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Using alpha, beta, and zeta diversity in describing the health of stream-based benthic macroinvertebrate communities

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ABSTRACT

Ecological monitoring of streams has frequently focused on measures describing the taxonomic, and sometimes functional, α diversity of benthic macroinvertebrates (BMIs) within a single sampled community. However, as many ecological processes effectively link BMI stream communities there is a need to describe groups of communities using measures of regional diversity. Here we demonstrate a role for incorporating both a traditional pairwise measure of community turnover, β diversity, in assessing community health as well as ζ diversity, a more generalized framework for describing similarity between multiple communities. Using 4,395 samples of BMI stream communities in California, we constructed a model using measures of α , β , and ζ diversity, which accounted for 71.7% of among-watershed variation in the mean health of communities, as described by the California Streams Condition Index (CSCI). We also investigated the use of ζ diversity in assessing models of stochastic vs. niche assembly across communities of BMIs within watersheds, with the niche assembly model found to be the likelier of the two.

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