Mercury in Ike Walton Zee Lakes, Lac du Flambeau Indian Reservation, Northcentral Wisconsin

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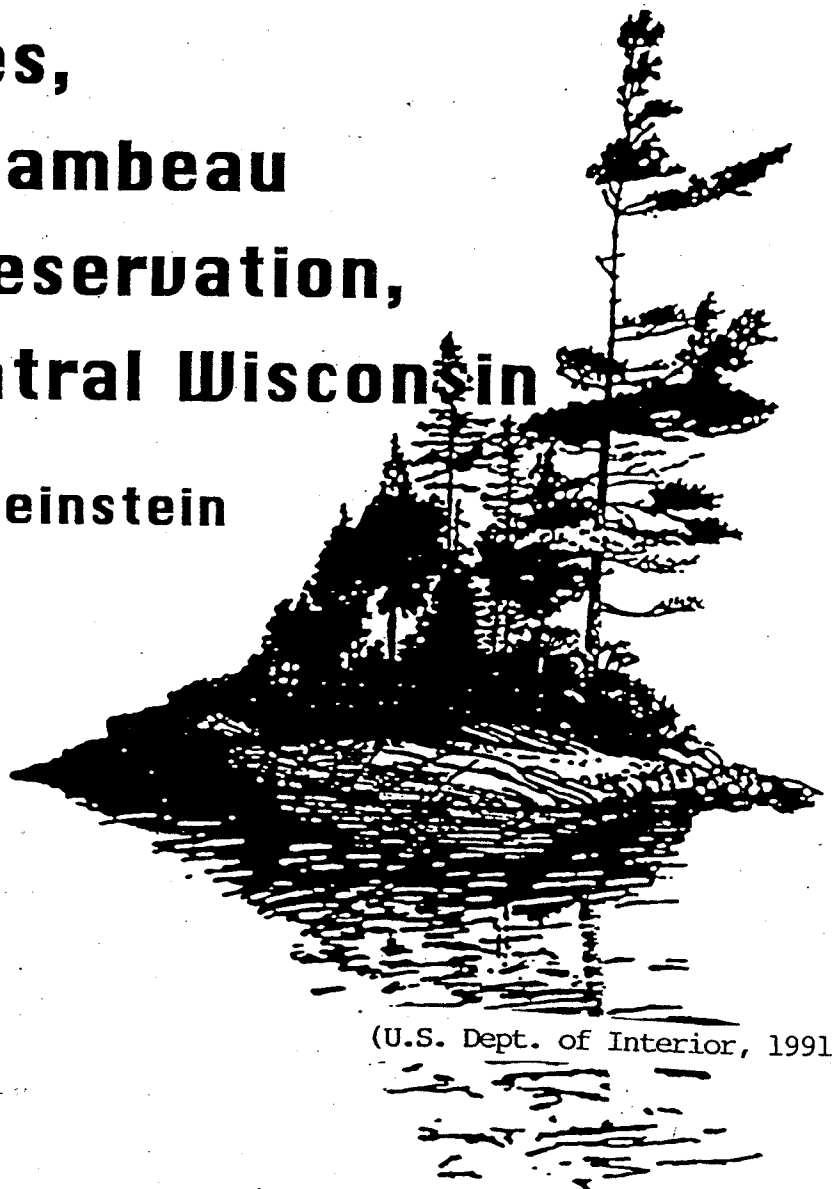

(U.S. Dept. of Interior, 1991, p.29)

Submitted in partial fulfillment of the requirements for the Degree of Bachelor of Science from the Center for Environmental Sciences at Brown University

December 1994

Abstract

In 1992, based on fish mercury concentration data from 1991 and 1992, the Water Resource Program of the Lac du Flambeau Department of Natural Resources, Lac du Flambeau Indian Reservation, northcentral Wisconsin, issued fish mercury advisories for Ike Walton Lake. *Stizostedion vitreum* (walleye fish) over 12" exceeded 1 ppm Hg wet weight and were thus, according to the Wisconsin health standard, unsafe for human consumption. These mercury levels, which were higher than any of the concentrations from the 11 other lakes studied, concerned the Lac du Flambeau Water Resource Program and Tribal Council, and provided the impetus for a paleolimnological (sediment core) study of Ike Walton and Zee Lakes. The tribe had two objectives for the sediment study: to determine if there has been a post European settlement increase in mercury deposition, as inferred from sediment mercury concentrations, and to determine if there has been a post European settlement decrease in lake pH, as inferred from diatom assemblages. Zee Lake was included as a comparison to Ike Walton Lake. Zee lake is believed to be a naturally acidic bog lake, whereas Ike Walton Lake is believed to be an anthropogenically acidified lake.

In 1994 the Tribe hired Dr. Marjorie Winkler, senior scientist at the Center for Climatic Research at the University of Wisconsin at Madison, to carry out the study. Over the summer of 1994 I worked in her lab on the sediment core study of Ike Walton and Zee Lakes. Livingstone piston cores and three frozen finger cores were taken from Ike Walton Lake, and one frozen finger core was taken from Zee Lake. All cores were analyzed for percent low and high loss on ignition (measurements of percent organic and percent carbonate, respectively); the top 150 cm of the Livingstone piston cores from Ike Walton Lake and the frozen finger core from Zee Lake were analyzed for elements (including several heavy metals); Ike Walton Lake's frozen finger cores 1 and 3 and Zee Lake's frozen finger core were analyzed for pollen; and all the frozen finger cores from Ike Walton and Zee Lakes were analyzed for mercury.

European settlement, 1900+/-10, determined from an increase in percent *Ambrosia* pollen, occurs at 61.2+/-19.4 cm in Ike Walton Lake frozen finger core 1, at 23+/-2 cm in the Zee Lake frozen finger core and was indeterminable for Ike Walton Lake frozen finger core 3. Lead (Pb), arsenic (As) and selenium (Se) all peaked at 20 cm in the Zee Lake frozen finger core. These metals are associated with industrialization and offer further support for the settlement time established by pollen analysis. Selenium and arsenic in the Livingstone piston cores from Ike Walton Lake remain constant for the 150 cm. Pb, however, peaks near settlement time at 50 cm.

Percent low loss on ignition increases with decreasing depth in Ike Walton Lake's Livingstone piston cores and frozen finger core 2, and in Zee Lake's frozen finger core. Percent low loss on ignition decreases with decreasing depth in Ike Walton Lake's frozen finger cores 1 and 3. Percent high loss on ignition remains low and near constant in all frozen finger cores. In the Livingstone piston cores from Ike Walton Lake, percent high loss on ignition varies with depth.

Wet weight mercury concentration increases with decreasing depth in Ike Walton Lake frozen finger core 1. For all other frozen finger cores, wet weight mercury values decrease with decreasing depth. Dry weight mercury concentrations increase with decreasing depth for all cores. However, given the amount of uncertainty I was only able to detect a difference in Ike Walton Lake frozen finger cores 1 and 2.

Organic content, as inferred from percent low loss on ignition, probably does not correlate with mercury concentration in Ike Walton Lake frozen finger core 1. This correlation was not determined for the other cores due to unreliability of percent low loss on ignition data.

Ike Walton Lake *S. vitreum* between 12" and 22", when compared to *S. vitreum* from other Wisconsin Lakes on the fish mercury advisory, have uncharacteristically high mercury concentrations. Ike Walton's low pH (5.6), low alkalinity (4.53 ueq $CaCO_3$/l) and ability to warm up in the summer months are probably contributing to the high mercury levels. The probable

increases in sediment mercury concentrations indicate that current *S. vitreum* mercury concentrations may be higher than they were in pre-European settlement times.

Possible risks and damages from Ike Walton Lake's *S. vitreum* mercury concentrations include health, ecological, economic and social/cultural risks and damages. Based on adult blood mercury levels, the risk of health effects from mercury are probably quite small. The risk to fetuses is probably slightly higher, and along with the risk to children, is an area which could merit from greater attention. No data on ecological damage on the Lac du Flambeau Reservation exists, but *S. vitreum* mercury levels indicate that loons may be experiencing adverse effects. Social/cultural risks include the restriction of spearfishing on, and management options for Ike Walton Lake.

Future options for decreasing the risks and damages associated with the mercury levels in Ike Walton Lake are limited. I do not believe there is an option which would effectively address all risks in the short term. A long term option to reduce all risks/damages is working towards reducing atmospheric mercury emissions. A short term solution to the health risks is continuing to limit access to Ike Walton Lake.