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Detection and Potential Effects of Pharmaceuticals and Personal Care Products in the Sacramento River

Abstract: Pharmaceuticals and personal care products (PPCP) are emerging as potential hazards to aquatic wildlife due to their down the drain disposal and known, purposeful, effects in humans. In the Sacramento River, the occurrence of such chemicals presents a particular threat to aquatic organisms inhabiting areas near the outfall of the Sacramento Regional Waste Water Treatment Plant (SRWWTP), a known source of PPCPs. There is currently little information regarding the effects of PPCPs on fish species in general, let alone risks posed to those populations in the lower Sacramento River. Here, a collaborative study utilizing molecular, organismal and ecologically relevant endpoints in fathead minnow (*Pimephales promelas*) exposed to river water from the Hood Field Station and Garcia Bend Park, locations upstream or downstream of the SRWWTP respectively, was conducted to begin addressing the issues outlined above. Weekly water samples, collected in Fall 2008 and Spring 2009, contained a number of PPCPs, of which the most common was the non-steroidal anti-inflammatory Ibuprofen and the fibrate drug Gemfibrozil.

In addition to chemical analyses, water collected at the respective field sites were used as exposure water for larval fathead minnow that then underwent behavioral and molecular assessments. Larvae and adult fish were also exposed at Hood using *in situ* devices and adult fish were assessed for altered vitellogenin levels and gross histological changes. We found that larvae exposed to the two study sites or a laboratory control displayed differential expression of genes associated with endocrine and neuromuscular pathways or general stress responses and demonstrated altered survival, growth and swimming ability. Adults displayed changes in liver histopathology characteristic of pollutant exposure but no changes in vitellogenin levels were seen.

Statement of Relevance: As emerging contaminants to aquatic environments, pharmaceuticals and personal care products often lack thorough risk assessments. To aid regulatory agency decision making, regarding threats to unintentionally exposed organisms, it is important to develop collaborative studies that assess the occurrence, potential sublethal mechanisms of impairment, and ecological implications of PPCPs.