15 YEARS OF LAKE WASHINGTON FISH TISSUE: METHODS AND CHALLENGES

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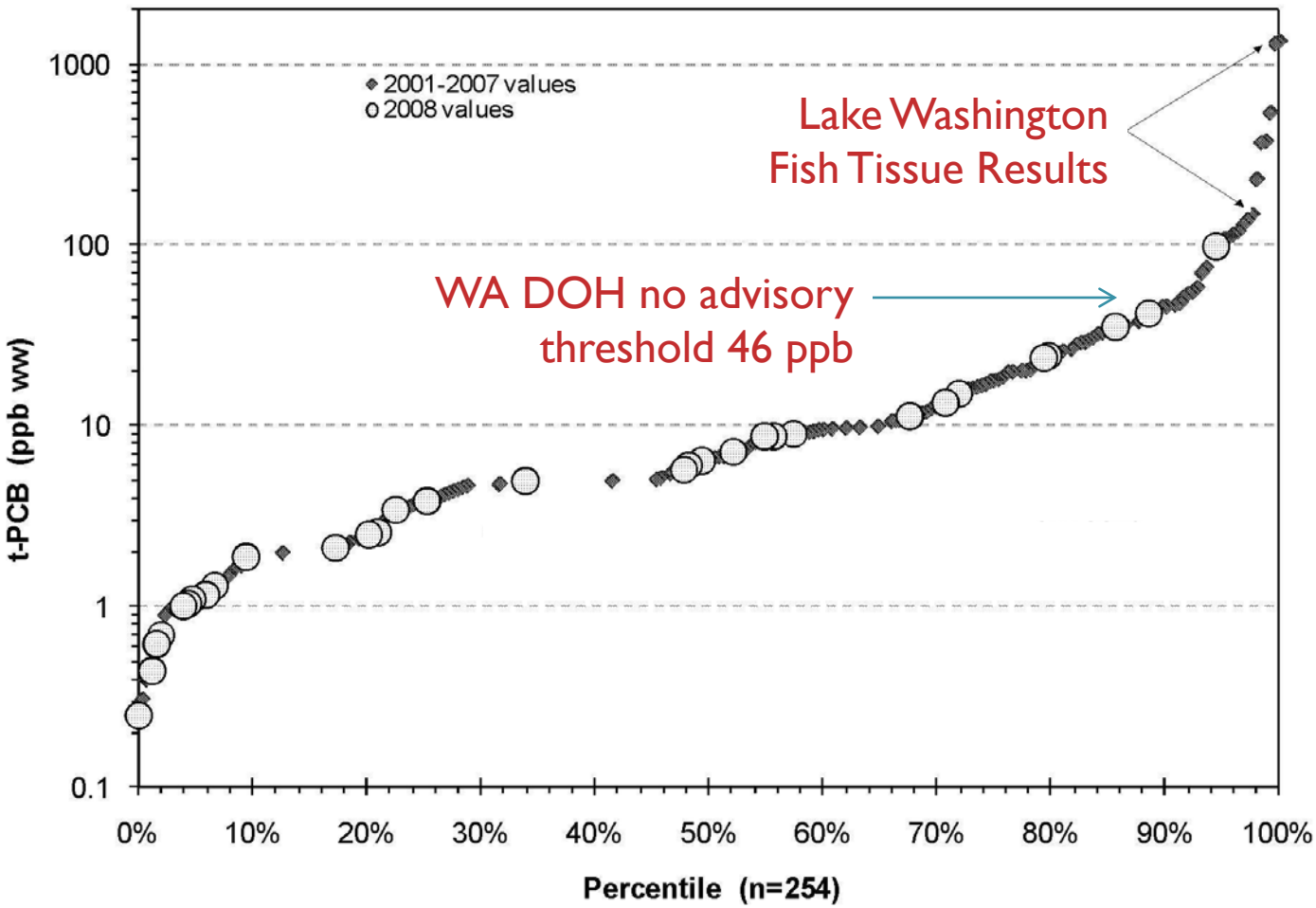
King County tissue monitoring

- 2002 sampling
  - One time graduate study of Lake food web
  - No follow-up due to funding limitations
  - Led to consumption advisory
- 2010 King County initiates tissue monitoring
  - Funding cut in recession
- 2014 King County reinitiates fresh and marine tissue monitoring
  - Freshwater program rotates through Lakes WA, Sammamish, Union and Green and Cedar Rivers.
- Purpose and goals
  - Focus BMP efforts, long term trends, document stormwater and sediment control success.

Problem: Lake Washington Fish are Contaminated



PCB Concentrations in Freshwater Fish Across Washington State

Modified from Ecology (2010)

2004 WA DOH Consumption Advisory

- Northern Pikeminnow
  - Do Not Eat
- Carp
  - Do Not Eat
- Cutthroat Trout
  - 1 meal a month
- Large yellow perch (>270mm)
  - 1 meal a week

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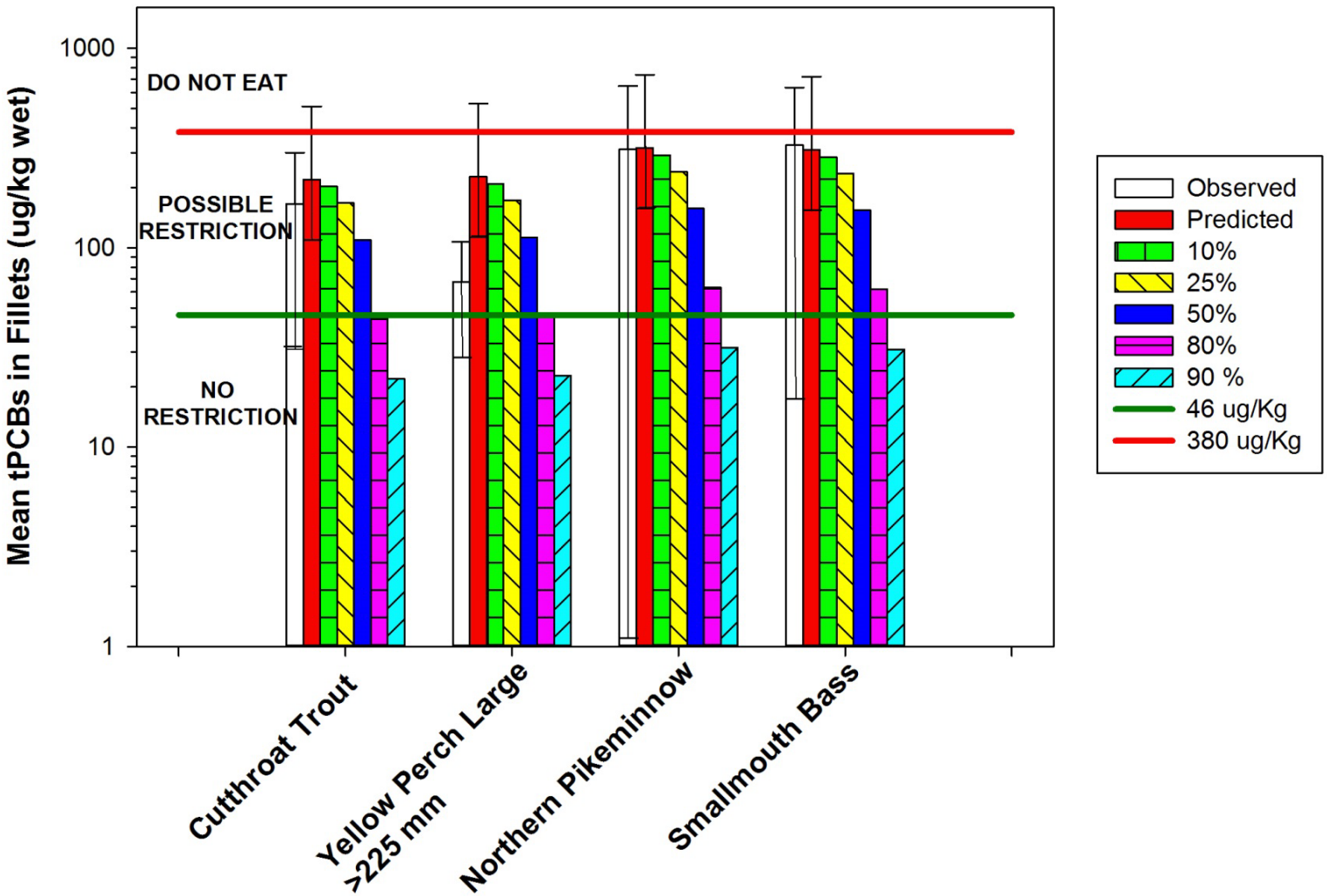
PCB Load Reduction modeling



Error bars on Observed are standard deviations on the mean. Error bars on Predicted are tissue concentrations using low and high tPCB load estimates.

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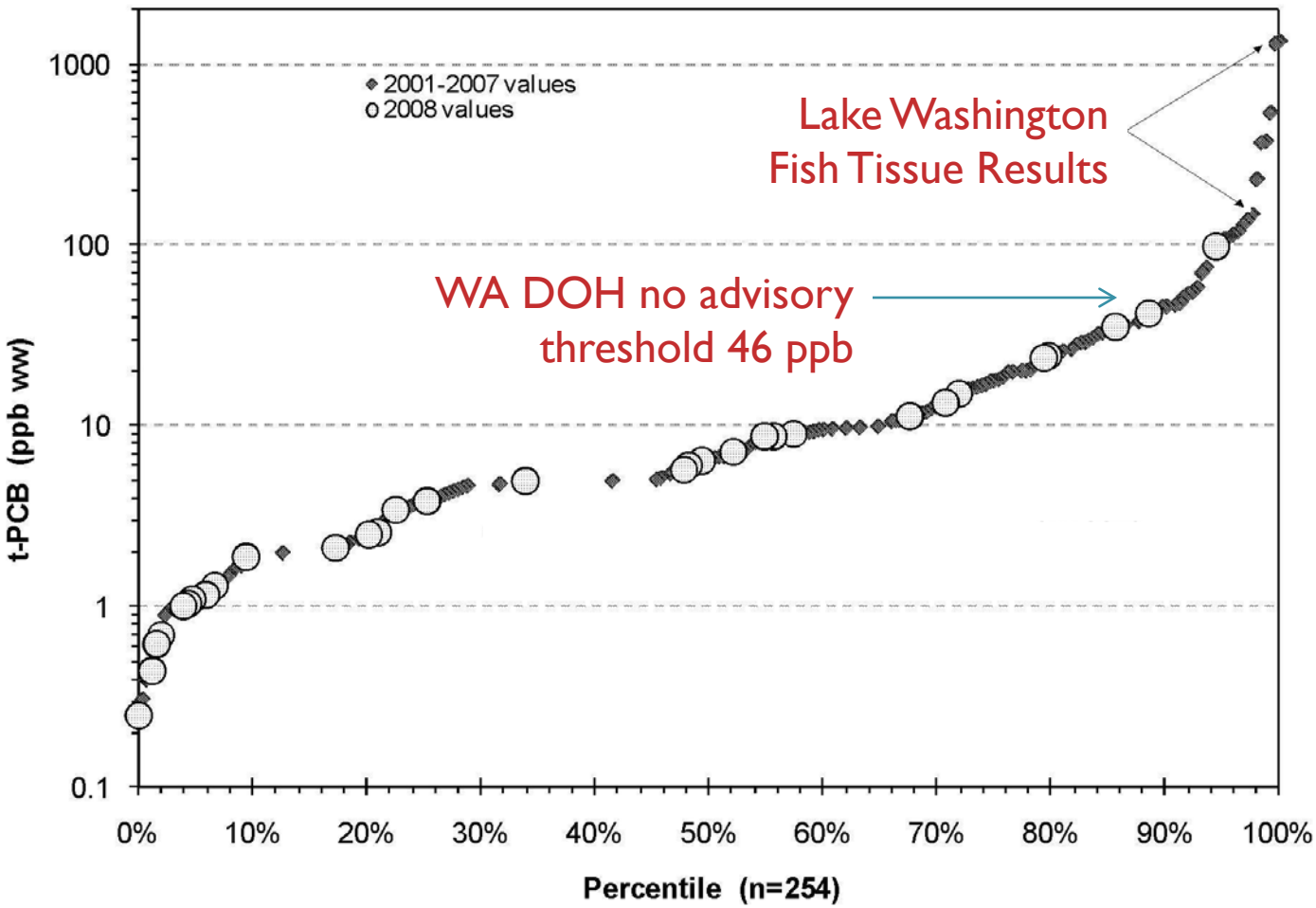

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2010 compared to 2014 sample species and types

2010 species	Sample type
Smallmouth Bass	Whole
	Fillet
Northern pikeminnow	Whole
Yellow perch	Fillet

2014 species	Sample type
Smallmouth Bass	Whole
	Fillet
	Eggs
Yellow perch	Fillet

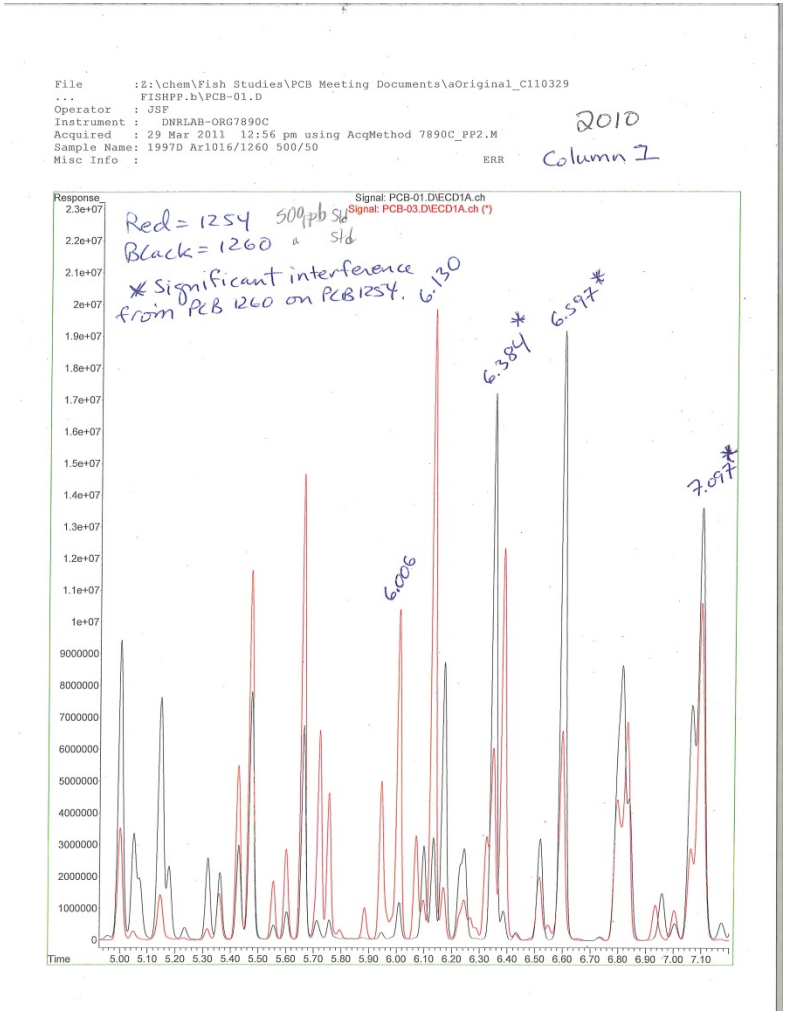
2010 vs 2014 Analysis changes

- Advances in analytical capability, changes in product availability, changes in EPA recommendations, knowledge of other new laboratory techniques may all precipitate analytical method changes
- Even though:
  - Different extraction and cleanup techniques may significantly change results
    - E.g. ability of a solvent to liberate PCBs from the tissue matrix
    - Acetone, hexane, methylene chloride choices/mixes
  - Soxhlet vs sonication
  - Silica gel cleanups

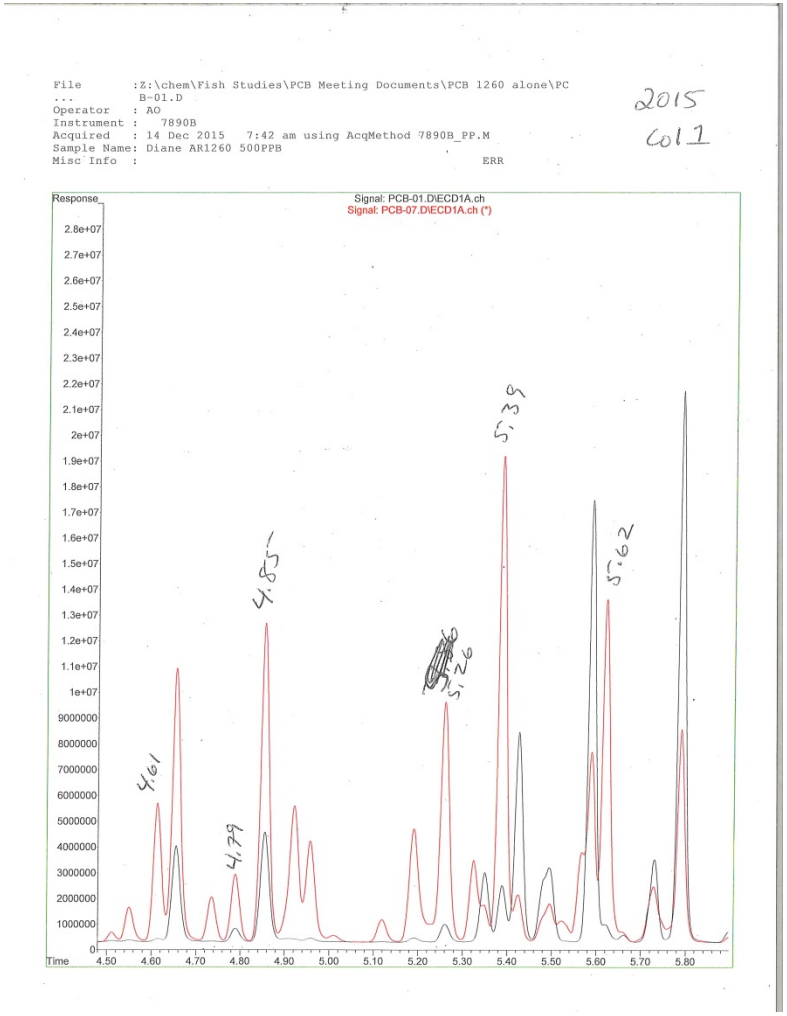
2010 vs 2014 Analysis changes

- Different extractions and cleanup may lead to different quantitation decisions
- Major changes in extraction technique
  - Sonication to Soxhlet
  - MeCL2/Acetone to Hexane/Acetone
  - Silica gel cleanup added
- Major change in Aroclor quantitation
  - Choice of chromatogram peaks
  - Excel macro development
- Addition of PCB homolog method
  - Not EPA approved for Clean Water Act

Cleanup and quantitation matters

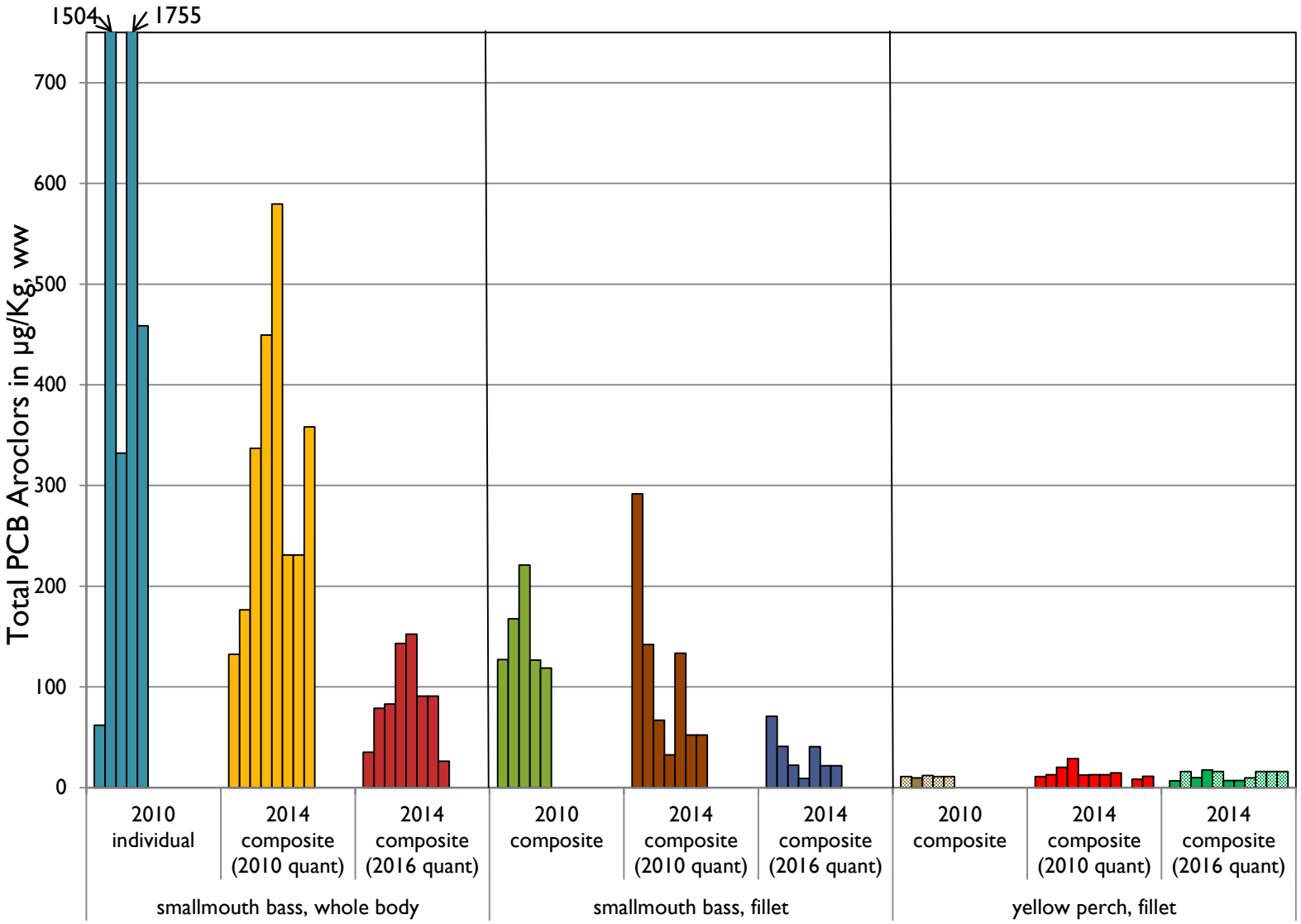


Old/no cleanup

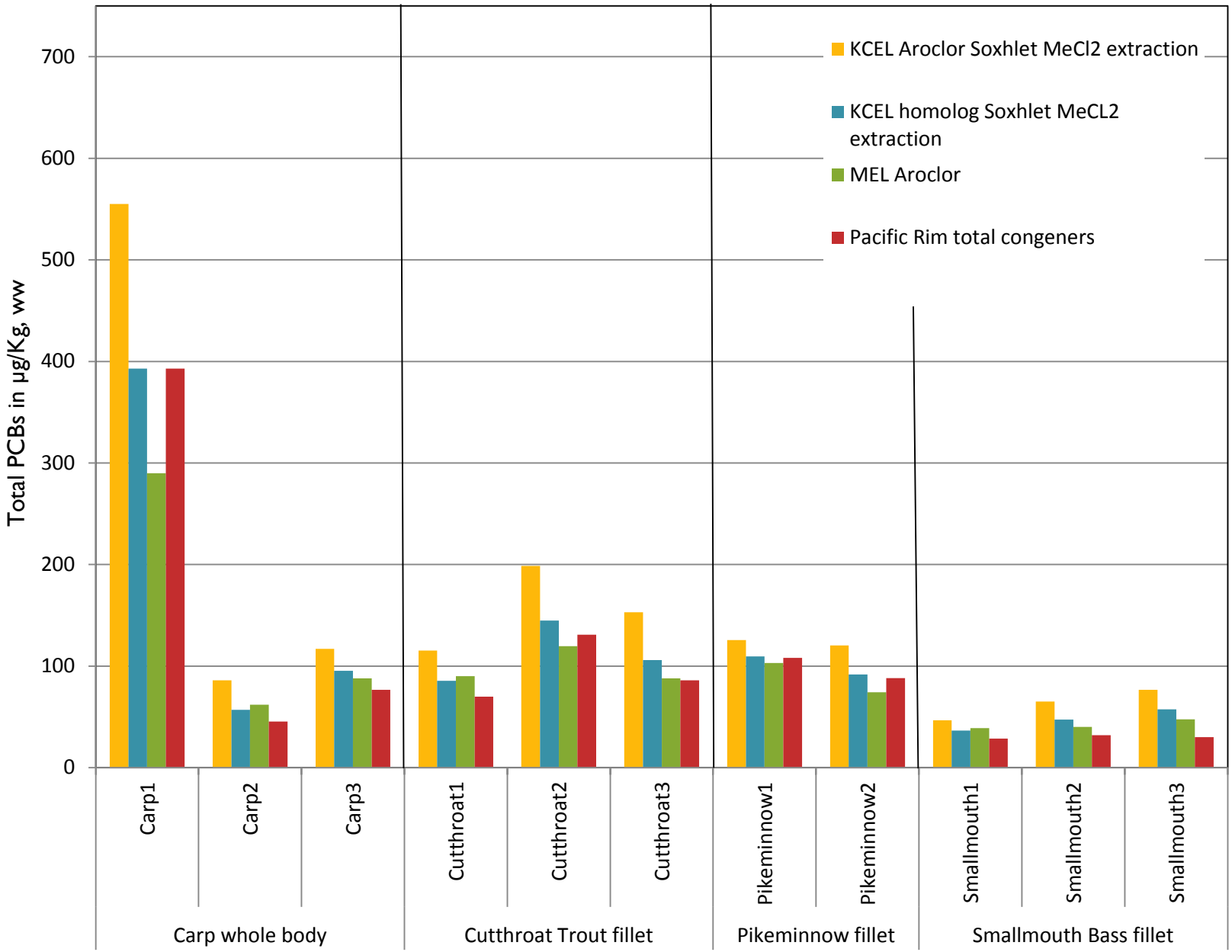


New silica gel cleanup

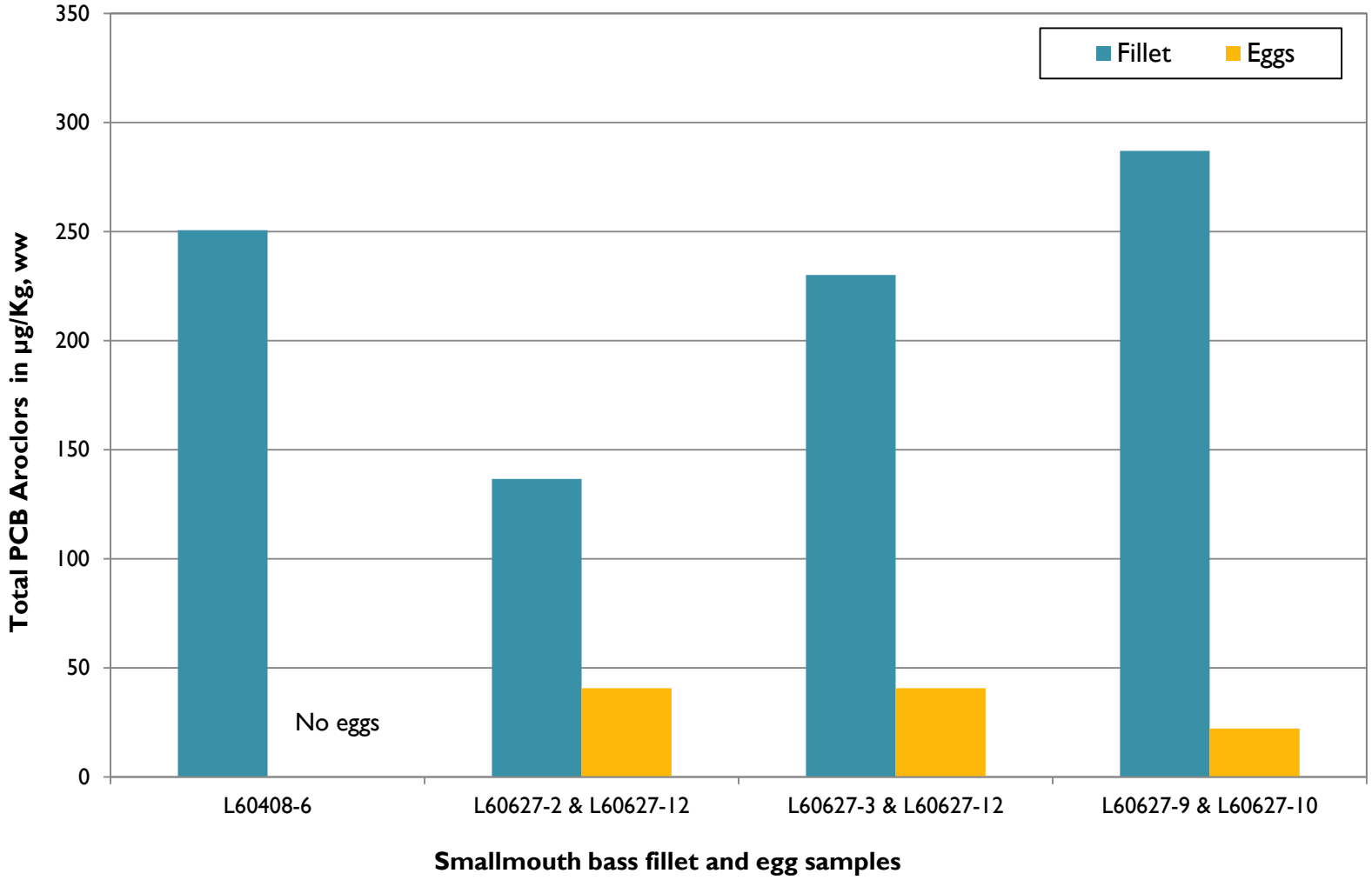
2010 to 2014 Lake WA tissue changes



PCB split samples



PCBs in smallmouth bass fillets vs. eggs



Conclusions

- Practices within method change over time even with the same "method"
  - All despite being the "same" method reference
- Trend analysis and changes over time are already complicated by different species, sizes, and sexes
  - Spawning condition may impact freshwater results as well
  - Fish eggs are likely to be a upper to lower trophic level mechanism for PCBs (downward)
- Lake Washington tissues are probably lower than previously estimated or declining. Additional confirmation advised with more samples, and species.
  - Current KCEL cleanup, extraction and analytical methods appear slightly high biased for Aroclors and on par with MEL and congener based laboratories for homologs