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Water Level Management and Contaminant Exposure in Tree Swallows Nesting on the Upper Mississippi River

by Thomas Custer and Christine Custer

The U.S. Army Corps of Engineers conducted a water level drawdown on Navigation Pool 8 of the Upper Mississippi River (fig. 1) in summers 2001 and 2002 to increase aquatic vegetation production and, thereby, improve fish and wildlife habitat.

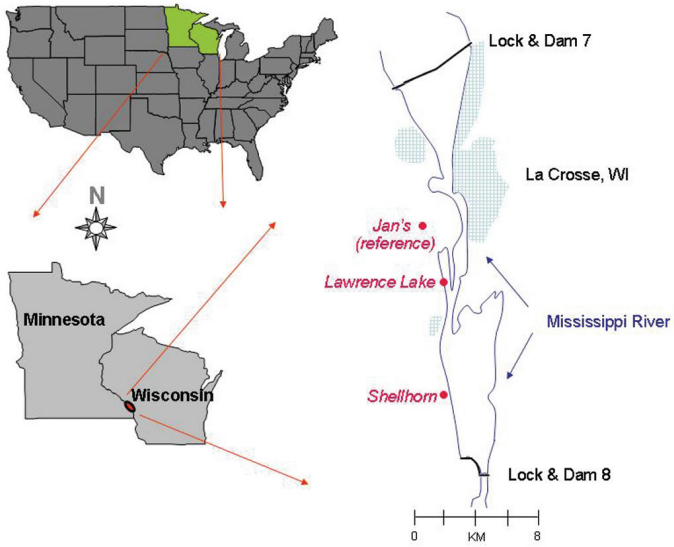

Figure 1. Tree swallow study sites (*red dots*) in 2000, 2001, and 2002. Lawrence Lake and Shellhorn were on Pool 8 of the Mississippi River. Jans was a nearby reference area.

Flooding of previously dried out wetlands, such as a year following a drawdown, may increase the rate of mercury methylation and in turn make mercury more available to terrestrial vertebrates that feed in aquatic environments.

Tree swallows (*Tachycineta bicolor*) are a useful species for contaminant assessment of sediments. They feed on emergent aquatic insects and, therefore, their eggs and tissues reflect sediment contamination. Because tree swallows feed close to their nest boxes, contaminant concentrations in eggs and nestlings are indicative of local contamination.

A study was initiated in 2000 to determine if tree swallow exposure to mercury and other contaminants increased after the 2001 Pool 8 water level drawdown. If true, then we would predict the mercury concentrations in tree swallows would be higher in 2002 than 2000 or 2001.

Methods

Figure 2. Tree swallow on nest box.

Bird nest boxes (fig. 2), suitable for tree swallows, were erected at two sites in Pool 8 of the Mississippi River (Lawrence Lake and Shellhorn) and at an in-basin reference location (Jans) in 2000, 2001, and 2002 (fig. 1). In all 3 years, samples of tree swallow eggs (fig. 3) and nestlings were collected and analyzed for mercury and other contaminants. The egg and nestling collections in 2001 were done before the 2001 drawdown.

Figure 3. Tree swallow nest with eggs.

Findings

Mercury concentrations in tree swallow eggs averaged below 0.35 ppm dry weight and did not significantly increase after the Pool 8 drawdown (fig. 4). We have no explanation for the higher levels of mercury in swallow eggs at Lawrence Lake in 2001 compared to 2000. However, this difference does not suggest an increase following the drawdown because mercury concentrations in 2002 were similar to 2000 and 2001.

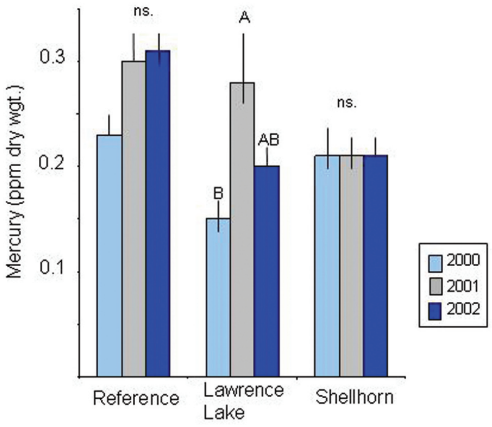

Figure 4. Mercury concentrations in tree swallow eggs did not differ (ns.) among years for the reference location and Shellhorn. Mercury concentrations were greater in 2001 than 2000 at Lawrence Lake (A versus B).

Mercury concentrations in eggs (means 0.15 to 0.31 ppm dry weight) were intermediate to levels reported in tree swallows from other North American locations and were not at toxic levels. Impairment of reproductive success in birds has been associated with egg concentrations of 2.5 to 10 ppm dry weight mercury.

Mercury concentrations in tree swallow nestlings averaged <0.25 ppm dry weight and were not significantly different after the Pool 8 drawdown (fig. 5).

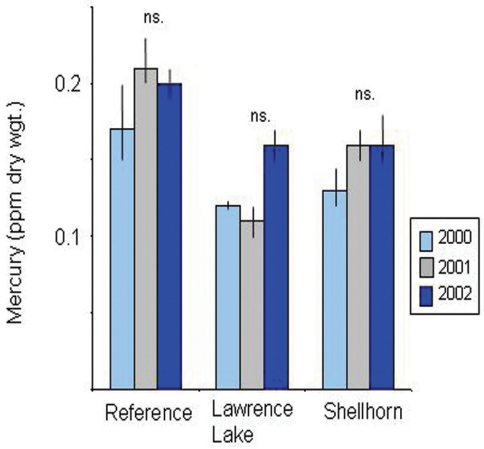

Figure 5. Mercury concentrations in tree swallow nestlings did not differ (ns.) among years.

Other trace elements, polychlorinated biphenyls, and organochlorine insecticides did not increase following the 2001 drawdown and were not elevated compared to similar samples collected from other North American locations (fig. 6). Physiological and genetic bioindicators did not change after the drawdown. Hatching success of eggs also did not differ among years or locations and was comparable to a nationwide average.

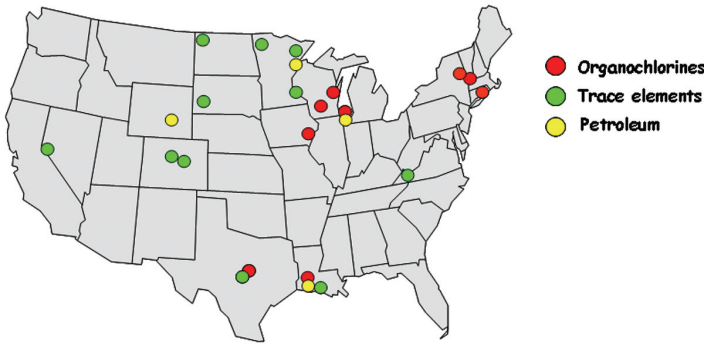

Figure 6. Location of tree swallow study sites by Upper Midwest Environmental Sciences Center scientists.

Acknowledgments

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