PMF Assessment Summary
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SRRTTF Data Synthesis Workshop

January 31, 2022

Data sets analyzed:

- With PMF
  - Ambient water
  - Stormwater/CSOs
  - WWTP influent
  - WWTP effluent
  - Biofilm+SPMD
  - Fish
  - Kaiser outfalls
  - Kaiser groundwater
- With MLR:
  - Bulk Atmospheric Deposition
  - Sediment (including suspended particulates)
  - Surface water CLAM (Continuous low-level aquatic monitoring) samples
  - Groundwater from the GE plant
  - Inland Empire Paper outfalls
  - Storm drain solids
  - Municipal products

Quality and completeness

- I examined all the available method 1668 PCB data
- Data was excluded from PMF analysis only when:
  - Insufficient data was available for that compartment. This data was examined by other means.
  - It was measured using a different GC column that the bulk of the data for that compartment. This data was examined by other means.
  - Congeners that were below detection in a majority of samples were not included. Care was taken not to exclude congeners from PMF that were important indicators of source types.
- Blank masses were significant for surface water. Peer-reviewed blank correction study determined the best method of blank correction (Rodenburg et al. 2020)

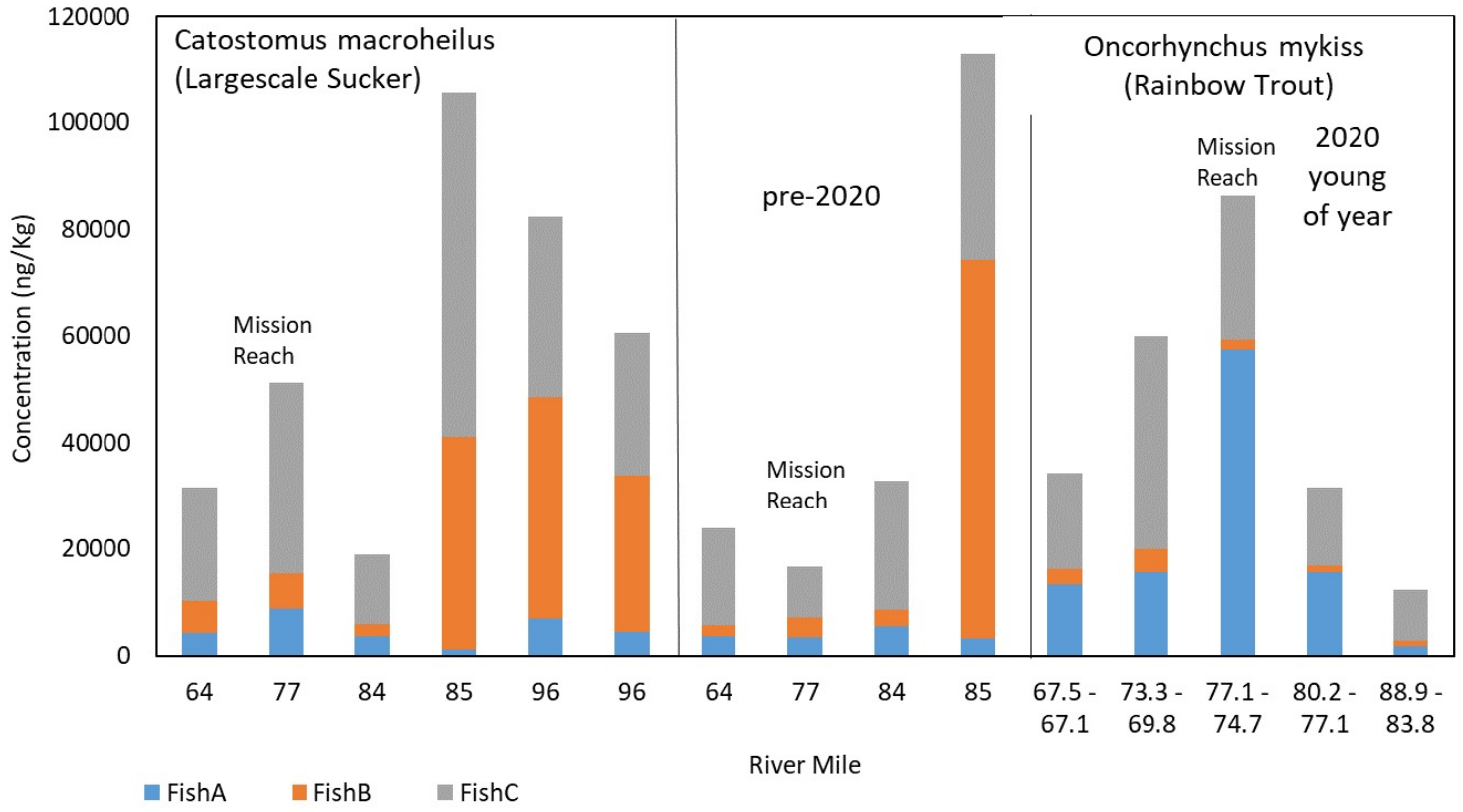
Aroclor vs. non-Aroclor sources

- Water column is about 90% Aroclors, 10% non-Aroclor, mostly PCB 11
  - Biofilm corroborates the presence of PCB 11 in the water column (not a blank issue)
- PCBs in fish are virtually entirely from Aroclors, PCB 11 usually BDL
- Integrated sources such as surface water, biofilm, stormwater, WWTP influent and effluent, and fish are a mixture of Aroclors
- Groundwater at Kaiser is almost entirely Aroclor 1248 with some microbial dechlorination occurring
- IEP influent and effluent are primarily Aroclor 1242 with some PCB 11
  - Indicates that A1242 from carbonless copy paper is still circulating in the recycled paper stream

Summary

- Fish
  - PCB burden may be shifting toward lower MW PCBs and likely declining over time
    - Not enough samples to be definitive
  - Non-Aroclor sources are negligible
- Biofilm
  - Lower concentration samples have very different relative abundance of factors from the high concentration samples.
  - 2018 spike resembles 1260; 2019 hits are primarily 1254
- Water column
  - 1248 is the most prominent component, non-Aroclor sources about 10%
  - Mass balance across Mission Reach inconclusive, but shows potential for load
  - Chlorination levels increase downstream of the Mission Reach, presumably reflecting inputs

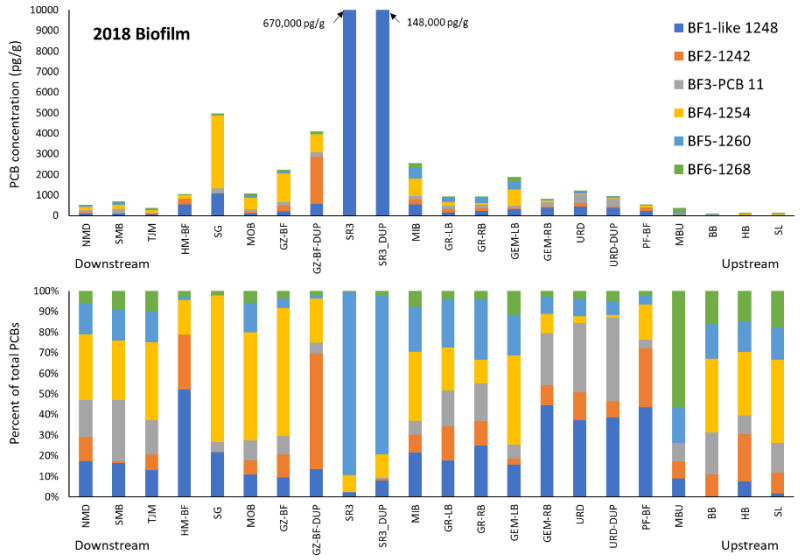
PMF: Fish

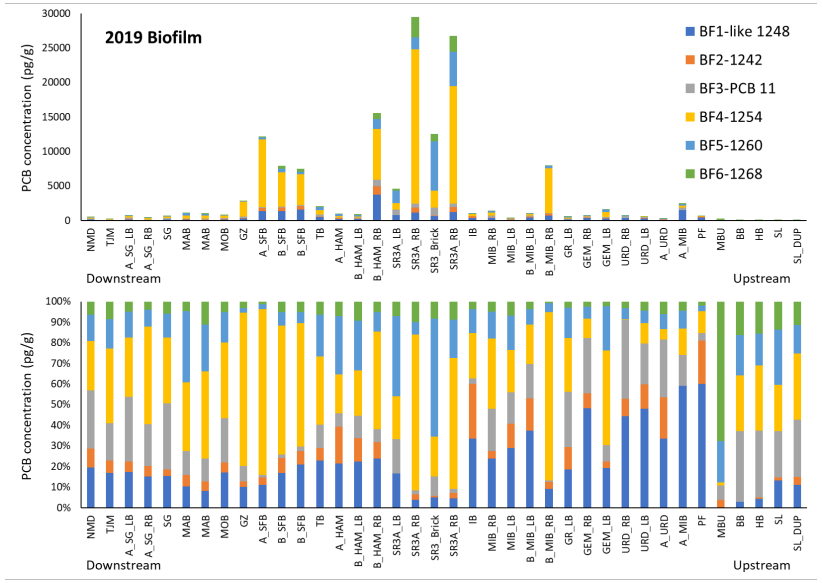


PCB burden is shifting toward lower MW PCBs and generally declining over time

PMF: Biofilm

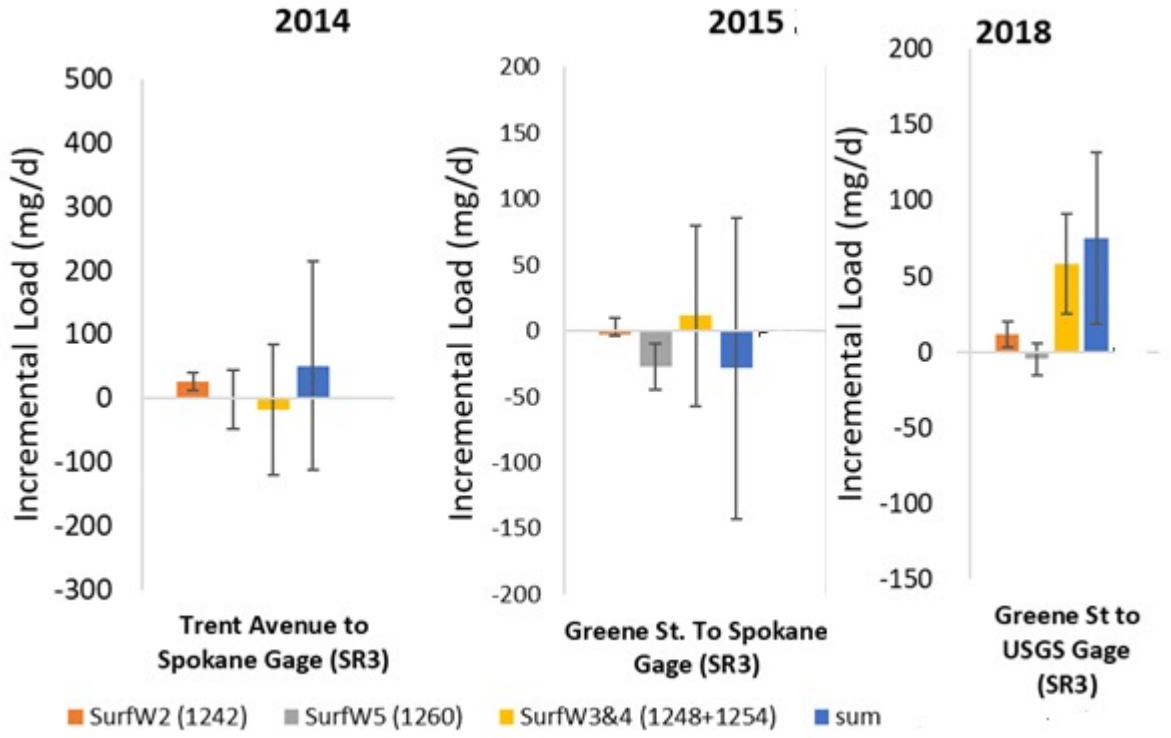
- Lower concentration biofilm samples (less than 1,000 pg/g) have very different relative abundance of factors from the high concentration biofilm samples.
  - 2018 spike resembles 1260; 2019 hits are primarily 1254





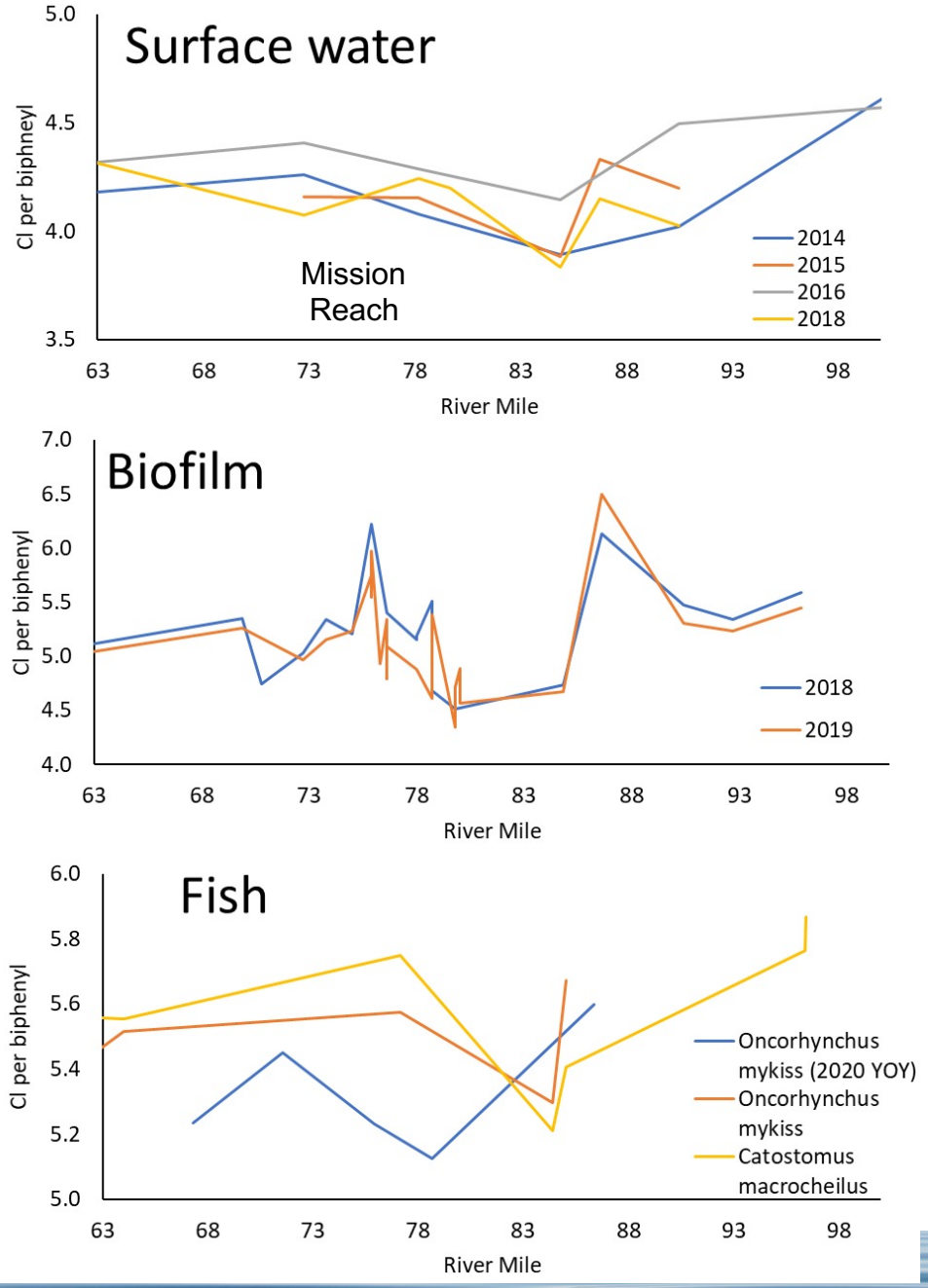
PMF: Water Column

- Mass balance across Mission Reach suggests apparent loading of (1254+1248) in 2018, inconclusive in 2014 and 2015



Water Column

- Chlorination levels increase around RM 75, presumably reflecting inputs from the Mission Reach hotspot

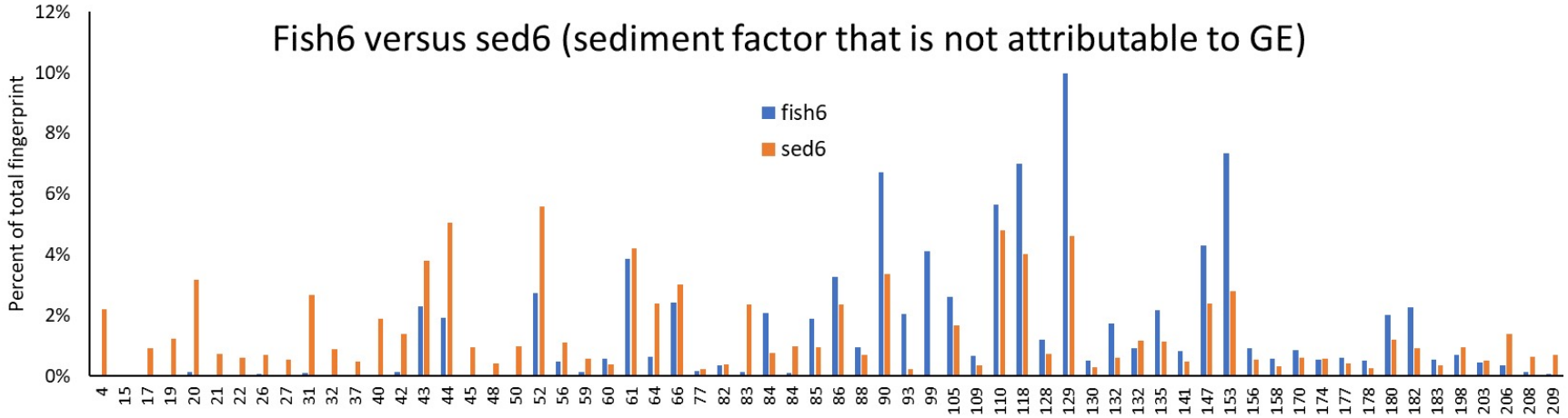


Comparisons to other systems

- Levels of PCBs in stormwater and CSOs in Spokane are about the same as other urban areas.
- Therefore, lower conc in surface water in Spokane is due to:
  - Lower population density
  - Better source control (newer WWTPs, fewer CSOs, etc.)
  - Less sediment
- Physical characteristics of the Spokane River are different:
  - Little or no sediment means no big reservoir of PCBs to buffer concentrations
  - Might mean faster response times to changes in loads
- Contaminated sites are important in most systems, including Spokane River
- Levels of non-Aroclor PCBs in the Spokane River are similar to other waterways

Upper Hudson River

- A high MW fingerprint in the fish of the UHR seems to match a fingerprint in the sediment:



- BUT:
  - This factor is <2% in the sediment but 13% in the fish
  - There is no spatial correlation between the two
- Maybe this shows the importance of ‘ephemeral’ PCBs?????

Conclusions – data collection

- A lot of very high-quality data have been collected
- More data are needed to see long-term time trends in water and fish
  - Blank problems in water are only going to get worse if PCB concentrations decline
- SPMDs are not very useful for source identification, but they might be good for measuring long-term declines in the water column
- Biofilm is very useful for identifying source areas and characterizing the river as a whole
- Volatilization/Atm Deposition may be data gaps
  - These affect low MW congeners most, which are not in fish

Conclusions – PCB sources

- Water column is about 90% Aroclors, 10% non-Aroclor, mostly PCB 11
- PCBs in fish are virtually entirely from Aroclors, PCB 11 usually BDL
- Kaiser GW is significant
- There are source(s) around Mission Reach that do seem to be meaningful contributors to the water column and fish
- There are diffuse sources that are hard to find/quantify/shut down
- IEP influent and effluent are primarily Aroclor 1242 with some PCB 11
  - Indicates that A1242 from carbonless copy paper is still circulating in the recycled paper stream