Hudson River PCBs Superfund Site Fish Data Update

Community Advisory Group Meeting
Thursday, May 28, 2020
Virtual Meeting

- Last fish data update – December 2019 CAG meeting
- Summary of sampling program
- 2019 fish data
  - QA/QC of data still underway
  - Upper and Lower Hudson Fish Update
    - Including Reaches 1-4 data
    - Spring – sport fish
    - Fall – small fish
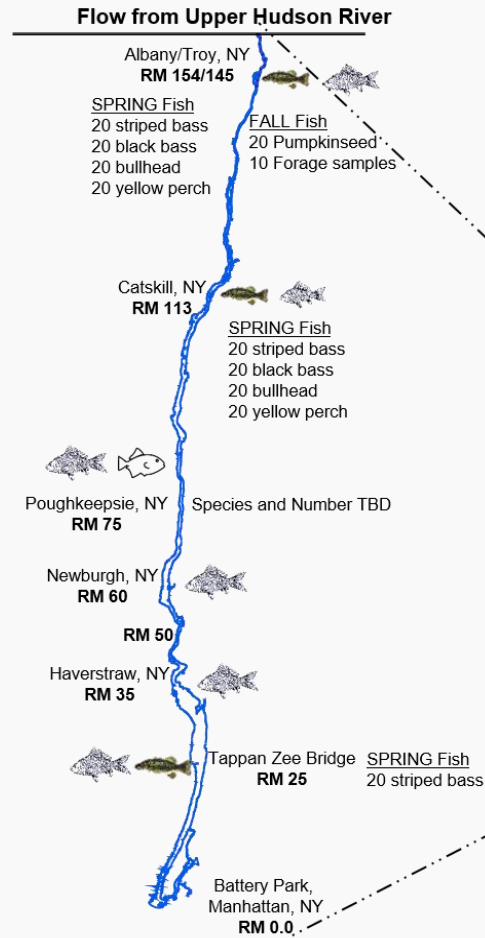- Continued EPA oversight of QA/QC procedures and review of documents

Hudson River Fish Monitoring Species and Stations

- NYS collects additional fish (typically Lower Hudson River, ongoing)

- OM&M work plan is under development (ongoing discussions with NYSDEC and GE)

- Upper Hudson River sport fish samples were collected from reaches 1-4 in 2019
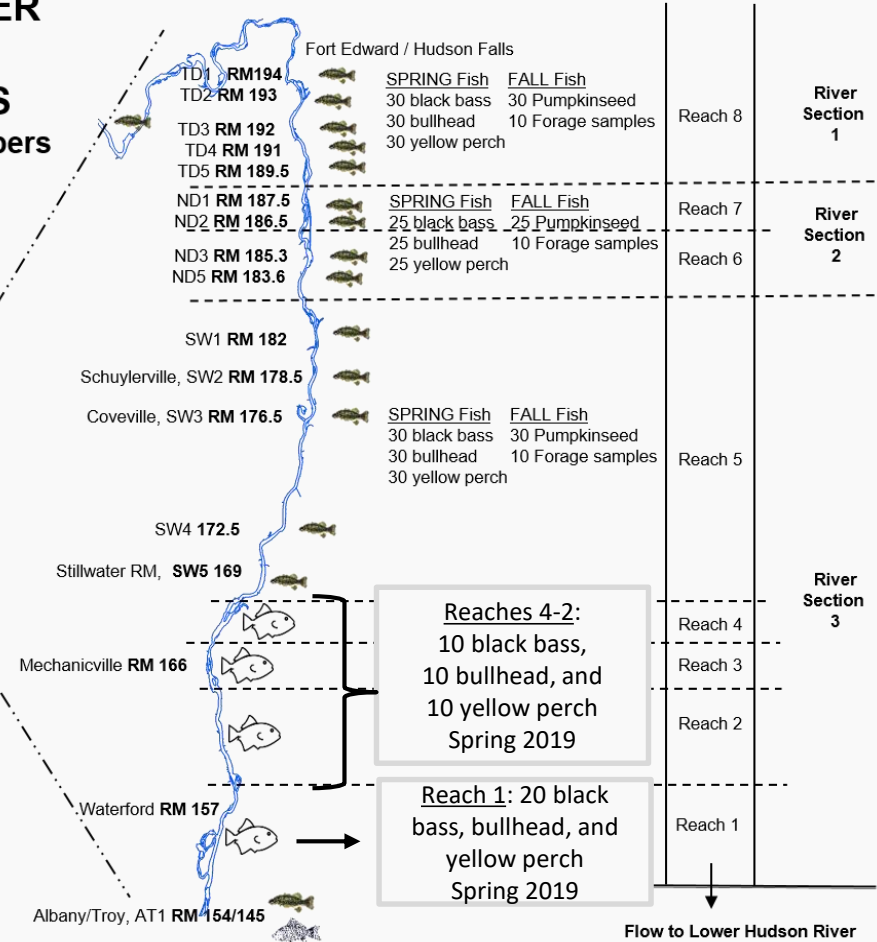

Lower Hudson River

Flow from Upper Hudson River

Albany/Troy, NY
RM 154/145

SPRING Fish
20 striped bass
20 black bass
20 bullhead
20 yellow perch

FALL Fish
20 Pumpkinseed
10 Forage samples

Catskill, NY
RM 113

SPRING Fish
20 striped bass
20 black bass
20 bullhead
20 yellow perch

Poughkeepsie, NY   Species and Number TBD
RM 75

Newburgh, NY
RM 60

RM 50

Haverstraw, NY
RM 35

Tappan Zee Bridge   SPRING Fish
RM 25   20 striped bass

Battery Park,
Manhattan, NY
RM 0.0

TYPICAL HUDSON RIVER FISH MONITORING PROGRAM STATIONS
With Target Species and Numbers

Current RAMP Fish Station

Potential OM&M Fish Monitoring Station

NYSDEC Fish Monitoring Station

Upper Hudson River

Fort Edward / Hudson Falls

TD1 RM194
TD2 RM 193

SPRING Fish   FALL Fish
30 black bass   30 Pumpkinseed
30 bullhead   10 Forage samples
30 yellow perch

TD3 RM 192
TD4 RM 191
TD5 RM 189.5

ND1 RM 187.5   SPRING Fish   FALL Fish
ND2 RM 186.5   25 black bass   25 Pumpkinseed
                 25 bullhead   10 Forage samples
ND3 RM 185.3   25 yellow perch
ND5 RM 183.6

SW1 RM 182

Schuylerville, SW2 RM 178.5

Coveville, SW3 RM 176.5   SPRING Fish   FALL Fish
                           30 black bass   30 Pumpkinseed
                           30 bullhead   10 Forage samples
                           30 yellow perch

SW4 172.5

Stillwater RM, SW5 169

Mechanicville RM 166

Waterford RM 157

Albany/Troy, AT1 RM 154/145

Reaches 4-2:
10 black bass,
10 bullhead, and
10 yellow perch
Spring 2019

Reach 1: 20 black bass, bullhead, and yellow perch
Spring 2019

	River Section
Reach 8	River Section 1
Reach 7	River Section 2
Reach 6	
Reach 5	
Reach 4	River Section 3
Reach 3	
Reach 2	
Reach 1	

Flow to Lower Hudson River

Spring Collection (Fillet):

Largemouth Bass
(*Micropterus salmoides*)

Smallmouth Bass
(*Micropterus dolomieui*)

Brown Bullhead
(*Ictalurus nebulosus*)

Yellow Perch
(*Perca flavescens*)

- 495 individuals from the 3 species groups collected annually
- An approximately 150 individuals were collected from Reaches 1 through 4 (same species groups)
- Sport fish species represent multiple food web niches and levels, reflect longer-term body burdens
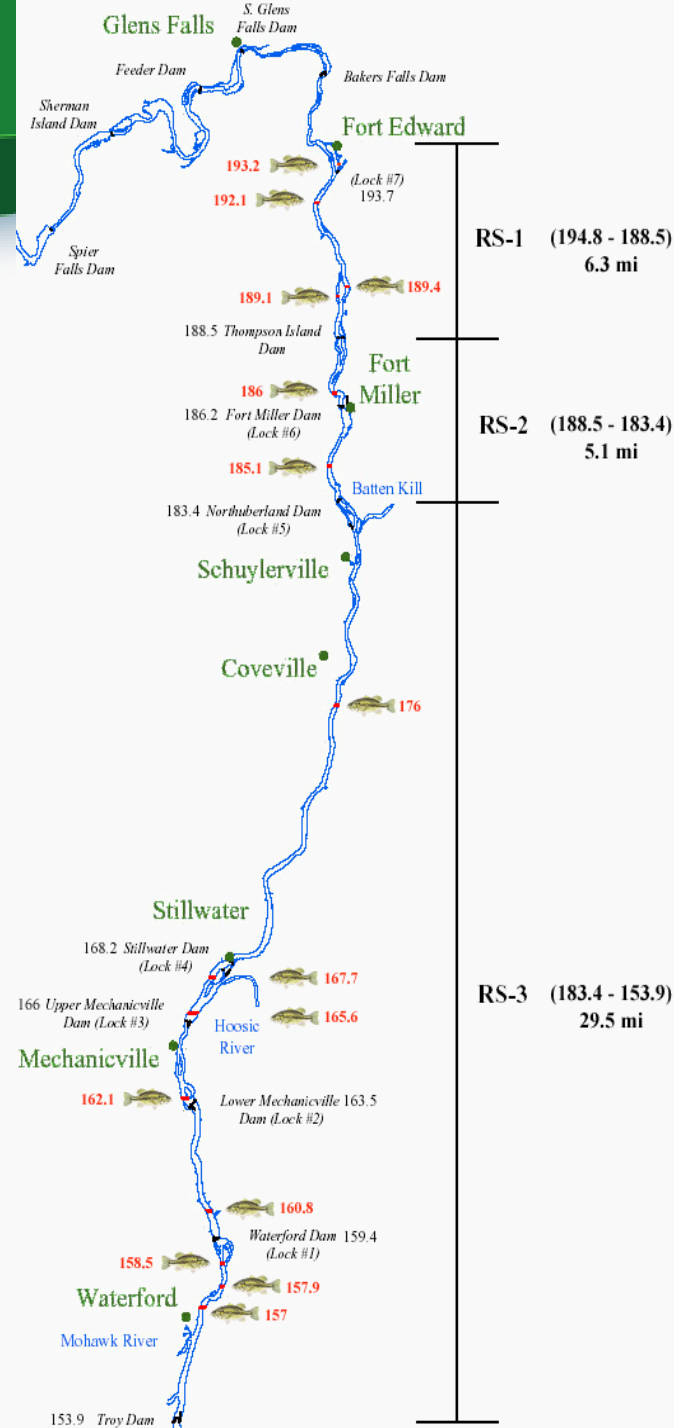
Fall Collected (Whole Body):

Pumpkinseed
(*Lepomis gibbosus*)

Spottail Shiner
(*Notropis hudsonius*)

- 125 individual pumpkinseed and 50 composite forage species samples collected annually
- Young of Year "rapid integrator" fish, more likely to reflect recent changes in water column PCB concentrations

Glens Falls
S. Glens Falls Dam
Feeder Dam
Bakers Falls Dam
Sherman Island Dam
Fort Edward
193.2
192.1
(Lock #7) 193.7
Spier Falls Dam
189.1
189.4
RS-1 (194.8 - 188.5) 6.3 mi
188.5 Thompson Island Dam
Fort Miller
186
186.2 Fort Miller Dam (Lock #6)
RS-2 (188.5 - 183.4) 5.1 mi
185.1
Batten Kill
183.4 Northumberland Dam (Lock #5)
Schuylerville
Coveville
176
Stillwater
168.2 Stillwater Dam (Lock #4)
167.7
166 Upper Mechanicville Dam (Lock #3)
165.6
Hoosic River
RS-3 (183.4 - 153.9) 29.5 mi
Mechanicville
162.1
Lower Mechanicville 163.5 Dam (Lock #2)
160.8
Waterford Dam 159.4 (Lock #1)
158.5
157.9
Waterford
157
Mohawk River
153.9 Troy Dam

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

HUDSON River
PCBs SUPERFUND SITE

Upper Hudson River Fish Trends:
-Wet Weight and Lipid Normalized

- Fish analyses considerations:
  - Evaluated as individual species and species weighted average
  - Geographic scale (i.e., station, river reach, river section, entire upper Hudson River)
  - Consistency in Aroclor identification and quantitation
  - Wet Weight
    - Used by NYSDOH for fish advisory considerations
    - Values associated with ROD targets and goal
      - 0.4 mg/kg – target- protective based on half-pound fish meal every two months
      - 0.2 mg/kg – target - protective based on half-pound meal every month
      - 0.05 mg/kg - goal - protective based on half-pound fish meal every week
  - Lipid Normalized
    - Accounts for natural variability in lipid concentrations among fish and over time
    - Used for evaluating trends over time
  - National Institute of Standards and Technology (NIST) standards used to confirm consistency over time

Fish Concentration Trend Considerations

- Variability in actual exposures

- Highly localized exposures

- Importance of sediment *vs.* water exposure pathways, which can vary over time due to prey availability

- Uncertainty and variability in lipid content of fish and prey items

- Uncertainty and variability in consumption of specific prey items and PCB concentrations in those prey

- Measurement uncertainty (including allowing for differences in sampling and analysis programs)

Upper Hudson River
Spring - Sport Fish
Fish that comprise the species weighted average

Upper Hudson Black Bass (Largemouth and Smallmouth) –Lipid Normalized, LPCB-HE, by River Section
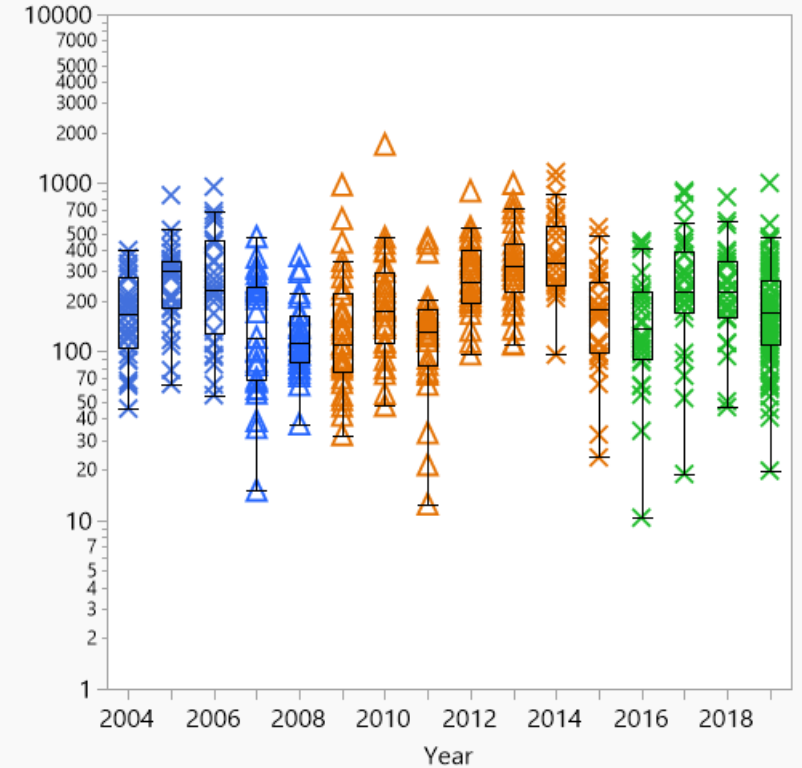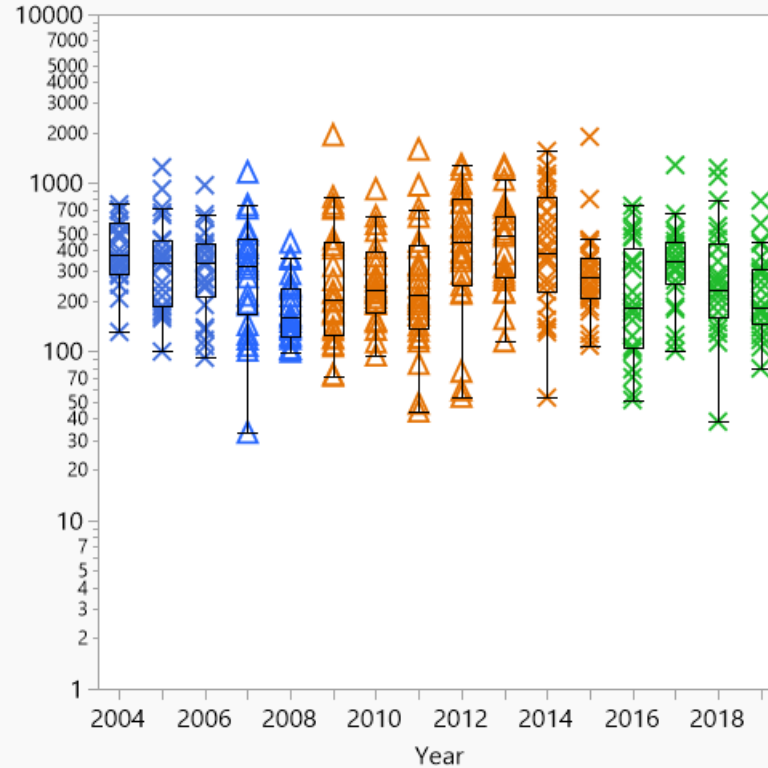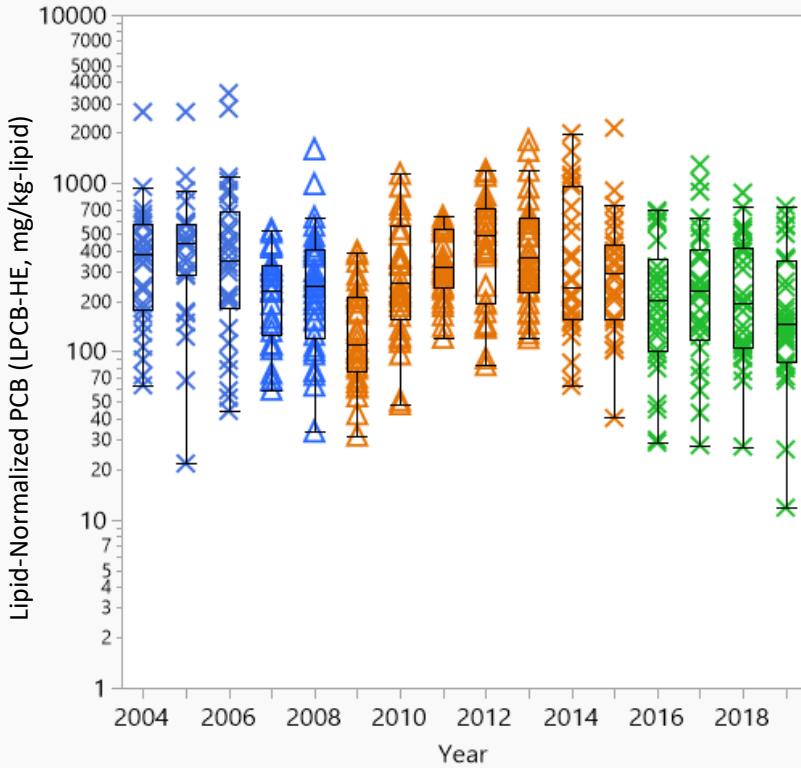
Upper Hudson Black Bass (Largemouth and Smallmouth) –Wet Weight, TPCB-HE, by River Section
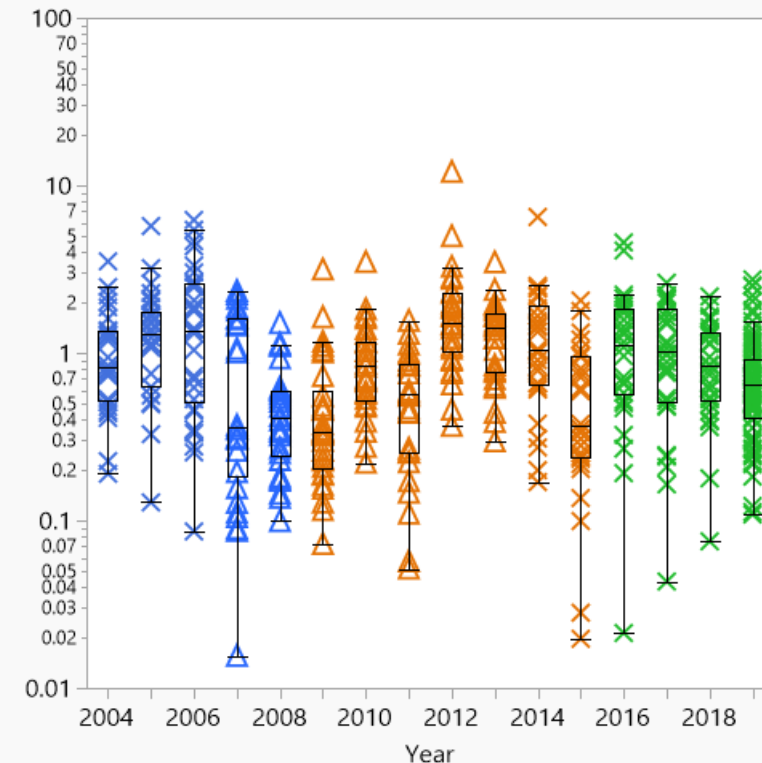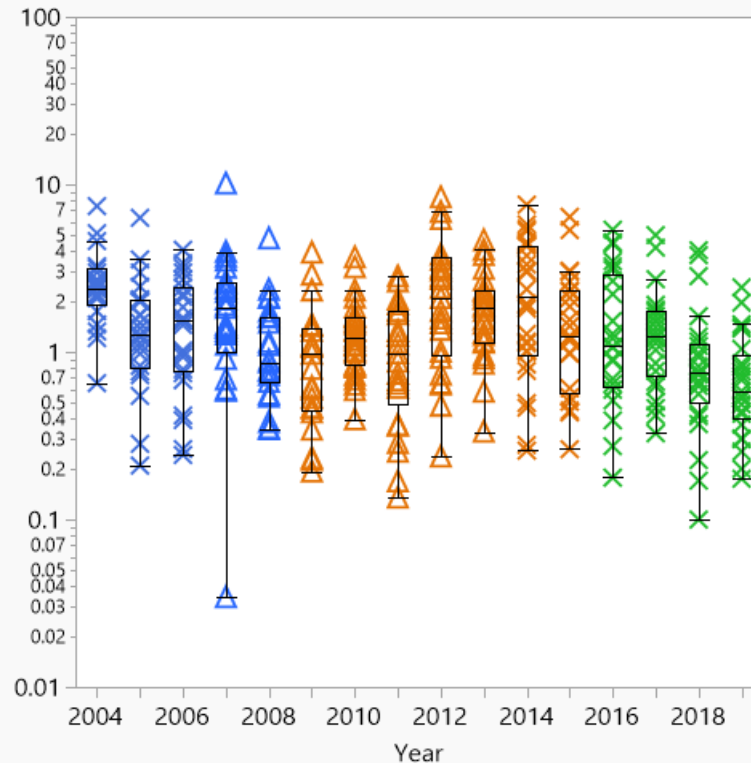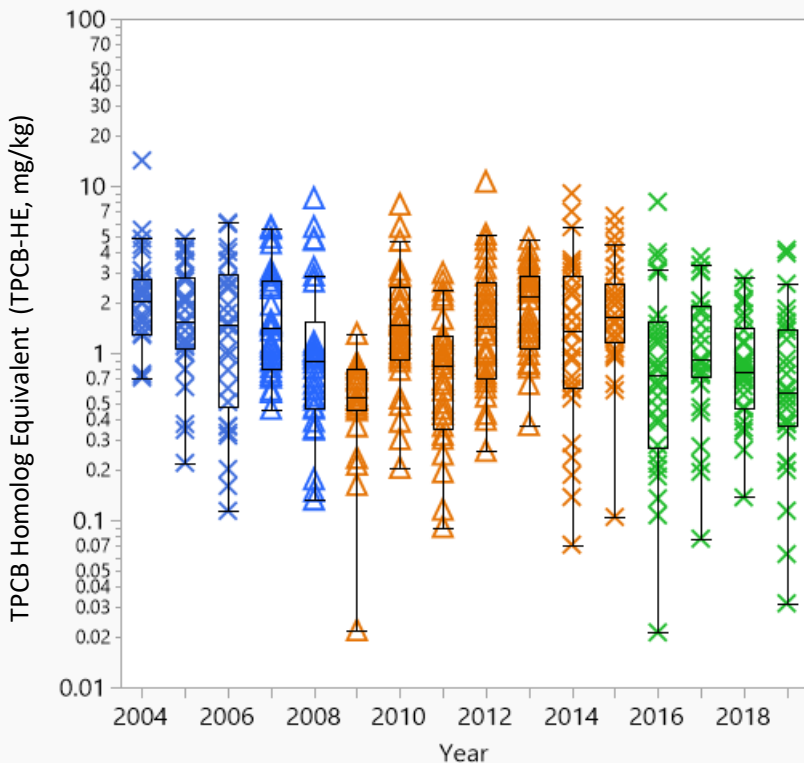
# Upper Hudson Brown Bullhead –Lipid Normalized, LPCB-HE, by River Section
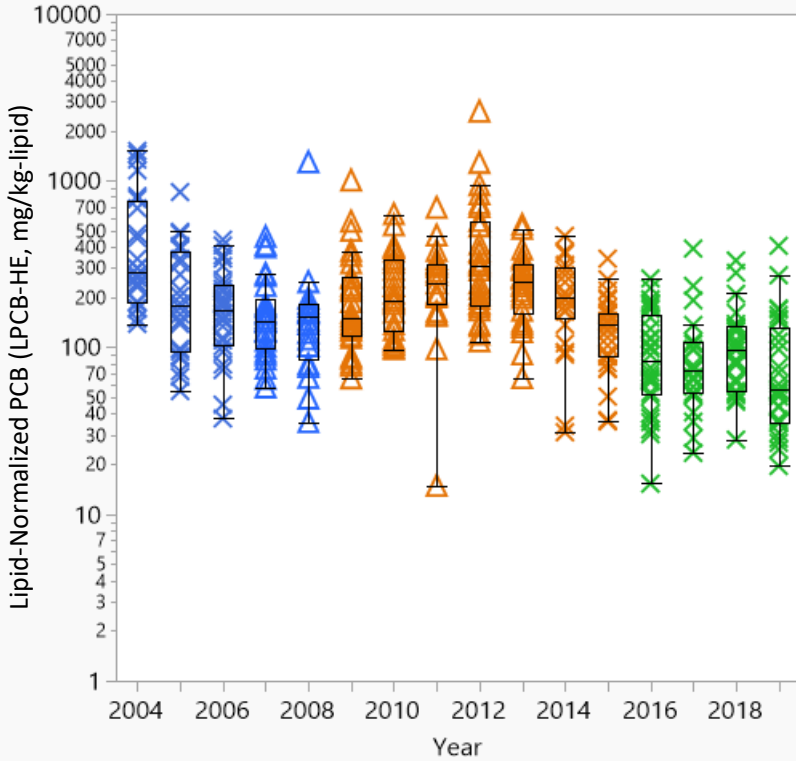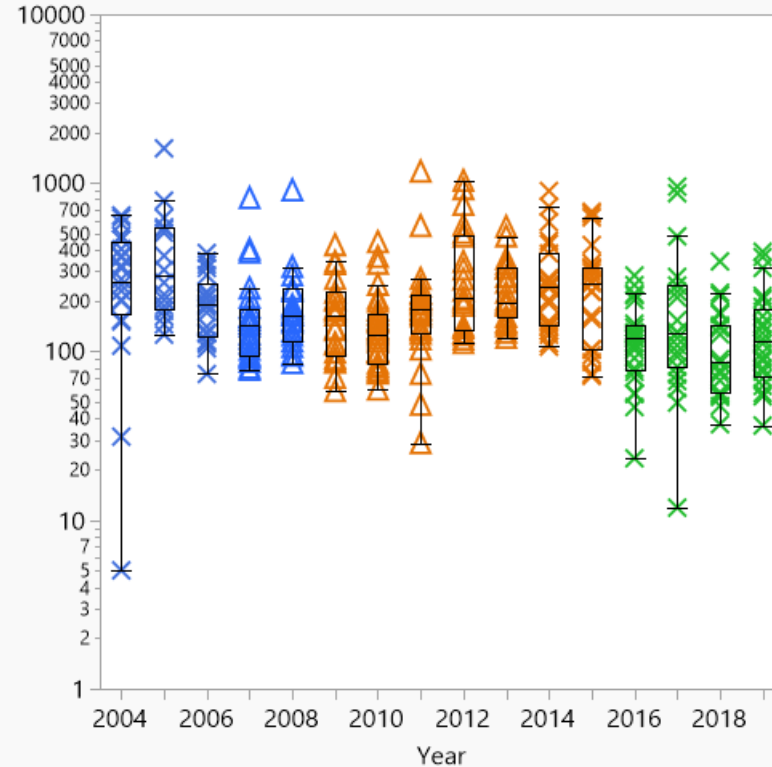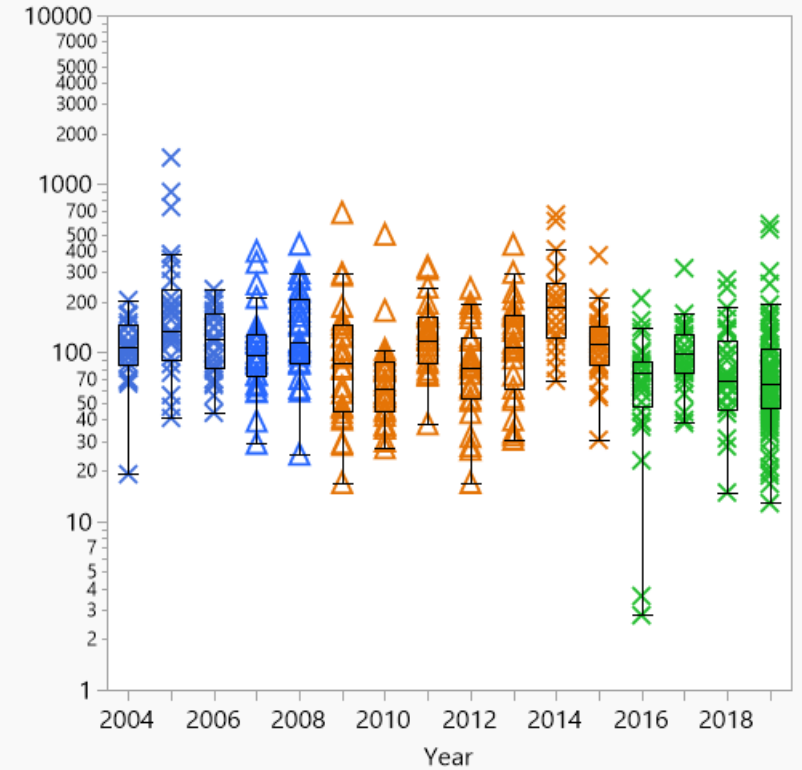
Upper Hudson Brown Bullhead –Wet Weight, TPCB-HE, by River Section
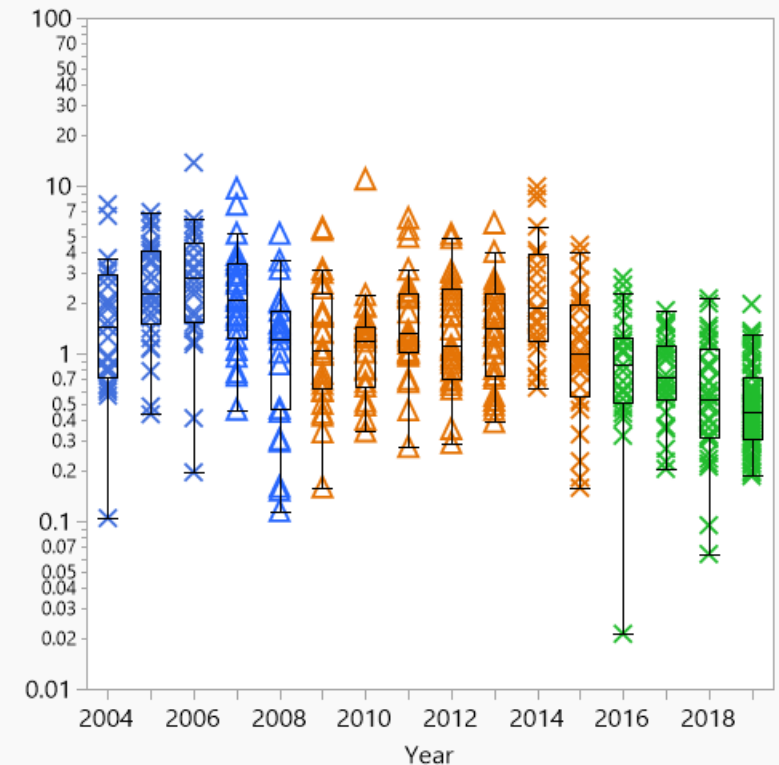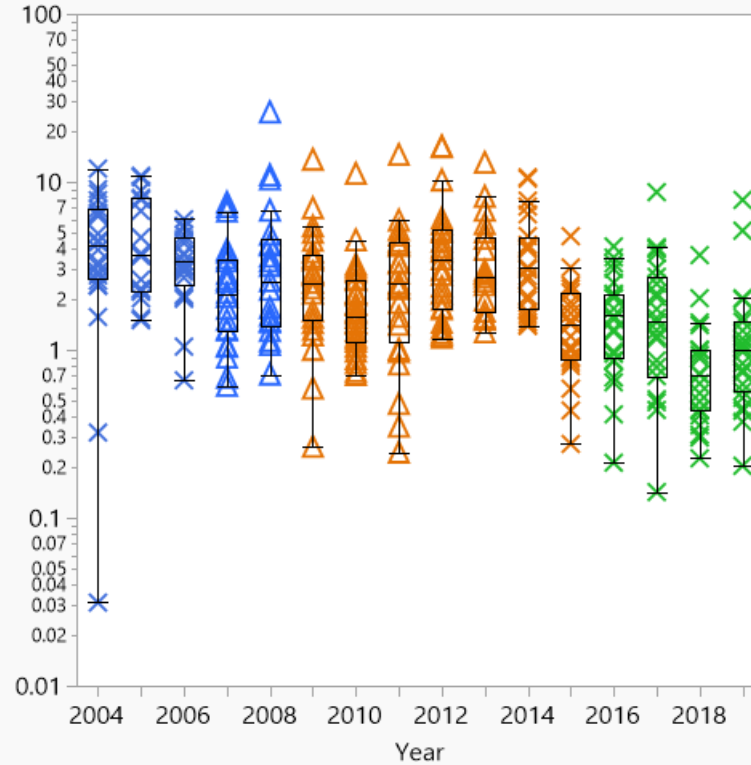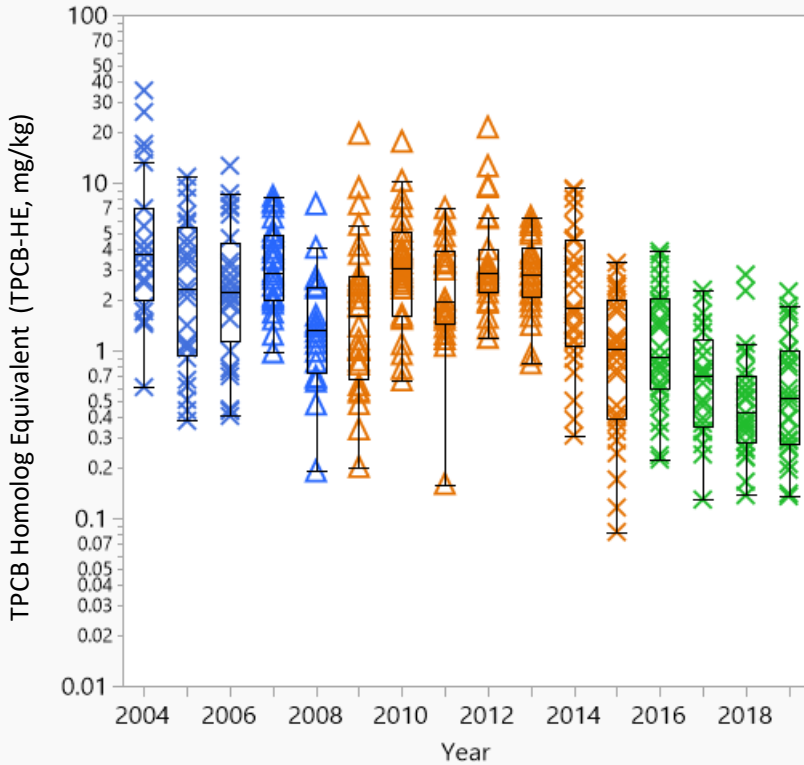
River Section 1

River Section 2

River Section 3

Before Dredging (2004-2008)
During Dredging (2009-2015)
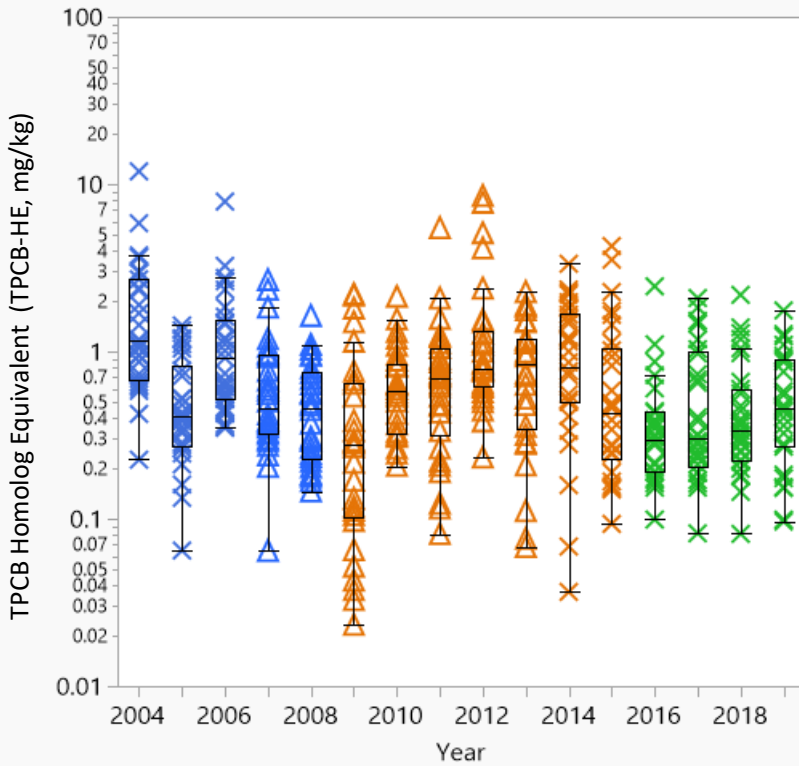After Dredging (2016-2019)

✕ Standard Fillet
△ Rib-out Fillet

Upper Hudson Yellow Perch
–Lipid Normalized, LPCB-HE, by River Section
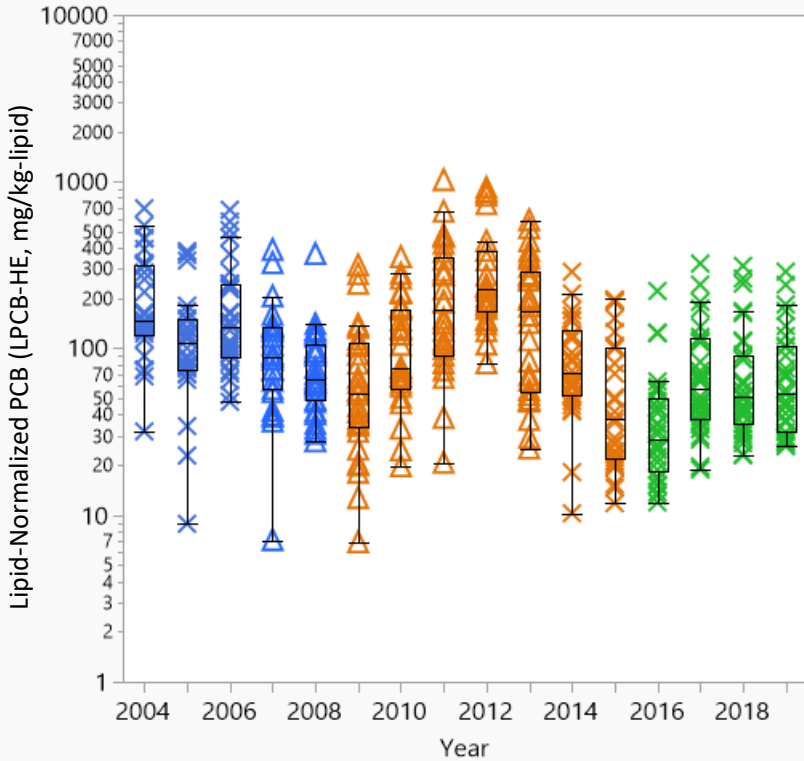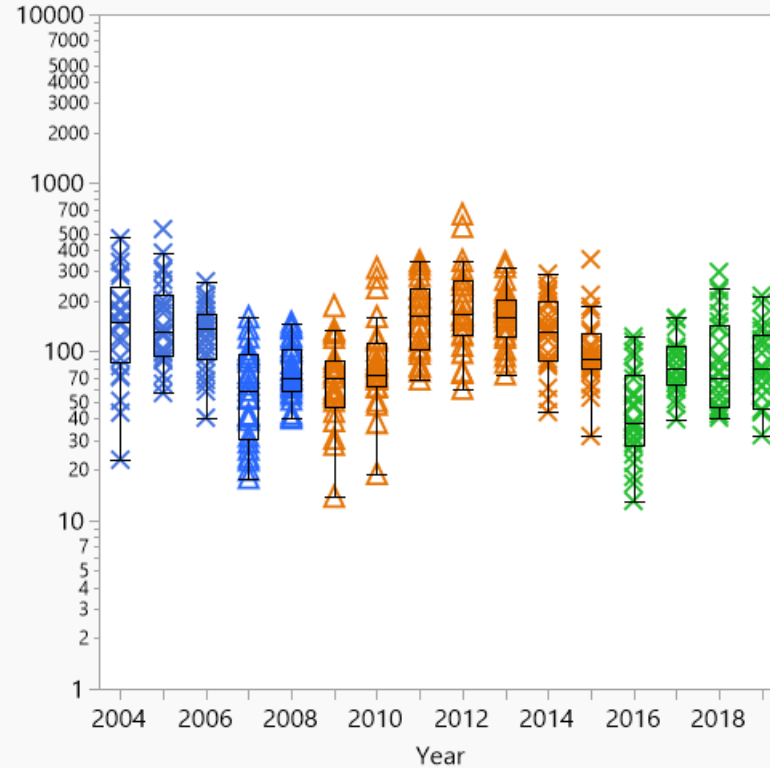
River Section 1

River Section 2
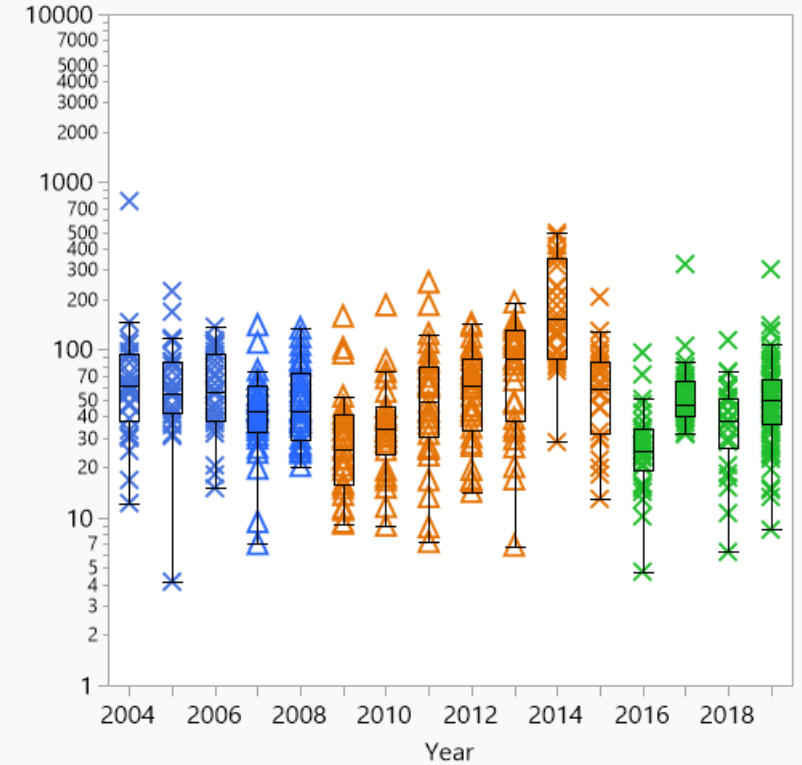
River Section 3

- ● Before Dredging (2004-2008)
- ● During Dredging (2009-2015)
- ● After Dredging (2016-2019)
- ✕ Standard Fillet
- △ Rib-out Fillet

Upper Hudson Yellow Perch –Wet Weight, TPCB-HE, by River Section
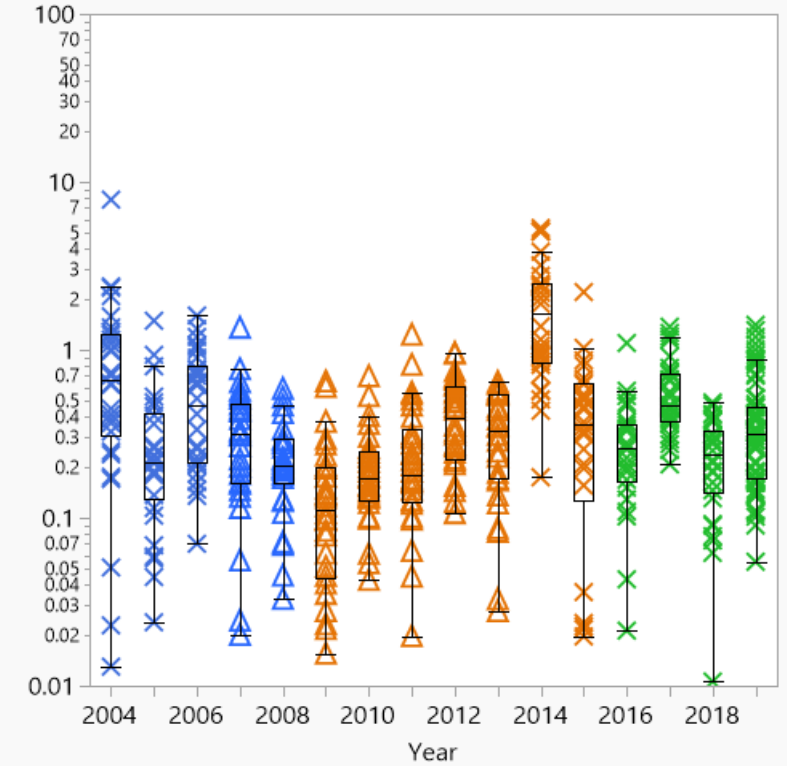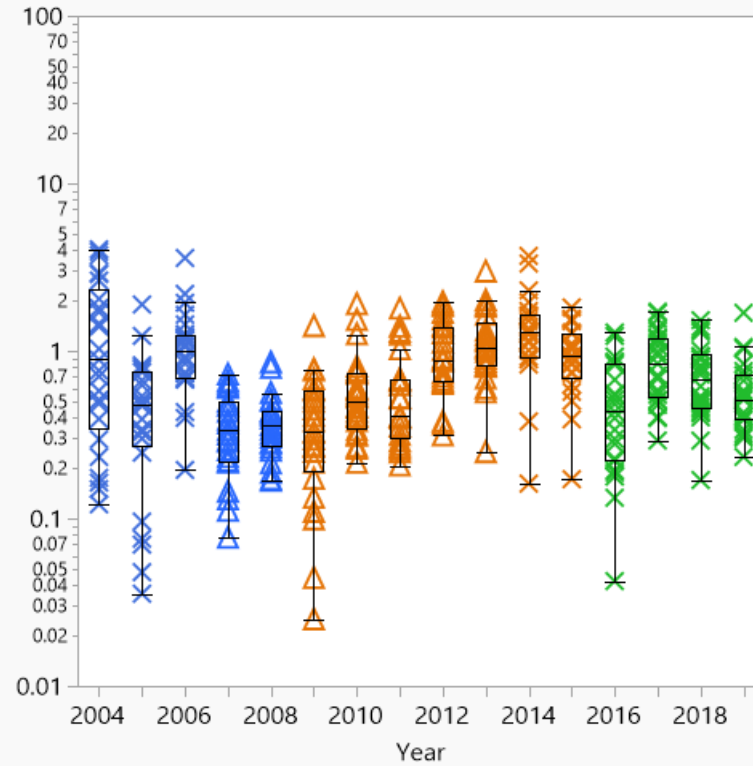
River Section 1

River Section 2

River Section 3

- ● Before Dredging (2004-2008)
- ● During Dredging (2009-2015)
- ● After Dredging   (2016-2019)

- ✕ Standard Fillet
- △ Rib-out Fillet

Upper Hudson Species-Weighted Average Calculation
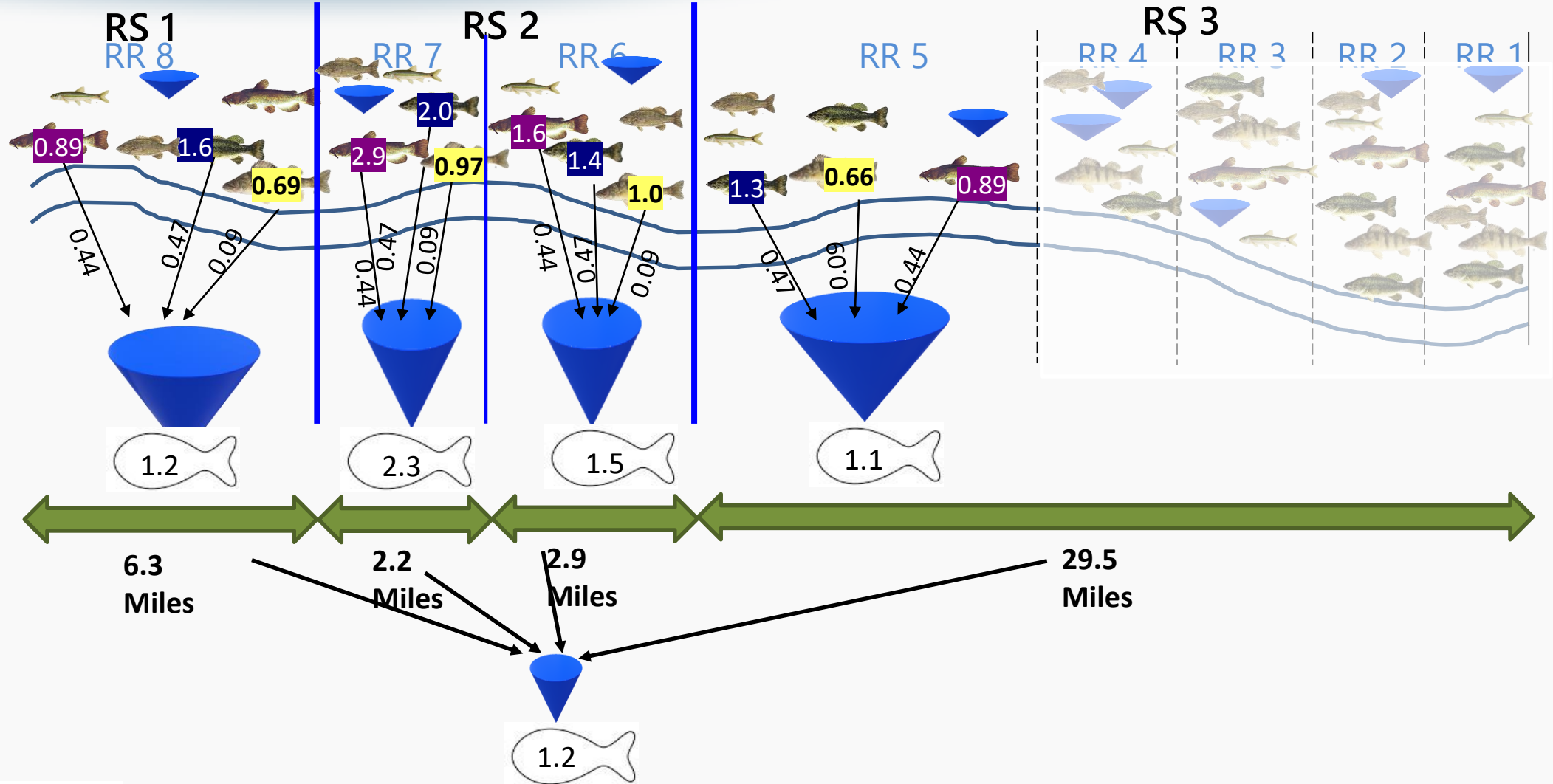
Hudson River Fish Species and Length Weighted Averages as Total PCB_{HE} (wet weight, mg/kg) 2004-2019

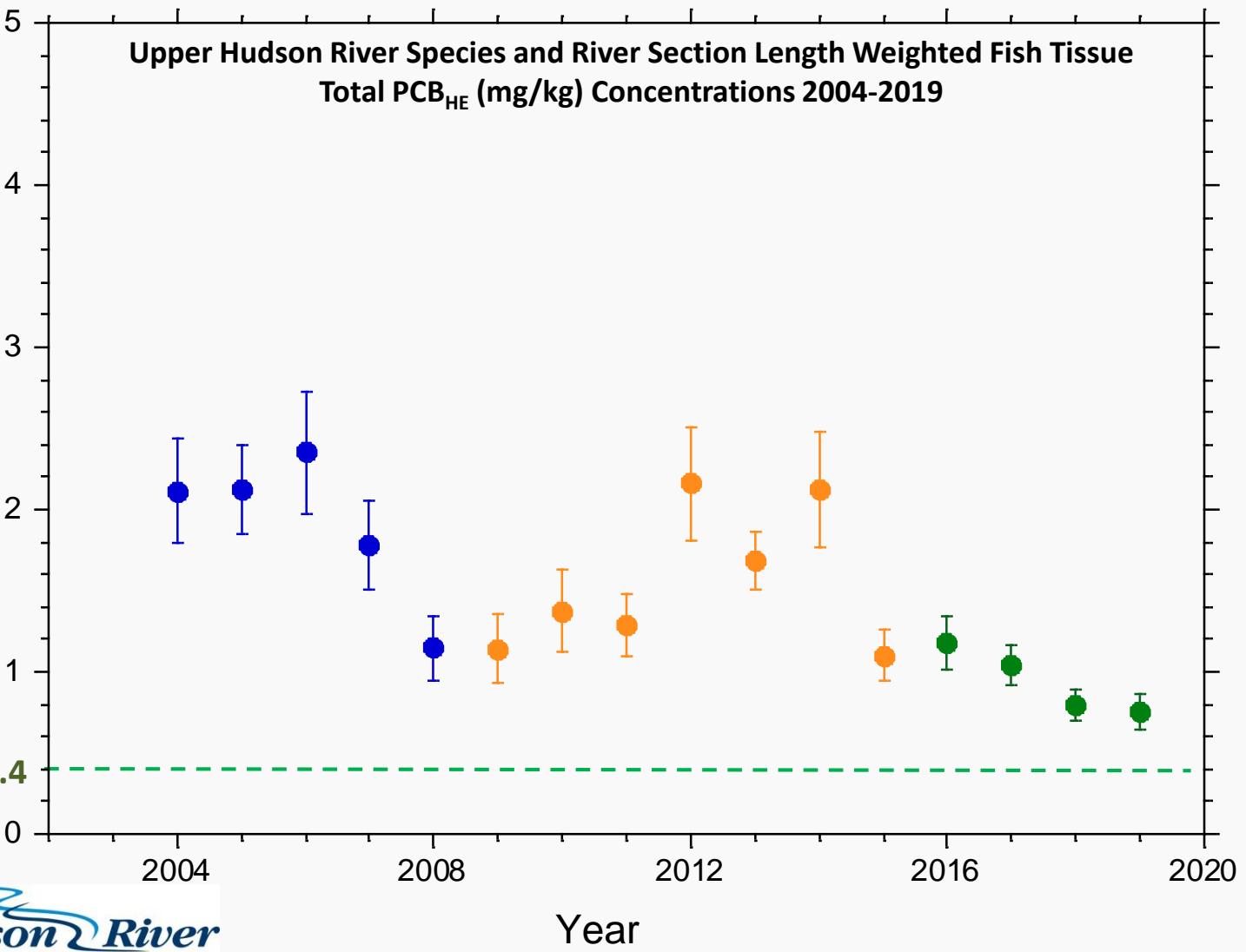| Monitoring Period	Year	Upper River Average		River Section 1		River Section 2		River Section 3	
		Sections 1-3 Mean	Confidence Interval	Section 1 Mean	Confidence Interval	Section 2 Mean	Confidence Interval	Section 3 Mean	Confidence Interval
Baseline (Pre-Dredge) Monitoring Period (BMP)	2004	2.1	1.8-2.4	4.3	2.9-5.7	3.4	2.8-4.0	1.4	1.1-1.7
	2005	2.1	1.8-2.4	2.3	1.8-2.8	2.9	2.2-3.5	2.0	1.6-2.3
	2006	2.4	2.0-2.7	2.5	2.0-3.1	2.4	2.1-2.8	2.3	1.8-2.8
	2007	1.8	1.5-2.1	2.5	2.0-2.9	2.2	1.7-2.7	1.6	1.2-1.9
	2008	1.1	1.0-1.3	1.5	1.1-1.9	2.5	1.6-3.5	0.83	0.6-1.0
Dredging (2009, 2011-2015) Remedial Action Monitoring Program (RAMP)	2009	1.1	0.9-1.4	1.5	0.9-2.1	1.9	1.4-2.4	0.93	0.7-1.2
	2010	1.4	1.1-1.6	2.6	2.0-3.3	1.6	1.3-1.9	1.1	0.7-1.4
	2011	1.3	1.1-1.5	1.5	1.2-1.9	2.0	1.4-2.5	1.1	0.9-1.4
	2012	2.2	1.8-2.5	3.0	2.2-3.7	3.3	2.5-4.1	1.8	1.4-2.2
	2013	1.7	1.5-1.9	2.4	2.1-2.7	2.6	2.1-3.1	1.4	1.1-1.6
	2014	2.1	1.8-2.5	2.3	1.7-2.8	3.0	2.5-3.6	1.9	1.5-2.4
	2015	1.1	0.9-1.3	1.7	1.3-2.0	1.6	1.2-1.9	0.90	0.7-1.1
OM&M Monitoring (on-going)	2016	1.2	1.0-1.3	1.3	0.9-1.6	1.6	1.3-1.9	1.1	0.9-1.3
	2017	1.05	0.9-1.2	1.0	0.8-1.3	1.6	1.2-2.0	0.95	0.8-1.1
	2018	0.80	0.7-0.9	0.81	0.7-1.0	0.94	0.7-1.2	0.77	0.6-0.9
	2019	0.75	0.6-0.9	0.82	0.6-1.0	1.0	0.7-1.4	0.69	0.6-0.8

Notes:
1. Reach and River Section fish tissue PCB concentrations are weighted by species. Black bass = 47%, bullhead = 44%, yellow perch = 9%.
2. Upper Hudson River average is weighted by both species and river reach length. Reach 8: = 6.3 miles (15.4%); Reach 7 = 2.2 miles (5.4%); Reach 6 = 2.9 miles (7.1%); and Reach 5 = 29.5 miles (72.1%). There are not currently fish sampling locations in river reaches 4-1. Reach 5/River Section 3 is weighted to reflect all 29.5 miles of River Section 3, while the fish monitoring stations representing River Section 3 are all located in Reach 5, which is 14 miles long.
3. Fish data were not available for Reach 7 in 2008.
4. Dredging was not performed in 2010 so that a planned peer-review of the project could be convened for the purpose of refining the selected remedy.
5. The Confidence Interval is equal to plus or minus 2 Standard Errors on the mean

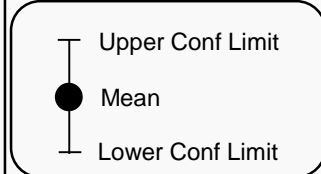# Upper Hudson River Species and River Section Length Weighted Average

Legend

- **Before Dredging (2004-2008)**
- **During Dredging (2009-2015)**
- **After Dredging (2016-2019)**

- Upper Conf Limit
- Mean
- Lower Conf Limit

Notes

1. River Section fish tissue PCB concentrations are weighted by species. Black bass = 47%, Ictalurid = 44%, yellow perch = 9%.
2. Upper Hudson River average is weighted by both species and river reach length. River Section 1: = 6.3 miles (15.4%); River Section 2= 5.1 miles (12.5%); and River Section 3= 29.5 miles (72.1%). There is not regular fish sampling from in river reaches 4-1 (of River Section 3). Reach 5/River Section 3 is weighted to reflect all 29.5 miles of River Section 3, while the fish monitoring stations representing River Section 3 are all located in Reach 5, which is 14 miles long.
3. Fish data were not available for Reach 7 of River Section 2 in 2008.
4. Dredging was not performed in 2010 so that a planned peer-review of the project could be convened for the purpose of refining the selected remedy.
5. The Confidence Interval is equal to the mean plus or minus 2 Standard Errors on the mean

Chart: Upper Hudson River Species and River Section Length Weighted Fish Tissue Total PCB$_{HE}$ (mg/kg) Concentrations 2004-2019

Y-axis: Total PCB Homologue Equivalent (mg/kg-wet weight), marked value 0.4

X-axis: Year (2004–2020)

2019 Spring Fish Reaches 1 - 4

- Purpose: Evaluate whether PCB fish tissue levels in these reaches are consistent with the average Reach 5 fish tissue PCB concentrations

- Data collected 2019, 6/27 – 7/10

- Targets: 30 fish from reaches 2-4 and 60 fish from reach 1
  - 10 each black bass, bullhead, and yellow perch
  - 20 each of these species in reach 1

- Targets collected for all species and reaches except yellow perch in reach 2 (lack of habitat)
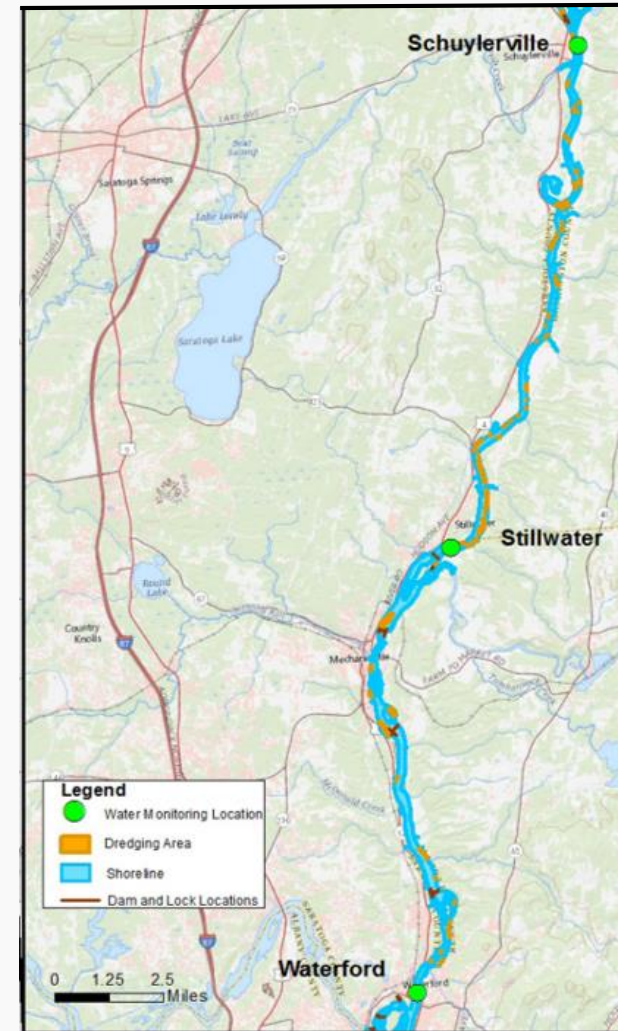
Black Bass 2019 for Reaches 1 to 5

2019 Black Bass T(Ar)PCB-HE for Reaches 5 through 1 (RS3)
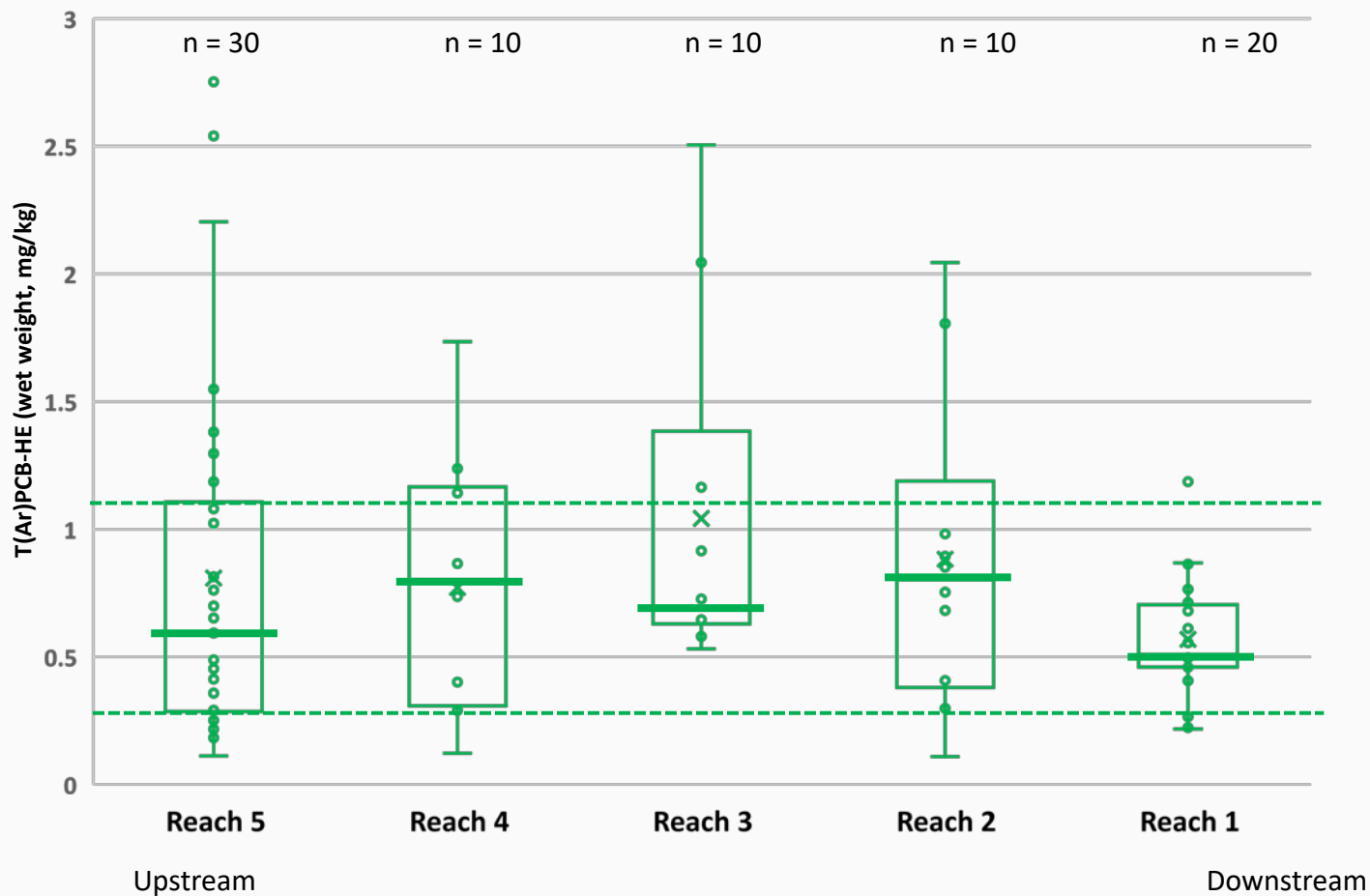
NOTE:
90% (45/50) of Reach 4-1 black bass collected were smallmouth bass. This is indicative of the relatively rocky substrate of these reaches relative to other reaches.

Brown Bullhead 2019 for Reaches 1 to 5

2019 Bullhead T(Ar)PCB-HE for Reaches 5 through 1 (RS3)
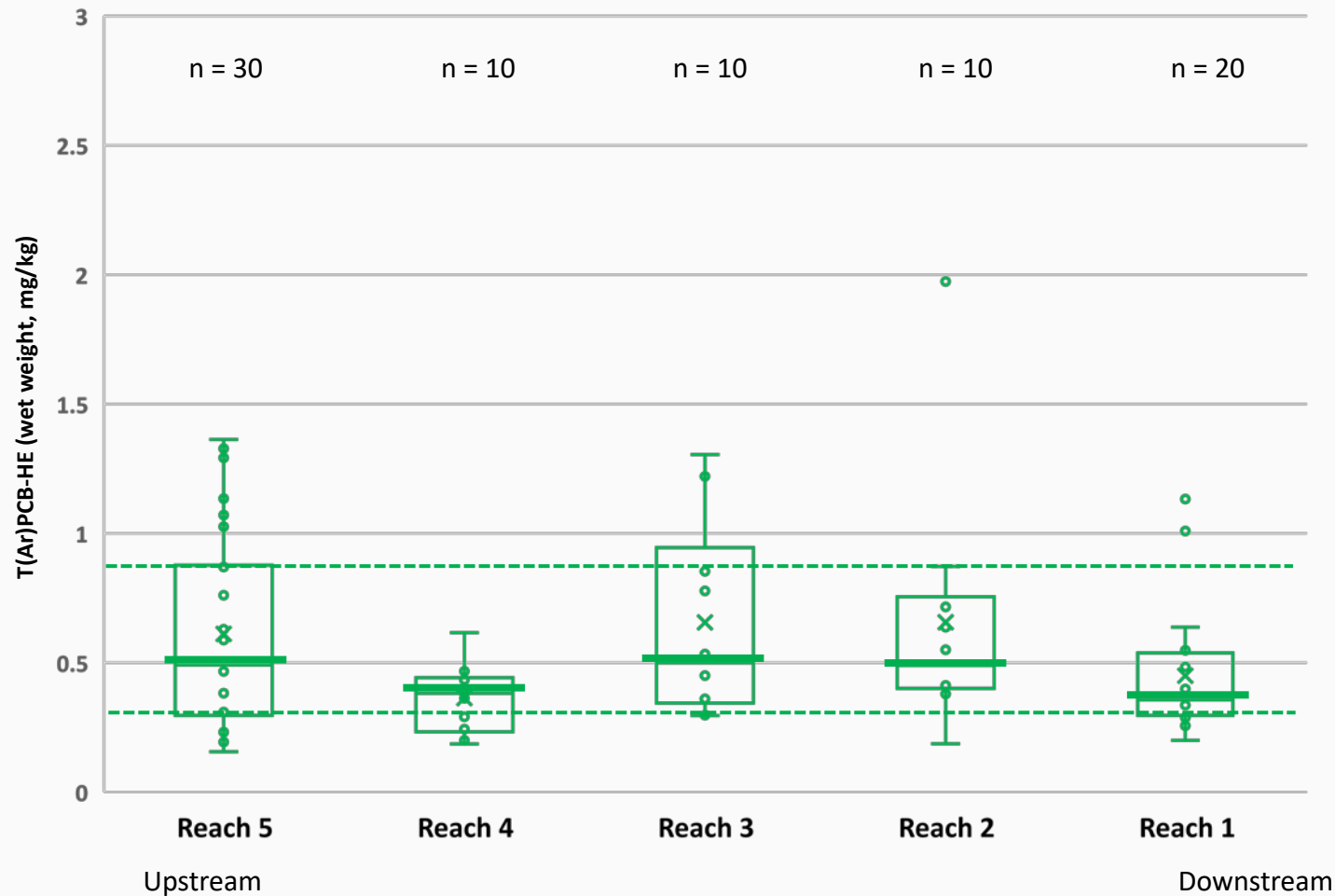
2019 Yellow Perch T(Ar)PCB-HE for Reaches 5 through 1 (RS3)
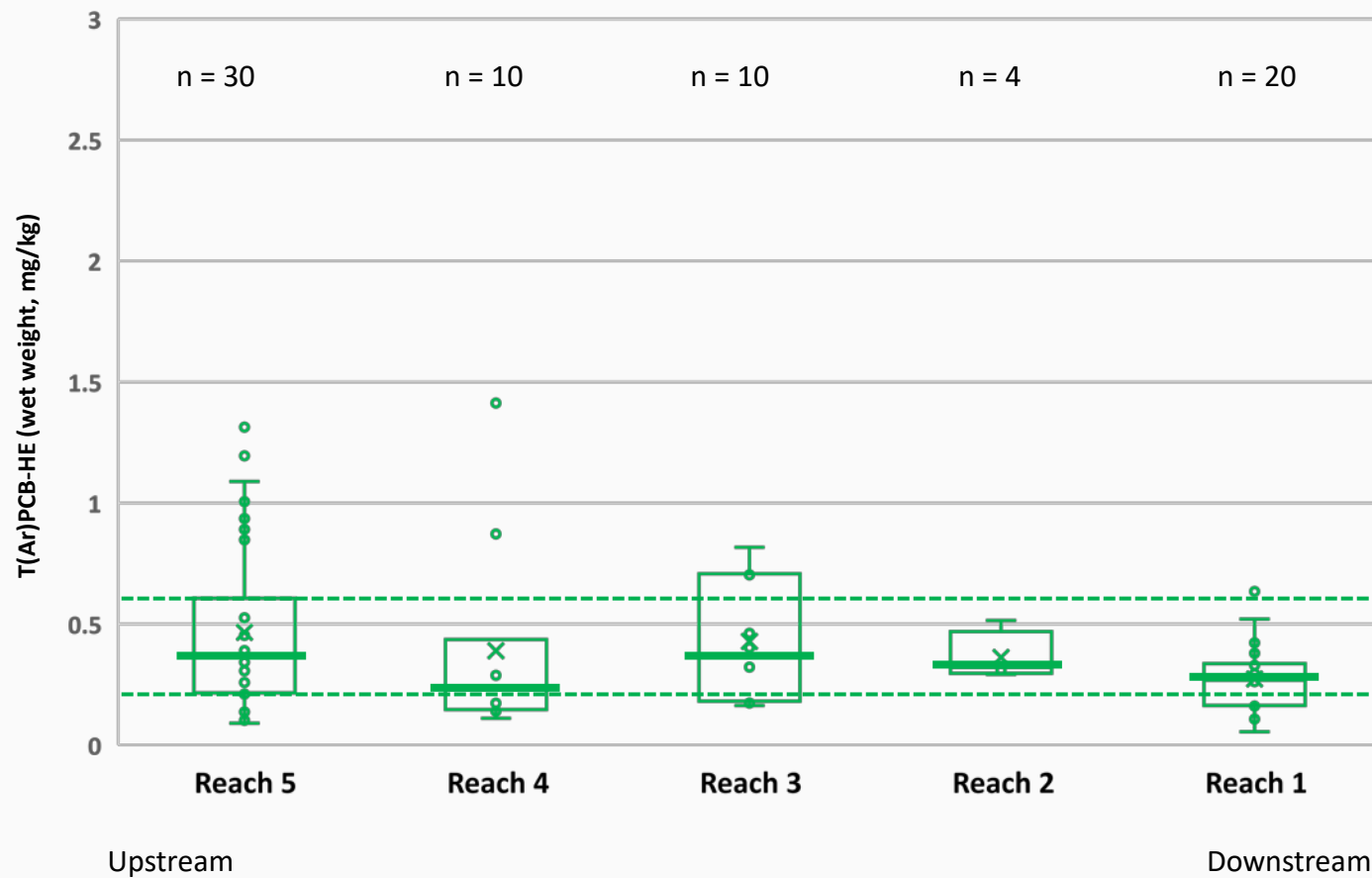
- Fish collected from Reaches 1 - 4 are consistent with EPAs understanding that Reach 5 Spring-collected fish are an appropriate representation of River Section (RS) 3
- The 2019 Upper Hudson River species weighted average concentration using reach 1 to 5 is 0.72 mg/kg (homologue equivalent, wet weight)
  - With only reach 5 representing all of RS3 it is 0.75 mg/kg

Upper Hudson River
Fall - Pumpkinseed

Rapid integrator species

Upper Hudson Pumpkinseed –Lipid Normalized, LPCB-HE, by River Section
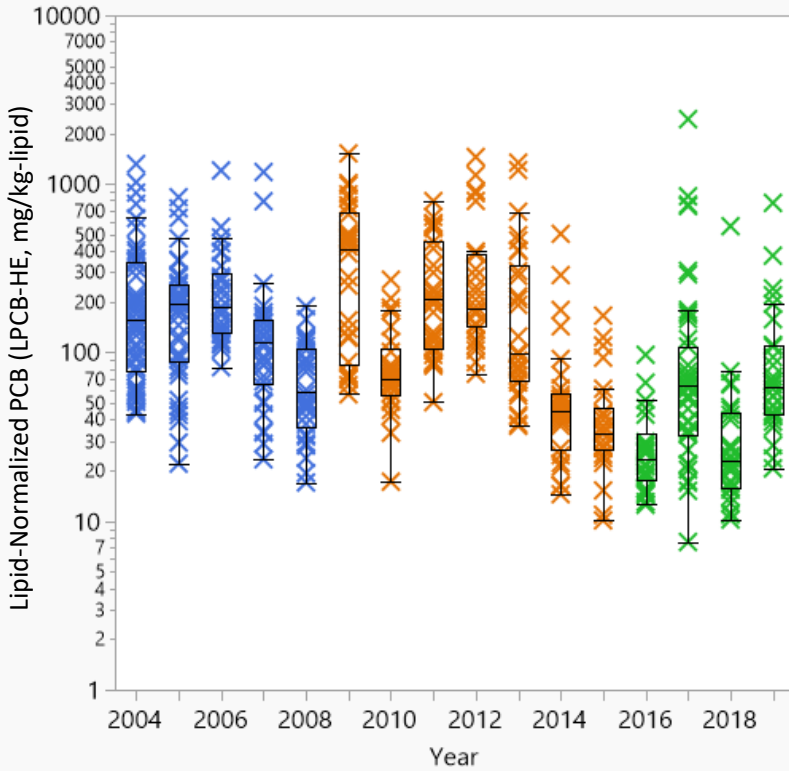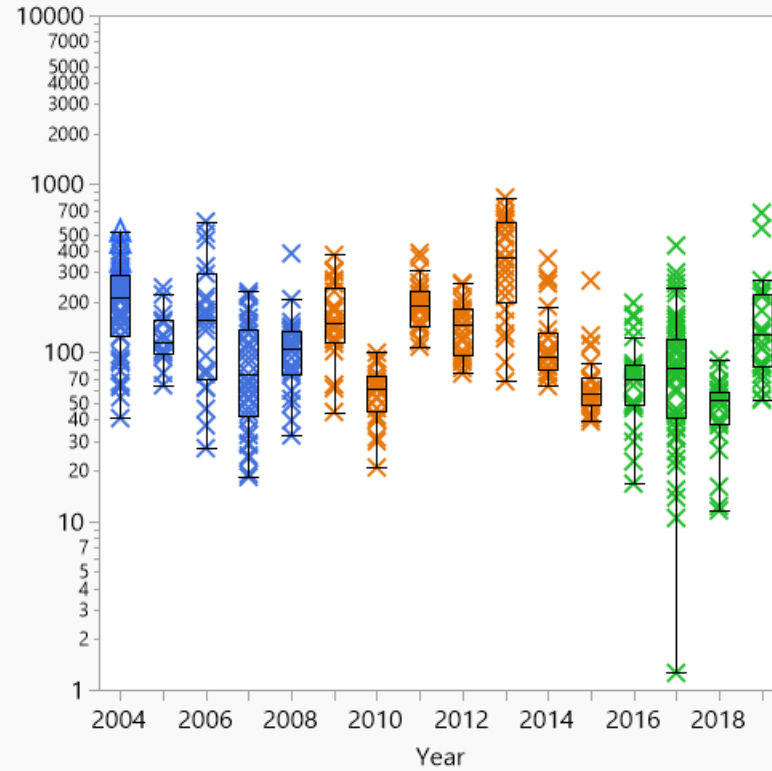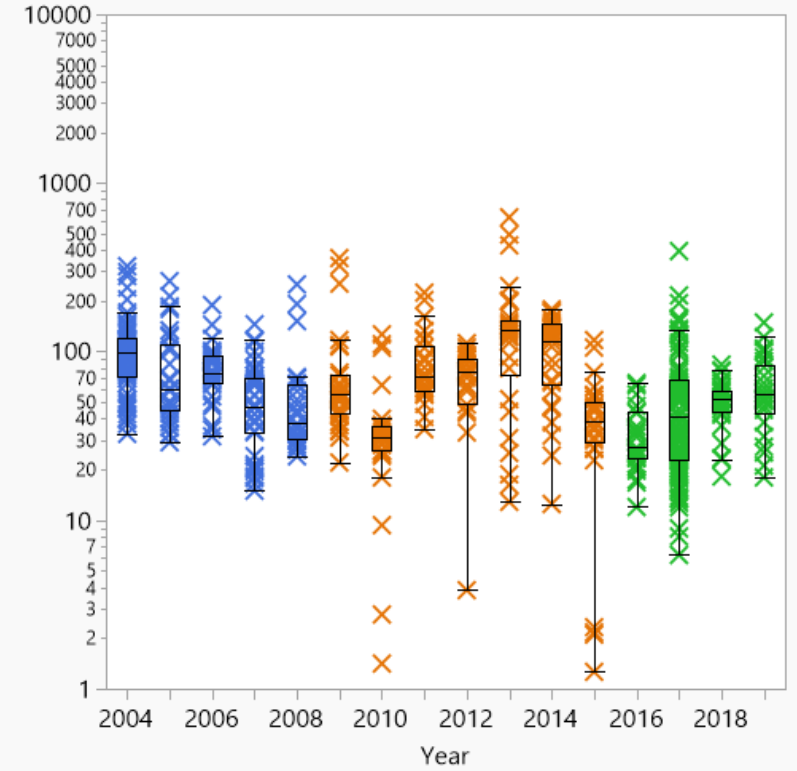
River Section 1

River Section 2

River Section 3

Lipid-Normalized PCB (LPCB-HE, mg/kg-lipid)

Year

● Before Dredging (2004-2008)
● During Dredging (2009-2015)
● After Dredging (2016-2019)

✕ Standard Fillet
△ Rib-out Fillet

Upper Hudson Pumpkinseed –Wet Weight, TPCB-HE, by River Section
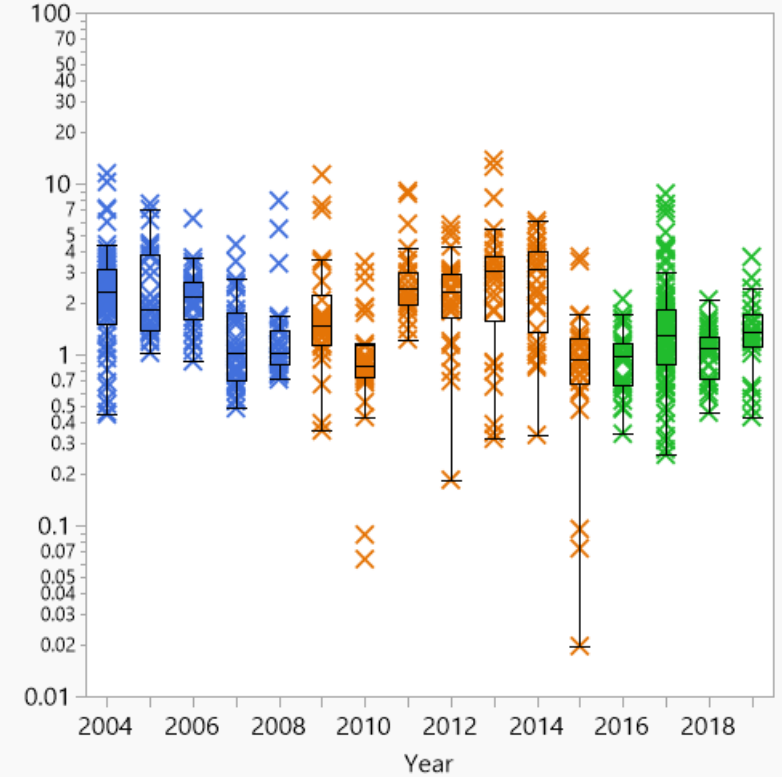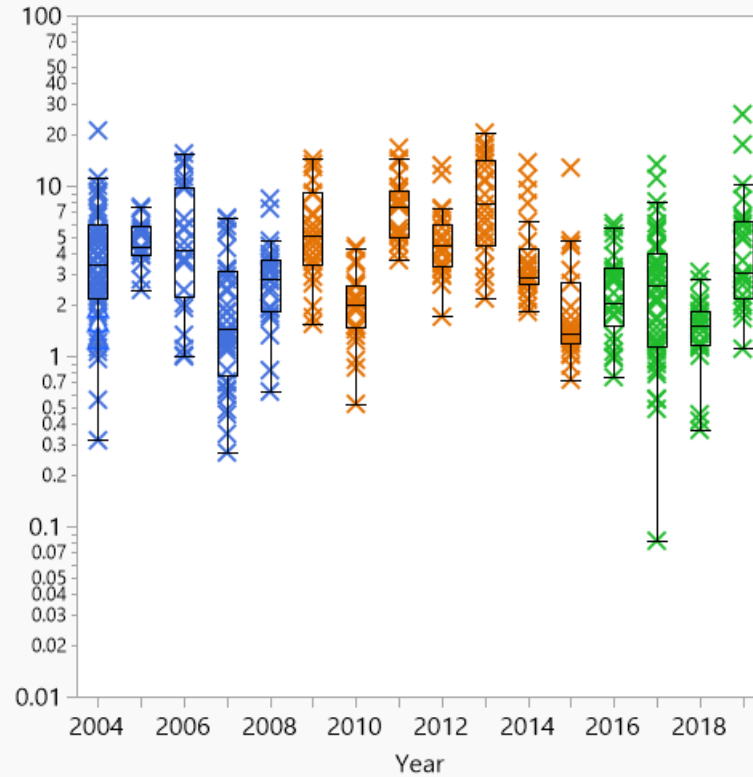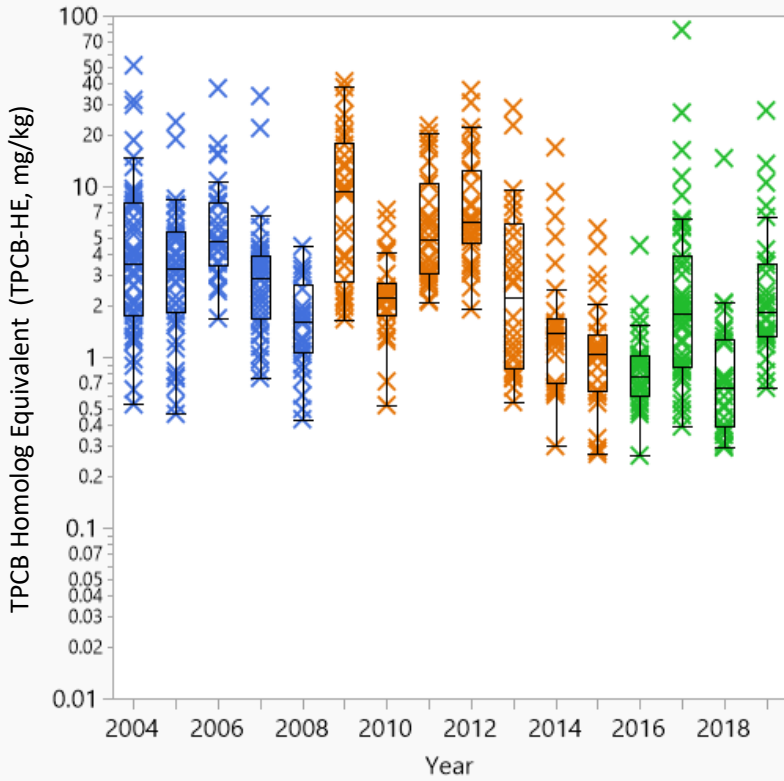
Lower Hudson River Fish

Spring Collection (Fillet):

Striped Bass (*Morone saxatilis*)

White Perch (*Morone americana*)

Smallmouth Bass (*Micropterus dolomieui*)

White Catfish (*Ictalurus catus*)

- 180 individuals from the 4 species groups collected annually
- Sport fish species represent multiple food web niches and levels, reflect longer-term body burdens
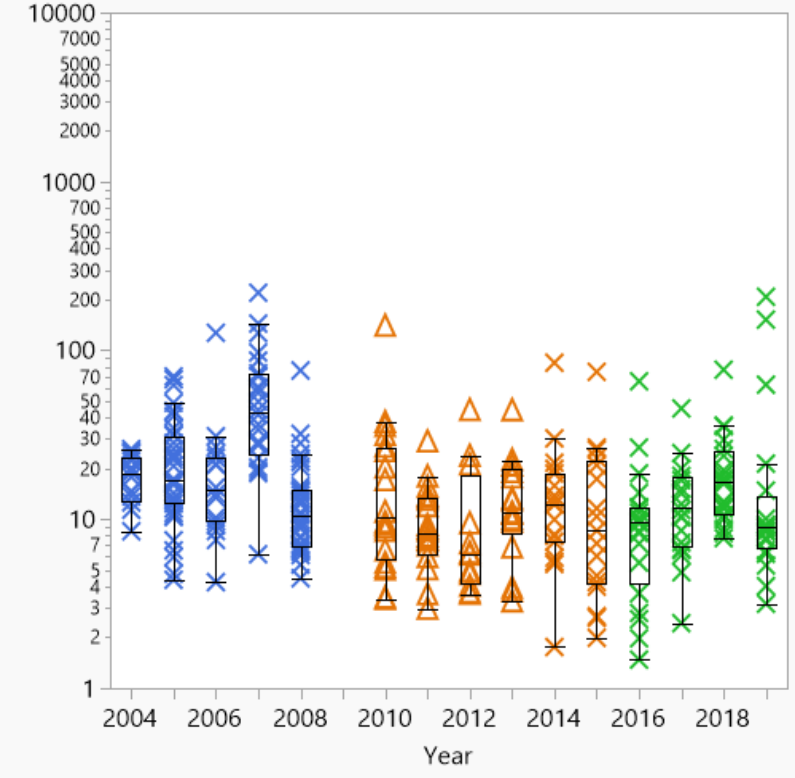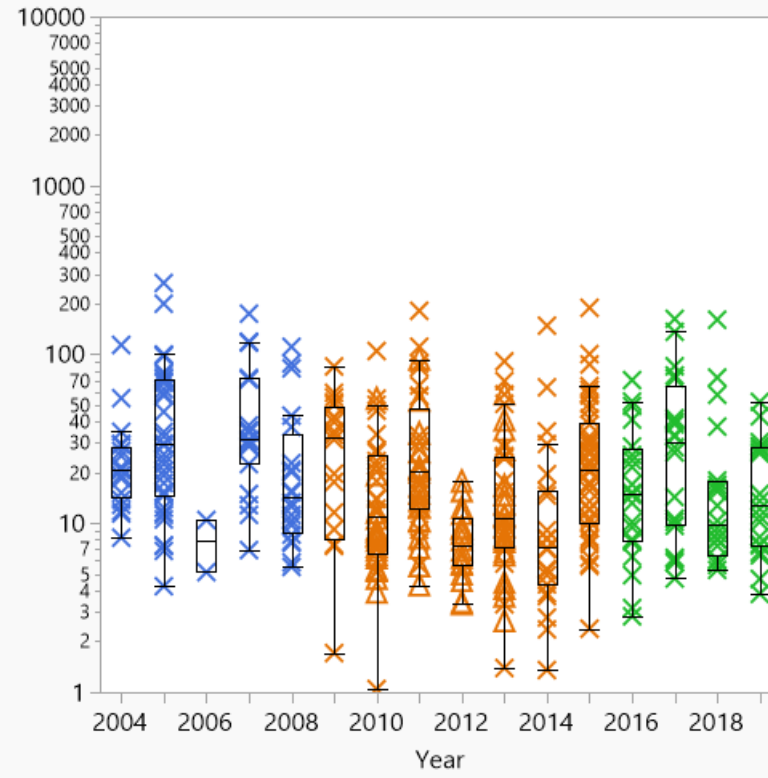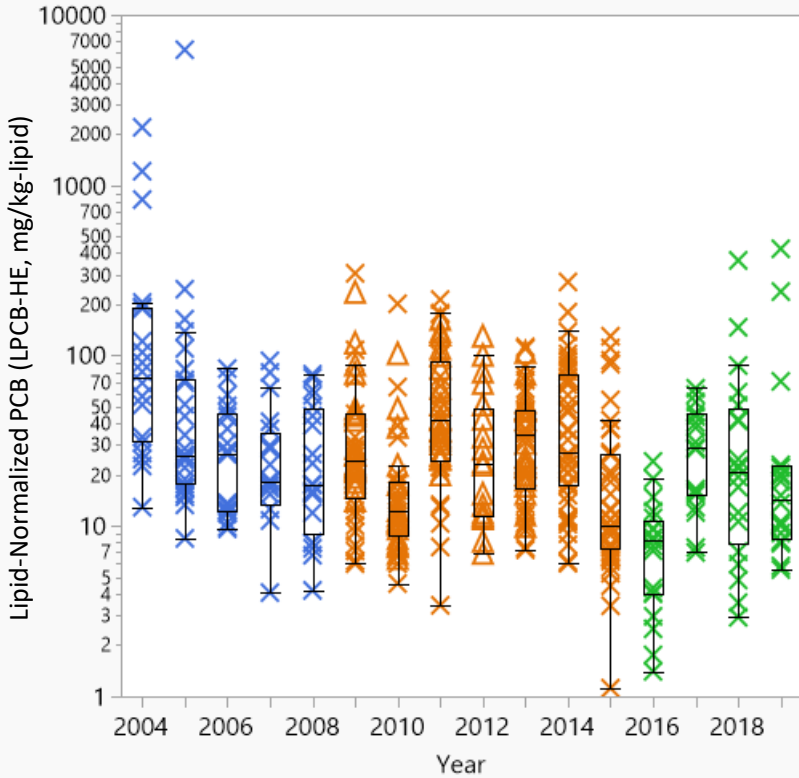- Supplemental fish collection under discussion

Albany

150
140
130
120

Catskill

110 Rip Van Winkle Bridge

Saugerties
100

Kingston
90

80

New Paltz

Poughkeepsie
70

Newburgh
60
50

Bear Mountain Bridge Peekskill
40

Croton-On-Hudson
30

Tappan Zee Bridge
20

Yonkers
10

0
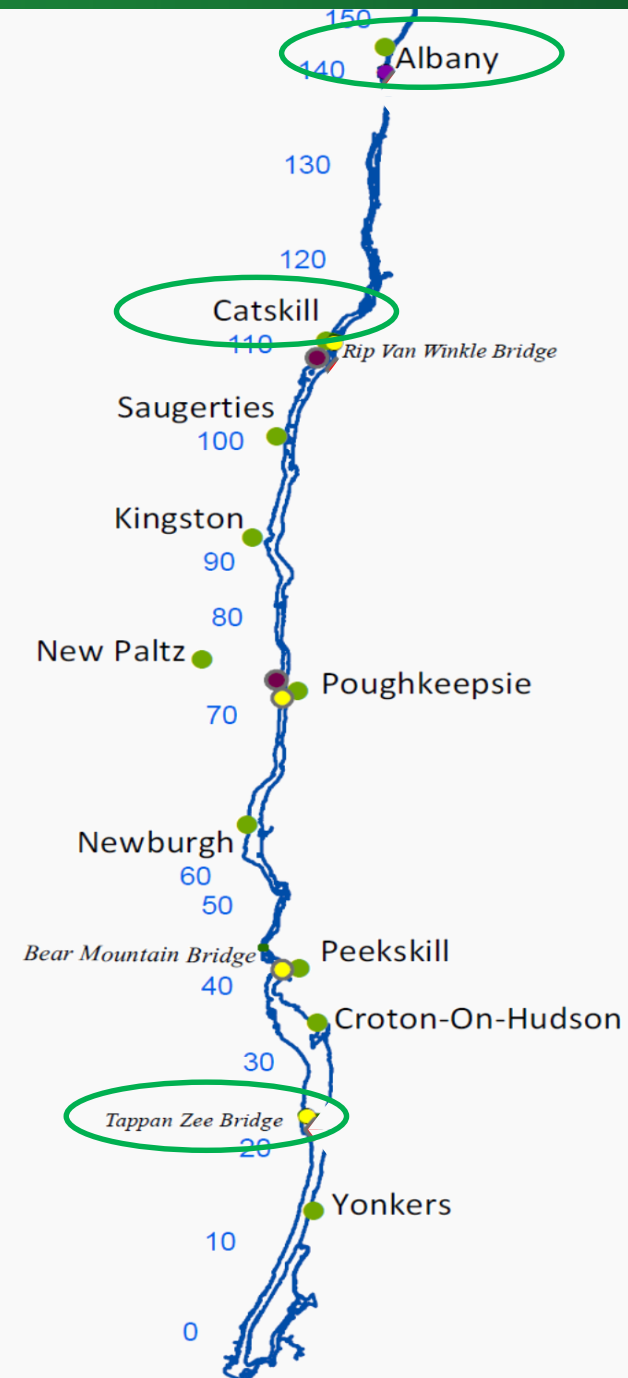
Lower Hudson Striped Bass
–Lipid Normalized, LPCB-HE, by Station

Albany/Troy (RM154)

Catskill (RM113)

Tappan Zee (RM27)

Legend:
- Before Dredging (2004-2008)
- During Dredging (2009-2015)
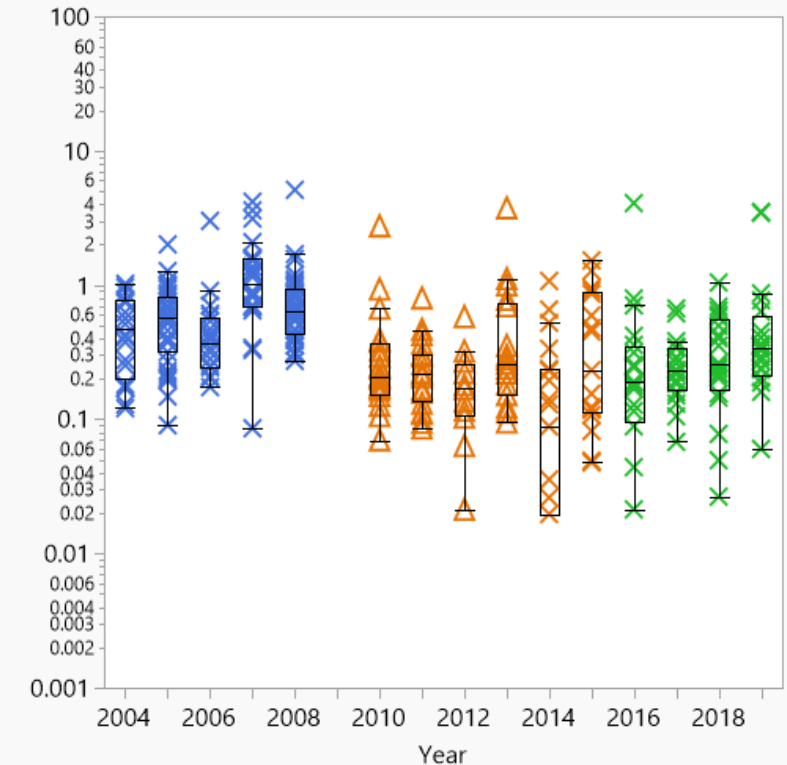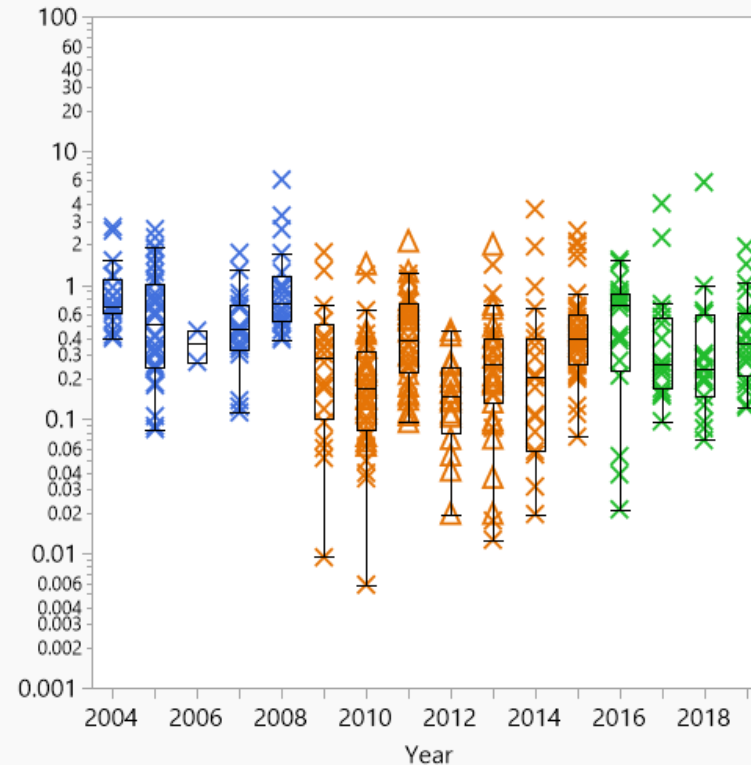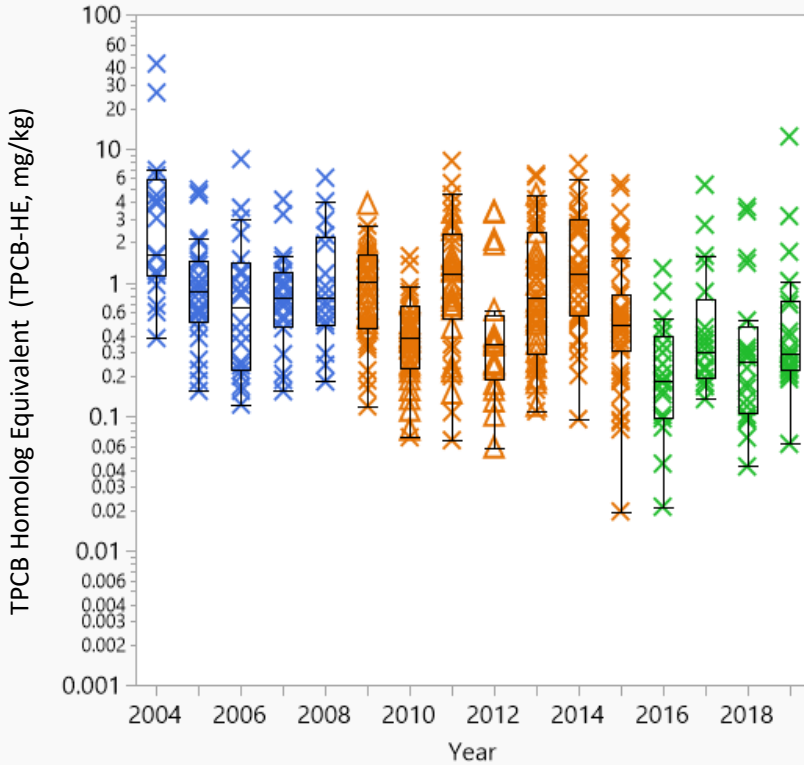- After Dredging (2016-2019)
- ✕ Standard Fillet
- △ Rib-out Fillet
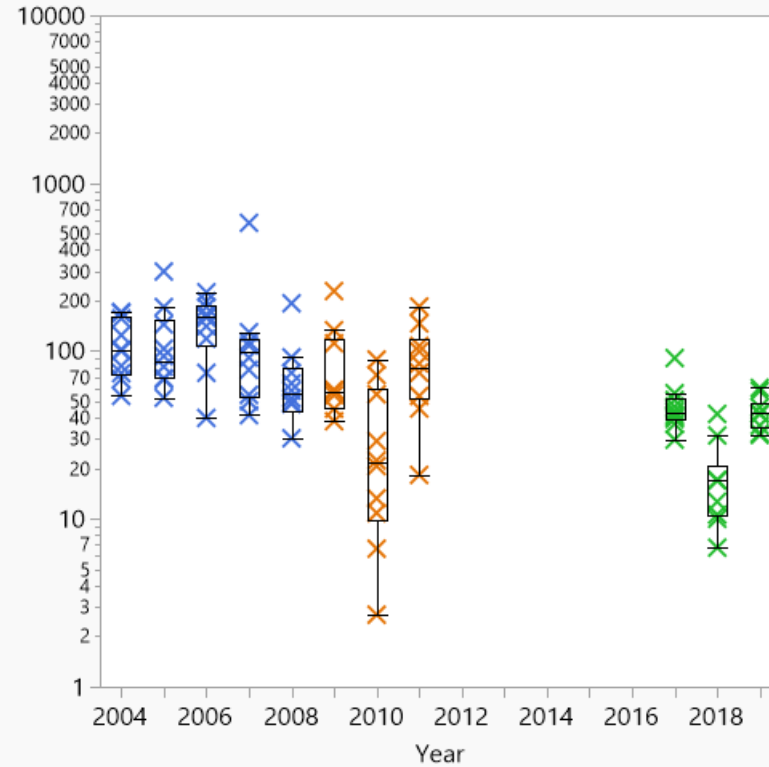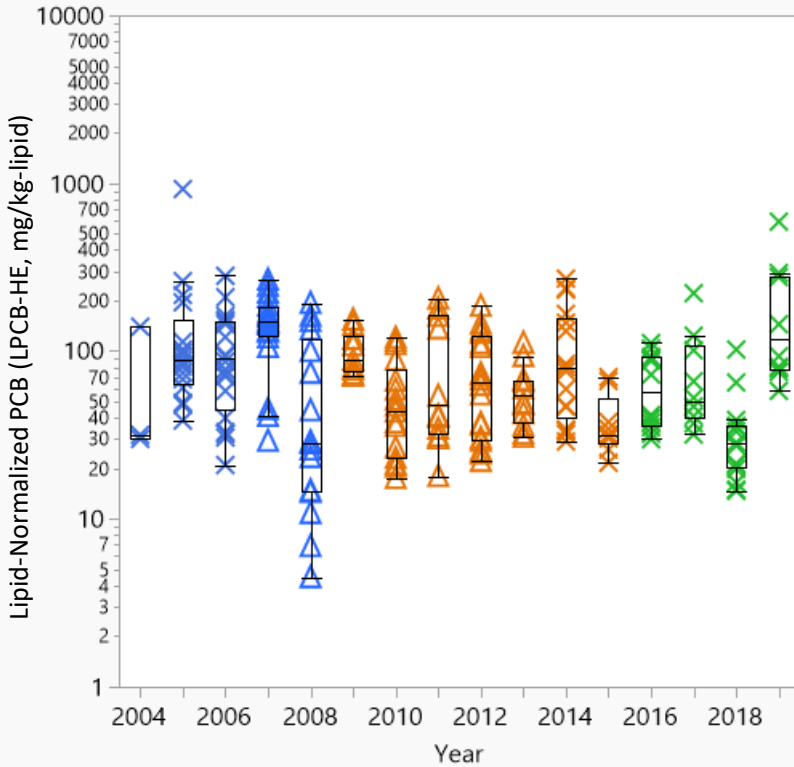
Albany/Troy (RM154)

Catskill (RM113)

Tappan Zee (RM27)

● Before Dredging (2004-2008)
● During Dredging (2009-2015)
● After Dredging   (2016-2019)

✕ Standard Fillet
△ Rib-out Fillet

Lower Hudson White Perch –Lipid Normalized, LPCB-HE, by Station

Albany/Troy (RM154)

Catskill (RM113)

● Before Dredging (2004-2008)
● During Dredging (2009-2015)
● After Dredging (2016-2019)
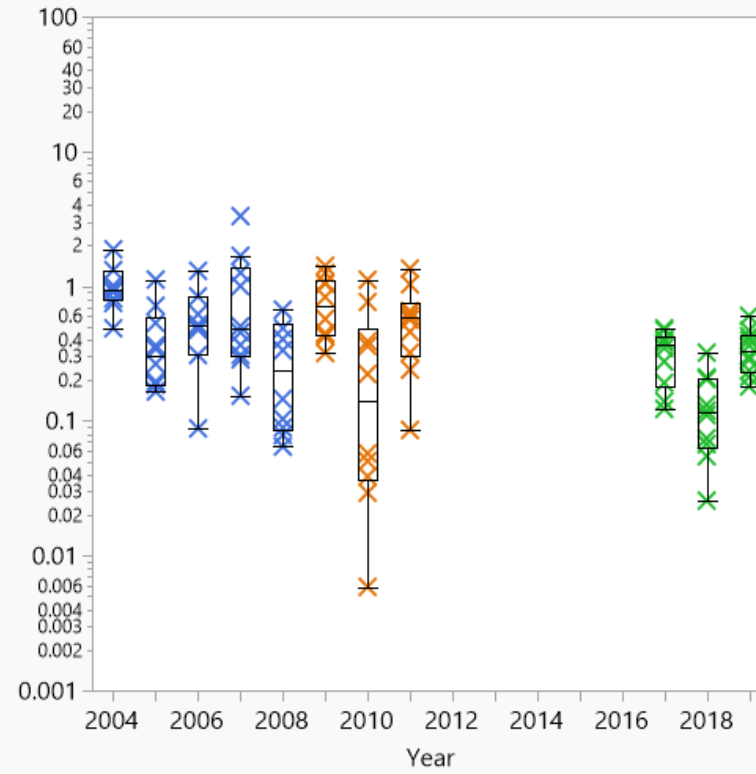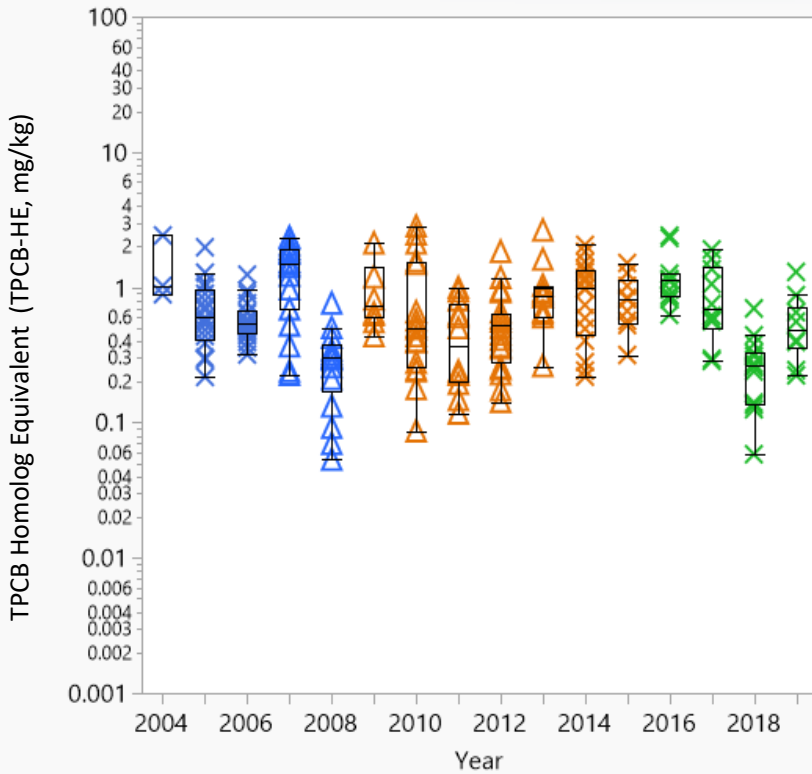
✕ Standard Fillet
△ Rib-out Fillet

Lower Hudson White Perch –Wet Weight, TPCB-HE, by Station

Albany/Troy (RM154)

Catskill (RM113)

- Before Dredging (2004-2008)
- During Dredging (2009-2015)
- After Dredging (2016-2019)

✕ Standard Fillet
△ Rib-out Fillet

Fish Quality Assurance Quality Control (QA/QC)

QA/QC Program Components

- Lab duplicates with each sample batch

- Matrix spike samples

- Lab control spikes and method blanks

- Standard Reference Material (NIST) – Added 2018

- 5% of fish analyzed by congener methods every other year
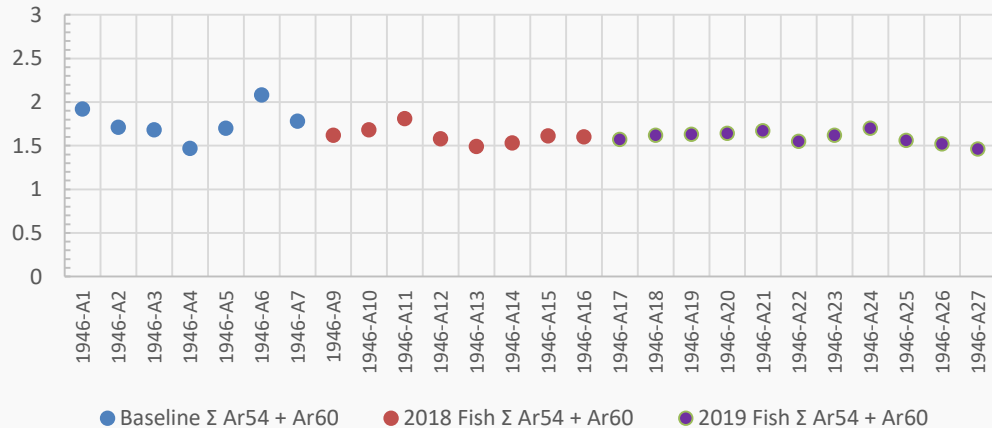
    - Last done in 2018
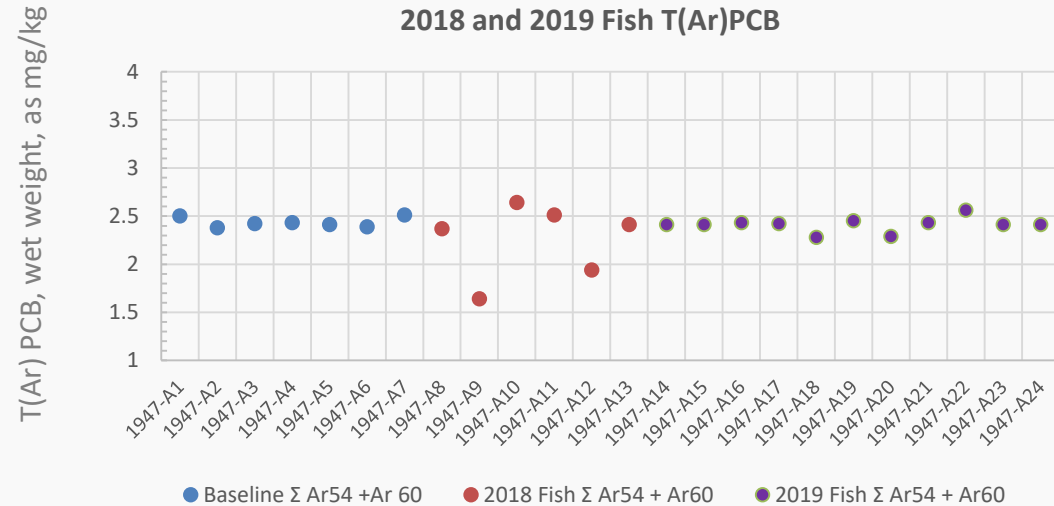
NIST Standard Reference Materials

- GE established a baseline for total PCBs for NIST 1946 and NIST 1947
  - NIST standards are certified for certain congeners
- 2018 and 2019 samples overall compare well to the 1946 and 1947 baselines

NIST1946 SRM T(Ar)PCB Baseline with 2018 and 2019 Fish T(Ar)PCB

NIST1947 SRM T(Ar)PCB Baseline with 2018 and 2019 Fish T(Ar)PCB

Upper Hudson River Fish Summary

- Overall, PCB concentrations in fish have largely recovered from dredging impacts and are now observed to be at or trending below baseline conditions

- 2019 results compared to 2018 show similar median/mean values for most species
  - Not statistically different

- Use of NIST standards as performance evaluation is on-going

- More years of data collection are needed to assess trends over time
  - As noted in the last five-year review, as many as 8 or more years of post-dredging fish data will be needed

- Results spring (2019) analyses of fish collected from reaches 1 to 4 indicate that fish collected from reach 5 represent RS3 fish

- QA/QC of data continues

- 2020 spring fish data collection is underway

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