

Spokane River PCBs in Biofilm, Sediment and Invertebrates, 2018 and 2019 Screening Study Results

*(Presentation to SRRTTF Technical Workgroup
on Final Report Findings)*

Brandee Era-Miller

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DEPARTMENT OF
ECOLOGY
State of Washington

Spokane River PCBs in Biofilm, Sediment, and Invertebrates, 2018 and 2019

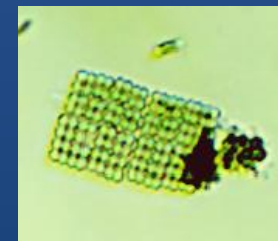
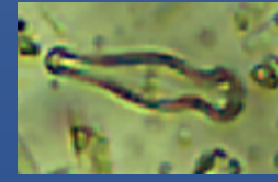
Screening Study Results



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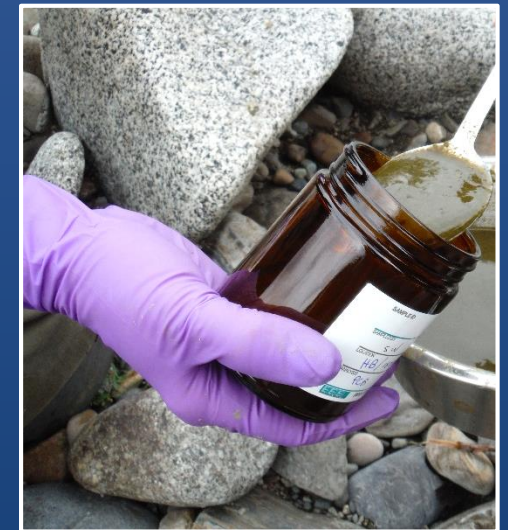
Review - Biofilms

- Complex, diverse assemblages of algae, microbes, fine sediments
- Attached to each other and surfaces via secretion of mucilage
- Base of aquatic food webs
- Can act as natural passive samplers

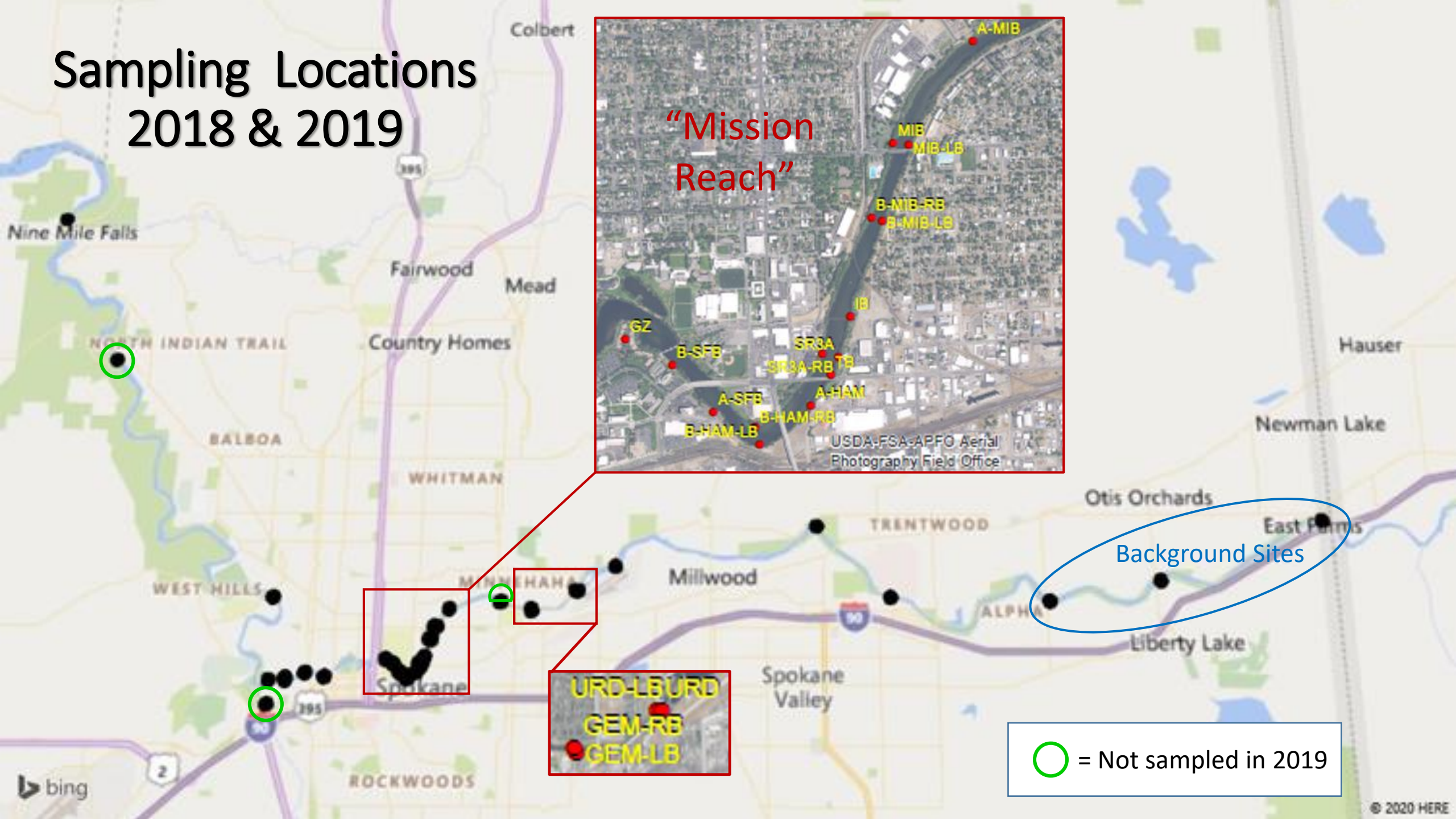


Review - Methods

- **19** Biofilm sites in 2018
- **33** Biofilm sites in 2019 -- *Most (16) of the 2018 sites with more focused efforts on suspected hot spots.*
- Compositing scrapings of slime from cobble-sized rocks into certified clean jars.
- Sediments – 3 locations (2018)
- Caddisflies – 2 locations (2018)
- SGS AXYS Laboratory
- EPA Method 1668C
- Inclusion of NJ-qualified results and 3x MB censoring



Sampling Locations 2018 & 2019



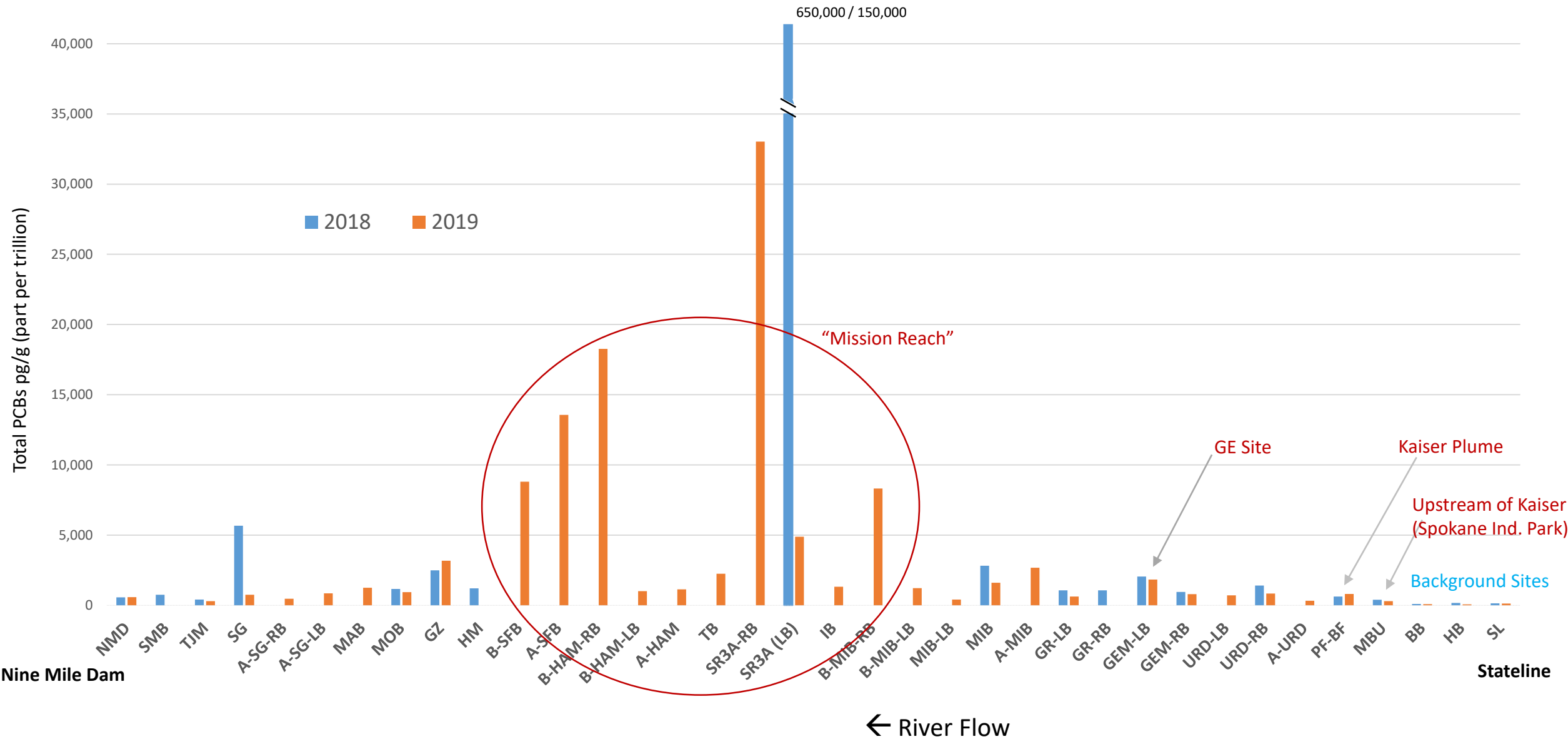
"Mission Reach"

Background Sites

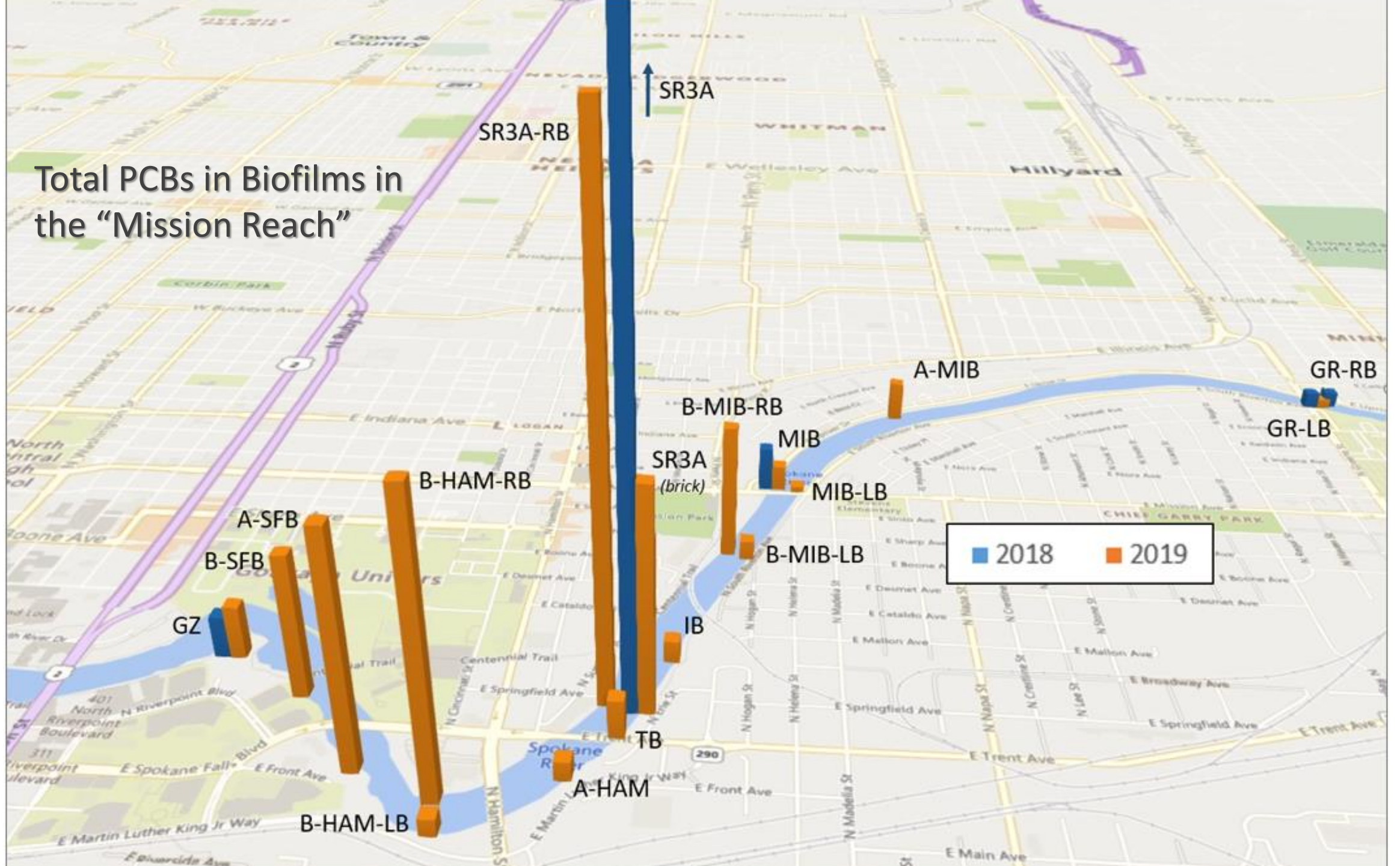
○ = Not sampled in 2019

URD-LB
URD-RB
GEM-RB
GEM-LB

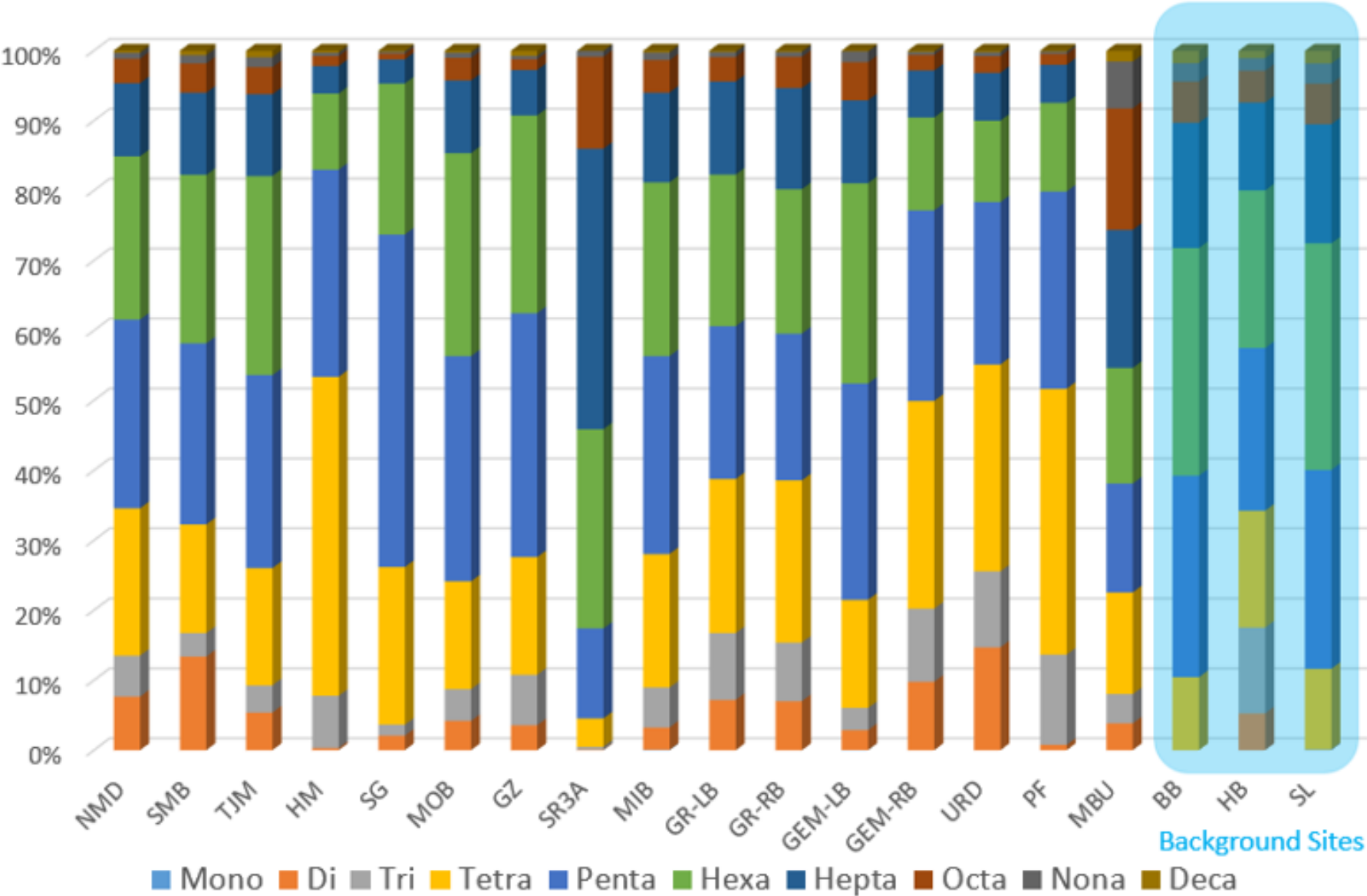
Total PCBs in Biofilms 2018 and 2019



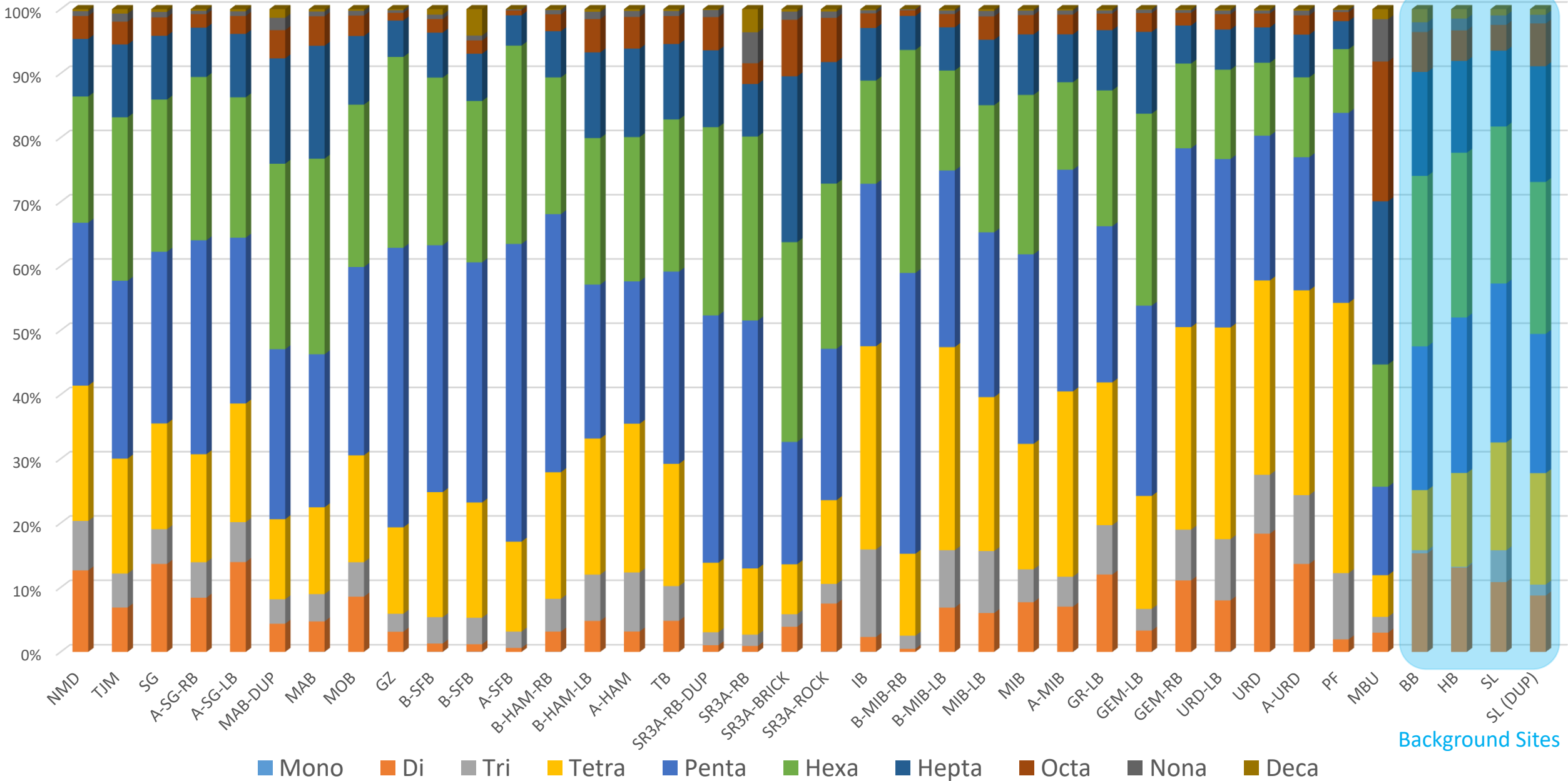
Total PCBs in Biofilms in the "Mission Reach"



Biofilm 2018 – PCB Homolog Patterns

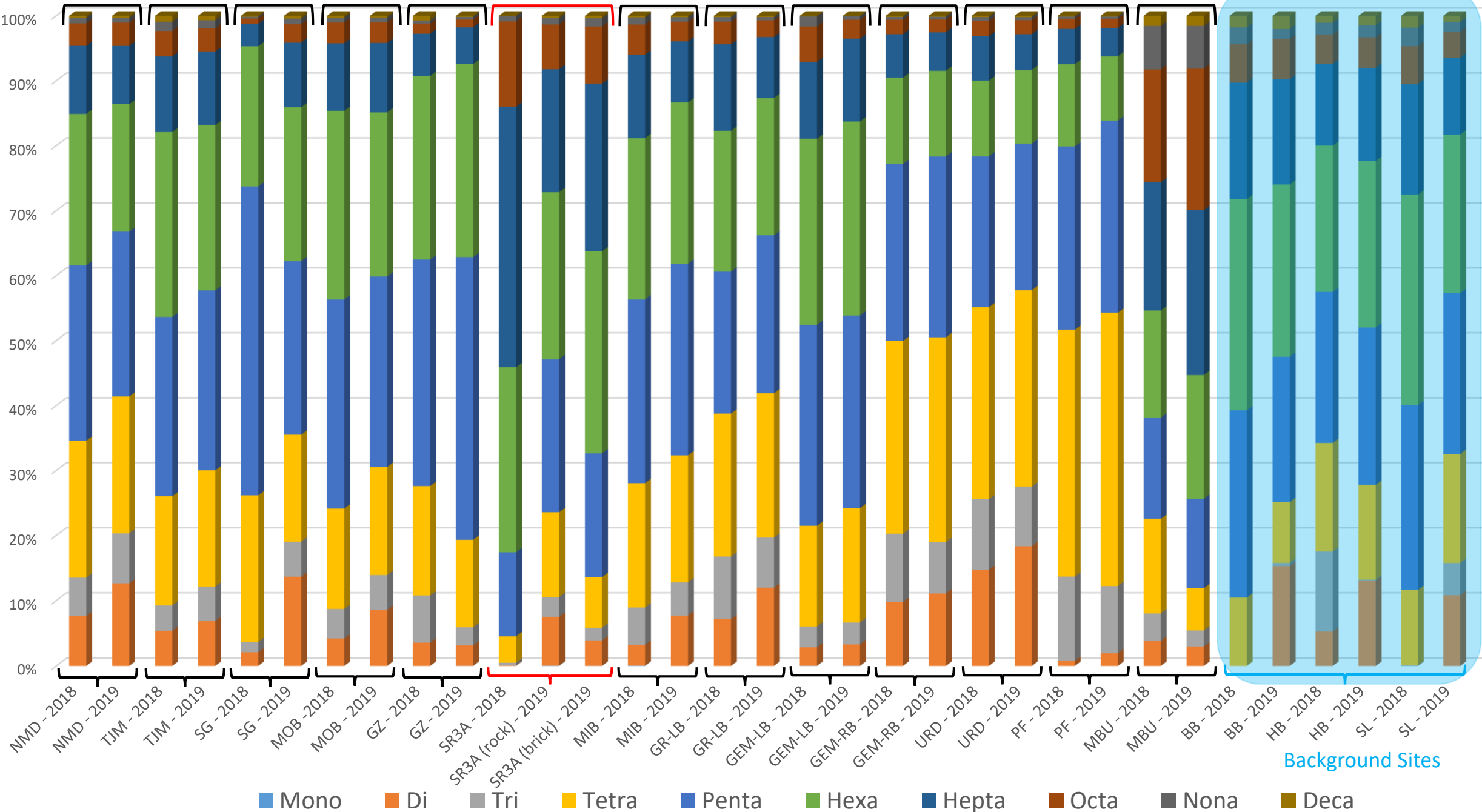


Biofilm 2019 - PCB Homologs



Background Sites

Biofilm 2018 and 2019 - PCB Homologs by Same Location



Background Sites

Principal Component Analysis – 2018 & 2019

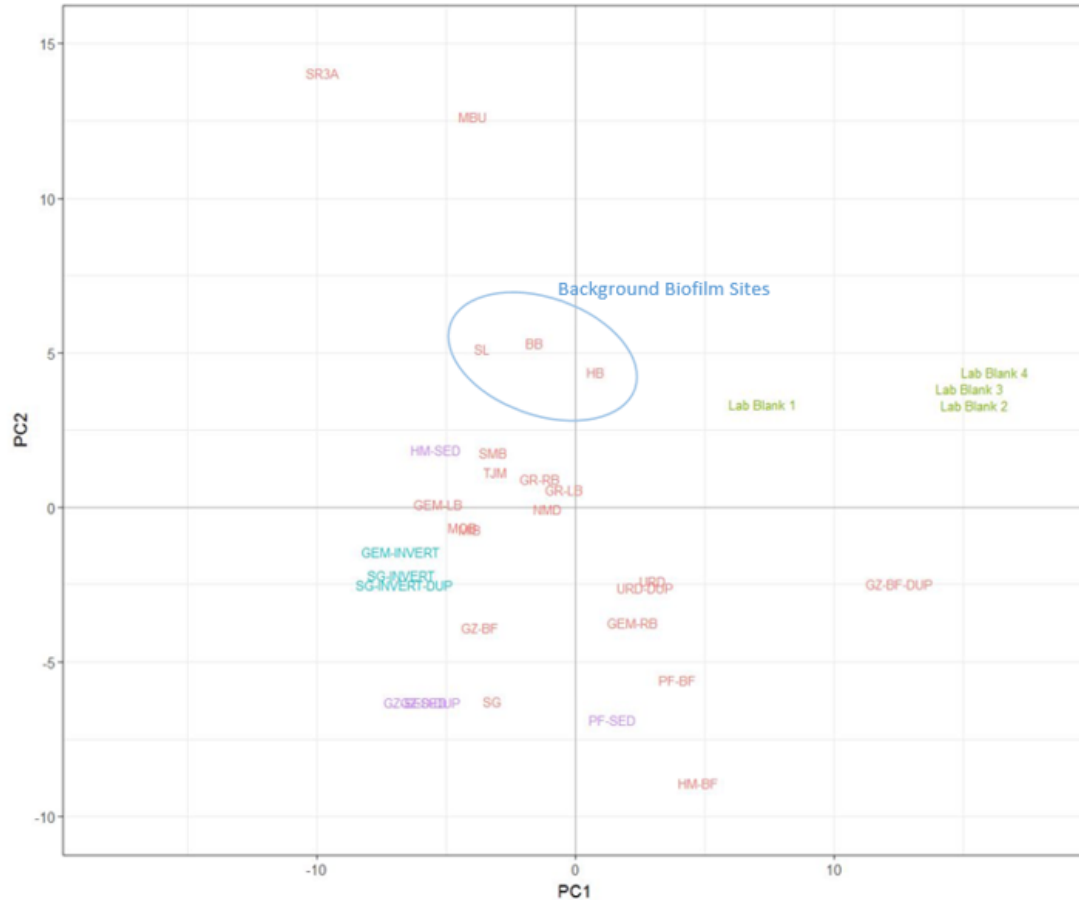


Figure 16. PCA of 2018 PCB Congener Data for Biofilm, Invertebrates, and Sediment.

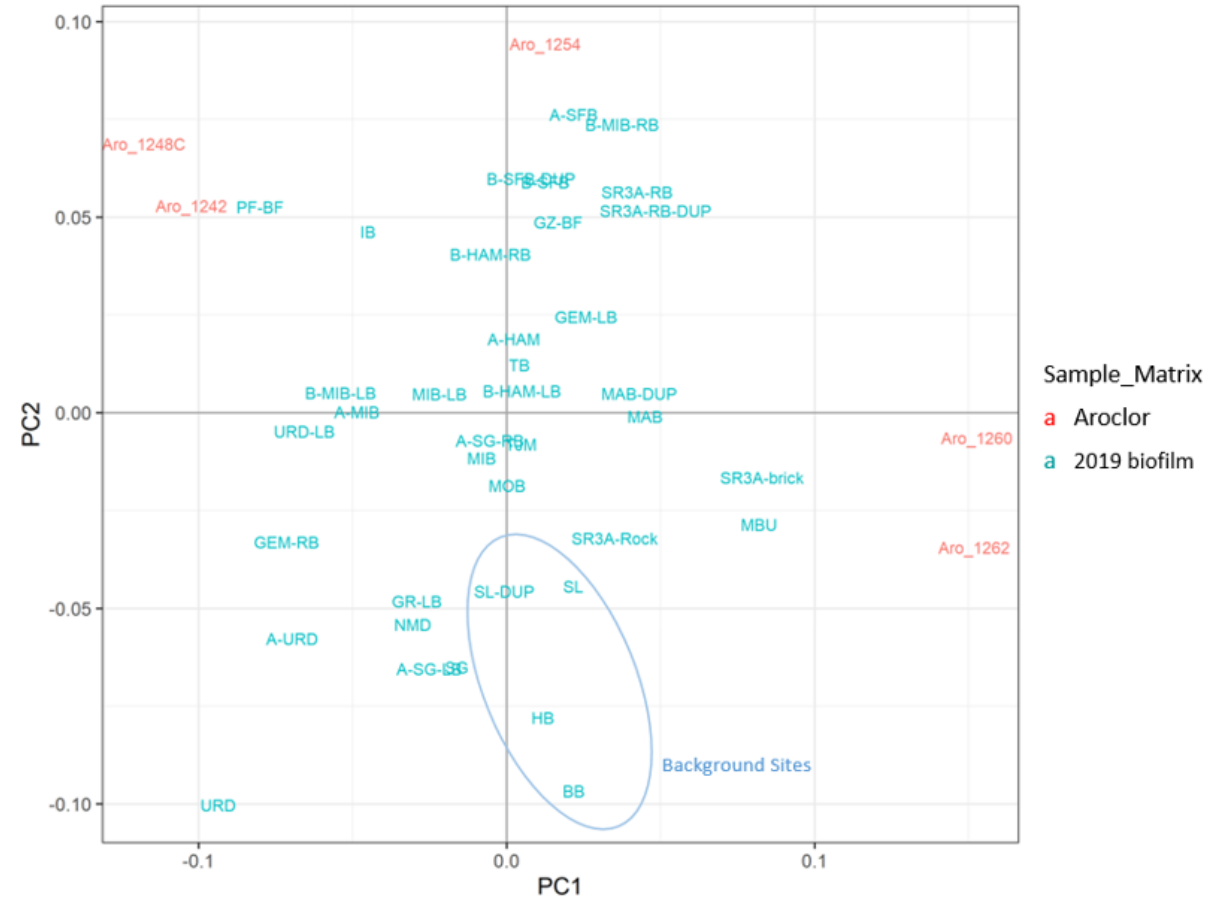


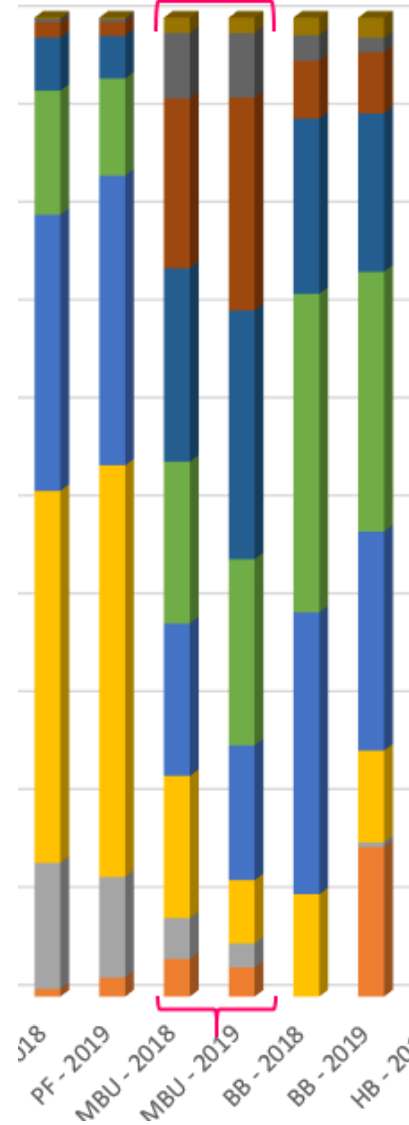
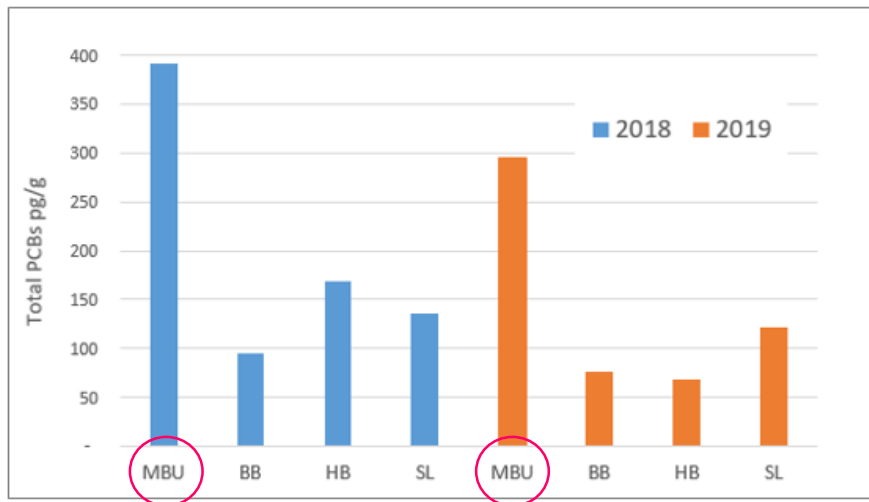
Figure 17. PCA Showing Similarities in Congener Patterns between 2019 Biofilm and Aroclors.

“Source Areas” (*Confirmed & Suspected*)

- Mirabeau
- Plantes Ferry
- Upriver Dam
- General Electric (GE)
- East Mission Ave Bridge
- Mission Reach
- Hangman Creek
- Spokane Gage

Mirabeau Source Area (*confirmed*)

- 2-4x >background sites
- Consistent pattern both years
- Higher % Hepta, Octa, and Nona
- Separate from adjacent sites in PCA
- *Estimated by others to have relatively “small” PCB load to river compared to Plantes Ferry*

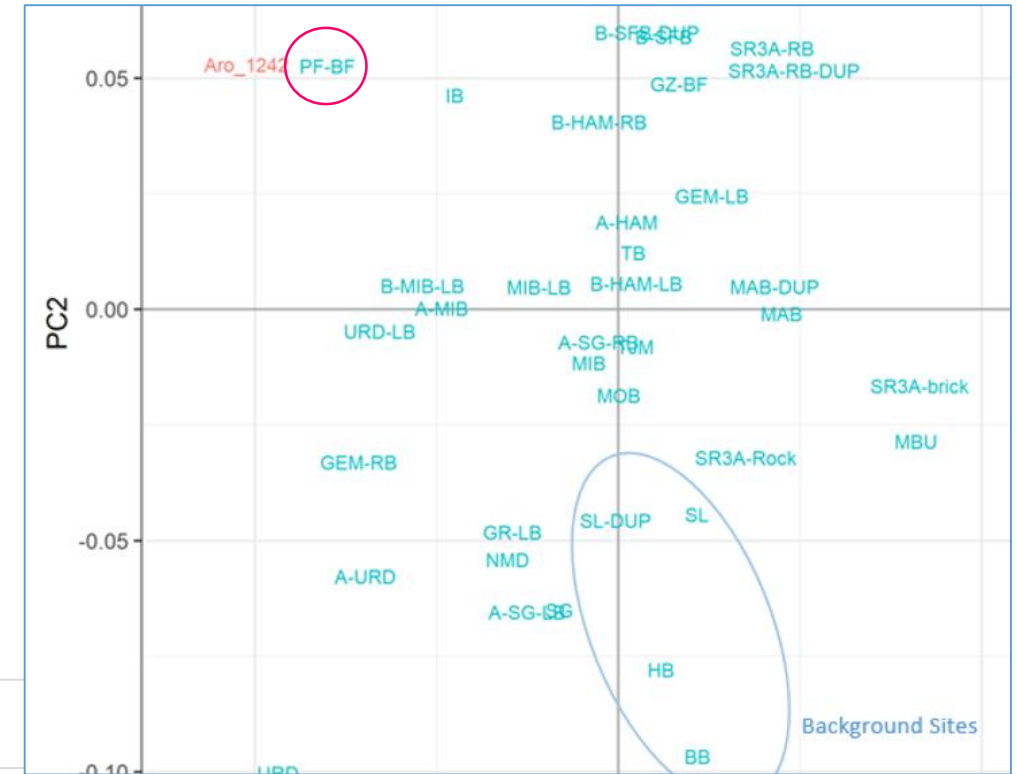
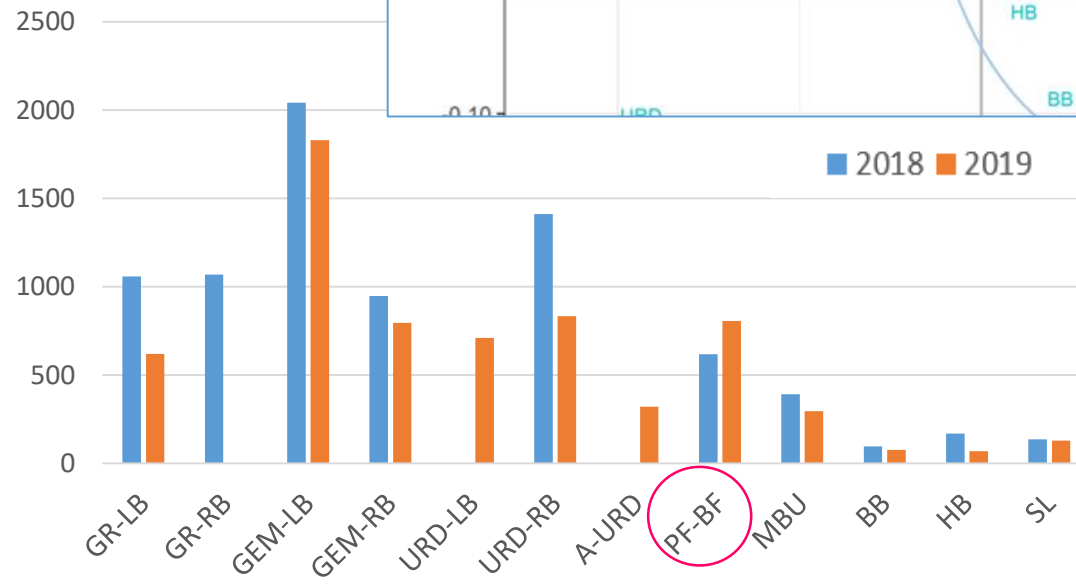
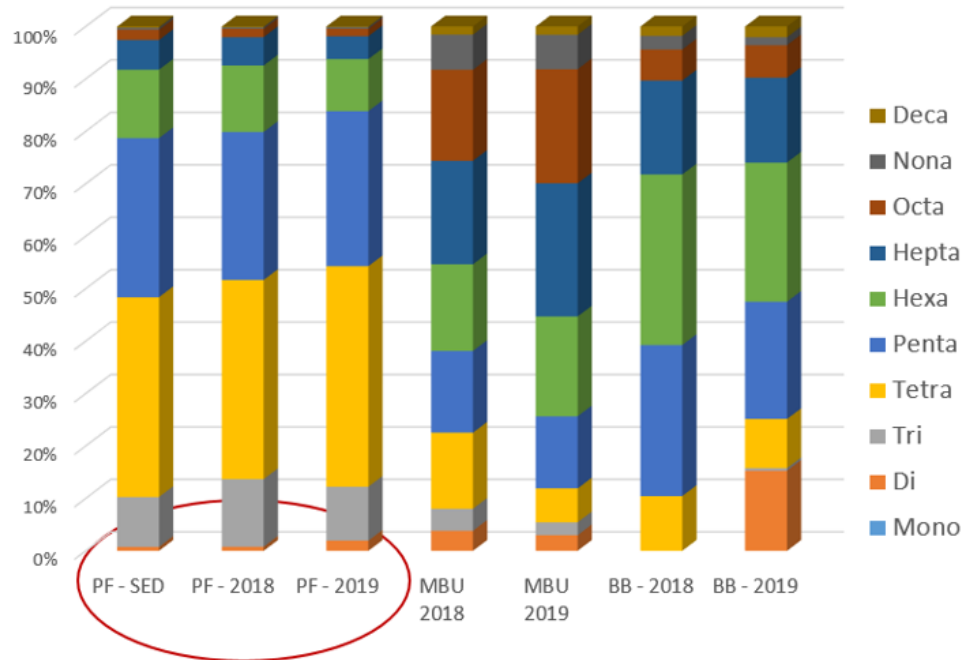


2019 biofilm

Plantes Ferry Source Area (*confirmed*)

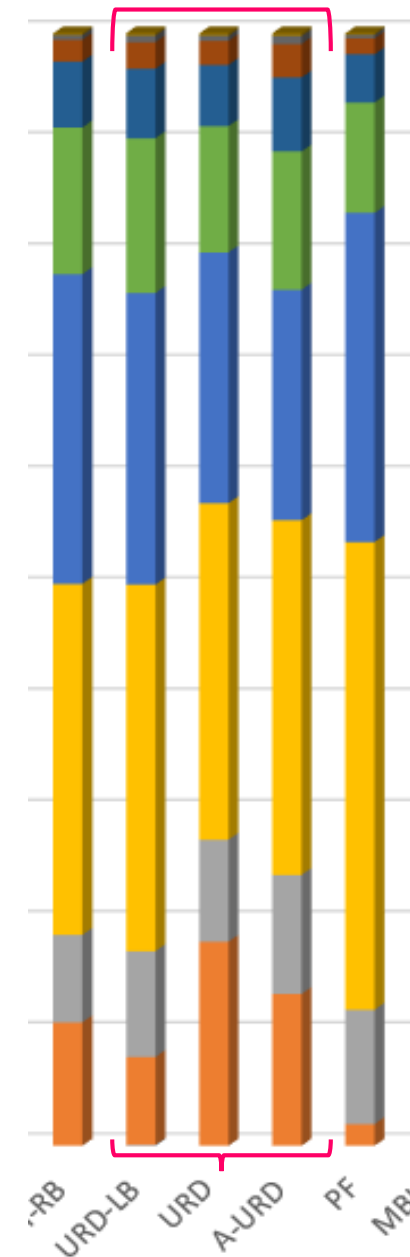
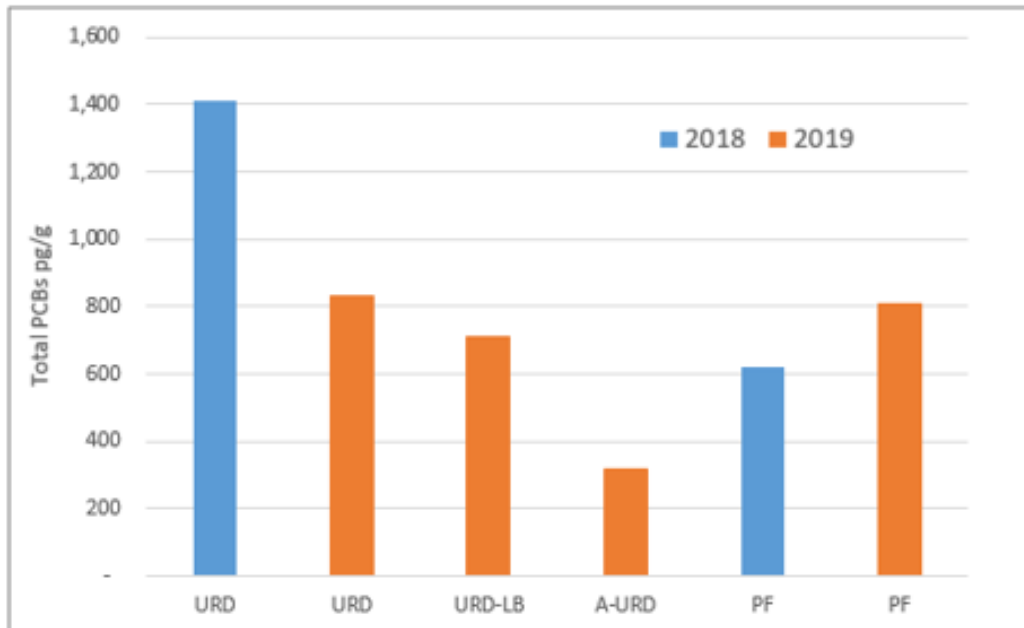
- >tPCBs compared to MBU & background sites
- Higher % Tri, Tetra, and Penta (40% tetra)
- Same pattern in biofilm both years & sediment
- Separate from adjacent monitoring sites in PCA
- Closest to Aroclor 1242 in PCA

2019 biofilm



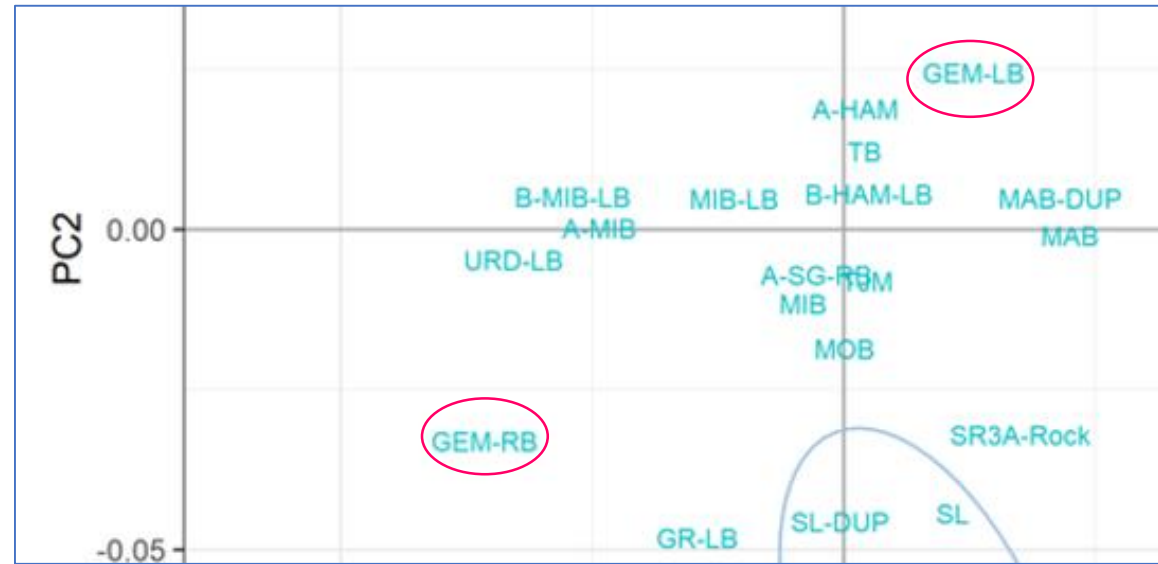
Upriver Dam Source Area (*suspected*)

- 2018 biofilm sample >PF for tPCBs
- 2019 biofilms: URD = PF for tPCBs
- No discernable homolog patterns between sites
- Some separation in PCA

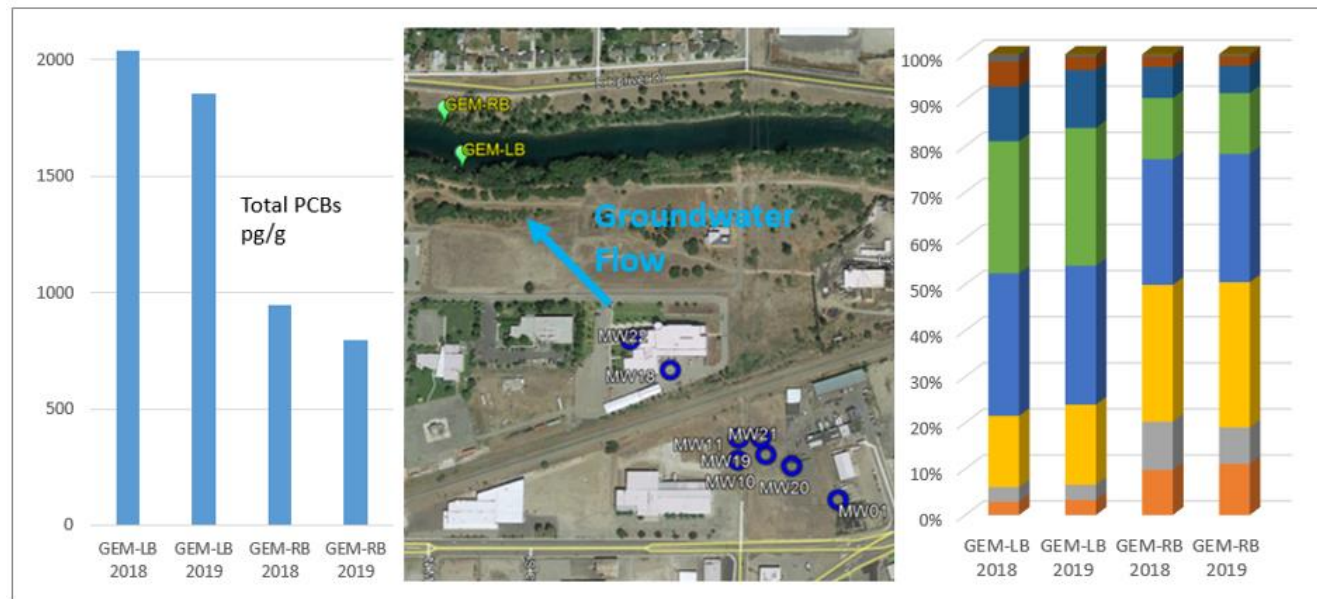


General Electric – Mission (GEM) Source Area *(confirmed)*

- Left bank 2x the tPCBs of the right bank
- Distinct homolog patterns for LB versus RB
- Separated in PCA
- Consistent pattern both years
- LB looks like mix of the GE groundwater PCB signal (Aroclor 1260) and ambient surface water (GEM-RB)

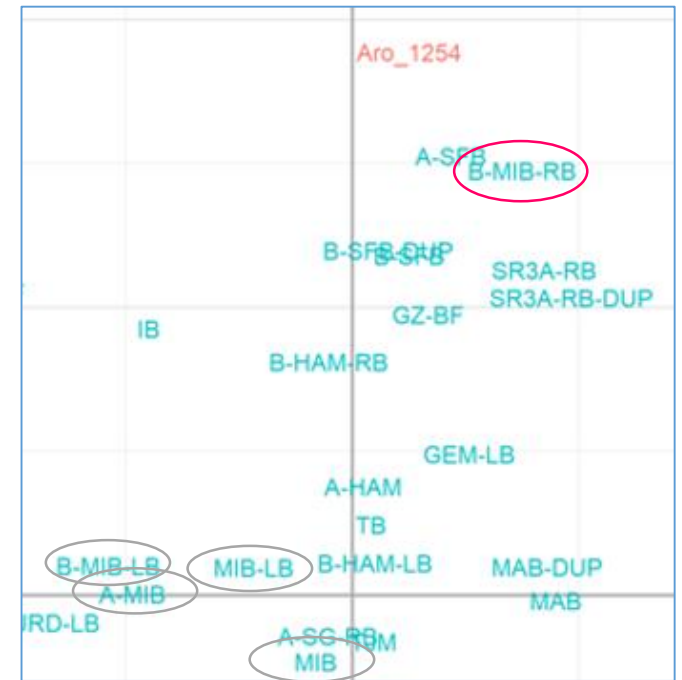


2019
biofilm

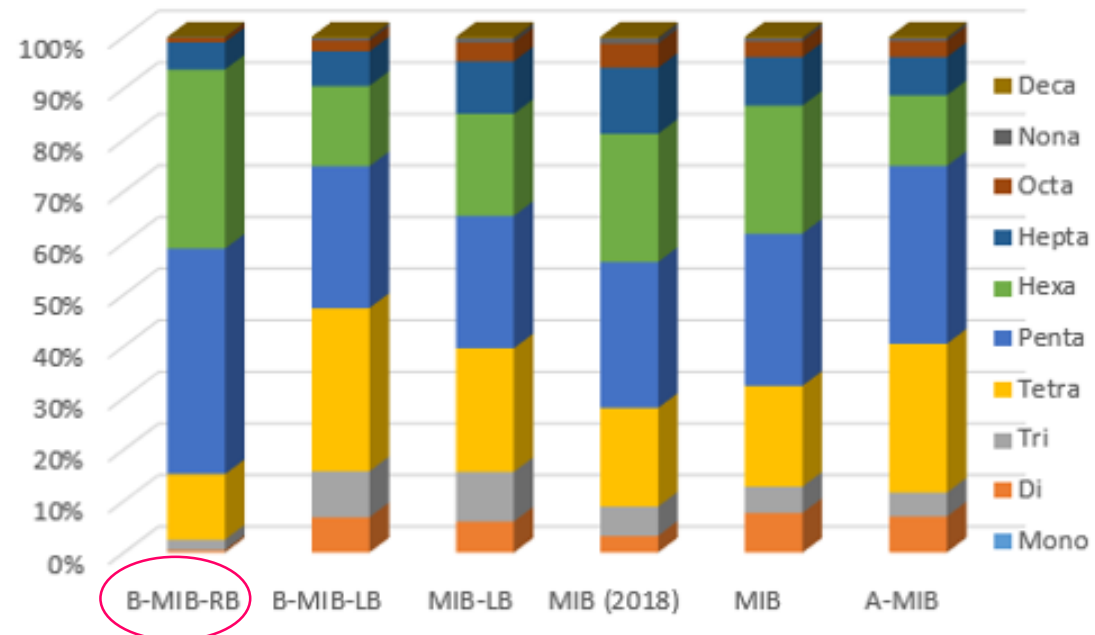
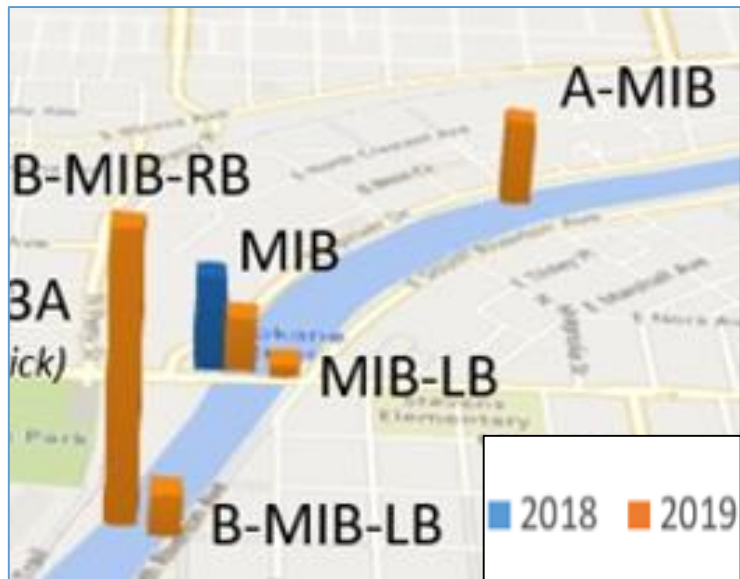


Below Mission Avenue Bridge *(confirmed)*

- 2018 biofilm had the 3rd highest tPCBs at MIB site, thus 4 sites added in 2019
- 2019 biofilm peak at B-MIB-RB
- tPCBs generally higher along right bank
- B-MIB-RB separate from adjacent sites in PCA
- B-MIB-RB close to Aroclor 1254 in PCA

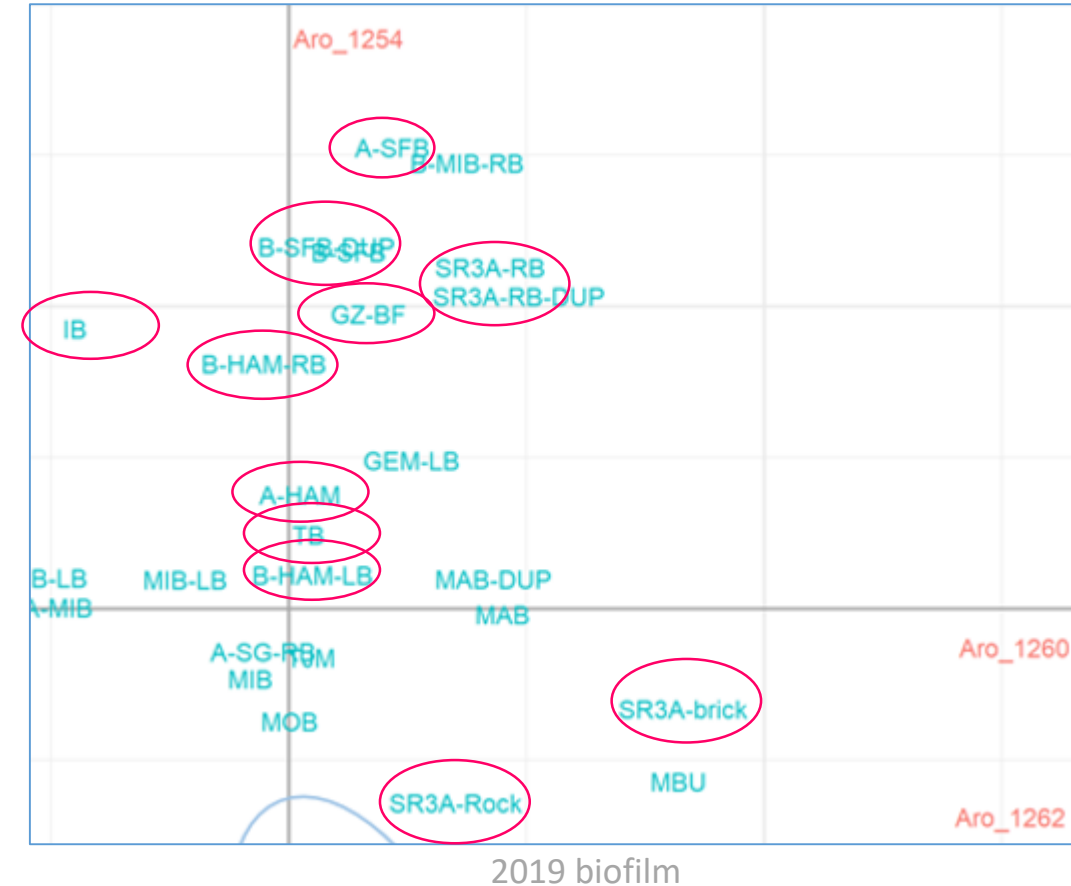
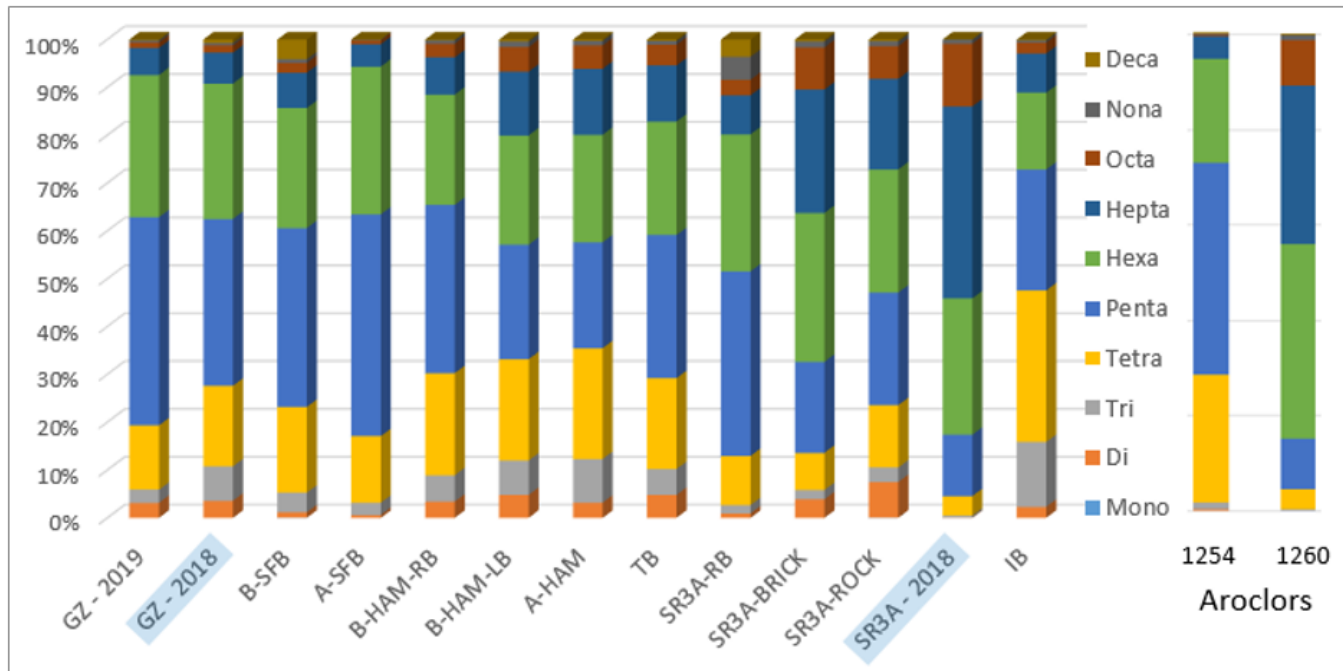


2019 biofilm



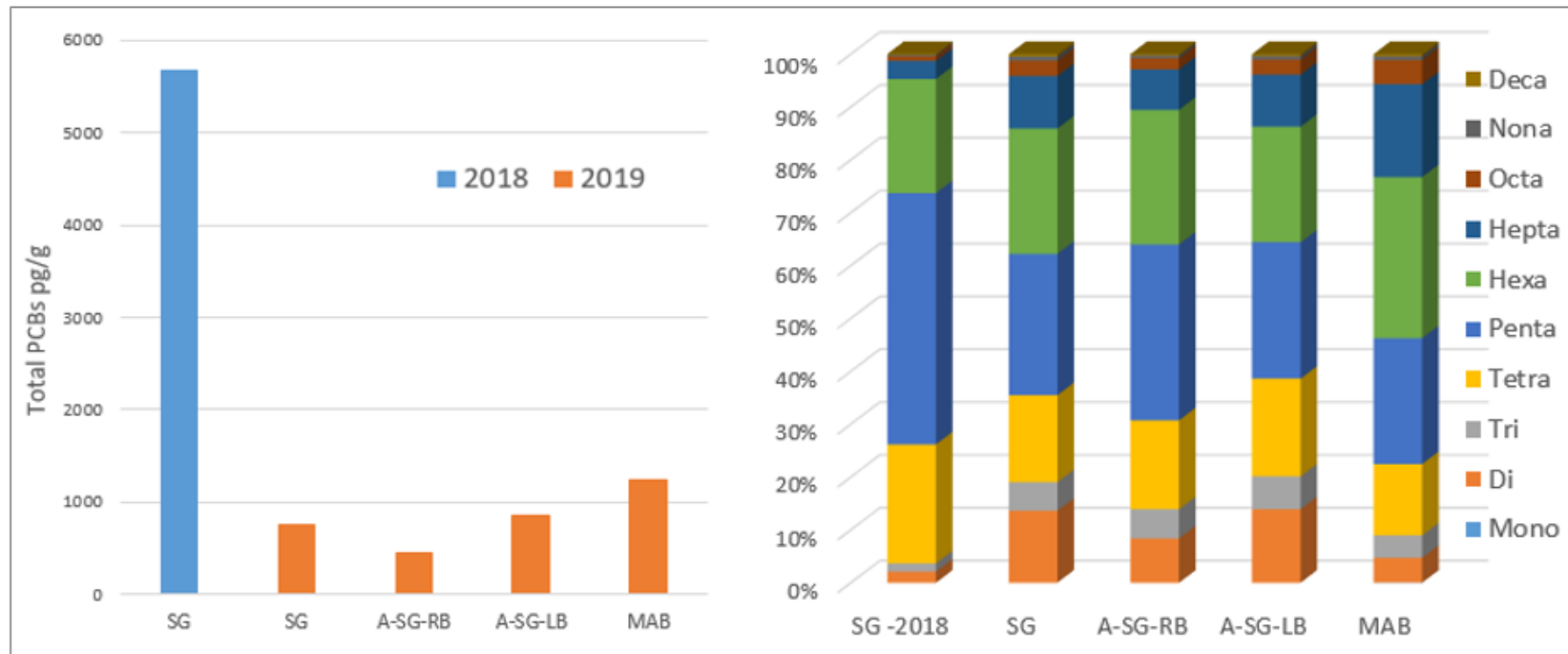
Mission Reach Source Area (*confirmed*)

- 2018 biofilm at SR3A (left bank) orders of magnitude higher than other sites, thus 8 sites added in 2019
- 2019 biofilm highest at SR3A-RB (right bank)
- SR3A-RB closer to Aroclor 1254 in PCA (*maybe some Aroclor 1268 also*)
- SR3A (2018) and SR3A-rock/brick (2019) [*all left bank sites*] appear most like Aroclor 1260



Spokane Gage (SG) Source Area (*suspected*)

- 2018 biofilm had the 2nd highest tPCBs at SG site, thus 3 sites added in 2019
- 2019 biofilms: No discernable homolog patterns between sites
- Some separation in PCA...

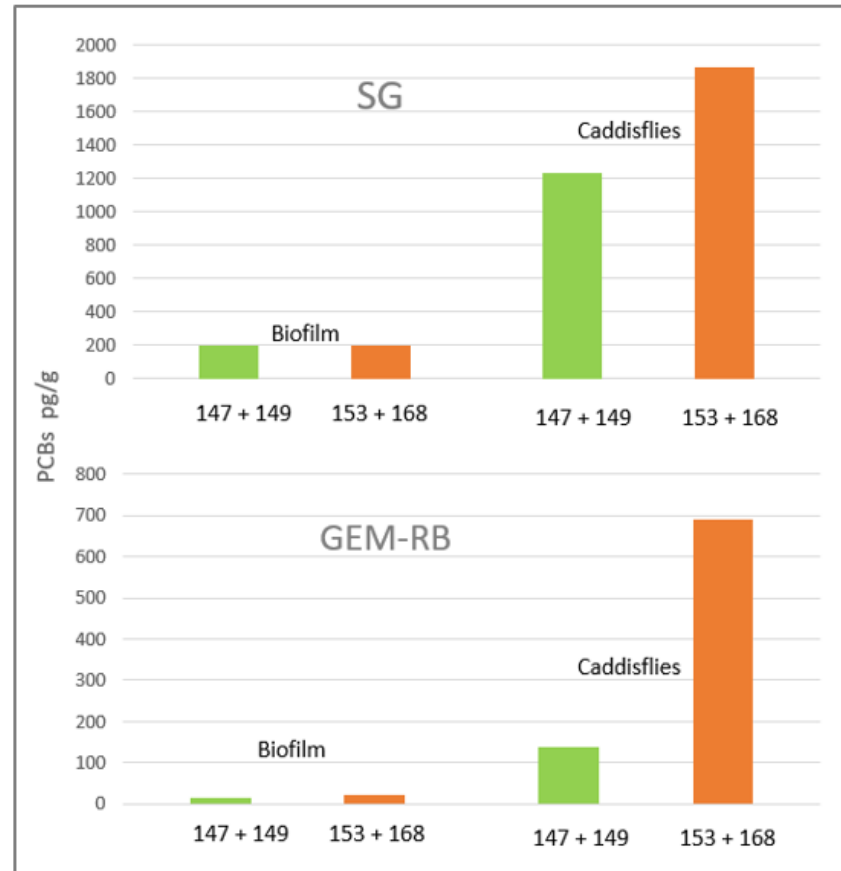
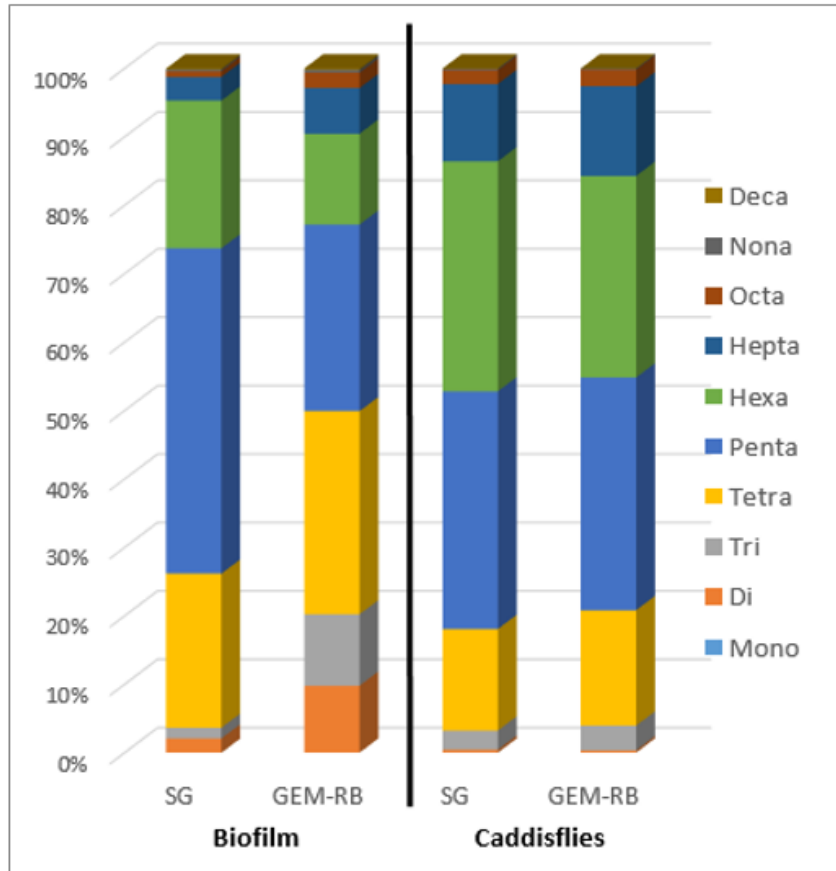


Source Areas – Recommendations for Follow-up

- **Mission Reach:** **High Priority.** Additional study underway.
- **B-MIB-RB:** **Moderate priority.** Higher density biofilm monitoring recommended. The 100 – 125-foot distance between sampling locations could be used since it is at the upstream boundary of the Mission Reach.
- **GEM-LB:** **Moderate priority.** A groundwater load assessment using piezometers would help determine if the groundwater load was large enough to justify additional cleanup at the site or if natural attenuation is most practical.
- **Mirabeau:** **Moderate priority.** Follow-up actions such as sampling at the Spokane Industrial Park should be considered and prioritized compared to other source areas.
- **Upriver Dam:** **Low priority.** Higher density biofilm monitoring below Upriver Dam.
- **Hangman Creek:** **Low priority.** Stormwater source tracing.
- **Spokane Gage:** **Low priority.** Higher density biofilm monitoring near SG along with desk research into possible sources such as stormwater.
- **Plantes Ferry:** **No additional work recommended at this time.**

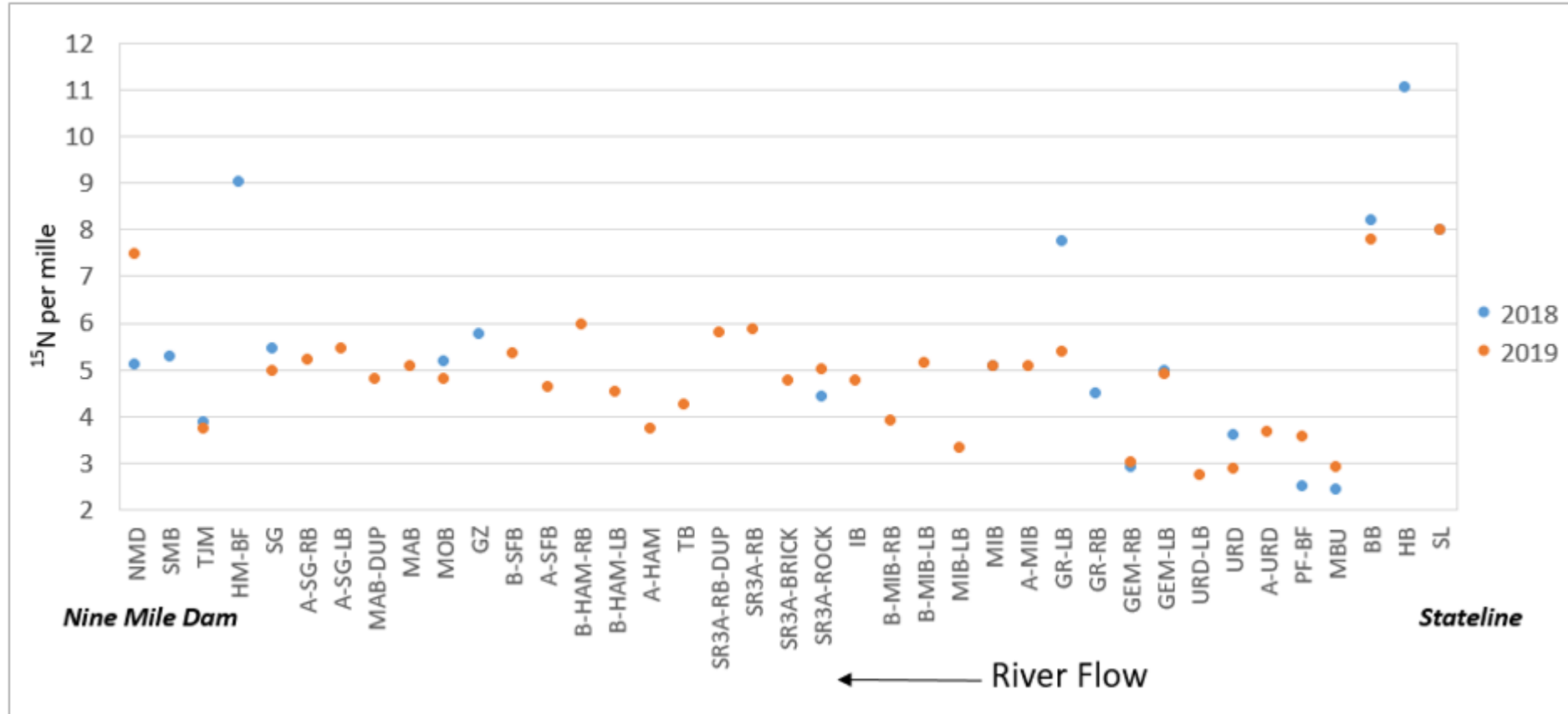
Other Results...

Homolog patterns and metabolism of PCBs in Caddisflies versus Biofilms at the same monitoring sites...



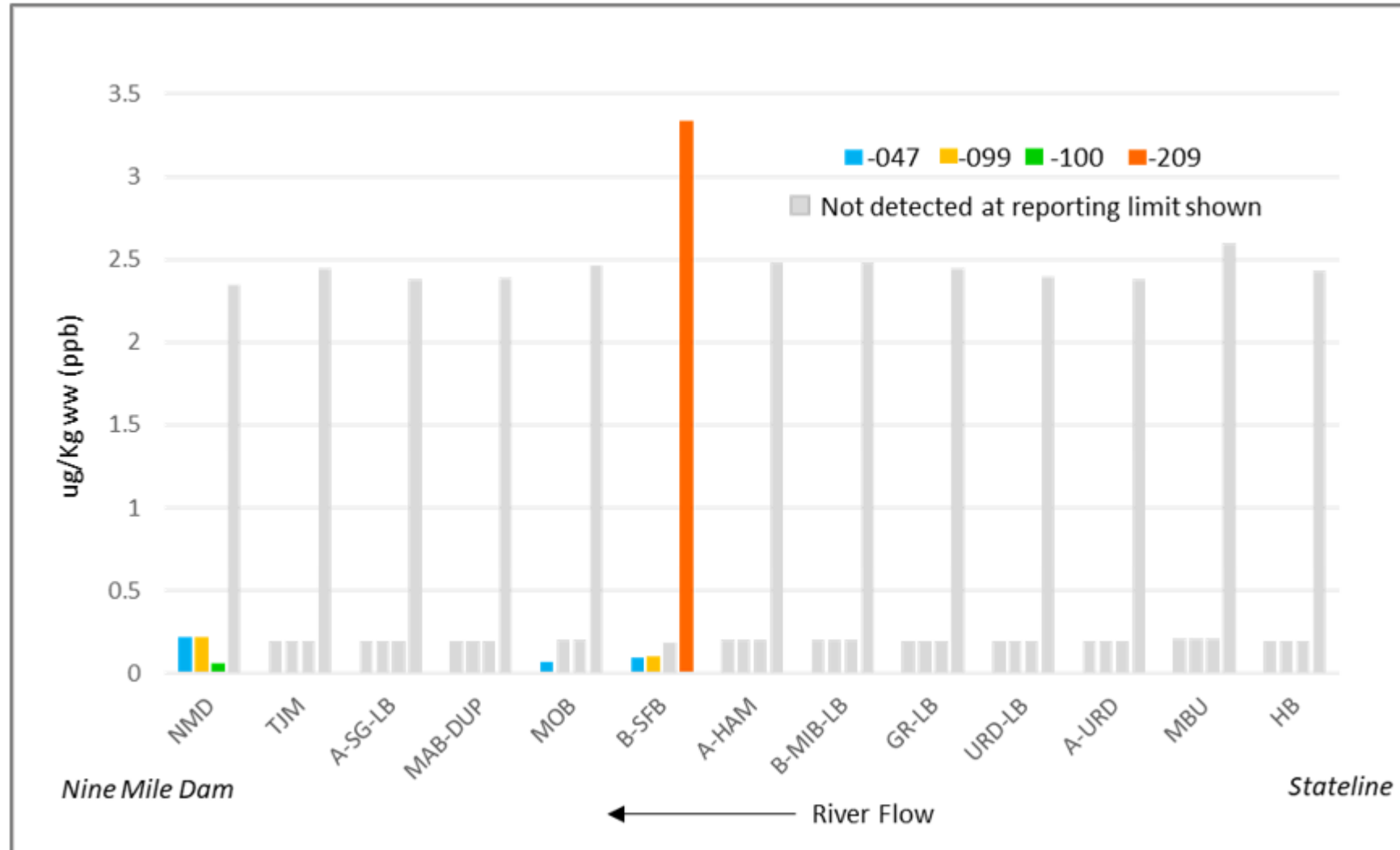
Other Results...

Using Nitrogen isotope ^{15}N to assess differences in nutrient sources and to fill data gaps for future food web studies.



Other Results...

PBDE low resolution analysis on a subset of the 2019 biofilm samples from archive. Reporting limits were too high with Method SW8270.



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Questions?

