

## ORAL PRESENTATION

### PALEOLIMNOLOGY OF SHALLOW LAKES: LIMITATIONS OF DIATOM-BASED TRANSFER FUNCTIONS AND A MULTI-PROXY APPROACH

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Diatom-based paleolimnological techniques have been used throughout Minnesota and Wisconsin (northcentral USA) to quantitatively reconstruct historical environmental conditions, including total phosphorus (TP) concentrations. Diatom-based TP reconstructions have been used as one line of evidence for developing regional and lake-specific nutrient standards. Weighted averaging reconstructions have worked well to infer past TP concentrations in deep lakes; however, shallow lakes have posed problems with these traditional methods. We have used a 145-lake diatom based transfer function to explore why TP reconstructions are often unreliable in shallow lakes, and to identify the stressors (beyond nutrient inputs) that may be driving the changes in diatom communities in these systems.

To determine the ecological history of shallow lakes we have adopted a multi-proxy approach. Dated sediment cores from a subset of shallow lakes have been analyzed for diatom community composition (changes from benthic to planktonic assemblages, species turnover, and diversity measures), macrophyte abundance, biogenic silica, sediment phosphorus, and loss-on-ignition.

The results of a multi-proxy analysis of Horse Lake (northwest Wisconsin) demonstrate that there have been dramatic changes in the ecological state of this lake over the past two hundred years. However, the diatom TP reconstruction in this lake was problematic; modern measured TP was much higher than modern inferred TP. The sediment record indicates that prior to the early 1900s this was a macrophyte-dominated lake with less turbid water and lower diatom productivity. By the 1970s, most of the macrophytes had disappeared, the planktonic portion of the diatom community had increased, and diatom productivity was increasing and has continued to increase into modern times.

Extending paleolimnological techniques to include multi-proxy approaches in addition to diatom-based TP reconstructions will give lake managers a more complete picture of how the ecological conditions of shallow lakes have changed in conjunction with major-land use stressors, and will define appropriate ecological endpoints for lake restoration.