

PCBs in Select Organisms of the Hudson River Floodplain: Frogs, Small Mammals, Birds

Scott Jamieson, Sierra Hellwitz, and Sean Madden

New York State Department of Environmental Conservation
Bureau of Habitat



Background

Past and continuing discharges of polychlorinated biphenyls (PCBs) have contaminated the natural resources of the Hudson River. The Hudson River Natural Resource Trustees (Trustees) – New York State, the U.S. Department of Commerce, and the U.S. Department of the Interior – are conducting a natural resource damage assessment to assess and restore those natural resources injured by PCBs. PCBs were discharged to the river from two General Electric (GE) manufacturing plants in Hudson Falls and Fort Edward, NY (EPA 2002). Once PCBs entered the river, they contaminated surface water, sediments, and the food web (Trustees 2013).

Between 2009 and 2015, GE, under direction of EPA, conducted targeted dredging to remove some PCB-contaminated sediment from a 40-mile section of the upper Hudson River between Fort Edward and Troy, NY (EPA 2002), however, the Hudson River floodplain is also contaminated with PCBs (Trustees 2013). During high flow events when the river tops its banks, contaminated sediments may be resuspended and deposited on the floodplain. In October 2014, EPA announced that GE would conduct an investigation of PCB contamination in the floodplain soils of the upper Hudson River, and elements of that investigation have begun.

While dredging was underway on the river, the Trustees analyzed PCB concentrations in frogs, small mammals, and a bird species (gray catbird, *Dumetella carolinensis*) living on the Hudson River floodplain (Trustees 2017a, Trustees 2017b). We compiled data from these two studies to assess PCB contamination in organisms living and feeding in the Hudson River floodplain.

Methods

We collected frogs, small mammals, and catbirds from four river sections (RS) from Hudson Falls to Schodack Island (Figure 1). We collected some samples from a river section upstream of the GE plant sites as a reference, which we called RS 0.

Adult and juvenile frogs as well as tadpoles were collected in summer 2009 using seines, dip nets, minnow traps, and drift fences with pitfall traps. The species collected included green frogs (*Lithobates clamitans*), northern leopard frogs (*Lithobates pipiens*), and bullfrogs (*Lithobates catesbeiana*). Mammals were collected in the fall of 2009 using mouse-sized snap traps (Victor, Inc.) and pitfall traps. Target species included mice (*Peromyscus spp.*), meadow vole (*Microtus pennsylvanicum*), and short-tailed shrew (*Blarina brevicauda*). Gray catbird eggs were collected in spring 2015. When a nest was located, one egg from the nest was randomly selected for contaminant analysis.

Frog and small mammal specimens were homogenized in the laboratory and individuals were composited into samples as necessary to have adequate sample mass for contaminant analysis (median individuals per composite = 8). Catbird egg contents were removed in the laboratory and not composited. All samples were analyzed for the 209 PCB congeners using high resolution mass spectrometry, and tPCBs calculated by the sum of congeners. All contaminant results from catbird eggs were corrected for moisture loss.



Table 1. Total PCBs in biota collected from different sections of the Hudson River floodplain.

River Section	Total PCBs (ppm) (min-max) n = sample size		
	Small Mammal	Frogs	Catbird Eggs
Reference	0 (0.0005-0.009) n = 4	0.007 (0.0022-0.019) n = 4	na
Upper Hudson	1 2.263 (0.008-6.35) n = 10	0.263 (0.017-1.26) n = 8	0.406 (0.05-1.47) n = 4
	2 0.084 (0.003-0.42) n = 6	0.085 (0.043-0.207) n = 8	1.818 (0.122-8.04) n = 9
	3 0.319 (0.005-2.78) n = 10	0.060 (0.023-0.106) n = 8	0.857 (0.030-3.11) n = 16
Lower Hudson	4 0.020 (0.0008-0.076) n = 7	0.005 (0.003-0.008) n = 7	0.043 (0.035-0.060) n = 5

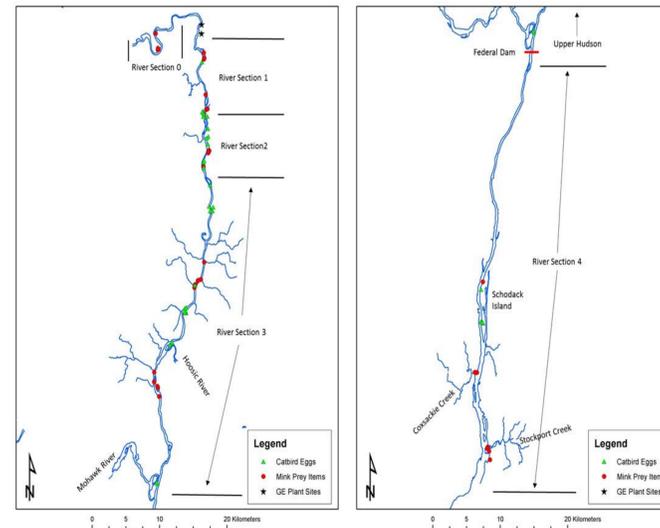


Figure 1. Biota sample locations along the Hudson River floodplain.

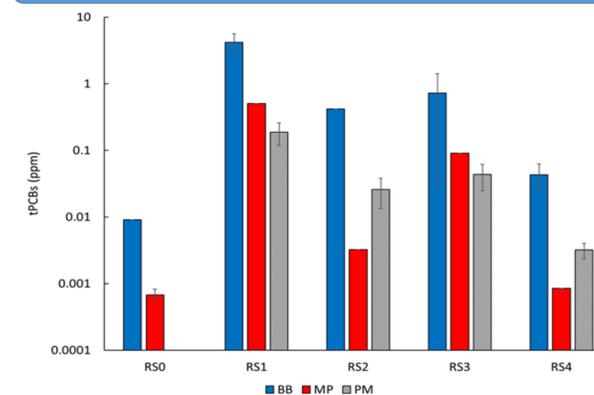


Figure 2. Total PCBs (tPCBs) in small mammal species across different river section (RS) of the Hudson River. BB = shrew; MP = vole; PM = mice. Note: Log scale.

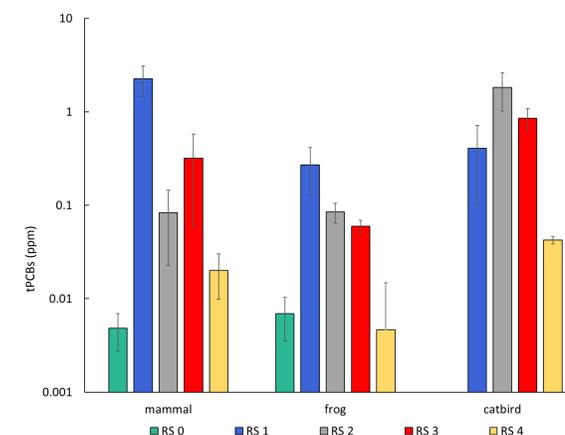


Figure 3. Total PCBs (tPCBs) in Hudson River floodplain biota across river sections (RS). Note: Log scale.

Results

All samples contained detectable levels of PCBs (Table 1). In general, frogs had lower PCB concentrations than small mammals or catbirds. In small mammals, the highest concentrations were found in the more carnivorous short-tailed shrew (Figure 2). Maximum PCB levels in upper Hudson River frogs, small mammals, and catbirds were 1.26, 6.30, 8.03 ppm, respectively. For the mammal and frog samples, which were collected during the first year of dredging, PCB concentrations were greatest in RS 1. In contrast, catbird samples, which were collected after the majority of dredging was complete, had the greatest PCB concentration in RS 2. Total PCB concentrations in small mammals, frogs, and catbirds were approximately 50, 30, and 40 times greater in the upper Hudson than the lower Hudson (Figure 3). Small mammals had mean tPCB concentrations that were 165 times greater than those in the reference site, and frogs were 17 times greater than those from the reference.

Conclusion

The results of these studies confirm that PCBs are present in floodplain biota and a thorough investigation of the Hudson River floodplain is needed to determine the scope of contamination and an appropriate strategy for clean-up.

Acknowledgments

Many parties have made these studies possible, including the Hudson River Natural Resource Trustees, Rebecca Quail, Chuck Nieder, Alan Lorefice, Corbin Gosier, Elise Rodriguez and Mary Jo Crance.

The opinions expressed in this presentation are those of the authors, and they do not necessarily represent the official positions of the Department of Environmental Conservation, New York State, or the Hudson River Natural Resource Trustees.

Literature Cited

- Hudson River Natural Resource Trustees. 2013. PCB Contamination of the Hudson River Ecosystem: Compilation of Contamination Data through 2008. January 2013. U.S. Department of Commerce, Silver Spring, MD.
- Hudson River Natural Resource Trustees. 2017a. Data report for the collection of gray catbird eggs along the Hudson River from Hudson Falls to Schodack Island, New York for Exposure To Polychlorinated Biphenyls (PCBs). Hudson River Natural Resource Damage Assessment. U.S. Department of Commerce, Silver Spring, MD.
- Hudson River Natural Resource Trustees. 2017b. Data report for PCB concentration in mink prey items - fish, frogs, and small mammals - collected from the Hudson River, New York. U.S. Department of Commerce, Silver Spring, MD.
- United States Environmental Protection Agency (EPA). 2002. Hudson River PCB's Site Record of Decision. Washington, D.C., USA.