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PCB's in Fish from Selected Waters of New York State¹

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ABSTRACT

PCB residues in fish from 41 stations throughout New York State were monitored in 1975. Nearly all fish contained PCB's in detectable amounts although the levels of contamination and specific Atachor varied. The Hudson River contained the highest known PCB concentrations within the United States, levels often exceeded 100 ppm. Other waters and fish which were significantly contaminated include Lake Ontario salmonids and Cayuga Lake lake trout. Onondaga Lake, previously closed to fishing because of mercury contamination, also appears to have abnormally high levels of PCB's approaching in some instances the action level of the Food and Drug Administration, U.S. Department of Health, Education, and Welfare. Samples from marine waters generally have contaminant levels substantially below 5.0 ppm.

A summary of PCB data collected during 1970-75 is presented.

Introduction

The Division of Fish and Wildlife, New York State Department of Environmental Conservation, began analyzing fish flesh for DDT in the early 1960's. This work was conducted in response to data suggesting that chlorinated hydrocarbons may interfere with reproduction of fish and wildlife resources. Results of the investigation led to State restrictions on use of DDT in 1965. During this time, research indicated that DDT analyses could be biased through sample contamination with similar compounds, polychlorinated biphenyls (PCB's) (8). To minimize errors in future work, both DDT and PCB's were extracted and analyzed to obtain separate values. From 1971 through 1975 PCB's were evaluated in all fish flesh analyses as a part of DDT monitoring.

The recent concern over the impact of PCB's on human health and their possible effect on New York's natural resources as well as reports of their ubiquitous nature (6, 13, 20) precipitated a shift from low-level monitoring

in the statewide monitoring described in this report. The new program promulgated by the Department of Environmental Conservation in August 1975 revised all existing directions. Specific fish species and desired sizes were defined (Table 1). Stations were located in most large waterways throughout the State where PCB contamination could occur (Figure 1, Table 2) and, when possible, where earlier samples had been taken. Several Adirondack streams were included to ascertain statewide ambient conditions. Where contamination was known to exist sampling was intensified. This was the case of the Hudson River where inordinately high concentrations of the contaminant in fish were reported by the U.S. Environmental Protection Agency (EPA) (16).

The objectives of this program were to determine the level and extent of PCB contamination in fish inhabiting or migrating through major waterways in New York State and to isolate contaminated portions or reaches of waterways, thereby identifying specific areas to be addressed by agencies which control water pollution.

TABLE 1. Desired species and size distribution of fish from New York waters analyzed for PCB content, 1975

SPECIES	LENGTH, IN		
	SMALL	MEDIUM	LARGE
Smallmouth bass	5-7	10-12	14-16
Largemouth bass	5-7	10-12	14-16
Walleye	7-9	11-13	19-21
Brook trout	4-6	8-10	11-13
Carp	5-7	13-15	28-30
Goldfish	4-6	7-9	10-12
Suckers	6-8	10-12	13-19
Striped bass	11-14	16-18	28-32
WATERY CRE*			
Salmon (fish)	1-2	4-6	8-12
Brook trout	3-5	8-12	15-20
Brook trout (steelhead trout)	1-2	3-5	8-12
Lake trout	1-2	4-6	8-12

* Minimum number of fish per sample was 6.

* Average number of fish per sample was 5.

* Maximum number of fish per sample was 5.

* Minimum number of fish per sample was 5.

¹ New York State Department of Environmental Conservation, Bureau of Environmental Protection, 50 Wolf Road, Albany, N.Y. 12233

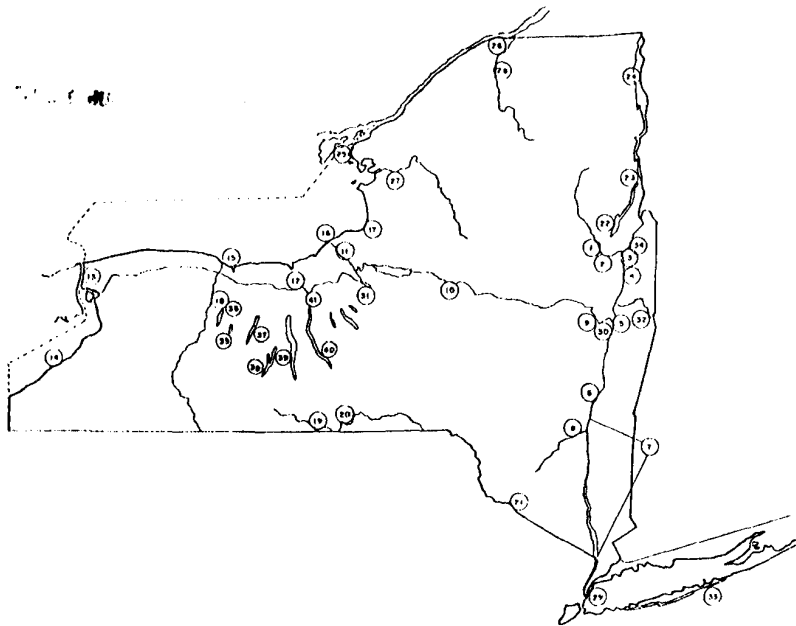


FIGURE 1. Fish collection stations for PCB studies, New York State 1975

Stations selected for fish sampling were included in a major water column and sediment monitoring program conducted by the State Division of Pure Waters. Data from all sources are being used to track down sources of PCB contamination and to recommend remedial action.

Fish Collections

Regional Fish and Wildlife personnel were instructed on specific species and sizes of fish desired, general location of the stations, and timetable for collections. Sampling methods were primarily gill nets and electrofishing; angling and rotenone were used when other techniques were inadequate. On occasion, fish were donated by or purchased from commercial and recreational anglers.

The composition of the fish samples directed to the laboratories varied slightly, depending on the success of the collection teams. Specifications in Table 1 were flexible in order to accommodate a sampling program involved with diverse waters. Specific instructions requested that at each location members of two trophic levels, predators and forage species, be sampled in three size categories: small or sublegal, medium or minimally legal, and large.

The collection team chose the representative species and followed the length and number specifications in Table 1. In those areas where a commercial species is harvested, representative specimens were included.

All specimens were individually tagged, measured and weighed, placed by groups in polyethylene bags, and deposited in a cooler or freezer for shipment to a laboratory.

TABLE 2. Statewide sampling stations for PCB analysis, New York—1975

STATION NO. ¹	WATERBOD	WATERWAY	LOCATION
1	Upper Hudson River	Hudson River	Above Cortland
2			Above Chenango Falls
3			At Fort Edward
4			Below General Electric Co.
5			5 miles below Fort Edward
6	Lower Hudson River		Watford area
7			Catskill-Catskill area
			Lower Hudson
			Mouth of Rondout Creek
			Mouth of Wappingers Creek
			Mouth of Esopus Creek
			Kongers/Rhinecliff Bridge
8		Rondout River	Tappan Zee Bridge area
9			West Point
10			George Washington Bridge area
11			Highland/Poughkeepsie area
12	Seneca Oneida Oswego Rivers	Seneca Oneida/Oswego Rivers	Rondout River above first dam
13			Below Schenectady
14	Lake Erie-Niagara River	Niagara River	Below Oriskany
15			Below Fulton
16	Lake Erie-Niagara River	Lake Erie	Below Clyde
17			Dunkirk
18	Lake Ontario	Lake Ontario	Off Rochester
19			Oswego
20	Genesee River	Genesee	Pulaski (salmonids)
21			Below Industry
22	Chemung River	Chemung	Chemung
23			Chemung
24	Susquehanna River	Susquehanna	Smithboro
25			Smithboro
26	Delaware River	Delaware	Below Pt. Jervis
27			(State line)
28	Lake Champlain	Lake George	Redfin Landing
29			Ticonderoga
30	Lake Champlain	Lake Champlain	Plattsburg
31			Plattsburg
32	St. Lawrence River	St. Lawrence	Cape Vincent
33			Massena
34	Black River	Black River	Watkins
35			Watkins
36	St. Lawrence River	Rapquette River	Norfolk
37			Norfolk
38		Tuloni Fish Market	
39			Albany Fish Market
40	Seneca Oneida Oswego Rivers	Ontonago Lake	
41			
42	Upper Hudson River	Wallkill/Hudson Rivers	
43			
44	Long Island	Marine Waters	
45			
46	Upper Hudson River	Champlain Canal	Lock 8
47			
48	Genesee River	Hemlock Lake	
49			
50	Seneca Oneida Oswego Rivers	Candor Lake	
51			
52		Cattaraugus Lake	
53			
54		Kewau Lake	
55			
56		Seneca Lake	
57			
58		Cayuga Lake	
59			
60		Seneca River	
61			
62			Montezuma National
63			Wildlife Refuge

¹See map, figure 1

or storage center. Common names of fishes used throughout this report are those adopted by the American Fisheries

Society (1) and are presented with their scientific nomenclature in Table 3.

TABLE 3. Common and scientific names of fish and shellfish species analyzed for PCB's - 1975

COMMON NAME	SCIENTIFIC NAME
Spring darters	<i>Squalus acanthias</i>
Atlantic sturgeon	<i>Acipenser oxyrinchus</i>
American eel	<i>Anguilla rostrata</i>
Blackback herring	<i>Alosa aestivalis</i>
Ah-wake	<i>Alosa pseudoharengus</i>
American shad	<i>Alosa sapidissima</i>
Atlantic menhaden	<i>Brevoortia tyrannus</i>
Cape or lake herring	<i>Coregonus artedii</i>
Coho salmon	<i>Oncorhynchus kisutch</i>
Chinook salmon	<i>Oncorhynchus tshawytscha</i>
Karibou trout	<i>Salmo gairdneri</i>
Atlantic salmon	<i>Salmo salar</i>
Brown trout	<i>Salmo trutta</i>
Fake trout	<i>Salvelinus namaycush</i>
Rainbow smelt	<i>Osmerus mordax</i>
Chain pickerel	<i>Esox niger</i>
Northern pike	<i>Esox lucius</i>
Codfish	<i>Gadus macrocephalus</i>
Carp	<i>Cyprinus carpio</i>
White sucker	<i>Catostomus commersoni</i>
Silver chubster	<i>Moxostoma valenciennae</i>
Roundtail yellow perch	<i>Moxostoma valenciennae</i>
Brown bullhead	<i>Ictalurus nebulosus</i>
Channel catfish	<i>Ictalurus punctatus</i>
Garfish	<i>Lepisosteus americanus</i>
Atlantic eel	<i>Anguilla rostrata</i>
Atlantic tomcod	<i>Microgadus tomcod</i>
Menhaden	<i>Brevoortia tyrannus</i>
Atlantic silverside	<i>Menidia menidia</i>
White perch	<i>Morone americana</i>
White bass	<i>Morone chrysops</i>
Striped bass	<i>Morone saxatilis</i>
Rock bass	<i>Ambloplites rupestris</i>
Redbreast sunfish	<i>Lepomis microlophus</i>
Pumpkinseed	<i>Lepomis gibbosus</i>
Bluegill	<i>Lepomis macrochirus</i>
Smallmouth bass	<i>Micropterus dolomieu</i>
Large-mouth bass	<i>Micropterus salmoides</i>
Black crappie	<i>Pomoxis nigromaculatus</i>
Yellow perch	<i>Perca flavescens</i>
Walleye	<i>Stizostedion vitreum</i>
Blue fish	<i>Pomatomus saltatrix</i>
Weakfish	<i>Cynoscion regalis</i>
Strip	<i>Stenotomus chrysops</i>
Tautog	<i>Apogonichthys gangeticus</i>
Atlantic tomcod	<i>Microgadus tomcod</i>
Atlantic croaker	<i>Chelodactylus</i>
Bluefish	<i>Pomatomus saltatrix</i>
Crabs	<i>Callinectes sapidus</i>
Crabs	<i>Libinia emarginata</i>
Summer flounder	<i>Paralichthys dentatus</i>
Winter flounder	<i>Paralichthys americanus</i>
Northern puffer	<i>Spheroideus maculatus</i>

SHLECHTER

Blue, clay fish
Northern lobster
Hard clam
Soft-shell
American oyster
Common mussel

Callinectes sapidus
Homarus americanus
Mytilus edulis
Spisula solidissima
Crassostrea virginica
Mytilus edulis

Laboratory Analyses

Four State laboratories collaborated in the analysis of fish flesh: Department of Environmental Conservation Laboratories at Rome and Stony Brook, Department of Agriculture and Market Food Laboratory in Albany, and the Department of Health Griffin Laboratory in Guilfordland. Limited analyses were conducted in the Buffalo, N.Y., laboratory of the Food and Drug Administration. U.S. Department of Health, Education, and Welfare. Specific analytical techniques have been described (5, 9, 10, 14, 15, 17, 24).

Frozen fish samples were defrosted, generally prepared as described below, ground three times, and blended.

FISH SIZE	PREPARATION
Very small less than 100 g	Whole fish composites, see Table 4
Small 100-150 g	Head and viscera removed Individuals composited
Medium 25-60 cm	Head and viscera removed Composite if needed
Large 61-76 cm	Left fillet or anterior half of left fillet with skin intact Composite if needed
Jumbo over 76 cm	Anterior third of left fillet with skin intact

Brown bullhead, American eel, and Atlantic Ocean fish were the only species skinned before grinding; this is the common method of preparing them for consumption. Composites of medium through jumbo fish were of ground and blended flesh; total weight of each individual was proportional to the total weight of the composite.

Laboratories performing analyses are noted in Tables 4 and 5. Recoveries by the analytical techniques cited above are 85 percent or more. Data were not adjusted to reflect recovery rate. Each procedure has a sensitivity of 0.01 ppm although two laboratories reported results only as low as 0.1 ppm. Very limited numbers of fish from Lake Ontario were subjected to mass spectrometry for confirmation of analytical results.

A quality assurance program was implemented to assure that results from the various laboratories were comparable. Table 6 shows that none of the participating laboratories had contamination problems; all reported zero for sample A. At the level of approximately 1 µg/ml of extract, which corresponds to the action level of 5 µg/g in fish, precision among the laboratories was remarkably good. No gross bias existed, although the laboratories had standard Aroclor mixtures obtained at different times and one laboratory used Aroclor 1242 for quantitation instead of Aroclor 1016. Results at higher concentrations indicate similar agreement.

In Table 6, the two sets of results from Griffin Laboratory illustrate the effects of using separate standards to quantitate the two Aroclor types and of using a mixed standard. Although all laboratories used individual standards, Table 6 results indicate basic similarity to results obtained for a mixed standard, Aroclors 1242 and 1254. This is probably due to differing gas chromatograph column conditions, and differing techniques of measuring the various Aroclors. To measure check samples such as these the use of individual Aroclors is the most desirable, but for environmental samples which are nearly always mixtures, use of mixed standards is analytically faster and probably more accurate. Table 7 supports this contention; some laboratories used mixed standards and some used indi-

TABLE 4. Concentrations of PCB's in fish and shellfish in New York State, 1975

WATER	STATION	LABORATORY ¹	SPECIES	ANALYST	NO. FISH ANALYZED	NUMBER OF ANALYSES	CONCENTRATION OF PCB'S PPM NET WEIGHT ²		
							WEIGHTED AVERAGE	HIGH	LOW
Hudson River	1, 7	DEC R	Smallmouth bass	1247/1016 1254	26	12	0 TR	0 TR	0
			Walleye	1242/1016 1254	2	2	0 TR	0 TR	0
			Yellow perch	1242/1016 1254	15	11	0 TR	0 TR	0
			White sucker	1242/1016 1254	4	4	0 TR	0 TR	0
Hudson River (0-40 miles below Cornwall Electric Company)	3	DEC R	Walleye	1247/1016 1254	14	2	91.01 36.01	104.21 41.80	81.12 28.79
			Edible fish	1242/1016 1254	4	1	9.88 8.31	9.88 8.31	
			Yellow perch						
			Whole fish	1242/1016 1254	30	2	164.56 37.14	235.40 62.88	125.31 24.21
			Edible fish	1242/1016 1254	10	1	61.10 15.24	61.10 18.24	
			Rock bass	1242/1016 1254	2	1	27.35 ND	27.35	
			Alewife	1242/1016 1254	1	1	20.55 ND	20.55	
			White sucker	1242/1016 1254	9	2	41.75 23.19	82.78 47.51	8.8 7.72
Hudson River (3 miles below Fort Edward)	4	DEC R	Smallmouth bass	1242/1016 1254	1	1	100.27 22.64	100.27 22.64	
			Walleye	1242/1016 1254	3	3	56.73 16.67	157.27 20.74	5.16 5.56
			Yellow perch						
			Whole fish	1242/1016 1254	26	2	87.20 30.15	88.18 34.21	52.51 18.55
			Edible fish	1242/1016 1254	3	1	35.51 15.11	35.51 15.11	
			White sucker ³	1242/1016 1254	10	5	47.50 19.42	78.60 41.10	28.61 8.13
			Brown bullhead	1242/1016 1254	5	2	27.03 37.25	95.30 38.32	73.24 36.49
			Emmensmouth bass						
			Whole fish	1242/1016 1254	8	2	11.65 8.42	14.11 9.84	8.99 6.07
			Edible fish	1242/1016 1254	4	1	19.25 10.59	24.85 15.97	12.40 4.34
Hudson River (Watkins)	4A	DEC R	American eel ⁴	1242/1016 1254	2	2	209.34 83.47	403.18 155.87	11.25 11.67
			Brown bullhead	1242/1016 1254	1	1	4.66 7.99	4.66 7.99	
			White sucker	1242/1016 1254	6	2	58.32 15.73	154.29 31.92	19.34 11.93
Hudson River (Watkins)	5	DAM	Smallmouth bass	1242/1016 1254	10	2	30.60 17.70	36.07 17.5	27.0 14.5
			Walleye	1242/1016 1254	2	1	23.30 9.30	23.3 9.3	
			White sucker	1242/1016 1254	11	2	27.44 10.15	36.0 12.9	20.5 7.4
Hudson River (below Troy Dam)	6, 7a,b	DEC R	Striped bass	1242/1016 ⁵ 1254	21	2	0.10 1.75	2.19 1.90	0 1.66
			Edible fish	1242/1016 1254	42	21	12.05 17.01	56.42 50.06	0 1.66

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TABLE 4 (cont'd.). Concentrations of PCB's in fish and shellfish in New York State, 1975

WATER	STATION	LABORATORY	SPECIES	ANALYSIS	NO. FISH ANALYZED	NUMBER OF ANALYSES	CONCENTRATION OF PCB'S		
							PPM WET WEIGHT*	Mean	Max
Hudson River (Below Troy Dam)	6, 7a & 10 C R	D C R	Smallmouth bass	1242/1016	2	2	0.05	15.76	2.32
				1254 *	1	1	2.18	2.18	
			Largemouth bass	1242/1016	10	10	5.43	10.75	0
				1254			4.62	7.65	1.71
			Yellow perch	1242/1016	7	7	1.19	4.19	0
				1254 *	5	1	5.28	5.28	
			White perch	1242/1016	30	9	9.00	30.67	0
				1254 *	18	4	6.98	9.65	4.34
			Chain pickerel	1242/1016	1	1	8.68	8.68	
				1254			ND		
			Atlantic tomcod	1242/1016	47	2	6.49	6.68	6.27
			Whole fish	1254			7.75	9.85	5.12
			Edible fish	1242/1016	6	2	1.50	2.07	0.93
				1254			1.32	1.63	1.00
			American shad	1242/1016	15	6	1.35	9.00	0
				1254			1.14	1.88	0
			Blueback herring	1242/1016	4	4	0.72	1.85	0
			Whole fish	1254			1.41	4.69	0
			Edible fish	1242/1016	2	1	0	0	
				1254			5.13	5.13	
			American eel	1242/1016	11	7	54.74(25.61)*	186.22	0
				1254			27.20(19.15)	57.20	3.00
Rondout Creek	8	DAM	Atlantic sturgeon	1242/1016	20	5	7.69	13.48	0
				1254			8.15	9.84	6.25
			Brown bullhead	1242/1016	1	1	0	0	
				1254			3.38	3.38	
			Atlantic menhaden	1242/1016	8	2	0	0	
				1254			1.67	1.83	1.41
			Largemouth bass	1242/1016	7	2	0	0	
				1254			1.39	1.97	1.16
			White sucker	1242/1016	5	1	0	0	
				1254			1.60	1.60	
Mohawk River (Schenectady)	9	DAM	Carp	1242/1016	3	1	0	0	
				1254			1.50	1.50	
			Smallmouth bass	1242/1016	3	1	0.70	0.7	
				1254			1.50	1.5	
			White sucker	1242/1016	5	1	0.00	0.8	
				1254			1.00	1.9	
			Black crappie	1242/1016	9	2	1.11	1.6	0.5
				1254			1.13	1.4	0.8
			Largemouth bass	1242/1016	8	2	0.95	1.2	0.7
				1254			3.40	4.7	2.1
Mohawk River (Hate Falls)	10	DAM	Blueback herring	1242/1016	6	1	2.70	2.1	
				1254			1.60	1.6	
			Walleye	1242/1016	10	2	4.45	4.9	4.0
				1254			9.25	9.5	9.0
			Smallmouth bass	1242/1016	2	1	1.90	1.9	
							9.50	9.5	
			White sucker	1242/1016	11	2	0	0	
				1254			2.39	4.2	1.1
			Brown bullhead	1242/1016	3	1	2.70	2.7	
				1254			11.50	11.5	
Herkner Oswego Canal	11	DRI	Smallmouth bass	1242/1016	14	3	2.29	4.4	0
				1254			1.13	2.5	0.7

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TABLE 4 (cont'd.). Concentrations of PCB's in fish and shellfish in New York State, 1975

WATER	STATION	LABORATORY	SPECIES	ANALYSES	NO. FISH ANALYZED	NUMBER OF ANALYSES	CONCENTRATION OF PCB'S, $\mu\text{g/g}$ (WET WEIGHT)		
							Whole fish average	Heart	Liver
Erie Canal	12	DRI	Carp	1242/1016	10	2	2.00	4.0	0
				1254			5.60	7.2	4.0
			Largemouth bass	1242/1016	1	1	0	0	
				1254			0.80	0.8	
			Northern pike	1242/1016	1	1	2.00	2.0	
				1254			1.30	1.3	
Niagara River	13	DRI-CR	Carp	1242/1016	8	2	0.60	1.6	0
				1254			0.30	0.8	0
			Goldfish	1242/1016	5	1	0	0	
				1254			1.8	1.8	
			Largemouth bass	1242/1016	1	1	0	0	
				1254			3.10	3.10	
Lake Erie	14	DRI-CR-DAM	Smallmouth bass	1242/1016	1	1	0	0	
				1254			1.30	1.30	
			White bass	1242/1016	1	1	0	0	
				1254			11.31	11.31	
			Walleye	1242/1016	19	4	0.19	0.4	0
				1254			0.72	1.0	0.6
Lake Erie	14	DRI-CR	Walleye	1242/1016	19	9	0.19	0.6	0
				1254			0.70	1.65	1.8
			Yellow perch	1242/1016	10	2	0.40	0.4	0.4
				1254			0.60	0.6	0.6
			Goldfish	1242/1016	4	1	1.00	1.0	
				1254			1.40	1.4	
Lake Erie	14	DRI-CR	Brown trout	1242/1016	20	9	0.21	2.4	0
				1254			1.60	3.24	0.57
			Rainbow trout	1242/1016	10	9	0	0	
				1254			2.03	3.77	0.76
			Chinook salmon	1242/1016	8	8	0	0	
				1254			1.21	2.71	0.98
Lake Ontario	15-16	DRI-CR	Coho salmon	1242/1016	15	4	0	0	
				1254			2.36	5.06	0.66
			Chinook salmon	1242/1016	23	15	0	0	
				1254			8.05	18.65	2.09
			Rainbow trout	1242/1016	29	17	0.21	6.07	0
				1254			14.48	24.57	4.67
Lake Ontario	15-16	DRI-CR	Rainbow trout	1242/1016	9	9	0	0	
				1254			5.76	12.35	1.47
			Brown trout	1242/1016	12	12	0	0	
				1254			5.25	16.76	0.98
			Lake trout	1242/1016	19	14	0	0	
				1254			9.38	14.62	1.35
Lake Ontario	15-16	DRI-CR	White perch	1242/1016	27	5	0	0	
				1254			0.05	0.48	
			Yellow perch	1242/1016	25	4	0.18	0	
				1254			0.18	0.69	
			Northern pike	1242/1016	17	10	0	0	
				1254			1.79	4.02	0.96
Lake Ontario	15-16	DRI-CR	Largemouth bass	1242/1016	5	5	0	0	
				1254			1.79	4.25	0.17
			Smallmouth bass	1242/1016	7	2	0	0	
				1254			1.81	2.69	1.15
			Rock bass	1242/1016	11	2	0	0	
				1254			0.83	3.58	0.55
Lake Ontario	15-16	DRI-CR	Brown bullhead	1242/1016	10	2	0	0	
				1254			0.57	0.25	0.30

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TABLE 4 (cont'd). Concentrations of PCB's in fish and shellfish in New York State, 1975

WATER	STATION	LABORATORY ¹	SPECIES	ANALYST	NO. FISH ANALYZED	NUMBER OF ANALYSES	CONCENTRATION OF PCB'S PPM WET WEIGHT ²		
							WEIGHTED AVERAGE	MEAN	MAX
Lake Ontario (Solomon River/ Pelee's West)	17	DEC-R	Pumpkinseed	1242/1016 1254	19	4	0 0.01	0 0.26	0 0
			Walleye	1242/1016 1254	5	4	0 2.87	0 7.39	0 0.31
			Rainbow smelt	1242/1016 1254	10	4	0 2.10	0 4.55	0 1.16
			American eel	1242/1016 1254	2	2	0 6.78	0 10.74	0 1.87
			Black crappie	1242/1016 1254	8	6	0 1.35	0 2.07	0 0.20
			White sucker	1242/1016 1254	5	5	0 3.39	0 7.90	0 1.18
			Coho salmon	1242/1016 1254	9	20	0 9.31	0 12.67	0 4.48
			Chinook salmon	1242/1016 1254	21	15	0.11 6.98	2.28 17.01	0 2.84
			Smallmouth bass	1242/1016 1254	13	3	1.77 2.23	4.0 5.6	8.5 0.5
			Silver redhorse	1242/1016 1254	14	3	1.55 1.45	3.0 2.4	1.0 0.5
			Chumung River	1242/1016 1254	12	3	0 0.88	0 1.5	0 8.6
			Rock bass	1242/1016 1254	2	1	0.40 0.40	0.4 0.4	0 0
Susquehanna River	20	DHI	White sucker	1242/1016 1254	13	3	0.29 0.55	0.5 0.9	0 0.2
			Smallmouth bass	1242/1016 1254	12	2	0.20 0.45	0.2 0.5	0.2 0.4
			Walleye	1242/1016 1254	6	2	0.15 0.75	0.3 0.7	0.1 1.0
			White sucker	1242/1016 1254	18	3	0.20 0.80	0.2 0.8	0.2 0.8
			Carp	1242/1016 1254	11	2	0.41 1.25	0.5 1.5	0.5 1.2
			Smallmouth bass	1242/1016 1254	3	2	1.33 0.67	1.6 0.8	0.8 0.6
Delaware River	21	DHI	White sucker	1242/1016 1254	5	1	0.40 0.50	0.4 0.5	0 0
			American eel	1242/1016 1254	9	3	1.24 0.36	2.8 0.8	0 0
			Lake trout	1242/1016 1254	10	5	0.71 3.94	2.0 15.0	0 0
			Rainbow trout	1242/1016 1254	6	6	0 0.00	0 0.00	0 0.00
Lake Champlain	23, 24	DHI & DEC-R	Smallmouth bass	1242/1016 1254	14	5	0.29 0.27	1.0 1.0	0 0
			Yellow perch	1242/1016 1254	15	3	0.57 0.31	1.2 0.6	0 0
			Cisco	1242/1016 1254	10	2	0.50 3.95	0.6 4.7	0.4 5.2
			Smallmouth bass	1242/1016 1254	29	6	0.75 1.21	3.0 3.5	0 0
			Walleye	1242/1016 1254	5	1	0.50 0.20	0.3 0.2	0 0
			Northern Pike	1242/1016 1254	4	2	0.2 0.4	0.3 0.6	0.1 0.2

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TABLE 4 (cont'd.) Concentrations of PCB's in fish and shellfish in New York State, 1975

WATER	STATION	LABORATORY ¹	SPECIES	ANALYST	NO. FISH ANALYZED	NUMBER OF ANALYSES	CONCENTRATION IN PERCENT OF TOTAL WEIGHT ²		
							WEIGHTED AVERAGE	HIGH	LOW
St. Lawrence River	25, 26	DLC R	Yellow perch	1242/1016 1254	17	3	0.40 0.59	0.4 0.8	0 0.2
			Brown bullhead	1242/1016 1254	14	3	0.34 0.45	0.3 1.2	0 0
			Smallmouth bass	1242/1016 1254	16	9	0 4.58	0 6.85	0 1.62
			Walleye	1242/1016 1254	11	3	0 1.83	0 2.05	0 1.58
			Walleye	1242/1016 1254	8	2	1.25 3.11	2.0 4.5	0 0.8
			Brown bullhead	1242/1016 1254	10	2	0.95 2.50	1.5 4.0	0.4 1.0
Rappahannock River	28	DHL	Smallmouth bass	1242/1016 1254	15	4	0.40 0.90	0.4 1.7	0.2 0.3
			Shorthead redhorse	1242/1016 1254	14	3	0.32 0.44	0.4 0.6	0.2 0.3
			Smallmouth bass	1242/1016 1254	9	3	1.82 3.13	1.9 4.0	1.2 1.2
Oneida Lake	31	DLC R	Walleye	1242/1016 1254	1	1	3.10 2.50	3.1 2.5	0 0
			White perch	1242/1016 1254	11	2	2.28 2.33	4.1 4.9	0.6 0.2
			White sucker	1242/1016 1254	3	1	0.70 0.20	0.7 0.2	0 0
			atp	1242/1016 1254	7	2	2.20 6.04	3.0 7.5	0.2 2.3
			Brown bullhead	1242/1016 1254	5	1	3.10 5.30	3.1 5.3	0 0
			Large mouth bass	1242/1016 1254	5	2	2.62 2.98	3.8 3.5	2.5 2.2
Wallkill & Housatonic River	32	DHL	Yellow perch	1242/1016 1254	4	1	2.00 3.40	2.0 3.4	0 0
			White sucker	1242/1016 1254	7	3	1.73 1.58	2.9 2.9	0.7 0.6
			Bluefish	1242/1016 1248 1254	26	15	0 0 1.43	0 0 8.19	0 0 0.21
			Striped bass	1242/1016 1248 1254	29	17	0 0 1.05	0 0 3.59	0 0 1.8
			Porgy	1242/1016 1248 1254	12	2	0 0 0.29	0 0 0.42	0 0 0.25
			Atlantic menhaden	1242/1016 1248 1254	18	7	0 0 1.07	0 0 1.53	0 0 0.44
Atlantic Ocean	34	DLC SR	Spiny dogfish	1242/1016 1248 1254	60	4	0 0 0.25	0 0 0.27	0 0 0.22
			Bluefin tuna	1242/1016 1248 1254	7	7	0 0 1.42	0 0 6.65	0 0 0.19
			Atlantic mackerel	1242/1016 1254	5	5	0.46	0.52	0.31
			Weakfish	1242/1016 1248 1254	1	1	0 0 0.21	0 0 0.21	0 0 0

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TABLE 4 (cont'd.). Concentrations of PCB's in fish and shellfish in New York State, 1975

WATER	STATION	LABORATORY ^a	SPECIES	ANALYSIS	NO. FISH ANALYZED	NUMBER OF ANALYSES	CONCENTRATION OF PCB'S PPM WT. WEIGHT ^b		
							WEIGHTED AVERAGE	HIGH	LOW
(Champlain Canal)	34	DLS R	Summer flounder	1242/1016	1	1	0	0	
				1248			0	0	
				1254			0.36	0.56	
			Winter flounder	1242/1016	16	10	0	0	
				1248			0	0	
				1254			0.09	0.36	TR
			Atlantic cod	1242/1016	9	9	0	0	
				1248			0	0	
				1254			0.1R	0.34	TR
			Tautog	1242/1016	3	3	0	0	
				1248			TR	TR	TR
				1254			0	0	
			Eelp	1242/1016	1	1	0	0	
				1248			0	0	
				1254			0.33	0.33	
			White perch	1242/1016	2	2	0	0	
				1248			0	0	
				1254			3.11	5.19	1.07
			Atlantic silverside	1242/1016	50	2	0	0	
				1248			0	0	
				1254			0.9R	1.51	0.45
			American eel	1242/1016	1	1	0	0	
				1248			0	0	
				1254			3.75	1.75	
			Glooselish	1242/1016	1	1	0	0	
				1248			0	0	
				1254			TR	TR	
			Northern puffer	1242/1016	1	1	0	0	
				1248			0	0	
				1254			TR	TR	
			Hard clam	1242/1016	36	3	0	0	
				1248			0.73	0.36	0.01
				1254			0	0	
			Soft clam	1242/1016	6	1	0	0	
				1248			0.36	0.36	
				1254			0	0	
			Blue claw crab	1242/1016	14	2	0	0	
				1248			0.32	0.44	TR
				1254			0	0	
			Northern lobster	1242/1016	1	1	0	0	
				1248			0.13	0.13	
				1254			0	0	
			American oyster	1242/1016	48	4	0	0	
				1248			0	0	
				1254			TR	0.15	TR
			Common mussel	1242/1016	36	3	0	0	
				1248			0	0	
				1254			TR	TR	TR
(Champlain Canal)	34	DLS R	Rock bass	1242/1016	1	1	4.40	4.40	
				1254			7.7R	3.7R	
			Freshwater drum	1242/1016	2	1	0	0	
				1254			1.36	2.33	0.5R
			Edible fish	1242/1016	2	2	0	0	
				1254			TR	TR	
			Yellow perch	1242/1016	4	3	0	0	
				1254			0.92	0.92	
			Alewife	1242/1016	100	1	0	0	
				1254			1.60	1.60	

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TABLE 4 (cont'd). Concentrations of PCB's in fish and shellfish in New York State, 1975

WATER	STATION	LABORATORY*	SPECIES	ANALYSIS	NO. FISH ANALYZED	NUMBER OF ANALYSES	CONCENTRATION OF PCB'S		
							WEIGHTED AVERAGE	PPM WEIGHT	PPM WEIGHT
								How	Low
			White sucker						
			Whole fish	1242/1016	5	3	0	0	TR
				1254			0.59	0.92	
			Pumpkinseed						
			Whole fish	1242/1016	5	1	0	0	
				1254			2.00	2.00	
Hudson Lake	35	DLC R	Lake trout	1242/1016	10	10	TR	TR	0
				1254			TR	TR	0
			Rainbow trout	1242/1016	2	2	0	0	
				1254			0	0	
			Chain pickerel	1242/1016	9	5	0	0	
				1254			0	0	
			White sucker	1242/1016	3	1	TR	TR	
				1254			0	0	
			Carp	1242/1016	4	1	0	0	
				1254			0	0	
			Cisco	1242/1016	3	1	TR	TR	
				1254			0	0	
			Alewife	1242/1016	5	1	0	0	
				1254			0	0	
			Rainbow smelt	1242/1016	5	1	TR	TR	
				1254			0	0	
			Yellow perch	1242/1016	7	2	TR	TR	
				1254			0	0	
Cattaraugus Lake	36	DLC R	Lake trout	1242/1016	7	7	0	0	
				1254					
			Rainbow trout	1242/1016	5	5	0	0	
				1254					
Cattaraugus Lake	37	DLC R	Lake Trout	1242/1016	17	12	3.11	25.78	0
				1254			5.18	21.69	1.12
			Brown trout	1242/1016	1	1	2.58	2.58	
				1254					
Kenzie Lake	38	DLC R	Lake trout	1242/1016	18	8	16	TR	0
				1254			0.09	1.77	0
			Rainbow smelt	1242/1016	6	1	0	0	
				1254			0	0	
			Alewife	1242/1016	9	2	0	0	
				1254			0	0	
Seneca Lake	39	DLC R	Lake trout	1242/1016	10	10	0	0	
				1254			6.42	15.99	2.62
Cayuga Lake	40	DLC R	Lake trout	1242/1016	7	7	0	0	
				1254			0.15	8.25	1.16
Montezuma National Wildlife Refuge	41	DLC R	Carp	1242/1016	3	3	0.66	1.59	TR
							5.67	1.51	0.59

* Laboratory code: DLC R - Department of Environmental Conservation, Rome Laboratory, New York State

DAM - Department of Agriculture and Markets, Food Laboratory, New York State

DHL - Department of Health, Griffin Laboratory, New York State

DLC SH - Department of Environmental Conservation, Stony Brook Laboratory, New York State

* Indicates absence of data or no value less than 0.5 was reported in column headed "How"

TR = trace

ND = not determined

* In fish, only fish analyzed for both analyses; 1 fish not included

* Sample no. index one highly contaminated specimen

* Sample does not include 6 fish for which Anal. for 1242/1016 was not determined

* Sample does not include 1 fish for which Anal. for 1254 was not determined

* Sample does not include 2 fish for which Anal. for 1254 was not determined

* Sample does not include 12 fish for which Anal. for 1254 was not determined

* Data in parentheses are weighted average PCB concentrations excluding two fish with exceptionally high concentrations

TABLE 5. Concentrations of PCB's in fish, 1970-74

WATER	SPECIES	YEAR COLLECTED	ANALYSES	NO. FISH ANALYZED ¹	NUMBER OF ANALYSES	CONCENTRATION OF PCB'S, PPM WET WEIGHT		
						WEIGHTED AVERAGE	HIGH	LOW
Hudson River (Watkinsburg)	Smallmouth bass	1970	1254	1	1	0.18	0.18	
Hudson River (Below Tarry Dam)	Largemouth bass	1970-72	1254	20(19)	19(18)	6.58(4.09)	53.81	0.66
	Smallmouth bass	1970-72	1254	4(3)	4(3)	6.42(2.70)	17.58	2.36
	Striped bass	1970-72	1254	3	3	4.35	10.48	1.67
		1973	1254	22	22	14.75	49.63	3.70
	Atlantic sturgeon	1970-72	1254	4	4	6.71	7.03	5.73
	Northern pike	1972	1254	1	1	17.78	17.78	
	Yellow perch	1972	1254	13	2	0.79	0.92	0.79
	White perch	1972	1254	39	31	4.79	15.81	0.38
	Black crappie	1970-72	1254	3	2	0.78	1.42	0.46
	Pumpkinseed	1972	1254	21	3	0.47	0.64	0.46
	Bluegill	1972	1254	4	1	0.52	0.52	
	Redbreast sunfish	1972	1254	12	1	0.75	0.75	
	Smallmouth bass	1970	1254	2	2	14.23	17.58	10.88
	Largemouth bass	1970	1254	7	7	5.05	9.52	2.60
Rensselaer River	Largemouth bass	1971	1254	1	1	0.57	0.57	
Lake Champlain	Smallmouth bass	1971	1242/1016	1	1	0.80	0.80	
	Largemouth bass	1971	1242/1016	1	1	4.21	4.21	
	Walleye	1971	1242/1016	2	2	28.15	55.46	0.84
	Northern pike	1971	1242/1016	1	1	0.80	0.80	
	Chain pickerel	1971	1242/1016	1	1	0.15	0.15	
	Atlantic salmon	1971	1242/1016	1	1	0.98	0.98	
	Black crappie	1971	1242/1016	1	1	1.45	1.45	
	Channel catfish	1971	1242/1016	2	2	7.00	7.85	6.15
	Brown bullhead	1971	1242/1016	1	1	0.68	0.68	
	Freshwater drum	1971	1242/1016	1	1	0.70	0.70	
	Carp	1971	1242/1016	1	1	1.94	1.94	
	White sucker	1971	1242/1016	1	1	0.50	0.50	
	Yellow perch	1971	1254	1	1	1R	1R	
	White fish (species not known)	1971	1254	1	1	0.87	0.87	
Lake Erie	Chinook salmon	1973	1254	13	13	1.70	2.91	0.60
		1974	1254	26	26	1.74	5.88	1R
	Chinook salmon	1973	1254	4	4	1.48	1.89	1.20
		1974	1254	4	4	2.98	4.92	2.20
	Smallmouth bass	1971	1254	1	1	0.42	0.42	
	Freshwater drum	1971	1242/1016	1	1	1.72	1.72	
Niagara River	Smallmouth bass	1971	1242/1016	2	2	11.30	20.27	2.32
	Walleye	1971	1242/1016	1	1	1.02	1.02	
	Freshwater drum	1971	1242/1016	2	2	16.54	23.53	9.53

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TABLE 5 (cont'd) Concentrations of PCB's in fish, 1970-74

WATER	SPECIES	YEAR COLLECTED	ANALYST	NO. FISH ANALYZED ¹	NUMBER OF ANALYSES	CONCENTRATION OF PCB'S PPM WET WEIGHT		
						WEIGHTED AVERAGE	HIGH	LOW
Lake Ontario	Coho salmon	1971	1254	9	9	6.67	21.97	6.66
		1973	1254	29	29	6.26	10.77	3.00
	Chinook salmon	1971	1254	12	12	21.45	34.48	9.21
		1974	1254	9	9	7.15	14.77	1.56
Lake Ontario	Rainbow trout	1974	1254	3	3	1.97	2.81	1.45
	Brown trout	1974	1254	4	4	7.69	14.50	2.70
	Northern pike	1970	1254	4	4	5.32	12.86	1.38
	Smallmouth bass	1970	1242/1016	3	3	7.11	8.81	4.36
		1254		2	2	3.88	4.57	3.24
	Large-mouth bass	1970	1254	1	1	2.84	2.84	
	Rock bass	1970	1254	2	2	0.49	0.59	0.40
	White bass	1970	1254	3	3	10.26	15.46	6.37
	White perch	1970	1254	3	3	3.42	5.15	2.12
	Carp	1970	1254	1	1	0.71	0.71	
	Rainbow smelt							
Whole	1972	1254	10	10	4.02	7.12	2.26	
Edible	1972	1254	11	11	2.16	3.42	1.15	
Lake Ontario (Salmon River Polaski West)	Coho salmon	1970	1254	17	17	7.92	12.10	5.01
		1971	1254	20	20	10.35	21.43	0.85
		1972	1254	20	20	4.65	13.29	0.82
		1974	1254	5	5	7.05	11.29	3.48
Lake Ontario (Salmon River Polaski West)	Chinook salmon	1971	1242/1016	2	2	19.38	28.11	10.65
		1254		4	4	9.37	12.10	5.88
		1973	1254	51	51	5.81	13.14	1.45
Lake Ontario	Rainbow trout	1974	1254	1	1	7.24	8.38	5.76
	Coho salmon	1971	1254	3	3	2.60	6.10	0.76
Little Salmon River	Chinook salmon	1971	1254	4	4	15.75	29.36	4.66
	Coho salmon	1972	1254	1	1	6.81	6.81	
Lake Ontario (Spring Brook)	Coho salmon	1971	1254	9	9	6.67	21.97	6.66
		1973	1254	29	29	6.26	10.77	3.00
		1974	1254	9	9	7.15	14.77	1.56
		1970	1254	4	4	5.32	12.86	1.38
St. Lawrence River	Smallmouth bass	1971	1254	7	7	5.55	9.76	1.11
		1971	1242/1016	1	1	3.42	3.42	
	Walleye	1971	1242/1016	1	1	11.89	11.89	
	Sturgeon (species not known)	1971	1242/1016	1	1	65.85	81.79	19.91
Allegheny River	Channel catfish	1971	1242/1016	2	2	2.21	2.36	2.06
	Smallmouth bass	1971	1242/1016	2	2	2.21	2.36	2.06
	Brook flounder	1970	1242/1016	1	1	2.71	2.71	
Genesee River (Lower portion)	Smallmouth bass	1971	1254	2	2	7.36	10.59	1.12
	White bass	1971	1254	1	1	7.76	7.76	
Chemung River	Smallmouth bass	1971	1254	3	3	0.46	0.62	0.23
	Walleye	1971	1254	2	2	1.02	1.09	0.94
	Yellow perch	1971	1254	2	2	0.14	0.24	1.8
	Smallmouth bass	1971	1254	1	1	0.90	0.90	
Cohoes River (above Bait)	Smallmouth bass	1971	1254	1	1	0.90	0.90	
	Brown trout	1971	1254	1	1	2.80	2.80	

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TABLE 5 (cont'd.). Concentrations of PCB's in fish, 1970-74

WATER	SPECIES	YEAR COLLECTED	CONCENTRATION		NUMBER OF ANALYSES	CONCENTRATION OF PCB'S		TOLERANCE
			ANALYSIS	NO. FISH ANALYZED		WEIGHTED AVERAGE	THIS	
Mohawk River	Smallmouth bass	1971	1254	3	3	3.57	4.01	2.73
	Smallmouth bass	1971	1254	1	1	2.41	2.41	
	Large-mouth bass	1971	1254	1	1	1.48	1.48	
Hudson River	Smallmouth bass	1971	1254	2	2	2.49	2.67	2.35
	Large-mouth bass	1971	1254	3	3	2.70	4.39	0.52
Raquette River	Smallmouth bass	1970	1254	1	1	0.32	0.32	
	Yellow perch	1970	1254	1	1	0.27	0.27	
	Pumpkinseed	1970	1254	1	1	0.81	0.81	
	Smallmouth bass	1970	1254	7	7	1.53	4.85	0
Oswegatchie River	Large-mouth bass	1970	1254	1	1	4.17	4.17	
	Northern pike	1970	1254	5	5	0.9	0.46	0
	Yellow perch	1970	1254	9	9	0.12	1.07	0
	Pumpkinseed	1970	1254	1	1	TR	TR	
	White sucker	1970	1254	1	1	20.92	20.92	
	Smallmouth bass	1971	1254	1	1	0.13	0.13	
Black Lake	Smallmouth bass	1971	1254	1	1	TR	TR	
Beam Lake	Large-mouth bass	1971	1254	1	1	TR	TR	
Champlain Reservoir	Brown trout	1971	1254	6	6	0.25	1.65	0
Chautauque Lake	Smallmouth bass	1971	1254	1	1	0.16	0.16	
	White sucker	1971	1254	1	1	TR	TR	
Conesus Lake	Large-mouth bass	1971	1254	1	1	0.54	0.54	
Kraus Lake	Large-mouth bass	1971	1254	1	1	0.54	0.54	
	Rainbow trout	1971	1254	1	1	1.33	1.33	
Lake George	Lake trout	1971	1254	6	6	4.74	6.07	2.37
Ontonagon Lake	Smallmouth bass	1972	1254	14	14	0.71	2.08	TR
	White perch	1972	1254	7	7	1.58	2.62	0.70
	Yellow perch	1972	1254	4	4	0.31	0.48	0
	Northern pike	1972	1254	1	1	1.75	1.75	
	Black crappie	1972	1254	4	4	0.98	1.54	0.39
	Freshwater drum	1972	1254	4	4	1.17	1.78	0.57
	Brown bullhead	1972	1254	4	4	0.44	0.89	0.17
	Channel catfish	1972	1254	3	3	8.39	16.53	1.40
Ontonagon Lake	American eel	1972	1254	2	2	5.44	6.97	3.91
	Smallmouth bass	1971	1254	1	1	0.80	0.80	
	Brown trout	1971	1254	7	7	0.74	2.62	TR
	Smallmouth bass	1971	1254	1	1	1.16	1.16	
Pepin Reservoir	Smallmouth bass	1971	1254	3	3	0.05	0.16	0
Schubert Reservoir	Walleye	1971	1254	3	3	0	0	
	Brown trout	1971	1254	3	3	0	0	
Waukegan Lake	Chain pickerel	1971	1254	3	3	TR	TR	TR
Whitney Point Reservoir	Large-mouth bass	1971	1254	1	1	0	0	
	Walleye	1971	1254	5	5	TR	TR	0

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TABLE 5 (cont'd.). Concentrations of PCB's in fish, 1970-74

WATER	SPECIES	YEAR COLLECTED	ANALYST	NO. FISH ANALYZED ^a	NUMBER OF ANALYSES	CONCENTRATION OF PCB'S PPM BY WEIGHT		
						WEIGHTED AVERAGE	HIGH	LOW
Atlantic Ocean	Black crappie	1971	1254	3	3	TR	TR	0
	Striped bass	1972	1254	5	2	0.57	0.59	0.57
	Bluefish	1972	1254	5	5	1.82	1.19	0.09
	Winter flounder	1972-74	1254	180	9	0.13	0.76	0
	Atlantic silverside	1973-74	1254	900	9	0.16	0.19	0
	Mummichog	1973	1254	11	1	0.30	0.30	
	Gizzard	1973	1254	20	1	0.19	0.19	
	Spiny topfish	1972	1254	4	4	0.25	0.27	0.24
	Northern lobster	1974	1254	1	1	0.15	0.15	
	Oyster	1974	1254	56	3	0.34	0.75	0.12

NOTE: Results tabulated only for those fish for which the specific PCB was reported. All analyses conducted by Department of Environmental Conservation Laboratory, Rome, N.Y., except Atlantic Ocean analyses which were conducted by the Stony Brook Laboratory.

Indicates absence of data.

TR = trace

^a Parenthesis numbers exclude one individual fish with high PCB concentration

TABLE 6. Laboratory comparisons of single atochlor in hexane and m-xylene solutions

ANALYST & SOLUTION	ARCHOR	RESIDUE, $\mu\text{g/ml} \times 10^3$					
		KNOWN STANDARD	DAM	DEC-SB	DEC-R	DH	LPA
Xylene	1016	0	0	0	0	0	SV
	1242	0	0	0	0	0	NV
	1254	0	0	0	0	0	SV
Hexane	1016	0.80	0.89 ^a	1.09 ^b	1.15 ^c	0.71	SV
	1254	0	NV	NV	NV	NV	NV
Hexane	1016	0	NV	NV	NV	NV	SV
	1254	0.95	0.92	1.32	1.01	0.97	SV
Isocytane (combined standards)	1016	55.5	73.3 ^a	NV	39.8 ^b	54.2(41.8)	26
	1254	27.0	92.8	NV	90.4	32.2(90.0)	91
	1016+1254	127.5	166.1	177.3	130.2	126.4(133.8)	117
Isocytane (combined standards)	1016	61.0	70.0	NV	NV	NV(103.4)	38
	1242	64.5	30.0	NV	70.3	125.8 ^c	60
	1016+1242	125.5	120.0	145.3			98

^a Laboratory code: DAM = Department of Agriculture and Markets, Food Laboratory, New York State

DEC-SB = Department of Environmental Conservation, Stony Brook Laboratory, New York State

DEC-R = Department of Environmental Conservation, Rome Laboratory, New York State

DH = Department of Health, Griffin Laboratory, New York State

LPA = U.S. Environmental Protection Agency Laboratory, Region II, New York City

SV = No value reported for this Archor

NV = no sample sent to this laboratory

^b Residue reported as Archors 1242 and 1254

^c Residue reported as Archor 1242

TABLE 7. Laboratory comparison of PCB's in fish.

SAMPLE ID	ANALYST	RESIDUES, ppm ¹					SD, % ²
		DAM	DEC. SB	DEC. R	DH	FDA	
14R10	1016	NS	NS	NV	NS	2.32	
	1254			3.89		4.32	
14R11	1016	NV	NV	NV	4.3	NS	45
	1254	3.3		2.58	6.0		
	1247/1254		2.03 ³				
14R12	1016	NV	NS	NV	1.0	4.31	11
	1254	8.4		7.16	9.5	8.49	
14R44	1016	NV	NV	NV	NS	NA	
	1254	6.6		5.55			
	1247/1254		2.63 ³				
14R45	1016	NV	NV	NV	NS	NA	
	1254	4.2		6.34			
	1247/1254		2.23 ³				

¹ Laboratory code: DAM - Department of Agriculture and Markets, Food Laboratory, New York State.

DEC. SB - Department of Environmental Conservation, Stony Brook Laboratory, New York State.

DEC. R - Department of Environmental Conservation, Rome Laboratory, New York State.

DH - Department of Health, Griffin Laboratory, New York State.

FDA - Food and Drug Administration Laboratory, New York, N.Y.

² NV - no value reported for this Aroclor.

NS - no sample sent to this laboratory.

NA - sample not analyzed.

³ SD - standard deviation, determined when there were sufficient analyses for comparison.

⁴ Reported as Aroclors 1262 and 1254.

vidual standards, but the agreement for Aroclor 1254 is reasonable. Unfortunately, no split samples contained much Aroclor 1016 but from the synthetic check samples there is no reason to believe that agreement would be different for this mixture.

Results

Tables 4 and 5 summarize results of the 1975 PCB analyses and compilation of earlier results. For the purpose of the discussion concentrations as a function of fish length are not discussed. Data are being compiled for use as a resource management tool wherein harvest of specific lengths may be regulated to protect the consumer while using the resource. Furthermore, concentration/length-species correlations may shift preferred species management in contaminated waters to favor that group of fish with a low propensity for PCB accumulation. Whole fish analysis results have been separated from flesh analysis results. The data are offered as a weighted average of each individual analyzed from a composite sample and are derived using the following formula:

$$\frac{(C_1n_1 + C_2n_2 + \dots + C_n n_n)}{(n_1 + n_2 + \dots + n_n)} = \text{Weighted average (concentration of PCB's)}$$

Where, for each species of fish,

n , $n+1$, $n+2$, etc.

C_n , C_{n+1} , C_{n+2} , etc.

C_n , C_{n+1} , C_{n+2} , etc.

individual or group of fish analyzed.

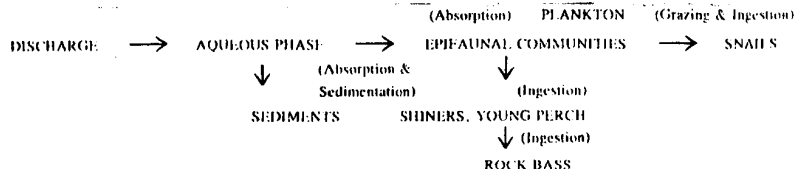
number of fish in group n , $n+1$, $n+2$, etc.

concentration of PCB of group n , $n+1$, $n+2$, etc.

Zero concentrations were included in the weighted average. High and low individual readings in each sample are included to indicate end points of the data.

Discussion

PCB's are a ubiquitous contaminant of most environments. The source of this manufactured compound varies but appears to be primarily industries, open burning or incineration of solid wastes and waste oils, or migration from disposal sites (13). Once in the environment, PCB's, like organochlorine insecticides, are readily available for biomagnification since they are fat soluble compounds absorbed and stored in animal lipids. Nadeau (16) suggests a hypothetical transfer model for the biomagnification of PCB's in the Hudson River:



This model can be modified to show direct uptake by each biotic community from the aqueous phase (17, 18, 19). Through this avenue, a steady state may be achieved within a short period of time (±30 days) in highly contaminated waters (23, 24). Therefore, monitoring fish populations and analyzing properly composited samples for PCB contamination can indicate whether it is safe to consume fish flesh based on the Food and Drug Administration action level of 5 ppm, and to what degree a waterway is contaminated by PCB's. Indirectly, monitoring studies can show the need for specific studies to address the impact of PCB's on natural communities and/or populations, and the need to re-evaluate existing discharge permit limits.

The 1975 analyses confirmed that PCB's expressed as Aroclor 1016/1242 and/or 1254 were present in detectable amounts in most fish sampled. The level of contamination and specific Aroclor vary according to waterway size, location, and peripheral land use. Table 4 summarizes the data for edible fish except in the cases indicated. Following is a general discussion of the findings in each waterway.

HUDSON RIVER; Stations 1-8, 32, 34. This major river system contains fish with the highest average concentration of total PCB's of any waterway sampled. Sampling nearly the entire extent of the river shows that contamination is widespread from Hudson Falls to the mouth of the river. The average level of contamination decreases in the lower reaches of the Hudson, perhaps through dilution from tributary waters, deposition in the sediments and aquatic organisms, and the effects of marine waters. Similar results occurred in fish collected from 1970 and 1973 (Table 5).

MOHAWK RIVER; Stations 9 and 10. Concentrations in 5 of 13 analyses in 1975 exceed the Food and Drug Administration action level of 5 ppm. Highest average concentrations appear upstream at the Little Falls station rather than at Schenectady, indicating a source of contamination above the town of Little Falls. The problem appears localized and does not affect the entire waterway as indicated by the Schenectady samples.

Earlier samples (Table 5) were either absent or too small to be compared.

SENECA/ONEIDA/OWSEGO RIVERS; Stations 11 and 12. PCB's are present, averaging 4 ppm. Concentrations are lowest at the Clyde station.

NIAGARA RIVER; Station 13. Largemouth and smallmouth bass have concentrations below 5 ppm; one white bass had levels above 10 ppm. The station was located below Lewiston, thus indicating no major source of PCB contamination from the Buffalo/Niagara Falls industrial complex. Earlier data are too sparse for direct comparison. However, additional study is warranted based on

the 1971 analytical results and the single white bass noted above.

LAKE ERIE; Station 14. Samples from Lake Erie were taken at two locations, Dunkirk and the mouth of Cattaraugus Creek at Irving. The several species of fish contained levels of total PCB's well below 5 ppm. This is consistent with the 1973-74 data which indicated the presence of the contaminant at low concentrations.

LAKE ONTARIO; Stations 15-17. Generally, low levels of PCB's were found in warm water species, in contrast to the elevated concentrations commonly found in three species of salmonids taken from the lake proper. However, reduced levels were noted in the salmon that had migrated upstream in one major tributary, the Salmon River (Station 17). A reduction of the body fat through metabolic activities such as spawning and migration apparently caused the loss or displacement of some of the PCB burden in the edible flesh.

Comparison of the 1975 data with earlier findings is difficult. General trends indicate that concentrations similar to the present levels existed as early as 1970.

GENESEE RIVER; Station 18. Analysis of fish taken from the lower portion of the river below the village of Industry indicates a potential PCB problem in large fish. In two samples, one each of smallmouth bass and silver redhorse, levels were noted at or near 5 ppm. However, the 1971 samples, which were analyzed only for Aroclor 1254, indicate levels higher than those found in 1975. Due to the size of the earlier samples no trends can be identified except that PCB's (Aroclor 1254) are still present in substantial concentrations.

CHEMUNG/SUSQUEHANNA/DELAWARE RIVERS; Stations 19-21. These three independent river systems have been grouped for discussion since they reflect low levels of contamination, averaging 1 ppm or less. These figures are comparable to the samples collected in 1971 in the Chemung River.

LAKE GEORGE; Station 21. The larger, fatty lake trout of Lake George contain levels of PCB's (primarily Aroclor 1254) above 5.0 ppm. Lake George lake trout are known to have elevated levels of DDT (4). The analytical methodology used converted only DDT metabolites to dichlorobenzophenone rather than DDT itself. Therefore, PCB levels in lake trout and other species in Lake George, particularly ciscoes, may be overstated. Further study of the lake is warranted.

LAKE CHAMPLAIN; Stations 23 and 24. These stations were located at Ticonderoga and Plattsburgh, respectively.

Reflected in the sampling are species in both the summer and winter fisheries as well as the limited commercial fishery. In all species sampled, total PCB's did not exceed 5 ppm although smallmouth bass from Plattsburgh approached that limit. These data are consistent with those obtained in 1971.

ST. LAWRENCE RIVER; Stations 25 and 26. Fish were collected from two stations, Massana (26) and Cape Vincent (25). Aroclor 1254 occurred but Aroclor 1242 did not. Walleye averaged about 1.8 ppm; smallmouth bass ranged from 1.62 to 6.85 ppm. Earlier data are consistent for the bass but suggest higher levels in lake sturgeon and catfish, species not sampled in 1975.

BLACK RIVER AND RAQUETTE RIVER; Stations 27 and 28. Fish from both the Black and Raquette Rivers had generally low levels of PCB contamination. These results were expected since the rivers are located in remote areas of the State away from industrial waters.

ONONDAGA LAKE; Station 31. Several species of fish, notably brown bullhead, white perch, smallmouth bass, and walleye, have concentrations of PCB's near or exceeding the FDA action level of 5 ppm. The lake has been closed to fishing since 1970 because of mercury pollution.

MARINE WATERS; Station 33. All species of fish and shellfish tested generally have total concentrations of PCB's less than 1 ppm. On rare occasions large oily fish such as bluefish have elevated levels; in one case the level exceeded 5 ppm.

CHAMPLAIN CANAL; Station 34. Fish from this waterway indicate the presence of PCB's, primarily Aroclor 1254, at low levels. A single individual rock bass, suspected to be a migrant from the Hudson River in the vicinity of Fort Edward, had levels above 5 ppm.

HEMILOCK, CANADICE, AND KEUKA LAKES, AND MONTEZUMA NATIONAL WILDLIFE REFUGE; Stations 35, 36, 38, and 41. These four waters have been grouped because they reflect low levels of PCB contamination.

CANANDAIGUA LAKE; Station 37. Chromatograms obtained for fish from this water were atypical; however, results are initially reported as PCB's. No use or spills of PCB's is known in the watershed.

SENECA AND CAYUGA LAKES; Stations 39 and 40. Previous use of small amounts of PCB's by local industry

may have contaminated the fisheries. Results for Cayuga Lake (Station 40) generally confirm the findings of Bache et al. (2). Chromatograms for Seneca Lake display an atypical PCB pattern which is being investigated.

Conclusions

Nonindustrialized or lightly industrialized watersheds in New York State (Chemung, Susquehanna, Delaware, Black, and Raquette) contain fish with low levels of PCB's. Detectable amounts may result from atmospheric fallout, accidental spills, or land fill leachate. Several waterways have PCB's in amounts exceeding the action level of 5 ppm established by the Food and Drug Administration.

Rivers or waterways receiving contributions from industrialized watersheds contain organisms with high levels of PCB's. Hesse (12), Bremer et al. (3), and Veith (22) have indicated that levels in fish from the Great Lakes exceeded 5 ppm and that this level has not declined during the past five years. Information derived during the New York State 1975 study (Table 4) confirms these high concentrations in Lake Ontario. Large, long-lived, or fatty fish such as coho and chinook salmon, brown trout, and lake trout appear to bioaccumulate PCB's, generally above 5 ppm. A recent study (2) indicates that in salmonids the PCB level is directly and proportionally related to the age and oil of the fish. Findings in the present study generally support this premise.

The Hudson River below Hudson Falls contains fish with the highest level of total PCB's of any waterway sampled. Results above 50 ppm are not uncommon in the larger oilier fish; the highest individual concentration recorded was 559.25 ppm in a large cel. Comparison of the stations above Fort Edward with those immediately below indicates that a substantial PCB load is added to the river. This total loading probably does not emanate from atmospheric fallout or from other nondescript sources but rather from a major source of contamination or storage. Studies of water and sediment (7) have isolated industrial sources that are the subject of legal proceedings.

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