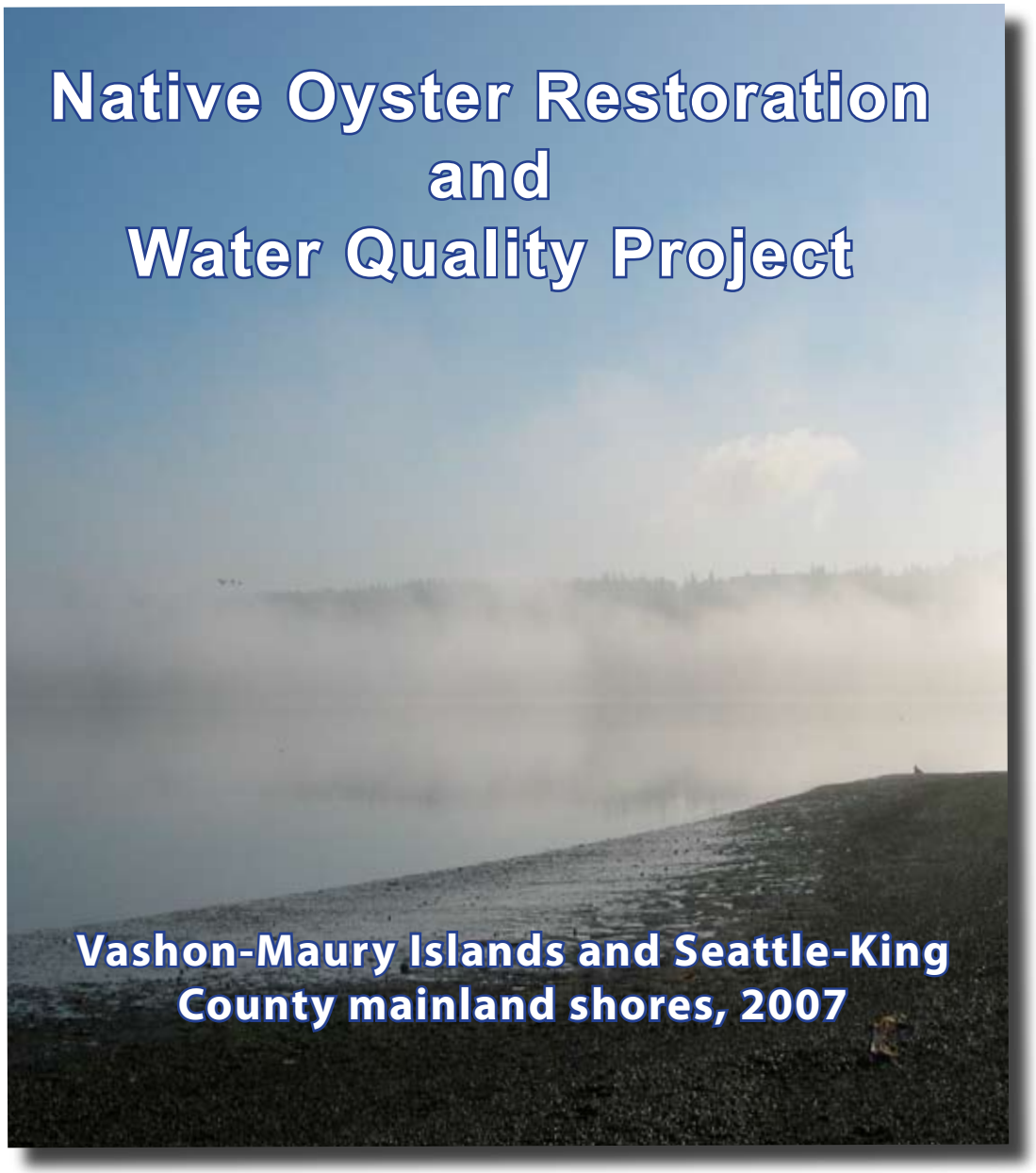
Protecting and Restoring the Nearshore:

Native Oyster Restoration and Water Quality Project



Vashon-Maury Islands and Seattle-King County mainland shores, 2007

PUGET **SOUNDKEEPER®** ALLIANCE

Local Groups Partner on Native Oyster Restoration and Water Quality Project

In 2007, local-non profit organizations, Puget Soundkeeper Alliance and Puget Sound Restoration Fund teamed up to restore an important intertidal species: the native Olympia oyster. The project also included a survey of the existing Olympia oyster populations on King County shorelines and an assessment of water quality in the area. This newsletter is a report to the community on the results and findings of the project.

Project Area:

Nearshore areas of King County including mainland shores and Vashon and Maury Islands. This area includes the marine reserves established by the City of Seattle and the Maury Island Aquatic Reserve established by the Washington Department of natural Resources.

Partners:

Puget Soundkeeper Alliance
Puget Sound Restoration Fund
Washington Department of Natural Resources

With support from:

Seattle Public Utilities
Suquamish Tribe
Brown Bear Car Wash
Nucor Steel
WA Department of Natural Resources
WA Department of Fish and Wildlife
Frontier GeoSciences
Fauntleroy Watershed Council

This project was funded through a WaterWorks grant from King County Department of Natural Resources.

The Olympia Oyster – The Only Oyster Native to the Pacific Northwest


Native Olympia Oysters

Oyster aficionados may know lots of varieties of oysters, but what many people don't realize is that there is only ONE oyster that is native to the Pacific Northwest, the Olympia oyster (*Ostreola conchaphila*). With a reported range that extends from Panama to Southeast Alaska, Olympia Oysters were abundant before European culture arrived. They historically provided an important part of the diet for Northwest tribes and comprised a vital element in the Northwest ecosystem. Healthy oyster populations filtered and purified seawater and created natural reefs that provided shallow-water habitat for crabs, anemones and even salmon.

After European culture arrived, oyster harvest initially provided a major industry for the early settlers, with harvests as high as 100,000 bushels a year. However, over-harvest, pollution and habitat destruction took its toll and oyster populations plummeted in the early 20th century.

Eventually faster-growing Pacific oysters were brought in to satisfy the shellfish market, and with those came unwanted hitchhikers: non-native predators such as the oyster drill, a highly predatory type of snail that can devastate oyster populations and is now a permanent resident of

Puget Sound. The biggest lessons learned from this era include the need to keep shells on the beach to maintain habitat and to avoid transporting live shellfish from one beach to another for the risk of spreading parasites and predators.

Today the biggest challenge is lack of habitat. Development and shoreline armoring have reduced available habitat and isolated remnant populations.

Because oysters are broadcast spawners, they rely on a healthy base population in order maintain or expand their numbers. Fertilized eggs become free-swimming oyster larvae, and are released into the marine environment where they seek to attach themselves to suitable substrate. Most hard surfaces offer a chance of recruitment, but by far the best surface is oyster shell.

Human intervention is necessary to bring healthy populations of Olympia oysters. Washington Department of Fish and Wildlife oversees the implementation of recovery efforts. Puget Sound Restoration Fund (PSRF) is a leader in this effort and has assisted in spreading over 5 million oysters and enhanced habitat at over 80 different sites.

Olympia Oyster map or graphic here?

Olympia Oyster facts:

- Native Olympia oysters are much smaller than Pacific oysters which are native to Japan and Asia. The typical size of a mature Olympia Oyster is about 1.5 inches although they occasionally grow larger.
- Adult Olympia oysters switch between male and female.
- Olympia oysters are filter feeders. Despite their small size, they are capable of filtering up to 12 gallons of water each day cleaning the water of sediment and excess nutrients. A healthy oyster reef can contain thousands of individuals.
- Olympia oysters survive best in a protected environment where they see low wave energy, mild currents and are able to stay covered with water so as not to overheat in the summer or freeze in the winter.
- Relatively warm water (by Puget Sound standards) is needed for spawning, typically around 55 degrees. (The average Puget Sound temperature is near 50 degrees).
- Because of the abundance of good habitat and slightly warmer water, South Puget Sound (bays and inlets that are south of Tacoma Narrows) has historically had the best native oyster populations in region.

For more information on Olympia Oysters see "Reestablishing Olympia Oyster Populations" by Tristan Peter-Contesse and Betsy Peabody available at:

www.wsg.washington.edu/mas/pdfs/olyoysterlr.pdf

Restoring Native Oysters to Central Puget Sound

In contrast to the relative abundance in South Puget Sound, the Central Puget Sound basin (including Vashon/Maury Islands and mainland King County and Seattle shorelines) has relatively exposed shores, higher currents, and relatively cool water temperatures making it less than ideal for native oyster production. This makes the recent discovery of a native oyster population in Raab's Lagoon, off Quartermaster Harbor on Maury Island, all that more special. "Quartermaster Harbor represents some of the best Olympia oyster habitat in the central Sound and that's why we were really excited to find remnant populations there" says Betsy Peabody of the Puget Sound Restoration Fund (PSRF).

In 2005 PSRF operating under a Community Salmon Fund grant administered by King County identified habitat in Raab's lagoon as an ideal restoration site and began to seed oysters there. Betsy's group also has worked to restore Olympia oysters in other areas of Puget Sound including a large project in Liberty Bay near Poulsbo.

Under new Department of Fish and Wildlife rules, native oysters may not be seeded from hatchery stock for restoration purposes. This rule is in place in order to preserve the genetic diversity of wild populations. Planning an oyster restoration project is therefore more of a challenge now, because in order to restore the beleaguered Olympia oyster, you must first find Olympia oysters.

This caused restoration groups to re-evaluate their projects. Instead of planting live baby oysters raised in hatcheries (known as "seed"), restoration efforts now focus on creating or improving settling habitat for nearby spawning oysters, a process know as "natural set". As it turns out, the best material available for encouraging natural set is oyster shell, and this is one time when it doesn't matter if it's Pacific or Olympia oysters. Olympia oyster larvae love to set on Pacific oyster shell. In fact, due to the surplus of Pacific oyster shell from large commercial growing operations, the cleaned shell material is readily available for restoration work.

The next step is to locate the populations of oysters. Between April and September 2007, project staff and volunteers performed low tide surveys of 13 public beaches in King County from Colvos Passage on west side of Vashon Island, to Carkeek Park in north Seattle to detect populations of the Olympia oyster. If existing populations of the species were discovered in the surveys, future restoration projects could be planned. However the best find from the surveys was three dead shells in Des Moines Marina – hardly a viable population.

Volunteers placing shell in Raab's Lagoon.

At this stage the hopes for success in Central Puget Sound would focus on Raab's Lagoon. Fortunately two willing landowners offered their shorelines for the restoration project.

In June of 2007, volunteers from PSRF, Puget Soundkeeper Alliance along with Vashon and Maury Island community members helped spread an entire truckload of oyster shell in the lagoon with the hopes of recruiting that summer's spat (oyster larvae that settle on a surface to grow to become adult oysters). The event was carefully timed to have clean shell in the water after the water warmed enough for the existing oysters to spawn.

Success was not a foregone conclusion. A lot of factors can influence the success of this type of

restoration, including water temperature, water quality, tides and currents, predators and competitors, and fouling or siltation on the newly placed shell substrate.

October 23, 2007 was the test. Staff from the PSRF surveyed the beaches at Raab's lagoon and discovered juvenile oysters growing on the shell placed earlier that year. Population estimates indicate that there are approximately 100 oysters now growing in these two restoration areas.

This proved several things:

- The water was warm enough for spawning in the summer of 2007 (this does not always occur).
- There was at least one male and one female oyster in the lagoon that spawned successfully.
- The selected locations for habitat enhancement were good. Currents and wave action did not carry the oyster larvae in the wrong direction and sediments and algae did not foul the newly placed substrate.

It is hoped that this small population in Raab's will survive and serve as a nursery for the Olympia oyster in Quartermaster Harbor. Based on this project, there will be no shortage of enthusiasm for recruiting volunteers to help. In the future, bagged shell with juvenile oysters attached may be moved short distances within the harbor to expand the population. This is also an indication that if given adequate habitat, native oysters can rebuild their fragile populations, which will not only help to preserve this species but will provide benefits to the Puget Sound nearshore ecosystem by filtering water and providing habitat for other creatures.

Natural set: Olympia oyster recruitment on Pacific oyster shell, Raab's Lagoon.

This in turn will be one step toward recovering the Puget Sound ecosystem which could benefit depleted populations of migratory seabirds, salmon and possibly even orca whales.

Map of Raab's Lagoon Here?

Water Quality in the project area

Fauntleroy Cove

How Clean is the Water?

Pollution in the Sound
Salmon, oysters, and people all need clean water to thrive. There are many types of pollutants affecting Puget Sound and the lakes, rivers and streams that flow into it, including: bacteria and pathogens, oil and grease, heavy metals, toxic chemicals, suspended solids, water temperature changes, and excess nutrients. These pollutants can sicken or kill fish and other marine life, interrupt feeding or migration, and/or alter spawning success.

Pollution can affect people directly by making seafood, swimming areas or drinking water unsafe. Examples are shellfish closures, fish harvest advisories, swimming beach closures and contaminated well water.

Pollution can also affect people indirectly by reducing recreational opportunities and/or the economic contributions made available by having plentiful fish, birds and wildlife avilable for people to enjoy. Activites such as fishing, SCUBA diving, birdwatching, and wildlife viewing all depend on clean water.

Some pollutants have known safe levels, below which marine life is not believed to be harmed. But certain dangerous pollutants like mercury and PCBs pose serious health risks, even in very small quantities because they accumulate in animal tissues. Each step of the food chain sees higher levels of these toxins. The highest risks are to top level predator species like eagles, harbor seals, orca whales and even humans.

Legal Protections
Water quality standards are developed for individual pollutants to set safe levels for the protection of aquatic life, recreational contact and where appropriate, drinking. Certain toxic chemicals or heavy metals are heavily restricted such as dioxin, lead or mercury. Some extremely toxic chemicals are banned altogether such as PCBs or DDT yet still show up in the environment because of historic contamination.

With passage of the federal Clean Water Act of 1972, water quality standards were set for point-source discharges from industry and sewage treatment. Today, the number-one source of pollution in Puget Sound is stormwater runoff from roads, parking lots, roof tops, lawns and businesses, which contains many harmful pollutants listed above. The regulations that apply to stormwater are tightening too, but implementing the regulations and controlling diverse pollution sources is a difficult challenge.

The Clean Water Act creates a mechanism for classifying impaired waters for further protection. This is known as the 303(d) list and is used by our state in order to set a strategy to reduce harmful poollution..

Measuring Water Quality
In conjunction with the restoration activities described in this newsletter, we include the following report on two specific types of pollution: bacterial contamination and toxic metals, as measured in the waters of our project area.

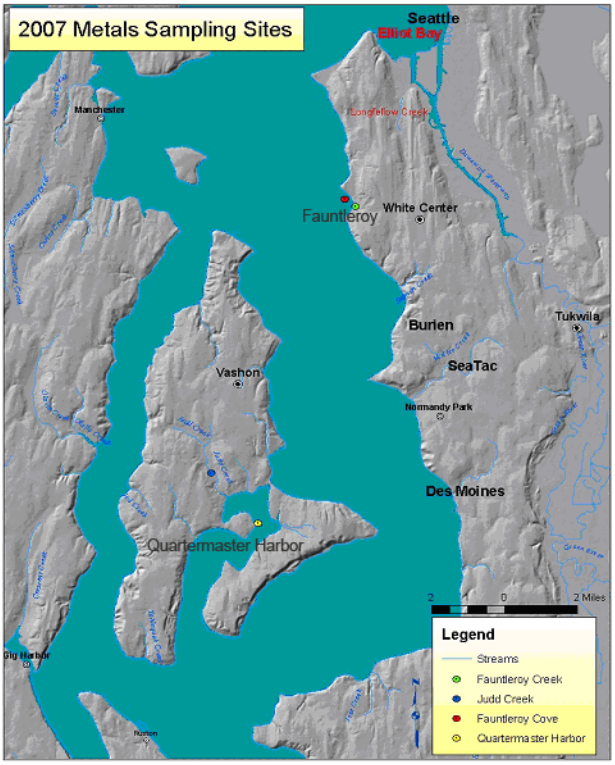
The large amounts of data available on bacterial contamination allowed us to review existing water-quality data from several public agencies.

However there was much less information available on concentrations of toxic metals, so we conducted our own study for trace concentrations of five heavy metals in the project area.

Test Area: Two Puget Sound nearshore areas within King County, including 2 small feeder streams:

Rural Focus Area: Vashon Island, (Judd Creek/Quartermaster Harbor).

Urban Focus Area: SW Seattle, Fauntleroy Creek/Fauntleroy Cove



Bacterial Contamination:
Bacterial and pathogen contamination of our waters is primarily a concern for human health. When bacteria levels exceed certain limits, agencies will close areas to shellfishing or swimming. When a waterbody regularly exceeds these limits it may be placed on the state list of impaired water bodies - the 303(d) list.

Bacteria monitoring generally focuses on two types: Enterococcus and fecal coliform bacteria. These two types are indicators of waste from warm-blooded animals: mammals (including humans) and birds. If levels are high, other disease carrying pathogens may be present.

Common sources of fecal coliform and enterococcus contamination are: inadequate sewage treatment or overflows, failing septic systems, illegal boat waste discharges, and animal waste (including wildlife and pets).

The Washington Department of Health regularly tests public beaches around Puget Sound and classifies them as “approved”, “conditionally approved” or “prohibited”, while some beaches remain unclassified. Once a beach is prohibited for shellfish consumption it will have to show an extended period of compliance for the beach to be reopened.

Heavy Metals
Certain toxic metals can enter our waters from a variety of sources including industrial practices, aerial pollution, residential or boat maintenance and runoff from roads (which includes inputs from tailpipe emissions, oil leaks, tire wear and brake pad residue). Many metals can be toxic to fish in very small quantities, often measured in micrograms per liter (µg/L), or parts per *billion*.

Permanent shellfish closure sign at Fauntleroy.

Local measurements for bacterial contamination:

Measurements are expressed in colony forming units per 100 millilitres, or cfu/100ml.

Judd Creek:
Recent water quality testing from King County Department of Natural Resources shows that fecal coliform levels exceed standards for recreational contact, with measurements as high of 1400 cfu. These levels are high even in relation to Fauntleroy Creek which is listed as impaired on the 303(d) list. Like Fauntleroy Creek, the readings were much higher in the summer months (June – September).

Quartermaster Harbor:
The Harbor is listed on state 303(d) list of impaired water bodies for fecal coliform. However, historic problems seem to be improving, and recent data from Department of Health at 21 beaches shows no exceedance of criteria for fecal coliform concentrations going back to October 2002. Although the Harbor contains 9 "approved" shellfish beaches, 11 beaches remain "prohibited" due to past monitoring results and/or proximity to known problem sources.

Similarly, 2007 King County data from 62 samples over 3 locations at different depths showed no exceedences of water quality standards for fecal coliform.

Fauntleroy Creek:
This creek which drains a large area of west Seattle is listed on the state 303(d) list as an impaired water body for fecal coliform. The state has issued a Total Maximum Daily Load (TMDL) study for the creek in an effort to study solutions to the problem and set benchmarks for compliance. Conditions have started to improve, although the creek still violates water quality standards in all seasons, but is particularly high in summer. Department of Ecology has identified the need to cut bacteria input by 80%.

Fauntleroy Cove:
Like the creek of the same name, Fauntleroy Cove is listed on the state 303(d) as an impaired water body for fecal coliform. Monitoring has shown fecal levels as high as 3100 cfu on 6/23/97, or more recently 3000 cfu on 8/21/02. Since then, conditions have improved to a degree but still exceed criteria part of the time.

There is some evidence that bacteria levels in Fauntleroy Creek are impacting Fauntleroy Cove. Like all beaches in the urban area from Tacoma to Everett on the East shore of Puget Sound, Fauntleroy Cove is classified as prohibited for shellfish harvest.

The Cove is also listed as impaired for fish habitat due to large blooms of ulvoid algae (known as sea lettuce) that pile up and decay on the beach sometime emitting a foul odor. One possibility is that the algae blooms are caused in part by excess nutrients coming from the Creek.

Local Measurements for Metals:

Project staff and volunteers sampled the four locations in the project area waters for 5 toxic trace metals: arsenic, cadmium, copper, lead and zinc. Sampling was carried out over 5 days in 2007. This small-scale project was created to screen for possible water quality problems that could warrant further study. All testing was performed using an EPA Ultra Clean Sampling protocol and analysis was done at Frontier Geo-Sciences, an EPA-accredited laboratory.

Metals sampling in Judd Creek.

Sampling dates were chosen to represent the low rainfall periods of late summer and high rainfall periods of autumn in order to probe for a relationship to stormwater runoff.

Findings:
Laboratory results were compared to state and federal water quality standards which are set at levels to protect aquatic life. Results were also compared to results from previous studies at two reference sites: Longfellow Creek (freshwater) and Elliott Bay (marine water) to look for local variations.

None of the metals measurements in the study area exceeded water quality standards, and most samples stayed below 10% of allowable limits. However several indications emerged:

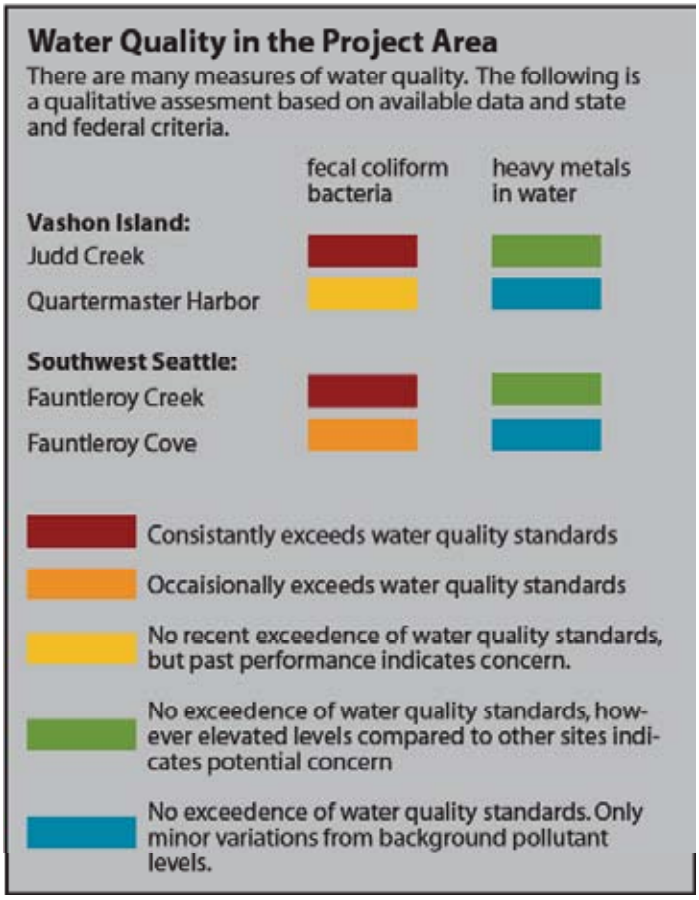
Arsenic levels: All locations showed an elevated level of arsenic compared to reference locations. This makes sense, given the path of historic pollution from the now defunct ASARCO smelter in Tacoma. It is widely known that Vashon and Maury Islands historically received much of this pollution however it should be noted that areas of Southwest Seattle and South King County were also impacted.

Zinc levels: The Faunleroy Creek location showed elevated levels of zinc compared to the Vashon sites and reference locations. There is no immediate conclusion of the cause but this is a possible subject for future study.

Lead levels: Lead showed the highest variabilityfrom one sample to the next with no clear trend. At one location samples ranged form a low of .05 to 1.42 µg/L, a level 28 times higher. The likely cause of this is not known.

Fresh vs. marine water: In general freshwater showed higher concentrations of metals than the marine water locations (except for cadmium which is known to occur naturally in Puget Sound). This reinforces the premise that local freshwater streams can be sources of pollution to marine water.

Precipitation influence: Despite the project design we were not able to draw a strong relationship between precipitation events and concentrations of metals in the water. This could be due to the fact that the area experienced several rain events in mid-late August and there was not a strong "first flush" as in some years.



For more information:

Map of ASARCO Smelter pollution:
http://apps.ecy.wa.gov/website/facsite/viewer.htm?sp_area=Tacoma%20Smelter%20Plume

King County Water Quality Monitoring
http://dnr.metrokc.gov/wlr/waterres/marine/index.htm

Fauntleroy Creek TMDL study
http://www.ecy.wa.gov/biblio/0710037.html

Swimming Beach Closures:
http://www.doh.wa.gov/ehp/ts/WaterRec/beach/default.htm

Shellfish safety:
http://www.doh.wa.gov/ehp/sf/

Protecting Water Quality: What Can We Do?

Because stormwater pollution is the number one source of pollution in Puget Sound, an effective solution will need to involve every one of us in different ways. Here are some simple things we all can do to reduce our footprint.

Practice Natural Yard Care. Fertilizers and weed killers can end up in creeks and eventually Puget Sound. They can poison aquatic life and upset the delicate nutrient balance. Select native plants, use compost instead of fertilizer and hand pull weeds instead of using "weed killer" products.

Stormwater Management. Position gutters so they direct rainwater away from stormdrains. Instead of cement patios and driveways try spaced paving stones or gravel. Never dump toxic substances down stormdrains.

Home Toxics: Select non-toxic environmentally-friendly cleaning products. Dispose of unneeded toxics at Houshold Hazardous Waste Stations – they're free. Don't flush unneeded medications down the drain.

Septic Systems: If you are on a septic system, consult a professional about maintenance. Once a drainfield fails it can be very expensive to fix the situation. Limit solid materials that can create sludge, cause a backup or cause nutrient pollution. Do not use chemical disinfectants or dispose of toxics down the drain. Septic customers are encouraged not to use an in-sink garbage disposal for food waste.

Drive Less/ Drive Smart: Combine trips, bicycle and/or use public transportation when possible. Select a fuel efficient car, avoid idling, and unnecessary acceleration.

At the Car Wash: Never wash your vehicle on the street because soap and road grime are both toxic to fish. The best option is to go to a commercial car wash where the water is treated and/or recycled. If a car wash is not convenient, wash your vehicle on your lawn where wash water seeps-in, rather than running off to a stormdrain.

Sound Vehicle Maintenance: Fix oil leaks (yes, even the expensive ones!), and keep cars tuned up and maintain proper tire pressure. It will save you money in the long run too.

Pets: Clean up after your dog. Keep dogs on the leash when near the water. Encourage cats to use a litterbox. Seattle Parks saltwater beaches are designated as Marine Reserves and are off limits for dogs.

Solid Waste: Plastic is an especially bad problem near the water. Animals can become entangled or may ingest small pieces of plastic mistaken for food. It has been said that every piece of plastic ever littered still exists in the environment. Fortunately some of this has been cleaned up by volunteers. Don't litter, and better yet pick up a piece or two of trash when you're out on the beach.

Know How to Report Pollution Problems: Most pollution goes unreported. Agency staff need your help to identify pollution problems.

General Hotline (Non Emergency)
Puget Soundkeeper Alliance:
1 (800) 42-PUGET

Stormwater Pollution:
City of Seattle Drainage Complaints:
206-684-8587

King County Drainage Services:
206-296-1900

Oil and Chemical Spills to Public Waters: (call both numbers if applicable)

All Waters: Washington State Emergency Management: 1-800-OILS- 911

Navigable Waterways: US Coast Guard: 1-800-424-8802

Invasive Tunicates: A New Threat to the Puget Sound Nearshore

Puget Sound has a new arrival. Actually three. Within the past 4 years, three different species of invasive tunicates have been spotted at various Puget Sound locations and they appear to be spreading. Experts believe the spread of these animals is a serious threat to shellfish aquaculture and native animals in Puget Sound.

Tunicates are a class of aquatic creatures also known as sea squirts. Despite a superficial resemblance to sponges or other invertebrate animals, tunicates are evolutionarily more advanced than meets the eye. They have a heart, a stomach and a primitive spinal cord.

There are native tunicates that belong in Puget Sound, but invasive tunicates species are from Asia or Europe and likely arrived here by traveling aboard ships or boats. Invasive tunicates are considered an aquatic nuisance species because they can multiply quickly and out-compete or smother native species and commercially valuable shellfish like clams, mussels and oysters. They have no known predators in our area.

At least a dozen invasive tunicate colonies have spread throughout the sound, turning up in Hood Canal, Birch Bay, Totten Inlet, Des Moines, Elliott Bay and Quartermaster Harbor. Three types of invasive tunicates have been discovered in Washington's waters:

- Clubbed tunicate (*Styela clava*)
- Solitary sea squirt (*Ciona savignyi*),
- Colonial sea squirt (*Didemnum lahillei*)

On Prince Edward Island in eastern Canada, clubbed tunicates have already caused substantial problems at commercial shellfish sites. First discovered on the island in 1998, the dense masses of tunicates have proliferated, growing on lines and other aquaculture gear, smothering and killing the mollusks. More than one million pounds of tunicates are removed from the island each year, yet they continue to come back.

Controlling the spread is a priority for state agencies. The Washington Department of Fish and Wildlife (WDFW) is working to eradicate these invasives from infested boats and marinas. In January and February of 2008 volunteer divers worked with WDFW to remove an infestation of colonial sea squirts form the Dockton marina.

Since 2006, WDFW has been inspecting boats and providing boaters at boat ramps and harbors throughout the state information on invasive species and how to properly clean boats and trailers. WDFW enforcement also will be involved in the effort, educating other law enforcement agencies on the invasive species problem, monitoring aquatic plant and animal dealers, and checking vessels at boat launches and harbors.

State aquatic managers also ask the public to report sightings of tunicates and other aquatic invasive species.

To report sightings: call the state hotline at: 1 (800) 54-SOUND

Rhoda Green photo

Colonial tunicates (yellow) smothering natve species at Dockton, Quartermaster Harbor.

For more information including guidance on identifying invasive tunicates:

http://www.pnwscuba.com/invasives/index.htm.
http://www.wdfw.wa.gov/fish/ans/index.htm

Excerpts from the Washington Department of Fish and Wildlife appear in the article.