Stormwater Action Monitoring

Project Title

Nearshore Sediment Monitoring for the Stormwater Action Monitoring (SAM) Program, Puget Sound

Receiving Waters

Lead Entity

U.S. Geological Survey

Partners

Washington State Department of Natural Resources, King County Environmental Lab, Washington State Department of Fish and Wildlife

Collectively improving stormwater management

Stormwater Action Monitoring (SAM) is a collaborative, regional stormwater monitoring program that is funded by more than 90 Western Washington cities and counties, the ports of Seattle and Tacoma, and the Washington State Department of Transportation. SAM's goal is to improve stormwater management to reduce pollution, improve water quality, and reduce flooding. We do this by measuring stormwater impacts on the environment and evaluating the effectiveness of stormwater management actions.

Questions about SAM? Send an email to SAMinfo@ecy.wa.gov

Study questions

The goals of this study are to assess environmental health in the Puget Sound nearshore adjacent to Urban Growth Areas (UGAs) and, in the long term, to monitor how nearshore health changes over time.

- What is the health of the Puget Sound nearshore as indicated by sediment quality?
- What are the existing sediment quality problems?
- What are the major natural and human stressors on nearshore sediment quality?

Stormwater management problem

Major cities and areas targeted for urban growth are located along the Puget Sound shoreline. Stormwater generated in these urban and urbanizing areas carries pollutants into Puget Sound. These pollutants, including metals and organics, can degrade the quality of Puget Sound marine nearshore habitats and impact the biota in these environments.

Local jurisdictions are increasing their efforts to manage stormwater to reduce these discharges of pollutants to Puget Sound. This is the first regional evaluation of nearshore health with a focus on areas covered by the municipal stormwater permits. Stormwater managers and policy makers need a better understanding of the most influential stressors on environmental health to help focus on the most promising solutions. Over time we anticipate detecting improvements in nearshore indicators in response to permittees' collective stormwater management efforts.

Project findings

Nearshore sediment samples were collected in 2016 from 41 spatially balanced nearshore sites (see Figure 1) along the Puget Sound UGA shorelines. The 41 sites represent 1,344 km (835 mi) of UGA shoreline. Because metals and organics tend to bind strongly to fine particles, only fine sediment was used for chemical analysis of ten metals, polycyclic aromatic hydrocarbons (PAHs), polybrominated diphenyl ethers (PBDEs), polychlorinated biphenyls (PCBs), and phthalates.

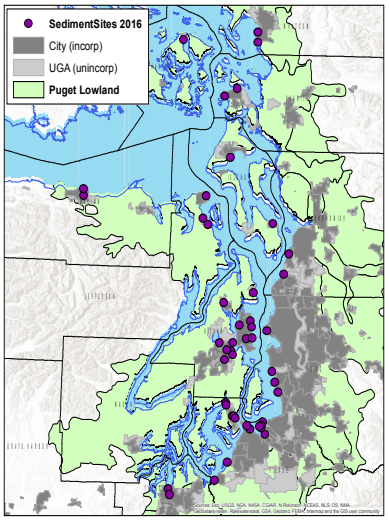

Figure 1. Puget Sound Urban Growth Area (UGA) nearshore sampling locations.

The concentrations of metals and organics in nearshore sediment were relatively low with the exception of site-specific, point-source problems. Most (95 to 99%) of the Puget Sound UGA nearshore had concentrations below Washington State marine sediment standards. Pollutant concentrations were highly variable across the region despite that we found some evidence of urban origination.

Natural variables appear to explain the variation in UGA nearshore sediment concentrations better than human factors. Except for a few metals, common indicators of urban growth and stormwater impacts explain very little of the variation. Lead, copper, and zinc concentrations were only weakly related to percent of urban cover, impervious surface, and road density.

Instead, sediment movement by strong ocean currents seems to govern spatial distribution of chemicals in the nearshore (see Figure 2). The sites with drift cells

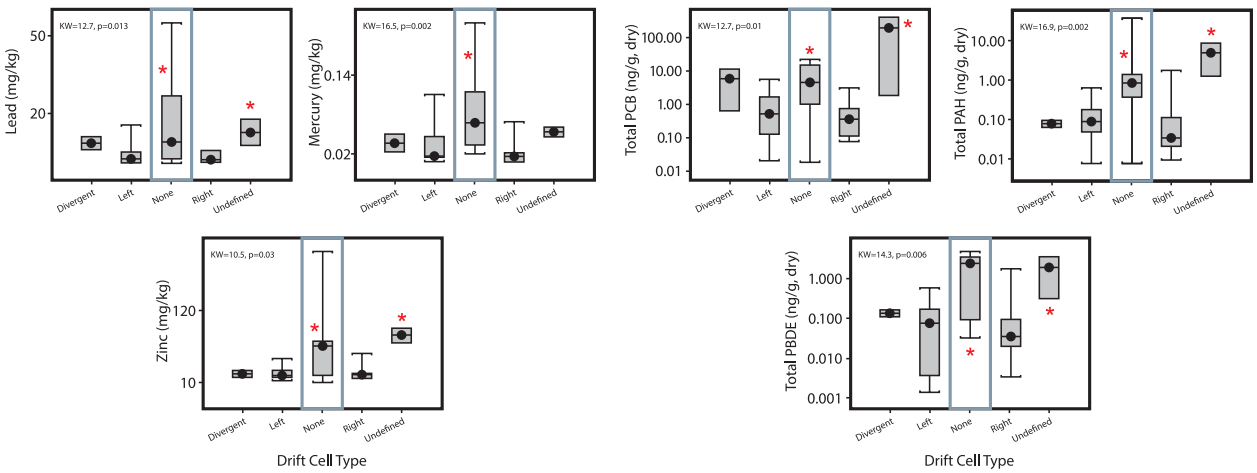

Figure 2. Pollutant concentrations compared to drift cell types indicative of water and sediment movement directions. None (blue box in center) indicates depositional areas with very low wave energy whereas divergent, left and right cell types are erosional areas. Undefined means no drift cell information was available. Red asterisks indicate significantly higher values for these drift cell types.

identified as depositional areas contained more chemicals than high-energy areas with strong water movement. This suggests that ocean currents likely disperse potentially contaminated sediment particles around Puget Sound and dilute urban signals on nearshore sediment chemistry. These findings help us understand why nearshore sediment concentrations, especially the low solubility organic pollutants, were not, or were only weakly, correlated to urban land use indicators.

Recommendations

Adjustments to the study design are needed to better sample where urban sediments are likely to be deposited in the nearshore where strong and complex currents drive the spatial pattern of sediment chemistry and stormwater impacts. Regional changes in these relatively low sediment concentrations will probably take a long time to occur and detect, so less-frequent monitoring is recommended.

Why does this study matter?

This project is one component of the SAM nearshore monitoring to evaluate impacts of stormwater in the Puget Sound nearshore. Regional-scale monitoring with a probabilistic sampling design is a cost-effective, unbiased way to assess status and trends to tell us how these impacts change over time with continuing stormwater management efforts. In contrast to the weak urban signal found in nearshore sediment chemistry, the SAM mussel monitoring study (see SAM FS #004) found significant bioaccumulation of contamination related to urban growth across the same study area.

What should we do with this information?

Stormwater managers in jurisdictions with direct discharges to Puget Sound should consider the complex mobility of contaminants in the urban and urbanizing nearshore in prioritizing stormwater management actions. Low-energy shorelines or embayments may benefit more quickly from stormwater retrofits and enhanced operation and management practices in pollutant-generating catchment areas.

What will Ecology do with this information?

Ecology will use this objective regional information to evaluate the efficacy of the overall permitting program over time in slowing or reversing the decline in receiving water conditions caused by stormwater from existing and new development. Ecology can use SAM's assessments of receiving water conditions in areas covered by the municipal stormwater permits to prioritize stormwater grant funding. This study will also help Ecology and other agencies to develop and adapt nearshore and marine monitoring and restoration programs.

For more information

Download the report at https://pubs.er.usgs.gov/publication/sir20185076