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Bioassessment tools in novel habitats: an evaluation of indices and sampling methods in low-gradient streams in California

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ABSTRACT

Biomonitoring programs are often required to assess streams for which assessment tools have not been developed. For example, low-gradient streams (slope $\leq 1\%$) comprise 20 - 30% of stream miles in California and are of particular interest to watershed managers, yet most sampling methods and bioassessment indices in the state were developed in high-gradient systems. This study evaluated the performance of three sampling methods [targeted riffle composite (TRC), reach-wide benthos (RWB), and the margin-center-margin modification of RWB (MCM)] and two indices [the Southern California Index of Biotic Integrity (SCIBI) and the ratio of observed to expected taxa (O/E)] in low-gradient streams in California for application in this habitat type. Performance was evaluated in terms of efficacy (i.e., ability to collect enough individuals for index calculation), comparability (i.e., similarity of assemblages and index scores), sensitivity (i.e., responsiveness to disturbance), and precision (i.e., ability to detect small differences in index scores). The sampling methods varied in the degree to which they targeted macroinvertebraterich microhabitats, such as riffles and vegetated margins, which may be naturally scarce in lowgradient streams. The RWB method failed to collect sufficient numbers of individuals (i.e., ≥ 450) to calculate the SCIBI in 28 of 45 samples and often collected fewer than 100 individuals, suggesting it is inappropriate for low-gradient streams in California; failures for the other methods were less common (TRC, 16 samples; MCM, 11 samples). Within-site precision, measured as the minimum detectable difference (MDD) was poor but similar across methods for the SCIBI (ranging from 19 to 22). However, RWB had the lowest MDD for O/E scores (0.20 versus 0.24 and 0.28 for MCM and TRC, respectively). Mantel correlations showed that assemblages were more similar within sites among methods than within methods among sites, suggesting that the sampling methods were collecting similar assemblages of organisms. Statistically significant disagreements among methods were not detected, although O/E scores were higher for RWB samples than TRC. Index scores suggested impairment at all sites in the study. Although index scores did not respond strongly to several measurements of disturbance in the watershed, percent agriculture showed a significant, negative relationship with O/E scores.

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