DEPARTMENT OF ECOLOGY
State of Washington

Sediment Quality in Puget Sound, 1989-2015

Major Findings

- Chemical contaminant levels in sediment have remained largely unchanged in most areas of Puget Sound and have decreased in urban bays. This finding could be related to cleanup and source control efforts.
- Sediments are non-toxic in most of the Sound, though toxicity has increased in some areas, likely unrelated to the chemicals measured.
- Regional benthic invertebrate communities have been impacted, mostly in urban bays and shallow restricted inlets with poor circulation.
- No significant correlation between chemicals measured, toxicity, and benthos has been found, suggesting other causes for impairments in benthos.

Two New Reports Highlight Changes Over 27 Years

The sea floor (benthic environment), which includes bottom sediments and the organisms that inhabit this area, is a key component of the Puget Sound ecosystem. Changes in the habitat and organisms can indicate responses of the ecosystem to stressors. Therefore, it is important to know not only current conditions, but also changes over time.

This fact sheet highlights results from two reports which assess benthic habitat quality in Puget Sound over time at long-term stations[1] sampled annually and at regional stations[2] sampled more widely but less often. Benthic conditions were evaluated from 1989-2015 by multiple indicators of environmental condition based on laboratory analyses, including:

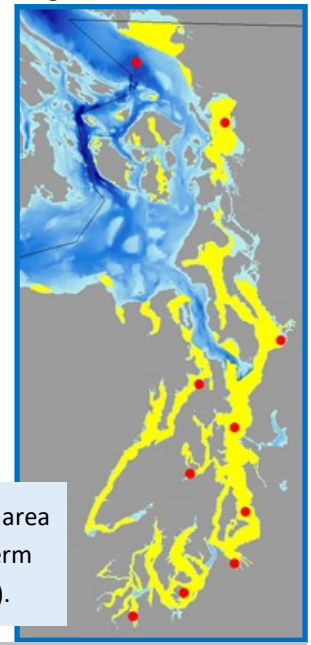
- Chemistry - concentrations of potentially toxic chemicals in sediment.
- Toxicity - sediment and porewater toxicity to test organisms.
- Benthos - species and abundance of sediment-dwelling invertebrates.

Sediment Monitoring Program

The Department of Ecology has monitored sediments since 1989 as part of the Puget Sound Ecosystem Monitoring Program, evaluating status and trends Sound-wide, not at cleanup sites.

Ten long-term stations represented different habitat types with distinct biological communities. Regional stations were randomly distributed over eight geographical regions of Puget Sound and five cross-region strata defined by waterbody type and human use.

Since 2016, this monitoring program has been revised.[3]



Sediment monitoring area (yellow) and long-term stations (red dots).

Ecology's website: ecology.wa.gov/Research-Data/Monitoring-assessment/Puget-Sound-and-marine-monitoring

Ecology scientists deploying grab sampler to collect surface sediments.

Taxonomist identifying marine benthic invertebrates.

Marine worm in the family Glyceridae collected from the sediment.

Special accommodations

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Chemistry

In general, the majority of Puget Sound did not have elevated levels of chemical contaminants. The highest concentrations were found in urban bays near population and/or industrial centers, including Bellingham, Everett, Seattle, Tacoma, and Bremerton. Metals and polycyclic aromatic hydrocarbons were detected in almost all samples. Other organic compounds were rarely detected, even as analytical detection improved.

The good news is that the higher contaminant levels in the industrialized nearshore areas have decreased significantly over the past three decades. This finding could be a reflection of cleanup and source control efforts in these areas.

Toxicity

Most of Puget Sound had non-toxic sediments, as indicated by laboratory biological tests. Greater levels of toxic response were measured primarily in sediments from terminal inlets or areas known to have poor water circulation, in both non-urban and urban areas. The toxicity is likely not related to the chemical contaminants measured because there were decreases or no change in contaminant levels where toxicity increased.

Benthic Community

The number of species (richness) and total invertebrate abundance are generally higher in northern Puget Sound and lower in South Sound and southern Hood Canal. Urban and industrialized areas have the highest abundances due to large numbers of polychaete worms tolerant of conditions such as increased organic input and low dissolved oxygen.

Significant declines in richness and abundance were seen in the Strait of Georgia and Admiralty Inlet regions and in Elliott Bay, Commencement Bay, and Bainbridge Basin. Annual sampling at the long term stations has shown complex patterns in invertebrate communities, which have remained largely stable over time, except where there has been ecological disturbance.

Publications

1. Partridge et al. 2018. Sediment Quality in Puget Sound: Changes in chemical contaminants and invertebrate communities at ten sentinel stations, 1989–2015. Washington State Department of Ecology, Olympia, WA. Publication 18-03-005.
2. Weakland et al. 2018. Sediment Quality in Puget Sound: Changes in chemistry, toxicity, and benthic invertebrates at multiple geographic scales, 1989–2015. Washington State Department of Ecology, Olympia, WA. Publication 18-03-004.
3. Dutch et al. 2018. Quality Assurance Monitoring Plan: Revisions to the Puget Sound Sediment Monitoring Program. Washington State Department of Ecology, Olympia, WA. Publication 18-03-109.