Stormwater Action Monitoring

# Project Title

2015/16 Mussel Monitoring Survey in the urban nearshore of Puget Sound

Receiving Waters

## Lead Entity

Washington Department of Fish and Wildlife

## Partners

Bainbridge Beach Naturalists, Bainbridge Island High School, Bainbridge Water Resource Council, Cherry Point Citizen Stewardship Committee, City of Bellingham, Coastal Volunteer Partnership at Padilla Bay, Evergreen State College, Feiro Marine Life Center, Harbor Wildwatch, King County, Kitsap County Public Works, Lighthouse Environmental Programs, Nisqually Reach Nature Center, NOAA's Northwest Fisheries Science Center, Pacific Lutheran University, Pacific Shellfish Institute, Penn Cove Shellfish, Port Gamble S'Klallam Tribe, Port Townsend Marine Science Center, Puget Sound Partnership, Puget Sound Corps, Puget Sound Ecosystem Monitoring Program, Puget Soundkeeper Alliance, San Juan County Marine Resources Committee (MRC), Seattle Aquarium - Beach Naturalist Program, Snohomish County MRC, Sound Water Stewards of Island County, South Puget Sound Salmon Enhancement, Stillaguamish Tribe, Suquamish Tribe, Toxics-focused Biological Observation System, University of Puget Sound, University of Washington-Tacoma, Vashon Nature Center, Washington Conservation Corps, Washington Department of Ecology, Washington Department of Natural Resources Aquatic Reserves Program, Western Washington University, Whatcom County MRC

*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 goals

Contaminant levels in mussels and tissues of other filter feeders are a good indicator of water contamination and whether the health of biota in the urban nearshore is improving, deteriorating, or remaining the same in the urban growth areas (UGAs) where stormwater management activities are currently focused. This project's study questions were designed to tell us:

- Do mussel tissue contaminant levels correlate with urbanization indicators such as land use and impervious surface in the adjacent shorelines and contributing watersheds?
- How do mussel tissue contaminant levels change over time in response to stormwater management and urban population growth in Puget Sound?

This long-term project will gather data every two years. The 2015-16 round of sampling and analysis answered the first question above. It also gathered information to refine the design for future trends monitoring to answer the second question. The project leverages previous and ongoing state and federal programs that assess the health of Puget Sound. It engages dozens of volunteers in learning more about stormwater pollution and its impacts on biota.

## Stormwater management problem

Stormwater delivers diverse toxic metals, organic contaminants, and other chemical pollutants into Puget Sound. These pollutants accumulate in biota. This study is specifically designed to assess Puget Sound nearshore biota health along urban growth area shorelines – the areas presumed to be most affected by stormwater runoff. Mussels and other filter feeders are a good tool to measure the extent of impacts from stormwater pollution.

## Project findings

Mussels were used to assess bioaccumulation of common stormwater pollutants over three winter months in the urban nearshore of Puget Sound. Native mussels (*Mytilus trossulus*) from Penn Cove were transplanted to 43 randomly selected sampling locations along shorelines of incorporated and unincorporated urban growth areas. The transplanted mussels were successfully retrieved from 90% of the sites with an overall 78% survival rate.

Polycylic aromatic hydrocarbons (PAHs) and polychlorinated biphenyls (PCBs) were the most abundant organic contaminants. They were detected in mussel tissues from every site. Polybrominated diphenyl ethers (PBDEs) and dichloro-diphenyl-trichloroethanes (DDTs) were detected in samples from about 85% of the sites. PAHs from 21% of the sites, PCBs from 5% of the sites, and DDTs from 5% of the sites exceeded Washington Department of Health threshold values for consumption. PBDEs

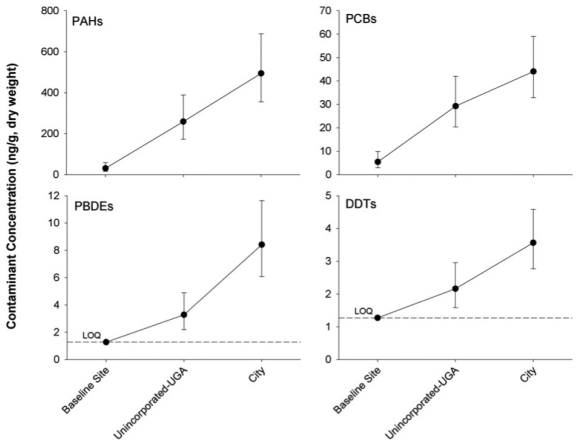


*Figure 1: Municipal land use designations adjacent to sampling sites show differences in concentrations of PAHs, PCBs, PBDEs, and DDTs in mussel tissue. Dots are geometric means and bars are 95% confidence intervals. LOQ is level of quantitation.*

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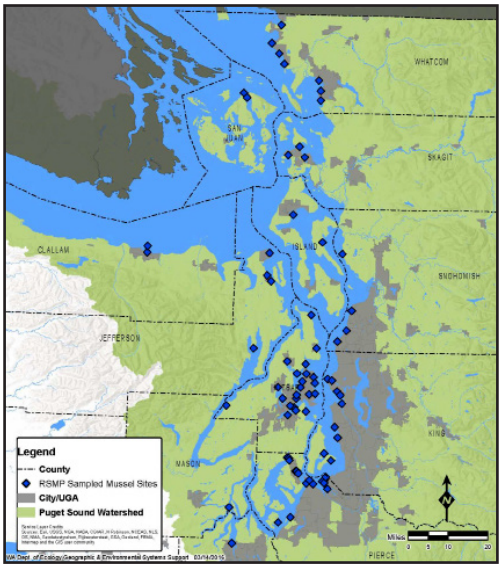
**Nearshore mussel sampling locations**




were lower than the threshold value at every site. Concentrations of all of these organic contaminants correlated with the urbanization characteristics of municipal land use classification and percent impervious surface. The other organic contaminants, including additional pesticides, were detected at only a few sites and at low levels.

Zinc, copper, cadmium, arsenic, and mercury were detected in mussels from every study site. Lead was detected at 86% of the sites. Metal contaminant levels in the mussel tissues were lower than toxic levels as defined by U.S. Environmental Protection Agency, Washington Department of Health, or otherwise available in scientific literature. Zinc was weakly related to urbanization characteristics and the other metals concentrations did not show a clear spatial pattern.

## Recommendations

This first round of data was collected for a new regional long-term study designed to assess stormwater impacts in Puget Sound. Improving the study design by adding substrata of land-use type may help identify the spatial patterns and track changes in contamination related to stormwater impacts. Additional sites sponsored by partner groups provided data outside the UGAs for comparison. Least-disturbed reference sites are needed to establish regional scale thresholds and natural variability.

This project is just one part of the SAM assessment of nearshore conditions relative to urban stormwater management. A similar suite of contaminants was measured in sediments at most of the same sites. The findings of both projects will be used to compile a regional assessment of conditions in Puget Sound and considered in making adjustments to future monitoring.

## Why does this study matter?

Local governments in Puget Sound spend hundreds of millions of dollars each year managing stormwater. The purpose of stormwater management is to minimize pollutants in stormwater runoff and protect designated uses of receiving waters. This project tells us how much bio-available contamination is in the food web during the winter months – a direct link to the health of Puget Sound biota – and will help us focus and support efforts to prevent contamination from entering Puget Sound via stormwater. We are improving our understanding of the effects of stormwater from a wide variety of landscape conditions. We will learn how conditions are changing over time and whether stormwater management is working to reduce and prevent these impacts to nearshore biota.

## What should we do with this information?

Stormwater managers should be aware that toxic contaminants are entering the nearshore food web of the greater Puget Sound, especially along shorelines adjacent to highly urbanized areas. Mussel tissue contamination levels in their areas, or in areas with similar land use patterns, can help permittees understand what problem areas likely exist along their shorelines. Permittees should use this information to help explain the importance of stormwater management in minimizing discharges of pollution and to inform local project priorities in catchments that drain to nearshore marine areas.

## What will Ecology do with this information?

This study provides Ecology and other agencies the means to measure and track progress in reducing impacts to the urban nearshore areas of Puget Sound. Ecology looks forward to the long-term results. Meanwhile this knowledge will be useful to support funding initiatives and to inform all of Ecology's programs that regulate discharges to nearshore marine environments and remediate polluted sites.

## For more information

Download the full report at http://wdfw.wa.gov/publications/01925.
Visit the project website at www.ecology.wa.gov/SAM.

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