SCCWRP #0778

Nitrogen-fixing cyanobacteria (free-living and diatom endosymbionts): their use in southern California stream bioassessment

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ABSTRACT

A weight-of-evidence approach was used to examine how nutrient availability influences stream benthic algal community structure and to validate nutrient-response thresholds in assessing nutrient limitation. Data from 104 southern California streams spanning broad nutrient gradients revealed that relative abundance of N2-fixing heterocystous cyanobacteria (Nostoc, Calothrix), and diatoms (Epithemia,Rhopalodia)-containing cyanobacterial endosymbionts, decreased with increasing ambient inorganic N concentrations within the low end of the N gradient. Response thresholds for these N2 fixers were 0.075 mg l-1 NO3-N, 0.04 mg l-1 NH4-N, and an N:P ratio (by weight) of 15:1. The NO3-N threshold was independently validated by observing nitrogenase gene expression using real-time reverse transcriptase PCR. Morphometric analysis of cyanobacterial endosymbionts in Epithemia and Rhopalodia indicated that endosymbiont biovolume per diatom cell decreased with increasing NO3-N. Our findings indicate that abundance of heterocyst-containing cyanobacteria and endosymbiont-containing diatom cells are good indicators for rapid nutrient biomonitoring. Because heterocystous cyanobacteria and Epithemia/Rhopalodia were not always recorded together at N-limited sites, examining both assemblages jointly may provide a more comprehensive assessment of stream nutrient limitation
than using either assemblage alone.