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Title

Documenting the History of Oxygen Depletion in Lake St. Croix, Minnesota, Using Chironomidae Remains in the Sedimentary Record

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Abstract

Lake St. Croix is a natural impoundment located at the southern end of the St. Croix River. Land use changes since European settlement (c. 1850) have resulted in nutrient runoff, eutrophication, and periodic oxygen depletion in the hypolimnion of Lake St. Croix. Establishing sound lake management practices requires knowledge of historical conditions obtained through paleoecological studies. Remains of non-biting midges (Insecta: Diptera Chironomidae) in lake sediments have been shown to be reliable indicators of past hypolimnetic oxygen conditions. Cores from two sub-basins in the lake were collected in 2006. Midge analysis indicated that shifts in species assemblages correspond to the times of land use change. *Chironomus* and *Procladius*, which are tolerant of low oxygen levels, increased in relative abundance as land use changes adversely impacted the St. Croix River's watershed. Volume-weighted hypolimnetic oxygen concentrations were estimated using a transfer function developed for southern Ontario. Mean post-settlement chironomid reconstructed average volume-weighted hypolimnetic oxygen values were 0.73 mg/L lower than mean pre-settlement values for sub-basin 1, near Prescott, WI and 0.45 mg/L lower for sub-basin 3, near Lakeland, MN. These results indicate that oxygen depletion has occurred in the lake since the time of European settlement, and are supported by increases in the relative abundance of eutrophic midge bioindicators and the decrease in relative abundance of bioindicators of less productive conditions since the 1850s. This study, in conjunction with other historical and paleoecological studies of Lake St. Croix, provides historical data for setting management goals and strategies for Lake St. Croix.

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