Heavy Metal Contamination of Bottom Sediments from Mining Operations at Cooks Pond, Madison, New Hampshire

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Heavy metals (Pb, Zn) from operations associated with the former Madison Lead Mine have contaminated sediments in Cooks Pond (14.3 ha) and potentially caused bioaccumulation of lead (Pb) in piscivorous fish. The mine opened in 1826 and closed in 1923, with the most intensive mining occurring from 1901 to 1923. Lead, Ag and Zn were extracted from galena and sphalerite associated with a highly fractured hydrothermal deposit of Jurassic age. Tailings (0.6 ha) from an ore processing facility on the pond shore entered the water and contaminated pond bottom sediments.

Six cores were collected from Cooks Pond using a Uwitec gravity corer with secondary hammer action. Sample sites were determined based on distance from the tailings fan and pond bathymetry. Cores (90mm diameter) were collected in water depths ranging from 4.5m to 7.5m and were 60-100cm in length. Two cores were split and scanned using an ITRAX core scanner for total chemistry. Sediment from a subset of the cores was sampled from the core barrel at 1cm intervals. Metals were extracted from these samples, as well as fish samples collected by seine net and hand line, using EPA method 3050A and analyzed by Inductively Coupled Plasma (ICP-OES).

Samples show a sharp increase in Zn and Pb within a high density layer in the top third of the cores reaching concentrations as high as: 12,000 ppm Zn and 7,600 ppm Pb. Metal concentrations also decrease with distance away from the processing plant. Washing of mine tailings into the pond explains the increase in Zn and Pb in the sediment and the added high density mineral matter to the normally low density organic rich sediment. This material flooded the ecosystem with heavy metals and could model happenings at other lead-zinc mines in New England.

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