

## Exposure Research

# In-situ exposure of fish for biomarker experimentation at Department of Water Resources (DWR) real-time monitoring sites

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### Description:

For decades, the field of aquatic toxicology has assessed the health of water bodies using, primarily, laboratory based static-renewal toxicity tests. In recent years, there has been a push to supplement traditional toxicity tests with experiments using molecular biomarkers to determine the physiological and biochemical responses of an organism to specific stressors. Molecular changes often result from the direct binding of a toxicant to its cognate receptor and thus are toxicant specific. Because they occur proximal to exposure, these changes are often tied directly to the toxicity and can potentially inform the mechanisms of action. One of the most well characterized molecular biomarkers is vitellogenin (Vtg) gene expression. Vtg is usually quiescent in males, but can be induced upon exposure to estrogenic compounds, which have been shown to negatively affect the reproductive capacity of aquatic vertebrates. We have designed a system that screens for estrogen mimicking compounds while exposing male fish in-situ. During two successive years, adult male fathead minnows were exposed to ambient water in flow through systems at two DWR field sites, the Sacramento River at Hood, and the San Joaquin River at Vernalis, for seven days for four successive weeks in both low and high flow periods. The second year had an additional 28-day exposure concurrent with the four single week exposures. Upon test termination, the brain, liver and gonads of each individual were removed and flash-frozen. Liver samples were analyzed for Vtg expression using Real-Time quantitative Polymerase Chain Reaction analysis and all samples were analyzed for histological anomalies. For year one, Vtg gene expression was elevated for several weeks at the Hood field station. Year two QPCR and histological results are pending. These data indicate the presence of estrogenically active substances in the Sacramento River, which coincides with periods of high flow.

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### Purpose/Objective:

The indeterminate condition of exposure indicator research stands to change markedly with the ability to connect molecular biological technologies with cellular or tissue effects and outcomes. Three focal areas of ecological research aim to develop a sequence of approaches where "the earliest recognizable signatures of exposure" (i.e., unique patterns of up- and down-regulated genes and proteins) are identified for numerous stressors, demonstrable in case studies and incorporated into Agency, State and Regional studies supported by EMAP and other programs.

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U.S. ENVIRONMENTAL PROTECTION AGENCY

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