

An examination of bald eagles PCB exposure on the Kalamazoo River, MI based on site-specific and regional-specific exposure profiles.

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Abstract

Bald eagles residing along the Kalamazoo River are exposed to PCBs from multiple sources. These include, PCBs originating from known upstream point sources, PCBs contained within prey items which move upstream from Lake Michigan such as anadromous Great Lakes fish, and "background" PCB exposure largely attributed to atmospheric deposition. Here we present the results of a four year study designed to assess the relative contributions of each of these sources by sampling bald eagle tissues and prey items from the Kalamazoo River as well as proximal breeding areas in lower Michigan. Nestling plasma and egg tissue samples were collected and analyzed on a congener-specific basis from three breeding areas with distinct exposure pathways: 1) the Kalamazoo River Area of Concern (KRAOC) with multiple PCB exposure sources, 2) the Pere Marquette and Manistee Rivers which have no upstream point sources but which do allow access to anadromous Lake Michigan fish, 3) breeding areas on interior Michigan waterways which have neither a point source nor access to anadromous Great Lakes fish but are susceptible to atmospheric deposition. Bald eagle nestling plasma from the Kalamazoo River basin contained 773 ug/kg (ww) total PCBs. For the Pere Marquette and Manistee Rivers concentrations of PCBs in nestling plasma ranged between 144-291 ug/kg (ww) (n=6). Michigan interior nests had concentrations of PCBs in nestling plasma which ranged between 1.6-119 ug/kg (ww) (n=13). PCB concentrations were significantly different among the three types of exposure areas with no overlap in data points.

Introduction

Polychlorinated biphenyls (PCBs) are a group of ubiquitous environmental contaminants that have been implicated in adverse effects observed in bald eagle (*Haliaeetus leucocephalus*) populations (Bowerman et al., 1990, Wiemeyer et al., 1984). These compounds tend to bioaccumulate in living tissues because they are lipophilic and recalcitrant in nature. Remedial activities designed to reduce exposures to receptors such as the bald eagle can only be effective if there is a clear understanding of both the origins and pathways of exposure. Here we present data from a four year study examining the regional specificity of bald eagle PCB exposure. These data were then used to gain a better understanding of exposures for bald eagles residing within the Kalamazoo River basin.

Methods

Tissue Collections

- Bald Eagle Tissues
 - Nestling plasma and addled eggs were collected at banding (6-8 weeks)
- Fish Samples
 - Whole fish were collected by electrofishing.



Methods (Continued)

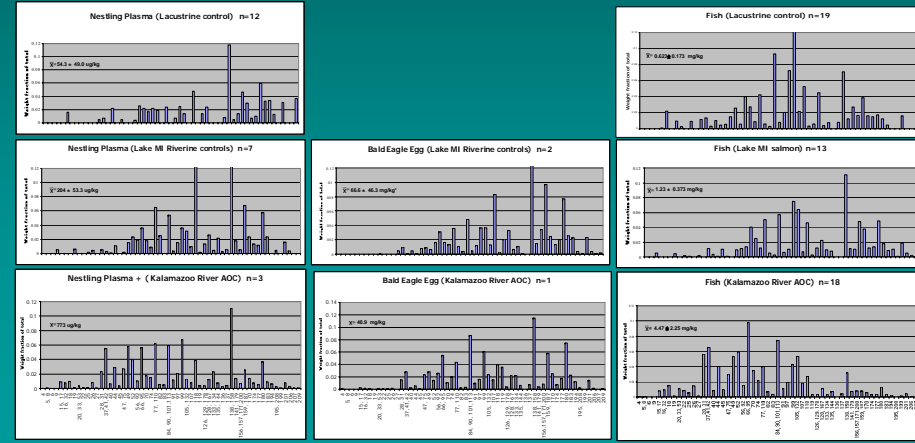
Sampling Locations and Expected Exposure Regime

- Kalamazoo River Area of Concern**
 - Swan Creek, Ottawa Marsh
 - Potential PCB exposure via resident KRAOC fish (point source + atmospheric deposition) and anadromous Great Lakes fish
- Coastal Lake Michigan Riverine Controls**
 - Manistee, Pere Marquette, Muskegon Rivers
 - PCB Exposure via resident fish (atmospheric deposition only) and anadromous Great Lakes fish
- North Central Lacustrine Controls**
 - Backus Flooding, Cranberry lake, little Manistee
 - PCB Exposure via resident fish (atmospheric deposition only)

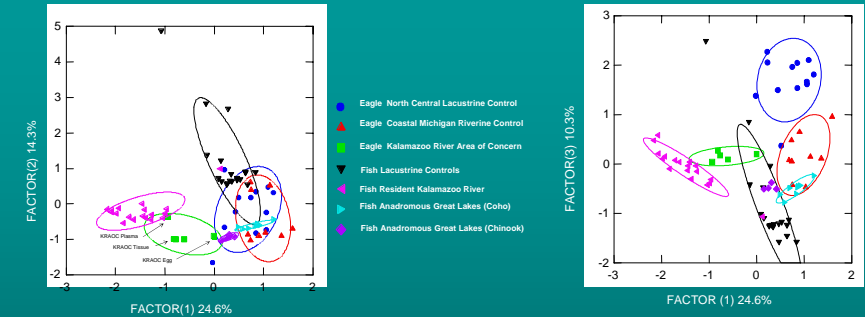


Results

Congener Profiles



Principle Component Analysis



Conclusions

- PCB congener concentrations and profiles varied by region and matrix.
- However, each region demonstrated a distinct congener profile.
- PCB congener profiles were similar for bald eagle plasma and eggs within individual regions.
- Mean total PCB concentrations were significantly different for plasma and fish between the three regions.
- PCB congener profiles for Kalamazoo bald eagle eagles tissues lie between those of resident KRAOC fish and Great lakes fish.
- Congener profiles support the hypothesis that KRAOC bald eagles have multiple exposure sources including point sources, atmospheric deposition and anadromous fish.
- Factor 1 variance explained by lesser chlorinated congeners IUPAC # 52, 49, 22, 138+158, 44,37+41+42, and 44.

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Congener-Specific PCB Analysis

Samples were Soxhlet extracted, concentrated, and then purified by passage through an acidic silica column. PCBs were quantified using a gas chromatograph-electron capture detector. A standard containing 98 individual PCB congeners was used to resolve peaks.

Congener Profile

Individual PCB congener concentration was divided by the sample total to determine relative congener contribution (expressed as a percentage). A mean was then calculated for each tissue type from each region.

PCA analysis

PCA analysis was performed for all samples by matrix and region to discern similarities in PCB congener profiles.