Algal Metric Approaches for Assessing Trophic Condition and Organic Enrichment in U.S. Streams and Rivers

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Biographical Sketches of Authors

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Abstract

Algal-community metrics (water-quality indicators) were calculated for periphyton samples collected from 976 streams and rivers sampled by the U.S. Geological Survey's National Water-Quality Assessment (NAWQA) Program during 1993-2001. Algal-metric scores were compared with nutrient concentrations from discrete samples collected on or near the same date of periphyton sampling and with modeled nutrient concentrations representing average conditions during various time periods prior to periphyton sampling. Algal-metric correlations with discrete and modeled nutrient concentrations were similar in most instances. Algal metrics with significant positive national and regional correlations with nitrogen and phosphorus concentrations include indicators of trophic status and indicators of tolerance to organic enrichment, low dissolved-oxygen concentrations, and moderate to high specific conductance. The relative abundance of algal taxa capable of fixing atmospheric nitrogen was negatively correlated with dissolved and total nitrogen concentrations, and generally was largest in streams draining undeveloped, forested basins. Algal indicators of eutrophic condition and tolerance were relatively higher in urban streams than those draining other developed basins, and non-linear, threshold responses were observed at very low percentages of urbanization. Algal-metric scores increased with stream size, possibly responding to cumulative nutrient enrichment from urban and agricultural activities. Nationally, algal indicators of eutrophic condition and tolerance were largest in streams draining the Mississippi River basin, coastal New England, and California, with relatively lower metric scores observed in the Pacific Northwest, Rocky Mountain, Ozark, and Appalachian regions. Algal biomass (biovolume) did not differ significantly among geographic regions or land-use classifications and was only weakly associated with nitrate concentrations. Although excessive amounts of algal biomass are an important consideration for establishing nutrient criteria, indicators of algal biomass (e.g. chlorophyll *a*) appear to be site specific and may be controlled by antecedent hydrologic disturbance, shading, and biological interactions more than by land-use practices or ambient nutrient concentrations