Ecological Risk Assessment for Fish

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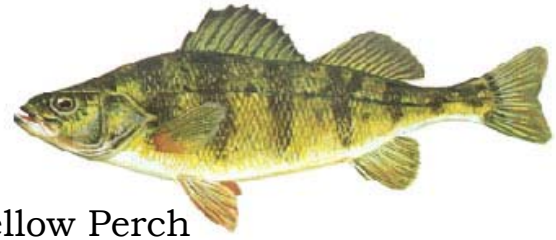
Representative Species

Predators



Yellow Perch

Largemouth bass

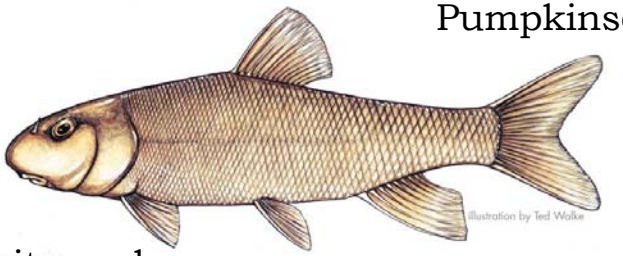
Bluegill

Forage Fish

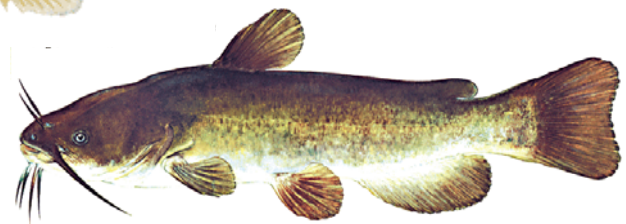
Assessment Endpoint: Survival, growth and reproduction of fish

Pumpkinseed

Bottom Fish



White sucker



Brown bullhead

3 Lines of Evidence

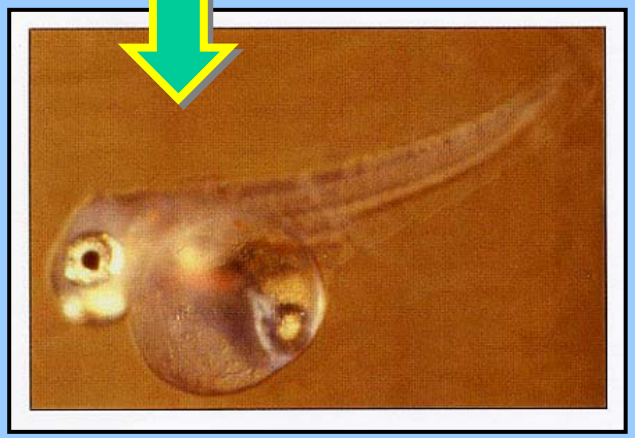
Consider Three Lines of Evidence

Chemistry (literature review)

Toxicity (Phase I and Phase II)

Biological Surveys (Community Assessment)

- **Survival**
- **Growth**
- **Reproduction**
- **Malformations**



Assess frequency and magnitude of exceedance

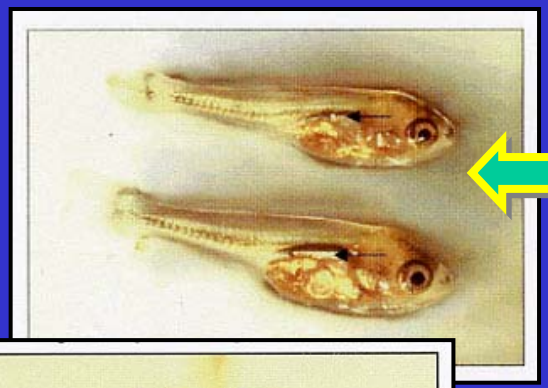
Comparison to Effects Thresholds

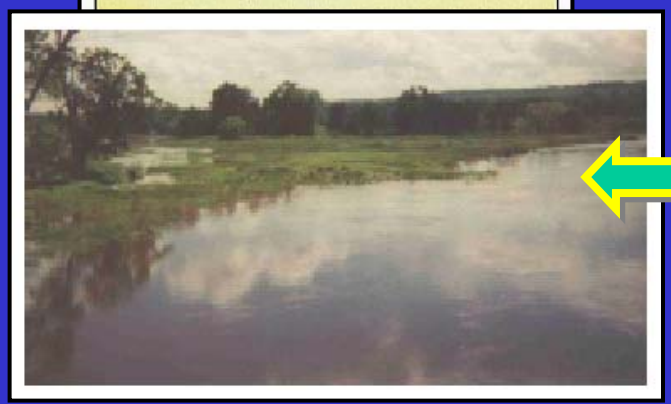
Qualitative Assessment

Classify Risks as High, Intermediate, or Low in PSA

Extrapolate Findings to Other Species and Downstream

Site-Specific Studies





- Phase I toxicity (USGS):

- Spawning bass from Housatonic River
- Directly assessed both adults and their lab-reared offspring

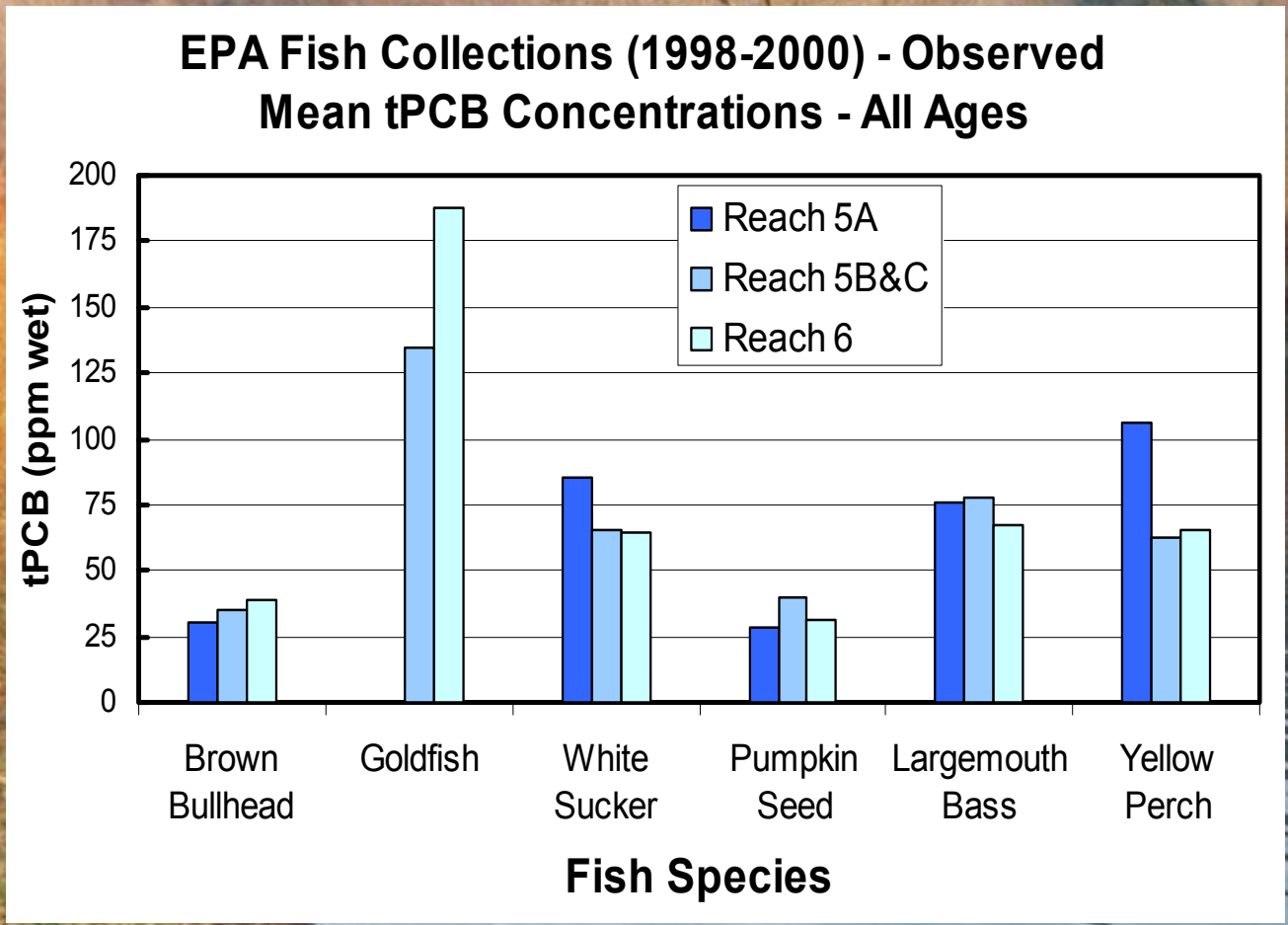
- Phase II toxicity (USGS):

- PCBs injected into clean eggs of fish (bass extracts, reference standards)
- Bass, medaka, rainbow trout eggs

- Field studies:

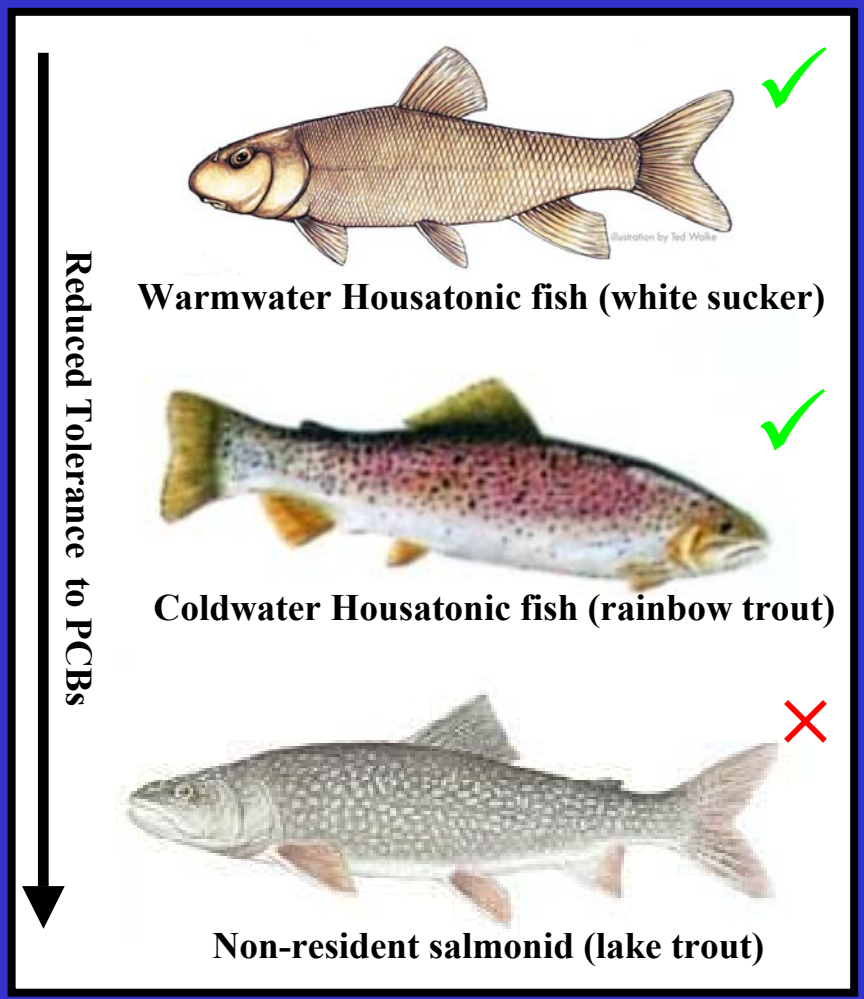
- EPA biomass study
- GE largemouth bass study

Exposure Assessment



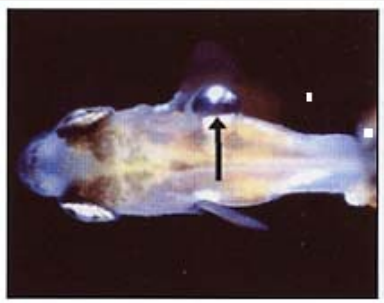
- Tissue PCB concentrations among highest ever observed
- Trends:
  - Trophic level
  - Reach
  - Age
  - Lipid
- Similar spatial and species patterns for TEQ

Effects Assessment – Literature Reviews



- Reviewed scientific literature
- Focused on PSA-relevant species (sensitivity)
- Extrapolated from egg to whole body PCB concentrations if required
- Determined effects thresholds for PSA fish

Effects Assessment – Phase I Toxicity Results



Largemouth bass fry:
A – normal
B – head deformity
C – edema
D – vertebral anomaly
E – partially external swim bladder (15-days post-swim up)

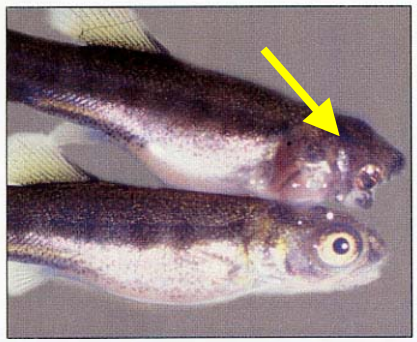
- Effects consistent with PCB/dioxin-like toxicity
- Increased effects relative to reference (Threemile Pond)
- Adults –liver; abnormal gonads
- Offspring – reduced survival at swim-up; delayed development; deformities; slower growth

Deformity Rates (N/1000) in 15-Day Offspring of Largemouth Bass Fry from the Housatonic River

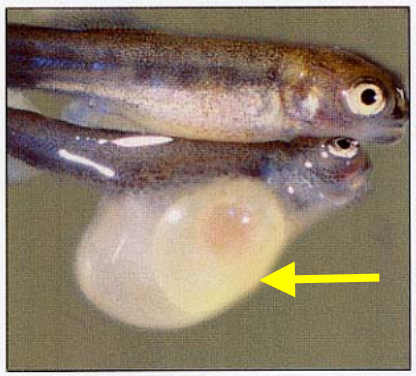
Deformity	Three-Mile Pond	Rising Pond	Woods Pond	Deep Reach
Swim Bladder				
- Uninflated	ND	333[a]	9[a]	24[a]
- Partially-inflated	ND	120[a]	429[a]	88[a]
- External	ND	67[a]	27[a]	24[a]
Shortened Operculum	ND	ND	ND	220[a]
Tail Deformity	ND	ND	18[a]	ND

Effects Assessment – Phase II Toxicity Results

Largemouth bass
PCB126 standard
External Swim Bladder



Rainbow trout
Housatonic River extracts
Head deformity

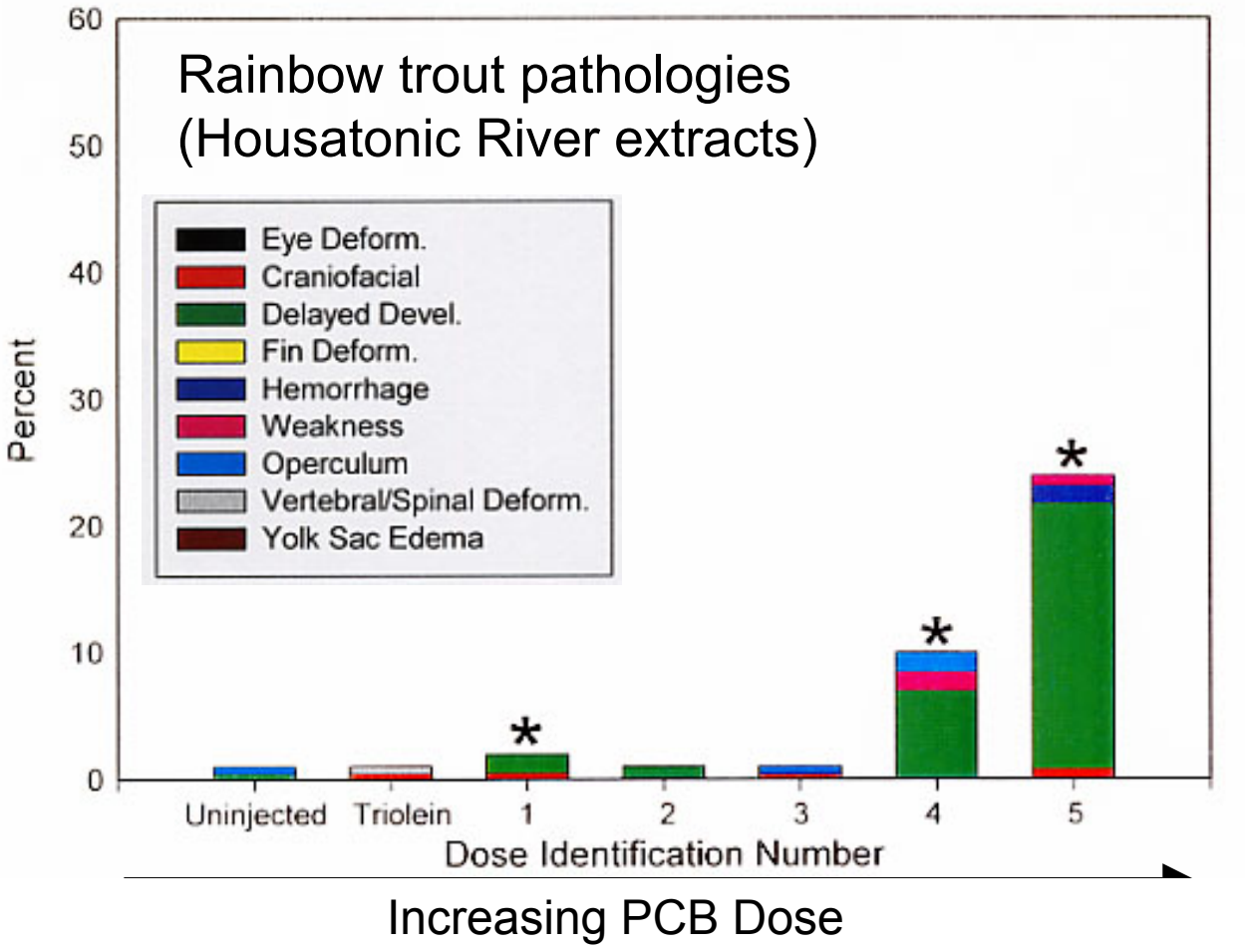


Rainbow trout
Housatonic River extracts
Yolk sac edema

- Trout, medaka, bass all showed reproductive and developmental responses
- Effects most pronounced at later stages (post swim-up)
- Several abnormalities dose-related
- Housatonic extracts consistent with PCB/TCDD standards
- Trout slightly more sensitive than warmwater species

Effects Assessment – Phase II Toxicity Results

- Concentration-response observed



- Combined survival and deformities
- Derived PCB and TEQ thresholds for effects (ppm tissue)

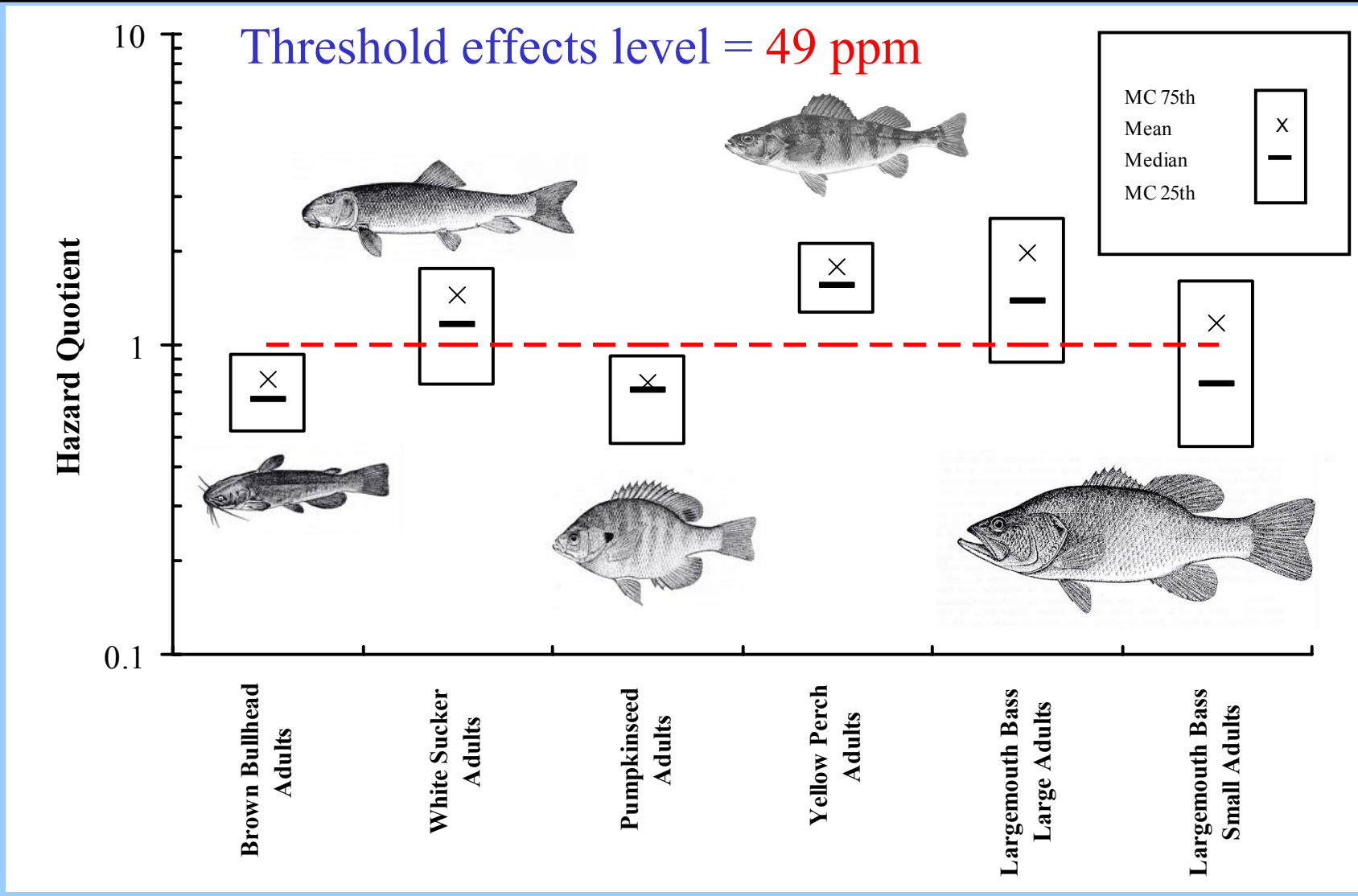
Effects Assessment – Field Studies

- Effects of PCBs are not “catastrophic”
- Populations of largemouth bass and other warmwater fish present in PSA
- Reproduction of LMB is occurring
- Age class structure and numbers reasonable
- Some indications of poor nest condition and reduced growth
- However,studies not designed to detect
  - subtle effects
  - impacts from additional stressors

Risk Characterization

Measurement Endpoints	Weighting	Evidence of Harm	Magnitude
A. Site-Specific Toxicity			
A1. Phase I reproductive effects	Mod/High	**Yes**	**Low**
A2. Phase II reproductive effects	High	**Yes**	**Intermediate**
B. Fish Body Burden			
B1. Observed fish tissue/ Literature toxic levels	Mod	**Yes**	**Low**
B2. Observed fish tissue/ Phase I toxic levels	Mod/High	**Yes**	**Low**
B3. Observed fish tissue/ Phase II toxic levels	Mod/High	**Yes**	**Low**
C: Fish Community and Reproduction Studies			
C1: EPA Study and GE Community Study	Low/Mod	**Undetermined**	-
C2: GE Reproduction Study	Low/Mod	**Undetermined**	-

Summary of Risks by Species



Extrapolation of Risks

- Other warmwater species in PSA similar to ERA surrogates
- Trout assumed to be 4 times more sensitive
- No risks to warmwater species (e.g., bass, sunfish) downstream of Woods Pond

- Coldwater species (e.g., brown trout, rainbow trout) have marginal risks between Woods Pond and MA/CT state line
- No risks to fish in Connecticut