Persistent pollutants in Puget Sound juvenile Chinook salmon: Changes after 25 years

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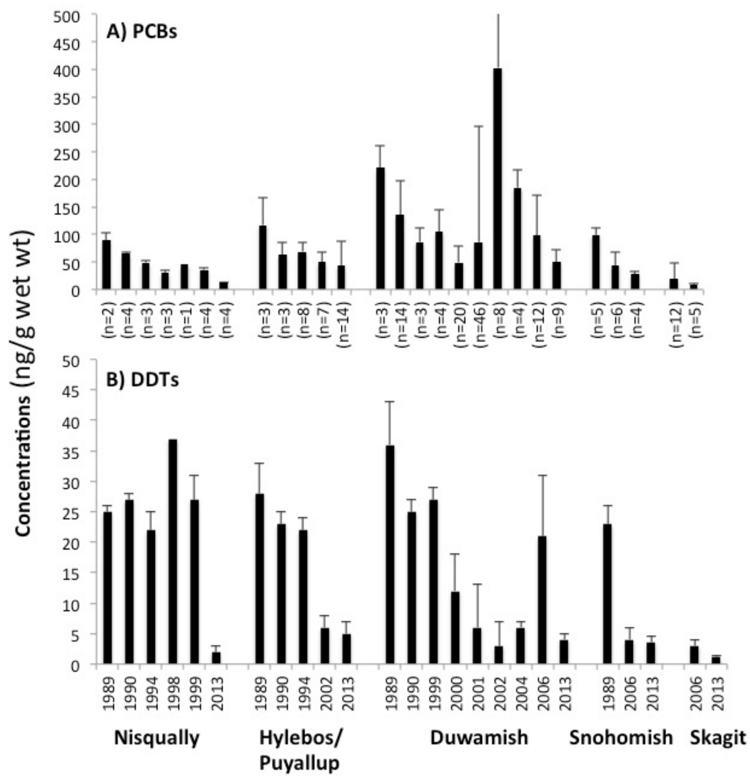
- Over the past 25 years, concentrations of PCBs, DDTs, and PAHs have declined in juvenile Chinook salmon from several urban embayments in Puget Sound.

Puget Sound Chinook salmon (*Oncorhynchus tshawytscha*) have been listed as a threatened species under the Endangered Species Act since 1999. Factors contributing to their decline include overharvest, hatchery impacts, and loss and modification of salmon habitats, including reduced habitat quality due to contaminant inputs. Since the late 1980s, NOAA Fisheries has been measuring concentrations of persistent organic pollutants (POPs) in juvenile salmon from Puget Sound, WA. Initial studies in 1986 and 1989 revealed unexpectedly high concentrations of polychlorinated biphenyls (PCBs), dichlorodiphenyltrichloroethanes (DDTs), and polycyclic aromatic hydrocarbons (PAHs) in juvenile Chinook salmon or their prey from urban areas in the Sound (McCain et al. 1990; Stein et al. 1995). Over the following 25 years, there have been numerous efforts to reduce contamination in Puget Sound, including remediation and restoration of superfund sites in Elliott Bay (Seattle, WA) and Commencement Bay (Tacoma WA), with associated assessment of contaminant exposure in juvenile salmon and other trust resources.

In 2013, the Washington Department of Fish and Wildlife and NOAA Fisheries conducted a joint study to measure concentrations of contaminants, including POPs, in juvenile salmon from five Puget Sound river-estuary systems: Skagit, Snohomish, Green/Duwamish, Puyallup/Hylebos, and Nisqually (O'Neill et al. 2015). We compared these current data to concentrations measured in salmon from the same locations in previous studies conducted from the late 1980s to 2006 (McCain et al. 1990; Stein et al. 1995; Stehr et al. 2000; Olson et al. 2008; Meador et al. 2010).

Results indicate declines in exposure to DDTs and PCBs (shown in the Figure), as well as PAHs, in juvenile Chinook salmon from several estuary systems. Concentrations of DDTs declined in both urban and non-urban esturaries, while PCBs showed the greatest declines in urban systems. Contaminant concentrations in the Duwamish system, while generally declining, showed increases in the mid-2000s, probably because of dredging activities occuring in the Duwamish Waterway as part of sediment cleanup at that time (EcoChem 2005).

Our findings suggest that efforts to reduce inputs of persistent pollutants to the Sound have had some success. A variety of factors, including source control and sediment cleanup, regulatory actions, and improved hatchery practices have likely contributed to declines in persistent pollutants in juvenile Chinook salmon. However, in a significant proportion of salmon, exposure to PCBs and PAHs is still above estimated toxicity thresholds, and other contaminants, including current use pesticides, polybrominated fire retardants, and pharmaceuticals and personal care products, may pose risks.



The mean concentrations (+SD) of PCBs (A) and DDTs (B) measured in juvenile Chinook salmon whole bodies. Sample sizes (number of composite samples) are in parentheses located beneath the bars of Figure A.

These data establish a time series of contaminant conditions in juvenile Chinook salmon in order to measure the effectiveness of past and current toxics reductions strategies and actions, inform future pollution reduction efforts, and enhance the recovery of Chinook salmon.

RECOMMENDED CITATION

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