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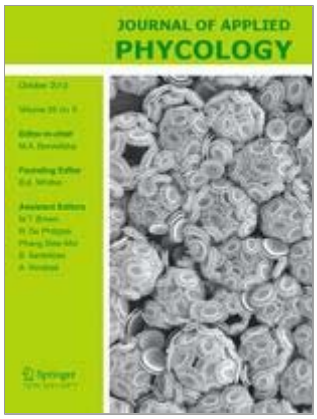
Development and comparison of stream indices of biotic integrity using diatoms vs. non-diatom algae vs. a combination

Abstract

Stream algal indices of biotic integrity (IBIs) are generally based entirely or largely on diatoms, because non-diatom ("soft") algae can be difficult to quantify and taxonomically challenging, thus calling into question their practicality and cost-effectiveness for use as bioindicators. Little has been published rigorously evaluating the strengths of diatom vs. soft algae-based indices, or how they compare to indices combining these assemblages. Using a set of ranked evaluation criteria, we compare indices of biotic integrity (IBIs) (developed for southern California streams) that incorporate different combinations of algal assemblages. We split a large dataset into independent "calibration" and "validation" subsets, then used the calibration subset to screen candidate metrics with respect to degree of responsiveness to anthropogenic stress, metric score distributions, and signal-to-noise ratio. The highest-performing metrics were combined into a total of 25 IBIs comprising either single-assemblage metrics (based on either diatoms or soft algae, including cyanobacteria) or combinations of metrics representing the two assemblages (for "hybrid IBIs"). Performance of all IBIs was assessed based on: responsiveness to anthropogenic stress (in terms of surrounding land uses and a composite water-chemistry gradient) using the validation data, and evaluated based on signal-to-noise ratio, metric redundancy, and degree of indifference to natural gradients. Hybrid IBIs performed best overall based on our evaluation. Single-assemblage IBIs ranked lower than hybrids vis-à-vis the abovementioned performance attributes, but may be considered appropriate for routine monitoring applications. Trade-offs inherent in the use of the different algal assemblages, and types of IBI, should be taken into consideration when designing an algae-based stream bioassessment program.



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