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Phytoplankton Assemblages, Environmental Influences and Their Seasonal Changes Measured Using Weighted Averages and Fuzzy Set Theory

The focus of this study is environmental influences on phytoplankton assemblages with respect to between-season changes. Canonical correspondence analysis (CCA) is used to ordinate Lake Huron phytoplankton abundances from June and August 1991 and environmental variables. Some taxa are found to be associated with one of two groups of environmental variables. June taxa are associated with NO_3 and chloride, while August taxa are associated with SiO_2 and temperature, and to some degree, with TSP and NH_3. Changes in assemblages are used to explore seasonal phytoplankton variation. To accomplish this, fuzzy set theory was used to measure the degree to which change in some taxa from June to August are indicated by changes in environmental influences. Species scores as weighted averages are used as n-dimensional vectors for each taxon and are translated into fuzzy membership functions. Additional CCAs are performed whereby each environmental variable group is partialled out. Each taxon vector is fuzzified from each CCA, and a fuzzy relation is devised where results from fuzzy operators (supremeum and minimum) used between the fuzzified original CCA species scores and partialled out fuzzy vectors show the degree of change between assemblages as a numerical value.