

PUGET SOUND VITAL SIGNS

INDICATOR CONTAMINANTS IN ENGLISH SOLE

The contaminants in English sole indicator measures chemical concentrations in fish fillets and disease occurrence in fish to assess impacts of contaminants in the benthic (seafloor) habitat. PCBs and PBDEs in fillets indicate contaminant levels people may be exposed to from eating benthic fish. Liver tumors and the presence of a female-specific protein, vitellogenin, in the blood of male fish indicate health impairments due to PAH and EDC exposure, respectively, in the benthic habitat.

Indicator Progress



Target Status



Target

By 2030, 95% of the samples gathered across Puget Sound habitats exhibit a declining trend of contaminant levels, or are below thresholds of concern for species or human health.

By 2050, 95% of the samples gathered across Puget Sound habitats exhibit contaminant levels below thresholds of concern for species or human health and show no increasing trends.

Target fact sheet

Data Source

PCB and PBDE contaminant levels and time trends calculated from [West et al. \(2017\)](#) and from [Washington Department of Fish and Wildlife, Toxics Biological Observation System](#) unpublished data.

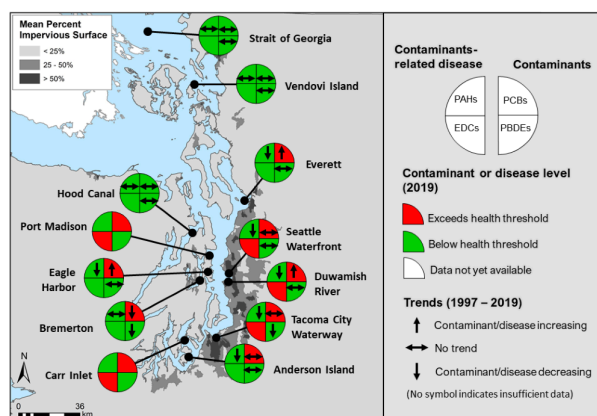
PAH-induced liver disease and EDC-induced vitellogenin odds ratios calculated from [Washington Department of Fish and Wildlife, Toxics Biological Observation System](#) unpublished data.

Indicator Lead

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Contaminant and disease levels in English sole from 12 index sites. For contaminants, red indicates high contamination, with some English sole (5th percentile or greater) exceeding the health thresholds and green indicates low contamination, with most English sole (95th percentile or greater) below the thresholds. For PAH- or EDC- related disease, red indicates significantly higher risk of disease compared to baseline, whereas green indicates no significantly elevated risk.

Key Vital Sign Indicator Results

- The Contaminants in English sole indicator did not meet the recovery goal (see target description) because PCB levels in English sole fillet tissue exceeded the human health screening value and English sole males showed signs of EDC-related reproductive impairment at multiple Central and South Puget Sound locations. For detailed results, see the [Interpretation of Results](#) section.
- PCB levels in English sole fillet tissue exceeded the human health threshold (i.e., the WA Department of Health (DOH) screening value concentration for subsistence fishers or high-level consumers) at nine out of twelve (75%) index sites. PCB levels have improved over the past 20 years for only one of those locations and continue to worsen at three locations (the Duwamish River, Everett, and Eagle Harbor).
- English sole fillet PBDE concentrations were below the human health threshold at all 12 locations, and they are either holding steady or decreasing.
- Liver disease resulting from exposure to PAHs has significantly declined at six index sites including Everett, Eagle Harbor, the Seattle Waterfront, the Duwamish River, Anderson Island, and Tacoma City Waterway. The risk of disease was 2.5 to 40 times higher at these sites compared to baseline in the mid-1990s and is no longer significantly elevated compared to background levels. The PAH 2020 recovery target was reached for all index sites as of 2019.
- Male English sole from five out of 12 (42%) sites showed increased risk of expressing vitellogenin, suggesting an increased risk of reproductive impairment at these sites.
 - Vitellogenin is a protein involved in female reproductive development and is normally only expressed in mature females with developing eggs.
 - Vitellogenin expression in male fish is commonly used as an indicator of exposure to estrogenic chemicals in their environment.
 - Vitellogenin expression in male fish has previously been linked to adverse reproductive health in a variety of fishes.
- Although there has been some improvement in the contaminants in English sole indicator (PAHs and PBDEs), PCB concentrations remain high in fish from urban and near-urban bays and EDC-related vitellogenin induction continues in both urban and non-urban (rural/residential) areas. These results suggest continued PCB and EDC inputs to Puget Sound, likely via stormwater runoff and wastewater effluent (EDCs). These sources will likely increase as the Puget Sound region population continues to grow.

CONTRIBUTING PARTNERS



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