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Novel Effects-based Monitoring Approaches to Evaluate Chemicals of Emerging Concern in Great Lakes Areas of Concern.

US EPA – MED: G. Ankley, J. Berninger, J. Cavallin, E. Eid, E. Durhan, K. Jensen, M. Kahl, C. Lalone, E. Makynen, M. Severson, K. Stevens, D. Villeneuve

US EPA – ERD: T. Collette, D. Ekman,

US Army – ERDC: E. Perkins

Mississippi State University: N. Garcia-Reyero

As part of an on-going program of research in support of the Great Lakes Restoration Initiative, we have been developing effects-based biomonitoring tools to evaluate the occurrence and potential hazards associated with Chemicals of Emerging Concern (CECs). Over three field seasons caged fathead minnows were deployed at multiple sites within several Great Lakes Areas of Concern, particularly near waste water treatment discharges. 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 sampled 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. Impacts on circulating concentrations of steroid hormones, as well as expression of xenobiotic metabolizing enzymes in liver were also detected. Vitellogenin, the egg yolk precursor protein widely used biomarker of estrogen exposure in male fish, was only significantly elevated at one site. Collectively, the experiments to date have evaluated a range of locations, exposure scenarios, and multiple time courses. 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.