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Comparison of national and regional sediment quality guidelines for classifying sediment toxicity in California

Steven M. Bay, Kerry J. Ritter, Doris E. Vidal-Dorsch and L. Jay Field[1]

[1]*National Oceanic and Atmospheric Administration, Seattle, WA*

ABSTRACT

A number of sediment quality guidelines (SQGs) have been developed for relating chemical concentrations in sediment to their potential for biological effects, but there have been few studies evaluating the relative effectiveness of different SQG approaches. Here we apply six SQG approaches to assess how well they predict toxicity in California sediments. Four of the SQG approaches were nationally derived indices that were established in previous studies: Effects Range Median (ERM), Logistic Regression Model (LRM), Sediment Quality Guideline Quotient 1 (SQGQ1), and Consensus. Two approaches were variations of nationally derived approaches that were recalibrated to California-specific data (CA LRM and CA ERM). Each SQG approach was applied to a standardized set of matched chemistry and toxicity data for California and an index of the aggregate magnitude of contamination (e.g., mean SQG quotient or maximum probability of toxicity) was calculated. A set of three thresholds for classification of the results into four categories of predicted toxicity was established for each SQG approach using a statistical optimization procedure. The performance of each SQG approach was evaluated in terms of correlation and categorical classification accuracy. Each SQG index was significantly correlated with toxicity and able to correctly classify the level of toxicity for up to 40% of samples. The CA LRM had the best overall performance, but the magnitude of differences in classification accuracy among the SQG approaches was relatively small. Recalibration of the indices using California data improved performance of the LRM, but not the ERM. The LRM approach is more amenable to revision than other national SQGs, which is a desirable attribute for use in programs where the ability to incorporate new information or chemicals of concern is important. The use of a consistent threshold development approach appeared to be a more important factor than type of SQG approach in determining SQG performance. The relatively small change in classification accuracy obtained with regional calibration of these SQG approaches suggests that further calibration and normalization efforts are likely to have limited success in improving classification accuracy associated with biological effects.

Full Text

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