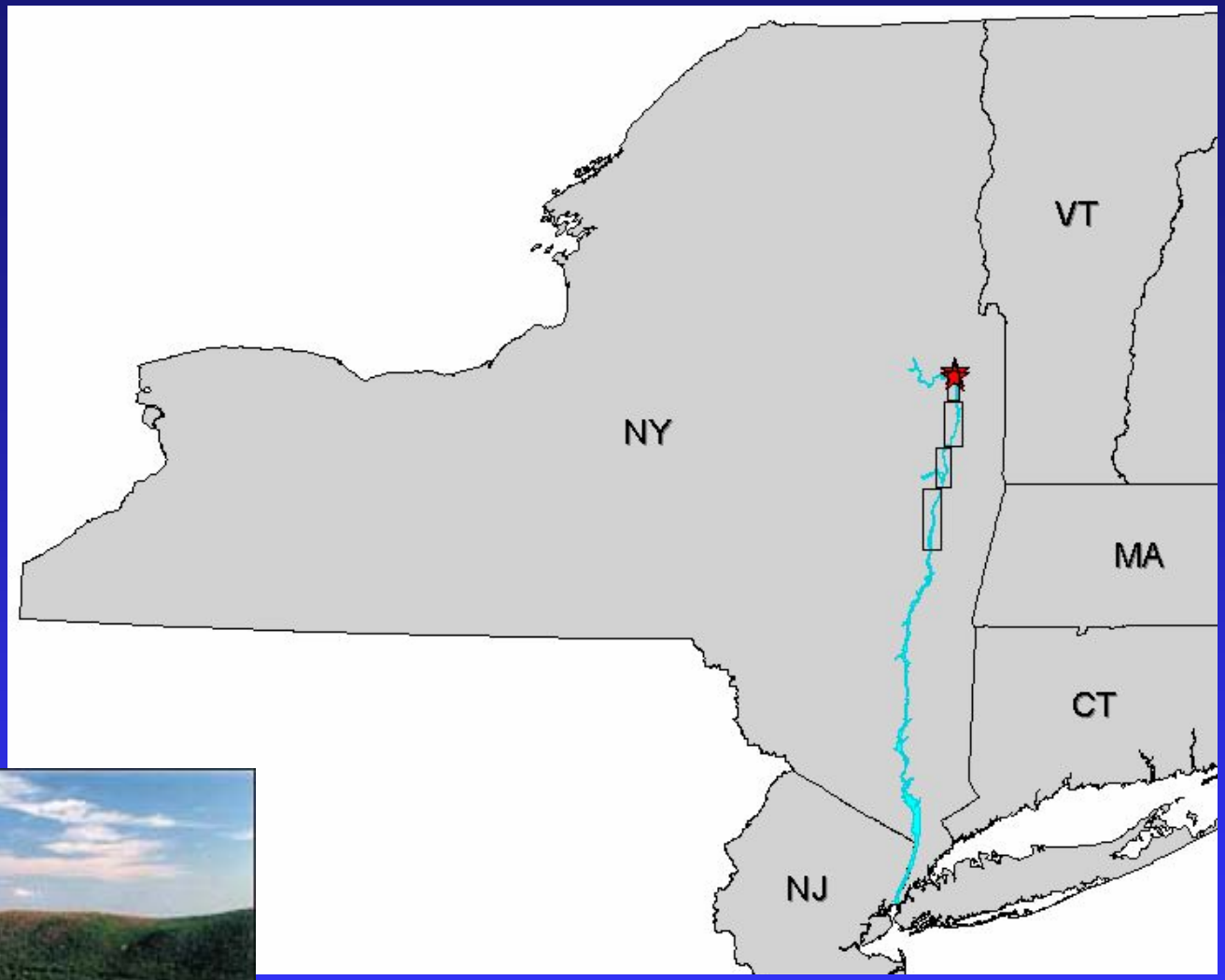
Hudson River NRDA Floodplain Data Summary

- New York State Department of Environmental Conservation
- United States Department of the Interior
- National Oceanic & Atmospheric Administration

Screening level assessments to determine if:

- Floodplain soils of the Upper Hudson River are contaminated with PCBs
- Terrestrial biota inhabiting these floodplains are contaminated with PCBs

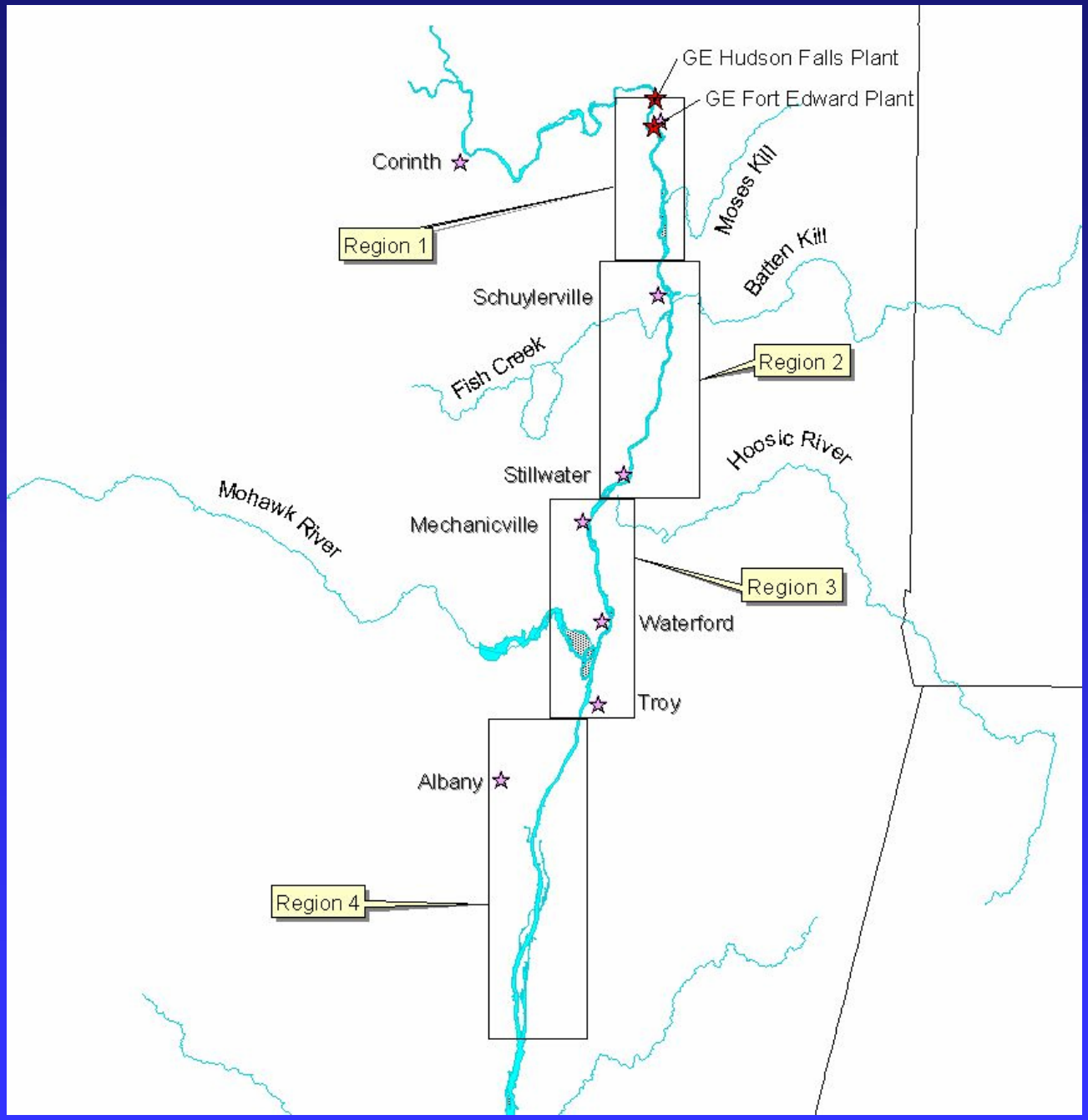
The Upper Hudson River



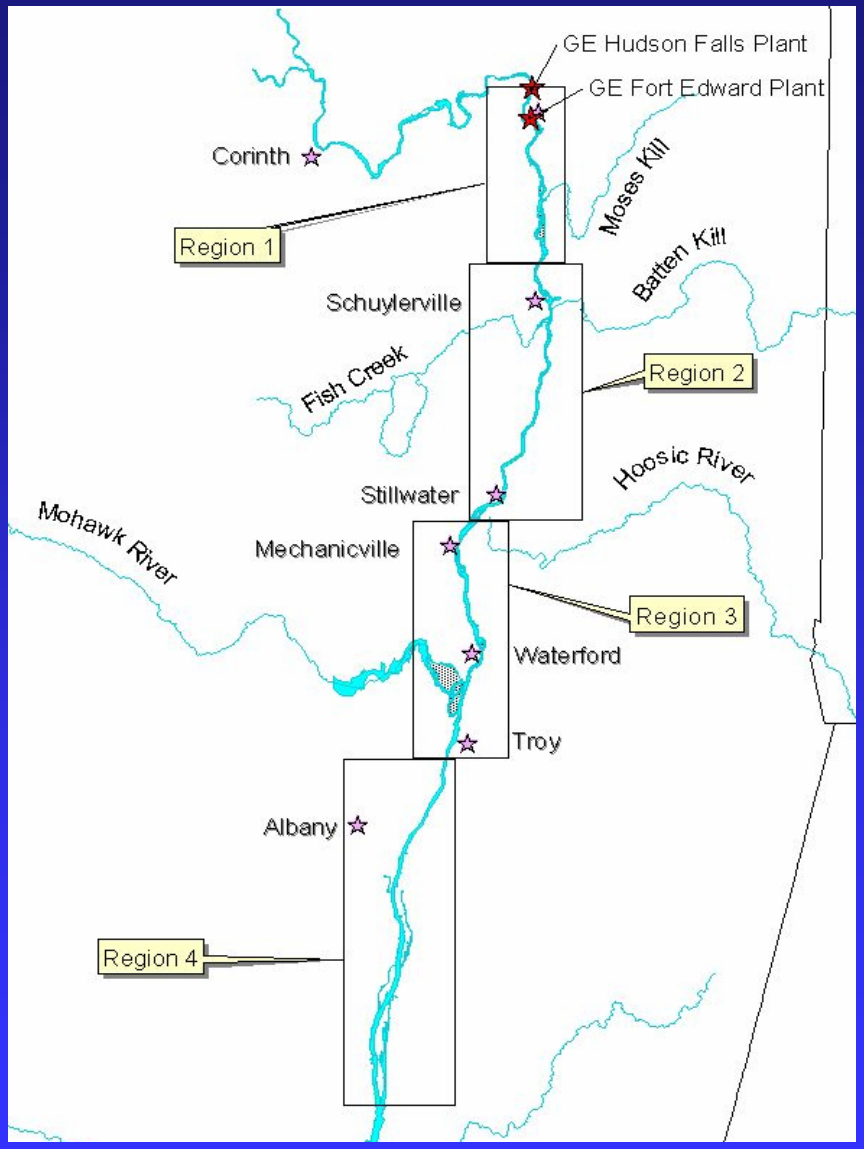
Upper Hudson River Sampling Regions

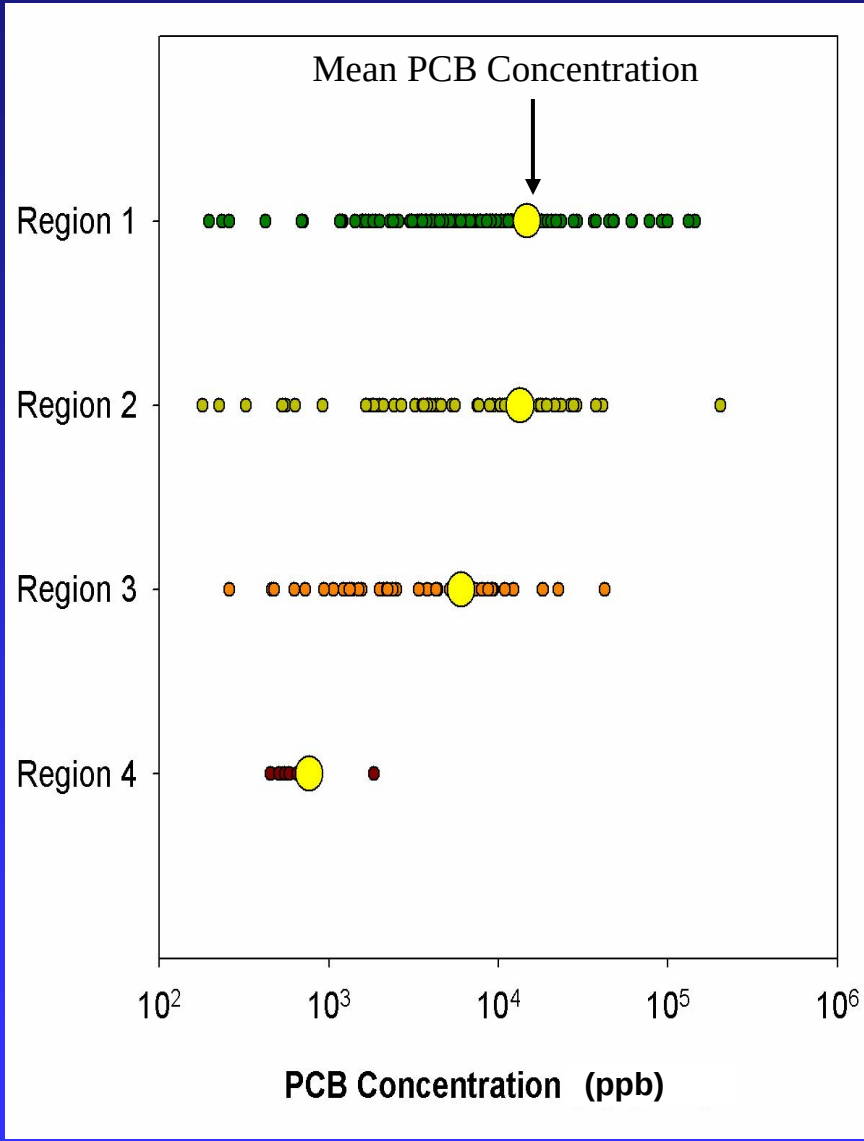
- Region 1: the area from Bakers Falls (at River Mile (RM) 196.9) downstream to the Fort Miller Dam (Lock 6) at RM 186.2 (Champlain Canal); this includes the Thompson Island Pool.
- Region 2: the area from the Fort Miller Dam (Lock 6) at RM 186.2 downstream to the Stillwater Dam (Lock 4) at RM 168.2; this includes the Stillwater Pool.
- Region 3: the area below the Stillwater Dam (Lock 4) at RM 168.2 downstream to the Federal Dam at Troy (RM 153.9), excluding Troy and its urban vicinity (approximately from Peebles Island State Park downstream to the Federal Dam).
- Region 4: the area below the Federal Dam at Troy (RM 153.9) extending south to Lower Schodack Island (RM 132), excluding Albany and its urban vicinity.

The Upper Hudson River Sampling Regions



Hudson River Sediment PCBs





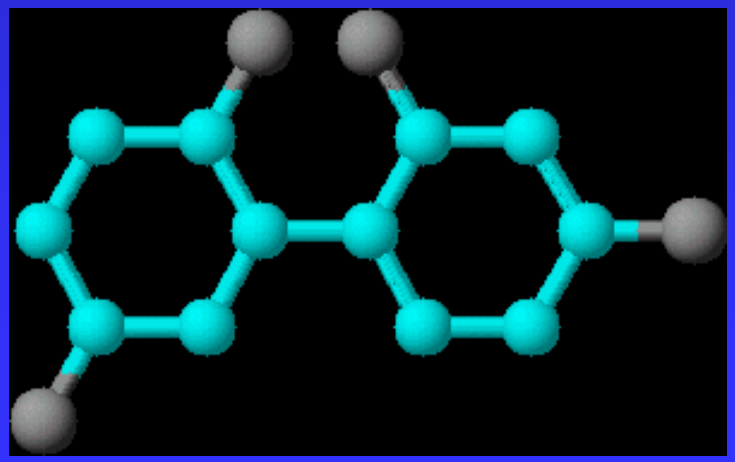
Sediment PCB concentrations represent surficial (0-25 cm) sediment data from various studies compiled on NOAA's Query Manager (http://response.restoration.noaa.gov)

Floodplain and Related Studies

- 2000 Floodplain Soils, Shrews and Earthworms
- 2001 Small Mammals and Woodcock
- 2001 Little Brown Bats
- 2002 Peregrine Falcon Eggs
- 2002 Snapping Turtle Eggs
- 2002 Avian Eggs
- 2003 Screech Owl Eggs
- 2003 Bullfrog Tadpoles and Sediments
- 2004 Wood and Leopard Frog Breeding Habitat Survey

PCB Congeners

- 48 PCB congeners selected for quantification
- Selected congeners are found, historically, in PCB composition of various Hudson River physical and biological samples
- 12 ‘Dioxin-like’ PCB congeners included among the 48



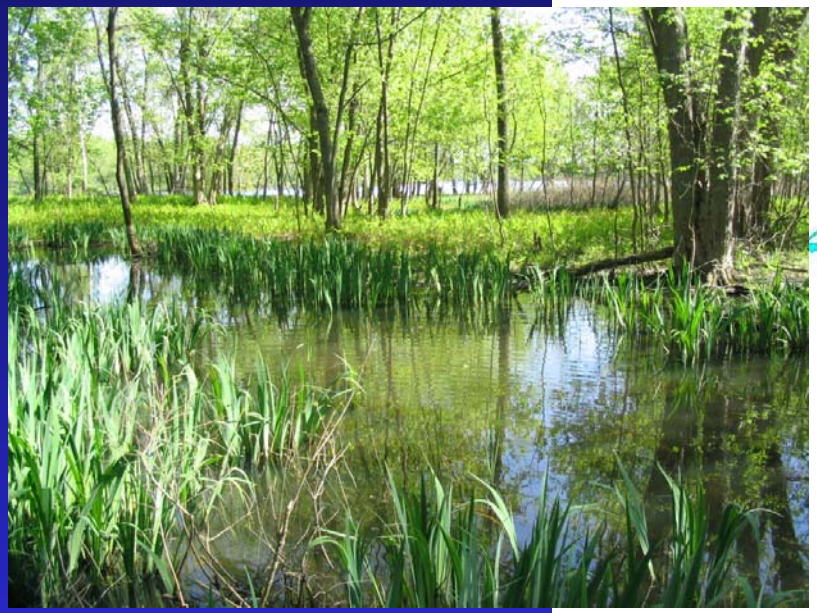
PCB Congeners

Di	Tri	Tetra	Penta	Hexa	Hepta	Octa	Nona	Deca
8	18	44	87	128	170	194	206	209
	31/28	45	95	138	174	195		
		47	99	146	177	201		
		49	101	149	180			
		52	**105**	151	183			
		56	110	153	187			
		66	**114**	**156**	**189**			
		70	**118**	**157**				
		74	**123**	158				
		77	**126**	**167**				
		81		**169**				

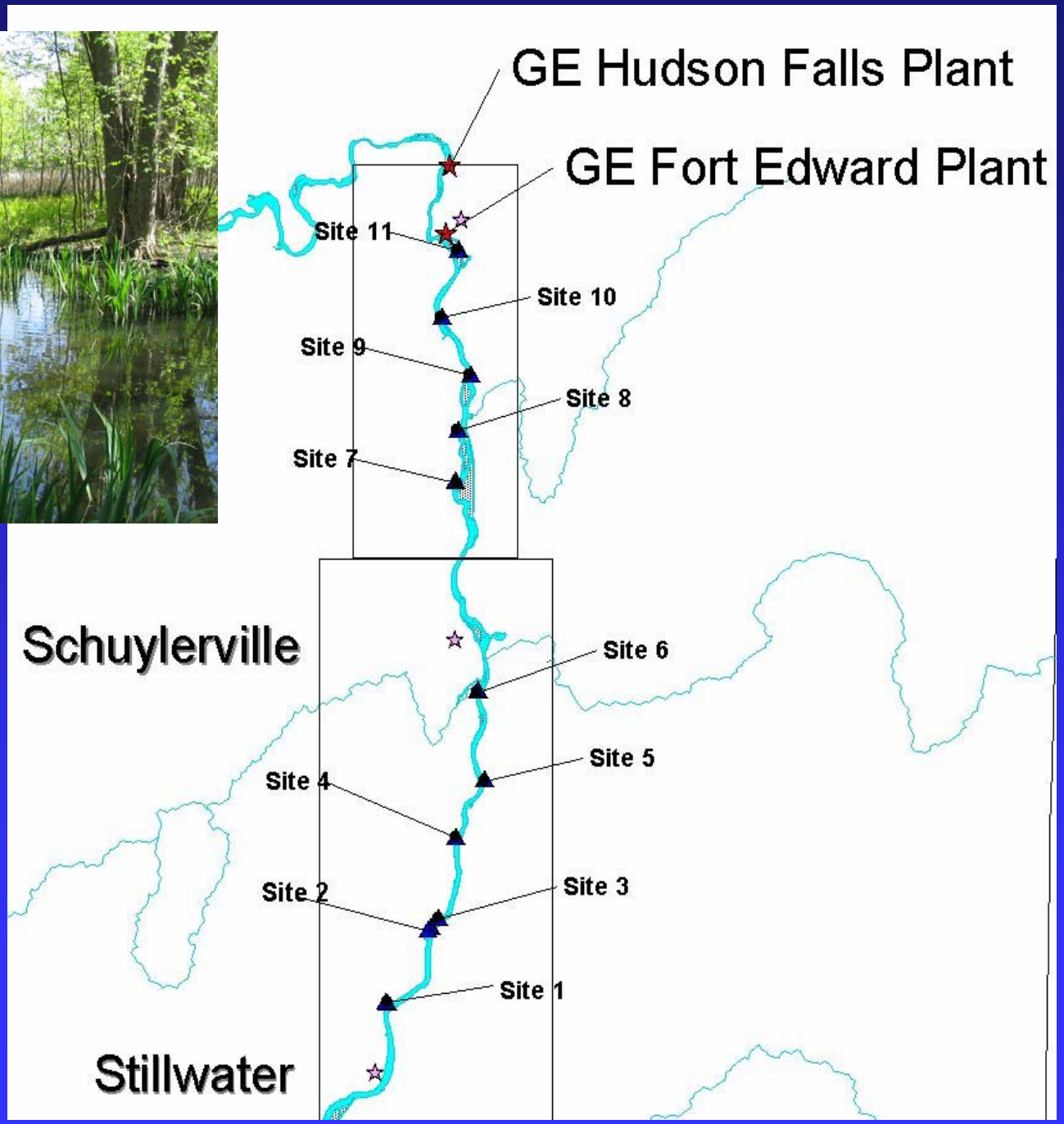
Red font indicates ‘Dioxin-like’ PCB congeners

2000 Floodplain Survey

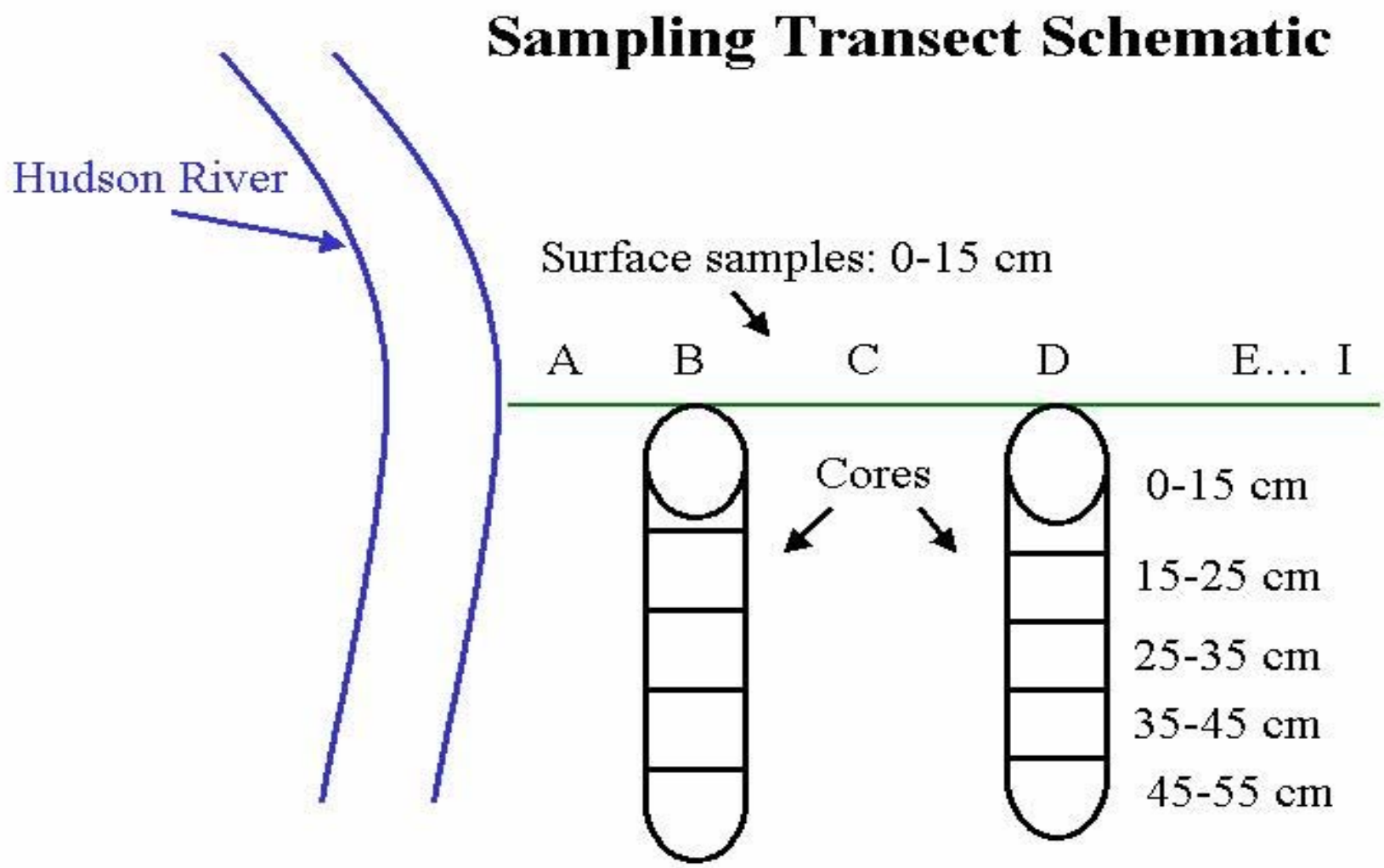
- 11 floodplain transects between Ft. Edward and Stillwater
- 6 – 9 samples (0-15 cm) per transect
- Two cores per transect, four sections per core
- 179 soil samples analyzed for t-PCBs, TOC and grain size
- Composited earthworm (n = 20+) samples collected from 10 sites
- Shrews (n = 6-9) collected from 10 sites
- Biota analyzed for t-PCBs and lipid content



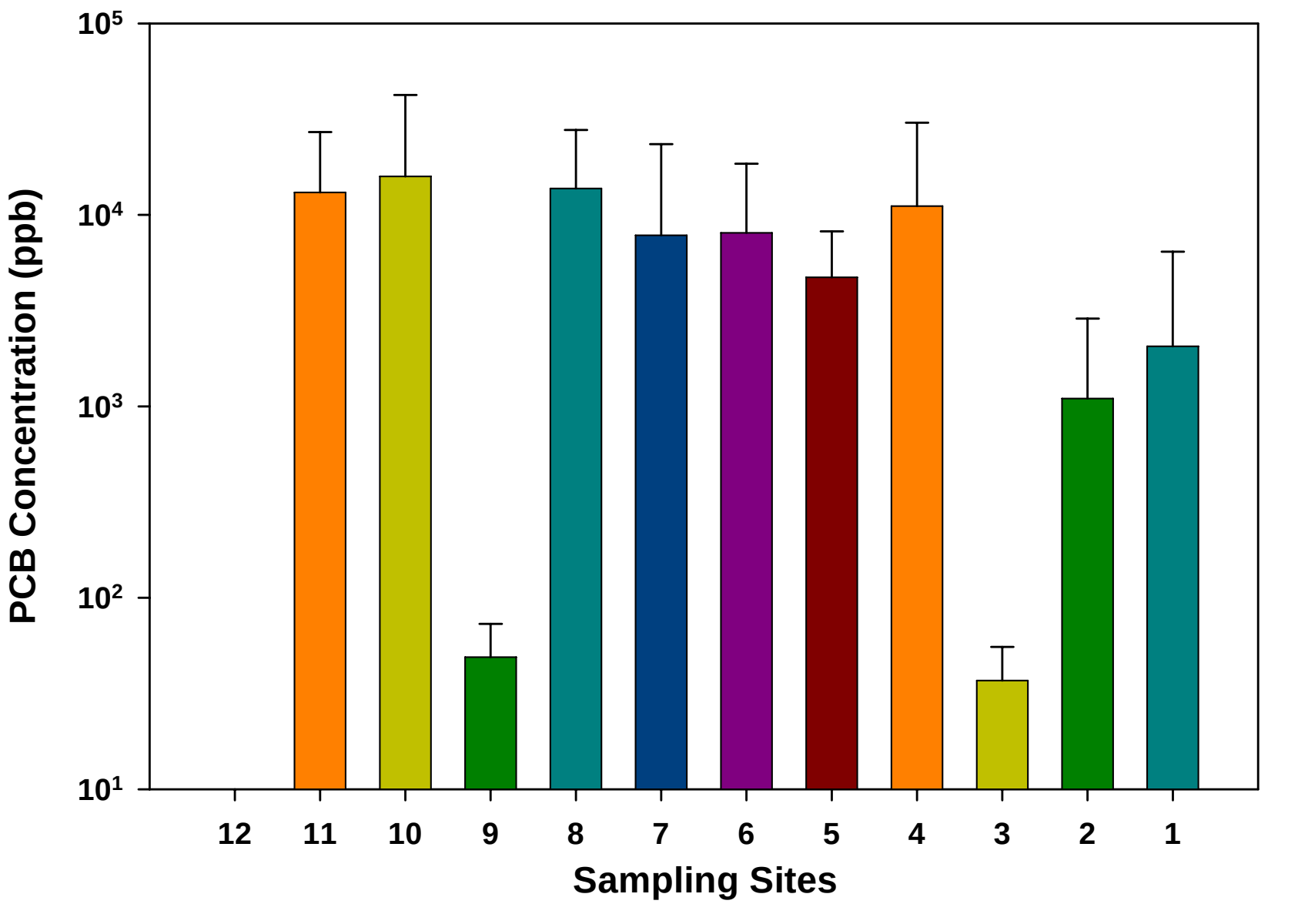
2000 Floodplain Survey



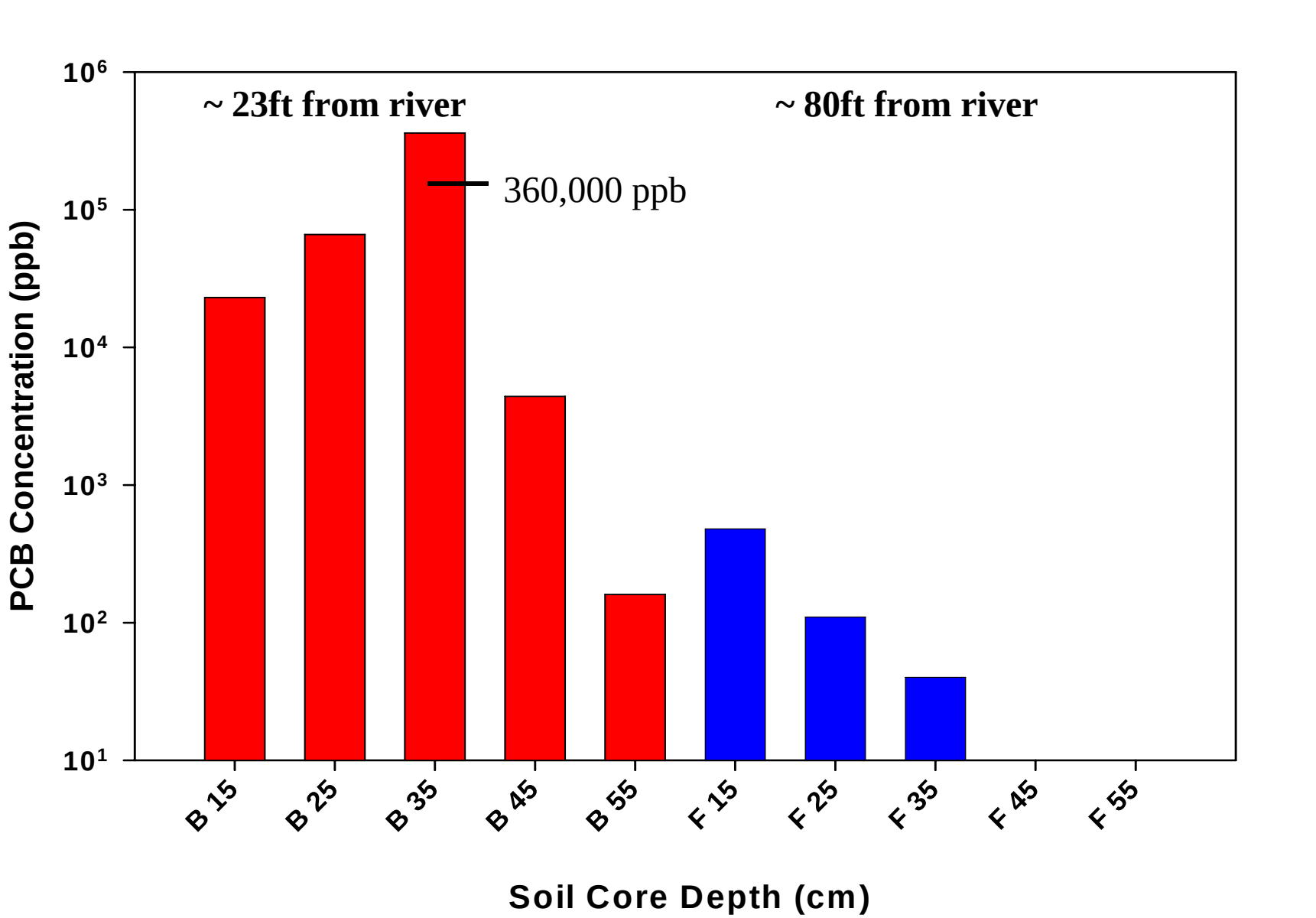
Soil Sampling Transects



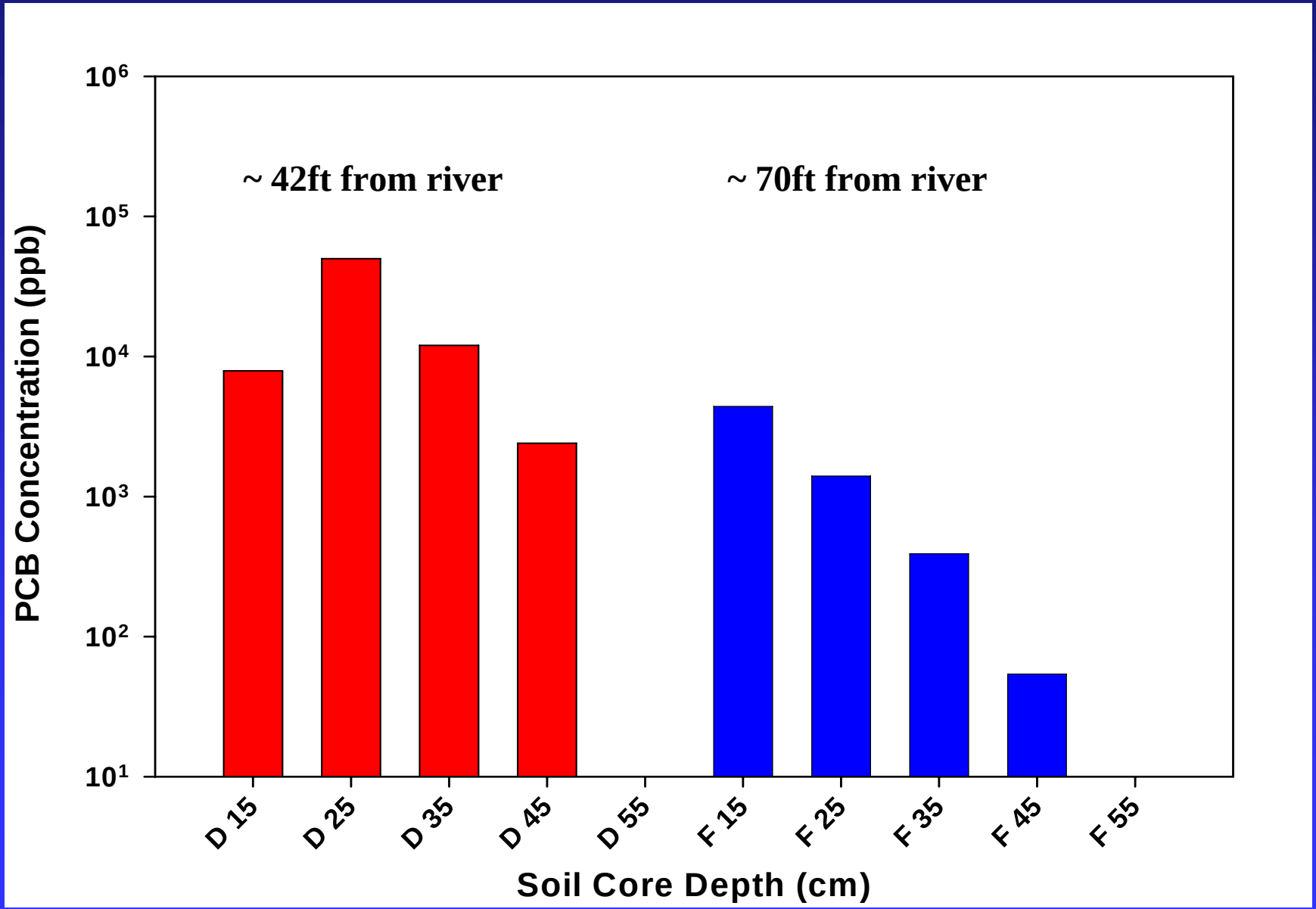
2000 Floodplain Soil (0-15 cm)



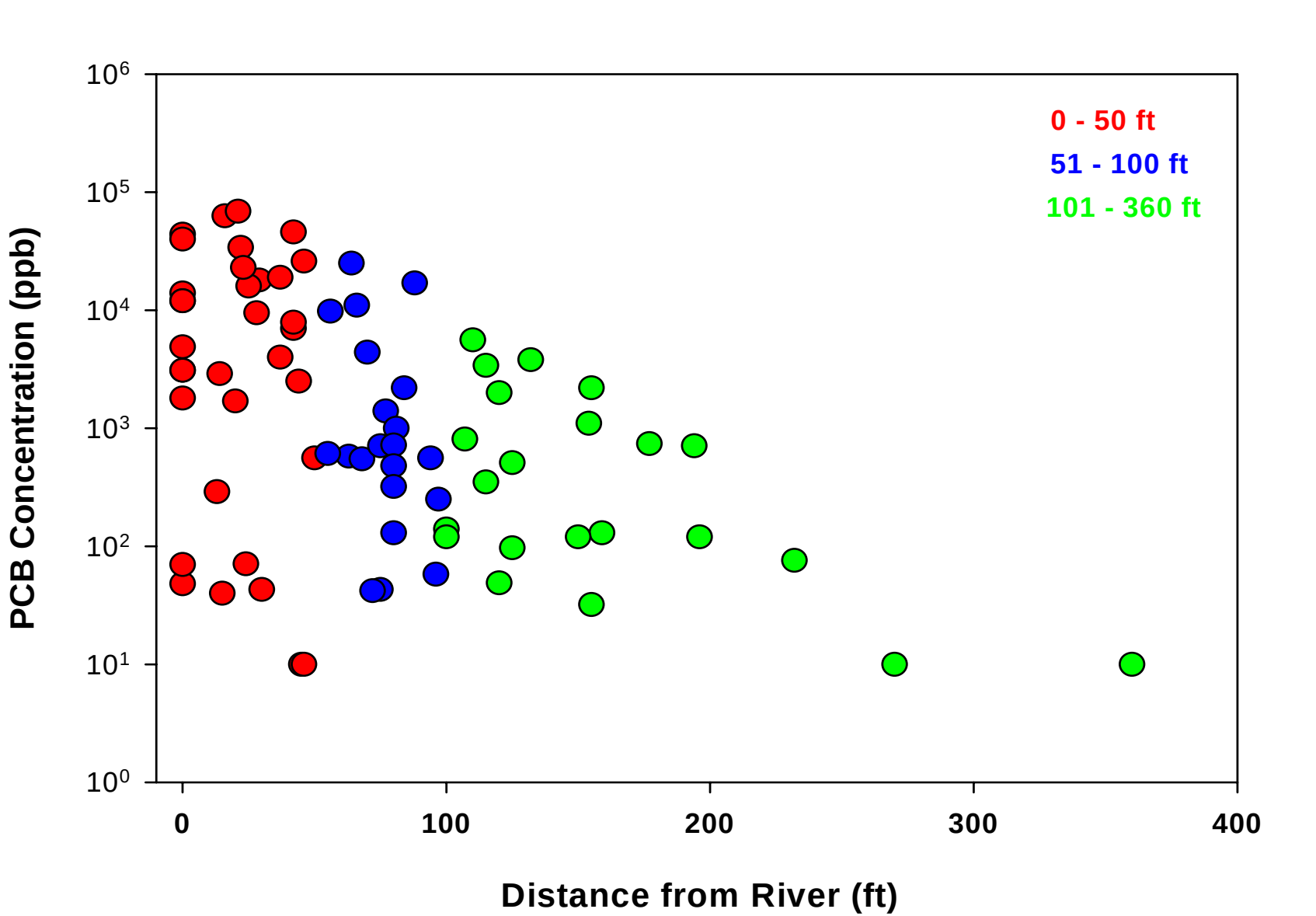
Site 8 Soil Depth Profiles (RM 189)



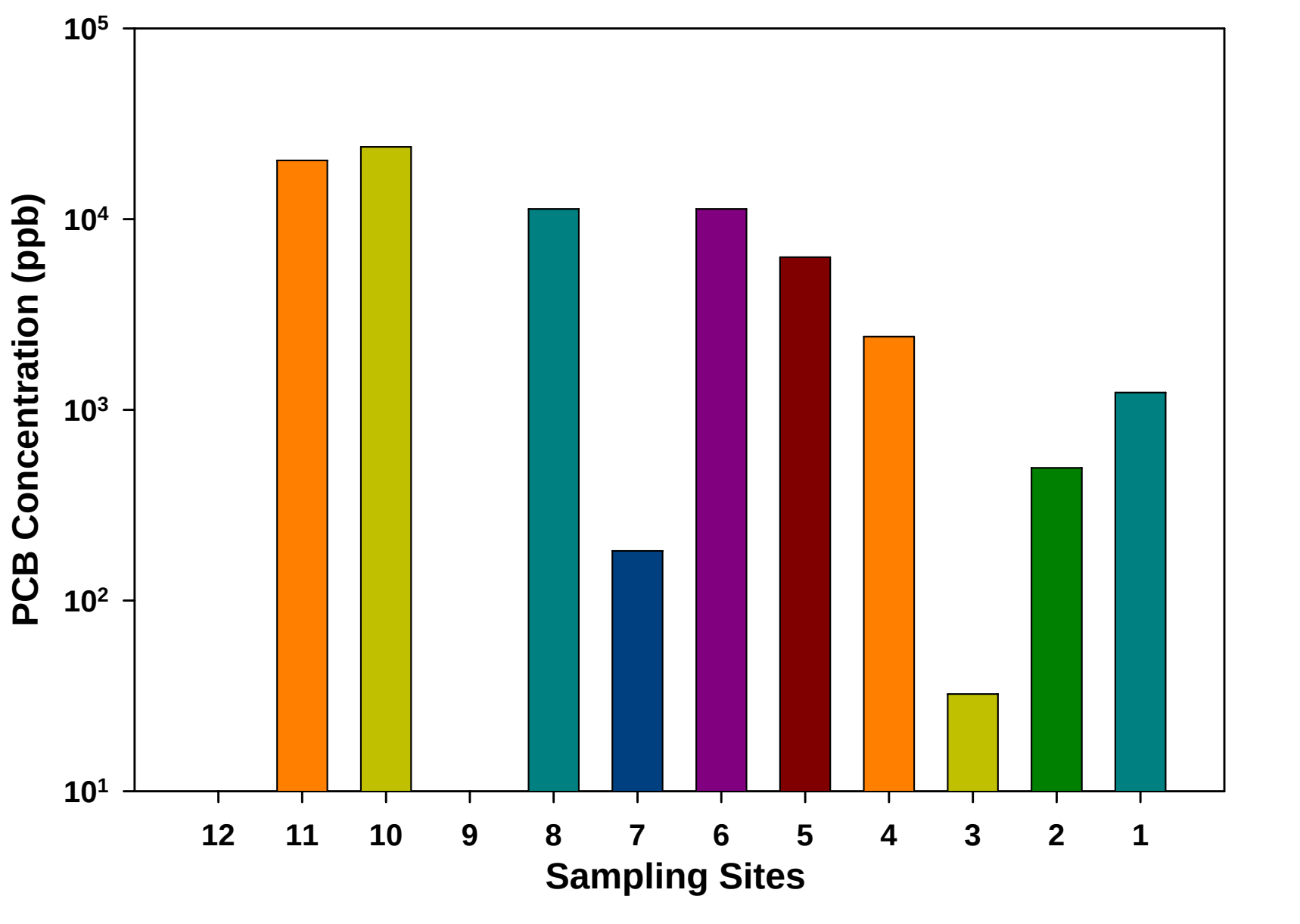
Site 5 Soil Depth Profiles (RM 179)



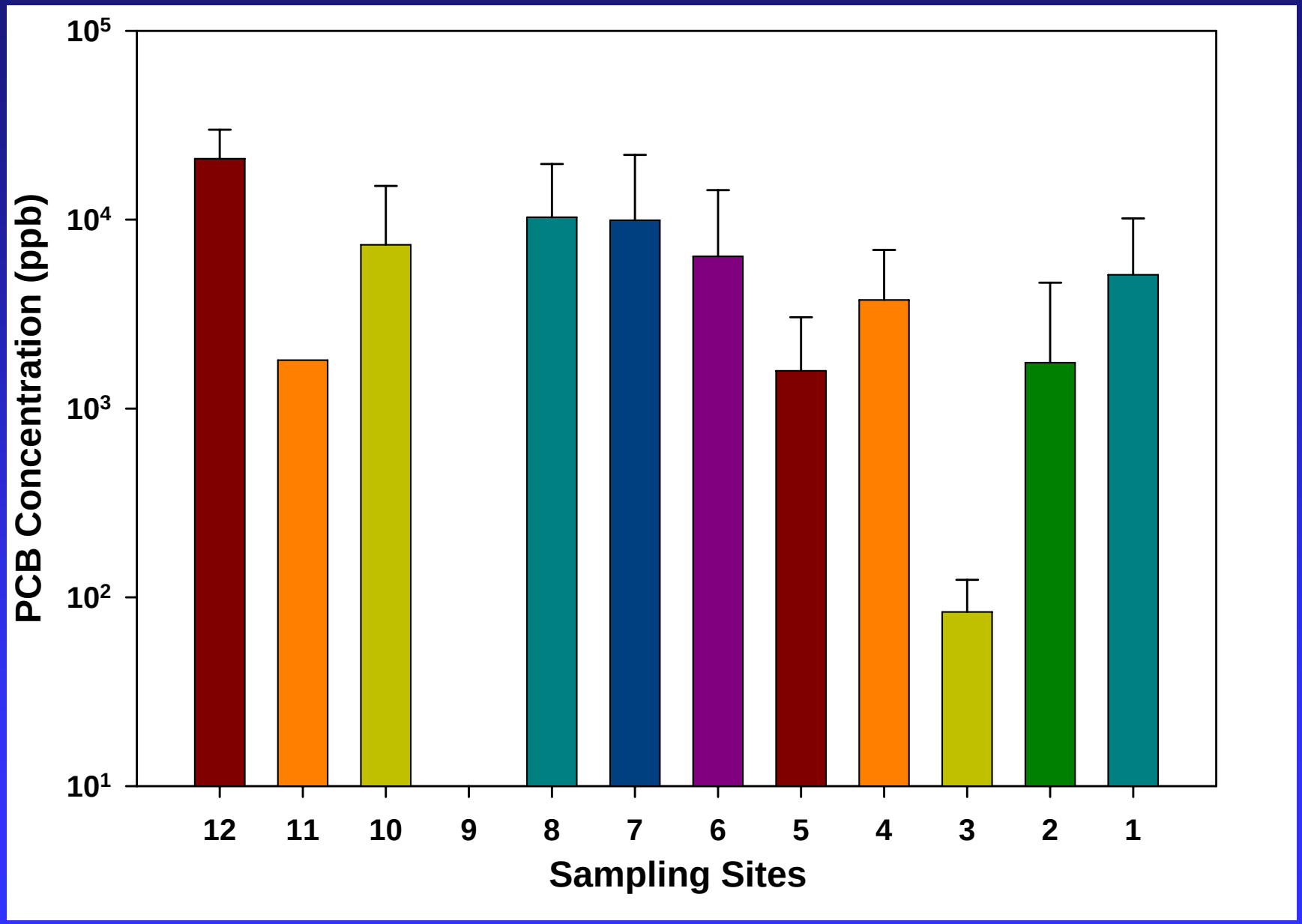
Soil PCBs vs Distance from River



2000 Floodplain Earthworms

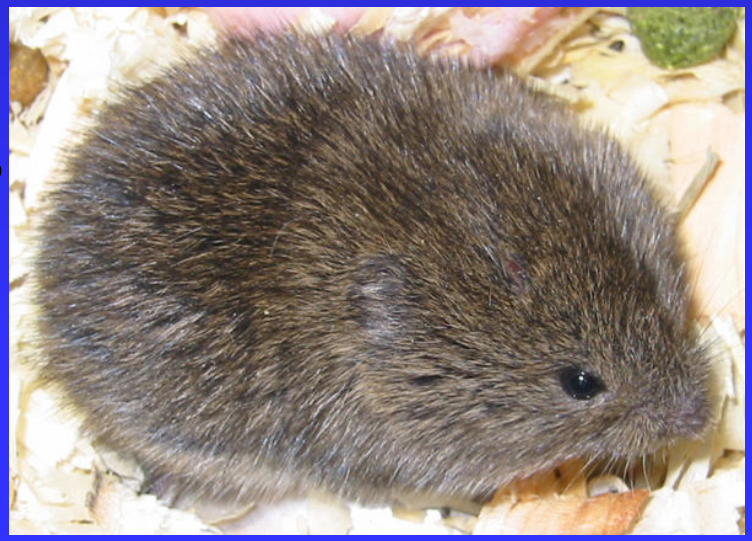


2000 Floodplain Shrews



2001 Small Mammal and Woodcock Survey

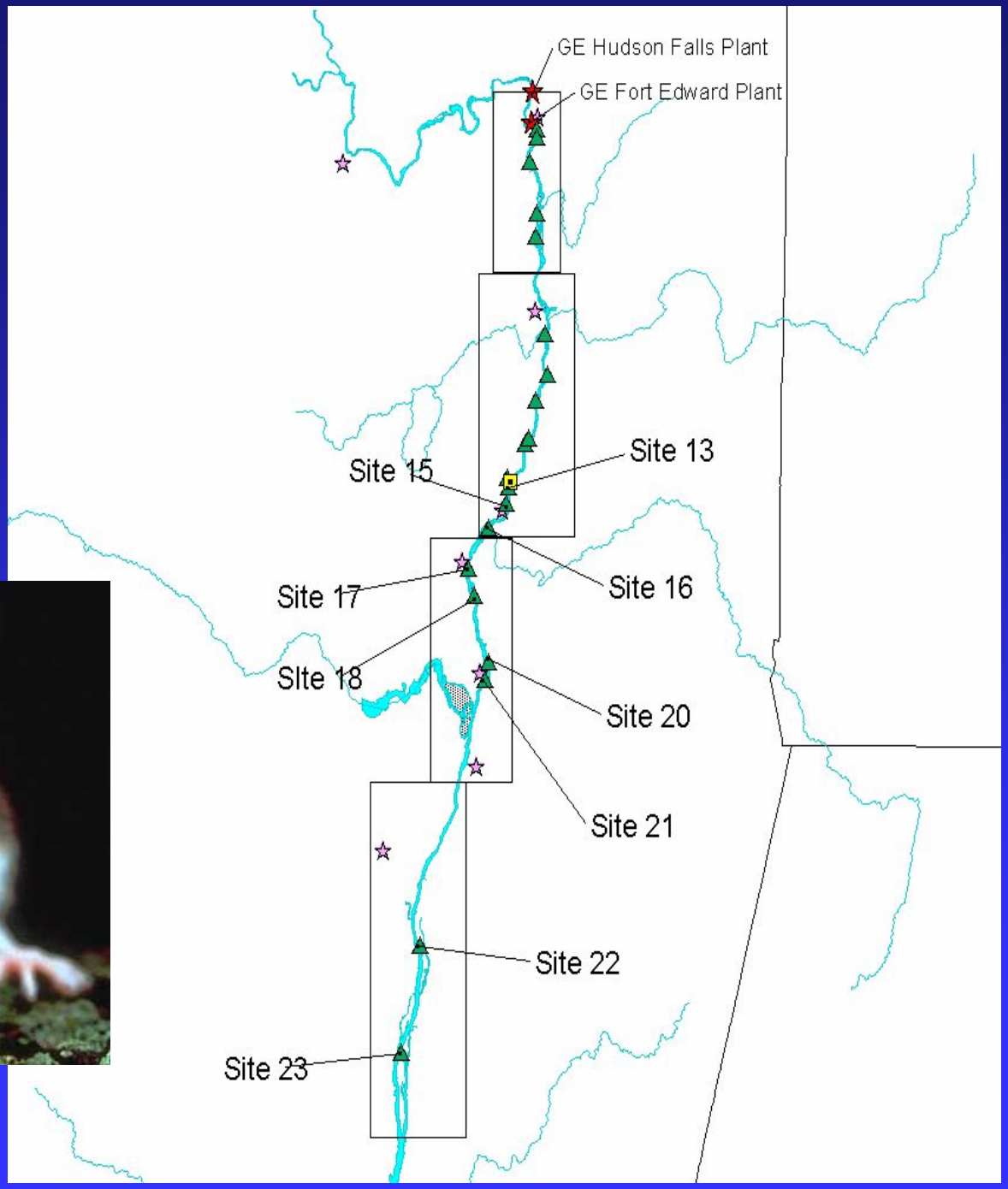
- Better define spatial gradient of contamination using shrews as integrators
- Expanded 2000 study from 20 miles to 65 miles of river
- Mice, voles, shrews and woodcock (2 livers)
- 20 sites along the Upper Hudson River
  - 2000 sites (11)
  - 9 additional downstream sites



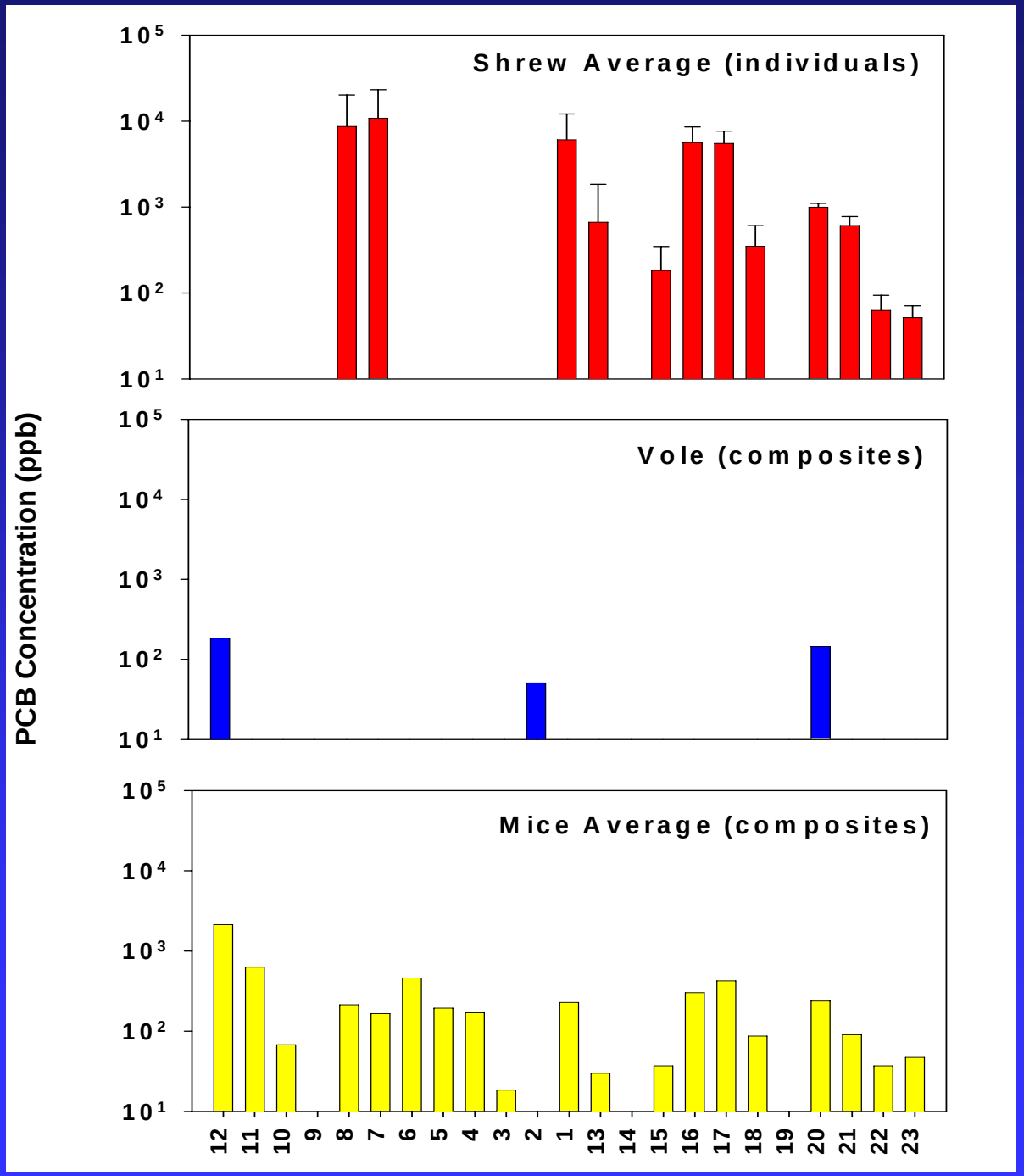
2001 Small Mammals

- 61 shrews and 108 mice/voles analyzed
- Shrews analyzed individually
- Mice composited into 19 samples of 4-5 animals
- Voles composited into 3 samples of 4-5 animals

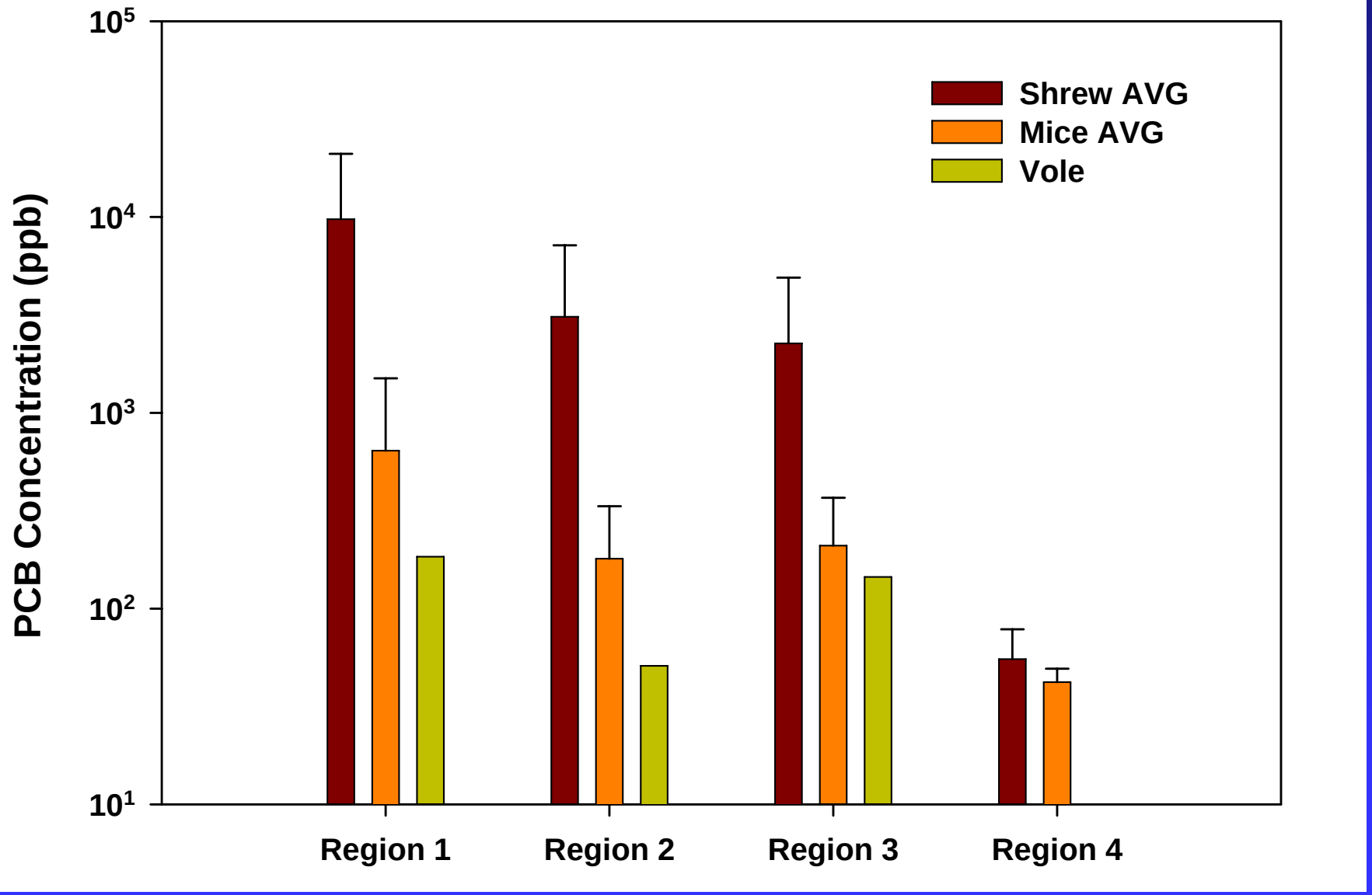
2001 Small Mammals



2001 Small Mammals



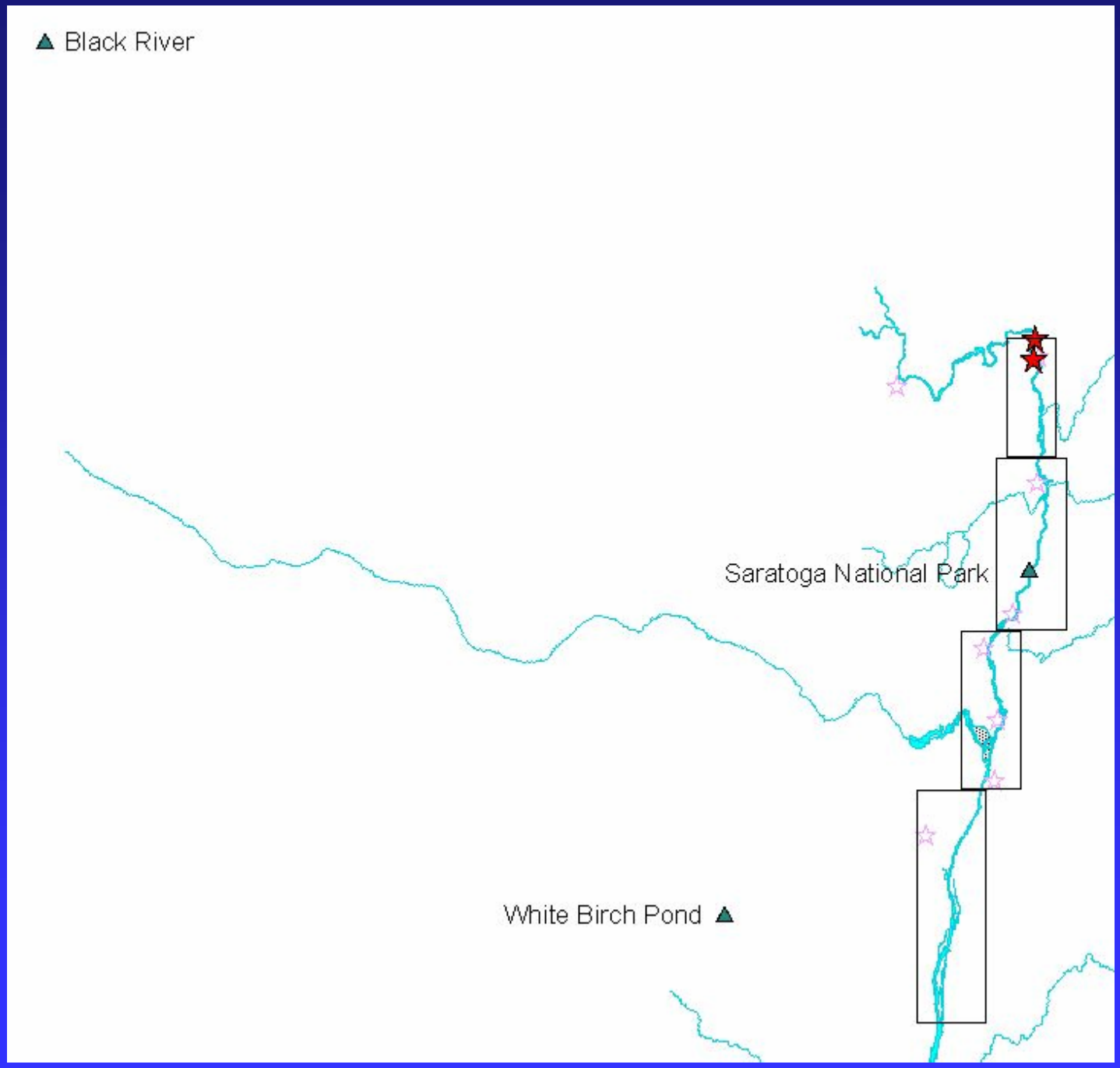
2001 Small Mammals



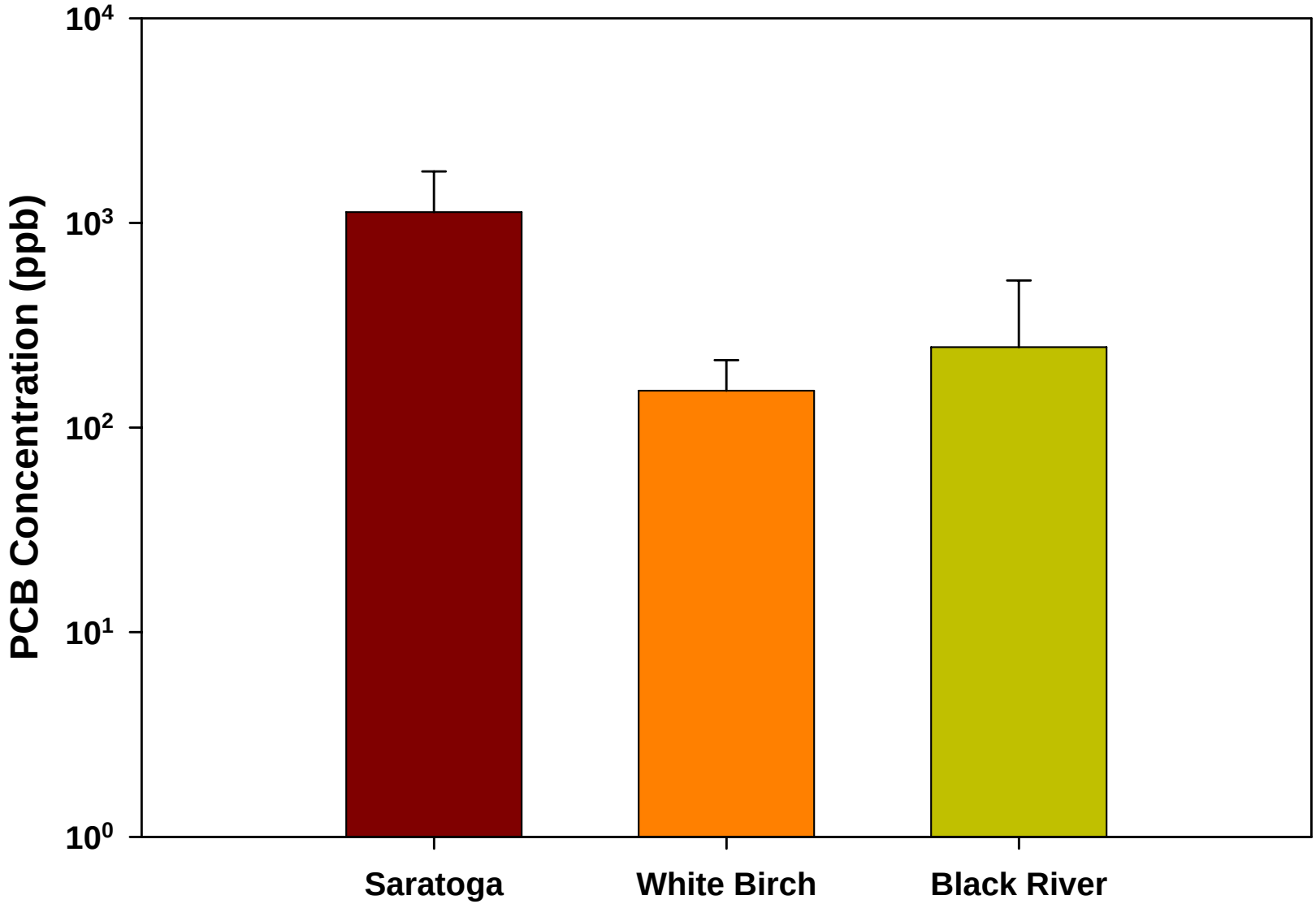
2001 Little Brown Bats

- Bats collected as part of NYSDEC study
- Saratoga National Park and two reference sites
- 31 bat brains (5 big brown, 26 little brown)
- Big brown: 32 – 640 ppb
- Little brown: 184 – 2400 ppb

2001 Little Brown Bats



2001 Little Brown Bats

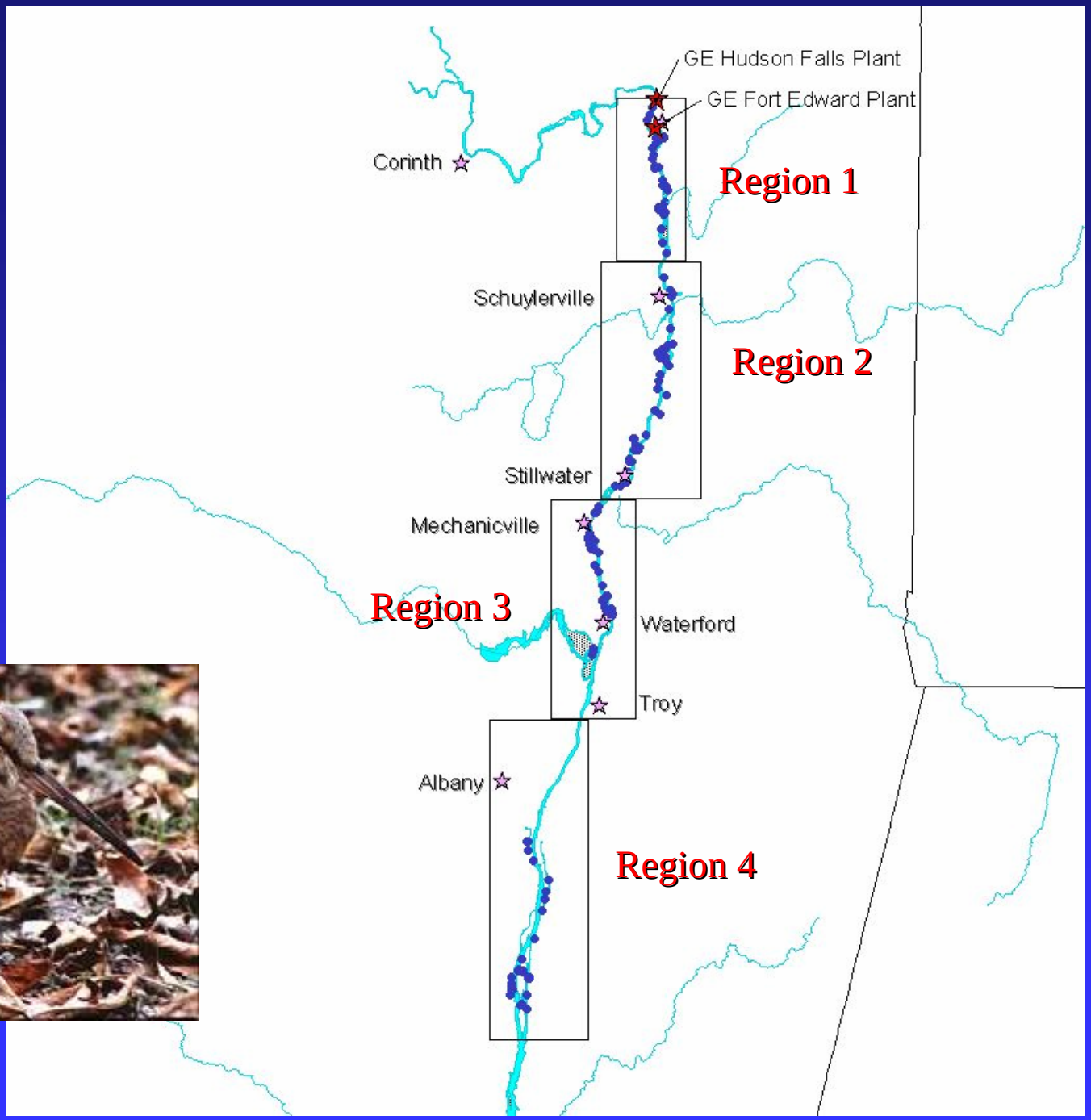


2002 Avian Egg Survey

- 11 species
  - American Robin
  - American Woodcock
  - Belted Kingfisher
  - Common Grackle
  - Eastern Bluebird
  - Eastern Phoebe
  - Barn Swallow
  - Red Winged Blackbird
  - Spotted Sandpiper
  - Eastern Screech Owl
  - Northern Rough Winged Swallow
- 220 eggs collected; 168 samples analyzed

Species of Interest:

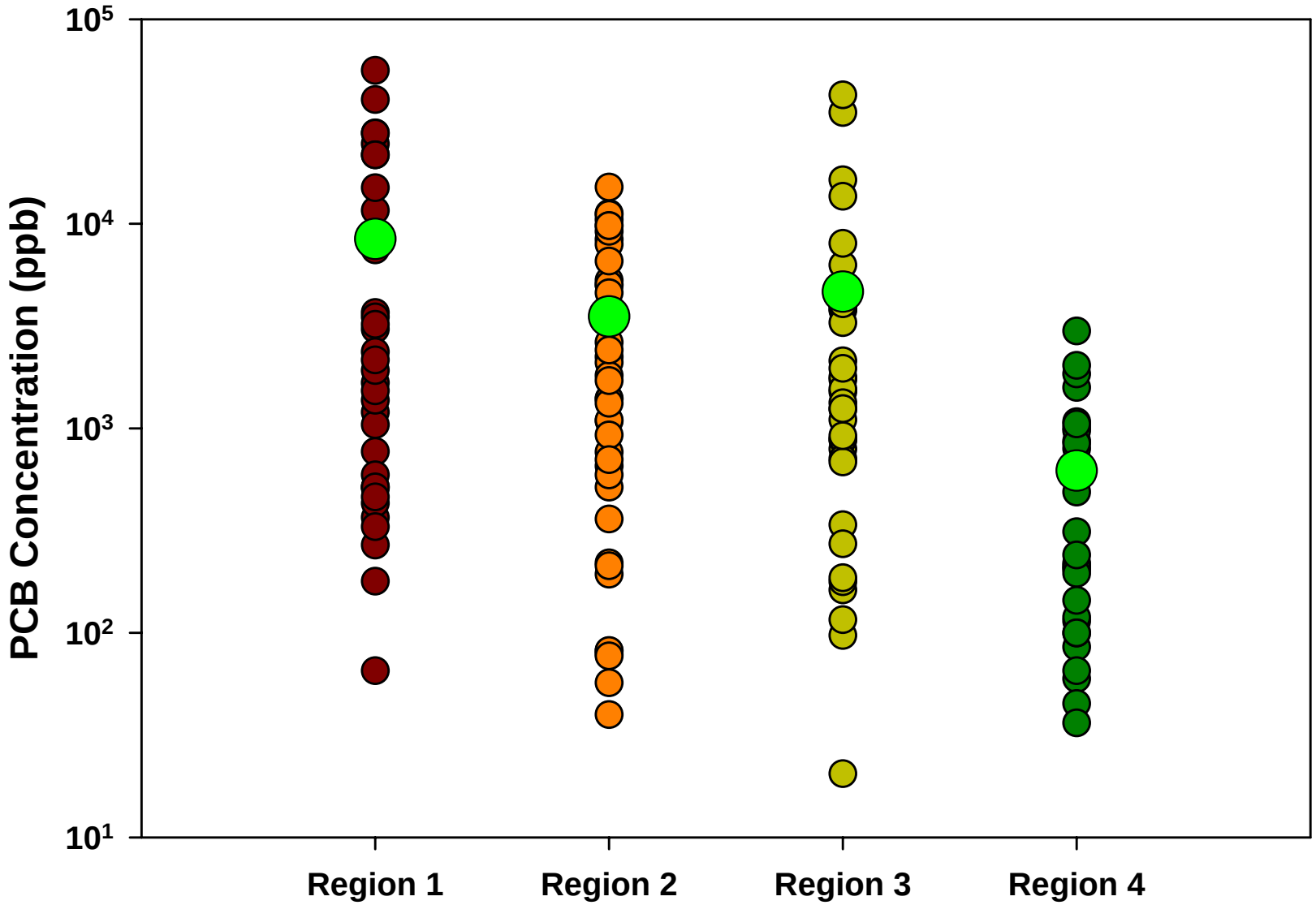
2002 Avian Eggs



2002 Avian Eggs

Species	n	Conc. Range (ppb)	Conc. Mean (+/- 1SD)
American Robin	40	20 – 11200	1120 +/- 2170
American Woodcock	2	91 – 101	96 +/- 7
Belted Kingfisher	10	2030 – 42700	13900 +/- 12500
Common Grackle	10	702 – 16400	4360 +/- 4880
Eastern Bluebird	5	196 – 1140	520 +/- 385
Eastern Phoebe	27	144 – 17300	2040 – 3350
Barn Swallow	10	663 – 5140	2990 +/- 1730
Red Winged Blackbird	40	65 – 35000	3670 +/- 6870
N. Rough Winged Swallow	10	2140 – 13900	7240 +/- 4170
Screech Owl	1	8010	-
Spotted Sandpiper	13	488 – 56200	15200 +/- 17700
Region	**n**	**Conc. Range (ppb)**	**Conc. Mean (+/- 1SD)**
Region 1	51	65 – 56200	7620 +/- 11300
Region 2	48	44 – 15100	3320 +/- 3870
Region 3	39	20 – 42700	4450 +/- 8860
Region 4	30	36 – 2990	607 +/- 718

2002 Avian Eggs



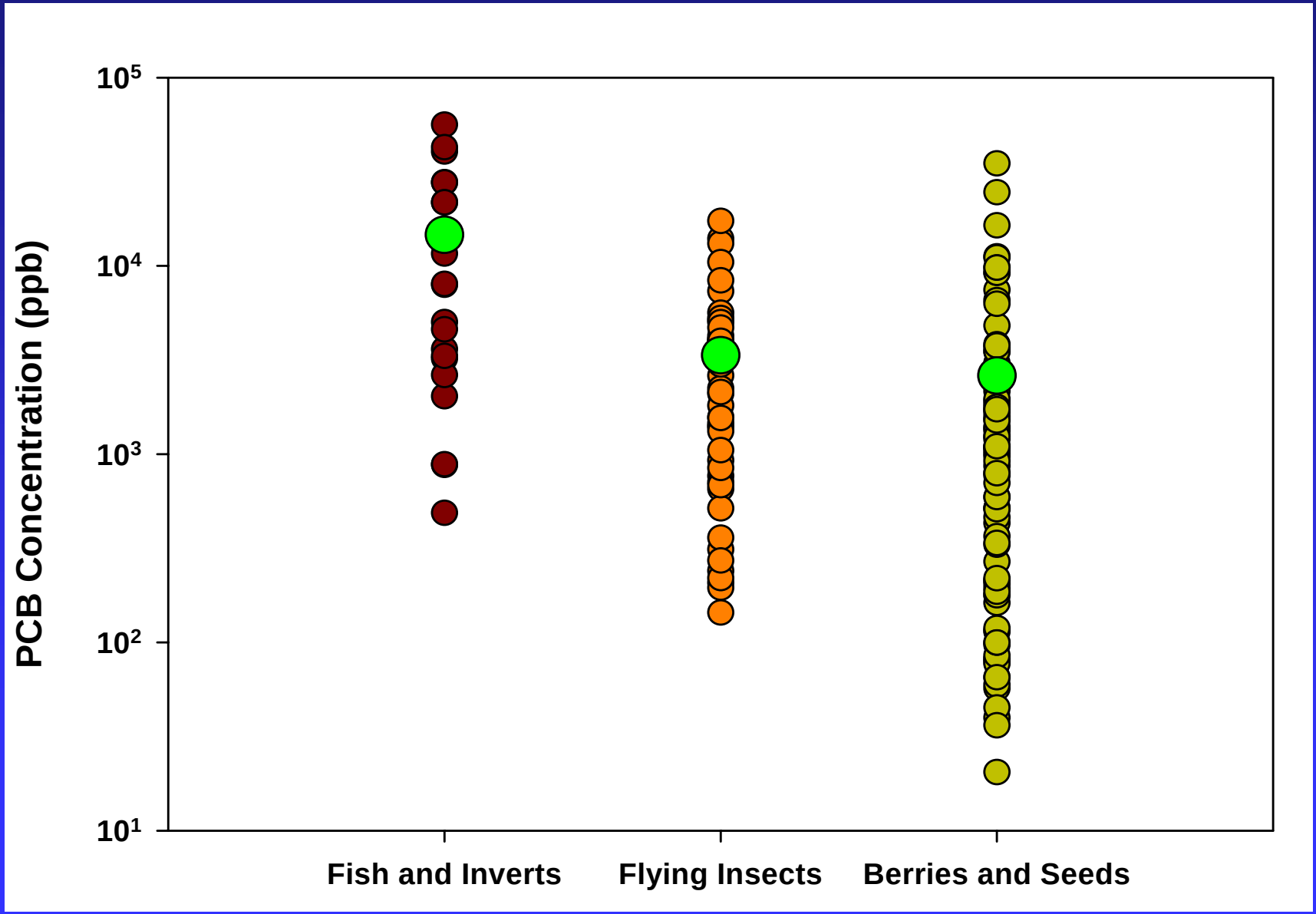
Feeding Guilds:

Barn Swallow
Eastern Phoebe
Rough Winged Swallow

Belted Kingfisher
Spotted Sandpiper

American Robin
Common Grackle
Red Winged Blackbird

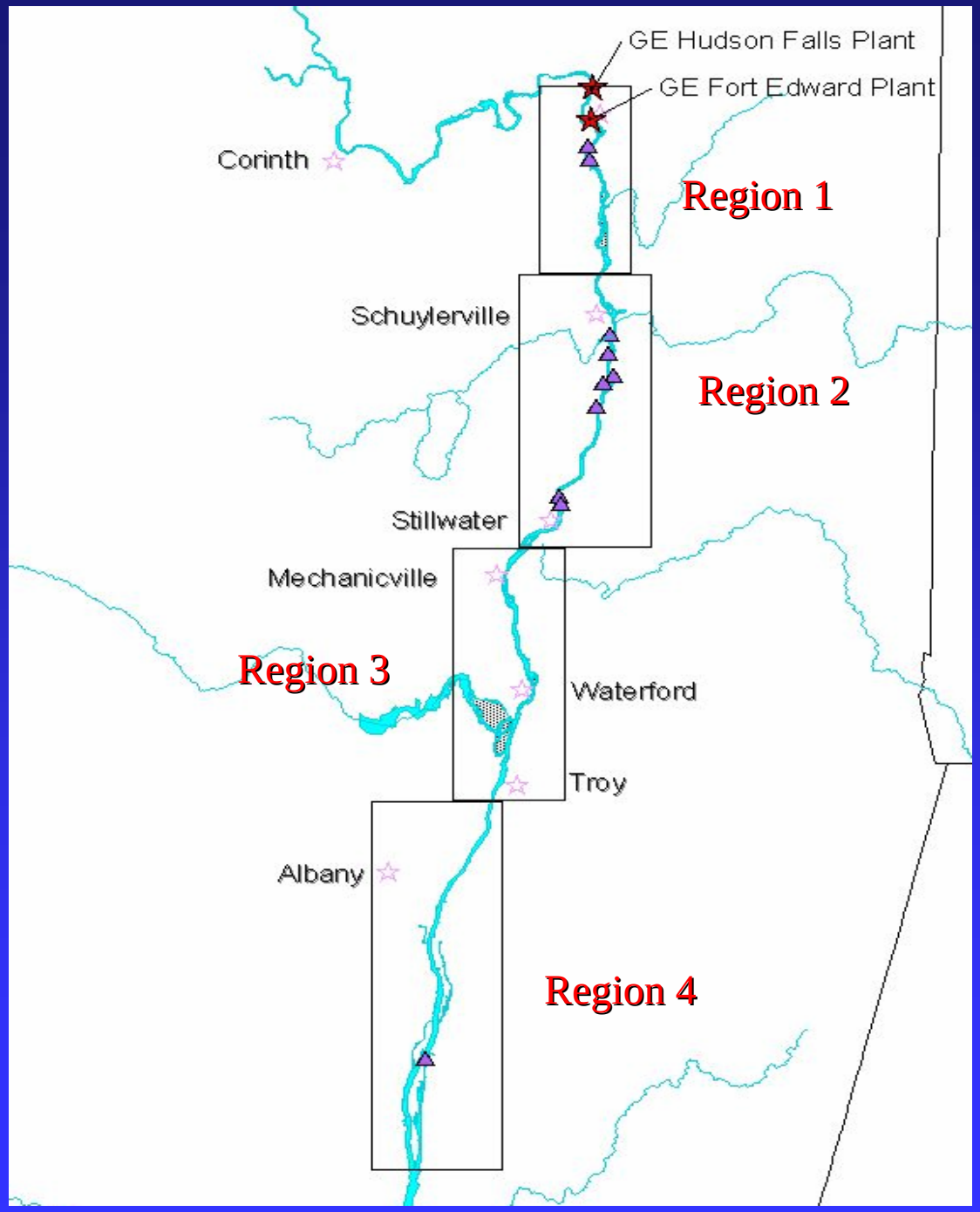
Feeding Guild Comparison



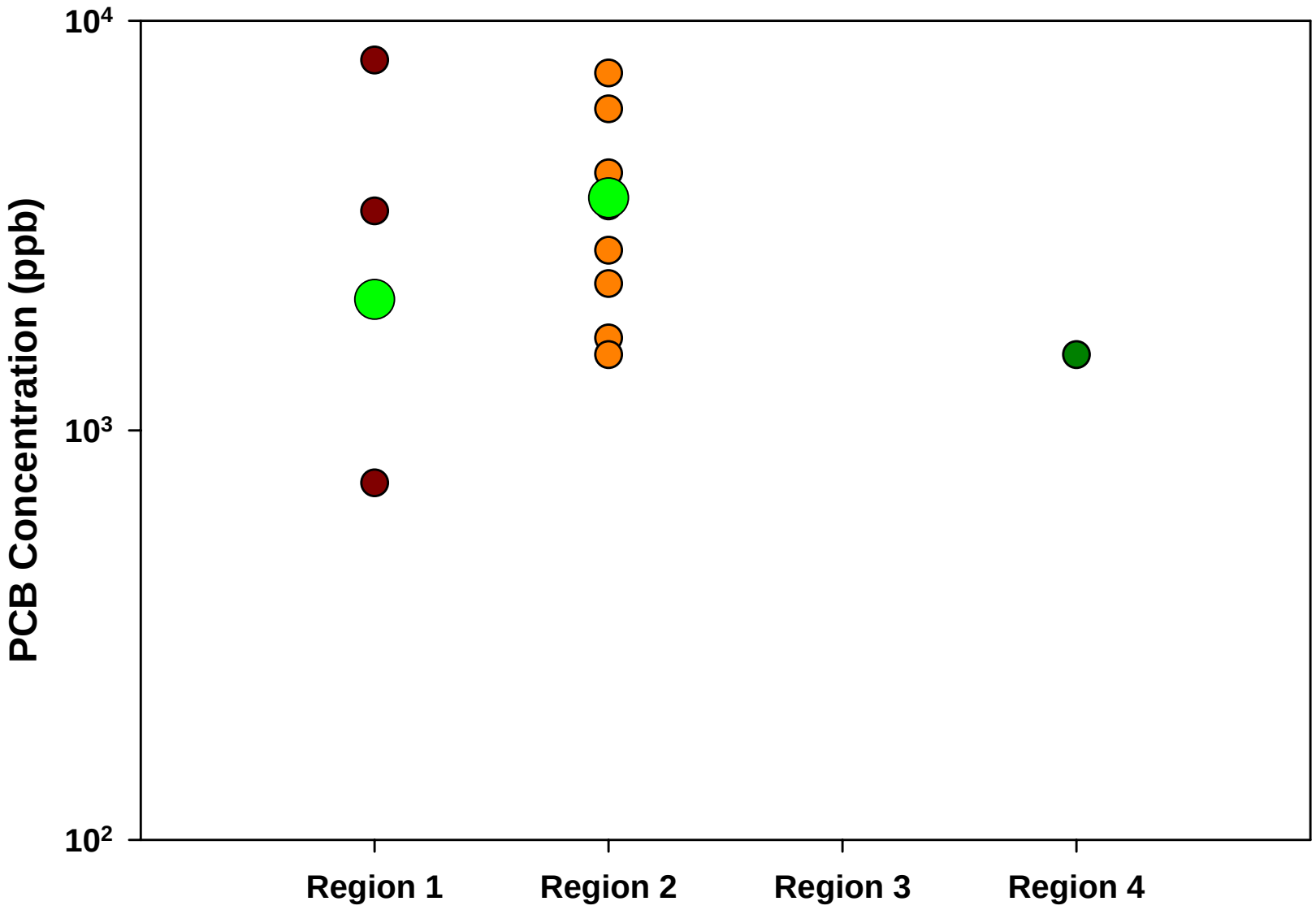
2002/2003 Screech Owl Surveys

- 2002 – only 1 egg collected (Region 1)
- Additional sampling in 2003 yielded 10 eggs
- 2002 egg: 8,010 ppb
- 2003 eggs: 744 – 7,450 ppb

2003 Screech Owl Eggs



2003 Screech Owl Eggs



2002 Peregrine Falcon Eggs

- 5 eggs (collected opportunistically)
- 2 Sites
  - Dunn Memorial Bridge (Albany)
  - Rip Van Winkle Bridge (Catskill)
- Analyses
  - Organochlorine pesticides
  - PCBs
  - % lipid
  - PBDEs
  - PCDD/Fs
  - Cadmium, lead and mercury

2002 Peregrine Falcon Eggs

Site	Egg mass (g)	t-PCBs (ppb)*
Dunn Memorial Bridge	32.55	5290
Dunn Memorial Bridge	30.24	6310
Dunn Memorial Bridge	31.98	6370
Rip Van Winkle Bridge	34.9	6690
Rip Van Winkle Bridge**	3.1	34200

*Wet weight basis, not corrected for moisture loss

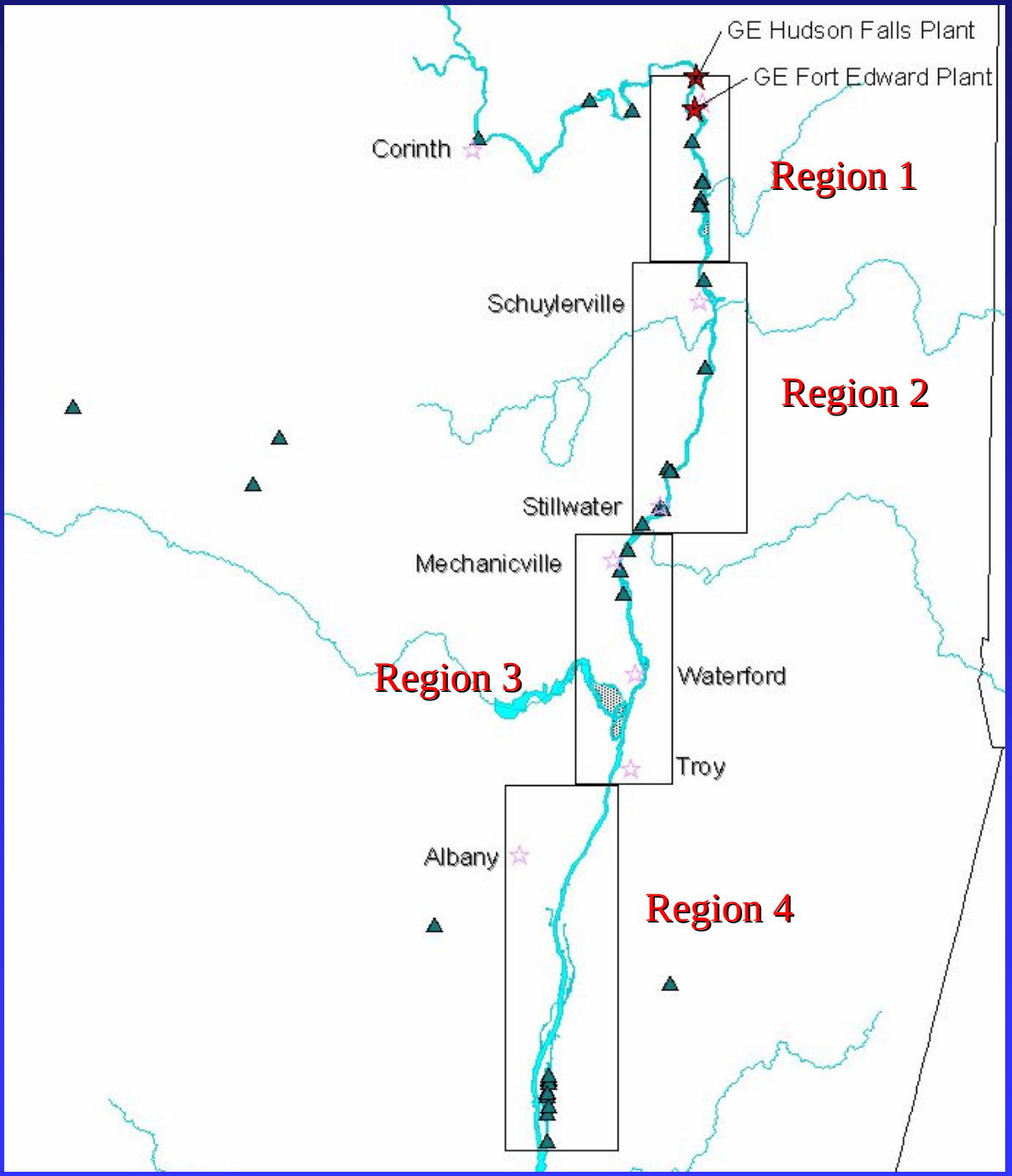
** This egg was cracked and severely dessicated, with no observable embryo

2002 Snapping Turtle Survey

2002 Snapping Turtle Survey

- Eggs from 42 nests or turtles were sampled within study site (Regions 1 – 4)
- Two reference sites (upstream and other) yielded 17 nests or turtles
- Each sample was a composite of 5 eggs (one sample consisted of 3 eggs)
- Study site t-PCBs: 70 – 31,800 ppb
- Reference site t-PCBs: 10 – 565 ppb

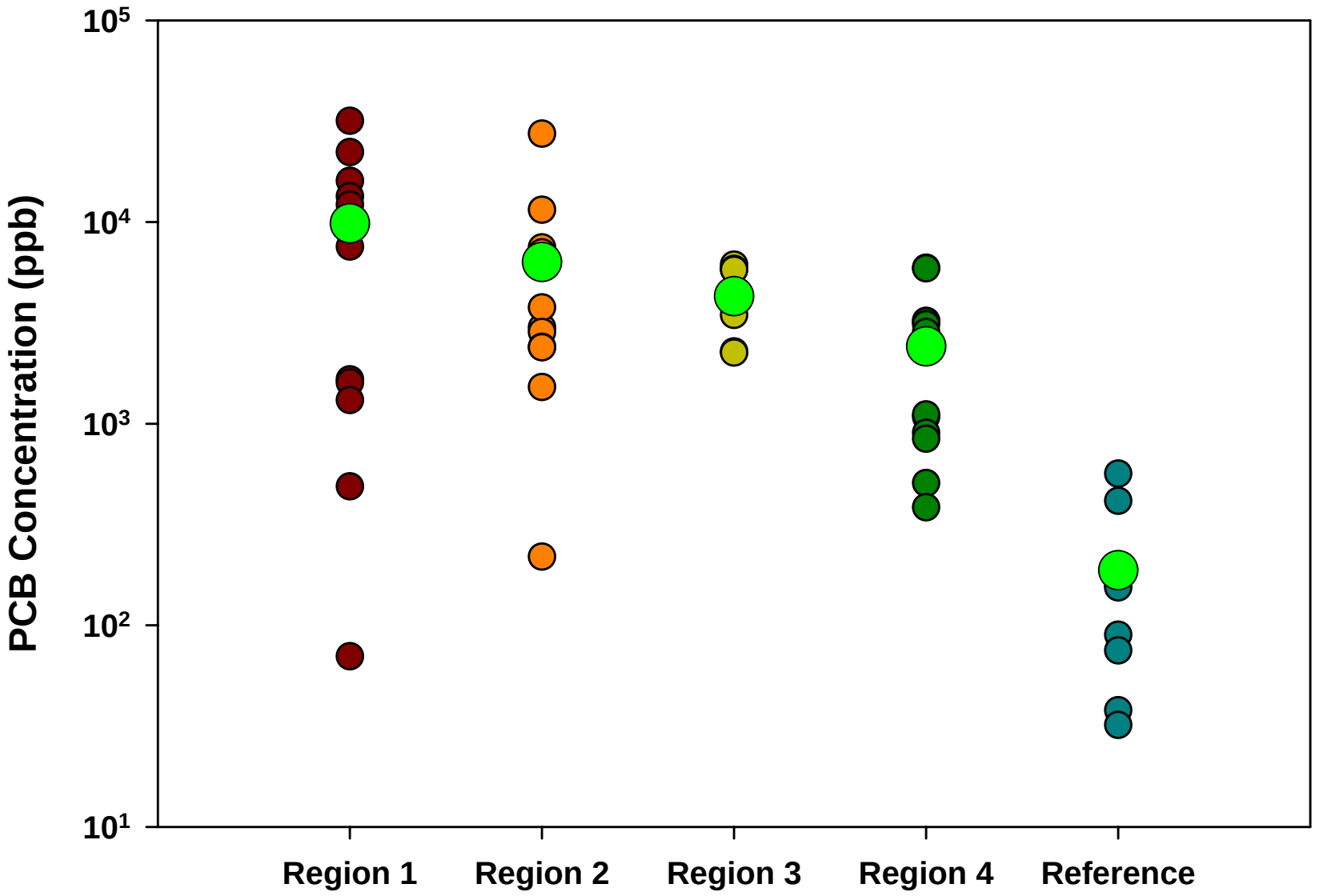
2002 Snapping Turtle Eggs



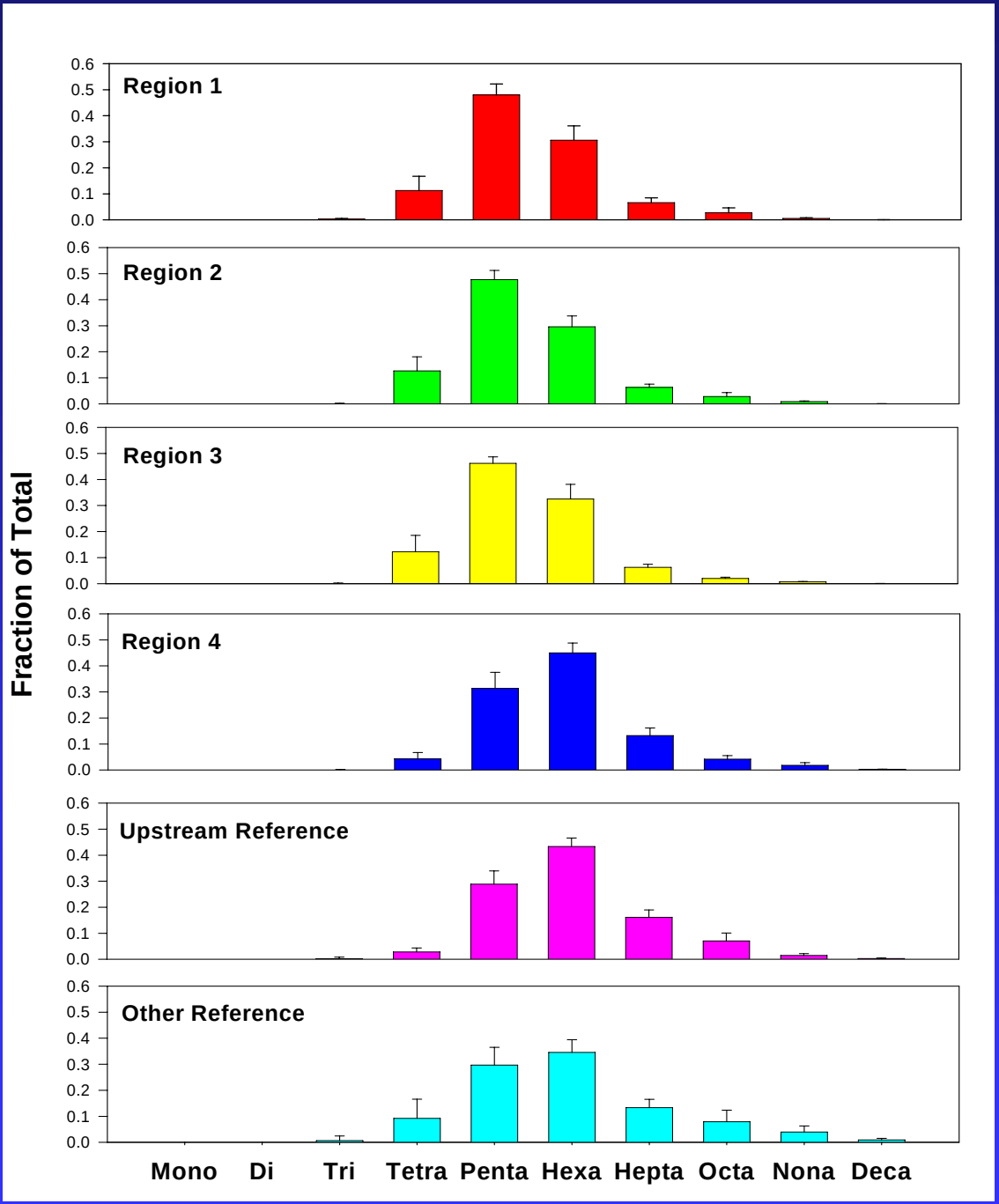
2002 Snapping Turtle Eggs

Site	n	Conc. Range (ppb)	Conc. Mean
Region 1	11	70 - 31800	9840 +/- 10400
Region 2	11	219 – 27400	6330 +/- 7710
Region 3	7	2250 – 6140	4290 +/- 1690
Region 4	13	385 – 5930	2420 +/- 1880
Upstream	9	32 – 565	187 +/- 182
Other	8	10 – 57	34 +/- 16

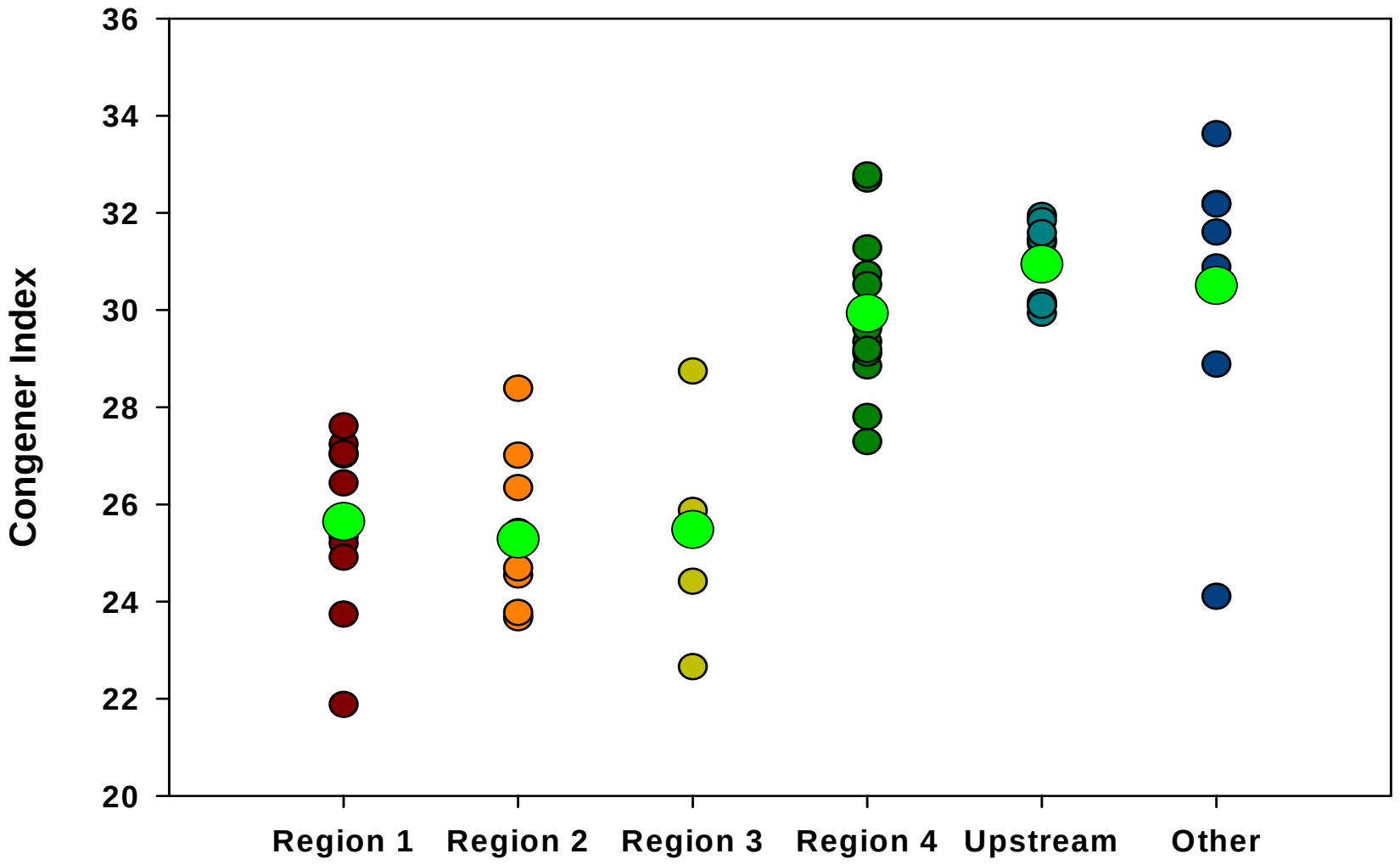
2002 Snapping Turtle Eggs



2002 Snapping Turtle PCB Homologue Composition by Region

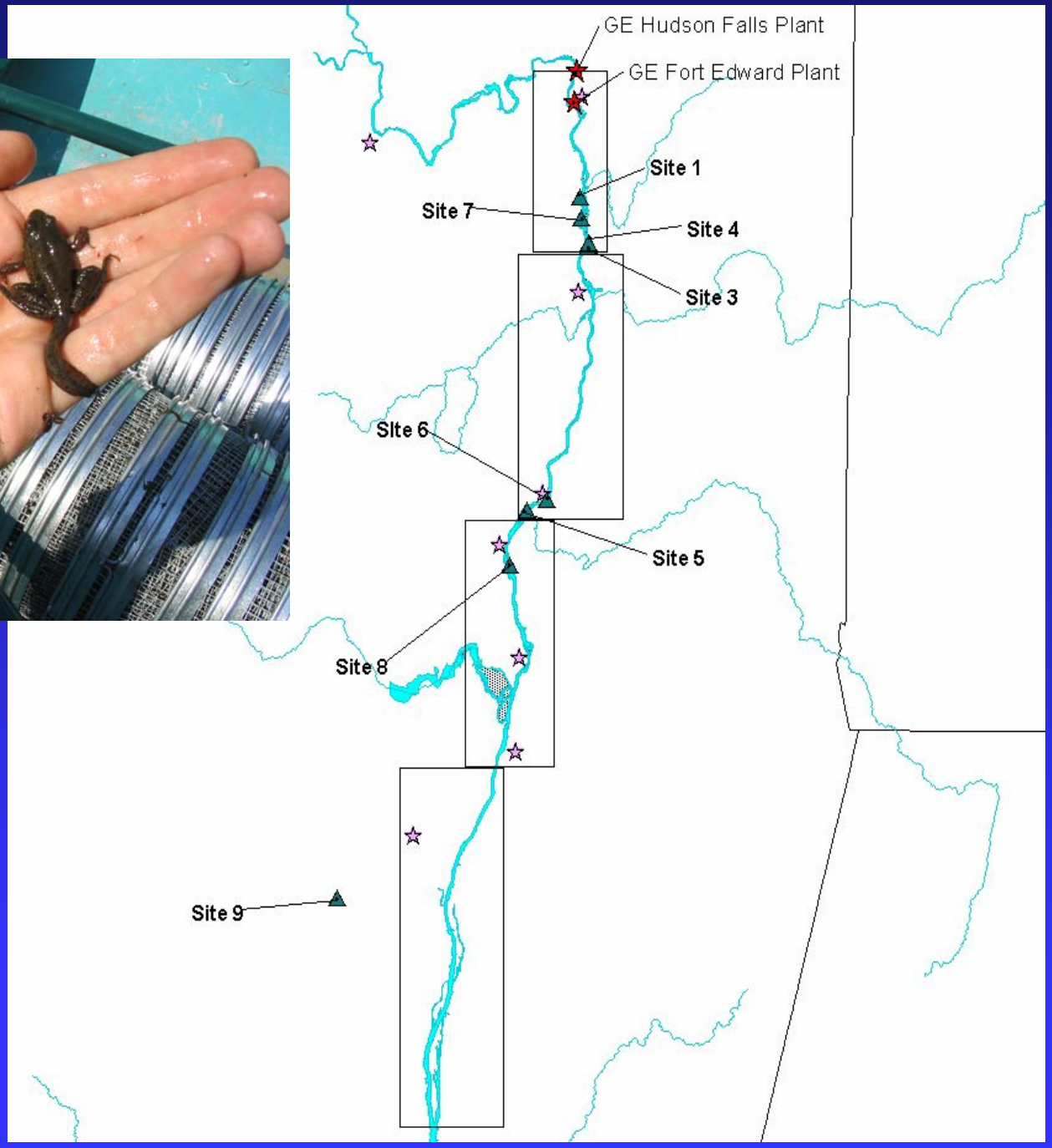


2002 Snapping Turtle PCB Congener Weighted Averages



2003 Bullfrog Tadpole Survey

- Sediment collected from 9 sites (2 reference)
- Composited samples (n = 9)
- Tadpoles collected from 8 sites (6 study, 2 reference)
- Tadpole gut coils were removed and individuals were composited based on developmental stage (n = 1 - 12)



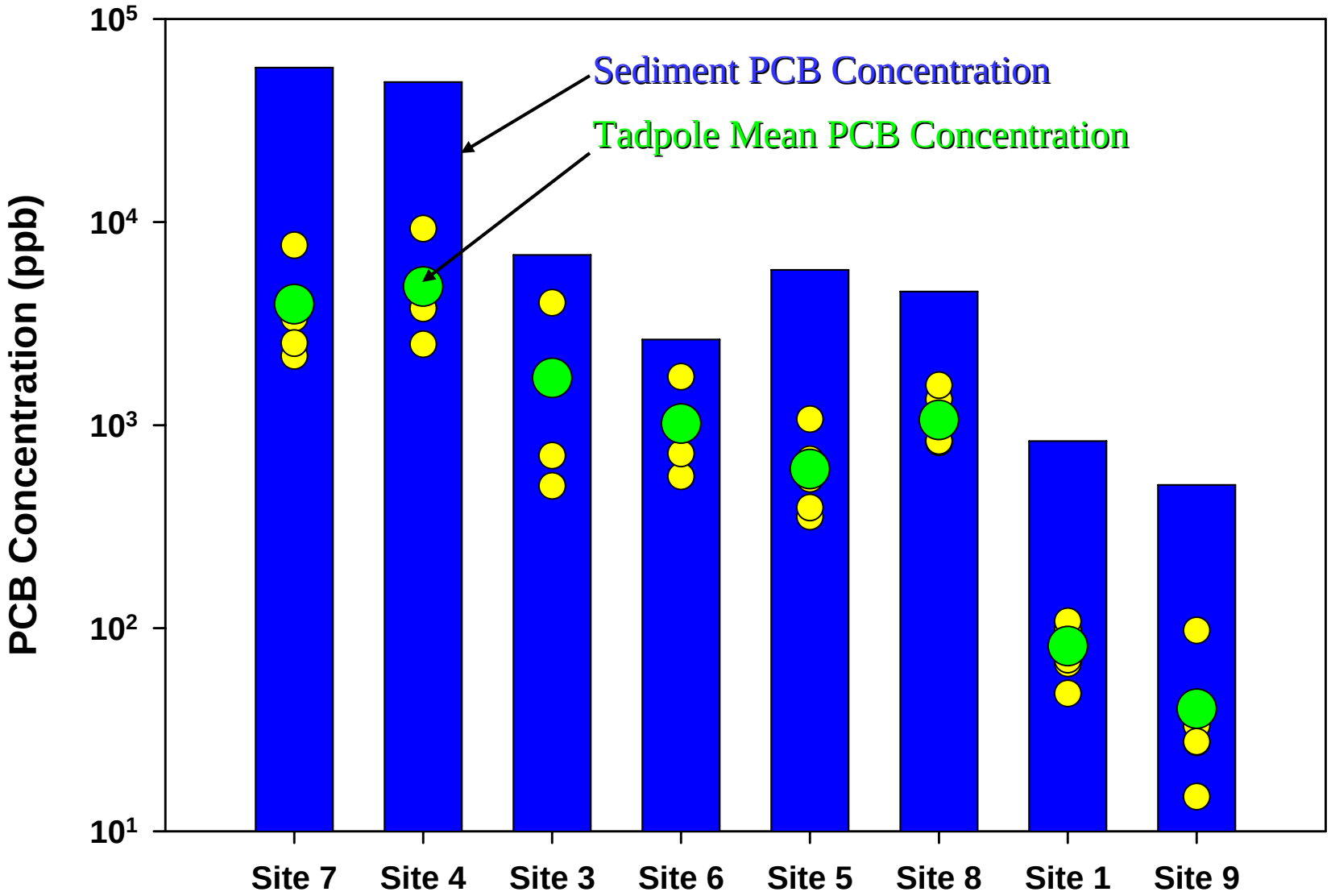
2003 Bullfrog Tadpoles

2003 Bullfrog Tadpoles

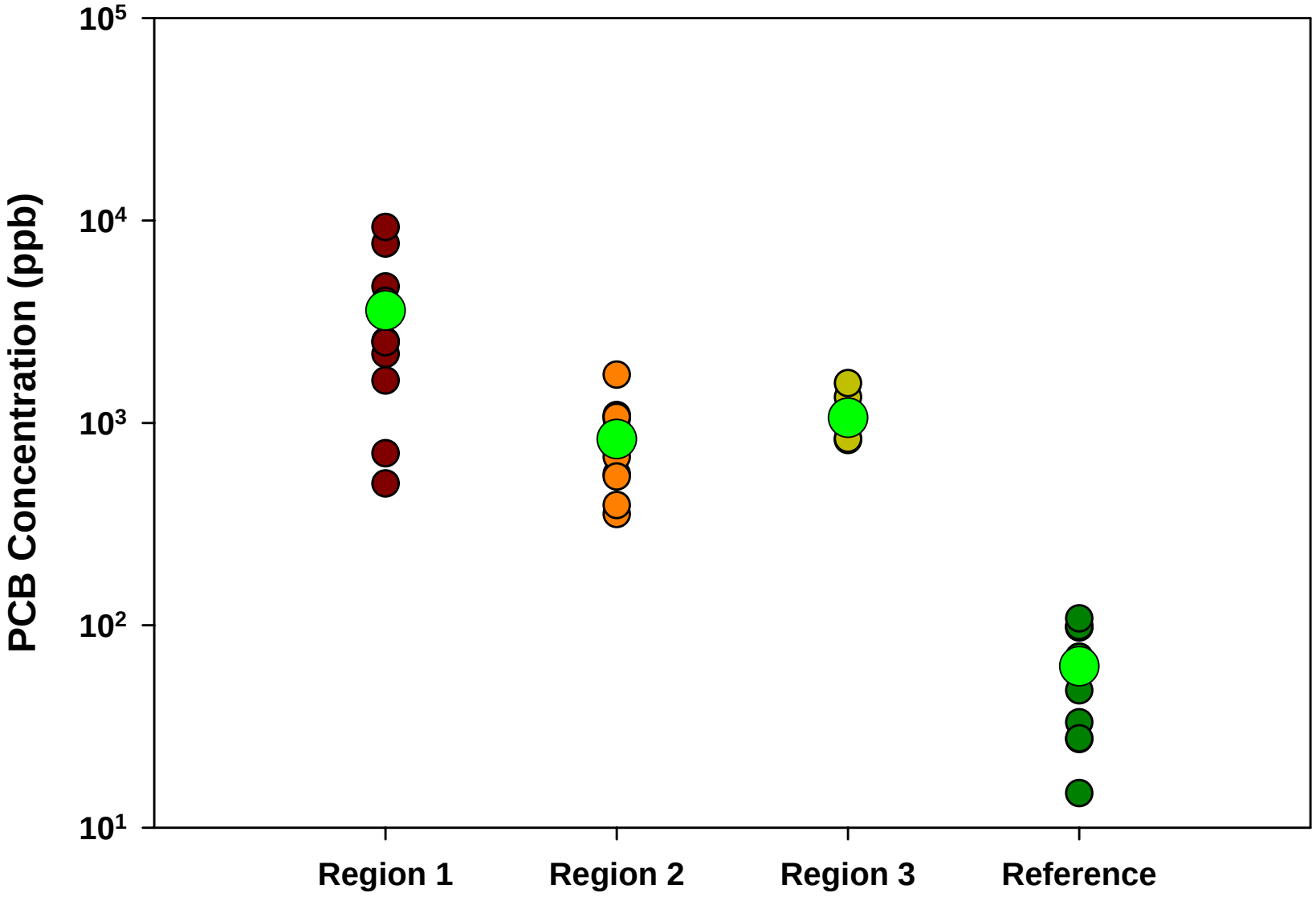
Site	n	Conc. Range (ppb)	Conc. Mean (+/- 1 SD)	Sediment
7	4	2190 – 7680	3940 +/- 2540	57600
4	5	2500 – 9280	4810 +/- 2620	48900
3	4	501 – 4000	1710 +/- 1600	6880
6	6	559 – 1730	1017 +/- 404	2640
5	5	354 – 1070	607 +/- 289	5820
8	6	823 – 1570	1060 +/- 319	4550
1	6	48 – 108	80 +/- 22	834
9	5	15 – 97	40 +/- 33	508

Study sites are listed upstream (Site 7) to downstream (site 8); Red font indicates reference sites

2003 Bullfrog Tadpoles



2003 Bullfrog Tadpoles



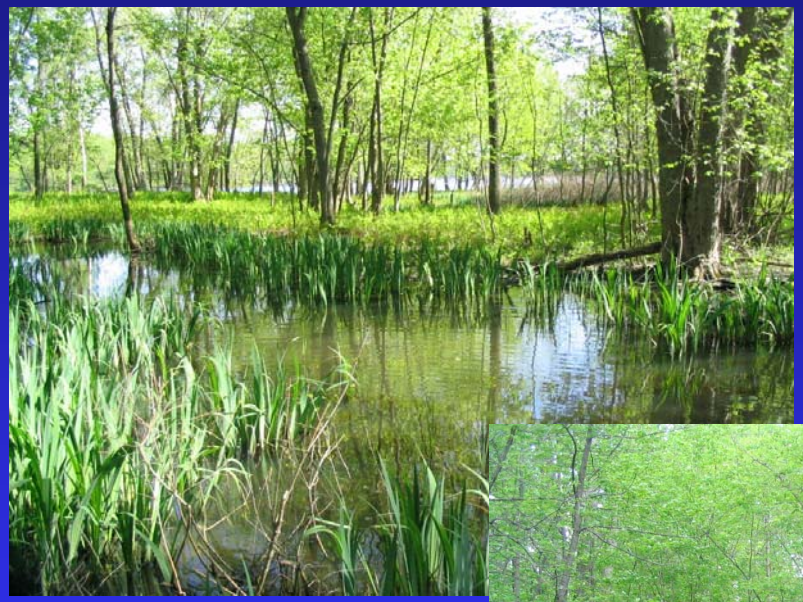
2004 Wood and Leopard Frog Breeding Habitat Survey

Potential wood and leopard frog breeding habitats in the Hudson River floodplain were surveyed in early spring 2004

Chorusing surveys were used to determine possible sampling sites

Sampling sites were established when egg masses were discovered and confirmed to be deposited by wood and/or leopard frogs

Researchers returned after several weeks, confirmed the presence of tadpoles and set up transects for the collection of soil samples



25 surficial (0-6 cm) soil samples were collected along a transect at each site using a hand corer

The 25 sub-samples were combined, homogenized and collected as one composited sample at each site

2004 Wood and Leopard Frog Breeding Habitat Survey Fact Sheet

Preliminary Investigation of Frogs and Sediments

Spring 2004

Hudson River Natural Resource Damage Assessment

Past and continuing discharges of polychlorinated biphenyls (PCBs) have contaminated Hudson River natural resources. While the U.S. Environmental Protection Agency is continuing with cleanup plans, federal and state trustee agencies are conducting a natural resource damage assessment (NRDA) to assess and restore natural resources injured by PCBs.

This fact sheet provides information about a preliminary investigation of frogs and sediments being implemented under the NRDA.

The Hudson River and its surrounding habitat support many species of amphibians, such as wood frog (*Rana sylvatica*) and northern leopard frog (*Rana pipiens*). These species spend a large part of their lives in contact with potentially contaminated substances-water, sediment, and soil-and consume potentially contaminated prey. Amphibians, such as frogs, are essential components of the food web. They eat insects, spiders, snails and worms, and in turn, are eaten by fish, snapping turtles, herons, mink, and raccoon. While providing nutrients for their predators, amphibians also pass on the hazardous substances they have accumulated.

PCB Exposure and Effects

Many laboratory and field studies have shown the potentially harmful effects of PCBs on fish, birds, mammals, and other wildlife. However, toxicological data on PCB impacts on amphibians are limited. Some studies indicate that when amphibians are exposed to PCBs they may die, become deformed, or experience problems during the change from tadpole to adult frog.

Purpose

The Trustees are investigating the feasibility of using amphibians for an injury determination study through a preliminary investigation focused on wood frogs and northern leopard frogs, and the habitats in which they breed. The goal of the preliminary investigation is to determine if a full-scale study of the effects of PCBs in the Hudson River on amphibians should be undertaken in the future. The objectives of the preliminary investigation are to:

- Establish whether northern leopard frog and wood frog are present in the Upper Hudson River in sufficient numbers and locations to support future injury studies.
- Determine contaminant levels in sediments from known breeding areas of the northern leopard frog and the wood frog.

There will also be opportunistic collection of data on three other amphibian species - the bullfrog (*Rana catesbeiana*), the green frog (*Rana clamitans*) and the American toad (*Bufo americanus*).

Study Location

The study will be conducted along the Hudson River from Bakers Falls in Hudson Falls, New York (River Mile 196.6) to the Federal Dam in Troy, New York (River Mile 153.9). If you own property along this portion of the Hudson River, a scientist from the New York State Department of Environmental Conservation may ask you for permission to enter your property for this study. If you grant permission, the scientist will survey your property for the presence of frogs and frog egg masses. This may involve listening for frogs, searching for frogs, and potentially collecting sediment samples from frog breeding habitat. The Trustees will not enter your property without your permission.