



# **Ecological Risk Assessment for Wildlife**

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# Overview

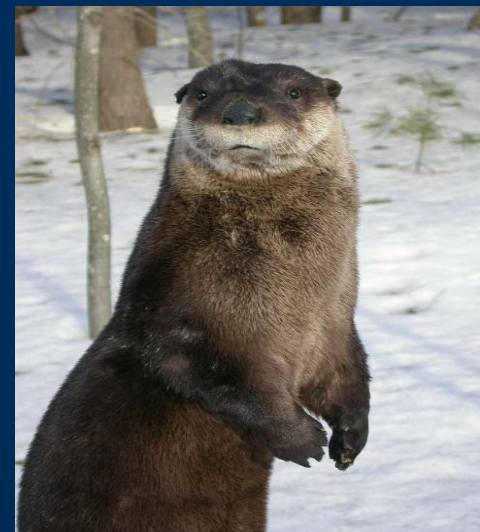
- Assessment endpoints and representative species
- Lines of evidence and measurement endpoints
- Site-specific studies
- ERA methods
  - Exposure assessment
  - Effects assessment
  - Risk characterization
- ERA results
- Summary of risks to wildlife





# Assessment Endpoints and Representative Species

- Survival, growth, and reproduction of:
  - Insectivorous birds
    - Tree swallow and American robin
  - Piscivorous birds
    - Osprey and belted kingfisher
  - Piscivorous mammals
    - Mink and river otter





# Assessment Endpoints and Representative Species

- Survival, growth, and reproduction of:
  - Omnivorous and carnivorous mammals
    - Red fox and Northern short-tailed shrew
  - Threatened and endangered species
    - Bald eagle, American bittern, small-footed myotis





# Lines of Evidence

Assessment Endpoint	Modeled Exposure And Effects	Field Study	Site-specific Toxicity
Insectivorous Birds	✓		Tree Swallow, Robin
Piscivorous Birds	✓		Belted Kingfisher
Piscivorous Mammals	✓	Mink	Mink
Omn/Carn Mammals	✓	Shrew	Shrew
T & E Species	✓		



# Modeled Exposure and Effects: Exposure Assessment

Exposure estimated from:

- Diet
- COC concentrations
- Food intake rate
- Foraging range



# Modeled Exposure and Effects: Exposure Assessment

## Probabilistic Risk Assessment

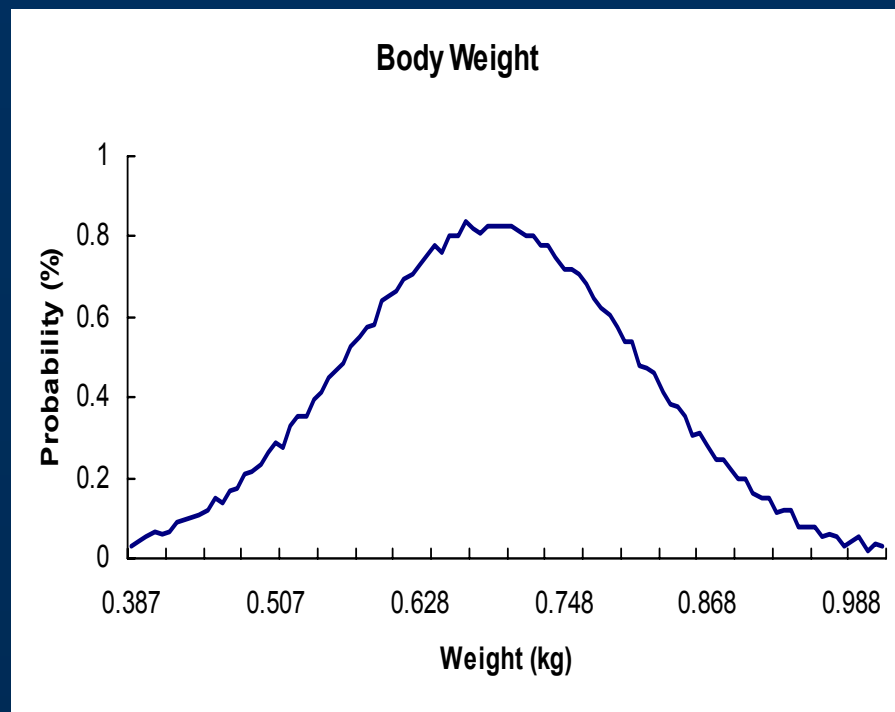
- Used distributions when there was uncertainty
- Methods propagated uncertainty through models
- Monte Carlo analysis
- Probability bounds analysis



# Modeled Exposure and Effects: Example Exposure Analysis

## Mink exposure model input parameters:

- Body weight (as shown)
- Food intake rate inputs
- Proportion diet:
  - Fish
  - Invertebrates
  - Birds
  - Mammals
  - Amphibians

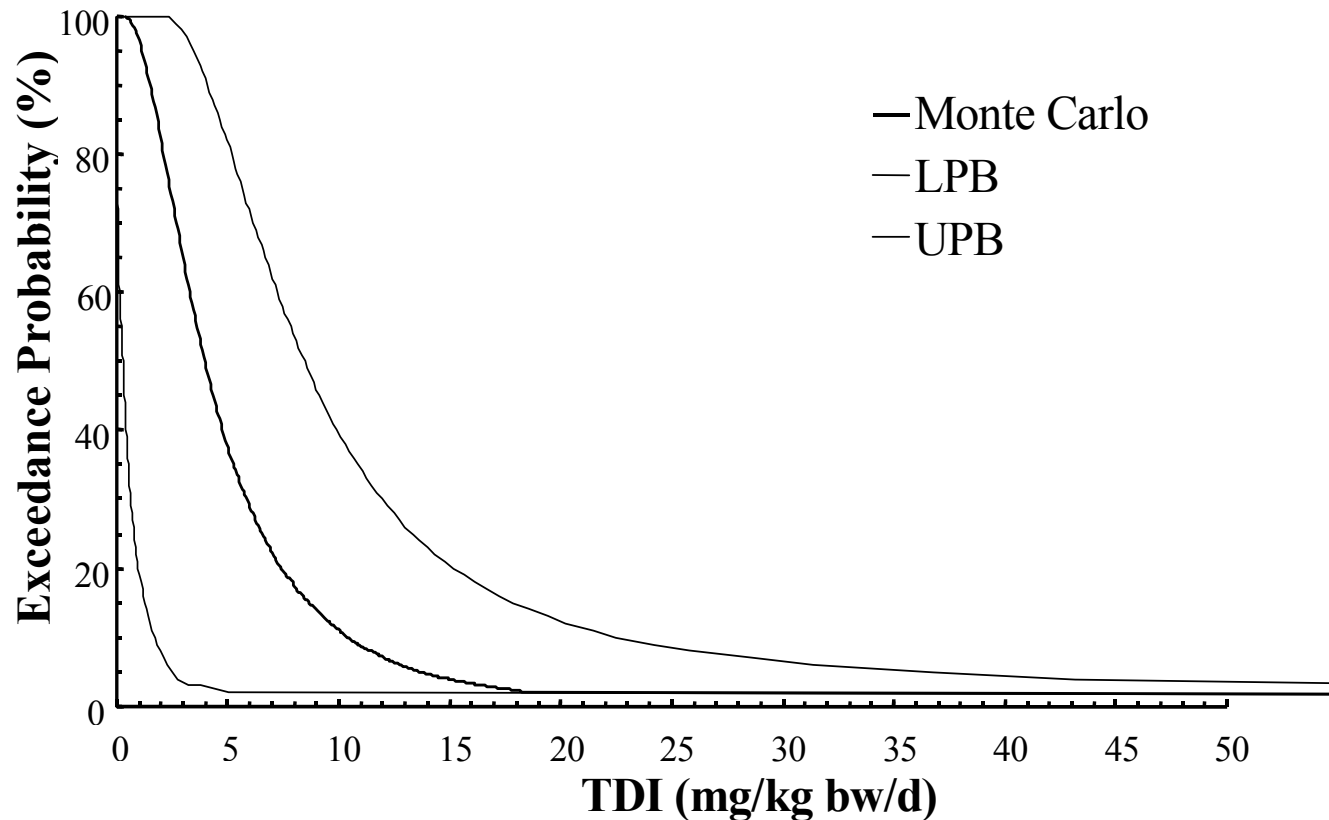






# Modeled Exposure and Effects: Example Output

## Mink Exposure to tPCB in Reach 5





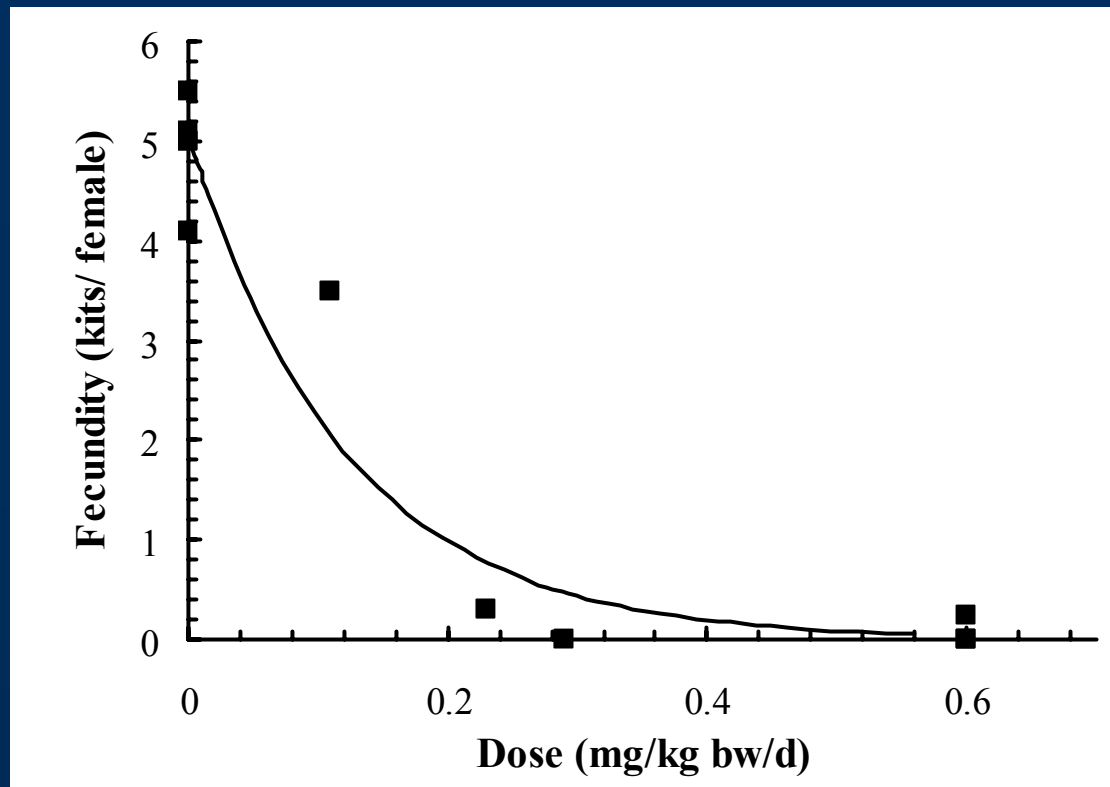
# Modeled Exposure and Effects: Effects Assessment

- Focused on literature studies
  - survival, reproduction and growth
- Few published studies available for birds
- More literature for mammals
- In a few cases, site-specific field studies were used to derive effects metrics



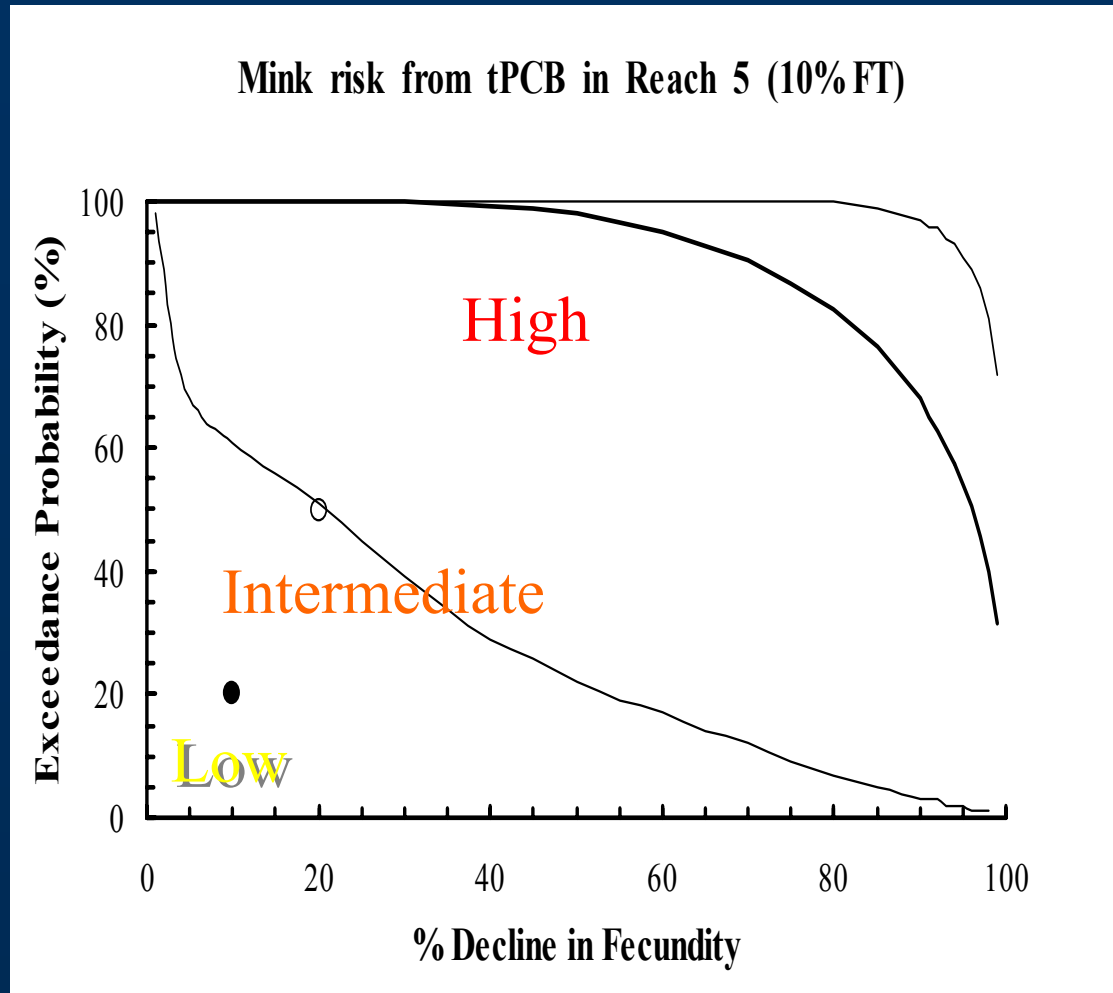
# Modeled Exposure and Effects: Example Dose-response Curve

## Effects of tPCBs on Reproduction of Mink





# Modeled Exposure and Effects: Example Risk Curve



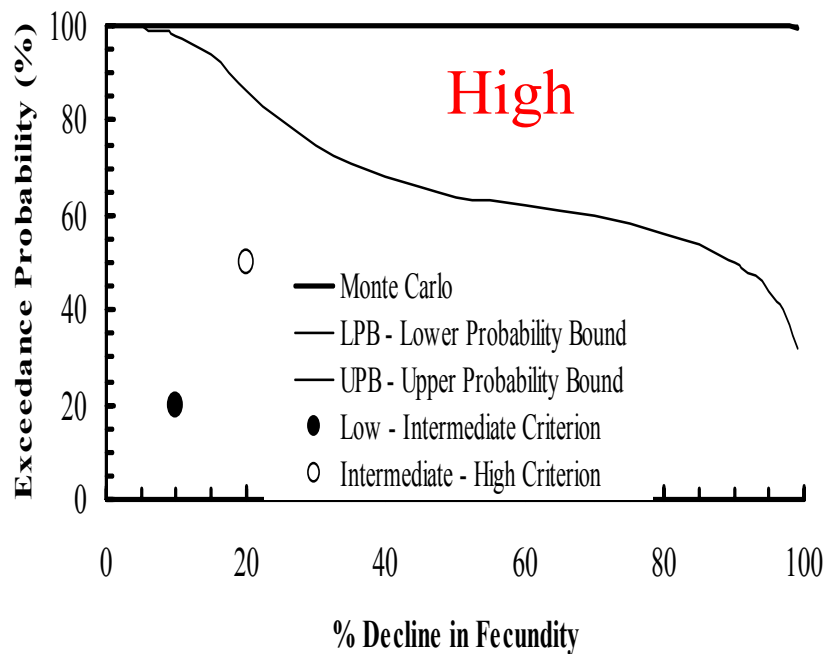


# PISCIVOROUS MAMMALS

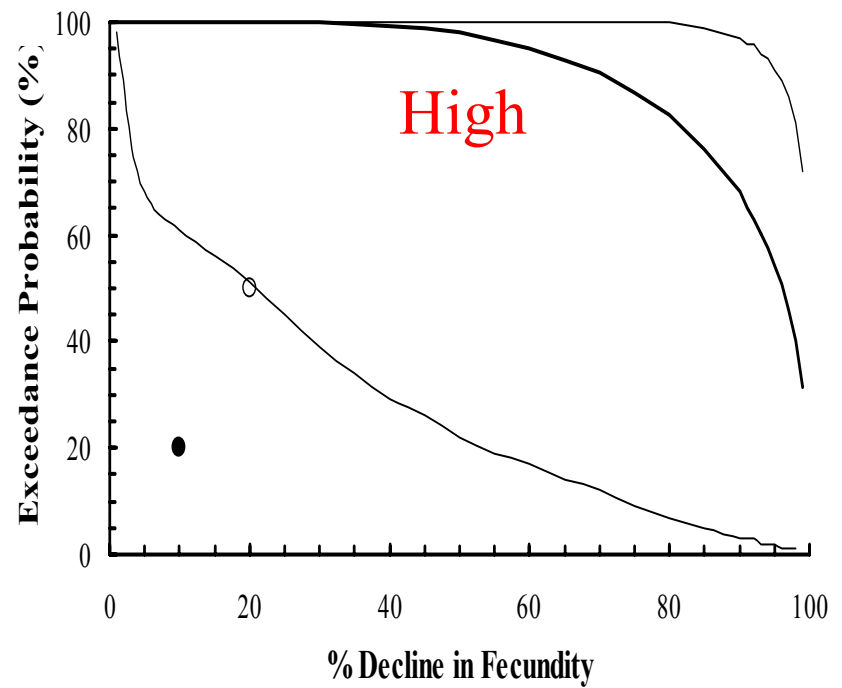


# Results – Modeled Exposure and Effects for Mink

### Risk to Mink from tPCBs in Reach 5 (100% FT)



### Mink risk from tPCB in Reach 5 (10% FT)





# Field Studies - Methods

- Field Surveys (Appendix A; Bernstein et al. 2003)
  - Woodlot recorded presence and relative abundance of mink and otter in PSA and reference areas from 1998 to 2001
  - Bernstein et al. conducted a study in the PSA using similar methods from 2001 to 2003
- Feeding Study (Bursian et al. 2002; Bursian & Yamini 2003)
  - fed fish collected from Woods Pond
  - monitored reproduction and development
  - 6 dose treatments



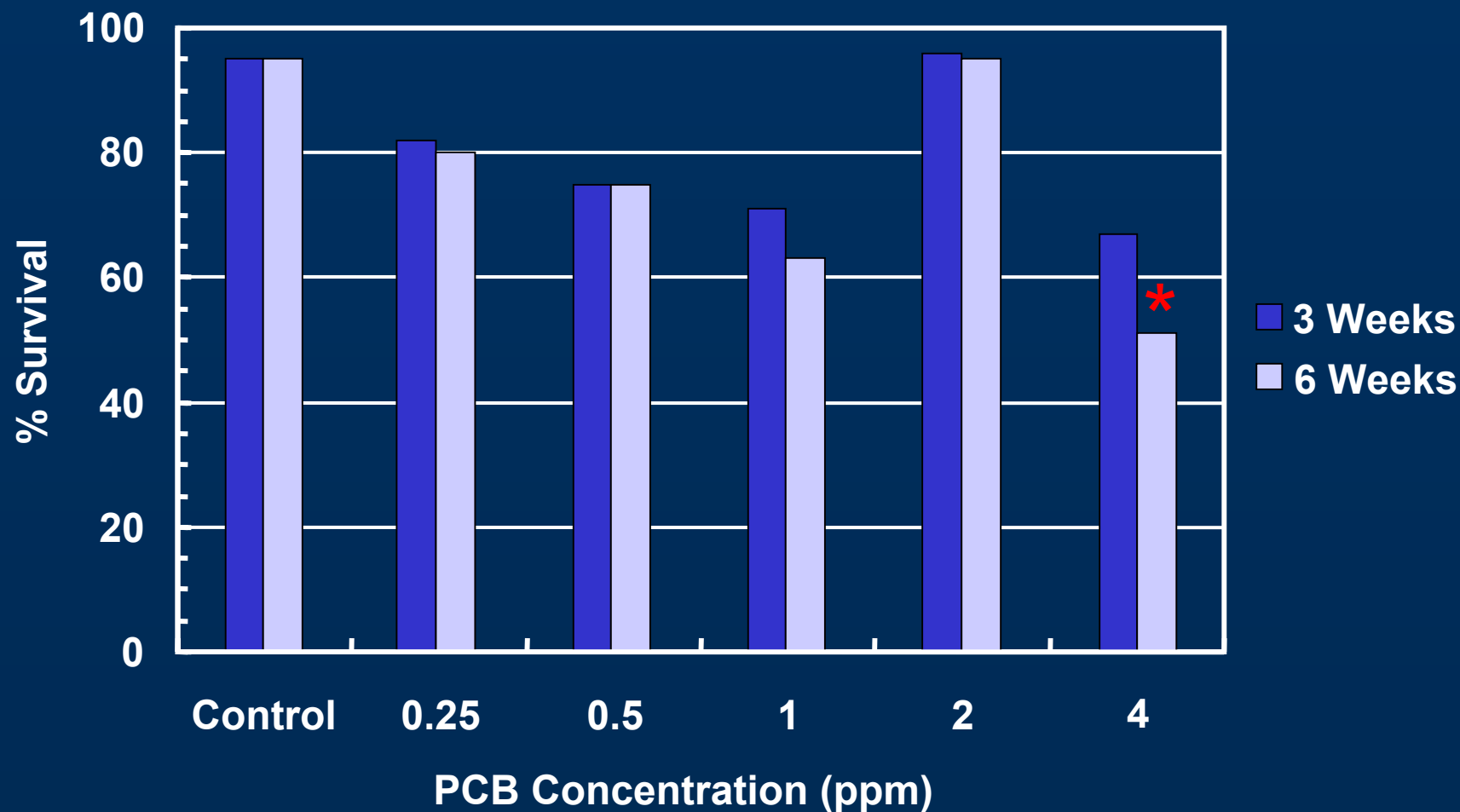
# Field Studies - Results

- Field surveys (EPA and GE)
  - mink and otter present in PSA in winter, but rare otherwise
  - mink and otter more common in reference areas
- Feeding study
  - adverse effects on survival of 6 week-old kits
  - dose-dependent incidence of jaw lesions





# Mink Feeding Study: Effect of PCBs on Kit Survival





# WOE – Piscivorous Mammals

Measurement Endpoints		Weighting Value (High, Moderate, Low)	Evidence of Harm (Yes, No, Undetermined)	Magnitude (High, Intermediate, Low)
Field Surveys	EPA	Moderate/High	Yes	High
	GE	Moderate	No	Low
Feeding Study		High	Yes	High
Modeled Exposure and Effects		Moderate/High	Yes	High



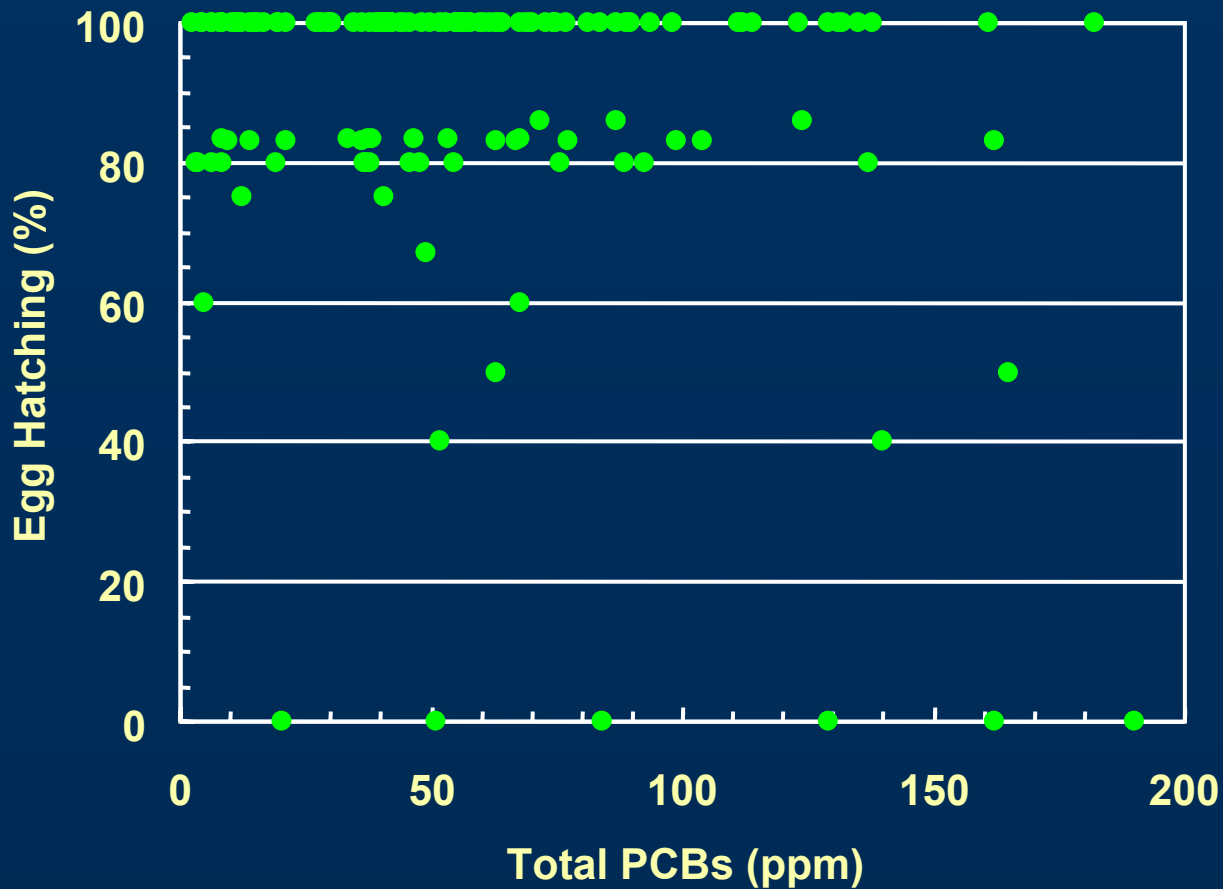
# ERA Results – Insectivorous Birds

- Modeled exposure and effects
  - intermediate to high risk
  - moderate weight
- Tree swallow field study (Custer 2002)
  - monitored reproduction of tree swallows in nest boxes for 3 years
  - 3 locations in PSA, 3 reference locations
  - No obvious adverse effects on reproduction
- American robin field study (Henning 2002)
  - monitored reproduction of robins for 1 year
  - within PSA floodplain (contaminated), outside PSA floodplain (uncontaminated)
  - No obvious adverse effects on reproduction
- WOE conclusion: **Low** Risk





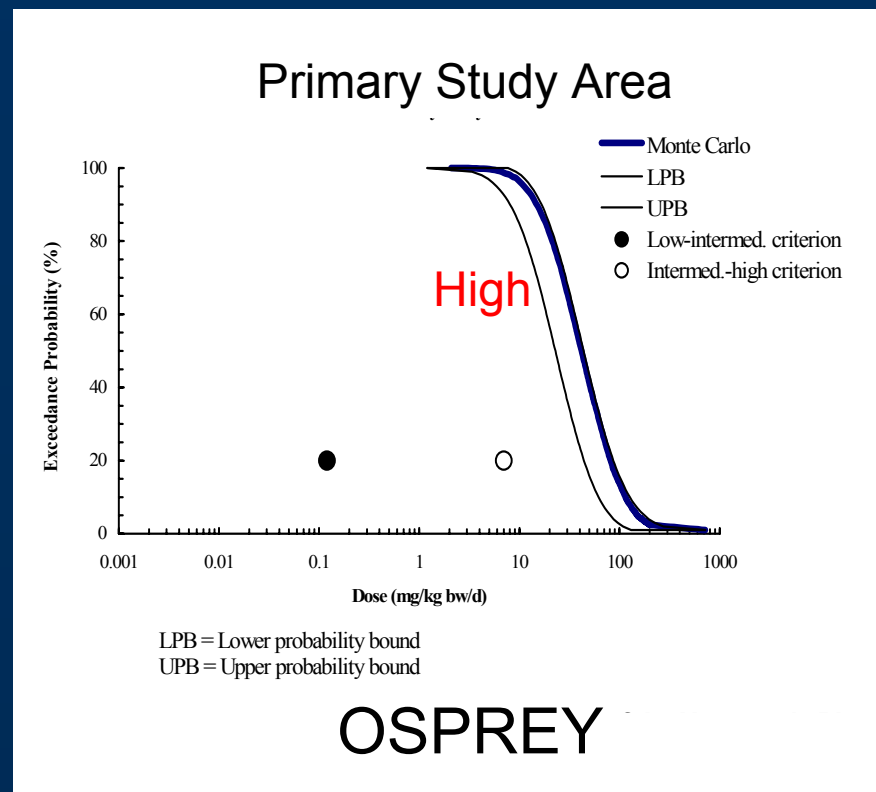
# Tree Swallow Study: Hatching Success Results





# ERA Results – Piscivorous Birds

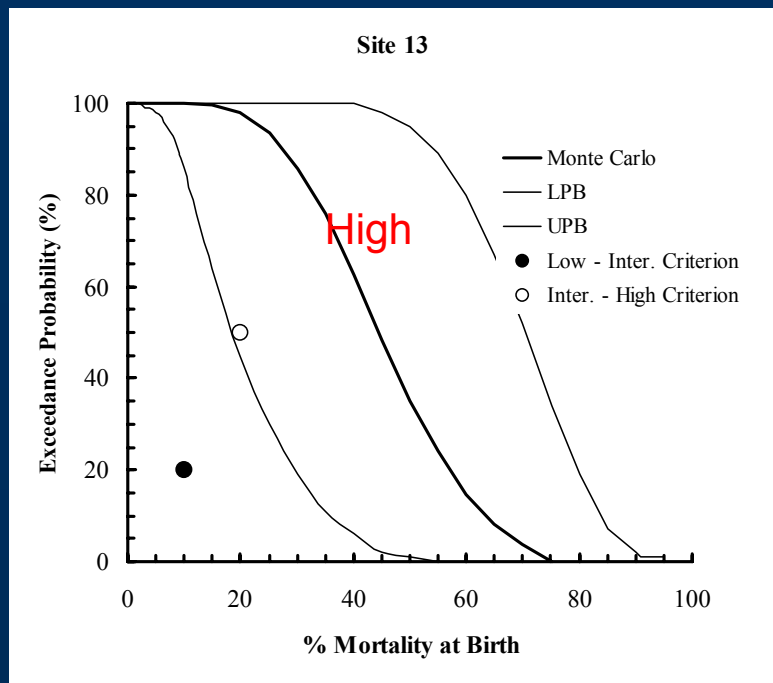
- Modeled exposure and effects
  - high risk
  - moderate weight
- Belted kingfisher field study (Henning 2002)
  - monitored reproduction of kingfishers for one year
  - 9 kingfisher burrows in PSA
  - no evidence of adverse effects
  - moderate-high weight
- WOE conclusion:  
**Intermediate** to **High** Risk for some species





# ERA Results – Omnivorous and Carnivorous Mammals

- Modeled exposure and effects
  - low to high risk
  - moderate-high weight
- Small mammal field survey (Appendix A)
  - presence, relative abundance and habitat usage from 1998 to 2001
  - low risk
  - moderate-high weight
- Shrew field study (Boonstra 2002)
  - survival, reproduction, growth, population density, sex ratio for 1 year
  - 6 locations in PSA
  - intermediate risk
  - moderate-high weight

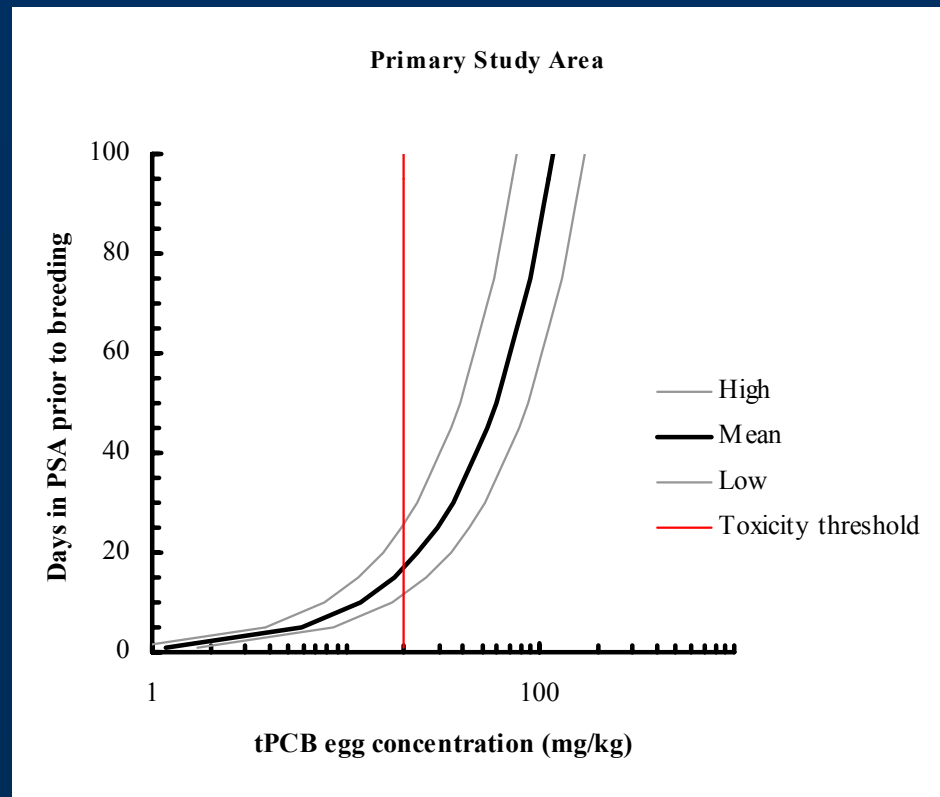


- WOE conclusion: **Intermediate** to **High** Risk for some species in some areas



# ERA Results – T & E Species

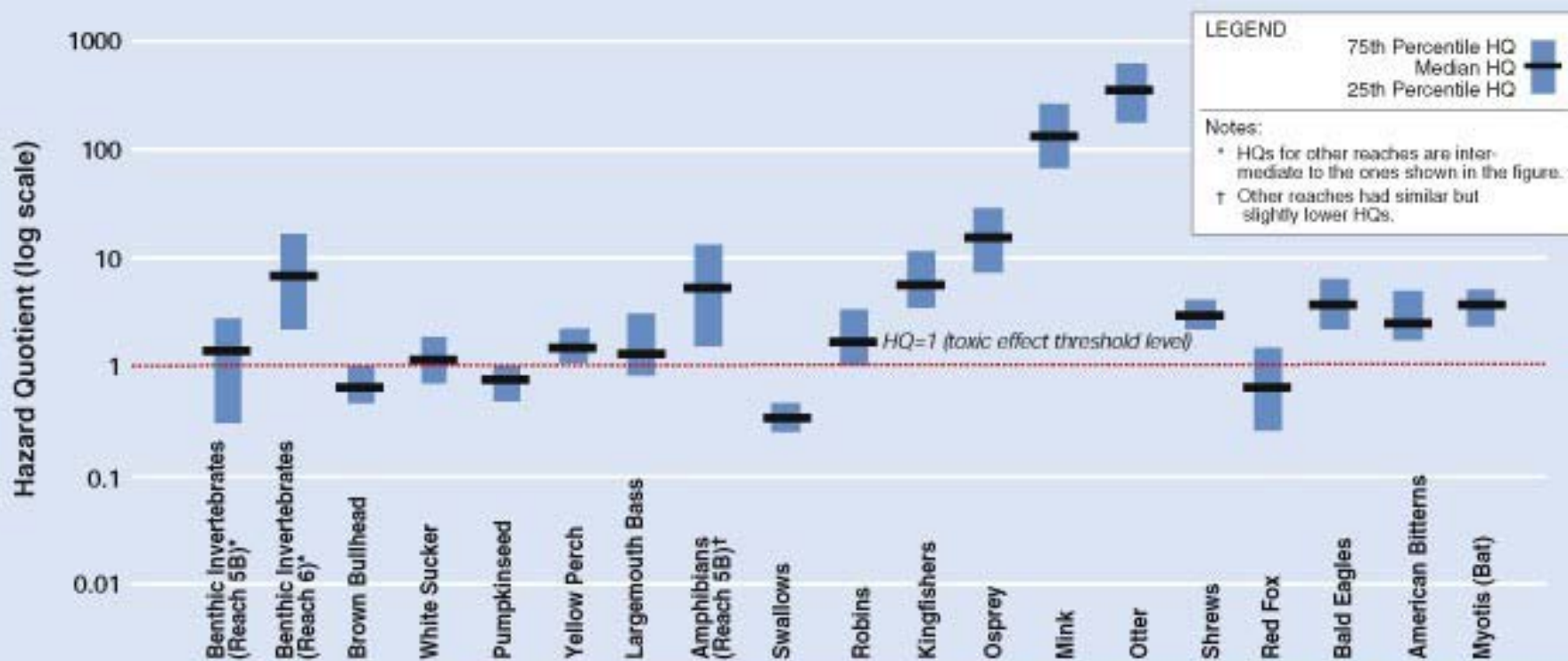
- Modeled exposure and effects
  - High risk for bald eagles
  - High risk for American bitterns
  - Intermediate risk for Small-footed myotis
- WOE conclusion – **Intermediate** to **High Risk**





# Summary of Risks in the PSA

## Summary of the Range of Hazard Quotients from Total PCBs for Selected Species







# Risk Characterization

- Risks potentially extend to other species (e.g., other shrews)
- ERA below Woods Pond
  - Mink, otter, and bald eagles
  - Derived threshold concentrations for tissues
  - Compared thresholds to concentrations measured in fish
  - When exposure exceeded threshold = Potential risk
  - Mink at risk to Reach 10, and otter at risk to Reach 12

