SCCWRP #0726

Incorporating contaminant bioavailability into sediment quality assessment frameworks

Keith A. Maruya[1], Peter F. Landrum[2], Robert M. Burgess[3] and James P. Shine[4]

[1]*Southern California Coastal Water Research Project, Costa Mesa, CA*

[2]*Fisheries and Illinois Aquaculture Center and Department of Zoology, Southern Illinois University, Carbondale, IL*

[3]*US Environmental Protection Agency, ORD/NHEERL—Atlantic Ecology Division, Narragansett, RI*

[4]*Department of Environmental Health, Harvard School of Public Health, Boston, MA*

ABSTRACT

The recently adopted sediment quality assessment framework for evaluating bay and estuarine sediments in the state of California incorporates bulk sediment chemistry as a key line of evidence (LOE) but does not address the bioavailability of measured contaminants. Thus, the chemistry-based LOE likely does not provide an accurate depiction of organism exposure in all cases, nor is it particularly well suited for assessment of causality. In recent years, several methods for evaluating the bioavailability of sediment-associated contaminants have emerged, which, if optimized and validated, could be applied to improve the applicability and broaden the scope of sediment quality assessment. Such methods include equilibrium-based biomimetic extractions using either passive sampling devices (PSDs) or measures of rapidly desorbing contaminant pools, which provide information compatible with existing mechanistic approaches. Currently, these methods show promise in relating bioaccessible chemicals to effects endpoints, including bioaccumulation of hydrophobic organic compounds and/or toxicity due to metals. Using these methods, a bioavailability LOE for organics is proposed based on PSD and equilibrium partitioning theory that can be employed as an independent LOE or in assessing causality in tiered toxicity identification evaluations. Current and future research should be aimed at comparing the performance of PSDs and their relationships with effects concentrations, field validation of the most promising methods, addressing contaminant mixtures, further developing the parameterization of the proposed bioavailability LOE, and providing a better understanding of the underlying diagenetic cycling of metal contaminants that lead to exposure, affect bioavailability, and drive adverse outcomes.