The accumulation of sedimentary PCBs in bullfrog (*Rana catesbeiana*) tadpoles from the Upper Hudson River

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Study Objectives

- Screening level survey of PCB contamination
- Preliminary measure for basing future investigations
Bullfrog Ecology

- Largest North American frog
- Native to Central and Eastern United States
- Highly aquatic
- Carnivorous
- Long lived (up to 10 yrs)
- Breed during late Spring in permanent water bodies
- Egg masses attached to submerged vegetation
Bullfrog Life Stages

Frog Spawn
Limb Bud
Pre-limb
Hind Limb
Metamorph

Bullfrog Tadpoles

- Hatch out in Summer
- Over winter in sediments
- May reach lengths greater than 8 cm
- Primarily herbivorous – organic debris, algae, plant tissue, detritus
Study Sites
Sampling Synopsis

- Samples collected August-September 2003
- Sediment collected from 9 sites (2 reference)
- Composited sediment samples (n = 9)
- 155 tadpoles collected from 8 sites (6 study, 2 reference)
- Individuals were composited based on developmental stage (42 composited samples, n = 1 - 12)
- Tadpole gut coils were removed prior to analysis
Sampling
Total PCBs
Sediment [PCB]

PCB Concentration (ppm)

Reference Sites

Hudson River Study Sites

Upstream

Downstream

Site 7 Site 4 Site 3 Site 6 Site 5 Site 8 Site 1 Site 9
Sediment & Tadpoles

\[ y = 0.07x + 503 \]
\[ R^2 = 0.89 \]
Tadpole Developmental Stage [PCB]

**Hudson River Study Sites**

**Reference Sites**

<table>
<thead>
<tr>
<th>PCB Concentration (ppm)</th>
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<th>Limb Bud</th>
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PCB Congeners

- 48 PCB congeners selected for quantification
- Selected congeners are found, historically, in PCB composition of various Hudson River physical and biological samples
- 12 ‘Dioxin-like’ PCB congeners included among the 48
## PCB Congeners

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<th>Penta</th>
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PCB Congeners

Upper Study Sites

Lower Study Sites
Hudson River Study Site Sediment PCB Congener Composition

Upper Study Sites

Lower Study Sites
Reference Site
Sediment PCB
Congener Composition

Site 1

Site 9
Hudson River Study Site
Tadpole PCB Congener Composition

Upper Study Sites
- 31/28
- 47,49,52

Lower Study Sites
- 31/28
- 47,49,52
Reference Site
Tadpole PCB
Congener Composition

Site 1

Site 9
Sediment vs Tadpole PCB Composition (One to One)
Tadpole : Sediment Ratios (TSRs)
Sediment Organic Carbon vs [PCB]

Tadpole Lipid Content vs [PCB]
Tadpole : Sediment Ratios (TSRs)

Tadpole PCBs (normalized to total)

Sediment PCBs (normalized to total)
TSRs

Hudson River Study Sites

Site 1
Log Kow vs Log TSR

Hudson River Study Sites

Site 1
Study Site Log Kow vs Log TSR

- Di
- Tri
- Tetra
- Penta
- Hexa
- Hepta
- Octa
Conclusions

• Hudson River bullfrog tadpoles are contaminated with PCBs
• Tadpole PCB body burdens and congener distributions reflect sediment PCB loads and composition
• Sediment and tadpole PCB congener distributions varied little within and between study sites
• Reference site sediment and tadpole PCB congener composition differed markedly from study sites
• The majority of sediment PCB congeners are found in greater relative fractions in collocated tadpole tissues