A local diatom-total phosphorus model for shallow, humus-rich and eutrophic boreal lakes: Calibration data from the Iisalmi region, eastern Finland

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The Water Framework Directive of the European Parliament commits the member states to achieve good quality status of all water bodies by 2015. One major cause for water quality problems is eutrophication. Nutrient-rich areas lack back-ground water quality observations due to the long settlement history often typical for these areas. Diatom-total phosphorus (TP) transformation functions are widely used for inferring past lake water TP concentrations. However, shallow lakes are considered problematic for this type of modeling, because of their more complex relationship with the environmental factors than in deeper lakes. For example, non- planktonic taxa, such as small Fragilaria, are often abundant in shallow lakes and might test a clear correlation with the available phosphorus. High humus and nutrient concentrations may also cause challenges.

The diatom-TP transformation function was constructed with weighted averaging partial least squares (WA-PLS) regression and using leave-out-out cross-validation. TP was selected based on the canonical correspondence analysis (CCA) results that showed the signals of the environmental variables on the diatom data. The environmental data was log-transformed to reduce skewness. Both non-transformed and sqrt-transformed species data were used for modeling. The final transfer function included 50 samples (one calibration set sample was excluded) and 110 diatom species (from the identified 50). It covers a TP gradient 7 µglm-1 - 121 µglm-1. The resulting models were tested with 27 stratigraphic samples, analyzed by Virtanen (2007), from one of the calibration set lakes (Lake Kirmanjärvi). The test set samples were tested with goodness-of-fit and modern analog methods.

The sampling sites in the Iisalmi region, eastern Finland.

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Contemporary water chemistry data forms a calibration data set that can be used to create a transfer function. Transfer functions can be used for reconstructing past water quality conditions based on the total diatom data.

The distributions of total phosphorus (TP), color and average lake depth values in the sample set that can be used to create a transfer function. Residuals indicate that a majority of the lakes are eutrophic, humus-rich and shallow.

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