



Department of
Environmental
Conservation

NYSDEC Upper Hudson River Data Collection

Hudson River Community Advisory Group

May 14, 2019

2017 DEC Sampling Program

Scope of Sampling Program

- Sediment sampling and fish sampling performed:
 - Sediment – 1678 locations attempted, 1156 samples collected.
 - Fish – 232 samples collected



Basis for 2017 DEC Surface Sediment Sampling Program

- Intended as an element of the long term monitoring program
- Difference in data quality objectives:
 - Greater spatial resolution – “pool by pool” vs. River Section
 - Greater temporal resolution – 5 years vs. 10 years



Basis for 2017 DEC Surface Sediment Sampling Program

- Provide a robust data set of a reproducible metric to represent change in sediment PCB concentrations over time.
- Metric chosen: Total PCB in 0-2" surface sediment grab samples (also used by GE/EPA).
- Gather sufficient data to evaluate the temporal and spatial trends in surface sediment PCB concentration.
- Temporal Resolution – Achieve assumed 8% annual decline in five years?



“The number of samples sufficient to achieve defined statistical objectives was determined using statistical design objectives specified by NYSDEC. The specific statistical design objectives included:

- (1) the ability to detect an 8% annual decline in mean sediment total PCB concentrations within a given reach between two consecutive 5-year monitoring periods with a statistical power of 80% at the 95% confidence level, and*
- (2) the ability to determine the arithmetic mean PCB concentration for each reach with a relative error no greater than 20%.”*

Table 3-1 Sediment Analytical Summary Statistics by Reach
Hudson River PCB Sediments Site OU-2, New York

Location	Analyte	Sample Counts	Frequency of Detect	Frequency of Non-detect	Detected Concentrations (mg/kg)		
					Minimum	Average	Maximum
Reach 8	Total Organic Carbon	211	211	0	496	9,410	77,900
	Total PCB Aroclors	211	187	24	0.0187	1.69	23.1
	Total PCB Congener	21	21	0	0.0386	3.27	42.5
Reach 7	Total Organic Carbon	90	90	0	701	12,100	61,900
	Total PCB Aroclors	90	87	3	0.0297	5.20	60.9
	Total PCB Congener	10	10	0	0.0890	8.52	24.2
Reach 6	Total Organic Carbon	79	79	0	826	18,200	53,000
	Total PCB Aroclors	79	78	1	0.161	2.40	19.1
	Total PCB Congener	7	7	0	1.37	2.70	5.88
Reach 5	Total Organic Carbon	242	242	0	656	14,300	51,900
	Total PCB Aroclors	242	236	6	0.0072	1.29	11.6
	Total PCB Congener	25	25	0	0.136	1.42	4.91
Reach 4	Total Organic Carbon	238	238	0	1,590	19,200	90,500
	Total PCB Aroclors	238	199	39	0.0218	1.66	67.1
	Total PCB Congener	21	21	0	0.0160	1.34	3.80
Reach 3	Total Organic Carbon	108	108	0	1,200	13,900	43,700
	Total PCB Aroclors	108	103	5	0.038	2.23	39.8
	Total PCB Congener	12	12	0	0.0560	1.95	8.11
Reach 2	Total Organic Carbon	69	69	0	1,460	8,620	24,700
	Total PCB Aroclors	69	63	6	0.0294	0.499	2.36
	Total PCB Congener	7	7	0	0.150	0.356	0.532
Reach 1	Total Organic Carbon	116	116	0	931	8,310	38,100
	Total PCB Aroclors	116	109	7	0.0218	0.745	15.4
	Total PCB Congener	12	12	0	0.0324	0.511	2.56
Old Champlain Canal	Total Organic Carbon	9	9	0	33,600	52,900	66,400
	Total PCB Aroclors	9	9	0	0.0874	8.69	50.1

Notes:

Statistics are based on detected results only and do not include field duplicates.

mg/kg: milligrams per kilogram

PCB: polychlorinated biphenyl

TOC: total organic carbon

Minimum, Maximum, and Average TPCB and TOC by river reach in 2017 DEC data set.

High mean PCB and variance in Reach 4 due to a single possible outlier in the data set.



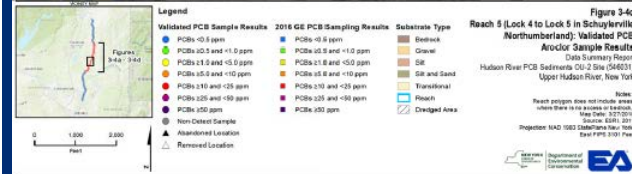
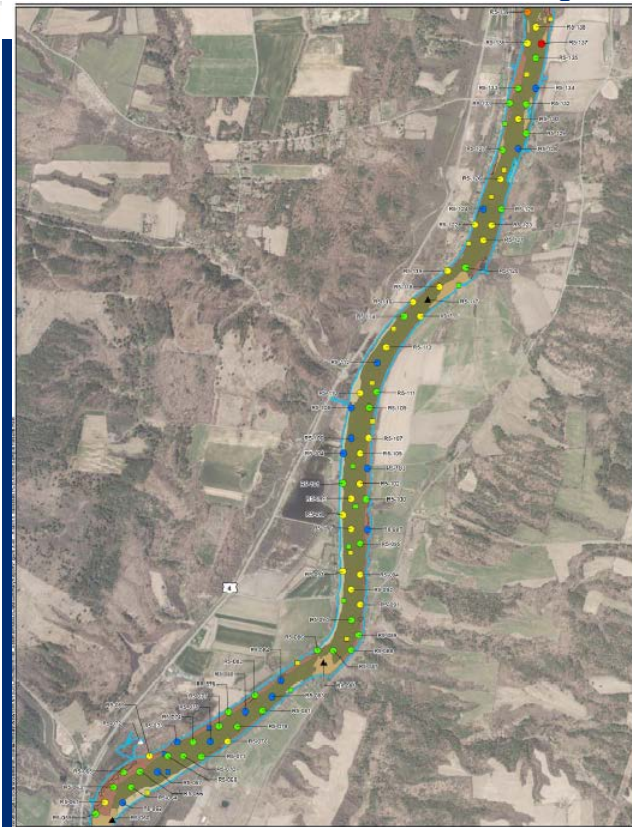
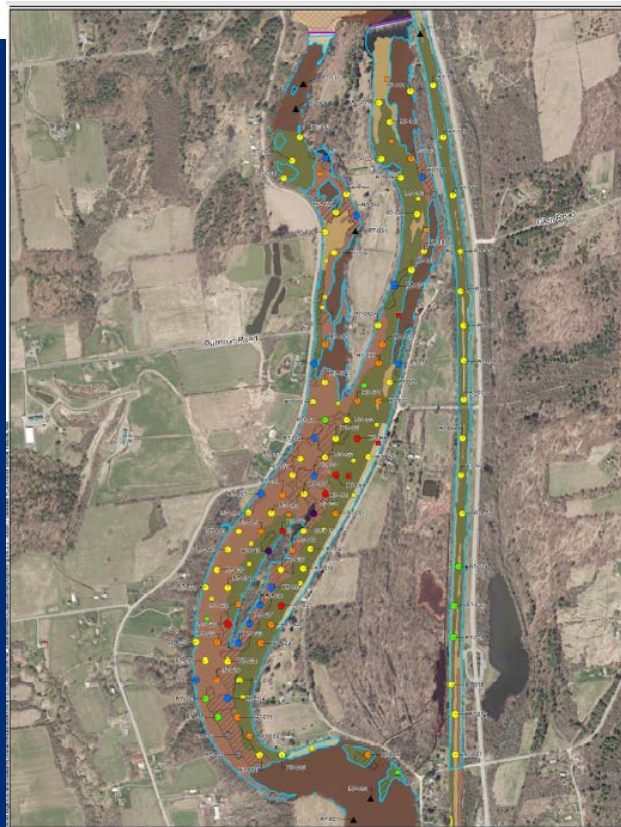
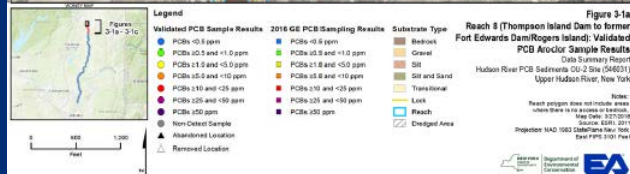
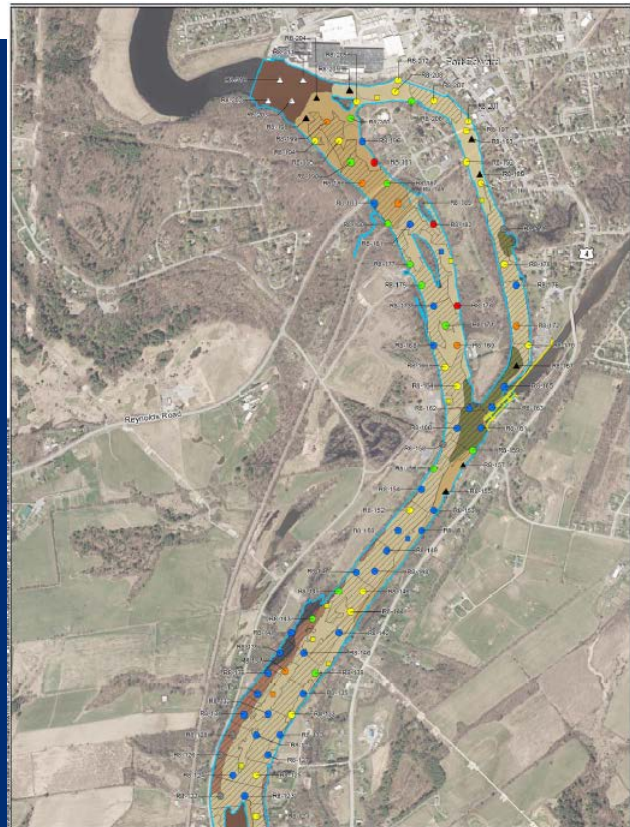
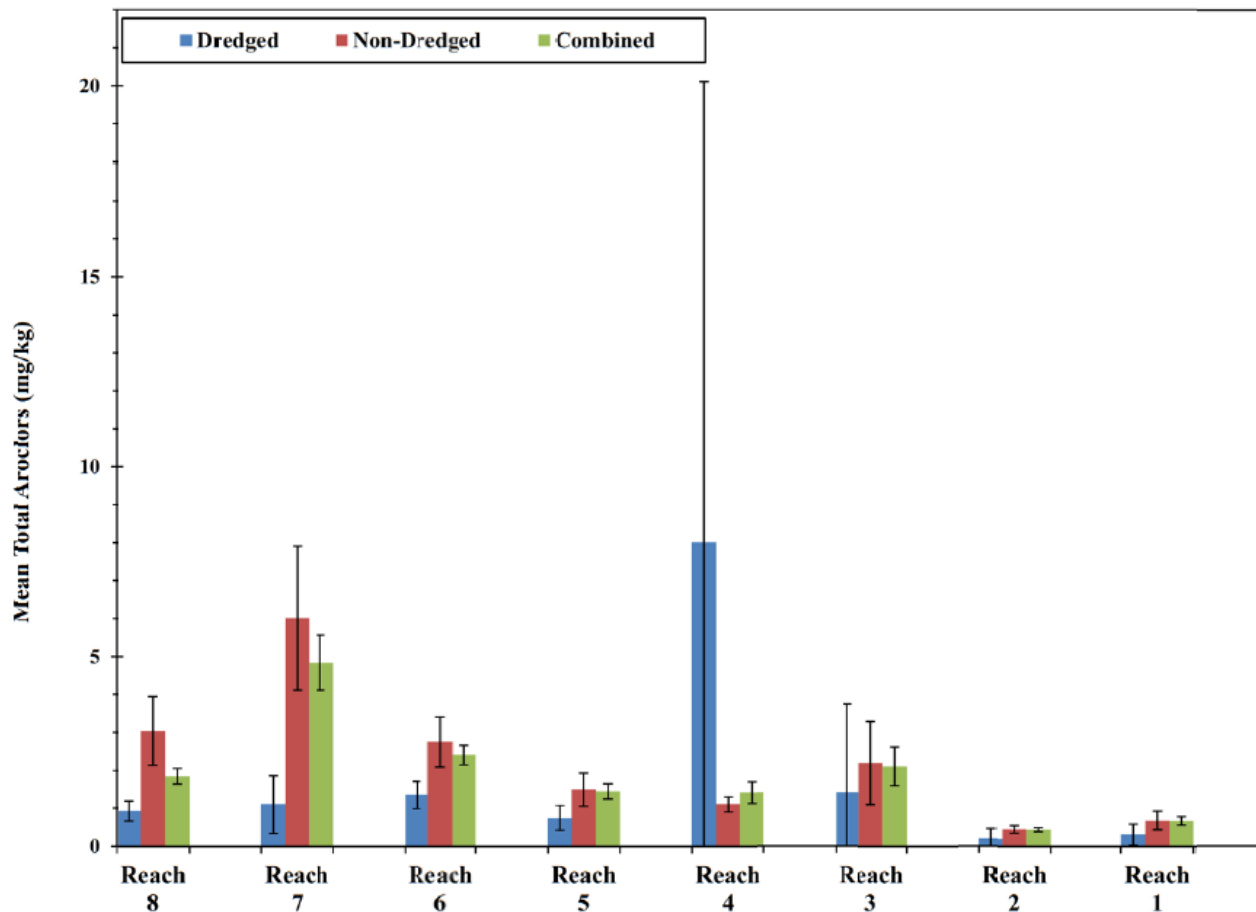


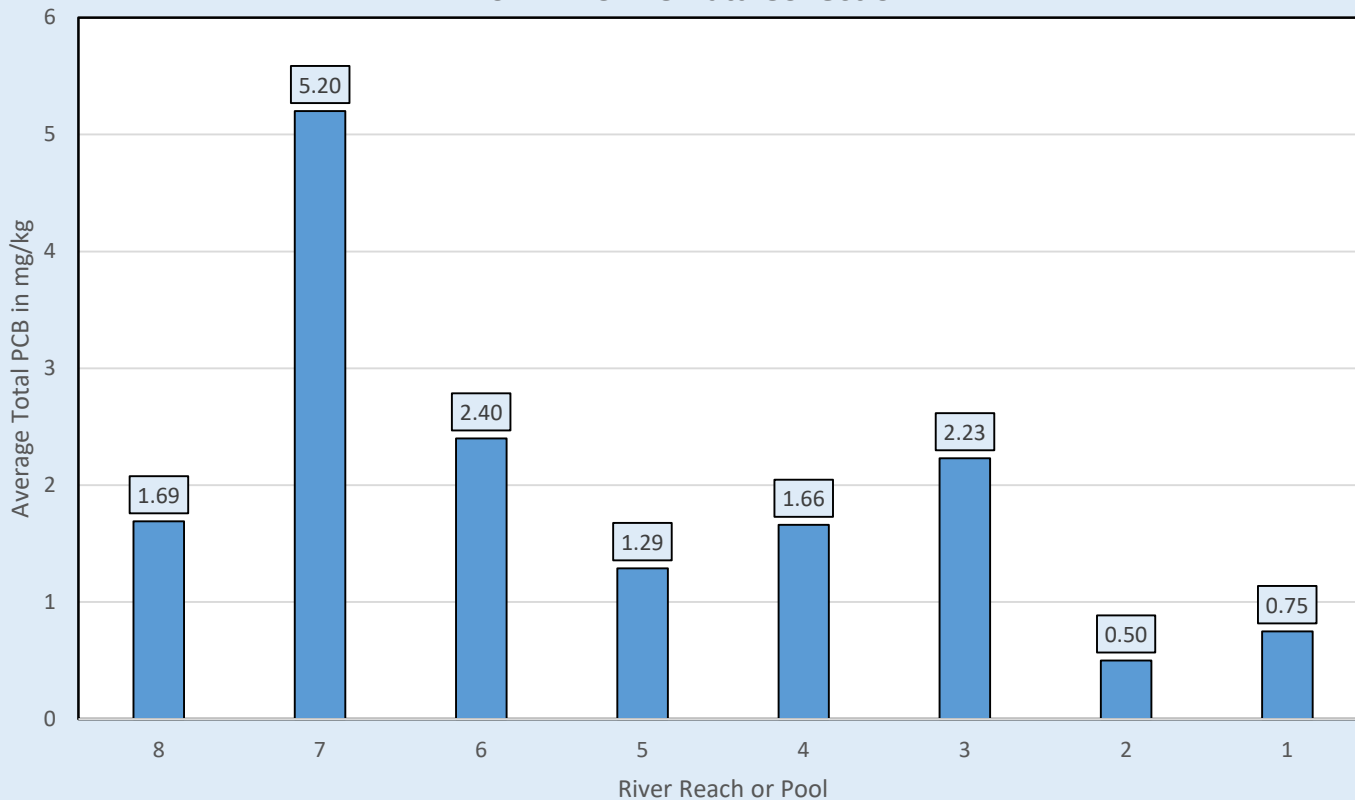
Figure 4-1 Mean Concentrations of Total Aroclors in Recoverable Sediment by Reach and Dredged vs. Non-Dredged. Error bars represent ± 2 standard errors of the mean.



Average TPCB
by river reach in
2017

Note differences
pool by pool;
outcome of
remedy varies
spatially.

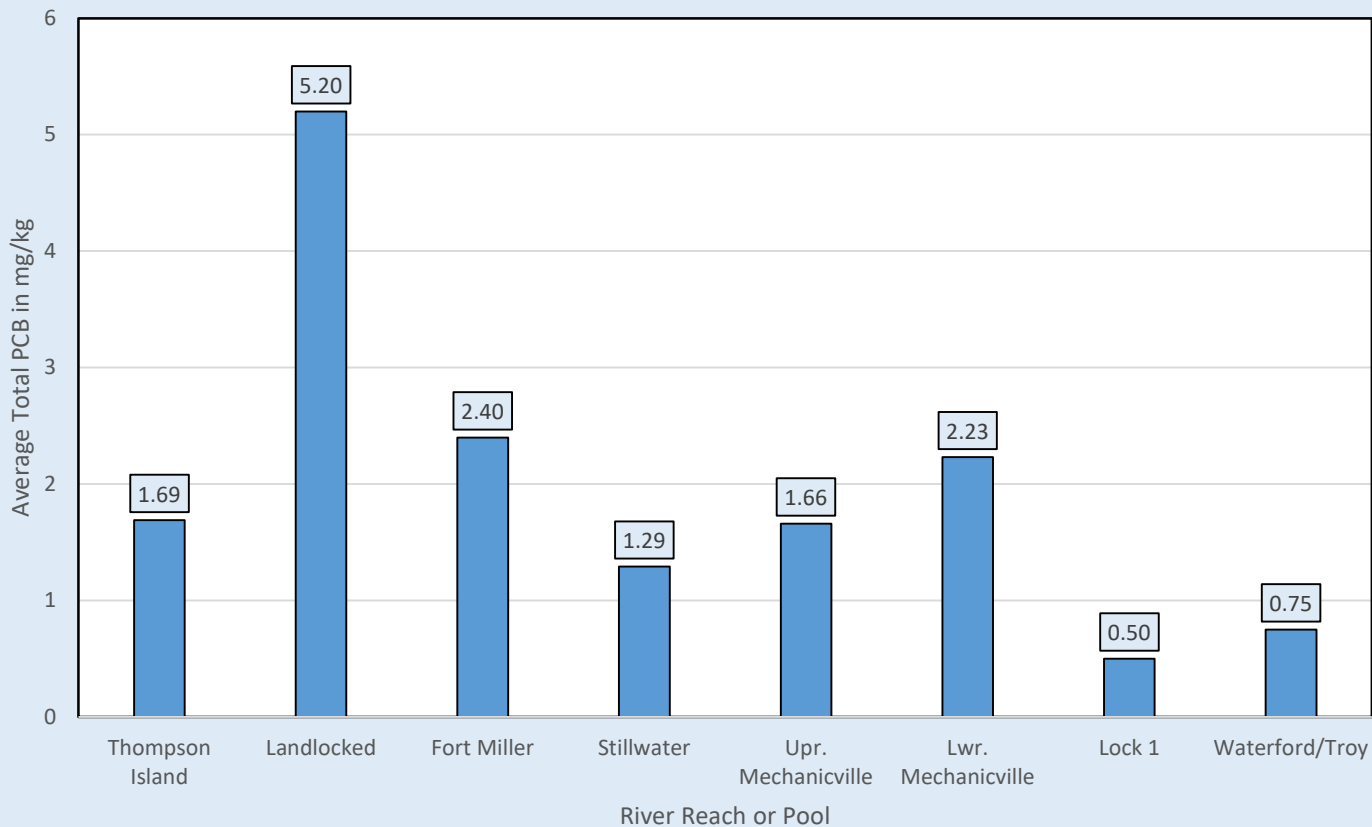
Upper Hudson River Sediment PCB Concentrations
Pool Average Surface (0-2") Sediment Total PCB
2017 NYSDEC Data Collection



Average TPCB
by river reach
in 2017

Overall Pool
Average Total
PCB

Upper Hudson River Sediment PCB Concentrations
Pool Average Surface (0-2") Sediment Total PCB
2017 NYSDEC Data Collection

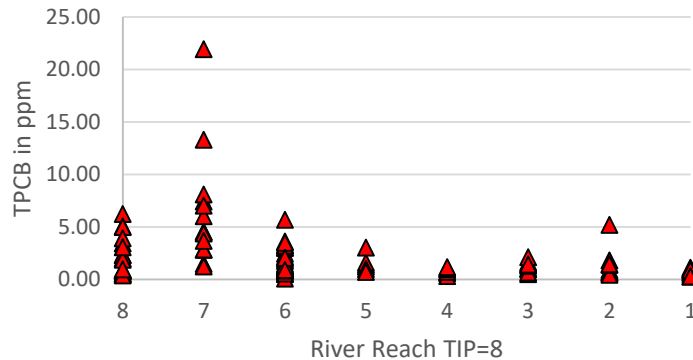


2017 DEC Fall Fish Sampling

- DEC also conducted fish sampling in the fall of 2017.
- Sampling was performed in each pool of the upper Hudson for the first time.
- Fall sampling - forage fish and small sunfish.

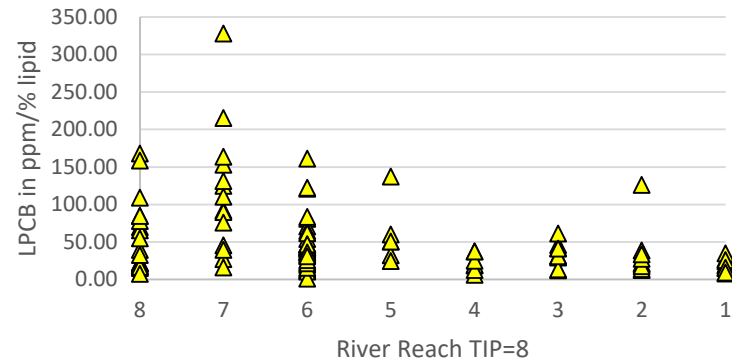


All Sunfish TPCB by Reach



Sunfish collected by size to target young of year.

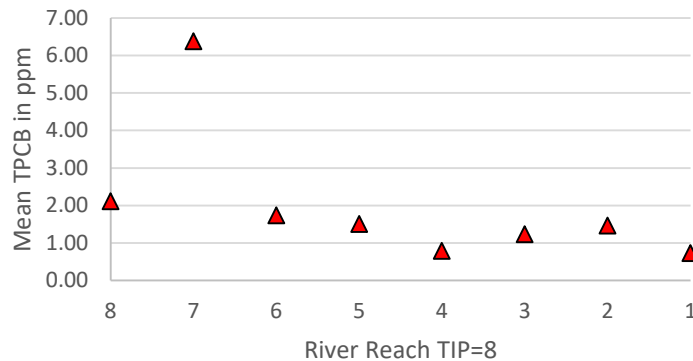
All Sunfish LPCB by Reach



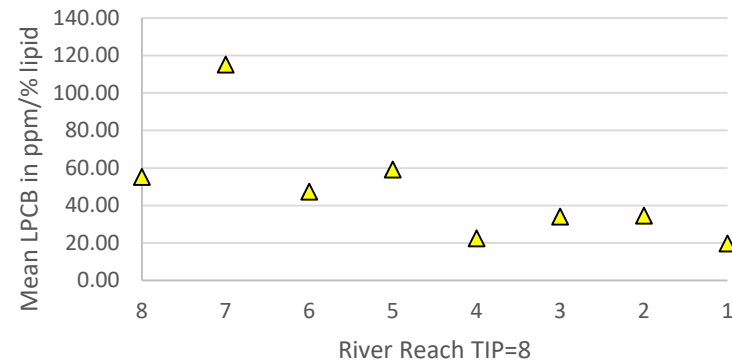
TPCB =
Total PCB

LPCB =
Lipid
Based PCB

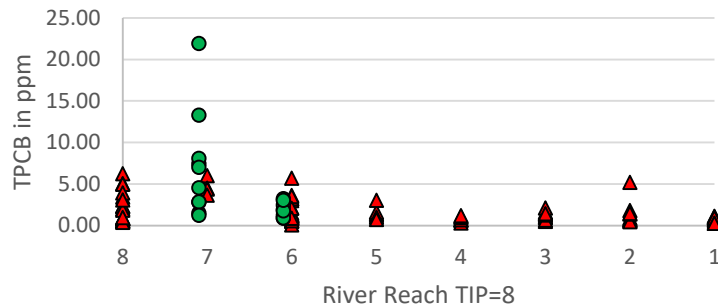
All Sunfish Mean TPCB by Reach



All Sunfish Mean LPCB by Reach



PKSD and RBRS TPCB by Reach

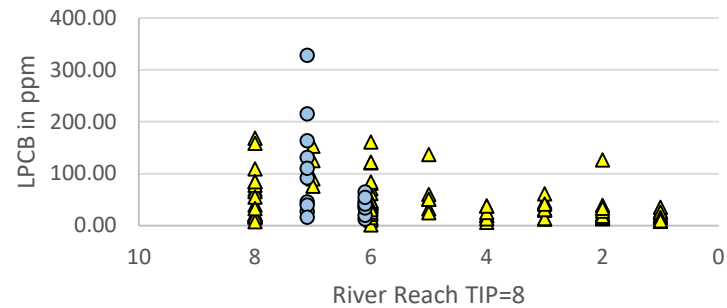


▲ PKSD TPCB by Reach ● RBRS TPCB by Reach

PKSD =
Pumpkin-
seed

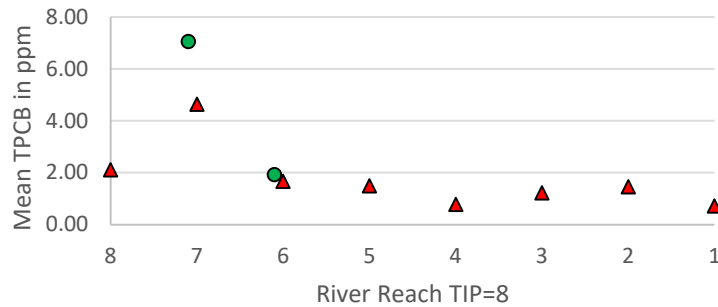
RBRS =
Redbreast
Sunfish

PKSD and RBRS LPCB by Reach



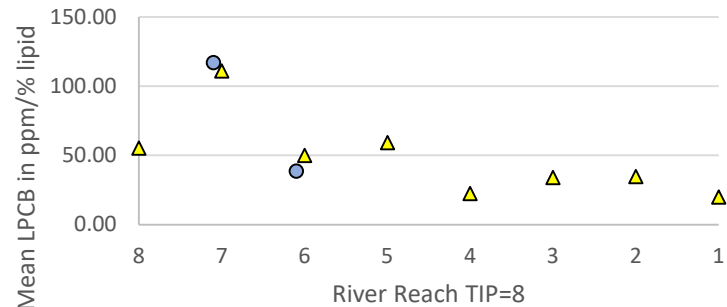
▲ PKSD LPCB by Reach ● RBRS LPCB by Reach

PKSD and RBRS Mean TPCB by Reach



▲ Mean PKSD TPCB by Reach ● RBRS Mean TPCB by Reach

PKSD and RBRS Mean LPCB by Reach



▲ Mean PKSD LPCB by Reach ● RBRS Mean LPCB by Reach

Observations

- Average surface sediment Total PCB concentrations vary on a pool by pool basis by an order of magnitude (0.5 mg/kg in Reach 2 vs. 5.2 mg/kg in Reach 7).
- Surface sediment PCBs are representative of continuing sediment sources to water column and to biota.
- More data are needed to quantify the rate of change in surface sediment PCB concentrations to evaluate remedy performance.

Thank You

Kevin L. Farrar

Division of Environmental Remediation,

NYSDEC

625 Broadway, 12th Floor

Albany, NY 12233-7013

kevin.farrar@dec.ny.gov

518-402-9778

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Available Fish Data

- The project baseline period was 2004 to 2008.
- Dredging began in 2009, and was completed in 2015.
- For areas dredged in Phase 1, there are eight years of post dredging data available.
- For other areas, there are two to seven years of data available.



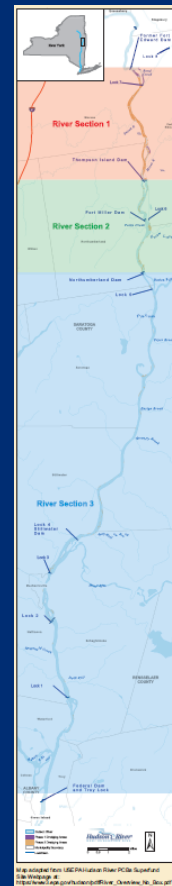
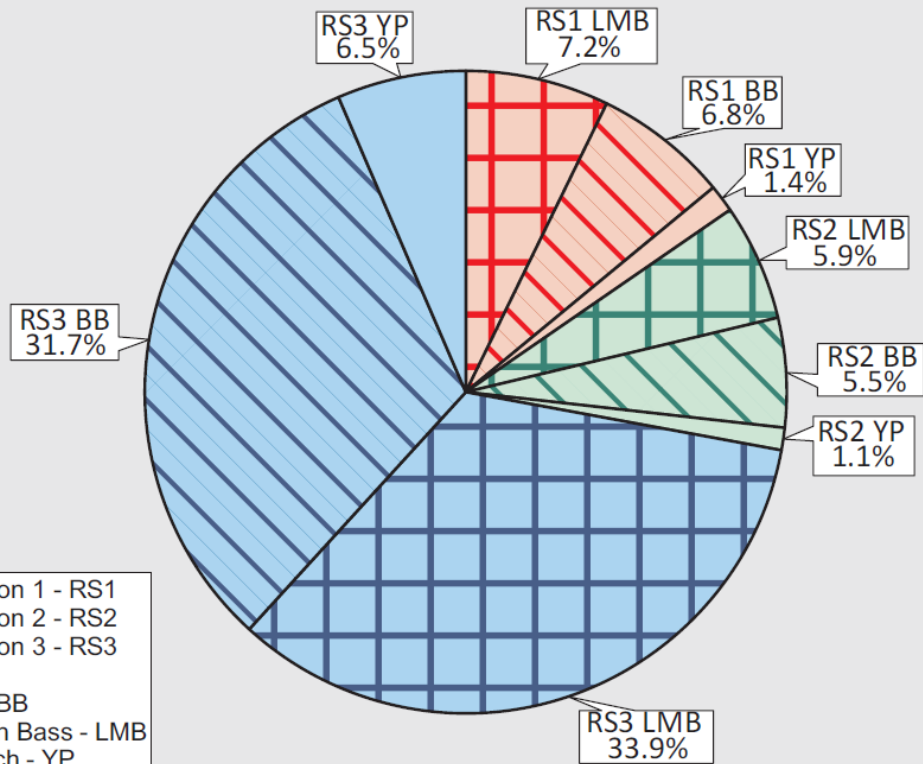
EPA ROD Objectives – PCBs in Fish

The primary remedy performance metric established by EPA in the 2002 Record of Decision (ROD) for the Hudson River PCBs Site is a Species and River Section Length Weighted Average Total PCB concentration in fish.

The Remedial Action Objectives (RAOs) in the ROD included specific time frames to achieve quantitative target concentrations using this metric – 0.4 parts per million (ppm) five years after dredging, and 0.2 ppm sixteen years after dredging.



River Section and Species Weighted Average Fish PCB Concentrations
Relative Contribution by Species and River Section Length



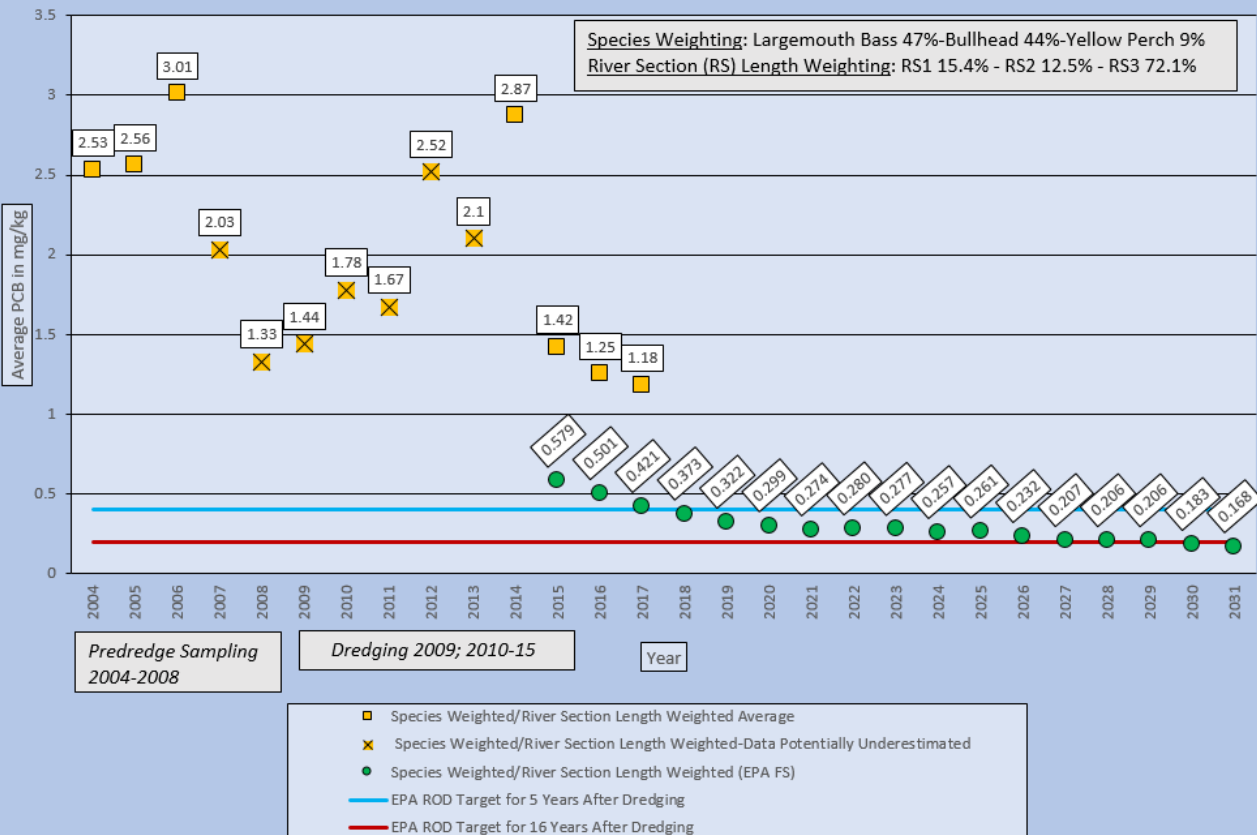
Available Fish Data vs. ROD Targets

By comparing the post-dredging fish PCB concentrations to those anticipated by EPA, and to the targets established in the ROD, remedy performance can be assessed.

The changes in fish PCB concentrations at individual stations can also be assessed to determine if the rates of decline are steady post dredging, or if they are slowing over time.



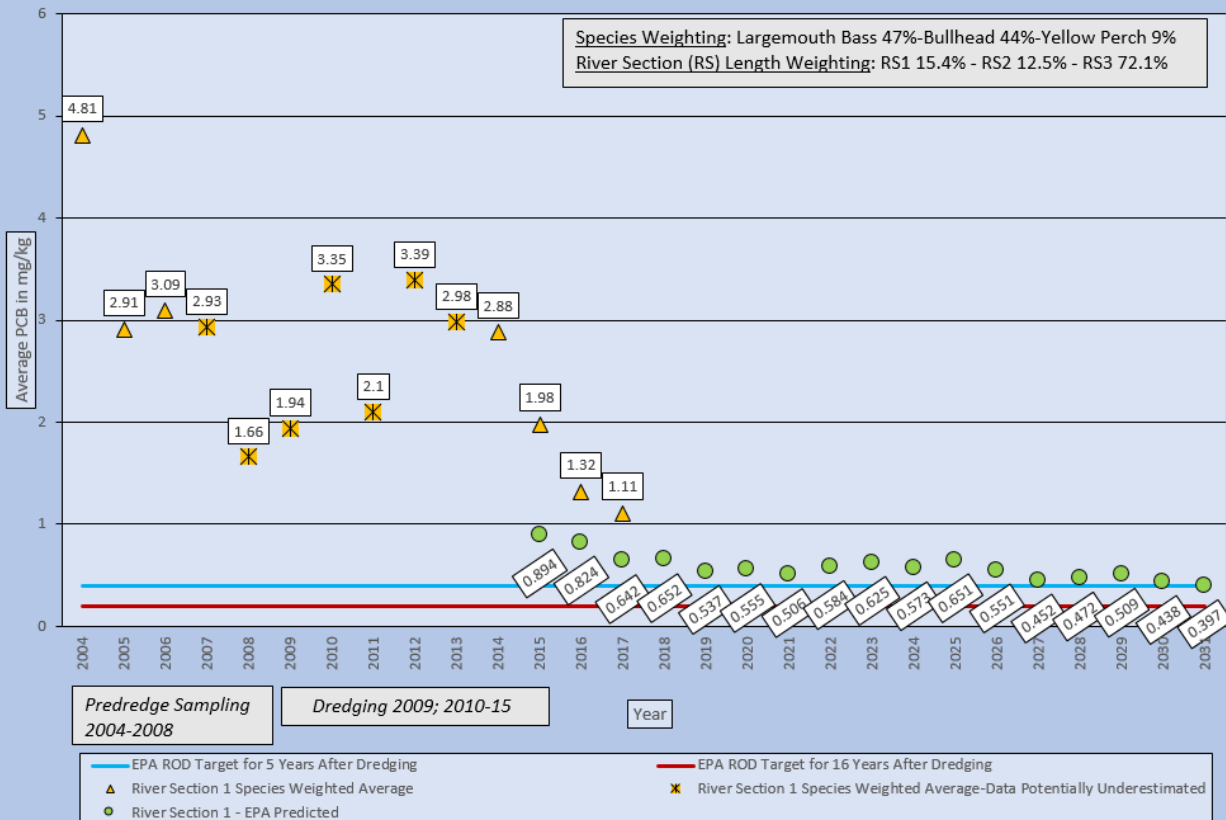
Upper Hudson River Fish PCB Concentrations 2004 - 2017 Species Weighted and River Section Length Weighted Averages



The overall weighted average fish PCB concentration is ~ 3X the target to be reached in 2020.

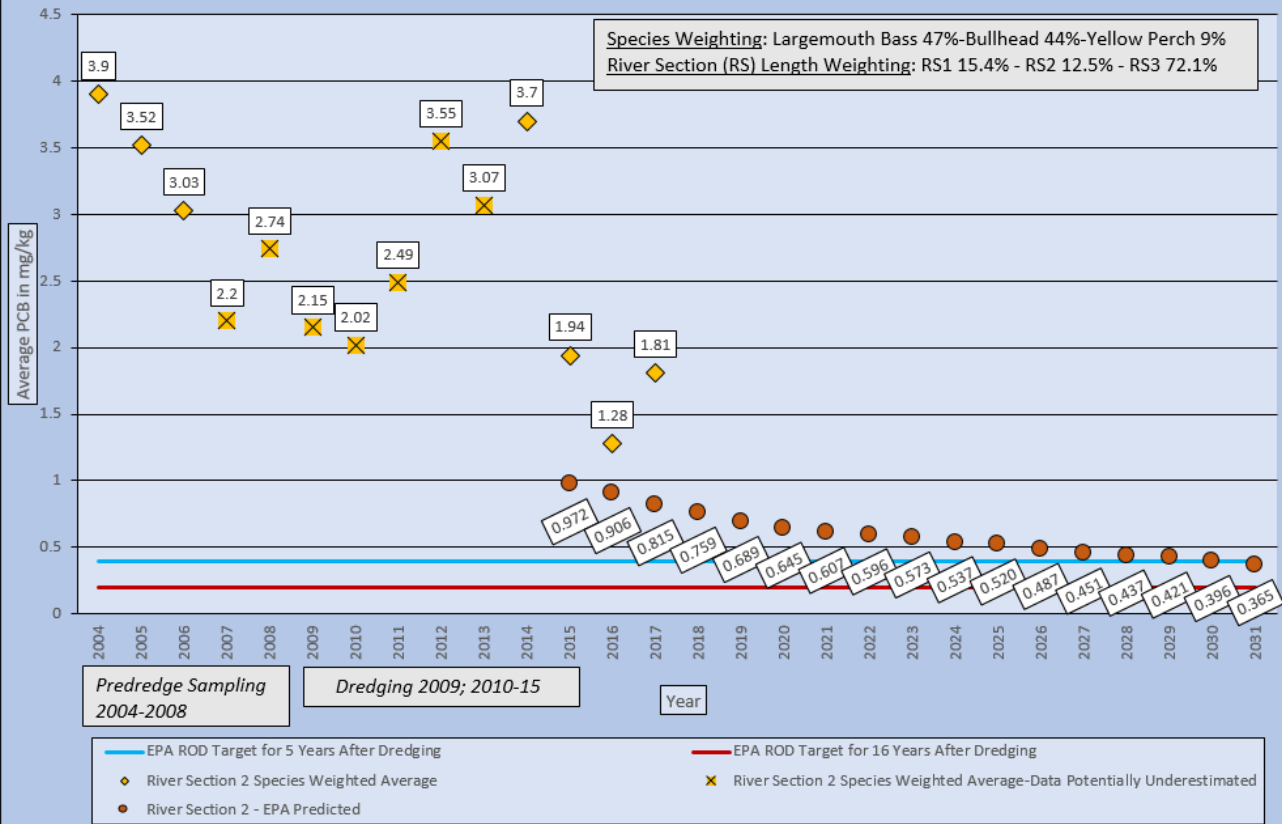
Upper Hudson River Fish PCB Concentrations 2004 - 2017 Species Weighted Averages River Section 1

Species Weighting: Largemouth Bass 47%-Bullhead 44%-Yellow Perch 9%
River Section (RS) Length Weighting: RS1 15.4% - RS2 12.5% - RS3 72.1%



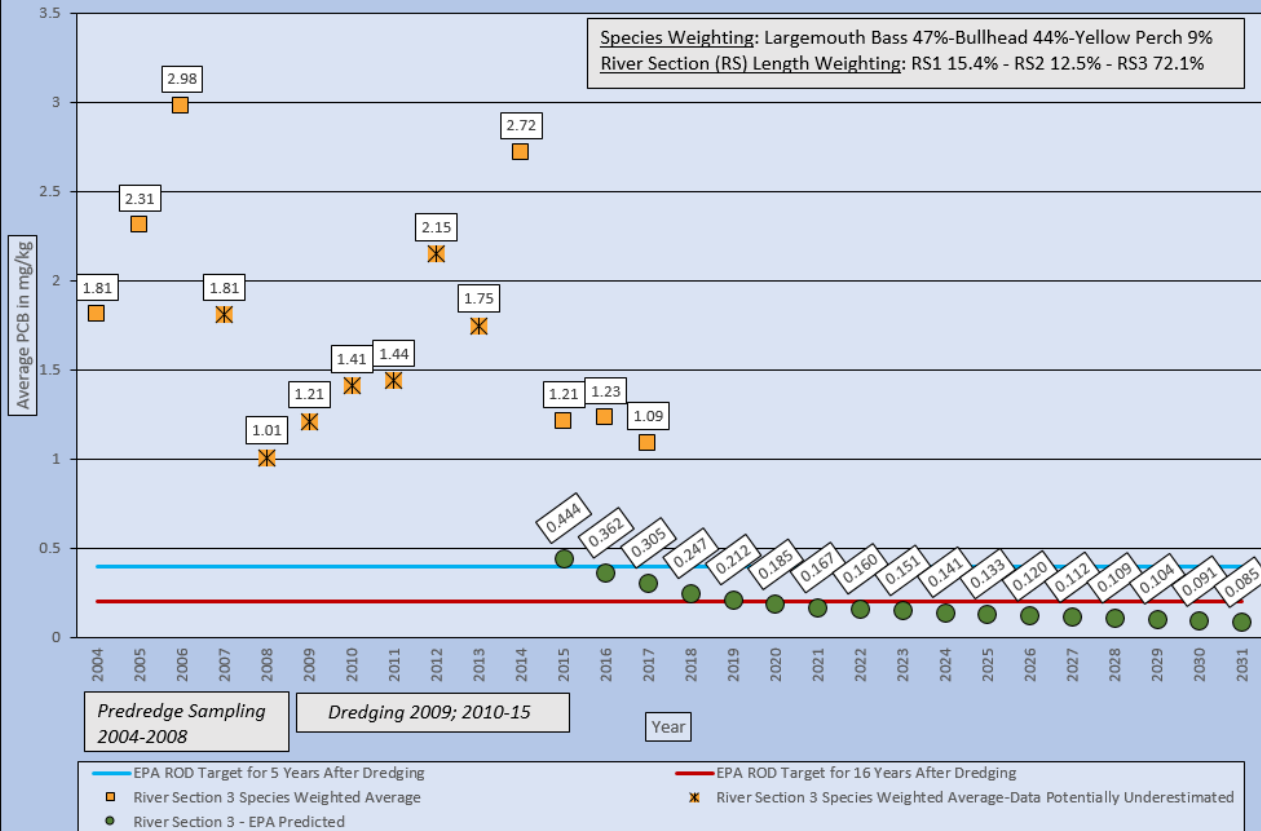
In River Section 1 (~ 15% of the upper Hudson) the river-wide target may be reached in 2020.

Upper Hudson River Fish PCB Concentrations 2004 - 2017
Species Weighted Averages River Section 2



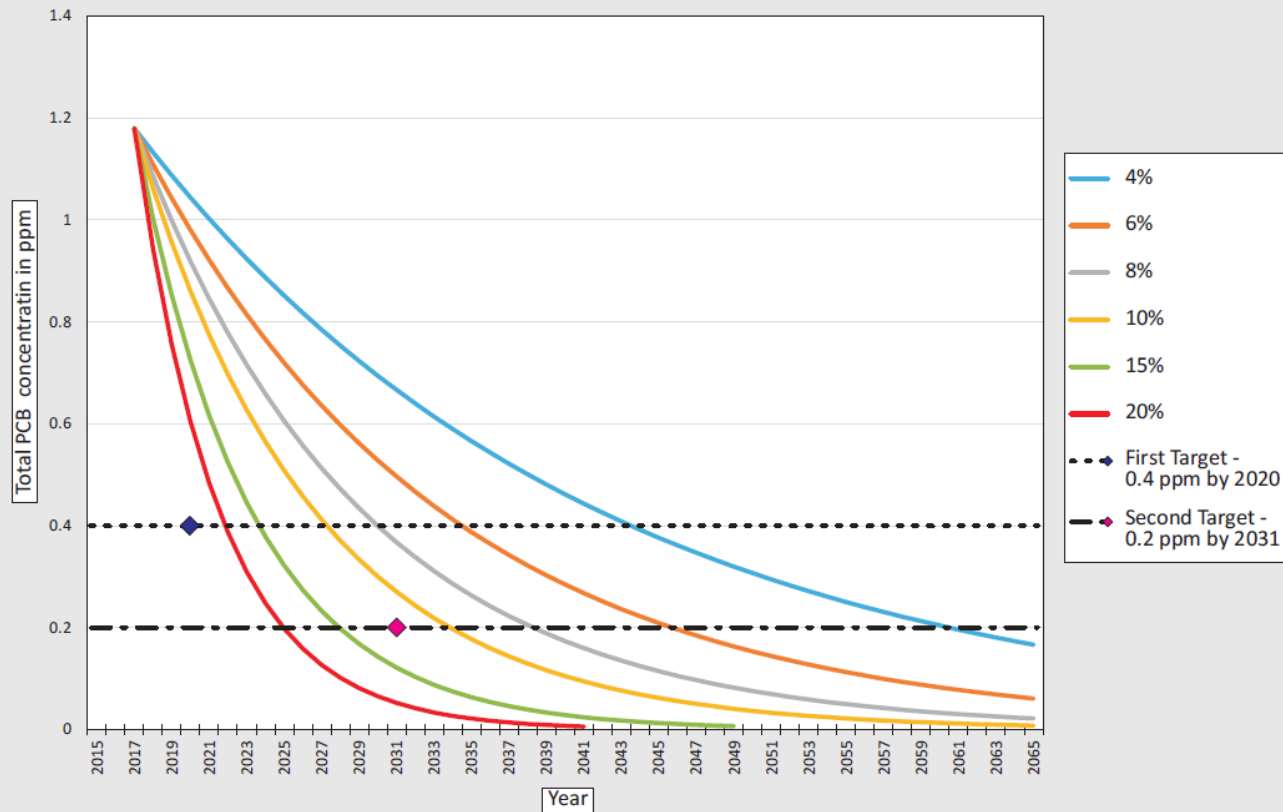
In River Section 2 (~ 12% of the upper Hudson) fish PCB concentrations remain > 3X the river wide target, with little apparent ongoing downward trend.

Upper Hudson River Fish PCB Concentrations 2004 - 2017 Species Weighted Averages River Section 3

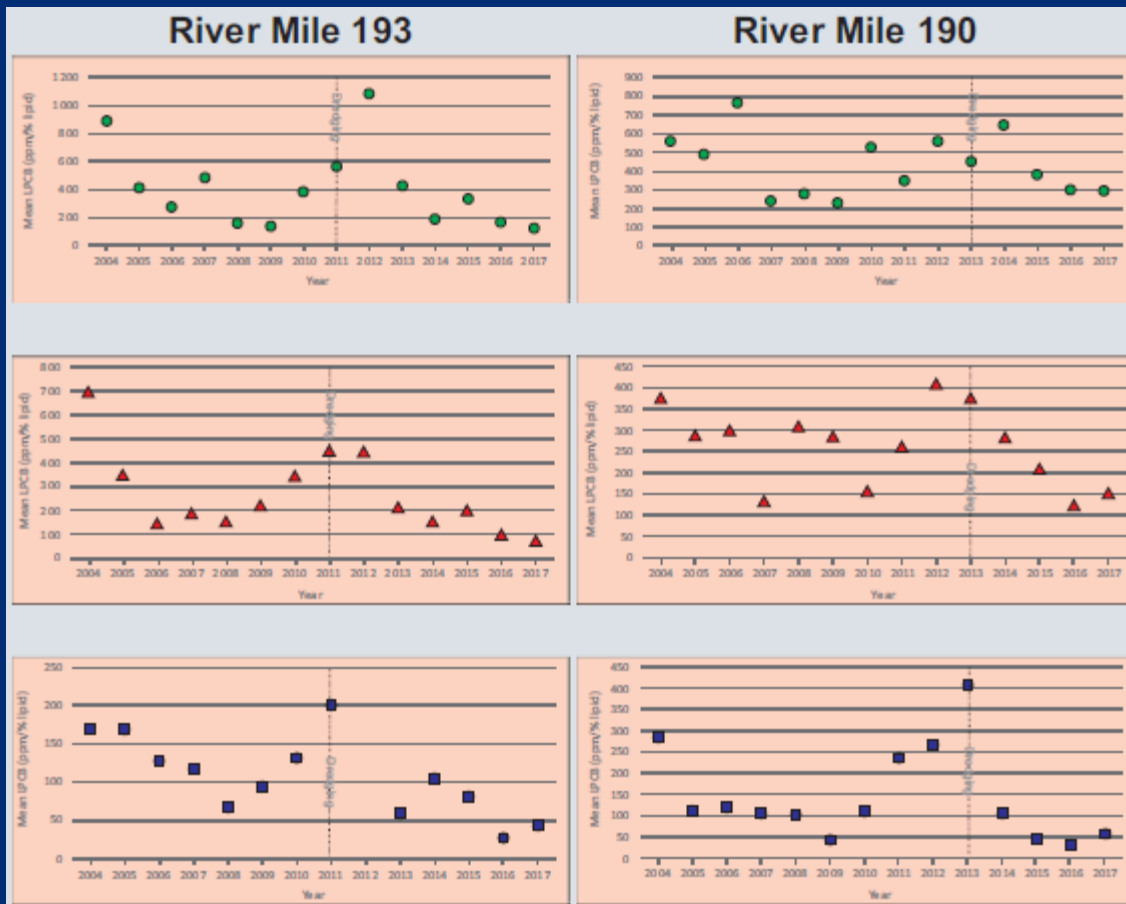


In River Section 3 (~72% of the upper Hudson) fish PCB concentrations remain > 3X the river wide target (to have been reached here immediately after dredging), with little apparent ongoing downward trend.

Species and River Section Length Weighted Average PCB concentrations
at Various Assumed Rates of Post Remedial Decline
2017 concentration = 1.18 parts per million



The rates of decline would need to exceed 20% per year to achieve the first target, and exceed 10% per year to achieve the second target.



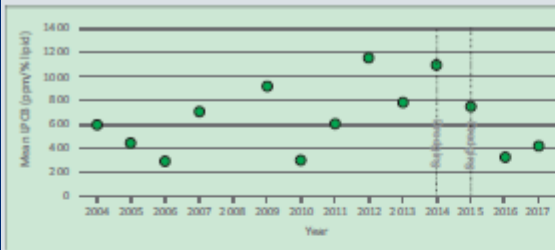
Four to eight years of post dredging data are available for River Section 1.

The rates of decline appears to be slowing in this River Section.

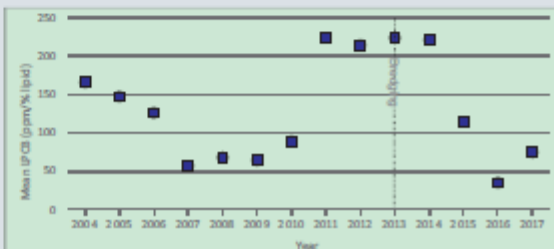
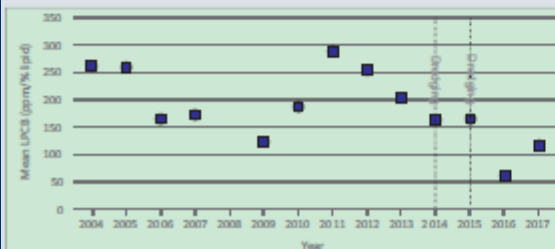
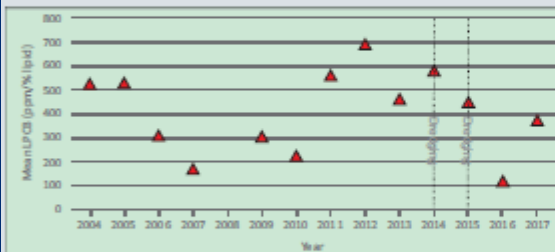
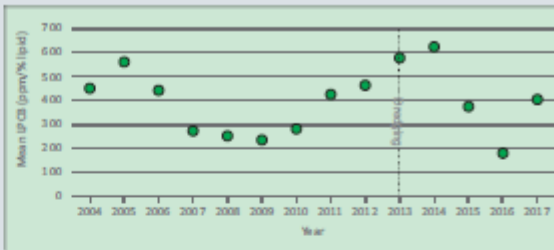
(Lipid normalized data shown)



River Mile 187



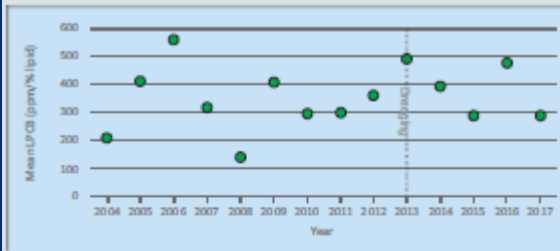
River Mile 184



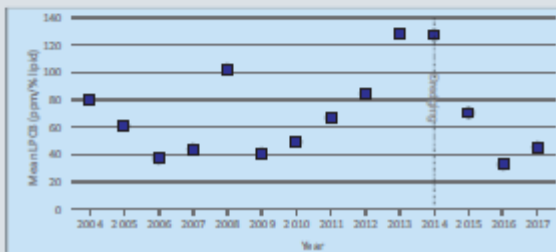
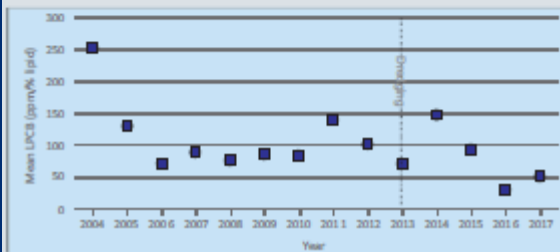
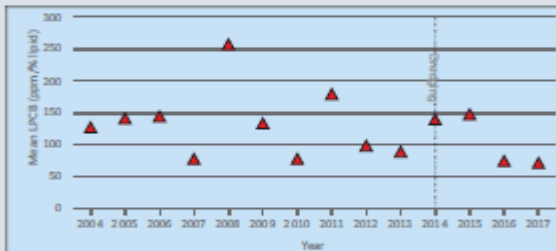
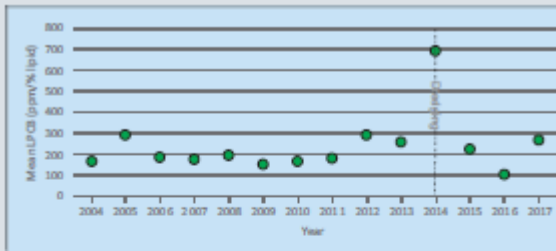
In River Section 2, two to four years of data are available.

The rates of decline also appears to be slowing in this River Section.

River Mile 182



River Mile 172



In River Section 3, two to four years of post dredging data are available.

Some stations show little appreciable change from before dredging, with slowing decline rates elsewhere.

Current DEC Assessment – Fish PCB Data

The fish PCB concentrations in the upper Hudson do not appear to have declined as predicted by EPA in the ROD.

To achieve the RAOs for the site, the rate of decline would need to exceed 20% per year to reach the five year target of 0.4 ppm by 2020, and exceed 10% per year to reach the 16 year target of 0.2 ppm by 2031.

