



Prepared for Ecology on behalf of the Stormwater Workgroup by Washington Department of Fish & Wildlife

Goal & Background



Figure 1. Bagged bay mussels (*Mytilus trossulus*) in a predator exclusion cage at the Duwamish West Waterway monitoring site.

The Stormwater Action Monitoring (SAM) Status and Trends in Receiving Waters program conducts monitoring in Puget Sound nearshore marine waters to provide a regional assessment of whether collective stormwater management actions are leading to improved receiving water conditions. The SAM Puget Sound Nearshore Mussel Monitoring studies focuses on the bioaccumulation of pollutants in caged native bay mussels (*Mytilus trossulus*) to evaluate the current status and trends of nearshore conditions (Figure 1). The 2023/2024 (hereafter referred to as 2024) survey was the fifth survey under the SAM program study and the second conducted under the new SAM study design, whereby the sampling area expanded to the entire nearshore of the Puget Lowland ecoregion and the study sites were stratified into four categories by estimates of average percentage of total impervious area (TIA%) of the contributing upland watersheds.

The primary goals for the study was to determine the status of contamination in the marine nearshore during the 2024 survey, evaluate changes occurring between the 2022 and 2024 survey under the new study design, and test for trends in the larger monitoring dataset across the eight-year monitoring period (2016 – 2024) using a subset of sites within

the urban growth area. The results characterized the spatial extent of contamination in the nearshore and the magnitude of concentrations for the most frequently detected contaminants monitored in the SAM studies. Determining how contaminant concentration results from the surveys compare against project-specific thresholds and across the four TIA% strata were also objectives.

Survey Findings

Similar to prior surveys, $\Sigma 16$ PAHs, TPCBs, $\Sigma 11$ PBDEs, $\Sigma 6$ DDTs continued to be the most abundant and highest concentration contaminants detected in mussels of the Puget Sound nearshore. Estimates of the spatial extent of mussel tissue contamination in the Puget Lowland ecoregion during the 2024 survey showed that most of the Puget Sound nearshore length had low concentrations of $\Sigma 16$ PAHs, $\Sigma 11$ PBDEs, and $\Sigma 6$ DDTs based on project-specific thresholds, and that a very small proportion of the nearshore length had high concentrations (Figure 2). TPCBs differed, showing that most of the Puget Sound nearshore length had intermediate concentrations of TPCBs, and that a quarter of the total nearshore length had high concentrations. The nearshore length with high concentrations of these organic contaminants primarily occurred within the most developed shoreline category (>40% TIA%). When comparing the spatial extent of mussel tissue contamination in the nearshore in the 2022 and 2024 surveys, the distribution patterns for $\Sigma 16$ PAHs, $\Sigma 11$ PBDEs, and $\Sigma 6$ DDTs were very similar. Whereas the spatial distribution patterns for TPCBs showed that concentrations across the nearshore increased in the 2024 survey. No meaningful changes were observed in the

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.

geometric mean concentrations of $\Sigma 16$ PAHs, $\Sigma 11$ PBDEs, and $\Sigma 6$ DDTs. In contrast, an increase in TPCB concentrations was observed in mussel tissue in 2024, at 2.3x higher than 2022.

When testing for trends in the larger eight-year, five survey monitoring period within the urban growth area, a moderate decline in $\Sigma 11$ PBDEs and a weak but plausible decline in $\Sigma 16$ PAHs was observed. No meaningful trends were observed for $\Sigma 6$ DDTs or TPCBs over the monitoring period. Given the complexity of Puget Sound ecosystem and the incremental nature of stormwater improvements, observable water quality responses are expected to emerge slowly and may require multiple years of data and multiple lines of evidence to confidently distinguish management effects from background variability. Additional sampling years under the new study design will help infer conclusions regarding any significant trends for contaminants across the nearshore of the broader Puget Lowland ecoregion.

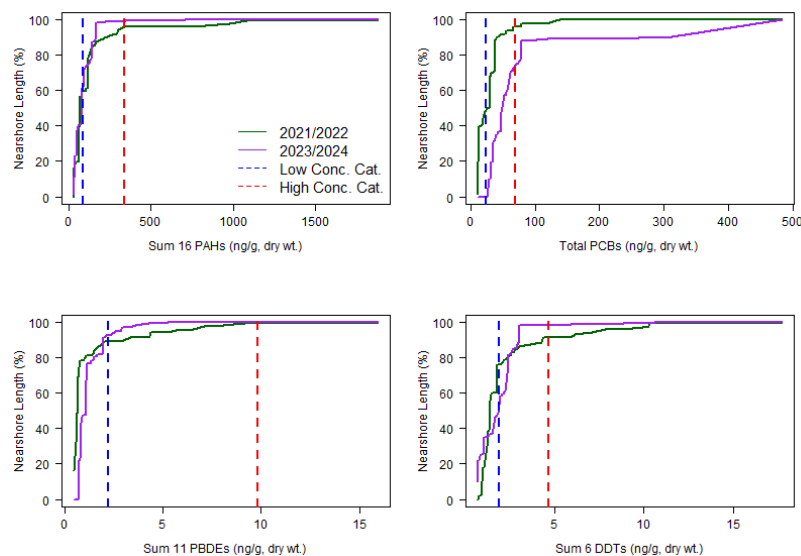


Figure 2. Cumulative distribution function (CDF) plot of $\Sigma 16$ PAHs, TPCBs, $\Sigma 11$ PBDEs, and $\Sigma 6$ DDTs concentrations in mussels from the 2023/2024 SAM study sites. Values to the left of the blue line represent low concentrations, and values to the right of red line represent high concentrations based on project-specific threshold values determined using percentiles (25th and 75th).

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 nearshore biota contaminant 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.

This study can be also used to help prioritize locations for infrastructure improvements and to guide funding decisions aimed at reducing stormwater-related contaminants in 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 development. Ecology supports SAM's receiving water studies and will continue to coordinate findings with SAM's urban stream monitoring program in Puget Sound.

For more information, including the full final report, visit the [SAM status & trends webpage](#). Data are available on [EIM database](#) with Study ID SAM_MNM.

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