

Effects-based monitoring with caged Fathead Minnows: An exposure gradient case study in the Duluth-Superior Harbor, USA.

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Abstract:

Within the Great Lakes there is an increased focus on contaminants of emerging concern (CECs) and consideration of potential effects of chemical mixtures. To further characterize the utility of caged fathead minnows (*Pimephales promelas*) for effects-based monitoring of CECs, we conducted a combination of laboratory and in-situ exposures representative of a gradient associated with wastewater discharge into the Duluth-Superior Harbor, Duluth MN, USA. Sexually mature fathead minnows were exposed at varying distances (proximal, distal, and far distal) from the treated effluent discharge of the Western Lake Superior Sanitary District treatment plant (WLSSD) and sampled after four, seven, and 14 days of exposure. Concurrently, a four day in-lab flow-through exposure was conducted with varying dilutions of final treated effluent collected from WLSSD (50% effluent, 5% effluent, and Lake Superior water control) as well as a single concentration of bisphenol A (10 µg/L), a CEC which had been previously detected in the effluent and receiving water. Preliminary results show modest androgenic (assessed using MDA-kb2 cell assays) and estrogenic (vitellogenin protein induction in male fathead minnows) activity associated with the 50% effluent exposure. Following dilution into receiving water, the activity was no longer detectable based on targeted endpoints, even for exposure durations up to 10 days longer. Initial analyses of targeted endpoints will be complemented with more open-ended transcriptomic and metabolomic analyses to further characterize biological responses along this exposure gradient.

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