

## DIATOM-INFERRED TOTAL PHOSPHORUS RECONSTRUCTIONS FOR LAKE MANAGEMENT: WHEN TO SAY WHEN IN INTERPRETING QUANTITATIVE PHOSPHORUS VALUES

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**High TP makes a lake gross and green,  
But how to restore a lake to a condition unseen?**

**Our best bet to manage  
Is to take good advantage**

**Of how diatoms changed in between.**

Modern water quality monitoring in the Lake Minnetonka Watershed District (MCWD) indicates current lake conditions vary widely, from mesotrophic to hypereutrophic, and 15 of 18 lakes and bays studied are currently in excess of suggested nutrient targets. To prioritize management efforts and to better understand the degree of impairment in individual lakes, modern and historical (pre-European) nutrient conditions were estimated for eighteen lakes using a combination of modern water quality monitoring and sediment core diatom analysis. A four sample “top-bottom” approach was used to most efficiently and cost-effectively characterize cores to achieve management goals. Sediment diatom assemblages and a statewide diatom calibration set for Minnesota were used to reconstruct historical water column total phosphorus concentrations and to compare recent diatom inferred total phosphorus values (DI-TP) to modern measured values.

Results from the 18 sites showed three main patterns of change in DI-TP from historical to modern samples: bays with direct connection to the main body of the Lake Minnetonka, the largest lake in the watershed, had mesotrophic water quality in historical and modern times, whereas upgradient bays and lakes tended to have eutrophic to hypereutrophic modern conditions and meso- to eutrophic historical water quality. Several lakes, however, showed decreases in DI-TP over time. Previous work with lakes in Minnesota has shown variability in the reliability of DI-TP reconstructions, particularly from shallow lakes. In several detailed reconstructions of lakes from ecoregions similar to the MCWD, trajectories of change down-core do not track TP gradients in modern calibration sets; DI-TP reconstructions from these lakes can therefore provide misleading information regarding the timing and degree of change in trophic status. The amount of variation in diatom assemblages explained by TP changes in shallow lakes (<5m) is also notably low in regional datasets. This makes it difficult to interpret the wide range of inferred changes across the study sites with confidence.

Here we discuss several means of evaluating the reliability of inferred TP values, including examining trajectories of change in core data, comparing historical lake diatom assemblages to modern analogues, and assessing the ability of modern diatom inferred measures to accurately predict modern measured values.

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