PCBs in Floodplain Soils and Shrews of the Hudson River, NY

Presentation Overview

• Background on PCB Contamination
• Assessing Floodplain PCB Contamination
  – Objectives
  – Methods
  – Results
  – Conclusions
Upper and Lower Hudson River

Floodplain Study Area

NPL SITE

NEW YORK

NEW JERSEY

VT

MA

CT

0 20 mi

0 25 k

Fresh

Saline
PCB Exposure in the Upper Hudson River

- Sediment range: 0.012 - 4,000 mg/kg
- Water range: 0.0052 – 9 ug/L
- Recent Maximum in Biota (mg/kg):
  - Fish: 27 – 445 (fillet)
  - Benthos: 10-20
  - Great Blue Heron: 220 (fat)
  - Tree Swallows: 77 (egg)
  - Snapping turtle: 3,091 (fat)
  - Otter: 22.5 (liver)
Objectives

- As part of a NRDA, conduct a screening level assessment to determine if:
  - 1. floodplain soils of the Upper Hudson River are contaminated with PCBs, and
  - 2. terrestrial biota using those floodplains are contaminated with PCBs.
Sampling Design: Soils

- 11 transects in floodplains along ~23 miles between Ft Edward and Stillwater
- Transects = 6-9 surface grabs per transect, w/in ~400 feet of the Hudson (see schematic)
- Two cores per transect, 4 sections per core
- 179 soil samples analyzed for total PCBs, TOC, grain size
Sampling Transect Schematic

Surface samples: 0-15 cm

Hudson River

Cores

A  B  C  D  E…  I

0-15 cm
15-25 cm
25-35 cm
35-45 cm
45-55 cm
Sampling Design: Biota

1. Shrews:
   - Predator known to accumulate organochlorines
   - Close association with soil to depths of 50 cm
   - Important prey item for owls and other predators.

2. Earthworms: collected @ each site and archived

Up to 5 shrews collected at each transect w/traps
Most collected w/in 20 m of transect.
43 shrews analyzed for total PCBs and lipids, sex, & length
# PCB Floodplain Summary Statistics

<table>
<thead>
<tr>
<th></th>
<th>RANGE</th>
<th>MEAN</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soil (mg/kg dry wt)</td>
<td>&lt;0.011 - 360</td>
<td>8.2</td>
</tr>
<tr>
<td>Soil (mg/kg TOC)</td>
<td>&lt;0.3 – 10,435</td>
<td>268</td>
</tr>
<tr>
<td>Shrew (mg/kg wet wt)</td>
<td>0.048 – 38</td>
<td>1.8</td>
</tr>
<tr>
<td>Shrew (mg/kg lipid)</td>
<td>3.1 – 1642</td>
<td>4.1</td>
</tr>
</tbody>
</table>
Surficial (0-15 cm) Soil PCBs vs Sampling Sites

N = 6 – 9 for each bar

PCB (mg/kg dw)

Rogers Isl.

Thompson Isl. Pool

Saratoga Battlefield
Surficial Soil PCBs vs. Sampling Sites
Normalized to Percent Silt

PCBs (mg/kg/% silt)

Sampling Sites
Surficial Soil PCBs vs Distance from River

Distance from River (ft.)

PCB (mg/kg dw)

Distance from River (ft.)

Surficial Soil PCBs vs Distance from River

Distance from River (ft.)

PCB (mg/kg dw)
Total PCB Depth Profiles
Thompson Island Pool (Site 8, RM 188.81)

~23 feet from river
~80 feet from river
Total PCB Soil Depth Profile
Opposite Coveville (Site 5, RM 178.5)

Soil Core Depth (cm)

PCB (mg/kg dw)

~42 ft from the river

~70 ft from the river

Soil Core Depth (cm)
PCBs in Shrews vs Sampling Sites
(Wet Weight)

![Bar chart showing PCB levels in shrews across different sampling sites.](chart.png)

- Sampling Sites: 12, 11, 10, 8, 7, 6, 5, 4, 3, 2, 1
- PCB (mg/kg ww): 0.01, 0.1, 1, 10, 100
- N=5 for each site, with error bars indicating variability.
PCBs in Shrews vs Sampling Sites
(Lipid Normalized)

PCB (mg/kg lipid)

Sampling Sites

N=5

PCB (mg/kg lipid)

Sampling Sites
Summary

- Screening level assessment: 179 soil samples, 43 shrews collected along 20 miles below Ft. Edward
- Most soil and all shrew samples collected were contaminated with PCBs
- Soil concentrations tend to decrease moving downstream and away from the river
- Surface concentrations tended to be highest in the top 25 cm
- 53% of surface soil samples and 28% of samples at depth >= 1 mg/kg
- Shrew PCB concentrations tend to decrease going downstream
Summary (cont.)

- Results are consistent w/a hypothesis that:
  
  - 1. PCBs from the river are contaminating Hudson River floodplains, and
  
  - 2. Floodplain PCBs are bioavailable to terrestrial biota.
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