

Background

Puget Sound Chinook salmon help define our local culture, are essential to protecting tribal treaty rights, and are important to the diet of endangered southern resident orca. Despite the federal protections and billions of dollars invested in recovery, Chinook abundance is still only a fraction of the recovery target. The survival of juvenile Chinook through Puget Sound is a key factor limiting recovery.

In 2014, Long Live the Kings and Canada's Pacific Salmon Foundation launched the Salish Sea Marine Survival Project, an international research effort leading 60 organization to understand why salmon are dying during their migration through Puget Sound, Strait of Georgia, and Strait of Juan de Fuca. The research, among other things, highlighted lack of estuary habitat and high levels of contaminants in fish as factors compromising some Chinook populations. This document discusses one type of contaminant, PBDEs.



SALISH SEA
MARINE SURVIVAL PROJECT



Washington
Department of
**FISH and
WILDLIFE**

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Scientists from the Tulalip Tribes sampling for juvenile Chinook in the Snohomish estuary.

Flame Retardants (PBDEs) in Wild Juvenile Chinook

OVERVIEW

PBDEs (polybrominated diphenyl ethers) are a class of flame retardant used since the 1970s in consumer and industrial products including textiles, polyurethane foam, wire insulation, and plastics. By the end of 2013, the use of PBDEs in new products was largely phased out, but many older products and some new products continue to release PBDEs into the environment which can eventually end up in our waterways. PBDEs are a long lasting pollutant, similar to PCBs (polychlorinated biphenyls).

Low levels of PBDEs can harm juvenile salmon by **increasing disease susceptibility and altering hormone production**. In the spring of 2016, WDFW's long term contaminant monitoring program found PBDEs in juvenile Chinook salmon at **all of the 11 major Puget Sound estuaries they sampled**. In parts of the Snohomish Estuary, PBDE levels in wild Chinook were significantly higher than other areas of the river basin, and in some cases, above the level known to cause health problems for juvenile salmon. Wild Chinook, versus hatchery raised, are known to spend more time in the estuary, subjecting them to higher risk of PBDE exposure.

For juvenile Chinook undergoing a critical growth period before migrating through Puget Sound, we predict that **high contaminant exposure likely impacts survival during their seaward migration**.

EXAMINING THE SOURCE

PBDEs enter our waterways from wastewater, stormwater, and particles moved through the air. Wastewater contains PBDEs released from consumer and commercial products (sofa, television, etc) which are bound to dust and washed down the drain. Industrial uses of PBDEs (textile/foam production) can also enter the wastewater stream.

Wastewater treatment plants are not designed to remove all toxics and count on their ratepayers to minimize putting toxics, like PBDEs, "down the drain." The plants do remove some PBDEs, but any that remain in the water are **discharged into public waterways** and PBDEs removed during the treatment process may be reintroduced to the environment via biosolids application or disposal. The City of Everett is examining PBDEs in their systems, but ultimately, the source may need to be identified "up the pipe."

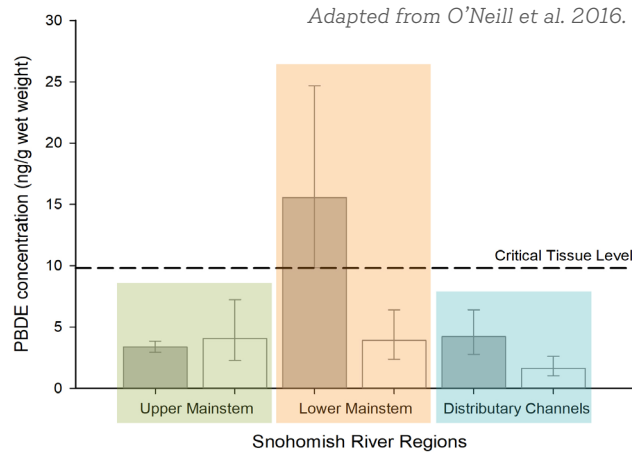
Toxics in Salmon - Snohomish Estuary

Graph - Levels of PBDEs measured in juvenile Chinook migrating through the Snohomish River system in 2016.

Darker bars indicate fish of wild-origin and no color indicates fish of hatchery-origin. On average, wild Chinook from the lower mainstem had levels of PBDEs approximately 1.5 times the critical tissue level, which is an estimate of the amount of the contaminant that the fish can tolerate before their health is adversely affected. Bars indicate a geometric mean \pm 95% confidence intervals.

Map - Areas where Chinook were sampled.

The map is shaded to match the shading on the graph. The Marysville Wastewater Treatment Plant and the Everett Water Pollution Control Facility are also noted.



PBDE FOCUS AREA

LLTK and our partners are working to identify PBDE hotspots in important salmon habitat in order to focus our efforts. The Snohomish River Estuary is an area where threatened wild Chinook are known to linger during an important stage in their lifecycle. Wild juvenile Chinook caught in the lower mainstem portion of the Snohomish river estuary had higher levels of PBDEs compared to hatchery Chinook collected at the same location and Chinook caught in other areas of the Estuary. Additional analysis suggested that PBDEs in wild juvenile Chinook are associated with municipal wastewater, but we are still working to confirm the pathway(s).

Two wastewater facilities have discharge pipes in the estuary, but the most contaminated fish were caught in the area where the City of Everett discharges a portion of its wastewater. There may be a number of explanations for this, such as that other unidentified pathways exist, the Everett facility experiences higher PBDE inputs than other facilities, wild Chinook behavior in the lower Snohomish results in greater PBDE exposure, suboptimal water treatment is occurring, or a combination of these or other factors.

FINDING SOLUTIONS

Over the past decade, scientists have learned more about the effects of PBDEs on aquatic species, especially salmon and orca which are federally protected. Further, they have learned that one of the largest pathways for PBDEs in Puget Sound appears to be publicly owned water treatment facilities.

Currently, in Washington State there are no regulatory requirements to monitor or limit PBDE levels in effluent from municipal wastewater treatment facilities, although National Marine Fisheries Service has recommended PBDE monitoring in another treatment facility in the state.

In the short-term, LLTK is working with the City of Everett, Tulalip Tribes, Dept. of Fish and Wildlife, Snohomish County and Dept. of Ecology **to further investigate PBDEs in the Snohomish Basin and develop strategies to evaluate and address the problem.** Initial actions include: piloting steps to minimize PBDE loading in the lower Snohomish and additional PBDE testing. Ultimately, the group will gain a better understanding of how juvenile Chinook adsorb PBDEs, how PBDEs are distributed throughout the watershed, and potentially, identify PBDE sources.

