Sediment Quality in Commencement Bay, 1999 to 2008

Commencement Bay, located in Central Puget Sound near Tacoma, has received chemical pollution from human activity for more than a century. Although pollution from industries, sewers, and shipping has decreased, new pollutants from many hard-to-trace sources still threaten the bay. Stormwater is a leading source of pollution to Commencement Bay and all urban areas of the state.

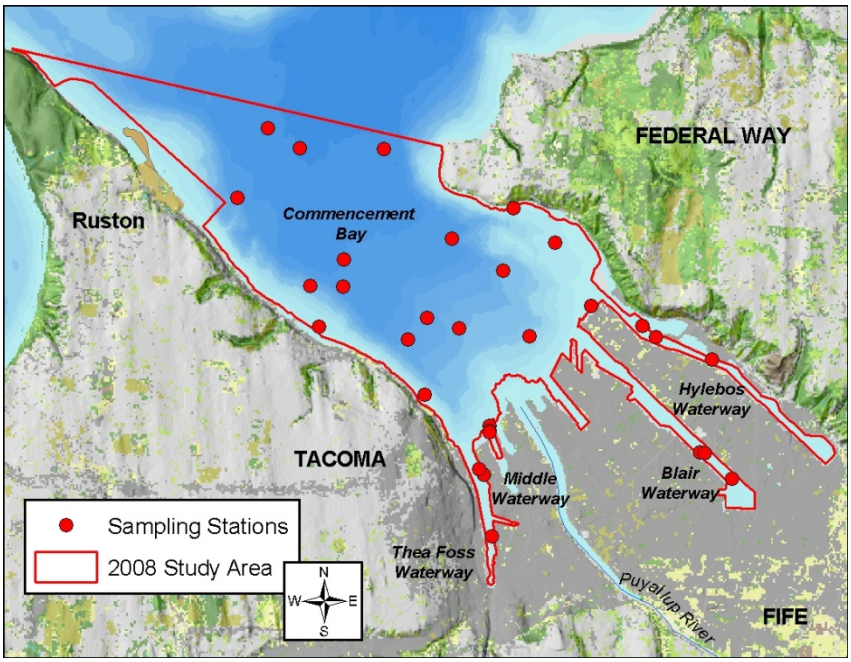

Figure 1. Thirty random sediment stations sampled in Commencement Bay in 2008 and 1999.

A bay-wide sediment survey

In 2008, the Washington State Department of Ecology (Ecology) conducted a bay-wide sediment quality assessment in Commencement Bay and its adjoining waterways. Scientists analyzed surface sediments from 30 stations (Figure 1) for levels of chemical contamination, sediment toxicity, and community composition of benthic (bottom-dwelling) organisms.

The 2008 data provide a "snapshot" of current sediment quality conditions for the entire Commencement Bay study area.

In 1999, Ecology took similar sediment quality measurements at the same stations for the Puget Sound Assessment and Monitoring Program (PSAMP). Ecology compared these measures to the 2008 data to see whether sediment quality has changed over the past decade.

Why It Matters

While this 2008 survey indicates declining levels of some sediment contaminants in Commencement Bay, levels of other contaminants have remained the same or increased, despite efforts to clean them up. In addition, impacts of some newer types of contaminants, such as pharmaceuticals, personal care products, and perfluorinated chemicals, still threaten the bay.

Faced with a growing human population in the Puget Sound area, we increasingly need to stop pollution at its source, clean up contaminated areas, and monitor the results to make sure our efforts are working.

Contact information

Valerie Partridge, Author

360-407-7217

valerie.partridge@ecy.wa.gov

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What does this study tell us?

- Most, but not all, sediment quality measures indicated improvements in sediment quality on a bay-wide scale between 1999 and 2008 (Table 1). Concentrations of most metals and polycyclic aromatic hydrocarbons (PAHs) decreased.
- Contamination by bis(2-ethylhexyl)phthalate, a common plasticizer, increased from 1999 to 2008.
- Health of sediment-dwelling invertebrates improved in the waterways, but declined in the central-southeast portion of the bay. The cause of the decline is not known but may be natural.
- The proportions of area with high sediment quality and degraded sediment quality both decreased from 1999 to 2008, and the proportion of area with intermediate sediment quality increased.
- Sediment in Commencement Bay is more degraded than non-urban areas of Puget Sound, which are less affected by human activity.

Table 1. Bay-scale changes from 1999 to 2008 in individual parameters measured in Commencement Bay sediment.

Improvements
Improved Benthic Communities in Waterways
Decreases in:
Metals: Arsenic, Copper, Lead, Mercury, Nickel, Silver, Tin, Zinc
Most LPAHs[1]
Most HPAHs[2]
No change
Metals: Cadmium, Chromium
LPAH: Acenaphthylene
HPAH: Benzo(b)fluoranthene
Polychlorinated biphenyls (PCBs)
Toxicity
Deterioration
Increase in Bis(2-ethylhexyl)phthalate[3]
Worsened Benthic Communities in Central-Southeast Commencement Bay

[1] Low Molecular Weight Polycyclic Aromatic Hydrocarbons
[2] High Molecular Weight Polycyclic Aromatic Hydrocarbons
[3] A common plasticizer; also known as DEHP

Why is this study important?

Changes in environmental quality throughout the area indicate that the combined effects of environmental regulation, pollution source control, and localized cleanup efforts have created bay-wide improvements since 1999. Other benefits are:

- It builds on the 20-year baseline of status-and-trends information established for Puget Sound by PSAMP. This baseline is essential for tracking changes in environmental conditions over time.
- It serves as an effectiveness monitoring tool and can be used to provide clues as to whether localized cleanups and source control efforts collectively have improved conditions for Commencement Bay.
- It tells managers of the scope of problems and associated potential corrective actions.
- It shows links to other ecosystem components. For example, a similar decline in PAH sediment levels in Elliott Bay was accompanied by a decrease in fish tumors. The Washington Department of Fish and Wildlife is looking to see if tumors in fish from Commencement Bay also decreased.

What about the other Urban Bays?

Ecology plans to monitor Bellingham Bay, Budd Inlet, and Everett Harbor from 2010 through 2012. Ecology conducted a similar urban bay sediment survey in Elliott Bay in 2007 and in Sinclair/Dyes Inlets and the Bainbridge Basin in 2009. View the Elliott Bay report at www.ecy.wa.gov/biblio/0903039.html. Data from the Bainbridge Basin are being analyzed. Re-assessment of all six urban bays will then continue on an annual, rotational basis. For the complete report, *Urban Waters Initiative, 2008: Sediment Quality in Commencement Bay*, see www.ecy.wa.gov/biblio/1003019.html. A four-page summary is at www.ecy.wa.gov/biblio/1003020.html.