Focus on: Sediment Quality in Commencement Bay

Commencement Bay with Mt. Rainer

Related Information

- Marine Sediment Monitoring Team's collection of interactive story maps [1] describe our sediment monitoring program and findings.
- Marine sediments — Washington State Department of Ecology[2]

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Commencement Bay Sediments Evaluated

Washington State Department of Ecology (Ecology) sampled surface sediments at 30 monitoring stations in Commencement Bay in June 2022 as part of Ecology's Puget Sound Sediment Monitoring Program — Urban Bays Surveys. Our results are published in an interactive story map[1]. The story map summarizes analyses of physical, biogeochemical, and chemical contaminant parameters and the composition of the sediment-dwelling invertebrate communities. These results are also compared with results from our previous surveys conducted in 1999, 2008, and 2014.

Summary of Findings

Habitat

Commencement Bay, located in Puget Sound next to the City of Tacoma, is an urbanized area with a diverse and heavily modified shoreline. This bay supports industrial, commercial, residential, and recreational activities. The study area of Commencement Bay has a broad range of depths. Surface sediments are predominantly composed of silt and sand, with finer-grained materials concentrated in the center of the bay. Elemental and isotopic carbon and nitrogen analysis revealed a distinct spatial pattern extending out from the Puyallup River mouth and along the shoreline.

[1] https://storymaps.arcgis.com/collections/aaec1a6656ff43e098d209c75ce00244
[2] https://ecology.wa.gov/ecologys-work-near-you/river-basins-groundwater/puget-sound/sound-science/marine-sediments

Chemical contamination

Exposure to potentially harmful chemicals, as measured with the Sediment Chemistry Index, was highest in the Thea Foss, Hylebos, and Middle Waterways. While exposure levels in Commencement Bay decreased from 1999 to 2022, concentrations of seven chemicals still exceeded Washington State's Sediment Quality Standards at three locations in the bay (two in the Thea Foss Waterway and one in the Blair Waterway). These locations represent 11% of the study area.

Sampling sediments in Commencement Bay.

Benthos

The 2022 benthic community in Commencement Bay displayed a clear spatial pattern with distinct communities in the waterways, along the shorelines, in the center, and at the entrance of the bay. Overall, communities were dominated by annelids, followed by mollusks, and arthropods, accounting for an average of 68%, 25% and 5% of the total abundance, respectively. Echinoderms and miscellaneous taxa were found least often, accounting for an average of less than 3% of the total abundance.

Survey results show that benthic communities at the majority (56%) of the sampling locations in Commencement Bay were adversely affected. These locations were in the waterways and the northeastern and central portions of the bay. Benthic community condition deteriorated over time. Adversely affected benthic assemblages represented a greater area in 2022 than in the previous three surveys. An increase in very tolerant species, which exhibit significant resilience to environmental stressors, may have partially driven this change. These species are highly tolerant of organic enrichment and oxygen depletion and often thrive in heavily polluted environments.

Putting it all together

Using multivariate statistical tools, we examined the benthos in relation to physical habitat, biogeochemistry, and chemical contaminants, all of which intersect to influence community structure. In the 2022 survey of Commencement Bay, benthic structure was primarily influenced by depth, grain size, isotopic nitrogen, and polycyclic aromatic hydrocarbon pollutants. A few highly abundant taxa dominated shallow sites in the waterways and along the eastern shoreline. These sites had sediments with high carbon, nitrogen, and sulfide content and higher exposure to chemical contaminants. In contrast, the deep stations at the entrance and in the center of the bay, with minimal exposure to chemical contaminants, had more evenly distributed benthic communities.

While habitat and chemical parameters accounted for some of the variability in these communities, nearly half of the variability in benthos remained unexplained by the parameters we measured. Additional research and collaborations are needed to improve our understanding of the pressures and impacts in Commencement Bay and their effects on the benthos.