Pharmaceuticals and Personal Care Products (PPCPs) & Perfluoralkyl Substances (PFASs) in Puget Sound Sediments
An Update: 2010 – 2015

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I. Introduction
- PPCPs and PFASs have been detected in the Puget Sound watershed’s ground and surface waters (1,2), municipal wastewater influent, effluent, and runoff (1-3), estuaries waters (4-5); and in estuarine sediments collected by Ecology’s Marine Sediment Monitoring Team (6-8).
- Results from sediment monitoring in 4 urban bays and 10 long-term monitoring stations are summarized in Table 1.

II. Methods
Sampling locations
- 2010 Long-term, n=10
- 2011 Bellingham Bay, n=30
- 2012 Elliott Bay, n=19
- 2014 Commencement Bay, n=10
- 2015 Bainbridge Basin, n=13

Sediment collection
- Sediments were collected using a 0.5-m² stainless steel double van Veen grab.
- The top 2 to 3 cm from multiple grabs at each station were combined and homogenized.
- Samples were sent to AYES Analytical Services Ltd., Sidney, BC, Canada for analysis.

Chemical analyses
- Sediments were tested for the presence of 119 PPCPs and 13 PFASs (Table I).
- AMS/Method: U-ATI (GDQ06.1860) for PPCPs and NLA-041 for PFASs were used, including high-performance liquid chromatography with positive and negative electrospray ionization modes and tandem mass spectrometry.

III. Results
- Detected chemicals
  - 3.9% of PPCPs and 2.6% of PFASs results were below detection concentrations.
  - 119 PPCPs and 7 of 13 PFASs were detected in samples (Table II).
  - PFOS, PFHxS, PFUnA, PFDA, and PFOA were detected most frequently.

- Occurrence and spatial gradients
  - Long-term and Bellingham Bay stations had fewer chemicals than stations in Elliott Bay, Commencement Bay, and the Bainbridge Basin.
  - In all bays, larger numbers of chemicals were detected near the head of each bay, likely near discharge sources, and in deeper, depositional locations (Figure 1).

- Concentrations
  - Concentrations varied among bays (Table III).
  - Concentrations were generally higher in Elliott Bay and Commencement Bay (Figure 2).
  - Concentrations differed among study areas but were generally higher in Elliott Bay and Commencement Bay (Figure 3).

- Standardized concentrations
  - Concentrations did not differ among study areas, but were generally higher in Elliott Bay and Commencement Bay (Figure 4).
  - Concentrations significantly differed among study areas, with the highest in Elliott Bay and Commencement Bay (Figure 4).