

A Tiered, Integrated Biological and Chemical Monitoring Framework for Contaminants of Emerging Concern in Aquatic Ecosystems

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ABSTRACT

The chemical-specific risk-based paradigm that informs monitoring and assessment of environmental contaminants does not apply well to the many thousands of new chemicals that are being introduced into ambient receiving waters. We propose a tiered framework that incorporates bioanalytical screening tools and diagnostic nontargeted chemical analysis to more effectively monitor for contaminants of emerging concern (CECs). The framework is based on a comprehensive battery of in vitro bioassays to first screen for a broad spectrum of CECs and nontargeted analytical methods to identify bioactive contaminants missed by the currently favored targeted analyses. Water quality managers in California have embraced this strategy with plans to further develop and test this framework in regional and statewide pilot studies on waterbodies that receive discharge from municipal wastewater treatment plants and stormwater runoff. In addition to directly informing decisions, the data obtained using this framework can be used to construct and validate models that better predict CEC occurrence and toxicity. The adaptive interplay among screening results, diagnostic assessment and predictive modeling will allow managers to make decisions based on the most current and relevant information, instead of extrapolating from parameters with questionable linkage to CEC impacts.

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