

EXECUTIVE SUMMARY

Is a healthy Puget Sound within our reach? A Puget Sound with plentiful fish and shellfish that are safe to eat, where our kids can swim without fear of illness, and where whales, diving ducks and salmon continue to grace our inland waters?

After many years of concerted efforts to clean up pollution, protect habitat and bring back some of the Sound's best-known species from the brink of extinction, the answer is yes—but only if we redouble our efforts and become much more effective.

State of the Sound 2007 takes a scientific look at the health of Puget Sound and the status of its marine life, habitats, water quality and climate. The report tracks more than two dozen environmental indicators that provide insight into the health of the Sound and threats to that health.

An overview of these indicators is provided in this executive summary. Each indicator is described in greater detail in the main body of the report and a full analysis can be found in the companion technical document to this report, *The 2007 Puget Sound Update* (at www.psat.wa.gov/update2007).



DON WILSON



LINDA FARMER

PHOTOS: (top to bottom) Aerial photo of the Seattle area. | Don Wilson, Port of Seattle; Storm culvert in Drayton Harbor | Linda Farmer; (opposite page) Father and son enjoying a view of the Olympics from the Safeco Field observation deck during a Mariners home game. | Rae A. McNally.

ADVANCES OF THE PUGET SOUND ACTION TEAM

State of the Sound 2007 also charts progress made in 2005 and 2006 by the Puget Sound Action Team to improve Puget Sound's health. The Action Team is made up of federal, state, tribal and local governments and citizens working together to define, coordinate and implement the State of Washington's environmental agenda for Puget Sound.

Over the past two decades many significant steps have been taken on the path to protect Puget Sound. During the past two years there have been more important accomplishments, many of which are documented throughout this report.


Highlights include:

- 1,200 acres of commercial shellfish harvest areas upgraded as a result of new pollution controls.
- Improved stormwater management at the local level:
 - 81 communities came under stronger stormwater management requirements in January 2007.
 - The number of municipalities carrying out various elements of a comprehensive stormwater program increased significantly.
 - 19 cities and counties worked to change regulations to facilitate low impact development.
- Toxic cleanups finished at 323 land-based sites and 23 water-based sites.
- Hundred of pounds of highly toxic mercury kept out of the waste stream through targeted efforts, and development of new control plans for flame retardants.
- \$21 million invested in on-the-ground actions to reduce nutrient pollution and fish kills in Hood Canal through a multi-agency coordinated response.
- All 12 Puget Sound counties put in place more rigorous management programs for septic systems.
- \$7 million in new funding allocated to counties to find and fix failing septic systems.
- 200 acres of high quality habitat permanently protected; 400 acres and 17 miles of riparian habitat restored to high quality.
- 600 tons of creosote logs removed from state aquatic lands.
- \$21 million allocated to improve sewage treatment at 24 state parks around Puget Sound.
- Recovery plans completed for threatened or endangered Puget Sound chinook; Hood Canal summer chum; bull trout and southern resident killer whales (orca).
- New safeguards, planning and inspection procedures adopted to prevent oil spills.
- New efforts initiated to control tunicates, a recently discovered invasive species.

These achievements, and the many others documented in this report, are the result of the work of thousands of people throughout the region who dedicate their time and energy to protect and restore Puget Sound. We greatly appreciate their contributions. Their work has been essential to the preservation of a functioning ecosystem.

REPORT CARD

How to use the State of the Sound Report Card

INDICATOR	DESCRIPTION	TREND
Safe swimming beaches	During the summer of 2005, 24 of 65 Puget Sound beaches violated water quality standards for bacteria. Seven beaches had multiple violations. This is a 12-percent decrease from 2004, when 28 of 66 beaches exceeded bacterial standards at least once during the summer season. In 2004, 10 beaches had multiple violations.	

What is an indicator? Indicators synthesize scientific data to help inform us about a topic of interest, in this case Puget Sound's health. Each indicator helps us understand the current condition of some key element of Puget Sound's health, and whether the trend for that key element is positive or negative. Taken together, these indicators paint an overall picture of Puget Sound's health.

How were indicators selected? Selecting indicators was a matter of both choice and opportunity. We consulted scientists and looked at existing research to see what data was available. The selected indicators are those that tell us something important about Puget Sound's current condition and its condition over time (where data was available, measured regularly and over a long enough period).

Status Ratings (dots):

- If the status dot is to the left of center, the status is generally negative, meaning "poor" or "critical" depending on how far to the left.
- If the status dot is to the right of center, the status is generally positive, meaning "good" or "excellent" depending on how far to the right.
- If the status dot is in the middle of the indicator bar, the status is "fair."

Trend Ratings (arrows):

- A trend arrow pointing left indicates a negative trend.
- A trend arrow pointing right indicates a positive trend.
- No trend arrow indicates either a neutral trend, or an unknown trend.

The indicator graphics are based on the Action Team's subjective interpretations of the data and may not fully reflect the views of contributing scientists.

State of the Sound's Water

Carved by glaciers and fed by 10,000 rivers and streams, Puget Sound is an ecosystem defined by the movement of water. The health of all living creatures—plants, fish, animals and humans—depend on clean water. While our waters may look pristine, beneath their surfaces they continue to be contaminated by and at risk from a wide array of pollutants.


Over the past century, human activities have introduced a variety of chemicals into the environment at levels that can be poisonous to fish and wildlife and even humans. Long-lived toxic contaminants continue to enter Puget Sound, where some have collected in bottom sediments. From there they can accumulate in harmful levels in fish and wildlife, and can cycle through the ecosystem for years.

Our waters also are vulnerable to nutrient and pathogen pollution from a variety of human and animal waste sources. Nutrient pollution is contributing to low dissolved oxygen conditions and sporadic fish kills in Hood Canal. And other parts of Puget Sound appear to be vulnerable to the same conditions. Pathogen and bacterial pollution has left nearly one-third of the Sound's commercial shellfish growing areas restricted from harvest and the number of shellfish beds threatened with closure has increased. This pollution has also restricted some recreational activities such as swimming.

INDICATOR	DESCRIPTION	STATUS/TREND
WATER QUALITY OVERALL		

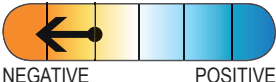
Marine water quality

The Department of Ecology is monitoring data from 39 sites throughout Puget Sound. Of these, the eight sites rated of highest concern are southern Hood Canal, Budd Inlet, Penn Cove, Commencement Bay, Elliott Bay, Possession Sound, Saratoga Passage and Sinclair Inlet. Locations of high concern include: Bellingham Bay, Case Inlet, Oakland Bay, Discovery Bay, Strait of Georgia, Carr Inlet, Port Orchard, West Point, Skagit Bay and Port Susan.



Marine and fresh water health

In 2004, there were approximately 1,474 listings of "impaired waters" in Puget Sound's fresh and marine waters. Fifty-nine percent of the waters tested were found to be impaired as a result of toxic contamination, pathogens, low dissolved oxygen or high temperatures. Less than one-third of these impaired waters have cleanup plans in place.



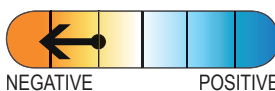
INDICATOR DESCRIPTION STATUS/TREND

WATER QUALITY | TOXIC CONTAMINATION

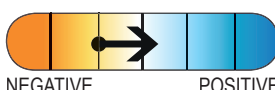
Toxics in sediments
 Long-lasting chemicals discharged into Puget Sound have accumulated in its mud and sediment and from there into the tissues of living organisms. In a study of 584,000 acres of submerged lands, about one percent (5,700 acres, primarily in urban bays) was found to be contaminated with high levels of toxic substances, and another 31 percent (179,000 acres) was moderately contaminated. PBDEs have been identified as an emerging contaminant of concern in the sediments of Puget Sound.



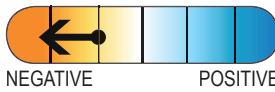
Toxics in chinook and coho salmon
 Chinook salmon from Puget Sound have two-to-six times the PCBs and five-to-17 times the PBDEs in their bodies compared to other West Coast chinook populations. PCB levels are staying stable but rising PBDE levels measured in Puget Sound seals suggest that PBDE levels in salmon are also increasing. Because of contamination, the Department of Health recently issued a consumption advisory for Puget Sound chinook.



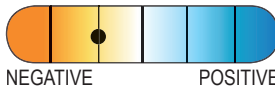
Toxics in mussels
 Mussels feed by filtering large quantities of water and so are valuable indicators of toxic contaminants. Mussel Watch data collected since 1984 shows Puget Sound mussels exceed national averages for PAHs (100-1,000 percent), PCBs (60 percent) and mercury (20 percent). Over time, PCB and PAH concentrations have generally declined; mercury levels have stayed fairly stable.



Toxics in harbor seals
 Because they feed on a wide variety of fish and invertebrates, harbor seals are sentinels of food web contamination. Harbor seal pups in south Puget Sound are seven times more contaminated with PCBs than seal pups from the Georgia Basin. PBDE levels in seals have increased dramatically over the past 20 years, from less than 50 parts per billion in fatty tissue to more than 1,000 ppb.



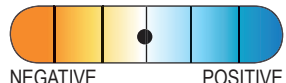
Liver disease in English sole
 English sole are a bottom-dwelling flatfish that consume invertebrates, shellfish and other organisms living in the sediments. Sole from Seattle's Elliott Bay and Tacoma's Thea Foss Waterway have increased risk (six and four times the risk respectively) of developing liver lesions compared to sole from uncontaminated sites. Soundwide, there has been a general decrease in liver disease from 1999-2005.



INDICATOR DESCRIPTION STATUS/TREND

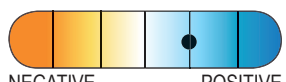
WATER QUALITY | POLLUTION FROM HUMAN AND ANIMAL WASTE

Oil spills
 A major oil spill could be catastrophic for Puget Sound's marine life and the economy. Since 2005, there have been no "major" spills (10,000 gallons or more) and the volume of oil released from such spills has steadily declined in the last 15 years. However, the risk of future spills remains high due to heavy tanker traffic, large quantities of oil transferred over marine waters and an increase in the size of cargo vessels (and their fuel tanks) entering Puget Sound.

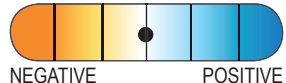


WATER QUALITY | POLLUTION FROM HUMAN AND ANIMAL WASTE

Safe swimming beaches
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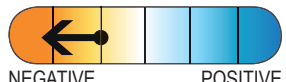


Safe, edible shellfish
 Shellfish such as clams and oysters can accumulate bacteria, viruses or other harmful pathogens from polluted water. In 2005, nearly one-third of the Sound's commercial shellfish growing areas had restrictions on harvest due to bacterial pollution. Between 1995 and 2005, improved water quality reduced harvest restrictions on 12,617 acres, while 5,218 acres had to be downgraded due to pollution. This 7,400-acre gain is tempered by a high number of areas currently classified as "threatened" with future restrictions.

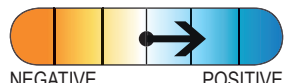


WATER QUALITY | STORMWATER RUNOFF

Impervious surface changes
 When native forests and prairies are replaced by rooftops, roads and parking lots, stormwater runoff and related pollution increases dramatically. Between 1991 and 2001, impervious surface increased 10.4 percent regionwide (43 square miles). In 2001, impervious surface covered 7.3 percent of the Puget Sound region below 1,000 feet elevation. Research shows significant decline in biological function when watersheds near or exceed 10 percent in impervious surface.



Local stormwater management programs
 Local governments have lead responsibility for managing stormwater runoff in the region. A 2004 survey found less than 40 percent of responding jurisdictions were implementing at least three-quarters of the elements of a comprehensive stormwater program. The trend is positive, however, as jurisdictions are improving their programs. In December 2006, approximately 81 cities and counties in the region came under heightened stormwater management requirements.



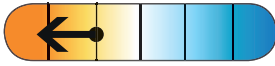


State of the Sound's Habitat




The Puget Sound region contains an amazing variety of habitats, each supporting diverse communities of plant and animal life, and each an integral part of a healthy Puget Sound. Extensive development, land conversion and the establishment of non-native and invasive species over the past 100 years have destroyed many once-intact habitats. As habitats become smaller and more isolated, they are less able to sustain the ecological processes necessary to support life. The loss and alteration of key habitats places more pressure on many of the Sound's living resources, from forage fish to salmon, and marine birds to orca whales.

State of the Sound's Species

The plants and animals living in Puget Sound are the ultimate indicators of the Sound's health, but the picture they paint is troubling. The Sound's diverse web of life is at risk. The building blocks of a healthy environment—clean water, abundant habitat and an intact food web—continue to erode. The effects of this erosion can be seen in declines in eelgrass, forage fish, salmon, rockfish, marine birds and orcas.

Currently, 10 species are listed as threatened or endangered by the state or federal government. An additional 33 marine species in Puget Sound—three invertebrates, 22 fish, seven birds and one mammal—are identified by state or federal governments as species of concern, meaning they are at risk.

INDICATOR	DESCRIPTION	STATUS/TREND
HABITAT		
Forest loss in Puget Sound lowlands	Loss of forested lands and corridors can dramatically impact river and stream systems and the species that depend on them. Between 1991 and 2001, approximately 190 square miles of forest (about 2.3 percent of the total forested area of the Puget Sound basin) was converted to other uses. In areas below 1,000 feet elevation, the change was more dramatic: 3.9 percent of total forest area was lost between 1991 and 2001.	 NEGATIVE POSITIVE
Eelgrass	Eelgrass grows in tidelands and shallow waters along much of Puget Sound's shoreline. Eelgrass habitat plays a critical role in the health of many Puget Sound fish and wildlife species, providing them with food, breeding areas and protective nurseries. Between 2003 and 2004, eelgrass declined Soundwide by four percent, but has not changed measurably since.	 NEGATIVE POSITIVE
Aquatic nuisance species	Puget Sound has become home to a number of non-native species. Two species of significant concern are tunicates, commonly called sea squirts, and spartina, a type of salt marsh grass. Significant progress has been made in the eradication of spartina. However, the recent establishment and spread of three species of non-native tunicates are a negative trend.	 NEGATIVE POSITIVE

INDICATOR	DESCRIPTION	STATUS/TREND
SPECIES		
Orca (killer whales)	In 2005, Puget Sound's southern resident killer whales were added to the federal Endangered Species list, recognition of the precarious state of the species. A draft recovery plan was released in late 2006 and recent births to Puget Sound orca pods are a positive trend, but these animals continue to face serious threats from pollution, declines in prey, increased noise from water vessels, and risk from oil spills.	 NEGATIVE POSITIVE
Salmon	Wild salmon are a keystone species of the Puget Sound ecosystem. As juveniles, salmon are a food source for other fish and marine birds. Later in life they are a favored prey of orcas. In 2002, out of a total 207 stocks, 81 stocks were listed as healthy, 52 were depressed, 12 were critical and for 62 stocks the status was unknown. Since 1992, seven stocks have become extinct and the number of healthy stocks declined from 93 to 81.	 NEGATIVE POSITIVE
Groundfish	Puget Sound has more than 150 species of groundfish that live on or near the bottom of the Sound most of their adult lives. While the majority of groundfish stocks are in good condition, many of the harvestable species are in sharp decline. Thirteen species of rockfish are designated by the state as candidates for future listing as threatened or endangered.	 NEGATIVE POSITIVE



RANDY SHUMAN

PHOTO: Red Irish Lord. | Randy Shuman.

INDICATOR	DESCRIPTION	STATUS/TREND
Herring	There are 19 designated populations of Pacific herring in Puget Sound. This small fish serves as food for a wide variety of seabirds, marine mammals and predatory fish. Although the overall spawning biomass decreased between 1980 and 1998, the trend has improved slightly since then.	NEGATIVE POSITIVE
Pinto abalone	Pinto abalone are mollusks that live in and help shape the nearshore rocky habitat. Once fairly abundant in the northern Sound, pinto abalone abundance at 10 sites in the San Juan Islands steadily decreased from 1992 to 2005, despite the fact that commercial harvest has never been permitted and statewide recreational harvest was closed in 1994. In 2004, the federal government listed pinto abalone as a species of concern.	NEGATIVE POSITIVE
Marine birds	More than 100 species of marine birds, including seabirds, sea ducks and shorebirds, are either part-time or full-time residents of Puget Sound. Many of these species are at or near the top of the food chain and thus are important indicators of overall ecosystem health. Nineteen of the 30 most common marine bird species in northern Puget Sound decreased by 20 percent or more between 1978 and 2004. Some species declined precipitously.	NEGATIVE POSITIVE

State of the Sound's Climate

Buildup of carbon dioxide and other “greenhouse” gases in the atmosphere are heating the earth and changing our planet and our region. What is still uncertain is how much warming will occur, where, in what time frame and with what impacts. As we hone our knowledge of global climate change, managing for the consequences on the local level becomes more crucial. We have added a section on climate to this year’s *State of the Sound* and we will continue to report on changes and trends in this area as it affects the Puget Sound basin.

INDICATOR	DESCRIPTION	STATUS/TREND
CLIMATE		
Temperature	Over the past century, the Puget Sound region warmed at a rate more than double that of average global temperature. The region’s waters have warmed as well, albeit more slowly. Projections indicate the region’s air temperatures will continue to rise. Even the lowest estimated warming will have negative environmental impacts, including smaller snow packs, warmer rivers and more intense dry spells.	NEGATIVE POSITIVE
Sea level rise	The melting of polar ice sheets, glaciers and ice fields, along with the warming of the ocean’s waters and the resulting thermal expansion, are causing global sea levels to rise. In the 20th century, global sea levels increased four-to-eight inches. The best scientific evidence indicates that sea levels will continue to rise, and this will negatively affect Puget Sound’s shorelines and nearshore habitats.	NEGATIVE POSITIVE
Stream flow	The timing and magnitude of freshwater flows into Puget Sound influences water temperature, salinity, circulation patterns, habitat characteristics and marine life. Less precipitation falling as snow and earlier spring snowmelt have increased winter stream flows and decreased summer flows. This trend is expected to continue and will have significant consequences for human and ecosystem water needs.	NEGATIVE POSITIVE
Snow pack	The Puget Sound ecosystem and its cities depend on snow pack. Slow-melting mountain snow sustains flows in rivers and streams over long periods and replenishes water reservoirs in the spring. Snow pack measurements show a marked decline since 1950 almost everywhere in the Cascades, exceeding 25 percent at most locations. Declines tended to be greatest at the lower elevations. With rising temperatures, these trends will continue.	NEGATIVE POSITIVE

CONCLUSION

The past two years have seen some good news and positive trends. Yet the future of Puget Sound remains at risk.

The Sound's overall trajectory, as charted in this report, continues to be one of decline, with continuing harm to the clean water, abundant habitat and intact natural processes that are the foundations of a healthy environment.

The pace of growth in the region, coupled with associated increases in impervious surface, alteration and loss of habitat, and pollutants in the air and water, are the drivers of this silent crisis. While the Sound appears beautiful, its web of life is in danger.

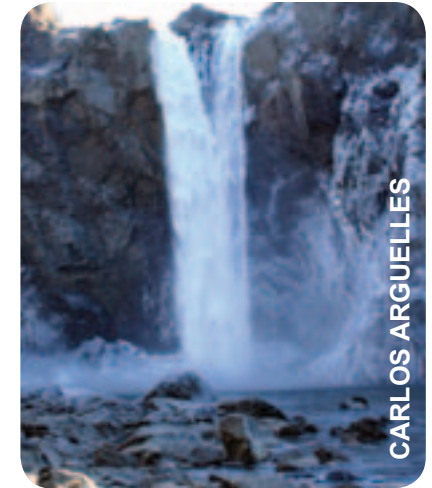
Continuing our current path means further losses in the Sound's fish and wildlife populations as well as the loss of opportunities to enjoy the Sound through harvesting oysters and clams, swimming at its beaches and watching the salmon swim upstream to spawn.

But a healthy Puget Sound can be reached if we are willing to make significant improvements in the way we develop the land and our built environment, use our natural resources and dispose of our wastes. Saving Puget Sound requires changes in our behavior, and a willingness to restrict or modify those actions that cause serious harm to the Sound.

Sustaining a healthy Puget Sound will also require perpetual effort and vigilance. As known threats are reduced or eliminated, new threats and challenges emerge. For example, flame retardants now turning up in fish, mammals and people were compounds we did not even track a decade ago. We will never reach the end point where the Sound is recovered and we can turn away to something else.

The path to a healthy Puget Sound is still available to us, but the decisions required along the way will not necessarily be easy nor inexpensive.

In the final analysis, saving Puget Sound is not about Puget Sound alone. What affects the Sound affects our lives and our future as well. Taking care of Puget Sound is taking care of our homes and our economy. It is taking care of the place that gives us shelter, provides food, maintains our health and makes our lives richer. Taking care of Puget Sound is also taking care of one of the most important legacies we have to pass on to our children and grandchildren.



PHOTOS: (top to bottom) Snowy winter day at Snoqualmie Falls, outside Seattle. | Shutterstock.com/Carlos Arguelles; Lyman Glacier, North Cascades. | Shutterstock.com/Matthew Greytak.

FIGURE 1-01: (right) This map shows the watersheds that drain into Puget Sound. This is the area covered by this report. Source: Action Team; Sanborn Mapping Solutions; Ecology.

