2019-2020 Nearshore Mussel monitoring survey in the urban nearshore of Puget Sound

Stormwater Action Monitoring

Receiving Waters

Lead Entity

Washington Department of Fish and Wildlife

Partners

Bainbridge Beach Naturalists, City of Bellingham, Feiro Marine Life Center, Harbor WildWatch, Jamestown S'Klallam Tribe, Jefferson County Public Health, King County, Kitsap County Public Works, Makah Tribe, NOAA's Northwest Fisheries Science Center, NOAA NCCOS, Penn Cove Shellfish, Port Townsend Marine Science Center, Puget Sound Corps, Puget Sound Ecosystem Monitoring Program, Puget Soundkeeper Alliance, Rich Passage Estates HOA, Salish Sea Stewards, San Juan County Marine Resources Committee (MRC), Seattle Aquarium, Snohomish County MRC, Sound Water Stewards of Island County, South Puget Sound Salmon Enhancement, Stillaguamish Tribe, Suquamish Tribe, Tulalip Tribe, 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, Washington State University

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, the Washington State Department of Transportation and the US NAVY.

SAM's goal is to improve stormwater management by measuring stormwater impacts on the environment and evaluating the effectiveness of stormwater management actions.

Highlights

- Mussels in the urban nearshore of Puget Sound accumulate organic contaminants (PAHs, PCBs, PBDEs, DDTs) at a greater rate than at the reference site.
- PAHs, PBDEs, and DDTs had significantly lower central tendency concentrations in mussels from this third survey (2019-20) than the prior two surveys.
- The spatial extent of the impacted urban nearshore remains unchanged in Puget Sound.

Stormwater goals related to the study

Stormwater delivers metals, organic contaminants, and other chemical pollutants into Puget Sound. These pollutants can accumulate in biota. The SAM Nearshore Mussel monitoring is conducted biannually using caged mussels (Mytilus sp.) as the primary indicator organism to assess the winter nearshore water quality, areas impacted by pollutants carried by stormwater. Randomly selected sites are located in the Puget Sound nearshore along urban growth area shorelines –areas presumed to be most affected by stormwater runoff. Mussels, filter feeders, are a good tool to measure the extent of pollutants present in the nearshore. The objectives of the SAM Mussel Monitoring survey are to; 1) characterize the spatial extent of contamination to which nearshore biota residing inside the UGA sampling frame may be exposed, and 2) track changes in tissue contamination over time inside the UGA sampling frame.

Project findings

This winter 2019/2020 monitoring survey was the third survey under this 'UGA' study design and provides the first opportunity to evaluate changes in contamination of nearshore biota residing inside the urban growth areas (UGAs) of Puget Sound. The other two surveys were conducted in winters of 2015/2016 and 2017/2018, hereafter surveys are referred to as 2016, 2018, and 2020 respectively. We characterized mussel tissue contaminant concentrations at 40 sites in the Puget Sound UGA nearshore each survey and changes in the spatial extent of contamination. Results are compared to a reference site established in Hood Canal, a site with consistently low contaminant concentrations.

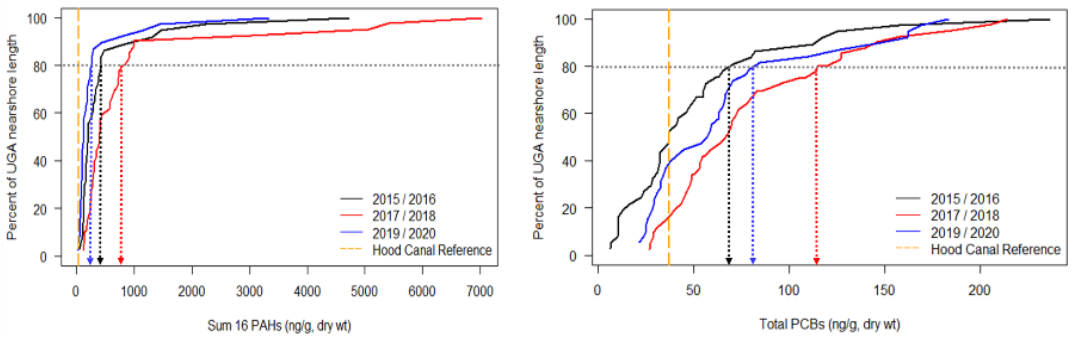

Figure 1. Cumulative frequency distribution (CFD) of Σ_{16}PAH and TPCB concentrations in mussels by survey. CFD plots represent the concentrations by the total sampled length of nearshore in Puget Sound UGAs. The dashed yellow line is the reference site concentration. Dotted lines are guides to read the plot, pointing to the concentrations observed in each survey year at 80% of the total sampled UGA nearshore length.

Most of the sampled UGA nearshore had sum total of 16 polycyclic aromatic hydrocarbons (∑16PAHs), total PCBs (TPCBs), sum total of 11 polybrominated diphenyl ethers (∑11PBDEs), and sum total of 6 dichlorodiphenyl-tricholoethanes (∑6DDTs) concentrations above the reference site concentration indicating mussels accumulated these contaminants at nearshore sites within the UGA.

The spatial extent of the measured organic contaminants in the UGA nearshore showed little to no decline over 4 years (Figure 1). The smooth slope of TPCBs CFD graph (Figure 1) suggest gradual accumulation of PCBs throughout the UGA shoreline. In contrast, the steep slope of PAHs CFD graph indicates relatively low level of PAHs in the study area with only few high contamination sites, possibly from another point source nearby.

PAHs, PBDEs, and DDTs had significantly lower central tendency concentrations in mussels from the 2020 survey than in the 2016 and/or 2018 survey. The declining PBDEs concentrations but stable PCBs concentrations were congruent with the temporal pattern in two other WDFW-TBiOS indicator species (English sole and Pacific herring) reported in the Toxics in Aquatic Life Vital Sign. The 2019-2020 SAM Puget Sound Nearshore Mussel Monitoring Survey report contains all findings.

This represents the final survey under the 'UGA design' and all future SAM mussel monitoring surveys will be done under the new design that expands the nearshore study frame to the entire Puget Sound lowlands. The 2021-22 survey will include a subset of the sites (15) sampled under this 'UGA design' to track changes in these locations. For more information on the revised design and study, see the SAM Marine Nearshore Mussel QAPP for 2021-2025.

Why does this study matter?

This long-term status and trends monitoring of the marine nearshore will evaluate whether and how stormwater discharge and the stormwater management actions implemented in the region are affecting or even detected in nearshore biota contaminants levels.

What should stormwater managers do with this information?

Stormwater managers know that effective and lasting improvements to infrastructure, best management practices, and changing behaviors of Puget Sound residents takes time. Monitoring long term in several key environments such as the marine nearshore will help us determine if conditions are getting better despite population growth as building codes and stormwater management improves in the areas adjacent to the nearshore.

What will Ecology do with this information?

Ecology will use this objective regional information to evaluate the efficacy of the municipal stormwater permitting program over time in slowing or reversing the decline in the marine nearshore. While there are many other potential dischargers beyond municipal stormwater impacting Puget Sound's water quality, the nearshore is the most likely environment for stormwater impacts to be measured and tracked, especially as the region expands existing and new development. Ecology supports SAM's receiving water studies under the municipal stormwater permits and will continue to coordinate findings with SAM's urban stream monitoring program in Puget Sound.

For more information on SAM's Marine Nearshore Mussel, see the completed Status and Trends study at ecology.wa.gov/SAM or contact Mariko Langness at Washington State Department of Fish and Wildlife Mariko.Langness@dfw.wa.gov.