

Whole-lake experiments: The annual record of fossil pigments and zooplankton

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Abstract

The annual record of fossil pigments and zooplankton was compared with detailed contemporaneous records from two manipulated lakes from 1940 to 1986. Annually resolved sedimentary records accurately monitored known changes in plankton communities, identified periods of trophic change, and proved a powerful tool for examining long-term, complex interactions. Both Paul and Peter Lakes underwent the same three complete changes in their fish assemblages (trout, cyprinid, bass), and Peter Lake received repeated inputs of lime. Alterations in fish community composition produced long-lived changes in zooplankton communities that cascaded to the microbial level of the food web. Liming, in concert with trophic changes, caused distinctive phytoplankton dynamics in Peter Lake.

Paleolimnological data recorded all major plankton dynamics known from coeval limnological data. Specifically, the sediment record showed transitions in cladoceran size structure and species composition, changes in water clarity resulting from both food web and chemical manipulations that affected vertical zonation of primary producers, and changes in absolute abundance of all algal divisions except dinoflagellates. Undegraded Chl *a* indicated deep blooms and, in conjunction with Chl *c*, fucoxanthin and β -carotene, indicated metalimnetic chrysophytes. Transient (2-3 yr) non-selective increases in sedimentation corresponded with increases in grazing rates. Isorenieratene indicated overlap of photic and anoxic zones, revealing changes in transparency and conditions for pigment preservation.