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CONTAMINANTS AND TREE SWALLOWS IN THE FOX RIVER DRAINAGE, GREEN BAY, WISCONSIN

Tree swallows (*Tachycineta bicolor*) are secondary-cavity nesting birds with several behavioral characteristics that permit their use in assessing and monitoring aquatic contamination. Tree swallows readily nest in nest boxes, are tolerant of handling, and usually feed within 500 m of their nests. They feed primarily on emergent aquatic insects that assimilate certain sediment-associated contaminants and can therefore be used to assess the bioavailability of sediment-associated contaminants in localized areas.

CONCENTRATIONS AND ACCUMULATION RATES ARE USED TO ASSESS CONTAMINATION

Eggs and sibling 12-day-old nestlings were collected in 1994 from four colonies near Green Bay, Wisconsin, to quantify organochlorine concentrations ($\mu\text{g/g}$ wet weight) and accumulation rates ($[\mu\text{g in nestling} - \mu\text{g in egg}] \div \text{nestling age in days}$). Two of the colonies, Kidney Island and Arrowhead Park, were located at the mouth of and along the Fox River, a drainage contaminated by polychlorinated biphenyls (PCBs). Two other colonies, Lake Poygan and High Cliff State Park, were located on nearby lakes and were our reference colonies. Five paired samples (egg and sibling 12-day-old nestling) of tree swallows were collected from each site except for High Cliff State Park, where we collected only two paired samples because of the small number of birds nesting there. One- and two-way analysis of variance (ANOVA) tests were used to test for differences among colonies, timing of nesting, and age (eggs or nestlings). Data were log transformed to meet the equal variance assumption of ANOVA. Geometric means are presented in text and figures.

TREE SWALLOWS ACCUMULATED POLYCHLORINATED BIPHENYLS (PCBs)

Tree swallows accumulated PCBs at the rate of $6.3 \mu\text{g/day}$ on Kidney Island and $1.3 \mu\text{g/day}$ in Arrowhead Park. These accumulation rates differed from one another and both were higher (one-way ANOVA, $F = 52.50$; $df = 2,14$; $P < 0.0001$) than the accumulation rate at the reference sites ($0.2 \mu\text{g/day}$, Fig. 1).

PCB CONCENTRATIONS WERE ELEVATED AT CONTAMINATED SITES

Concentrations of PCBs were higher in tree swallow eggs from Kidney Island and Arrowhead Park than in eggs from the reference colonies. Concentrations of PCBs in 12-day-old nestlings declined significantly in Arrowhead Park and in the reference colonies, but concentrations in nestlings did not decline on Kidney Island (two-way ANOVA, $F = 63.02$; $df = 5,58$; $P < 0.0001$, Fig. 2). These data are consistent with the higher accumulation rates on Kidney Island than in Arrowhead Park and the reference sites. Concentrations of PCBs in nestlings in Arrowhead Park and the reference sites declined because contaminant concentration was diluted by the addition of body tissue as the young were rapidly growing. On Kidney Island, however, the input of contaminants was higher ($6.3 \mu\text{g/day}$), therefore the concentrations were not diluted by the additional body tissue. Nestling weights were the same at all colonies (one-way ANOVA, $F = 0.29$; $df = 2,14$; $P = 0.753$), therefore nestling weight was not a factor affecting concentration.

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PCB LEVELS WERE HIGHER IN THE EGGS FROM LATE-NESTING PAIRS

Concentrations of PCBs were higher ($5.05 \pm 1.16 \mu\text{g/g}$) in the eggs of late-nesting tree swallows (nests initiated after 1 June) on Kidney Island and in Arrowhead Park than in the eggs of early-nesting pairs ($3.16 \pm 1.07 \mu\text{g/g}$; $F = 4.99$; $df = 3,56$; $P = 0.004$). The colony and interaction terms were not significant in this two-way ANOVA. These data are also consistent with the accumulation rate data; PCBs were present and therefore accumulated by adult tree swallows on Kidney Island and in Arrowhead Park. We have no residue data from late-nesting pairs from the reference sites.

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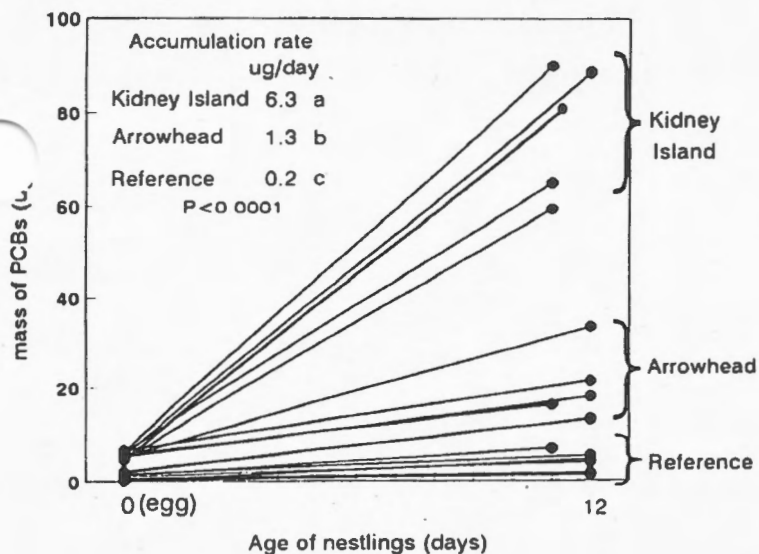


Fig. 1. Mass of PCBs in eggs and 12-day-old nestling tree swallows (*Tachycineta bicolor*) in the Green Bay, Wisconsin, area in 1994. Mean accumulation rates sharing the same letter are not significantly different.

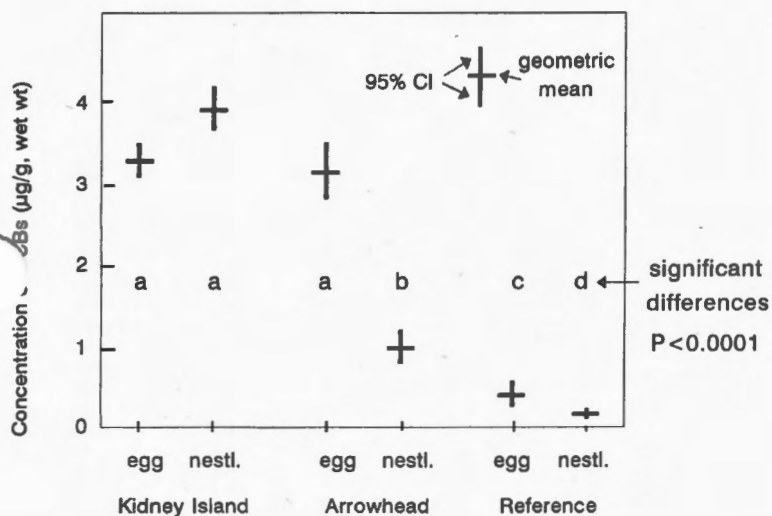


Fig. 2. Concentrations of PCBs in eggs and 12-day-old nestling tree swallows (*Tachycineta bicolor*) in the Green Bay, Wisconsin, area in 1994. Means sharing the same letter are not significantly different.