BIOACCUMULATION OF PCBS UNDER DIFFERENT RIVER FLOW REGIMES

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PCBs in fish tissue

- Mountain whitefish (*Prosopium williamsoni*) from the Wenatchee River have some of the highest PCB concentrations in Washington State.
Passive samplers

- Sampling from 2014-2017
- Semi-permeable membrane devices
- One-month deployment
- High and low flow periods
Biofilm Sampling

- Algae, microbial communities, and sediment.
- Base of the river food web
- Chemical concentrations strongly correlated to water ($r^2=0.8; p<0.001$)
Invertebrate Sampling

- Diet of the mountain whitefish is caddis fly and mayfly.
- Confirmation of diet by gut analysis
- Invertebrate samples composed of caddis fly and mayfly picked from river.
Whitefish and Largescale Sucker sampling

• Individuals and 5-fish composite tissue samples from two river reaches.
PCB Sources

- Very similar congener distribution between periphytic biofilms and dissolved in water
Two PCB Sources

• Different distribution between upstream and downstream locations = different sources
PCB fingerprint of primary producer and consumer

- invertebrates have similar profile to biofilm (food source)
PCB fingerprint for the source areas

- MWF caught from different areas reflect food source
- Both 3-yr old MWF
- Similar fat content
- Downstream fish has higher PCB concentrations
- Stable isotope work also reflects contaminant source areas
Bioaccumulation in the river food web

- largest biomagnification from water to biofilm

- LSS = largescale suckers (benthic feeder); MWF = mountain whitefish (top consumer)

- overlap of PCB concentrations in sucker and whitefish; possibly because suckers were older.
PCB Sources in the Wenatchee

- Two chemically distinct PCB sources
  - **Upstream Source**
    - Congener profile does resemble Aroclor 1254
  - **Downstream Source**
    - Congener profile resembles Aroclor 1242/1248 with congeners that suggest microbial dechlorination.

- Largest biomagnification from water – biofilm (~1600 fold)

- Same congener profile over time and at low and high flow = **constant source** (i.e. not stormwater); likely groundwater inputs
Hydrology - % change in discharge from normal

- 2015 exhibited higher flow in winter and early spring; much lower flow in the summer.
Low flow = higher PCB accumulation

- Higher PCB concentrations in water, biofilms and invertebrates in 2015.

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<tr>
<th>Invertebrate tissues (ng/g)</th>
<th>2015</th>
<th>2016</th>
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<td>315.0</td>
<td>6.1</td>
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- Sustained low flow in the summer months of 2015
Predicted Changes in Flow

- 2015 exhibited characteristics of projected climate changes.
- Future scenarios suggest prolonged periods of lower flow in the summer.

https://climatetoolbox.org/
Take-home

With continuous PCB sources, prolonged periods of lower river flow could yield higher PCB bioaccumulation in the river food web.

Continued Source Investigation

- groundwater and contaminant hotspots
Acknowledgments

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