and do not close when tapped on their shell. Both Pacific oysters and Manila clams can be stored in the refrigerator for up to 7 days from harvest. Clams that do not close their shell completely (softshell clams, horse clams, and geoducks) can be stored for 3-4 days. Shellfish removed from their shells can be kept in a refrigerator for up to 3 days and for up to 3 months in a freezer. For more information on safe handling practices, visit the WDOH's website.

Warmer summer weather can increase bacteria levels in shellfish, most notably *Vibrio parahaemolyticus* (*Vp*). Vp is found naturally in marine coastal waters, normally in low numbers that pose no problems. In the summer months, however, temperatures can rise and increase the risk of illness. Most cases of Vp related illness occur from eating raw or undercooked fish or shellfish, but poor food handling practices during preparation can also lead to illness. Even fully cooked food can be contaminated if rinsed with seawater. Failure to keep shellfish cold after harvesting can also contribute to the growth of the bacteria. To ensure proper food safety, shellfish must be cooked to an internal temperature of at least 145°F. If you don't have a food thermometer, here are some tips and recommended ways to cook shellfish safely:

- **Shucked shellfish** become plump and opaque when cooked thoroughly and the edges of the oysters start to curl. The Food and Drug Administration (FDA) suggests boiling shucked oysters for 3 minutes, frying them in oil at 375° F for 10 minutes, or baking them at 450° F for 10 minutes.
- **Clams and oysters** in the shell will open when cooked. The FDA suggests steaming oysters for 4 to 9 minutes or boiling them for 3 to 5 minutes after they open.

For more information on safe handling practices, visit the WDOH's Shellfish Program website: www.doh.wa.gov/CommunityandEnvironment/Shellfish.aspx

**Toxic Chemicals**

The National Oceanic and Atmospheric Administration's (NOAA) Mussel Watch Program monitors the status and trends of toxic contaminants in mussels throughout the US. The program started in 1986, and includes 26 stations in Washington State. In 2007, the Snohomish county Marine Resource council established additional sites along the Snohomish County coastline. With the help of the Stillaguamish and Tulalip Tribes there are now 10 Mussel Watch sites in Snohomish County and 1 in Island County.

In March 2014 WDOH reviewed chemical contaminant data from the Mussel Watch Program to help Snohomish County and the Warm Beach community to understand the potential human health risks from chemical contaminants in locally harvested shellfish. No significant human health risks were identified. In September 2014 the Snohomish County Surface Water Management's Stillaguamish Shellfish Protection Program sampled softshell clams in Port Susan for chemical contaminants analysis. WDOH evaluated the lab data from those samples and reported on December 3, 2014 that "consuming clams in not expected to result in harmful health risks."

**Appendix A – Contact Information** - Snohomish County Shellfish Gardening Project

**Project Funding**

**Sean Edwards**, *Senior Planner, Shellfish Protection Coordinator*
Snohomish County Public Works, Surface Water Management
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Website: http://cwd.surfacewater.info

**Project Coordinators**

**Aimee Christy & Mary Middleton**
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Olympia, WA 98501-8212
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## Appendix B - Additional Resources

**Washington Sea Grant Marine Advisory Service**
Teri King, Marine Water Quality Specialist
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Shelton, WA 98584
360.432.3054 phone
360.432.3055 fax
Email: guatemal@u.washington.edu
Website: www.wsg.washington.edu

Teri King is a Marine Water Quality Specialist and Aquaculture Coordinator with Washington Sea Grant Marine Advisory Service. Teri works on implementation of the Puget Sound National Estuary Program plan and has developed a series of publications and workshops regarding nonpoint pollution. She also conducts workshops on a variety of topics including on-site sewage systems and oyster gardening. Washington Sea Grant also maintains the State of the Oyster Program.

**Puget Sound Restoration Fund**
Betsy Peabody, Executive Director
590 Madison Ave. N.
Bainbridge Island, WA 98110
206.780.6947 phone
206.855.8820 fax
Email: betsy@restorationfund.org
Website: www.restorationfund.org

Puget Sound Restoration Fund (PSRF) is a Washington-based nonprofit organization dedicated exclusively to restoring marine habitat, water quality and native species in Puget Sound. PSRF conducts restoration efforts for native Olympia oysters, kelp, and abalone. PSRF also operates three community shellfish farms in Puget Sound and conducts shellfish gardening workshops on Bainbridge Island to restore and maintain healthy shellfish growing areas, spur cleanup efforts, and maintain community access to shellfish resources.

**Tulalip Tribes**
Mike McHugh, Shellfish Manager
Natural Resources Department
6406 Marine Drive
Tulalip, WA 98271
360.716.4615 phone
425.328.7451 fax
Email: mmchugh@tulaliptribes-nsn.gov
Website: www.tulalip.nsn.us/

Port Susan/Possesion Sound Marine Water Sampling.

**Stillaguamish Tribe of Indians**
Franchesca Perez, Marine Stewardship and Shellfish Program Coordinator
Stillaguamish Natural Resources Department
P.O. Box 277
Arlington, WA 98223
360.631.2620 phone
360. 435.3605 fax
Email: ggray@stillaguamish.com
Website: www.stillaguamish.nsn.us

Port Susan Marine water sampling and biotoxin monitoring.

**Washington Department of Health, Office of Shellfish and Water Protection**
Scott Berbells
Growing Area Section
Office of Shellfish and Water Protection, Division of Environmental Health
Washington State Department of Health
360.236.3324 phone
Email: scott.berbells@doh.wa.gov
Website: www.doh.wa.gov/CommunityandEnvironment/Shellfish.aspx

The Washington Department of Health, Office of Shellfish and Water Protection website contains information about regulations, beach closures, growing areas, biotoxins and shellfish related illness, recreational shellfish harvesting, and laws concerning shellfish aquaculture and other topics. For information relating to Recreational Harvest, contact Liz Maier at liz.maier@doh.wa.gov, 360.236.3308.

**Washington Department of Fish & Wildlife**
Natural Resources Building
1111 Washington St. SE
Olympia, WA 98501
360.902.2200 phone
Website: http://wdfw.wa.gov/fishing/shellfish

The Department of Fish and Wildlife's website provides detailed information on recreational shellfish species as well as human health concerns.

## Appendix C – 2014 Early Warning System Report for Snohomish County

**Washington State Department of Health**
**2014 Early Warning System Summary for**
**Shellfish Growing Areas in Snohomish County**

The Department of Health (DOH) places shellfish growing areas in a "Threatened" or "Concerned" status based on our assessment of threats to the growing area's classification. This assessment is currently based on the identification of pollution sources that may impact public health, and/or how close a water sampling station's bacteria levels are to the National Shellfish Sanitation Program's (NSSP) standards. The latter has been the most common and is described below.

The NSSP prescribes two methods to evaluate fecal coliform levels at water sampling stations to classify growing areas: Systematic Random Sampling (SRS) and Adverse Pollution Conditions (APC). Both use a minimum of the last 30 samples. With the SRS method, the estimated 90th percentile cannot exceed 43 fc/100mL. With the APC method, no more than 10% of the samples can exceed 43 fc/100mL. If any of these standards are exceeded, no shellfish can be directly harvested from the area of that station.

A Threatened status is assigned in SRS growing areas when a water sampling station's estimated 90th percentile is between 30 and 43 fc/100mL. In APC growing areas, a Threatened status is assigned if more than 6.0% of the samples have exceeded 43 fc/100mL. A Concerned status is assigned where a water sampling station's estimated 90th percentile is greater than 20 fc/100mL, but less than 30 fc/100mL.

The DOH is providing this information to county governments so that corrective actions can take place before water quality at the listed stations fails the shellfish standards. Growing areas in Threatened and/or Concerned status in your county are listed below.

**PORT SUSAN GROWING AREA**

| | |
|---|---|
| Station Number 335 | Threatened due to water quality |
| Station Number 297 | Concerned due to water quality |

**SOUTH SKAGIT BAY GROWING AREA**

| | |
|---|---|
| Station Number 180 | Concerned due to water quality |
| Station Number 183 | Concerned due to water quality |
| Station Number 184 | Concerned due to water quality |
| Station Number 185 | Concerned due to water quality |
| Station Number 192 | Concerned due to water quality |
| Station Number 269 | Concerned due to water quality |

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