Contaminants of emerging concern in Bay Mussels throughout the Salish Sea

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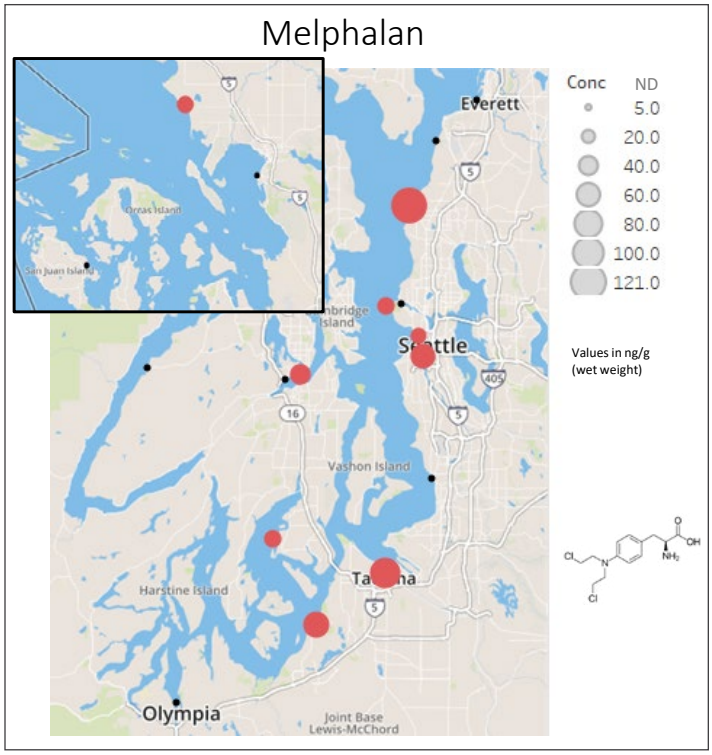
- **Transplanted mussels were deployed at 18 locations in Puget Sound and analyzed for CECs.**
- **Results indicated a wide range of exposure to low levels of medications and antibiotics, some at levels of biological concern.**

Monitoring of bay mussels (*Mytilus trossulus*) has been an important part of WDFW's Toxics-focused Biological Observing System (TBiOS) in the Puget Sound. Traditional monitoring has focused on a suite of priority compounds including PAHs, PCBs, PBDEs, and metals. In order to expand the range of compounds investigated, we undertook a pilot program in 2016 to analyze a select set of tissue samples for contaminants of emerging concern (CECs), utilizing two distinct analytical approaches. One set was analyzed by targeted methods focusing on a suite of over 200 pharmaceuticals, personal care products, and endocrine disrupting compounds. The results supported the notion of widespread exposure of marine organisms to trace levels of organic contaminants, including compounds such as the antidepressant sertraline, and the antibiotic virginiamycin. The synthetic opioid oxycodone was present in tissue samples collected from three sites, including one Elliot Bay and two near the Bremerton Shipyard. The chemotherapy drug melphalan was present in samples from 9 of 18 locations. Melphalan has been shown to induce DNA damage in exposed haemocytes of Zebra mussels (*Dreissena polymorpha*; Buschini et al. 2003), and so its presence may be of biological concern. Results also clearly demonstrated the importance of analytical considerations such as matrix effects, variable limits of detection, and quality assurance criteria when comparing data across an ecosystem.

A second set of tissue samples were analyzed by high resolution mass spectrometry (HRMS) in order to gain a broader understanding of exposures without focusing on a pre-defined list of analytes. This non-targeted approach utilized accurate mass, isotopic ratios, and retention time information for the identification of a wide range of unique compounds for follow up analysis. Additional criteria, such as differential occurrence patterns, potential for biological interactions, and/or compound properties (e.g., halogenation), are then applied to identify a subset for focused identification. In this instance a candidate list of approximately 175 unique compounds, was selected for identification based on common occurrence across samples and presence in existing accurate mass databases and libraries. Multiple compounds were identified, including synthetic hormones such as drospirenone, again supporting the notion of a wide range of CEC exposures in the nearshore of Puget Sound.



Summary of melphalan concentrations in transplanted mussel tissues deployed in various locations in Puget Sound. Concentrations are in ng/g tissue (wet weight). ND – not present at concentrations above the detection limit. The detection limits ranged from 16.8 to 82.4 ng/g tissue.

WDFW volunteer deploying mussel cage at North Avenue Park, Anacortes on the night of October 2015. Photo: Brenda Cunningham, WDFW Volunteer

RECOMMENDED CITATION

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