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Application of an Effects-Based Monitoring Strategy to Assess the Impact of Contaminants on Fish Health in an Urbanized Watershed

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Effects-based monitoring frameworks that combine the use of analytical chemistry with in vitro cell bioassays, as well as in vivo whole organism tests offer an integrative approach to broadly screen for chemical contaminants and link their presence with adverse effects on aquatic organisms. California (USA) is currently evaluating the use of such a framework to assess the impact of contaminants of emerging concern (CECs) on biota in urbanized rivers and other waterbodies. In the present study, the occurrence and effects of contaminants found in the Los Angeles River (Los Angeles County, CA, USA) were examined using analytical chemistry and in vitro and in vivo bioassays. Male fathead minnows were deployed infield ‐ based exposure units and exposed to river water for 21 d. The 2field sites (above Bull Creek [BLC] and below Glendale Water Reclamation Plant [GWR]) were selected based on their unique characteristics and different contaminant discharge sources. In addition, 2 control units (filtered city water and estrone ‐ spiked water) were added to the experimental design. Chemical analyses revealed differences in abundance of CECs between the 2field sites and the controls, with GWR having the highest number and concentrations of CECs and metals. Cell bioassays screening for estrogenic, glucocorticoid, progestin, and dioxin ‐ like activities were near or below detection limits in all river water samples, indicating a low potential for endocrine ‐ related toxicity and tissue damage. Cell bioassay results were corroborated by the in vivo analyses. Field ‐ exposed fish exhibited no changes in plasma hormones (e.g., estradiol), vitellogenin, or gonad maturation, but gene biomarkers of chemical exposure (cytochrome p450 1A and metallothionein) were significantly elevated, confirming exposure of the fish to complex chemical mixtures. The results demonstrate the value of a tiered monitoring approach to assess the sublethal effects of chemical mixtures on aquatic life.