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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 N_2-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 N_2 fixers were 0.075 mg L^{-1} NO_3-N, 0.04 mg L^{-1} NH_4-N, and an N:P ratio (by weight) of 15:1. The NO_3-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 NO_3-N (for levels <0.02 mg L^{-1}). 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.

Full Text

http://ftp.sccwrp.org/pub/download/DOCUMENTS/AnnualReports/2013AnnualReport/ar13_205_222.pdf