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Comparison of methods for evaluating acute and chronic toxicity in marine sediment

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ABSTRACT

Sublethal test methods are being used with increasing frequency to measure sediment toxicity, but little is known about the relative sensitivity of these tests compared to the more commonly used acute tests. The present study was conducted to compare the sensitivity of several acute and sublethal methods and to investigate their correlations with sediment chemistry and benthic community condition. Six sublethal methods (amphipod: *Leptocheirus plumulosus* survival, growth, and reproduction; polychaete: *Neanthes arenaceodentata* survival and growth; benthic copepod: *Amphiascus tenuiremis* life cycle; seed clam: *Mercenaria mercenaria* growth; oyster: *Crassostrea virginica* lysosome destabilization; and sediment–water interface testing with mussel embryos, *Mytilus galloprovincialis*) and two acute methods (amphipod survival with *Eohaustorius estuarius* and *L. plumulosus*) were used to test split sediment samples from stations in California. The test with *Amphiascus* proved to be the most sensitive sublethal test and the most sensitive overall, identifying 90% of the stations as toxic. The *Leptocheirus* 10-d test was the most sensitive of the acute tests, identifying 60% of the stations as toxic. In general, the sublethal tests were not more sensitive to sediments than the acute tests, with the sublethal tests finding an average of 35% of the stations to be toxic while the acute found 44%. Of the sublethal tests, only the *Amphiascus* endpoints and *Neanthes* growth significantly ($p \leq 0.05$) correlated with sediment chemical concentrations. Poor correspondence occurred between the toxicity endpoints and the indicators of benthic community condition. Differences in test characteristics such as mode of exposure, species-specific contaminant sensitivity, changes in contaminant bioavailability, and influence of noncontaminant stressors on the benthos may have been responsible for variation in response among the tests and low correspondence with benthic community condition. The influence of these factors cannot be easily predicted, underscoring the need to use multiple toxicity methods, in combination with other lines of evidence, to provide an accurate and confident assessment of sediment toxicity.

Full Text

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