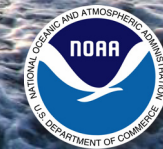


# CECs in marine biota: Presence of estrogenic chemicals in bile of English sole (*Parophrys vetulus*) from Puget Sound, WA



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Estrogenic chemicals measured in bile of English sole at 10 Puget Sound sites revealed fish from urbanized sites had elevated levels of Bisphenol A and tert-octylphenol and Elliott Bay fish had the highest estrogen exposure.

Marine waters near urban centers receive frequent inputs of chemicals that are emerging as threats to ecological and human health referred to as chemicals of emerging concern (CECs). Priority lists of CECs include some estrogenic chemicals (ECs) such as natural and synthetic estrogens; 17 $\beta$ -estradiol (E2), estrone (E1), estriol (E3), and 17 $\alpha$ -ethynylestradiol (EE2), as well as industrial phenolic compounds [e.g., bisphenol A (BPA), octylphenol (OP) and nonylphenol (NP)]. Recent information on the levels of these ECs in water indicates that they may pose a risk due to their widespread occurrence and their potential estrogenicity, affecting growth, development and reproduction of marine fish. Although limited data are available on exposure concentrations of ECs in biota of marine ecosystems, recent studies (da Silva et al. 2013) in Puget Sound have reported measurable levels of selected ECs in bile of male English sole at levels that are correlated with abnormal reproductive cycles and elevated in-plasma vitellogenin levels in this benthic species (Johnson et al. 2008). To improve the understanding on EC levels of contamination

in Puget Sound and ultimately provide monitoring of ECs for assessing the Toxics in Fish Vital Sign (PSP, 2016), we applied our method for analysis of ECs in bile of male and female English sole collected at 10 different sites, including low, moderate and high development sites (Figure 1, O'Neill et al. 2015). The results indicate that BPA and tert-OP (tOP) levels were significantly higher in English sole collected from the most highly developed sites compared to those collected at sites classified with either medium or low development (Figure 2). Moreover, the concentrations of natural hormones and nonsteroidal xenoestrogens detected indicate that sole from Elliott Bay had the highest estrogen exposure. The median total estradiol equivalent concentrations (EEQ) in female and male sole from Elliott Bay were 3000 and 410 ng/mL bile (Figure 3). These results suggest that Puget Sound fish are being exposed to elevated levels of ECs, particularly from highly-developed urbanized habitats, such as Seattle Waterfront/Elliott Bay and Sinclair Inlet. The chronic exposure to these ECs may cause endocrine disrupting effects such as reproductive impairment.

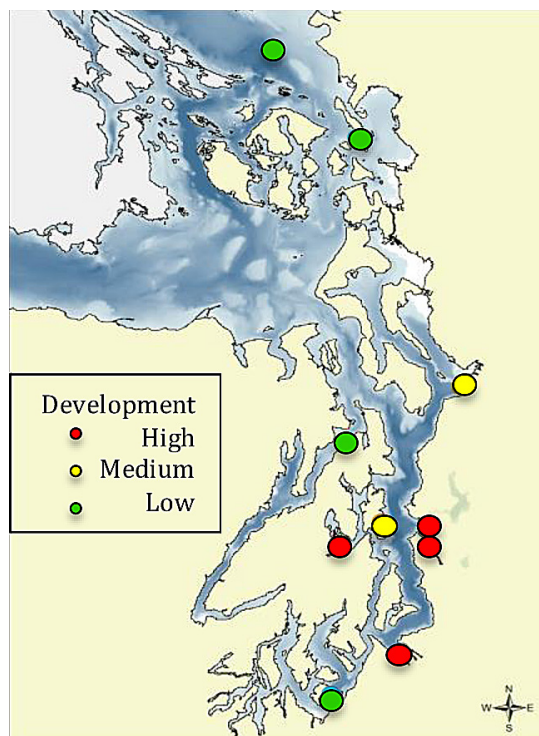


Figure 1: English sole were collected from 10 locations throughout Puget Sound which were classified as either high, medium, or low development basins. (Classifications were based on surrounding land use)

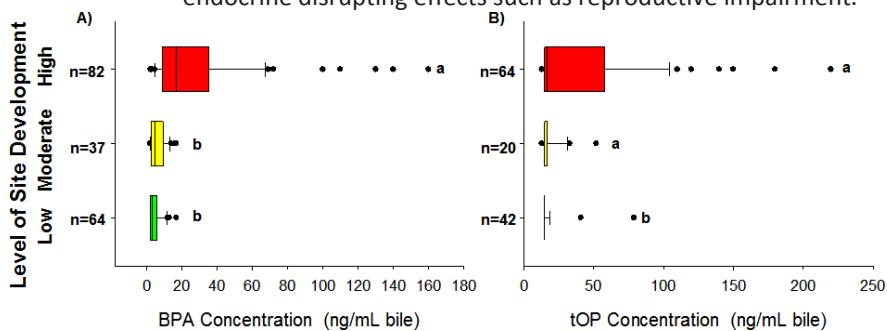


Figure 2: Bisphenol A (BPA) and tert-octylphenol (tOP) are higher in males and females from high development sites.

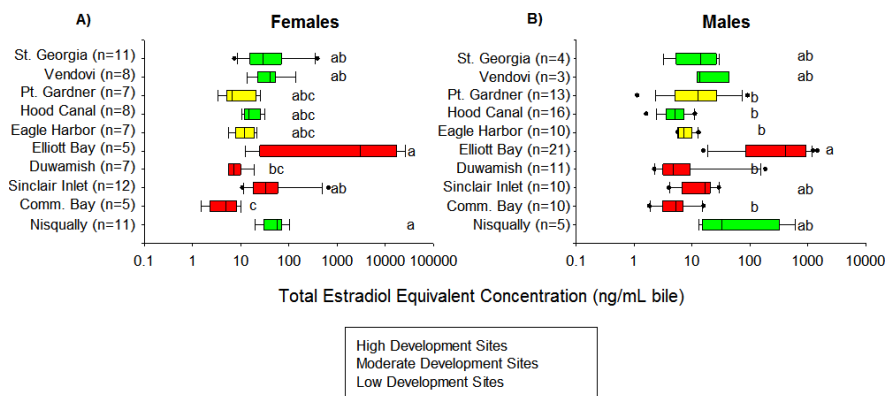


Figure 3: Concentrations of natural hormones and nonsteroidal xenoestrogens detected indicate that English sole from Elliott Bay had the highest estrogen exposure.

## RECOMMENDED CITATION

da Silva, D.A.M., O'Neill, S.M., Johnson, L.L., West, J.E., Swanson, P., and Ylitalo, G.M. (2017) CECs in marine biota: Presence of estrogenic chemicals in bile of English sole (*Parophrys vetulus*). p. 20 In 2016 Salish Sea Toxics Monitoring Review: A Selection of Research. Edited by C.A. James, J. Lanksbury, D. Lester, S. O'Neill, T. Roberts, C. Sullivan, J. West. Puget Sound Ecosystem Monitoring Program. Tacoma, WA. 68 pp; [https://www.eopugetsound.org/sites/default/files/features/resources/PSEMP\\_2016\\_ToxicsSynthesis%202017.05.09.pdf](https://www.eopugetsound.org/sites/default/files/features/resources/PSEMP_2016_ToxicsSynthesis%202017.05.09.pdf)

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