NATIONAL BIOLOGICAL SERVICE
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## Polychlorinated Biphenyls Accumulate in Sentinel Mallards at the Winston-Thomas Treatment Plant

The Winston-Thomas sewage treatment plant, Bloomington, Indiana, was operated by the city of Bloomington for nearly 50 years until its closure in 1982. From 1958 to 1977, the Westinghouse Electric Corporation of Bloomington disposed of off-specification electrical capacitors containing polychlorinated biphenyls (PCBs) in local landfills and limestone quarries. In 1975, Westinghouse advised the city that it had been discharging PCBs into the city sewer system. The treatment plant facilities include an inactive 7-ha tertiary treatment lagoon that is used by migratory waterfowl in fall and spring. The survival and reproduction of waterfowl may be adversely affected if the birds accumulate certain organochlorine (OC) contaminants during their stay. Moreover, waterfowl that reside at this site could pose a health risk to raptors, scavengers, and humans who may consume them.

### Sentinel Waterfowl Were Used to Assess the Bioavailability of Organochlorine Contaminants

Our objective was to assess the bioavailability and toxicity of OC contaminants in the Winston-Thomas lagoon from sentinel waterfowl, a technique that has recently been used to monitor chemical contamination at several wetland locations. Seventy-two 12-month-old female pinioned mallards (*Anas platyrhynchos*) were marked with uniquely numbered nasal saddles and released on the Winston-Thomas lagoon. A fence prevented the mallards from escaping the lagoon. Five birds were sacrificed on 14 July 1992 (day 0) as controls. Using a shotgun (steel shot), we collected five of our marked birds approximately every 10 days from day 10 to day 100.

### Concentrations of PCBs in Sentinel Mallards Are High

Concentrations of PCBs in carcasses increased linearly with time of exposure and exceeded 16 $\mu g\ g^{-1}$ wet weight by day 100 (Fig. 1); PCBs in breast muscle exceeded 3.9 $\mu g\ g^{-1}$ by day 100. These PCB values are among the highest recorded for wild or sentinel waterfowl. PCB concentrations in breast muscle (26–523 $\mu g\ g^{-1}$ lipid weight) were 50–1,000 times greater than guidelines for human consumption of edible poultry in Canada (0.5 $\mu g\ g^{-1}$ lipid weight) and 9–176 times greater than guidelines for consumption of edible poultry in the United States (3.0 $\mu g\ g^{-1}$ lipid weight). Additionally, PCB concentrations in carcass and breast muscle exceeded the threshold of the *do not eat* category (1.9 $\mu g\ g^{-1}$ wet weight) of the Great Lakes Sport Fish Consumption Advisory by day 20 and day 50, respectively. The PCBs accumulated by sentinel mallards in this study could have had an adverse effect on reproduction. PCB concentrations similar to those we observed have been linked to embryo mortality and chick deformities in several bird species.

### Hepatic Enzymes in Exposed Mallards Were Induced and Correlated to PCBs

Hepatic cytochrome P450-associated monooxygenases, including BROD (benzloxyresorufin-O-dealkylase), EROD (ethoxyresorufin-O-dealkylase), and PROD (pentoxyresorufin-O-dealkylase) were each significantly correlated to total PCBs (Fig. 2). Other studies with adult birds have generally not demonstrated a relation between induction of cytochrome P450-associated enzymes and

chemical exposure. We suspect that adult birds generally do not attain the exceptionally high PCB body burdens necessary to induce hepatic cytochrome P450-associated monooxygenase activity that we found in our study.

Our results with sentinel mallards suggest that even a limited exposure of migratory waterfowl to the Winston-Thomas lagoon may allow waterfowl to bioaccumulate certain OC residues that would make them unfit for human consumption and could adversely affect their survival and ability to reproduce successfully.

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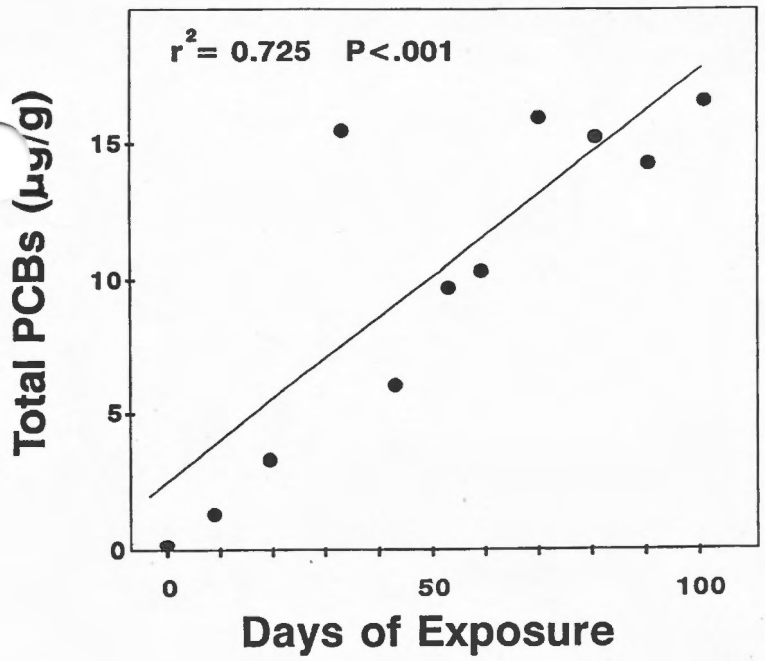


**Fig. 1.** Total PCB concentrations in carcasses of sentinel mallards (*Anas platyrhynchos*) exposed to the Winston-Thomas lagoon, Bloomington, Indiana, July–October 1992.

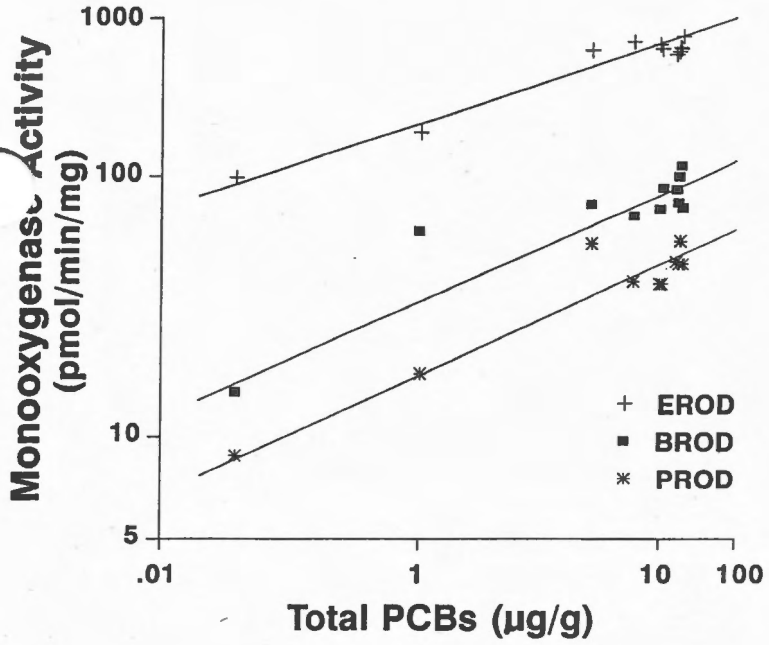


**Fig. 2.** Activity (pmol/min/mg liver) of EROD (+), BROD (■) and PROD (*) in hepatic microsomes of sentinel mallards (*Anas platyrhynchos*) in relation to the total PCB concentration (µg $g^{-1}$ wet weight) of their carcasses.