

Novel Effects-based Monitoring Approaches to Evaluate Chemicals of Emerging Concern in the St. Louis River Estuary.

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As part of an on-going program of research in support of the Great Lakes Restoration Initiative, the US EPA MED laboratory has been developing effects-based biomonitoring tools to evaluate the occurrence and potential hazards associated with Chemicals of Emerging Concern (CECs). Over the 2010 (pilot), 2011, and 2012 field seasons caged fathead minnows were deployed at multiple sites within the St. Louis River Estuary, including: a gradient of locations near the Western Lake Superior Sanitation District discharge, the Superior Municipal Treatment Plant discharge, Hog Island, Erie Pier, and Rice's point (adjacent to the Ship Canal). Grab and/or composite samples of surface water were collected concurrent with fish exposures and used for chemical analysis of target CECs as well as in vitro bioassays. Following exposure in the field, fish were brought back to the lab, dissected, and tissues analyzed using targeted methods relevant to reproductive and endocrine functions as well as more open-ended methods including transcriptomics and metabolomics. Estrogenic activity was detected in a number of surface water samples collected in the SLRE. However, the egg yolk precursor protein vitellogenin, a widely used biomarker of estrogen exposure, was not significantly elevated in male fish exposed at the same locations. Nonetheless, some impacts on circulating concentrations of steroid hormones as well as expression of xenobiotic metabolizing enzymes in liver were detected. Collectively, the experiments to date have evaluated a range of exposure scenarios, multiple time courses, and different seasons. Ongoing efforts will focus on the impacts of temperature, food availability, and changes in municipal discharges over time on biological response profiles in caged fish.