



# Assessing Risks to Resident Great Horned Owls in the Kalamazoo River Floodplain: The Exposure Assessment

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## ABSTRACT

The Baseline Ecological Risk Assessment (BERA) for the Kalamazoo River site identifies resident great horned owl populations as one of the environmental receptor species with the greatest potential risk from terrestrial-based dietary exposure to PCBs. To verify modeled exposures to resident great horned owl populations at the site, site-specific exposures to PCB-containing vehicles/trucks were measured for nesting pairs of owls. Worst-case exposures to floodplain owls were successfully obtained by deploying over 12 artificial nesting platforms in a 70 mile reach of the Kalamazoo River floodplain, including two discrete exposed sites and two discrete background locations. By employing a comprehensive array of habitat assessment, population survey and site observation techniques to select nest locations, MSU biologists achieved occupation rates of 23% and 12% for the 2001 and 2002 field seasons. Rigorous nest observation activities provided for the collection of 13 egg samples and 12 blood samples from active nest pairs, including multiple instances of re-nesting that provided tissue-based chemical exposure measurements from both fresh eggs and nestling plasma for the same breeding pair of birds. Nest site investigations also successfully located adult feeding perches (perch trees associated with each active nest). Collection and forensic analysis of over 30 owl pellet and prey remains samples (n=230 discrete prey items) from active nests and feeding perches provide for accurate, site-specific characterizations of owl feeding habits and diet composition. Site-specific dietary composition (80 and 89% mammals, 11 and 17% birds) varied from the proportions utilized to generate Baseline BERA models. Dietary links to the aquatic system are identified (especially along with a varied piscivore component). Three fishery perches the basis for field collection and chemical analysis of prey species in owl droppings and an estimate of potential average daily dose through ingestion of contaminated prey. The accuracy of modeled dietary exposures are examined through comparisons to measured PCB concentrations in owl tissues and evaluated for potential risks to owl populations.

## ISSUES and CONCERNS

- Great Horned Owl identified as a receptor of concern for terrestrial food chain
- Modeled exposure to Kalamazoo River Floodplain Birds: NSM&L HQ = 0.1 (MSHQ, 1995)
- Great Horned Owl identified as receptor of concern in deriving Proposed Remedial Action Goals for Floodplain soils, (MSHQ, 2000)
- Modeled exposure profiles concentrate exclusively on terrestrial exposure pathways.
- Discrepancy between modeled exposures and site-specific tissue concentrations.

## OBJECTIVES

Provide a Refinement (Dietary based) exposure assessment for Great Horned Owls, feeding within the Kalamazoo River Floodplain.

- Estimate up
- Characterize site specific dietary composition
- Collect and document PCB content of identified prey items
- Model daily dietary exposure to PCBs in site soils and sediments
- Compare modeled dietary exposure concentrations to measured concentrations in owl tissues collected from the site.

## MATERIALS and METHODS

### Owl Sampling

#### 1) Establish Active Floodplain Nesting Territories using Artificial Nesting Platforms:

- Nest Construction
  - Placed down drift by (1)stream
  - Was south-facing (to receive natural camouflage)
  - Wood break (1/2 inch or greater) intermediate
  - Nesting being with wood chip base
  - Change holes for moisture control
  - Experimental design
  - Wander lanes
  - Nesting being with wood chip base
  - Change holes for moisture control

#### 2) Nesting Platform Placement

- Territory Selection
  - Characterization
  - Call-response surveys
  - Visual Confirmation
    - Nest sightings
    - feeding perch/pellet observations
  - Unoccupied Territories
    - Visual Assessment
    - Nest Tree Survey

#### 2b) Habitat Assessment/Nest Tree Survey

- Tree Selection Criteria/ Nest Placement
  - Large Diameter to Mature Timber
  - Platform Height > 23 feet
  - Aluminum Flashing "Protractor Guards" in Drive position
- Habitat Assessment
  - Nest Tree Evaluated From Frequent Human Disturbance
  - Nest Tree In Close Proximity to Nesting Feeding Habitat
  - uncontaminated (heavy crown) depletion
  - feeding perches
  - productive floodplain feeding habitat (wooded canopy, wet meadows, marsh)

#### 3) Tissue Collections

- Fresh Eggs
- Added eggs

## MATERIALS and METHODS (Cont.)



**Prey Item Collections - Zones 1 & 2**  
 1) June 2000 - August 2002  
 2) Spatial Coverage  
 Zone 1 - Ft. Custer      2) Sampling Area  
 Zone 2 - Trenchbridge      2) Sampling Area  
 3) Prey Items  
 Small Mammals - Shermans Live Trap/Pitfall Trap  
 Muskrat - Keweenaw Trapping, Condoor body-trapper traps  
 Fur-bearing Birds - 12 Day Pin-Beige nestling nest-box sampling



### Owl Collections

The diet characterization component of the study is coupled with productivity monitoring, as each pellet and prey remains collection begins when nestlings are five to eight weeks of age. This is the age at which nestlings are blind (the blood plasma samples) and banded, and the first instance where the study team will visually disturb the nest.

To assure that diet determinations from all collected pellet and prey remains samples are truly representative of nestling feeding habits in each particular nest, sampling criteria include diet quality boundaries, including:

- Prey Remains - collect only from the nest and base of the nest tree
- Pellets - collect only from the base of the nest tree and adult feeding perches.

After nestling banding is completed the nest will be visited weekly to continue pellet collections. Weekly collections will continue until the new fledglings leave the nest, and adults abandon their feeding perches. A general collection of prey remains is completed shortly after nestlings fledge and the nest can be abandoned without endangering the safety of the young birds.

## RESULTS

### Results

**Diet Characterization**  
 Prey item determinations have been completed from live active nests supporting successful fledglings from 2000 through 2002. This includes four nests at the former Trenchbridge Impoundment and a single nest at Ft. Custer.

Prey item composition are complete on a mammalian basis. The most frequent taxa in each Class are noted in the following Table. A key finding of the diet characterization studies for the site is the presence of a Bony Aquatic Component in the Diet of Resident Great Horned Owl Populations.

### Site Specific Prey From PCB Characterization

Site-specific prey concentrations are developed for the small mammal, dove, muskrat, and piscivore populations of owl diet at both the Ft. Custer and Trenchbridge locations. Mean and 95% UCL total PCB concentrations are derived from MSU sample collection throughout the 2000-2002 field seasons. Waterfowl concentrations are values from previous US Fish and Wildlife Service investigations conducted between 1980 and 1988. Waterfowl concentrations are identical for both study sites, reflecting the migratory/seasonal nature of this family of birds.

Mean and 95% UCL prey item concentrations are multiplied by their respective proportional value (Site-specific Diet Characterization) at each site to derive mean and 95% UCL values for owl diet. These diet-specific values are used in the average-daily dose (ADD) equation to model a site-specific dietary exposure estimate for each site.

Site-specific Dietary Exposures are compared to the applicable Toxicity Reference Value (TRV), the No Observed Adverse Effect Level (NOAEL) and to the Lowest Observed Adverse Effect Level (LOAEL) to derive a diet-based Hazard Quotient (HQ).

$$HQ = \frac{\text{Modelled Site-Specific Diet Exposure Estimate}}{\text{NOAEL}}$$

The TRV for great horned owl dietary exposure include a dietary PCB exposure-based NOAEL value (0.12 mg/kg/day) from a controlled, laboratory study of the reproductive effects of PCBs on muskrat kits (McLane and Hughes, 1980). A LOAEL value of 1.07 mg PCBs/kg/day is also generated from this study by multiplying the NOAEL by an uncertainty factor of 9.

Dietary Hazard Quotients are below expected adverse effect levels for both NOAEL and LOAEL TRVs.

## CONCLUSIONS

### Agreement with Measured Values

The modeled site-specific daily dietary dosages for resident great horned owls can be converted to an approximate fresh egg concentration for comparison to measured tissue concentrations (prey values) at the same site. This allows for a cursory evaluation of diet modeling accuracy.

Estimated diet to egg concentrations plotted against measured egg concentrations for both the Ft. Custer and Trenchbridge study sites show strong agreement between the modeled diet-exposure and measured prey-derived exposure assessment methodology.

## REFERENCES

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